3. Traffic Models and Their Use

3.1 Use of Traffic Models

Depending on the computer software, a traffic model can provide numerous outputs for the assessment of various scenarios. In this study the key outputs that have been used in the analysis of the Do Minimum and Option Scenarios are the traffic volumes, travel speeds and intersection delays. These three outputs have been used for a number of purposes, however they are most commonly used for Deficiency Analysis and Economic Analysis.

3.2 Deficiency Analysis

By loading the trips associated with a particular land use onto a network, the areas of the network that are not operating well (i.e. those areas that are termed as deficient) can be identified. This is done using the concept of Level of Service (LOS), which is a measure of how well a road can handle the travel demand placed upon it. Level of Service describes the operating conditions of a traffic stream and how a motorist and/or passengers perceive them. The operating conditions of a facility (link or intersection) are related to the volume of traffic using the facility (link or intersection), the associated intersection capacity and the delays of the facility.

There are six LOS categories that have been defined using the following definitions (taken from the Highway Capacity Manual, 2000):

Level of Service A – Represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and manoeuvre within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger or pedestrian is excellent.

Level of Service B – Is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select speeds is relatively unaffected, but there is a slight decline in the freedom to manoeuvre in the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behaviour.

Level of Service C – Is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by the interaction with others in the traffic stream. The selection of speed is now affected by the presence of others, and manoeuvring within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

Level of Service D – Represents high density, but stable flow. Speed and freedom to manoeuvre are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level of Service E – Represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to manoeuvre within the traffic stream is extremely difficult, and is usually achieved by forcing another vehicle to "Give Way". Comfort and convenience levels are extremely poor and driver frustration generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

Level of Service F – Is used to describe forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount, which can traverse the point. Queues form. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable.

The procedures defined in the Highway Capacity Manual (HCM) 2000 to determine the LOS have been applied in two steps in this study. A course sieve analysis has been carried out to determine which links and intersections should be considered in more detail. The first course sieve analysis has been termed Performance Level Analysis and the

second, Detailed Level of Service Analysis. Refer to the Options Analysis Report, Section 5.2 for more detail of methodology for the two levels of analysis.

This process has been carried out for the Do Minimum Network and all option networks. By carrying out this process for the Do Minimum Network, areas of the network that need to be considered during the option analysis process have been identified. By repeating this process for each option network a check can be made to determine if the option network has addressed the deficiencies in the Do Minimum Network. It is noted that the option network can address deficiencies by either directly providing additional capacity to the deficient links or intersections, or indirectly by encouraging/allowing traffic to take alternative routes.

3.2.1 Do Minimum Network Performance Level Analysis

A Performance Level Analysis has been carried out on the Do Minimum Network to identify areas that are likely to be under pressure. From this analysis the areas listed in Table 5 through to Table 8 have been identified for further analysis using the Detailed Level of Service Analysis.

Link	Length
State Highway 1	Hornby to Rolleston
Springs Road	Trents to Main South Road
Carmen Road/Russley Road/Johns Road	Main South Road to Main North Road
The Southern Motorway	Curletts Road to Jerrold Street
Curletts Road	Blenhiem Road to Lincoln/Halswell Road
Main South Road/Blenheim Road	Springs Road to Curletts Road
Amyes Road/Awatea Road/Dunbars Road to Hendersons Extension	Shands Road to Sparks Road
Halswell Junction Road	Shands Road to Springs Road
Halswell Road	Nicholls Road to Lincoln Road

Table 5

Links predicted to have performance level D or worse - 2021 morning peak

Link	Length
State Highway 1	Hornby to Rolleston
Springs Road	Trents to Main South Road
Shands Road	Halswell Junction Road and the Main South Road
Carmen Road/Russley Road/Johns Road	Main South Road to Main North Road
The Southern Motorway	Curletts Road to Jerrold Street
Curletts Road	Blenhiem Road to Lincoln/Halswell Road
Main South Road/Blenhiem Road	Springs Road to Curletts Road
Amyes Road/Awatea Road/Dunbars Road to Hendersons Extension	Shands Road to Sparks Road
Halswell Junction Road	Shands Road to Springs Road
Halswell Road	Nicholls Road to Lincoln Road

Table 6

Links predicted to have performance level D or worse - 2021 evening peak

Intersection	Current Control Type
State Highway 1/Brookside Rd	Priority
State Highway 1/ Tennyson St	Priority
State Highway 1/Weedons Rd	Priority
State Highway 1/Curraghs Rd	Priority
State Highway 1/Kirk Rd	Priority
State Highway 1/Barters Rd	Priority
State Highway 1/Sawyers Arms Rd	Roundabout
Blenhiem Rd/Curletts Rd	Signals
Springs Rd/ Marshs Rd	Priority
Springs Rd/Hodgens Rd	Priority
Springs Rd/Tosswill Rd	Priority

Table 7

Intersections predicted to have performance level E or worse – 2021 morning peak

Intersection	Current Control Type
State Highway 1/Brookside Rd	Priority
State Highway 1/ Tennyson St	Priority
State Highway 1/Weedons Rd	Priority
State Highway 1/Curraghs Rd	Priority
State Highway 1/Dawsons Rd	Priority
State Highway 1/Kirk Rd	Priority
State Highway 1/Barters Rd	Priority
State Highway 1/Memorial	Roundabout
State Highway 1/Harewood	Roundabout
State Highway 1/Gardiners Rd	Priority
Main South Rd/Symes Rd	Priority
Blenheim Rd/Curletts Rd	Signals
Sockburn Roundabout	Roundabout
Parkhouse Rd/Treffers Rd	Priority
Curletts Rd/CSME Sth Bnd Off Ramp	Signals
Barters Rd/Waterloo Rd	Priority
Springs Rd/Amyes Rd	Priority
Springs Rd/Halswell Rd/CSME	Roundabout
Springs Rd/Marshs Rd	Priority
Springs Rd/Hodgens Rd	Priority
Springs Rd/Tosswill Rd	Priority

Table 8

Intersections predicted to have performance level E or worse – 2021 evening peak

3.2.2 Do Minimum Network Level of Service Analysis

Table 9 and Table 10 contain the predicted Do Minimum Network link and intersection levels of service in 2021 following detailed analysis for the locations identified in the Performance Level Analysis.

ROUTE	DESCRIPTION	Link Type	FWD Dir	Link Lanes	24 hour volume	AM Peak (1 hour equivalent volumes)				PM Peak (1 hour equivalent volumes)			
						FWD Vol	BAK Vol	FWD LOS	BAK LOS	FWD Vol	BAK Vol	FWD LOS	BAK LOS
SH1 - Hornby to Rolleston	SH1 Sth Carmen	Urbm	Sth	2	**19000**	444	975	Urban Link		999	699	Urban Link	
	SH1 Sth HJR	R2L	Sth	1	**27000**	964	1468	E		1660	1172	F	
	SH1 Sth Barters	Urb	Sth	1	**27000**	988	1611	Urban Link		1609	1363	Urban Link	
	SH1 Sth Kirks	R2LP	Sth	2	**30000**	1053	1586	Passing Lanes		1609	1411	Passing Lanes	
	SH1 Sth Dawsons	R2L	Sth	1	**29000**	1052	1516	E		1579	1388	F	
	SH1 Sth Weedons	R2LP	Sth	2	**25000**	1008	1311	Passing Lanes		1316	1306	Passing Lanes	
Springs - Trents to Main South	Springs Sth Main South	Urb	Sth	1	**22000**	758	1253	Urban Link		1443	1053	Urban Link	
	Springs Sth Amyes	Urb	Sth	1	**16000**	869	812	Urban Link		963	1029	Urban Link	
	Springs Sth HJR	R2L	Sth	1	**27000**	1113	1818	F		1743	1626	F	
	Springs Sth Marshs	R2L	Sth	1	**23000**	1018	1418	E		1441	1453	F	
	Springs Sth Birchs	Urb	Sth	1	**21000**	949	1286	Urban Link		1324	1333	Urban Link	
	Springs Sth Toswilll	Urb	Sth	1	**16000**	837	913	Urban Link		879	1123	Urban Link	
Shands - Halswell Junction to Main South	Sth Main South	Urb	Sth	2	**26000**	1096	1169	Urban Link		1359	1368	Urban Link	
	Sth Amyes	Urb	Sth	1	**11000**	561	532	Urban Link		794	586	Urban Link	
	Sth Seymour	Urb	Sth	1	**12000**	674	597	Urban Link		822	779	Urban Link	
SH1 - Belfast to Hornby	Johns Wst Main North	R2L	Wst	1	**20000**	1415	677	E		863	1468	E	
	Johns Wst Gardiners	R2L	Wst	1	**19000**	1337	644	E		815	1411	E	
	Johns Wst of Sawyers Arms	R2L	Wst	1	**27000**	1874	1034	F		1284	1978	F	
	Russley Sth Harewood	R2L	Sth	1	**22000**	1366	785	E		955	1589	E	
	Russley Sth Wairakei	R2L	Sth	1	**22000**	1338	880	E		1208	1469	E	
	Russley Sth Memorial	R2L	Sth	1	**31000**	1576	1522	F		1859	1741	F	
	Russley Sth Ryans	R2L	Sth	1	**24000**	1353	1114	E		1552	1433	F	
	Masham Sth Yaldhurst	Urb	Sth	1	**24000**	1111	1294	Urban Link		1224	1644	Urban Link	
	Carmen Sth Buchannans	Urb	Sth	1	**25000**	1316	1143	Urban Link		1525	1454	Urban Link	
	Carmen Sth Waterloo	Urb	Sth	1	**24000**	1175	1251	Urban Link		1303	1668	Urban Link	
CSM - Nash to Jerrold	CSM Wst Barrington	Mtw	Wst	2	**48000**	2501	3053	C	D	3359	2925	D	D
	CSM Wst Curletts	Mtw	Wst	2	**26000**	1294	2038	B	C	2080	1683	C	B
	CSM Wst Nash	Mtw	Wst	2	**26000**	1294	2038	B	C	2080	1683	C	B
	CSM Wst Awatea/Dunbars	Mtw	Wst	2	**26000**	1294	2038	B	C	2080	1683	C	B
Main South/Blenhiem - Springs to Curletts	Blenhiem Wst Curletts	Urbm	Wst	2	**35000**	1075	1694	Urban Link		1657	1485	Urban Link	
	Main South Wst Epsom	Urbm	Wst	2	**54000**	1539	2734	Urban Link		2576	2398	Urban Link	
	Main South Wst Lowther	Urbm	Wst	2	**48000**	1539	2020	Urban Link		2576	1799	Urban Link	
	Main South Est Springs	Urbm	Wst	2	**49000**	1429	2226	Urban Link		2629	1916	Urban Link	
Curletts - Blenhiem to Lincoln/Halswell	Curletts Sth Blenhiem	Urbm	Sth	2	**37000**	1658	1546	Urban Link		1882	1846	Urban Link	
	Curletts Sth Parkhouse	Urbm	Sth	2	**35000**	1851	1614	Urban Link		2070	1990	Urban Link	
	Curletts Sth CSME	Urb	Sth	1	**12000**	391	742	Urban Link		1013	525	Urban Link	
Amyes - Shands to Springs	Amyes Sth Shands	Urb	Sth	1	**17000**	714	816	Urban Link		977	945	Urban Link	
	Amyes Nth Springs	Urb	Sth	1	**20000**	911	933	Urban Link		1156	1208	Urban Link	
	Awatea Sth Springs	Urb	Sth	1	**18000**	699	998	Urban Link		1186	963	Urban Link	
	Awatea Nth Wigram	Urb	Sth	1	**11000**	429	582	Urban Link		726	626	Urban Link	
	Awatea Sth Wigram	Urb	Sth	1	**11000**	373	651	Urban Link		800	605	Urban Link	
	Dunbars Sth Wigram	Urb	Sth	1	**12000**	406	708	Urban Link		849	632	Urban Link	
	Dunbars Nth Halswell	Urb	Sth	1	**10000**	496	433	Urban Link		518	619	Urban Link	
	Dunbrs/Hndsns Est Halwell	Urb	Est	1	**14000**	505	858	Urban Link		983	695	Urban Link	
Halswell Junction - Main Sth to Springs	HJR Nth Shands	Urb	Sth	1	**8000**	545	515	Urban Link		501	889	Urban Link	
	HJR Nth Springs	Urb	Sth	1	**17000**	921	1218	Urban Link		1279	1196	Urban Link	
Halswell - Nicholls to Lincoln	Lincoln Sth Wrights	Urbm	Sth	2	**30000**	766	1829	Urban Link		1829	1276	Urban Link	
	Halswell Sth Curletts	Urb	Sth	2	**27000**	591	1779	Urban Link		1876	1101	Urban Link	
	Halswell Sth Aidenfield	Urb	Sth	1	**22000**	388	1361	Urban Link		1420	779	Urban Link	
	Halswell Sth Dunbars	Urb	Sth	1	**17000**	434	992	Urban Link		1056	804	Urban Link	

Table 9

2021 Link level of service for Do Minimum Network

Intersection	Control	AM Peak (seconds of delay) Worst App	Max App Del	Flw Wgt Del	LOS	PM Peak (seconds of delay) Worst App	Max App Del	Flw Wgt Del	LOS
SH1/Brookside Rd	P	Brookside	70.4	19.45	F	Brookside	31.2	5.88	D
SH1/ Tennyson St	P	Tennyson	45.7	5.91	E	Tennyson	47.6	4.82	E
SH1/Weedons Rd	P	Weedons	139.8	15.38	F	Weedons	66.8	5.68	F
SH1/Curraghs Rd	P	Robinsons	38.2	1.75	E	Robinsons	52.8	1.87	F
SH1/Dawsons Rd	P	Waterholes	29.7	2.07	D	Waterholes	41.2	2.51	E
SH1/Kirk Rd	P	Kirk	86.5	15.64	F	Kirk	184.8	21.78	F
SH1/Barters Rd	P	Barters	35.1	6.46	E	Marshs	70	7.20	F
SH1/Memorial	R	SH1 Sth	41.8	29.54	C	Memorial Wst	131.6	70.11	E
SH1/Harewood	R	SH1 Sth	21.3	18.32	B	Harewood Wst	128.6	38.67	D
SH1/Sawyers Arms Rd	R	SH1 Nth	123.5	53.44	D	SH1 Nth	29.3	9.37	A
SH1/Gardiners Rd	P	Gardiners	27.7	1.55	D	Gardiners	37.8	1.26	E
Main South Rd/Symes	P	Symes	16.3	0.67	C	Symes	32.4	1.56	D
Sockburn Roundabout	R	Epsom	27.8	17.37	B	Blenhiem	62.5	33.16	C
Blenhiem Rd/Curletts Rd	S	SH73 Wst	68.5	64.85	E	SH73 Wst	70.4	65.85	E
Parkhouse Rd/Treffers Rd	P	Treffers Est	21.5	2.94	C	Treffers Est	33.1	3.21	D
Curletts Rd/CSME Sth Bnd Of	S	Curletts Est	78.1	48.39	D	Curletts West	76.3	53.05	D
Barters Rd/Waterloo Rd	P	Waterloo Est	20.9	15.35	C	Waterloo Est	30.3	18.73	D
Springs Rd/ Amyes Rd	P	Amyes Est	20.9	10.28	C	Amyes Est	31.5	19.05	D
Springs Rd/HJR/CSME	R	Springs Sth	31.2	25.42	C	HJR Est	571.8	73.00	E
Springs Rd/ Marshes Rd	P	Marshs Wst	173.8	28.08	F	Marshs Wst	185.1	16.52	F
Springs Rd/Hodgens Rd	P	Hodgens	48.5	0.53	E	Hodgens	39.2	0.30	E
Springs Rd/Toswill Rd	P	Toswill	35.6	4.06	E	Toswill	41	3.40	E

Table 10

2021 Intersection level of service for Do Minimum Network

3.2.3 Desirable Levels of Service

It is necessary to determine what the desirable levels of service are for elements in the roading system to be operating under. Level of service "D" is generally accepted as the lowest level that should be planned for. The HCM states:

> *In reality LOS "E" is rarely attained.....perturbations in traffic flow as level E is approached cause a rapid transition to level F.*

Environment Canterbury's Regional Land Transport Strategy (RLTS) contains recommendations on minimum operational levels of service for roads in the Canterbury Region. Should a road be determined to be operating at a level of service worse than those listed, then appropriate planning investigations should be embarked upon. A poor level of service does not mean that a particular component of the network will be upgraded. The poor level of service may be acceptable in some circumstances or may be remedied by diverting traffic to other corridors (with improvements) or to other modes of travel through the use of travel demand initiatives.

The levels set out in Table 11 are recommended as the desirable minimum LOS.

Road Type	RLTS Class [1]	Peak Periods	Other Periods
Strategic Urban outside Chch Ring Rd including the Ring Rd	SU	LOS D	LOS C
Remainder classified network (except as stated below)	CO	LOS C	LOS B
Chch CBD	CBD	LOS F	LOS E
Remainder Chch classified network	CI	LOS E	LOS D
Other local Roads	OT	Local criteria [2]	Local criteria [2]

Table 11

Desirable Minimum Levels of Service

1 – The RLTS class codes have been developed for this study to simplify the reporting process.

2 – Individual authorities may have different criteria, however, the above criteria have been used in this analysis.

Table 12 contains a comparison of the routes and intersections listed in Table 9 and Table 10 with the lowest desirable levels of service for this study as defined in Table 11. Only the worst LOS for any portion of the route has been reported. This, however, does not mean that the whole route is operating at this LOS, refer to Table 9 and Table 10 for more detail LOS information.

Route/Location	Specific Portion	RLTS Class	AMP LOS	PMP LOS	Desirable Min Peak LOS	Issue
State Highway 1 Hornby to Rolleston	Rural	CO	E	F	C	Yes
State Highway 1 Hornby to Rolleston	Intersections	CO	F	F	C	Yes
Springs Road, Trents Road to Main South Road	Rural and intersections	CO	F	F	C	Yes
Shands Road, Halswell Junction Road to Main South Road	Intersections	CO	C or Better	C or Better	C	No
State Highway 1 Belfast to Hornby	Rural	CO	F	F	C	Yes
State Highway 1 Belfast to Hornby	Intersections	CO	D	E	C	Yes
Christchurch Southern Motorway	Ring Road	SU	D	D	D	No
Christchurch Southern Motorway Extension	Non Ring Road	SU	C	C	D	No
Main South Road/Blenheim Road - Springs Road to Curletts Road	Intersections	SU	E	E	D	Yes
Curletts Road – Blenheim to Lincoln	Ring Road Intersections	SU	D	D	D	No
Amyes Road - Shands to Springs	Intersections	CO	C or Better	D	C	Yes
Halswell Junction - Shands to Springs	Intersections	CO	C or Better	C or Better	C	No
Halswell - Nicholls to Lincoln	Intersections	CO	C or Better	C or Better	C	No

Table 12

2021 Links and intersections Do Minimum Network LOS compared to desirable minimum LOS

3.3 Economic Analysis

Economic Analysis is the process of determining the change in road network operating costs for the Study Area and comparing this change with the cost of works to achieve the change. This is typically called a Benefit Cost Ratio Analysis. The benefits are the change in the network operating costs and may be positive (i.e. benefits) or negative (i.e. disbenefits). Most commonly an option will attract benefits for a portion of the network but may impose disbenefits on another portion of the network. The costs of works are obtained through preparation of Construction Cost Estimates.

3.4 Construction Cost Estimates

Estimates have been prepared for the Transport Strategy, refer to Appendix A and B. Rates per metre for upgrading existing cross sections and constructing new roads have been included along with estimates for upgrading/constructing various intersection forms in Appendix A.

The cross section upgrade rates and intersection estimates have been prepared using historical and current construction rates. Current estimates for other projects that are to a higher level of detail than is intended for this report have been used as inputs for deriving the estimates. The two major projects used for this purpose are the State Highway 1 Russley Road / Carmen Road Four Laning Scheme Assessment Report and the Christchurch Southern Motorway Duplication and Extension Scheme Assessment Report. It has been noted that there are a number of geological differences between the area of construction for the Christchurch Southern Motorway Duplication and Extension and the Study area. The implications of the geological differences have been taken into account.

Generic land purchase costs have been provided by Binns Barber and Keenan Ltd (Registered Values and Property Consultants). Typical costs for numerous areas have been determined. The land costs have been included separately from the cross section upgrade rates and intersection estimates.

Contingencies have been allowed for in accordance with Transit New Zealand Cost Estimation Manual (SM 014) and Land Transport New Zealand Economic Evaluation Manual. Contingency costs of 30% on all works have been included at this stage of the study. Professional fees of 15% on the total construction estimate (including contingencies) for all future professional work stages have been included.

3.5 Network Operating Costs

The network operating costs consist of three components being travel time costs (TTC), vehicle operating costs (VOC) and accident costs (AXC). All of these costs have been calculated using the procedures from Land Transport New Zealand's (previously Transfund New Zealand) Economic Evaluation Manual (PEM) modified as appropriate for use in a Transportation Study as explained below.

These costs have been determined for each option network and the Do Minimum Network. The benefits or disbenefits gained from the option are therefore the difference between the Option Network operating cost and the Do Minimum Network operating cost.

The costs have been determined for the study area only, in order to limit any changes to those in the area of interest. This is because there is potential for minor changes in traffic flows outside the study area to have a significant effect on the network operating cost, due to the network outside of the study area not being improved from the 2011 Do Minimum Network. Therefore, it is likely that areas outside the study area may be experiencing high levels of congestion which will result in an increase in overall network costs for this study.

The following sections (3.5.1 to 3.5.3) provide a brief summary on the process used to determine the network operating costs. For details of the process refer to Section 7, Analysis Procedure, of the Options Analysis Report.

3.5.1 Travel Time Costs

The TTC have been determined using the total Vehicle Minutes of Travel (VMT) within the study area. The total VMT includes time spent travelling along the links and time due to delay at intersections. The TTC also includes the additional cost due to the effects of congestion.

3.5.2 Vehicle Operating Costs

The VOC has been determined using the sum of the fuel cost while stopped (stopped time at intersections), speed change of vehicles using intersections where there is delay and the vehicle running cost for a given speed.

The fuel cost is the minutes delayed at intersections by the value of fuel while stopped. The speed change cost is an additional cost that is associated with decelerating and accelerating. For the purposes of this transportation study it is assumed that all vehicles on an approach to an intersection that has a delay, experience a speed change cycle. The speed change cycle assumed is for a change in speed from 75 kph to 20 kph and then returning to 75 kph. The vehicle running costs are calculated using the kilometres of travel at the speeds determined from the modelling. The value of running a vehicle at a certain speed is then used to calculate the vehicle running costs. No additional cost has been included for the effects of road roughness on the vehicle running costs. This is due to the strategic nature of this study and the difficulty associated with gaining road roughness data and using it with the transport model.

3.5.3 Accident Costs

The accident costs have been determined using the typical injury accident rates and prediction models. The injury accident prediction models used are the Urban Intersection Models, Rural Intersection models, Urban Midblock models and Rural Midblock Models. All of these injury accident prediction models use AADT volumes whether it be linked volumes, or major or minor flows at an intersection. Once the number of injury accidents has been determined the value of injury accidents has been used to determine the cost of accidents.

4. Issues Identification

4.1 Issues Identification Process

The issues to be considered during the study have been identified using a three part process. The three parts of the process involved the public during initial consultation, the study brief, and traffic modelling. The issues identified were collated and summarised for use for developing options. Figure 7 shows the processes used to identify the issues.

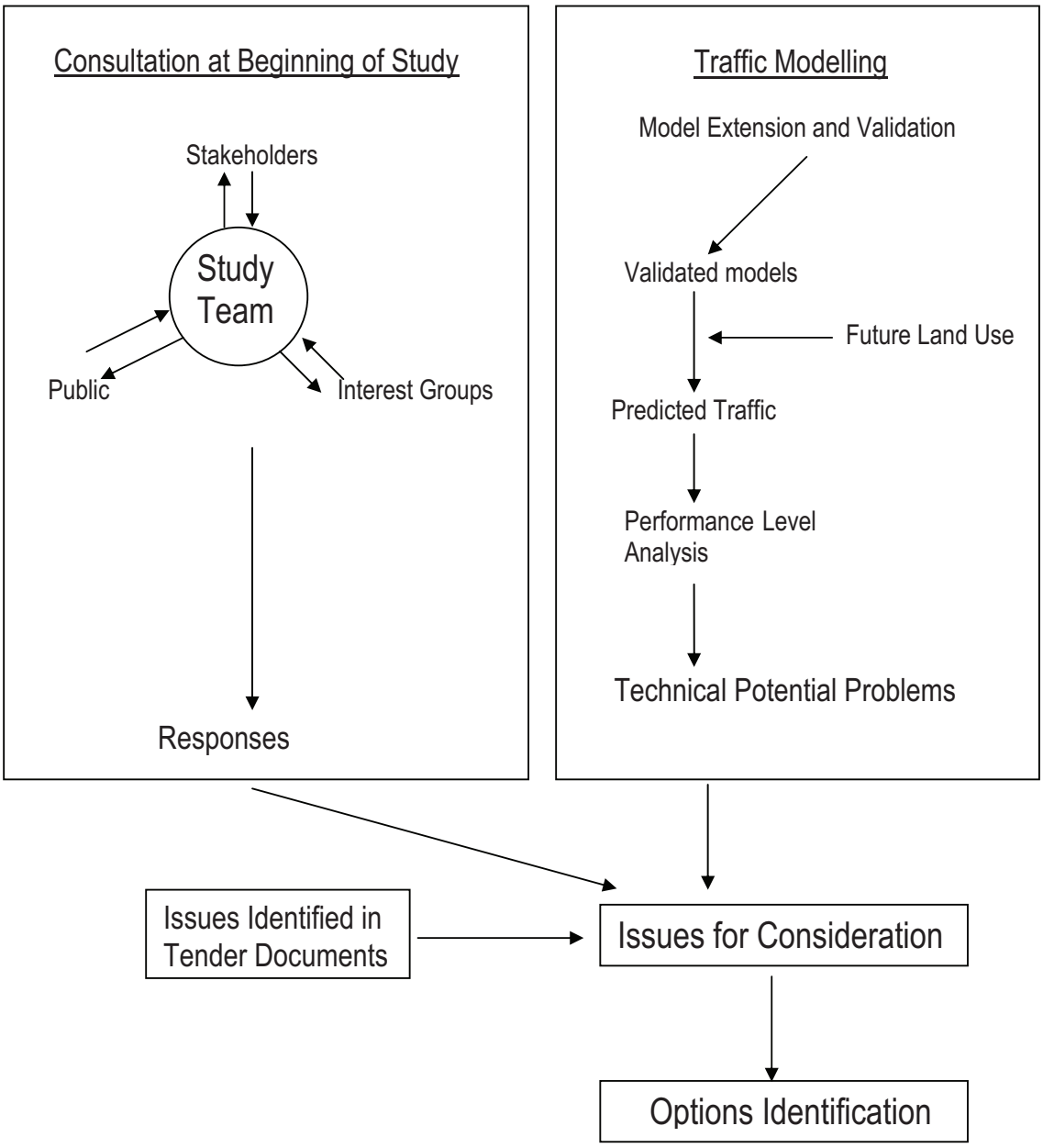

Figure 7
Three Part Issues Identification Process

The issues raised have been grouped into General and Specific Issues. These general issues are not specific to any location in the study area, whereas the specific issues are related to a particular link or area. The general issues have

been raised during initial public consultation and in the study brief. All three parts of the Issues Identification Process have raised specific issues.

4.2 General Issues

A summary of general issues includes:

- General issues related to road design, including the capacity of roads and intersections given existing and likely future traffic volumes,
- The hierarchy of roads in the network, related to network operation, capacity, efficiency, safety and access,
- The connectivity of the network, and the relationship between radial and orbital routes,
- Provision for alternative modes of travel i.e. public transport, cyclists and pedestrians,
- The provision for and impact of heavy vehicles,
- Rail and railway crossings,
- Issues related to structures (bridges and interchanges etc) including expense and amenity effects,
- Issues related to community severance, amenity values, schools etc in proximity to moderate or high traffic volumes,
- Tangata Whenua, Iwi and heritage issues,
- Land development.

Transportation analysis concepts of level of service and road network hierarchy have been used to expand and add to the general issues. The level of service concept is used for assessing how the network will operate and the road network hierarchy concept used to work towards a sustainable road network in the future. These concepts will be covered in more detail later in this report.

The comments on each of these General Issues has been included below.

4.2.1 Capacity of Network Links, Capacity of Intersections, Road Design

Links and intersections are discussed separately as part of this section. Where any specific design is required within this study, the design will be carried out in accordance with current practice.

Regardless of the outcomes of this study, ongoing traffic improvements must be continued. This involves carrying out routine maintenance, and isolated capital expenditure improvements as necessary. Examples of isolated capital expenditure improvements include the installation of passing lanes, construction of roading to service subdivisions, isolated intersection improvements, and isolated link improvements such as road realignments, bridge widening and road widening. Improvements such as these are only covered in this study where a link or intersection has been considered as part of this study.

Capacity of Network Links

The capacity of links in the network is affected by a number of aspects, two of which have the most significant impact. The first is the cross-section of the link and the second is the amount of access to the link. The access component is related to the hierarchy of roading discussed in Section 6 of this report.

With respect to the cross-section of the links, the most obvious component that will have an effect on the capacity is the number of lanes, (e.g. two or four). Other components of the cross-section that have a significant effect on capacity are the width of the lanes, the width of the shoulder, the width of the clear zone, and the pavement markings (or lack thereof). These components are especially relevant to rural links and some of these components also relate to urban links where factors such as on street parking also affect capacity.

In general two lanes per link are sufficient for most of the links in the study area. Where this is not the case the sites have been raised as specific issues to be addressed.

Many of the links within the study area do not have cross-sections that meet current design standards. The issue with the current cross-sections is not the number of lanes but the other components of design mentioned above. Together

with recommendations to address specific route or link issues, recommendations as to the appropriate cross-section will be provided.

By current design standards, it is meant those standards adopted by Transit New Zealand, and those utilised by the partner Road Controlling Authorities. These may include:

- Austroad Series of Guidelines,
- Manual of Traffic Signs and Markings (MOTSAM), Transit New Zealand/Land Transport New Zealand,
- Motorway Exits and Entrances: Geometric Details and Traffic Signing Details, Transit New Zealand,
- State Highway Geometric Design Manual, Transit New Zealand.

Other standards and guidelines covering pavement design, pavement surfacing, structures, and environmental and resource planning also exist. The Transit New Zealand Standards and Guidelines Manual SP/M/021 contains a list of Policies, Standards, Specifications and Guidelines used by Transit New Zealand. Other Road Controlling Authorities may use additional or alternative documents.

All the described capacities of the network components in this report refer to the equivalent vehicle capacity of a link. This is quite different from the people or goods carrying capacity of a link, whereby through the use of alternative distributions of modes of travel, the people or goods carrying capacity of a link can be changed significantly.

Capacity of Intersections

The capacity of an intersection is affected by a number of the same components that affect the capacity of a link. These are the number of lanes, lane width, pavement markings, provision for different movements, and width of shoulders. There are a number of typical intersection designs i.e. priority, roundabout, signals and merge. Each have different characteristics which are too numerous to be described here.

Initial analysis has shown a large number of the intersections within the study area are considered to have adequate capacity and are appropriate for the specific intersection. It is therefore not intended to consider every intersection within the study area. Where a specific issue has been raised regarding the capacity or safety of an intersection, the intersection types have been considered with respect to capacity and appropriateness.

4.2.2 Road Network Hierarchy, Network Operation, Capacity, Efficiency, Safety and Access

The Road Network Hierarchy is an important aspect of long-term road network planning and is discussed in more detail in Section 6 of this report. The network operation, capacity, efficiency and safety are all affected by access and all of these issues are related to the hierarchy.

4.2.3 Radial and Orbital Routes, Connectivity of Network

It is important that the transport network is developed so that it provides for all major travel demand movements. This means developing a network that is highly connected. Given that the network is based around the structure of Christchurch City, this is best achieved through the use of radial and orbital routes. These routes may take the form of urban or rural routes.

A large number of the specific options deal with this issue. When developing the package of works from the recommended options, any areas where the network is not considered complete will be addressed.

4.2.4 Provision for Alternatives: Cyclists, Pedestrians and Public Transport

It is necessary that a transportation network provides for all modes of transport including cyclists, public transport, pedestrians, freight and general traffic.

Current legislation and strategy documents including the New Zealand Transportation Strategy, the Land Transport Management Act, the Regional Land Transport Strategy, and Road Controlling Authority policies strategies place more emphasis on, and are more cognisant of, the need to provide for better alternative modes. Some Council's are producing specific Walking and Cycling Strategies to cover their Districts, including Selwyn District Council.

Many of the options proposed to address the specific issues raised, aim to reduce the volume of traffic travelling through developed areas. Where works are proposed for new facilities or upgrading of existing facilities, designs will take into account provisions for alternative modes of transport. Various alternative modes of transport include park and ride, bus, rail and cycling.

Section 7 contains more specific discussion on Alternative Transport Modes and the effects of increased uptake of these modes such as Public Transport.

4.2.5 Heavy Vehicles, Schools, Community Severance, Amenity Values, and Traffic Volumes

The above issues relate to the social impacts of traffic. For example, a large volume of traffic flowing through a township or past a school can result in severance issues or reduced amenity values. Decreased amenity values associated with the effects of traffic often fails to meet community objectives.

As stated in Section 4.2.4 above, many of the options proposed, aim to reduce the traffic volumes through the developed areas. Specific attempts in this study have been made to increase the amenity values, decrease severance issues, and reduce traffic volumes (and therefore heavy vehicles) through these built up areas. This principle has been continued through into the development of the strategies for the study area.

4.2.6 Rail and Railway Crossings

Rail Transport

The Canterbury Regional Land Transport Strategy supports rail as an integral part of Canterbury's strategic land transport system. The Main South Line (MSL) and the Midland Line to the West Coast pass through the study area. These are currently used for the movement of freight, especially coal from the West Coast, but also include one daily return passenger service to Greymouth.

Environment Canterbury is investigating the long term use of rail for commuter travel within the greater Christchurch area including links to Rangiora and Rolleston. It is recognised that this is an option that must be kept open for the future when there is a sufficient population base or incentives for this to be considered further, compared to bus based public transport provisions. It is therefore important that any options recommended in this study have adequate flexibility in the transport network for all modes of travel to be integrated in the future.

Public transport needs are currently met by Metro bus services from Christchurch through Rolleston to Burnham. If a rail transport operation was to be provided it has potential to provide a higher quality service, than current road based passenger transport can offer, and this may lead to increased public transport utilisation. It is important to note, however, that the ultimate take-up of passenger transport options will depend upon a number of factors other than just providing the service. This will include cost and frequency of the rail service integration with bus services, park and ride areas, and supporting demand management policies within Christchurch City.

When considering rail based Public Transport the high infrastructure cost of rail, including rolling stock, must be recognised and that a rail service requires a high population/patronage base to be economic. A current major hurdle is that the current Christchurch railway station does not serve the CBD, which requires a change in mode making travel by rail less attractive.

In the study area, increased passenger transport use will have the greatest effect on the State Highway 1 corridor adjacent to the MSL. The MSL is the line from Christchurch south through Hornby and Rolleston. Should a well patronised rail public transport system be developed that uses this line, there are two main effects on the outcomes of this study.

The first effect is a potential decrease in demand on the roading network. However, even with a well patronised rail public transport system, the growth expected in the study area will still require upgrading of the roading network. Therefore the decrease in demand is unlikely to remove the need for upgrading the roading network. The decrease in demand may defer the need for upgrading of the roading network, i.e. it may affect the timing of works.

The second effect is that any upgrading of the roading network needs to be carried out in a flexible manner so as not to preclude rail transport. This means that upgrades to the roading network need to be carried out so that the

development of road-rail interface facilities (such as park and ride facilities) and integration with bus services are not precluded.

The effects of rail transport are considered later in this report under Chapter 7, Alternative Transport Modes.

Rail Crossings

There are currently a large number of rail crossings along the MSL railway within the study area. The clearance between the railway and adjacent parallel roads is very limited in some instances. This results in the safety requirements not being met at the crossings, as there is limited space for vehicles accessing the parallel roads to queue between the railway and the parallel road.

Some of these sites have been addressed but there are some substandard crossings still remaining that do not meet safety requirements. The worst of these is the Kirk Road railway crossing near State Highway 1 in Templeton. This site is currently covered by a length restriction bylaw (CCC) controlling use by large vehicles. Other sites of concern are Walkers Road near State Highway 1, and Jones Road near Railway Road. The Jones Road crossing is programmed to be upgraded by OnTrack in 2008 with the installation of Flashing Lights and Bells (FLB). The Walkers Road crossing is similarly due to be upgraded in 2009. It is intended to address any other issues associated with rail crossings within the strategy developed for this study.

There is a specified distance between intersections and rail crossings to ensure the safety of the rail and road network users. The relevant point for the use of this information is at scheme assessment stage and detailed design stage. Allowances have been included in this study for the modification of the roading and rail network, where appropriate, to comply with this standard.

4.2.7 Structures

This issue relates to structures such as bridges, interchanges and other grade separated structures that may be needed as a result of upgrading the roading network. Structures are expensive to construct and may, because of height, have a detrimental effect on amenity values of the surrounding area through impacts on the skyline and increased dispersion of the noise from traffic travelling over the structures.

An assessment of the environmental effects from any new structures has been included in the analysis of each of the options to be carried out in subsequent reports.

4.2.8 Environmental effects

The environmental effects of the options have been considered using the Resource Management Act Assessment of Environmental Effects process. The environmental effects associated with the options have been assessed during the analysis of each option. Preliminary Assessments of Environmental Effects have been prepared for each option.

4.2.9 Tangata Whenua, Iwi and Heritage Issues

As is the case for environmental effects, Tangata Whenua, Iwi and Heritage Issues have been considered in developing a transport network to cater for the future travel demand. The Tangata Whenua, Iwi and Heritage issues have been included as an indicator in the analysis of each option.

4.2.10 Stock Truck Effluent

Work is currently underway to address the issue of stock truck effluent on the roads. This work is being carried out by Transit New Zealand, Selwyn District Council and Christchurch City Council, in consultation with the Stock Transport Industry and Federated Farmers and facilitated by Environment Canterbury. Included in the Canterbury Regional Land Transport Strategy (RLTS) is an environmental policy to “Ensure the adverse environmental impacts from transport are monitored and national and regional standards are met.” One of the physical methods associated with the environmental policy of achieving this is to provide infrastructure such as disposal sites for stock effluent from trucks.

A study carried out prior to this study has identified a number of sites for the installation of stock truck effluent disposal sites. These sites, together with the installation of holding tanks on stock trucks and the encouragement of changes to farm management practices, are expected to result in a significant reduction in the amount of effluent on the roads. It is not intended to carry out any further work on this issue within this study.

4.2.11 Land Use Development and Intensification

Land use development and intensification has a significant effect on the road network. Development can result in significant increases in traffic volumes and delays on and accessing the road network, and also cause road safety issues if the development is inconsistent with good road network access management practice. The transport network is there to serve all road users. To this end, the transportation needs of a new development and the effects of these needs must be balanced against the needs of existing and potential users of the existing and future road network.

This study has made an attempt to take into account the transportation needs of potential future land use development and intensification up until 2021 and balance these needs with the needs of other road users. It has also tested the effects of the landuse pattern subsequently developed by UDS as detailed in Section 25. This study does not look at the needs and effects of individual developments but rather the needs of all in the study area by proposing a roading hierarchy to support the traffic movements resulting from the land use development and intensification patterns.

4.3 Specific Issues

All three parts of the Issues Identification Process have raised specific issues. The specific issues are issues relating to the operation and capacity of specific network elements. However, as groups of individual elements may serve the same function the specific issues have been grouped into growth areas and corridors. Options have been considered for each element, however, this has been done in conjunction with other elements in each growth area/corridor. The growth areas and corridors are show in Figure 8.

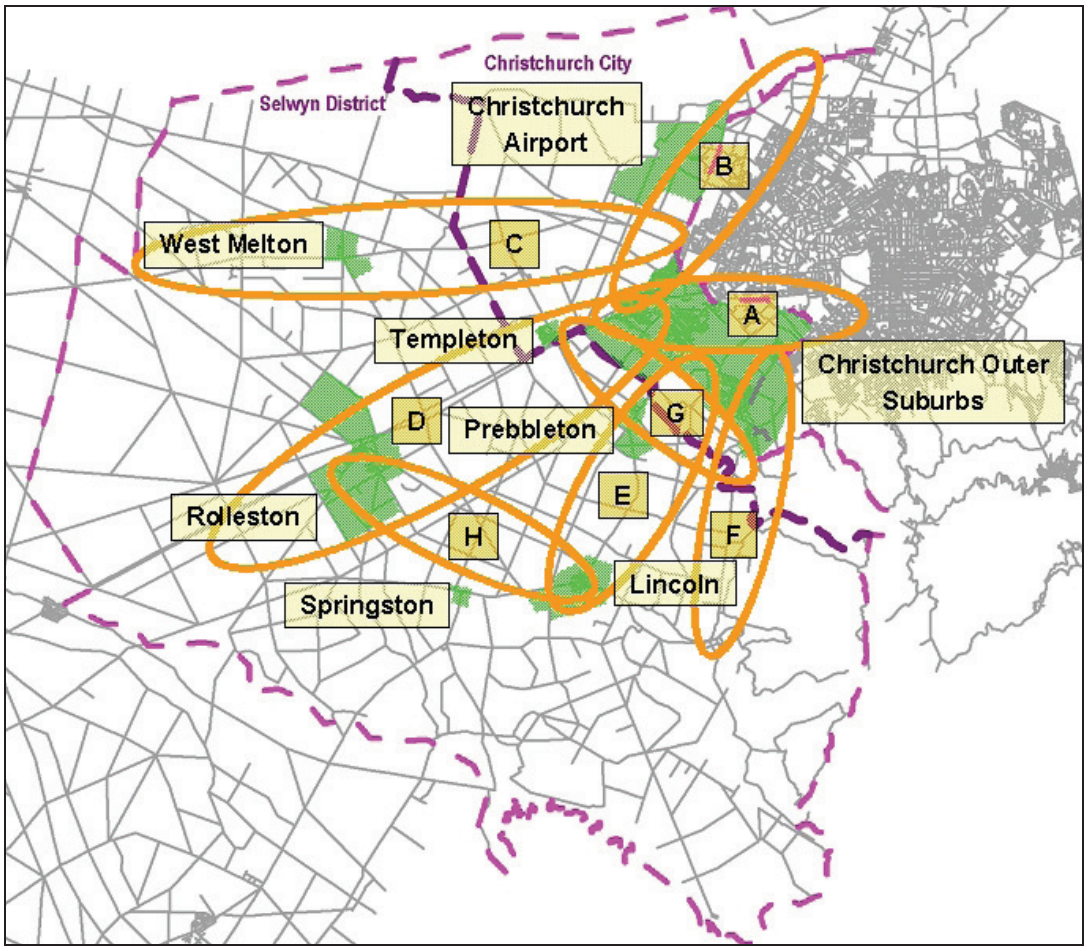

Figure 8
Corridors and Growth Areas

A total of 47 individual options were considered and reported on in the Options Analysis Report. From the analysis of the individual options, 10 packages of options were formed and considered with the findings taken to the stakeholders

for feedback. Below is a summary of the option locations and drivers considered for each corridor and the growth areas.

Corridor A – Christchurch Southern Access Corridor

- The planned Christchurch Southern Motorway duplication and extension – Barrington Street to Springs Road,
- A future Christchurch Southern Motorway extension – West of Halswell Junction/Springs Road to State Highway 1 with five route options,
- Options of grade separated intersections at Nash Road, Dunbars Road, Springs Road, Shands Road and State Highway 1 and combinations of these, road closures and overbridges at locations without grade separated intersections.

Corridor B – Belfast to Hornby Corridor

- State Highway 1 – Carmen, Masham, Russley and Johns Roads. Appropriateness of the prior scheme assessment outcomes,
- McLeans Island Road intersection changes due to safety issues and options for alternative access,
- Christchurch International Airport internal road network and connections with State Highway 1,
- Merrin Street extension – Hawthornden Road to Russley Road,
- Hornby Bypass from between State Highway 1 near Russley to State Highway 1 near Islington including four route options and intersection type and location options.

Corridor C – Russley to Aylesbury Corridor

- State Highway 73 - State Highway 1 to Aylesbury, traffic management upgrades,
- The form of the intersection of State Highway 73 and Pound Road,
- West Melton access to State Highway 73 – intersection forms.

Corridor D – Hornby to Burnham Corridor

- Main South Road/Blenheim Road Corridor – Carmen Road to Curletts Road layout options in terms of operation and safety,
- State Highway 1 – Hornby to Burnham, operation, safety, appropriate cross section, location and type of intersections and access,
- Rolleston to Christchurch local road connection, appropriate cross section, type of intersections,
- Rolleston Township access to State Highway 1, location and type of intersections and access.

Corridor E –Christchurch to Lincoln Corridor incorporating Prebbleton

- Springs Road – Trents Road to Main South Road and Prebbleton Township, existing routes, four route options, operation, safety, appropriate cross section, location and type of intersections.

Corridor F - Christchurch to Tai Tapu Corridor

- State Highway 75 – Curletts Road to Tai Tapu, traffic management options.

Corridor G –South Western Orbital Corridor

- Amyes Road – Awatea / Dunbars Road, operation, safety, appropriate cross section, location and type of intersections,
- South western linkage State Highway 1 to State Highway 75, two route options, operation, safety, appropriate cross section, location and type of intersections,
- Shands Road – Halswell Junction Road to Main South Road, appropriateness of the prior scheme assessment outcomes.

Corridor H – Rolleston to Lincoln Corridor

- Lincoln Rolleston Road and Boundary Road, operation, safety, appropriate cross section, type of intersections,

- Boundary Road deviation – operation and safety,
- Springston Rolleston Road, Weedons Road and Ellesmere Junction Road, operation, safety, appropriate cross section and type of intersections.

Growth Areas - Townships

- Templeton Township – effects of traffic through the township due to State Highway changes,
- Rolleston internal road network – Rolleston Drive Inner Ring Road; Outer Ring Road utilising Weedons Road/Levi Road/Lowes Road/Dunns Crossing Road, Byron Street or Moore Street extension, additional southern collector road, and connections over the State Highway between the northern industrial and southern residential areas.
- Rolleston Industrial Area – connection to State Highway 1 and 73,
- Lincoln Township – three bypass alignments, Springs Road/Ellesmere Junction Road/Gerald Street intersection operation and safety, local area traffic improvements,
- Prebbleton Township – two bypass options, Springs Road traffic increase and effect of increased traffic through the township, local area traffic improvements,
- Springston Village – two bypass alignments, local area traffic improvements.

Supporting policies and options

As well as the specific infrastructure options identified above, a number of supporting policies and options have been considered during the course of the study. These have included passenger transport, cycling and other travel demand management initiatives.

5. Packages of Options Development

5.1 Package of Options Works

From the analysis of the 47 individual options and 10 Packages of Options (or potential strategies) considered in the Options Analysis Report and the feedback received from the stakeholders a Package of Options was developed for further analysis. As the study progressed it became clear that there was a limited number of areas requiring major works to be investigated. These include:

- Hornby to Burnham Corridor incorporating the Templeton Growth Area,
- Christchurch Southern Access Corridor,
- Belfast to Hornby Corridor (Western Corridor),
- Christchurch to Lincoln Corridor incorporating Prebbleton,
- South Western Orbital Corridors.

The major works investigated for these corridors includes cross section upgrades (i.e. conversion from two lanes to four), construction of new links, realignment of existing links, and intersection changes including the intersection type and priority given to a specific traffic movement.

There are a number of areas where minor works were investigated. These included:

- Russley to Aylesbury Corridor,
- Christchurch to Tai Tapu Corridor,
- Rolleston to Lincoln Corridor,
- Christchurch Outer Suburbs,
- Prebbleton,
- Rolleston,
- Lincoln,
- Springston.

The minor works include pavement widening, intersection improvements (not change in intersection form), local area traffic management, minor safety improvements, seal smoothing, passing lanes etc. The nature of the model used in this study is such that the minor works are not amenable to strategic traffic modelling.

A specific version of the model has been developed for the Christchurch International Airport. There are also a number of major works that have been considered for the airport area and the adjacent roads. From the options analysis reported in the Christchurch International Airport Options Analysis Report, it is evident that there are a limited number of major works to be further investigated. These include intersection upgrades and public access issues.

There are three parts to the Packages of Options, the major works, the minor works and the Christchurch International Airport (CIAL) works. The Package of Options developed in this study are not a conclusive list of works for the study area. General maintenance has not been covered in this study which focuses on enhancements and new capital works.

5.2 Package of Options Hierarchy

In addition to the work considered during the development and analysis of the Package of Options, is the function of each of the links and the development of a road network hierarchy to promote and maintain the function of the links. This involved identifying the function of the current roads in the study area, and the function of the roads in each option. Functional classification is the process by which the roading network is grouped into classes according to the character of the service they are intended to provide. Underlying this process is the recognition that individual roads and streets generally do not serve complete trips, rather they provide shorter components of a complete trip. It is therefore necessary to determine how trips can be channelled through a network in a logical and efficient manner.

Functional classification describes the nature of the channels by defining the part that any particular road or street should play in serving the flow of trips through a highway network.

The roading network can be categorised as mobility, access, or a mixture of both. It is not efficient or safe to have a road that has a high level of mobility, i.e. high volumes at high speeds, and also a high degree of land access. Therefore a decision must be made on the appropriate function for each road and the road must be managed to ensure that it is both safe and it appropriately serves its function.

Local roads or streets have the principal function of access to land, where the Arterial networks have the principal function of mobility. Collector Roads have a function between access and mobility. The concept of access versus mobility is demonstrated in Figure 9.

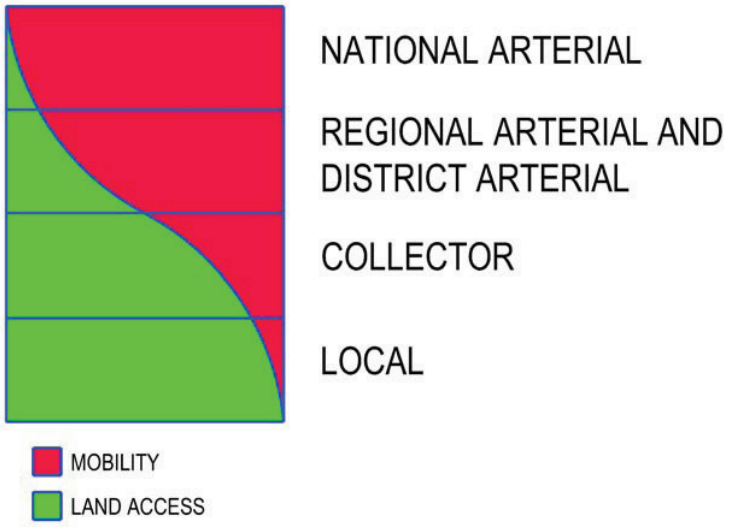

Figure 9
Hierarchy Classifications Function

When attributing a hierarchy classification to a road, the function of the road, (mobility or access), needs to be considered in conjunction with a number of other related factors. This is so that the hierarchy classification does not clash with other uses of the road. A road with high volumes and high speeds connecting high traffic generation centres, for example, will not work well as a local or collector road due to safety and capacity issues.

The factors that have been used in preparing the classification descriptions contained in this report are:

- Existing and future population or employment centres connected by the road,
- Existing and future traffic volumes on the road,
- Existing and preferred future speed limits on the road,
- Current access provisions and preferred future access provisions to the road,
- Connectivity with other classified roads.

These points are also important with respect to the long-term planning for the land adjacent to a road. It is imperative that the long-term planning for land adjacent to a road and the intended use of the road are in harmony. It is important to have appropriate access control and land use planning in conjunction with the network planning. Should this not occur, the result may be either a highly developed area of land with poor access to the roading network or a high mobility road with a poor safety record and poor capacity due to high level of access.

For any network planning to be effective and sustainable, appropriate controls must be associated with the hierarchy classifications. There are various levels of access control ranging from no access, to permitted access meeting the rules in District Plans. The access levels used in this hierarchy classification have been described in Table 13.

Access Level	Description	Current District Plan Classifications	Functional Classification Adopted for this Study
No Access	No access to roads except other classified roads	Motorways/Expressways	National Arterials which are Motorways/Expressways
Limited Access	No access to roads except other classified roads or access permitted under Limited Access rules	Major Arterials	National Arterials (other than Motorways/Expressways), Regional or District Arterials
Controlled Access	Other roads and private access assessed as a restricted discretionary activity.	Minor Arterials	District Arterials
Permitted Access	Other roads and private access where District Plan standards are met.	Collectors (Distributors) / Local Roads	Collectors (Distributors) / Local Roads

Table 13

Hierarchy Classifications Access Levels

Land-use planning and network planning are best undertaken together to ensure appropriate hierarchy's for transport are established. This is generally done under the Resource Management Act (RMA)/District Plan processes but can involve other legislation e.g. Local Government Act/Transit New Zealand Act.

5.3 Hierarchy Classifications

The hierarchy classification system adopted for this study has four main classifications, namely National Arterials, Regional and District Arterials, Collectors and Local roads. The function and nature of these road classifications are described below.

National Arterials:

- Are associated with State Highways,
- Are roads that connect areas of national importance,
- Have been defined in Transit New Zealand's National State Highway Strategy to have the following functions:
  - Connect major centres of population,
  - Provide access to major ports, major industrial areas, major primary production areas, and major tourist areas,
  - Serve as major urban corridors.
- Major centres and major areas are those of national economic importance as opposed to areas of regional, district, or local importance,
- Are generally higher speed (appropriate for the road form and environment), high capacity roads, with generally either no access or limited access roads,
- Are designed so that they are the most attractive roads for long distance travel,
- Have priority at priority intersections, and control as appropriate at non-priority intersections, that is to say signals, roundabouts and grade separation,
- Should be supplemented by a parallel road system of lower function roads where access locations to the national arterial are limited.

Regional Arterials:

- Are roads that connect areas of regional importance not already connected by national arterials,
- Also function as regional tourist links between national arterials and centres of regional importance,
- Centres of regional importance are towns, universities, research centres, tourist destinations, major commercial hubs and other centres of economic importance to the region,
- Are to supplement and support National Arterials,
- Are generally higher speed (appropriate for the road form and environment), high capacity roads, hence are generally either limited access or controlled access roads,

- Are designed so that they are attractive roads for regional travel,
- With the exception of national arterials, are to have priority at priority intersections and control as appropriate at non-priority intersections i.e. signals, roundabouts and grade separation,
- Connection to national arterials limited to key locations.

District Arterials

- Are roads that connect areas of district importance not already connected by roads higher in the hierarchy,
- Are to supplement and support National Arterials and Regional Arterials,
- Are generally higher speed (appropriate for the road form and environment), medium capacity roads and may have access controls, and so have an increased degree of access compared to roads higher in the hierarchy,
- Designed to a lower standard than roads higher in the hierarchy, however are still attractive roads for district travel,
- With the exception of roads higher in the hierarchy, are to have priority at priority intersections and control as appropriate at non-priority intersections, that is signals and roundabouts,
- Connection to roads higher in the hierarchy limited to key locations.

Collectors

- Roads that function as routes for trips within a localised area, or moving traffic between local roads and roads higher in the hierarchy,
- Are to supplement and support roads higher in the classification,
- Are low to medium speed (appropriate for the road form and environment), medium capacity roads and have an increased degree of access compared to roads higher in the hierarchy,
- Are designed to feed traffic from local roads onto arterials,
- Designed to a lower standard than roads higher in the hierarchy and have a balance between property access and road network mobility,
- With the exception of roads higher in the hierarchy, are to have priority at priority intersections and control as appropriate at non-priority intersections, that is signals and roundabouts,
- Connection to roads higher in the hierarchy is limited to key locations.

Local Roads

Local roads are a significant part of the roading network providing property access to adjoining land use. They are not formally included in this study, as the traffic volumes on local roads are generally significantly below the current capacity of the roads and their form is generally governed by the amenity values of the local community.

5.4 Road Form

Roads in a roading hierarchy are generally of two different basic forms dependent on their location; urban or rural. Regardless of the road location and hence form, roads of the same hierarchical classification still have the same function.

Urban roads differ from rural roads in that they generally pass through or adjacent to urban areas either now or in the future and generally have speed limits of 70kph or less. Rural roads pass through rural areas and generally have speed limits between 70kph and 100kph. Urban and Rural Roads often have different forms of cross section, intersection layout and control, and roadside environment.

More specific road forms or cross sections for each type of road in the hierarchy are included in Appendix A. These cross sections have been used in the preparation of estimates for each of the options. Appendix A also contains typical cost estimate rates to achieve these cross sections, given existing cross sections.

5.5 Input into Option Analysis

The function of all roads in the network is not the same because of the differing types of travel on the roads. Therefore the road design, level of access control, etc is important when analysing the options for the issues raised. As the roads highest in the hierarchy have the highest level of access control and are intended to act as high mobility roads, the options for these roads have been considered first in the following sections.

5.6 Access Controls

Having classified roads within the hierarchy it is necessary to ensure that each road is able to perform the function required of it. There are essentially two parts to this equation, one being design and the other being controls on land use (Hierarchy Controls).

Both Transit New Zealand and local authorities have influence over access controls for roads mainly through District Plan provisions. Transit's responsibilities relate solely to State Highways.

Transit has the means to influence access through:

- Declaring State Highways as Limited Access Roads (ss.88-98 Transit New Zealand Act 1989) and regulating access,
- Submissions during the District Plan review process,
- Affected party approvals during applications for land use consents and subdivision consents alongside or near State Highways.

Local Authorities have the means to influence access controls through:

- Declaring roads other than State Highways as Limited Access Roads (ss.346-346J Local Government Act 1974) and regulating access,
- Formulation of access controls for roads through the District Plan,
- Decision-making on land use consents and subdivision consents.

5.6.1 Limited Access Roads

Where access is proposed to a Limited Access Road, approval must first be sought from the road controlling authority. The road controlling authority may decline a request for access, subject to certain procedures.

5.6.2 District Plans and hierarchies

The Study Area falls within the territorial area of two local authorities, Christchurch City Council and Selwyn District Council. Therefore, the District Plans of these two local authorities are of relevance to this discussion of access controls. Both Councils have current District Plans that classify roads into a hierarchy.

The hierarchy of the Operative Christchurch City Plan is currently comprised of:

- Major arterial
- Minor arterial
- Collector
- Local

The hierarchy of the Proposed Selwyn District Plan is currently comprised of:

- Strategic
- Arterial
- Collector
- Local

If changes recommended in this study are adopted it will be necessary to update the classification of roads within the roading hierarchy in each district plan. The rules in both documents are different but are directed towards the same outcome; to ensure that the function of different road classifications is not compromised by inappropriate subdivision and land use.

5.6.3 Christchurch City Council – Plan rules

In terms of the Operative Christchurch City Plan, the following provides a brief overview of the relevant provisions.

Subdivision

Access is not permitted to any Limited Access Road unless there is no practicable access to another road. Any proposal to do so requires resource consent for a non-complying activity under Part 13, Transport, Critical Standard 5.3.2.

Activities

There are also a variety of specific transport controls which vary according to road classification in respect of distances of vehicle crossings from intersections, distances between intersections (for when new roads are created), minimum sight distances, maximum number of vehicle crossing per site, etc. These appear to be standard controls that are found in most district plans. In addition to the specific controls, there are numerous other rules that limit the scale of activities across various zones that have the indirect effect of limiting traffic levels. In addition any activity in the Study Area that generates more than 250 vehicle movements per day or provides more than 25 car park spaces requires resource consent as a restricted discretionary activity. Any such application which does not comply with these various control is subject to an assessment against the following matters:

(a) The actual or potential level of vehicle, cycle, and pedestrian traffic likely to be generated from, and moving past, the proposed access point(s).

(b) The extent to which the traffic using the access, either alone or in association with other nearby activities, will adversely affect the traffic function and/or the safety of the surrounding road network (Variation 86).

(c) Whether the present and projected vehicle, cycle and pedestrian flows along the frontage road will exacerbate any adverse effects created by extra on-street parking and manoeuvring associated with the site.

(d) The ability to gain access to an alternative road which has a lesser traffic function and the environmental impacts on that alternative road in respect of residential amenities where relevant.

(e) The extent to which the noise, vibration and fumes of vehicles using the access would affect surrounding activities, particularly residences.

(f) The adverse effects of extra traffic, particularly heavy vehicles, generated by the development on the amenity and safety of surrounding residential streets.

(g) The extent to which the physical form of the frontage road may mitigate the adverse effects of the extra vehicle movements generated for example, the presence of a solid median to stop right hand turns.

(h) Any cumulative effects of traffic generation from the activity in conjunction with traffic generation from other activities in the vicinity.

(i) Whether the speed of vehicles travelling on the frontage road is likely to exacerbate the adverse effects of the access on the safety of road users.

(j) The proximity of the access to other high traffic generating land use access points and intersections. (Variation 86).

(k) The extent to which any extra conflict may be created by vehicles queuing on the frontage road past the vehicle crossing.

(l) The extent to which the traffic generated by the site will adversely affect the frontage road, particularly at times of peak traffic flows on the road.

(m) Whether the adverse effects of the traffic could be minimised / mitigated by on-street traffic management measures including the installation of signals or pedestrian refuges or deceleration and acceleration lanes.

(n) The actual or potential effects on the safety and efficiency of the state highway.

(o) Whether the sight distances at the access are adequate to provide safe access/egress with reference to "Road and Traffic Standards Guidelines for Visibility at Driveways".

(p) For retail activity in the B3, B3B, B4 and BRP zones, the relationship of parking, access and manoeuvring areas, including freight deliveries, in respect to the safety of pedestrians. (Variation 86).

5.6.4 Selwyn District Council – Plan rules

The Proposed Selwyn District Plan is in two volumes (Rural and Township Volumes). The following provides a brief overview of the relevant provisions.

Rural Volume:

Subdivision

The creation of any allotment wishing to gain access to a Strategic Road is a restricted discretionary activity. As such, there is no permitted access onto a Strategic Road when it comes to subdivision. The assessment criteria when considering any such application includes:

(i) Whether the access will adversely affect the safe and efficient flow of traffic along the Strategic Road [R14.3], including any cumulative effects of multiple vehicular access ways on to the Strategic Road [R14.3];

(ii) The number, design and siting of any vehicular access ways or vehicle crossings;

(iii) Whether the allotments created can be designed to have legal access on to an alternative legal road other than a Strategic Road [R14.3], and whether this alternative access is appropriate.

Furthermore, there is an advisory note outlining the specific controls that apply to Limited Access Roads. There are also specific rules relating to the design and location of access.

Activities

In terms of land use activities for instance where access ways already exist the following limits apply:

- Arterial and Strategic Roads, 30 ecm/d per site averaged over a week,
- Local and Collector Roads, 60 ecm/d per site averaged over a week.

Note: ecm/d is equivalent car movements per day. This unit recognises that heavy vehicles have greater effects on the network operation than light vehicles i.e. cars, so heavy vehicles are converted to an equivalent number of cars.

If the above limits are to be exceeded for any land use a resource consent is required as a restricted discretionary activity.

The assessment criteria by which any resource consent to exceed the above will be assessed includes matters such as adverse effects on amenity, compliance with Council design guidelines, any financial contributions payable, the position and design of the access way, and effects on other road users.

As with the Operative Christchurch City Plan there are also a variety of standard controls in respect of distance of vehicle crossings from intersections (which vary according to road classification), distances between intersections (for when new roads are created), minimum sight distances, maximum number of vehicle crossing per site, etc.

Township Volume:

Subdivision

All subdivision is a restricted discretionary activity if all standards are not complied with. As such, Council has the ability to decline any subdivision application provided there is a basis to do so within the controls included in the Plan. There is an advisory note outlining the specific controls that apply to Limited Access Roads. The same sort of assessment criteria for accesses to Strategic Roads in the rural area also apply in the townships. Once again there is no permitted access to a Strategic Road. A resource consent is required in every instance access is proposed to a Strategic Road.

Activities

In terms of land use activities access is only permitted to Strategic Roads where the speed limit is less than 70km/h and the site generates less than 100 equivalent car movements per day. If these standards can not be met, resource consent is required for a restricted discretionary activity. The assessment criteria for assessing such applications include the matter of adverse effects on traffic safety and flow on Strategic and Arterial Roads. Again there are the normal controls regarding access design and the like, which are common in District Plans as well as numerous other rules that limit the scale of activities across various zones that have the indirect effect of limiting traffic levels.

Objectives and Polices

A review of the Objectives and Policies of the Proposed Selwyn District Plan has identified that there are few provisions that would assist the Selwyn District Council in deciding on a resource consent application that breaches any of the traffic related rules. To ensure that the rules that are included in the Proposed Selwyn District Plan achieve their intended purpose, additional objectives and polices addressing the purpose of the hierarchy are needed.

5.6.5 Summary

The Transport Strategy has identified a recommended roading hierarchy (attached as Appendix E). It is considered that in general terms, the combination of hierarchy controls for Transit and local authorities should be sufficient to ensure that the intended function of Strategic Roads will be achieved. Arterial and Collector Roads may require additional controls to ensure their intended functions are protected. It appears that additional objectives and policies, that would come into play when any resource consent application for a breach of rules was made, relating to the intended function of roads within the hierarchy, would assist in deciding on such consent applications.

6. Study Partners Pre-Consultation Discussions

6.1 Study Partners Discussions

An early draft of the Interim Assessment Report was forwarded in February 2006, to the Study Partners, namely Transit New Zealand, Christchurch City Council, Selwyn District Council, Environment Canterbury and Christchurch International Airport. This was to allow the Partners to review the strategy and consider any implications of the strategy with respect to new policy development. In February 2006 the strategy was developing around Package of Options K (as detailed in the Draft Transport Strategy Interim Assessment Report September 2006 and its underlying assumptions.

Transit New Zealand raised a concern about the sustainability of the proposed Southern Motorway, and the ability for the motorway to serve the function of being a strategic freight route into the future. The Christchurch Southern Motorway forms the major southern access to Christchurch and the Port of Lyttelton. It has a vital strategic function for the economic well-being of not only Christchurch, but the wider Canterbury and South Island communities. It is crucial that travel time reliability is maintained along the Christchurch southern corridor into the future. The proposed Southern Motorway bypasses the current built up areas of Hornby and Sockburn, to then rejoin Brougham Street (a four lane median divided road) east of Barrington Street. The capacity of Brougham Street is restricted by many intersections and adjacent activities. Transport analysis has shown that the traffic entering Brougham Street from the Southern Motorway would be split 50% from Curletts Road (SH73) and 50% from the new Southern Motorway Extension. To maintain a reasonable travel time along this corridor requires that the traffic flows east of Curletts Road be limited to below 50,000 vehicles per day in the future. Strategy K as proposed failed to meet this criteria and hence alternative options were explored including no motorway access around Awatea/Dunbars Road or Nash Road.

Past history has shown that utilising strategic arterial roads for local traffic purposes degrades the function of the strategic arterial. Furthermore the New Zealand Transport Strategy (Land Transport Management Act) and the Canterbury Regional Land Transport Strategy promote an integrated, safe, responsive and sustainable land transport system. To achieve this local travel demand is encouraged to be met by more sustainable modes of transport such as public transport, walking and cycling. For these reasons access to the Southern Motorway from the Halswell/Awatea/Wigram areas has been removed from the original scheme. Local access to Christchurch from these areas will be provided by urban arterial roads, a high quality bus corridor along Halswell Road, and cycle facilities both on and off-road. Of particular note is that the Amyes/Awatea orbital arterial extending Dunbars Road to Sparks Road provides access to the Frankleigh/Milton/Gasson corridor that feeds into the heart of the CBD.

The Ellesmere Road extension to the Southern Motorway connection was developed to alleviate issues by reducing traffic volumes through Prebbleton, Sockburn and Halswell while also reinforcing connectivity to proposed southern and eastern growth areas at Lincoln and to the University. Due to the concerns regarding the potential high traffic volumes on the Christchurch Southern Motorway an alternative route for the extension of Ellesmere Road was sought which did not connect it directly to the Southern Motorway. It was decided during the Study Partners discussions to investigate connecting the Ellesmere Road extension to Wigram Road and then north across the Southern Motorway via grade separation where it would intersect with Awatea/Dunbars Roads. Also included with this is the extension of Wigram Road to Magdala Place via a fly over of Curletts Road to access Blenheim Road and the CBD. This would therefore provide a route from Lincoln that passes near Prebbleton and Halswell to Blenheim Road near Riccarton.

Other topics of discussion between the Study Partners included:

- Improved provision for public transport, namely buses, along Halswell Road through the construction of four lanes that would possibly operate in a similar fashion to the way Fendalton Road currently operates. This also involves rationalising the number of intersections along Halswell Road through modifications such as combining intersections, closing intersections and limiting some movements,
- Connection of the proposed Wigram development area to the Sockburn intersection via a new rail crossing from the Haytons/Washbourne area to Alloy Place,
- Inclusion of a bridge extending Nash Road over the Christchurch Southern Motorway to connect the northern portions of Aidanfield/Halswell and Wigram when development occurs,

- A full interchange (i.e. access and egress to and from all directions) at the intersection of the Christchurch Southern Motorway Extension, Shands Road and Marshs Road.

These proposals have been the basis of ongoing discussions between Transit and Christchurch City Council, who have agreed in principle a package of activities in the south west area of Christchurch that delivers an integrated and sustainable land transport system. This package is summarised in the next section and formed part of the overall strategy for consultation outlined in the next chapter.

6.2 Christchurch Southern Motorway and the South West Christchurch Transport Package

The Christchurch Southern Motorway Duplication and Extension scheme was revised as discussed above. The key difference from the original scheme is the exclusion of access at Awatea/Dunbars and Nash Road (but connectivity over the motorway is provided at both). Analysis showed that if these accesses are provided the motorway becomes overloaded east of Curletts Road and downstream on Brougham Street. By restricting access the motorway can fulfil the strategic function into the future, while local travel demand is facilitated through the urban arterial network, public transport, walking or cycling.

The overall package proposed for the SW Christchurch area is shown in Figure 10 and summarised below:

- Christchurch Southern Motorway (assumed Do Minimum Work):
  - Duplication of the existing Christchurch Southern Motorway (Collins St to Curletts Rd)
  - Extension of the motorway to Halswell Junction Road
  - Improvements along Halswell Junction Road till it rejoins State Highway 1 at new traffic signals at Main South Road
  - Major interchanges at Barrington Street and Curletts Road
  - An upgraded roundabout at Springs Road/Halswell Junction Road
  - Intersection improvement at Shands Road
  - Motorway underpasses will be built at Awatea/Dunbars and Nash Rd (also called Aidanfield Drive)
  - Includes various walk/cycle crossing points and a cycleway
- Radial Arterial Roads
  - Springs Road, minor improvements
  - Wigram Road, upgrade and extensions north and south
    - North via bridge over Curletts Road to Magdala Place (via motorway overbridge) and Birmingham Drive to Matipo St (to link with Blenheim Road) and Wrights Road (to link with Lincoln Road)
    - South via bridge over new Southern motorway to link with new greenfields link to Lincoln via Ellesmere Road
- Halswell Road (SH75)/Lincoln Road, upgrade to four lanes with public transport priority
    - Traffic signals at Dunbars Road and new Hendersons link/Aidanfield North link
    - Templeton connected to new Aidanfield North link
    - Left in/out at Tankerville Road, Kinnaird Place, Guise Lane, the southern end of Warren Crescent, Cardinal Drive and existing Hendersons Road
    - Priority intersections at Nash Road, Rowley Ave and Warren Cres north
- Orbital Arterial Roads
  - Amyes/Awatea/Dunbars upgrade with new Dunbars extension through to Sparks Road
- Other features
  - Nash Road collector link to Wigram
  - Wigram development collector roads
  - Haytons Extension and rail crossing to Sockburn intersection
  - Includes various walk/cycle crossing points and a cycleway (by CCC) within the motorway corridor for much of the length

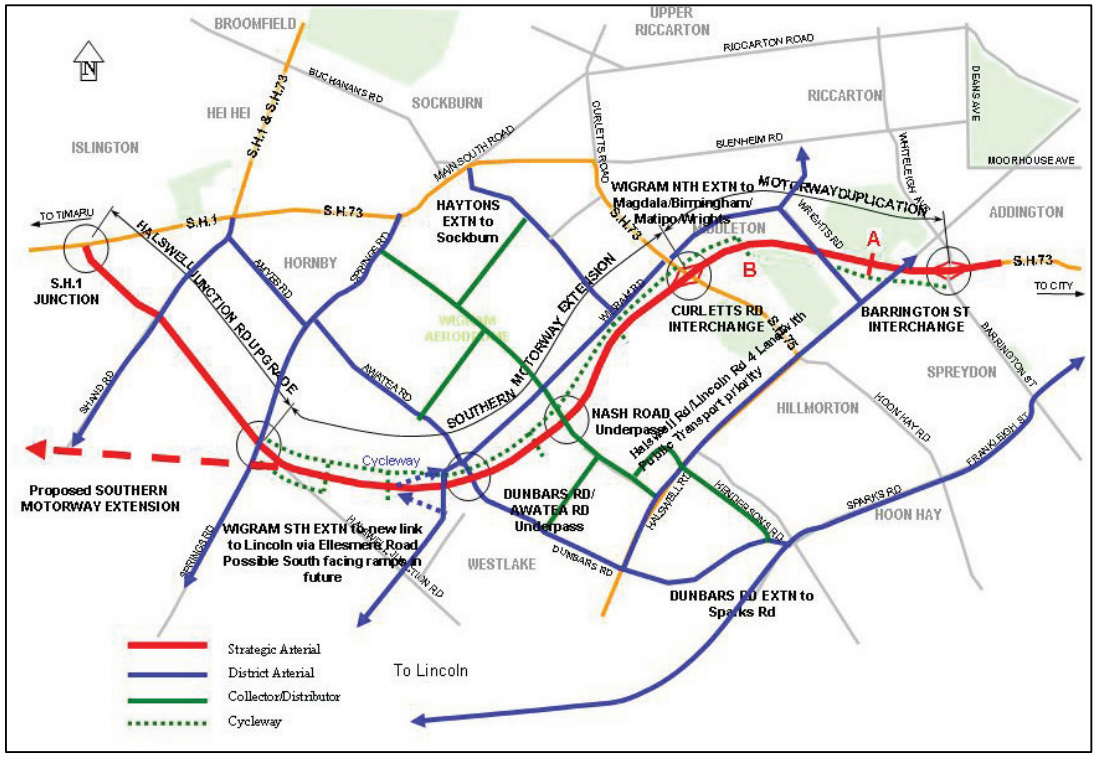

Figure 10

Christchurch Southern Motorway Duplication and Extension and SW Christchurch Transport Package

6.3 Do Minimum Modifications

The discussions above lead to a better appreciation of the likely projects within the study area over the next 10 years, and the Do Minimum Network (see Section 2) was revised accordingly. The modifications include the Nash Road over bridge over the Christchurch Southern Motorway and the provision of a free flow right hand turn movement from the north at the intersection of Curletts Road and the Christchurch Southern Motorway.

These modifications to the Do Minimum Network have a minor effect on the travel demand however they enable the network to better provide for the demand. This being the case it was important to include these modifications in the Do Minimum Network. Unfortunately changing the Do Minimum Network means that any option network based upon (and therefore compared with) the new Do Minimum Network cannot be directly compared with any options based upon an older Do Minimum Network. This means that the Options P01 to P1K inclusive, set out in previously noted reports, cannot directly be compared to either the Draft Transport Strategy or the Transport Strategy.

7. Alternative Transport Modes

7.1 General

It is necessary that a transportation network provides for all modes of transport. This includes private motor vehicles, trucks, public transport, rail freight, cyclists, pedestrians etc. Within the study, where it is proposed that works be carried out, whether new facilities or an upgrade of existing facilities, the assumed design of the facility has taken into account provision for alternative modes of transport.

The package of works which makes up the Transport Strategy, where possible, reduces traffic volumes through developed areas and provides for key strategic routes. This has two specific advantages for alternative modes such as buses and cyclists. These include removing through traffic from developed areas making these areas safer for cyclists and easier for buses to access and meet timetables, as well as providing capacity on key strategic routes for express buses.

7.2 Rail

A rail corridor predominantly used for freight is in place within the study area between Rolleston, Templeton, Hornby and Christchurch Central. The use of rail for freight should be encouraged in the future, particularly for key industrial generators such as those at the Rolleston Industrial Park.

The study has considered the potential for commuter rail services in the study area. To ascertain the likely patronage of a service using this corridor, a rail corridor test was set up. For the test, the following assumptions and parameters were established:

- Catchment for origin and destination of trips are shown in Figure 11,
- Twenty percent of all people moving between the catchments assumed to travel by rail,
- AM peak used,
- Trains available on demand (compared to a set timetable).

The test showed that very few people would use a rail service. In the morning peak, only some 300 trips from a total of 203,200 trips would use rail instead of the road to move between the catchments shown in Figure 11. The largest effect is to State Highway 1 between Hornby and Rolleston where approximately 80 trips out of 4000 would use rail instead of road.

The two main reasons for the relatively low response are the relatively low population living close to the rail and that rail has one inflexible route. For example, a person living at Rolleston can access Templeton, Hornby and Christchurch Central by rail but no other destination, nor travel to a 3rd area before returning to the origin.

It has therefore been concluded that bus based public transport will be more cost effective in the short to medium term. As travel demand for public transport increases, other modes could be explored in the future, such as larger buses or bus rapid transit.

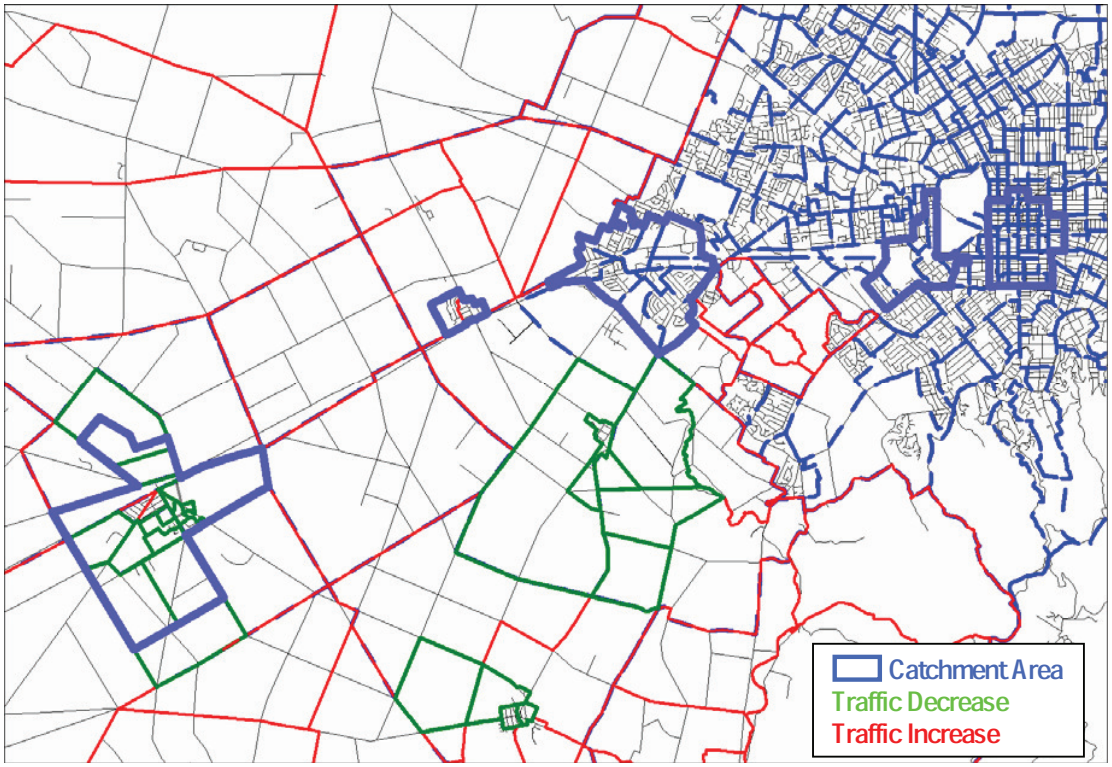

Figure 11

Rail Catchments Areas

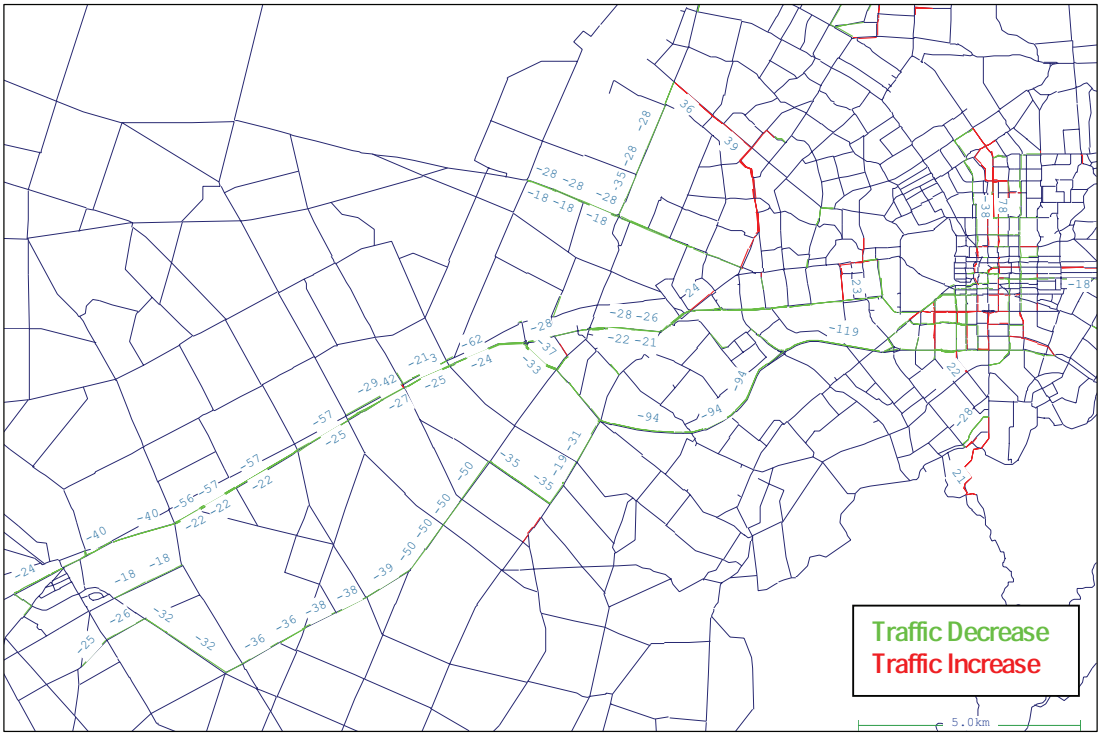

Figure 12

Rail catchments change plot. (2021 AM Peak)

7.3 Bus Transport and Park and Ride

With the increase in population in both Rolleston and Lincoln, opportunities for Park and Ride have been looked at. The success of Park and Ride will depend on easy and quick access to the Park and Ride facility, security and frequency of the bus service. A suitable area to construct such a facility at Rolleston has to date not been confirmed, however a site near the corner of Rolleston Drive and State Highway 1, opposite the Rolleston Railway Station, has been earmarked for a possible future facility. Further options maybe considered in a forthcoming Rolleston Structure Plan process to be undertaken by the Selwyn District Council.

Such a facility could also be provided for at Lincoln, if the need was justified. While any bus service to Lincoln and the University would most likely include a series of pick up and drop off points (bus stops), a facility could be provided for people living in the surrounding area to drive to and park, and then catch a regular bus service to Christchurch. A recent Structure Plan process for Lincoln undertaken by the Selwyn District Council looked at 5 possible sites. A facility to the north of Lincoln on Boundary Road close to the proposed Birchs Road public transport route is currently the preferred option.

Any Park and Ride service would need to be the subject of a separate study to its viability, looking particularly at the need in terms of likely patronage. Intermediate low cost solutions can utilise existing carparks such as at the University, or at a Local Hall, School or Hospital that can be piggy backed on the existing regular bus services.

The Transport Strategy provides for specific public transport corridors. These corridors have both been developed as part of the CRETS study and supported by and expanded on as part of the UDS Inquiry by Design (IBD) and ongoing structure planning of Lincoln and Rolleston.

Figure 13 shows the proposed main public transport corridors within the CRETS study area for Selwyn. Incorporated within these corridors are the general locations of likely Park and Ride facilities, major bus stations / transfer points, and bus priority routes. This is similar to that identified by the UDS process. Final routes and facilities will be subject to more investigation of demand vs service that can be logistically provided by Environment Canterbury to serve growing populations at Rolleston and Lincoln.

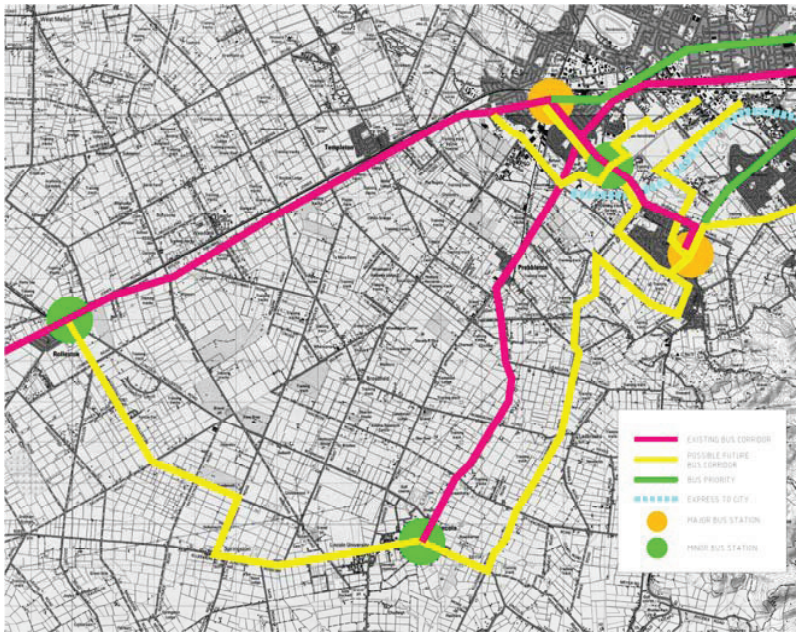

Figure 13
Main Public Transport Corridors for Selwyn

7.4 Cycling

Provision for cycling can be incorporated into individual works by providing wide shoulders and cycle lanes as appropriate. In particular cycling facilities can be incorporated into proposed urban upgrading works for Rolleston including Rolleston Drive, Tennyson Street, and the urban sections of Lowes Road, while in Lincoln cycle lanes can be incorporated into Gerald Street and Edward Street to improve connectivity from the township to the University.

The study has deliberately developed by promoting Shands Road, Springs Road and Ellesmere Roads as the main link options to minimise traffic on Birchs Road between Prebbleton and Lincoln to allow it to be used for cycling and buses.

The Selwyn District Council has recently completed the construction of an off road cycleway between Prebbleton and Lincoln as part of a "Christchurch to Little River Rail Trail" experience, an initiative connecting Hornby to Lincoln and beyond to Motukarara and Little River. While the section of the Rail Trail between Prebbleton and Lincoln forms part of an overall recreational linkage to Little River, it has demonstrated its value as a walking and cycling commuter route to Lincoln that encourages the use of active modes.

Based on the success of this section, more thought has gone into the development of potential cycling networks and it has been identified that the route between Lincoln and Rolleston utilising Lincoln Rolleston Road and Boundary Road would be an ideal opportunity to provide an off road cycleway in the same manner that has occurred on Birchs Road. Similarly a link between Rolleston and Hornby has been identified that could utilise Jones Road or Selwyn/Shands Road route to Christchurch. This would provide a triangle of connectivity between significant growth centres at Lincoln and Rolleston connecting to Hornby were there is a public transport hub as shown in Figure 13. There are also opportunities closer to Christchurch to link to cycleway initiatives being incorporated into the Southern Motorway Extension.

As with Birchs Road, the study has deliberately developed options to minimise traffic on Boundary Road by promoting Springston/Rolleston Road as the main link, to allow Boundary Road to be used for cycling.

One of the study objectives where possible, has been to divert through traffic away from townships. The Transport Strategy meets this objective by diverting traffic away from Templeton, Islington, Prebbleton and Lincoln. In doing so, the reduced traffic volume makes it safer for cyclists and pedestrians.

Many other recreational cycling opportunities were raised during public consultation. While these have merit in promoting cycling, they do not form a significant part of the everyday transport system.