Auckland State Highway Strategy

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EXECUTIVE SUMMARY

Auckland is New Zealand's major urban area and economic centre. It has been experiencing considerable growth in recent years and is expected to continue to grow in the foreseeable future. Central to this continued growth and economic prosperity is the provision of a comprehensive transport network that meets the needs of this growing region.

As its prime focus, Transit is required to provide an affordable, integrated, safe, responsive and sustainable transport system. The National State Highway Strategy (NSHS) sets out concepts for New Zealand's urban and rural highways that achieve these objectives and provide value for money. The state highway network is a major component of the Auckland transport system and is important in supporting the growing urban area and creating a world-class city.

The Auckland State Highway Strategy sets out 'how' Transit will give effect to the NSHS support the region's growth, and the Regional Land Transport Strategy (RLTS). Transit is committed to continuous monitoring and review of its business practices and performance. The prime focus is to give effect to the new goals and objectives of the Update to the New Zealand Transport Strategy (UNZTS).

This strategy is based on strong principles to provide a high level of service to transport users while reflecting the changing needs of the wider community and environment. These principles, established in the NSHS, include

- **Safety** for drivers, pedestrians and cyclists.
- **Network operations** to providing the most efficient use of road space for all users.
- **Asset management** to optimise the use and life span of the nation's investment in the state highway asset.
- **Managing demand** to meet the travel supply in a sustainable manner.

- Ensuring **environments and communities** are improved and protected.
- **Integrating planning** so that transport and land use development is delivered in a complementary fashion.
- **Educate** to ensure that all road users are well informed of conditions and issues.
- Continuous monitoring and review of Transit's business and performance to ensure the **continued improvement** of service to our customers.

In the Auckland region we have three principal targets

- To provide Auckland with a fully integrated, complete and robust state highway network to service present and future vehicle, freight and public transportation needs through the completion of the ladder concept.

- To manage and operate the network to maximise the operation and efficiency of this considerable asset for all users, while ensuring the sustainable use of natural resources.

- To integrate the delivery of state highway transport infrastructure with the local road network, surrounding land uses and other modes of transport such as walking and cycling.

This strategy is consistent with all other statutory documents and responds to the directions of the UNZTS. It aims to complement the objectives of our Regional partners (Land Transport New Zealand, Auckland Regional Council [ARC], Auckland Regional Transport Authority [ARTA], Ontrack and Local Councils). We are committed to working collaboratively with our partners to produce a fully integrated transport network. Transit has a huge amount of planning information and background data and has developed a considerable skills base in transport planning and project implementation and we are committed to achieving the right outcomes for Auckland.

In providing for and developing an overall integrated transport plan, this strategy continues and extends a range of passenger transportation initiatives that are consistent with and support ARTA's Passenger Transport Network Plan 2006-2016 and the Auckland Transport Plan 2006, which sets out the vision for how the Auckland region will develop its road network and public transportation system.

The purpose of the ASHS is to identify how Transit is supporting regional strategies and is also intended to influence future land transport strategies and community council plans by identifying existing state highway constraints and future opportunities.

The ASHS sets out Transit's goals and intentions for developing the state highway network in association with local authorities and is not a programme of works. Transit has committed funding to 2010/11, beyond which new policies and funding allocations will apply. This overall strategy sets the direction under which future funding will be sought.

1.0 INTRODUCTION

Transit New Zealand's role is to plan, build and manage the country's 10,894 kilometres of state highway. In this role we seek to provide an affordable, integrated, safe, responsive and sustainable transport system. The National State Highway Strategy 2007 sets out concepts for New Zealand's urban and rural highways that achieve these objectives. The state highway network is a major component of the Auckland transport system and will continue to play a major role in supporting the growing urban area. There is over 350km of state highway (SH) in Auckland, which serves a vital role in the region's transportation network.

The Auckland State Highway Strategy (ASHS) 2008 sets out how we plan to develop and operate the state highway network. It looks at the state highway network from the northern most boundary of Rodney District Council to the southern most boundary of Franklin District Council and aligns with the Regional Land Transport Strategy boundary. Furthermore, this strategy addresses inter-regional connections to the Northland and to areas south of Auckland.

1.1 ABOUT THE AUCKLAND STATE HIGHWAY STRATEGY

Preparation of this Auckland State Highway Strategy follows major changes in Auckland's transport sector following the enactment of the Land Transport Management Act (LTMA) and Local Government Act (Auckland) Amendment (LGAAA). In particular, the Ministry of Transport established the New Zealand Transport Strategy (NZTS). This provides the umbrella policy for how New Zealand will develop an affordable, integrated, safe, responsive and sustainable transport system by 2010.

The NZTS identifies five key goals to deliver the Ministry of Transport's (MoT) vision of *'an affordable, integrated, safe, responsive and sustainable transport system'*

- Assisting economic development.
- Assisting safety and personal security.
- Improving access and mobility.

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- Protecting and promoting public health.
- Ensuring environmental sustainability.

The ASHS strategy sets out the plans for achieving these objectives over the next 30 years.

Recently the MoT released a discussion document as the first step in updating the NZTS. The ASHS will focus on how the state highway system will achieve these new targets identified by MoT, in particular

- Local environmental impacts of transport (including air and water quality) to be at accepted at international standards.
- Doubling passenger transit usage.
- Moving people and freight more efficiently.
- Improving journey time reliability.
- Operate to world-best practice safety standards for all modes of transport.
- Increase walking and cycling and other 'active modes' to 30% of total trips in urban areas.

The National State Highway Strategy (NSHS) in turn, outlines how we plan to support the government's vision for an affordable, integrated, safe, responsive, and sustainable transport system. The Auckland State Highway Strategy relates the higher order directives to the local context, such as the Regional Land Transport Strategy, See Figure 1. The RLTS sets regional objectives and policies that provide a framework for transport solutions. The goal of the RLTS is to provide *'a transport system which enhances the Auckland region as a great place to live, work, and play.'*

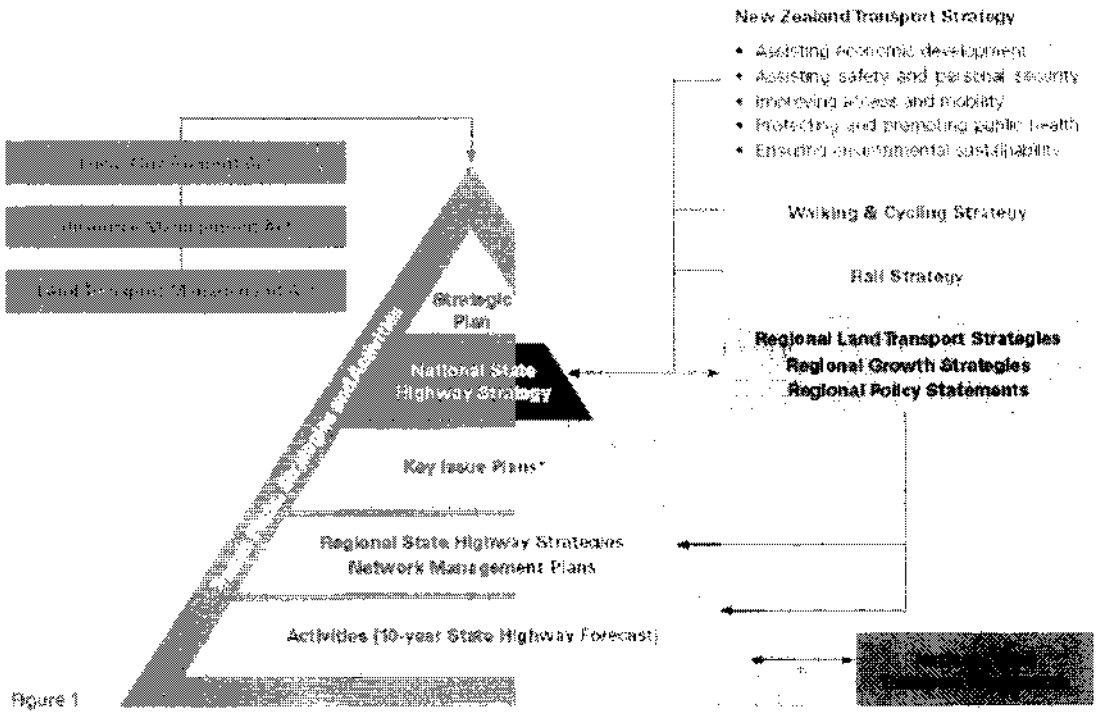

Figure 1 **[designtalk – change dark blue emphasis from NSHS to RSHS**

The ASHS sits below the NSHS, whilst at the same time supporting and influencing the RLTS and Long Term Community Council Plans (LTCCP) as they relate to state highways. See Figure 2 below.

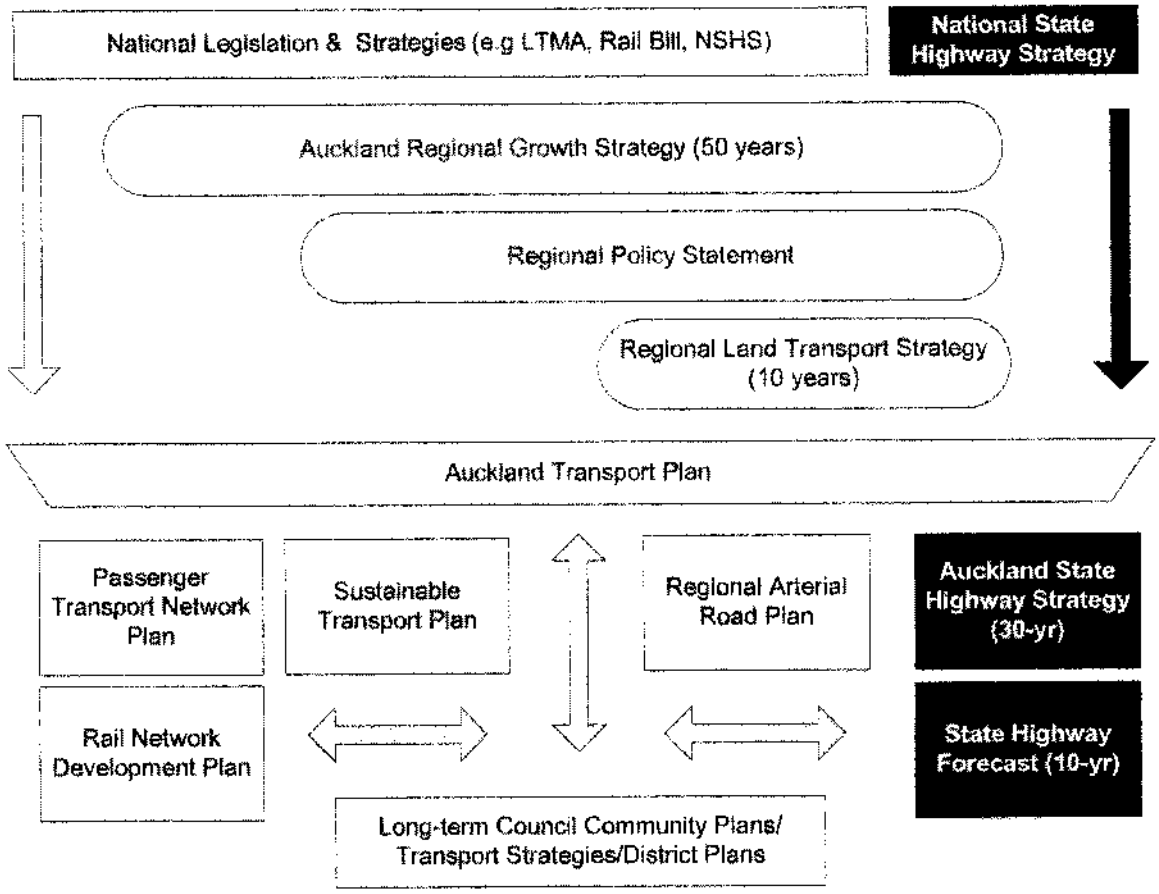
National Legislation & Strategies (e.g LTMA, Rail Bill, NSHS)
National State Highway Strategy
Auckland Regional Growth Strategy (50 years)
Regional Policy Statement
Regional Land Transport Strategy (10 years)
Auckland Transport Plan
Passenger Transport Network Plan
Sustainable Transport Plan
Regional Arterial Road Plan
Auckland State Highway Strategy (30-yr)
Rail Network Development Plan
State Highway Forecast (10-yr)
Long-term Council Community Plans/ Transport Strategies/District Plans

Figure 2

1.2 VISION FOR STATE HIGHWAYS IN AUCKLAND

The transport vision for Auckland, is described by the three principal targets:

- To provide Auckland with a fully integrated, complete and robust state highway network to service present and future vehicle, freight and public transportation needs through the completion of the ladder concept.

- To manage and operate the network to maximise the operation and efficiency of this considerable asset for all users, while ensuring the sustainable use of natural resources.

- To integrate the delivery of state highway transport infrastructure with the local road network, surrounding land uses and other modes of transport such as public transportation, walking and cycling.

1.2.1 Ladder concept

Historically, Auckland was primarily served by SH1 as a route through the centre of the region linking Northland to the rest of the North Island. This has led to linear development and dependence on a single corridor. The development of the ladder concept is designed to provide a more resilient network capable of providing for diversions in the event of major incidents closing key links. The ladder concept is defined as two parallel highways primarily SH1 and SH20 running north and south with connections (rungs) running between them.

State Highway 1 forms the eastern side of the ladder and the Western Ring Route makes up the western side of the ladder. The four rungs are represented by the SH20 to SH1 Manukau Extension in the south; a proposed east to west connection north or south of Manukau Harbour forms the central rung; the SH16 Northwestern Motorway to the Port, and the SH18 Upper Harbour Corridor connection to SH1 create the final rungs.

When the ladder is complete, Auckland will have a fully functional state highway network that serves all of the major growth nodes and is able to meet the needs of a world-class city (see figure 1). There are a number of projects required to complete the ladder that are not provided for in the current 10-year forecast. These include

- Changes to SH16 to improve freight access to the port and Mechanics Bay (known as Grafton Gully Stage 3).
- Upgrading SH18 Upper Harbour Highway between Albany Highway and SH1 to a motorway standard.
- A new state highway or motorway to connect SH1 Southern Motorway to SH20 Southwestern Motorway to the north or south of the Manukau Harbour.
- Waterview Connection, SH20 to SH16
- Additional Waitemata Harbour Crossing

Away from the urban area the strategy aims to protect the connections to the rest of the country by upgrading SH1 and SH16 up to the northern boundary of the region, and SH1 and SH2 to the southern boundary of the region. SH22 needs to be carefully managed in terms of supporting regional growth and providing an alternative to SH1 through the Waikato in the event of a blockage on SH1 over the Bombay Hills.

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Auckland state highways

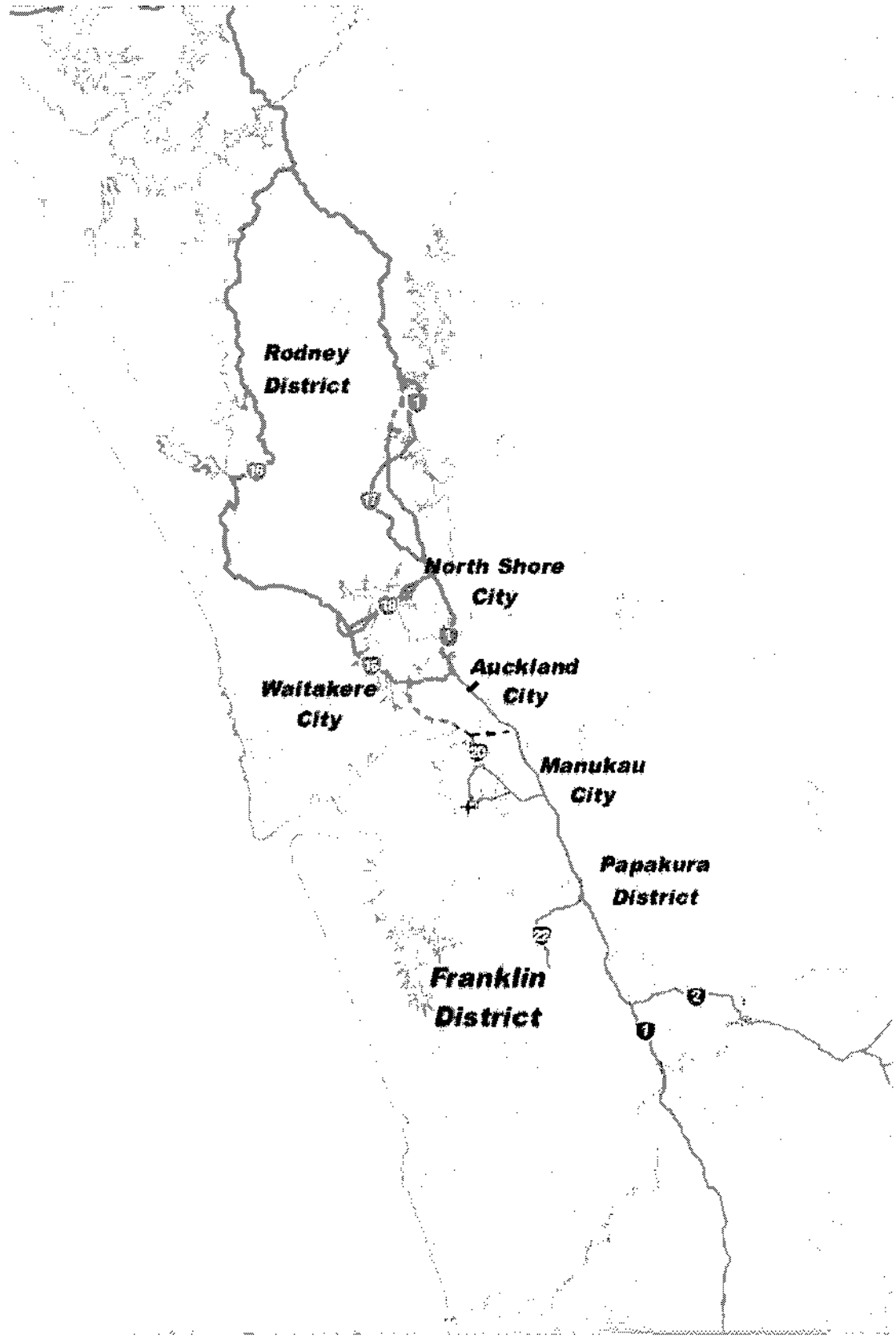

Figure 2

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1.2.2 Managed lanes for priority users

Auckland's population is expected to continue growing. Predictions by ARC show that the population is set to reach two million within the next 40 or 50 years. This growth will to lead to a continual increase in demand for travel within the region. Increased pressure will be placed on the transport corridors including the state highway network. Beyond the completion of the urban network outlined above, it is not considered that further expansion of the state highway network, to accommodate private passenger vehicles, is an appropriate way to meet this demand.

The present and planned roading network on its own will not provide enough capacity to address long-term travel demand in Auckland. Current planned major investments will just keep up with growth (Update to the New Zealand Transport Strategy 12/07 [UNZTS]).

For state highways, this means using innovative measures to manage travel demand. Transit is implementing intelligent transportation systems (ITS) and active travel demand management (TDM) measures to manage congestion and the related environmental and economic costs. Transit will continue to investigate and implement TDM measures drawn from international success stories to optimise the effectiveness of our vital national asset. Other additional operational and safety improvements will also be required to dynamically manage future traffic flows.

Transit will develop opportunities to increase vehicle occupancy by implementing managed lanes for priority users such as HOVs or freight specific lanes. Section 2.1.2 describes additional initiatives for freight. Priority for passenger transport is provided on a number of state highways, most notably the Northern Busway. All new projects on the Western Ring Route are being designed and built with bus priority shoulder lanes.

The state highway passenger transportation initiatives described in this document are consistent with ARTA's Passenger Transport Network Plan 2006-2016. The Passenger Transport Network Plan sets out the vision for how the Auckland region

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will develop its public transportation system; a combination of bus, rail and ferry services that utilises

- **Rapid transit network** (RTN) – a passenger transport system with a high frequency, high quality service, operating on 'transport spines' that does not get held up by road traffic congestion. This network will be primarily based on upgrading and expanding the current rail network and expanding the Northern Busway.
- **Quality transit network** (QTN) – provides fast, high frequency and high quality passenger transport services between key centres, mainly based on major bus corridors and uses extensive bus priority measures, modern bus shelters, information and branded services.

Further to this, Transit will pursue provision of other priority measures such as the use of high occupancy vehicles (HOV) and freight traffic lanes within the state highway network.

The following section summarises how these concepts will be applied region wide in the, southern, northern and western sectors. Additional details regarding specific state highway corridors are provided in the appendices.

1.2.3 Local Network Integration

Much of what Transit does regarding integration of state highways with local roads and land use requires a partnership approach. Transit works with a broad range of national, local, regional and community groups.

[Side comment in final document] "*Together Land use and transport are 'city-shaping'.*"[1]

There is a strong need to support and better integrate the local roading network with the state highway network to reduce community severance and improve safety and efficiency.

Transit welcomes more direction from ARC and ARTA, in the form of Updates to the Regional Growth Strategy, the Regional Land Transport Strategy and the Regional Arterial Roads Plan, on how future local roading improvements and land uses can be better integrated with the state highway network to improve safety, freight movement, regional growth and the multi-modal functioning of local roads. Transit supports local authorities in developing local transport networks and complimentary land uses that allow short local trips to take place away from the motorway network.

Transit is committed to working with our regional partners to create a world class Auckland by implementing sound urban design principles that includes a responsible and sustainable commitment to the surrounding communities and environment.

[1] ARC website titled "Land Use and Transport Integration" http://www.arc.govt.nz/auckland/aucklands-growth/land-use-and-transport-integration_home.cfm

1.3 SECTOR SUMMARIES

The following sections provide a brief summary of strategies for state highways in the southern, northern and western sectors. Table 1 outlines the sectors and associated highways. This summary section is in addition to the appendices that includes expanded and corridor specific summaries for each state highway in the Auckland region.

Table 1

Sector	State Highway
Southern sector	- SH1 Southern Motorway - SH2 (within Franklin District) - SH22
Northern sector	- SH1 CMJ to Wellsford including Northern Motorway - SH16 (Westgate to Wellsford) - SH17
Western sector	- SH20 Southwestern Motorway - SH20A & SH20B (Airport connections) - SH16 Northwestern Motorway (CMJ to Westgate) - SH18 Upper Harbour Motorway, SH18A (Hobsonville Road)

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1.3.1 Southern sector summary

State Highways in the Southern Sector
▪ SH1 Southern Motorway ▪ SH2 (within Franklin District) ▪ SH22

Summary of Recommendations

Significant development is planned in the Southern Sector over the next 50 years. This will lead to continued pressure on the Southern Motorway. Consequently, there is the need to increase the capacity on SH22 and the Southern Motorway. These improvements will need to be fully investigated and it is likely that future capacity will be managed and prioritised, in line with the strategy for the rest of the region.

The northern section of the Southern Motorway (Central Motorway Junction [CMJ] to Mt. Wellington) is one of the most critical links in the network as it serves the most densely urbanised part of New Zealand. It is already at capacity and there is little potential for future expansion. Widening of any part of this section would have significant costs and is not seen as appropriate. Instead it is considered more appropriate to seek to dynamically manage this section to optimise its efficiency within the existing designation.

Future Growth

ARC identified, future growth centres, such as Papakura and Manukau, are identified in Figure 3

Major business growth is expected near the Airport, Mt Wellington, Onehunga, Highbrook, East Tamaki, Wiri and Papakura. Additionally strong economic growth is anticipated in the 'Golden Triangle' of economic activity between Auckland, Tauranga and Hamilton, with SH1 and SH29 being the primary national route connecting these cities.

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Servicing Southern Sector Travel Demand

The following sections describe how Transit will manage future travel demands by implementing:

- Passenger Transport and HOV Opportunities,
- Walking and Cycling Opportunities, and
- Freight Opportunities.

Table 2: Summary of Southern Sector Opportunities

Committed projects[1]	- SH1, Newmarket Viaduct (enabling construction committed) - Ramp signals & advanced traffic management systems
Programmed projects[2]	- SH2, Kopuku Realignment - SH1, Papakura Interchange
Future Capacity Investigations	SH1, 6-laning with interchange upgrades south of Mt Wellington - SH1, Investigate 4-laning to Hamilton - SH2, Mangatawhiri Deviation, safety improvements - SH2, Kopuku Realignment - SH22, Investigate 4-laning
Passenger Transport & HOV	- SH1, QTN south of Mt Wellington - SH1, Dynamic Traffic Management between CMJ and Mt Wellington (including HOVs)
Walking and Cycling	- Progress the completion of the regional cycle across the state highways. - SH1, Pedestrian linkages across motorway to rail stations between Remuera and Penrose - SH22, Maintain adequate shoulders for cycle use
Freight	- Opportunities for freight priority initiatives, such as ramp signal bypass lanes.

[1] All of these projects are greater than $20 million and in Transit's Statement of Intent as key deliverables to be built and opened, or to have a substantial construction start by 2011.

[2] As per Transit's 10-year programme, includes projects funded for investigation.

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Southern sector

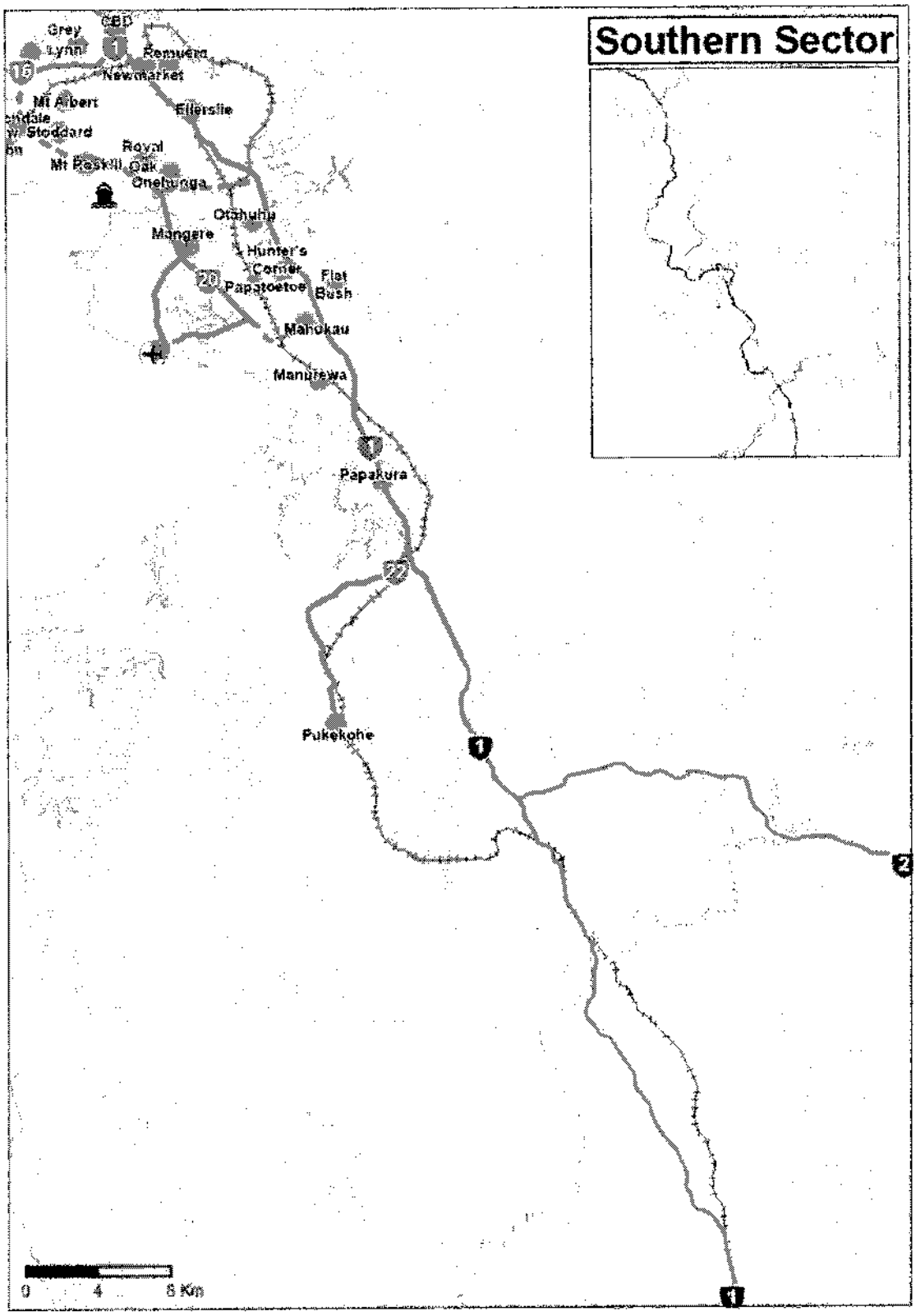

Figure 3

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Passenger Transport and HOV Opportunities

The public transportation provision, RTN, in this sector is provided by the Isthmus Rail line (CBD to Westfield), which runs parallel to the Southern Motorway. With the high level of service from rail, it is considered unlikely that rapid transit bus provision will be required on this section of the Southern Motorway. However, options for quality transit provision, such as bus shoulder lanes will be investigated.

With passenger transport, RTN, being provided by rail, the road space is more appropriately prioritised for other road users. Investigation of HOVs use will be undertaken. Further to this, there are considered to be significant gains to be made through the implementation of technological systems to improve the dynamic management of the motorway. Systems incorporating variable message signs, variable speed limits and information systems in other countries have shown improvements to the operational efficiency of highways as part of the transport network.

Walking and Cycling Opportunities

Transit will investigate and implement where appropriate walking and cycling projects that achieve the objectives set out by the UNZTS, RLTS, ARTA's Sustainable Transport Plan and TLA walking and cycling strategies.

Additionally, Transit will ensure quality pedestrian access to rail stations, across the Southern Motorway. Further south, Transit will work to improve cycle access to a regional cycle route on Great South Road, especially between Sylvia Park and Takanini. The Papakura interchange improvements will include walking and cycling facilities that connect new development with the town centre. In Franklin Transit will maintain quality shoulders for cyclists.

In summary, Transit will work with local authorities to double active (walking and cycling) modes of transport to 30% of total trips by building and maintaining quality facilities within the Auckland urban areas. Urban areas are described in Figure 7

and in each state highway appendix. Additionally, walking and cycling facilities in non-urban areas will be investigated and implemented where appropriate.

Freight Opportunities

It is envisaged that long term focused investment on SH1 (between Auckland and Hamilton) and SH29 (in the Bay of Plenty) will improve travel times between Auckland, Hamilton and Tauranga and contribute to economic development in these regions. This approach is consistent the NSHS, Waikato RLTS and Bay of Plenty RLTS. This strategy reflects the national priorities and constraints of the area and is further discussed in the SH2 Appendix.

1.3.2 Northern sector summary

State Highways in the Northern Sector
• SH1 Wellsford to CMJ including Northern Motorway • SH16 (Westgate to Wellsford) • SH17

Summary of Recommendations

The busiest section of the Northern Motorway from the Harbour Bridge to Albany has reached its effective operational capacity and there are no plans to increase this capacity for general traffic. Additional transport demand will be met by the completion of the Northern Busway.

Between Albany and Silverdale, the Northern Motorway currently operates at satisfactory levels of service. It is expected that this section's level of service will begin to deteriorate over the next 10 years as more development occurs in the northern region. Planning is being undertaken to protect Transit's ability to extend the Northern Busway from Silverdale to Orewa to meet additional demand. Underlying this planning is the need to protect a corridor, which sometime beyond this planning period, may need to be upgraded to a rail corridor.

North of Silverdale the motorway is being extended as far as Puhoi. In the medium to long term it may be beneficial to continue the motorway as far as Warkworth, with a bypass around the town. The need for this motorway extension will largely depend on the increase in demand generated by additional development in Rodney District. The levels of development and the effects on travel demand are being monitored and reviewed.

Minor improvements to SH16 urban areas between Kumeu and Helensville are expected. However passenger transport provisions are expected to be accommodated by rail service between Kumeu and Helensville.

Future Growth

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ARC identified, future growth centres, such as Albany and Warkworth, are identified in Figure 4.

Major business growth is expected in Wairau Valley, Albany, and Silverdale as well as in areas further north, such as the port at Marsden Point. Furthermore SH16 between Westgate and Wellsford is considered an emergency detour route to SH1 in the event of an emergency.

Servicing Northern Sector Travel Demand

The following sections describe how Transit will manage future travel demands by implementing:

- Passenger Transport and HOV Opportunities,
- Walking and Cycling Opportunities, and
- Freight Opportunities.

Table 3: Summary of Northern Sector Opportunities

Committed projects[1]	- SH1, ALPURT – Sector B2 Toll Road - SH1, Auckland Harbour Bridge structural upgrade - Ramp signals & advanced traffic management systems
Programmed projects[2]	- SH1, Vic Park Tunnel - SH1, Schedewys Hill Deviation - SH1, Warkworth Intersection Improvements
Future Capacity Investigations	- SH1, additional Waitemata Harbour Crossing, - SH1, Puhoi to Warkworth 4-laning - SH1, Warkworth Bypass - SH1, Dome Valley safety improvements - SH1, Warkworth to Wellsford 4-laning
Passenger Transport & HOV	- SH1, Northern Busway extension to Orewa - SH1, HOVs on Northern Busway
Walking and Cycling	- Progress the completion of the regional cycle network across the state highways. - Provide quality walking and cycling links to Northern Busway Stations. - Provide walking and cycling facilities across Waitemata Harbour - SH16, Strategic cycle route between Westgate and Wellsford.
Freight	- Opportunities for freight priority initiatives, such as ramp signal bypass lanes.

[1] All of these projects are greater than $20 million and in Transit's Statement of Intent as key deliverables to be built and opened, or to have a substantial construction start by 2011.
[2] As per Transit's 10-year programme, includes projects funded for investigation.

Northern sector

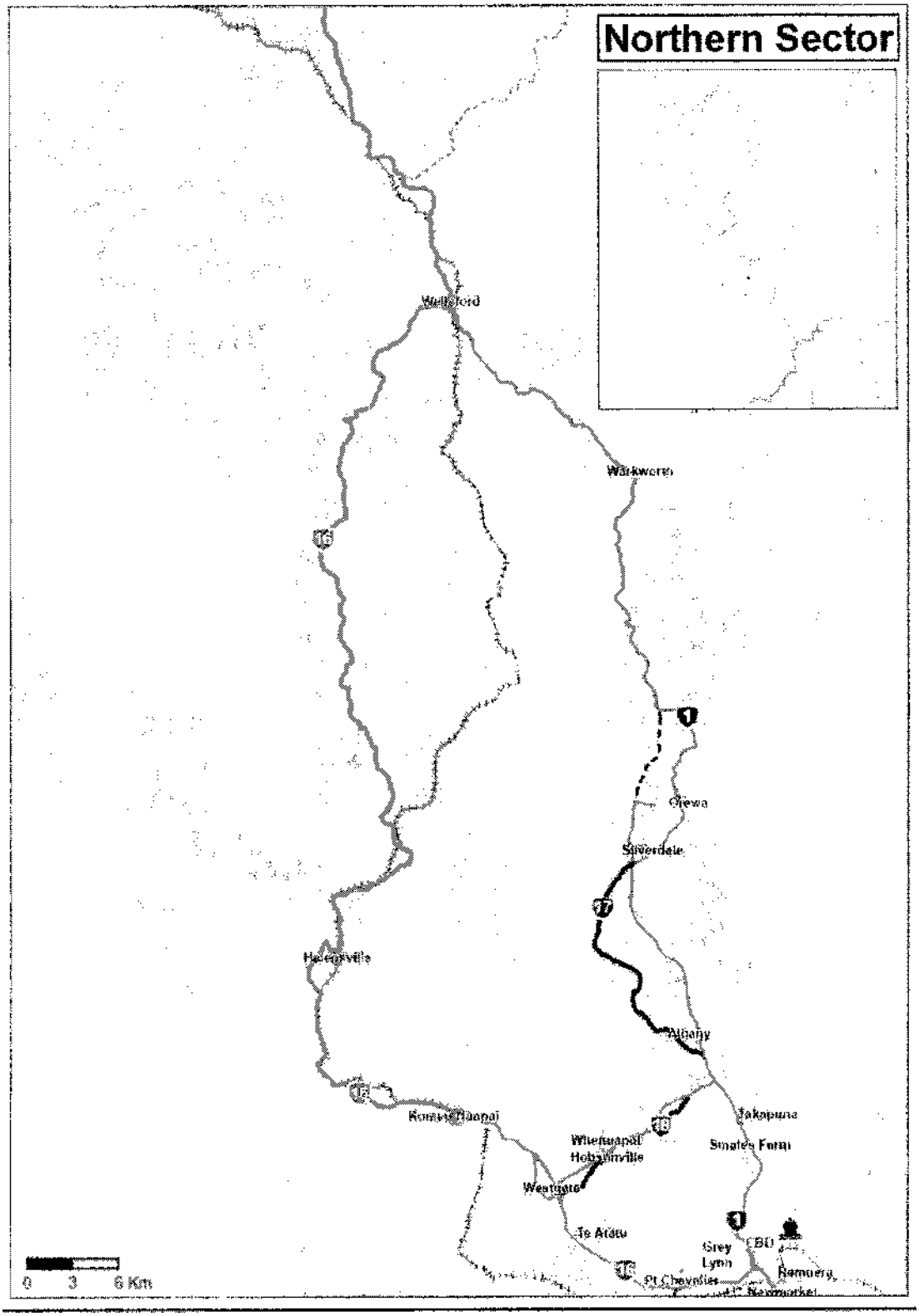

Figure 4

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Passenger Transport and HOV Opportunities

As outlined above, the Northern Motorway provides separate bus lanes for passenger transport services. Investigations are underway to extend this service to Orewa. Planning and investigation is ongoing into the use of the Northern Busway for HOVs. The introduction of HOVs within the Busway corridor itself will need to be carefully implemented and monitored to ensure that bus services are not hindered or restricted. In addition, opportunities to connect the Northern Busway with bus priority lanes on SH18 (Upper Harbour Motorway) will be investigated.

A new Waitemata Harbour crossing is expected to have a strong passenger transport component and is likely to encourage greater public transport use on the North Shore, possibly through the introduction of rail. The timeframes for a future crossing are uncertain but a route needs to be protected.

Walking and Cycling Opportunities

Transit will investigate and implement, where appropriate, walking and cycling projects, that achieve the objectives set out by the UNZTS, RLTS, ARTA's Sustainable Transport Plan and TLA walking and cycling strategies. For instance Transit, with North Shore City Council, will review and implement new pedestrian and cycle access routes to the Northern Busway stations. Transit will investigate the opportunities to link these new walking and cycling routes on the western side of the Northern Motorway to enable the completion of the Northern Motorway Cycleway, as identified in the Regional Cycle Network. It is envisaged that new users to these facilities will increase and will in the long term support and align with a Waitemata Harbour crossing for walking and cycling.

In summary, Transit will work with local authorities to double active (walking and cycling) modes of transport to 30% of total trips by building and maintaining high quality facilities within the Auckland urban areas. Urban areas are described in Figure 7 and in each state highway appendix. Additionally, walking and cycling facilities in non-urban areas will be investigated and implemented where appropriate.

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Freight Opportunities

Freight priority projects will be investigated on the Northern Motorway. Additionally, it is envisaged that capacity improvements on SH1 from Puhoi to Wellsford and to areas further north will contribute to economic development and improved freight movement.

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1.3.1 Western Sector Summary

State Highways in the Western Sector
▪ SH16, Northwestern Motorway, and further north ▪ SH18, Upper Harbour Motorway ▪ SH20, Southwestern Motorway ▪ SH20A & B, Airport connections

Summary of Recommendations

The western sector is currently programmed to receive a large level of investment in the short to medium term with the anticipated completion of the Western Ring Route (WRR) and the upgrade of links to the Auckland International Airport, all of which are of regional and national priority. Completion of the WRR will provide Auckland with a more robust and resilient network and remove pressure from State Highway 1. All the links of the WRR are being constructed to accommodate QTN bus shoulder lanes and some sections of the WRR may need RTN provisions.

Future Growth

ARC identified, future growth centres, such as Westgate and Albany, are identified in Figure 5.

Major business growth is expected near the Airport, Rosebank, Onehunga, Highbrook, East Tamaki, Rosedale, and Mt Wellington.

Servicing Western Sector Travel Demand

The following sections describe how Transit will manage future travel demands by implementing:

- Passenger Transport and HOV Opportunities,
- Walking and Cycling Opportunities, and
- Freight Opportunities.

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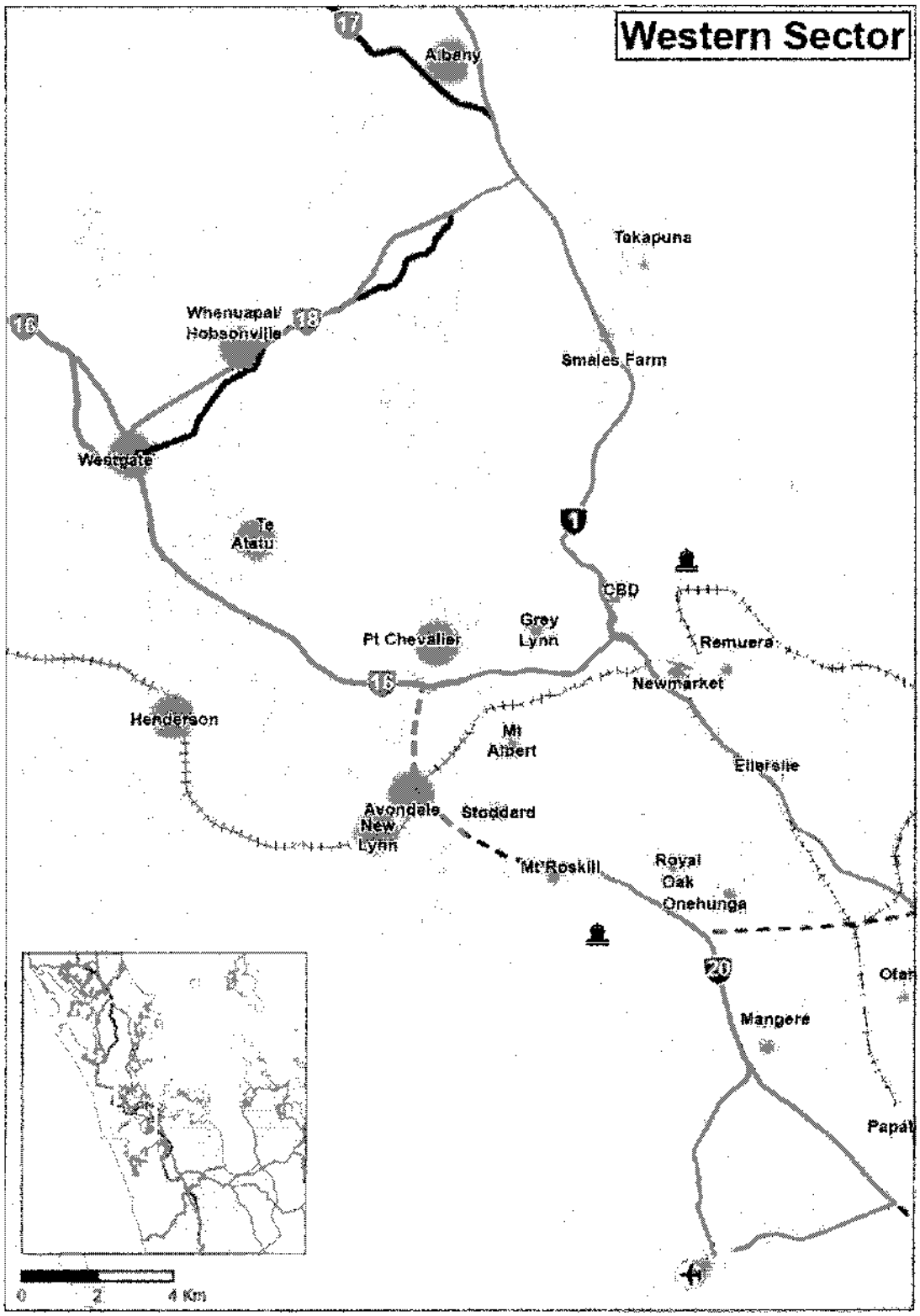
Table 4: Summary of Western Sector Opportunities

Committed projects[1]	- SH18, Hobsonville Deviation - SH20, Mt Roskill Extension - SH20, Manukau Harbour Crossing - SH20, Manukau Extension - Ramp signals & advanced traffic management systems
Programmed projects[2]	- SH16, Te Atatu to Royal 6-lane - SH16, Waterview to Rosebank 8-lane - SH16, Rosebank to Te Atatu 8-lane - SH16, Brigham Creek Extension - SH20, Waterview Connection
Future Capacity Investigations	- Investigate new east-west link from Southwestern Motorway to Southern Motorway (last rung of ladder) - SH18, Complete motorway connection to SH1
Passenger Transport & HOV	- SH16, HOV/Freight/QTN Priority - SH18 Rapid Transit Network - SH18, HOVs - SH20 Rapid Transit Network - SH20A/B Quality Transit Network
Walking and Cycling	- Progress the completion of the regional cycle network across the state highways. - SH16, complete and improve existing Northwestern Cycleway. - SH18, Upper Harbour cycle facilities - SH20A/B, complete and improve cycle facilities
Freight	- Investigate opportunities for freight priority initiatives, such as ramp signal bypass lanes. - SH16, Freight priority (as above)

[1] All of these projects are greater than $20 million and in Transit's Statement of Intent as key deliverables to be built and opened, or to have a substantial construction start by 2011.

[2] As per Transit's 10-year programme, includes projects funded for investigation.

Figure 5:


Western Sector
Albany
Takapuna
Whenuapai
Hobsonville
Smales Farm
Westgate
Te
Atatu
CBD
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Grey
Lynn
Remuera
Newmarket
Henderson
Mt
Albert
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Avondale
New
Lynn
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Passenger Transport and HOV Opportunities

The existing western rail line running largely parallel to SH16 will generally accommodate the passenger transport demand for the west of Auckland. It is therefore not proposed to provide a high level of passenger transport provision on SH16. However Transit is investigating the possible implementation of HOV lanes along the Northwestern Motorway which experiences high levels of peak hour traffic and has strong tidal traffic movements.

On the new four-lane SH18 Upper Harbour Motorway, analysis has indicated that unrestrained growth could mean that peak hour capacity could be reached over the next 15 years. In the immediate future passenger transport, QTN, is proposed on the major arterial road SH18A (Hobsonville Road) rather than the new Upper Harbour Motorway. However, the new motorway shoulders are able to accommodate QTN services where required. Investigation into the provision for RTN (a separated passenger transport facility perhaps similar to the Northern Busway) is programmed for 2008/09.

All the links of the SH20 (WRR) are being constructed to accommodate QTN bus shoulder lanes. Analysis has indicated that there may be a long-term requirement to provide rapid transit facilities within or alongside the motorway designation between Auckland International Airport and New Lynn. This will largely depend upon the future provision for rail in the vicinity and in particular the possible development of the Avondale to Southdown rail line. Along most of its length, SH20 has a relatively wide designation and, not withstanding the possible rail provision, it is appropriate to investigate and protect options for rapid transit alongside the state highway.

Walking and Cycling Opportunities

Transit will investigate and implement where appropriate walking and cycling projects to achieve the objectives set out by the RLTS, ARTA's Sustainable Transport Plan and TLA walking and cycling strategies.

Additionally, the Northwestern Cycleway is a significant cycle commuter facility, and is an attractive alternative to driving on the Northwestern Motorway.

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Completing the final linkage near Kingsland, and extending this facility to the growing Westgate areas will be a high priority amongst other Transit related walking and cycling projects. Another priority is connecting the Northwestern Cycleway to the eastern side of the CBD, including linkages to the University of Auckland and a new Parnell Rail Station. Walking and cycling movements near SH16 (Quay St to Ronayne St) will have to be carefully balanced with through freight traffic.

A significant portion of the regional cycle network will be completed in the course of construction of the Western Ring Route, such as new walking and cycling facilities on the Mt. Roskill Extension and improvements to the old Mangere Bridge as a part of the Manukau Harbour Crossing.

Transit will work with local authorities to double active (walking and cycling) modes of transport to 30% of total trips by building and maintaining high quality facilities within the Auckland urban areas.

Freight Opportunities

It is anticipated that the completion of the Western Ring Route will facilitate greater inter-regional freight movement, providing access to the Auckland International Airport and industrial areas of southern Auckland. Should RTN provisions not be required on SH20 there may be the potential to provide HOV or freight priority lanes.

1.4 RURAL TRANSPORT SOLUTIONS

The rural areas of Auckland will largely be dependent on car based transport solutions for the foreseeable future. However, Transit will work with regional stakeholders to address the following rural issues

- Support ARC's metropolitan urban limit, as no infrastructure provider should be expected to provide services for unplanned growth.
- Work with ARTA to develop school based travel plans that incorporate safe pedestrian access to schools on or near state highways.
- Investigate and implement pedestrian and cycle facilities, especially those that support access to public transportation in communities such as Kumeu and Helensville, both of which have rail stations.
- Identify safety black spots and implement practical solutions.

Specific improvements are identified in the appendices.

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1.5 REGIONAL PARTNERS

Much of what Transit does regarding integration of state highways with local roads and land use requires a partnership approach. Transit works with a broad range of national, local, regional and community groups including those below.

1.5.1 Auckland Regional Council

The ARC is responsible for the Auckland Regional Growth Strategy 2050 (ARGS), which sets out a vision for the future and provides certainty as to the outcomes Aucklanders want to achieve as the region grows and develops.

'The region's local authorities support the direction of the strategy and are committed to aligning policy and funding in their areas to support and implement the ARGS. The key areas will be

- *Integrating rapid transit investment with transit-supportive, higher density mixed land use al the western, southern and northern transit corridors;*
- *Upgrading the storm water and waste water infrastructure within the existing urban area to provide intensification opportunities; and*
- *Providing or upgrading the social infrastructure to service new development areas.'*

A recent review of the strategy (2007) highlighted two key concepts that Transit supports; retaining the existing metropolitan urban limit[2] and prioritising regional growth centres.

Transit supports the Auckland Regional Growth Strategy (ARGS), which envisages a *'compact multi-centred settlement pattern with a strong CBD, supported by well planned infrastructure'*.[3] Transit advocates coordinating the development of future

[2] ARC defines the metropolitan urban limit as a planning technique used to define urban limits and limit sprawl on rural areas. It is a line drawn on regional planning documents to define the allowed extent of urban zoning. Sometimes called urban limits or growth boundary.
[3] Growing Smarter: An Evaluation of the Auckland Regional Growth Strategy 1999 (July 2007).

transport infrastructure with high growth areas, essential for value for money spent on the provision of passenger transport facilities.

The ARC is also responsible for physical and environmental planning, as well as producing the Regional Land Transport Strategy (RLTS). The RLTS sets out regional transport objectives and policies and incorporates a diverse mix of transport solutions. A review of the RLTS will be completed by the end of 2008[4].

1.5.2 Auckland Regional Transport Authority

ARTA is responsible for planning, prioritising funding and developing the Auckland regional land transport system. Established in 2004 as New Zealand's first regional transport authority, ARTA also develops the regional 10-Year Land Transport Programme (LTP), an integrated strategy that includes all transport modes.

ARTA has also recently published the Auckland Transport Plan 2007 (ATP). The ATP establishes a 30-year vision for the region. It includes a mix of alternative transport initiatives and improvements to the local and state highway network. Transit's 10-year State Highway Plan and Forecast was provided to the ATP to establish a complete multi-modal land transport programme.

1.5.3 Land Transport New Zealand

Land Transport New Zealand is a Crown Entity formed by the LTMA 2003 to promote land transport sustainability and safety and allocate government funding.

In 2007, the Minister of Transport announced that Land Transport New Zealand and Transit will merge to form a new Crown Entity called the New Zealand Transport Agency. Transit welcomes this opportunity to further streamline transport services. The merger will be completed by July 2008 and the details are being developed by an Establishment Board.

[4] To be confirmed by ARC.

1.5.4 Ontrack

Ontrack owns and maintains the railway infrastructure in New Zealand. Transit works closely with Ontrack where railways and state highways interface. We will continue to support our memorandum of understanding with Ontrack and the design standards established by Land Transport New Zealand for rail crossings.

Transit also supports ARTA's Rail Development Plan 2006 and concurs that increasing rail facilities will ease congestion. Further dialogue between ARTA, Transit and Ontrack is required to clarify and further strengthen the role of rail in reducing congestion, particularly considering recent commitments to significantly improve rail infrastructure. Transit also supports the use of rail for freight movement.

1.5.5 Local authorities

Transit prefers an early and collaborative approach to working with territorial local authorities on new projects. Since the last ASHS, numerous agreements have been created to develop even better working relationships with local councils. Transit continues to seek early engagement in regional district planning to make sure the state highway network is efficiently integrated with its surrounding areas.

1.6 FUNDING AND AFFORDABILITY

In the next 10 years it has been estimated that $13.7[5] billion should be spent in the Auckland region on transport through Ontrack, ARTA, local councils and Transit. Actual funding will need to be addressed by the Long Term Council Community Plans (LTCCP), the Government Policy Statement, and the New Zealand Transport Agency.

Transit supports ARTA in its task to prioritise the region's transport programme. The shift to public transport and other sustainable transport solutions needs to be highly coordinated across all organisations.

[5] Auckland Transport Strategic Alignment Project: Common Strategic View 2007

1.7 ALTERNATIVE FUNDING SOURCES

Regional fuel taxes and/or developer contributions may be used to fund transport strategies. Transit has established a developer contribution policy as set out in Transit's Planning Policy Manual where, for example, developers contribute to the cost of upgrading state highways to cope with additional pressure created by new development.

Investigation into alternative funding mechanism including road congestion pricing for Auckland is being undertaken by Ministry of Transport. Transit will support and contribute towards the investigation of alternative funding initiatives including road congestion pricing by contributing knowledge and technical expertise where and when appropriate.

2.0 IMPLEMENTING THE AUCKLAND STATE HIGHWAY NETWORK

2. 1 INTRODUCTION

State highways enable long distance travel and the movement of freight and people between major centres of population, ports, airports, industrial, primary production and tourism areas and places of interest.

The National State Highway Strategy (NSHS) sets out eight planning principles for building, operating and maintaining state highways

- Safety.
- Network operation.
- Asset management.
- Managing demand.
- Environment and communities.
- Integrated planning.
- Education.
- Continual improvement.

In implementing the principles the order of priority is to

- Ensure the safe efficient and effective performance of the existing network.
- Improve network performance by implementing travel demand management measures.
- Improve infrastructure to accommodate planned growth and development.

The following sections describe how these principles are applied in Auckland and how they will support the ambitious new targets set by the developing UNZTS.

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2.1.1 Safety

Safety for all road users is a key driver of the NSHS. The Government's 'Road Safety to 2010 Strategy' is to reduce casualties to no more than 300 deaths and 4,500 hospitalisations a year by 2010. The UNZTS has set the next target for 2040 as being no more than 200 casualties per annum and provide world best-practice safety standards for all transport modes. Furthermore, Transit is a participant of the KiwiRAP (New Zealand Road Assessment Programme)[6], which identifies three elements contributing to road safety. Transit's primary contribution is to build and maintain safer roads as illustrated by the figure below.

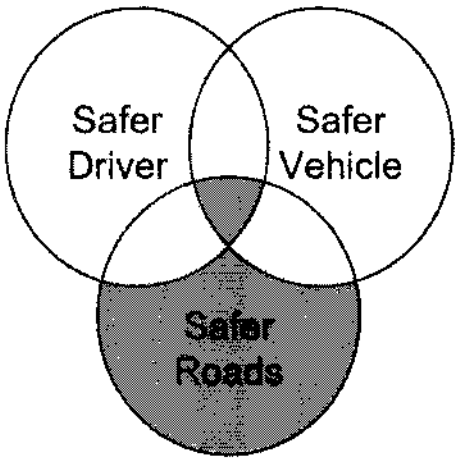

Figure 3: Safe Road system Elements

In the Auckland region, individual fatal crashes have decreased since 2002, but the number of people dying in those crashes has increased (see Figure 6). The majority of the crashes are due to driver error, drink driving or fatigue.

[6] http://www.kiwirap.org.nz/

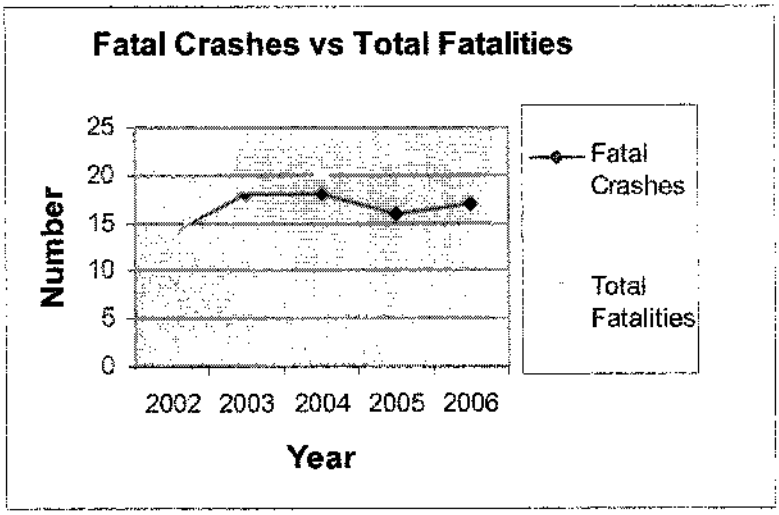

Figure 6

The Auckland region has a safety management system and road safety plan, which turns policy requirements such as the Road Safety to 2010 strategy into processes that improve safety and reduce crashes. The Auckland region will upgrade its safety management system by 2011 to achieve the new 2040 targets.

Transit is continually working on key safety issues in Auckland, including

- Congestion, leading to rear end crashes.
- Driver factors such as alcohol, drugs and speeding.
- Loss of control on bends and head-on collisions.
- Vulnerable road users and vehicle crashes.
- Serious injury crashes resulting from collisions with roadside hazards.

Four road safety task forces have been established to address particular safety challenges.

Road safety task force	Scope
RSTF	SH1 – between Orewa and Puhoi
RSTF2	SH1 – Dome Valley (north of Warkworth and south of Wellsford)
RSTF3	SH18 – between Hobsonville and Albany
RSTF4	SH22 – between Drury and Glenbrook Road

Transit will also improve safety by continuing to

- Collaborate with regional road safety organisations and other stakeholders on safety campaigns.
- Conduct crash reduction studies, review accident records and identify potential black spots.
- Continue state highway inspections to identify deficiencies and remedies.
- Conduct safety audits to ensure that new construction is safely designed and built.
- Implement Transit's Geometric Design Manual for best practice design standards.
- Introduce skid resistant road surfaces where appropriate.
- Implement safety guidelines for passing and overtaking.
- Work closely with the police on enforcement.
- Ensure safe and frequent crossing points for walking and cycling.

2.1.2 Operating the network

In Auckland, operating the state highway network ranges from implementing Intelligent Transportation Systems (ITS) and support for the regional freight strategy to the use of overweight and over dimension permits.

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The following chapter describes Auckland's ITS initiatives and how they are coordinated with local authorities via the Traffic Management Unit (TMU) and Advanced Transit Traffic Operation Management System (ATTOMS).

2.1.2.1 Traffic Management Unit

The Traffic Management Unit (TMU) is a joint initiative between Transit New Zealand, Auckland City, North Shore City, Manukau City, Waitakere City, Papakura District and Rodney District Councils to provide a strategic, integrated and collaborative approach to managing traffic. The TMU monitors and manages the motorway network and key regional arterial roads across the region. Furthermore the TMU manages and prioritises traffic signal maintenance and upgrades, CCTV on arterial roads and motorways and traffic management.

ATTOMS (Traffic Management Centre)

The operations division of the TMU, 'ATTOMS', (Auckland's Traffic Management Centre), operates a control centre operating 24 hours everyday of the week, which facilitates the operation of Auckland's motorways, state highways and urban arterial roads. ATTOMS uses state of the art technology to monitor and manage traffic in real time. This advanced monitoring system enables real time communication of the Auckland transport network to make journey times more consistent. For instance, ATTOMS coordinates the clearance of traffic incidents in a timely manner. ATTOMS also manages traffic around special events and incidents.

The ATTOMS integrated traffic management systems include

- Sydney Coordinated Adaptive Traffic System (SCATS) traffic control system to monitor traffic signals.
- Communication technologies and software systems to manage traffic flow.
- Remote viewing of 110 closed circuit television sites and local authority traffic control systems.
- Lane control signals.

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- Variable message signs (VMS) displaying up to date messages to enable road users to plan their journeys.
- Operation of ramp signals.
- Traffic producer provides regular traffic bulletins to more than 20 radio stations at peak times.
- Operation of moveable lane barrier on the Auckland Harbour Bridge.

Initial evaluation of the above operational systems shows improved incident detection and response times resulting in reduced delays. These benefits totalled $10 million in 2003. Future upgrades, such as the ramp signalling project and the new Journey Time Predictive System, will improve travel times between urban areas and key economic nodes.

Ramp signalling

Ramp signalling is a new traffic management initiative in New Zealand using technology that has been successful in other parts of the world.

Ramp signals are traffic signals on motorway on-ramps that manage traffic during peak flows. With each green signal, cars drive down the ramp, merge easily with motorway traffic and cause less disruption to the traffic flow. The signals operate according to traffic flow. Electronic sensors, built into the road, send messages via fibre optic cable to an automated server that continually monitors traffic conditions throughout the network and operates the signals when required. The server adjusts the length of time between green lights as motorway traffic flows change. Ramp signals are being installed on all Auckland motorway on-ramps.

Additionally, and in association with the ramp signalling project, approximately 15 interchanges will have freight or HOV bypass lanes.

The projected operational outcomes are summarised in the following table:

Table 5

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Desired Auckland outcome	Achievements worldwide
More consistent and predictable travel times	22% decrease in travel time 91% improvement in reliability (journey times)
Safer merging and fewer accidents	24% reduction in crashes
Better throughput of vehicles on motorway	9% increase in throughput of vehicles
More consistent speeds	14% overall speed increase

Other operational and safety improvements will also be required to dynamically manage traffic flows across the network as developments occur and as particular pressure increases.

2.1.2.2 Freight

According to the Moving Auckland Freight[7] discussion paper, '*$45 billion of freight and goods is carried annually between producers and markets, including nearly half of the nation's exports and imports worth about $34 billion, which is shipped through the Ports of Auckland and Auckland International Airport'*. Furthermore the freight industry predicts that freight vehicles will double by 2020 despite industry-wide shifts to rail and sea carriers. The percentage of heavy vehicles on state highways is provided in the Appendices.

Issues facing freight are varied and in the Auckland region include

- The direct financial impact of road congestion on the profitability of regional manufacturing and distribution sectors has been estimated at around $100 million p.a. due to delays and inefficiencies in the delivery of goods and services (Auckland Region Freight Strategy 2006).
- Journey time reliability and spreading peak hour congestion.

[7] Draft Report for Discussion August 2007, prepared for the National Road Carriers

- Changes in logistics industry, including shifts to rail and sea freight movement.
- Residential and retail property demands driving property values on industrial lands.
- Integrating new business lands with transport infrastructure will be difficult because the ARC indicates a region wide estimated deficit of 500-1,000 hectares of greenfield land needed for additional business growth.
- Enabling ramp signalled priority at particular interchanges to assist freight traffic (e.g. Grafton Gully).
- Transit will also investigate other priority measures to support the movement of freight across and through the region.

The ARC's Auckland Regional Freight Strategy 2006 (ARFS) sets out a regional policy for promoting the efficient, safe and environmentally sustainable distribution of freight within Auckland. It contributes towards the objectives of the Regional Land Transport Strategy (RLTS). The UNZTS now includes a specific national policy to address the issues facing freight.

Transit will gain a better understanding of the needs of the industry by working closely with the road transport industry.

Transit will contribute towards the ARFS objectives by

- Collecting and making freight data available to ARC and others.
- Supporting ARC and ARTA's review of overweight and over dimension routes.
- Undertaking a study with regional stakeholders to identify the heavy vehicle demands on regional routes and the benefit and costs to Auckland and the transport industry.
- Working with regional partners to develop the Strategic Freight Network.

- Working with ARC and ARTA to allow greater over dimension and overweight loads on motorways under controlled conditions and safety standards.
- Working with ARC to support and provide infrastructure for an additional estimated 500-1000 hectares of greenfield land needed for additional business growth.
- Ensuring that the road network functions more reliably through effective use of traffic management and demand management measures and selected capacity improvements.

2.1.3 Asset management

Transit will continue to proactively manage motorway traffic by ensuring

- Highest quality surface conditions are used; for example skid resistant aggregate on parts of the motorway.
- The road is not allowed to deteriorate to the stage where it could increase congestion through accidents or emergency repairs.
- Tunnelling of utilities under the motorway is carefully managed.
- Maintenance is performed at night to reduce impact on motorists.
- Incidents are managed to limit congestion, rapidly secure damage, and get traffic flowing again.

Annual surveys are conducted to identify ways to extend the life of the road through resurfacing and rehabilitation.

For instance, adopting the Open Graded Porous Asphalt Layering System provides structural strength to the road surface and has improved efficiency. Over the last 10 to 15 years, it has created cost savings in the order of $4 million, and lowered the entire maintenance cost by 10 percent. This approach is of considerable interest to other organisations in New Zealand and overseas because of the savings it has achieved.

Inter-regional relationships have been established to respond to emergencies. Transit participates in the ARC sponsored lifeline project, which *'identifies measures and coordinates efforts to reduce the vulnerability of Auckland's lifelines to hazard events and to improve service reinstatement after a disaster.'*

2.1.4 Managing demand

In the context of Transit's business, Travel Demand Management (TDM) is '*any initiative that modifies travel decisions so as to reduce the negative impacts of road transport'.*[8]

Transit's Travel Demand Management (TDM) Manual, available on Transit's website, sets out how these aims are to be achieved across Transit's business.

Recently, more than 100 new walking and cycling projects alongside or across state highways have been identified in the Auckland region and will be prioritised against the objectives of the RLTS and ARTA's Sustainable Transport Plan in Transit's Walking and Cycling Strategy. Projects connecting schools, supporting growth nodes, and improving accessibility to public transport in urban areas will be progressed immediately to increase the active mode share to 30% in Auckland (UNZTS). Projects will be implemented to improve accessibility for people with disabilities, which will also improve access for all users, subject to meeting funding criteria.

Transit will support national efforts to review the funding procedures for walking and cycling projects. It is recommended that a specialised methodology be adopted for those projects that support ARTA's Regional Cycle Network and/or provide pedestrian access to Auckland's major public transport nodes.

Furthermore Transit will undertake a combined HOV and freight study to determine the best corridors for managed lanes for priority users (HOV, freight, public transport) to reduce single occupancy kilometres travelled and to assist economic

[8] This definition was developed from the Austroads publication *Travel Demand Management: A Resource Book.*

development. The requirements of ARTA's public transportation network will be carefully considered to ensure the most efficient use of managed lanes to achieve the mode shift targets identified in the UNZTS.

Transit also participates in numerous working groups, such as ARTA's TDM working group, which coordinates workplace and school travel planning among other region-wide TDM initiatives. Transit officers will continue to participate and collaborate with regional stakeholders by contributing expertise towards TDM based solutions and encourage provisions for TDM within district and regional council documents.

2.1.5 The environment and communities

The sustainable use and management of natural resources is a key component of the strategy. Transit is committed to the continual improvement of the environmental management of the state highway network. Transit has developed a large collection of data on environmental impacts and will continue to update, research and make data available to other stakeholders.

Transit uses its Environmental Plan as a foundation for managing environmental effects within the statutory framework. The Environmental Plan helps Transit identify where and how to undertake projects that contribute to environmental sustainability and the social well being of local communities.

Transit will also improve environmental impacts of transport. Below are examples of existing measures:

Noise and vibration	All new projects are assessed for noise and vibration impacts. Where standards are exceeded, funding for noise mitigation is sought to enable Transit to reduce noise problems and minimise public health effects.
Air quality	Base line and predictive models of air quality completed for all new projects. Transit research on air quality in Auckland not only supports its own projects but also provides data that enables regulatory authorities to manage the region's air quality and set future targets. Reducing air pollution from vehicles ensures a reduction in premature deaths and serious illness arising from air pollution.
Water resources	Transit continues to use innovative ways to improve the quality of discharges to waterways. State of the art erosion and sediment controls and stormwater quality systems are constantly being developed and used to work with Auckland's diverse topography and geology. Transit regularly tests new environmental management techniques.
Culture, heritage and ecological resources	Across all projects, Transit develops partnerships with key stakeholders including iwi to ensure it has identified cultural heritage features and recognises these in appropriate and pragmatic ways. Apart from physical protection of heritage sites, Transit assists with and coordinates events such as project celebrations, special sites and natural ecosystems and in some cases provides support or leads education on these issues.

Transit is committed to the new UNZTS targets of halving per-capita domestic transport green house gasses and will implement ecological solutions as well as

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managing demand for state highways to achieve this goal by 2040. Some examples of ecological solutions Transit has employed in the past include more innovative air quality assessments including a CO^2 discharge assessment for the ALPURT B2 project. This study established the CO^2 footprint for the project but also identified a range of opportunities across the design, construction and management phases of highway development where emissions (within and related to works) could be reduced.

Transit will contribute to environmental enhancement and mitigations including

- Minimising impacts on ecological corridors and revegetation using native species (land and water ways).
- Salvage and relocation of native, lizards, fish and other animals including birds (fern birds, robins, dotterels).
- Creating fish passages and habitats within culverts.
- Building physical structures such as viaducts or tunnels to avoid and protect valued habitats.
- Varying vertical and horizontal geometry of road design and adjacent batters to avoid sensitive areas and reduce discharges.

Transit often implements these approaches in collaboration with a wide range of local government and other stakeholders including territorial local authorities and the ARC. For instance, when a pair of rare sandy-brown New Zealand dotterels was found at the Northern Busway construction site, Transit established the Shore Bird Technical Working Group, with representatives from Transit, the Auckland Regional Council and the Department of Conservation. Five new nesting areas were created for the dotterels. The dotterels are nesting successfully and have reproduced. Other native birds in the area have also increased.

Long term, Transit aims to create highly effective working relationships with all regulatory agencies to achieve better environmental outcomes.

Communities and consultation

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Transit uses a set of guidelines to manage stakeholder relationships and consultation with Maori. Transit has also established informal and formal relationships with many iwi and hapu and Maori organisations, some via signed memoranda of understanding. Apart from physical protection of heritage values and sites, Transit assists with and coordinates events such as project celebrations, special sites and natural ecosystems and in some cases provides support or leads education on these issues. Furthermore all Transit staff, from administrative staff to senior management, attends two day bi-cultural training on a Marae. Transit is working to consolidate and improve relationships with Maori in Auckland and recognises that relationships can always be improved and strong communications channels need to be maintained.

2.1.6 Integrated planning

Integrated planning requires partnership and a combined approach to regional planning, transport provision, and the location and distribution of land use activities. It involves all transport modes for the movement of people and goods including commuting and recreational travel, public transport, freight movements, walking and cycling.

Transit works closely with local authorities and developers with the objective of ensuring that land use is fully integrated with the built environment, the state highway and local transport networks in order to reduce the need to travel. Well-planned local transport networks enable sustainable land use and improve quality of life. Examples include Transit's early involvement in the development of structure plans, plan changes and working with private developers to ensure that transport is fully integrated in new development proposals. Transit also support's ARTA's Integrated Transport Assessment guidelines as the foundation for which land use developments are assessed

> *'An ITA is a comprehensive review of all the potential transport impacts from a Structure Plan, Proposed Plan Change, a metropolitan urban limit shift or a major trip generating activity... to identify and inform any actions required to avoid, remedy or*

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