Whitford Activity Centre

Revised Structure Plan Transport Report

CEB06572

Prepared for
Scentre Group

31 March 2015

Cardno
Shaping the Future

Document Information

Prepared for	Scentre Group
Project Name	Revised Structure Plan Transport Report
File Reference	20150302 Final Draft Transport Report.docx
Job Reference	CEB06572
Date	31 March 2015

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Document Control

Version	Date	Description of Revision	Author Initials	Author Signature	Reviewer Initials	Reviewed Signature
1	25/02/2015	Draft Report	DJG		SRH	
2	27/02/2015	Draft 2 Report	DJG		SRH	
3	03/02/2015	Final Draft Report	DJG		SRH	
4	31/03/2015	Final Report	DJG		SRH	

Version	Reason for Issue / Stage of Deliverable	Approver Initials	Approved Signature	Approved Release Date
1	Draft Report for Review	SRH		
2	Second Draft Report for Review	SRH		
3	Final Draft Report	SRH		
4	Final Report	SRH		1/04/2015

Executive Summary

Background

This transport report accompanies the Whitfords Activity Centre Structure Plan. The development of Whitford Activity Centre (the Centre) will embrace the principles outlined in current strategic planning for the Perth Metropolitan Area. The planning intent is to utilise and develop existing as well as new activity centres as places for living, working and relaxing. This will reduce the need for people to travel to the Perth CBD as a primary destination and will negate the capital cost of simply providing additional private vehicle capacity.

This study has provided an assessment of the transport network impacts associated with the Centre and determine a framework by which to develop the various uses of the Centre, based on the yields outlined in the proposed Structure Plan. In undertaking this study, various policy and guideline documents have been used, of particular note:

> State Planning Policy 4.2 – Activity Centres Policy
> Transport Assessment Guidelines for Developments – Volume 2 – Structure Plans
> City of Joondalup Planning Scheme
> Public Transport for Perth in 2031 and
> Transport Assessment Guidelines for Developments – Volume 2 – Structure Plans

During the undertaking of this assessment, various discussions and workshops have been held with the following stakeholder to assist in determining the appropriate outcomes:

> The City of Joondalup
> The Department of Transport (DoT)
> The Public Transport Authority (PTA)
> Main Roads Western Australia (MRWA) and
> Department of Planning (DoP)

The assessment has been based on the proposed design horizon (2026) Structure Plan yields determined as:

Land Uses	Estimated Area
'Retail' (PLUC 5)	77,500 sqm
'Entertainment' (PLUC 9)	16,000 sqm
'Other Retail' (PLUC 6)	11,500 sqm
'Storage and Distribution' (PLUC 3)	8,500 sqm
'Health, Welfare and Community' (PLUC 8)	23,500 sqm
'Service Industry' (PLUC 4)	4,500 sqm
'Office' (PLUC 7)	22,500 sqm
'Residential' (PLUC 10)	739 dwellings

Public Transport

Existing public transport in the vicinity of the Centre is provided by Transperth feeder bus services. The majority of these services run east-west along Whitfords Avenue to service the Whitford Train Station. Bus shelters have been provided along Whitfords Avenue, though not along most other local roads. Public transport between the Centre and major transport destinations is of a high standard, with efficient and frequent connections to Joondalup and the Perth CBD, among others.

The Department of Transport document *Public Transport in Perth* 2031 shows Whitfords Avenue forming part of a Bus Rapid Transit (BRT) corridor between Joondalup and Warwick Stations. This has been tentatively indicated for after 2031 but is assumed to depend on patronage projections and economic viability facilitated by appropriate development, and could therefore be brought forward in the right circumstances.

The proposed Structure Plan public transport strategies aim to build on the existing provisions, accounting for the form of and location of new development as well as responding to the wider strategies, such as BRT. This provides potential solutions to set the framework for the future infrastructure provisions that any new development will respect and provide for, where deemed necessary to account for the transport impacts of that development.

- Bus rerouting – in conjunction with the Endeavour District developments, rerouting of the 442 service onto Endeavour Road to better serve the higher intensification.
- Bus station – A potential new bus station on the south side of Whitfords Avenue to consolidate bus stops and provide better access between the shopping centre and public transport, refer Appendix A for a concept layout
- New and improved bus stops – particularly where the 441 and 442 services are consolidated on Endeavour Road
- Bus lanes – provided on Whitfords Avenue across the Marmion Avenue intersection

Active Transport

Pedestrian footways are provided on the both side of all roads in the Centre with the exception of the residential access roads south of Banks Avenue that have footways on only one side. Controlled road crossings are provided at all signalised intersections and informal crossings elsewhere. A pedestrian underpass is located on Whitfords Avenue providing a connection between the shopping centre and both the bus stops on Whitfords Avenue and residences to the north. Close to the school entrance on Endeavour Road, there is a single control point, attended during school peaks by a crossing guard.

The existing cycling infrastructure links the Centre and surrounding area to the Mitchell Freeway and rail station. Various standards of cycle provision are provided within the Centre. It is noted that the current Joondalup Bike Plan from 2009 proposes new on-road cycle paths on Whitfords Avenue, east of Dampier Avenue and an arterial shared path along Marmion Avenue as part of future planning.

Potent improvements for active networks identified in the Structure Plan are:

- Improved footways as part of new development within the Centre
- Improvements for the pedestrian underpass on Whitfords Avenue
- The activation of Endeavour Road allowing better crossing opportunities and lower vehicle speeds
- Improved footways on Banks Avenue and
- The provision of cycle lanes on Endeavour Road as detailed in Section 5.5

Bicycle parking is to be provided as the following rates:

Use	Minimum Long Term Parking	Minimum Short Term Parking
Multiple Dwelling	As per the Residential Design Codes	As per the Residential Design Codes
Short Stay Accommodation, Hotel (accomm), Motel	1 space per 40 guest bedrooms	Nil.
Commercial **	1 space per 1,500m² NLA	1 space per 1,000m² NLA
Office	1 space per 250m² NLA	1 space per 750m² NLA
Consulting Rooms, Medical Centre	1 space per 8 practitioners	1 space per 4 practitioners
Hotel, Tavern, Small Bar, Nightclub	1 space per 100m² of bars and public areas including lounges, beer gardens and restaurants.	1 space per 150m² of bars and public areas, including lounges, beer gardens and restaurants
Recreation Centre, Private Recreation.	1 space per 400m² NLA available to the public, including swimming pools	1 space per 200m² NLA available to the public, including swimming pools
Public exhibition facility, Place of Worship, Place of Assembly, Reception Centre.	Nil	1 space per every 30 people the space is designed to accommodate.
Showroom	1 space per 750m² NLA for premises greater than 300m² NLA.	1 space per 1,000m²NLA

** Commercial includes a Shop, bank, Betting Agency, Convenience Store, Drive Through Food Outlet, Lunch Bar, Restaurant, Restricted Premises and Service Station. Uses not listed will be at the discretion of the City.

End of trip facilities support the use of bicycle transport by allowing cyclists the opportunity to shower and change at the beginning or end of their journey to and from work. The following provisions will be provided for non-residential incremental development:

> A minimum of one locker for each bicycle space
> A minimum of one unisex shower and change room. Additional shower facilities are to be provided at a rate of one female shower and one male shower for every additional 10 bicycle parking bays, to a maximum of five female and five male showers per development
> End of journey facilities must be located as close as possible to bicycle parking facilities and
> End of journey facilities must be located in convenient locations, such as near building entrances and near cycling routes

Roads

An assessment of the impacts on the road network was undertaken based on various assumptions regarding background traffic growth and trip generation. These assumptions were considered conservative as they did not allow for any shift in modal choice or account for future development that may have been accounted for in MRWA's growth rate determination thereby delivering a 'worst case' assessment.

The existing road hierarchy was developed based on both the Main Roads Functional Hierarchy and that described in the Liveable Neighbourhoods document. The overlap of these hierarchies is described below.

Main Roads Functional Road Hierarchy	Liveable Neighbourhoods	Description	Characteristics
Primary Distributor	Primary Distributor	Regional links	Multi-lane highways
District Distributor A	Integrator A	Arterial links connecting suburbs and centres to regional links	Four-lane, parking, cycle lanes
	Integrator B		Two-lane, parking, cycle lanes
Local Distributor	Neighbourhood Connector A	Sub-arterial links connecting access roads to arterial links	Two-lane divided, parking, cycle lanes
	Neighbourhood Connector B		Two-lane undivided, parking
Access Road	Access Streets	Provides access to property, low speed environment	Undivided, parking indents

The proposed Structure Plan identifies the following changes to the road hierarchy:

> Endeavour Road between Whitfords Avenue and Banks Road to be a Neighbourhood Connector A to assist the activation of this street and
> Banks Avenue to be a Neighbourhood Connector A but without a median

An assessment of road operations was conducted based on survey data for the year 2012 and trip generation calculations that utilised historical data as well as survey data of the existing Structure Plan uses. Growth rates as agreed with MRWA were applied to the surveyed data in addition to Structure Plan development generated traffic for the design horizon of 2026. The net traffic generation increase of the proposed Structure Plan yields by the design horizon was calculated to be 1,498 vehicle movements on a weekday evening peak hour and 1,811 vehicle movements for a Saturday midday peak hour.

The following upgrades were determined:

Intersection	Details of Upgrade
Whitfords Avenue/Dampier Avenue/Access 2	▪ Additional dedicated approach for buses on eastern arm to allow all-movements exit from Whitfords Avenue Bus Station ▪ Stand-up lane for left turns east to south, 122m in length
Banks Avenue/Access 10	▪ 2 lane circulatory carriageway ▪ 4 lanes east to Marmion Avenue/Banks Avenue intersection ▪ 30m through/left turn lane on western approach
Whitfords Avenue/Marmion Avenue	▪ 6 lane cross-section, Marmion Avenue, with southbound carriageway merging to 2 lanes 50m south of Whitfords Avenue ▪ Additional bus lanes on east and west approaches ▪ 140m right turn lane on northern approach ▪ 160m double right turn lanes on eastern approach ▪ 120m double left turn on eastern approach ▪ 140m double left turn lane on western approach ▪ 130m right turn lane on western approach ▪ 200m left turn lane on southern approach ▪ 90m right turn lane on southern approach
Banks Avenue/Solander Road	▪ 4 lane cross-section, Banks Avenue
Marmion Avenue/Banks Avenue	▪ 6 lane cross-section, Marmion Avenue, northern arm, northbound carriageway ▪ 4 lanes west to Banks Avenue/Access 10 intersection ▪ Additional 30m right turn lane on northern approach ▪ 200m left turn lane on southern approach

Parking

No particular parking issues are currently evident with the Centre. For future provisions, SPP 4.2 requires the provision of a rate of 4 to 5 spaces per 100sqm for retail and 2 spaces per 100sqm for office space. It is proposed to provide linear development parking rates across each precinct. The total parking provision based upon these rates and the Structure Plan yields are detailed below.

Land Use	Land Use (PLUC)	Yield	Parking Provision	
			Rate	Total
Retail Precinct	Retail (PLUC 5)	77,500sqm	4.5/100sqm	4,566
	Entertainment (PLUC 9)	16,000sqm		
	Office (PLUC 7)	7,960sqm		
Endeavour Precinct	Other Retail (PLUC 6)	11,518sqm	2.7/100sqm	1,339
	Service Industry (PLUC 4)	14,540sqm		
	Health, Welfare and Community (PLUC 8)	23,505sqm		
Banks Precinct	Storage and Distribution (PLUC 3)	8,578sqm	2.7/100sqm	351
	Service Industry (PLUC 4)	4,400sqm		
Residential	Residential (PLUC 10)	739 units	2/unit*	1,478
TOTAL		**-**	**-**	**7,734**

* - could be reduced to 1 per unit if BRT is available

The parking rate of 4.5 spaces per 100sqm for the shopping centre represents a decrease when compared to the existing provision of 4.8 spaces per 100sqm. This will assist in promoting changes in modal choice and reduce future congestion on the road network. To enable the activation of streets, on-street parking is proposed along Endeavour Road and Banks Avenue.

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Appendices

1 Introduction

Scentre Group has commissioned Cardno to prepare a Transport Report in support of the Structure Plan for the Whitford Activity Centre. This report includes consideration of transport requirements, opportunities, constraints and assessment of a potential future development scenario as part of the Structure Plan.

The development of the Whitford Activity Centre (the Centre) will embrace the principles outlined in current strategic planning for the Perth Metropolitan Area. The planning intent is to utilise and develop existing as well as new activity centres as places for living, working and relaxing. This will reduce the need for people to travel to the Perth CBD as a primary destination and will negate the capital cost of simply providing additional private vehicle capacity.

1.1 Scope of This Report

This report combines the output of high level assessments undertaken on the transport network with the outcomes of discussions with various stakeholders that have included:

> The City of Joondalup
> The Department of Transport (DoT)
> The Public Transport Authority (PTA) and
> Main Roads Western Australia (MRWA) and
> Department of Planning (DoP)

The findings of these studies and discussions have resulted in the identification of the required transport infrastructure upgrades for the Centre by the nominated design horizon of 2026. This sets the framework for any subsequent changes required by future development within the Centre to ensure compatibility with the future planning at the design horizon.

In preparing this report, the following tasks were undertaken:

> Review of relevant planning documentation
> Assessment of existing public transport infrastructure and the development of public transport strategy for the redeveloped Centre
> Assessment of the existing and future pedestrian and cycling infrastructure in terms of accessibility, legibility and safety
> Review of key roads and intersections affected by the proposed Centre redevelopment, along with a suggested road hierarchy to be adopted to assist future road planning
> Estimation of the future Centre traffic generation and distribution
> High level analysis of the effects of additional development traffic by the design year, 2026
> Review of parking provision rates for the overall Centre in line with best practice and
> Summarising a framework of improvement for the Structure Plan

1.2 References

The following documents have been used as a guide to the preparation of this report:

> *Structure Plan Preparation Guidelines* – Department of Planning, August 2012
> *Directions 2031 and Beyond – Metropolitan Planning Beyond the Horizon*, Department of Planning, August 2010
> *Outer Metropolitan Perth and Peel – Sub-regional Strategy*, Department of Planning, August 2010
> *Public Transport for Perth in 2031* – Department of Transport, July 2011
> State Planning Policy 4.2 – *Activity Centres for Perth and Peel*, Government of Western Australia, August 2010
> *Transport Assessment Guidelines for Developments – Volume 2 – Structure Plans,* Department of Planning, August 2006
> City of Joondalup – *Local Planning Strategy*
> *Bike Plan 2009 – City of Joondalup*, Aurecon, June 2009
> *Metropolitan Region Scheme,* Department of Planning
> *Liveable Neighbourhoods,* Department of Planning, January 2009, Update 02

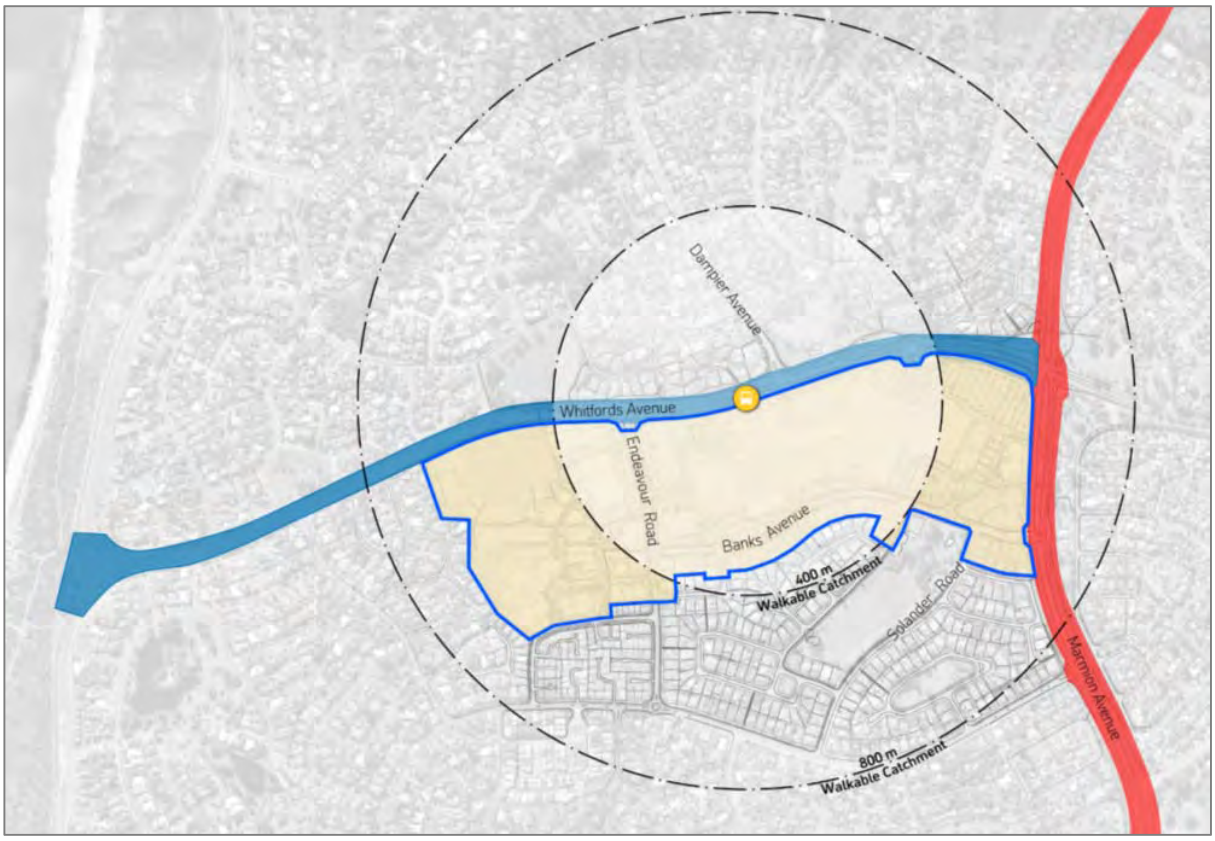
> *Parking Generation,* Third Edition, The Institute of Transportation Engineers, 2004 and
> *Trip Generation*, Seventh Edition, The Institute of Transportation Engineers, 2003.

2 Planning Context

2.1 Site Location

Whitford Activity Centre is located in the suburb of Hillarys within the City of Joondalup approximately 20km north of the Peth CBD. The Centre is bounded by Whitfords Avenue to the north and Marmion Avenue to the east, incorporating the existing Westfield Whitford City Shopping Centre and adjacent commercial areas. In addition, the proposed Structure Plan includes St. Marks Anglican Community School, mixed-use development along Banks Avenue and development within existing residential neighbourhoods to the south and west.

Figure 2-1 Whitford Activity Centre – Site Location



2.2 Policy

Various planning policies direct the development and supporting infrastructure in Activity Centres such as Whitford. Those relevant are:

- ***Directions 2031 and Beyond (2010)*** - in terms of transportation, the 2031 plan encourages the planning and development of key public transport corridors, urban corridors and transit oriented developments to accommodate increased housing needs and encourage reduced vehicle use. The 2031 plan encourages connectivity through creating and enhancing transport and freight movement networks between activity centres and industrial centres
- ***Outer Metropolitan Perth and Peel Sub-Regional Strategy (Draft, 2010)*** - the sub-regional strategy is a supplementary document of *Directions 2031 and Beyond* within the Perth and Peel strategic planning hierarchy. It sets out guidance for implementing the 2031 plan at a local level, ensuring a seamless approach to planning issues that traverse local government boundaries including transport accessibility
- **State Planning Policy 4.2 *Activity Centres for Perth and Peel (2010)***– this document specifies broad planning requirements for the planning and development of new activity centres and the redevelopment and renewal of existing centres in Perth and Peel and

> ***Public Transport for Perth in 2031 (draft)*** - The aim of this plan is to increase the level and quality of public transport provision in Perth; the plan is focused on the delivery of a new mass transit system for Perth, using existing road transport corridors. This will be implemented through provision of Light Rail Transit (LRT) in more active, central areas and Bus Rapid Transit (BRT) in outer areas

BRT at Whitford has been tentatively indicated as part of the post-2031 network but is assumed to depend on patronage projects and economic viability and therefore sections could be brought forward/reworked/removed as required.

Figure 2-2 Possible Rapid Transit Infrastructure – 2031

Source: Department of Transport

2.3 Development Context

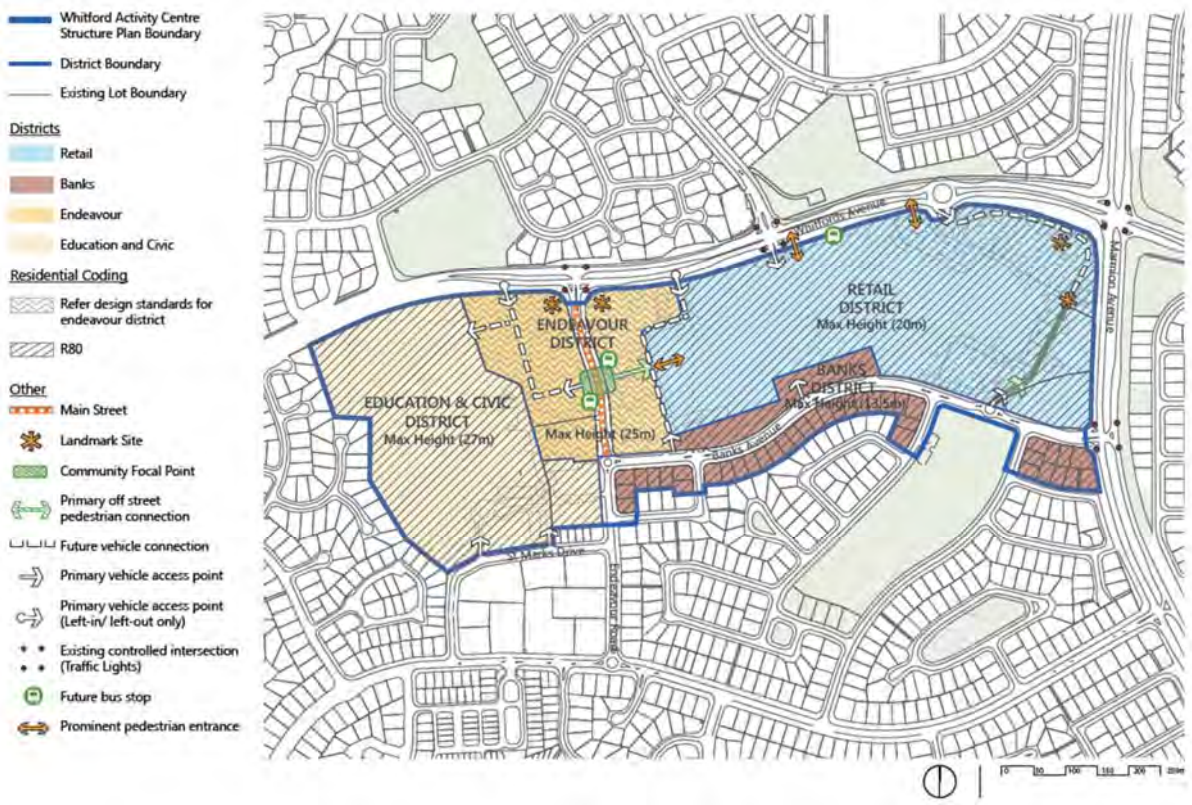
The proposed quantum and type of land uses within the Structure Plan has been determined by the performance criteria contained within SPP4.2 and the local context. By the year 2026, the proposed development will consist of a mix of uses including intensification of existing retail development and residential land uses, with the addition of mixed-use office/residential and recreation facilities.

The composition for the proposed development consists of the following:

Land Uses	Estimated Area
'Retail' (PLUC 5)	77,500 sqm
'Entertainment' (PLUC 9)	16,000 sqm
'Other Retail' (PLUC 6)	11,500 sqm
'Storage and Distribution' (PLUC 3)	8,500 sqm
'Health, Welfare and Community' (PLUC 8)	23,500 sqm
'Service Industry' (PLUC 4)	4,500 sqm
'Office' (PLUC 7)	22,500 sqm
'Residential' (PLUC 10)	739 dwellings

Figure 2-4 shows the proposed Westfield Whitford Activity Centre Structure Plan diagrammatically.

Figure 2-3 Whitford Activity Centre Structure Plan



3 Public Transport

3.1 Existing Public Transport Provision

Existing public transport in the vicinity of the Centre is provided by Transperth feeder bus services. The majority of these services run east-west along Whitfords Avenue to service the Whitford Train Station. Bus shelters have been provided along Whitfords Avenue, though not along most other local roads. Figure 3-1 shows the existing bus network in and around the Whitford Activity Centre.

Figure 3-1 Existing Transperth Bus Routes

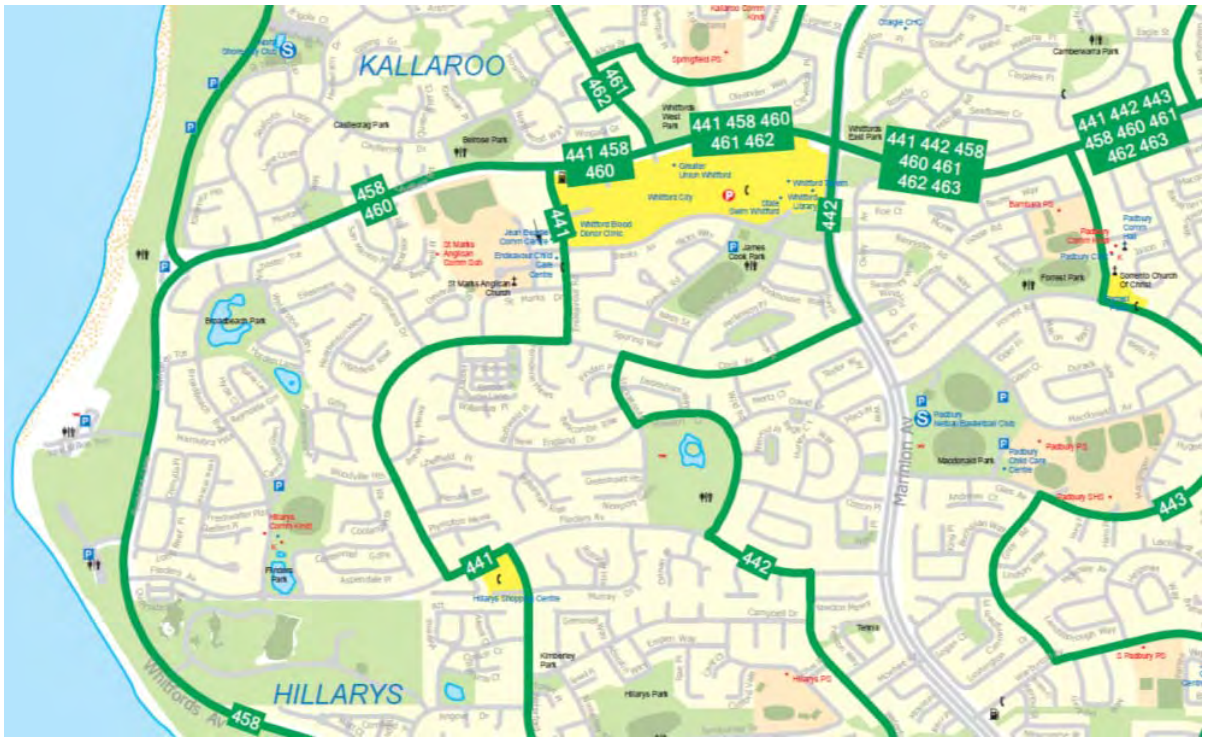


Table 3-1 describes the existing bus services and frequencies to the Whitford Activity Centre.

Table 3-1 Bus Routes and Service Frequencies

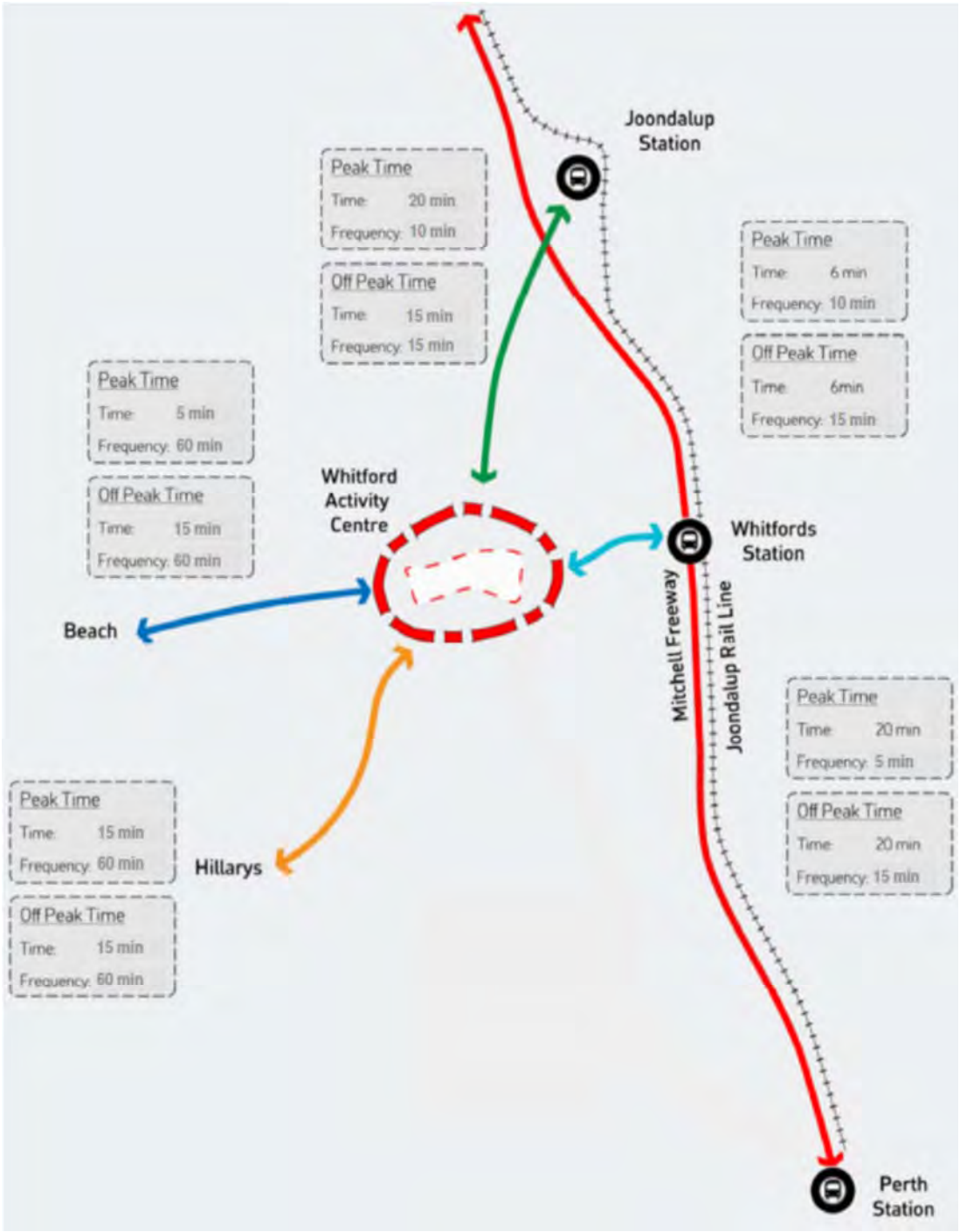
Route		AM Peak Frequency	PM Peak Frequency	Weekday Midday Frequency	Saturday Midday Frequency
To Whitfords	**Origin**				
441	Warwick Station via Hillarys	20 min	10 min	30 min	60 min
442	Warwick Station via Padbury	20 min	10 min	30 min	60 min
458*	Hillarys Marina via Scarborough	N/A	N/A	60 min	60 min
460	Joondalup Station via Kallaroo	20 min	20 min	30 min	N/A
461	Joondalup Station via Mullaloo	15 min	20 min	30 min	30 min
462	Joondalup Station via Beldon	15 min	20 min	30 min	N/A
From Whitfords	**Destination**				
441	Warwick Station via Hillarys	20 min	20 min	30 min	60 min
442	Warwick Station via Padbury	20 min	20 min	30 min	60 min
458*	Hillarys Marina via Scarborough	N/A	N/A	60 min	60 min
460	Joondalup Station via Kallaroo	N/A	10 min	30 min	N/A
461	Joondalup Station via Mullaloo	30 min	10 min	30 min	30 min
462	Joondalup Station via Beldon	30 min	10 min	30 min	N/A
Combined					
	To Whitfords Station	3.5 min	3 min	5.5 min	12 min
	From Whitfords Station	6 min	2.5 min	5.5 min	12 min

* - 458 service due to be removed in February 2015 as part of timetable restructure

While all services are bi-directional, service frequencies between Whitford and Warwick are dependent upon the peak period. Peak frequencies in this case apply for southbound (to Warwick) services in the AM peak, and for northbound (to Whitford) services in the PM peak.

Public transport between the Centre and major transport destinations is of a high standard, with efficient and frequent connections to Joondalup and the Perth CBD, among others. Figure 3-2 shows the average journey times between these destinations and the Whitford Activity Centre.

Figure 3-2 Public Transport Frequency and Journey Time



From the information shown in Figure 3.2 above, it is clear that the Centre is well served by public transport for the purpose of connecting passengers to the Northern Train Line and Joondalup. Local service from the surrounding catchment into the Centre is also reasonable.

Pedestrian access to the Centre from local bus stops is primarily from Whitfords Avenue, with passengers crossing via the existing pedestrian facilities at the signalised intersections of Whitfords Avenue with Endeavour Road and Dampier Avenue. A pedestrian underpass facility is also provided close to the bus stops located to the west of the vehicular access roundabout on Whitfords Avenue.

The mix of uses proposed in the Structure Plan, particularly with respect to office uses, provides an opportunity to promote public transport modes. The close proximity and high frequency of bus service from the Northern Train Line implies a high attractiveness for public transport modes.

3.2 Regional Strategy – Bus Rapid Transit

The Department of Transport document *Public Transport in Perth* 2031 indicates a large increase in patronage between Whitford train station and Perth CBD and a subsequent increase in bus passenger patronage along Whitfords Avenue.

The 2031 plan shows Whitfords Avenue forming part of a Bus Rapid Transit (BRT) corridor between Joondalup and Warwick Stations. This has been tentatively indicated for after 2031 but is assumed to depend on patronage projections and economic viability facilitated by appropriate development, and could therefore be brought forward in the right circumstances.

Through discussions with DoT, Whitford City has been determined as a possible location for a BRT stopping point.

3.3 Structure Plan Public Transport Strategies

The proposed Structure Plan public transport strategies aim to build on the existing provisions, accounting for the form and location of new development as well as responding to the wider strategies, such as BRT. This provides potential solutions to set the framework for the future infrastructure provisions that any new development will respect and provide for, where deemed necessary to account for the transport impacts of that development.

3.3.1 Rerouting of Bus Services

In creating the mixed land uses within the Endeavour Precinct, it may be appropriate to further activate Endeavour Road and provide increased choices to utilise public transport, particularly for new residential uses. To this end, the 442 bus service has been identified as a service that could be rerouted to Endeavour Road, increasing the number of services and bus frequencies in this area. This change would only exert a very minor impact on catchment along the existing corridor and would maximise catchment through the new higher density development. The timing of this alteration would be dependent on the increased density within the Endeavour Road Precinct.

3.3.2 Bus Station and Bus Stop Locations

The existing location of bus stops on Whitfords Avenue are well placed to serve the Centre retail district and will therefore be the focus of development of a high frequency system of bus routes serving the Centre between Joondalup and Whitford Station. However, potential upgrades to the facilities on Whitfords Avenue have been considered, particularly regarding the possible consolidation of bus services to one location. One potential solution considered is the creation of a bus station on the southern side of Whitfords Avenue with a provision of four bus stands to be utilised by both westbound and eastbound services. This improves public transport accessibility to the shopping centre by shortening the walking distance between the station and the shopping centre while consolidating bus stops. A concept of this bus station is included at Appendix A.

The concept considers an ultimate form of the high frequency station and determines its preferred location relative to shopping centre access points, built form integration and further determines that appropriate reservations exist to accommodate the concept. The delivery of this concept will be aligned with the PTA's BRT implementation.

The operation of the bus station as shown in the concept would require eastbound buses to U-turn at the shopping centre car park access roundabout on Whitfords Avenue before entering the bus station and performing a U-turn under a dedicated signal phase at the Whitfords Avenue / Dampier Avenue signals to exit the bus station and continue eastbound along Whitfords Avenue. Details of the impact of these operations on bus journey times and other vehicles are detailed in Section 0. This concept is fully compatible with bus lanes added to the eastbound and westbound corridors as part of future planning for the BRT.

Following the intensification of bus services on Endeavour Road as described above, the construction of premium bus stops in the Endeavour Road Precinct should be considered to maximise the customer experience and make the use of public transport more attractive.

3.3.3 Additional Measures to Encourage Patronage

In addition to the above, the following measures should also be considered as part of an ongoing program to make public transport use more attractive:

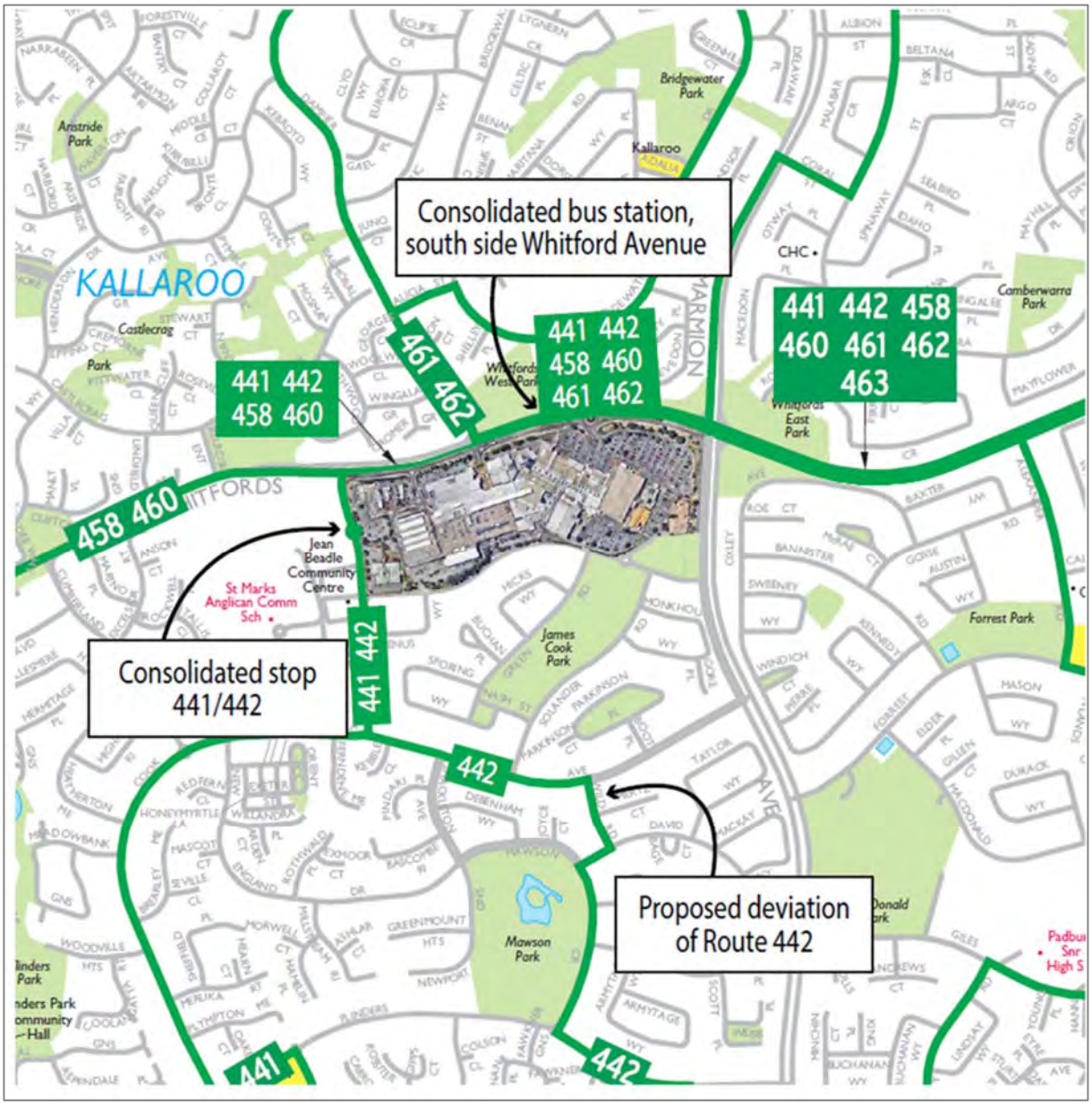
> Real-time information to advise patrons of incoming services to minimise existing uncertainty in the system. This would be particularly effective during off-peak periods
> Provide secure bicycle parking/storage for commuters at high quality public transport nodes and
> Investigate potential for providing queue-jump lanes and signal phasing for buses at signalised intersections

The above measures would greatly assist in changing travel attitudes of both the local residents and those that commute to the Centre.

The existing bus network in the vicinity is shown in Figure 3-3, with the proposed bus network shown in Figure 3-4.

Figure 3-3 Existing Bus Network

Figure 3-4 Proposed Structure Plan Bus Network



3.3.4 Future Planning – Rapid Transit for Perth's North-West

In the long term, the potential future BRT route would pass the Centre on Whitfords Avenue. The aim of rapid transit is to achieve something akin to a suburban rail service. BRT would run on a limited stop, express service basis, providing a convenient, reliable service with as little interruption to journeys as possible. It is assumed, due to the planning of the BRT corridor between Joondalup and Warwick and the subsequent downgrade to bus lanes towards Balcatta, that BRT vehicles will have higher priority over traffic along the BRT route. This would entail provision of bus lanes and signal phasing that would allow bus priority through selected (or potentially all) signalised intersections.

The concept plans in Appendix A show potential bus priority measures that are compatible with the above principles and include the dedicated exit from the bus station on Whitfords Avenue to the Whitfords Avenue / Dampier Avenue intersection and the west and eastbound bus lanes through the Marmion Avenue / Whitfords Avenue intersection.

4 Active Transport

4.1 Existing Active Transport Provisions

Pedestrian footways are provided on the both side of all roads in the Centre with the exception of the residential access roads south of Banks Avenue that have footways on only one side. Controlled road crossings are provided at each of the Signalised intersections:

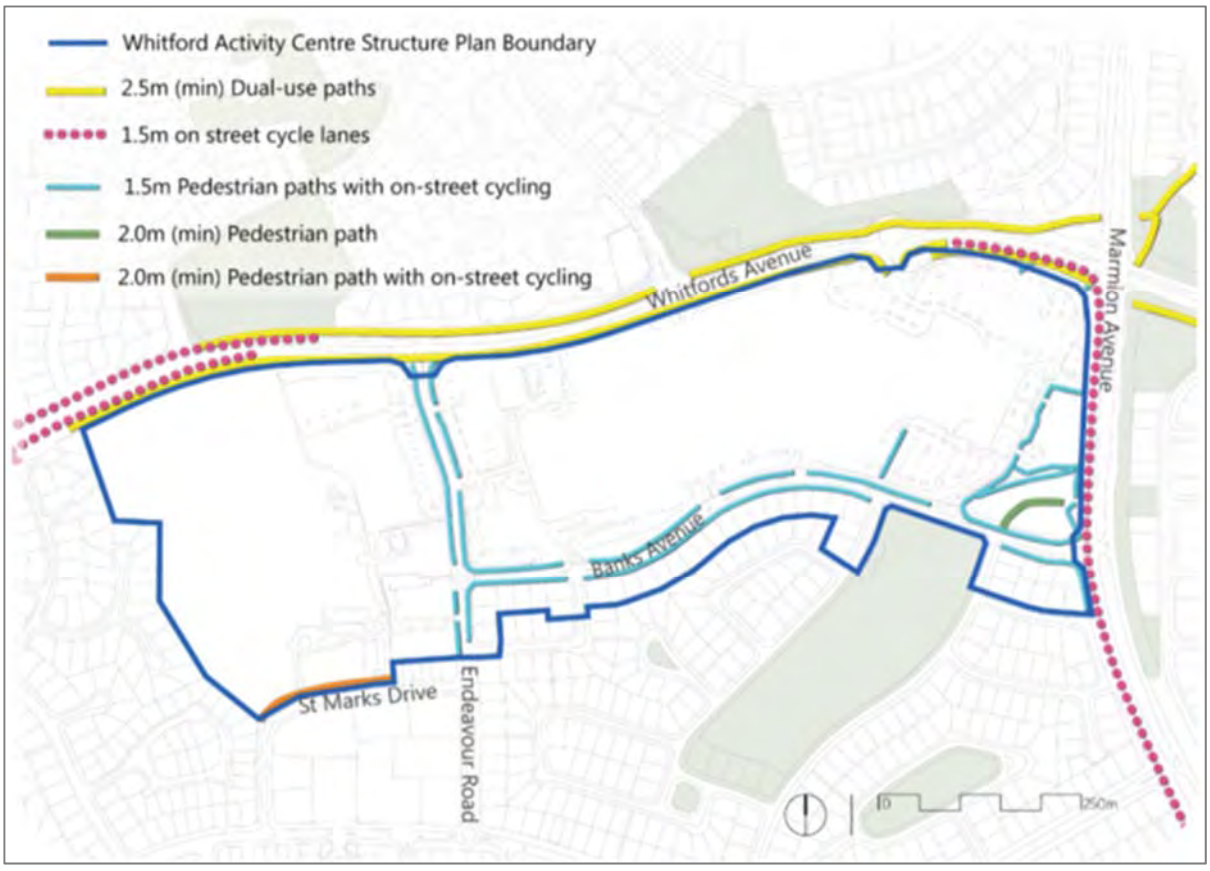
> Marmion Avenue / Whitfords Avenue
> Marmion Avenue / Banks Avenue
> Whitfords Avenue / Dampier Avenue and
> Whitfords Avenue / Endeavour Road

Informal crossing points are also located close to intersections and the main pathways to and from the shopping centre. A pedestrian underpass is located on Whitfords Avenue providing a connection between the shopping centre and both the bus stops on Whitfords Avenue and residencies to the north. Close to the school entrance on Endeavour Road, there is a single control point, attended during school peaks by a crossing guard.

The existing cycling infrastructure links the Centre and surrounding area to the Mitchell Freeway and rail station. Various standards of cycle provision are provided within the Centre. It is noted that the current Joondalup Bike Plan from 2009 proposes new on road cycle paths on Whitfords Avenue, east of Dampier Avenue and an Arterial Shared Path along Marmion Avenue as part of future planning.

The existing pedestrian and cycling facilities that serve the Centre are shown in Figure 4-1.

Figure 4-1 Existing Pedestrian and Cycling Infrastructure



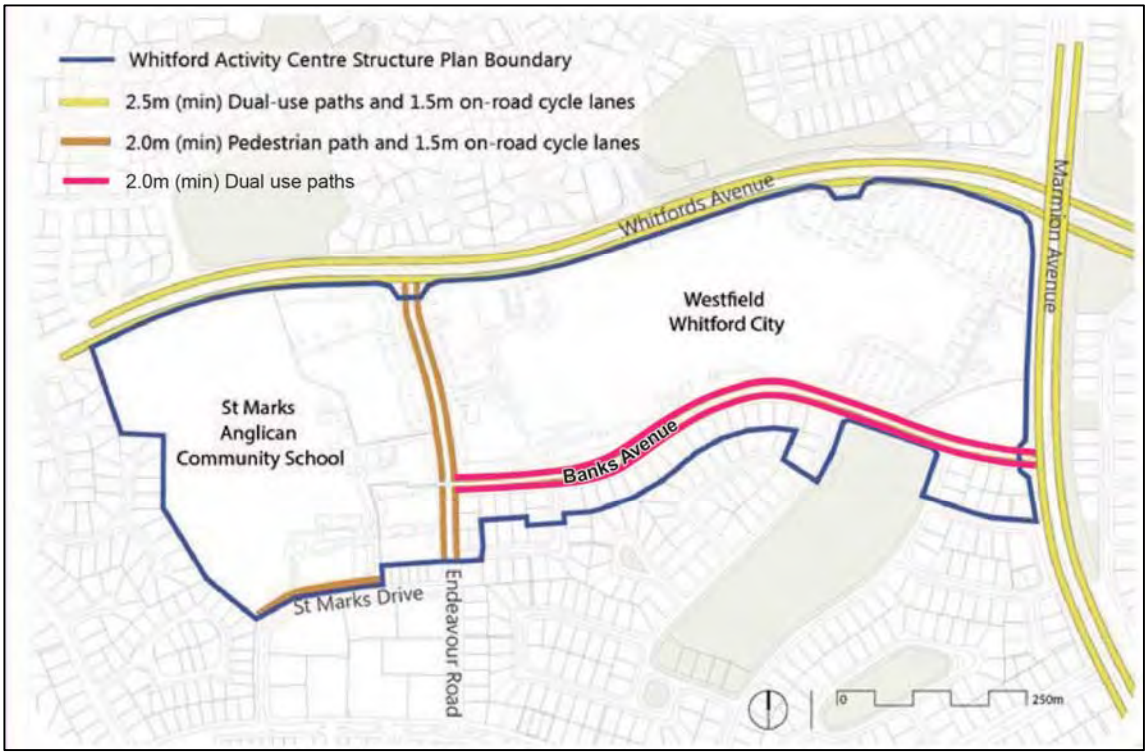
4.2 Structure Plan Active Transport Strategies

The Structure Plan identifies opportunities for pedestrian and cyclist access from the surrounding residential neighbourhood and within its boundaries. Through the use of integrated mixed-use development, residents and employees will be located within close walking distance to a variety of destinations, including retail, business and entertainment precincts. The development of the Centre will place a focus on the improvement of existing and provision of new facilities to promote the use of active transport modes within the site and to/from the surrounding residential area, including:

> Providing an improved network of footways around and within the Centre
> Improved access across customer car parks accessing main building entrances, adhering to pedestrian/cyclist desire lines from outside the Centre
> improving amenity within subways across Whitfords Avenue and Marmion Avenue
> Careful consideration of new public transport infrastructure and how this is to link with entrances to buildings within the Centre and existing/new pedestrian/cyclist facilities
> Placing high quality end-of-trip facilities at key locations within the Centre, such as:
  - secure parking for cyclists for all land uses in line with national standards
  - lockers, showers and changing facilities for staff and
  - commuter end of trip facilities at public transport nodes

The Structure Plan improvements are shown in Figure 4-2 and specific improvements discussed below.

Figure 4-2 Proposed Pedestrian and Cycling Infrastructure



Note that on road cycle lanes along Whitfords Avenue are shown as they are included in the 2009 City of Joondalup Bike Plan.

4.2.2 Pedestrian Access

Improvements to the existing subway connections across Whitfords Avenue and Marmion Avenue will enhance the use of these connections as safe alternatives to at-grade crossing.

Upgrades identified include wall treatments and artwork along with inventive lighting that will make these spaces more attractive and improve pedestrian amenity, safety and connectivity. Entry treatments such as canopies and landscaping will help better define these connections; provision of consistent and legible routes and signage will also help increase usage and thereby increase passive surveillance.

The footways along Banks Avenue will be widened from 1.2m to 2.0m. This will enable shared use with cycles.

These improvements would improve the quality of, and create attractive and safe links to the Centre, but would also have substantial benefits for local residents. Integrating any potential improvements into the public transport and pedestrian networks would further promote active and sustainable transport modes.

4.2.3 Cycling

As part of the Structure Plan, on-road cycle lanes are indicated along Endeavour Road. Widened footways along Banks Avenue will enable dual use. This can be achieved through the reallocation of carriageway space along this road while also incorporating on-street parking along the northern side of this road. The existing and future cross-sections for Banks Avenue and Endeavour Road are described in Section 5.5.

Improvements to off-street paths through the creation of a comprehensive network of safe shared facilities will promote a mode shift towards active transport modes and away from vehicular modes. This is particularly important for members of the community with minimal access to motorised transport such as students, elderly persons and persons with disabilities. In particular, safe and secure road crossings are imperative for providing accessibility.

4.2.4 Cycle Parking and End of Trip Facilities

Cycle parking is to be provided as per the rates described in Table 4-1.

Table 4-1 Cycle Parking Rates

Use	Minimum Long Term Parking	Minimum Short Term Parking
Multiple Dwelling	As per the Residential Design Codes	As per the Residential Design Codes
Short Stay Accommodation, Hotel (accomm), Motel	1 space per 40 guest bedrooms	Nil.
Commercial **	1 space per 1,500m² NLA	1 space per 1,000m² NLA
Office	1 space per 250m² NLA	1 space per 750m² NLA
Consulting Rooms, Medical Centre	1 space per 8 practitioners	1 space per 4 practitioners
Hotel, Tavern, Small Bar, Nightclub	1 space per 100m^2 of bars and public areas including lounges, beer gardens and restaurants.	1 space per 150m² of bars and public areas, including lounges, beer gardens and restaurants
Recreation Centre, Private Recreation.	1 space per 400m² NLA available to the public, including swimming pools	1 space per 200m² NLA available to the public, including swimming pools
Public exhibition facility, Place of Worship, Place of Assembly, Reception Centre.	Nil	1 space per every 30 people the space is designed to accommodate.
Showroom	1 space per 750m^2 NLA for premises greater than 300m^2 NLA.	1 space per 1,000m^{2}NLA

** Commercial includes a Shop, bank, Betting Agency, Convenience Store, Drive Through Food Outlet, Lunch Bar, Restaurant, Restricted Premises and Service Station. Uses not listed will be at the discretion of the City.

End of trip facilities support the use of bicycle transport by allowing cyclists the opportunity to shower and change at the beginning or end of their journey to and from work. They include separate male and female changing rooms with shower facilities and lockers for the storage of clothing and other personal items.

All non-residential development, where more than six bicycle spaces will provide end of trip facilities in accordance with the below standards:

- A minimum of one locker for each bicycle space
- A minimum of one unisex shower and change room. Additional shower facilities are to be provided at a rate of one female shower and one male shower for every additional 10 bicycle parking bays, to a maximum of five female and five male showers per development
- End of trip facilities must be located as close as possible to bicycle parking facilities and
- End of trip facilities must be located in convenient locations, such as near building entrances and near cycling routes

5 Road Infrastructure

5.1 Road Hierarchy

MRWA define their functional road hierarchy over four levels. The Department for Planning defines a greater number of levels in their *Liveable Neighbourhoods* document with a focus on being able to distinguish a greater array of characteristics. Table 5-1 describes how the two differing hierarchy descriptions align and their various characteristics with consideration of the road within the Centre.

Table 5-1 Road Hierarchy Definition

Main Roads Functional Road Hierarchy	Liveable Neighbourhoods	Description	Characteristics
Primary Distributor	Primary Distributor	Regional links	Multi-lane highways
District Distributor A	Integrator A	Arterial links connecting suburbs and centres to regional links	Four-lane, parking, cycle lanes
	Integrator B		Two-lane, parking, cycle lanes
Local Distributor	Neighbourhood Connector A	Sub-arterial links connecting access roads to arterial links	Two-lane divided, parking, cycle lanes
	Neighbourhood Connector B		Two-lane undivided, parking
Access Road	Access Streets	Provides access to property, low speed environment	Undivided, parking indents

The current road hierarchy for the Centre is shown in Figure 5-1.

Figure 5-1 Existing Structure Plan Road Hierarchy

5.2 Current Road Network

5.2.1 Current Road Links

Marmion Avenue

Marmion Avenue functions as the primary north-south arterial road for the local area, connecting the north-west subregion with West Coast Highway and onward to Fremantle. It is a Red Road (primary regional road) under the MRS and is therefore controlled by Main Roads WA (MRWA). Marmion Avenue is a four-lane divided road within a road reserve of approximately 60 metres and a speed limit of 60km/h in the vicinity of the Centre.

Whitfords Avenue

Whitfords Avenue functions as an east-west sub-arterial, connecting the suburbs of Kallaroo, Craigie, Hillarys and Padbury with Mitchell Freeway. It is a Blue Road under the MRS and is therefore controlled by WAPC. Whitfords Avenue is a four-lane divided road within a road reserve of approximately 40 metres and a speed limit of 60km/h in the vicinity of the Centre, increasing to 70km/h either side of the Centre. The road downgrades to a two lane undivided road between Endeavour Road and Belrose Entrance.

Endeavour Road

Endeavour Road functions as a north-south local distributor, connecting the Hillary suburb to Whitfords Avenue and is controlled locally by the City of Joondalup. Endeavour Road is a two-lane undivided road with a painted median strip in a road reserve of approximately 25m. The speed limit is generally 50km/h along this road.

Banks Avenue

Banks Avenue functions as an east-west local distributor connecting Marmion Avenue with Endeavour Road. The road is locally controlled by the City of Joondalup. Banks Avenue is a two-lane undivided road with a painted median strip in a road reserve of approximately 25m. The speed limit is 50km/h along this road.

5.2.2 Current Road Intersections

Access to the Centre is provided primarily via Marmion Avenue and Whitfords Avenue. Local access is also available from the south and west via the local road network. Endeavour Road and Banks Avenue provide connections through the Centre from major roads. The major intersections in the vicinity of Whitford City are outlined below.

Whitfords Avenue/Endeavour Road

A 3-way signal controlled intersection including left and right turning pockets along Whitfords Avenue and a wide central median sufficient for storage of right-turning cars as shown in Figure 5-2 with integrated pedestrian crossing facilities.

Figure 5-2 Whitfords Avenue/Endeavour Road Intersection

Whitfords Avenue/Dampier Avenue/shopping centre access

A 4-way signalised intersection including left and right turning pockets on Whitfords Avenue as shown in Figure 5-3. Provision for crossing pedestrians is included within the signal phasing.

Figure 5-3 Whitfords Avenue/Dampier Avenue Intersection

Whitfords Avenue/Marmion Avenue

A major 4-way signalised intersection including right turning pockets and left-turn unsignalised slip lanes on all approaches. The existing layout of this intersection is shown in Figure 5-4. Pedestrian provision has not been explicitly included within the signal phasing; however actuated crossing facilities are provided. Phases for all approaches provide sufficient crossing time for pedestrians intending to cross at this location.

Figure 5-4 Whitfords Avenue/Marmion Avenue Intersection

Marmion Avenue/Banks Avenue

A 3-way signalised intersection including a right turning pocket and unsignalised left turn slip lanes on Marmion Avenue and Banks Avenue, as shown in Figure 5-5.

Figure 5-5 Marmion Avenue/Banks Avenue Intersection

The proximity of higher order roads including Whitfords Avenue and Marmion Avenue allows for efficient access to and from the Centre. The location of these roads and the high quality of access from the Centre implies that the majority of traffic demands will be accommodated within the regional road network and will minimise future local traffic issues.

5.3 Current Centre Access Arrangements

Access to Whitford City Shopping Centre and adjacent retail and commercial land uses is provided from Whitfords Avenue, Endeavour Road and Banks Avenue. There is no direct access via Marmion Avenue. A total of ten access intersections are currently in operation for the shopping centre making access convenient for visitors from all directions. These include:

From Whitfords Avenue

> 3-way main roundabout intersection west of Marmion Avenue
> 4-way signalised intersection with Dampier Avenue into basement car parking and
> Priority controlled intersection east of Endeavour Road, restricted to left-in/left-out only.

From Endeavour Road

> 3-way roundabout south of Whitfords Avenue and
> 3-way roundabout north of Banks Avenue into Endeavour Business Centre.

From Banks Avenue

> Priority controlled 3-way intersection east of Endeavour Road into Endeavour Business Centre
> 4-way priority controlled intersection opposite Venus Way, restricted egress to left-out only
> 3-way priority controlled intersection east of Venus Way into basement car park
> Minor priority controlled 3-way intersection west of Green Road and
> 3-way main roundabout intersection east of Green Road.

Access to the education precinct is currently from St Marks Drive.

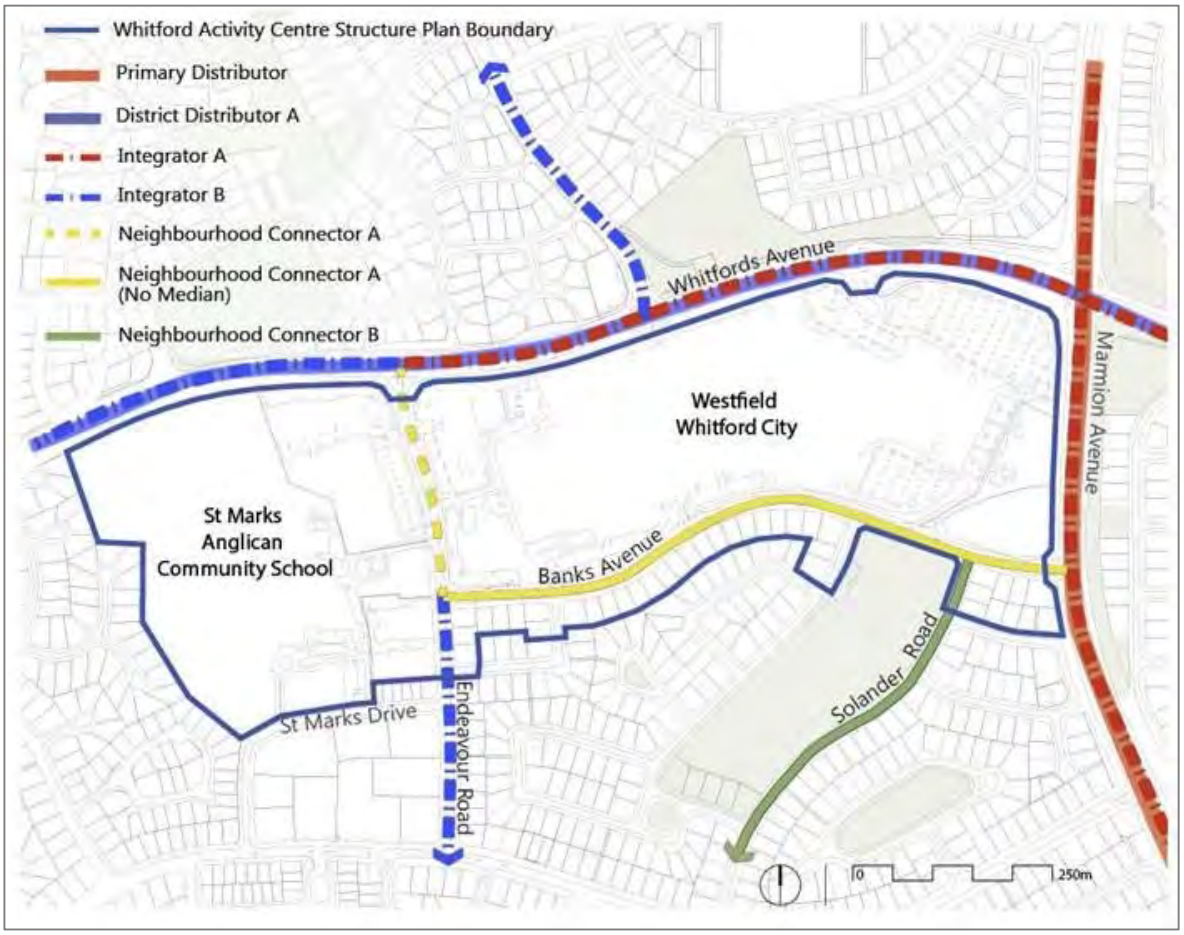
Access for the Endeavour Precinct is from driveway access onto Endeavour Road while all residential uses are from driveway access to Access Roads.

5.4 Structure Plan Road Hierarchy

A road hierarchy has been developed based on the examples given in Liveable Neighbourhoods and tailored to suit the existing road reserves in the Structure Plan area while the use of appropriate dimensions allows flexibility in design across all the higher and lower order roads that predate Liveable Neighbourhoods. This will allow any upgrade treatments to be applied within existing road reserves, with more generous median and verge dimensions applied where necessary.

The proposed future road hierarchy for the Structure Plan road network is shown in Figure 5-6 below. The extent of the ‘Integrator A’ along Whitfords Avenue is dictated by the future planning of a cycle lane indicated by the 2009 City of Joondalup Bike Plan.

Figure 5-6 Future Structure Plan Road Hierarchy



5.5 Structure Plan Road and Intersection Form

The development of the required Structure Plan road and intersection forms have been determined through the assessment contained within Section 6 of this report and potential solutions for the future form contained within the concepts shown in Appendix A.

Based on the above hierarchy, cross-sections have been developed for Endeavour Road and Banks Avenue as detailed in Figures 5.7 and 5.8 respectively. The median on Banks Avenue is removed to enable the provision of parking on both sides of the road and widened footways are provided in either direction. For Endeavour Road, the median is retained but kerbed to allow more pedestrian crossing locations. Indents are provided for bus stops.

Figure 5-7 Proposed Endeavour Road Cross-Section

Figure 5-8 Proposed Banks Avenue Cross-Section

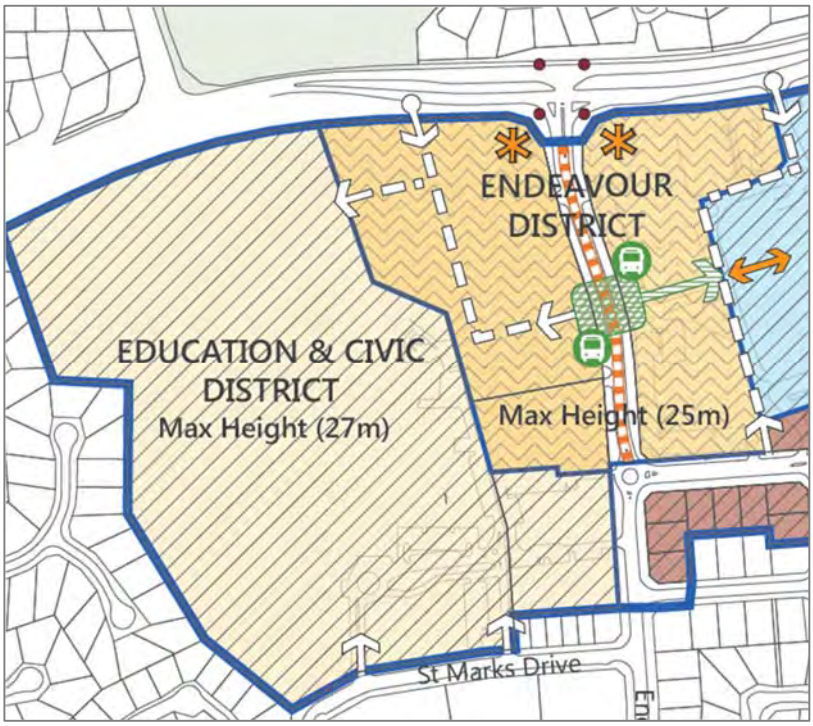
5.6 Structure Plan Access Strategy

The large number of available shopping centre access points tends to spread demand over a range of intersections. As a result, traffic impacts at individual access points are decreased. However, site observations suggest that some accesses attract a substantial proportion of the demand with resulting peak period delays and queuing for both inbound and outbound traffic. Any future expansion of the shopping centre would provide an opportunity to improve existing access intersections to increase capacity, reduce delays and minimise queuing. This may be through changes to access geometry or by improving way finding and directional signage to promote alternative access points.

Given the intended densification of the Endeavour District, together with the intended reconfiguration of Endeavour Rd to a 'high street', it is intended that circulation routes broadly located at the western and eastern boundaries of the Endeavour District enable access. These circulation routes are intended to service the intended form of the development in the Endeavour District. For the western circulation route, this will take the form of a public access in the form of a Local Access Road connecting with a left-in / left-out intersection with Whitfords Avenue and with the current shopping centre access roundabout to the south. In the case of the eastern route, this will be a circulation route also servicing the shopping centre.

- Access to the shopping centre and commercial uses currently located off Endeavour Road are proposed to be relocated or closed to encourage vehicles to use alternative routes to major generators. This implies that the majority of vehicles will access commercial and retail uses via existing access points along Whitfords Avenue and Banks Avenue. Requirements for the accommodation of these additional trips have been considered in this assessment.
- The western circulation road will, in the interim connect to the shopping centre car park access roundabout. Ultimately, this circulation route can extend further south, making a four-arm intersection with Endeavour road and Banks Avenue. A connection will also be made available to the Education and Civic District boundary for future potential access.

Figure 5-9 Indicative Alignment of Access to "Endeavour District" and "Education & Civic District"



These links will provide rear access to the buildings located along Endeavour Road. It is envisaged at this stage that the northerly access for the western circulation road to and from Whitfords Avenue would be limited to left-in/left-out movements only. The left-in movement would be provided with a dedicated deceleration lane and would therefore not impede traffic flow along Whitfords Avenue. The absence of right turns will mean no traffic queuing on Whitfords Avenue while removing the possibility for right angle crashes either in to or out of

the proposed link road. The concept of this intersection is shown in Appendix A, combined with proposed improvements (4-lane widening) of Whitfords Avenue, promoted by the City of Joondalup. The resulting intersection spacing from the new access point to the roundabout intersecting Whitfords Avenue with Bellrose Entrance is around 180m. This is consistent with intersection spacing at other road junctions along Whitfords Avenue.

6 Private Vehicle Demands

6.1 Existing Traffic Volumes

Existing traffic flows were obtained from the following sources:

- Pneumatic tube counter surveys placed on all roads bordering the Centre, undertaken in 2010
- 2010 SCATS data was sourced from Main Roads WA for the following signalised intersections:
  - Marmion Avenue/Whitfords Avenue
  - Marmion Avenue/Banks Avenue
  - Whitfords Avenue/Dampier Avenue
- 2012 Manual turning movement traffic counts at each of the access points to the shopping centre

All surveyed volumes have been adjusted where required to demonstrate 2012 traffic volumes.

In order to determine the weekday AM and PM Peak hours for the assessment, the total traffic volumes entering and exiting the intersections were surveyed for successive one hour increments and have been compared. The peak hours identified from this analysis are as follows:

- AM Peak Hour 8:00am to 9:00am
- PM Peak Hour 5:00pm to 6:00pm.

Saturday peak hour movements were also obtained, but represented lower overall traffic flows. For the purposes of this assessment, Thursday has been chosen as a peak weekday, due to the impacts of existing and proposed retail uses in the Centre. The Thursday data obtained has been calibrated to an equivalent 20th design day by comparing historic door count data from the shopping centre. This represents an additional 10% trip generation above the observed data. 2012 peak hour volumes are shown at Appendix B.

6.2 Design Year Selection and Traffic Growth

It is understood that MRWA have advised that the Regional Operations Model (ROM) indicates traffic volume increases of 17.5% between the modelled years 2011 to 2031.

Conservatively this assessment has applied growth to the network between 2012 and the assessed design horizon of 2026 by interpolating the expected growth to a per annum increase of 0.85%. This growth rate has been applied to background trips only, which is considered appropriate noting that traffic associated with additional Structure Plan yields have been added to baseline road network volumes.

In addition, MRWA have indicated that the 17.5% growth rate is based on daily trips rather than peak period growth. It is unlikely that peak period traffic volumes would grow at this rate noting that the road network is already congested. Instead traffic peaks are likely to spread, allowing for increases in daily traffic volumes but reducing peak traffic volume growth. Application of this growth rate to peak traffic volumes is therefore considered highly conservative.

Design horizon traffic volumes are shown at Appendix C that include development generated and background traffic growth. Details of trip generation calculations are shown at Appendix D.

6.3 Key Intersection Performance

Intersection capacity analysis using the SIDRA computer package was undertaken for key intersections to assess the traffic operations under existing and future traffic demand scenarios.

SIDRA is a commonly used intersection-modelling tool by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of degree of saturation, level of service, average delay and 95% queue. These characteristics are defined as follows:

- **Degree of Saturation (DoS)** is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity
- **Level of Service (LOS)** is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are six levels of

services, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow)

> **Average Delay** is the average of all travel time delays for vehicles through the intersection

> **95% Queue** is the queue length below which 95% of all observed queue lengths fall.

Key characteristics of the study intersections within the Structure Plan are summarised in Table 6-1. The location of each is illustrated on Figure 6-1.

Table 6-1 Key Intersections Overview

ID	Intersection	Existing Form
E-1	Whitfords Avenue/Access 1	Roundabout
E-2	Whitfords Avenue/Dampier Avenue/Access 2	Traffic Signals
E-3	Whitfords Avenue/Access 3	Priority
E-4	Endeavour Road/Access 4	Roundabout
E-5	Endeavour Road/Access 5	Roundabout
E-6	Banks Avenue/Access 6	Priority
E-7	Banks Avenue/Access 7	Priority
E-8	Banks Avenue/Access 8	Priority
E-9	Banks Avenue/Access 9	Priority
E-10	Banks Avenue/Access 10	Roundabout
E-11	Whitfords Avenue/Marmion Avenue	Traffic Signals
E-12	Whitfords Avenue/Endeavour Road	Traffic Signals
E-13	Endeavour Road/Banks Avenue	Roundabout
E-14	Banks Avenue/Green Road	Priority
E-15	Banks Avenue/Solander Road	Priority
E-16	Marmion Avenue/Banks Avenue	Traffic Signals

Figure 6-1 Key Intersections Overview

6.4 Trip Generation

To assess the potential traffic impacts associated with the proposed Structure Plan, a traffic generation and distribution exercise was undertaken. The aim of this exercise was to establish the amount of traffic that could be generated by the intensification and to then quantify the effect that the additional traffic has on the surrounding road network.

Land uses which are located in the Westfield Whitford City Shopping Centre (Westfield Whitford City) precinct have been clustered in order to estimate future traffic volumes e.g. entertainment yields are currently located within the Westfield Whitford City precinct and therefore these yields are assumed to generate traffic at shopping centre rates.

The traffic generation of other land uses were estimated based on individual land use generation rates. A detailed assessment of the Structure Plan area traffic generation is shown in Appendix D. No change in modal split has been assumed for future generation rates and in addition to the background growth applied, the trip generation is considered worst case.

6.4.1 Adopted Development Yields

Table 6-2 provides an overview of the Structure Plan area yields adopted in this assessment.

Table 6-2 Adopted Structure Plan Area Development Yields

Land Use	2012 Development Yield	Design Horizon Development Yield
Shop Retail (PLUC 5)	49,847sqm	77,500sqm
Other Retail (PLUC 6)	8,895sqm	11,518sqm
Office/Business (PLUC 7)	7,820sqm	22,360sqm
Health/Welfare/Community(PLUC 8)	16,214sqm	23,505sqm
Entertainment (PLUC 9)	9,492sqm	15,992sqm
Storage/Distribution (PLUC 3)	3,885sqm	8,578sqm
Service Industry (PLUC 4)	2,783sqm	4,400sqm
Residential (PLUC 10)	35 dwellings	739 units
TOTAL	**98,936sqm***	**163,853sqm***

* - excluding residential
Source: Scentre Group – September 2014

6.4.2 Shopping Centre Land Uses.

Shopping Centres are an aggregation of a number of uses (generally, Retail, Office, Entertainment & Storage). Given that shopping centres are normally assessed independently (including in District Planning Scheme No. 2), in terms of traffic generation and car parking rates, Table 6-3 below articulates the allocation of land uses contained within the shopping centre relative to the remainder of the Centre.

Table 6-3 Land Use Allocation for Assessment Purposes

Land Use	Land Use (PLUC)	Yield	
Shopping Centre	Retail (PLUC 5)	77,500sqm	101,460sqm
	Entertainment (PLUC 9)	16,000sqm	
	Office (PLUC 7)	7,960sqm	
Other Retail	Other Retail (PLUC 6)	11,518sqm	11,518sqm
Office/Business	Service Industry (PLUC 4)	14,540sqm	14,540sqm
Health/Welfare/Community (Clinic)	Health, Welfare and Community (PLUC 8)	23,505sqm	23,505sqm
Storage Distribution	Storage and Distribution (PLUC 3)	8,578sqm	8,578sqm
Service Industry	Service Industry (PLUC 4)	4,400sqm	4,400sqm
Residential	Residential (PLUC 10)	739 units	739 units
TOTAL		**163,853sqm***	**163,853sqm***

6.4.3 Total Traffic Generation

The resultant Design Horizon trip generation for the Structure Plan area is summarised in Table 6-4.

Table 6-4 Design Horizon Traffic Generation

Land Use	Yield	Trip Rates		Traffic Generation (vph)	
		Thursday PM	Saturday AM	Thursday PM	Saturday AM
Shopping Centre – 85th%ile	101,312sqm	4.5 trips/100sqm GFA	5.9 trips/100sqm GFA	4,593	6,009
Other Retail (Bulk Retail)	11,518sqm	2.7 trips per 100sqm	3.9 trips per 100sqm	311	449
Office/Business	14,540sqm	1.2 trips per 100sqm	0.6 trips per 100sqm	174	87
Health/Welfare/ Community (Clinic)	23,505sqm	3.4 trips per 100sqm	3.4 trips per 100sqm	796	796
Storage Distribution (Industrial)	8,578sqm	0.56 trips per 100sqm	0.28 trips per 100sqm	48	24
Service Industry (Industrial)	4,400sqm	0.56 trips per 100sqm	0.28 trips per 100sqm	25	12
Residential (Medium Density)	739 units	0.4 trips per dwelling	0.4 trips per dwelling	296	296
TOTAL	**163,853sqm***	**-**	**-**	**6,243**	**7,673**

* - excluding residential

The net increase in traffic volumes associated with the Structure Plan Design Horizon yields are summarised in Table 6-5 by subtracting the generation associated with the existing uses within the Centre.

Table 6-5 Net Increase Traffic Generation

Land Use	Traffic Generation (vph)	
	Thursday PM	Saturday AM
Shopping Centre (85%ile Design Horizon minus 2012 Survey)	660	1,048
Other Retail (Bulk Retail)	71	102
Office/Business	174	87
Health/Welfare/Community (Clinic)	247	247
Storage Distribution (Industrial)	27	13
Service Industry (Industrial)	9	4
Residential (Medium Density)	310	310
TOTAL	**1,498**	**1,811**

6.5 Traffic Distribution

Shopping Centres extensively research and document their customer base including where they come from. In this context the Shopping Centre customer distribution is a good proxy for the general Centre's traffic distribution. (External traffic distribution was based on analysis of credit card data for the existing Westfield Whitford City). Credit card data identifies the proportion of transactions which come from Statistical Areas. Assumptions about the most likely route travelled to/from the centre were then made based on the location of each Statistical Area.

Table 6-6 outlined the traffic distribution applied to new trips associated with the increased yields within the Structure Plan area. This distribution focuses on the uses having the greatest influence on the intersections within the Centre.

Table 6-6 Adopted Local Traffic Distribution

Origin/Destination	Proportion
South via Endeavour Road	5%
South via Marmion Avenue	25%
West via Whitfords Avenue	15%
East via Whitfords Avenue	30%
North via Marmion Avenue	20%
North via Dampier Avenue	5%

6.6 Intersection Assessment Outcomes

A summary of the outcomes of the intersection assessments is shown in Table 6-7. Modifications or upgrades required to maintain an acceptable level of operation and/or mitigate the impacts of the proposed development by the design horizon are considered potential solutions for the Centre as a whole. The requirements of any improvements as the result of development alone would be subject to specific assessment. Concepts of all changes are shown in Appendix A and detailed operational analysis can be found in Appendix D.

Table 6-7 Traffic Analysis Summary

ID	Intersection	Upgrade Required	Details of Required Upgrade
E-1	Whitfords Avenue/Access 1	×	N/A
E-2	Whitfords Avenue/Dampier Avenue/Access 2	✓	▪ Additional dedicated approach for buses on eastern arm to allow all-movements exit from Whitfords Avenue Bus Station ▪ Stand-up lane for left turns east to south, 122m in length
E-3	Whitfords Avenue/Access 3	×	N/A
E-4	Endeavour Road/Access 4	×	N/A
E-5	Endeavour Road/Access 5	×	N/A
E-6	Banks Avenue/Access 6	×	N/A
E-7	Banks Avenue/Access 7	×	N/A
E-8	Banks Avenue/Access 8	×	N/A
E-9	Banks Avenue/Access 9	×	N/A
E-10	Banks Avenue/Access 10	✓	▪ 2 lane circulatory carriageway ▪ 4 lanes east to Marmion Avenue/Banks Avenue intersection ▪ 30m through/left turn lane on western approach
E-11	Whitfords Avenue/Marmion Avenue	✓	▪ 6 lane cross-section, Marmion Avenue, with southbound carriageway merging to 2 lanes 50m south of Whitfords Avenue ▪ Additional bus lanes on east and west approaches ▪ 140m right turn lane on northern approach ▪ 160m double right turn lanes on eastern approach ▪ 120m double left turn on eastern approach ▪ 140m double left turn lane on western approach ▪ 130m right turn lane on western approach ▪ 200m left turn lane on southern approach ▪ 90m right turn lane on southern approach
E-12	Whitfords Avenue/Endeavour Road	×	N/A
E-13	Endeavour Road/Banks Avenue	×	N/A
E-14	Banks Avenue/Green Road	×	N/A
E-15	Banks Avenue/Solander Road	✓	▪ 4 lane cross-section, Banks Avenue
E-16	Marmion Avenue/Banks Avenue	✓	▪ 6 lane cross-section, Marmion Avenue, northern arm ▪ 4 lanes west to Banks Avenue/Access 10 intersection ▪ Additional 30m right turn lane on northern approach ▪ 200m left turn lane on southern approach

6.7 Impacts to Public Transport

The identified road upgrades to facilitate improved public transport will have both positive and negative impacts to journey times for existing bus services. These have been assessed and a summary is provided in Table 6-7.

Table 6-8 Average Bus Journey Time Change

	Eastbound Services	Westbound Services
Interchange Delay	10 seconds	10 seconds
Bus Station Environment Delay	15 seconds	15 seconds
Dampier Avenue Priority Delay	50 seconds	10 seconds
Distance Penalty	45 seconds (500m at 40 km/h)	-
Roundabout Delay	20 seconds	-
Whitford Avenue / Marmion Avenue intersection Bus Priority	10 seconds (improvement)	30 seconds (improvement)
Total	Approximately 2 minutes	Approximately 1 minute

The impacts concluded above are only minor and it is assumed that these impacts would be further mitigated by bus priority measures that would be installed on the network outside of the Centre as part of general network improvements and the future BRT. Some minor changes to timetabling may be required to ensure suitable interchange times and alignment with rail timetables.

6.8 Impacts to Pedestrians

No significant adverse impacts are expected to pedestrian movement as part of the development included in the Structure Plan yields. Instead, positive outcomes are expected with more coherent and usable paths within the Centre. For road crossings, the controlled crossings at all signalised intersections will be maintained as will the pedestrian underpass on Whitfords Avenue that will also be improved.

The intention of the Structure Plan is to make Endeavour Road a more activated street. It is necessary to consider the types of pedestrian crossings that are required for this road being appropriate for the type of environment and the volume of traffic using the road. For an activated street, the aim is to allow uncontrolled crossings to allow more freedom of movement and the provision of more crossings without causing an adverse impact on vehicle movement.

This assessment assumes a conservative upper volume of 900 vehicles per hour at the design horizon on Endeavour Road. The State document Transport Assessment Guidelines for Developments (Volume 4, Table 2) suggests that with a traffic volume of 1,100 vehicles per hour for an undivided road or 2,800 vehicles per hour for a divided road it is still appropriate to maintain uncontrolled crossings. At this level of traffic movement, pedestrians would experience a Level of Service of E (LOS A being best, LOS F being worst).

Based on the formula contained within Transport Assessment Guidelines for Developments and Austroads Guide to Traffic Engineering Practice Volume 5 it is determined that at least LOS of D would in fact be experienced by pedestrians along Endeavour Road with the worst case forecast traffic volumes.

7 Car Parking Management

7.1 Current Parking Demands

Car parking analysis has been undertaken which compares the 20th busiest design day to the observed occupancy for the existing uses. The Institute of Transportation Engineers publication *Parking Generation* has been used to provide indicative demands for the existing and future land use. In addition, the benefits of mixed-use and alternative modes have been considered. The existing Centre uses provide approximately 4,700 parking spaces, representing a car parking rate of 4.8 spaces per 100sqm.

7.2 Future Parking Requirements

For future parking provisions, SPP 4.2 requires the provision of a rate of 4 to 5 spaces per 100sqm for retail and 2 spaces per 100sqm for office space. It is proposed to provide linear development parking rates across each precinct. The total parking provision based upon these rates and the Structure Plan yields are detailed in Table 7-1.

Table 7-1 Structure Plan Parking Yields

Land Use	Land Use (PLUC)	Yield	Parking Provision	
			Rate	Total
Retail Precinct	Retail (PLUC 5)	77,500sqm	4.5/100sqm	4,566
	Entertainment (PLUC 9)	16,000sqm		
	Office (PLUC 7)	7,960sqm		
Endeavour Precinct	Other Retail (PLUC 6)	11,518sqm	2.7/100sqm	1,339
	Service Industry (PLUC 4)	14,540sqm		
	Health, Welfare and Community (PLUC 8)	23,505sqm		
Banks Precinct	Storage and Distribution (PLUC 3)	8,578sqm	2.7/100sqm	351
	Service Industry (PLUC 4)	4,400sqm		
Residential	Residential (PLUC 10)	739 units	2/unit*	1,478
TOTAL		**-**	**-**	**7,734**

* - could be reduced to 1 per unit if BRT is available

The parking rate of 4.5 spaces per 100sqm for the shopping centre represents a decrease when compared to the existing provision of 4.8 spaces per 100sqm. This will assist in promoting changes in modal choice and reduce future congestion on the road network.

7.3 Parking Location and Access

The majority of vehicles accessing the Centre will use off-street parking facilities and the remainder will be accommodated on-street within Endeavour Road and Banks Avenue. Parking for the Education & Civic District is expected to be contained on-site, satisfying its own parking demand, as is the current situation.

The location of parking and access to the retail precinct largely determines the traffic flow patterns on local streets. For this reason, the locations for existing massed car parking have been assessed to promote the use of major roads and to reduce traffic along local streets.

This is of particular importance along Endeavour Road which provides an opportunity to conceal the associated car parking behind properties, ensuring an active public street that includes street level retail and entertainment uses, with a focus on pedestrian amenity and legibility.

Therefore, existing accesses to the shopping centre at Endeavour Road would be closed, redirecting traffic onto Banks Avenue and Whitfords Avenue. Similarly, access to the proposed residential, retail, commercial and entertainment uses on the western side of Endeavour Road would be relocated closer to the ends of Endeavour Road to minimise traffic and improve pedestrian crossing safety.

7.4 Structure Plan Parking Strategies

On the basis of the above, the overall parking strategy for the Centre is as follows:

> Provide an integrated set of land uses that will enable reciprocal parking, thereby reducing overall demand
> Transition towards permanent seven-day trading, assisting to spread trade, traffic and parking demand over the whole week
> Prepare, implement and commit to an overall and dynamic PMTP for Whitford Activity Centre, this may be supplemented by PMTPs for individual land uses to address their specific needs as necessary
> Prioritise parking for particular user groups such as ACROD and parents with children
> Ensure the PMTP includes provision for the management of staff parking to ensure these users do not consume any prime parking
> Locate parking to ensure major roads around the development are used in preference to lower order streets and
> Conceal parking in basements and behind or above street level properties to promote an active street environment.

8 Conclusions

This study has provided an assessment of the transport network impacts associated with and determined a framework by which to develop the various uses of the Whitford Activity Centre (the Centre), based on the yields outlined in the proposed Structure Plan for the Centre. In undertaking this study, various policy and guideline documents have been used, of particular note:

> State Planning Policy 4.2
> Transport Assessment Guidelines for Developments – Volume 2 – Structure Plans and
> City of Joondalup Planning Scheme

During the undertaking of this assessment, various discussions and workshops have been held with the following stakeholders to assist in determining the appropriate outcomes:

> The City of Joondalup
> The Department of Transport (DoT)
> The Public Transport Authority (PTA) and
> Main Roads Western Australia (MRWA)

The assessment has been based on the proposed design horizon (2026) Structure Plan yields determined as:

> Expansion of the Westfield Whitford City Shopping Centre to accommodate approximately 77,500 sqm of 'Retail' floor area
> Expansion of the existing 'Entertainment' uses to approximately 16,000 sqm
> An increase in the 'Other Retail' land uses to approximately 11,500 sqm
> An increase in Storage and Distribution uses to approximately 8,500sqm
> An increase in Health, Welfare and Community uses to approximately 23,500sqm
> An increase in Service Industry uses to approximately 4,500sqm
> Consistent increase in 'Office' land uses to approximately 22,500 sqm and
> An additional 739 dwellings in a medium density format

A review of the current transport networks concluded the following:

> The existing centre has very good access to higher order roads for vehicles from local and regional areas
> The roads within the Centre generally operate within an acceptable limit of operation, however assessment of future years based on assumptions provided by Main Roads WA concluded that some congestion would be expected within the design horizon, particularly on Marmion Avenue
> The Centre is served well by public transport with frequent bus services that allow ongoing connections to rail. There is a desire to provide a future Bus Rapid Transit service through the Centre, although this is in the very early stages of planning
> There is an adequate provision of pedestrian facilities on all roads. Crossing of the busier roads is assisted by signal control at the key intersections
> For safety reasons, a crossing controller is required on Endeavour Road to serve children attending the school at the western side of the Centre
> While provisions for cyclists exist, they are of varying standards and some gaps between facilities exist

An assessment of the impacts on the transport networks was undertaken based on various assumptions regarding background traffic growth and trip generation. These assumptions were considered conservative as they did not allow for any shift in modal choice or account for future development that may have been accounted for in MRWA's growth rate determination thereby delivering a 'worst case' assessment.

A number of potential transport network modifications or upgrades were determined that would adequately mitigate the impact of the future Structure Plan yields while simultaneously accounting for increases in background usage. These solutions are shown in Table 8-1.

Table 8-1 Potential Structure Plan Transport Network Modifications

Network	Improvement
Public Transport	Bus station, Whitfords Avenue
	Bus priority at the Whitfords Avenue / Dampier Avenue intersection
	Bus lanes, Whitfords Avenue at Marmion Avenue intersection
	Bus Service catchment improvement through rerouting
	Improved bus stops
Road	Additional through and turning lanes at the Marmion Avenue / Whitfords Avenue intersection
	Additional turning lanes at the Marmion Avenue / Banks Avenue intersection
	Additional turning lanes at the Banks Avenue / shopping centre access roundabout
Active Transport	Activation of Endeavour Road with better crossing opportunities and lower vehicle speeds
	Cycle lanes on Banks Avenue and Endeavour Road
	Improved cycle parking facilities at all new development
	Provision of end of trip facilities at non-residential development
Parking	Reduction in the parking rate for the shopping centre to promote change in mode choice
	Parking provision on Banks Avenue and Endeavour Road to activate these streets

The conclusion of this study is that the provision of the proposed Structure Plan development yields together with the appropriate application of the transport network framework improvements described above will ensure the suitable future operation of the transport network. This will also ensure alignment with the various State and local planning policies and integration with existing future planning for these networks.