Annexure 4

Integrated Transport Assessment

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TRANSPORTATION SPECIALISTS

Marsden Point - Ruakaka Structure Plan: 2008

Transport Assessment

June 2008

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APPENDICES

1 INTRODUCTION

1.1 Background

Flow Transportation Specialists Limited (Flow) has been commissioned by North Holdings Limited, to give traffic engineering and transportation advice with regard to a proposed Structure Plan for the One Tree Point area.

By way of a summary, it is considered that the proposed land uses and the layout of the area can provide an integrated land use and transport network that will facilitate sustainable development of the area. Accessibility has been considered as a key aspect in the location and provision of different land uses, rather than just catering for a high level of mobility.

1.2 Site Location

The location of the Structure Plan area is shown in Figure 1 below. Whangarei is some 30 km by road to the SH15A/One Tree Point Road intersection. Port Marsden is a further 6 km by road from this intersection.

Figure 1: Location Plan

1.3 Planning and Policy Considerations

Planning and policy documents that have been considered in the development and assessment of the Structure Plan include:

- New Zealand Transport Strategy – Ministry of Transport, 2002
- Regional Policy Statement for Northland – Northland Regional Council, 2002
- Regional Land Transport Strategy for Northland 2006-2016 – Northland Regional Council
- Regional Passenger Transport Plan - Northland Regional Council, 2005
- Draft Walking and Cycling Strategy - Northland Regional Council
- Draft Traffic Demand Management Strategy - Northland Regional Council
- Heavy Traffic Volumes Report – Northland Regional Council, February 2007
- Whangarei District Plan – Whangarei District Council
- Long Term Council Community Plan 2006-2016 – Whangarei District Council
- Whangarei District Walking and Cycling Strategy 2007 – Whangarei District Council
- Marsden Point – Ruakaka Structure Plan 2002
- Ten Year State Highway Forecast – Transit New Zealand

Appendix A provides an overview of the relevant national and local guiding principles and policies from the above documents, with regards to transport and the integration of land uses.

1.4 Report Structure and Content

The report that follows covers the following:

- Section 2: existing and planned development in the Structure Plan area
- Section 3: proposed Structure Plan
- Section 4: impact assessments
- Section 5: summary and conclusions

2 EXISTING AND PLANNED DEVELOPMENT

2.1 Land Use

Recent and planned development, based on Structure Plan (SP2000) adopted by Whangarei District Council in the area includes the following.[1]

Table 1: Recent and Planned Developments

Activity	Size	Type
PORT AND ADJACENT ACTIVITIES		
Northland Port Expansion berths 3 and 4	2 berths	Port
Northland Port Corporation Land Section 53	53 ha	Industry
Northland Port Corporation Land Lot 5	47 ha	Industry
Carter Holt Harvey Log Processing, Wood Making, LVL Plant Expansion	50 to 60 ha	Industry

[1] Sourced from spreadsheets developed by Flow Transportation Specialists Limited and SKM Limited for North Holdings and Transit New Zealand, 2006

Table 1: Recent and Planned Developments

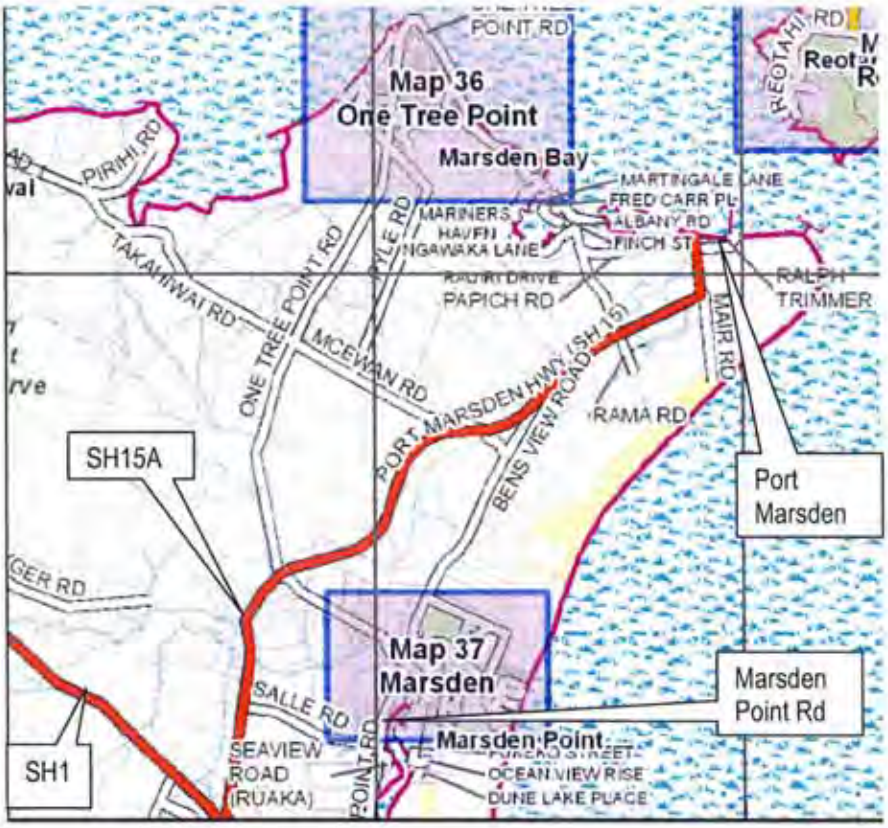
Activity	Size	Type
Electricity Farm Holdings Land	25 ha	Industry
Northland Port Corporation Section 38	30 ha	Industry
Northland Port Corporation Land Lot 1	20 ha	Industry
Business 4, east of Marsden Point Road	97 ha	Business 4
MRP Ash Disposal	60 ha	Industry
Other	Approx 400 ha	Business 4
Total Port and Adjacent Activities	**Approx 800 ha**	
ONE TREE POINT RESIDENTIAL		
Marsden Cove Canal Development	700 lots + 250 marina berths	Residential
La Pointe	229 lots	Residential
Northlakes	310 lots	Residential
Dannemora Holdings & Fulton Hogan Ltd: One Tree Point Stage 2 Subdivision	410 lots	Residential and commercial
Wood & Partners Lot 1, DP 153407	52 lots	Residential
Kowi Lake	154 lots	Residential
Other	1261 lots (approx 126 ha)	Residential
Total One Tree Point Residential Lots	**Approx 3,120 lots**	
ONE TREE POINT INDUSTRIAL		
North Holdings	92 ha	Industrial
Great Northern Land Company	34 ha	Industrial
Total One Tree Point Industrial Lots	**Approx 260 lots**	
SALLE ROAD FUTURE RESIDENTIAL		
Salle Road Residential	2200 lots (138 ha)	Residential
Total Salle Road Residential Lots	**Approx 2,200 lots**	

2.2 Existing and Planned Transport Provisions

2.2.1 Road Network

Figure 2 provides a plan of the area and the existing road network.

Figure 2: Existing Road Network[2]



As shown in Figure 2 above, the existing road network in the Marsden / One Tree Point area is made up of the following main routes:

- Marsden Point Road connecting State Highway 1 (SH1) in the south, through Ruakaka to Port Marsden Highway in the north.
- Port Marsden Highway (SH15A) connecting SH1 in the south to Marsden Point. The highway includes 2.75 km of a reconstruction of One Tree Point Road from SH1 to McCathie Road, a new 3.5 km deviation from McCathie Road to Marsden Point Road and reconstruction of 3.5 km of Marsden Point Road to Northport.
- One Tree Point Road, a loop route off SH15A which extends from the southern intersection with SH15A, northwards through the One Tree Point residential area, following the One Tree Point peninsula and then turning southeast to intersect with SH15A at Marsden Point.

An assessment undertaken in 2006 by Flow Transportation Specialists Limited and SKM Limited on behalf of North Holdings Limited and Transit New Zealand to understand the effects of planned development in the area, recommended the following state highway improvements, based on the planned land uses included in Table 1 above.

[2] Map Source: Whangarei District Council website

Table 2: Road Upgrades

Intersection	Existing Layout	Medium Term Improvements by 2026	Expected Long Term improvements
SH1 / SH15A	Priority Give Way Intersection	2 Lane Roundabout	Full grade separated Interchange
SH15A / Salle Rd	Priority Give Way Intersection	'Left in Left out' Give Way Intersection	'Left in Left out' Give Way Intersection
SH15A/One Tree Point Road (west) / McCathie Road	Priority Give Way Intersection	Replace with a 2 Lane Roundabout. Depending on the eventual flows, it may require an additional left turn slip lane on the One Tree Point Approach	Full grade separated Interchange
SH15A/Marsden Point Road	Priority Give Way Intersection	Priority intersection retained, however right turn from Marsden Point Road to SH15A to be banned. Provision of an East Facing Ramp for northbound traffic travelling to the Port from McEwan or Marsden Point Road.	Full grade separated Interchange
SH15A/One Tree Point (east)/Rama Road	Staggered Priority Stop Intersection	Retain Priority Intersection. Upgrade One Tree Point Road leg with separate left/right turn exit lanes and a left turn deceleration lane into One Tree Point Road.	Depending on the provision of a train track parallel to SH15A this may require a roundabout or two separate 'T' intersections

2.2.2 Cycling and Walking

Cycling and walking to work has declined in Northland over the last decade. A number of issues have been identified against cycling, including narrow carriageways, little or no road shoulders, and the number of trucks.

2.2.3 Bus Services

Currently there is only one contracted passenger transport service in Northland, a bus service operating within Whangarei City. In 2005 it accommodated 215,000 annual passenger trips.

2.2.4 Ferry Services

From time to time, a passenger ferry service has operated between Whangarei Heads and Marsden Point, across the Whangarei harbour.

2.2.5 Marsden Point Rail[3]

In late 2006, the Regional Council completed a regional capability review of infrastructure in Northland in order to identify gaps or constraints to regional growth and to prioritise the need for further infrastructure development. One of the six top priorities identified is the establishment of a rail link to the Marsden Point area (Oakleigh to Marsden Point Rail Link Project), in an attempt to move more heavy freight by rail.

It is recognised there is additional capacity within the rail network to accommodate increased freight movement by rail. Where appropriate, rail freight can provide a more fuel efficient and environmentally sustainable alternative to road based freight transport. However, rail tunnels would need to be enlarged in order to accommodate new "High Cube" containers which are increasingly being used.

This rail link is vital given the contributions the developing Bream Bay area makes to Northland's economy through its port and other businesses. A feasibility study completed in 2003 for the Regional and Whangarei District Councils found that developing the link would offer a host of benefits, including helping to ease forestry-related traffic volume and congestion problems on the region's roads. The study also found development of the rail link could create the equivalent of more than 200 fulltime jobs during the construction period and inject millions into the local economy. It could also help attract other big businesses to the Marsden Point area.

The proposed Oakleigh to Marsden Point rail link leaves the existing North Auckland Line (NAL) at Oakleigh approximately 25 km south of Whangarei City. It travels eastwards for approximately 16 km to link with the new deepwater port at Marsden Point.

The first stage in this project is the designation of the land needed for the rail link corridor. Designating the route means that the land will be available in the future when the funding is identified to build the railway. Recently[4], the Northland Regional Council formally agreed to proceed with the formation of a 50/50 joint venture to share the costs of designating land for the proposed Marsden Point 16 km long rail corridor. The designation will preserve the opportunity for the rail link to be built by central government and/or other funders at some time in future.

2.3 Existing Traffic Conditions

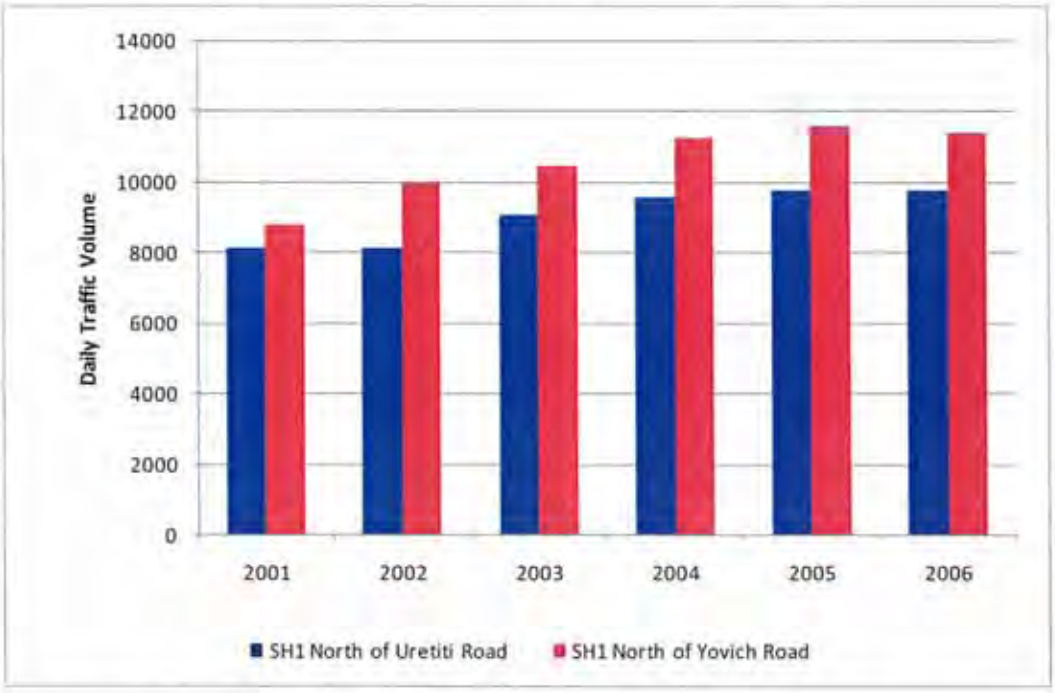
Existing traffic flow data has been obtained for SH1 and SH15A from the Transit New Zealand, Traffic Data Booklets. Count sites exist on SH1 to the north and south of SH15A, being at Yovich Road and Uretiti Road respectively. The count site located on SH15A is at One Tree Point Road.

Figure 3 and Figure 4 provides the two-way daily traffic volumes for SH1 and SH15A respectively.

[3] Information sourced from the website: http://www.nrc.govt.nz/Your-Council/Council-Projects/Marsden-Point-Rail-Link/

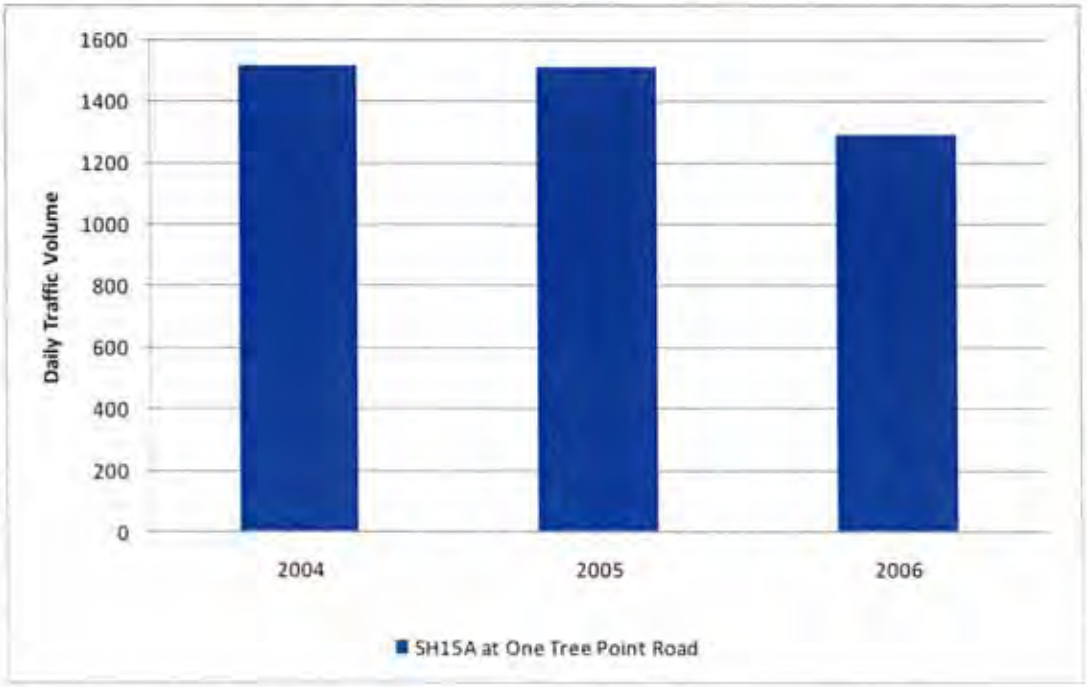
[4] At a meeting on 20 February 2008

Figure 3: Historical State Highway 1 Daily Traffic Flows – Two Way



The daily traffic volume along State Highway 1 to the south of SH15A is in the order of 10,000 vehicles per day. The daily traffic volume along State Highway 1 to the north of SH15A is in the order of 11,500 vehicles per day. An increase in traffic volumes each year occurred between 2001 and 2005. Traffic volumes for 2006 remained consistent with that in 2005. The major factor attributing to the growth in traffic can be attributed to the Marsden Port, which is discussed further below.

Figure 4: Historical State Highway 15A Daily Traffic Flows – Two Way



The daily traffic volumes along State Highway 15A are in the order of 1,300 to 1,500 vehicles per day. The daily traffic flow recorded in 2006 indicates a slight reduction to that observed in previous years. It has been assumed that the 2006 data could be light, and the typical daily traffic flow along SH15A is most likely closer to that observed in 2004 and 2005.

2.4 Freight Traffic

Northland relies heavily on road haulage to transport freight throughout the region, and to and from Auckland. Key industries associated with heavy traffic volumes include forestry, stock, dairy, horticulture, solid waste, heavy industry, tourism, school buses and passenger transport. Northland Regional Council has recently updated their Heavy Traffic Volumes Report (February 2007) which provides an overview of the regions trends, in particular Marsden Point's rising trends.

The report identifies that the current heavy vehicle percentage of SH1 is between 10% and 11%, with SH15A having a heavy vehicle percentage of 26% (approximately 400 heavy vehicles per day). The report explains the key reasons for this, which includes the following.

- Closing Port Whangarei (2004) shifted significant volumes of freight (primarily timber related) onto the State Highway road network to access Marsden Port (opened 2003). A consequence of the relocation to Marsden Port is a reduction (by half) in rail freight to Port Whangarei.
- The new port created demand for a new state highway connecting SH1 with Marsden Port. The construction of SH15A was completed in 2003/04 and it was designated as a state highway in 2005.
- Industrial development at Marsden Point is expanding. This includes heavy industry such as the fertiliser and cement works.

The report suggests that rail should be considered for the long term future for the region, by introducing a rail link from the Main Truck Line to Marsden Point, connecting Auckland to Marsden Port. Section 2.2.5 below provides details of the designation process that is to be initiated.

2.5 Traffic Safety

A crash analysis using the Land Transport New Zealand's crash analysis system (CAS) was conducted in the vicinity of the site. The area surveyed encompassed the One Tree point area. In total, there were 42 reported accidents over the past 5 years that resulted in injury: 4 fatal crashes, 8 serious crashes and 30 minor crashes.

In terms of location, the crashes were predominantly on or near intersections with Marsden Point Road (14 crashes), One Tree Point Road (8 crashes) and State Highway 1 (15 crashes). In comparison, SH15A had fewer crashes (3). A summary of the types of crashes is shown below in Table 3.

Table 3: Summary of Crash Types

Crash Type	Number of Crashes	% of Total Crashes
Overtaking	2	5%
Straight road, lost control/head on	7	17%
Bend, lost control/head on	15	36%
Rear end/obstruction	9	21%
Crossing / turning	6	14%

Table 3: Summary of Crash Types

Crash Type	Number of Crashes	% of Total Crashes
Pedestrian crashes	3	7
Miscellaneous crashes	0	0
Total	42	100 %

In more detail, the predominant cause of accidents was losing control at either a straight road or a bend. This accounted for 53% of all accidents in the area. Specifically, on One Tree Point Road, 75% of the crashes were due to loss of control, as were the majority of accidents in the vicinity of Ruakaka Beach and on Marsden Point Road. There were a broad range of factors influencing these crashes, including alcohol, fatigue, poor tyre conditions, excessive speed and driver inattention. Of these, it is estimated that 29% of crashes involved alcohol and 52% of crashes involved poor observation. This is typical of rural roads, as the higher speed limit means that little errors are more likely to result in serious crashes.

There did not seem to be much correlation between road conditions and the accidents. Accidents were spread throughout the day and most accidents were in fine weather.

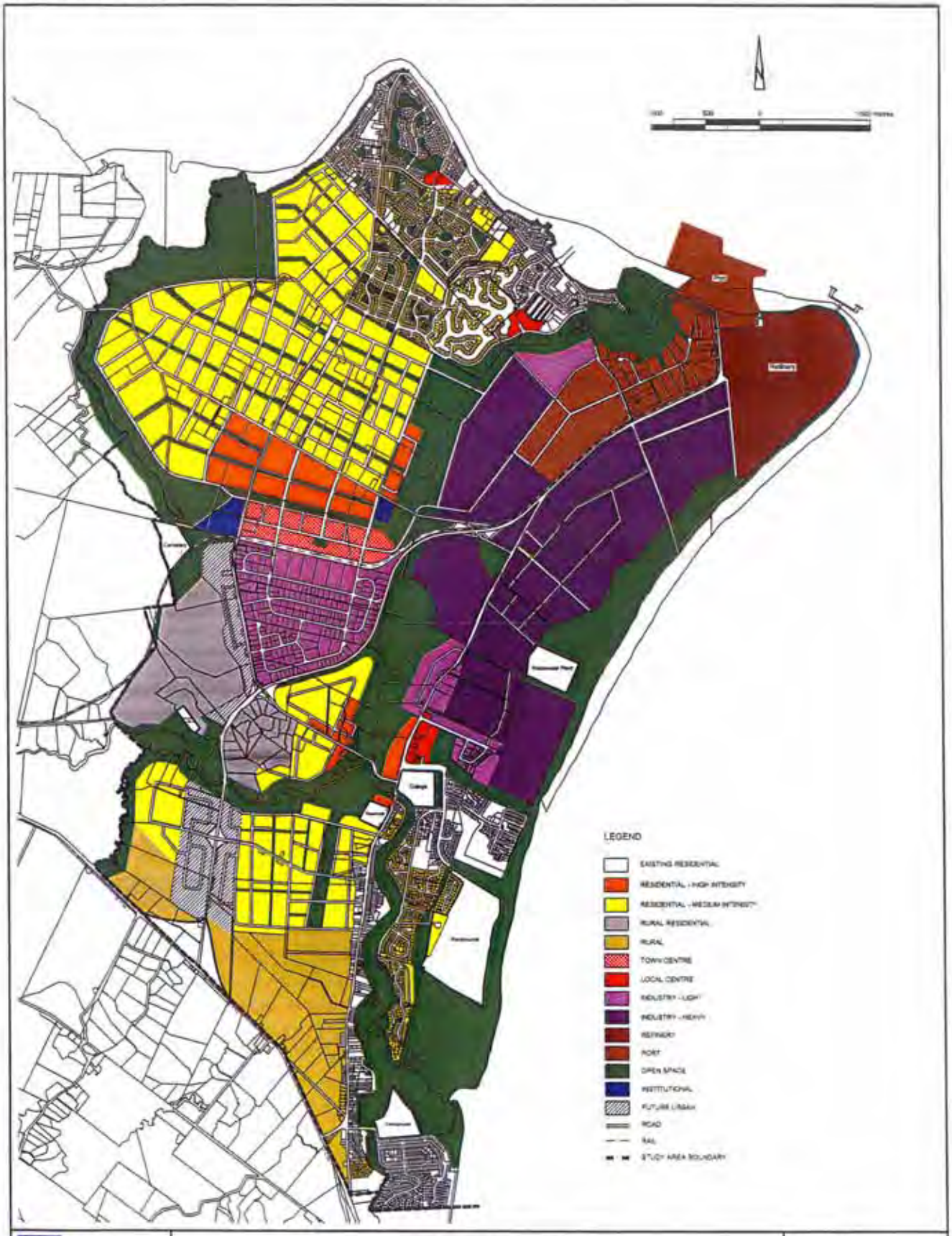
3 PROPOSED STRUCTURE PLAN

3.1 Development Description

The land uses proposals of the Structure Plan are shown in Figure 5 overleaf.

Almost all of the industrial, port and refinery land uses are already zoned. Current or approved residential subdivisions are shown with the details of local roads.

Figure 5: Structure Plan Land Uses



terra nova PO Box 466 Orewa 0946	Marsden Point - Ruakaka Structure Plan: 2008	Prepared for Whangarei District Council
	Plan 6: Land Use Proposals	Date June 2008 Scale 1:20 000 @ A3 REV H

The new land uses in the structure plan that are different from SP2000 include the following.

- A new retail and commercial town centre is proposed to be located abutting the proposed rail line, including a passenger station in the town centre. Passenger services could connect to Whangarei and Auckland.
- Immediately to the north of the town centre is a high density residential area, providing some 1,846 dwellings to the east, north and west of the town centre. Further north is medium density residential. A local neighbourhood centre is located at One Tree Point.
- Open space is provided throughout the structure plan.
- Educational land uses are included at the western end of the town centre (likely to be tertiary) and to the east of the high density residential area (likely to be secondary). Junior and primary schools will be provided but their locations are not shown in the structure plan.
- Immediately to the south of the town centre is (already zoned) light industrial land use, which will be able to make use of sidings abutting the rail line to transport freight by rail.
- Some high density residential and medium density residential land uses are proposed along McCathie Road and around the existing Ruakaka centre.
- Medium density residential and future urban land uses are located at the southern end of SH15A, in the vicinity of Salle Road.

3.2 Transport Opportunities and Constraints

Opportunities and constraints to the development of the transport network include the proposed rail line. The rail line acts as a boundary between the commercial/retail/residential areas of the Town Centre from industrial areas to the south, but will also provide for freight and passenger movement along the rail corridor. Three road crossings are proposed in the vicinity of the new Town Centre, including One Tree Point Road and two that will connect the industrial area with the Town Centre. All these road crossings will have footpaths and will also cater for cyclists.

SH15A is another transport related opportunity and constraint. It acts as a physical barrier, separating one community from another, but also provides access and stimulates demand for new development. Grade separated interchanges are likely to be provided at SH15A/McCathie Road/One Tree Point Road and at SH15A/McEwan Road (with the intersection of SH15A/Marsden Point Road being closed). Upgrades/changes to the intersections at SH15A/Salle Road and SH15A/One Tree Point Road/Rama Road will be required.

The viability of passenger transport will be affected by the staged growth of the area. Ideally, passenger transport services would be provided from the outset of development to ensure that residents and workers are used to using passenger transport. This will be helped if initial high density development is focused along the passenger transport corridors.

3.3 Reasons for Land Use Location and Density

The port and adjacent heavy industrial land uses provides the impetus for a local work force to be provided in close proximity. The workforce requires supporting land uses including housing, retail, education, commerce, entertainment and open space. The location of the Town Centre, providing mainly retail and commercial activity is situated with a focus on a town square and train station. The station is intended to become a hub for passenger (train and bus) transport and a "centre" for the town, together with other amenities and community facilities.

The density of the town centre is estimated to be 50 employees per hectare. This is typically supportive of local bus services[5]. The high residential density at some 28 units per hectare supports active trips to the town centre and is typically supportive of a premium bus service.

Facilities that enable high speed broadband connections that allow working from home, shopping at home, etc and thus reduce vehicle trips should be provided to all homes, education, commercial and retail establishments.

3.4 Urban Design Opportunities and Constraints

Urban design, involving the design and placement of buildings, roads and open spaces in town and cities to create desirable places in which to live, work and play is concerned with urban and rural structure, the pattern of buildings, open space and movement networks, and how roads, open spaces and building interact, appear and function.

3.5 Spatial Location of Community Facilities, Residential Areas, Employment Areas, Education and Recreation

Local community education, retail, recreation and other facilities should be provided throughout to reduce the length of trips and enable accessibility by walking and cycling. Locating these facilities close to bus stops and the walking and cycling networks allows people to access these amenities using passenger transport and active modes, as well as providing an active setting for those using the bus and then walking to their destination.

3.6 Travel Characteristics

The road network developed uses the current road network within One Tree Point as a platform and adds to it to enable connectivity between local land uses and the state highway network. The One Tree Point area has two major physical barriers that prevent connectivity between the north-west areas of One Tree Point and the south-east areas of One Tree Point. The barriers are SH15A and the future proposed rail line that connects the main trunk line with Marsden Port.

The crossing locations of these barriers need to provide safe environments for all modes of transport, being vehicles, cyclists and pedestrians. Providing safe efficient crossing locations for cyclists and pedestrians will encourage active modes, therefore assisting in achieving a sustainable development.

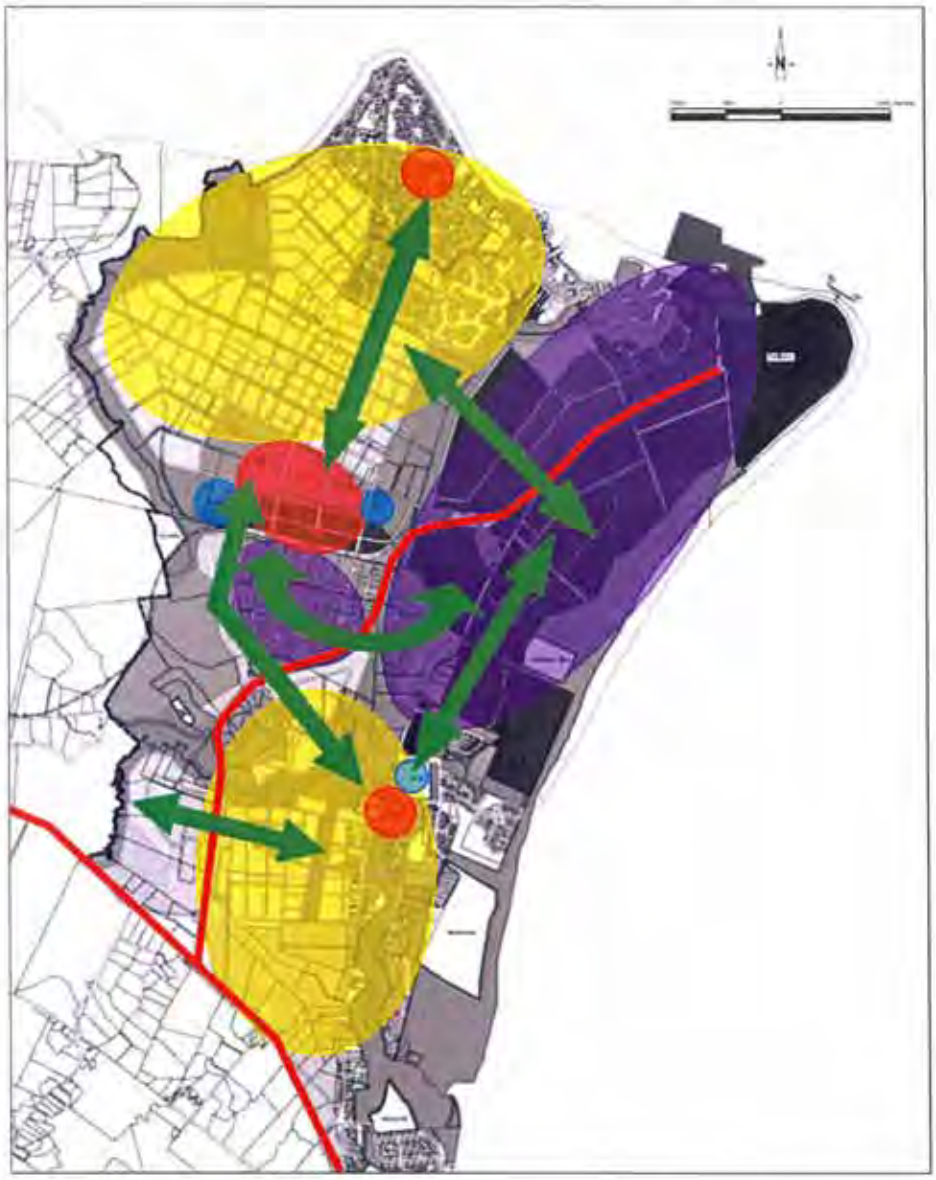
The road network has considered the following internal land use connections:

- Connections between the residential areas located south of One Tree Point Road with the Town Centre, institute, industrial and residential areas located north of One Tree Point Road.
- Connections between the residential areas located north of One Tree Point Road with the industrial areas located to the east of SH15A.
- Connections between the residential areas located south of SH15A with the industrial areas located to the east of SH15A.
- Connections between the Town Centre and the One Tree Point Centre located at the northern tip.
- Connections between the industrial areas located to the west and east of SH15A.

[5] Household and Employment Densities Required in High Density Centres and Corridors to Support the Passenger transport System, Auckland Regional Council

Figure 6 illustrates the connectivity considered (using green arrows) between the different activities that exist or are proposed for the structure plan area.

Figure 6: Internal Land Use Connectivity



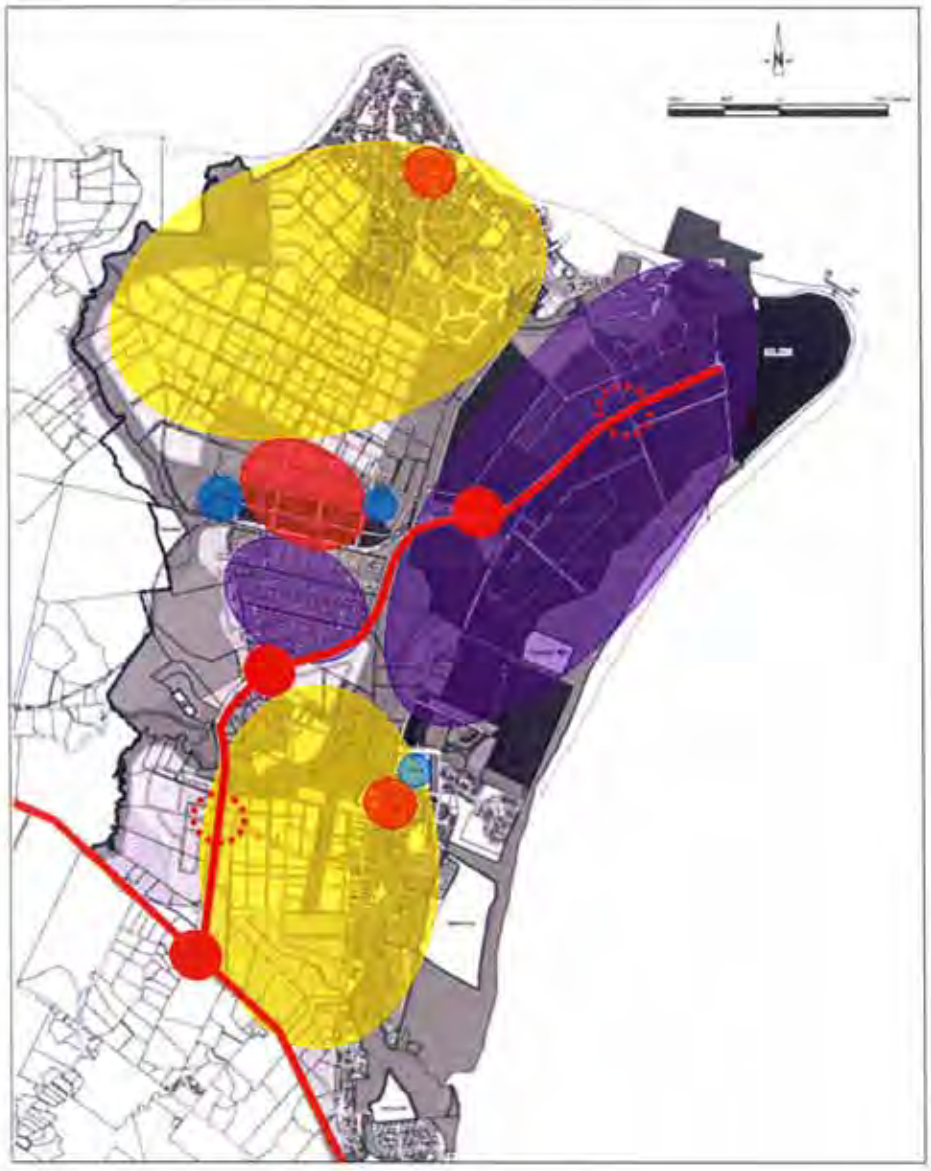
In addition to these internal connections, there also needs to be connectivity with the rest of the region, accessed via SH15A and Marsden Point Road to SH1, via the proposed rail line and via the deep water port.

It is considered necessary to provide several locations within the area for people to access or exit SH15A. The connections to and from the strategic SH15A network have concentrated on the areas that already provide connection or crossing points on SH15A. Two primary interchange locations that will help serve the area are proposed at One Tree Point Road and McEwan Road. These interchanges will be grade separated, providing for all movements, and are suitably spaced apart between SH1 and each other. These interchanges provide connectivity between the residential and business areas and the state

highway network, whilst also providing crossing points across the state highway and rail line barriers for local traffic.

Two other locations that require connection or crossing of SH15A include Salle Road and One Tree Point Road north. The design and limitation on permitted traffic movements at these locations will be progressed by Transit New Zealand, and will also be determined by other factors such as rail sidings, and land ownership. The assessment of future SH15A interchange locations will be assessed by Transit, within the SH15A Strategy Study, which is likely to start mid to late 2008. This study will provide further details as to the proposed crossing point locations along SH15A, as well as the permitted movements allowed at each interchange. Figure 7 illustrates the interchange locations. The One Tree Point Road and Marsden Point Road/McEwan Road interchanges are highlighted in bold red, whilst the interchanges that require further Transit and key stakeholder input (Salle Road and One Tree Point Road north) are highlighted using a red dotted circle.

Figure 7: State Highway Interchange Locations and Connectivity



3.7 Road Network

The road network internal to the Structure Plan area has primarily been based on the current road network. The new roads proposed within the Structure Plan provide a comprehensive road network with clear and legible connectivity between land uses.

The objectives of roads, as stated within the Whangarei District Plan, Part 1, Appendix 9 are to:

a) Ensure safe and efficient movement of people, vehicles and goods, with minimum adverse effect on the environment;

b) Provide for network utilities, subject to objective (a).

The layout of the transport network for the Structure Plan area has considered the objectives above and the existing road hierarchy used in the Whangarei District Plan.

The Whangarei District Plan, Part 1, Appendix 6 provides the road hierarchy used in Whangarei. Four road categories are defined in the District Plan, and are as follows.

- State Highways
- Arterial Roads
- Collector Roads
- Local Roads

The function of each of the road category is provided below.

State Highways form part of a national network of strategic importance and transport a very high proportion of through traffic. They should be designed for safe and efficient operation at high speeds. Access to abutting land may be controlled so that the operational efficiency of the road is not impaired.

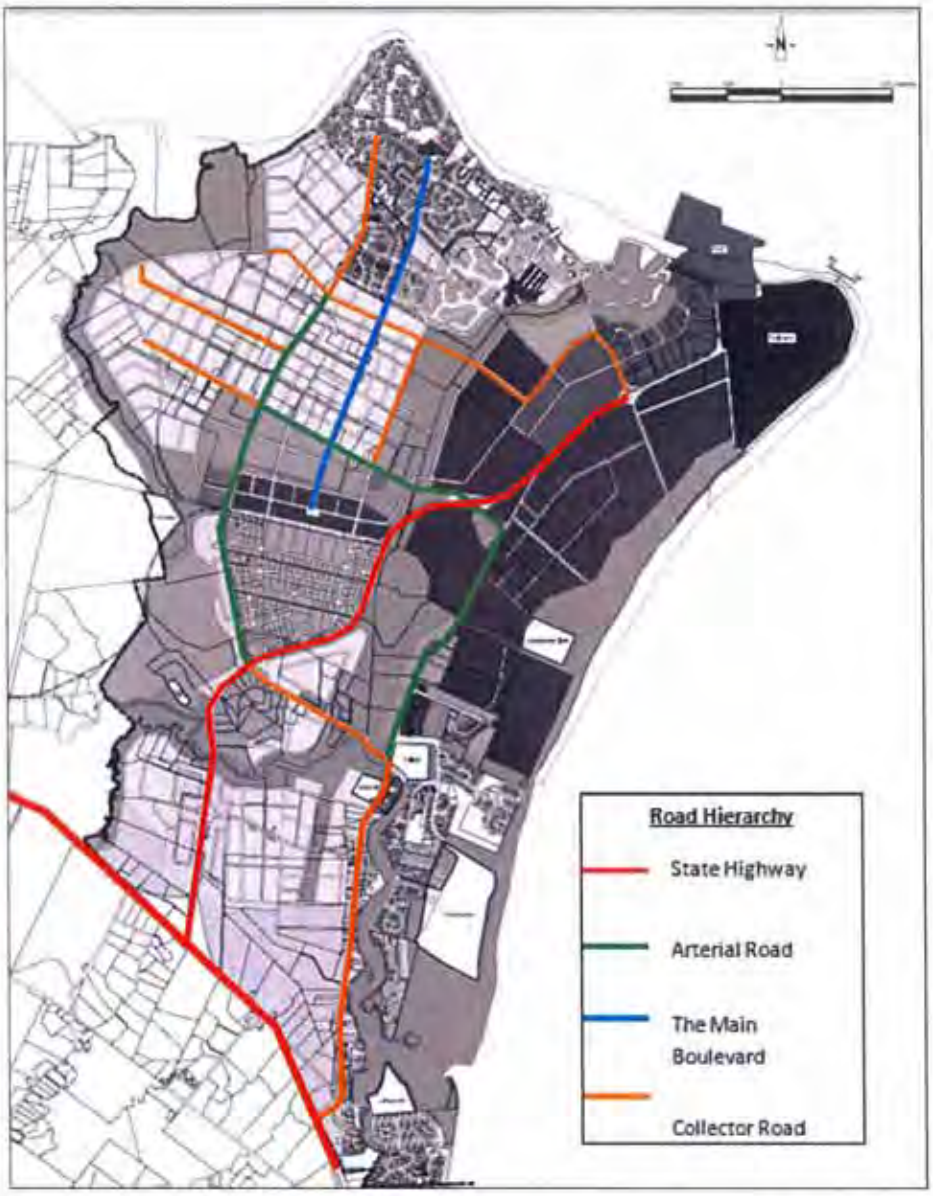
Arterial Roads cater mainly for traffic between major nodes or suburbs. These roads carry a high proportion of through traffic and should be designed for safe and efficient operation at moderate speeds. Arterial Roads traffic volumes range between 5,000 and 25,000 vehicles per day.

Collector Roads collect traffic from local roads and distribute traffic from the arterial roads. They also act as local main roads, supplementary to the primary network. Traffic flows on Collector Roads typically range between 2,000 and 10,000 vehicles per day.

The main function of **Local Roads** is to give access to abutting land and they have limited (if any) through traffic. Local Roads should be designed for safe and efficient operation of motor vehicles at low speeds, allowing for easy and safe movement around neighbourhoods by pedestrians and cyclists. Traffic volumes on Local Roads are generally less than 1,500 vehicles per day, and can be as low as one or two hundred vehicles per day.

The road hierarchy for the Structure Plan area road network is illustrated in Figure 8.

Figure 8: Structure Plan Road Hierarchy



"The Main Boulevard" is defined as an arterial type road as it links the Town Centre with the One Tree Point local centre, providing for the safe movement of people using all modes of transport, with a particular emphasis on buses, cycling and walking. A single vehicle lane per direction, cycle lanes and shared cycle/pedestrian paths will provide connectivity with the residential areas along the route, whilst also providing a vibrant environment for users of The Main Boulevard. Intermittent parking and bus bays will be provided through indents into tree-planted berms. Further details of the provisions within the road reserves of the major roads are provided in Section 4.6 below.

3.8 Passenger Transport Provisions

3.8.1 Buses

Possible bus routes for the Structure Plan area have been developed. Bus services should operate as soon as major trip generating activities within the area are initiated.

The following has been taken into account in developing bus routes for the Structure Plan area.

- The intersection control along the route. For example, it is preferable that buses turning right predominantly do so at signalised intersections.
- Penetration into the key residential areas, such as the high density area.
- Connection between the Town Centre and the retail/commercial node at One Tree Point.
- Connection between the educational facilities and the residential areas
- Connections between key external nodes and the Town Centre

Proposed bus routes are shown in Figure 9.

Figure 9: Proposed Structure Plan Bus Routes

A description of each route is detailed in Table 4, with the proposed frequencies.

Table 4: Bus Route Description

Route Colour	Description	Peak Period Frequency	Interpeak / Shoulder Frequency
Red	Connects Ruakaka with the Town Centre and One Tree Point Centre	15 minutes	30 minutes
Blue	Connects Whangarei with the Town Centre	30 minutes	60 minutes
Yellow	Ring Route: to be run in both directions. Connects residential, Town Centre, Industrial and Education	15 minutes	30 minutes
Green	Town Centre and High Density ring route	10 minutes	20 minutes

3.8.2 Trains

Once the rail line is constructed, passenger services will be possible to and from Whangarei and Auckland.

3.9 Walking Environment

Pedestrian amenity is a key factor for the success of the development as many trips will be made by foot, and most trips made by passenger transport will involve walking to some degree. The provision of good, convenient and safe facilities for pedestrians and cyclists is essential and the emphasis is on simple permeable street and off road layouts that will provide direct access to amenities and passenger transport, with suitable priority, safety and security.

3.10 Cycle Network

A cycle network for the area should be comprehensive and provide for all different types of users (commuter, school, recreational, fitness etc) with easy to navigate and safe routes to all areas.

Cycle facilities (on and off road) will be provided along The Main Boulevard, connecting the One Tree Point centre through the residential areas to the Town Centre.

Off road shared cycle/footpaths will be provided through the open space networks, which also provide corridors for the water management system. Where these cross main roads, it may be feasible to provide cycle/footpath grade separated crossings beneath the road, as well as providing them at grade, at signalised crossings or mid block facilities, as appropriate.

3.11 Freight Traffic

Freight traffic will generally use the rail line (once constructed), SH15A and the primary routes. Freight traffic will not be encouraged to use the residential streets, which will have a "people" focus.

3.12 Commercial Traffic

Commercial traffic will be encouraged to use the primary routes through the design of residential streets having perceived and real narrow lane widths and traffic calming (if necessary) to reduce any rat running.

3.13 Means to Influence Travel

A key aspect of the design of the structure plan area has been the consideration and integration of infrastructure and land use that will support efficient and ecologically aware means of travel to, from and within the area. Transport demand management (TDM) is a general term for strategies that result in more efficient use of transportation resources. These strategies might be aimed at creating liveable communities, improving personal security, improving traffic safety, reducing vehicle energy consumption and emissions, improving public health, reducing congestion and addressing parking problems. Typically the measures that are used for one strategy will often contribute to other strategies. TDM includes a whole range of measures, generally encompassing reducing the need to travel, providing appropriate options for travel, influencing travel choices, and pricing.

Reducing the need to travel can be achieved through the provision of land uses that enable multi purpose trips and can also be achieved through the use of telecommunications for work and shopping, etc. Providing for travel choices has been considered in the design and layout of the area, including the provision of a comprehensive pedestrian network, cycle facilities, bus and rail infrastructure and services, telecommunication facilities and a safe road network. Influencing travel options has been considered in the design through considering pedestrians, cyclists and passenger transport users as top in the transport hierarchy. Parking provision and management can also influence travel choice – providing less or charged parking at the destination end of the trip, ie work, school, shops, etc discourages car use and also less parking discourages car ownership at the origin end of the trip, ie home.

3.14 Off Street Parking

Parking requirements will be as per the District Plan. Where appropriate, consideration should be given to offsetting parking requirements with walk and cycle facilities (secure, covered cycle sheds, showers, lockers and changing facilities). These facilities need to be provided in an appropriate and easy to use location and be of a suitable standard to encourage more sustainable travel habits.

3.15 On Street Parking

On-street spaces on public roads are always unallocated although they can be reserved for a particular purpose such as residents' parking. On-street parking does make a valuable and flexible contribution to the overall supply of parking and need not be problematic, especially when streets are designed so that traffic speeds are kept low and adequate space is allowed for moving vehicles and pedestrians. Residential overflow and visitor parking will be provided for on street and could have resident permit and or time restrictions imposed in certain locations to prevent this parking being used as all day parking by employees, school staff or students.

Time restricted parking will be parking may be required in the areas where local shops, medical services, etc are provided. Space will be set aside for mobility impaired and taxi parking.

4 IMPACT ASSESSMENTS

4.1 Environmental Assessment

The provision of well integrated walking and cycling networks, and passenger transport infrastructure and services will help to minimise noise and air quality effects of those living and working within the area.

4.2 Safety Assessment

The design of the road, cycle and pedestrian networks will be undertaken to appropriate standards. Signal controlled pedestrian crossings will be provided at key intersections. Cycle lanes will be provided along The Main Boulevard, with off road shared cycle/pedestrian paths provided along most of the open space connections.

Potential conflicts between pedestrians, cyclists and other vehicles will be minimised through appropriate design of minor roads, the location of building accesses and the provision of well marked and signed pedestrian crossings.

4.3 Accessibility Assessment

Local amenities, including schools, shops, open space, passenger transport and work opportunities are provided within the structure plan area and can be easily accessed by walking, cycling, and the proposed passenger transport services. The Town Centre will be easily accessed by walking, cycling, (future) rail and bus. Bus services will connect the residential areas with the port and adjacent industrial areas. . In addition, the roading network will provide a comprehensive system, connecting to SH1 via SDH15A and Marsden Point Road as well as throughout the area.

4.4 Integration Assessment

The focus on sustainable means of travel is a key component of many regional and local policies and strategies. The residential areas link well to the Town Centre and secondary/tertiary education facilities, as well as to the proposed bus routes. The integration of community facilities and employment opportunities with the structure plan area will reduce the need to travel by car for work, shopping, education, recreation and leisure.

4.5 Economic Assessment

Walking, cycling and the use of high occupancy vehicles (buses and through ride sharing) will allow a more efficient use of resources than single occupant cars.

The mix of land uses within the structure plan area will promote local commuting and reduce pressure to build new roads.

4.6 Traffic Impact Assessment

4.6.1 Traffic Modelling

The road and intersection layouts proposed for the Structure Plan area have been developed and tested in Whangarei District Council's 3-Step Transportation Model operated by Gabites Porter. The TRACKS model has recently been updated (December 2006) to reflect a validated base year of 2001, with the model boundary being extended to incorporate the extent of the Whangarei District.

In order to accurately model the proposed Structure Plan, the road network and land use pattern within the Structure Plan area has been further refined. The detail of the land use pattern used is discussed within the following sections.

4.6.1.1 Time Periods Modelled

The AM (0700 to 0900) and PM (1600 to 1800) periods have been modelled with the peak hour totals being presented. The AM peak hour is assumed as 0800 to 0900, with the PM peak hour being 1700 to 1800. The AM and PM period totals have been used in conjunction with the interpeak model (0900 to 1600) to derive daily traffic volumes.

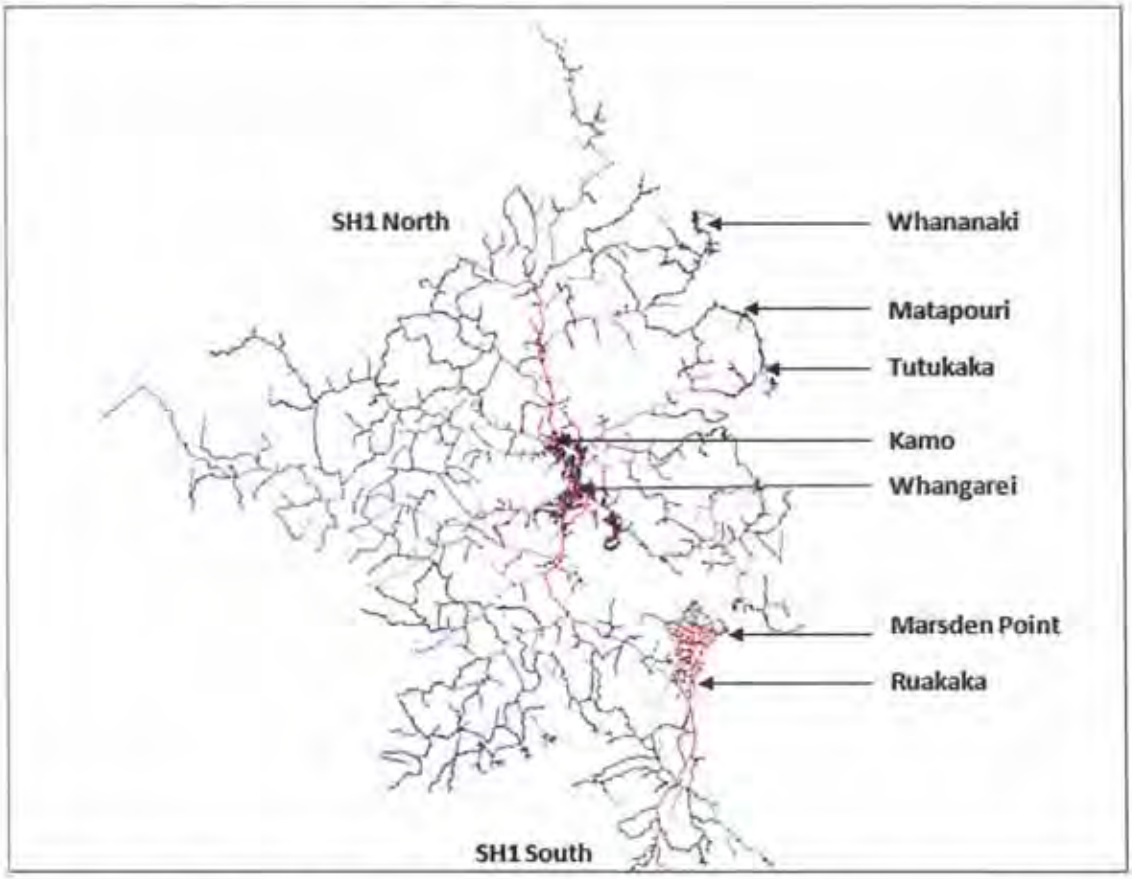
The 2021 future year Whangarei model (also developed by Gabites Porter) has been used to provide background traffic and regional transport projects.

The Marsden Point - Ruakaka Structure Plan assessment has been modelled assuming that the Structure Plan area is 100% populated. Modelling the area fully populated allows a clear understanding of what roading infrastructure is necessary in the future to enable the road network to operate efficiently and safely. It allows sufficient intersection and interchange footprints to be identified today, so that when development progresses, it does so whilst not intruding onto land needed for future roading infrastructure upgrades.

4.6.1.2 Modelled Network

The Whangarei District TRACKS model has been used as a basis with which to assess the predicted vehicle volumes associated with the proposed Marsden Point - Ruakaka Structure Plan. The Whangarei model has been validated by Gabites Porter, with the model being reviewed by Traffic Design Group (in 2006) and accepted for the purposes of providing supportive information to transport related local and regional projects. Figure 10 provides the extent of the Whangarei wider area model.

Figure 10: Extent of Whangarei District TRACKS Transport Model



The road layout of the Structure Plan area has been updated within the TRACKS model to reflect the road layout proposed in the Structure Plan. The updated road layout of the Whangarei District model is illustrated in Figure 11. The roads modelled represent the state highway, arterial and collector roads only. The local residential roads have not been assessed within the model, although have been developed to provide a comprehensive network of vehicle, pedestrian and cycle connections.

Figure 11: Updated Model Road Layout

4.6.1.3 Land Use Pattern Definition

Initially there were 52 land use points for loading traffic onto the road network for the Structure Plan area. The number of land use points has been increased to 67 zones, with each key land use area being represented by one or more traffic loading locations.

4.6.1.4 Transport Model Inputs

The Structure Plan's proposal land use capacities, as calculated by Terra Nova Planning provide the basis for the modelling inputs. Capacities include household, population, land use and employment details. Land use capacities used in the assessment are included in Appendix B.

The home based trips have been based on vehicle ownership and population inputs. The employment related trips have been based on employment density, being the number of jobs per hectare. Table 5 summarises the expected population and employment numbers when the Structure Plan area is 100% populated. These numbers have been broken down into areas and land use, and are provided in Appendix B.

Table 5: Land Use Capacity Summary

Activity	Assumptions	Population	Employment	
			Low	High
Residential – Medium Intensity	14 households / gross hectare. 2.5 persons per dwelling	28,760	N/A	
Residential – High Intensity	28 households / gross hectare. 2.5 persons per dwelling	5,740		
Residential - Rural	2 households / gross hectare. 2.5 persons per dwelling	1,225		
Retail / Commercial	50-100 * persons employed / hectare	N/A	2,280 – 4,560	
Light Industry	30-40 * persons employed / hectare		3,060 – 4,080	
Medium Industry	20 persons employed / hectare		1,960	
Heavy Industry	10 persons employed / hectare		6,300	
TOTAL		**35,725**	**13,600 – 16,900**	

* the employment density for retail and commercial was assumed to be 50 persons employed per hectare and light industry was assumed to be 30 persons employed per hectare in the strategic transport model. Greater densities would encourage further local commuting.

4.6.1.5 Verification of Model Outputs

Flow provided the land use detail inputs per zone (within the Structure Plan area) to Gabites Porter, to include in the transport modelling using the Whangarei District TRACKS model. Gabites Porter ensured that the model converged when including the future land use assumptions.

Home based vehicle trips produced by the modelling process within the Structure Plan area have been assessed and verified by Flow. Table 6 summarises the modelled traffic generation rate and distribution for the residential land use activities within the Structure Plan area. The table compares the modelled outputs from the Gabites Porter model with trip generation rates documented within industry guidelines, being:

- The Roads and Traffic Authority (RTA) Guide to Traffic Generating Developments; and
- The Institute of transportation Engineers (ITE) Trip Generation, 7th Edition.

Table 6: Residential Trip Assessment

Activity	Trip Rate Guideline[6]	Trip Rate Modelled		Distribution Guideline[7]				Distribution Modelled			
	Peak Hour	AM Peak	PM Peak	AM In	AM Out	PM In	PM Out	AM In	AM Out	PM In	PM Out
Medium Intensity	0.85	0.8	0.9	26%	74%	64%	36%	17%	83%	69%	31%
High Intensity	0.50 – 0.65	0.6	0.6	17%	83%	63%	37%	17%	83%	69%	31%
Rural	0.85	0.8	0.9	26%	74%	64%	36%	17%	83%	69%	31%

[6] RTA Guideline. Medium Intensity and Rural Residential use rates specified for Dwelling Housing. High Intensity uses rates specified for Medium Density Residential Flat Building, with larger units.
[7] ITE Guideline. Medium Intensity and Rural Residential use distribution specified for Single Family Detached Housing. High Intensity uses distribution specified for Low Rise Apartment.

The model generally reflects the peak hour trip rates and distributions to that provided within the industry documentation.

4.6.2 Future Traffic Volumes

Predicted traffic volumes have been assessed for the Structure Plan area. The predicted flows represent a 100% populated scenario, as opposed to a specific year, such as 2021. The background traffic in the model (for the entire Whangarei District) uses 2021 demands.

Predicted traffic volumes for the Structure Plan area (assuming the area is 100% populated) are provided at Appendix C for the AM, PM and Daily periods.

4.6.2.1 State Highway Traffic Volumes

The future traffic volumes using State Highway 1 (SH1) and State Highway 15A (SH15A) have been predicted by the model for the main sections of highway, when the Structure Plan area is fully developed.

The predicted state highway traffic volumes are summarised below.

- Future daily traffic volumes for SH1, between Whangarei and SH15A are predicted to be around 26,500 vpd.
- Future daily traffic volumes for SH1, to the south of SH15A are predicted to be around 15,000 vpd.
- Future traffic volumes for SH15A are predicted to be above 12,000 vpd along the entire route. The busiest section is between SH1 and One Tree Point Road with a predicted daily volume of 30,000 vpd.

Table 7 summarises the predicted two-way AM, PM and annual daily traffic volumes (ADT) on the state highways.

Table 7: Traffic Volume Summary – State Highways (Predicted Two-Way Volumes) 100% Populated Development

Road	Section	AM Peak (vehicles per hour)	PM Peak (vehicles per hour)	Daily Volume (vehicles per day)
SH1	North of SH15A – To Whangarei	450	2,200	26,500
	South of SH15A – To Wellsford	1,000	1,300	15,000
SH15A	Between SH1 and One Tree Point Road	1,900	2,600	30,000
	Between One Tree Point Road and McEwan Road	1,300	1,300	13,500
	Between McEwan Road and Marsden Port	1,800	1,650	21,000

4.6.2.2 Structure Plan Area Traffic Volumes

The predicted two-way AM, PM and daily traffic volumes for selected roads within the Structure Plan area are presented in Table 8. Plots providing predicted traffic volumes for all the modelled roads are provided in Appendix C.

Table 8: Traffic Volume Summary – Predicted Two-Way Volumes, 100% Populated Development

Road / Section	AM Peak (vehicles per hour)	PM Peak (vehicles per hour)	Daily Volume (vehicles per day)
One Tree Point Road – between SH1 and Town Centre	1,650 – 2,100	2,300 – 2,450	23,500 – 25,000
McEwan Road – between Pyle Road and Marsden Point Road	1,500 – 2,000	1,750 – 2,300	15,000 – 27,000
One Tree Point Road – between Town Centre and Pyle Road West	600 – 2,100	550 – 2,050	4,850 – 21,000
McCathie Road	850 – 1,000	750 – 1250	6,500 – 8,000
Takahiwai Road	800 – 1,700	600 – 1,200	6,000 – 12,750
Marsden Point Road	550 – 2,000	650 – 1,800	5,500 – 16,750
Pyle Road East (The Main Boulevard)	500 - 650	550 – 1,000	5,000 – 9,250
Salle Road	50 – 800	50 – 1,100	1,000 – 10,750
One Tree Point Road – northern section	50 – 150	50 – 150	100 – 1,100

4.6.3 Midblock Lane Requirements

For strategic planning purposes lane requirements for key roads within the Structure Plan area have been determined using the peak hourly traffic volume outputs from the AM and PM peak Whangarei District Transportation models and level of service (LOS) criteria for urban and rural roads from the RTA Guide to Traffic Generating Developments. The urban road criteria has been used to assess the lane requirements within the Structure Plan area, except for SH15A, where lane requirements are based on the criteria provided within Transit New Zealand's Planning and Policy Manual. The AUSTROADS[8] description of level of service is outlined in Table 9, together with the RTA Guide peak hourly flows (vehicles per hour) for each level of service.

Table 9: RTA Criteria – Level of Service – Urban Roads

Level of Service	AUSTROADS Description	Urban road peak hour flows per direction	
		One Lane (veh/hr)	Two Lanes (veh/hr)
LOS A	Free flow in which drivers are *virtually unaffected* by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high and the general level of *comfort and convenience is excellent.*	200	900
LOS B	Stable flow where drivers still *have reasonable freedom* to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is less than LOS A.	380	1,400
LOS C	Stable flow but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience has declined noticeably.	600	1,800
LOS D	Approaching unstable flow where all drivers are severely	900	2,200

[8] AUSTROADS *Guide to Traffic Engineering Practice – Part 2: Roadway Capacity* (1988)

Table 9: RTA Criteria – Level of Service – Urban Roads

Level of Service	AUSTROADS Description	Urban road peak hour flows per direction	
		One Lane (veh/hr)	Two Lanes (veh/hr)
	restricted in their freedom to select desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor and small increases in traffic flow will cause operational problems.		
LOS E	Traffic volumes are at or close to capacity and there is virtually no freedom to select desired speed and to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause break-downs in operation.	1400	2,400
LOS F	Forced flow. The amount of traffic approaching a point exceeds that which can pass it. Flow break-downs occur, and queuing and delays occur.	>1,400	>2,400

The development of the number of lanes required (excluding the State Highway) has been based on LOS D, whereby the trigger to allow for two lanes per direction is when hourly traffic volumes exceed 900 vehicles per hour.

Exceptions have been made in certain areas of the network where traffic volumes suggest 2 lanes are required, however only 1 lane has been proposed. This has only been included on short sections of road where bus routes are proposed. For example, a route predicted to carry 1,000 vehicles per hour in one direction may warrant two general traffic lanes based on the LOS D criteria, however with a passenger transport service proposed for the route, it would be best to provide one general traffic lane, along with bus priority measures.

The assessment for the number of lanes required along SH15A refers to the criteria provided within Transit's Planning and Policy Manual. The criteria for 4-laning for rural and peri-urban environments states: "*On national state highways with flat road gradient, four laning may be considered where traffic flow over the next 30 years is projected to be over 12,000 vpd. However it will generally become a likely option where projected traffic flow is 20,000-25,000 vpd*". This has been taken into account in the number of lanes recommended.

The number of general traffic lanes (excluding cycle lanes, parking and bus priority measures) predicted for the state highway, arterial, boulevard, collector and local roads is indicated in Figure 12.

Figure 12: Directional Midblock General Traffic Lanes Required

The number of lanes planned for the key roads is summarised below.

Table 10: Number of Lanes for Key Roads

Road	Modelled 2-Way Traffic Flow (vpd)	Recommended Number of Lanes
SH1, south of SH15A	14,800 to 16,500	4 general traffic lanes (2 may be sufficient depending on % of trucks)
SH1, north of SH15A	26,400	4 general traffic lanes
SH15A, south of One Tree Point Road	29,000 to 31,000	4 general traffic lanes
SH15A, between One Tree Point Road and McEwan Road	12,200 to 13,400	4 general traffic lanes (2 may be sufficient depending on % of trucks)
SH15A, north of McEwan Road	18,900 to 21,600	4 general traffic lanes
One Tree Point Road, between SH15A and Town Centre Main Street	23,500 to 24,900	4 general traffic lanes
One Tree Point Road, between Town Centre Main Street and Takahiwai Road	19,800	4 general traffic lanes
The Main Boulevard (Pyle Road)	3,900 to 9,200	2 general traffic lanes (2.0 m wide parking and 1.8 m wide cycle lane would allow bus/HOV lanes to be provided in future, if required)
Takahiwai Road	6,.000 to 12,800	2 general traffic lanes with an extra eastbound lane to the west of One Tree Point Road
McEwan Road, between Marsden Point Road and the eastern North-South collector	18,200 to 26,700	4 general traffic lanes
Marsden Point Road, between McCathie Road and McEwan Road	16,500 to 16,700	4 general traffic lanes

Other roads in the Structure Plan area will generally not require more than two general traffic lanes. Localised widening at intersections may be required; the key intersection layouts are assessed in Section 4.6.5 below.

4.6.4 Road Cross Sections

Indicative cross sections of roads have been developed for the key roads within the Town Centre and typical roads within the residential areas, as detailed below in Table 11. In addition, auxiliary turn lanes will be required at key intersections. Right turn bays may be required at minor road intersections.

One way streets, wide raised medians and split carriageways (eg either side of parks) should be avoided as inexperienced drivers can drive along them in the wrong direction. Kerbside berms should be of sufficient width to provide a minimum of 1.0 m clearance to tree trunks and trees should be located mindful of street lighting design. Generally the minor road carriageway widths are recommended to be 5.5 to 6 m with indented parking bays. No stopping restrictions will need to be imposed where the carriageway is 6 m wide or less. Speed calming should be considered for The Main Boulevards, park roads and minor residential streets, as appropriate to the conditions.

Table 11: Indicative Road Reserve Cross Sections

Road	Nature	Indicative Road Reserve Cross Section Components									Total Road Reserve
One Tree Point Road, between SH15A and Town Centre Main Street	Arterial road, carrying buses, commercial, freight traffic. No private vehicle access.		3 m shared cycle/ footpath	2.5 m indented bus stops / berm	2 x 3.5 m traffic lanes	No median	2 x 3.5 m traffic lanes	2.5 m indented bus stops / berm	3 m shared cycle/ footpath		25 m
One Tree Point Road, between Town Centre Main Street and Takahiwai Road	Arterial road, carrying buses, commercial, traffic. Limited private vehicle access.	3 m shared cycle/ footpath	2.2 m indented parking / bus stops	1.8 m cycle lane	2 x 3.2 m traffic lanes	2.6 m median / right turn bays	2 x 3.2 m traffic lanes	1.8 m cycle lane	2.2 m indented parking / bus stops	3 m shared cycle/ footpath	29.4 m
One Tree Point Road, north of Takahiwai Road	Arterial road residential traffic.	2.5 m shared cycle/ footpath	2.2 m indented parking	1.8 m cycle lane	3.2 m traffic lane	2.6 m median / right turn bays	3.2 m traffic lane	1.8 m cycle lane	2.2 m indented parking	2.5 m shared cycle/ footpath	22 m
Town Centre Main Street	Buses, retail, commercial. No private vehicle access	4 m footpath	2.2 m parking / bus stops	1.8 m cycle lane	3 m traffic lane	No median	3 m traffic lane	1.8 m cycle lane	2.2 m parking / bus stops	4 m footpath	22 m
The Main Boulevard	Arterial road carrying buses, active mode focus, residential traffic.	6.5 m shared cycle /footpath / trees	2.2 m indented parking / bus stops	1.8 m cycle lane	3.2 m traffic lane	2.6 m median / right turn bays	3.2 m traffic lane	1.8 m cycle lane	2.2 m indented parking / bus stops	6.5 m shared cycle /footpath / trees	30 m
			Possible future 4 m bus / HOV / cycle lane					Possible future 4 m bus / HOV / cycle lane			

Table 11: Indicative Road Reserve Cross Sections

Road	Nature	Indicative Road Reserve Cross Section Components									Total Road Reserve
High Density Residential North-South Boulevards	Collector road active mode focus, residential traffic.		6 m shared cycle/ footpath / trees	2.2 m indented parking / berm	3.2 m traffic lane	2.6 m median / right turn bays	3.2 m traffic lane	2.2 m indented parking / berm	6 m shared cycle/ footpath / trees		25.4 m
Medium Density Residential North-South Boulevards	Collector road, residential traffic.		3 m shared cycle/ footpath / trees	2.2 m indented parking / berm	3.2 m traffic lane	2.6 m median / right turn bays	3.2 m traffic lane	2.2 m indented parking / berm	3 m shared cycle/ footpath / trees		19.4 m
East-West Park Roads – Southern Side	Active front, residential focus.	8 m shared cycle/ footpath / trees	2.2 m indented parking / berm	6 m carriageway	2.2 m indented parking / berm	Park					18.4 m
East-West Park Roads – Northern Side	Active front, residential focus.					Park	2.2 m indented parking / berm	6 m carriageway	2.2 m indented parking / berm	3 m shared cycle/ footpath	13.4 m
Minor Residential Streets	Residential.			2 m footpath	2.5 m indented parking / berm	5.5 to 6 m carriageway	2.5 m indented parking / berm	2 m footpath			14.5 to 15 m

4.6.5 Key Intersection Layouts

The key intersections within the Structure Plan area have been assessed in detail. The predicted traffic flows modelled in the Whangarei District Model (which assumes the Structure Plan area is 100% developed according to the Structure Plan) have been extracted and input into isolated intersection traffic modelling software (SIDRA). The intersection layout and type of control proposed for the intersection is based on a 100% populated development. The timeframe in which the control needs to be implemented will be dependent on the take-up of the development, and has not been assessed within this document.

The SIDRA analysis has enabled the indicative intersection lane layouts and performance to be assessed and reported on. The road hierarchy proposed and the predicted traffic flows output from the regional traffic modelling provides an understanding of the locations of the key intersections. The key intersections are detailed below.

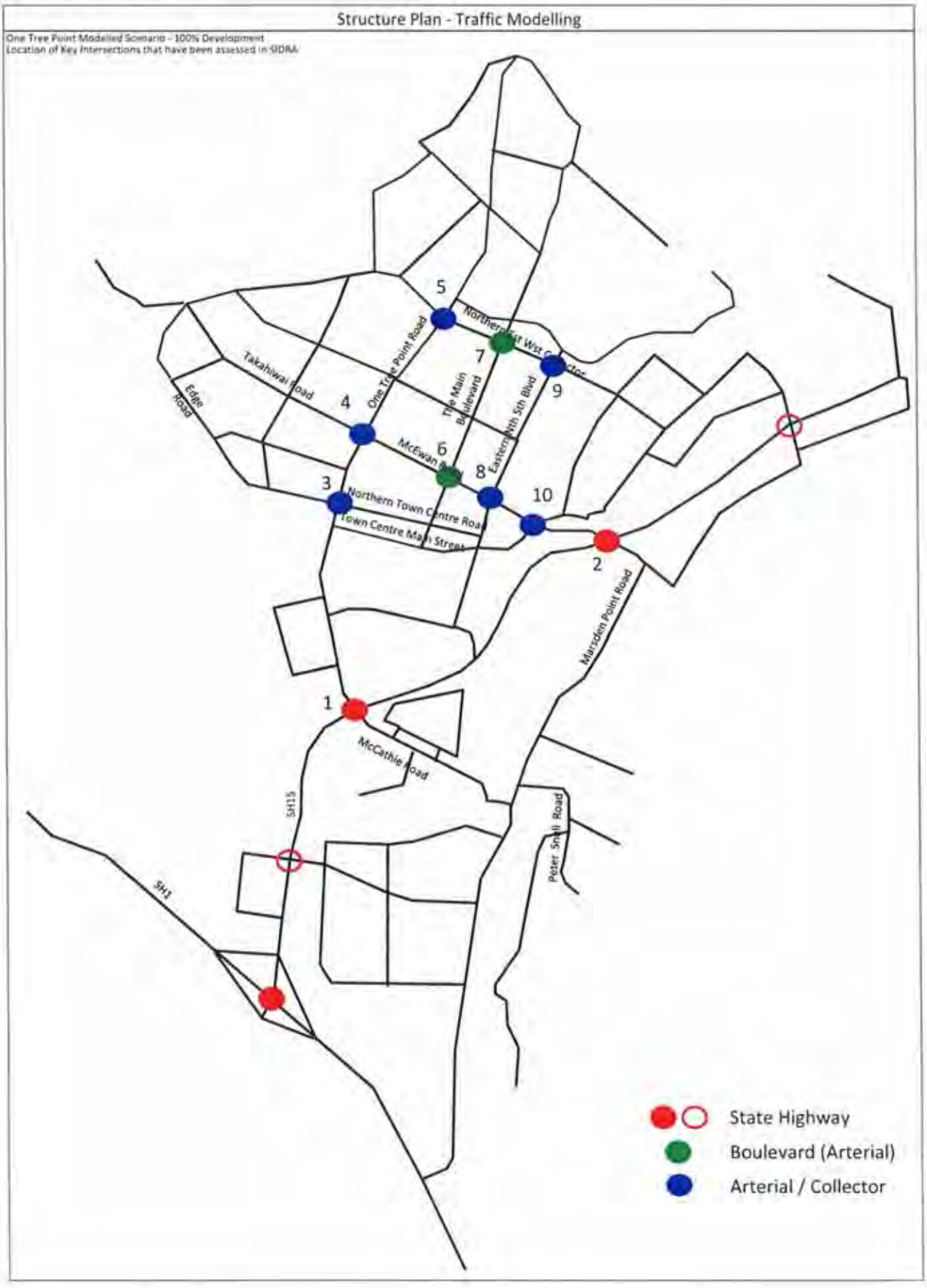
1. State Highway 15A interchange at One Tree Point Road
2. State Highway 15A interchange at McEwan Road
3. One Tree Point Road / Edge Road / Northern Town Centre Road
4. One Tree Point Road / Takahiwai Road / McEwan Road
5. One Tree Point Road / Northern East-West Collector
6. The Main Boulevard / McEwan Road
7. The Main Boulevard / Northern East-West Collector
8. Western North-South Boulevard / McEwan Road
9. Western North-South Boulevard / Northern East-West Collector
10. McEwan Road / Town Centre Main Street and Industrial Connector

The State Highway 15A intersections/interchanges with SH1, Salle Road and the northern connection of One Tree Point Road are important, however have not been assessed in detail using SIDRA. Reasons for this are that the form and shape of these intersections requires input from key stakeholders, being Transit, the Council and other key stakeholders. All state highway crossing points will require detailed scheme assessments. This will also apply for the One Tree Point Road and McEwan Road interchanges, however the general location, shape and form of these interchanges is somewhat more straight forward and has been included in this assessment.

Each of the intersection locations is identified in Figure 13. Three colours have been used to distinguish the different road functions on which the intersections are located. These are:

- Red — State Highway Interchanges. SH15A is a strategic route that connects SH1 with Marsden Port. Any future interchanges located at Salle Road and the northern connection with One Tree Point Road have been circled as being important, however have not been assessed, as the design of these intersections will require further Transit and key stakeholder input.
- Green — The Main Boulevard intersections which intersect with key east-west routes.
- Blue — Arterial Roads and busy Collector Roads

Figure 13: SIDRA Assessed Intersections



The number of lanes and lane configuration has been developed using the criteria that each approach and all key movements should not experience worse than a LOS D for average delay and LOS E for degree of saturation during the peak periods for each approach. This means that for signal and roundabout controlled intersections the average vehicle delay[9] (US Highway Capacity Manual (HCM) criteria) experienced by vehicles on any approach should be less than 55 seconds and the degree of saturation[10] should be less than 0.95.

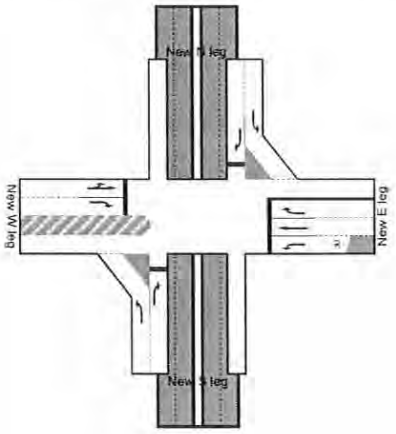
The intersection layouts and performance outputs (average delay and degree of saturation) are summarised below for each of the 10 intersections assessed in SIDRA. The full summary results for the 10 intersections are included at Appendix D, which includes the intersection layout, hourly traffic volumes, signal phasing diagrams and modelling outputs.

The SIDRA analysis has assumed that pedestrian movements are not called every signal cycle. Intersections where high pedestrian activity is predicted (eg Intersection 6) have included pedestrian movements each signal cycle.

4.6.5.1 State Highway 15A Interchange at One Tree Point Road (Intersection 1)

The proposed layout for the interchange includes signal control for the One Tree Point Road and McCathie Road approaches and the right turn movements from the off ramps. Controlled pedestrian and cycle facilities need to be included in the design. Figure 14 illustrates the lane layout of the interchange, whilst Table 12 summarises the interchange performance. Each approach has a degree of saturation less than 0.85, with the overall LOS for the interchange being LOS C.

Figure 14: SH15A / One Tree Point Road Proposed Interchange Layout



[9] Vehicle delay includes deceleration and acceleration delays for the major stop experienced by queued vehicles, as well as the geometric delays experienced by all vehicles in negotiating the intersection.
[10] Degree of saturation is the ratio of demand (arrival) flow to the theoretical capacity Degrees of saturation above 1 represent oversaturated conditions where demand flows exceed capacity

Table 12: SH15A / One Tree Point Road / McCathie Road Interchange SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – SH15A	0.33	0.84	14	20	B	C
E Leg – McCathie Road	0.68	0.92	31	53	C	D
N Leg – SH15A	0.01	0.08	16	14	B	B
W Leg – One Tree Point Road	0.66	0.90	31	36	C	D
OVERALL	**0.68**	**0.92**	**27**	**34**	**C**	**C**

4.6.5.2 State Highway 15A interchange at McEwan Road (Intersection 2)

The proposed layout for the interchange includes signal control for the McEwan Road approaches and the right turn movements from the off ramps. Controlled pedestrian and cycle facilities need to be included in the design. Figure 15 illustrates the lane layout of the interchange, whilst Table 13 summarises the interchange performance. Each approach has a degree of saturation less than 0.85, with the overall LOS for the interchange being LOS C during the AM peak and LOS D in the PM peak.

Figure 15: SH15A / McEwan Road Proposed Interchange Layout

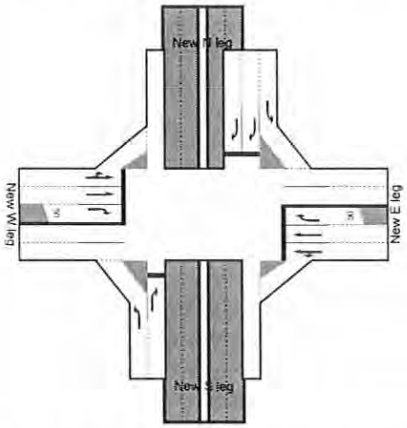


Table 13: SH15A / McEwan Road Interchange SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – SH15A	0.68	0.48	33	31	C	C
E Leg – McEwan Road	0.71	0.80	42	34	D	C
N Leg – SH15A	0.42	0.77	35	49	D	D
W Leg – McEwan Road	0.70	0.83	20	38	C	D
OVERALL	**0.71**	**0.83**	**28**	**38**	**C**	**D**

4.6.5.3 One Tree Point Road / Edge Road / Northern Town Centre road (Intersection 3)

The proposed layout for the One Tree Point Road / Edge Road / Northern Town Centre Road includes signal control, as shown at Figure 16. Table 14 summarises the predicted performance of the intersection. Each approach has a degree of saturation less than 0.95, whilst the overall LOS for the intersection is LOS D. High pedestrian movements are expected at this intersection, and have been modelled as being called each phase during the peak periods.

Figure 16: One Tree Point Road / Edge Road / Northern Town Centre Road Intersection Layout

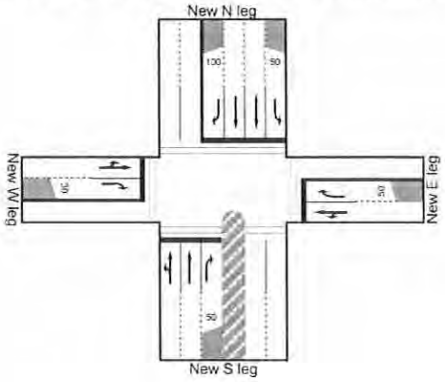


Table 14: One Tree Point Road / Edge Road / Northern Town Centre Road Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – OTP Road	0.63	0.93	30	48	C	D
E Leg – Northern TC Road	0.12	0.88	39	52	D	D
N Leg – OTP Road	0.90	0.41	40	19	D	B
W Leg – Edge Road	0.86	0.32	52	44	D	D
OVERALL	**0.90**	**0.93**	**39**	**42**	**D**	**D**

4.6.5.4 One Tree Point Road / Takahiwai Road / McEwan Road (Intersection 4)

The proposed layout for the One Tree Point Road / Takahiwai Road / McEwan Road intersection includes signal control, as shown in Figure 17. Controlled pedestrian and cycle facilities need to be included in the design. The degree of saturation of each approach is less than 0.90, with the overall LOS for the intersection being LOS D. Table 15 summarises the predicted intersection performance.

Figure 17: One Tree Point Road / Takahiwai Road / McEwan Road Intersection Layout

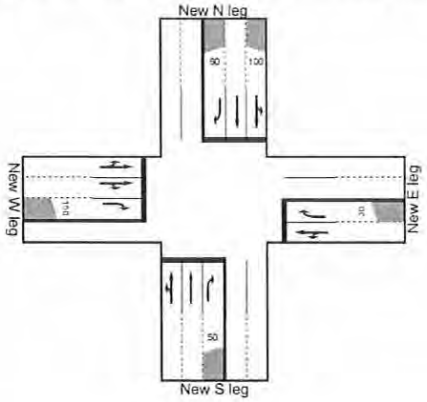


Table 15: One Tree Point Road / Takahiwai Road / McEwan Road Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – OTP Road	0.74	0.86	40	42	D	D
E Leg – Takahiwai Road	0.81	0.88	49	43	D	D
N Leg – OTP Road	0.80	0.60	40	30	D	C
W Leg – McEwan Road	0.83	0.80	39	54	D	D
OVERALL	**0.83**	**0.88**	**41**	**42**	**D**	**D**

4.6.5.5 One Tree Point Road / Northern East-West Collector (Intersection 5)

Figure 18 shows the proposed One Tree Point Road / Northern East-West Collector signalised intersection layout. Controlled pedestrian and cycle facilities need to be included in the design. Table 16 provides a summary of the predicted intersection performance. The degree of saturation at each approach is less than 0.95, with the overall LOS for the intersection being LOS D for both the AM and PM peak periods.

Figure 18: One Tree Point Road / Northern East-West Collector Intersection Layout

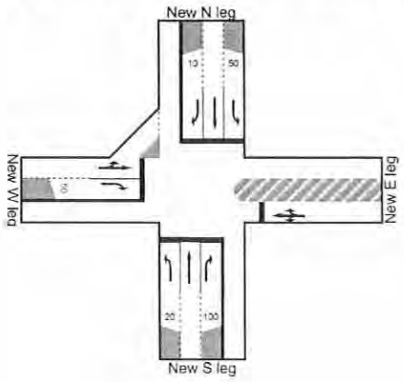


Table 16: One Tree Point Road / Northern East-West Collector Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – OTP Road	0.87	0.88	47	34	D	C
E Leg – EW Collector Road	0.48	0.86	50	42	D	D
N Leg – OTP Road	0.88	0.33	42	25	D	C
W Leg – EW Collector Road	0.91	0.78	33	53	C	D
OVERALL	**0.91**	**0.88**	**40**	**38**	**D**	**D**

4.6.5.6 The Main Boulevard (Pyle Road) / McEwan Road (Intersection 6)

Figure 19 shows the proposed layout of The Main Boulevard (Pyle Road) / McEwan Road signalised intersection. Controlled pedestrian and cycle facilities need to be included in the design. Table 17 provides a summary of the predicted intersection performance. The degree of saturation at each approach is less than 0.95, with the overall LOS for the intersection being LOS D for the AM and PM peak periods. Average delays on each approach are higher than the criteria of 55 seconds for LOS D. This is considered acceptable for this intersection, where active transport modes and bus travel are important. Providing extra lanes on each approach will increase the distance for pedestrians and cyclists to cross. Given the people-moving focus of The Main Boulevard, the expected delay for vehicles is considered to be appropriate. Bus priority measures may be necessary so that buses can reach the stop line rather than wait in any queues during peak times.

Figure 19: The Main Boulevard (Pyle Road) / McEwan Road Intersection Layout

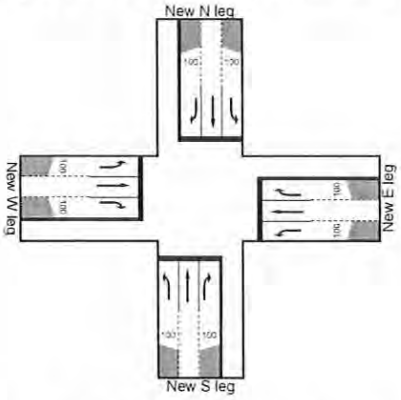


Table 17: The Main Boulevard (Pyle Road) / McEwan Road Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – Pyle Road	0.47	0.89	62	49	E	D
E Leg – McEwan Road	0.34	0.91	32	37	D	D
N Leg – Pyle Road	0.89	0.60	68	44	E	D
W Leg – McEwan Road	0.89	0.88	46	50	D	D
OVERALL	**0.89**	**0.91**	**50**	**43**	**D**	**D**

4.6.5.7 The Main Boulevard (Pyle Road) / Northern East-West Collector (Intersection 7)

The proposed intersection layout for The Main Boulevard (Pyle Road) / Northern East-West Collector includes signal control and is shown in Figure 20. Controlled pedestrian and cycle facilities need to be included in the design. Table 18 summarises the predicted intersection performance. Each approach has a degree of saturation less than 0.95, with the overall LOS for the intersection being LOS C.

Figure 20: The Main Boulevard (Pyle Road) / Northern East-West Collector Intersection Layout

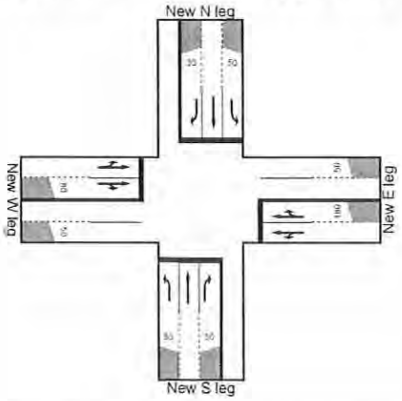


Table 18: The Main Boulevard (Pyle Road) / Northern East-West Collector Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – Pyle Road	0.75	0.66	36	37	D	D
E Leg – EW Collector Road	0.67	0.79	52	27	D	C
N Leg – Pyle Road	0.90	0.83	44	41	C	D
W Leg – EW Collector Road	0.91	0.80	25	51	C	D
OVERALL	**0.91**	**0.83**	**35**	**34**	**C**	**C**

4.6.5.8 Western North-South Boulevard / McEwan Road (Intersection 8)

The proposed Western North-South Boulevard / McEwan Road intersection layout is illustrated in Figure 21 with signal controlled. Controlled pedestrian and cycle facilities need to be included in the design. Each approach has a degree of saturation less than 0.85, with the overall LOS for the intersection being LOS C. Table 19 summarises the intersection performance.

Figure 21: Western North-South Boulevard / McEwan Road Intersection Layout

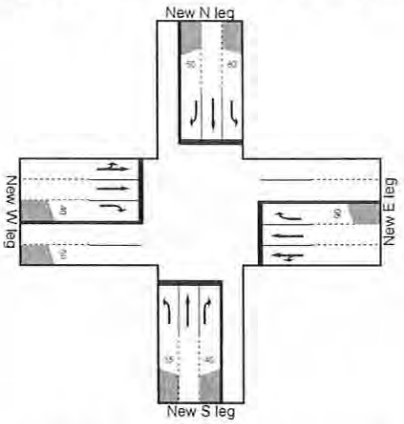


Table 19: Western North-South Boulevard / McEwan Road Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – NS Collector Road	0.47	0.85	33	44	C	D
E Leg – McEwan Road	0.62	0.85	45	28	D	C
N Leg – NS Collector Road	0.67	0.45	39	26	D	C
W Leg – McEwan Road	0.64	0.85	20	50	D	D
OVERALL	**0.67**	**0.85**	**29**	**35**	**C**	**C**

4.6.5.9 Western North-South Boulevard / Northern East-West Collector (Intersection 9)

Figure 22 presents the Western North-South Boulevard / Northern East-West Collector intersection layout, with signal control. Controlled pedestrian and cycle facilities need to be included in the design. Table 20 provides a summary of intersection performance. Each approach has a degree of saturation less than 0.85, with the overall LOS for the intersection being LOS C.

Figure 22: Western North-South Boulevard / Northern East-West Collector Intersection Layout

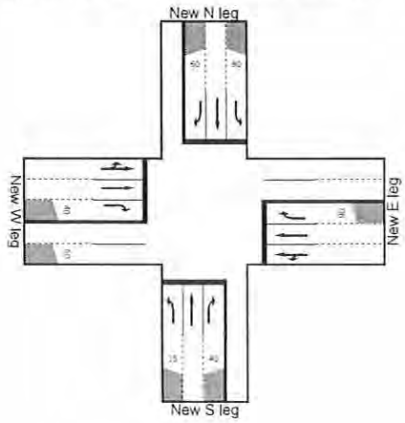


Table 20: Western North-South Boulevard / Northern East-West Collector Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Average Delay (s)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – NS Collector Road	0.47	0.85	33	44	C	D
E Leg – EW Collector Road	0.62	0.85	45	28	D	C
N Leg – NS Collector Road	0.67	0.45	39	26	D	C
W Leg – EW Collector Road	0.64	0.85	20	50	D	D
OVERALL	**0.67**	**0.85**	**29**	**35**	**C**	**C**

4.6.5.10 McEwan Road / Town Centre and Industrial Connector (Intersection 10)

Figure 23 shows the proposed layout of the McEwan Road / Town Centre and Industrial Connector intersection, whilst Table 21 summarises the intersection performance. Each approach has a degree of saturation less than 0.90, with the overall LOS for the intersection being LOS C.

Figure 23: McEwan Road / Town Centre and Industrial Connector Intersection Layout

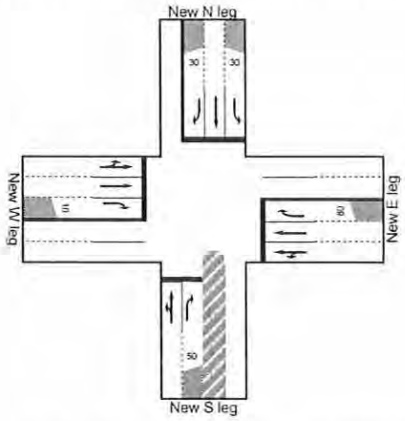


Table 21: McEwan Road / Town Centre and Industrial Connector Intersection SIDRA Modelling Outputs

Approach	Degree of Saturation		Level of Service		Average Delay (s)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
S Leg – TC and Industrial Connector	0.44	0.41	53	44	D	D
E Leg – McEwan Road	0.77	0.85	31	34	C	C
N Leg – TC and Industrial Connector	0.50	0.87	53	50	D	D
W Leg – McEwan Road	0.76	0.40	22	19	C	B
OVERALL	**0.77**	**0.87**	**28**	**33**	**C**	**C**

4.6.6 Other Intersections in the Model

The operation of other intersections has used the modelled level of service (LOS) of the worst approach at each intersection throughout the Structure Plan area as a measure. The LOS assessment uses the LOS

criteria adopted by Gabites Porter when reporting on the network performance in the Whangarei Transportation Study, which is the same as that used for the key intersection assessment documented within this report.

The modelling indicates the following.

AM Peak

- State Highway interchanges operate at LOS D or better.
- All key intersections along One Tree Point Road, The Main Boulevard (Pyle Road) and the eastern North-South collector operate at LOS D or better.
- High delays (in the order of 80 seconds per vehicle) are experienced by vehicles exiting Peter Snell Road, with a LOS F predicted if the intersection remains as priority (give-way) control. Traffic signals or a roundabout may be required in the future.
- High delays (in the order of 80 seconds per vehicle) are expected at a one of the local residential road approaches to One Tree Point Road (north of the Town Centre). The modelled intersection control of this intersection is priority and as such attracts low vehicle volumes. The majority of people use the collector road (Takahiwai Road) to access One Tree Point Road.
- Delays at the intersection of Takahiwai Road and the north-south residential road to the west of One Tree Point Road are expected to result in a LOS E during the AM peak.

PM Peak

- Interchange approaches along SH15A north of SH1 operate at LOS D or better.
- All key intersections along One Tree Point Road, The Main Boulevard (Pyle Road) and the eastern North-South Boulevard operate at LOS D.
- Turning delays between 50 and 80 seconds are predicted at a local residential road intersection with One Tree Point Road, opposite the industrial area to the south of the Town Centre. The turning traffic volumes predicted at this location are low (less than 50 vehicles per hour) access into this future urban area, (modelled with priority control) would most likely be designed to tie into the proposed signalised intersections providing access to the industrial land on the eastern side of One Tree Point Road.

The few intersections that are predicted to have an overall LOS worse than "D" represent the locations within the network where future traffic conditions are approaching unstable flow. The levels of congestion are based on the modelled intersection layouts. The final design of the key intersections should be reconsidered when the vehicle generating activities within the Structure Plan area are further refined.

5 SUMMARY AND CONCLUSIONS

Movement around, to and from the Structure Plan area is a key component of the location of land use and transport infrastructure. As well as considering transport needs, the design of the area provides the following.

- Complementary land uses that will enable and encourage shorter trips to be made by more sustainable means than driving alone, such as walking, cycling and passenger transport.
- A range of activities enabling linked trips to be made.
- A pedestrian network that provides direct, easy and safe access to local facilities and passenger transport services.

- A cycle network that provides direct, easy and safe access to facilities within the area.
- The use of open space and water management corridors to complement the cycle/footpath networks.
- Broadband facilities to facilitate the reduction of trips through working and shopping from home.
- Passenger transport facilities in central localities, accessible by the majority of residents and visitors.
- Proposed bus and train infrastructure and services serving the area.
- A road system providing a comprehensive network throughout the area and across physical barriers (SH15A and the proposed rail line).

Accordingly, the Structure Plan has been designed appropriately to integrate land uses with transport systems.