

SH 1/16 Auckland to Wellsford Strategic Study



STRATEGY REPORT

- Final
- March 2003



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- Final
- March 2008

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1. Executive Summary

This report describes a study commissioned by Transit New Zealand (Transit) into a recommended future strategy for State Highways 1 and 16, between Auckland and Wellsford. The purpose of the study was to identify the future function and format for each state highway, and to provide guidance on what level of transport investment would be required on each of the state highway corridors.

SH1 and SH16 both provide transport routes between Auckland and Northland, although each route is significantly different. SH1 is the primary choice for travel between Auckland and Northland whilst SH16 provides more regional functionality, linking the townships along it to the Auckland and Northland areas. There is also little through traffic between Auckland and Wellsford on SH16, except during holiday periods when Transit encourages use of this route to avoid delays on SH1 at Orewa.

The study investigated future transport needs for a period up to 2050. This time horizon is consistent with the Auckland Regional Growth Strategy (ARGS), which defines how land use development will take place in the region, out to 2050. The study area, which is predominantly in Rodney District, is experiencing significant growth in residential development and economic activity which is likely to continue. Therefore an approach was adopted to test the amount of development which might occur over the timeframe of the ARGS, and then examine what the travel demands of this future scenario would entail.

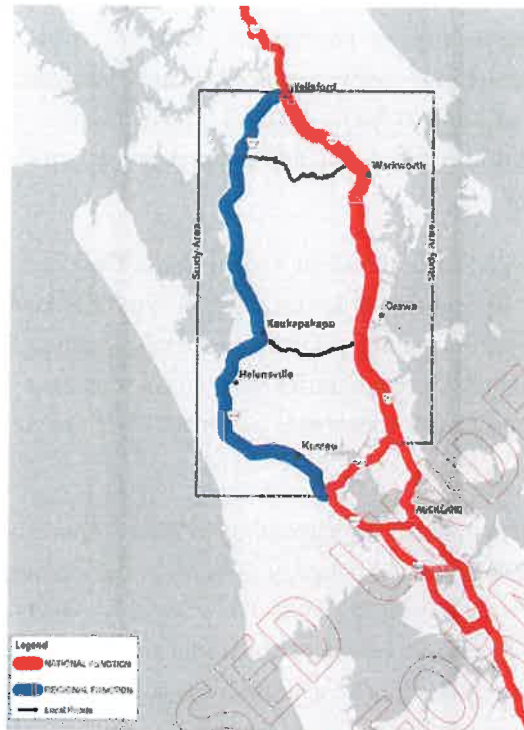
The study was undertaken in two parts; the first part focused on options for the strategic function of both state highways, and reached a conclusion about which option was preferred. In the second part, work was undertaken to determine how functionality in the recommended strategy could be implemented, taking account of factors such as economic development, environmental issues and viability.

Transit New Zealand published its National State Highway Strategy (NSHS) in 2007, which outlined a new system of defining functions of state highways into three separate categories, national, regional and sub-regional. Strategy options were developed which different functions for each of SH1 and 16 (plus a new inland route), recognising that the national function must be maintained to provide the critical strategic link between Auckland and Northland.

After a careful review of the needs, issues and constraints in the study area the recommended strategy which emerged from a LTMA based evaluation framework, was retention of the functions defined in the NSHS, namely the national function on SH1, with SH16 fulfilling a regional function. This concept is shown on Figure 1-1 overleaf.



■ **Figure 1-1 Recommended Strategy**



Once a recommended strategy was identified, work continued to establish how it would be implemented. With a focus on moving more people and goods rather than just providing more traffic capacity, several opportunities for alternative modes were explored, including bus and rail. A substantial proportion of freight moving between Northland and Auckland is already moved by rail; however logistical issues suggest that opportunities to move significantly more freight by rail are limited. Transit had already investigated extending the Northern Busway to Silverdale, which will provide for the growth in commuter travel from the Hibiscus Coast to Auckland. No other improvements to SH1 south of Puhoi are needed to support the recommended strategy.

ARTA has recently announced that passenger rail services will be introduced to Kumeu and Helensville in 2009. While this initiative will assist, it is unlikely that this will be sufficient to cater for anticipated increased travel demand on the SH16 corridor between Westgate and Waimauku. Therefore some form of upgrade to SH16 will be required within the time horizon of this strategy. Traffic modelling undertaken in this study indicated that a Kumeu bypass would not be viable, as the majority of traffic using this section of road is making trips which start or end in the urban area. A detailed investigation of the scope of this upgrade is beyond this strategic assessment, which should be undertaken as a separate process in future.

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SH1 north of Puhoi will be upgraded to a four lane dual carriageway to Wellsford. Future travel demands and operational factors including access control suggest this upgrade should be motorway standard at least as far as Warkworth. Route standards could be relaxed to expressway standards north of this point to Wellsford.

An initial economic assessment of the recommended strategy suggested that upgrading some sections of SH1 would not be viable under current funding conditions. However, this assessment assumed a specific growth forecast in land use and associated travel demands; the current level of growth is running ahead of the ARGs, and if this accelerated rate of growth continues it will put pressure on the need to bring forward implementation of the strategy. Therefore, it is recommended that the whole route is protected for the implementation of the strategy over the time horizon of this strategy. In the meantime, work should take place on the Schedewys Hill and Dome Valley sections, to address specific safety problems.

During the study period, Government announced a series of themes or outcomes required from the transport sector. While some themes were directly related to Auckland matters, the strategy was tested and found to be consistent with the themes relevant to this project. Further, the strategy was found to make a positive contribution to the economic activity of the region, albeit to a relatively small degree.

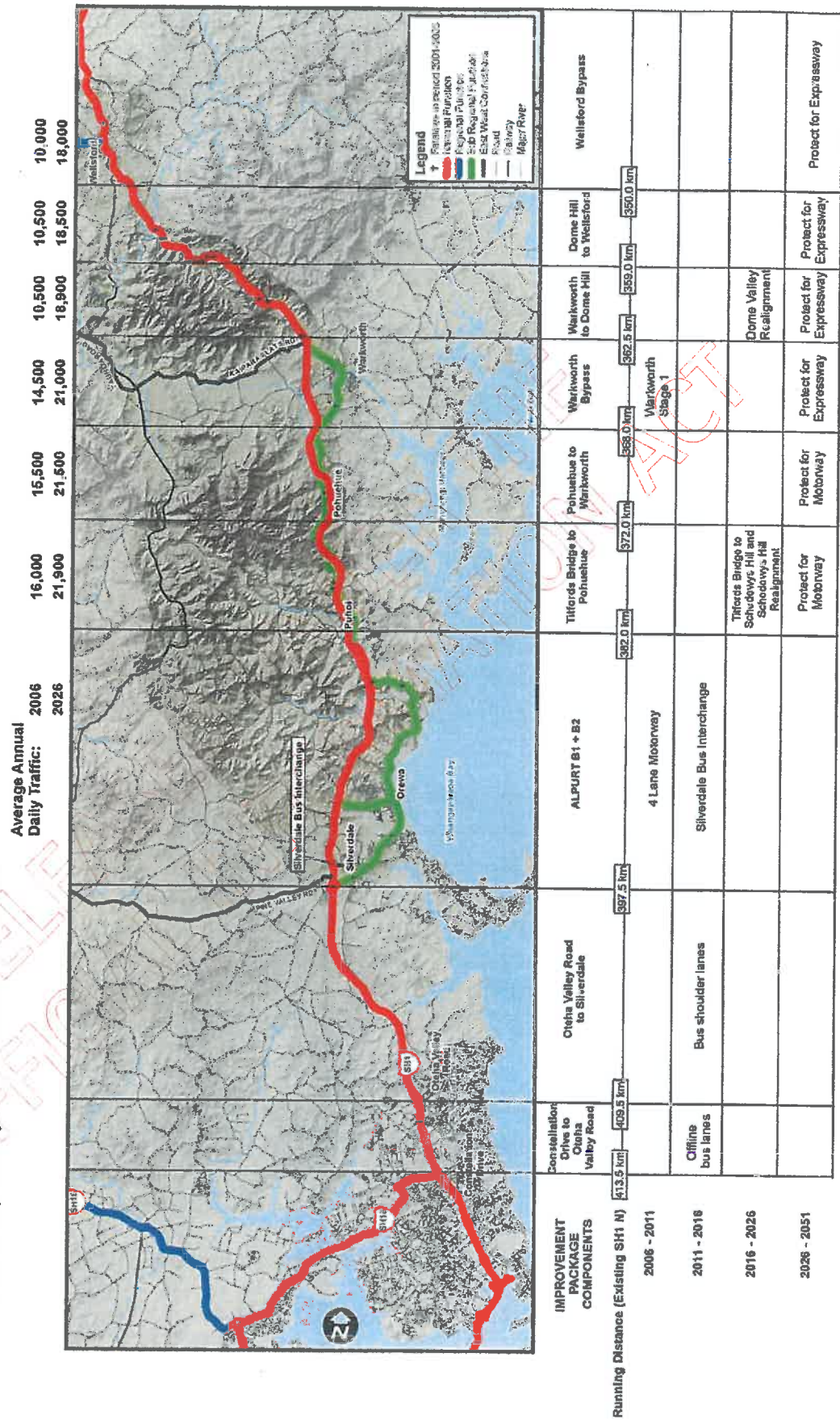
Government also announced the Update to the New Zealand Transport Strategy (UNZTS) late in 2007. In this update, targets for the transport sector were identified, which are focused towards sustainability, energy and climate change. Although several targets relate to matters beyond this state highway strategy, such as vehicle emission standards, many of the targets were directly relevant to new infrastructure provision. In these areas, it was concluded that the recommended strategy supported the UNZTS, although it is recognised that private vehicle transport will continue to dominate in rural areas. Improvements to vehicle motive technology are more likely to influence greenhouse gas emissions in this predominantly rural study area, than would be the case in urban areas.

In addition to the major works identified in the study, a series of minor projects and safety improvements will complement the overall strategy. Transit had previously developed a series of minor work proposals. Where these have been identified and can be seen to be consistent with the overall strategy, it is recommended that they are implemented as previously planned.

Details of how the strategy is intended to be implemented on SH1 and SH 16 are shown overleaf.

The SH1 Strategy is to provide for a national function between Auckland and Wellsford by:

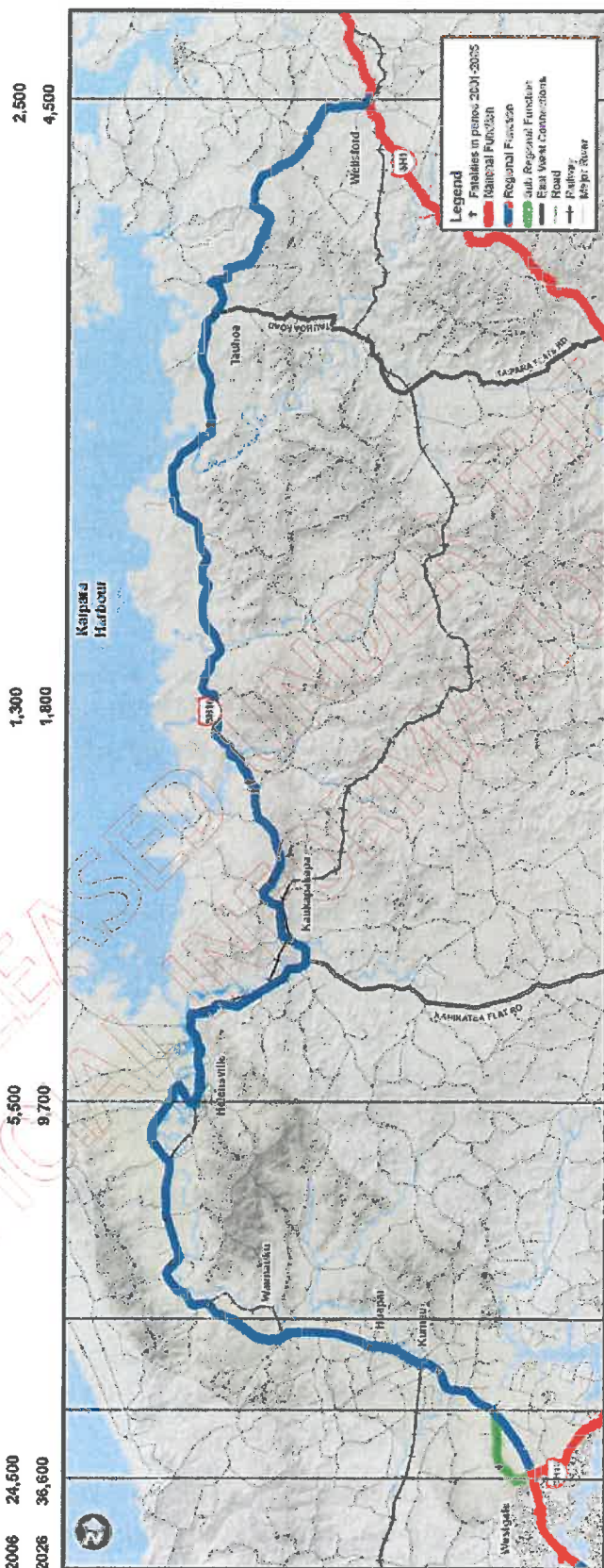
- Providing a high standard access controlled four lane dual carriageway with bus lanes from Auckland to Silverdale
- Providing a high standard access controlled four lane dual carriageway from Silverdale to Warkworth
- Protect for expressway from Warkworth to Wellsford



- Providing a high standard access controlled four lane dual carriageway from Auckland to Brigham Creek

- Providing a high standard access controlled four lane dual carriageway from Auckland to Bringham Creek
- Kumue/Huapai Transportation Action Plan
- Completing safety improvements from Waimauku to Helensville
- Completing minor safety improvements along sections of the route between Helensville and Wellsford

Average Annual Daily Traffic: 2006	24,500
	36,600



IMPROVEMENT PACKAGE COMPONENTS	Running Distance (Excluding SR16)					Helensville to Wellsford	102.0 km
	12.5 km	23.5 km	34.0 km	45.0 km	56.0 km		
Brigham Creek Rd Extension						Waikauka to Helensville	
2 Lane Expressway						Passenger Rds (A1/A2)	
						Minor Safety Improvements 1	
						Minor Safety Improvements 2	
						Minor Safety Improvements 3	
4 Lane Urban Expressway Improvements						Minor Safety Improvements 4	
						Safety & Passing/Over-taking Improvements	
						Safety Improvements 2	
						Safety Improvements 3	
						Safety Improvements 4	

* Minor Safety Improvements Shown in Strategic Study Report
* National Cycle Route Provided on Existing SH16



2. Introduction

2.1 Background

Sinclair Knight Merz (SKM) was engaged by Transit New Zealand (Transit) to undertake a strategic study for the future of SH1 and SH16 from Auckland to Wellsford, up to 2051. The key objective of the study was to determine the future function of SH1 and SH16 as part of a multi-modal network, which appropriately balanced the State Highways' national, regional and sub-regional roles with predicted future land use. This Strategic Study Report is the final in a series of deliverables, and follows the 'Transport Network Performance Assessment', the 'Planning Baseline', the 'Issues Constraints Risks and Opportunities Report', and the 'Transport Modelling Report'.

2.2 Study Objectives

The goal of this strategic study was to identify a package of improvement projects to provide for an integrated, safe, responsive and sustainable transport network between Auckland and Wellsford. This network was to be in support of sustainable land use developments in the region whilst also addressing inter-regional transport needs.

The study objectives included:

- Undertaking a review of the SH1 and SH16 corridors including their functions, issues, constraints, risks, opportunities, physical conditions and performance;
- Identifying the existing, planned and future land use developments which will have impacts on SH1 and SH16;
- Identifying an improvement project package to address the increasing travel demands and balance the state highways' roles and their role in contributing to assist with economic growth and regional land use developments; and
- Establishing a development strategy for SH1 and SH16 up to 2051.

2.3 Report Purpose

The purpose of this report is to describe the study process and outcomes, together with conclusions and recommendations of a strategy for both of the SH1 and SH16 corridors. In addition, an implementation plan for the strategy has been developed.

The implementation strategy provides guidance on when and what level of transport investment is required on each of the state highway corridors. The strategy is primarily based on assumptions about the timing of land use development in the area, mainly based on the recommendations of the



Auckland Regional Growth Strategy (ARGS). The ARGS defines how land use development will take place in the region, out to 2051. However, the current level of growth is running ahead of the ARGS, and if this accelerated rate of growth continues it may be necessary to accelerate implementation of the strategy.

2.4 Study Area

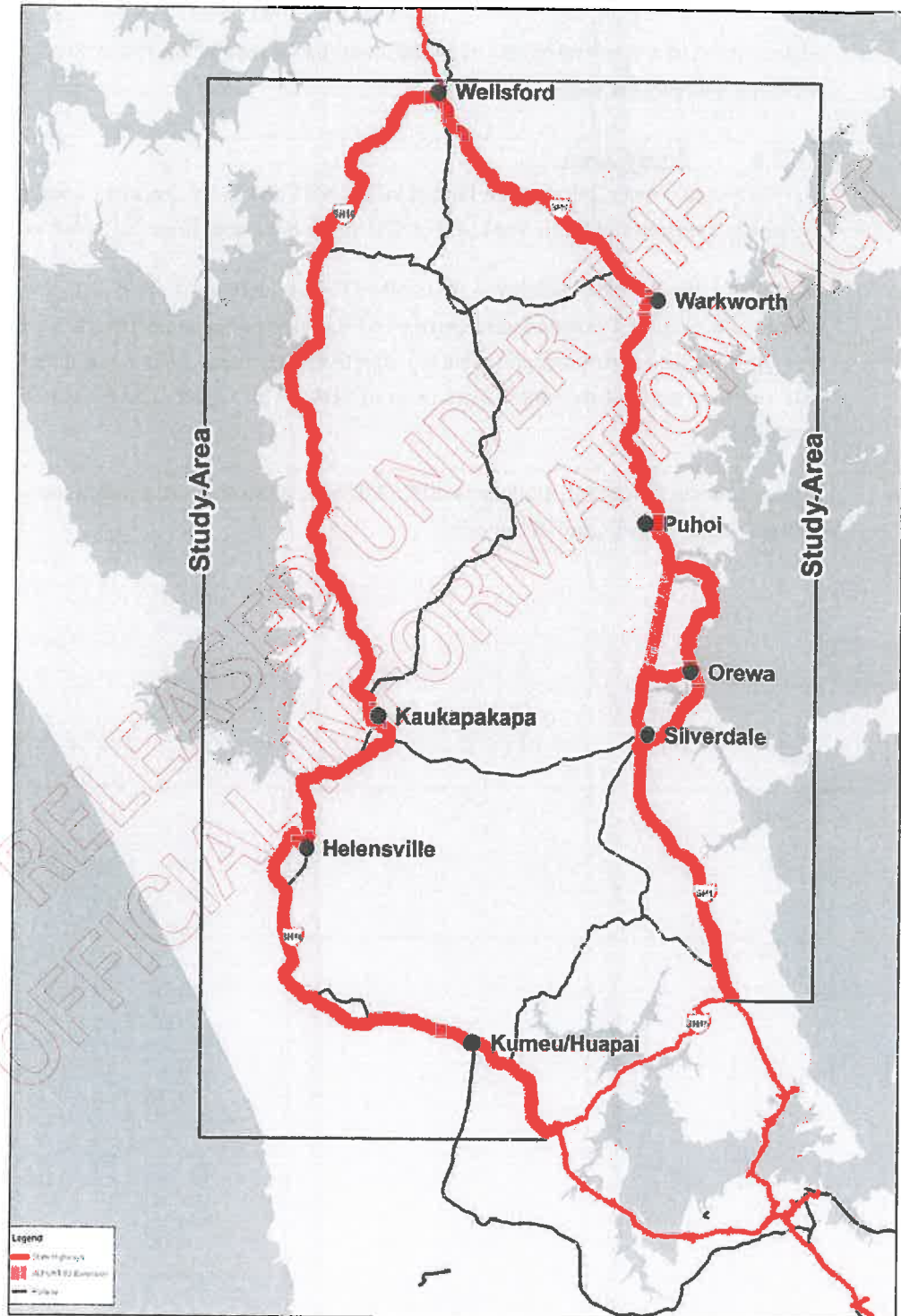
The study area covers (but was not limited to) the SH1 and SH16 corridors from the Central Motorway Junction (CMJ) in Auckland to SH1 north of Lovers Lane (RP336/7.34) in Wellsford.

While CMJ was the official starting point, plans for the sections of the state highway network between the CMJ and Constellation Drive on SH1 and Westgate on SH16 are well developed. It was agreed at the project inception that the effective study area was to be from north of SH18 on SH1 and from north of the motorway section of SH16. This report focuses on these sections of SH1 and SH16.

A map showing the overall study area, SH1, SH16, key east to west connections and the rail network is shown in Figure 2-1 overleaf.



■ Figure 2-1 Study Area





3. Strategy Background

This section describes the needs and requirements of the strategy for State Highways 1 and 16 from a strategic and functionality perspective. This is based on national, regional and local land use and transport policy documents, together with Transit's own network planning policies and strategies. This information was used to develop strategic options, as described in Section 4 of this report.

3.1 Transport and Land Use Policy

The policy context for this study is a combination of legislation, strategies, statements and plans. These documents operate at national, regional and local levels. The influence of these policies on transport infrastructure varies between documents. However, it is important to recognise that a policy hierarchy exists, which places national policy above regional policy, etc.

The New Zealand Transport Strategy (NZTS) released in 2002 guides New Zealand transport policy at all levels with principles that seek to create a sustainable, affordable, integrated, safe and responsive transport system. The strategy's objectives are:

- Assisting economic development
- Safety and personal security
- Access and mobility
- Protecting and promoting public health
- Ensuring environmental sustainability

The Land Transport Management Act (LTMA) gives effect to the NZTS objectives and principles. Under the LTMA, Transit's objectives and functions include preparing and controlling a programme for the State Highway system that contributes to an integrated, safe, responsive, and sustainable land transport system. In doing so Transit must exhibit a sense of social and environmental responsibility and consider alternative modes to road transport, travel demand management and the integration of land use development with transport network development.

The LTMA requires all Regional Councils to produce a Regional Land Transport Strategy (RLTS). The goal of the Auckland RLTS is a transport system which enhances the Auckland region as a great place to live, work, and play. The vision is of a resource efficient transport system where people and goods are able to move when necessary, using modes that are integrated, safe and effective. Transit's State Highway Programme must take into account the RLTS.

The Auckland Regional Growth Strategy (ARGS) is a statutory document constituted under the Local Government (Auckland) Amendment Act (LGAAA) 2004. The purpose of the ARGs is to ensure growth is accommodated in a way that meets the best interests of the inhabitants of the



Auckland region. The strategy provides a vision for what Auckland could look like in 50 years time with a population of two million including sustaining strong supportive communities, a high-quality living environment, and a region that is easy to get around. The ARGS also provides a land use context for Transit's network proposals.

The Resource Management Act, 1991, requires all Regional Councils to prepare a Regional Policy Statement (RPS). The Auckland RPS was produced by Auckland Regional Council (ARC) and became operative in 1999. District Plans and the RLTS may not be inconsistent with the RPS. The RPS has minimal direct relevance to Transit's network development programme. However, the RPS is directly relevant to land use development matters which Rodney District Council (RDC) must consider.

3.2 National State Highway Strategy (NSHS)

The National State Highway Strategy (NSHS) was released in 2007 and is Transit's high level, non statutory response to the New Zealand Transport Strategy. It is subservient to the LTMA and must take account of relevant Regional Land Transport Strategies (RLTS).

A key aspect of the NSHS is the classification of all state highways as fulfilling either a National, Regional or Sub-Regional function and outlines the anticipated network development strategy for these roads within a 30 year period. Within the study area, SH1 and SH16 are identified as serving National and Regional functions respectively.

National State Highways are defined as those which:

- Connect places of national significance;
- Connect major cities of over 30,000 people, international ports handling more than 500,000 tonnes and airports with passenger numbers of over 500,000 per year or regular international flights;
- Facilitate long distance inter-regional movement throughout the country;
- Generally carry at least 400 Heavy Commercial Vehicles or 10,000 vehicles per day for more than two thirds of their length; or
- are designated motorways within major urban cities;
- In urban areas, designed to reflect a greater level of access control, with recognition of the dual function of state highways in terms of mobility and access

Regional State Highways are defined as those which:



- Connect territorial regions and places of regional significance;
- Connect key tourist destinations, regional ports, and serve inter-regional trips;
- Link more than two regions with traffic flows of 100 to 400 Heavy Commercial Vehicles or traffic of between 1000 to 10,000 vehicles per day;
- Have a particular strategic function within a region.

The NSHS also proposes that SH1 will be widened to four lanes or more from Auckland to Wellsford within a 30 year period. Improved passing and overtaking opportunities are proposed for SH16 within the same 30 year time frame.

3.3 Policy Conclusions

None of the relevant policy documents are prescriptive in terms of detailing specific actions that Transit must take. Rather, they are concerned with identifying outcomes that should be achieved. Further, the outcomes sought are multiple and in all cases there is no indication that any one outcome is more important than another.

This gives flexibility in developing and implementing strategy for state highways in the study area. As the NSHS has been developed in the context of the key national transport policies, enshrined in the NZTS and the LTMA, the key conclusion on policy context is that the strategy for state highways in the study area should be entirely consistent with the NSHS.

A further important conclusion on policy is that the scale and timeframe for land use development envisaged by regional and district plans is uncertain and therefore the implementation programme for the SH1/16 Strategy will need to be developed in close conjunction with land use development.

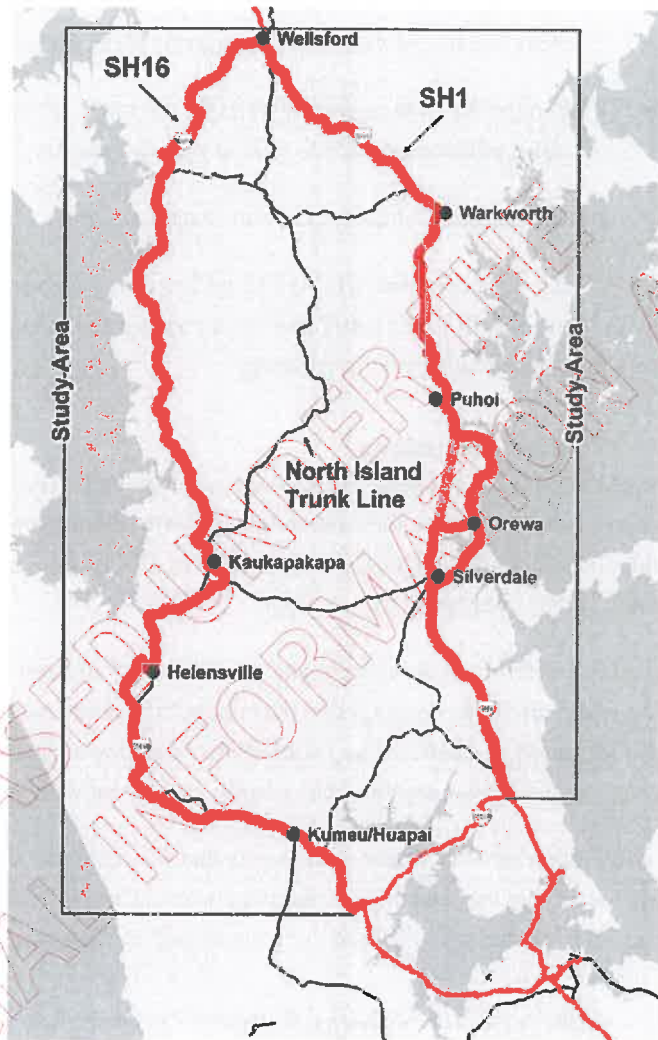
3.4 Existing State Highway Network Performance

SH1 and SH16 both provide transport routes between Auckland and Northland. The form and function of each is significantly different. In broad terms SH1 is the primary choice for travel between Auckland and Northland whilst SH16 provides more regional functionality, linking the townships along it to the Auckland and Northland areas. There is also little through traffic between Auckland and Wellsford on SH16, except during holiday periods when Transit encourages use of this route to avoid delays on SH1 at Orewa.

The following sections summarise the form and function of each corridor. The state highway network is shown on Figure 3.1 overleaf.



■ Figure 3-1 Existing State Highway Network



3.4.1 State Highway 1 – Form and Function

SH1 is the primary transport corridor from Auckland to Wellsford and beyond to Whangarei and Northland. It serves as an access route to many of the east coast communities and beaches such as Mangawhai and Omaha, and hence is used by local traffic from Orewa, Warkworth and Wellsford. It is also the preferred route for tourists and freight movements north of Auckland.

At the southern end of the study area, SH1 is the Northern Motorway and is a dual 2-lane carriageway from Constellation Drive to Silverdale (plus crawler lanes either side of the incline to Oteha Valley Road). The Northern Motorway ends at Silverdale, but the ALPURT B2 toll road currently under construction will extend the motorway to Puhoi. The current SH1 alignment, which



passes through Orewa, will then primarily provide a local transport function, although it will remain a state highway and will be the free alternative to the toll road.

North of Orewa SH1 is a single carriageway and serves the dual purpose of providing the national transport function between Northland and the Auckland region as well as providing access to Waiwera, Puhoi, Warkworth and Wellsford. North of Orewa the surrounding environment becomes rural and the topography more challenging. Approximately 50% of SH1 between Puhoi and Warkworth is mountainous, 35% rolling and just 15% level. There are a number of sharp bends and steep grades, particularly around Waiwera and Puhoi. Figure 3-2 overleaf shows the topography within the SH1 corridor between Orewa and Wellsford. The route also passes through 'Schedewys Hill', a region north of Puhoi which has both steep grades and sharp corners resulting in a crash rate that far exceeds the national average.

There are eight passing lanes between Orewa and Warkworth, with four in each direction. This section of SH1 comes very close to conforming to Transit's passing and overtaking strategy which seeks to provide a passing lane every 5km in each direction of travel. Figure 3-2 overleaf shows indicatively these passing lane locations.

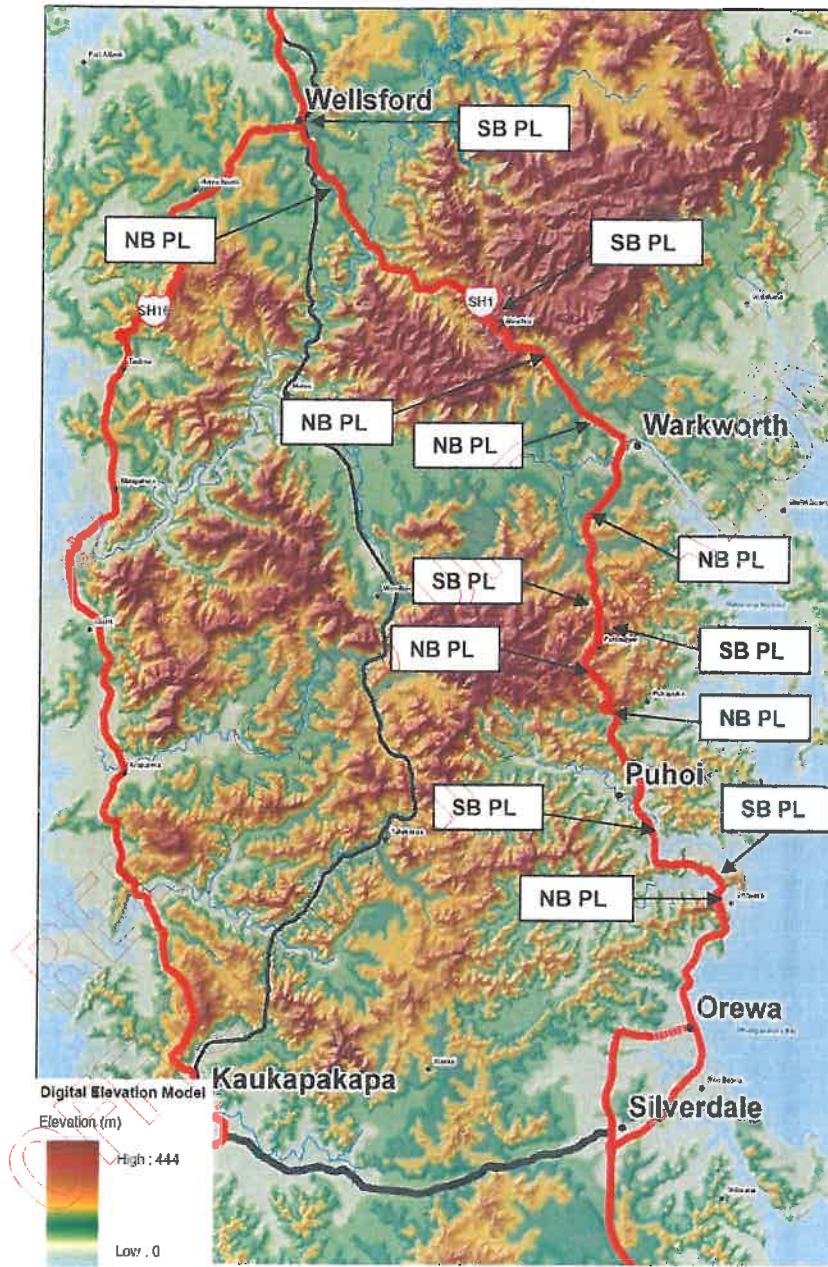
Warkworth is a busy and established community with access to the nearby east coast beaches. These beaches have high numbers of weekend and holiday accommodation, which attract large numbers of trips. Hence during peak holiday periods SH1 through Warkworth is heavily congested.

Between Warkworth and Wellsford, the topography continues to be mountainous and rolling as seen in Figure 3-2, each approximately 45% and 55% respectively with an environment that is largely rural. In this section of SH1 is the 'Dome Valley', a section of road notorious for its very high crash rate due to poor geometry and steep grades.

There are five passing lanes between Warkworth and Wellsford, two for southbound vehicles and three for northbound vehicles as seen indicatively in Figure 3-2. This is less than Transit's desired provision of a passing lane approximately every 5km, particularly for southbound traffic. This shortage of passing lanes causes delays and disruption to traffic, particularly where heavy vehicles move slowly on the steep grades.



Figure 3-2 Passing Locations and Topography On SH1 (Orewa – Wellsford)



SH1 also passes through the centre of Wellsford. It is at this point where SH16 joins with SH1. At all periods Wellsford tends to be busy with typical township activity such as on-street parking and frequent at-grade intersections that reduce the level of service for vehicles travelling through Wellsford. This problem is exacerbated during peak holiday periods.



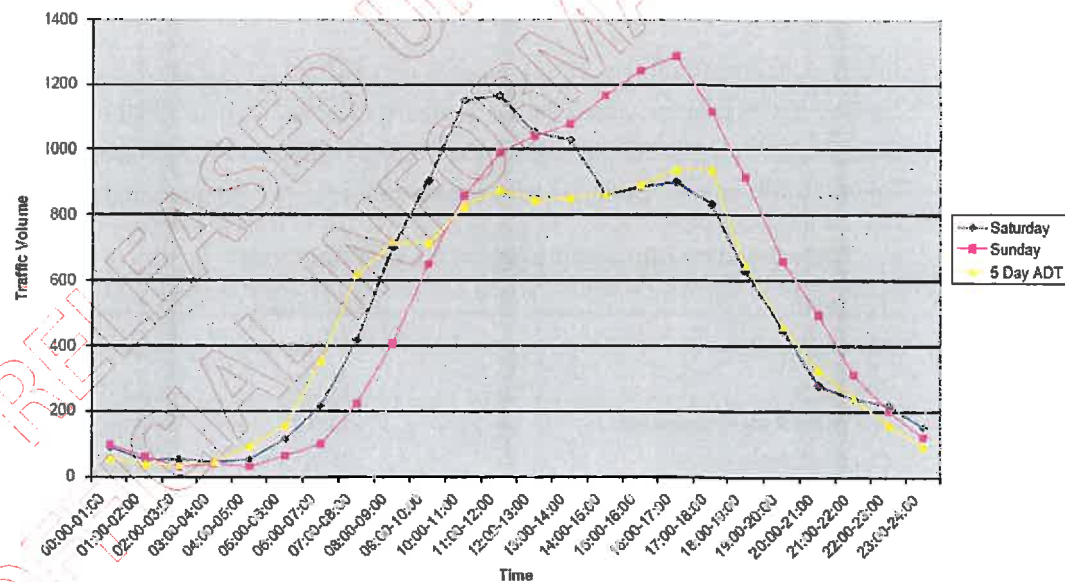
3.4.2 State Highway 1 – Traffic Flows

The southern end of SH1, at locations such as Constellation Drive, experiences distinctive morning and evening peaks reflecting the importance of the commuter function on the Northern Motorway.

North of Orewa, the daily traffic profile loses these distinctive peaks in the morning and evening, which indicates that the commuting function of this part of the road is far less prevalent. These more northern parts of SH1 largely function to provide local access and longer distance inter-regional travel. This pattern of traffic suggests that the beachside development and townships served by the more northern parts of SH1 are more self contained in terms of employment or, in the case of the beachside development serve recreational purposes.

Generally the daily weekend flows are higher than the weekday flows, particularly north of Orewa. This typical traffic profile north of Orewa is seen in Figure 3-3. This gives further evidence for the recreational function of the numerous beachside developments and their impact on SH1.

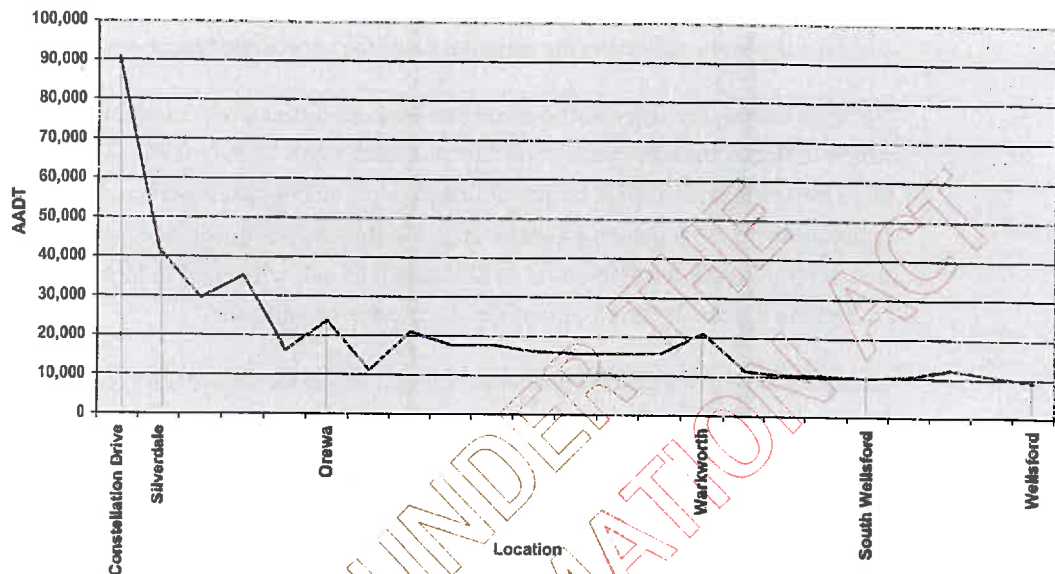
Figure 3-3 SH1 2006 Traffic Profiles (South of Kaipara Flats Road)



Traffic flows are significantly higher at the southern end of the study area as it is still located in a highly urbanised area, and forms part of the Northern Motorway. Traffic noticeably drops further north. There are also increases in AADT flows when the state highways pass through towns due to the local traffic. This is shown overleaf in Figure 3-4.



■ Figure 3-4 State Highway 1 Demand Plot (2006 AADT Profile)



In this section, traffic flows are expressed in terms of AADT, vehicle/capacity ratios and a resultant level of service in accordance with the Highway Capacity Manual. Traffic data has been sourced from Transit New Zealand State Highway Traffic Volumes 2001 – 2006 and Rodney District Council traffic counts. Table 3-1 summarises traffic flows within the study area on SH1.

■ Table 3-1 State Highway 1 Level of Service Summary

Location	AADT (2006)	V/C Ratio	LOS
Constellation Drive	91,000	0.95*	F
Silverdale	42,000	0.49*	C
North of Whangaparaoa Rd	17,000	0.68	D
North of Orewa Bridge	24,000	0.96	F
Hatfields Beach	18,000	0.72	E
South of McKinney Road (Warkworth)	16,000	0.64	D
South of Wellsford	10,500	0.42	C

*V/C Ratio and LOS for Northern Motorway are given for the peak period. A capacity of 1,900 vehicles per lane per hour is assumed.

While the method used to determine LOS indicators is based solely on traffic flows and does not take into account factors such as terrain and passing opportunities, it still gives an indication as to the general nature of operational conditions on SH1.

On SH1 it is apparent that the Northern Motorway near Constellation Drive has major capacity issues in the peak periods. This is due to its close proximity to the Auckland City CBD and the resultant commuting function. However, this congestion does begin to ease at the northern end of



the Motorway near Silverdale. A general trend is that the demand on SH1 reduces further away from Auckland. However, there are constraints on the network, namely Orewa, Warkworth and Wellsford. As Table 3-1 shows, Orewa Township has a LOS F. While the table does not show counts inside the town centres of Warkworth and Wellsford, there are similar levels of peak period congestion. During the peak periods and holiday traffic this problem is further exacerbated, and a LOS approaching F is not uncommon in these three towns.

3.4.3 State Highway 16

SH16 runs from the Port of Auckland to Wellsford. Whilst it predominantly serves as an access route for development near the highway, it also acts as a strategic relief route to SH1 in the event of an incident on SH1, as well as in peak holiday periods such as Easter and Christmas. SH16 is a single carriageway route north of the Westgate Shopping Centre (end of the Northwestern motorway).

From Westgate to Kaukapakapa the topography is generally rolling and the surroundings are predominantly rural. The areas of Kumeu, Huapai and Helensville are flat. This topography can be seen in Figure 3-5. Kumeu is a rural centre which has grown significantly in recent years and is identified as a growth node in the ARGS. There is significant commuting between Kumeu and Auckland and growing traffic levels has led to increased congestion and severance in the town centre.

Helensville is also a rural centre but with less commuting to Auckland than Kumeu. It has also been identified as a future growth node in the ARGS.

North of Kaukapakapa the topography becomes much hillier and the alignment standard between Kaukapakapa and Wellsford is low as seen in Figure 3-5. There are many sections of steep grades in excess of 10% and sharp bends with curve advisory speeds as low as 35km/hr. From Kaukapakapa to Wellsford there are many deficient curves in terms of horizontal alignment. The vertical alignment is also very sharp at some points, and with the winding alignment, this often leads to blind crests. Some curves also have poor camber or tightening radii leading to problems, particularly for HCVs.

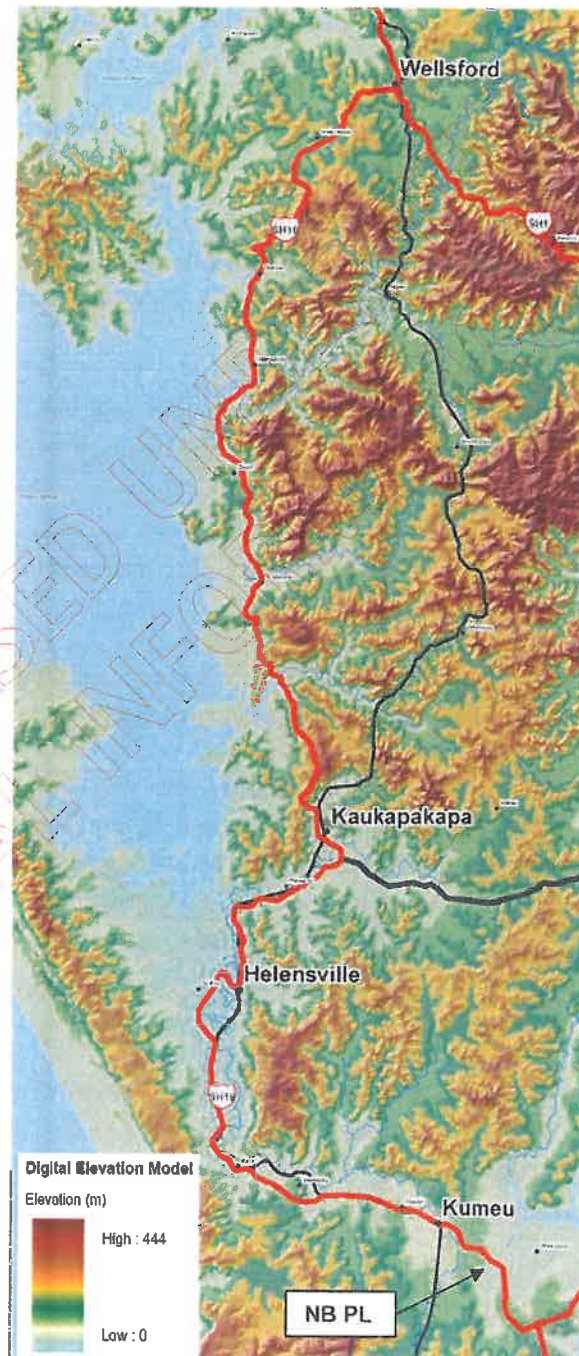
Lack of seal width is of major concern on this segment of road. Concerns have been raised by the local community and industry groups including the heavy transport industry with regard to seal width and road user safety. The bridges on this section can generally be characterised as narrow with none having a width greater than 8.0m. Three bridges have narrow widths of only 6.1m.

Within the study area there is currently only one passing lane provided on SH16 between Westgate and Kumeu as seen in Figure 3-5. This is well below the desired standard of Transit's passing and overtaking strategy which seeks to provide one passing lane for each travel direction approximately



every five kilometres. This problem is exacerbated north of Kaukapakapa where due to the poor standard of alignment and mountainous terrain, passing opportunities are limited.

■ **Figure 3-5 SH 16 Topography and Passing Lane Location**





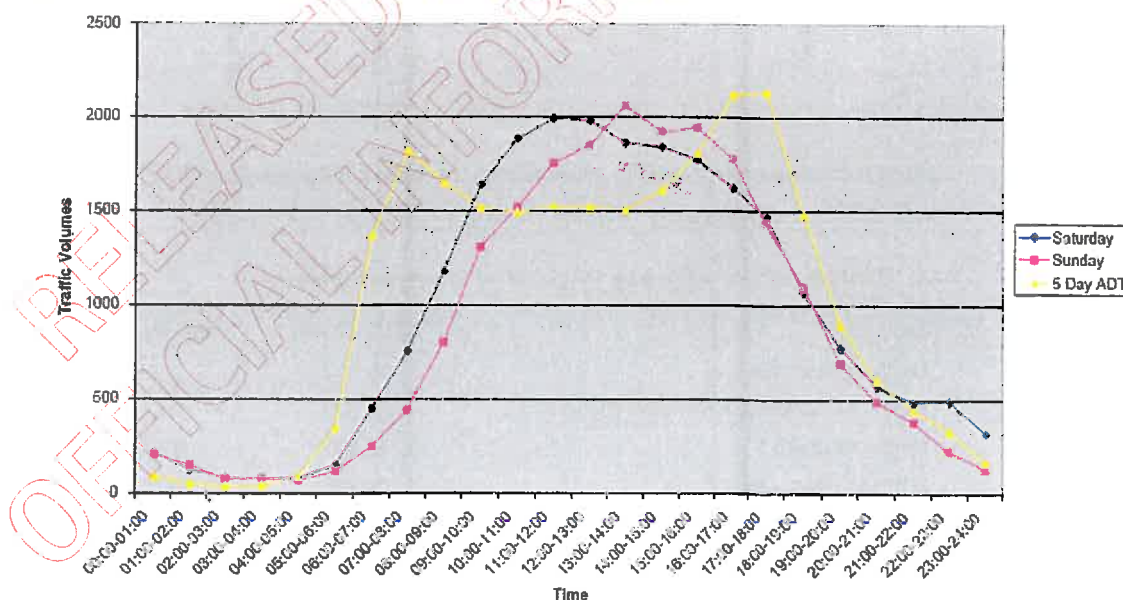
Access onto SH16 on the section south of Helensville is adversely affected by the high flows on this southern end of SH16. North of Helensville, issues predominantly arise from poor sight distance and insufficient shoulder width.

The main hazard which affects SH16, particularly towards the northern end, is rainstorm events which cause flooding and slope movement. The road passes through low lying areas comprising recently deposited alluvium and swamp deposits over rivers and estuaries. Major works would be required to remedy this problem, as the current drainage cannot be easily improved without raising road levels significantly.

3.4.4 State Highway 16 – Traffic Flows

As the secondary route from Auckland to Wellsford, SH16 has lower traffic volumes than SH1, particularly north of Helensville. However, in the case of a diversion from SH1 or in peak holiday season, traffic flows can increase by more than 60% than typical flows. Analysis of the weekday daily traffic profiles shows distinctive morning and evening peaks from Westgate, to as far north as Kaukapakapa, suggesting a strong commuter function to this point as illustrated in Figure 3-6.

■ **Figure 3-6 SH16 Traffic Profile (2006, North of Westgate)**





North of Kaukapakapa, traffic demand becomes considerably less. This change in demand is shown in Figure 3-7.

■ **Figure 3-7 State Highway 16 Demand Plot (2006 AADT Traffic Profile)**

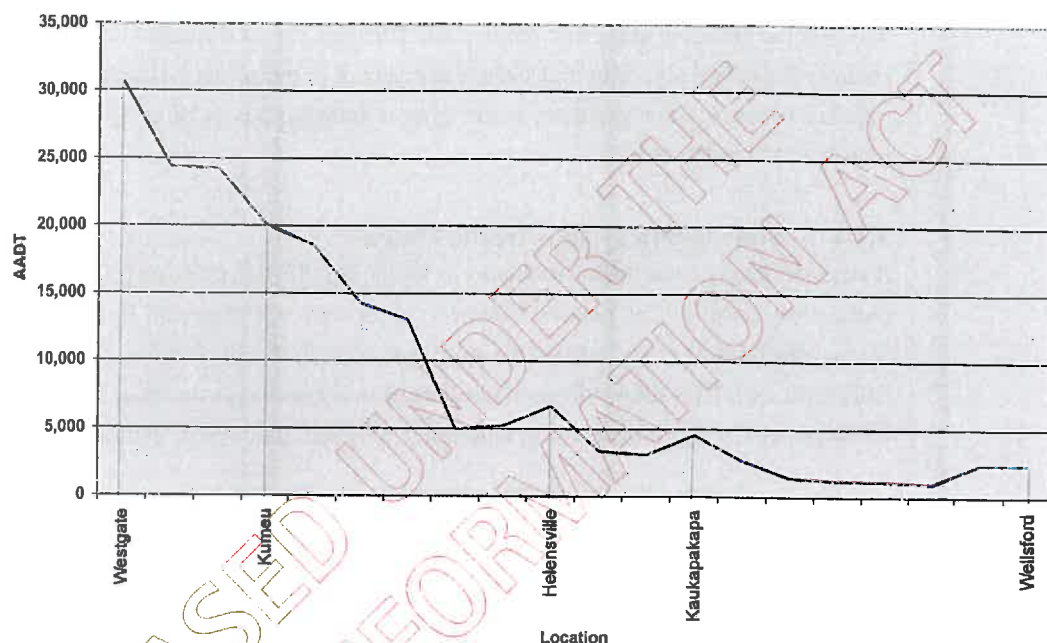


Table 3-2 summarises AADT, vehicle/capacity ratios and a resultant level of service in accordance with the Highway Capacity Manual on SH16 within the study area.

■ **Table 3-2 State Highway 16 Level of Service Summary**

Location	AADT (2006)	V/C Ratio	LOS
North of Westgate	25,000	1.0	F
North of Coatesville Riverhead Highway	20,500	0.82	E
North of Kumeu	13,500	0.54	D
North of Waimauku	5,500	0.22	B
South of Helensville	7,000	0.28	B
South of Kaukapakapa	5,000	0.2	B
North of Kaukapakapa	3,000	0.12	A
South of Wellsford	2,500	0.1	A

It is apparent from Table 3-2 that the level of service at the southern end of SH16 from Westgate to Kumeu is poor. However, these LOS are based on AADT values and hence, while it is likely the LOS approaches F during peak period congestion at the southern end of SH16, this is not the case



outside of these times. During the weekend, there are no pronounced morning and evening peaks as seen in Figure 3-6, but the road between Westgate and Kumeu remains busy for a longer period during the middle of the day, albeit with a less intense peak than the weekday evening peak.

3.5 Land Use Development- Planning Baseline

3.5.1 Background

The purpose of the planning baseline was to develop projections of land use development and growth up to 2051. Land use and transport planning are intrinsically linked, and it was essential to develop an appreciation of the potential growth through the study area and beyond, as well as identifying where this growth is predicted to influence traffic and travel patterns.

Growth predictions were derived for both population (permanent and holiday) and employment (primarily anecdotal information). Predictions have been made for three time frames within the study period; 2016, 2026 and 2051. For each of these time frames 'expected' and 'high' growth scenarios have been identified.

3.5.2 Methodology

The information used to develop the planning baseline was derived from a variety of sources including discussions with strategic planners from both Rodney District Council (RDC) and Auckland Regional Council (ARC), a desk top review of information available over the internet and from observations from the project team based on their experience and a site visit undertaken in March 2007.

Discussions with both RDC and ARC provided a structured context for the information gathered from other sources. It was apparent from these discussions that the later period of the ARGS (i.e. beyond 2026) has little definition in strategic planning documents. Furthermore, the implication of present growth rates is that Rodney District's projection for growth as required under the ARGS and the Northern Sector Agreement will be met well prior to 2051 (estimated to be fulfilled by 2040).

3.5.3 Key Planning Issues

The key influences in population and employment are outlined below. A key finding of this work was that the rural areas of RDC have the capacity to accommodate 15,000 house sites (either from undeveloped existing rural residential or lifestyle sites or from potential sites that have not yet been subdivided) under current District Plan provisions. The likelihood of this development occurring will, in part, be influenced by infrastructure provision, including drainage, water supply and wastewater treatment.



There appears, over the timeframe of the study, to be several key factors that will influence the style and timeframe of development. These are as follows:

- Consolidation of Warkworth township to be a self sustaining centre for employment and services, will increase the likelihood of rural residential development, as more opportunities for employment and commerce are created in the area;
- Similarly residential development will be encouraged by greater employment opportunities within centres such as Silverdale/Orewa, and Huapai/Kumeu;
- With greater access to local employment, there will be less reliance on inter district or intercity travel – RDC's population prefer local employment opportunities;
- Less coastal development will be permitted between Pakiri and Mangawhai than the remainder of the eastern coast line within the study area;
- Development that could occur "as of right" within the rural areas might incrementally be more influential with respect to growth (in terms of total numbers) than planned growth within urban areas;
- Greater employment opportunities within Silverdale could result in RDC seeking changes to the MUL to include a further 200 - 400 ha, which might serve a sub-regional demand rather than a local one;
- New developments have the potential to stimulate growth beyond the boundary of the specific development – this cannot be quantified but is a risk that needs to be considered; and
- The existence of Maori land and concentration of Marae along the Kaipara Harbour and SH16 need to be considered in the context of being sensitive to new development and as a deterrent to growth in those localities.

Each of these factors, either in isolation or in combination, will affect a change to the activities and character of the area. In general, the planning focus is to encourage more self sustaining communities, which would reduce the need for longer trips to centres such as Auckland and Whangarei. The scale and pace of these changes will influence how successful this overall approach will be.

3.5.4 Land Use Scenarios

For the three time frames looked at, 'expected growth' and 'high growth' scenarios were considered. The population projections for each scenario are best estimates based on the information available and subsequent interpretation of that information. External factors that can not be quantified at this point such as petrol prices, telecommuting, property values and immigration policies have not been taken into account.

The study area was divided into the following segments for the planning baseline:

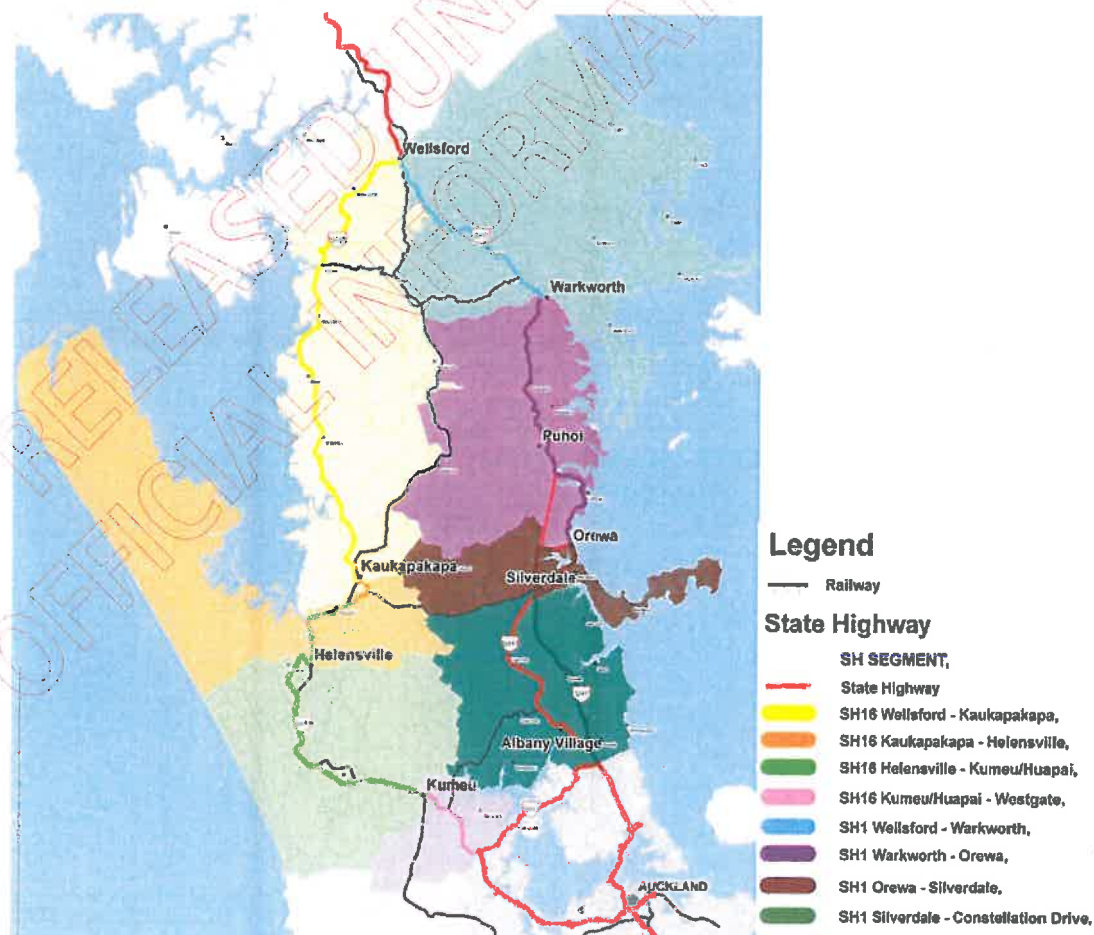
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- Wellsford to Warkworth (SH1)
- Warkworth to Orewa (SH1)
- Orewa to Silverdale (SH1)
- Silverdale to Constellation Drive (SH1)
- Wellsford to Kaukapakapa (SH16)
- Kaukapakapa to Helensville (SH16)
- Helensville to Kumeu/Huapai (SH16)
- Kumeu/Huapai to Westgate (SH16)

These sections and the corresponding land areas can be seen in Figure 3-8.

■ **Figure 3-8 Planning Baseline Section Land Areas**





3.5.4.1 Expected Growth

The expected growth land use scenario was derived from census data and projected growth forecasts provided by RDC, North Shore City Council and Statistics New Zealand. Comparisons were then made to applicable planning documents such as structure plans, to understand how they anticipate growth in different areas. The key growth areas identified in these documents include Orewa, Warkworth, Kumeu and to a lesser extent Helensville. The average occupancy rate was set at 2.8 persons per housing unit. Table 3-3 below shows the projected population under this scenario. It was also assumed that uptake of the 15,000 sites within RDC which have the potential to be subdivided would occur at current take up rates with moderate growth.

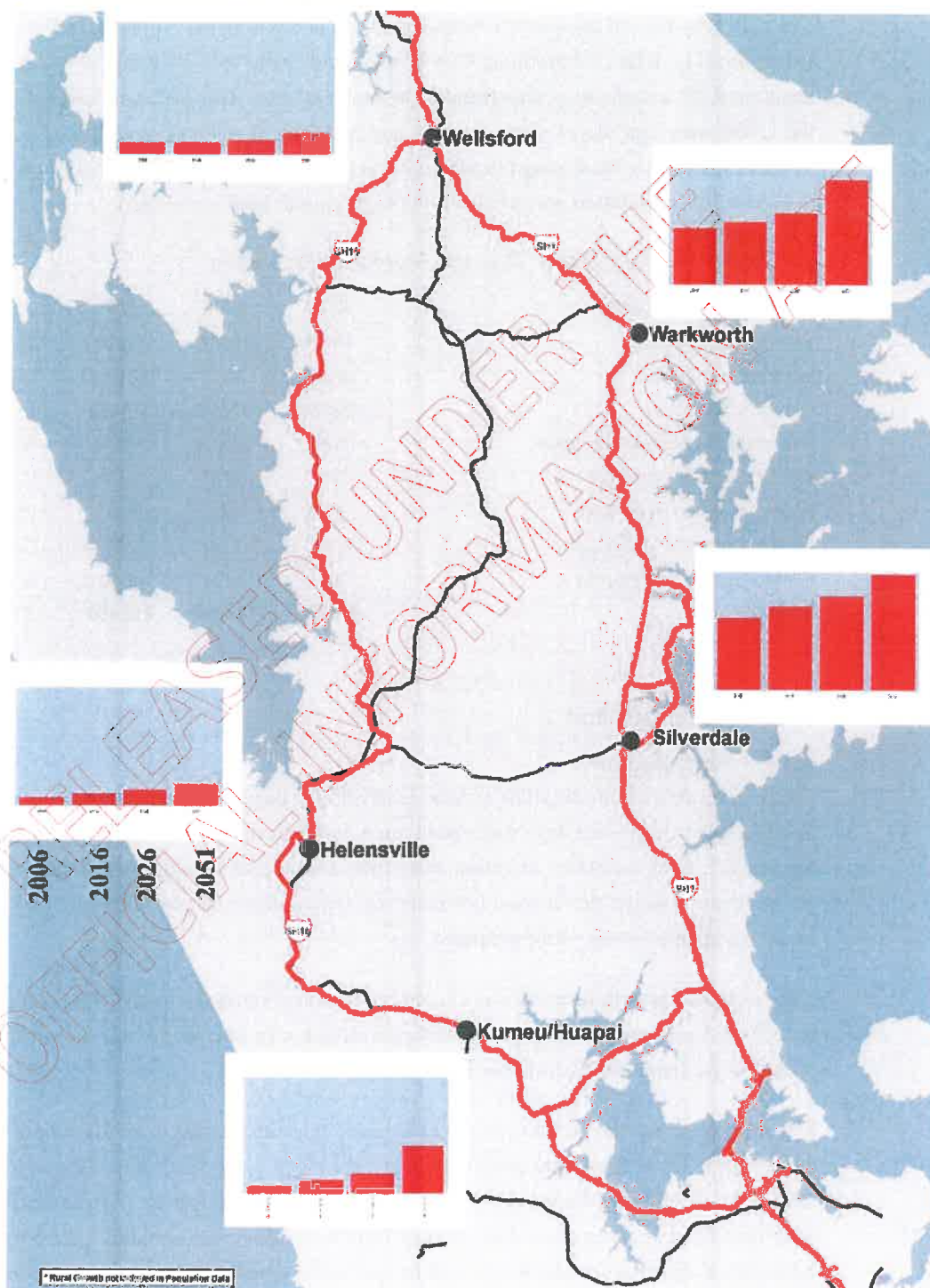
■ Table 3-3 Expected Growth Scenario Projected Population

State Highway Section	2001	2006	2016	2026	2051
Wellsford to Warkworth	10560	11900	15470	18880	31140
Warkworth to Orewa	6190	7460	16160	25640	34880
Orewa to Silverdale	29180	33090	42480	49640	64870
Silverdale to Constellation Drive	63660	74350	95590	108150	123080
Wellsford to Kaukapakapa	2940	2900	3300	3600	4160
Kaukapakapa to Helensville	3570	4500	6590	8090	10600
Helensville to Kumeu/Huapai	8190	9760	13510	16370	24690
Kumeu/Huapai to Westgate	2870	3260	4730	6260	11610
Total	127160	147220	197830	236630	305030

The expected population growth within the study area between 2006 and 2051 is illustrated overleaf in Figure 3-9.



■ Figure 3-9 Expected Population Growth 2006 – 2051





3.5.4.2 High Growth

The high growth land use scenario was derived by combining the project statistics growth extrapolated by RDC, North Shore City Council and Statistics New Zealand with proposed developments and planning opportunities in the study area. This includes the possibility that all of the 15000 sites (and more) within Rodney that currently have the potential to be subdivided would be taken up. Again, the average occupancy rate has been set at 2.8 persons per housing unit. Table 3-4 shows the population projection for the high growth land use scenario.

■ Table 3-4 High Growth Scenario Projected Population

State Highway Section	2001	2006	2016	2026	2051
Wellsford to Warkworth	10560	11900	23650	39150	65540
Warkworth to Orewa	6190	7460	16990	31290	54340
Orewa to Silverdale	29180	33090	40400	48000	63800
Silverdale to Constellation Drive	63660	74350	94050	107440	122380
Wellsford to Kaukapakapa	2940	2900	6910	12740	20300
Kaukapakapa to Helensville	3570	4500	8090	11090	16600
Helensville to Kumeu/Huapai	8190	9760	16330	22020	29990
Kumeu/Huapai to Westgate	2870	3260	4560	5910	10910
Total	127160	147220	210980	277640	383860

3.6 Travel Demand

3.6.1 Introduction

Traffic forecasts within the study area were developed based on the expected land use scenario. The high growth forecast was more speculative, in terms of the overall level of development that may occur. Also, the policy direction away from a total predict and provide transport planning environment suggests that it would be inappropriate to plan transport infrastructure on the highest level of demand that may be anticipated.

If the expected growth forecast was exceeded at some point in the future, the impact would be to accelerate the timeframe for implementing the strategy for improving SH1 and SH16, rather than changing the scope and scale of the improvements.

Trip rates were assigned to the additional land use to estimate trips in addition to those already on the network. These trips were assigned to the network to determine future forecast traffic volumes using a trip length distribution and a land use self-containment factor. These factors have been determined from travel survey data collated from several sources, including the cordon survey information obtained during recent work to update the Auckland Regional Transport Model (ATM2).



The ATM2 surveys also provided information related to mode share, albeit limited due to the geographic coverage of the ATM model. Within the northern suburbs of Auckland the percentage mode share for passenger transport (PT) was typically in the 4% to 8% range for morning peak periods. Higher mode shares for passenger transport were found in the centre of Orewa (11%) and Silverdale (11%). PT mode share in Kumeu / Waiwera was typically in the 2% to 3% range.

For future travel demands, it has been assumed that the key change which will occur in mode share within the study area is that passenger transport will accommodate a significant portion of demand growth from the Hibiscus Coast to Auckland. Although rail services are planned to Kumeu and Helensville the ATM2 survey data suggests that the impact of this initiative on vehicle demand will be smaller. For the purposes of making trip forecasts in the remainder of the study area, it was assumed that the current mode share pattern will continue in the future.

The future traffic volumes derived using this method are summarised in Table 3-5.

Table 3-5 Future Travel Demands (AADT)

State Highway Section	2006	2026	2051
Waiwera to Warkworth	11,000	18,900	29,100
Warkworth to Orewa	18,000	21,900	31,100
Orewa to Silverdale	48,100	71,900	103,500
Silverdale to Constellation Drive	46,900	68,900	98,800
Waiwera to Kaukapakapa	1,500	1,800	3,000
Kaukapakapa to Helensville	4,000	7,400	13,400
Helensville to Kumeu/Huapai	9,500	9,700	16,000
Kumeu/Huapai to Westgate	25,000	36,600	46,600

3.6.2 Passenger Transport

Passenger transport services in the study area operate mainly in the southern sector and provide for trips to and from Auckland. Bus is the key mode on the SH1 corridor and is expected to grow with the opening of the Northern Busway in 2008. On the SH16 corridor there are commuter bus services as far north as Helensville and rail services which operate as far as Waitakere City.

The Northern Busway is Auckland's first purpose built road dedicated to bus passenger transport and will form a key part of Auckland's rapid transit network. When operations commence in 2008 the northern extent of the busway will be Otahua Valley Road. Current plans are that the busway will be extended further north to Orewa. Such an extension of the busway with suitable bus frequencies could cater for a significant proportion of the travel demand between Orewa, North Shore City and Auckland.



ARC has recently announced that passenger rail services on the Waitakere line will be extended to Kumeu and Helensville in 2008. It is understood that this will initially be a peak hour service only. However, without significant improvements to track and signalling on the route, travel times between Helensville and Auckland are likely to be an impediment to encouraging a significant shift in travel mode to rail. Investing in improved track conditions and signalling is likely to lead to increased patronage on this line, although no plans are currently in place for this work to be implemented.

As land develops northwards from Silverdale to Wellsford there will be more viable opportunities for travel demand to be served by local bus services. In particular, future emerging sub-regional self supporting hubs such as Silverdale, Orewa, Warkworth, Wellsford and Helensville could be served by bus.

Therefore, while passenger transport is likely to have an increased mode share to key destinations such as the North Shore and Auckland, it is unlikely to make a significant impact on the overall traffic growth within the study area. There are limited opportunities where passenger transport may play a significant role, although the Northern Busway extension to Silverdale and passenger rail services to Kumeu / Helensville will be very important on this corridor.

3.6.3 Freight Movements

A significant amount of freight is moved within the study area, predominantly on the SH1 corridor. At the southern end of the study area, heavy vehicle flows on SH1 are about 50 percent higher than on SH16. However, heavy vehicle volumes on SH1 exceed SH16 by a factor of four further north near Warkworth. This, in part, may reflect the difficult road geometry on the northern part of SH16.

The volume of trucks on SH1 and SH16 suggests that maintenance requirements for SH1 would be greater, although other factors including ground conditions will have a significant influence on this. From a safety perspective, growth in truck numbers will be an impediment to faster moving traffic in future years and may lead to an increased number of crashes involving heavy vehicles.

3.6.3.1 Current Truck Volumes

Daily traffic count information available for SH1 and SH16 includes the proportion of heavy vehicles. Data is also available for Kahikatea Flat Road, which is a key east to west connection between the two corridors. These are presented in Table 3-6.



■ **Table 3-6 Average Daily Truck Volumes (2005)**

Location	Average Daily HCV Numbers
Constellation Drive (SH1)	1760
Oteha Valley Road (SH1)	1490
Orewa (SH1)	1380
Warkworth (SH1)	690
Wellsford (SH1)	500
North of Coatesville-Riverhead Highway (SH16)	1010
Kaukapakapa Bridge (SH16)	230
North of Port Albert Road (SH16)	140
West of Pine Valley Road (East West connection)	730
Pine Valley Road (East West connection)	580

3.6.3.2 Long Distance Road Freight

Northland Regional Council undertook road and rail freight surveys in 2006 and has data for long haul trips between Whangarei and Auckland within the SH1 corridor. Table 3-7 shows the average weekday volumes.

■ **Table 3-7 Road Freight between Whangarei and Auckland - 2006¹**

Commodity	Heavy Vehicle Trips per day
Forestry	4
Dairy (milk tankers)	22
Solid Waste	22

These low volumes show that a substantial proportion of the total heavy vehicles movements on SH1 between Wellsford and Auckland are not long haul trips and are serving other origins and destinations within the study area.

3.6.3.3 Long Distance Rail Freight

There are typically two return freight trains per day between Whangarei and Auckland, Monday to Friday; one for logs and one for general freight (containers). The average daily volume by commodity make up of these movements is shown in Table 3-8.

¹ From survey undertaken by Northland Regional Council in 2006



■ **Table 3-8 Rail Freight between Whangarei to Auckland - 2006**

Commodity	Quantity per Weekday
General containers	55 to 60
Logs out of Northland	400 Tonnes
Containers of Woodchip	10
Logs into Marasumi chip	800 Tonnes

The above rail movements are equivalent to 86 HCV movements per day. When compared to long haul truck movements it can be seen that rail is making a significant contribution to long haul freight movements through the study area.

3.6.3.4 Future Truck Movements

Without detailed economic projections by industry it is difficult to estimate future truck movements. However, the change in truck vehicle kilometres travelled is known to be correlated to change in Real Gross Domestic Product. Over recent years Auckland's Real Gross Domestic Product has been growing at a rate of 2.9% per annum. Assuming that this growth is sustained into the future and that this growth is evenly distributed over the region, then truck volumes under these conditions could almost double in a twenty year period. This may lead to problems on the existing two lane sections of both SH1 and SH16 as increased truck volumes will lead to increased delays and driver frustration.

3.6.3.5 Future Rail Movements

With few rail movements each day on the track between Wellsford and Auckland there is an opportunity to put much more freight onto rail. However, the potential mode shift to rail is hampered by a number of factors.

For economic reasons, rail is attractive in moving bulk goods over long distances. However, even though new technology can reduce the time and effort of loading and unloading containers on trucks to rail, the time and cost penalty of doing so still means that road freight is less expensive and more convenient for shorter distance freight trips.

A comparison of long haul truck and rail movements shows that rail is already moving a significant proportion of long haul trips. The majority of the existing truck movements on SH1 are servicing shorter distance movements. Under current economic conditions, rail can be expected to make only modest increases in its modal share of freight traffic through the study area.



3.6.4 Tourism

3.6.4.1 Current Tourist Movements

Information about tourism travel patterns was obtained from the Lincoln University tourism model. This provides data on current tourist numbers (2005) and forecasts of future numbers (2012).

Table 3-9 presents the annual number of tourists on SH1 and SH16 for 2005 and 2012. Tourists have to use the state highways, either as drivers or passengers in road vehicles as there are no passenger services available on the rail corridor.

■ **Table 3-9 Tourist Flows between Auckland and Wellsford²**

Highway Segment	2005 Annual Tourists (actual persons)	2012 Annual Tourists (forecast persons)
SH1 Orewa to Warkworth	7,585,000	8,340,000
SH1 Warkworth to Wellsford	5,451,000	6,003,000
SH16 Helensville to Wellsford	220,000	240,000

It is clear from the above table that SH1 carries the substantial majority of tourist movements between Auckland and Wellsford. However, SH16 is an important alternative route for tourist traffic movements during peak holiday periods. This information also shows that the forecast annual growth in tourist numbers within the study area is in the order of 1.4%, less than the underlying rate of general traffic growth.

3.7 Issues and Constraints

A number of issues have been identified as being important to the current and future performance of transport within the study area. These are outlined below.

3.7.1 Economic

SH1 serves a dual function of serving long distance travel and local access. As the network comes under pressure from traffic growth and nearby development, both these functions will be served less effectively. In comparison, SH16 has limited economic function as it primarily serves local destinations and with little commercial traffic.

² Lincoln University Tourism Model



3.7.1.1 Freight

Freight traffic is increasingly becoming impeded by traffic growth across the network. Most movements are serving sites within the study area and need access near the highways. Long distance freight movements are smaller in number but also need to be able to move through the study area unimpeded.

The potential for freight to shift to rail is limited. Therefore, truck movements are likely to grow significantly in future. The consequential effects of increasing congestion on the network will therefore be significant.

3.7.1.2 Tourism

Tourists will continue to suffer long delays until significant bottlenecks on the network are improved during the peak holiday periods. The continued use of SH16 as an alternative route to SH1 in these periods will grow in importance over future years as general traffic increases.

However given tourist traffic is forecast to grow at a lower rate than general traffic, any improvements to the state highway network are likely to provide proportionally a greater advantage for tourists.

3.7.1.3 Regional Connectivity and Agglomeration

Transport links enable distinct economic activities to become more integrated within a region, enabling them to operate more effectively and efficiently feed and become more economically integrated. Delay and congestion on the network disrupts this process and breaks down the ability of an area to act as an integrated economic entity.

The local access function from the highways is critical to regional connectivity and agglomeration. Increased conflict between long distance travel and local access, and the sheer size of the local access demand will reduce regional connectivity and agglomeration. This will militate against emerging land developments and key satellite towns such as Orewa, Warkworth, Wellsford, Kumeu and Helensville becoming successful economic hubs. These towns will require good access so they can integrate economically with their surrounding areas and one another.

Orewa and Warkworth, as identified growth areas in the vicinity of SH1, will need good access to support land development. This will require planned connections to SH1, supported with an effective local road network, so that traffic can move safely and efficiently between these developments and the State Highway.



3.7.2 Safety and Personal Security

3.7.2.1 Crashes and Closures

On SH1, crashes are concentrated within two sections of road, Schedewys Hill and the Dome Valley, south and north of Warkworth respectively. Crash rates in these locations far exceed the national average and if no significant improvements are made, crash numbers are likely to generally grow with increasing traffic volumes. On SH16, there is less concentration of crashes, and there are no identified crash black spots.

Serious incidents necessitate road closures. SH1 and SH16 have each been closed on average between eight to twelve times per year over the past five years. Each closure has affected the route for a minimum of one hour, with the longest incident taking over seven hours to clear. In these situations, it is vital that an alternative route is available to maintain a road link between Auckland and Northland. The east to west routes at Kahikatea Flat Road – Pine Valley Road and Kaipara Flats Road provide vital linkages between the two road corridors during closures on either of SH1 or SH16.

Forecast future travel demands indicate high growth in traffic numbers on SH1 due to significant land use development in the area. This will further increase crash numbers and incidents along the length of SH1 unless measures are implemented to reduce crash rates.

3.7.2.2 Severance

Severance occurs where the volume of traffic along a highway leads to an actual or perceived barrier within an urban area. Within the study area the state highways currently pass through Orewa, Warkworth, Wellsford, Kumeu, Waimauku, Helensville and Kaukapakapa (although Orewa will be bypassed in 2009 when ALPURT B2 is open). In these locations, there is a conflict of the highway function, (to move traffic), and the functioning of the town. Severance is often a key reason why communities press for bypasses to resolve this conflict.

Limited research on measuring severance is available in New Zealand or Australia. The UK "Design Manual for Roads and Bridges – Vol3, Section 11, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects" sets out a method for assessing severance from roads. This method only assesses traffic volumes and the likely delay to pedestrians trying to cross roads. Applying the guidance within this document to the towns along SH1 and SH16, severance using 2006 traffic volumes can be classified as seen in Table 3-10.

■ **Table 3-10 Degrees of Severance (2006)**

Location	Degree of Severance
Orewa (SH1)	Severe

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Location	Degree of Severance
Warkworth (SH1)	Moderate
Wellsford (SH1)	Moderate
Kumeu (SH16)	Severe
Waimauku (SH16)	Moderate
Helensville (SH16)	Moderate
Kaukapakapa (SH16)	Slight

In 20 years time under the 'expected' growth scenario all locations will be classified as severe with the exception of Kaukapakapa which is likely to have moderate severance.

3.7.3 Integration and Responsiveness

The integration of land use planning with transport planning is a key issue for the study area, as the anticipated high level of land development will require significant investment in transport infrastructure. If these issues are not planned together, access and mobility problems will arise.

It should be recognised that all trip purposes and trip lengths do not have the same characteristics or needs. For example, it is not reasonable to provide walking facilities for long distance travel or move large goods. This requires the network, both local and highway, to be developed in parallel with land development so that pragmatic choices involving other modes can be made as appropriate.

Furthermore, it should be ensured that the highway does not function as a barrier to alternative modes. This may require, for example, underpasses or overpasses for buses, pedestrians or cyclists across the highways at locations important to these modes of travel.

3.7.4 Sustainability

It is essential that the transport network developed is a sustainable one, creating benefits that are not eroded with time.

In the context of this study improvements on SH1 may encourage increased development and commuting to Auckland from locations north of Orewa. If so, then the benefits of any network improvements could be eroded. Therefore, any improvements must be planned in the context of appropriate access provision, to limit increases in local traffic movements on new state highways.

Both SH1 and SH16 pass through, or lie close to, sensitive environments. However, it is not foreseen that any fundamental environmental constraints exist, which would prevent implementation of suitable improvements for moving goods and vehicles through the study area, while providing for improved environmental conditions along road corridors.



In the Auckland region road aggregate is becoming increasingly scarce. This non-renewable resource is important to network upgrades. This issue will increase the cost of projects and put increased pressure on the use of other materials such as recycled glass, concrete and asphalt. Other secondary aggregates such as steel slag may be considered. It is also likely that use of concrete roads will be considered in future, as an alternative to bitumen based products.

3.7.5 Cost and Economic Efficiency

ALPURT B2 has shown how complex and costly road building can be in this region. It is noted that the terrain north of Puhoi is even more mountainous than that encountered in ALPURT B2.

Incrementally constructed projects are generally easier to fund because of their lesser impact on the national funding programme. Incremental projects have their costs distributed over an extended time period and are more manageable in terms of overall size. This means that bypasses and targeted improvements to overcome specific operational problems, such as high crash rates, will be easier to fund.

3.7.6 Constraints

There are numerous constraints in the study area which influenced the options considered. These are summarised below.

3.7.6.1 Physical

The topography varies greatly within the study area. Typically the terrain is flatter south of Orewa / Kumeu compared to the northern section. There is mountainous terrain and complex geotechnical and geological formations within both corridors. Areas of SH16 are also subject to flooding and swampy conditions which further constrains options. While this is unlikely to be an absolute constraint in engineering terms, it is the cost implications and their importance to the affordability of an option where the constraint is likely to apply.

3.7.6.2 Exotic Forestry

Within the study area there is 30,800 hectares of exotic forestry, most of which is located in three areas. The largest of these areas is between Wellsford and Warkworth, with other areas between Warkworth and Puhoi and just north of Kumeu. These sites are generally located away from SH1 and SH16 and are unlikely to impact on any improvements to these routes.

Once existing timber has been logged, these areas have some potential for rural residential development. Therefore the constraint imposed by exotic forested areas is small, although further pressure for travel demand could result from further residential development.



3.7.6.3 Iwi/Maori Land and Archaeological Sites

There are a number of small tracts of Maori land identified within the study area. The two main areas of land are located north east of SH1 near Pakiri and on SH16 north of Kaukapakapa. There is also a smaller area on SH16 near Rewiti. It is known that there are other areas of land and Marae occupied by Maori which are not necessarily recorded under Maori Land titles.

There are a large number of archaeological and protected areas within the study area. However, given their location and localised geography these are unlikely to have a major impact on the viability of key options.

3.7.6.4 Regional Parks and Department of Conservation Land

The Wenderholm Regional Park is located north of Waiwera on SH1. Other parks located within the study area are significant distances from both SH1 and SH16. These include Long Bay, Shakespeare, Mahurangi, Tawharanui, Pakiri, South Kaipara and Muriwai.

All the regional parks have a sea boundary at some point. It is concluded that Regional Parks and Department of Conservation Land will not be constraints on key options.

3.7.6.5 Local Access

The expected growth scenario discussed previously in this report illustrates that continued development pressure in the study area will be at a high level for the foreseeable future, and therefore it is critical that improvements to both SH1 and SH16 separate the through traffic from local access function as much as possible.

Given that the NSHS defines SH1 as a national highway, improvements to this route will include strictly limited access with grade separated interchanges. Current Transit policy is to designate routes of this nature as motorways if possible. This configuration provides complete separation between long distance and local access functions by providing a separate road. Therefore, it is critical that the existing road is maintained for local access.

As SH16 is designated as a regional highway in the NSHS, it is appropriate to consider less stringent access control. However, the through movement function will still need to be dominant. Hence, measures such as prohibiting new accesses and designation of existing sections of the route as limited access road would likely be required. In addition, any new off line improvements such as a Kumeu Bypass would need to have limited connectivity to the existing highway network, to ensure the balance of local trips is made on the local road network.

3.7.6.6 Financial

The availability of project funding will be a key constraint on the implementation of the recommended strategy. The scale of engineering works involved with this strategy will involve



costs that may be a major component of the likely investment in roads nationally. Therefore, a key outcome of this strategy study is identifying when each separate package of work is likely to be fundable.

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4. State Highway Strategy

4.1 Strategy Options

Based on the study objectives, policies and transport requirements described in the preceding sections, options for the future of the SH1 and SH16 corridors were developed. At the outset, it was decided that the most appropriate method to determine a recommended strategy was to consider the appropriate function of each section of state highway, now and in the future. This approach was compatible with the classification system adopted by Transit in its NSHS.

Once the function of the corridor was finalised, the form and operation of the corridor required to meet the strategic functionality could be determined in the next stage of the study process. A important aspect of the investigation into how the desired functionality could be delivered, was the role that alternatives to roading could provide, for example passenger transport and rail freight.

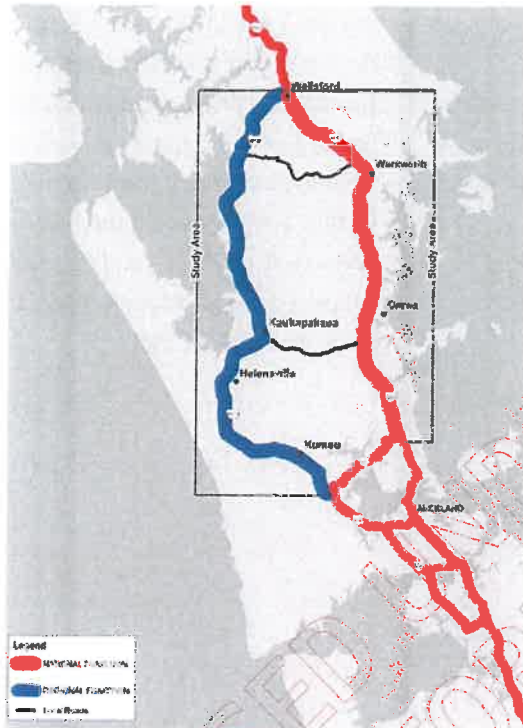
In developing functionality options for the respective corridors, the definitions for state highway functionality were adopted from the National State Highway Strategy. It also became evident that in considering the functionality of the corridors, that certain parameters and criteria applied to all options, as set out below:

- Traffic flows on SH1 dictate that it must retain at least a regional function;
- A new inland route would only function as national route (to avoid urban intensification in new areas); and
- Selection of corridor functionality would not be predicated on holiday peak basis.

Using these criteria, four distinct functionality options emerged, as illustrated overleaf.



4.1.1 Option 1



This option is consistent with the NSHS in that SH1 and SH16 serve national and regional functions respectively.

4.1.2 Option 2



In this option a new inland route was proposed, broadly following the existing railway route to avoid physical and environmental constraints as far as possible. This route would serve a national function only and would have very strict access control, to avoid promotion of commuting and inappropriate development. The new route would link into the Auckland Western Ring Route, and thereby promote a national strategic north to south link avoiding the Auckland CBD (CMJ). SH1 would serve a regional function and SH16 north of Brigham Creek Road would no longer be a state highway.

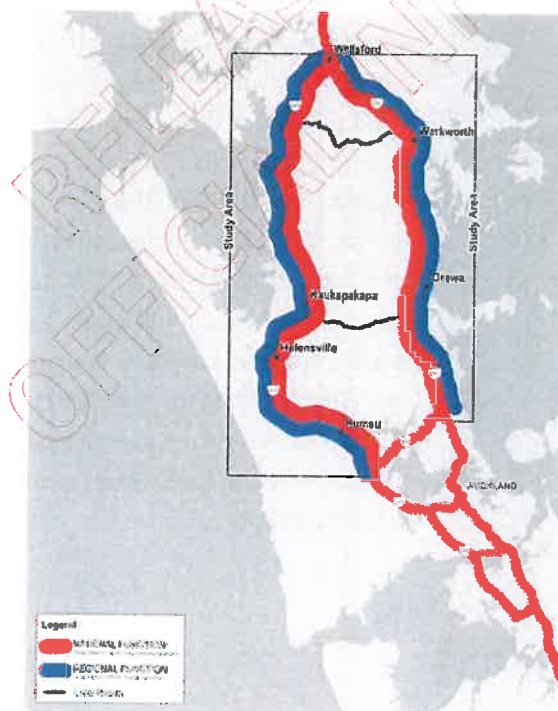


4.1.3 Option 3



Option 3 would relocate the national function to the SH16 corridor. SH1 would serve a regional function. This concept would be consistent with the notion of separating longer distance travel from routes serving local centres. As with Option 2, SH16 would link into the Auckland Western Ring Route, and thereby promote a national strategic north to south link avoiding the Auckland CBD (CMJ).

4.1.4 Option 4



In this option both existing corridors would be upgraded to combine national and regional functions. Provision of this functionality would require parallel access routes, to comply with standards and appropriate means of access to adjacent land uses.



4.2 Strategy Option Evaluation

An evaluation framework for the project was developed, to allow a comparison to be made between the four strategy options. The framework was based on the LTMA criteria, extended as necessary, to include the project objectives and an appreciation of the functional requirements for the future transport network, based on the expected travel demands.

The scoring system for the evaluation framework was developed based on assessing and comparing the potential impacts of each of the alternatives at a future date against a notional future year Do Minimum base. In the Do Minimum, the current situation was assumed to be unchanged with only the minor improvements necessary to maintain a minimum level of service.

Careful consideration of transport planning principles and Transit's own standards and policies led to a number of key decisions being made in this evaluation, including:

- National route functionality would require a high quality route with divided carriageways, grade separated interchanges and no side friction. Motorway standards were assumed. Very limited access would be provided on new routes to discourage use for local trips (typically one interchange per township);
- Upgrading to a regional functionality would provide a good quality route that would typically have at grade intersections and some degree of side friction; and
- Upgrading existing routes would improve accessibility to existing towns and new development areas through provision of new connectivity with reasonable linkages into urban areas (several intersections or continuous access);

These decisions were paired with key findings of the study including:

- The proportion of long distance traffic crossing the study area is small and the potential for diversion between SH1/SH16 would be correspondingly little;
- SH16 is a significantly longer route than SH1 and so any diversion of longer distance traffic into Auckland would likely be less than if SH1 was improved;
- The majority of the future development is expected to take place in identified centres in the eastern part of the study area;
- The volume of crashes is a function of the road quality and the volume of traffic. A new segregated inland route would provide a safer road but would attract only limited volumes of traffic. Upgrading SH1 and/or SH16 would result in improvements to the safety characteristics of the roads (but less than for a fully segregated route);



- The environmental amenity of land which would be required is highest for the SH16 corridor, moderate for a central route and lowest for the SH1 corridor.

The individual criteria used in the evaluation framework can be seen in Table 4-1.

■ **Table 4-1 Evaluation Criteria**

Key Criteria	Sub Criteria
Support for Economic Development	Facilitation of movement of freight Impact on inter-regional movement
Regional Integration and Agglomeration	Support for regional integration Support for agglomeration
Assists Safety and Personal Security	Crashes Severance Congestion
Access and Mobility	Accessibility to key town centres and potential new growth areas Impact of freight vehicles on other traffic Route security
Integration	Integration with land use development Integration with other modes Capacity for holiday traffic
Responsiveness	Responsible agencies Conformity with published local and regional plans Separation of transport network
Sustainability of Transport Network	Scope for measures to sustain functionality of State Highway network over long term Balance between State Highway and local road network
Environmental Sustainability	Impact on natural environment Impact on non-renewable resources Impact on climate change
Costs/Efficiency	Cost Engineering difficulty Complexity

The option evaluation framework criteria were assessed using a comprehensive assessment process, and a summary of the option evaluation is shown overleaf in Figure 4-1.



Figure 4-1 Evaluation Framework Summary

Summary of Initial Option Evaluation				
	Option 1	Option 2	Option 3	Option 4
Routes satisfying highway function				
National	SH1	Inland Route	SH16	SH1/SH16
Regional	SH16	SH1	SH1	SH1/SH16
Local	-	SH16	-	-
	Score	Score	Score	Score
Support for Economic Development	●●	●●●	●●	●●
Regional Integration and Agglomeration	●●	●●●	●●	●●
Assists Safety and Personal Security	●●	●●	●	●●
Access and Mobility	●●	●●	●	●●
Network Resilience	●	●●●	●●	●●
Integration	●●●	●●	●	●●
Responsiveness	●●	●●	●●	●●●
Sustainability of Transport Network	●●	●●	●	●
Environmental Sustainability	●●	●●	●●	●●
Climate Change	●	●	●	●
Overall Effectiveness (Rank)	2	1	4	3
State Highway Functionality				
Costs/Efficiency				
Cost (\$Bn 2006 prices)	4-6	5-8	7-10	5-8
Overall Assessment (Rank)	1	2	3=	3=

Scoring Legend

● Beneficial Impacts
● Adverse Impacts
* More symbols = larger impact

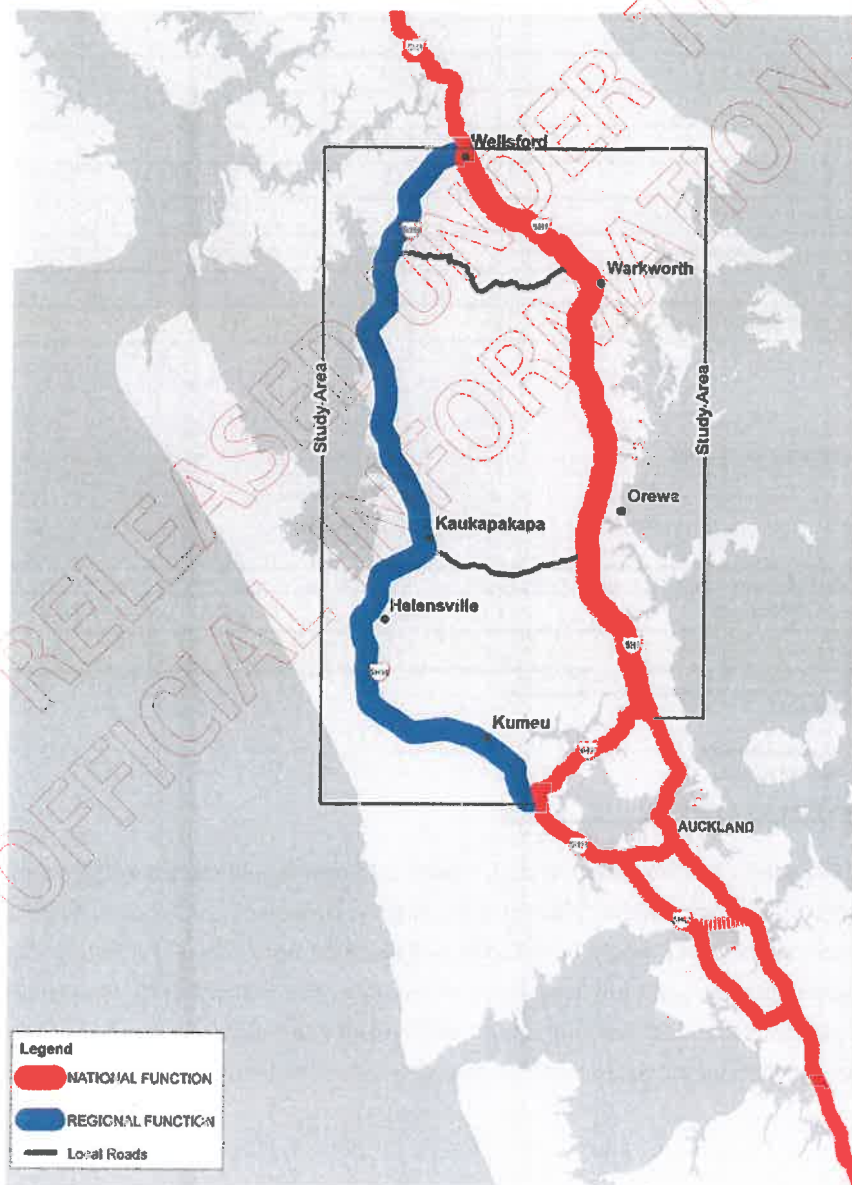
Figure 4-1 shows that exclusive of cost, Option 2 (a new inland route serving a national function) would be the optimal solution in terms of functionality. However, given such a route would have very high construction costs, would be difficult to stage and implement as a number of smaller construction projects, and full benefits would likely not be realised until completion, Option 1 which places the national function on the SH1 corridor and builds on current investment, and the regional function on the SH16 corridor, was determined to be the highest ranked option.



4.3 Recommended Strategy

Based on the evaluation outlined above in Section 4.2, Option 1 was selected for the recommended functionality for State Highways 1 and 16. This places the national function within the SH1 corridor and the regional function within the SH16 corridor. While the evaluation was undertaken on a transparent basis, another key advantage to this outcome is that the strategy maintains continuity with previous transport planning and land use development decisions that have been made for the region.

■ **Figure 4-2 Recommended Strategy**





5. State Highway Strategy Implementation

5.1 Initial Corridor Configuration

Once the recommended strategy for State Highways 1 and 16 had been determined, Stage 2 of the study was to determine an implementation strategy for each state highway corridor. This involved a two stage process; definition of operational and infrastructure requirements in each corridor, leading to decisions about corridor configurations (or state highway form). Subsequently a review of the economic issues associated with major new infrastructure, including viability, was undertaken. This process is described below.

The policy background to the study emphasised that the strategy needed to focus on movement of goods and people, rather than more vehicles. Therefore, opportunities for introducing alternatives to road transport within each corridor to satisfy forecast demands were given priority. With this aspect in mind, combined with the overall scale of the development strategy, it was decided that the strategy would need to be implemented in stages, taking into account practical matters such as which organisation would be responsible for delivery, the potential complexity of approval processes and funding constraints. For each stage, projects, or packages combining several projects could be involved.

With respect to infrastructure, the forecast travel demands described in Section 3.6 were used as the basis for defining corridor requirements for the long term future. As a general principle, level of service "C" would be desirable on road corridors, subject to environmental and planning constraints. However, provision of additional capacity which would encourage commuter travel to Auckland by car was to be avoided. Careful consideration was also given to the most suitable form of access control, to avoid encouraging urban sprawl and land use patterns which did not support travel containment within smaller areas.

In addition, the following principles were agreed with Transit:

- The national function of SH1 requires a high standard route; for safety and operational consistency on improved sections of road, it would be desirable to maintain the design standards adopted for ALPURT on SH1 (i.e. design speed of 110km/hr, central median barriers, etc); and
- Transit's current policy is to designate new routes as motorways, to ensure appropriate access controls to state highways;

Based on these points, the following initial decisions were made about the most appropriate corridor configuration to support the recommended strategy.

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5.1.1 SH1

5.1.1.1 Constellation Drive to Silverdale

Forecast increased travel demands for commuter trips on this section of SH1 would support additional passenger transport services, operating on dedicated bus facilities within the SH1 road reserve. Planning for this development has been undertaken in some detail by Transit (Opus report "Northern Busway Extension Constellation to Orewa Concept Report, August 2005"), and involves new off line bus lanes from Constellation Drive to Silverdale. A new bus interchange would also be constructed, probably within the Silverdale North development.

No additional general traffic capacity would be provided on this section of SH1.

5.1.1.2 Silverdale to Puhoi (Titfords Bridge)

ALPURT sections B1 and B2 will provide the required infrastructure to satisfy the National Route function. The Sub-Regional function could continue to be provided by the existing SH1 Hibiscus Coast Highway, as the free alternative to the ALPURT toll route.

It is unlikely that the future demand for passenger transport services north of Silverdale would justify dedicated bus lanes, or other specific facilities for passenger transport. Buses could use general traffic lanes, without encountering any significant delays.

5.1.1.3 Puhoi (Titfords Bridge) to Wellsford

Creation of a four lane high standard route would involve both on-line and off-line improvements. Several sections of this route are significantly below the desired standard for the strategy, and therefore new roading infrastructure would have to be constructed.

As with the section between Silverdale and Puhoi, demand for future passenger transport services on this section of state highway is unlikely to justify dedicated facilities such as bus lanes.



5.1.2 SH16

5.1.2.1 Waitakere to Kumeu / Helensville

ARTA's Rail Development Plan includes the extension of passenger rail to Kumeu by 2016 and on to Helensville. Recently, it was announced that this plan would be accelerated, to introduce peak travel services to Helensville by 2009. However, these services would not cater for all the anticipated growth in travel demand on the network, and road improvements of some form would be necessary.

5.1.2.2 Westgate to Brigham Creek Road

The SH18 Hobsonville Extension project currently being tendered by Transit includes a new 2 lane arterial connection from the SH16 North Western Motorway to Brighams Creek Road. The designation obtained for this project allows for widening to 4 lanes.

5.1.2.3 Brigham Creek Road to Waimauku

Designations exist for widening the existing SH16 through this section. Also, work had been undertaken previously on potential bypass options for Kumeu. Therefore both concepts were tested with a traffic model (described below).

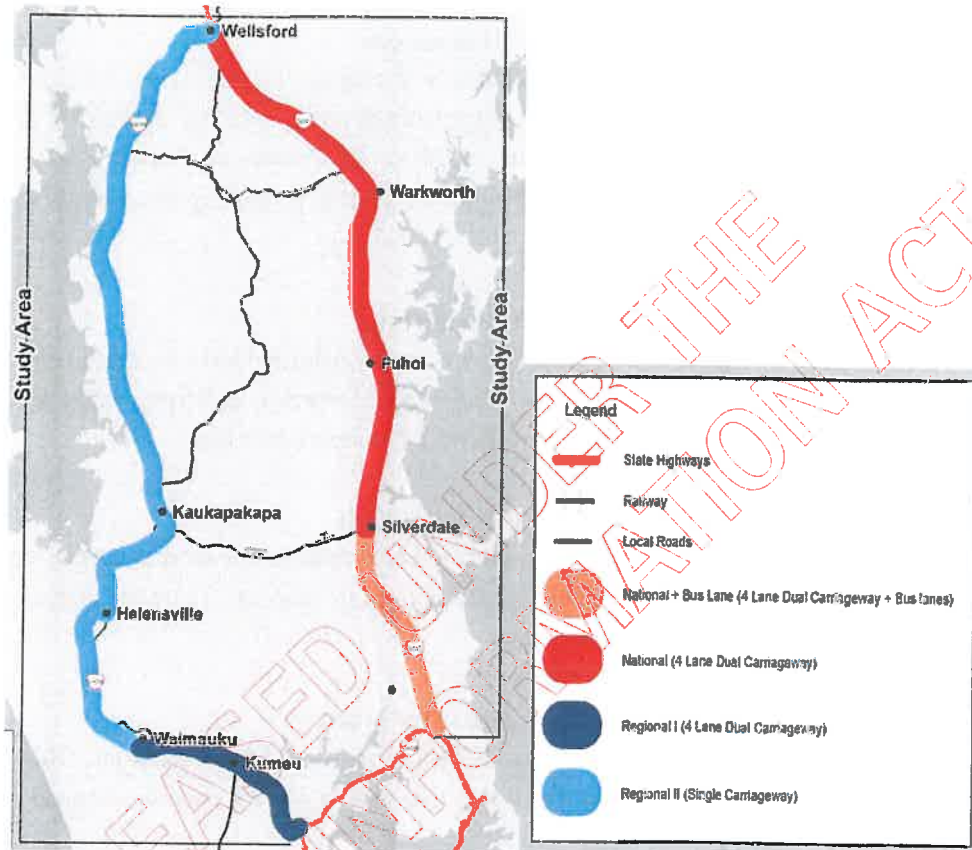
5.1.2.4 Waimauku to Helensville / Wellsford

Travel demands on this section were unlikely to justify additional capacity. However, operational and safety improvements would be warranted, such as passing opportunities and shape corrections.

Combining these requirements, the initial configuration of each section of route was determined, as shown in Figure 5-1 below.



■ Figure 5-1 Initial Corridor Configuration



5.2 Traffic and Transport Effects (Network Modelling)

A strategic SATURN transport model was developed to undertake a high level assessment of the traffic effects of implementing the recommended strategy. The model scope and network effects are fully described in two reports; "SH1/16 Transport Model and Economic Scoping Report (August 2007) and "SH1/16 Transport Model and Economic Assessment Report (January 2008).

The transport model provided data about how the strategy for SH1/16 would cater for forecast travel demands, how traffic would use the network and travel time savings for the roading improvements. The geographic coverage of the model is shown in Figure 5-2 below.



■ **Figure 5-2 Transport Model Coverage**



The transport model was calibrated to 2006 traffic flows, and then forecasts for future years developed. Peak period (evening) and interpeak weekday periods were modelled, to assess the effects of network improvements. The planning baseline provided a prediction of potential population growth through the study area and growth predictions were made for three time frames within the study period; 2016, 2026 and 2051.

To establish the link between population and trips, the following assumptions were made:

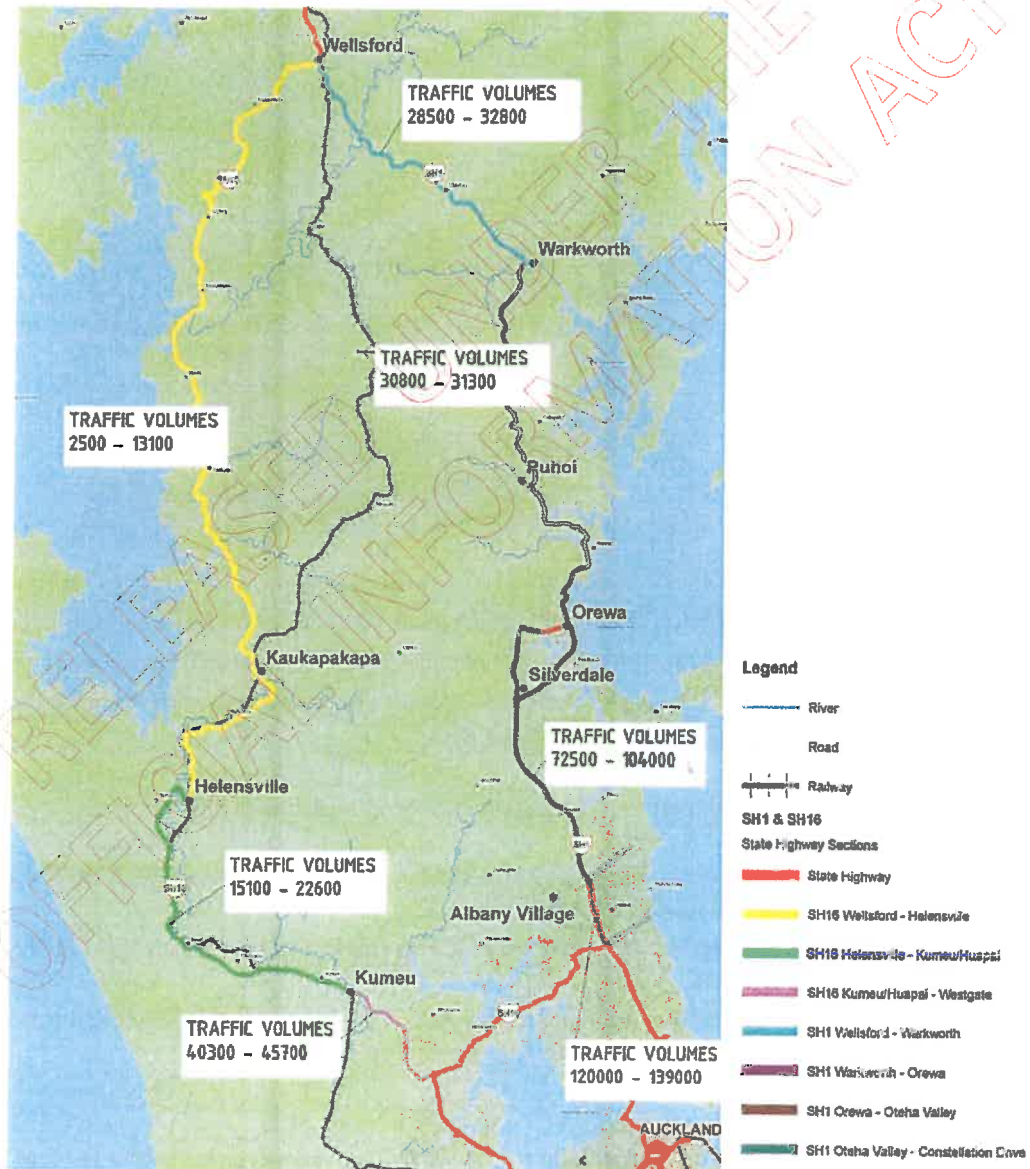
- An average household size of 2.8 (taken from the Auckland Regional Transport (ART) model household travel surveys);
- A peak hour household trip rate of 0.85 (taken from the Roads and Traffic Authority (RTA)); and
- A peak direction split of 63% inward, 37% outward (taken from the Institute of Transportation Engineers Trip Generation – 6th Edition).

This gave total potential growth in trips for individual areas (zones) within the study region, which corresponded to the population growth area. Once the traffic generation was calculated for these zones, a comparison was made with the traffic from the calibrated base year. This generated



factors between the total amount of traffic generated by the zone and the amount of traffic from that zone which travels to or from it externally. By applying these factors in the future, trips totally contained within zones were estimated and also any discrepancy in the 63% / 37% split between inbound and outbound trips were accounted for. The resulting network forecast flows for 2051 (AADT) are shown in Figure 5-3.

Figure 5-3 Forecast Traffic Flows (AADT) 2051





5.2.1 Network Modelling Results

The network modelling results led to the following key conclusions:

- Forecast travel demands indicated that motorway standards on SH1 as far north as Warkworth would be desirable;
- North of Warkworth, lower forecast demands suggested that alignment and access controls could be relaxed to expressway standards;
- Implementation of the recommended strategy for SH1 / 16, involving creating of the configuration of each corridor section described in Section 5.1, would be sufficient for the level of forecast travel demands in 2051;
- The amount of traffic transferring between SH1 and SH16 as a result of the strategy improvements was minimal;
- On SH1, the substantial majority of traffic transferred to the new improved sections of route where the existing route was maintained for local access;
- On SH16, a Kumeu / Waimauku bypass had minimal benefits, as most traffic had destinations within the townships along the existing route; and
- Around Warkworth, the volume of traffic which transferred to the bypass from the existing SH1 was approximately 70%. This reflects that a significant proportion of traffic using SH1 has destinations in the town or the popular areas to the north east around Matakana, etc.

The traffic modelling results supported the general decisions about the configuration of each section of corridor described in Section 5.1. The results also suggested that separating through movements from local access was important, especially on SH1 as far north as Warkworth, to maintain benefits associated with new road infrastructure.

On SH16, the traffic modelling showed that a bypass solution for Kumeu would not be viable within the time horizon of this strategy, as most traffic on SH16 would continue to use the existing road. Therefore, improving the existing corridor, utilising the current designation, would be needed to achieve the strategy objectives. However, the inter-relationship between the movement function, access to existing development and integration of the transport route with the urban form of the area would require a more detailed urban transport investigation, to identify suitable solutions.

5.3 Recommended Implementation Strategy

Based on the results from the network modelling and the corridor configurations required to deliver the recommended strategy, the next stage in the study was to identify the major works needed to deliver this.



5.3.1 SH1 Major Works

Given the magnitude of infrastructure within the SH1 corridor required to deliver the recommended strategy, it was recognised that implementation would need to be carried out in a number of stages due to financial constraints. It was also recognised that all of the simpler projects within this corridor have already been built and that any projects in the future are likely to be large scale, expensive projects in difficult terrain.

The likely funding arrangements in the short to medium term for new infrastructure suggest that the largest practical size of an individual stage would be similar in scale to the current ALPURT B2 project, namely 5 to 8 kms in length. Past experience suggests that the timeframe for delivery of a project of this scale would be up to 10 years from inception to completion.

These considerations led to the view that for SH1 between Puhoi and Wellsford, at least six separate stages for implementing the strategy would be involved, with a time horizon out to at least 2051. Previous commitments to addressing safety concerns implied that first priority would be given to Schedewys Hill and Dome Valley improvements, otherwise the general priority would be a progression of works northwards from the end of ALPURT.

Following this approach, the major works required to deliver the recommended strategy on SH1 are summarised in Table 5-1 below. Work in each corridor is described in terms of discrete projects which together executed to deliver the required corridor configurations to achieve the recommended strategy.



■ Table 5-1 SH1 Major Works

SH1 Work Package	Package Description
Constellation Drive to Silverdale	Bus Lanes Extension (within current designation), combined with new bus interchange at Silverdale
Silverdale to Puhoi (Titfords Bridge)	ALPURT B2 (currently under construction)
Puhoi (Titfords Bridge) to Schedewys Hill	Titfords Bridge to Schedewys Hill. Offline four lane motorway standard dual carriageway with 100km/hr design speed and strict access control. Existing alignment retained at all stages to provide for local access.
Schedewys Hill	Schedewys Hill Realignment. Offline four lane motorway standard dual carriageway with 100km/hr design speed and strict access control. Existing alignment retained at all stages to provide for local access.
Schedewys Hill to Warkworth	Schedewys Hill to Warkworth. Offline four lane motorway standard dual carriageway with 100km/hr design speed and strict access control. Existing alignment retained at all stages to provide for local access.
Warkworth	Warkworth Stage 1 Warkworth Bypass. Four lane expressway standard dual carriageway with 100km/hr design speed and strict access control. Existing alignment retained to provide for access within Warkworth.
Warkworth to Dome Valley	Warkworth to Dome Valley. Four lane expressway standard dual carriageway with 100km/h design speed and strict access control. Existing alignment retained where necessary to provide for local access.
Dome Valley	Dome Valley Realignment. Four lane expressway standard dual carriageway with 100km/hr design speed and strict access control. Existing alignment maintained where necessary to provide for local access.
Dome Valley to Welsford	Dome Valley to Welsford. Four lane expressway standard dual carriageway with 100km/h design speed and strict access control. Existing alignment maintained where necessary to provide for local access.
Welsford	Welsford Bypass. Four lane expressway standard dual carriageway with 100km/hr design speed and strict access control. Existing alignment retained where necessary to provide for local access.



5.3.2 SH16 Major Works

The configuration of SH16 needed to implement the recommended strategy described in Section 5.1 found that only the section between Westgate and Waimauku required major works. These are summarised in Table 5-2 below.

■ **Table 5-2 SH16 Major Work Packages by Section**

SH16 Section	Project Description
Westgate to Brigham Creek Road	■ Widening of Brigham Creek extension from single carriageway to 4 lane dual carriageway. Expressway standard with access control and 100km/hr design speed.
Brigham Creek Road to Waimauku	■ Kumeu/Huapai Transportation Action Plan ■ Ongoing safety and passing lane projects
Waimauku to Wellsford	■ Ongoing safety and passing lane projects

5.4 Passenger Transport (inc. proposals by other Transport Agencies)

5.4.1 Bus

The Northern Busway is Auckland's first purpose built road dedicated to bus passenger transport and will form a key part of Auckland's rapid transit network. Initially constructed to Oteha Valley Road, Transit has resolved to extend the busway further north to Silverdale. Such an extension of the busway with suitable bus frequencies could cater for a significant proportion of the travel demand between Orewa, North Shore City and Auckland.

5.4.2 Rail

ARTA has announced that peak hour passenger rail services to Helensville via Kumeu will commence in 2009. It is likely that these services will be extended to other time periods as demand increases in time.

5.5 Complementary Measures – Cycling, Walking, Travel Demand Management

The NSHS requires Transit to consider cycling facilities with all its projects. Given the configuration, traffic flows and physical constraints of the state highways within the study area, it was concluded that SH16 should be formalised and promoted as the main route for cyclists through progressive upgrades as part of routine maintenance. With the recommendation to declare SH1 as motorway (at least to Warkworth), cyclists would not be permitted. However, where other suitable routes exist alongside the motorway, these could be used by cyclists.

The majority of SH1 and SH16 in the study area are in rural areas. Therefore provision for walking will be limited to access points to walking tracks, etc. Where SH1 will be motorway,



access would need to be from alternative routes. It is not anticipated that there would be a need for other significant facilities.

In urban areas, walking facilities in the form of dedicated footpaths will be an essential feature of the state highway, for example SH16 through Kumeu. The layout of these facilities will be determined from the detailed study of urban improvements through the town.

Transit's approach to travel demand measures in urban areas has predominantly focused on ramp signalling. It is anticipated that this technique will be extended along SH1 and SH16 north from Auckland as demand increases in these areas. In other areas, the key form of travel demand management that will be exercised will be strict application of Transit's access policy to state highways, to ensure that the state highway operates in an appropriate manner.

From an operations perspective, it is also anticipated that Intelligent Transport Systems will be deployed along SH1 and SH16 progressively. SH1 and 16 are able to be operated as a tactical pair of routes, allowing diversions to be advised to travellers when incidents occur or peak traffic flows. Initially, it is expected that CCTV surveillance systems and traffic count loops will be introduced, to monitor traffic conditions and detect incidents. Traveller information, in the form of strategically located Variable Message Signs should also be introduced, to advise drivers about congestion, incidents and traffic conditions on the network. With these tools, delays from incidents and congestion can be reduced, providing more consistent and reliable travel times.

5.6 Other Planned Improvements

There will be a number of safety and minor improvements which will be required within the timeframe of this strategic study. While these have not all been specifically identified given the higher level nature and focus of this study, projects in the Transit 10 year state highway forecast have been examined to establish if they are consistent with the overall strategy.

5.6.1 Transit New Zealand 10 Year State Highway Forecast

Within the SH1 corridor Transit has identified the following projects in the 10 year forecast:

- Wayby Valley Road intersection
- Hoteo River southbound passing lane
- Waitaraire passing lane
- Sheep World southbound passing lane
- Warkworth Stage 1
- Toovey Road southbound passing lane
- Schedewys Hill Deviation



Only two of these are 'major' projects; Warkworth Stage 1 and Schedewys Hill Deviation, both of which are consistent with the recommended strategy. While the strategy may recommend higher design standards than previous work undertaken on the Schedewys Hill Deviation, this is in order to achieve consistency with the proposed long term corridor configuration. The other five projects are smaller and are complimentary to the strategy and should continue to be pursued.

Within the SH16 corridor there are also a number of projects proposed:

- Waitangi Bridge to Basil Orr Road seal widening
- Punganui Stream Bridge replacement
- Kumeu No.2 Bridge westbound passing lane
- Old Railway Road eastbound passing lane
- Taupaki Road/Old North Road intersection upgrade
- Don Buck Road to Brigham Creek Road safety improvements

None of these projects are identified as being major works as part of the proposed SH16 strategy. However, the strategy should support continued minor and safety improvements on this stretch of road, so all should continue as planned.

5.6.2 Transit New Zealand Passing and Overtaking Strategy

Transit has developed a passing and overtaking strategy for the state highway network with a time frame of 25-30 years. It is important that this strategic study of SH1/16 is consistent with the strategy to ensure consistency across the state highway network. Table 5-3 overleaf presents a summary of the Transit passing and overtaking strategy.



■ **Table 5-3 Summary of Passing and Overtaking Strategy Types**

Strategy Types	Summary of Strategy	Typical 25-30 Year Projected AADT	
		Flat	Rolling/Mountainous
Overtaking	<ul style="list-style-type: none"> ■ Sight distance improvements ■ Overtaking enhancements ■ Possibly, isolated short passing lanes, slow vehicle bays, shoulder widening or crawler shoulders 	Less than 4,000	Less than 2,000
Mainly Overtaking	<ul style="list-style-type: none"> ■ Sight distance improvements ■ Overtaking enhancements ■ Possibly some short "in series" (i.e. regular and frequent) passing lanes, slow vehicle bays, shoulder widening or crawler shoulders 	4,000 – 5,000	2,000 – 4,000
Passing & Overtaking	<ul style="list-style-type: none"> ■ In series passing lanes³ ■ Overtaking enhancements ■ Crawler lanes, where appropriate 	5,000 – 12,000	4,000 – 10,000
Passing	<ul style="list-style-type: none"> ■ 2+1 lanes on flat/rolling road gradients (subject to comparison with four lanes) ■ Passing lanes in series³ on mountainous road gradients 	12,000 – 25,000	10,000 – 25,000

Using the estimated 2026 flows as in Section 3.6, Table 5-3 suggests that in addition to the specific works identified in Section 5.3 the following passing and overtaking strategies would be appropriate to implement within the study area.

- **SH16 from Waimauku to Helensville:** Passing lanes in series, overtaking enhancements and crawler lanes where appropriate.
- **SH16 from Helensville to Wellsford:** Sight distance improvements, overtaking enhancements, and possibly some short "in series" (i.e. regular and frequent) passing lanes, slow vehicle bays, shoulder widening or crawler shoulders.

5.7 Major Works Costs

Cost estimates for new major work components of the strategy were developed, to enable an economic assessment of the strategy implementation to be made. A spatial analysis provided

³ Except for 2+1 lanes, passing facilities in series are those that are frequently and regularly spaced (i.e. every 5 or 10km) between the end of the merge taper for a facility to the start of the diverge taper of the next facility when travelling in one direction.



indications of physical infrastructure requirements, which is summarised in Appendix C. Data on construction costs were obtained from previous studies and projects under construction, such as ALPURT B2.

Preliminary estimates were provided by Transit's cost consultants, MacDonald International, using Transit's Benchmark Estimator software. MacDonald provided OE based estimates, as defined in the Transit Cost Estimation Manual. Separate order of magnitude checks were made to ensure that these estimates were reasonable, given the level of information available at this stage. Indicative estimates for property acquisition were also made, given current knowledge about land use and possible land requirements. Risk was assessed in a qualitative approach, which is appropriate for a strategic study of this nature.

The range of costs estimated for each section of the strategy is highlighted in Table 5-4 below.

■ **Table 5-4 Major Works Costs**

Corridor Section	Cost Range (2007 values)
Constellation Drive to Silverdale Busway	\$470M - \$500M *
Titfords Bridge to Schedewys Hill	\$100M - \$120M
Schedewys Hill	\$190M - \$210M
Schedewys Hill to Warkworth	\$240M - \$260M
Warkworth Bypass	\$75M - \$90M
Warkworth to Dome Valley	\$55M - \$70M
Dome Valley	\$55M - \$65M
Dome Valley to Wellsford	\$180M - \$195M
Wellsford Bypass	\$95M - \$110M
Kumeu/Huapai/Waimauku Town Centre Upgrade	\$150M - \$180M

*Cost estimate taken from report by Opus Consultants, "Northern Busway Extension Constellation to Orewa Concept Report, August 2005"

5.8 Economic Benefits (EEM Evaluation)

A preliminary economic assessment of the new major works in the recommended strategy (excluding the bus lanes between Constellation Drive and Silverdale) was undertaken, using the EEM procedures. Three areas of tangible benefits were assessed, as follows:

- Travel Time Benefits (taken from the traffic model described previously)
- Vehicle Operating Cost Benefits
- Accident Benefits

Each corridor section was assessed, based on an indicative completion year, assuming that priority would be given to Schedewys Hill and Dome Valley improvements (to address safety concerns),



followed by a general south to north progression of works. It was also assumed that the later sections of the strategy would be open by 2051.

Combining the total benefits and costs of each section of the strategy implementation, gave the following initial results for each section of state highway improvements.

■ **Table 5-5 Economic Summary**

Project	BCR	Assumed Opening Year
Constellation Drive to Silverdale Busway	1.2 – 1.4*	2015
Titfords Bridge to Schedewys Hill	0.4 – 0.6	2021
Schedewys Hill	0.3 – 0.5	2021
Schedewys Hill to Warkworth	0.1 – 0.3	2041
Warkworth Bypass	1.1 – 1.3	2026
Warkworth to Dome Valley	0.2 – 0.4	2036
Dome Valley	0.4 – 0.6	2021
Dome Valley to Wellsford	0.6 – 0.8	2041
Wellsford Bypass	0.9 – 1.1	2051
Kumeu/Huapai/Waimauku Town Centre Upgrade	0.6 – 0.8	2021

*BCR values taken from report by Opus Consultants, "Northern Busway Extension Constellation to Orewa Concept Report, August 2005"

5.9 Factors Affecting Implementation

The economic evaluation summarised in Table 5-5 indicates that improvements to some sections of SH1 and 16 would have costs exceeding benefits. Under present arrangements, this suggests that these projects may not succeed in being funded. However, a number of factors also need to be considered;

- The forecast benefits are very dependant on traffic growth. As discussed in earlier sections of this report, the "expected" land use development scenario has been used for this assessment; if the higher growth scenario eventuated, then the level of benefits would increase and the funding case for each part of the strategy implementation may be satisfied sooner than the indicative year of opening.
- Other strategic factors could dictate that the need to provide better connectivity to the region and from Auckland to Northland may make the strategy implementation more attractive.
- Alternative funding sources, such as tolling, may improve the viability of some of these projects and thereby accelerate the implementation programme.
- The strategic nature of the modelling undertaken will have under reported the benefits of the strategy.



Therefore, while this preliminary assessment has demonstrated that not all the major works needed to implement the strategy could be justified under current funding regimes, other key factors listed above suggest there is still merit in ensuring that a full four lane route from Auckland to Wellsford is protected, as well as achieving consistency with the National State Highway Strategy. As planning for transport infrastructure is a long term process, it is considered important that the opportunity to ensure the strategy is fully implemented should be maintained.

Based on this an implementation strategy has been developed for both of the SH1 and SH16 corridors, and this is shown visually in Appendix A.

5.9.1 Regional Economic Impacts

Within the initial evaluation framework, the relative effects of strategy options for the state highway network were considered. Further work was undertaken to assess the potential magnitude of implementing the strategy on the regional economy. The key conclusions that arose from this assessment were:

- The economy of Northland is relatively weak with low regional GDP per capita and a low historic growth rate.
- The economy also has a relatively high concentration of activities in the agriculture and natural resources sectors, areas where key demand may lie overseas rather than elsewhere in New Zealand. For this traffic, interactions with Auckland may decline with the development of port facilities at Marsden Point and the construction of a connecting rail link.
- The key centre in the Northland is Whangarei, which is at a considerable distance from the main centres in the Auckland region. The areas south of Whangarei are relatively lightly developed containing about 10-15 per cent of total regional employment, and the scope for substantial economic growth with the upgrading of SH1 is limited.
- The activity most likely to benefit from the improvement of SH1 to Wellsford is tourism. However, this is relatively small scale in the areas in the south of Northland with a contribution to GDP of about \$30-50 million. Even a significant increase in this contribution would be modest when set against the likely costs of road upgrading.

Therefore, regional economic issues are unlikely to make a significant contribution to the viability for implementing the strategy. However, it is clear that the strategy would make an overall positive contribution to the region.



6. Government Transport Policy and Strategy Announcements

During the study, Government made a number of significant announcements about transport policy and strategy. In mid 2007, the Contribution to Government's Theme Objectives for the Land Transport Sector was announced. Later in the year, an Update of the New Zealand Transport Strategy was released.

The contribution and implications of each of these matters on the recommended strategy for SH1/16 has been assessed, as described in the following sections.

6.1 Contribution to Government's Theme Objectives

The Government announced four key themes sought from the land transport sector. The impact of the recommended strategy on these themes is as follows:

***Theme:** Increasing International Connections of Firms to Overcome Constraints of Size and Distance, noting that secure supply chains and effective transport logistics are fundamental to our export competitiveness*

- The recommended strategy contributes to the above objective by enhancing network resilience and hence improving the security of supply chains to/from Northland. In addition the proposed strategy will improve the accessibility of Northland by significantly reducing journey times, specifically between the economic centres of Auckland and Whangarei.

***Theme:** Create a world-class Auckland by leveraging off the Rugby World Cup 2011 to address inefficiencies and underinvestment in infrastructure to correct bottlenecks and failures, in particular in transport.*

- There is no direct contribution to this theme due to the timescales for the Strategic Study.

***Theme:** Improving the Value Derived from the Sustainable Use of Management of Natural Resources by moving to a low gas emissions economy through improved energy efficiency and greater technology uptake and development, noting that there are opportunities to reduce emissions in a number of key sectors including transport.*

- The proposed strategy will improve energy efficiency as compared to the existing network through the provision of a high standard motorway or expressway environment for long-distance traffic. This will have improved design features including gradients and length, which will lead to significant reductions in emissions particularly in relation to truck movements which are forecast to increase significantly within the State Highway 1 corridor.



***Theme: Ensuring Efficient Use of Existing Transport Infrastructure and High Quality Investment in Transport** noting that there is scope for more efficient use of existing and future infrastructure, particularly in Auckland, by ensuring high quality investment, use of traffic management and travel demand management techniques. We also need to provide a transport system that is resilient so that it can continue to provide for the movement of people and goods.*

- The strategy makes best use of the existing infrastructure by re-enforcing the functionality of the respective State Highways. Through separating out the national and regional/local functions along State Highway 1 and by creating a new limited access national route in conjunction with the existing regional route, the aim is to provide for the appropriate movement of people and goods which are key to the national economy whilst trying to limit the extent to which undesirable regional sprawl might erode infrastructure benefits.

Overall, it is considered that the recommended strategy contributes towards to the Government's themes and objectives for the land transport sector.

6.2 Update of the New Zealand Transport Strategy

The Update of the New Zealand Transport Strategy (UNZTS) gives further direction for the transport sector, in the context of Government's sustainability agenda. It also includes specific outcome targets for 2040, across a range of issues that Government is seeking to achieve.

For this study, an initial assessment of how the preferred state highway strategy for SH1 and 16 contributes towards those targets is presented below.

Halve per capita domestic greenhouse gas transport emissions:

Vehicle manufacturers are making technological advances that are already reducing greenhouse gas emissions from the national vehicle fleet. While it is difficult to quantify greenhouse gas transport emissions in the future, continual improvement in the operating efficiency of the private vehicle fleet is likely to result in an overall reduction in emissions within the study area.

The recommended strategy aims to improve the efficiency of individual trips, by improving the standards and operation of transport infrastructure. Travel time savings and vehicle operating costs will be reduced through these measures, which will also reduce greenhouse gas emissions. In addition, strict access control measures will discourage a proliferation of short distance trips on the state highway network, which will support the "self containment" objective in land use development policy.

Travel times by all modes will be predictable:



The recommended strategy is consistent with the National State Highway Strategy, by improving the level of service for travellers. Improved traffic operations with less disruption from adjacent land uses will be achieved through strict access control. Alternatives to the use of the private car in congested areas around Auckland are a fundamental part of the strategy. The strategy includes use of intelligent transport systems, including incident detection and real time traveller information, which will reduce delays from incidents and congestion.

All these measures will contribute towards providing more consistent travel times.

Travel times by principal routes to be improved relative to 2007 for identified critical intra and inter-regional connections, as determined with each region:

The study has considered both intra and inter-regional connections within the study area and proposes to upgrade SH1 and SH16 to a standard which will provide national and regional functions respectively. The traffic assessment undertaken as part of this study has confirmed that travel times on these two principal routes will be improved by implementation of the strategy.

All individuals have access to the facilities and activities they need, such as work, education, medical care and shopping centres, to participate in society:

Access and mobility have both been key evaluation criteria used in the process to determine the recommended strategy. A detailed examination of land use issues has been a key feature of the study, from which future travel demands have been assessed. This has led to the conclusion that the recommended strategy will provide for improved access to facilities and activities within the study area.

Public health effects of transport to be at accepted international standard:

With the improved operating efficiency of the private vehicle fleet and improved passenger transport services within the highly urbanised centres, transport pollution and greenhouse gas emissions will reduce. In more rural areas, improved road standards will lead to more efficient use by vehicles, with reduced emissions and improved air quality. Further to this, active transport modes such as cycling will be encouraged by the strategy.

Therefore the recommended strategy supports this objective.



Local environmental impacts of transport (including air and water quality) to be at accepted international standard:

A significant proportion of the state highway network within the study area is proposed to be upgraded. New infrastructure will all be constructed to high standards and environmental control (including the effects on air and water quality). As such, it is expected that the local impact of transport on the environment will be improved.

Operate to world best-practice safety standards for all modes of transport:

Safety has been a key evaluation criteria used in the study process, and the recommended strategy supports network-wide geometric and safety improvements. Key components of the strategy include improvements to address significant crash areas including Schedewys Hill and the Dome Valley.

Become one of the first countries in the world to widely deploy electric vehicles:

Not influenced by the recommended strategy.

A biofuels sales obligation that will begin at a level of 0.53 percent from 2008, increasing to 3.4 percent of annual petrol and diesel sales by 2012.

Not influenced by the recommended strategy.

Reduce the kilometres travelled by single occupancy vehicles in major urban areas on weekdays by ten percent per capita by 2015 compared to 2007:

Strict access control measures will discourage a proliferation of short distance trips on the state highway network, which will support the “self containment” objective in land use development policy. The strategy recommends improved passenger transport services in the major urban areas including improved bus facilities as far north as Silverdale on SH1, and extended rail services in the SH16 corridor.

All these measures seek to reduce the kilometres travelled by single occupancy vehicles.

Proposed intermediate or detailed targets for 2040

Identify and remove any barriers to the uptake of plug-in hybrid and full electric vehicles that meet appropriate safety standards:

Not influenced by the recommended strategy.

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Effective real-time information systems in place to enable road users to plan their journeys to avoid congestion, minimising delay and fuel wastage, by 2015.

As previously noted, the strategy includes use of intelligent transport systems, including incident detection and real time traveller information, which will reduce delays from incidents and congestion. These systems have already demonstrated their ability to deliver benefits to urban sections of the state highway network and their extension to the study area can readily be achieved by 2015.

Road deaths no more than 200 per annum:

Safety has been a key evaluation criteria used in the study process, and the recommended strategy supports network-wide geometric and safety improvements and also addresses significant crash black spots including Schedewys Hill and the Dome Valley. These measures seek to reduce the number of road deaths on the road network within the study area.

Over 40 percent of the light vehicle fleet to have four star or better occupant protection (currently ten to 15 percent) by 2015 and 90 percent by 2040:

Not influenced by the recommended strategy.

Over 25 percent of light vehicles to have electronic stability control (currently less than five percent) by 2015 and 95 percent by 2040:

Not influenced by the recommended strategy.

Lift coastal shipping's share of inter-regional freight to around 30 percent (currently about 15 percent of tonne-kilometres):

Not influenced by the recommended strategy.

Lift rail's share of domestic freight to around 25 percent (currently about 18 percent of tonne-kilometres):

A comparison of long haul truck and rail movements within the study area shows that rail is already moving a significant proportion (over 50%) of the long haul trips. The majority of the existing truck movements on SH1 are servicing shorter distance movements.

While the logistics of rail freight transport are outside the terms of reference for this study, it is noted that the capacity of the rail network to move more freight is considerable.



Increase the public transport mode share of peak hour travel (journeys to work) in Auckland, Wellington and Christchurch from an average of nine percent to 20 percent and work with each region to optimise peak hour travel targets:

The strategy recommends improved passenger transport services in the major urban areas including improved bus facilities as far north as Silverdale on SH1, and extended rail services in the SH16 corridor. Both measures seek to increase the public transport mode share of commuter travel trips.

At least double the overall public transport mode share to seven percent of all passenger trips (currently about two to three percent):

While the study area is largely rural, the strategy recommends improved passenger transport services in the major urban areas, where passenger transport is likely to be viable. Measures include improved bus facilities as far north as Silverdale on SH1, and extended rail services in the SH16 corridor.

In addition, local passenger services (by bus) presently exist, particularly around Orewa and Warkworth. It is anticipated that demand and supply for such services will increase in future, as land use planning policy encourages more mixed use development and activity.

Increase walking and cycling and other “active modes” to 30 percent of total trips in urban areas (currently about 17 percent):

The strategy encourages active travel modes and also recommends an online national cycle route on SH16 for longer distance movements. However, the rural nature of the study area, and the large distances between main centres, suggest that cycling in the study area will be mainly associated with tourism and sporting activities, rather than commuting.

Ensure a substantial reduction in premature deaths and serious illnesses arising from air pollution from motor vehicles:

On-going improvements to emission standards of the private vehicle fleet are likely to result in an overall reduction of emissions within the study area. As the recommended strategy seeks to improve road operating conditions, these factors will work together to reduce premature deaths and seriousness illnesses which arise from air pollution from motor vehicles.

Manage noise to minimise any public health effects:

All of the proposed works in the recommended strategy will need to meet current noise standards which will help minimise and public health effects.



No net loss of indigenous vegetation or fauna from infrastructure construction or maintenance:

The environmental controls and standards achieved on the ALPURT B2 project set new benchmarks for infrastructure construction. These are likely to be developed further as other projects are initiated. In the future, offset planting and replacement are likely to be common features of all infrastructure schemes.

Government agreed targets to reduce harmful emissions from cars and trucks:

Reduce the rated CO₂ emissions per kilometre of combined average new and used vehicles entering the light vehicle fleet to 170 grams CO₂ per kilometre by 2015 (currently around 220 grams CO₂ per kilometre), with a corresponding reduction in average fuel used per kilometre:

Not directly influenced by the recommended strategy, although improved geometric design standards for roads will reduce vehicle emissions.

Ensure 80 percent of the vehicle fleet is capable of using at least a ten percent blend of bio-ethanol or bio-diesel, or is electric powered, by 2015:

Not influenced by the recommended strategy.

Proposed targets that will help further reduce harmful emissions from cars and trucks

Thirty-five percent of the vehicle fleet to have emissions technology consistent with Euro 4 (or equivalent) standard by 2015:

Not influenced by the recommended strategy.

Imported used petrol, LPG, CNG and diesel vehicles (light and heavy) are to be of Euro 4 (or equivalent) standard by 2012:

Not influenced by the recommended strategy.

Imported new petrol, LPG, CNG and diesel vehicles (light and heavy) are to be of Euro 4 (or equivalent) standard by 2009:

Not influenced by the recommended strategy.



7. Conclusions

A comprehensive investigation of the future needs, issues and opportunities for State Highways 1 and 16 between Auckland and Wellsford has been undertaken for the period up to 2051, in the context of current transport policy (national and regional), land use development proposals and travel demands. There is some uncertainty surrounding the rate and scale of future growth and hence there is the need for ongoing monitoring and review of the timing and eventual form of any recommended projects. This monitoring and review will be determined by the effectiveness of ongoing travel demand and land use initiatives

Physical and environmental conditions in the study area are challenging for transport infrastructure construction, as has been previously demonstrated by the ALPURT project. In addition, the study has concluded that the simpler, more straightforward projects within the SH1 corridor have already been completed and as such, future projects are likely to be large scale, expensive upgrades through difficult terrain. Nevertheless, land use development in Rodney District, and the desire for better inter-regional connectivity between Auckland and Northland, will bring increasing pressure for enhanced transport links in the future.

A high level assessment of the requirements of the state highway network led to development of options for the future of both routes, which would satisfy the overall project objectives and would be technically achievable. An evaluation of the options concluded that the recommended strategy would maintain the national function of SH1 from Auckland through to Wellsford, with SH16 providing a regional functionality, confirming the intent of Transit's National State Highway Strategy and maintaining consistency with previous transport and land use planning decisions in the region.

Once a recommended strategy was identified, work continued to establish how it would be implemented. With a focus on providing significantly improved accessibility and route security for strategic nationally significant transport movements whilst limiting the scope for encouraging urban sprawl within the Auckland region, several opportunities for alternative modes were explored, including bus and rail. With regard to freight, a substantial proportion of freight moving between Northland and Auckland is already moved by rail hence the scope for moving significantly more freight by rail is limited.

In terms of supporting alternative modes through public transport, Transit has already investigated extending the Northern Busway to Silverdale, which will provide for the growth in commuter travel from the Hibiscus Coast to Auckland. Within the SH16 corridor, ARTA has recently announced that passenger rail services will be introduced to Kumeu and Helensville in 2009. However, while public transport is likely to have increased mode share to key destinations in Auckland, the North shore and the lower parts of SH16, it is unlikely to make a significant impact

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on overall traffic growth in the study area given the dispersed nature of the population. Likewise, tourism was also considered. However, growth in tourist numbers was considered unlikely to be a major determinant for increased road capacity, and as such was not a key factor in influencing the recommended strategy.

On SH16, it is unlikely that the planned rail initiative will be sufficient to cater for anticipated increased travel demand on the SH16 corridor between Westgate and Waimauku. Therefore some form of upgrade to SH16 will be required within the time horizon of this strategy. Traffic modelling undertaken in this study indicated that a bypass would not be justified or cost effective, as the majority of traffic using this section of road is making trips which start or end in the urban centres. However, some form of on-line improvement to SH16 will be required within the time horizon of the study. The detailed consideration of the scope of this upgrade is beyond this strategic assessment, which should be undertaken as a separate investigation in future.

SH1 from Puhoi north, will be upgraded to a four lane dual carriageway to Wellsford. Future travel demands and operational factors including access control suggest this upgrade should be motorway standard at least as far as Warkworth. The route should be relaxed to expressway standards north of this point to Wellsford on the basis of forecast demand and affordability.

An initial economic assessment of the recommended strategy suggested that upgrading some sections of SH1 would not be viable under current funding conditions. However, this assessment assumed a specific growth forecast in land use; faster growth in the region could make a material difference to the viability of upgrading SH1. Therefore, it is recommended that the whole route is protected for the implementation of the strategy over the time horizon of this strategy. In the meantime, work should take place on the Schedewys Hill and Dome Valley sections, which have particular safety problems, and on developing a specific town centre action plan for the future of SH16 through Kumeu and Huapai.

During the study period, Government announced a series of themes or outcomes required from the transport sector. While some themes were directly related to Auckland matters, the strategy was tested and found to be consistent with the themes relevant to this project. Further, the strategy was found to make a positive contribution to the economic activity of the region, albeit to a relatively small degree.

Government also announced the Update to the New Zealand Transport Strategy (UNZTS) later in 2007. In this update, targets for the transport sector were identified, which are focused towards sustainability, energy and climate change. Although several targets relate to matters beyond this state highway strategy, many of the targets were directly relevant to new infrastructure provision. In these areas, it was concluded that the recommended strategy supported the UNZTS, although it has to be recognised that as private vehicle transport will continue to dominate in rural areas,



improvements to vehicle motive technology are much more likely to influence greenhouse gas emissions than operational strategies in urban areas.

In addition to the major works identified in the study, a series of minor projects and safety improvements including passing/overtaking opportunities will complement the overall strategy. It is recommended that projects within the 07/08 Annual Plan proceed.

In conclusion, the key components of the strategy and its implementation are as follows:

- SH1 will continue to provide the National Route Function and SH16 will provide a Regional Route Function
- Passenger transport initiatives in the study area will be given high priority, including extending the North Shore Busway on SH1 north to Silverdale, with a new bus interchange at Silverdale, and passenger rail services to Kumeu and Heilensville
- SH1 will ultimately be a four lane divided road between Auckland and Wellsford; motorway standards will be provided between Auckland and Warkworth, but will be relaxed to expressway standards from Warkworth to Wellsford
- First priorities on SH1 will be addressing the safety concerns at Schedewys Hill and Dome Valley; the remaining works will be implemented in stages going north from ALPURT B2.
- The timeframe for implementation of the full four laning on SH1 will be influenced by development in the northern sector of Rodney District; under current forecasts the full four laning may not be justified within the time horizon of this study (2050)
- On SH16 the main improvements involve the area around Kumeu and Huapai; a detailed investigation of the most appropriate method to integrate through movements, local access and urban form in this area is needed.
- On SH16 north of Waimauku ongoing safety improvements and projects are required to meet the aspirations of Transit's Passing and Overtaking Strategy.

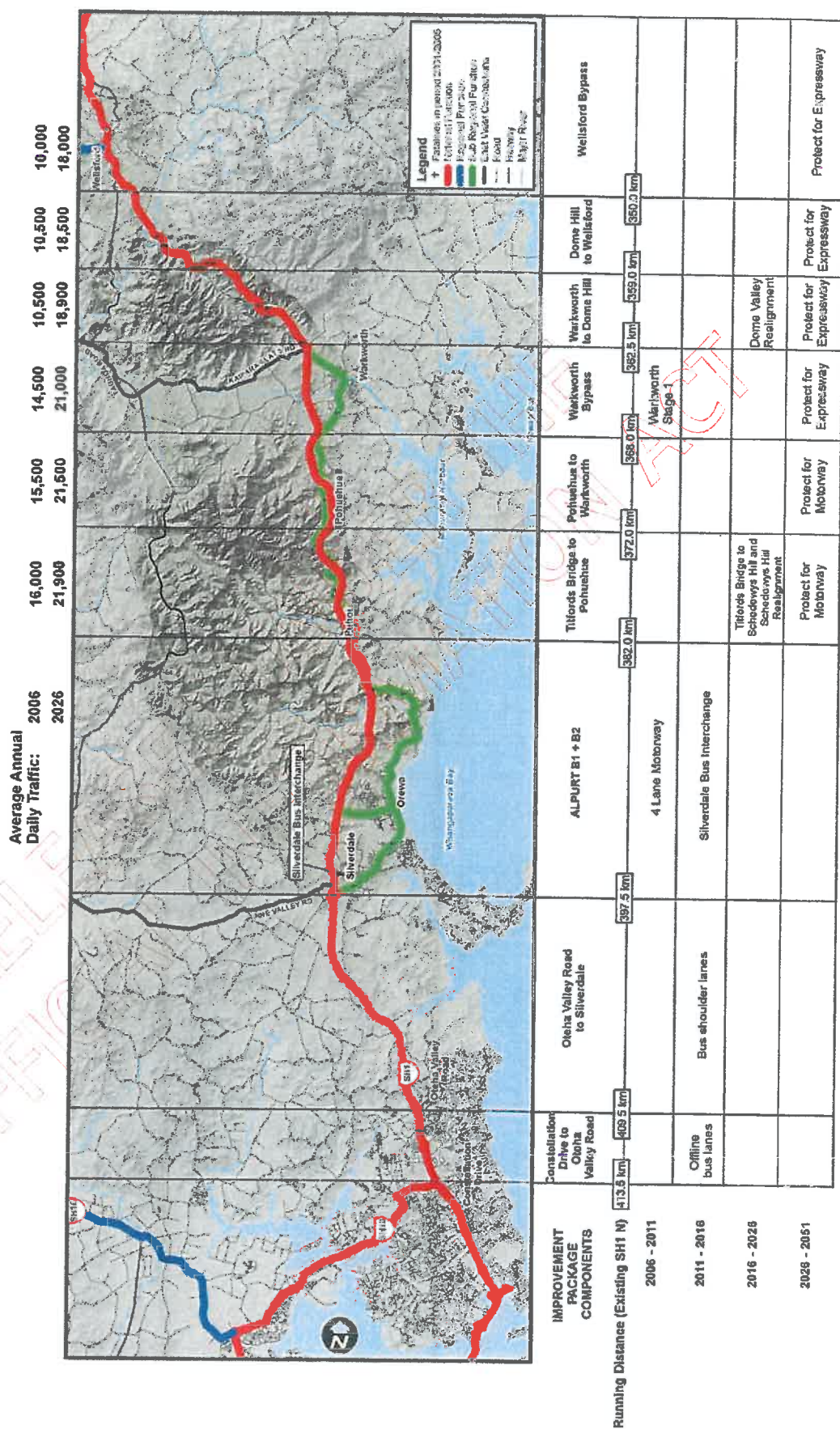


Appendix A Implementation Strategy

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The SH1 Strategy is to provide for a national function between Auckland and Wellsford by:

- Providing a high standard access controlled four lane dual carriageway with bus lanes from Auckland to Silverdale
- Providing a high standard access controlled four lane dual carriageway from Silverdale to Warkworth
- Protect for expressway from Warkworth to Wellsford



The SH16 Strategy is to provide for a regional function between Auckland and Wellsford by:

- Providing a high standard access controlled four lane dual carriageway from Auckland to Brigham Creek
- Kumeu/Huapai Transportation Action Plan
- Completing safety improvements from Waimauku to Helensville
- Completing minor safety improvements along sections of the route between Helensville and Wellsford

Average Annual
Daily Traffic: 2008 24,500
2026 36,800

2,500
4,500



**IMPROVEMENT
PACKAGE
COMPONENTS**

Running Distance
(Existing SH16)

2006 - 2011

2011 - 2016

2016 - 2026

2026 - 2051

Helensville to
Wellsford

Safety & Passing/Overlapping Improvements

Safety Improvements 2

Safety Improvements 3

Safety Improvements 4

Waimauku to
Helensville

Passenger Rail (ART) /
Minor Safety Improvements 1

Minor Safety Improvements 2

Minor Safety Improvements 3

Minor Safety Improvements 4

Kumeu to
Waimauku

3x 0.1m

2 Lane
Expressway

4 Lane
Expressway

4 Lane
Expressway

Brigham
Creek Rd
Extension

13.5 km

23.5 km

3x 0.1m

53.0 km

Wellsford

17.0 km

* Minor Safety Improvements Shown in Strategic Study Report
* National Cycle Route Provided on Existing SH16



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