ST ANDREWS DISTRICT STRUCTURE PLAN – TRANSPORT STUDY

YANCHEP SUN CITY PTY LTD

- March 2007
- Final

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Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
A	25/8/06	R. Russell	E. Richardson	25/8/06	Final
B	12/12/06	R. Russell	E. Richardson	12/12/06	Amended Final
C	12/3/07	R. Russell	E. Richardson	12/3/07	Amended Final

Distribution of copies

Revision	Copy no	Quantity	Issued to
Final	Electronic	-	Roberts Day
Amemnded Final	Electronic		Roberts Day, YSC
Amended Final		10 Copies	Roberts Day

Printed:	12 March 2007
Last saved:	12 March 2007 11:23 AM
File name:	I:/DEVN/Projects/DE02547/Deliverables/R14exrjmf.dec06.doc
Author:	Emmerson Richardson
Project manager:	Emmerson Richardson
Name of organisation:	YANCHEP SUN CITY PTY LTD
Name of project:	ST ANDREWS DISTRICT STRUCTURE PLAN – TRANSPORT STUDY
Name of document:	TRANSPORT STUDY
Document version:	Amended Final
Project number:	DE02547

Executive Summary

This transport planning study has been prepared in an integrated manner as part of the broader district structure planning for St Andrews. Sinclair Knight Merz has developed a transport strategy and network plan for St Andrews over a number of years as part of a multi-disciplinary team that has worked interactively with Yanchep Sun City Pty Ltd., the City of Wanneroo, the Department for Planning and Infrastructure and other Government agencies.

The transport study builds on previous and extensive planning work undertaken for St Andrews, much of which is referred to and encapsulated in the St Andrews Concept Plan (Roberts Day – October 2004). In developing the strategy we have been guided by a number of Government and Local Government policy documents including:

- Network City: Community and Planning Strategy for Perth and Peel (2004)
- City of Wanneroo Smart Growth Strategy (2005)
- State Sustainability Strategy (2003)
- Liveable Neighbourhoods (Edition 3, 2004)
- Metropolitan Transport Strategy (1995)

The transport planning study has taken a long term view of the transport challenges that will emerge as St Andrews is developed over the next 50 years. A primary purpose of the report is to establish the long term transport needs so that land can be protected now for future development of the transport system.

Planning for St Andrews embraces the development of a sustainable transport system within its region. At the outset it is accepted that transport is a means to an end rather than an end in itself. The St Andrews District Structure Plan has been prepared in an integrated manner so that transport will:

- support sustainable growth and development;
- be an economic enabler;
- be energy efficient and environmentally responsible;
- promote place making and community building; and
- facilitate access and movement in an equitable and affordable manner.

In the long term, with full development, it is estimated there will be 669,000 trips per day to, from and within St Andrews by all modes of transport – cars, public transport, walking and cycling. The breakdown of estimated trips by mode is shown below.

- **Table - Estimated Trip by Mode per Day**

Mode	Total	Fully Internal to St Andrews	Internal / External	Percentage Trips Internal to St Andres
Public transport	60,500	34,500	26,000	57%
Car driver	357,000	255,000	102,000	71%
Car passenger	134,000	110,000	24,000	82%
Walk and cycle	117,500	117,500	0	100%
Total	**669,000**	**517,000**	**152,000**	**77%**

External Road Conditions

In recent years there has been a greater emphasis on connectivity and legibility of the road network and provision of good overall accessibility. This has influenced road cross sections. Government policy documents such as Liveable Neighbourhoods and Network City are now promoting roads that integrate communities rather than result in severance. The road network proposed for St Andrews has been developed in accordance with these principles.

The total corridor demand for vehicular travel between St Andrews and Alkimos to the south has been estimated to be between 115,000 and 120,000 vehicles per day. This includes an estimated 15,000 vehicles per day travelling from the South beyond St Andrews (through traffic). Main roads traffic modelling (ROM) estimates a slightly lower corridor traffic flow of 106,000 vehicles per day. This traffic can be accommodated on the following road network.

- Marmion Avenue (4 lanes) up to 40,000 vehicles per day
- Mitchell Freeway (6 lanes) up to 80,000 vehicles per day
- Wanneroo Road (2 lanes) up to 12,000 vehicles per day

Internal Street Network

Since the concept plan for St Andrews was produced in October 2004, further consideration has been given to development of the road system. The concept plan only showed the major road system. The district structure plan outlines a much finer grained network, providing more detail of how traffic is projected to move around the area. The development of the road network has been based on the following principles:

- The road network should be well connected and legible;
- The road network should be sufficiently fine grained to eliminate the need for 6 lane roads within the area and to limit the number of 4 lane roads, thus maximising the movement and access potential of non-motorist travel.

The proposed functional road hierarchy is shown in Figure 5.2. Proposed cross sections for the different road types have been developed through discussion with the DPI and the City of Wanneroo and are shown in Figures 5.3 to 5.12.

Public Transport

It is estimated there will be over 60,000 public transport trips per day when St Andrews s fully developed. It may well be that this figure could be exceeded in the longer term if oil prices continue to rise and congestion on the Mitchell Freeway south of Alkimos limits longer distance car travel.

The major infrastructure and services proposed to meet demand for public transport are:

- Extension of the Perth Metropolitan rail system to the St Andrews area
- Provision for a surface light rail, streetcar or busway system linking the southern regional activity centre to the northern regional activity centre and the northern coastal village.
- Integrated feeder bus system linking residential neighbourhoods to the regional, district and neighbourhood centres and to the regional rail system.

Non-Motorised Travel

The transport plan for St Andrews has focussed on achieving a high level of accessibility and amenity for pedestrians and cyclists.

It is not proposed that a path network be agreed at the district structure planning stage. However it is considered appropriate to include the following guidelines in the text of the district structure plan.

- District Distributor A and B roads- a 2.5 metre shared path on both sides.
- Local Distributor roads- a 2.5 metre shared path on one side and a 1.5 metre footpath on the other.
- Access roads- a 1.5 metre footpath on both sides, except where the street has very low traffic volumes and provides limited or no connectivity.
- In the vicinity of schools, universities shops or where pedestrian volumes are high a minimum footpath width of 2.0 metres will be provided.
- In mixed use office or retail areas in regional or district activity centres or along the transit boulevard, wider paved pathways will be required. These paths will be designed specifically to meet requirements and will be discussed more fully in local structure plans.
- Pram ramps to universal access design standards are required to be provided at all intersections and at mid-block pedestrian crossing areas.

Staged Development of Transport Infrastructure

It is proposed that external transport linkages to St Andrews be constructed in the following sequence:

- Marmion Avenue - by end of 2007
- Railway connection to St Andrews – between 2015 and 2020
- Mitchell Freeway – after 2020

The internal road, street and public transport networks will be developed in stages to meet travel and access needs as St Andrews develops progressively.

1. Introduction

This transport study has been prepared for the St Andrews District Structure Plan being prepared by Yanchep Sun City. This transport study is one of a number of reports prepared in support of the district structure plan.

Sinclair Knight Merz has developed a transport strategy and network plan for St Andrews over a number of years as part of a multi-disciplinary team that has worked interactively with Yanchep Sun City Pty Ltd., the City of Wanneroo, the Department for Planning and Infrastructure and other Government agencies. Sinclair Knight Merz acknowledges the contributions made by other consultants in the team, particularly Roberts Day (Town Planning and Design) and Bruce Aulabaugh (Traffic Engineering and Traffic Planning).

The transport study builds on previous and extensive planning work undertaken for St Andrews, much of which is referred to and encapsulated in the St Andrews Concept Plan (Roberts Day – October 2004). In preparing this report we have also been guided by a number of Government and Local Government policy documents including:

- Network City: Community and Planning Strategy for Perth and Peel (2004)
- City of Wanneroo Smart Growth Strategy (2005)
- State Sustainability Strategy (2003)
- Liveable Neighbourhoods (Edition 3, 2004)
- Metropolitan Transport Strategy (1995)

This transport planning study has taken a long term view of the transport challenges that will emerge as St Andrews is developed over the next 50 years. A primary purpose of the report is to establish the long term transport needs so that land can be protected now for future development of the transport system.

The vision is for a sustainable multi-modal transport system with increasing proportions of public transport, walking and cycling trips. Nevertheless, the road infrastructure planning is based on just over half of all trips into and within St Andrews being car driver trips. This means that a substantial and well connected road network will be required.

The remainder of this report is contained within the following sections:

2. **St Andrews within Its Region**. This provides a context for regional planning and shows how St Andrews will relate to areas outside Metropolitan Perth.
3. **Key Guiding Transport Planning Principles**. This short section outlines how transport is intended to support and facilitate sustainable growth and development in St Andrews. It

demonstrates how the St Andrews plan supports and is in conformity with important Government policies.

4. **Long Term Transport Demand**. This section provides an estimate of long term transport demand into and within St Andrews by the different transport modes.
5. **Road Network**. This section looks at the demand for travel on a proposed road network to and within St Andrews. In the light of this analysis recommendations are made on a desirable network of roads. These recommendations relate to the road network linking St Andrews to the remainder of the Perth Metropolitan Area to the south and the road network internal to St Andrews.
6. **Public Transport**. This section considers the long term demand for public transport and provides recommendations for future infrastructure. Separate recommendations are provided for travel to the area from the south and for an intra area transitway system along the proposed major activity and employment corridor. A supporting bus network has been developed in consultation with the Public Transport Authority
7. **Non Motorised Travel.** This section provides guidelines for walking and cycling paths in St Andrews.
8. **Staged Development of Transport Infrastructure**. This section looks briefly at how the long term infrastructure may be staged, taking account of the views expressed at the North West Corridor Structure Plan workshop, convened by the Department for Planning and Infrastructure in January 2004.

2. St Andrews within Its Region

St Andrews is an area of 4,200 hectares extending approximately 10 kilometres north to south and 4 to 6 kilometres east to west. Its location within the broader region is shown diagrammatically in **Figure 2.1**. St Andrews at build out will be a community of about 160,000 people with approximately 55,000 jobs.

2.1 St Andrews' Role as a Hub of the Region

St Andrews will relate to the Perth urban area (the St Andrews town centre is 50 kilometres north of the Perth CBD) as an edge city, but because of its size, will also be a significant attractor of employment, shopping and recreational trips from the north and east. As shown in **Figure 2.1**, Guilderton is approximately 25 kilometres to the north on the coast, with Gingin and Muchea both approximately 35 kilometres away on the Brand highway to the northeast and southeast respectively.

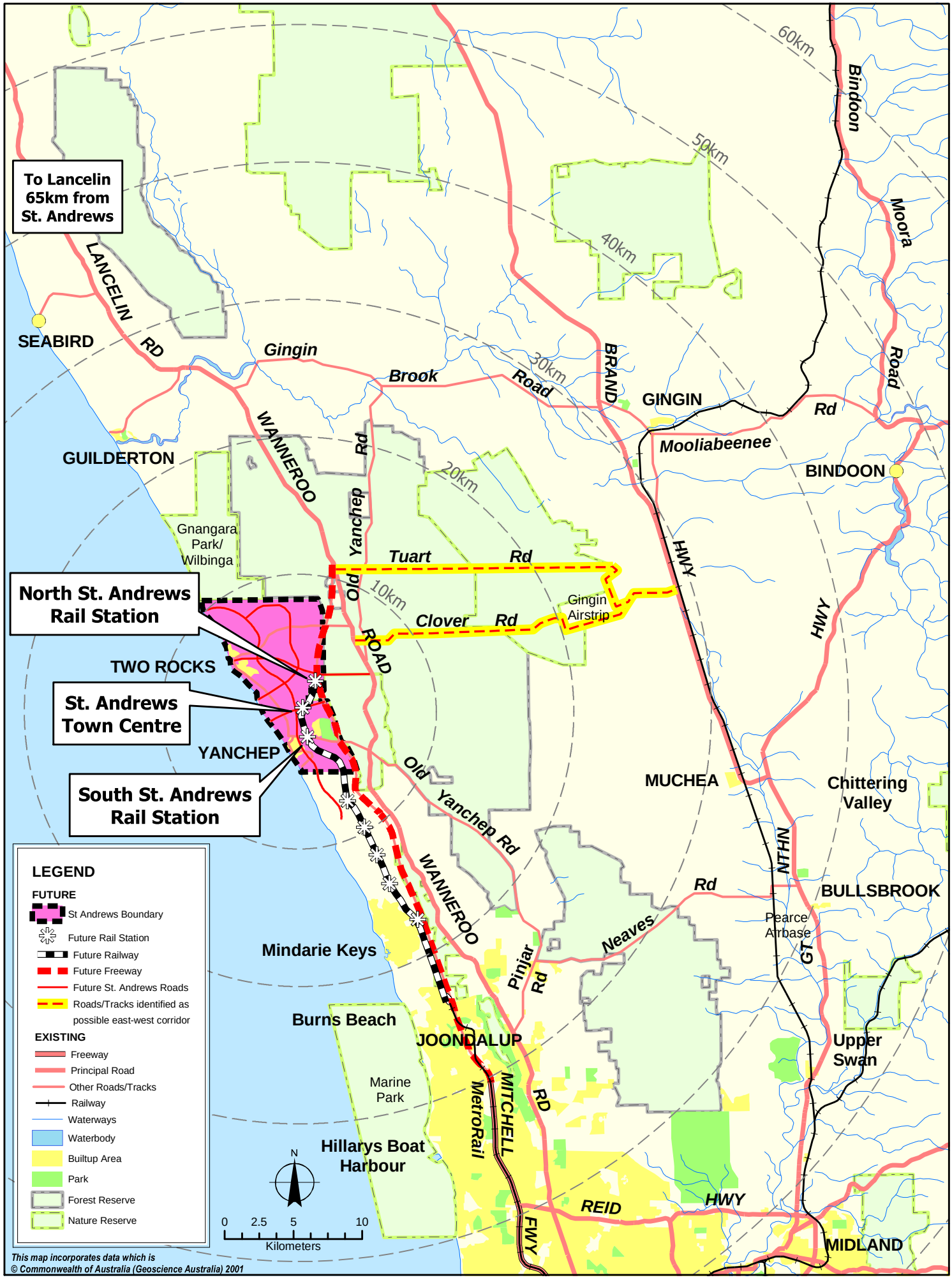
2.2 Planning for Areas within the St Andrews Sphere of Influence

The road network to the north has been the subject of recent planning by the Government with the Gingin Coast Structure Plan being finalised and released in February 2006. The Shire of Gingin is expected to grow from a current population of just over 2000 to up to 16,000 by about 2031.

To the east, the North-East Corridor Extension Strategy (July 2003) developed a long-term development vision for an area centred on the Brand and Great Northern Highway corridor, from Bullsbrook in the south to the Shire of Gingin boundary in the north (12 kilometres north of Muchea). The Brand and Great Northern Highways diverge north of Muchea. 5,000 people currently live in this study area with a long term population prediction of 30,000. This includes 5,000 growth in the Bullsbrook area, 10,000 more in a new urban settlement in the southern portion of study area and up to 10,000 for a new urban settlement south of Bindoon. Brand Highway is the major road and freight connection between Perth and Geraldton.

2.3 Road Access to St Andrews

St Andrews' demographic estimates suggest that there will be 43,000 external home-based and 27,000 externally based business and commercial vehicle trips in and out of the St Andrews area each day at buildout (refer section 4 of this report). The majority of these trips will come from the Perth urban area to the south but a growing number of trips will come from the north and east in the longer term. **Figure 2.1** identifies the major urban developments, regional roads and key land features which affect the transport network.



ST. ANDREWS ENVIRONS

FIGURE 2.1

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North

Immediately north of St Andrews is the Gnangara Park/Wilbinga nature reserve which eliminates the opportunity to create a more direct north-south road to Guilderton, west of the current Mitchell Freeway extension. Mitchell Freeway /Wanneroo Road will function as the inter-regional highway between the St Andrews area and the Shire of Gingin and beyond. The northern terminus of the Mitchell Freeway is at Wanneroo Road north of Two Rocks at the Perth Metropolitan Area boundary. To the north a high quality rural road will provide for inter-regional traffic movement.

There is a potential for a formal entry into the Wilbinga nature reserve from the St Andrews Area, where an interpretive centre and the Coastal Plain Walk Trail can be accessed.

Old Yanchep Road runs directly north from Wanneroo Road in the vicinity of Two Rocks north to Gingin Brook Road, which allows travel from St Andrews to Gingin without having to go all the way to Guilderton to access Gingin Brook Road.

The Coast Road Traffic Study (Main Roads, 2000) investigated the future travel demand in the greater Lancelin-Dongara corridor and the proposed impact of the Lancelin to Cervantes Link. The study projects an average all day traffic (AADT) level for the year 2021 along the Wanneroo / Lancelin Road corridor of 5,000 to 7,000 at the northern boundary of Yanchep / Wanneroo (currently 2,000) possibly increasing to as high as 8,000 in the Guilderton area and reducing to 3,000 to 6,000 in the Lancelin area. The Brand Highway corridor is projected to have 3,000-5,000 AADT in the vicinity of Muchea and Gingin.

East

There is currently no direct east-west road link between St Andrews and Gingin and/or Muchea. Although Gingin is only 35 kilometres away in a direct line, current road travel is about 50 kilometres (Wanneroo Road to Old Yanchep Road to Gingin Brook Road). The similar situation exists for Muchea (30 plus kilometres to the southeast). In this case, travel by road is about 55 kilometres (Old Yanchep Beach Road to Neaves Road to Brand Highway).

The Gnangara Water Mound is the significant land feature that limits the existence of and opportunities for direct east-west road links to the east of St Andrews.

Gingin Brook Road connects Guilderton with Gingin and has a daily traffic flow of about 500. Old Yanchep Road runs in a northwest to southeast direction and provides access from St Andrews to Neaves Road, which in turn connects to the Brand Highway in the vicinity of Muchea.

There is however an opportunity to create a more direct east-west road link between St Andrews and the Brand Highway. There are formal tracks (unsealed roads) which bissect (in some cases only partially) the area between Gingin Brook Road and Neaves Road, that could be the alignment for a future regional connection. The two most direct options are:

- Tuart Road is the easterly continuation of Wilbinga Road which extends from east of Wanneroo Road to the Wilbinga nature reserve near the coast. This road is a track west of Wanneroo Road and has limited potential for upgrade due to its environs
- Clover Road provides a connecting link between Wanneroo Road and Brand Highway. It also provides access to the Gingin Airstrip discussed in section 2.6. In the future, Clover Road could be upgraded to provide a regional road connection between Wanneroo Road and Brand Highway, immediately adjacent to St Andrews.

South

Marmion Avenue, the Mitchell Freeway and Wanneroo Road will provide regional road access between St Andrews and the remainder of Metropolitan Perth. The demand for road travel along this corridor is estimated to be just over 100,000 vehicles per day when St Andrews is fully developed. This is discussed in Section 4.

2.4 Public Transport Requirements

Section 4 identifies that there will be a demand for approximately 60,000 daily public transport trips when St Andrews is fully developed. About 43% or 26,000 of these trips are expected to be external to the area. This demand for 60,000 daily public transport trips will be addressed by a combination of an extension of the existing Perth Metropolitan Railway to the southern St Andrews regional centre, a high capacity north/south light rail or busway system within St Andrews and a local bus network. This is discussed more fully in section 6.

Planning for the railway has left open the option to extend the railway to the north as a country rail service, initially within the Mitchell Freeway corridor to the east of St Andrews.

2.5 Internal Major Road Network

A well connected internal road network is proposed for St Andrews. It provides good linkages both within the area and to the major external connections- Mitchell Freeway, Marmion Avenue and Wanneroo Road. This is discussed more fully in Section 5.

2.6 Other Regional Transport Facilities

3 marinas are proposed along the coast in the St Andrews area which will require good road connections to the St Andrews internal road network and to Marmion Avenue and the Mitchell Freeway.

There are currently no active commercial airports in the St Andrews area. However, consideration could be given in the longer term, to upgrading the role of the Gingin Airstrip, which is conveniently situated on a possible east-west connecting road between St Andrews and the Brand Highway. This would need to be negotiated with the RAAF, who currently uses the airstrip.

3. Key Guiding Transport Planning Principles

3.1 A Sustainable Transport Planning Approach

In September 2003, the Western Australian State Government released the State Sustainability Strategy. It defined sustainability as:

"Meeting the needs of current and future generations through an integration of environmental protection, social advancement and economic prosperity".

At the outset it is accepted that transport is a means to an end rather than an end in itself. The St Andrews District Structure Plan has been prepared in an integrated manner so that transport will:

- Support sustainable growth and development;
- Be an economic enabler;
- Be energy efficient and environmentally responsible;
- Promote place making and community building; and
- Facilitate access and movement in an equitable and affordable manner.

Planning for St Andrews embraces the development of a sustainable transport system, defined as follows:

"A sustainable transport system is one that:

- *Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.*
- *Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.*
- *Limits emissions and waste within the planets ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise".*

This definition was developed by the Centre for Sustainable Transportation in Canada and has obtained a high level of acceptance throughout the world, including by the European Council of Ministers for Transport.

A sustainable transport system will be developed sequentially in support of the proposed urban development for St Andrews.

3.2 Integrated Multi- Modal Transport and Land Use Planning

The State Government's Metropolitan Transport Strategy (MTS, 1995) set targets for the year 2029 for increased walking, cycling and public transport and for a reduced proportion of trips to be made by car drivers.

Since 1995, successive government transport policy and strategic directions papers have continued to promote the development of a more balanced transport system with a greater choice of travel mode and less dependence on car travel. For example, in 1999 the then Department of Transport launched its Integrated Transport Planning initiative with the objective of "maximising accessibility of the transport system, utilising a variety of transport modes and managing transport demand in a way that improves liveability and minimises overall costs to users and the community".

Greater integration and mutual support between the transport system and land uses was one of the major long term implementation themes set out in the Metropolitan Transport Strategy. Practical support for this aim has received a boost recently through the integration of the State's Transport and Planning agencies and through the "Dialogue with the City" project led and promoted by the Minister for Planning and Infrastructure.

Network City: Community Planning Strategy for Perth and Peel was released in 2004. The vision, values, principles and objectives outlined in Network City are attached as **Appendix A**.

Liveable Neighbourhoods is an operational policy for the design and assessment of structure plans. The principal aims of Liveable Neighbourhoods, as set out in the document, are outlined in **Appendix B**.

In terms of the movement network, Liveable Neighbourhoods states:

"The emphasis is upon connectivity, amenity and integration to achieve safe, efficient and attractive street networks. The priority is to develop a street network that not only works for vehicles and public transport provision but specifically aims to attract a high level of use by pedestrians, cyclists and the disabled"

The City of Wanneroo has developed a Smart Growth Strategy in support of strategic State Government Planning policies, including the State Sustainability Strategy and Network City. The Smart Growth Principles are attached in **Appendix C**.

There is an extremely close match between State Government and the City of Wanneroo's transport policy and land use planning (as summarised above) and the structure planning and the integrated transport and land use planning undertaken for the St Andrews region. Key aspects of the St Andrews Transport and Land Use Planning and its relationship to Government policies or strategies are listed below:

Key Feature of St Andrews Planning	Links to Government Policies and Strategies
Aim to achieve a population of 155,000 people with 75% self-sufficiency in jobs.	Supports the goals and directions of the State Sustainability Strategy (SSS), the City of Wanneroo's Smart Growth Strategy and the objectives of the Metropolitan Transport Strategy (MTS) to reduce kms of car travel and car dependence.
The district structure plan is based on transit oriented design and employment focussed on strategic centres and an employment boulevard and a legible fine grained street network.	Supports MTS goals of increasing public transport usage and the principal aims of Liveable Neighbourhoods (as outlined in **Appendix B**). It also supports and is compatible with the Network City objectives (particularly objectives 2, 3, 4, 8 and 9).
Mixed use activity centres located throughout the St Andrews area, ensure that no neighbourhood is more than a short walk from a pedestrian scaled, mixed use village environment. These centres will have shops, services, restaurants, civic uses, transit infrastructure and housing.	Supports Liveable Neighbourhood aims and objectives, MTS goals of increasing walking, cycling and public transport and reducing car dependency and SSS goals and directions on settlements (urban design, land use and balanced transport). Strong compatibility with Network City objectives 2, 3, 4, 6, 8 and 9.
A permeable street network throughout the area providing quality direct linkages for walking, bicycle and car trips between residential and mixed use areas and town and village centres, shops public transport etc.	The street networks support the Liveable Neighbourhoods aims and objectives for good accessibility by all transport modes, particularly walking and cycling. Strong compatibility with Network City objectives 2 and 4.
A variety of neighbourhoods and activity centres are connected by a mixed use transit corridor that changes in character across the site: to the south it is primarily an employment boulevard and to the north it is a mixed use residential zone.	The mixed use transit corridor provides strong practical support for the Metropolitan Transport Strategy policies and objectives. It has strong compatibility with Network City objectives 3, 4, 6 and 8.
A mix of transport infrastructure (railway, urban arterial and freeway) have been planned to link St Andrews with the remainder of the metropolitan area based on trip generations and mode splits targeted in the MTS and as agreed with the DPI.	The balanced transport infrastructure planned to serve St Andrews, including linking St Andrews to the rest of Perth by rail, provide practical support for Metropolitan Transport Strategy policies and objectives. The transport corridor planning to St Andrews has strong compatibility with Network City objectives 3 and 4.

4. Long Term Transport Demand

4.1 Spreadsheet Transport Demand Analysis

The long term transport demand to, from and within St Andrews has been estimated based on the following:

- A long term population of 160,000 people[1].
- Total jobs of 55,000 within St Andrews.
- A home based total trip rate of 3.4 trips per person, per day.
- 75% of jobs within St Andrews filled by St Andrews residents.
- Non-home based business and commercial trips being 15% of home based generated trips within St Andrews.
- Average mode share for public transport being 9%

Surveys in Australia and around the world have shown that total home based trips per day stay very constant over time. In both Perth and Melbourne there are 3.4 trips per person per day.

All of the above assumptions have been discussed extensively with the DPI's transport planning section, who tested key assumptions against the Strategic Transport Evaluation Model (STEM) outputs. Following these discussions our preliminary mode split assumptions were modified to reflect current DPI views.

Based on the above assumptions, the total daily trips in and around St Andrews are estimated to be:

- **Table 4.1 Total Estimated Daily Trips (All Modes)**

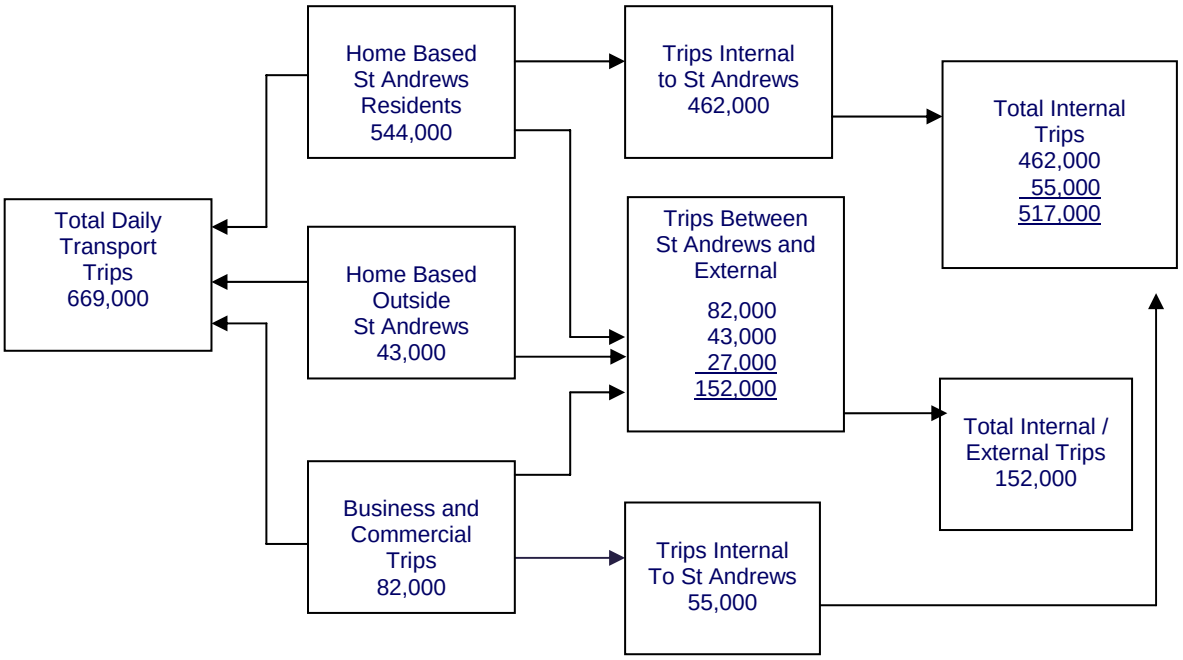
Home based from St Andrews households	544,000
Home based (external to St Andrews)	43,000
Business and commercial (non-home based)	82,000
Total Estimated Daily Trips	**669,000**

Figure 4.1 provides an estimate of total transport trips that are fully internal to St Andrews and those trips between St Andrews and external areas.

Further details of estimated trips by mode share, internal/external trips and trip purpose is contained within **Appendix D**. The main findings are summarised in **Tables 4.2 to 4.5** below.

[1] The DSP provides 155,000. Therefore, the transport analysis is conservative.

- **Figure 4-1 Total Transport Trips – All Modes**



- **Table 4-2 Internal/External Trips by Mode per day**

Mode	Total	Fully Internal to St Andrews	Internal/External	Percentage Trips Internal to St Andrews
Public transport	60,500	34,500	26,000	57%
Car driver	357,000	255,000	102,000	71%
Car passenger	134,000	110,000	24,000	82%
Walk and cycle	117,500	117,500	0	100%
Total	**669,000**	**517,000**	**152,000**	**77%**

These estimates suggest that about 77% of all trips are expected to be internal to St Andrews. These estimates assume a workforce to population ratio similar to that which exists today. It is possible, with the aging population that this will decrease. If that occurs the internal/external trips will be less and the fully internal trips will be more, resulting in an overall decrease in vehicles kilometres. The modelling outputs are therefore considered to be conservative.

- **Table 4.3 Mode Shares**

Mode	Fully Internal to St Andrews	St Andrews To/From External	All Trips To/From/Within St Andrews
Public transport	7%	17%	9%
Car driver	49%	67%	53%
Car passenger	21%	16%	20%
Walk and cycle	23%	0%	18%
All Modes	**100%**	**100%**	**100%**

- **Table 4.4 External Trips to St Andrews by Mode**

Internal/External Trips by Mode	
Public transport	26,000 (17%)
Car driver	102,000 (67%)
Car passenger	24,000 (16%)
Walk and cycle	0 (0%)
Total	**152,000 (100%)**

- **Table 4.5 Internal/External Public Transport Trips by Direction and Time of Day**

	Northbound	Southbound	2 Way
AM Peak Period	2,800	5,000	7,800
PM Peak Period	5,000	2,800	7,800
Off Peak	5,200	5,200	10,400
Total	**13,000**	**13,000**	**26,000**

4.2 Main Roads ROM Modelling

At the request of the Department for Planning and Infrastructure, Main Roads has undertaken modelling for St Andrews using its Regional Operations Model (ROM).

The ROM is a four step modelling process. It was applied to 41 zones in the St Andrews area. The land use inputs to the model have been provided by Roberts Day with input from Calthorpe and Associates. It reflects predicted land uses in St Andrews at full build out, which could be around 2060. The remainder of the model uses the "trend case" land use forecast as provided by the DPI. Thus whilst the model outputs are referred to as 2031 trips, they are much more likely to reflect traffic around St Andrews at full build out, possible around 2060.

Main Roads was able to apply the mode split factors for home based trips provided by Sinclair Knight Merz through the DPI. However Main Roads advised that it was unable to change the mode

share for other trip purposes without very significant changes to the model. The mode share provided for home based work trips was:

- Home based work trips internal to external trips
  - car driver 61%
  - car passenger 10%
  - public transport 29%
  - walking and cycling 0%
- Home based work trips internal to St Andrews
  - car driver 64%
  - car passenger 10%
  - public transport 16%
  - walking and cycling 10%

Home based work trips only amount to approximately 20% of travel. Therefore the other 80% of trip purposes will have a much greater influence on travel than work trips. For these purposes Main Roads used the mode splits that have been built into its model over a number of years. The trip generation for the Main Roads ROM has been compared to that in the spreadsheet modelling developed by the St Andrews team in consultation with the DPI (refer Table 4.6 below).

Table 4.6 Car Driver Trip Generation Modelling Comparison

	Main Roads ROM	Spreadsheet Model
Internal to St Andrews Trips	397,258 (78.6%)	255,000 (68.5%)
Internal/ External Trips	101,285 (20%)	102,000 (27,5%)
Through Traffic	7140 (1.4%)	15,000 (4%)
Total	**505,683 (100%)**	**372,000 (100%)**

Main Roads modelling has estimated about 35% increase in car driver trips when compared to the SKM/ DPI based analysis. Reason for this could be:

- Use of a higher trip generation rate for home based trips than 3.4 trips per person
- Greater number of non home based car driver trips than 15% of home based trips.
- Higher mode share for car driver trips

In the spreadsheet model, SKM used a total trip generation rate of 4.2 daily trips per St Andrews resident, comprising:

- Home based within St Andrews 3.4
- Home based outside St Andrews 0.3

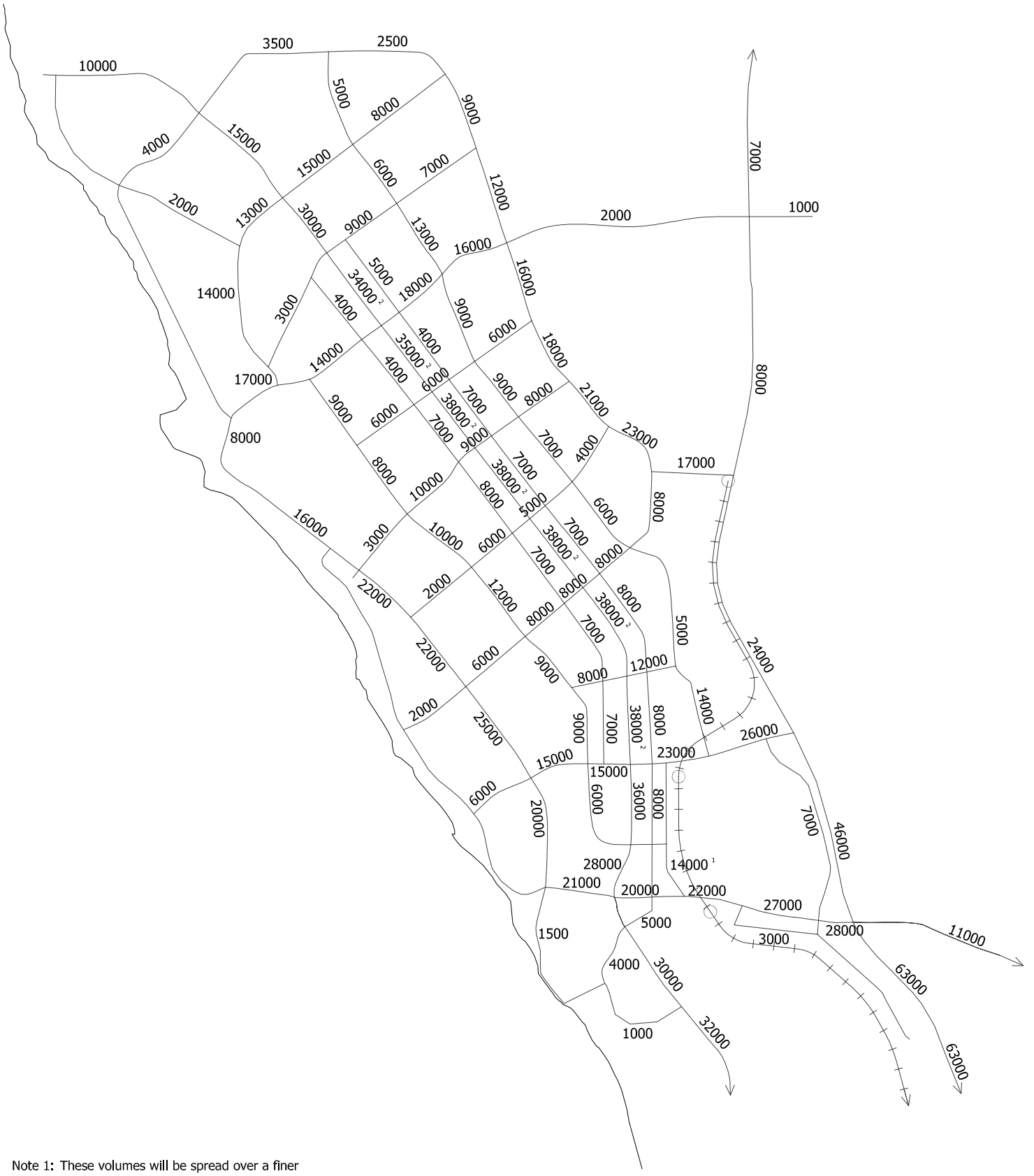
- Non home based trips 0.5

The DPI's Strategic Transport Evaluation model uses a figure of 3.8, which excludes home based travel generated outside of the area. This compares to 3.9 used in the SKM spreadsheet modelling. Overall we believe there is unlikely to be much variation from the overall trip generation rate of 4.2 used in the SKM spreadsheet model.

The current car driver mode share in most suburbs in Perth is around 60%. In its spreadsheet analysis for St Andrews in about 2050 (full build out) SKM has assumed an average mode share for car driver trips of 53.4%. The mode share for car drivers for fully internal trips is estimated by SKM to be 49.3% and for internal/ external trips (where walking and cycling is less of an option) to be 67.1%. Assuming the total trip generation figures were the same in the Main Roads modelling as in the spreadsheet modelling the car driver mode share in the ROM modelling would be:

- Internal to St Andrews 77% (cf 49% SKM)
- Internal to external 67% (cf 67% SKM)
- Total 72% (cf 53% SKM)

Our overall conclusion is that the traffic generation estimated by the Main Roads ROM is too high for trips fully internal to St Andrews. However, it is recognised that ROM is a strategic 24 hour model designed to produce an order of magnitude traffic estimate on individual streets. Allowing for variation on individual streets we consider the traffic estimates provided by ROM and shown in **Figure 4.2** will be adequate to access the road network generally. The road type and cross sections proposed for individual streets will need to take account of the transport modelling, but will need to address a range of other issues. Where traffic volumes, as estimated by ROM, are higher than desirable to meet community and urban design objectives, it may be necessary to manage the traffic rather than seek to accommodate traffic estimates that are considered likely to be too high.



Note 1: These volumes will be spread over a finer grained road network in the commercial area.

Note 2: The computer estimated volumes on the transitway are higher than desirable. Traffic management will need to be employed to limit traffic flow along the transitway to about 25000 vpd (refer to section 5.2).

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St Andrews District Structure Plan
Estimated 24 hour traffic volumes - Ultimate Development
(Main Roads ROM)

March 2007
FIGURE 4.2

DE02547/ASM

5. Road Network

This section addresses the road network requirements for the area within St Andrews and in the urban corridor linking St Andrews to the South. These requirements are linked closely to the long term transport demand (estimated in section 4) and to the need to provide good accessibility through a well connected transport network.

5.1 St Andrews Internal Road Network

The district structure plan shown in **Figure 5.1** has been developed over a number of years with input from land owners, government agencies, the City of Wanneroo and the multi-disciplinary consultant team.

Since the concept plan for St Andrews was produced in October 2004, further consideration has been given to development of the road system. The concept plan only showed the major road system. The district structure plan outlines a much finer grained network, providing more detail of how traffic is projected to move around the area. The development of the road network has been based on the following principles:

- The road network should be well connected and legible;
- The road network should be sufficiently fine grained to eliminate the need for 6 lane roads within the area and to limit the number of 4 lane roads, thus maximising the movement and access potential of non-motorist travel.

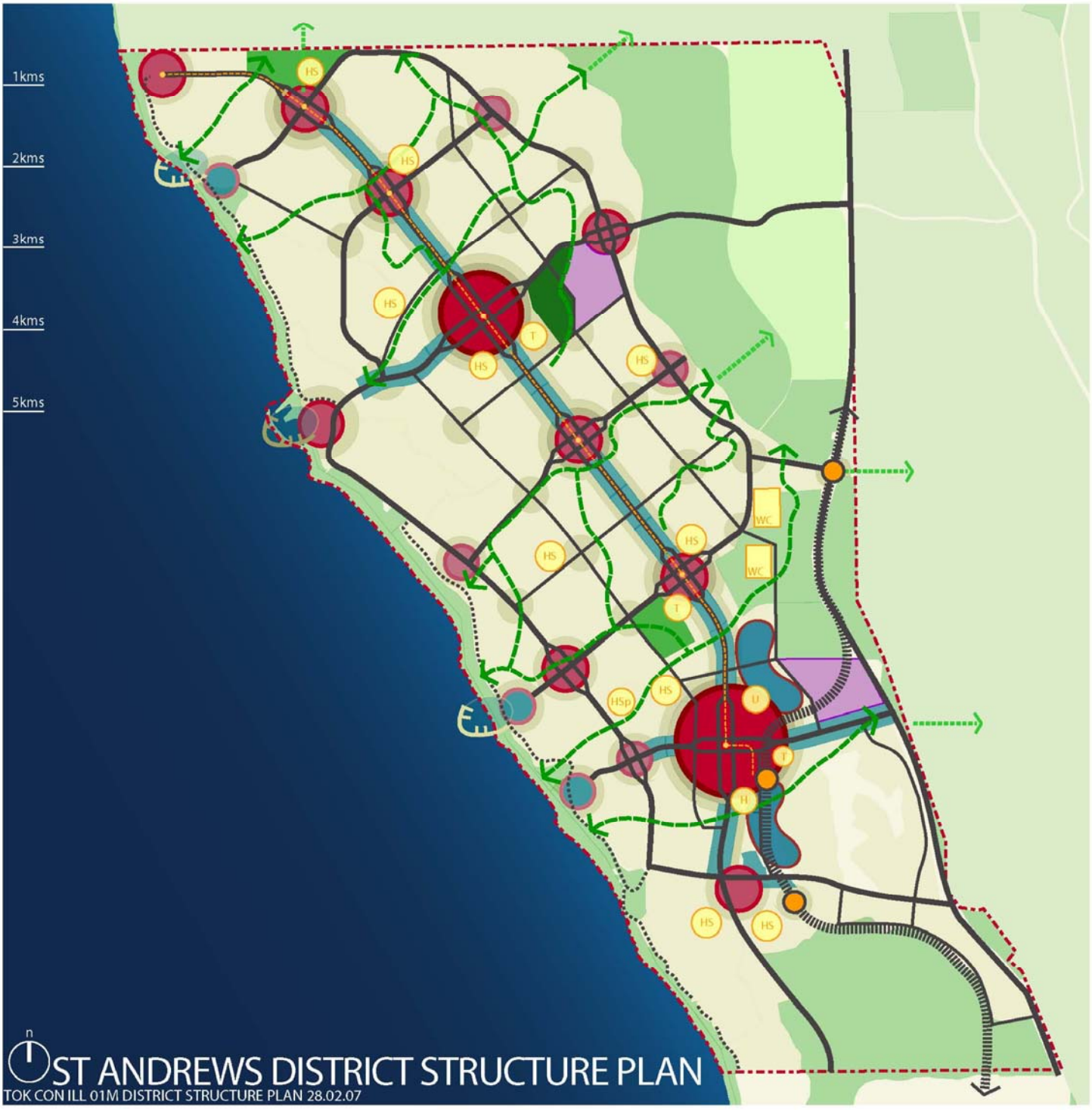
5.1.2 Proposed Functional Road Hierarchy

The functional road hierarchy comprises the following road types:

- Primary distributor
- District distributor A
- District distributor B
- Local distributor
- Access roads
- Special- transit boulevard

Main Roads (Metropolitan Functional Road Hierarchy, November 1997) has defined these road types as follows:

- **Primary Distributors** *"These provide for major regional and inter-regional traffic movement and carry large volumes of generally fast moving traffic. Some are strategic freight routes and all are National or State roads".*



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St Andrews District Structure Plan

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FIGURE 5.1

- **District Distributor *A*** *"These carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property".*
- **District Distributor B** *"Perform a similar function to type A district distributors but with reduced capacity, due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and generally not through them, forming a grid which would ideally space them around 1.5 kilometers apart".*
- **Local Distributor** *"Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks*".
- **Access Roads** *"Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly".*

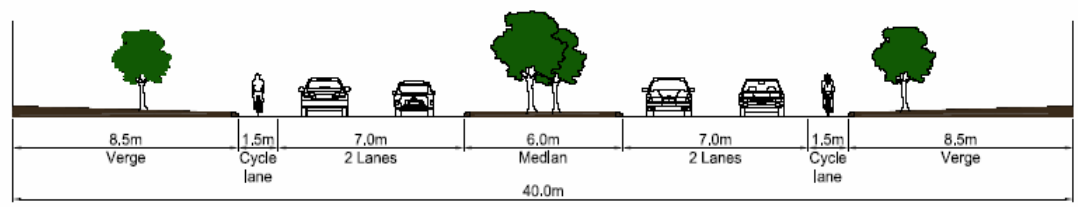
In recent years there has been a greater emphasis on connectivity and legibility of the road network and provision of good overall accessibility. This has influenced road cross sections. Government policy documents such as Liveable Neighbourhoods and Network City are now promoting roads that integrate communities rather than result in severance. The road network developed for St Andrews has been developed in accordance with these principles.

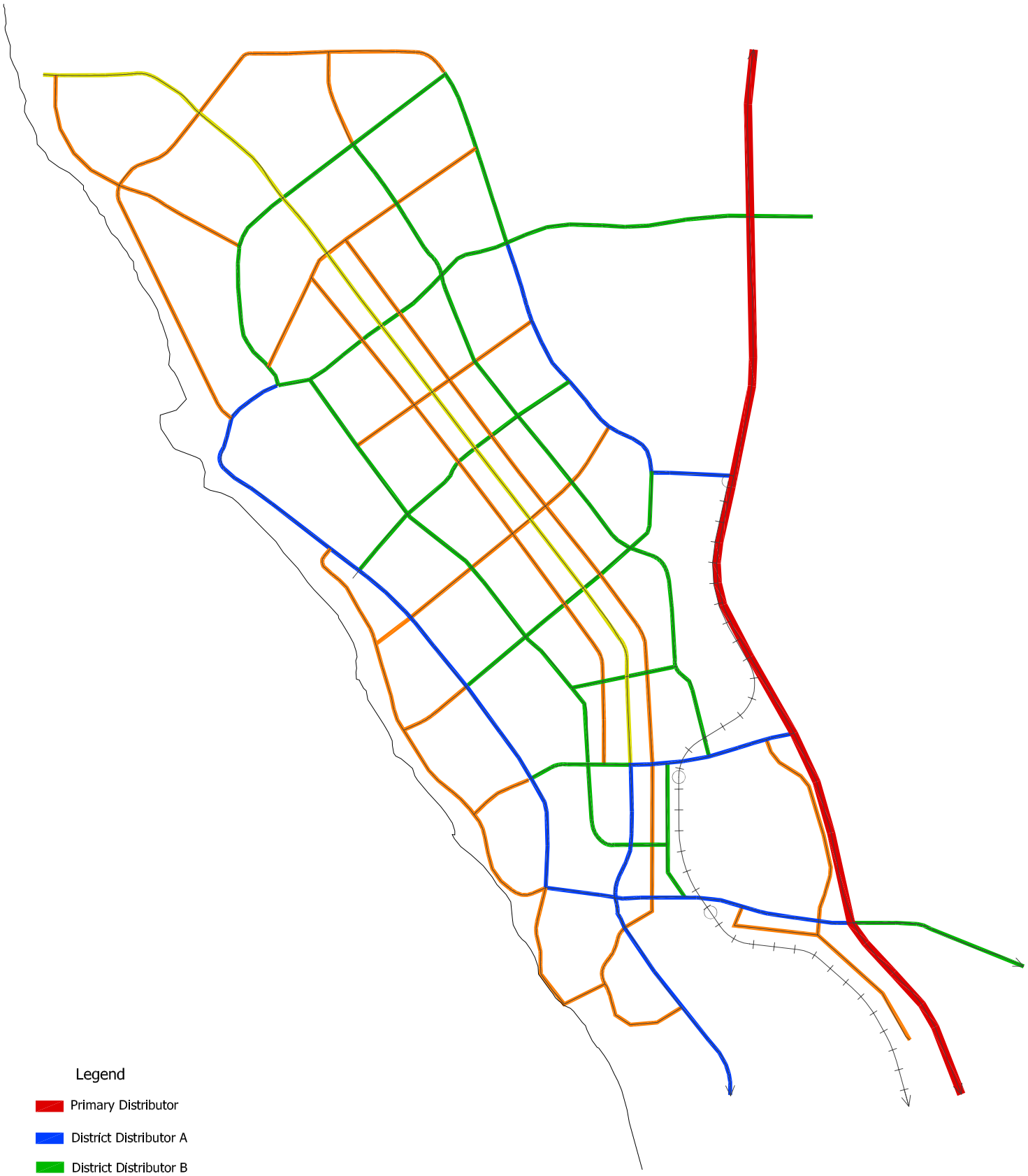
The demand for north/south traffic is greater than east/west traffic. To meet the overall demand for traffic without unduly increasing traffic volumes on individual roads, the north/south road spacing for district distributor roads has been reduced to closer to 1km spacing. The proposed functional road hierarchy is shown in **Figure 5.2**. The following cross sections have been proposed by Sinclair Knight Merz and Bruce Aulabaugh Traffic Engineering and Transport Planning following consultation with the City of Wanneroo and DPI staff.

District Distributor A

A generic cross section is shown in Figure 5.3

- **Figure 5.3 District Distributor A**





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St Andrews District Structure Plan
Functional Road Classification Plan

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FIGURE 5.2

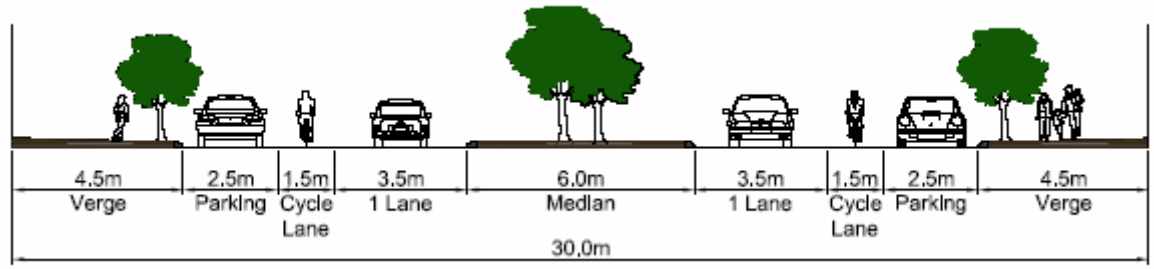
DE02547/ASM

- Description – 4 lane dual carriageway urban arterial roads designed for high traffic volumes within the urban area.
- Operating Speed – 60-70 kph.
- Nominal Road Capacity – 40,000 vehicles per day.
- Parking – 24 hour clearways on main carriageway. Access to parking from side streets.
- Bus Priority – Not generally envisaged.
- Road Reservation – 40.0 metres.
- Median- at least 6 metres wide.
- Wide verge to accommodate trunk services and shared use path, but could be less than 8.5 metres in some circumstances.

District Distributor B

The generic cross section is shown on **Figure 5.4**

- **Figure 5.4 District Distributor B**

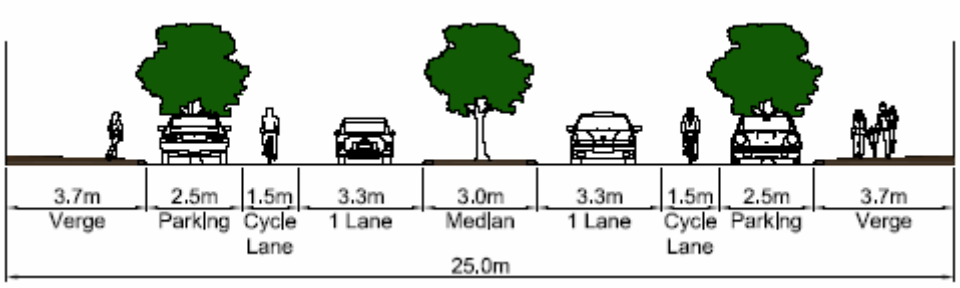


- Description – Dual carriageway two lane boulevard.
- Operating Speed – 50-60 kph.
- Nominal Road Capacity – up to 20,000 vehicles per day.
- Parking – Permitted both sides.
- Bus Priority – Not generally required.
- Road Reservation – 30.0 metres.
- Median- 6 metres
- Verge- 4.5 metres. Trees may be located on nibs in the parking bays

Local Distributor

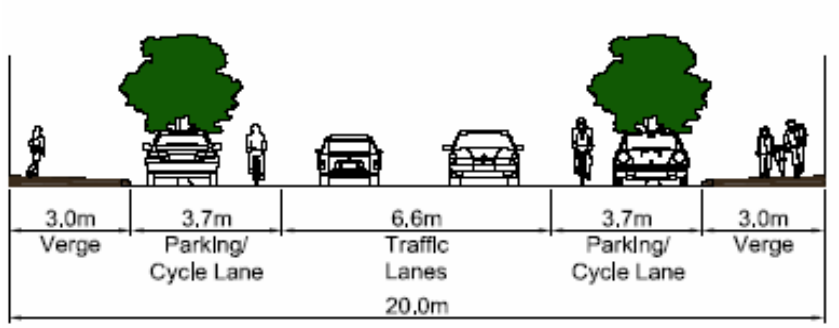
Two generic cross sections have been developed **(Figures 5.5 and 5.6).** Option 1 is a liveable neighbourhoods' boulevard neighbourhood connector, which is likely to be preferred on streets outside of the business areas. Option 2 provides a more compact street layout without a median. It is likely to be more applicable in business areas, such as on the proposed streets each side of the transit boulevard, where there is a fairly high demand for access and egress to car parks.

- **Figure 5.5 Local Distributor (Option 1)**



- Description – Liveable Neighbourhoods Boulevard Neighbourhood Connector.
- Operating Speed – 50 kph.
- Nominal Road Capacity – 15,000 vehicles per day.
- Parking – Permitted both sides.
- Bus Priority – Not required.
- Road Reservation – 25.0 metres.
- Median- 3.0 metres. Additional width may be required depending on tree species
- Verge- 3.7 metres. In area where al fresco dining is proposed, building setbacks may be required.

- **Figure 5.6 Local Distributor (Option 2)**



- Description – Business Area Neighbourhood Connector
- Operating Speed – 50 kph.
- Nominal Road Capacity – 10,000 vehicles per day.
- Parking – Permitted both sides.
- Bus Priority – Not required.
- Road Reservation – 20-22 metres.
- Median- none
- Verge- 3-4 metres

5.2 Transit Boulevard

The St Andrews District Structure Plan includes a major employment corridor between the southern and the northern regional activity centres (refer **Figure 5.1**). To serve this high density employment corridor, it is proposed to provide a high frequency public transport service operating along its own right or way. Further details on how this transit route would interact with the remainder of the public transport system is provided in section 6.

The district structure plan makes provision for the employment corridor to be a high capacity transit corridor for both public and private transport. Estimates of travel along the corridor are:

- Public Transport- between 15,000 and 25,000 trips per day with the higher volumes along the southern part of the corridor.
- Vehicle Traffic- about 40,000 trips per day along the corridor between the northern and southern regional activity centres

Main Roads modelling indicates that the demand for vehicles travelling along the transit boulevard corridor could be about 52,000 vpd. The transit boulevard corridor composes the transit boulevard plus the local distributor roads flanking it along each side. It is considered that the practical capacity to retain a vibrant pedestrian friendly commercial street environment is about 40,000 vpd, comprising:

- 25,000 vpd along the transit boulevard
- 7000 to 8000 vpd along each of the parallel local distributor streets.

We consider it to be both practical and desirable to manage traffic along the transit boulevard so that the traffic volume remains below 25,000 vehicles per day. As noted in section 4, we are of the view that the Main Roads Regional Operations Model has over estimated traffic movement within St Andrews by over 100,000 trips per day or over 30% of total demand. Under these circumstances we consider that the overall north/ south traffic is likely to be over estimated in ROM by about 30,000 vehicles per day. This suggests it will be possible to maintain traffic levels of less than 25,000 vpd along the transit boulevard without increasing traffic along other streets.

Part of the process of managing transport demand will be to develop a parking policy for the regional activity centres and the employment centres- transit boulevard and the employment area to the south of the southern regional activity centre. As the St Andrews region develops over the next 50 years it will be necessary to apply increasing levels of restraint on car driving. Limits on the maximum level of parking permitted in employment areas will be an important component of this strategy.

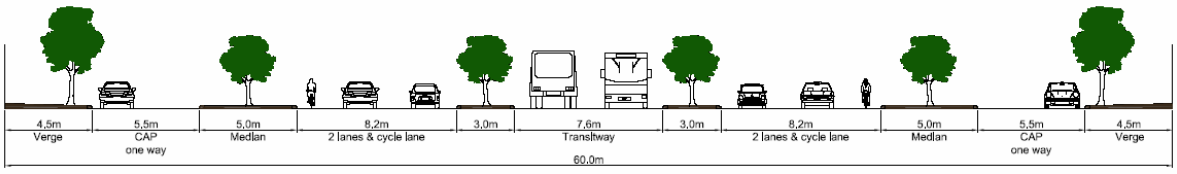
Transit Boulevard Role and Design

The role of the transit boulevard is multi-functional. It is required to:

- Provide priority for public transport, including light rail in the longer term
- Provide for reasonably high traffic volumes along the main employment corridor
- Provide some short term on street parking to support businesses
- Provide for safe movement of bicycles
- Provide a quality pedestrian environment to support adjacent land uses- retail, office, cafes etc

Two different cross sections are proposed for the transit boulevard. Option 1 (**Figure 5.7**) is proposed for that section of the boulevard between the southern and the northern regional activity centres.

- **Figure 5-7 Transit Boulevard (Option1)**



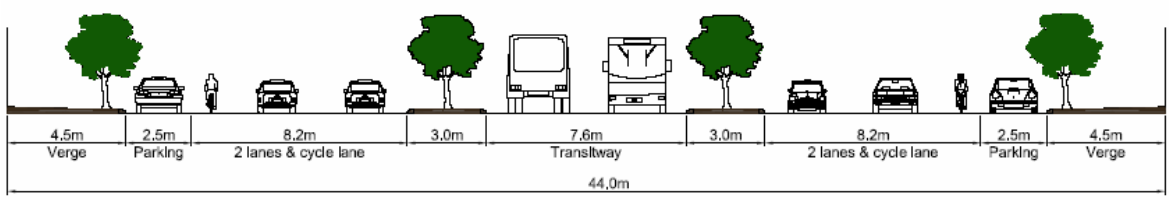
- Description – Transit corridor with service roads.
- Operating Speed – 50-60 kph.
- Nominal Road Capacity – 30,000 vehicles per day.
- Parking – Permitted in CAP roads only.
- Public Transport Priority – Dedicated transitway.
- Road Reservation - 60 metres.

- Verge – 4.5 metres

There are a variety of possible intersection configurations of the transit boulevard with crossing roads. The treatment shown in **Figure 5.8** provides for a simple traffic signal phasing with safe crossing facilities for pedestrians. The final intersection treatment to be adopted will be agreed at the local structure planning stage of development.

North of the northern regional activity centre, the level of activity along the route is less and a transitway without a service road is proposed (Option 2, **Figure 5.9**)

- **Figure 5.9 Transit Boulevard (Option 2)**



- Description – Transit corridor without service roads.
- Operating Speed – 50-60 kph.
- Nominal Road Capacity – 30,000 vehicles per day.
- Parking – Permitted both sides.
- Public Transport Priority – Dedicated transitway.
- Road Reservation – 44 metres.
- Verge – 4.5 metres

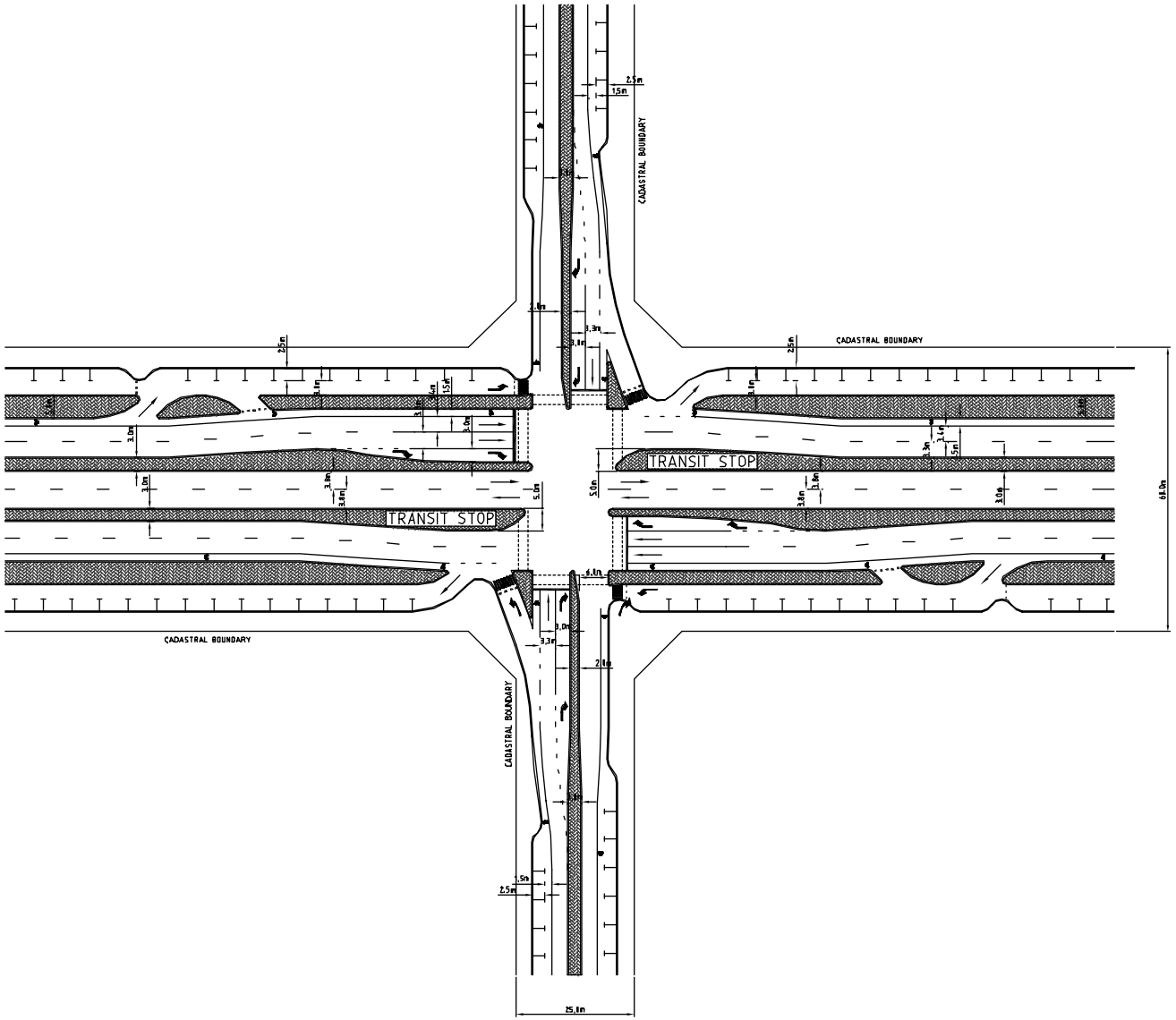
As with option 1, the cross section at intersections will vary. The though carriageways can be diverted 2 metres to the left to create a right turn pocket on the near side of the intersection and sufficient width for a transit stop on the far side of the intersection. The additional width required can be made available by prohibiting parking on the approach to the intersection.

There are many famous boulevards around the world, but this type of street is new to Western Australia. Some concern has been raised about the width of the boulevard and the segregation effect this will have between the two sides of the street.

Jacobs, McDonald and Rofe in *"The Boulevard Book- History, Evolution, and Design of the Multiway Boulevard"* present the following guidelines for choosing the location of boulevards:

- *"Boulevards are appropriate where there is a need to carry both through traffic and local traffic, where there is good reason for the through traffic to move faster than the local traffic and/or where there is real or potential conflict between the two traffic types.*
- *They are appropriate for streets that, by virtue of their size and/or location, can become significant elements in the city. They have a potential to become special places.*

FIGURE 5.8



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No	DRAWING NUMBER	REFERENCE DRAWING TITLE

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CLIENT: YANCHEP SUN CITY
PROJECT: ST ANDREWS DISTRICT SCHEMATIC PLAN

DRAFTER	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
J. HELLMUTH			
DESIGNED	DESIGN REVIEW		
E RICHARDSON			

TITLE: SCHEMATIC TRANSIT BOULEVARD INTERSECTION LAYOUT

SCALE	SKM PROJECT No	DRAWING No	AMDT
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- *Boulevards are appropriate where there is either a significant volume of pedestrians who need to cross the street or a potential desire to do so. Commercial streets, streets with high residential density, streets that incorporate public transit, or streets with a significant presence of public institutions are examples."*

Both of the boulevard options are wide streets designed to accommodate fairly high traffic volumes and frequent public transport services along a central dedicated transitway. St Andrews has been designed around the metropolitan rail system interchanging with an at grade transitway at the southern town centre. Patronage on the transitway north of the southern town centre is estimated to be about 25,000 trips per day, which justifies ultimate construction of a light rail system in its own right of way.

From a traffic engineering viewpoint, both of the boulevard options (the 60 metre and 44 metre wide cross sections) are capable of accommodating estimated traffic flows and both will result in some degree of segregation. The major advantages of the 60 metre wide transit boulevard option relate to improved amenity along the footpaths and to occupants of adjacent properties. This is created by constructing a service road with slow moving and public traffic between the footpath and the faster moving through traffic. This is a major feature of boulevards. Another is the ability to create a special street with significant architectural merit.

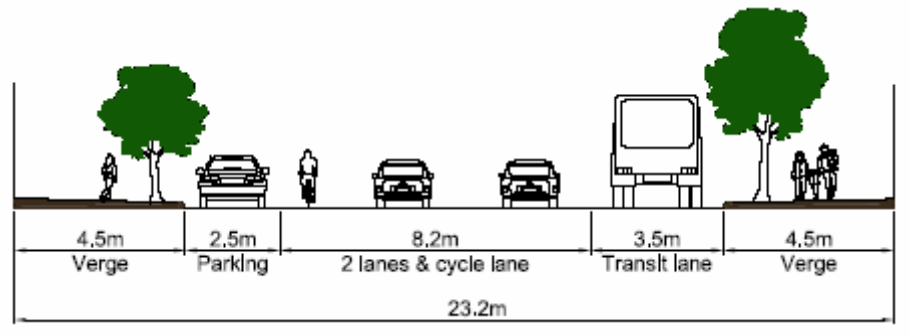
Couplets

In order to reduce the severance at busy town centres with estimated high volumes of pedestrians, couplets are proposed. A number of one way couplets are proposed along the transit boulevard as shown on the district structure plan (**Figure 5.1**). These couplets are proposed to simplify intersections and provide more capacity without the need for very wide streets. They reduce pedestrian crossing distances at intersections, improving pedestrian accessibility and safety.

In the regional activity centres, where traffic volumes and pedestrian volumes are highest, two way couplets are proposed. In the district centres one way couplets along the transit boulevard are proposed. If two way couplets were to be introduced in the district centres along the transitway, it would result in an excessive number of traffic signals along the transit boulevard.

Two different cross sections are proposed for the couplets. Option 1 (**Figure 5.10**) is the generic cross section along the length of the couplet. Option 2 (**Figure 5.11**) is the cross section at traffic signals where transit stops are required.

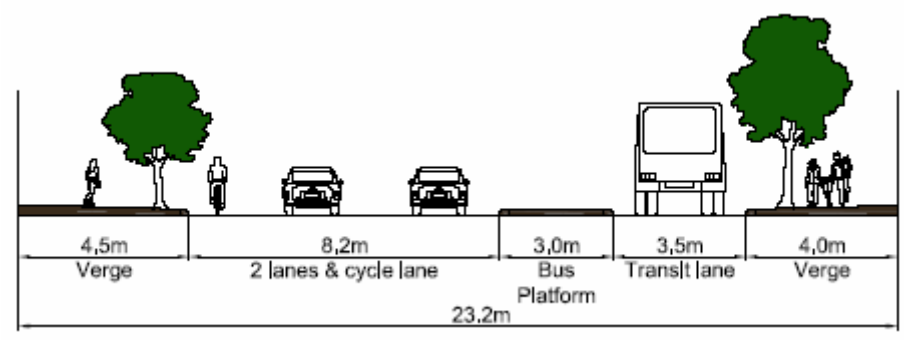
- **Figure 5.10 Couplet (Option 1)**



- Description – Two lane one way street through regional or district activity centre.
- Operating Speed – 50 kph.
- Nominal Road Capacity – 15,000 to 20,000 vehicles per day (one way).
- Parking – Permitted left side only.
- Public Transport Priority – Right side transit lane.
- Road Reservation – 23.2 metres.
- Verge- 4.5 metres. Trees may be located on nibs in parking bays.

A right side transit lane can operate satisfactorily for trams, light rail or purpose designed vehicles with right side loading and unloading. However, if buses are permitted to use the transit lane, as will be the case in the initial years of operation, provision will need to be made for a platform for left side loading and unloading. A cross section for a couplet at transit stops is shown in **Figure 5.11**.

- **Figure 5.11 Couplet (Option 2)**



- Description – Two lane one way street at traffic signals
- Operating Speed – 50 kph.
- Nominal Road Capacity – 15,000 to 20,000 vehicles per day (one way).
- Parking – Not provided

- Public Transport Priority – Right side transit lane.
- Road Reservation – 23.2 metres.

One way street systems in town centres are sometimes criticised for introducing an unnecessary complexity, lack of legibility, lengthening vehicle travel and increasing vehicle speed. However most of these potential problems are not evident with short lengths of couplets linking through the town centre to the transit boulevard.

Whilst the transit boulevard has been created to develop energy and vitality along the employment corridor, the couplets have been introduced through the regional and district centres to reduce segregation and create pedestrian friendly streets.

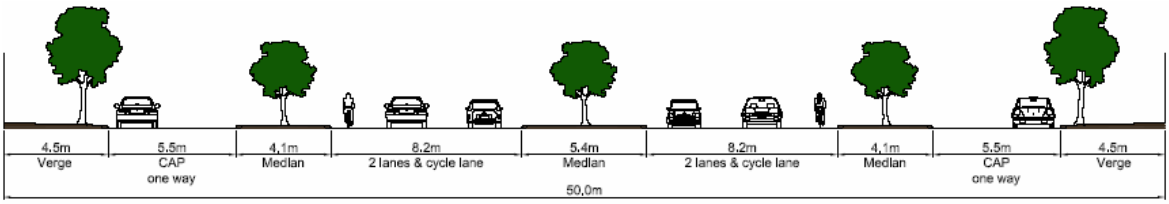
It is considered that the construction of the transit boulevard and couplets in centres will result in a unique transit oriented development along the main employment corridor of St Andrews.

Gateway Treatment

Marmion Avenue to the south of Yanchep Beach Road is proposed to be a typical district distributor A road with wide verges and median linking St Andrews to Alkimos. There is a need to create a transition between Marmion Avenue and the southern town centre and the transit boulevard. A gateway treatment is proposed for that section of Marmion Avenue north of Yanchep Beach Road linking with the southern town centre north/ south couplet.

The cross section for the gateway road is shown in **Figure 5.12**

- **Figure 5.12 Gateway Treatment**



- Description - Four lane high capacity dual carriageway road with service roads
- Operating speed - 60 kph
- Normal road capacity – 40,000 vehicles per day
- Parking – permitted in service roads
- Bus priority – not generally required
- Road reservation – 50.0 metres
- Median – 5 metres
- Verge – 4.5 metres

The gateway treatment is proposed to have marginally narrower lane widths and median to assist in reducing traffic speed on approach to the town centre. The service roads allow street parking to service mixed commercial and residential and some retail uses along this important entry point to St Andrews.

5.3 External Regional Road Connectors

ROM modelling has estimated the following traffic volumes on the extended road network at full development of St Andrews:

- Mitchell Freeway, south of St Andrews- 63,000 vpd
- Marmion Avenue, south of St Andrews- 32,000 vpd
- Yanchep Beach Road, east of Mitchell Freeway- 11,000 vpd
- Mitchell Freeway, north of Breakwater Drive, 7,000 vpd

Main Roads has advised that there is provision for the Mitchell Freeway to be 6 lanes in the long term. This would provide more than sufficient capacity along the freeway in this area. However it is likely that there will continue to be capacity limitations on the freeway to the south. This is a major reason why more corridor capacity is being planned by linking St Andrews to Perth by the northern suburbs railway.

The estimated long term traffic flow along Marmion Avenue is well within the capacity of a 4 lane dual carriageway. Marmion Avenue, south of Yanchep Beach Road, is proposed to be a district distributor A road with a cross section as shown in **Figure 5.3.**

Yanchep Beach Road, east of the Mitchell Freeway provides an important linkage between St Andrews and Wanneroo Road and other activity centres within the City of Wanneroo. The long term estimated traffic flow on Yanchep Beach Road of 11,000 vpd could be accommodated on a 2 lane road with protected turn lanes. However, because of the rural nature of this road, it may be preferable to upgrade to a 4 lane dual carriageway road in the long term, if warranted. The road reservation is wide enough to accommodate a 4 lane dual carriageway road.

The Mitchell Freeway is currently planned to extend north to connect with Wanneroo Road. It will function as an inter regional rural highway between St Andrews and the Shire of Gingin and beyond.

It can be seen from **Figure 4.2** that traffic volumes along the Mitchell Freeway are predicted to be considerably lower along the northern section than adjacent to or to the south of the southern regional activity centre. Predicted traffic volumes at build out of St Andrews are:

- South of Yanchep Beach Road- 63,000 vpd
- South of access to southern regional centres- 46,000 vpd
- North of access to southern regional centres- 24,000 vpd
- South of Breakwater Drive- 8000 vpd

On the basis these predicted flows, the Mitchell could reasonably be expected to terminate as a freeway at the St Andrews entrance adjacent to the proposed northern park and ride station. Traffic

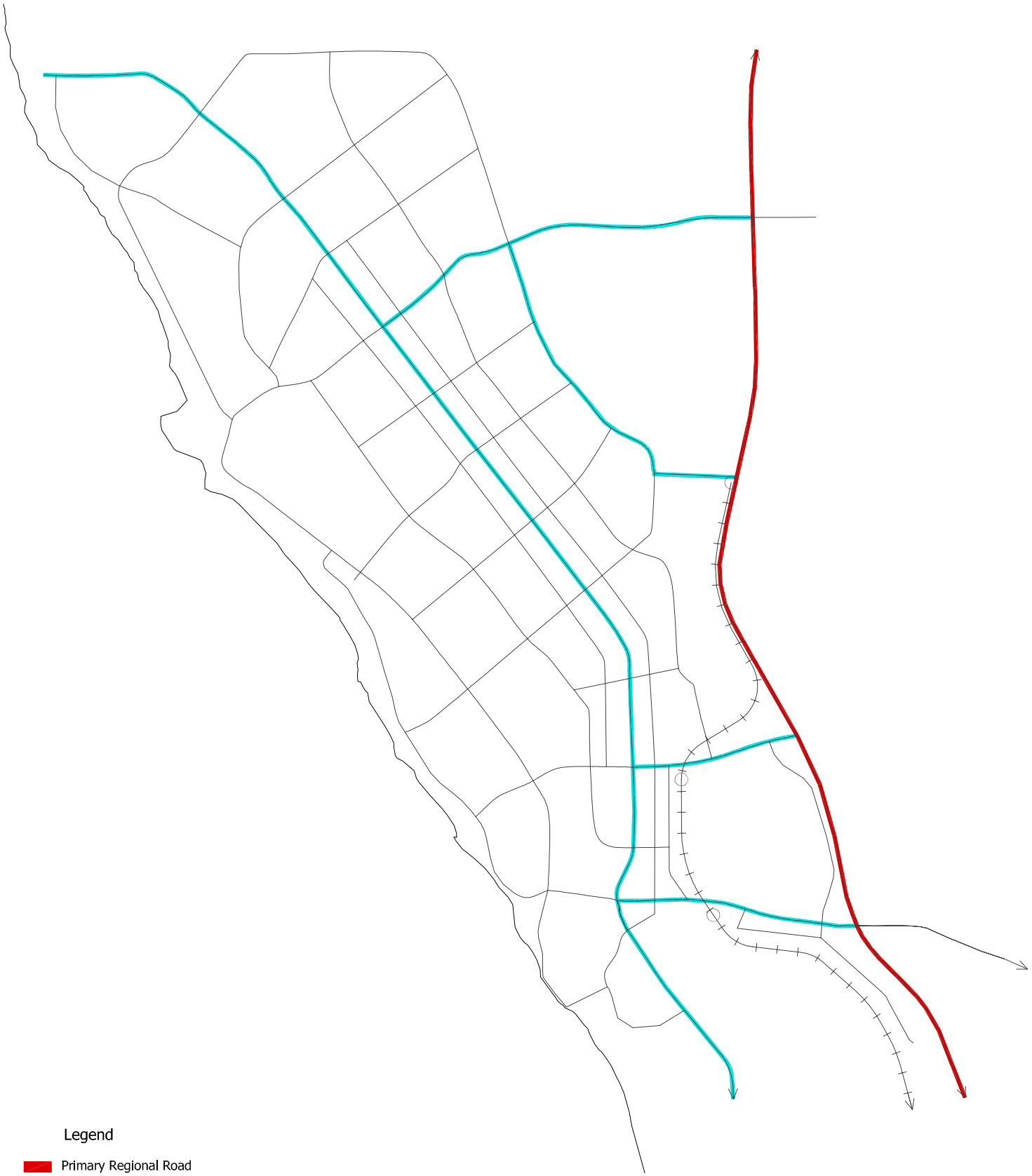
signals or a roundabout could be used to demarcate between the freeway to the south, a rural highway to the north and an urban arterial road to the west.

5.4 Relationship to the Metropolitan Region Scheme

The proposed functional road hierarchy and appropriate road cross sections has been discussed in sections 5.1, 5.2 and 5.3.

Figure 5.13 shows the proposed primary and other regional roads.

The Mitchell Freeway and rural highway extension to the north is the only proposed primary regional road within the area. Marmion Avenue and the proposed transit boulevard are considered to be roads of a regional nature and have been classified as other regional roads. The remaining other regional roads are all direct connections between the transit boulevard/ Marmion Avenue and the Mitchell Freeway.



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March 2007

FIGURE 5.13

DE02547/ASM

6. Public Transport

This section addresses the public transport requirements for the area. It includes the following main elements:

- Extension of the Perth Metropolitan rail system to the St Andrews area
- Provision for a surface light rail, streetcar or busway system linking the southern regional activity centre to the northern regional activity centre and the northern coastal village.
- Integrated feeder bus system linking residential neighbourhoods to the regional, district and neighbourhood centres and to the regional rail system.

The proposed integrated bus and rail transit system, shown in **Figure 6.1**, has been developed following extensive consultation with officers of the Public Transport Authority, the Department for Planning and Infrastructure and the City of Wanneroo.

The estimated long term patronage on the metropolitan rail, light rail or busway spine services is shown in **Figure 6.2.**

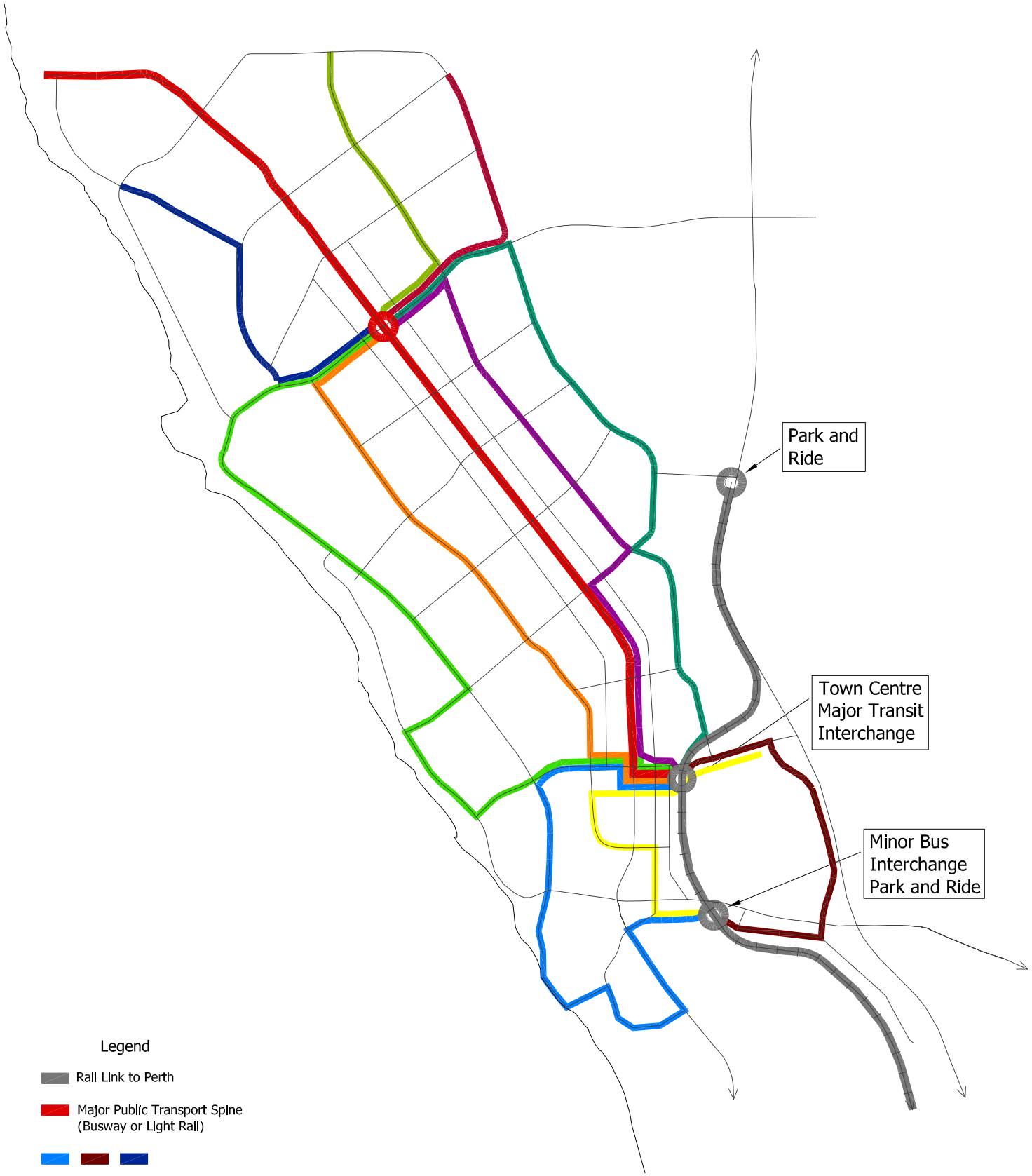
It is estimated there will be over 60,000 public transport trips each day based on a public transport mode share of 7% within St Andrews and 17.3% for trips external to St Andrews. These mode share projections were developed in consultation with the DPI more to provide a conservative upper level of car driver trips to use in assessment of road infrastructure, than a firm belief that this would represent an upper level of public transport travel in the long term. If, as is likely, oil prices continue to increase, or alterative fuels become a necessity, we may well see a substantial increase in car driving costs. In the long term this may well result in higher levels of public transport, walking and cycling than is provided in the estimates in section 4. The public transport infrastructure we are proposing- metropolitan rail connection to Perth, busway or light rail along transit corridor and feeder bus routes on the street system is capable, with progressive rolling stock expansion, to meet demands of 100% more than predicted in section 4 should the need arise. This is considered to be a prudent and robust approach to structure planning for a large area like St Andrews.

6.1 Perth Metropolitan Rail System

North West corridor structure planning includes provision for extension of the northern suburbs railway to the St Andrews southern regional activity centre. There was extensive discussion on rail planning for the North West Corridor at the corridor workshop held from 28 to 30 January 2004. The following statement was agreed by workshop participants:

"This workshop supports:

- *The railway leaving the freeway at Lukin Drive, with stations at Butler, Jindalee and Romeo Road, as agreed at the 2001 charette and endorsed by the WAPC.*



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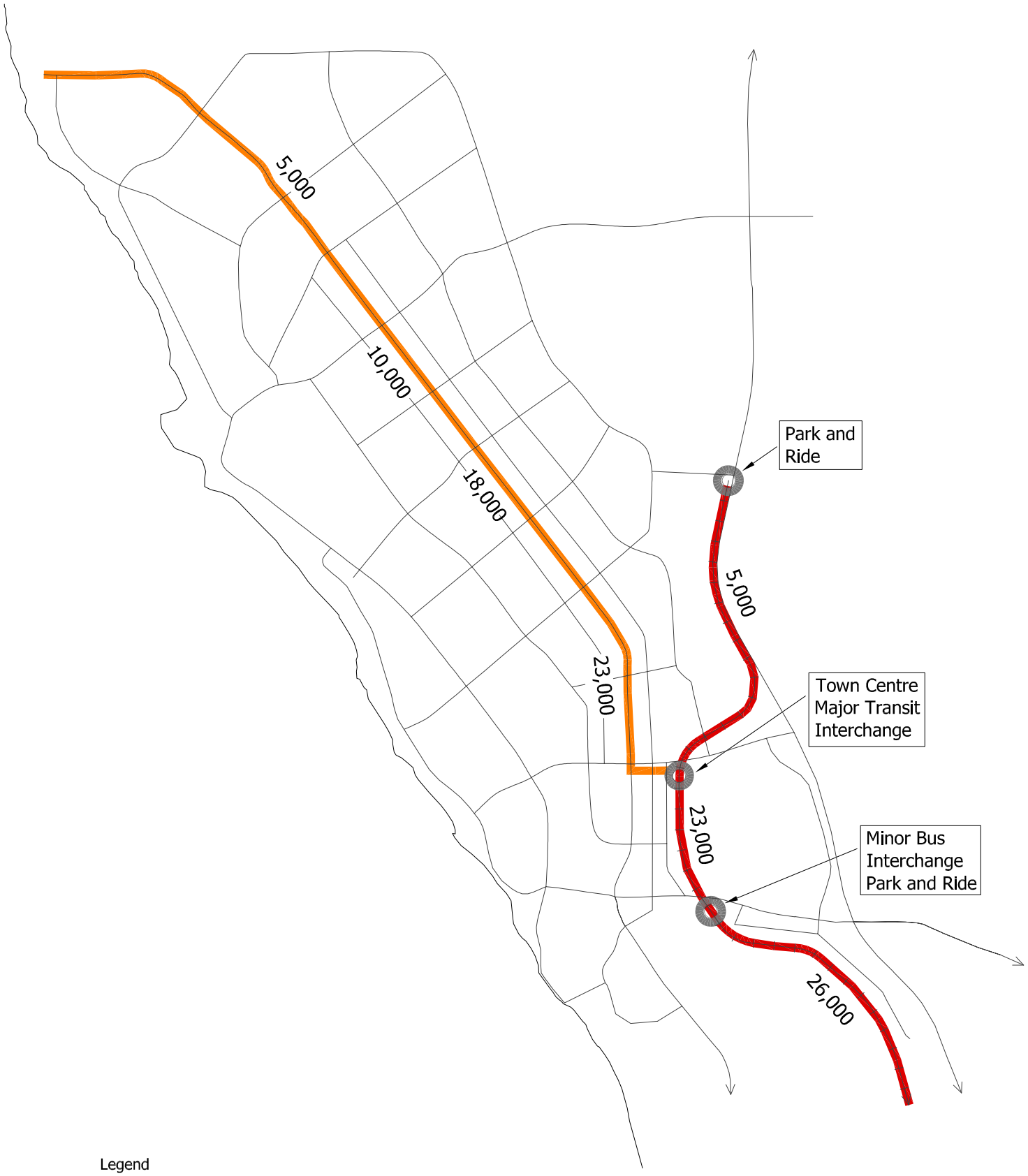
St Andrews District Structure Plan
Intergrated Bus/ Rail Public Transport Service

March 2007
FIGURE 6.1

DE02547/ASM



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St Andrews District Structure Plan
Estimated daily public transport patronage 2050

March 2007
FIGURE 6.2

DE02547/ASM

- *A rail alignment north of Romeo Road with stations at Alkimos, Eglinton and St Andrews (South).*
- *An alternative mode (such as light rail) north of St Andrews (South) that is more suited to serving a linear employment mixed used centre with close up spaced stations.*
- *Construction of the railway preceding construction of the freeway to assist in establishing patronage and public transport usage.*
- *A staged construction of the railway stations sufficiently early to influence the form and density of development around the train stations.*
- *Mandatory minimum densities as an integral part of the structure plan within station precincts (800m radius).*
- *A decision by government by May 2004 on – a) the offer by Butler to pre-fund the railway to Butler-Lukin Drive; b) the timing of construction of the railway to Jindalee and Romeo Road with a target of 2008/09.*
- *The structure plan to incorporate station locations and rail alignment."*

The estimated public transport travel on the rail system south of St Andrews is 26000 persons per day (refer section 4). The estimated peak period (6.00am – 9.00am) passenger movement is 7800 persons per 3 hour period. Based on the current profile of rail demand in the northern suburbs, we estimate the peak hour travel to be around 4000 persons/ hour with 2500 of these moving in the peak direction.

In 2005, the DPI commissioned GHD to undertake a rail definition study for the railway through Alkimos to Yanchep (GHD, June 2005). The report confirmed the alignment shown in **Figure 6.1** as far north as the St Andrews southern regional activity centre. To the north the report did not recommend a specific alignment. Since that time, SKM has further developed the rail alignment to the north of the St Andrews southern regional activity centre in consultation with New Metro Rail. The alignment shown in **Figure 6.1** and in the District Structure Plan **(Figure 5.1)** represents the proposed rail alignment in this area. This alignment has been accepted as appropriate by the PTA, who advised as follows by email on 14th March 2006:

"Option 3- Sketch 'B', is satisfactory to PTA. You can progress district structure planning on this basis.

PTA accept the following associated planning implications:

1] The first curve after the station will be 300 m radius operating at a maximum design speed of 70km/hr.

2] This curve will have 70 m transitions and a maximum superelevation of 85 mm.

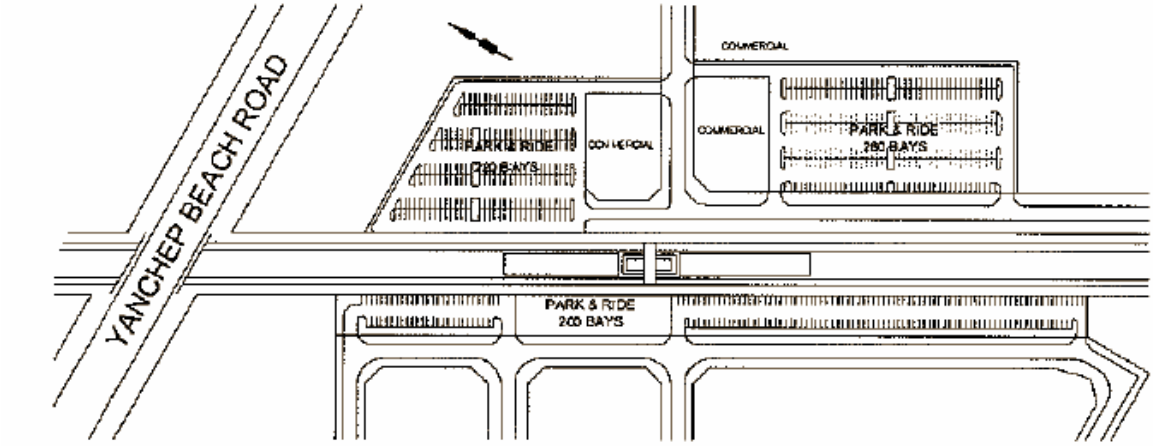
3] The curve into the centre of the freeway will be 700 m radius operating at a maximum design speed of 110km/hr

4] This curve will have 110 m transitions and a maximum superelevation of 95 mm.

5] The straight between them will be approximately 190 metres long, transition to transition".

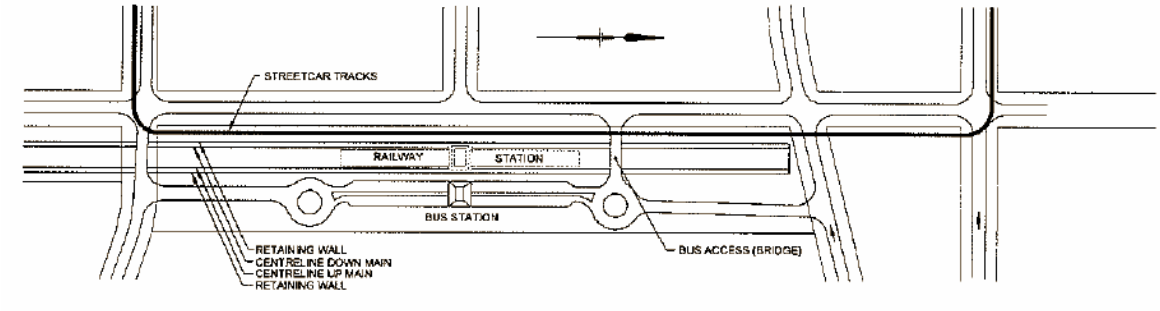
Conceptual plans have been developed for the Yanchep Beach Road and the southern regional activity centre stations by GHD in their rail alignment study (June 2005). The conceptual plans are shown in **Figures 6.3, 6.4 and 6.5**.

- **Figure 6.3- Yanchep Beach Road Station**



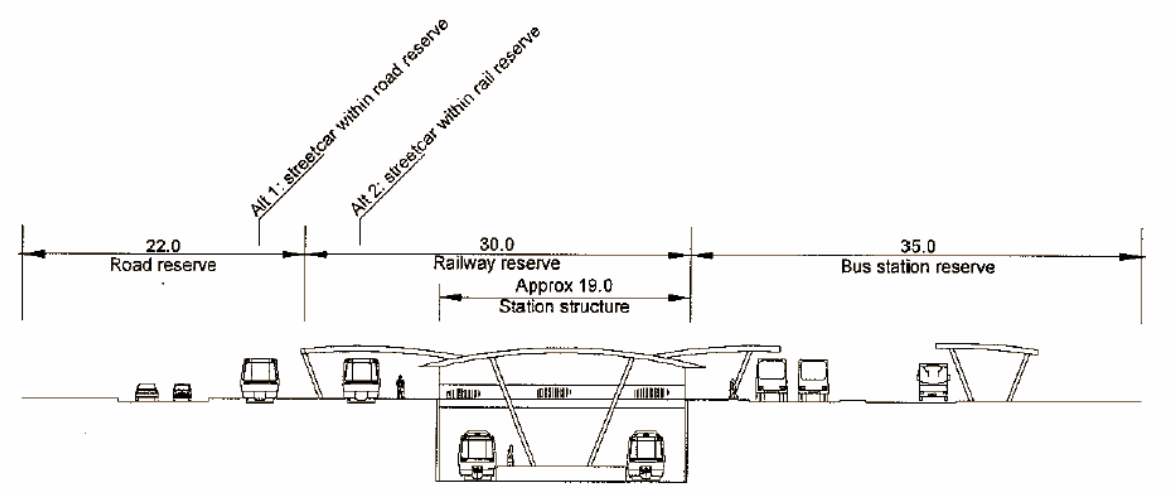
Source: Northern Suburbs Railway Alignment Definition Study GHD (June 2005)

- **Figure 6.4- St Andrews Regional Centre Station**



Source: Northern Suburbs Railway Alignment Definition Study GHD (June 2005)

- **Figure 6.5- St Andrews Regional Centre Station Cross Section**



Source: Northern Suburbs Railway Alignment Definition Study GHD (June 2005)

No conceptual plans have been developed for the northern park and ride station. This station is likely to be located in the centre of the proposed freeway. As neither the freeway or this section of the railway are likely to be constructed for many years, it is proposed that plans be prepared at the local structure planning stage.

Key features of the 3 stations are summarised in **Table 6.1**

- **Table 6.1- Rail Station Features**

Feature	Yanchep Beach Road Station	Regional Centre Station	Northern St Andrews Station
Park and Ride	Yes. Approximately 700 bays	In the short term. Approximately 700 bays	Yes. Approximately 1000 bays
Public Transport Interchange	Minor Bus Interchange	Major interchange with high frequency transit and bus	None considered at this stage but could be reviewed later
Other	High density TOD around station	Major City Centre Station	

6.2 Surface Light Rail or Busway System

At full development it is predicted there will be over 60,000 public transport trips made each day by residents and visitors to St Andrews. About 57% of these trips are estimated to be made wholly within the area. Over half of the remainder are likely to use some part of the public transport system within St Andrews.

The district structure plan provides for a high density of mixed use development along a transit boulevard designed on a North/South alignment through the area to the north of the southern regional activity centre. The form, type and density of land uses along this corridor is predicted to result in high use of transit. The high use will require a frequent service, which in turn will result in even greater use of the service.

We have estimated that over 20,000 trips per day will be made along this southern portion of the transit corridor. This would translate into peak hour patronage of between 3500 and 4000 trips per hour with about 2500 of these in the peak direction. As noted in section 6.1, public transport trips per day could potentially be much greater in the longer term. The demand for travel projected above would require buses running at a frequency of about 1minute or light rail at a frequency of 4 to 5 minutes. Whilst either system could meet the demand for travel based on these estimates, there would be some operational problems with large numbers of buses at the southern regional centre transit interchange and potentially at the proposed far side bus stops along the transit corridor.

There are some other advantages with a light rail system. Firstly the infrastructure associated with light rail provides a sense of permanence that provides confidence to those wishing to invest along the light rail corridor. This can often result in higher quality, higher density development than would otherwise be the case. The second advantage with rail systems, including light rail is that they typically generate 10% to 15% more patronage than buses for like systems. This is often referred to as the 'sparks' effect. It is clear that any decision to implement a light rail system at St Andrews will be a matter for the State Government in the future. The district structure plan has made provision for a busway system to be introduced first, which can be upgraded to light rail in the future.

6.3 Feeder Bus Services

The regional rail and light rail / busway corridor services will be supported by a network of feeder bus services. Many of the trips projected to use the regional rail and transit services along the transit corridor will use the feeder bus services for part of their trip. The approach to public transport provision in St Andrews, as in the rest of Perth, is based on a fully integrated transport system, which incorporates integrated ticketing and comfortable, convenient transfers for passengers. The Public Transport Authority is working progressively to increase bus frequencies, which will make transfers less of a deferent to using the system than they have been in the past.

The proposed feeder bus routes have been developed in liaison with the Public Transport Authority. We believe it is important that the bus routes are established and agreed in the district structure plan for the following reasons:

- Proposed bus route streets can be designed appropriately
- Provides a degree of certainty for developers and investors. This enables particular uses to be located in close proximity to bus routes (eg group housing, elderly citizens housing etc).

The bus route network is show in Figure 6.1. It can be seen that it provides a good coverage of the area, with routes passing close to or through all of the district, neighbourhood and coastal activity centres.

Most of the bus routes are proposed on the district distributor B roads which have a single lane of travel of 3.5 metres in width (refer to Figure 5.4). This provides for the comfortable movement of buses and enables fairly easy pedestrian crossing to access bus stops. The majority of these roads are predicted to carry up to about 10,000 to 12,000 vehicles per day at full development or up to about 800 vehicles per hour in the peak duration during peak hours. Buses will be able to operate at reasonable efficiency in mixed traffic without the need for bus priority lanes. Provision does exist within the proposed road reservation of 30 metres to install short bus lanes at congestion points should they ever be required.

In general, mid-block bus bays would be provided by removing car parking at the bus stop. However there may be instances where it is appropriate to stop the bus on the through carriageway. These instances may relate to sight distance criteria or a desire to provide an element of bus priority and would need to be agreed between the PTA and the City of Wanneroo.

It will also be necessary to provide bus stops close so the intersections at the approximate 1 km grid spacing. It may be possible to locate the bus stops on either the approach or the departure side of the intersection. The location and design of bus stops will need to be addressed at the local structure planning stage.

There are two bus routes shown in Figure 6.1 proposed to travel along district distributor A (dual carriageway) roads. The two roads in question are predicted to have traffic volumes of between 12,000 and 22,000 vehicles per day and are at the lower end of traffic volumes justifying dual carriageway. Under these circumstances we believe it would be preferable for buses to stop in the through lanes rather than develop indented bus bays.

There are a small number of bus routes or parts of bus routes that will be on local distributor roads. In this case the traffic lane will be 3.3 metres adjacent to a 1.5 metre cycle lane (refer Figure 5.5).

On local distributor roads it is generally acceptable for traffic to stop behind buses at stops rather than provide for indented bus bays. This can provide an element of traffic calming that will assist in ensuring that local distributor roads do not become de-facto district distributor roads.

To the south of the southern regional activity centre there is provision in the district structure plan for a university, hospital and TAFE college and for a major employment zone comprising non-industrial uses. In the longer term, there is likely to be a demand for a CAT type service linking these uses to the regional activity centre and to the train station. Whilst we have shown an indicative route, this will need to be further developed and agreed at the local structure planning stage.

An indicative layout of the bus/ rail interchange at the southern regional centre transit interchange is shown in **Figure 6.4**. This layout is satisfactory to the Public Transport Authority. In relation to the Yanchep Beach Road bus interchange, the Public Transport Authority has noted that convenient bus access will be required on both sides of the railway and have requested that more detailed planning be undertaken at the local structure plan stage.

6.4 Provision for Future Regional Rail Service to the North

Provision has been made in the district structure plan to extend the railway to the north of St. Andrews should this ever be required. Within the district structure plan area, the railway could be accommodated in the Mitchell Freeway reservation.

6.5 Metropolitan Region Scheme Amendment (Rail)

The existing Metropolitan Region Scheme includes provision for construction of a railway as far north as the northern regional activity centre. Current district structure planning makes provision for a busway or light rail within the median of a boulevard along the employment corridor linking the southern and northern regional activity centres (refer **Figure 5.7** in section 5.2). This is supplemented by an extension of the metropolitan railway to a park and ride station as shown in **Figure 6.1**.

The location and alignment of the railway north of St Andrews has been discussed with the PTA, which has provided advice on how the railway could fit into the district structure plan (see section 6.1)

It is recommended that the existing railway reservation in the Metropolitan Region Scheme within St Andrews be deleted and replaced by the alignment outlined in **Figure 6.1**.

7. Non-Motorised Travel

Planning for St Andrews (St Andrews Concept Plan and District Structure Plan) has focused on achieving a high level of accessibility and amenity for pedestrians and cyclists.

The district structure plan incorporates

- 2 regional activity centres;
- 9 district activity centres;
- 4 local activity centres;
- 3 coastal activity centres;
- A major transit boulevard flanked by mixed land uses
- A mixed use office and employment area contiguous with the southern regional activity centre
- Universities, hospitals and colleges at the periphery of the regional activity centres

All of these activity centres are designed to encourage walking and cycling by providing facilities within convenient walking distances of homes, businesses and public transport. The residential areas surrounding the activity centres have been designed with a high level of permeability and connectivity to provide safe, secure, comfortable walking and cycling routes.

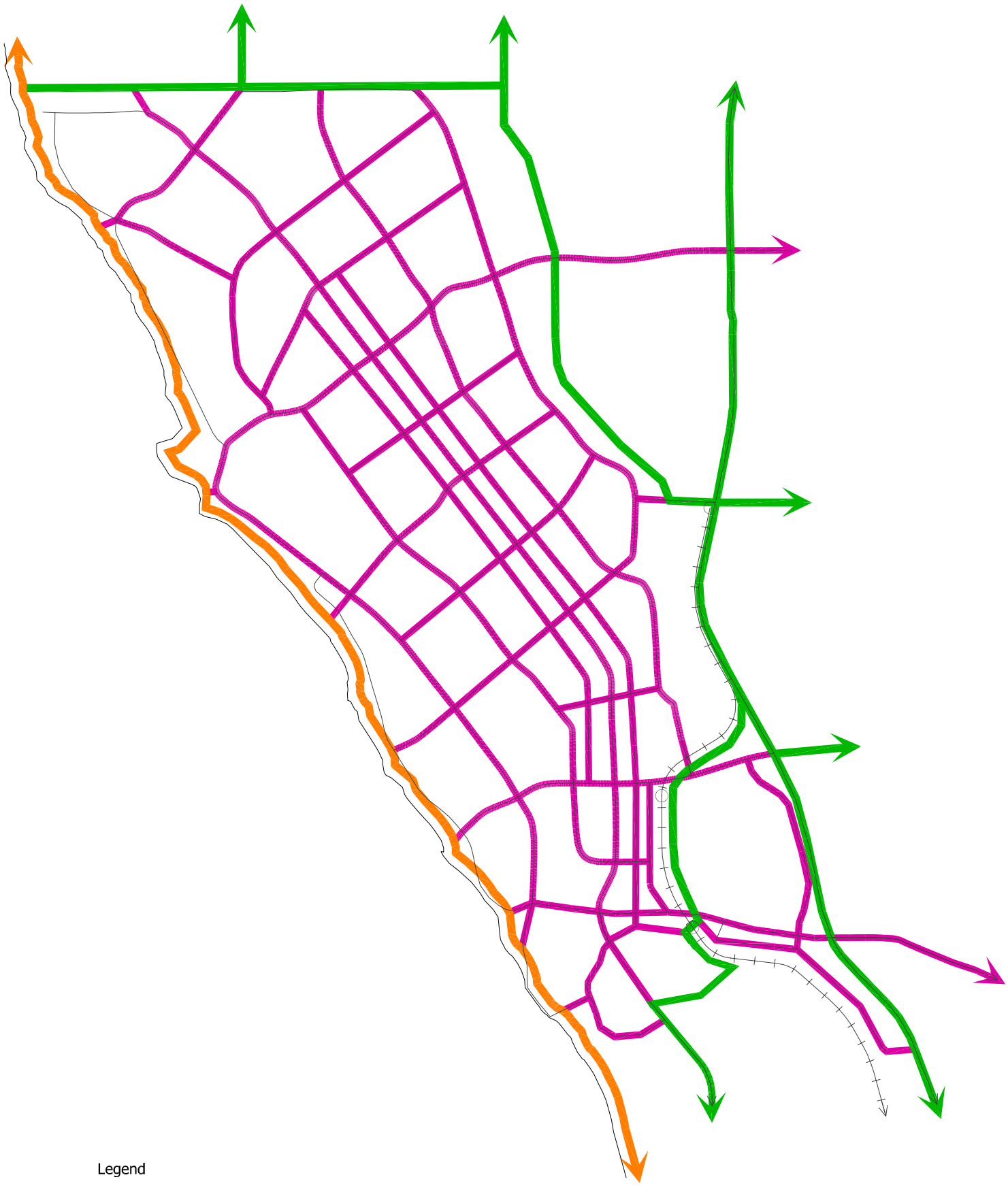
We have projected that there will be about 117,000 walking and cycling trips each day in St Andrews (refer section 4). This represents 22.7% of all trips within St Andrews and 17.5% of all trips including longer distance trips external to St Andrews.

7.1 Cycling

The mode share of cycling can vary markedly in different areas, depending on the quality and perceived safety of the cycling network. The average mode share of cycling in Perth is currently about 3%.

With the provision of a high quality cycling network, as in proposed for St Andrews, it is considered that the mode share of cycling could be increased to about 6% of all internal trips in St Andrews - about 31000 cycling trips per day.

The major network of shared paths proposed in the district structure plan is shown in **Figure 7.1**. It comprises:



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St Andrews District Structure Plan
Shared Path Network

May 2006
FIGURE 7.1

DE02547/ASM

- **Principle Shared Paths.** Principle shared paths are the highest level of off road bicycle and shared user facilities. They are generally constructed to a width of 3.0 metres and grade separated crossings are often provided over major roads.
- **Regional Recreation Paths.** These paths are often provided along river and ocean frontages They are generally constructed to a width of 3.5 metres.
- **Other Shared paths.** It is proposed that shared paths be provided along major road networks in St Andrews as follows;
    - district distributor A roads - both sides
    - district distributor B roads - both sides
    - local distributor roads - one side

  Other shared paths are generally constructed to a width of 2.5 metres.

It is proposed there be two principle shared paths linking St Andrews to the south - one along the Mitchell Freeway and the other along Marmion Avenue. It is normal in Perth to construct principle shared paths along freeways and railways. However, to the south of Yanchep Beach Road, the railway and the freeway are very close together. For this reason we believe a principle shared path along Marmion Avenue would be of more use than a shared path along the railway. It is possible that this path could transfer to the railway reserve further south in Eglington or Alkimos. It is proposed that the principle shared path network be developed, over time, around the perimeter of the urban footprint of St Andrews.

A regional recreational path is proposed along the entire ocean frontage of St Andrews as shown on **Figure 7.1**

Experienced cyclists generally prefer to use the road system rather than shared paths. On road bicycle lanes have been proposed on both sides of all distributors A and B roads and all local distributor roads **(refer to Figures 5.3, 5.4, 5.5 and 5.6).** In addition, on road bicycle lanes have been proposed on both sides of the transit boulevard **(refer Figures 5.7, 5.8 and 5.9)** and along the left side of the one way couplets **(refer Figures 5.10 and 5.11)**

7.2 Walking

Under this section, any reference to walking, pedestrians or pedestrian infrastructure (such as footpaths) should be interpreted to be inclusive of people with a disability, such as people in a wheelchair.

Perth Walking (Metropolitan Region Pedestrian Strategy, 2000) estimated that walking accounted for about 10% of all trips in metropolitan Perth and noted that the proportion has been decreasing

in recent years. The Metropolitan Transport Strategy (1995) set a target to increase the proportion of walking trips to 12.5% by 2029.

The district structure plan proposes a good network of pedestrian routes to link mixed use activity centres, residential precincts and public transport stations and stops. It is envisaged that walking trips will comprise about 17% of all trips within St Andrews or about 86,000 trips per day.

Walking is also a significant proportion of many public transport trips and some car trips (eg walk trip to and from car parks). A survey undertaken for Perth Walking (2000) found that "*56% of those who use public transport to get to work, also walk for 15 minutes as part of their trip*"

Taking account of these additional walking trips we believe the real number of walking trips in St Andrews at full development is likely to be more than 100,000 trips per day.

It is not proposed that a path network be agreed at the district structure planning stage. However it is considered appropriate to include the following guidelines in the text of the district structure plan.

- District Distributor A and B roads- a 2.5 metre shared path on both sides.
- Local Distributor roads- a 2.5 metre shared path on one side and a 1.5 metre footpath on the other.
- Access roads- a 1.5 metre footpath on both sides, except where the street has very low traffic volumes and provides limited or no connectivity.
- In the vicinity of schools, universities shops or where pedestrian volumes are high a minimum footpath width of 2.0 metres will be provided.
- In a mixed use office or retail areas in regional or district activity centres or along the transit boulevard, wider paved pathways will be required. These paths will be designed specifically to meet requirements and will be discussed more fully in local structure plans.
- Pram ramps to universal access design standards are required to be provided at all intersections and at mid-block pedestrian crossing areas.

8. Staged Development of Transport Infrastructure

The transport infrastructure in St Andrews will be developed in stages to meet the travel and access needs of the growing community.

8.1 External Linkages

Government policy for Perth's North West corridor has been to construct major transport infrastructure in the following sequence:

1. Arterial road connections

2. Regional railway

3. Freeway

St Andrews in currently connected to the rest of the Perth Metropolitan area by Yanchep Beach Road and Wanneroo Road. Agreement has been reached for Marmion Avenue to be extended north to St Andrews initially as a single carriageway road by the end of 2007. This extension is being pre-funded by the Capricorn Village Joint Venture.

In accordance with past and current policy, it is proposed that the next major transport infrastructure linkage to the south be the construction of the Perth to St Andrews railway to the St Andrews Regional Central Station with an intermediate station at Yanchep Beach Road. The timing of the railway extension will be a decision for the State Government. However, there are transport policy advantages to building the railway early. They include, early establishment of a culture of public transport usage, particularly for long distance travel and the achievement of dense, mixed use development around the rail stations. We consider that the railway would need to be constructed to St Andrews by no later than 2020, but desirably by around 2015 or 2016.

The Mitchell Freeway extension to St Andrews will occur after the rail bas been constructed and after Marmion Avenue had been constructed to dual carriageway standard. This is not likely to occur until after 2020.

The extension of the railway to the northern park and ride station is not likely to be required until development is well underway in the north east segment of the area. This is likely to be after 2020. There is potential to extend the railway to the north of St Andrews. However, no business case for the extension has been established and any rail extension to the north is likely to be a very long term proposition - beyond 2050.

There is also provision to extend the Mitchell Freeway north of St Andrews as a rural road to join with Wanneroo Road to the north of St Andrews. This linkage is not likely to be required until after the Mitchell Freeway has been extended to St Andrews – i.e. post 2020.

8.2 Internal Transport Infrastructure Staging

The internal road, street and public transport networks will be developed in stages to meet travel and access needs as St Andrews develops progressively. An indicative land use staging plan has been produced and is shown in the district structure plan. It would be preferable to construct the transit boulevard at around the same time as the adjacent mixed use development takes place. Under these circumstances it is likely that the north south roads would be constructed in the following sequence to provide access to the Northern development areas (refer Figure 5.2):

- Two Rocks Road (exists)
- District Distributor B roads each side of the transit boulevard
- Local Distributor roads adjacent to the transit boulevard
- District Distributor A road along the eastern boundary of development
- Transit Boulevard

The road staging will be considered in more detail at the local structure planning stage.

The public transport system has been designed to provide linkages to the St Andrews Regional Centres and the train stations. Prior to the railway being extended to St Andrews, it will be necessary to run line haul bus services along Marmion Avenue between St Andrews and the rail head.

Appendix A Network City Vision, Values, Principles and Objectives.

Network city

While plans and objectives will change over the years as circumstances change the planning system in Western Australia should always operate in accordance with the following four basic tenets of good planning:

Dialogue:
Planning is a dialogue about the future, it should be conducted in an open and inclusive manner.

Vision:
Ensure that at key points in time this dialogue is resolved into one clear, widely supported vision for the future.

Objectives:
To facilitate implementation the vision should incorporate clear objectives, strategies and actions that, when implemented, will combine to achieve the vision.

Implementation:
Ensure that the planning system is well administered and appropriately resourced so that the objectives, strategies and actions will be implemented.

Objectives may be categorised or grouped in many ways and the arrangement chosen should itself support the vision. The objectives of the *Network city* are stated in this introduction and are developed in each of the following seven chapters.

OUR VISION

By 2030, Perth people will have created a world-class sustainable city; vibrant, more compact and accessible, with a unique sense of place

In working towards our vision it is anticipated that all elements of our community will share the same values:

VALUES

- *Sustainability*
- *Inclusiveness*
- *Innovation and creativity*
- *Sense of place*
- *Equity*

When taking decisions about the future there are certain principles that will need to be adhered to:

PRINCIPLES

- *Enhance efficiency of urban land use and infrastructure*
- *Protect and rehabilitate the environment, and improve resource efficiency and energy use*
- *Enhance community vitality and cohesiveness*

Having established a vision, values and principles, there is a need to be clear about what the *Network city* sets out to achieve over the quarter century to 2030. The following are the key objectives to support the principles:

KEY OBJECTIVES

1. *Deliver urban growth management*
2. *Accommodate urban growth primarily within a Network city pattern, incorporating communities*
3. *Align transport systems and land use to optimise accessibility and amenity*
4. *Deliver a safe, reliable and energy-efficient transport system that provides travel choice*
5. *Protect and enhance the natural environment, open spaces and heritage*
6. *Deliver for all a better quality of life, building on our existing strengths*
7. *Plan with the communities*
8. *Ensure employment is created in centres*
9. *Deliver a city with 'urban' energy, creativity and cultural vitality*
10. *Provide a city plan that will be implemented, provide certainty and deliver results*

From principles, objectives and strategies can be captured eight headline statements:

KEY THEMES

1. *Manage growth by sharing responsibility between industry, communities and government*
2. *Make fuller use of urban land*
3. *Plan with communities*
4. *Nurture the environment*
5. *Encourage public over private transport*
6. *Strengthen local sense of place*
7. *Develop strategies which deliver local jobs*
8. *Provide for affordable housing*

The objectives span the breadth of *Network city: community planning strategy* and are supported by priority strategies and their associated actions, which are organized into seven separate chapters. A summary of these is contained in the following action plan, with the strategies listed in priority order. The process diagram following this action plan provides a guide as to the order in which each of the strategies and their associated actions will need to be tackled. Given the breadth and scope of *Network city* these actions will need to be tackled over the coming years, with the proposed implementation action plan (see Action (2-9(a)) establishing the timing, resources and funding required to deliver this comprehensive program of community engagement in planning for Perth's future.

Swan River, Perth

Appendix B Principle Aims of Liveable Neighbourhoods

1) To provide for an urban structure of walkable neighbourhoods clustering to form towns of compatibly mixed uses in order to reduce car dependence for access to employment, retail and community facilities.
2) To ensure that walkable neighbourhoods and access to services and facilities are designed for all users, including users with disabilities.
3) To foster a sense of community and strong local identity in neighbourhoods and towns.
4) To provide for access generally by way of an interconnected network of streets which facilitate safe, efficient and pleasant walking, cycling and driving.
5) To ensure active street-land use interfaces, with building frontages to streets to improve personal safety through increased surveillance and activity.
6) To facilitate new development which supports the efficiency of public transport systems where available, and provides safe, direct access to the system for residents.
7) To facilitate mixed use urban development which provides for a wide range of living, employment and leisure opportunities capable of adapting over time as the community changes, and which reflects appropriate community standards of health, safety and amenity.
8) To provide a variety of lot sizes and housing types to cater for the diverse housing needs of the community at a density that can ultimately support the provision of local services.
9) To ensure the avoidance of key environmental areas and the incorporation of significant cultural and environmental features of a site into the design of an area.
10) To provide for a more integrated approach to the design of open space and urban water management.
11) To ensure cost-effective and resource-efficient development to promote affordable housing
12) To maximise land efficiency wherever possible

Appendix C City of Wanneroo Smart Growth Principles

3.0 OUR **SMART GROWTH** PRINCIPLES

THE FOLLOWING PRINCIPLES REFLECT THE CITY OF WANNEROO'S STRATEGIC DIRECTION AS WELL AS PRACTICAL EVIDENCE OF THE CHANGING NEEDS OF OUR COMMUNITY.

IT IS IMPORTANT TO NOTE THAT THE PRINCIPLES SHOULD NOT BE VIEWED IN ISOLATION. EACH PRINCIPLE FORMS AN INTEGRAL COMPONENT OF THE SMART GROWTH APPROACH.

EACH PRINCIPLE IS IDENTIFIED AND DEFINED IN THIS SECTION, WITH A MORE DETAILED EXPLANATION INCLUDING IMPLEMENTATION STRATEGIES, ACTION EXAMPLES AND MEASUREMENT INDICATORS OUTLINED IN SECTION 5.

PRINCIPLE 1
LIFESTYLE AND HOUSING CHOICE

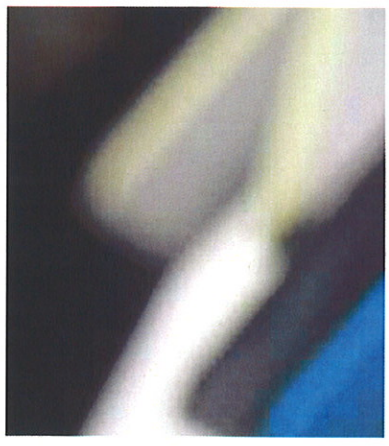
Smart Growth encourages the provision of a variety of housing types and the enhancement of lifestyle options.

PRINCIPLE 2
EFFECTIVE USE OF LAND AND INFRASTRUCTURE

Smart Growth supports the effective use and development of land and buildings for the benefit of the local area.

PRINCIPLE 3
LONG TERM HEALTH OF THE ENVIRONMENT

Smart Growth promotes development that minimises environmental impact, together with practices that conserve and enhance natural areas



PRINCIPLE 4
IDENTITY, EQUITY AND INCLUSIVENESS

Smart Growth is creating opportunities to enhance and develop the identity of our places and our people, and to improve equity and inclusiveness within our community.

PRINCIPLE 5
LONG TERM ECONOMIC HEALTH

Smart growth supports opportunities that enhance industry growth and promote job creation within our region.

PRINCIPLE 6
PEOPLE AND GOVERNMENT

Smart Growth encourages citizen and stakeholder participation in governance and development decisions.

Appendix D Daily Transport Trips To, From and Within St Andrews for Full Development- Spreadsheet Analysis

Estimated Daily Transport Trips To, From and Within St Andrews for Full Development

July 2006

Key Assumptions

- Population 160,000[1]
- Jobs 55,000
- 75% of jobs by St Andrews residents[2]
- Home Based Trip Generation - 3.4 trips per person per day
- Business and Commercial Non Home Based Trips - 15% of home based trips
- Average mode share for public transport – 9%

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[1] The DSP assumes a population of 155,000. Therefore, this analysis is conservative

[2] Based on discussions with DPI Transport Group

Estimated Work Trips

Assumptions:	Internal jobs	55000
	Internal labour force	68000
	75% of jobs for St Andrews residents	

- Work trips wholly within St Andrews 84000
- Home based work trips to external 52000
- Home based work trips from external to St Andrews 26000

Estimated Total Trips

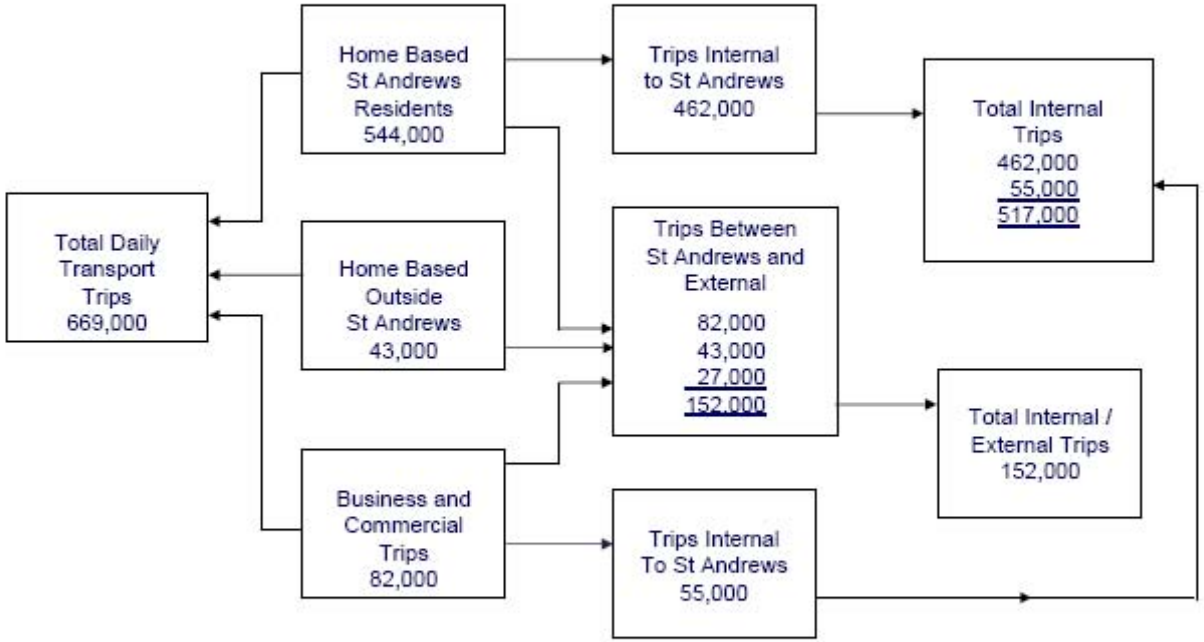
> Home Based from Within Area (3.4 x 160,000)	544,000
> Home Based (External to St Andrews) 26,000 work trips; 17,000 other trips;	43,000
> Business and Commercial Non Home Based (15% of 544,000)	82,000
TOTAL DAILY TRIPS	669,000

Total Trips – Internal / External

	Total	External	Internal
> Home Based St Andrews Generated	544,000	82,000	462,000
> Home Based Trips to St Andrews	43,000	43,000	-
> Business and Commercial Non Home Based	82,000	27,000	55,000
TOTAL TRIPS	669,000	152,000	517,000

Estimate: 77% of all trips in the area are internal

Total Transport Trips – St Andrews (At Build Out)



St Andrews Home Based Trips

		Internal	External
Home Based Trips (from St Andrews)	544,000		
Work (25%)	136,000	84,000	52,000
Shopping (20%)	109,000	103,000	6,000
Social/Leisure (35%)	185,000	172,000	13,000
Education (9%)	49,000	45,000	4,000
Escort (9%) (Serve Passengers)	49,000	46,000	3,000
Other	16,000	12,000	4,000
TOTAL	544,000	462,000	82,000

Estimate: 85% of home based trips are internal

Home Based Trips from St Andrews to External

	All Modes	PT
> Work	52,000	12,000 (23%)
> Shopping	6,000	600 (10%)
> Leisure	13,000	800 (6%)
> Education	4,000	2,000 (50%)
> Escort	3,000	-
> Other	4,000	600 (15%)
ALL PURPOSES	82,000	16,000 (22%)

External Home Based Trips to St Andrews

	All Modes	PT
> Work	26,000	6,800 (26%)
> Other	17,000	1,200 (7%)
TOTAL	43,000	8,000 (18.5%)

External Business and Commercial Trips

All Modes	PT
27,000	2,000 (7.5%)

Total External PT Trips

	PT Trips	% PT Trips
> Home Based from St Andrews	16,000	19.5%
> Home Based External to St Andrews	8,000	18.5%
> Non Home Based Business and Commercial	2,000	7.5%
TOTAL	26,000	17.6%

Total Public Transport Trips

	Total PT	Int / Ext	Total Internal
> Home Based St Andrews	47,500	16,000	31,500
> Home Based External	8,000	8,000	0
> Business and Commercial	5,000	2,000	3,000
TOTAL	60,500	26,000	34,500

Internal to External PT by Time of Day

	NB	SB	2 Way
> AM Peak Period	2,800	5,000	7,800
> PM Peak Period	5,000	2,800	7,800
> Off Peak	5,200	5,200	16,400
TOTAL	13,000	13,000	26,000

Internal / External Trips By Mode

	Total	Internal	External
> Public Transport	60,500	34,500	26,000
> Car Driver	357,000	255,000	102,000
> Car Passenger	134,000	110,000	24,000
> Walk and Cycle	117,500	117,500	0
TOTAL	669,000	517,000	152,000

Mode Shares

	All Trips To/From/ Within St Andrews	Fully Internal to St Andrews	St Andrews To/From
> Public Transport	9%	6.7%	17.1%
> Car Driver	53.3%	49.3%	67.1%
> Car Passenger	20%	21.3%	15.8%
> Walking and Cycling	17.7%	22.7%	0%

Estimated Modal Split (All Trips)

> Public Transport	60,500	(9%)
> Car Driver	357,000	(53.4%)
> Car Passenger	134,000	(20%)
> Walk and Cycle	117,500	(17.6%)
TOTAL	669,000	100%