Table of Contents

List of Figures

List of Tables

Table *Page*

List of Appendices

1. Introduction

1.1 Introduction

The Christchurch, Rolleston & Environs Transportation Study (CRETS) began in early 2002. The study is being undertaken by Connell Wagner (the Consultant), on behalf of the Study Partners, comprising (in no particular order):

- Transit New Zealand – Road Controlling Authority for State Highways,
- Selwyn District Council – Road Controlling Authority for roads in Selwyn District excluding State Highways,
- Christchurch City Council – Road Controlling Authority for roads in Christchurch City excluding State Highways,
- Environment Canterbury – Responsible for Public Transport and managing the Regional Land Transport Strategy,
- Christchurch International Airport Ltd – Responsible for Airport Operations and most roads on the Airport Campus.

Other interested groups in this study have been identified as but not limited to (in no particular order):

- Land Transport New Zealand (previously Land Transport Safety Authority and Transfund New Zealand),
- New Zealand Police,
- Road Transport Forum,
- Automobile Association,
- Public Transport Operators,
- Cycling Advocate Networks / Spokes,
- Ngai Tahu.

In the Terms of Reference for the study, the Objective is:

> *'The study of transportation requirements in the Christchurch to Rolleston broad area is seen as a key component in the planning for the development of the roading network to the west and south of Christchurch for the ensuing 25 year period.*
>
> *The key output of the study is the identification, justification and reporting of a strategy that details the most appropriate stages for the progression of improvement projects that will achieve an ideal roading network to satisfy projected demands."*

This study focuses on identifying shortcomings in the strategic transport network to the southwest and south of Christchurch and developing and assessing various options to find a strategy to counter the short comings identified. The area includes the Selwyn towns of Rolleston, Lincoln, Springston, West Melton, Tai Tapu, Templeton and Prebbleton; the south western suburbs of Christchurch generally including Hornby, Sockburn, Wigram and Halswell; and the Christchurch International Airport. The study area within the context of greater Christchurch has been included as Figure 1.

With the introduction of the NZ Transport Strategy 2002 and the Land Transport Management Act (LTMA) in 2003, the study now takes into account the relevant sections of the LTMA which requires solutions to contribute to an integrated, safe, responsible and sustainable land transport system. As a result, the study not only considers improvements to the roading network, but also includes other transport mode opportunities, including passenger services (both road and rail) and cycling.

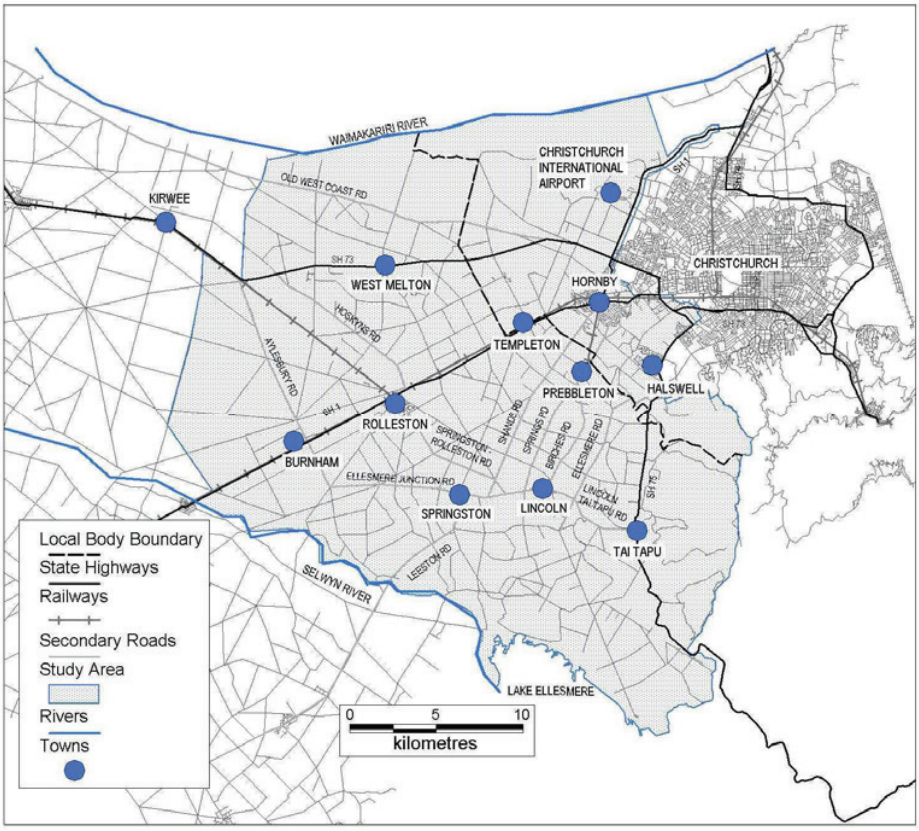

Figure 1
Study Area

1.2 Study Process

The study process has been set up in ten consecutive steps, including:

1. Identification, Review of, and Consultation on Issues,
2. Review of Data,
3. Data Collection,
4. Traffic Model Preparation,
5. Deficiency Analysis,
6. Identification of Project Options and Potential Strategies,
7. Analysis and Assessment of Project Option and Potential Strategies,
8. Detailed Analysis and Assessment to form a Draft (Consultation) Transport Strategy,
9. Public Consultation on the Draft Transport Strategy,
10. Final Report.

Each step of the study process contributes to the inferred objectives for the study as follows:

1. Identification, Review of, and Consultation on Issues
   A comprehensive list of initial, mainly technical study partner, issues were provided in the Scope for Services for assessment by the study. These issues were used to provide structure to ensuing analysis and have been discussed, assessed and revised throughout the study as new information has become available.

   Initial consultation with the stakeholders and public was carried out to identify issues of concern to the community. Some of the community issues were in line with the initial issues raised in the Scope of Services, however, additional issues were raised by the community and added to the issues to be considered in this study. The initial consultation data has been collated and reported on in the Stage 1 Consultation Report – July 2002, Revision 1.

2&3 Review of Data and Data Collection

A review of the available data indicated the need for additional data. The data required consisted of traffic count data (both links and intersection turning movements) and travel speed surveys for use in validating the CRETS traffic models. The additional traffic count and speed survey data was collated and reported in the Traffic Data Report – March 2003, Revision 0.

4. Traffic Model Preparation

The Christchurch Transportation Study (CTS) base year traffic models were updated from 1996 to 2001 census data as part of the CRETS study. The models have been extended and refined to a level of detail, especially in the study area, to meet the purposes of this study. This involved increasing the detail in the modelled zone structure and roading network. Other improvements made to the models include modifying the travel pattern methodology for Burnham Military Camp, Lincoln University and the trips from outside the study area. Detail of the formation of the 2001 CRETS models is included in the Model Validation Report – April 2005, Revision 12.

The Christchurch International Airport is a unique traffic generator in terms of traffic generation, timing and directionality of trips. For these reasons and given the potential changes in land use patterns, a project model (modified version of the CRETS models) and a sub model for the Airport were developed. Detail of the Airport project and submodel models development is included in the Christchurch International Airport Model Validation and Identification of Potential Problem Areas Report – August 2005 – Version 2.

5. Deficiency Analysis

The 2021 CTS model has been extended and refined the same way as the 2001 CTS models to form the 2021 CRETS models. The 2021 land uses for the CRETS models are based on medium growth projections from Statistics New Zealand which has been used to predict the 2021 vehicle travel demand. A Do Minimum Network was formed using the currently planned improvements in the ten year plans from each of the Road Controlling Authorities (RCA). By applying the 2021 traffic demand to the 2011 Do Minimum Network, areas of the network that are likely to be under pressure in 2021 were identified. Details of the formation of the 2021 CRETS models, the Do Minimum Network and the areas of the network that are likely to be under pressure in 2021, are included in the Identification of Potential Problem Areas Report – April 2005, Revision 10.

As specific models have been developed for the Christchurch International Airport, the process used to identify areas of the network that are likely to be under pressure in 2021 for the CRETS models, has been applied to the Airport models. Details of the formation of the 2021 Airport project and submodel models, the Airport Do Minimum Network and the areas of the road network that are likely to be under pressure in 2021, are included in the Christchurch International Airport Model Validation and Identification of Potential Problem Areas Report – August 2005 – Version 2.

6. Identification of Project Options and Potential Strategies

This step of the study process involved bringing together, summarising and grouping the issues to be considered in this study and identifying options that may potentially address the issues. The issues were grouped as general issues applying to the whole of the study area and specific issues applying to specific locations or routes in the study area. Using these issues, Project Options were identified to potentially address the issues. Detail of this step of the study is included in the Issues and Options Identification Report – April 2005, Revision 9.

7. Analysis and Assessment of Project Option and Potential Strategies

This step of the study process looked in detail at the way in which some 47 different roading improvement proposals would address the issues identified earlier in the study. The viable project options were then grouped into packages of options and the way in which packages of improvements would work together, or not, were analysed. A set of proposals was prepared, which, subject to changes as a result of consultation, forms the basis of the consultants' recommendations to the study partners. Detail of this step of the study is included in the Options Analysis Report – December 2005, Revision 4.

8. Detailed Analysis and Assessment of Consultation Project Options to form a Draft Transport Strategy

The Draft Transport Strategy took the initial packages of options identified in the Options Analysis Report and subjected them to a more detailed analysis, including intersection analysis, link travel time analysis, staging

analysis and risk analysis. The Draft Transport Strategy, including the Executive Summary, formed the basis of the 2006 public consultation documents.

9. Public Consultation
   Public consultation on the Draft Transport Strategy was undertaken between 29 September 2006 and 17 November 2006. The public consultation process and outcomes are reported on in the report titled *'Consultation Report 2007, Christchurch, Rolleston and Environs Transportation Study'*.

10. Final Report
    This final report titled *'Christchurch, Rolleston and Environs Transportation Study, Transport Strategy Final Report, September 2007'* sets out the Transport Strategy prepared following, and taking into account feedback from stakeholder, public consultation and sensitivity testing (including UDS land use) of the strategy.

    Each of the reports mentioned above are available from the Project Managers of the Study Partners mentioned in Section 1.1.

2 Traffic Modelling

2.1 Model History

The traffic model used for this study is the 2001 version of the Christchurch Transportation Study (CTS) model. As the CTS model did not have sufficient detail in the study area nor did it extend far enough southwest, additional detail was added to the model along with the extension of the model boundaries to meet the purposes of the study. The CTS model originally supplied had a base year of 1996 which was subsequently updated to 2001. The model was then validated to the requirements of Land Transport New Zealand's Economic Evaluation Manual.

Modifications were specifically made to the model for the Burnham Military Camp, Lincoln University and the trips from outside the study area. Detail of the formation of the 2001 and 2021 CRETS models is included in the Model Validation Report – April 2005, Revision 12 and the Identification of Potential Problem Areas Report – April 2005, Revision 10.

An additional model has been developed for Christchurch International Airport area titled the CIAL Project Model. Whilst the airport activity has been included in the main model, the level of detail is such that the operation of the roads and intersections in close proximity to the airport was insufficient. The CIAL Project Model is a copy of the main model but with additional detail specifically included in the Airport area. As a result of this the main model is not used to provide information for the area between Yaldhurst Road, Pound Road and Sawyers Arms Road, it is instead substituted with information from the CIAL Project Model. This applies to all aspects of the traffic model outputs such as traffic volumes, intersection delays, travel speeds etc.

2.2 Land Use Activity

A key driver behind the need to carry out this type of study is the projected growth in population within the South West Christchurch area. For the purposes of the traffic modelling, population growth has been considered as growth in Households and Employment (termed the Land Use Data). The growth in these two variables is then used to determine the growth in the number of trips made through calibrated mathematical function and parameters.

The land use data used in the traffic modelling has been obtained from Census information held by Statistics New Zealand and growth projections carried out by Statistics New Zealand. The base year for the traffic model must be the same as a census year; hence the base year for the model is 2001 that was the only data available at the outset of the study. The future year for the traffic model is 2021 which at the time of this study is the last year that Statistics New Zealand have sufficiently detailed land use projection data. The medium growth projections were used as the basis for 2021 population. The study partners, given their knowledge of the study area and development patterns, have allocated the land use for 2021 as supplied by Statistics New Zealand. The 2021 adopted land use has been used for the bulk of this study. However, it is recognised, that there are other potential land use growth scenarios. For this reason sensitivity testing has been carried out using the Urban Development Strategy (UDS) landuse growth forecasts. The sensitivity testing is discussed and reported in Section 25.

As it is impractical to consider every household and employer individually, the land use data is aggregated into zones or sub areas of relatively homogeneous land use activity. Refer to the Model Validation Report – April 2005, Revision 12 and the Identification of Potential Problem Areas Report – April 2005, Revision 10 for the zone systems for 2001 and 2021 respectively.

For reporting purposes, the land use data for various zones has been aggregated to the approximate extents of the Selwyn Townships, Christchurch City Suburbs, the remainder of the CTS modelled area and the model expansion area. Table 1 shows the 2001 land use data as obtained from Statistics New Zealand, the projected 2021 medium growth scenario landuse data and the associated growth. Figure 2 shows the projected growth in households for each of the township and suburb areas.

Area	2001 CRETS		2021 CRETS		Growth 2001 to 2021	
	HH	Jobs	HH	Jobs	HH	Jobs
Rolleston	959	260	5296	2107	452%	710%
Lincoln	665	1492	1750	1571	163%	5%
Prebbleton	503	397	2000	468	298%	18%
Templeton	710	843	833	903	17%	7%
West Melton	554	215	758	263	37%	2%
Hornby	4782	5820	4654	6521	-3%	12%
Avonhead	4448	722	4283	756	-4%	5%
Wigram	264	506	3388	1635	1183%	223%
Halswell	4568	984	8743	1439	91%	46%
CTS Area Total	**138332**	**119548**	**170796**	**129280**	**23%**	**8%**
Area of Expansion	989	485	1404	562	42%	16%
Total	**139321**	**120033**	**172200**	**129842**	**24%**	**8%**

Table 1

Growth in Households and Employment

2.3 Relationship to the Urban Development Strategy

Since the outset of the CRETS study, the Greater Christchurch Urban Development Strategy has developed a future growth strategy for the area. Transit, SDC, CCC and ECan are also partners in the Greater Christchurch Urban Development Strategy (UDS) along with Waimakariri District Council. The UDS process is overseen by a forum made up of elected member representatives from each participating local authority and representatives from such stakeholders as the Canterbury Employers' Chamber of Commerce, Federated Farmers, Ngai Tahu and the Ministry of Education.

The UDS is "*a long-term planning strategy to prepare a consistent direction and plan for the growth and development of the greater Christchurch area, which encompasses an area beyond the existing city boundaries to include such townships as Rangiora, Woodend, Kaiapoi and Rolleston*" (source: http://www.greaterchristchurch.org.nz/FAQ/).

The UDS has a planning horizon to around 2041 with a mid-point analysis year of 2026 while this study has a planning horizon to 2021. The study area of the UDS is also wider than that of the Christchurch Rolleston and Environs Transportation Study and is considering a much wider range of issues than simply transport. Consultation on the UDS was carried out in late 2006 and was formally adopted on 22 June 2007. The Strategy is detailed in the "Greater Christchurch Urban Development Strategy and Action Plan 2007" document.

There is ongoing dialogue between those working with the UDS and those working on this study to ensure a consistency between the processes.

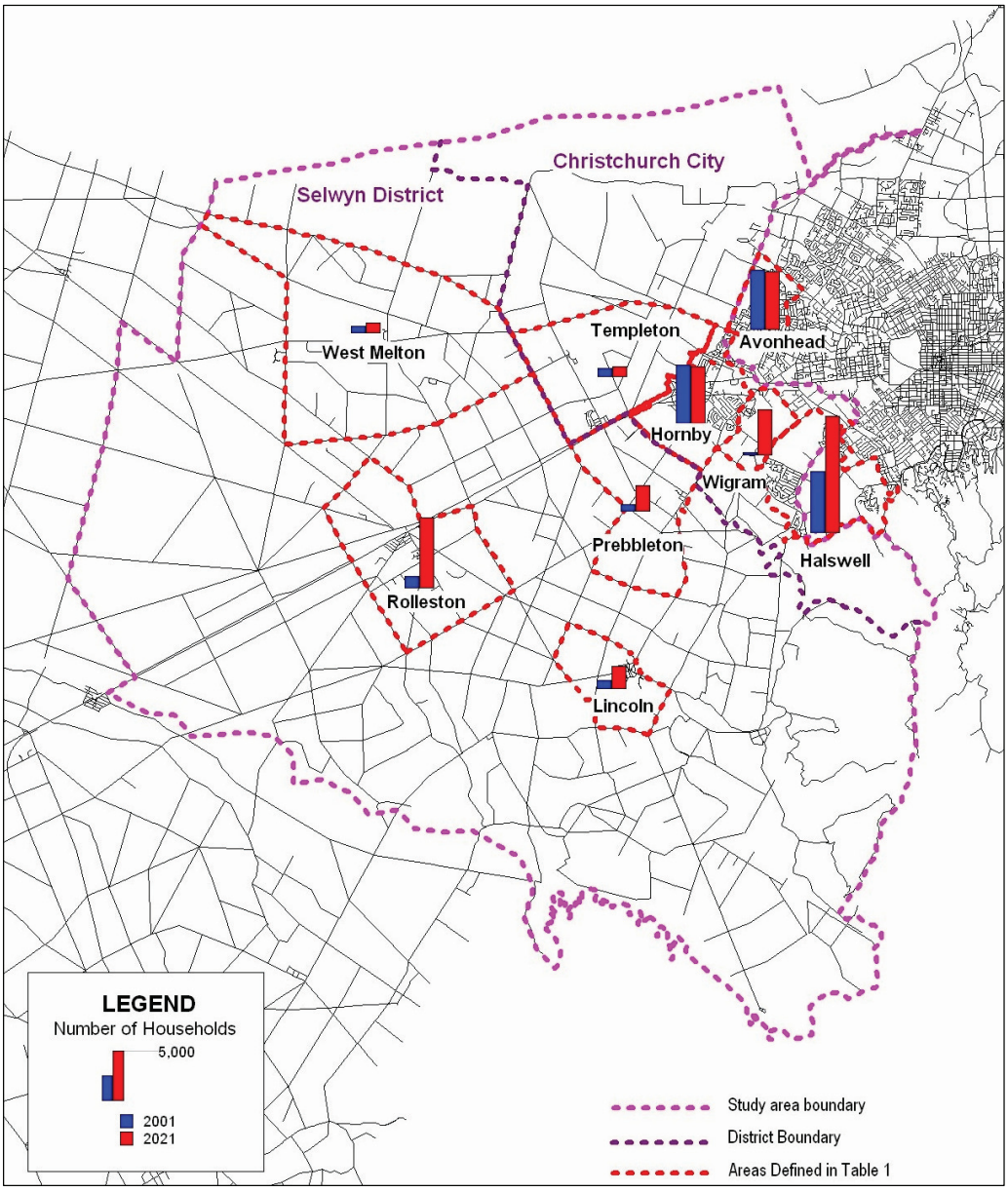

Figure 2
Household Growth (CRETS 2021)

2.4 Do Minimum Network

The Do Minimum Network is a roading network that contains the minimum amount of upgrades necessary for the future (2021) travel demand to be met. There is no requirement for the Do Minimum Network to meet the travel demands efficiently, however the travel patterns must be possible. The road controlling authorities in the study area have current plans in place for upgrades to their respective roading networks. Using these current plans, a 2011 Do Minimum Network for this study has been developed. The development of the Do Minimum Network involves taking the 2001 validation network and including the planned upgrades till 2011. The 2001 to 2011 upgrades included in the Do Minimum Network are shown in Table 2.

Upgrades	Comment
Aidanfield development roads	Included
Bealey/Fitzgerald Signal upgrade	Included
Belfast/Marshland Roundabout	Included
Blenheim Rd deviation	Included
Carmen / Buchanans signals	Built
Clarence/Whiteleigh/Rail station Signals	Built
Cranford/Innes Signal upgrade	Included
Cranford/Westminster Signal upgrade	Included
CSM (Extra lanes Barrington-Curletts)	Included
CSM Barrington Grade Separation	Included
CSM Extension	Included (TNZ design stage 1)
Curletts/Lunns/Parkhouse Signals	Built (includes 3 lanes from Parkhouse, 2 being RHT)
Deans Ave/Riccarton Signals	Included
Dunbars to Hendersons Link	Included
Elizabeth St/SH 1 closing	Included
Fendalton / Glandovey Signals	Built
Fendalton Rd (Extra Lanes Clyde-Wairarapa)	Built
Ferry/Humphreys Signals	Included
Ferrymead Bridge 4 laning	Included
Garland/Opawa Signals	Built
Gloucester/Linwood Signals	Built
Halswell Junct/Main Sth Signals	Included
Halswell/Dunbars Signals	Included
Halswell/Kennedys Bush/Sparks Signals	Built
Hills Rd 4 laning North Avon to Aylesford	Included
Hoskyns/State Highway 1 Signals	Included
Innes/Rutland Signals	Built
Johns/Main Nth Signals	Built (includes 2 lanes to and from Johns to North)
Lincoln Rd 4 Laning – Sylvan-Curletts	Included
Linwood/Dyers Signals	Built
Lowes Rd extension	Built
Main Nth Rd (Extra Lanes Farquhars-Radcliffe)	Included (rail overbridge 2 lanes, under construction)
Main Sth/Shands Signal Upgrade	Built
Milnes Road extension	Not included – Milnes Rd/Halswell Rd has been closed
Nash Rd extension	Included through Wigram but not across CSME
Opawa Rd (Extra lanes Garlands-Chapman)	Not included as can't be included in modelled
Pound/Yaldhurst Roundabout	Included
Prestons/Marshlands Rbt Upgrade	Included
QEII Dr/Travis Rd Extra lanes	Included
Radcliffe Rd ext Hawkins – Marshland	Included
Rolleston Drive North/State Highway 1 Signals	Built
Rolleston Drive South/State Highway 1 Priority	Included
St Andrew/Ferry Roundabout	Included
Wigram Development Roads	Included
William Brittan Drive	Included
Woolston Burwood Expressway	Included (stage 2)
Yaldhurst / State Highway 1 Signals	Built
Yaldhurst S293 development roads	Included

Table 2

Upgrades to form Do Minimum Network

2.5 Travel Demand Estimation

Using the 2001 and 2021 land use scenarios, the associated networks, the calibrated CTS trip generation models and the calibrated CTS trip distribution models, a matrix of trips to and from every zone has been developed. For more detail on the trip generation and distribution models refer to the CTS model calibration reports and the Model Validation Report – April 2005, Revision 12 and the Identification of Potential Problem Areas Report – April 2005, Revision 10.

The distribution of trips between zones is dependent upon the time and distance of travel (contained in matrices) between the zones. Initially the time and distance matrices may not be related to the network being considered, however, the process of assigning the trips matrix to the network produces a new set of time and distance matrices given the traffic volumes (the time and distance of trips is dependent upon the number of trips). These new time and distance matrices are used to redistribute the trips and form a new trips matrix. This process of distributing trips, assigning trips to the network and then redistributing the trips is repeated until the cost of operating the network (based on the total minutes and distance of travel) does not change by more than one percent.

For the cost of operating a network to convergence of less than one percent there must be sufficient capacity in the network so that the number of trips does not result in extreme congestion, however there can be significant congestion. It is also desirable that the network that is used to converge the trips has a similar capacity to the strategy for the roading network to be determined in this study. This is so that the distribution of trips is not dissimilar to that which would occur with the strategy in place. Therefore an Analytical Trips Network has been developed for converging the travel demand matrix. This Analytical Trips Network is similar to the Do Minimum Network described in Section 2.4, with upgrades shown in Table 3 also included.

Works	Comment
State Highway 1 Four Laning	Hornby to Rolleston Drive North
Halswell Junction Road Four Laning	Springs Road (CSME) to State Highway 1
Springs Road Four Laning	Halswell Junction Road (CSME) to Barters Road
Carmen Road/Russley Road Four Laning	Hornby to Sawyers Arms Road
Wigram to Curletts Road connection	Connect Wigram Road to Curletts Road/CSME Interchange

Table 3

Upgrades to form Analytical Trips Network

As mentioned these upgrades have been included for the purposes of providing sufficient capacity to converge the trips matrix and they may or may not be included in the final strategy. The CTS model structure is such that the 24 hour travel matrix is converged and the period (morning peak, off peak, evening peak) trip matrices are derived from the 24 hour component trip matrices by trip purpose. Using the Analytical Trips Network the daily trip matrix has been converged. Figure 3 shows the percentage change in the Total Vehicle Minutes (TVM) and Total Vehicle Kilometres (TVK). Figure 4 shows the absolute network operating costs and Figure 5 shows the percentage change in the network operating costs for the last 15 iterations of the convergence process.

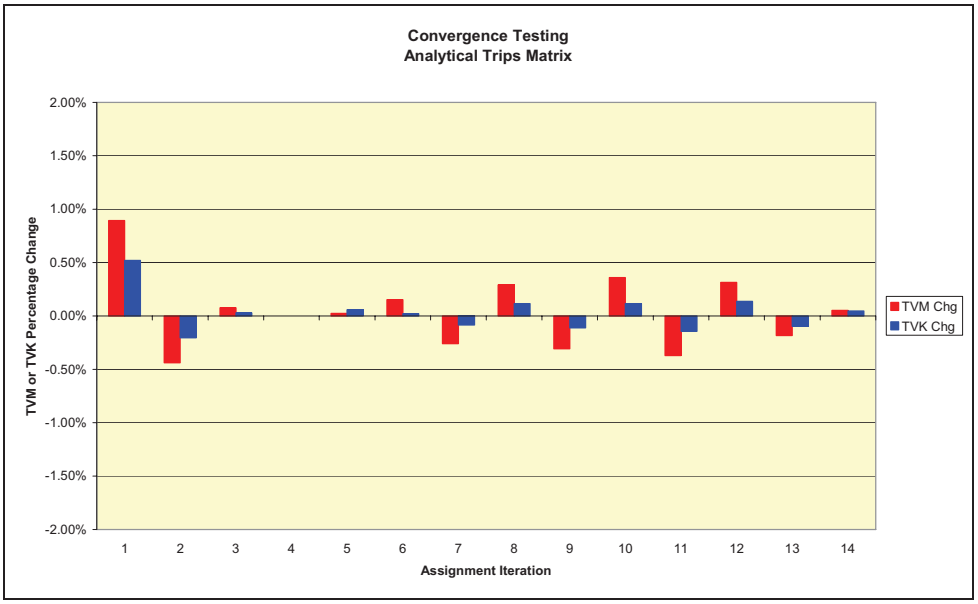

Figure 3

Analytical Trips Matrix Convergence – Percentage Change Total Vehicle Minutes and Kilometres

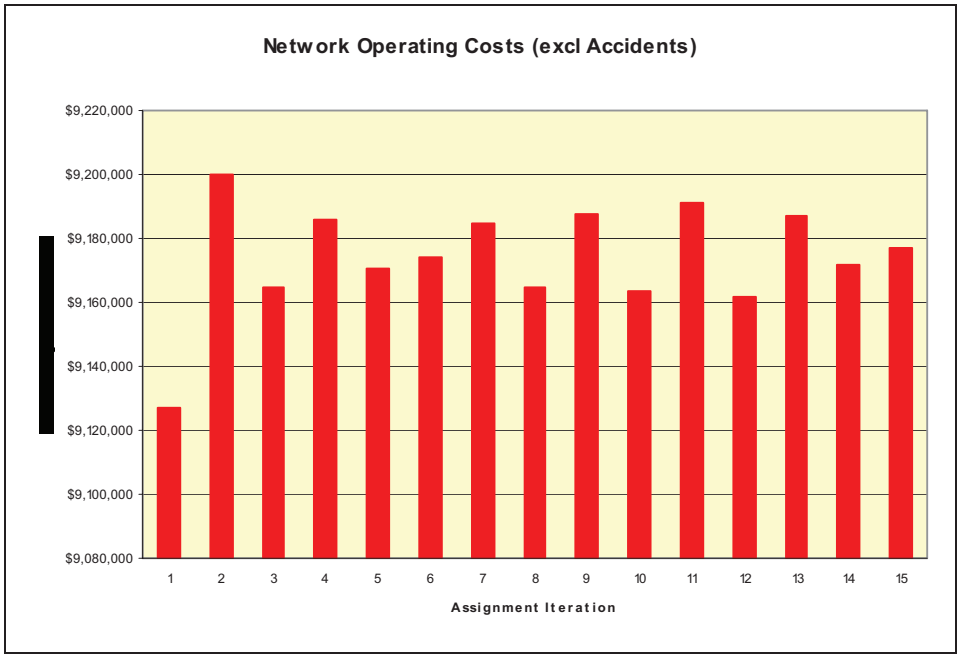

Figure 4

Analytical Trips Matrix Convergence – Network Operating Cost

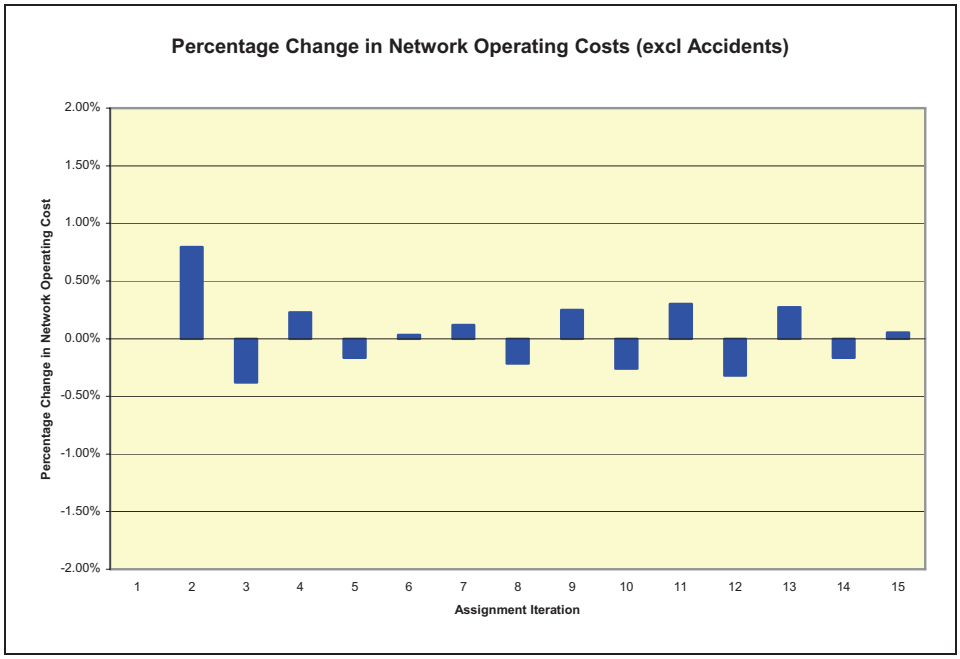

Figure 5

Analytical Trips Matrix Convergence – Percentage Change Network Operating Cost

2.6 Traffic Flows

The 2001 and the 2021 traffic volumes have been plotted on the 2011 Do Minimum Network using a volume bandwidth plot. Figure 6 below provides an indication of the predicted growth in traffic volumes. Where the 2021 volume bandwidth is wider than the 2001 volume bandwidth, this shows the predicted growth in traffic. Table 4 includes detailed traffic volumes for both 2001 and 2021 for a number of locations.

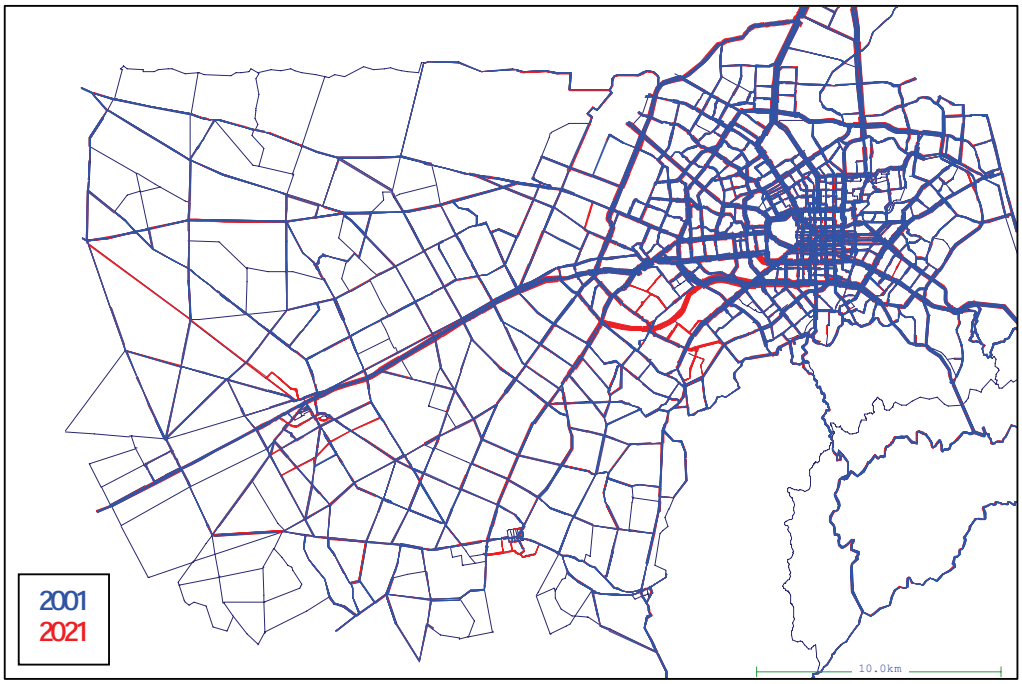

Figure 6

2001 and 2021 24 Hour Traffic Volume Bandwidth Plot

ROUTE	DESCRIPTION	24 hour volumes Validation Network 2001	Do Min Network 2021	Growth Val to Do Min
SH1 - Hornby to Rolleston	SH1 Sth Carmen	16400	19200	17%
	SH1 Sth HJR	15500	26600	72%
	SH1 Sth Barters	15800	27300	73%
	SH1 Sth Kirks	16300	29800	83%
	SH1 Sth Dawsons	15700	29200	86%
	SH1 Sth Weedons	14700	28900	97%
Springs - Trents to Main South	Springs Sth Main South	18000	22400	24%
	Springs Sth Amyes	14600	16200	11%
	Springs Sth HJR	10300	27300	165%
	Springs Sth Marshs	10500	23200	121%
	Springs Sth Birchs	9200	21400	133%
	Springs Sth Toswilll	6500	15900	145%
Shands - Halswell Junction to Main South	Sth Main South	21100	26200	24%
	Sth Amyes	11400	11000	-4%
	Sth Seymour	12500	12100	-3%
SH1 - Main South to Main North	Johns Wst Main North	12100	19800	64%
	Johns Wst Gardiners	11300	18700	65%
	Johns Wst of Sawyers Arms	17100	27300	60%
	Russley Sth Harewood	16500	21700	32%
	Russley Sth Wairakei	16900	22100	31%
	Russley Sth Memorial	22200	30800	39%
	Russley Sth Ryans	18000	23700	32%
	Masham Sth Yaldhurst	16100	23600	47%
	Carmen Sth Buchannans	16900	25400	50%
	Carmen Sth Waterloo	17100	23800	39%
CSM - Nash to Jerrold	Barrington Wst Selwyn	27300	43800	60%
	CSM Wst Barrington	24000	48500	102%
	CSM Wst Curletts		26100	NA
	CSM Wst Nash		26100	NA
	CSM Wst Awatea/Dunbars		26100	NA
Main South/Blenhiem - Springs to Curletts	Blenhiem Wst Curletts	40200	35500	-12%
	Main South Wst Epsom	50200	54400	8%
	Main South Wst Lowther	43300	48000	11%
	Main South Est Springs	44500	48700	9%
Curletts - Blenhiem to Lincoln/Halswell	Curletts Sth Blenhiem	35500	37400	5%
	Curletts Sth Parkhouse	35400	35100	-1%
	Curletts Sth CSME	12000	11900	-1%
Amyes - Shands to Springs	Amyes Sth Shands	7700	16900	119%
	Amyes Nth Springs	10600	20500	93%
	Awatea Sth Springs	2600	18300	604%
	Awatea Nth Wigram	2400	10700	346%
	Dunbars Sth Wigram	5100	12000	135%
	Dunbars Nth Halswell	4700	9800	109%
Halswell Junction - Main Sth to Springs	HJR Nth Shands	1800	8200	356%
	HJR Nth Springs	7200	16900	135%
Halswell - Nicholls to Lincoln	Lincoln Sth Wrights	24400	30500	25%
	Halswell Sth Curletts	23500	27200	16%
	Halswell Sth Aidenfield	18000	22100	23%
	Halswell Sth Dunbars	13600	17500	29%
Rolleston Drive	Rolleston Sth SH1	2400	5900	146%
	Rolleston Sth Tennyson	100	2300	2200%

Table 4

Traffic Volumes and Growth 2001 to 2021 for selected locations