



Wellington Transport Strategy Model

**Forecast Report
Final**



SINCLAIR KNIGHT MERZ



Wellington Transport Strategy Model

Forecast Report

Final

February 2004

prepared for



**Greater Wellington – The
Regional Council**

By



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1. Introduction

The Wellington Transport Strategy Model (WTSM) has been updated to 2001 utilising 2001 census data, as well as specifically collected household survey and intercept survey travel data.

This update is fully documented in a series of technical notes describing technical design, survey strategy, data processing, model calibration and model validation.

This report describes the base forecasts for 2011 and 2021 derived from the new model.

A description of the projects and network modifications adopted in the 2011 and 2021 forecast networks is described in Section 2. Section 3 of the report details the planning data forecasts adopted for the transport model as provided by Mera, while updates to other input data are described in Section 4.

The forecasts are provided in Section 5 and cover car ownership, trip ends, trips by mode, time period and sector, vehicle screenline and key location growth results, changes in average trip lengths and forecasts of changes in public transport boardings and alightings.



2. Future Year Networks

A detailed listing of the future year road and public transport network improvements is included in Table 1 and Table 2. This list of projects has been created with the assistance of Greater Wellington, and represents the best estimate of future projects. The key projects include:

- Road Projects
 - Inner City Bypass in both 2011 and 2021 network scenarios;
 - SH2 / SH58 grade separation in both 2011 and 2021 network scenarios;
 - Ngauranga - Aotea tidal flow in the 2021 network scenario;
- Public Transport Projects
 - 3 new railway stations by 2011 (Raumati, Lindale, Timberlea);
 - Frequency increases on the Kapiti and Upper Hutt railway lines in both 2011 and 2021 network scenarios;
 - Wellington CBD Bus priority in both 2011 and 2021 network scenarios;
 - Karori bus lane in both 2011 and 2021 network scenarios; and
 - Other Bus service and interchange improvements.

Specifically these future networks do not include any additional major projects such as Transmission Gully or road pricing.



■ **Table 1 WTSM Future Year Road Projects**

Project	Current	2011	2021	Description
Kapiti Western Link Road		Y	Y	New link between Paraparaumu North and Raumati South.
Korokoro SH2 improvements		Y	Y	Korokoro Partial grade separation
Dowse SH2 improvements		Y	Y	Dowse Drive Full grade separation. Minor changes have been made to transit lines crossing the Dowse intersection.
SH2/58 grade separation		Y	Y	Haywards SH2 interchange
Pauatahanui bridge	Y	Y	Y	Pauatahanui Bridge replacement. The improvements included a new two-lane bridge, a new roundabout and the realignment of highway.
Inner city bypass		Y	Y	Stage 2. Terrace tunnel southbound connected to Vivian St. Vivian St becomes eastbound only from Willis St to Cambridge Terrace. Buckle St extended through Arthur St. New link connecting Arthur St to Terrace tunnel (westbound only). Ghuznee St becomes two way, with one lane in each direction. Southbound link from Terrace tunnel to Ghuznee St closed. Minor changes have been made to transit lines crossing the bypass.
Plimmerton Mana stage 2		Y	Y	4 Laning between Plimmerton and Mana Bay.
Ngauranga – Aotea tidal flow		N	Y	Between Ngauranga merge and Aotea off ramp. AM - 3 to 4 lanes westbound (inbound) - 3 to 2 lanes eastbound (outbound) IP - 3 lanes both directions PM - 3 to 2 lanes westbound (inbound) - 3 to 4 lanes eastbound (outbound)
McKays Crossing safety improvements (2 lane bridge)	Y	Y	Y	Overbridge over the railway line
Kaitoke Hill Road upgrade	Y	Y	Y	A new highway between Kaitoke and Te Marua
Basin Reserve-John Street upgrade		Y	Y	



■ **Table 2 WTSM Future Year Public Transport Projects**

Project	Current	2011	2021	Description
Raumati railway station		Y	Y	Near Poplar Avenue, services between Waikanae and Wellington stop there.
Lindale Station		Y	Y	Near Awatea Avenue, the services between Waikanae and Wellington stop there.
Waikanae electric rail service		Y	Y	4 services/hr in AM peak between Waikanae and Plimmerton. 5 services/hr in AM peak between Plimmerton and Porirua. 7 services/hr in AM peak between Porirua and Wellington (4 are express). The services between Parapauma and Wellington extends to Waikanae.
Kapiti-Wellington rail frequency increase		Y	Y	15min peak, 30 min off-peak
Upper Hutt-Wellington rail frequency increase		Y	Y	10min peak, 15 min off peak
Timberlea railway station		Y	Y	New rail station in Timberlea, the services between Masterton and Wellington stop there.
Wellington CBD bus priority (incremental)	Y	Y	Y	New bus only lane along the Golden Mile. Northbound: Lambton Quay between Grey and Molesworth. Southbound: Thorndon Quay between Hobson St. and Mulgrave, Lambton Quay between Johnson St. and Panama St., Hunter St. between Featherston St. and Willis. Running AM, IP, PM
Wellington rail station bus/rail interchange	Y	Y	Y	All services passed through Stout St. previously, changes to through Lambton Quay.
Karori bus lane to Karori tunnel	Y	Y	Y	New bus only lane westbound in Chaytor from Curtis St. to Korori Tunnel for AM, IP, PM.
Additional suburban bus services (Wainuiomata, Eastbourne, Upper Hutt, Stokes Valley to Wellington)		Y	Y	
Porirua railway station connection		Y	Y	
Extension of Airbus Flyer 91 to Upper Hutt	Y	Y	Y	Flyer 91 extends to Upper Hutt. 30min for all time period. Started from May 2003.



3. Planning Data Forecasts

As the trip generation models in WTSM are person based models rather than household based, the forecast population growth (by person type) is the key determinant of future trip making. The table below details the projections for each of the key planning variables as provided by Mera.

Mera's forecast growth in households at 8.4% per annum is greater than the corresponding growth in population of 5% to 2011; Average household size decreases from 2.69 in 2001 to 2.61 by 2011. The corresponding forecasts for 2021 continue this trend with the average household size decreasing further to 2.49.

Overall employment growth of 6.7% slightly outstrips population growth for the period 2001 to 2011 but only grows an additional 0.1% between 2011 and 2021. The 10.2% growth of employment in the CBD is approximately twice the regional average until 2011 and 1.7% from 2011 to 2021. Education enrolments are forecast to grow by 7% for the 10 years to 2011 and drop by 8.9% over the following 10 year period.

■ Table 3 Forecast Planning Data

Planning Data	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
Total Population	423,547	444,629	5.0%	453,657	2.0%
Total Households	157,297	170,530	8.4%	182,244	6.9%
Average Household Size	2.69	2.61	-3.0%	2.49	-4.6%
Employment - CBD	68,470	75,487	10.2%	76,754	1.7%
Employment - Total	213,520	227,725	6.7%	227,885	0.1%
Education Enrolments	98,710	105,665	7.0%	96,290	-8.9%

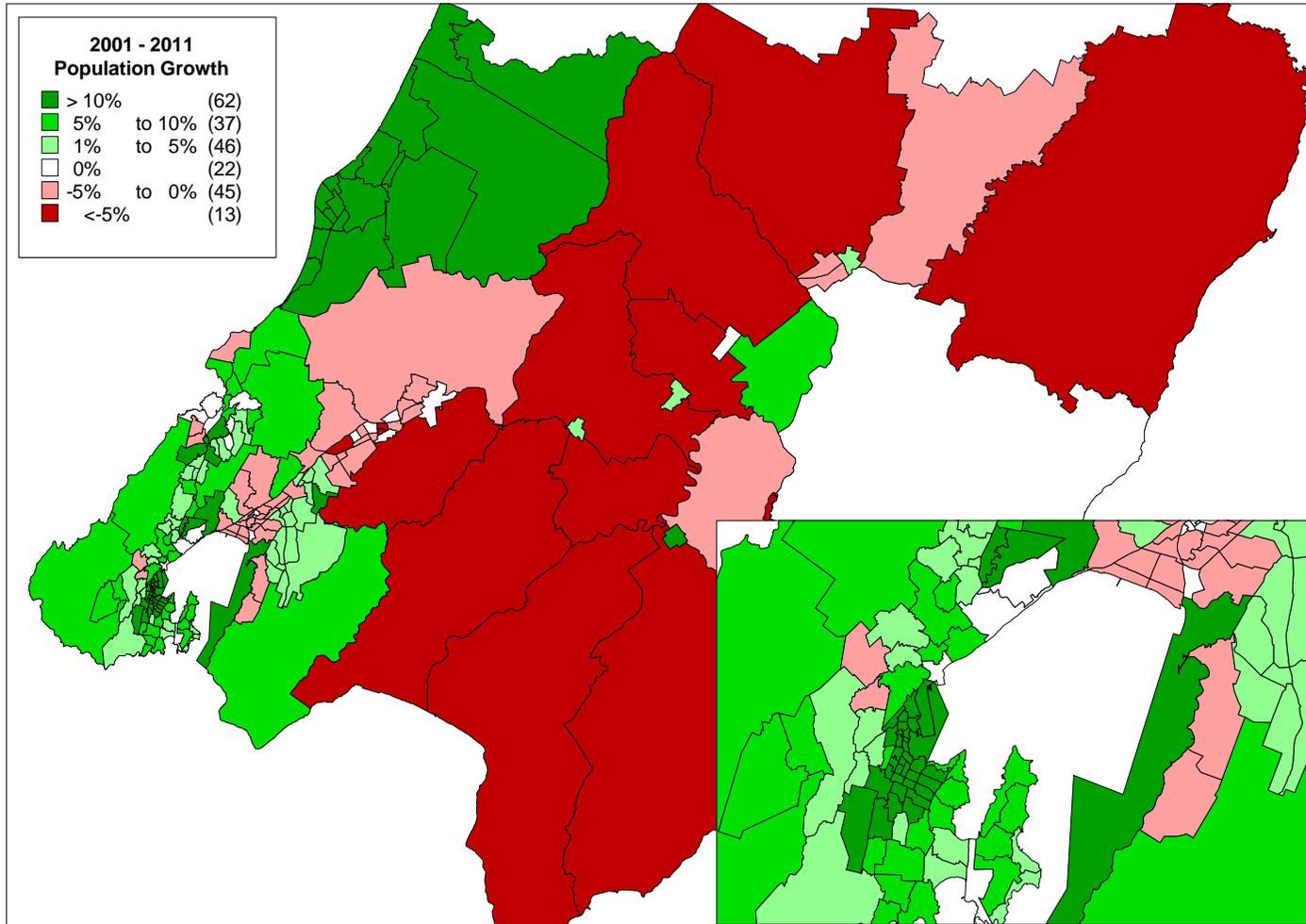
The geographic distribution of population and employment growth is shown in the following series of figures. In each figure the zones coloured red decline over the period with the darker red corresponding to the zones with the highest rate of decrease. The zones coloured green represent those zones with positive growth. Again the darker green corresponds to those zones with the highest growth. Those zones unshaded represent the zones with static population or employment levels.

The key observations from these figures are the high population growth in the Kapiti Coast District and moderate growth in Porirua and Wellington City, with population reductions in the rural areas of the region.

This observation is similar for the employment forecasts, although there is some growth in employment in the Masterton District to 2011 which is reversed by 2021, and much of Lower Hutt and parts of Wellington City shows a reduction in employment.

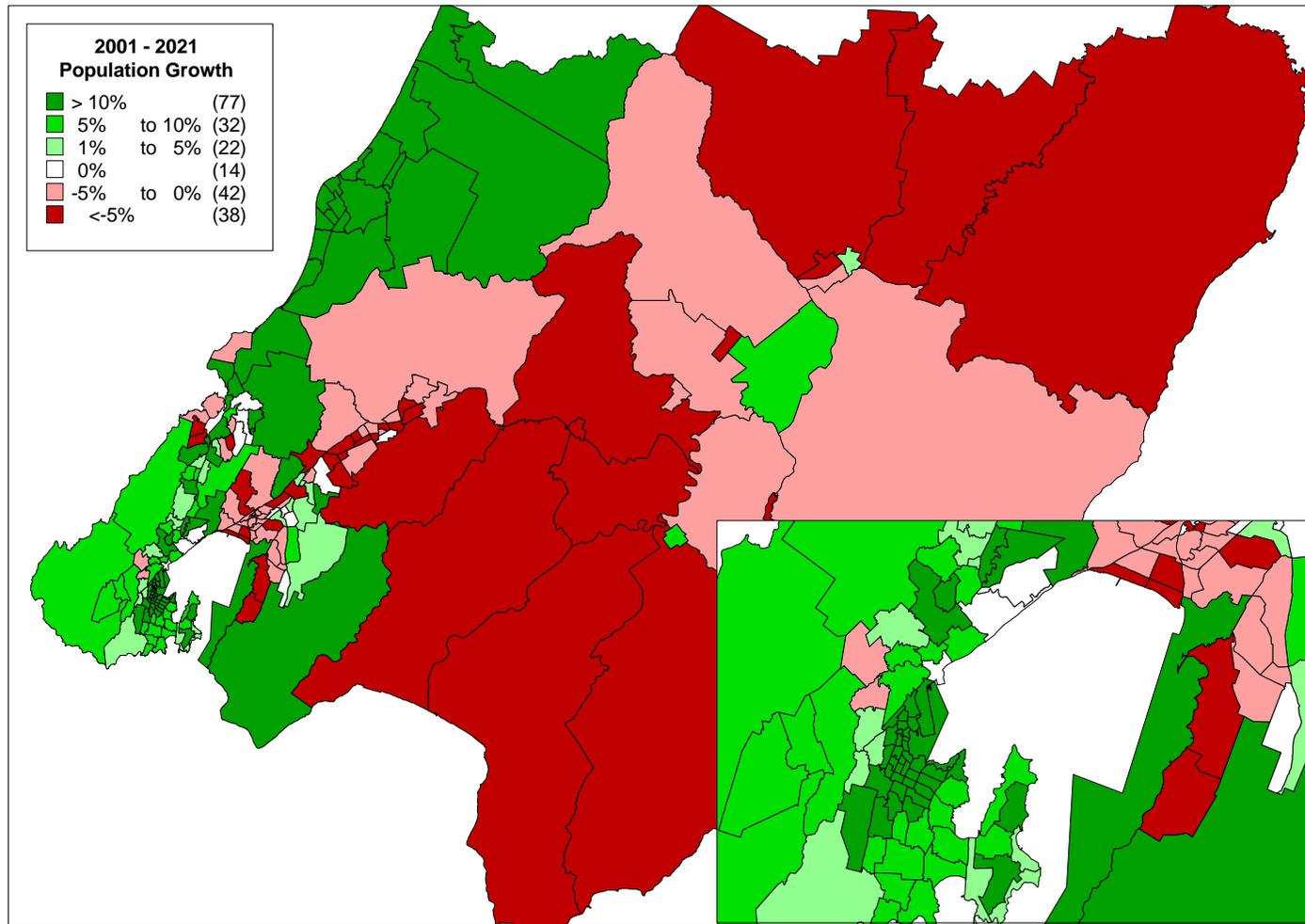


■ Figure 1 2001-2011 Population Growth



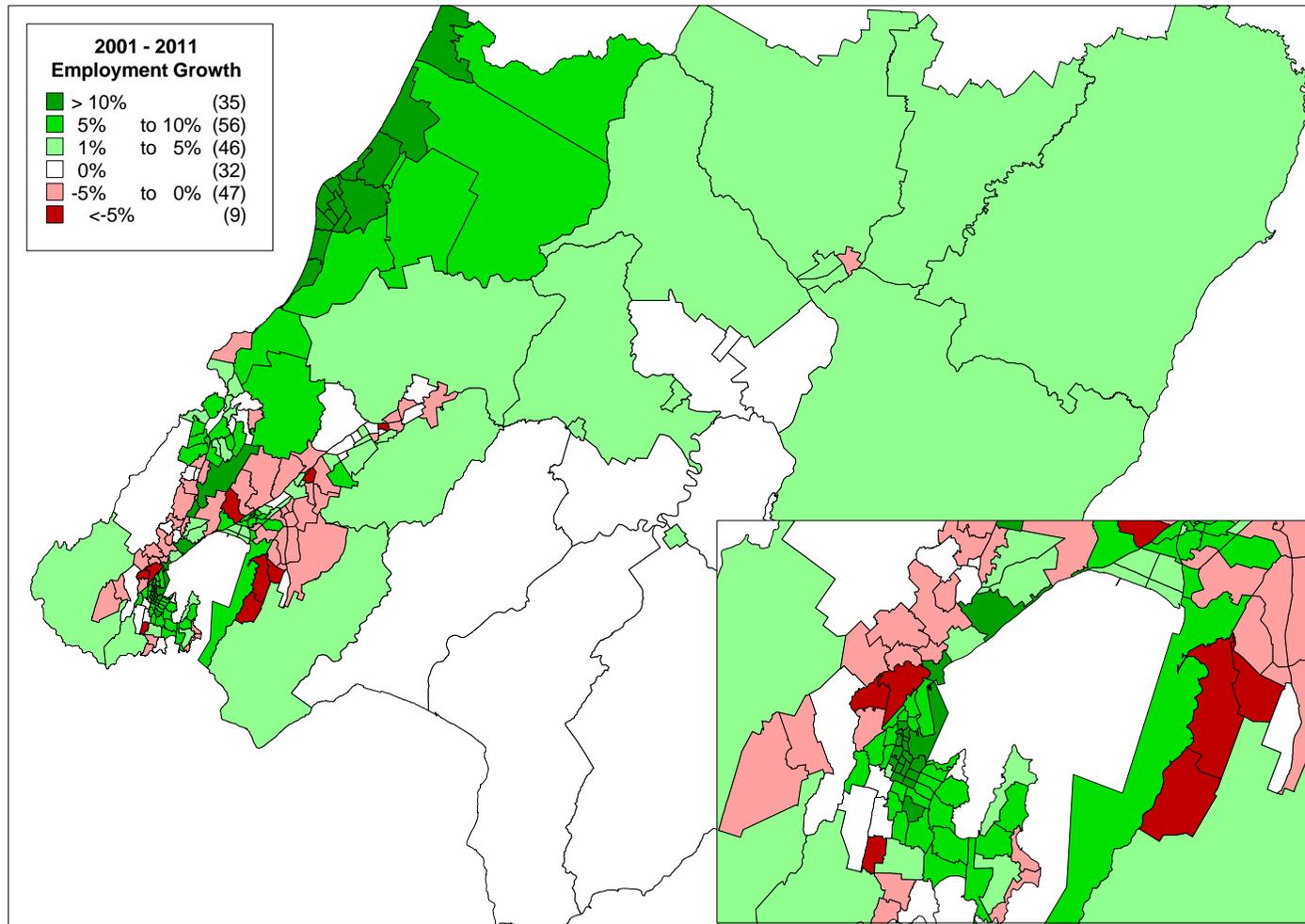


■ Figure 2 2001-2021 Population Growth



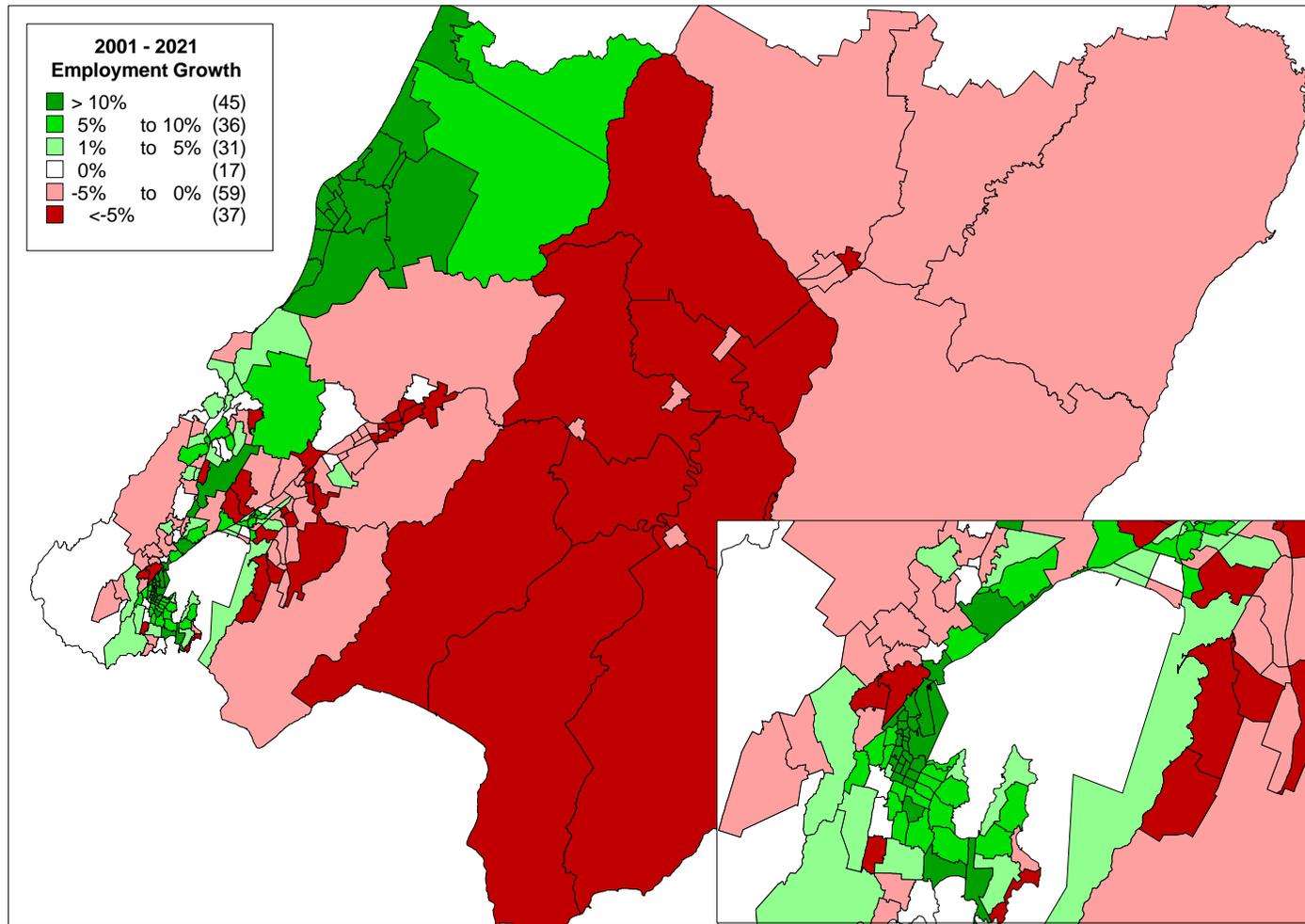


■ Figure 3 2001 – 2011 Employment Growth





■ Figure 4 2001 – 2021 Employment Growth





4. Other Data Inputs

A number of other input variables are required for WTSM. The table below summarises the main assumptions.

■ Table 4 Miscellaneous Data Assumptions

Data	2011 Assumption	2021 Assumption	Source
Value of Time	No change to 2001 values	No change to 2001 values	
Vehicle Operating Costs	No change to 2001 values	No change to 2001 values	
Parking Costs	No change to 2001 values	No change to 2001 values	
Public Transport Fares	No change to 2001 values	No change to 2001 values	
Airport Passengers	Increase to 14,500 passengers per day	Increase to 18,000 passengers per day	WIAL(2001) ¹
Real Income Growth	0.75% growth per annum	0.75% growth per annum	GDP Growth / Population Growth

Note 1: Appendix 6 WIAL Comment on Historic and forecast Growth 2001 - Based on forecasts by Leigh Fisher Associates and Tourism Futures International

For consistency purposes, a constant price forecast has been adopted. This has kept a fixed value of time and vehicle operating costs and assumed that all prices in the model remain constant in real terms. The GDP growth forecast adopted has been based on historical trends and agreed with Greater Wellington as appropriate for these forecasts.

The airport forecasts have been derived from an annual forecast undertaken in 2000 and represents strong growth in the international market at Wellington Airport which increases the international share from 11% in 2000 to 17% by 2021.

The base year public transport fare matrix represents the fare for both bus and rail between any given origin and destination and has been based on analysis of operators' ticketing data and current fare levels. This process has been repeated for future years, without updating the fare levels, but with adjustments to available services where appropriate.



5. Forecasts Results

5.1 Introduction

The following series of tables and figures illustrate the results for the 2011 and 2021 forecasts. Included are:

- Car ownership,
- Trip ends and trips by mode,
- Vehicle kilometres travelled and average trip lengths,
- Road screenline volumes,
- Selected motorway growth forecasts and average speeds,
- Public transport assignment volumes, and
- Selected network volume plots.

While the model results presented in the validation report exclude the effects of the matrix estimation, these matrix adjustments have been incorporated in both the base year and forecast model runs presented in this report.

The methodology for incorporating these factors is described in the matrix estimation report, but in summary the matrix estimation has generated multiplicative factors that have been applied both to the base 2001 matrices and the forecast 2011 and 2021 matrices.

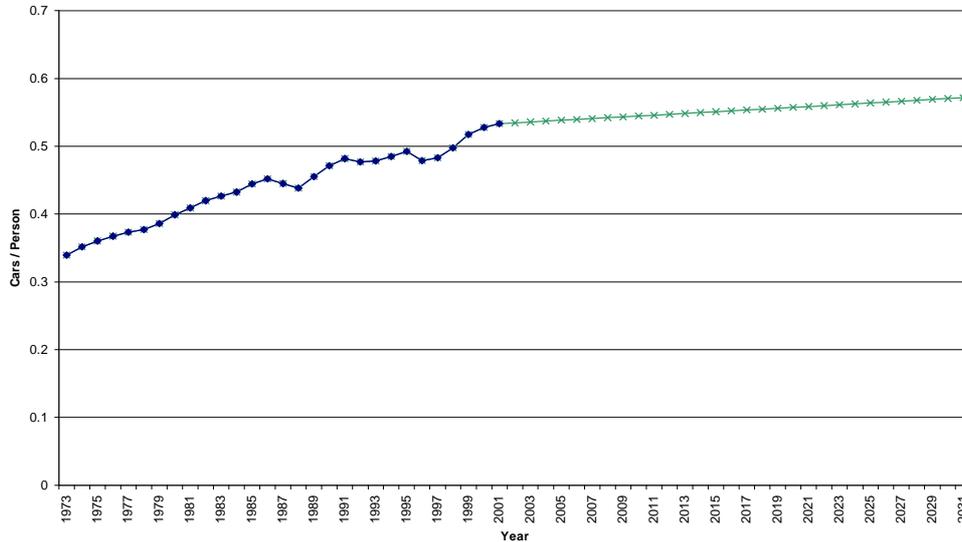
5.2 Car Ownership

Figure 5 illustrates the forecast growth in cars per person for 2001 to 2031 using a growth of 0.75% per annum for GDP / head, compared to the growth experienced over the last 18 years (with GDP / head growth of 1.7% per annum).

The model forecasts for 2011 and 2021 are 0.544 and 0.559 cars/person respectively reflecting a likely growth of 4.7% over the 20 year period.



■ **Figure 5 Car Ownership Forecasts – Cars per person**



5.3 Trip Ends

The forecast growth in trip ends is detailed below in Table 5. This table contains the forecast growth for each purpose and car availability segment.

■ **Table 5 Trip End Forecasts**

Purpose	Car Availability Segment	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
HBW	Captive	13,688	15,148	10.7%	15,948	5.3%
	Competition	111,413	120,995	8.6%	120,219	-0.6%
	Choice	139,246	144,398	3.7%	145,423	0.7%
	Total	264,347	280,541	6.1%	281,590	0.4%
HBEd	Captive	7,924	8,204	3.5%	8,518	3.8%
	Combined Choice	80,630	84,226	4.5%	75,011	-10.9%
	Total	88,554	92,430	4.4%	83,529	-9.6%
HBSH	Captive	30,974	34,717	12.1%	40,625	17.0%
	Combined Choice	258,082	278,911	8.1%	295,568	6.0%
	Total	289,056	313,628	8.5%	336,193	7.2%
HBO	Captive	26,896	29,782	10.7%	33,779	13.4%
	Combined Choice	345,430	366,243	6.0%	372,308	1.7%
	Total	372,326	396,025	6.4%	406,087	2.5%
NHBO	Captive	33,018	36,610	10.9%	40,733	11.3%
	Combined Choice	456,591	486,737	6.6%	494,254	1.5%
	Total	489,609	523,347	6.9%	534,987	2.2%
BU	Combined Choice	165,012	173,766	5.3%	172,131	-0.9%
Total	Total	1,668,904	1,779,737	6.6%	1,814,517	2.0%



The key observations of these forecasts are:

- overall the forecast in trip growth is forecast to be 6.6% between 2001 and 2011 dropping to 2% growth between 2011 and 2021;
- the home based work forecast trip growth reflects the growth in employment across the region of 6.1% between 2001 and 2011, and 0.4% from 2011 to 2021;
- there is less growth in employers business trips (5.3%) compared to home based work between 2001 and 2011, and a decrease of 0.9% between 2011 and 2021;
- low growth to 2011 in home based education trips (4.4%) which becomes negative between 2011 and 2021 (-9.6%), consistent with the drop in education enrolments and the ageing population over this period;
- a forecast of strong growth in the other purposes, particularly home based shopping forecast to grow by 8.5% to 2011 and 7.2% between 2011 and 2021. This derives from the growth in population, car ownership and real income through the period;
- generally captive trips are growing faster than the corresponding competition or choice trips. Despite the growth in car ownership across the region in terms of cars / person, the growth of 4.7% between 2001 and 2021 is less than the decrease in household size of (-7.5%). Coupled with this is the high growth in retired or unemployed households, hence the number of cars per household *drops* across the region, increasing the captive market.

Table 6 details the forecast for HCV growth. As documented in the HCV report, the HCV growth model is a function of employment and economic growth data. HCV trips are forecast to grow by 18.7% to 2011, slightly higher than non HCV trips. The growth from 2011 to 2021 is lower at 12.6%.

■ **Table 6 HCV Forecasts**

Data	Time Period	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
HCV Trips	24Hr	87,056	103,347	18.7%	116,398	12.6%
HCV VKT	AM	117,055	138,443	18.3%	155,265	12.2%
	IP	123,968	146,467	18.1%	164,148	12.1%
	PM	109,180	129,077	18.2%	144,718	12.1%

5.4 Trips by Mode

The forecast trips by mode and sector are shown in Table 7. For each mode the forecast trips have been sectorised into three sectors:

- To WCBD – trips to the Wellington CBD,



- To WCC – trips to Wellington City,
- Other – all other movements.

The car mode encompasses both car driver and car passenger trips. The key results observed from this table are:

- public transport trips are forecast to grow by 8.5% to 2011, faster than car trips (6.3%) and the walk / cycle modes (7.5%) - this is consistent with the strong growth in CBD, and the general slowing down on the key motorway links between 2001 and 2011 (see Table 14);
- between 2011 and 2021 the growth in all forms of travel in the region is low;
- growth in trips to the Wellington CBD to 2011 is higher than other attractors, for all modes - consistent with the growth in CBD employment;
- reflecting trip end growth, the growth forecast for the 2001 to 2011 period is significantly greater than that between 2011 and 2021.

■ **Table 7 24 Hr Trips by Mode**

Mode	2001	2001 Mode Share	2011	2011 Mode Share	2001 - 2011 Growth	2021	2021 Mode Share	2011 - 2021 Growth
Car - To WCBD	209,307	68.0%	228,200	67.6%	9.0%	231,511	67.3%	1.5%
Car - To WCC	366,978	78.9%	384,470	78.6%	4.8%	394,235	78.5%	2.5%
Car – Other	695,319	80.3%	738,510	80.3%	6.2%	752,281	80.3%	1.9%
Car – All	1,271,604	77.6%	1,351,179	77.4%	6.3%	1,378,026	77.3%	2.0%
PT - To WCBD	28,056	9.1%	30,880	9.1%	10.1%	31,767	9.2%	2.9%
PT - To WCC	21,761	4.7%	23,275	4.8%	7.0%	23,230	4.6%	-0.2%
PT – Other	23,894	2.8%	25,811	2.8%	8.0%	26,350	2.8%	2.1%
PT – All	73,711	4.5%	79,966	4.6%	8.5%	81,347	4.6%	1.7%
Slow - To WCBD	70,529	22.9%	78,693	23.3%	11.6%	80,972	23.5%	2.9%
Slow - To WCC	76,383	16.4%	81,563	16.7%	6.8%	84,888	16.9%	4.1%
Slow – Other	146,626	16.9%	155,157	16.9%	5.8%	157,767	16.8%	1.7%
Slow – All	293,537	17.9%	315,413	18.1%	7.5%	323,627	18.2%	2.6%
All - To WCBD	307,891		337,772		9.7%	344,250		1.9%
All - To WCC	465,122		489,308		5.2%	502,352		2.7%
All - Other	865,839		919,478		6.2%	936,398		1.8%
Total	3,277,705		3,493,116		6.6%	3,565,999		2.1%

Table 8 details the car driver and public transport trip matrix totals by time period. For car travel, the highest growth is in the interpeak for both 10 year periods, consistent with the excess capacity in the interpeak period as demonstrated by the average speeds shown in Table 14. To 2011 public transport growth is slightly higher in the evening peak, consistent with most education trips (with



low growth) occurring in the AM and interpeak periods. In both instances, consistent with the 24 hr trip matrices shown above, growth is substantially less in the period between 2011 and 2021 than the previous 10 years.

■ **Table 8 Car Driver / PT Trips By Time Period**

Mode	Time Period	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
Car Driver	AM	149,549	160,027	7.0%	163,525	2.2%
	IP	143,492	155,310	8.2%	161,552	4.0%
	PM	180,458	193,972	7.5%	200,416	3.3%
Public Transport	AM	27,475	29,975	9.1%	29,582	-1.3%
	IP	9,235	10,048	8.8%	10,293	2.4%
	PM	23,753	26,260	10.6%	26,808	2.1%

These results are repeated below for car driver drivers, without peak spreading (using a peak spreading parameter of -0.015 applied as per the time period report), indicating the minimal effects of congestion on travel time choice.

■ **Table 9 Car Driver Trip - Impact by Time Period of Peak Spreading**

Time Period	2011 With	2011 Without	Difference	2021 With	2021 Without	Difference
AM	160,027	160,190	0.10%	163,525	163,681	0.10%
IP	155,310	155,234	-0.05%	161,552	161,426	-0.08%
PM	193,972	194,132	0.08%	200,416	200,936	0.26%

5.5 Vehicle Kilometres Travelled

Table 10 and Table 11 detail the forecast vehicle kilometres travelled (VKT) and the forecast changes in average trip length. These forecasts indicate a slowly increasing trip length leading to growth in VKT greater than the corresponding forecast of car driver trips as detailed in the previous table.

These tables illustrate a higher forecast growth rate in total kilometres travelled for the interpeak compared to the morning and evening peaks to 2011 and 2021. This is consistent with the increase in trips to the Wellington CBD.

■ **Table 10 Vehicle Kilometres Travelled**

Time Period	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
AM	1,333,116	1,437,864	7.9%	1,481,326	3.0%
IP	1,048,222	1,150,187	9.7%	1,205,296	4.8%
PM	1,458,515	1,584,054	8.6%	1,642,293	3.7%



■ **Table 11 Average Trip Length (km)**

Time Period	2001	2011	2021
AM	8.91	8.99	9.06
IP	7.31	7.41	7.46
PM	8.08	8.17	8.19

5.6 Impact of Matrix Estimation

A further series of results has been extracted to assess the impact of matrix estimation on the forecast car trip matrices and vehicle kilometres travelled. These results are shown in the table below.

■ **Table 12 Matrix Estimation Impacts**

	Time Period	2001	2001 No ME	Diff	2011	2011 No ME	Diff	2021	2021 No ME	Diff
Car Driver Trips	AM	149,549	150,975	1.0%	160,027	161,613	1.0%	163,525	165,193	1.0%
	IP	143,492	143,779	0.2%	155,310	155,516	0.1%	161,552	161,718	0.1%
	PM	180,458	183,862	1.9%	193,972	197,493	1.8%	200,416	204,078	1.8%
VKT	AM	1,333,116	1,394,042	4.6%	1,437,864	1,508,833	4.9%	1,481,326	1,558,826	5.2%
	IP	1,048,222	1,101,094	5.0%	1,150,187	1,208,916	5.1%	1,205,296	1,267,078	5.1%
	PM	1,458,515	1,553,505	6.5%	1,584,054	1,688,240	6.6%	1,642,293	1,753,538	6.8%

The effect of the introduction of matrix estimation factors in forecast years is consistent with the effect in the 2001 base year upon which the factors have been based.

5.7 Forecast Auto Screenline Volumes

Figure 7 and Figure 6 illustrate the screenlines used in WTSM. Table 13 details the growth in total screenline volumes between 2001 and 2011 as well as between 2011 and 2021.

As for car driver trips, the growth in total screenline volumes between 2001 and 2011 is highest for the inter peak period, a trend that is repeated between 2011 and 2021. This is consistent with the higher growth in VKT for the interpeak periods.

■ **Table 13 Auto Screenline Volume Growth**

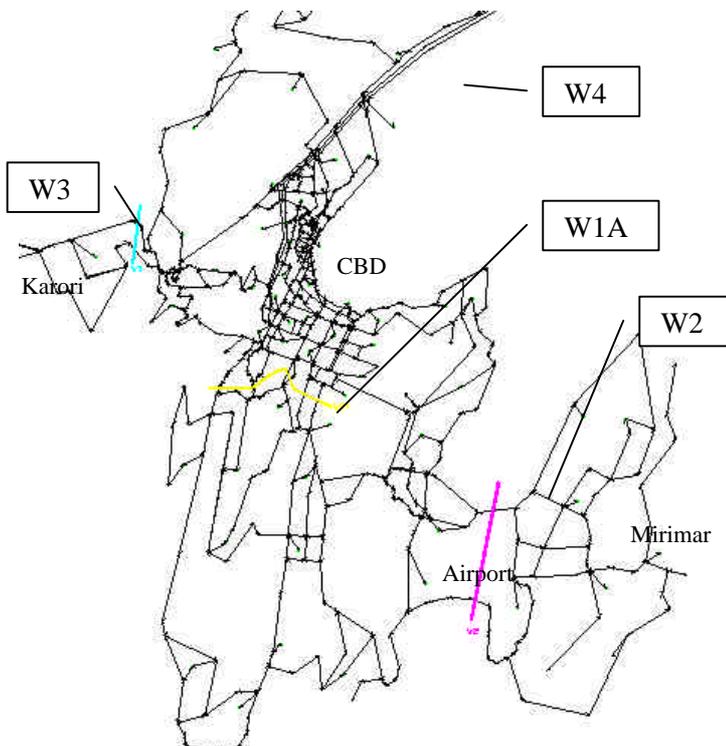
Time Period	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
AM	149,394	160,224	6.7%	163,483	2.0%
IP	110,683	119,973	7.8%	124,437	3.7%
PM	157,274	168,788	6.7%	172,691	2.3%



Figure 8 to Figure 10 demonstrate the growth on each screenline for both 10 year periods, 2001 to 2011 and 2011 to 2021 for each time period. The bars above the x-axis represent positive growth, while those below represent screenlines with negative growth. Appendix A includes the full screenline results that Figures 8 to 10 are based upon.

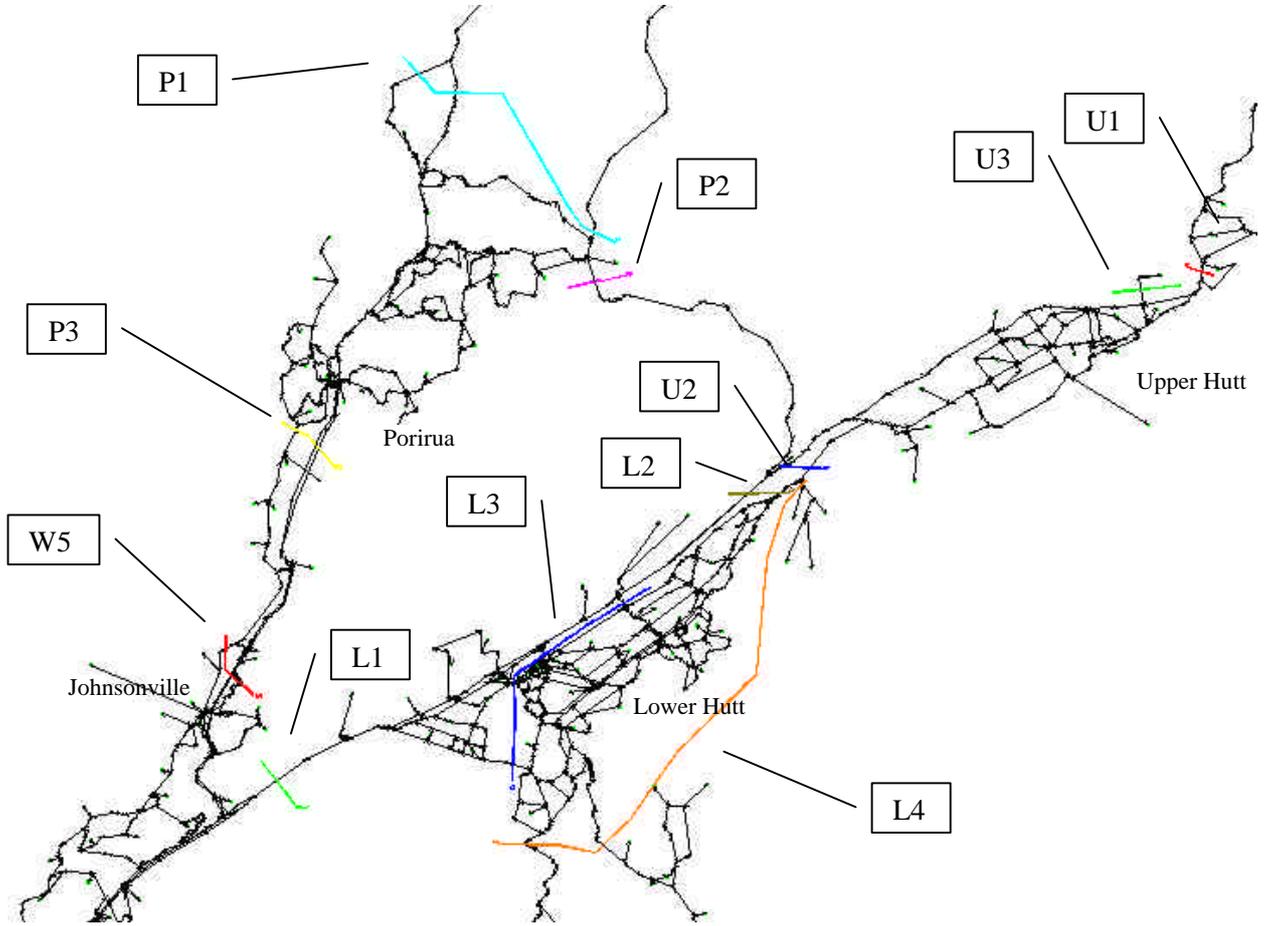
In general these figures demonstrate strong growth between 2001 and 2011 with a smaller increase between 2011 and 2021. Some key observations from these figures:

- For 2001 to 2011
 - positive growth for nearly all screenlines,
 - high growth in the AM period for U1 northbound and P2 eastbound, with increased capacity provided with the grade separation of the SH2 and SH58 interchange
 - high growth in the interpeak and PM periods for P1 (Porirua) in both directions, linked to the increase in capacity on SH1 with the 4 laning between Plimmerton and Mana,
 - For 2011 to 2021
 - generally lower growth for all screenlines, with some reductions across a few screenlines. This is compatible with the low forecast of trip end growth between 2011 and 2021, with some reductions in population (and trips) forecast for a number of areas, particularly the rural areas of the region and the Hutt's.
- **Figure 6 Screenline Locations – Southern Region**



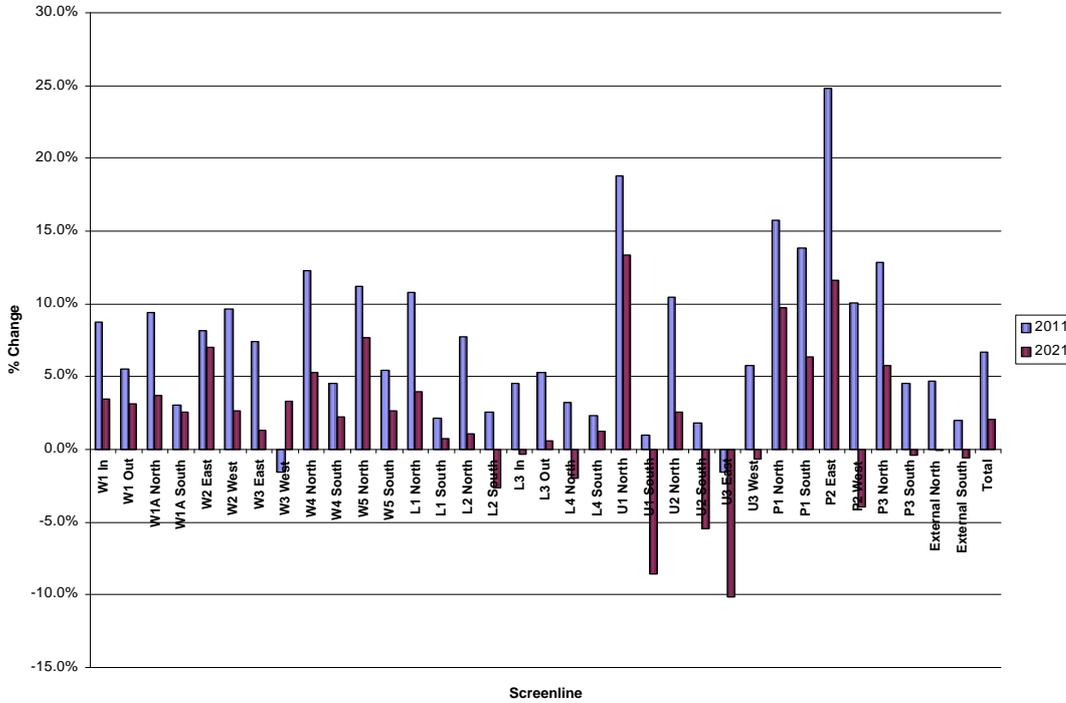


■ **Figure 7 Screenline Locations – Northern Region**

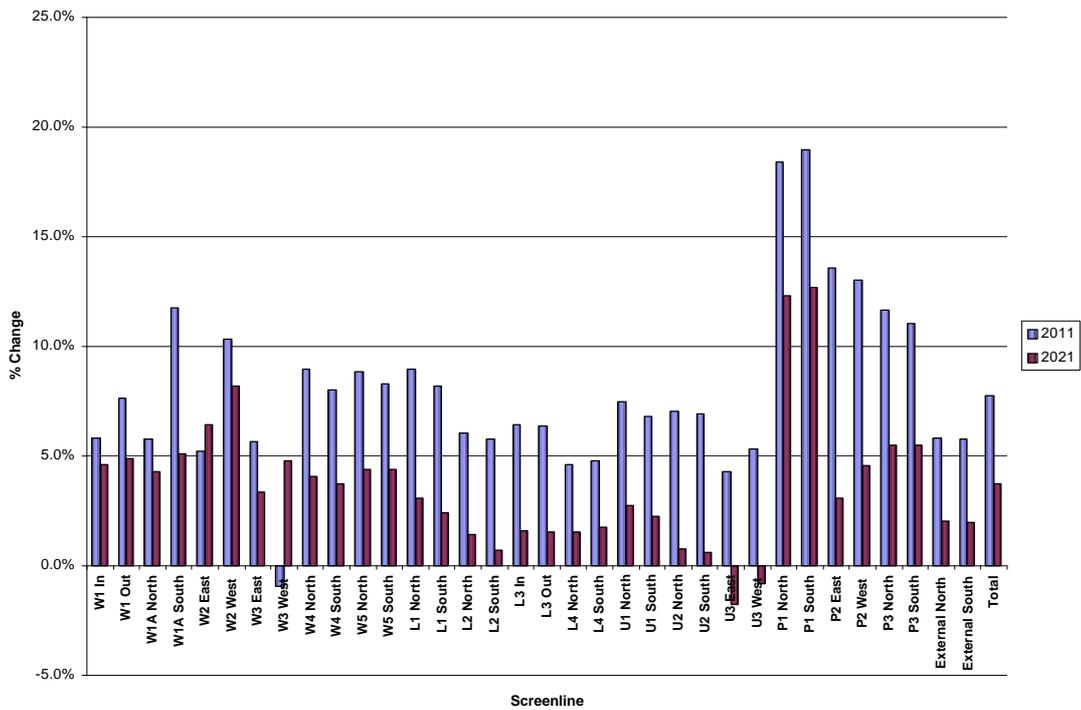




■ Figure 8 AM Screenline Growth - 2011 and 2021

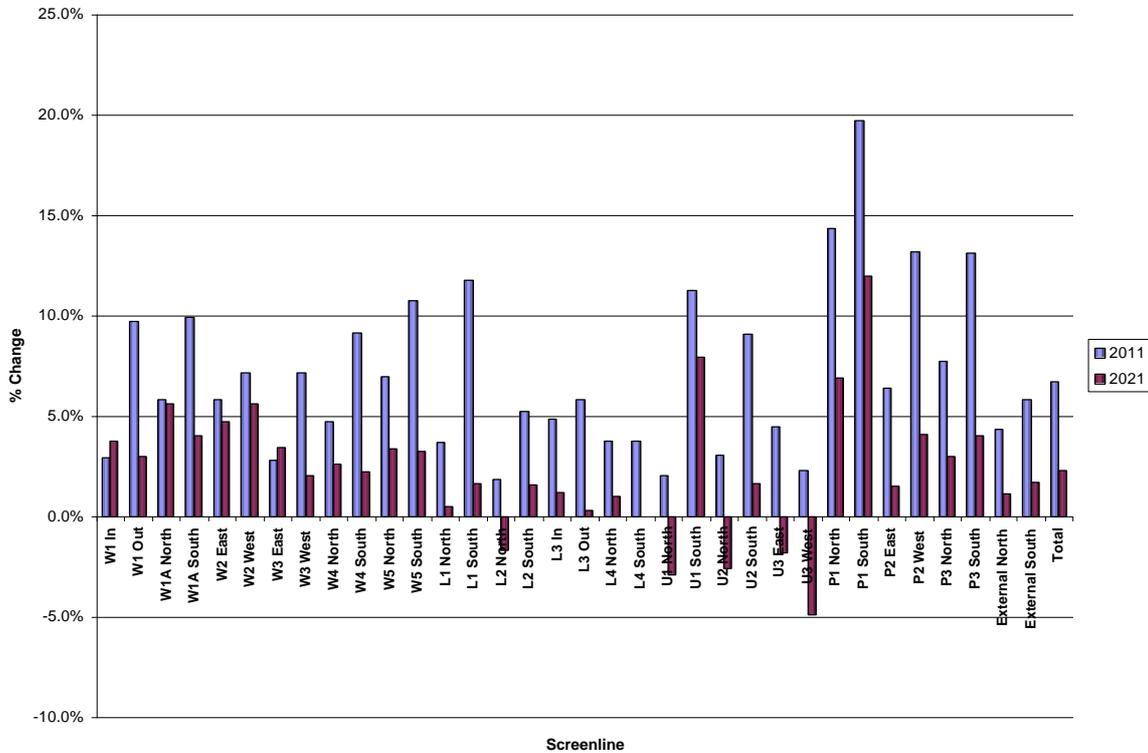


■ Figure 9 IP Screenline Growth - 2011 and 2021





■ Figure 10 PM Screenline Growth - 2011 and 2021



5.8 Average Speeds and Motorway Growth Forecasts

Table 14 details the changes in average speed across a number of road types between 2001, 2011 and 2021. Between 2001 and 2011 average speeds in the two peak periods will decrease, with the largest drop in the morning peak as congestion increases. This drop is approximately 2 km/hr or 3.5% on the motorways to 2011.

In the interpeak, additional motorway capacity provided in 2011 (eg the 4 laning between Mana and Plimmerton) has the effect of increasing the average motorway speed by 2.6% or 2.3 km/hr.

Between 2011 and 2021 the average speed on motorways in the peak across the region rises slightly (by between 0.2% and 1.7%), consistent with the increase in capacity between Ngauranga and Aotea due to the introduction of the tidal flow scheme. This increase is not reflected in the interpeak period where no additional capacity has been provided. All other speeds generally decrease slightly to 2021 reflecting the small increase of car driver trips in each time period.



■ **Table 14 Average Speed by Road Type (km/hr)**

Time Period	Road Type	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
AM	Collectors	40.5	38.4	-5.2%	37.0	-3.6%
	Arterials	40.7	40.9	0.6%	40.1	-2.1%
	Motorways	62.2	60.0	-3.5%	61.0	1.7%
IP	Collectors	45.1	44.7	-1.0%	44.3	-0.8%
	Arterials	45.3	44.7	-1.3%	44.2	-1.1%
	Motorways	86.9	89.2	2.6%	89.1	-0.1%
PM	Collectors	44.0	43.6	-1.0%	43.1	-1.0%
	Arterials	41.4	41.7	0.8%	40.9	-1.8%
	Motorways	76.3	74.7	-2.1%	74.9	0.2%

Forecast traffic growth on the State Highways at selected locations is provided in Table 15. These results generally mirror the total screenline results.

The key observation is that with the exception of SH1 at Taupo Swamp where extra capacity has been provided by the 4 laning, between 2001 and 2011, higher growth is evident in the AM and PM peak periods in the non-peak direction. That is, away from Wellington City in the morning peak and towards Wellington City in the evening peak.

This trend reflects the observed trend between 1992-2001, with AM northbound motorway counts increasing by 2% per annum over this period (the counterpeak direction) and southbound counts (the peak direction) actually decreasing by -0.9% per annum. These figures have been reported in the Preliminary Studies Report, Task 2.1 - Review of Performance of Existing Model.

The predicted speeds at the key points on the motorway are predicted to drop sharply in the peak direction for both the AM and PM periods (eg from 37km/hr to 28 km/hr North of Ngauranga on SH2), with little impact on the counter peak direction speeds. This has had the effect of constraining the growth in car traffic in the peak direction. Additionally higher population growth in Wellington and Porirua City compared to the Hutts results in a growth of traffic out of Wellington in the AM and into Wellington in the PM.

With these two effects, the growth in the counterpeak direction is generally greater than that in the peak direction with the exception of SH1 north of Porirua as discussed above.

This pattern is repeated between 2011 and 2021 albeit with lower growth rates.



■ Table 15 Selected Motorway Traffic Volume Growth

Time Period	Screenline	Direction	Motorway	Location	2001 Count	2001 Modelled	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
AM	L1	North	SH 2	North of Ngauranga Interchange	5,033	5,194	5,756	10.8%	5,982	3.9%
	L1	South	SH 2	North of Ngauranga Interchange	7,510	7,519	7,680	2.1%	7,735	0.7%
	U1	North	SH 2	South of Akatarawa Rd	613	631	750	18.8%	851	13.4%
	U1	South	SH 2	South of Akatarawa Rd	1,771	1,667	1,684	1.0%	1,539	-8.6%
	P1	North	SH 1	Taupo Swamp	955	976	1,129	15.7%	1,245	10.2%
	P1	South	SH 1	Taupo Swamp	2,140	2,064	2,385	15.5%	2,529	6.0%
	P2	East	SH 58	Pauatahanui East	1,046	1,092	1,363	24.8%	1,522	11.6%
	P2	West	SH 58	Pauatahanui East	1,537	1,385	1,525	10.1%	1,464	-4.0%
IP	L1	North	SH 2	North of Ngauranga Interchange	4,387	4,404	4,800	9.0%	4,947	3.1%
	L1	South	SH 2	North of Ngauranga Interchange	4,495	4,479	4,846	8.2%	4,962	2.4%
	U1	North	SH 2	South of Akatarawa Rd	904	928	997	7.5%	1,025	2.7%
	U1	South	SH 2	South of Akatarawa Rd	873	898	959	6.8%	981	2.3%
	P1	North	SH 1	Taupo Swamp	1,352	1,310	1,547	18.1%	1,729	11.7%
	P1	South	SH 1	Taupo Swamp	1,271	1,254	1,489	18.7%	1,680	12.9%
	P2	East	SH 58	Pauatahanui East	658	631	717	13.5%	738	3.1%
	P2	West	SH 58	Pauatahanui East	628	645	729	13.0%	762	4.6%
PM	L1	North	SH 2	North of Ngauranga Interchange	7,484	7,456	7,733	3.7%	7,771	0.5%
	L1	South	SH 2	North of Ngauranga Interchange	5,713	5,744	6,421	11.8%	6,527	1.6%
	U1	North	SH 2	South of Akatarawa Rd	1,875	1,786	1,823	2.0%	1,770	-2.9%
	U1	South	SH 2	South of Akatarawa Rd	1,038	1,043	1,161	11.3%	1,253	7.9%
	P1	North	SH 1	Taupo Swamp	2,633	2,368	2,939	24.1%	2,999	2.1%
	P1	South	SH 1	Taupo Swamp	1,325	1,315	1,580	20.2%	1,771	12.1%
	P2	East	SH 58	Pauatahanui East	1,519	1,461	1,555	6.4%	1,579	1.5%
	P2	West	SH 58	Pauatahanui East	981	1,082	1,225	13.2%	1,276	4.1%



5.9 Public Transport Forecasts

Table 16 below illustrates the forecasts for public transport boarding and alightings for the AM and interpeak periods (note as in the old WTSM model there is no public transport assignment for the evening peak). The changes in these boarding volumes are displayed graphically in Figures 11 and 12 detail the public transport boarding growth by area for both bus and rail travel. In the AM these results indicate stronger growth between 2001 and 2011 for most areas compared to 2011 to 2021, particularly for rail in the Johnsonville and Pauraparamu lines which experience very strong growth between 2001 and 2011 with the strong growth of population and employment in the CBD. This strong growth is not evident on the Upper Hutt line, consistent with the population forecast for both Lower and Upper Hutt.

In the interpeak, growth is much reduced, particularly for the rail boardings on the Upper Hutt line (consistent with the growth in population in these areas), but also for the bus boardings in the Kapiti CBD. This low growth in Kapiti is offset by the stronger growth on the Pauraparamu rail line, indicating some switching from the bus to rail between 2001 and 2011. The growth between 2011 and 2021 is much reduced.

Figure 11 and Figure 12. In summary the key results are:

- rail boardings (11.7%) and bus boardings (7.8%) are forecast to grow strongly between 2001 and 2011 in the AM peak corresponding to the strong growth in the captive market over this period,
- this growth is much reduced in the morning peak between 2011 and 2021 as the tidal flow scheme between Ngauranga and Aotea has reduced travel times for car trips into the CBD,
- there is a slight reduction in interpeak rail boardings, and an increase in bus boardings between 2001 and 2011, linked to the increased speed of the road network in the interpeak period and hence a corresponding decrease in bus travel times,
- both bus and rail interpeak boardings have small changes forecast from 2011 to 2021 (0.3% for rail boardings and 0.4% for bus boardings).
- **Table 16 Public Transport Boarding Volumes**

Time Period	Mode	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
AM	Rail Boarding	12,370	13,812	11.7%	13,196	-4.5%
	Bus Boarding	18,187	19,601	7.8%	19,467	-0.7%
IP	Rail Boarding	2,658	2,579	-3.0%	2,587	0.3%
	Bus Boarding	7,037	7,836	11.4%	7,869	0.4%

The forecasts for total passenger kilometres is slightly higher than that for boardings. This is illustrated in Table 17 with strong growth between 2001 and 2011 for both time periods, small



negative growth between 2011 and 2021 in the AM period and a small positive growth for the interpeak kilometres.

■ **Table 17 Passenger Kilometres Travelled**

Time Period	2001	2011	2001 - 2011 Growth	2021	2011 - 2021 Growth
AM	359,536	408,423	13.6%	400,105	-2.0%
IP	94,068	108,188	15.0%	108,391	0.2%

■ **Table 18 Average Trip Length (km)**

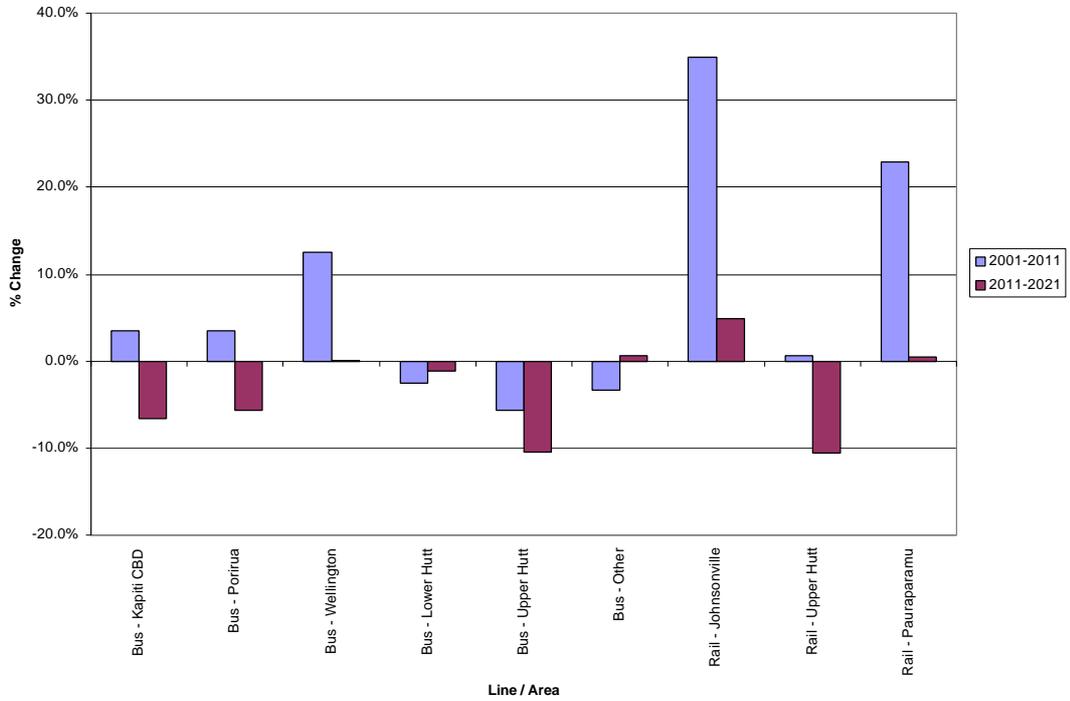
Time Period	2001	2011	2021
AM	13.09	13.63	13.53
IP	10.19	10.77	10.53

Figures 11 and 12 detail the public transport boarding growth by area for both bus and rail travel. In the AM these results indicate stronger growth between 2001 and 2011 for most areas compared to 2011 to 2021, particularly for rail in the Johnsonville and Pauraparamu lines which experience very strong growth between 2001 and 2011 with the strong growth of population and employment in the CBD. This strong growth is not evident on the Upper Hutt line, consistent with the population forecast for both Lower and Upper Hutt.

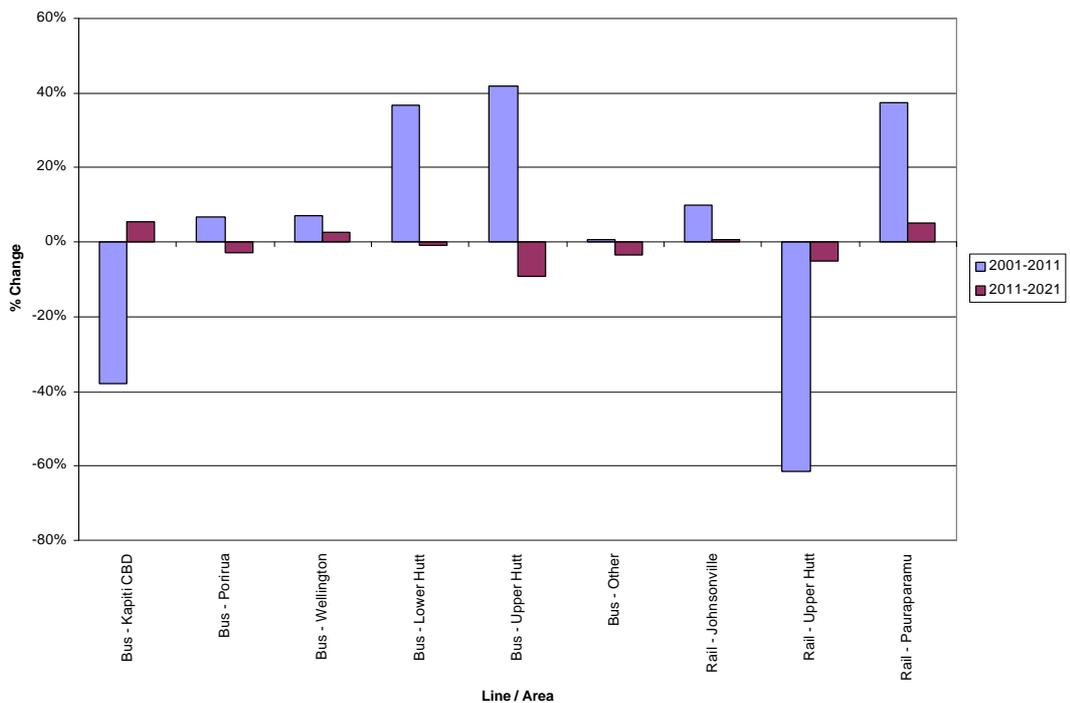
In the interpeak, growth is much reduced, particularly for the rail boardings on the Upper Hutt line (consistent with the growth in population in these areas), but also for the bus boardings in the Kapiti CBD. This low growth in Kapiti is offset by the stronger growth on the Pauraparamu rail line, indicating some switching from the bus to rail between 2001 and 2011. The growth between 2011 and 2021 is much reduced.



■ **Figure 11 AM Public Transport Boarding Growth**



■ **Figure 12 IP Public Transport Boarding Growth**



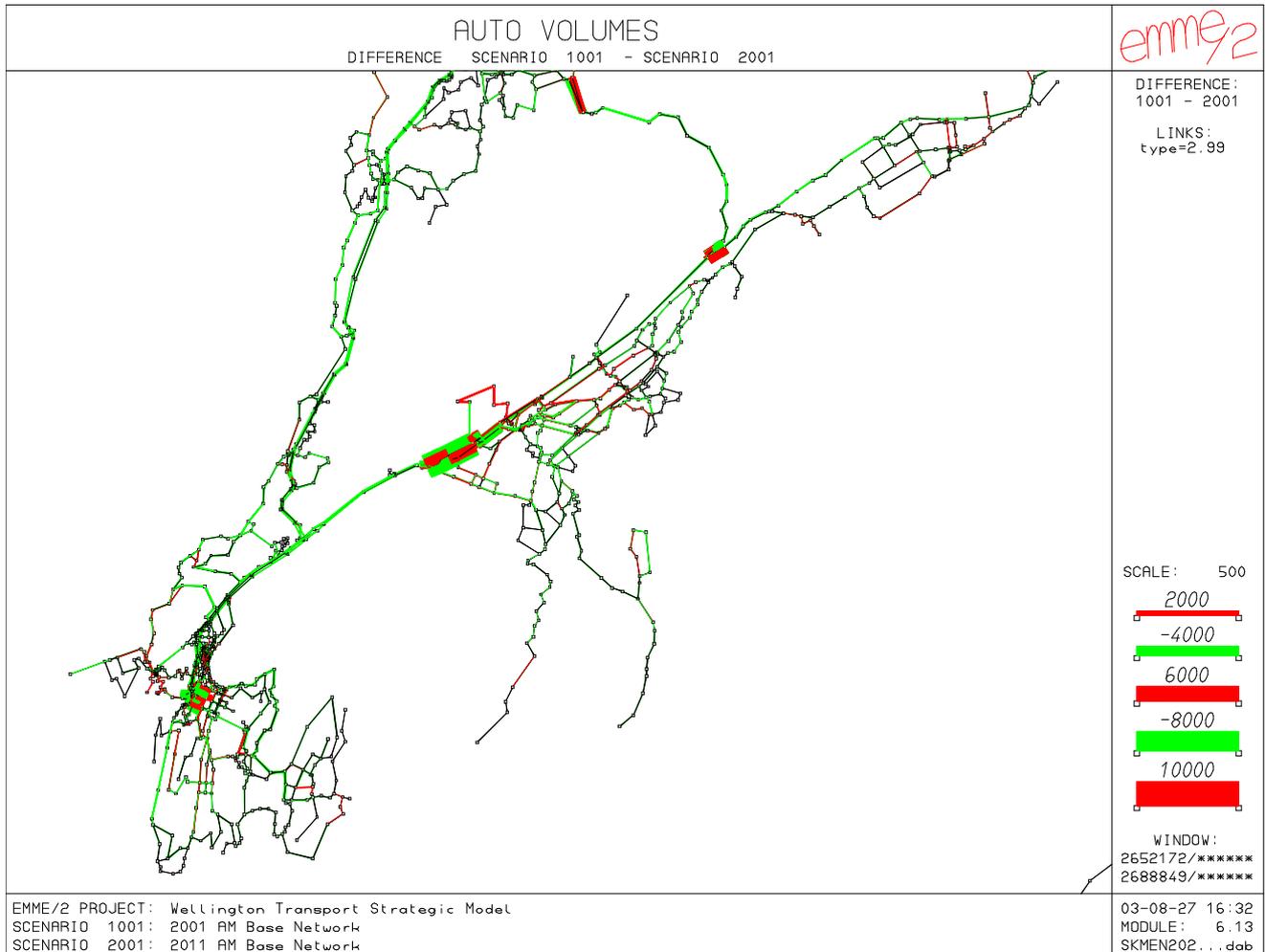


5.10 Traffic Volume Plots

A series of traffic volume difference plots are provided for each time period comparing 2011 volumes against 2001 volumes and 2021 volumes against 2011 volumes in Figure 13 through to Figure 16. Each of these plots presents the difference in traffic volumes as bars on the network with green bars reflecting a growth in traffic and red bars reflecting a drop.

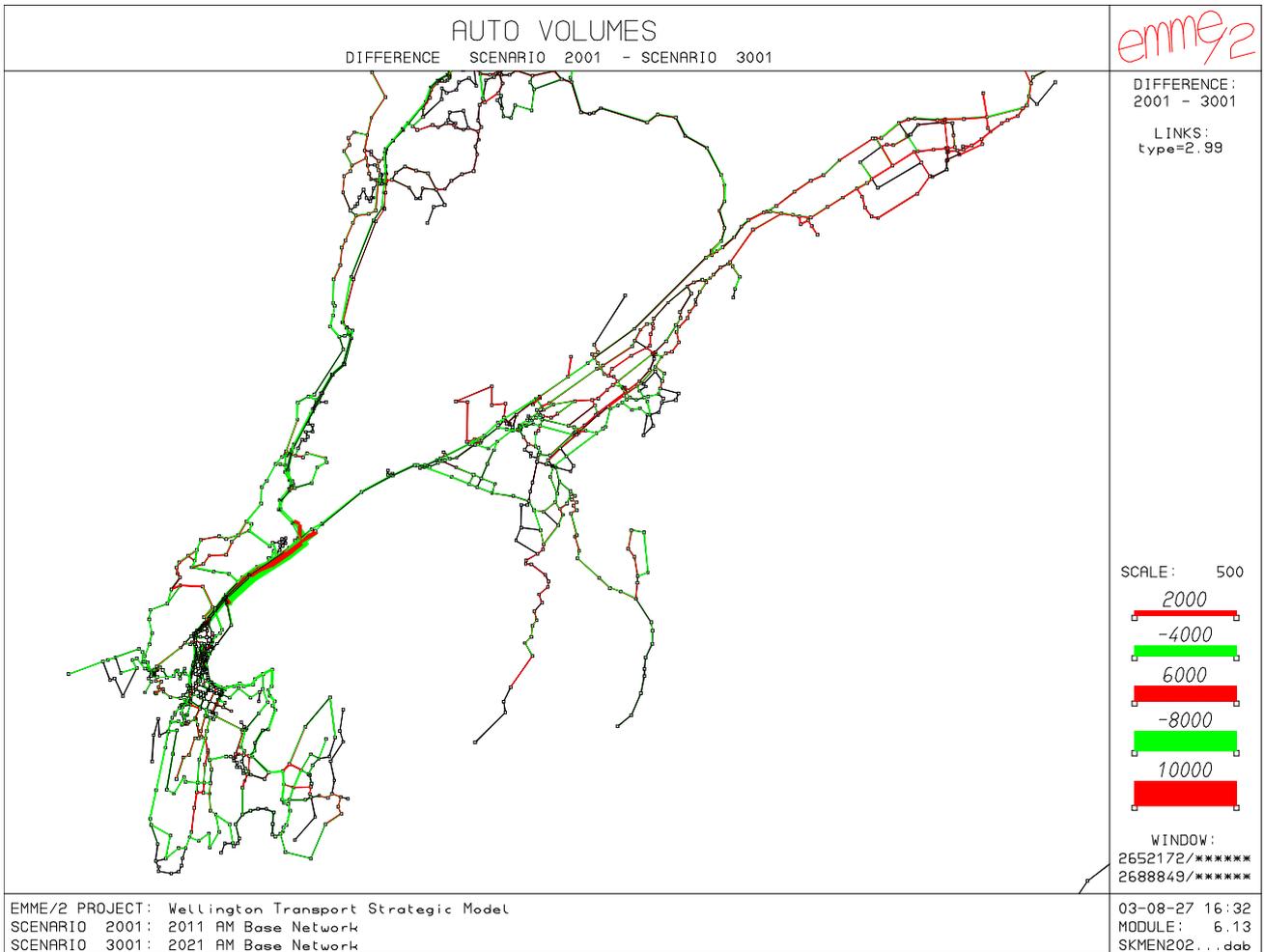
Note that for new links in future year networks, the differences displayed will be a misrepresentation of the actual changes in traffic volumes and care should be taken when interpreting the results around each future year project.

■ Figure 13 2011 v 2001 AM Traffic Volumes



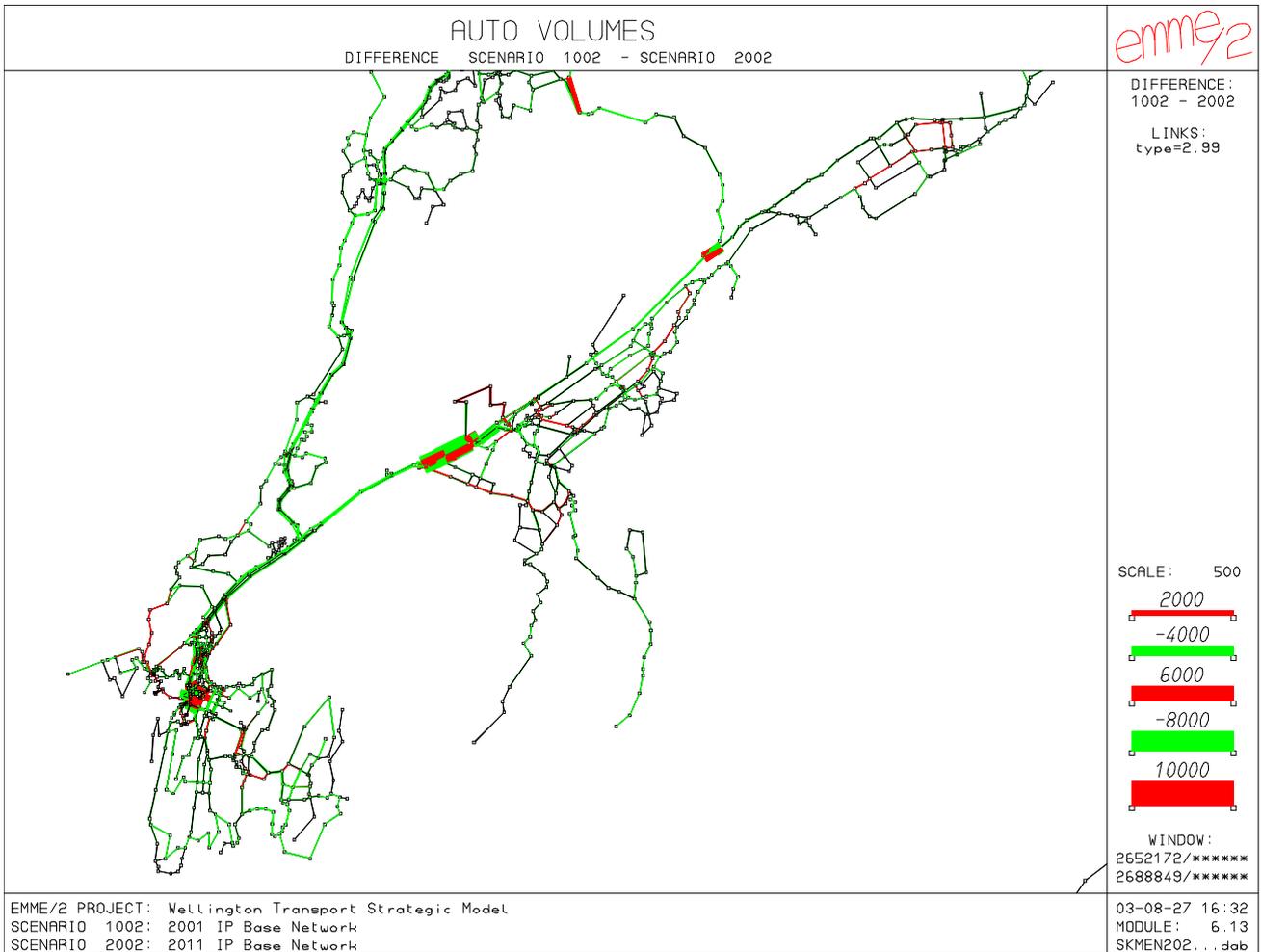


■ **Figure 14 2021 v 2011 AM Traffic Volumes**



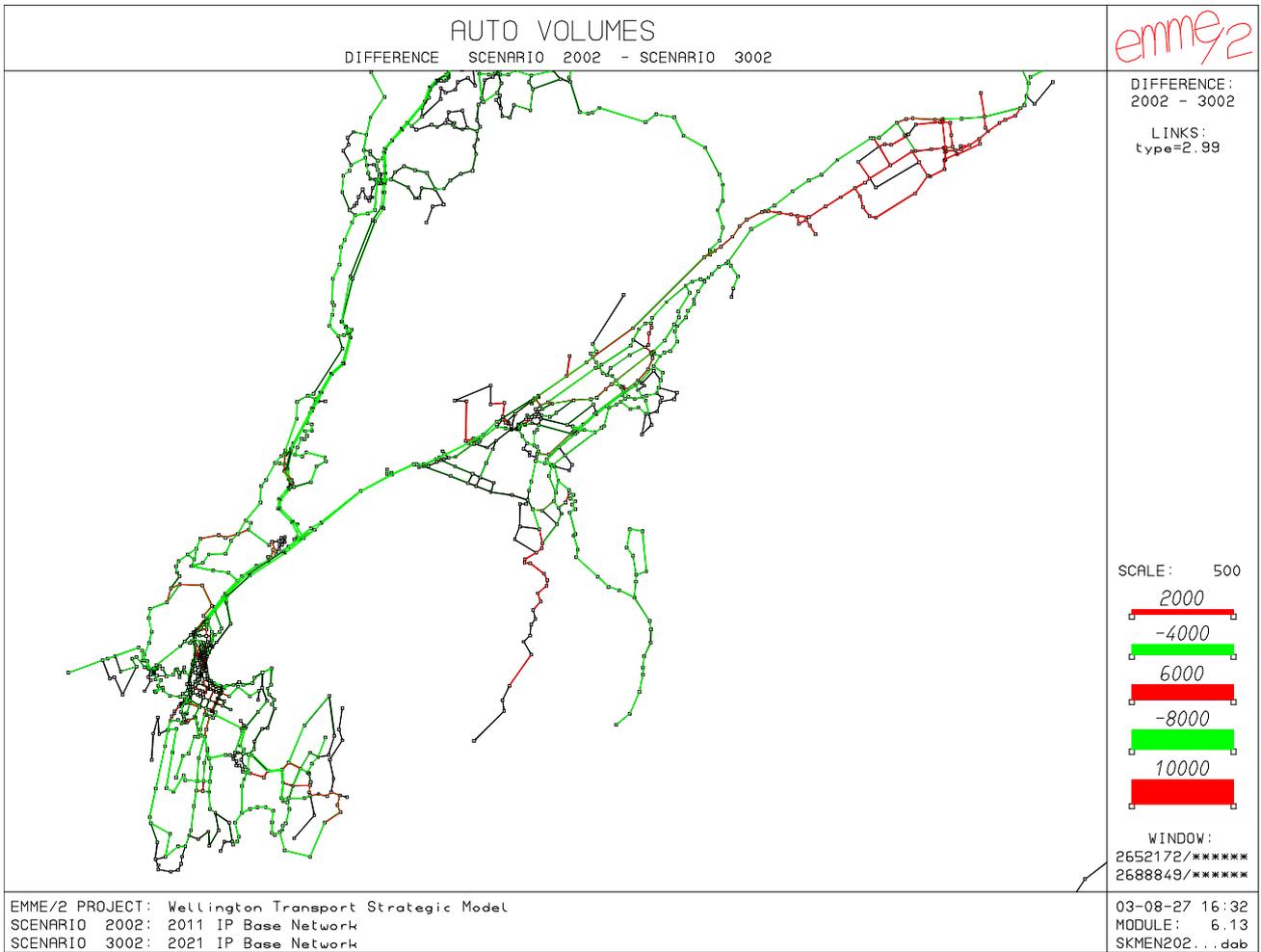


■ Figure 15 2011 v 2001 IP Traffic Volumes



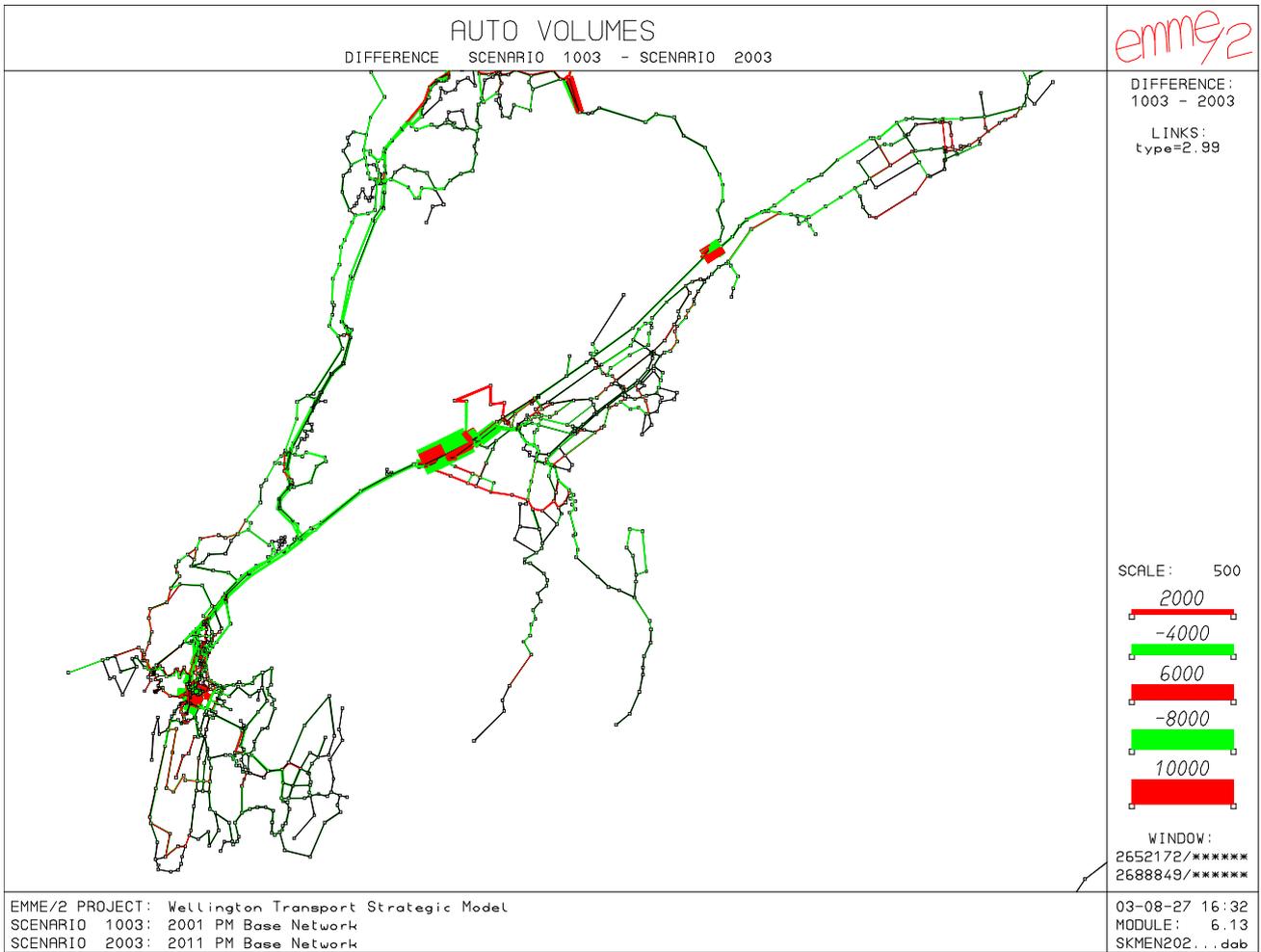


■ Figure 16 2021 v 2011 IP Traffic Volumes



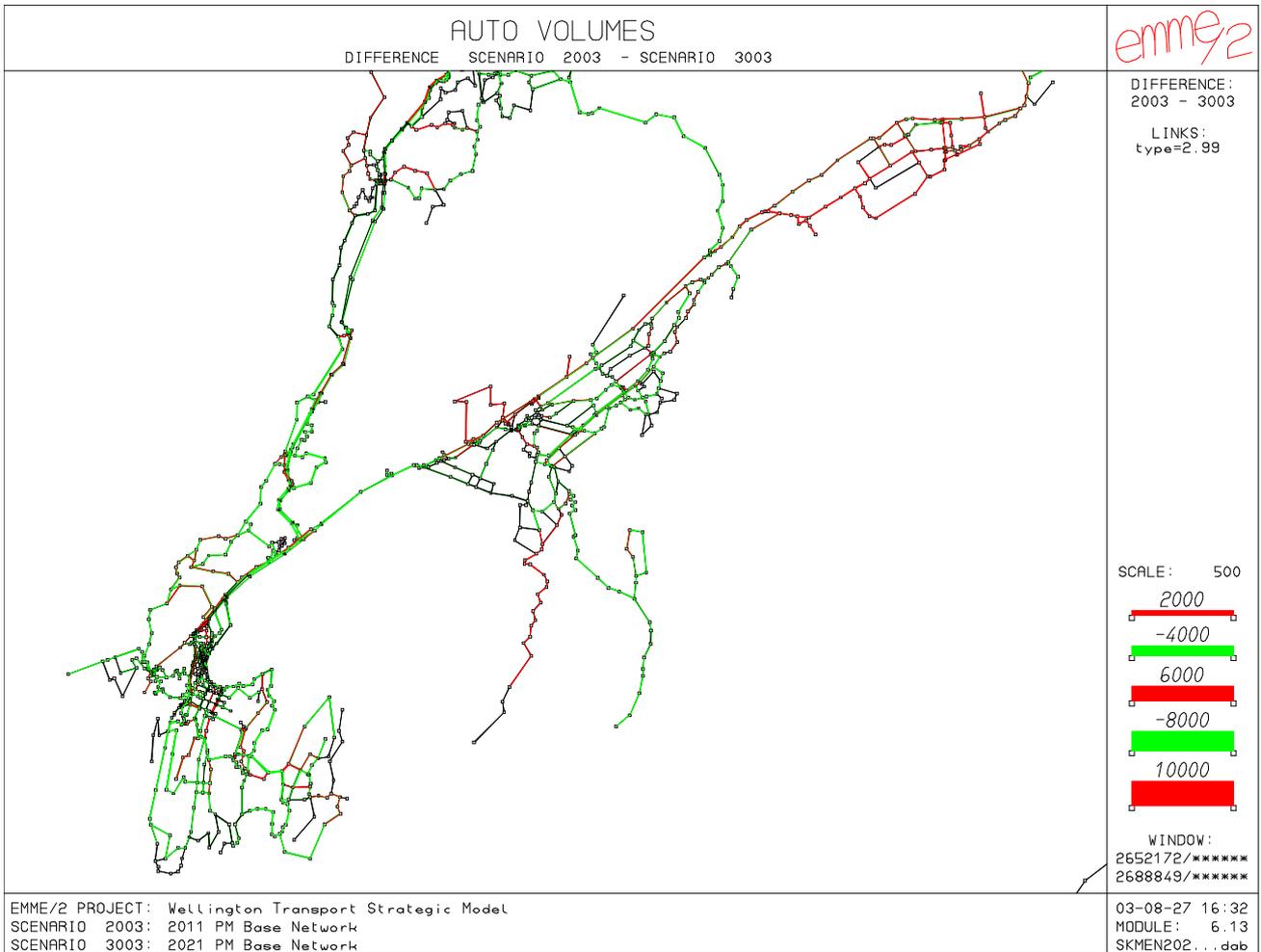


■ Figure 17 2011 v 2001 PM Traffic Volumes





■ Figure 18 2021 v 2011 PM Traffic Volumes





Appendix A Detailed Screenline Volumes

■ Table 19 AM Screenline Volume Results

Screenline	Direction	2001 Model	2011 Model	2001 - 2011 Growth	2021 Model	2011 - 2021 Growth
W1	In	14,782	16071	8.7%	16,629	3.5%
W1	Out	9,110	9614	5.5%	9,914	3.1%
W1A	North	5,036	5510	9.4%	5,716	3.7%
W1A	South	3,248	3347	3.1%	3,433	2.6%
W2	East	2,526	2731	8.1%	2,923	7.0%
W2	West	3,978	4363	9.7%	4,478	2.6%
W3	East	2,101	2256	7.4%	2,286	1.3%
W3	West	954	939	-1.6%	970	3.3%
W4	North	6,800	7635	12.3%	8,038	5.3%
W4	South	15,474	16175	4.5%	16,538	2.2%
W5	North	3,477	3866	11.2%	4,164	7.7%
W5	South	6,789	7155	5.4%	7,344	2.6%
L1	North	5,194	5756	10.8%	5,982	3.9%
L1	South	7,519	7680	2.1%	7,735	0.7%
L2	North	4,242	4570	7.7%	4,621	1.1%
L2	South	5,118	5248	2.5%	5,110	-2.6%
L3	In	8,527	8914	4.5%	8,883	-0.3%
L3	Out	9,262	9750	5.3%	9,805	0.6%
L4	North	5,437	5613	3.2%	5,502	-2.0%
L4	South	1,645	1682	2.3%	1,702	1.2%
U1	North	631	750	18.8%	851	13.4%
U1	South	1,667	1684	1.0%	1,539	-8.6%
U2	North	4,137	4570	10.5%	4,688	2.6%
U2	South	3,758	3825	1.8%	3,618	-5.4%
U3	East	1,134	1116	-1.6%	1,003	-10.1%
U3	West	268	283	5.8%	281	-0.7%
P1	North	1,119	1295	15.8%	1,421	9.7%
P1	South	2,527	2876	13.8%	3,059	6.3%
P2	East	1,092	1363	24.8%	1,522	11.6%
P2	West	1,385	1525	10.1%	1,464	-4.0%
P3	North	3,614	4078	12.8%	4,312	5.7%
P3	South	4,916	5141	4.6%	5,118	-0.4%
External	North	1,277	1337	4.7%	1,336	-0.1%
External	South	1,476	1505	2.0%	1,497	-0.6%



■ **Table 20 IP Screenline Volume Results**

Screenline	Direction	2001 Model	2011 Model	2001 - 2011 Growth	2021 Model	2011 - 2021 Growth
W1	In	9,525	10,079	5.8%	10,542	4.6%
W1	Out	9,237	9,945	7.7%	10,430	4.9%
W1A	North	3,527	3,731	5.8%	3,891	4.3%
W1A	South	3,108	3,474	11.8%	3,650	5.1%
W2	East	2,728	2,871	5.2%	3,055	6.4%
W2	West	2,773	3,060	10.3%	3,311	8.2%
W3	East	1,208	1,277	5.7%	1,319	3.3%
W3	West	1,055	1,045	-0.9%	1,095	4.8%
W4	North	7,481	8,150	8.9%	8,484	4.1%
W4	South	7,947	8,582	8.0%	8,905	3.8%
W5	North	3,247	3,533	8.8%	3,689	4.4%
W5	South	3,200	3,465	8.3%	3,618	4.4%
L1	North	4,404	4,800	9.0%	4,947	3.1%
L1	South	4,479	4,846	8.2%	4,962	2.4%
L2	North	2,856	3,029	6.1%	3,072	1.4%
L2	South	2,799	2,960	5.8%	2,980	0.7%
L3	In	7,602	8,092	6.4%	8,220	1.6%
L3	Out	7,629	8,114	6.4%	8,237	1.5%
L4	North	2,371	2,482	4.6%	2,520	1.6%
L4	South	2,465	2,583	4.8%	2,628	1.8%
U1	North	928	997	7.5%	1,025	2.7%
U1	South	898	959	6.8%	981	2.3%
U2	North	2,523	2,701	7.0%	2,721	0.7%
U2	South	2,533	2,708	6.9%	2,724	0.6%
U3	East	489	510	4.3%	501	-1.8%
U3	West	446	470	5.3%	466	-0.8%
P1	North	1,469	1,740	18.4%	1,955	12.3%
P1	South	1,399	1,665	19.0%	1,876	12.7%
P2	East	631	717	13.5%	738	3.1%
P2	West	645	729	13.0%	762	4.6%
P3	North	3,286	3,668	11.6%	3,870	5.5%
P3	South	3,262	3,622	11.0%	3,821	5.5%
External	North	1,632	1,727	5.8%	1,761	2.0%
External	South	1,555	1,645	5.8%	1,678	2.0%



■ **Table 21 PM Screenline Volume Results**

Screenline	Direction	2001 Model	2011 Model	2001 - 2011 Growth	2021 Model	2011 - 2021 Growth
W1	In	11,064	11,391	2.9%	11,821	3.8%
W1	Out	13,842	15,188	9.7%	15,650	3.0%
W1A	North	3,824	4,048	5.9%	4,276	5.6%
W1A	South	4,574	5,029	9.9%	5,231	4.0%
W2	East	3,659	3,872	5.8%	4,055	4.7%
W2	West	2,759	2,957	7.2%	3,124	5.7%
W3	East	1,250	1,285	2.8%	1,330	3.5%
W3	West	2,309	2,475	7.2%	2,527	2.1%
W4	North	13,594	14,239	4.7%	14,616	2.7%
W4	South	8,533	9,315	9.2%	9,526	2.3%
W5	North	6,055	6,478	7.0%	6,699	3.4%
W5	South	3,825	4,237	10.8%	4,377	3.3%
L1	North	7,456	7,733	3.7%	7,771	0.5%
L1	South	5,744	6,421	11.8%	6,527	1.6%
L2	North	5,514	5,617	1.9%	5,523	-1.7%
L2	South	4,339	4,566	5.2%	4,640	1.6%
L3	In	9,647	10,116	4.9%	10,240	1.2%
L3	Out	9,835	10,412	5.9%	10,442	0.3%
L4	North	2,386	2,477	3.8%	2,503	1.0%
L4	South	5,450	5,655	3.8%	5,654	0.0%
U1	North	1,786	1,823	2.0%	1,770	-2.9%
U1	South	1,043	1,161	11.3%	1,253	7.9%
U2	North	4,089	4,216	3.1%	4,107	-2.6%
U2	South	3,789	4,134	9.1%	4,203	1.7%
U3	East	592	619	4.5%	608	-1.8%
U3	West	946	968	2.3%	921	-4.9%
P1	North	2,846	3,255	14.4%	3,480	6.9%
P1	South	1,483	1,776	19.8%	1,990	12.0%
P2	East	1,461	1,555	6.4%	1,579	1.5%
P2	West	1,082	1,225	13.2%	1,276	4.1%
P3	North	5,111	5,509	7.8%	5,676	3.0%
P3	South	4,447	5,031	13.1%	5,234	4.1%
External	North	2,012	2,099	4.3%	2,123	1.1%
External	South	1,803	1,908	5.8%	1,941	1.7%