Technical Note 50 – WRTM Tidal Flow Study

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Quality statement

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1	14 Aug 23	Draft, 2055 PM	DK	JEB	JEB	JEB
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1 Background

The Waikato Regional Transportation Model (WRTM) 3-stage and 4-stage models (referred to as '2018 Comprehensive Models') have been updated to account for future year demographics for the years 2025, 2035, 2045, 2055 and for Medium and High growth scenarios. These demographics were input to the WRTM 3-stage model that was validated to 2018. The source of the input demographics is post-processed land use from the WISE (Waikato Integrated Scenario Explorer) model for the Waikato Region, plus future year demographics provided by Tauranga City Council and Auckland Forecasting Centre, with Statistics New Zealand projections used for Rotorua.

The traffic flows produced by the input demographics were reviewed and there was a concern related to reversed tidal flows observed on SH29 between Tauranga and Hamilton. Preliminary work has been done and reported in the "WRTM Preliminary Forecasts using 2018-Based Demographic Projections – Memo" document.

Further investigation was done to check if the reversed tidal flows could be observed in the preceding WRTM models, i.e., the '2018 Interim Model' (Medium) and '2013 Model' (Medium), focusing on the PM peak period. The former uses 2018-based WISE projected demographics at the Territorial Authority (TA) level, for years 2031, 2041, and 2051, and demographics' distribution derived from 2013-based WISE projections at the zonal level to distribute the TA demographics to zones. The latter is the WRTM 3-stage model that was validated to 2013, with 2013-based WISE projections (i.e., not factored at TA level to match 2018-based WISE projections).

The results show that reversed tidal flows on SH29 occur not only in the 2018 Comprehensive Model, but also in the preceding Models. Note that the extent of the reversed tidal flows is exacerbated in the 2018 Comprehensive Model compared with the 2018 Interim Model. The 2018 Interim Model produces desired tidal flows for the years 2018 and 2051, with the prominent reversed tidal flows being observed for the year 2031.

There remains a topic of discussion about which aspects and what magnitude of the demographics creates the tidal flow issues. To shed some light on this issue, this work is divided into **four parts**:

- **Part-1: 2055 Scenario Testing & Method Formulation**
  This part (Sections 2 to 4) focuses on testing different scenarios by adjusting the 2055 input demographics (Medium projection) to identify variable(s) likely responsible for creating the reversed tidal flow issues observed in the 2055 Comprehensive modelled flows. This period was selected to allow us to build upon and compare the results of this study with the previous work (summarized in Section 2) that also focused on the PM peak period only. Outputs of this first part are: a) the identification of demographics likely responsible for creating reversed tidal flows, b) method to address them, and c) the 'revised' 2055 demographics (Medium projection). The latter was then input to the 2055 Comprehensive (Test) Model for the AM peak, interpeak and PM peak periods. The modelled flows and tidality were subsequently compared to the model flows and tidality of the 2055 (Base) Comprehensive Model. This was reported in version 1 of this technical note for the 2055 PM peak.

- **Part-2: Checking Approach using 2035**
  This part (Sections 5 and 6) focuses on implementing the method identified in Part-1 to the 2035 input demographics input (Medium projection). The adjusted demographics was used as input to the 2035 Comprehensive (Test) Model, for the AM, interpeak, and PM peak periods. The tidality pattern observed from the 2035 Comprehensive modelled traffic flows (Base) were compared with the pattern from the 2055 Comprehensive (Test) models. This provides a check on the consistency of the method in producing a certain tidality pattern.

- **Part-3: 2023 Observed vs 2025 Modelled**
  This part (Sections 7 to 9) focuses on comparing the modelled flows from the 2025 Comprehensive (Test) model which includes adjusted 2025 input demographics (Medium projection), with 2023 observed flows (sourced from Traffic Monitoring System/TMS). This gives a gauge on how well the modelled traffic flows meet the observed flows and allows the tidality to be compared for the observed and modelled flows.

- **Part-4: Conclusion and Recommendations**
  This part (Section 10) focuses on drawing conclusions from the entire parts and recommendations for future directions.

Throughout this technical note, "Base" refers to traffic flow forecasts from input Comprehensive demographics that were projected by WISE. "Test" refers to traffic flow forecasts after our adjustment of the input demographics, with the adjustments designed to produce tidality patterns similar to current conditions.

All traffic flows represent periods two hours in duration.

All percentage change figures per annum are based on applying linear growth.

Part-1: 2055 Scenario Testing & Method Formulation

2 Locational Check

While the previous focus was on the tidal flows issue occurring on SH29 between Tauranga and Hamilton, the Comprehensive Model also produces reversed tidal flows on SH1 between Hamilton and Cambridge for the year 2055. Therefore, it becomes crucial to investigate the tidality of modelled traffic flows at significant locations, i.e., major roads between large towns/cities.

A total of six locations were selected, as listed below, and shown in Figure 2-1.

- SH1, between Auckland and Hamilton
- SH1, between Hamilton and Cambridge
- SH1, south of Cambridge
- SH2, between Auckland and Tauranga
- SH29, between Hamilton and Tauranga
- SH36, between Tauranga and Rotorua

Figure 2-1 Locations for Investigation

First, PM peak flows from the 2018 observed data, and modelled flows from the 2018 validated model, Interim 2051 Model, and Comprehensive 2055 Model (the latter being the baseline of this study) were checked. The 2051 and 2055 future years are both Medium projections. The results are summarized in Table 2-1 showing the percentage of the two-way flow on the road for each direction of travel. The tidality from 2018 observed data is used as a reference, and the tidal flows from each of the models are compared to the reference, with 'green' indicating conformity, 'yellow' indicating nearly conformity, and 'red' indicating disagreement.

Table 2-1 PM Peak Traffic Flows, Observed vs. Modelled 2018, 2051 Interim, 2055 Comprehensive

Discription	Direction	2018 Obs	2018 Validated	GEH	2051 Interim	2055 Comprehensive
SH1, between Auckland and Hamilton	Toward Auckland	48%	49%	1.5	68%	55%
SH1, between Auckland and Hamilton	Toward Hamilton	52%	51%	0.2	32%	45%
	Total 2-Dir Flows	**3,449**	**3,547**		**9,397**	**7,749**
SH1, between Hamilton and Cambridge	Toward Cambridge	55%	50%	5.8	54%	31%
SH1, between Hamilton and Cambridge	Toward Hamilton	45%	50%	0.0	46%	69%
	Total 2-Dir Flows	**4,311**	**3,925**		**8,400**	**8,098**
SH1, south of Cambridge	Toward Cambridge	50%	45%	9.6	48%	80%
SH1, south of Cambridge	Opposite Cambridge	50%	55%	4.5	52%	20%
	Total 2-Dir Flows	**3,230**	**2,480**		**4,885**	**5,049**
SH2, between Auckland and Tauranga	Toward Tauranga	51%	54%	1.3	28%	26%
SH2, between Auckland and Tauranga	Toward Auckland	49%	46%	1.4	72%	74%
	Total 2-Dir Flows	**1,596**	**1,595**		**2,996**	**4,746**
SH29, between Hamilton and Tauranga	Toward Tauranga	54%	64%	2.2	62%	12%
SH29, between Hamilton and Tauranga	Toward Hamilton	46%	36%	6.5	38%	88%
	Total 2-Dir Flows	**1,958**	**1,804**		**3,176**	**3,608**
SH36, between Tauranga and Roturua	Toward Rotorua	50%	60%	0.1	32%	85%
SH36, between Tauranga and Roturua	Toward Tauranga	50%	40%	5.0	68%	15%
	Total 2-Dir Flows	**717**	**598**		**738**	**1,365**

In general, the 2018 modelled flows replicate the observed tidal flows relatively well at all of the checked locations. The modelled tidal flow between Tauranga and Rotorua does not align, but the volumes are numerically small. The GEH metric is included to demonstrate the 2018 modelled flows (factored to one hour) generally replicate observed flows well, with a GEH value below five indicating a very good match.

The Interim modelled flows only moderately replicate the observed tidal flows, with half the locations matching, and half not matching (i.e., SH1 between Auckland and Hamilton, SH2 between Auckland and Tauranga, and SH36 between Tauranga and Rotorua), with reversed tidality predicted. The modelled flows from the Comprehensive (Base) Model do not replicate the tidality at nearly all of the checked locations.

It is noted that tidality in the future could be different to current conditions. However, the Comprehensive demographics produce such different tidality, that it has raised questions on the robustness and likelihood of the resulting forecast traffic flows.

3 2055 Scenario Development

3.1 Background

The previous work, reported in the "WRTM Preliminary Forecasts using 2018-Based Demographic Projections – Memo" document, investigated whether job deficits in Hamilton and job surplus in Tauranga might contribute to the reserved tidal flows on SH29 from the Comprehensive (Base) 2055 Model.

Note that the tests involved subtracting 10K jobs from Tauranga and adding between 10K and 50K jobs into Hamilton, depending on the scenarios tested. The results, re-shown in Table 3-1, suggest that changing the balance in the employment figures in Hamilton and Tauranga (-10K Tauranga and +50K Hamilton) might almost flip the tidality back to what is observed in 2018. Note that 'T' and 'H' in the table indicate Tauranga and Hamilton in turn.

Table 3-1 Summary of Results of the Previous Work

Location	Direction	2018, Observed vs. Modelled Flows		2051, Interim, %Modelled	2055, Comprehensive, Modelled Flows	2055, Comprehensive, Modelled Flows, Preliminary Work as Reported in "WRTM Preliminary Forecasts using 2018-Based Demographic Projections – Memo"			
		%Obs Prop	%Modelled		%Base	%-10T,+10H	%-10T,+30H	%-10T,+50H	%+30H
SH29, between Hamilton and Tauranga	Toward Tauranga	54%	64%	62%	12%	20%	31%	48%	22%
SH29, between Hamilton and Tauranga	Toward Hamilton	46%	36%	38%	88%	80%	69%	52%	78%
	Total Flows 2-Dir	**1,958**	**1,804**	**3,176**	**3,681**	**2,892**	**2,462**	**2,422**	**2,758**

Additionally, a comparison of the demographics by TA used in the Interim and Comprehensive models has also indicated that there might be too many households and population in both Tauranga and Western Bay of Plenty.

3.2 Preliminary Tests

Based on the above, a total of **seven preliminary scenarios** were developed and tested by adjusting employment and household figures in the demographic file input to the model. These tests are summarized in Table 3-2, with 'no adjustment' meaning that those demographic figures are unchanged. Note that the scenarios were developed in parallel and run overnight in 'bulk' (two to three tests each night), modelled traffic flows were then analysed, and the next bulk of scenarios planned accordingly.

The focus was adjusting employment in Hamilton, Tauranga and Western Bay of Plenty, and reducing household (including population and labour force) in Tauranga and Western Bay of Plenty.

Most scenarios reached convergence, except for Test-6 where it failed to converge within a reasonable amount of time and was therefore aborted.

Table 3-2 Summary of Preliminary Tests/Scenarios, 2055 Demographics

Test	Employment		Household		Bulk Run
Test-0	Adjusting employment figure in the input Comprehensive demographics for every TA using Employment to Labour Force ratio of the Interim demographics		No adjustment		1
Test-1	Repeating Test-0, but maintaining Total Employment in Comprehensive demographics		No adjustment		
Test-2	No adjustment		Reducing households in Tauranga and WBOP		2
			Tauranga	-4,100	
			Western Bay of Plenty	-2,800	
Test-3	Repeating Test-1		Repeating Test-2		
Test-4	Reducing employment in Tauranga and WBOP and adding employment in Hamilton		Reducing households in Tauranga and WBOP		3
	Tauranga	-23,500	Tauranga	-4,000	
	Western Bay of Plenty	-8,500	Western Bay of Plenty	-3,000	
	Hamilton	26,000			
Test-5	Repeating Test-4		No adjustment		
Test-6	Reducing employment in Tauranga and adding employment in Hamilton		No adjustment		
	Tauranga	-50,000			
	Western Bay of Plenty	50,000			

The figures were calculated by examining labour force (home end) to employment ratios by TA for the Interim demographics and applying them to the Comprehensive demographics. Population and household totals in each TA were also examined in the Interim and Comprehensive demographics.

3.3 Final Scenario Development

The results of the preliminary tests can be found in Appendix A and are not discussed in detail. Briefly, the results suggest that changing employment or households (in Hamilton, Tauranga, and Western Bay of Plenty) or a combination of both can substantially flip the tidal flows at different locations. This point is important, as it highlights the need to make an informed decision on sensible demographics to ensure traffic flow forecasts are robust.

However, none of these tests produced a very satisfactory outcome, meaning that the scenarios produced 'correct' tidal flows at some check locations (relative to 2018 observed data), but 'incorrect' tidality at other locations. It is noted that if there is substantial population growth in Hamilton, without a similar increase in jobs, then tidal traffic patterns could well change compared to observed. So here, 'incorrect' effectively means different to current patterns.

The results of the preliminary testing suggest that the issues are much more complex, and beyond the interplay between employment and households in Tauranga, Hamilton, and Western Bay of Plenty.

To investigate this further, employment, labour force, population, and households by TA in the whole model area were reviewed. The results are summarized below.

3.3.1 Employment verses Labour Force

To investigate the extent of job surplus and deficits, the labour force[1] (home end) figures in the demographics, input to the Comprehensive (Base) Model, were compared to the employment (workplace end) figures. Note that in the 3-step and 4-step models, the employment figures are used in the trip attraction equations (in trip generation). Total trip attractions are factored to total trip productions in the trip balancing process. This implies that employment figures are not used as an absolute term but in a relative term.

To address this, in this study, total employment is factored to meet total labour force. Furthermore, to understand the extent of the problem, trends observed in the 2055 figures are compared with that in 2018.

The labour force, employment (unfactored and factored), and the difference between them, for the years of 2018 and 2055, can be seen in Table 3-3, showing areas with the largest job surplus (in the darkest shades of blue in the table) and deficits in 2055 (in the darkest shades of red).

Table 3-3 Labour Force verses Employment, 2018 and 2055

TA	Employment, 2018				Employment, 2055			
	Labour Force, 2018	Unfactored	Factored	Difference Emp Factored-Labour Force	Labour Force, 2055	Unfactored	Factored	Difference Emp Factored-Labour Force
Tauranga City	70,867	61,896	78,059	7,192	108,801	94,487	126,642	17,841
Hamilton City	84,136	79,419	100,157	16,021	145,896	107,142	143,603	-2,293
Thames-Coromandel District	14,129	11,910	15,020	891	12,321	14,211	19,047	6,726
Matamata-Piako District	17,706	15,328	19,330	1,624	21,963	18,333	24,572	2,609
Taupo District	19,785	16,523	20,838	1,053	23,457	19,927	26,708	3,251
Waitomo District	5,137	4,444	5,604	467	5,685	5,468	7,329	1,644
Hauraki District	9,185	7,138	9,001	-184	9,454	8,156	10,932	1,478
South Waikato District	11,299	8,839	11,147	-152	13,471	10,664	14,293	822
Rotorua District	34,407	25,411	32,046	-2,361	39,187	29,457	39,481	294
Otorohanga District	5,140	3,883	4,897	-243	6,831	4,815	6,454	-377
Western Bay of Plenty District	23,042	13,214	16,664	-6,378	34,097	29,586	39,654	5,557
Waipa District	29,397	22,079	27,845	-1,552	39,415	28,364	38,016	-1,398
Auckland	27,306	17,355	21,887	-5,419	66,708	34,933	46,821	-19,887
Waikato District	40,688	23,573	29,729	-10,959	61,282	33,585	45,014	-16,268
Total	**392,224**	**311,011**	**392,224**		**588,566**	**439,128**	**588,566**	

The table shows that in 2018, Hamilton has the largest job surplus (in fact, it is the largest surplus in the whole model area for that year). However, in 2055, Hamilton has a job deficit. Additionally, in 2055, Tauranga has the largest job surplus, whereas in 2018, the surplus is relatively moderate. These differences in the balance between employment and labour force in 2018 and 2055 were then suspected to be the main contributing factors to the tidality issues (shown previously in Table 2-1).

[1] People aged 15 years and over who are available for work, whether employed full-time, part-time, or unemployed. This excludes retired people, those undertaking unpaid family care duties, attending educational institutions, or permanently unable to work due to physical or mental disabilities.

3.3.2 Population and Households

Further investigation was conducted on population and household figures. The summary can be found in Table 3-4 below.

Table 3-4 Population and Household, 2018 and 2055

TA	Population			Household		
	2018	2055	Growth (2025-2018)/2018	2018	2055	Growth (2025-2018)/2018
Auckland	52,485	124,173	137%	17,964	48,805	172%
Hamilton City	168,432	276,440	64%	57,651	105,189	82%
Waikato District	78,245	131,932	69%	25,866	46,181	79%
Waipa District	55,298	82,357	49%	20,342	31,730	56%
Western Bay of Plenty District	44,466	65,525	47%	16,207	24,894	54%
Tauranga City	142,711	217,422	52%	52,957	80,667	52%
Otorohanga District	9,977	14,278	43%	3,457	5,196	50%
Matamata-Piako District	34,564	47,423	37%	13,009	19,201	48%
Hauraki District	20,024	27,602	38%	7,860	11,461	46%
Rotorua District	69,632	95,727	37%	24,425	33,861	39%
Taupo District	38,330	50,118	31%	14,507	19,709	36%
Thames-Coromandel District	30,670	37,372	22%	13,257	16,982	28%
South Waikato District	25,068	31,088	24%	8,897	11,059	24%
Waitomo District	9,816	11,472	17%	3,598	4,382	22%
Total	**779,717**	**1,212,930**		**279,995**	**459,317**	

The table shows that in 2055, population and households in Auckland are projected to increase by 137% and 172% in turn (relative to their figure in 2018), followed by Hamilton, i.e., 64% for population and 82% for households.

This again highlights the imbalance in the population/labour force and employment growth discussed earlier. Two areas with the highest projected household growth (Auckland and Hamilton City) are in fact showing a deficit in employment (Table 3-3).

3.3.3 Final Scenario

The results of this analysis led to the development of another scenario that focused on correcting the large job deficit/surplus ('employment adjustment' in Table 3-5 below). By addressing the employment deficits and surplus (in relation to labour force) in a scenario, it would indirectly take into account considerable growth in population and households in different areas.

Table 3-5 Final Scenario (Test-7), 2055

TA	Labour Force, 2055	Employment, 2055					
		Unfactored	Factored	Difference Emp Factored-Labour Force	Employment Adjustment	Final Employment (Employment Unfactored - Employment Adj.)	Emp Adj. Factor (Final Emp./Unfac. Emp.)
Tauranga City	108,801	94,487	126,642	17,841	-15,000	79,487	0.841
Hamilton City	145,896	107,142	143,603	-2,293	5,000	112,142	1.047
Thames-Coromandel District	12,321	14,211	19,047	6,726	-5,000	9,211	0.648
Matamata-Piako District	21,963	18,333	24,572	2,609	0	18,333	1.000
Taupo District	23,457	19,927	26,708	3,251	0	19,927	1.000
Waitomo District	5,685	5,468	7,329	1,644	0	5,468	1.000
Hauraki District	9,454	8,156	10,932	1,478	0	8,156	1.000
South Waikato District	13,471	10,664	14,293	822	0	10,664	1.000
Rotorua District	39,187	29,457	39,481	294	0	29,457	1.000
Otorohanga District	6,831	4,815	6,454	-377	0	4,815	1.000
Western Bay of Plenty District	34,097	29,586	39,654	5,557	-5,000	24,586	0.831
Waipa District	39,415	28,364	38,016	-1,398	0	28,364	1.000
Auckland	66,708	34,933	46,821	-19,887	15,000	49,933	1.429
Waikato District	61,282	33,585	45,014	-16,268	15,000	48,585	1.447
Total	**588,566**	**439,128**	**588,566**			**449,128**	

The 'Emp Adj. Factor' in the table is used to scale the employment figures in the 2055 input demographics (Medium projection). This final scenario increases the total employment across the modelled area from around 439,000 to 449,000. However, this is not an issue as employment figures are used only on a relative term, as discussed in Section 3.3.1.

4 2055 Results

The results of the modelled flows from Test-7 can be seen in Table 4-1, with 2018 observed traffic flows, 2018 modelled flows from the validated base, and the 2055 Comprehensive Model forecasts derived using the input demographics as provided. Again, green shading indicates directional tidality aligning with 2018 observed, yellow a marginal tidality comparison, and red that the tidality is quite different. Note that the modelled flows in the AM peak and interpeak periods are also included in the table. "Comp Base" refers to forecasts from the Comprehensive demographics as provided, while "Comp Test" is based on our adjusted demographics.

Table 4-1 Traffic Flows, Observed vs. Modelled 2018, Modelled 2055 Comprehensive Base and Test

		AMP				INP				PMP			
Discription	Direction	2018 Obs	2018 Validated	2055 Comp. Base	2055 Comp. Test	2018 Obs	2018 Validated	2055 Comp. Base	2055 Comp. Test	2018 Obs	2018 Validated	2055 Comp. Base	2055 Comp. Test
SH1, between Auckland and Hamilton	Toward Auckland	45%	51%	38%	57%	49%	49%	44%	48%	48%	49%	55%	39%
SH1, between Auckland and Hamilton	Toward Hamilton	55%	49%	62%	43%	51%	51%	56%	52%	52%	51%	45%	61%
		2,701	**2,639**	**7,043**	**5,071**	**2,889**	**2,849**	**4,493**	**6,178**	**3,449**	**3,547**	**7,749**	**6,934**
SH1, between Hamilton and Cambridge	Toward Cambridge	46%	43%	63%	43%	49%	48%	46%	45%	55%	50%	31%	48%
SH1, between Hamilton and Cambridge	Toward Hamilton	54%	57%	37%	57%	51%	52%	54%	55%	45%	50%	69%	52%
		3,572	**3,864**	**6,201**	**5,644**	**3,033**	**2,902**	**5,380**	**4,430**	**4,311**	**3,925**	**8,098**	**6,678**
SH1, south of Cambridge	Toward Cambridge	49%	65%	21%	61%	50%	54%	55%	58%	50%	45%	80%	58%
SH1, south of Cambridge	Opposite Cambridge	51%	35%	79%	39%	50%	46%	45%	42%	50%	55%	20%	42%
		2,442	**2,414**	**4,511**	**3,049**	**2,597**	**1,896**	**4,148**	**2,456**	**3,230**	**2,480**	**5,049**	**3,648**
SH2, between Auckland and Tauranga	Toward Tauranga	54%	45%	78%	30%	49%	48%	48%	48%	51%	54%	26%	74%
SH2, between Auckland and Tauranga	Toward Auckland	46%	55%	22%	70%	51%	52%	52%	52%	49%	46%	74%	26%
		1,174	**1,402**	**3,563**	**1,504**	**1,618**	**1,357**	**1,314**	**2,058**	**1,596**	**1,595**	**4,746**	**1,905**
SH29, between Hamilton and Tauranga	Toward Tauranga	45%	43%	90%	26%	49%	48%	46%	45%	54%	64%	12%	61%
SH29, between Hamilton and Tauranga	Toward Hamilton	55%	57%	10%	74%	51%	52%	54%	55%	46%	36%	88%	39%
		1,582	**973**	**3,113**	**2,509**	**1,481**	**1,242**	**3,083**	**2,357**	**1,958**	**1,804**	**3,608**	**2,644**
SH36, between Tauranga and Roturua	Toward Rotorua	45%	49%	43%	90%	52%	34%	38%	36%	50%	60%	85%	21%
SH36, between Tauranga and Roturua	Toward Tauranga	55%	51%	57%	10%	48%	66%	62%	64%	50%	40%	15%	79%
		591	**327**	**431**	**667**	**380**	**427**	**399**	**709**	**717**	**598**	**1,365**	**1,058**

Test-7 ("Test") largely reinstates the current tidal pattern, in particular for the PM peak period. Across all periods, the Test produces a tidality pattern that is generally the same as the 2018 validated base, with only two differences in the AM peak and one in the PM peak.

For the interpeak period, the tidality in both the Base and Test are the same as the 2018 validated base.

In the Test, SH1 between Hamilton and Cambridge still has a slight reversed tidal flow in the PM peak, however, the magnitude is significantly less than the Base. In the AM peak, the tidality at this location matches observed in the Test (but not the Base).

In the Test, SH1 south of Cambridge also exhibits a slight tidality issue in the AM and PM peak periods. However, similar to above, the issue has been lessened compared with the Base, and the magnitude of the total flow also seems more plausible in the PM peak. In contrast, in the AM peak and interpeak, relatively low growth in two-way traffic is predicted, with 0.7-0.8% increase per annum (p.a.), which is low.

The reversed tidal flows still can be observed on SH36 between Tauranga and Rotorua for all periods, noting this was an issue in the 2018 validated base for the interpeak and PM peaks. However, the magnitude of the total flow in the Test seems more likely in comparison to 2018. In the PM peak, the "towards Tauranga" directional volume exhibits high growth, increasing 6.8%p.a. from the 2018 modelled to the 2055 Test. Similarly, in the AM peak, the directional volume "towards Rotorua" exhibits high growth, with a 7.5%p.a. increase. As noted above, the flows are numerically smaller than other key locations so are perhaps of less concern.

The directional flow on SH29, from Tauranga to Hamilton, also shows considerable growth of 6.4%p.a. in the AM peak. However, in the interpeak and PM peak, the growth seems to be more plausible (2.8%p.a. and 1.7%p.a. respectively).

In contrast, low growth is shown in the two-way flow between Auckland and Tauranga, at 0.2%p.a. for the AM peak and 0.5%p.a. for the PM peak from 2018 modelled to the 2055 Test.

So while the tidality in the 2055 modelled flows for the Test are more similar to current patterns than the 2055 Base, there are locations where very low growth in traffic is predicted. The low traffic growth may also occur in the Base, but our focus is the Test since we are artificially manipulating demographics.

Part-2: Checking Approach using 2035

In the following sections, Test-7 is shortened to "Test".

5 2035 Scenario Development

The method used to address large job deficits/surplus in 2055 input demographics, as discussed in Section 3.3.3, was then applied to the 2035 demographics. The employment adjustment and final employment are shown in Table 5-1. The largest job surplus and deficit for that forecast year are highlighted in the darkest shades of blue and red in the table respectively.

Table 5-1 Final Scenario (Test), 2035

TA	Labour Force	Employment, 2035					
		Unfactored	Factored	Difference Emp Factored-Labour Force	Employment Adjustment	Final Employment (Employment Unfactored - Employment Adj.)	Emp Adj. Factor (Final Emp./Unfac. Emp.)
Tauranga City	91,493	78,250	102,454	10,961	-8,500	69,750	0.891
Hamilton City	117,603	93,970	123,037	5,434	-3,000	90,970	0.968
Thames-Coromandel District	12,882	13,256	17,356	4,474	-3,000	10,256	0.774
Matamata-Piako District	19,903	17,346	22,712	2,809	0	17,346	1.000
Taupo District	21,926	18,623	24,383	2,458	0	18,623	1.000
Waitomo District	5,220	4,961	6,495	1,276	0	4,961	1.000
Hauraki District	9,067	7,733	10,125	1,058	0	7,733	1.000
South Waikato District	11,979	9,619	12,595	616	0	9,619	1.000
Rotorua District	36,964	28,400	37,184	221	0	28,400	1.000
Otorohanga District	6,044	4,524	5,924	-120	0	4,524	1.000
Western Bay of Plenty District	32,060	23,506	30,777	-1,283	0	23,506	1.000
Waipa District	35,248	25,132	32,905	-2,343	2,000	27,132	1.080
Auckland	48,609	28,800	37,709	-10,900	8,500	37,300	1.295
Waikato District	53,029	29,304	38,368	-14,661	11,000	40,304	1.375
Total	**502,025**	**383,425**	**502,025**			**390,425**	

This final scenario increases the total employment across the modelled area from around 380,000 to 390,000.

6 2035 Results

The resulting AM, interpeak, and PM peak modelled flows from the Test can be seen in Table 6-1, with 2055 Test figures included for checking whether the 2055 tidality is maintained. Again, green shading indicates directional tidality aligning with 2018 observed, yellow a marginal tidality comparison, and red that the tidality is quite different.

Table 6-1 Traffic Flows, Observed vs. Modelled 2018, Modelled 2035 Base and Test, Modelled 2055 Test

Discription	Direction	AMP					INP					PMP				
		2018 Obs	2018 Validated	2035 Comp. Base	2035 Comp. Test	2055 Comp. Test	2018 Obs	2018 Validated	2035 Comp. Base	2035 Comp. Test	2055 Comp. Test	2018 Obs	2018 Validated	2035 Comp. Base	2035 Comp. Test	2055 Comp. Test
SH1, between Auckland and Hamilton	Toward Auckland	45%	51%	37%	55%	57%	49%	49%	47%	48%	48%	48%	49%	54%	38%	39%
SH1, between Auckland and Hamilton	Toward Hamilton	55%	49%	63%	45%	43%	51%	51%	53%	52%	52%	52%	51%	46%	62%	61%
	Total 2-Dir	**2,701**	**2,639**	**5,673**	**4,287**	**5,071**	**2,889**	**2,849**	**3,696**	**4,893**	**6,178**	**3,449**	**3,547**	**6,125**	**5,855**	**6,934**
SH1, between Hamilton and Cambridge	Toward Cambridge	46%	43%	53%	46%	43%	49%	48%	47%	45%	45%	55%	50%	36%	45%	48%
SH1, between Hamilton and Cambridge	Toward Hamilton	54%	57%	47%	54%	57%	51%	52%	53%	55%	55%	45%	50%	64%	55%	52%
	Total 2-Dir	**3,572**	**3,864**	**4,764**	**4,784**	**5,644**	**3,033**	**2,902**	**3,732**	**3,749**	**4,430**	**4,311**	**3,925**	**6,148**	**5,556**	**6,678**
SH1, south of Cambridge	Toward Cambridge	49%	65%	34%	58%	61%	50%	54%	53%	56%	58%	50%	45%	78%	55%	58%
SH1, south of Cambridge	Opposite Cambridge	51%	35%	66%	42%	39%	50%	46%	47%	44%	42%	50%	55%	22%	45%	42%
	Total 2-Dir	**2,442**	**2,414**	**2,868**	**2,647**	**3,049**	**2,597**	**1,896**	**2,139**	**2,137**	**2,456**	**3,230**	**2,480**	**4,383**	**2,943**	**3,648**
SH2, between Auckland and Tauranga	Toward Tauranga	54%	45%	72%	47%	30%	49%	48%	48%	48%	48%	51%	54%	29%	67%	74%
SH2, between Auckland and Tauranga	Toward Auckland	46%	55%	28%	53%	70%	51%	52%	52%	52%	52%	49%	46%	71%	33%	26%
	Total 2-Dir	**1,174**	**1,402**	**2,561**	**1,644**	**1,504**	**1,618**	**1,357**	**952**	**1,693**	**2,058**	**1,596**	**1,595**	**3,288**	**1,585**	**1,905**
SH29, between Hamilton and Tauranga	Toward Tauranga	45%	43%	80%	26%	26%	49%	48%	50%	45%	45%	54%	64%	22%	68%	61%
SH29, between Hamilton and Tauranga	Toward Hamilton	55%	57%	20%	74%	74%	51%	52%	50%	55%	55%	46%	36%	78%	32%	39%
	Total 2-Dir	**1,582**	**973**	**1,317**	**1,883**	**2,509**	**1,481**	**1,242**	**1,403**	**1,915**	**2,357**	**1,958**	**1,804**	**2,468**	**2,151**	**2,644**
SH36, between Tauranga and Roturua	Toward Rotorua	45%	49%	57%	84%	90%	52%	34%	35%	33%	36%	50%	60%	57%	25%	21%
SH36, between Tauranga and Roturua	Toward Tauranga	55%	51%	43%	16%	10%	48%	66%	65%	67%	64%	50%	40%	43%	75%	79%
	Total 2-Dir	**591**	**327**	**354**	**481**	**667**	**380**	**427**	**479**	**530**	**709**	**717**	**598**	**661**	**785**	**1,058**

Tidality of flows for 2035 are largely consistent with 2055 for all periods in the Test.

Note that there are differences in the major job surplus and deficits by area between 2035 and 2055 (as shown in Table 3-5 for 2055 and Table 5-1 for 2035). For instance, in 2035, Hamilton City has a large job surplus, however in 2055, it has a large job deficit. Different factors were therefore applied by year and by area to adjust the input demographics. Strikingly, these adjustments produce a similar tidality pattern. This might imply that if major job surplus/deficits are addressed, the 2018 tidality could largely be maintained across the forecast years. This also confirms that tidality can be changed by adjusting the input employment by area.

The Test produces a relatively high directional volume on SH1 from Auckland to Hamilton, with an increase of 6%p.a. from 2018 modelled to 2035 in the PM peak. In general, for all periods, the annual growth in two-way traffic is high on this road, at around 4%p.a.

In the Test and similar to 2055, the directional volume on SH36 from Tauranga to Rotorua exhibits high growth, increasing 8.7%p.a. between the 2018 modelled and 2035. As noted previously, the flow is numerically smaller than other key locations. In the AM peak, the directional volume from Tauranga to Rotorua exhibits high growth, with a 9.1%p.a. increase.

The directional flow on SH29 from Tauranga to Hamilton also shows high growth of 8.8%p.a. in the AM peak. In the interpeak, the growth seems to be more plausible (3.7%p.a.). However, in the PM peak, the growth is very low at 0.4%p.a.

On SH2, there is no growth in traffic between 2018 modelled and the 2035 Test in the PM peak for the two-way flow between Auckland and Tauranga. In the AM and interpeak periods, traffic volumes increased moderately at 1% and 1.5% per annum.

Relatively low growth in two-way traffic flows is also predicted on SH1 south of Cambridge, with around 0.6%p.a. in the AM peak and interpeak periods.

The 2035 Test produces the same tidality as the 2055 Test, and also has some locations with very low growth in traffic from 2018.

Part-3: 2023 Observed vs 2025 Modelled

7 2025 Scenario Development

Part-1 concludes that the tidality observed in 2018 could, to some extent, be replicated in the 2055 Test by reallocating employment by area.

Part-2 confirms that the method of adjusting input demographics produces a consistent tidality pattern in 2035.

However, there remains a fundamental question whether the tidality produced by the Test is correct. While this question must be decided by the WRTM User Group, a check was done comparing the modelled flows from a 2025 Test with 2023 observed traffic volumes sourced from TMS.

The method for correcting large job deficits/surplus was applied to 2025 demographics (Medium projection). The employment adjustment and final employment are shown in the table below, with the largest job surplus and deficits being highlighted in the darkest shades of blue and red respectively.

Table 7-1 Final Scenario (Test), 2025

TA	Labour Force	Employment, 2025					
		Unfactored	Factored	Difference Emp Factored-Labour Force	Employment Adjustment	Final Employment (Employment Unfactored - Employment Adj.)	Emp Adj. Factor (Final Emp./Unfac. Emp.)
Tauranga City	79,850	69,017	87,116	7,266	-6,000	63,017	0.913
Hamilton City	99,005	85,489	107,907	8,902	-6,000	79,489	0.930
Thames-Coromandel District	13,533	12,579	15,877	2,344	-2,000	10,579	0.841
Matamata-Piako District	18,780	16,448	20,761	1,981	0	16,448	1.000
Taupo District	20,871	17,692	22,332	1,461	0	17,692	1.000
Waitomo District	5,144	4,715	5,951	807	0	4,715	1.000
Hauraki District	9,007	7,358	9,287	280	0	7,358	1.000
South Waikato District	11,462	9,212	11,628	165	0	9,212	1.000
Rotorua District	34,686	27,337	34,506	-180	0	27,337	1.000
Otorohanga District	5,498	4,329	5,465	-33	0	4,329	1.000
Western Bay of Plenty District	26,986	18,940	23,906	-3,079	3,000	21,940	1.158
Waipa District	32,225	23,337	29,456	-2,768	0	23,337	1.000
Auckland	34,551	24,443	30,853	-3,697	3,000	27,443	1.123
Waikato District	46,992	26,574	33,542	-13,449	12,000	38,574	1.452
Total	**438,588**	**347,470**	**438,588**			**351,470**	

This final scenario increases the total employment across the modelled area from around 347,000 to 350,000.

8 Observed Counts

Observed traffic volumes at 13 locations were extracted from TMS and processed. These locations are listed below and are shown in Figure 8-1.

- SH1 South of Cambridge
- SH1 between Hamilton and Taupo (South of Putāruru)
- SH1 between Hamilton and Cambridge (Peake Rd Overbridge)
- SH1 between Hamilton and Cambridge (Pickering Rd Fly Over)
- SH2 between Auckland and Tauranga (Auckland)
- SH2 between Auckland and Tauranga (Thames)
- SH2 between Auckland and Tauranga (Tauranga)
- SH5 between Rotorua and Hamilton
- SH27 between Auckland and Tauranga
- SH29 between Hamilton and Tauranga
- SH36 between Tauranga and Rotorua
- SH1 between Auckland and Hamilton (North of Huntly)
- SH1 between Auckland and Hamilton (North of Pōkeno)

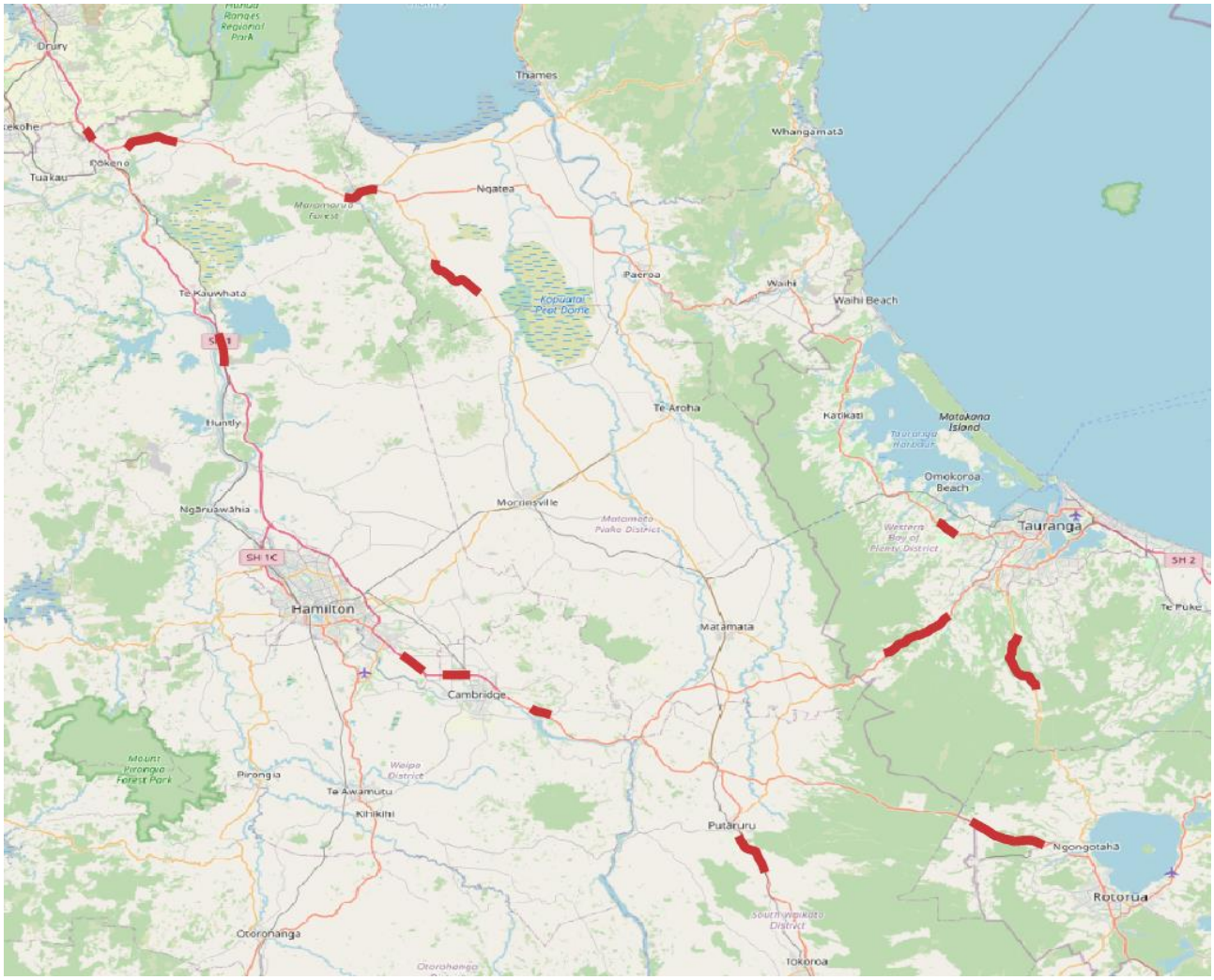

Figure 8-1 Traffic Counts Locations

The observed traffic volumes (light plus heavy vehicles) in 2018 and 2023 at the above locations are summarized in Table 8-1, with green shading indicating directional tidality in 2023 aligning with 2018, yellow indicating a marginal tidality comparison, and red showing flipped tidality. Per annum growth in traffic volumes from 2018 to 2023 is also shown, with shades of 'red' and 'blue' indicating a decrease and an increase in traffic in turn.

The 2023 total two-way traffic volume (top number), the growth from 2018 (bottom percentage figure), and the 2023 peak direction can also be seen in the schematic figures for the AM (Figure 8-2) and the PM peak (Figure 8-3). A green arrow indicates similar tidality as 2018, the yellow indicates nearly conformity, and the red signifies flipped tidality (2023 vs 2018).

Table 8-1 Traffic Flows, Observed, 2018 vs. 2023

Discription	Direction	AMP			INP			PMP		
		2018 Obs	2023 Obs	Annual Growth	2018 Obs	2023 Obs	Annual Growth	2018 Obs	2023 Obs	Annual Growth
SH1 South of Cambridge	N	49%	43%	-1.8%	50%	48%	2.7%	50%	52%	2.3%
SH1 South of Cambridge	S	51%	57%	3.3%	50%	52%	4.6%	50%	48%	0.4%
SH1 South of Cambridge	**Total**	**2,442**	**2,545**	**0.8%**	**2,597**	**3,065**	**3.6%**	**3,230**	**3,448**	**1.3%**
SH1 Between Hamilton and Taupo (South of Putāruru)	N	45%	43%	-9.1%	52%	43%	-3.9%	52%	55%	0.3%
SH1 Between Hamilton and Taupo (South of Putāruru)	S	55%	57%	-8.3%	48%	57%	2.7%	48%	45%	-1.7%
SH1 Between Hamilton and Taupo (South of Putāruru)	**Total**	**1,333**	**755**	**-8.7%**	**1,517**	**1,464**	**-0.7%**	**1,713**	**1,658**	**-0.7%**
SH1 Between Hamilton and Cambridge (Paeke Rd)	W	57%	58%	3.3%	51%	56%	3.1%	46%	51%	2.6%
SH1 Between Hamilton and Cambridge (Paeke Rd)	E	43%	42%	2.5%	49%	44%	-1.3%	54%	49%	-1.2%
SH1 Between Hamilton and Cambridge (Paeke Rd)	**Total**	**2,258**	**2,592**	**3.0%**	**1,969**	**2,065**	**1.0%**	**2,830**	**2,907**	**0.5%**
SH1 Between Hamilton and Cambridge (Pickering Rd)	W	54%	61%	1.4%	51%	60%	-0.3%	45%	55%	0.3%
SH1 Between Hamilton and Cambridge (Pickering Rd)	E	46%	39%	-4.2%	49%	40%	-6.7%	55%	45%	-6.3%
SH1 Between Hamilton and Cambridge (Pickering Rd)	**Total**	**3,572**	**3,360**	**-1.2%**	**3,033**	**2,503**	**-3.5%**	**4,311**	**3,599**	**-3.3%**
SH2 Between Auckland and Tauranga (Auckland)	W	49%	54%	-2.3%	50%	49%	-8.5%	47%	42%	-10.1%
SH2 Between Auckland and Tauranga (Auckland)	E	51%	46%	-5.3%	50%	51%	-8.0%	53%	58%	-8.1%
SH2 Between Auckland and Tauranga (Auckland)	**Total**	**1,531**	**1,238**	**-3.8%**	**2,311**	**1,358**	**-8.2%**	**2,226**	**1,217**	**-9.1%**
SH2 Between Auckland and Tauranga (Thames)	W	46%	47%	-5.1%	51%	54%	-6.7%	49%	51%	-5.6%
SH2 Between Auckland and Tauranga (Thames)	E	54%	53%	-5.8%	49%	46%	-8.3%	51%	49%	-6.5%
SH2 Between Auckland and Tauranga (Thames)	**Total**	**1,174**	**853**	**-5.5%**	**1,618**	**1,011**	**-7.5%**	**1,596**	**1,114**	**-6.0%**
SH2 Between Auckland and Tauranga (Tauranga)	W	43%	33%	-6.4%	49%	45%	-4.3%	58%	57%	-2.2%
SH2 Between Auckland and Tauranga (Tauranga)	E	57%	67%	0.3%	51%	55%	-1.6%	42%	43%	-1.4%
SH2 Between Auckland and Tauranga (Tauranga)	**Total**	**3,227**	**2,812**	**-2.6%**	**2,963**	**2,526**	**-2.9%**	**3,733**	**3,381**	**-1.9%**
SH5 Between Rotorua and Hamilton	W	53%	48%	1.3%	51%	55%	1.6%	45%	55%	2.3%
SH5 Between Rotorua and Hamilton	E	47%	52%	6.0%	49%	45%	-1.7%	55%	45%	-4.5%
SH5 Between Rotorua and Hamilton	**Total**	**659**	**776**	**3.6%**	**890**	**887**	**-0.1%**	**1,020**	**949**	**-1.4%**
SH27 Between Auckland and Tauranga	N	43%	45%	-8.1%	49%	50%	-11.8%	57%	58%	-11.8%
SH27 Between Auckland and Tauranga	S	57%	55%	-8.9%	51%	50%	-12.1%	43%	42%	-12.2%
SH27 Between Auckland and Tauranga	**Total**	**499**	**284**	**-8.6%**	**727**	**292**	**-12.0%**	**714**	**286**	**-12.0%**
SH29 Between Hamilton and Tauranga	N	45%	45%	3.7%	49%	48%	4.6%	54%	52%	-1.2%
SH29 Between Hamilton and Tauranga	S	55%	55%	3.4%	51%	52%	5.4%	46%	48%	0.0%
SH29 Between Hamilton and Tauranga	**Total**	**1,582**	**1,861**	**3.5%**	**1,481**	**1,852**	**5.0%**	**1,958**	**1,894**	**-0.7%**
SH36 Between Tauranga and Rotorua	N	55%	44%	-6.7%	51%	42%	-3.6%	45%	48%	-3.1%
SH36 Between Tauranga and Rotorua	S	45%	56%	0.8%	49%	58%	3.4%	55%	52%	-4.6%
SH36 Between Tauranga and Rotorua	**Total**	**682**	**569**	**-3.3%**	**440**	**436**	**-0.2%**	**788**	**633**	**-3.9%**
SH1 Between Auckland and Hamilton (North of Huntly)	N	45%	48%	4.3%	49%	51%	10.0%	48%	50%	2.8%
SH1 Between Auckland and Hamilton (North of Huntly)	S	55%	52%	2.0%	51%	49%	8.3%	52%	50%	1.2%
SH1 Between Auckland and Hamilton (North of Huntly)	**Total**	**2,701**	**3,107**	**3.0%**	**2,889**	**4,214**	**9.2%**	**3,449**	**3,795**	**2.0%**
SH1 Between Auckland and Hamilton (North of Pōkeno)	N	46%	52%	2.3%	47%	49%	2.3%	45%	49%	3.6%
SH1 Between Auckland and Hamilton (North of Pōkeno)	S	54%	48%	-1.7%	53%	51%	0.7%	55%	51%	-0.2%
SH1 Between Auckland and Hamilton (North of Pōkeno)	**Total**	**5,238**	**5,279**	**0.2%**	**6,148**	**6,596**	**3.8%**	**7,016**	**7,534**	**1.5%**

Aside from a few exceptions, the directional flows are generally quite balanced in all peak periods, with the peak direction generally attracting up to 55% of the two-way flow.

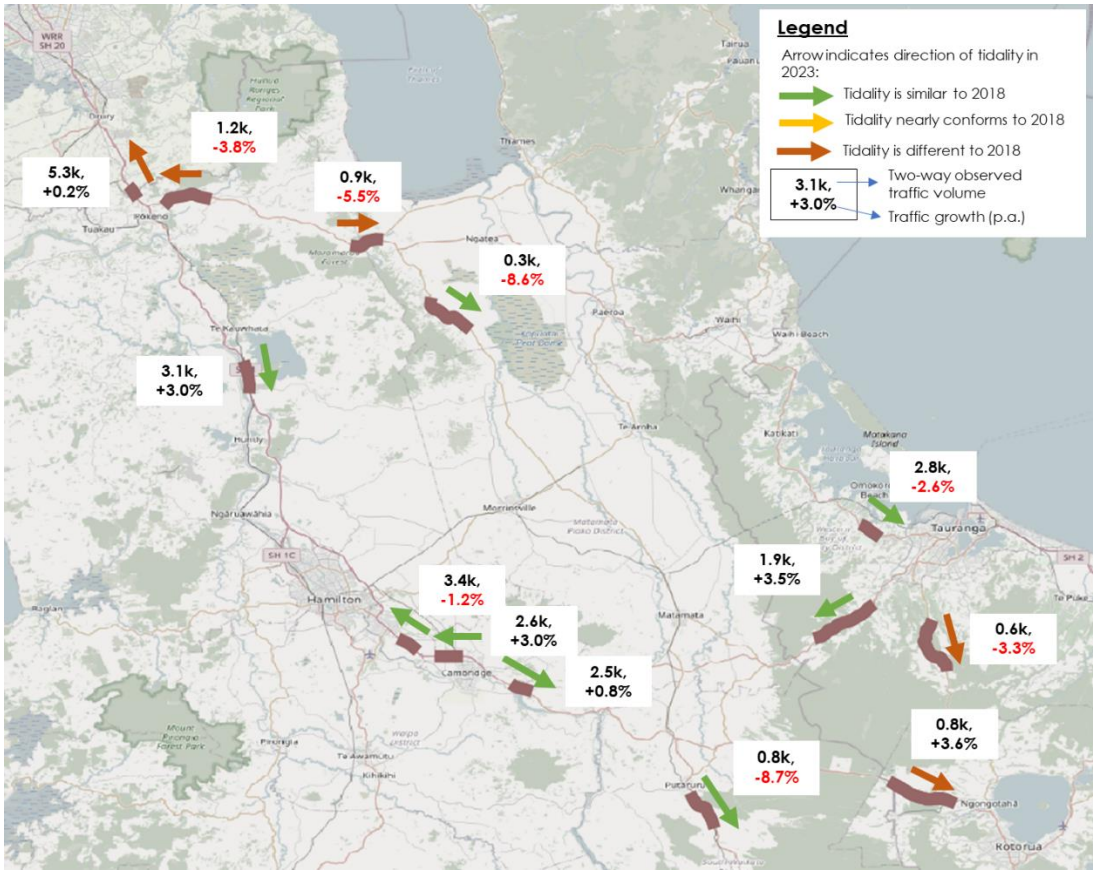

Figure 8-2 AM Peak, Observed 2023, Annual Growth and Peak Direction (vs 2018)

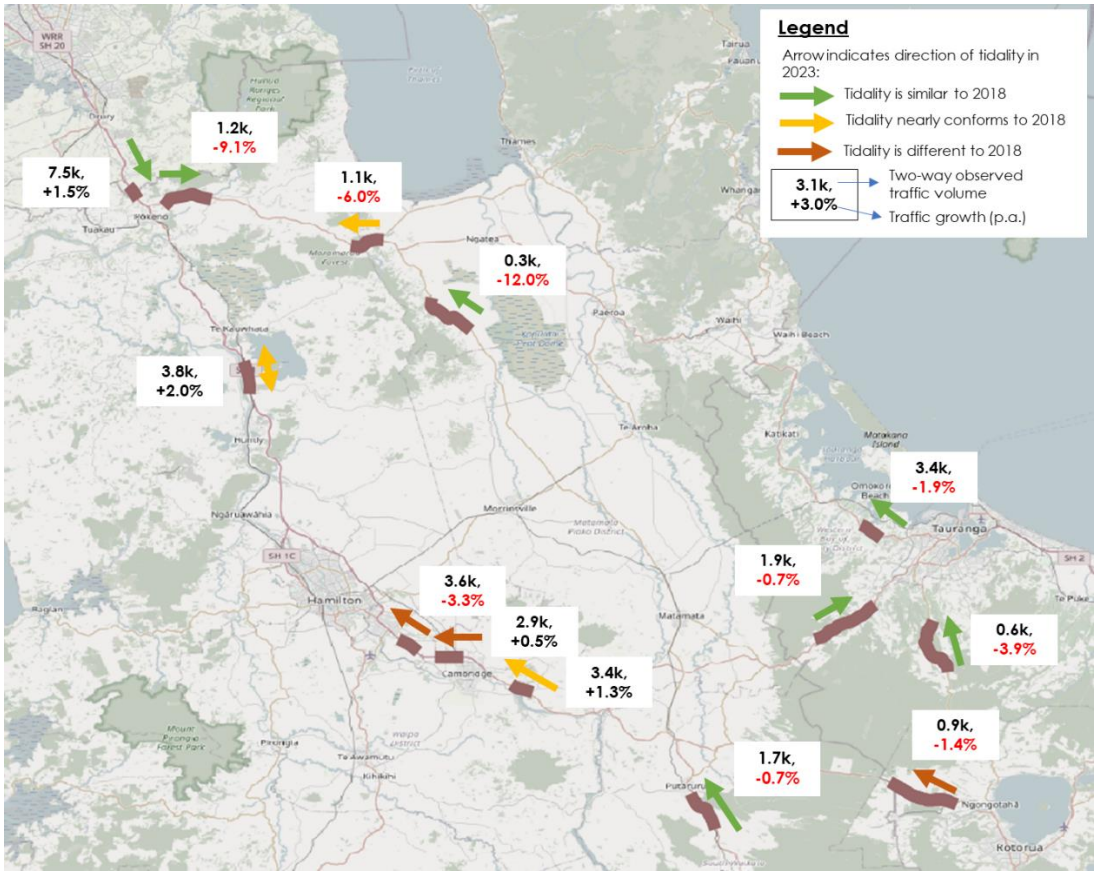

Figure 8-3 PM Peak, Observed 2023, Annual Growth and Peak Direction (vs 2018)

The table and figures show that tidality pattern in 2018 is largely preserved in 2023. However, there are several key locations in which the tidality in 2023 is flipped, such as on SH1 between Auckland and Hamilton (South of Putāruru) in the AM peak, SH2 between Auckland and Tauranga (Auckland) in the AM peak, and SH1 between Hamilton and Cambridge in the PM peak. This highlights the need to decide on the likely tidality for other forecast years, in particular on major roads connecting major cities/town.

The key findings regarding growth in traffic volume per annum from 2018 to 2023 are summarized below.

- SH2 between Auckland and Tauranga has a large decrease in traffic volume at all three locations (Auckland, Thames and Tauranga) and all periods, with Auckland and Thames having the largest decrease. This is reenforced by the annual average daily traffic (AADT) flows published by Waka Kotahi.
- SH27 between Auckland and Tauranga has a substantial decrease in traffic volume per annum, and this is consistent across different periods. However, the total volume is relatively small compared to other roads in the network.
- SH1 between Hamilton and Taupo has a substantial decrease in traffic volume per annum in the AM peak, and a slight decrease in the interpeak and PM peak. However, the total two-way traffic volume is also low.
- SH36 between Tauranga and Rotorua has a moderate decrease in traffic volume annually in the AM and PM peak, and a slight decrease in the interpeak. Again, the magnitude of volume is relatively low compared to other major roads investigated.
- SH1 between Auckland and Hamilton (North of Huntly) has a moderate increase in traffic volume per annum in all time periods. However, at the location North of Pokeno, the increase per annum is very low, in particular in the AM peak.
- SH29 between Hamilton and Tauranga has a moderate increase in traffic volume in the AM peak and interpeak periods. However, in the PM peak, a decrease could be observed.

This demonstrates that peak directions change in reality, and that traffic flows can also decrease over time.

9 2025 Results

The results of the 2025 AM, interpeak, and PM peak modelled flows from the Test can be seen in Table 9-1, along with the Base. The tidality from 2018 and 2023 observed traffic is also provided. Green shading indicates directional tidality of the modelled flows aligning with 2023 observed, yellow shows a marginal tidality comparison, and red displays flipped tidality.

The schematic representations of the table, showing the results of the 2025 Base and Test, can be seen in Figure 9-1 to Figure 9-4, focusing on the AM peak (Figure 9-1 and Figure 9-2) and PM peak (Figure 9-3 and Figure 9-4). Note that the tidality in the interpeak period produced by the Test is quite similar to the Base, and also the 2023 observed. This pattern could also be seen in other forecast years being investigated (2035 and 2055). This implies that the method of adjusting input demographics, does not seem to affect the tidality in the interpeak period, which does not display the extreme and concerning changes seen in the commuting periods.

Table 9-1 Traffic Flows, Observed 2018 & 2023 vs. Modelled 2025 Base and Test

Discription	Direction	AMP				INP				PMP			
		2018 Obs	2023 Obs	2025 Base	2025 Test	2018 Obs	2023 Obs	2025 Base	2025 Test	2018 Obs	2023 Obs	2025 New Base	2025 Test
SH1 South of Cambridge	N	49%	43%	47%	57%	50%	48%	54%	54%	50%	52%	64%	51%
SH1 South of Cambridge	S	51%	57%	53%	43%	50%	52%	46%	46%	50%	48%	36%	49%
SH1 South of Cambridge	**Total**	**2,442**	**2,545**	**2,319**	**2,416**	**2,597**	**3,065**	**1,820**	**1,949**	**3,230**	**3,448**	**2,930**	**2,712**
SH1 Between Hamilton and Taupo (South of Putāruru)	N	45%	43%	43%	43%	52%	43%	53%	54%	52%	55%	60%	58%
SH1 Between Hamilton and Taupo (South of Putāruru)	S	55%	57%	57%	57%	48%	57%	47%	46%	48%	45%	40%	42%
SH1 Between Hamilton and Taupo (South of Putāruru)	**Total**	**1,333**	**755**	**1,091**	**1,094**	**1,517**	**1,464**	**1,030**	**1,041**	**1,713**	**1,658**	**1,656**	**1,617**
SH1 Between Hamilton and Cambridge (Paeke Rd)	W	57%	58%	56%	59%	51%	56%	58%	59%	46%	51%	59%	52%
SH1 Between Hamilton and Cambridge (Paeke Rd)	E	43%	42%	44%	41%	49%	44%	42%	41%	54%	49%	41%	48%
SH1 Between Hamilton and Cambridge (Paeke Rd)	**Total**	**2,258**	**2,592**	**2,014**	**2,020**	**1,969**	**2,065**	**1,456**	**1,471**	**2,830**	**2,907**	**1,895**	**1,809**
SH1 Between Hamilton and Cambridge (Pickering Rd)	W	54%	61%	52%	55%	51%	60%	54%	54%	45%	55%	56%	52%
SH1 Between Hamilton and Cambridge (Pickering Rd)	E	46%	39%	48%	45%	49%	40%	46%	46%	55%	45%	44%	48%
SH1 Between Hamilton and Cambridge (Pickering Rd)	**Total**	**3,572**	**3,360**	**4,351**	**4,344**	**3,033**	**2,503**	**3,295**	**3,297**	**4,311**	**3,599**	**5,064**	**4,895**
SH2 Between Auckland and Tauranga (Auckland)	W	49%	54%	45%	60%	50%	49%	49%	49%	47%	42%	47%	32%
SH2 Between Auckland and Tauranga (Auckland)	E	51%	46%	55%	40%	50%	51%	51%	51%	53%	58%	53%	68%
SH2 Between Auckland and Tauranga (Auckland)	**Total**	**1,531**	**1,238**	**1,887**	**2,163**	**2,311**	**1,358**	**1,686**	**2,283**	**2,226**	**1,217**	**2,091**	**2,399**
SH2 Between Auckland and Tauranga (Thames)	W	46%	47%	40%	61%	51%	54%	52%	51%	49%	51%	56%	29%
SH2 Between Auckland and Tauranga (Thames)	E	54%	53%	60%	39%	49%	46%	48%	49%	51%	49%	44%	71%
SH2 Between Auckland and Tauranga (Thames)	**Total**	**1,174**	**853**	**1,536**	**1,767**	**1,618**	**1,011**	**1,044**	**1,654**	**1,596**	**1,114**	**1,736**	**1,573**
SH2 Between Auckland and Tauranga (Tauranga)	W	43%	33%	27%	35%	49%	45%	50%	51%	58%	57%	65%	58%
SH2 Between Auckland and Tauranga (Tauranga)	E	57%	67%	73%	65%	51%	55%	50%	49%	42%	43%	35%	42%
SH2 Between Auckland and Tauranga (Tauranga)	**Total**	**3,227**	**2,812**	**3,528**	**3,539**	**2,963**	**2,526**	**3,685**	**3,608**	**3,733**	**3,381**	**4,366**	**4,482**
SH5 Between Rotorua and Hamilton	W	53%	48%	34%	40%	51%	55%	60%	58%	45%	55%	59%	51%
SH5 Between Rotorua and Hamilton	E	47%	52%	66%	60%	49%	45%	40%	42%	55%	45%	41%	49%
SH5 Between Rotorua and Hamilton	**Total**	**659**	**776**	**642**	**693**	**890**	**887**	**511**	**532**	**1,020**	**949**	**761**	**802**
SH27 Between Auckland and Tauranga	N	43%	45%	54%	65%	49%	50%	43%	43%	57%	58%	41%	36%
SH27 Between Auckland and Tauranga	S	57%	55%	46%	35%	51%	50%	57%	57%	43%	42%	59%	64%
SH27 Between Auckland and Tauranga	**Total**	**499**	**284**	**349**	**354**	**727**	**292**	**388**	**425**	**714**	**286**	**514**	**531**
SH29 Between Hamilton and Tauranga	N	45%	45%	67%	35%	49%	48%	50%	49%	54%	52%	45%	70%
SH29 Between Hamilton and Tauranga	S	55%	55%	33%	65%	51%	52%	50%	51%	46%	48%	55%	30%
SH29 Between Hamilton and Tauranga	**Total**	**1,582**	**1,861**	**1,018**	**1,495**	**1,481**	**1,852**	**1,224**	**1,522**	**1,958**	**1,894**	**1,652**	**2,094**
SH36 Between Tauranga and Rotorua	N	55%	44%	62%	46%	51%	42%	59%	64%	45%	48%	40%	57%
SH36 Between Tauranga and Rotorua	S	45%	56%	38%	54%	49%	58%	41%	36%	55%	52%	60%	43%
SH36 Between Tauranga and Rotorua	**Total**	**682**	**569**	**508**	**468**	**440**	**436**	**587**	**535**	**788**	**633**	**888**	**799**
SH1 Between Auckland and Hamilton (North of Huntly)	N	45%	48%	47%	60%	49%	51%	49%	48%	48%	50%	45%	34%
SH1 Between Auckland and Hamilton (North of Huntly)	S	55%	52%	53%	40%	51%	49%	51%	52%	52%	50%	55%	66%
SH1 Between Auckland and Hamilton (North of Huntly)	**Total**	**2,701**	**3,107**	**3,917**	**3,875**	**2,889**	**4,214**	**3,817**	**4,696**	**3,449**	**3,795**	**4,688**	**5,463**
SH1 Between Auckland and Hamilton (North of Pōkeno)	N	46%	52%	53%	60%	47%	49%	48%	48%	45%	49%	42%	36%
SH1 Between Auckland and Hamilton (North of Pōkeno)	S	54%	48%	47%	40%	53%	51%	52%	52%	55%	51%	58%	64%
SH1 Between Auckland and Hamilton (North of Pōkeno)	**Total**	**5,238**	**5,279**	**6,685**	**7,372**	**6,148**	**6,596**	**7,850**	**9,066**	**7,016**	**7,534**	**8,730**	**10,226**

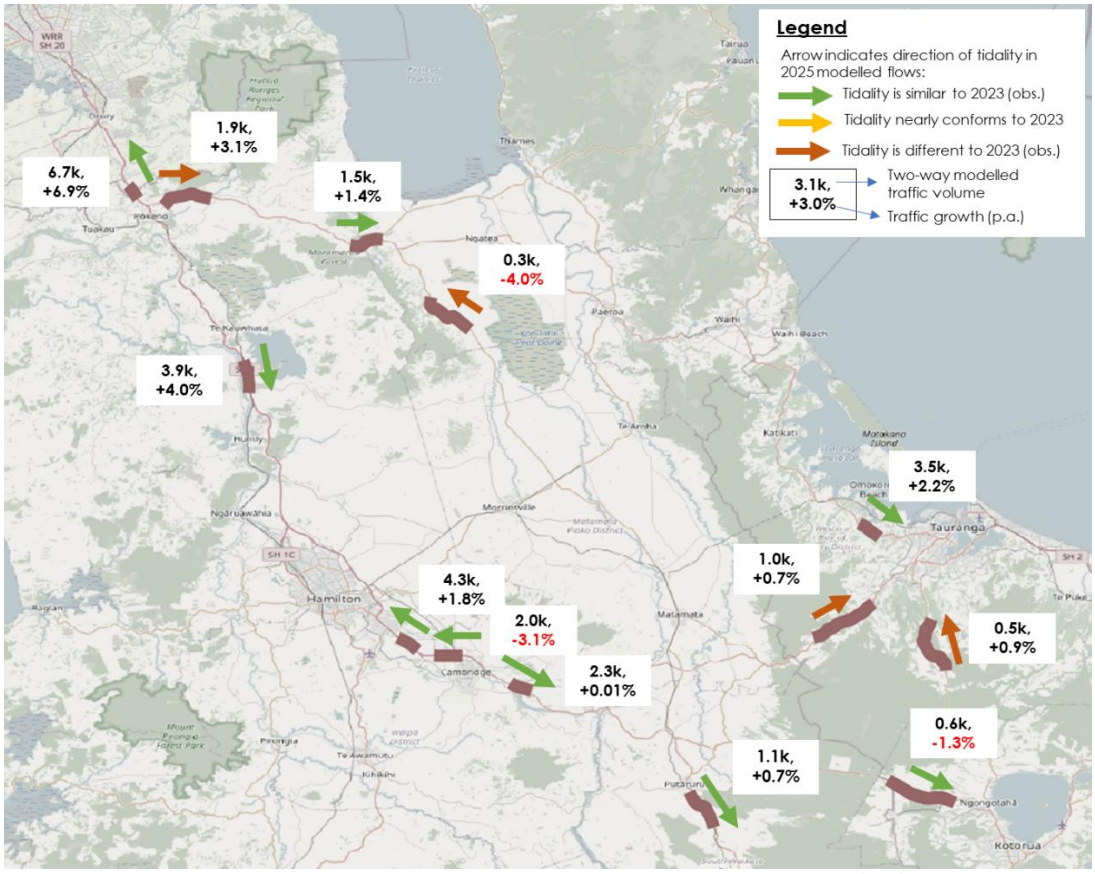

Figure 9-1 AM Peak, Modelled 2025 Base, Annual Growth (vs 2018 Modelled), and Tidality (vs 2023 Observed)

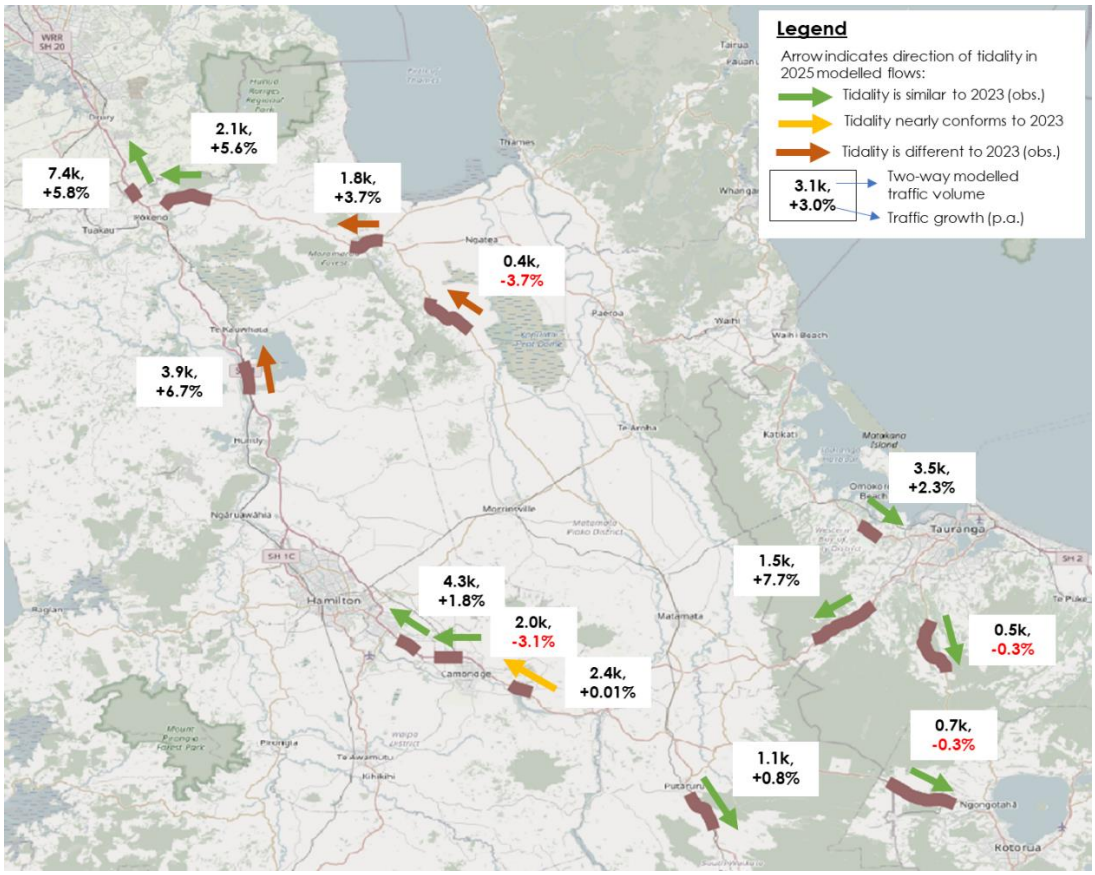

Figure 9-2 AM Peak, Modelled 2025 Test, Annual Growth (vs 2018 Modelled), and Tidality (vs 2023 Observed)

In the AM peak, on SH2 (Auckland and Thames), the direction of tidality in the Base shows stronger attraction toward Tauranga whereas the Test shows stronger attraction toward Auckland. This might happen because 3,000 jobs were added into Auckland to reduce a deficit. The Test produces tidality on SH2 (Auckland) that conforms with the 2023 observed. However, the observed indicates that the tidality at Thames should be flipped. The 2023 observed seems to be less plausible, noting that the counts are relatively low at this location (850) compared with 2018 observed (around 1,200).

The Test produces tidal flow toward Auckland on SH1, North of Pokeno. This tidality is flipped from the Base and observed. The reason might be because 6,000 jobs were removed from Hamilton whereas 3,000 jobs were added to Auckland.

The tidality on SH1, South of Cambridge and between Cambridge and Hamilton, shows stronger attraction toward Hamilton in the AM peak. This seems plausible as Hamilton is the largest city in that area.

The Test also produces 'correct' tidality (implying conformity with observed) on SH29 and SH36. However, the growth in modelled two-way traffic from 2018 on SH29 is relatively high at 7.7%p.a.

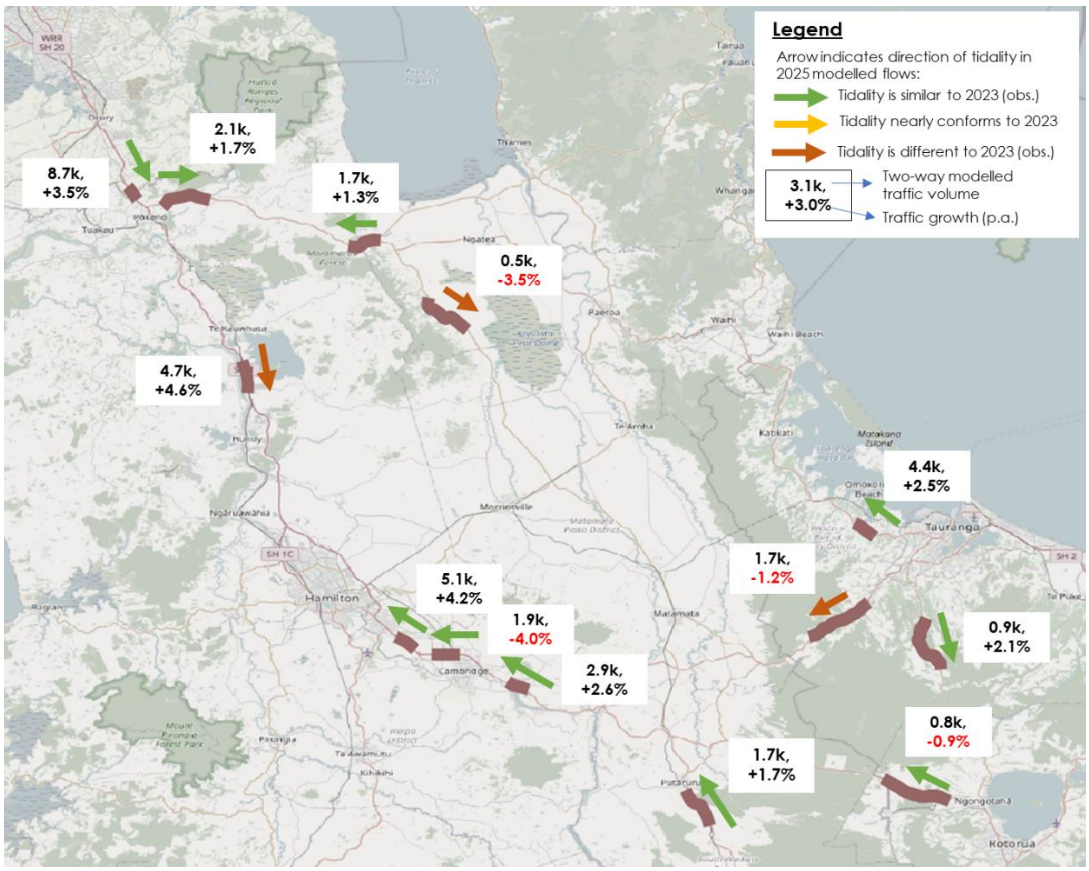

Figure 9-3 PM Peak, Modelled 2025 Base, Annual Growth (vs 2018 Modelled), and Tidality (vs 2023 Observed)

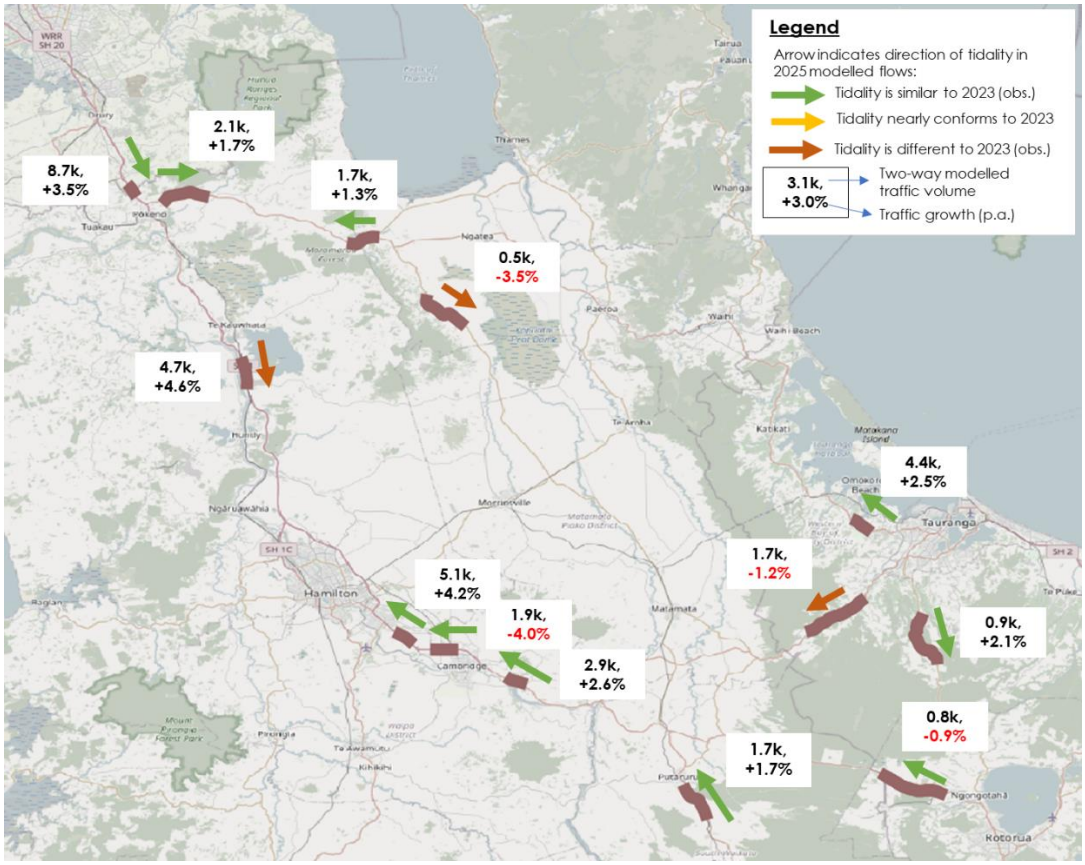

Figure 9-4 PM Peak, Modelled 2025 Test, Annual Growth (vs 2018 Modelled), and Tidality (vs 2023 Observed)

In the PM peak, the Test produces the opposite tidality to the AM peak at most locations. However, on SH1, South of Cambridge and between Cambridge and Hamilton, the tidality in the AM peak is similar to the PM peak. It should be noted however that this tidality conforms with the observed tidality and although the Base and Test produce the same tidal pattern on this road, the tidality produced by the Test is more tempered and closer to observed than the Base.

Some major roads in the Test's network exhibit moderate to high growth in modelled traffic volume per annum from 2018, and they are quite consistent in the AM and PM peak periods. These roads are SH1 North of Pokeno (6-7%), SH1 North of Huntly (7%), SH2, in Auckland (4-6%), and SH1 in Tauranga (2-3%). Note that moderate to high growth in traffic volume could also be observed in the Base modelled traffic flow, however, at several key locations, the Test produces higher volumes than the Base.

Part-4: Conclusions and Recommendations

10 Conclusion and Recommendations

Traffic flows are tabulated in three tables in Appendix B for the AM, interpeak, and PM peaks respectively, including:

- Observed, 2018 and 2023
- Modelled, 2018 validated base
- Modelled, 2025, 2035, and 2055 using the Base input demographics (as provided)
- Modelled, 2025, 2035, and 2055 using the Test input demographics, modified by Stantec considering labour force and employment ratios by area.

Below are the conclusions, followed by next steps.

- After developing different scenarios by adjusting input demographics, results show the importance of **ensuring the appropriateness of the input demographic data**.

  One of the most important demographic components that seemed out of balance is the labour force and employment relationship. Substantial deficit in jobs in an area would force people to find work elsewhere, in particular in areas nearby with a job surplus. In a large model that involves many cities/towns, the surplus and deficits in jobs (in relation to labour force) are the push and pull factors that result in modelled traffic flows.

- In this assessment, the tidality in the observed 2018 flows was set as the refence point to compare modelled flows from 2035 and 2055, on the basis that 2018 observed tidality would be preserved in future years. When comparing the tidality in the observed 2018 with 2023, results show that tidality is flipped at some key locations. Therefore, it becomes **crucial to assess the plausibility of the forecast tidal flows.**

- Results also show that **employment is a key factor** that affects the tidality of the modelled flows. This is very important as different tidality patterns can then be created by adjusting employment figures. This again highlights the importance of **ensuring the appropriateness of the input demographic data**.

- Traffic flows produced from the Base demographics in the commuting periods showed a reverse of current (2018) tidality patterns and an extreme shift in the proportion of directional tidality (i.e. a much higher flow in the peak direction, and reduced flows compared with 2018 for the non-peak direction) for 2035 and 2055. The same issues occurred in 2025 but to a lesser extent.

- For the interpeak period, the Base demographics do not result in the same imbalance.

- Redistributing employment by area considering major job surplus and deficits in terms of labour force and employment has reduced the directional imbalance in the commuting patterns and makes minimal change in the interpeak period.

- Key points to note are:

  - The Test generally reduces traffic flows in the commuting periods for the key locations examined for 2035 and 2055, whereas for all years in the interpeak and the 2025 AM and PM periods, a small increase in flow occurs.

  - The Test consistently produces relatively low growth in traffic on SH2 between Auckland and Tauranga (Thames) in the AM and PM periods for all future years examined, which was not the case in the Base. The opposite happens in the interpeak, with the Base having flows less than 2018 modelled, whereas the Test shows modest increases over time. Observed 2023 flows are less than 2018 at Thames in all three modelled periods.

  - On SH1 North of Pokeno, the interpeak flows in the Test are significantly higher than the Base. By 2055 in the Test, the peak commuting directions are northbound in the AM and southbound in the

PM peak. This is the opposite of the flows produced using the Base demographics and aligns with the 2023 observed tidality (noting the observed AM tidality changed between 2018 and 2023).

Our recommendation are:

- The WRTM User Group should consider whether the labour force to employment surplus and deficits embedded in the input demographics are considered likely by area.
- The WRTM User Group should consider whether the forecast flows from the Tests are more plausible than the current Base (Base uses demographics as supplied).

Appendix A

List of Tests (as shown in Table 3-2)

Test	Employment		Household		Bulk Run
Test-0	Adjusting employment figure in the Comprehensive demographics for every TA using Employment to Labour Force ratio of the Interim demographics		No adjustment		1
Test-1	Repeating Test-0, but maintaining Total Employment in Comprehensive demographics		No adjustment		
Test-2	No adjustment		Reducing households in Tauranga and WBOP		2
			Tauranga	-4,100	
			Western Bay of Plenty	-2,800	
Test-3	Repeating Test-1		Repeating Test-2		
Test-4	Reducing employment in Tauranga and WBOP and adding employment in Hamilton		Reducing households in Tauranga and WBOP		3
	Tauranga	-23,500	Tauranga	-4,000	
	Western Bay of Plenty	-8,500	Western Bay of Plenty	-3,000	
	Hamilton	26,000			
Test-5	Repeating Test-4		No adjustment		
Test-6	Reducing employment in Tauranga and adding employment in Hamilton		No adjustment		
	Tauranga	-50,000			
	Western Bay of Plenty	50,000			

Test Results

Note: Results of Test-6 were omitted as the scenario failed to converge.

Location	Direction	2018, Observed vs. Modelled Flows		2055, Comprehensive, Modelled Flows						
		%Obs Prop	%Modelled	%Base	%Test-0	%Test-1	%Test-2	%Test-3	%Test-4	%Test-5
SH1, between Auckland and Hamilton	Toward Auckland	48%	49%	53%	64%	64%	56%	63%	62%	62%
SH1, between Auckland and Hamilton	Toward Hamilton	52%	51%	47%	36%	36%	44%	37%	38%	38%
	Total Flows 2-Dir	**3,449**	**3,547**	**7,363**	**10,957**	**10,615**	**7,772**	**10,592**	**9,955**	**9,990**
SH1, between Hamilton and Cambridge	Toward Cambridge	55%	50%	29%	49%	49%	29%	46%	50%	53%
SH1, between Hamilton and Cambridge	Toward Hamilton	45%	50%	71%	51%	51%	71%	54%	50%	47%
	Total Flows 2-Dir	**4,311**	**3,925**	**8,447**	**7,400**	**7,332**	**8,301**	**7,243**	**7,192**	**7,384**
SH1, south of Cambridge	Toward Cambridge	50%	45%	80%	52%	52%	81%	59%	52%	44%
SH1, south of Cambridge	Away from Cambridge	50%	55%	20%	48%	48%	19%	41%	48%	56%
	Total Flows 2-Dir	**3,230**	**2,480**	**5,080**	**4,150**	**4,080**	**5,052**	**3,998**	**3,788**	**4,205**
SH2, between Auckland and Tauranga	Toward Tauranga	51%	54%	26%	32%	34%	26%	31%	32%	35%
SH2, between Auckland and Tauranga	Toward Auckland	49%	46%	74%	68%	66%	74%	69%	68%	65%
	Total Flows 2-Dir	**1,596**	**1,595**	**4,708**	**3,711**	**3,384**	**4,865**	**3,749**	**3,214**	**2,829**
SH29, between Hamilton and Tauranga	Toward Tauranga	54%	64%	12%	74%	74%	11%	69%	67%	73%
SH29, between Hamilton and Tauranga	Toward Hamilton	46%	36%	88%	26%	26%	89%	31%	33%	27%
	Total Flows 2-Dir	**1,958**	**1,804**	**3,681**	**4,311**	**4,244**	**3,694**	**3,303**	**3,103**	**4,055**
SH36, between Tauranga and Roturua	Toward Rotorua	50%	60%	85%	12%	12%	89%	15%	17%	13%
SH36, between Tauranga and Roturua	Toward Tauranga	50%	40%	15%	88%	88%	11%	85%	83%	87%
	Total Flows 2-Dir	**717**	**598**	**1,887**	**2,197**	**2,072**	**2,497**	**1,546**	**1,230**	**1,649**

Appendix B – Forecast Traffic Flows

Location	Direction	AM Peak											
		Observed		Modelled							Difference		
				Validated	Base			Test			Test - Base		
		2018	2023	2018	2025	2035	2055	2025	2035	2055	2025	2035	2055
SH1 South of Cambridge	N	1,193	1,087	1,558	1,092	981	951	1,378	1,542	1,850	286	561	899
SH1 South of Cambridge	S	1,249	1,457	856	1,227	1,887	3,560	1,038	1,105	1,199	-189	-782	-2,361
Total 2-Dir		**2,442**	**2,545**	**2,414**	**2,319**	**2,868**	**4,511**	**2,416**	**2,647**	**3,049**	**97**	**-221**	**-1,462**
SH1 Between Hamilton and Taupo (South of Putāruru)	N	600	327	515	469	396	396	473	421	432	4	25	36
SH1 Between Hamilton and Taupo (South of Putāruru)	S	733	429	523	622	895	1,265	621	788	941	-1	-107	-324
Total 2-Dir		**1,333**	**755**	**1,038**	**1,091**	**1,291**	**1,661**	**1,094**	**1,209**	**1,373**	**3**	**-82**	**-288**
SH1 Between Hamilton and Cambridge	W	1,286	1,498	1,667	1,121	1,151	1,191	1,195	1,362	1,679	74	211	488
SH1 Between Hamilton and Cambridge	E	972	1,094	909	893	1,109	2,040	825	901	1,057	-68	-208	-983
Total 2-Dir		**2,258**	**2,592**	**2,576**	**2,014**	**2,260**	**3,231**	**2,020**	**2,263**	**2,736**	**6**	**3**	**-495**
SH1 Between Hamilton and Cambridge	W	1,924	2,061	2,185	2,274	2,232	2,320	2,399	2,576	3,199	125	344	879
SH1 Between Hamilton and Cambridge	E	1,648	1,299	1,679	2,077	2,532	3,881	1,945	2,208	2,445	-132	-324	-1,436
Total 2-Dir		**3,572**	**3,360**	**3,864**	**4,351**	**4,764**	**6,201**	**4,344**	**4,784**	**5,644**	**-7**	**20**	**-557**
SH2 Between Auckland and Tauranga (Auckland)	W	758	670	889	843	868	925	1,304	1,098	1,213	461	230	288
SH2 Between Auckland and Tauranga (Auckland)	E	773	568	663	1,044	1,972	2,911	859	1,027	789	-185	-945	-2,122
Total 2-Dir		**1,531**	**1,238**	**1,552**	**1,887**	**2,840**	**3,836**	**2,163**	**2,125**	**2,002**	**276**	**-715**	**-1,834**
SH2 Between Auckland and Tauranga (Thames)	W	544	405	771	613	720	789	1,082	878	1,047	469	158	258
SH2 Between Auckland and Tauranga (Thames)	E	630	448	631	923	1,841	2,774	685	766	457	-238	-1,075	-2,317
Total 2-Dir		**1,174**	**853**	**1,402**	**1,536**	**2,561**	**3,563**	**1,767**	**1,644**	**1,504**	**231**	**-917**	**-2,059**
SH2 Between Auckland and Tauranga (Tauranga)	W	1,373	934	815	937	894	975	1,233	1,174	1,400	296	280	425
SH2 Between Auckland and Tauranga (Tauranga)	E	1,855	1,878	2,236	2,591	2,981	3,241	2,306	2,709	2,807	-285	-272	-434
Total 2-Dir		**3,227**	**2,812**	**3,051**	**3,528**	**3,875**	**4,216**	**3,539**	**3,883**	**4,207**	**11**	**8**	**-9**
SH5 Between Rotorua and Hamilton	W	348	372	426	219	169	177	278	309	409	59	140	232
SH5 Between Rotorua and Hamilton	E	310	404	281	423	465	767	415	398	418	-8	-67	-349
Total 2-Dir		**659**	**776**	**707**	**642**	**634**	**944**	**693**	**707**	**827**	**51**	**73**	**-117**
SH27 Between Auckland and Tauranga	N	213	127	280	188	195	231	229	193	229	41	-2	-2
SH27 Between Auckland and Tauranga	S	285	158	205	161	241	352	125	145	134	-36	-96	-218
Total 2-Dir		**499**	**284**	**485**	**349**	**436**	**583**	**354**	**338**	**363**	**5**	**-98**	**-220**
SH29 Between Hamilton and Tauranga	N	712	845	418	681	1,049	2,793	525	497	640	-156	-552	-2,153
SH29 Between Hamilton and Tauranga	S	871	1,017	555	337	268	320	970	1,386	1,869	633	1,118	1,549
Total 2-Dir		**1,582**	**1,861**	**973**	**1,018**	**1,317**	**3,113**	**1,495**	**1,883**	**2,509**	**477**	**566**	**-604**
SH36 Between Tauranga and Rotorua	N	375	250	298	313	306	389	215	184	147	-98	-122	-242
SH36 Between Tauranga and Rotorua	S	308	319	180	195	226	212	253	384	554	58	158	342
Total 2-Dir		**682**	**569**	**478**	**508**	**532**	**601**	**468**	**568**	**701**	**-40**	**36**	**100**
SH1 Between Auckland and Hamilton (North of Huntly)	N	1,223	1,485	1,336	1,829	2,076	2,651	2,325	2,340	2,900	496	264	249
SH1 Between Auckland and Hamilton (North of Huntly)	S	1,478	1,622	1,303	2,088	3,597	4,392	1,550	1,947	2,171	-538	-1,650	-2,221
Total 2-Dir		**2,701**	**3,107**	**2,639**	**3,917**	**5,673**	**7,043**	**3,875**	**4,287**	**5,071**	**-42**	**-1,386**	**-1,972**
SH1 Between Auckland and Hamilton (North of Pōkeno)	N	2,434	2,720	3,022	3,576	3,596	4,443	4,426	4,390	5,583	850	794	1,140
SH1 Between Auckland and Hamilton (North of Pōkeno)	S	2,803	2,558	2,212	3,109	5,062	6,536	2,946	3,633	4,050	-163	-1,429	-2,486
Total 2-Dir		**5,238**	**5,279**	**5,234**	**6,685**	**8,658**	**10,979**	**7,372**	**8,023**	**9,633**	**687**	**-635**	**-1,346**

Location	Direction	Interpeak											
		Observed		Modelled							Difference		
				Validated	Base			Test			Test - Base		
		2018	2023	2018	2025	2035	2055	2025	2035	2055	2025	2035	2055
SH1 South of Cambridge	N	1,304	1,477	1,027	978	1,134	2,280	1,055	1,202	1,422	77	68	-858
SH1 South of Cambridge	S	1,293	1,588	869	842	1,005	1,868	894	935	1,034	52	-70	-834
Total 2-Dir		**2,597**	**3,065**	**1,896**	**1,820**	**2,139**	**4,148**	**1,949**	**2,137**	**2,456**	**129**	**-2**	**-1,692**
SH1 Between Hamilton and Taupo (South of Putāruru)	N	783	629	541	546	562	645	559	574	627	13	12	-18
SH1 Between Hamilton and Taupo (South of Putāruru)	S	735	835	473	484	507	579	482	508	570	-2	1	-9
Total 2-Dir		**1,517**	**1,464**	**1,014**	**1,030**	**1,069**	**1,224**	**1,041**	**1,082**	**1,197**	**11**	**13**	**-27**
SH1 Between Hamilton and Cambridge	W	1,008	1,166	1,102	851	1,010	1,613	868	1,047	1,285	17	37	-328
SH1 Between Hamilton and Cambridge	E	961	899	635	605	690	1,169	603	660	816	-2	-30	-353
Total 2-Dir		**1,969**	**2,065**	**1,737**	**1,456**	**1,700**	**2,782**	**1,471**	**1,707**	**2,101**	**15**	**7**	**-681**
SH1 Between Hamilton and Cambridge	W	1,537	1,511	1,513	1,765	1,989	2,908	1,776	2,044	2,422	11	55	-486
SH1 Between Hamilton and Cambridge	E	1,497	992	1,389	1,530	1,743	2,472	1,521	1,705	2,008	-9	-38	-464
Total 2-Dir		**3,033**	**2,503**	**2,902**	**3,295**	**3,732**	**5,380**	**3,297**	**3,749**	**4,430**	**2**	**17**	**-950**
SH2 Between Auckland and Tauranga (Auckland)	W	1,155	663	851	823	722	768	1,127	1,174	1,346	304	452	578
SH2 Between Auckland and Tauranga (Auckland)	E	1,157	696	866	863	777	855	1,156	1,184	1,388	293	407	533
Total 2-Dir		**2,311**	**1,358**	**1,717**	**1,686**	**1,499**	**1,623**	**2,283**	**2,358**	**2,734**	**597**	**859**	**1,111**
SH2 Between Auckland and Tauranga (Thames)	W	817	544	701	541	494	680	849	886	1,061	308	392	381
SH2 Between Auckland and Tauranga (Thames)	E	801	467	656	503	458	634	805	807	997	302	349	363
Total 2-Dir		**1,618**	**1,011**	**1,357**	**1,044**	**952**	**1,314**	**1,654**	**1,693**	**2,058**	**610**	**741**	**744**
SH2 Between Auckland and Tauranga (Tauranga)	W	1,453	1,140	1,472	1,858	2,215	2,346	1,834	2,158	2,343	-24	-57	-3
SH2 Between Auckland and Tauranga (Tauranga)	E	1,511	1,386	1,409	1,827	2,170	2,336	1,774	2,069	2,227	-53	-101	-109
Total 2-Dir		**2,963**	**2,526**	**2,881**	**3,685**	**4,385**	**4,682**	**3,608**	**4,227**	**4,570**	**-77**	**-158**	**-112**
SH5 Between Rotorua and Hamilton	W	451	486	311	305	324	602	310	308	442	5	-16	-160
SH5 Between Rotorua and Hamilton	E	439	401	220	206	209	339	222	218	266	16	9	-73
Total 2-Dir		**890**	**887**	**531**	**511**	**533**	**941**	**532**	**526**	**708**	**21**	**-7**	**-233**
SH27 Between Auckland and Tauranga	N	354	145	217	168	161	172	181	180	202	13	19	30
SH27 Between Auckland and Tauranga	S	373	147	273	220	216	240	244	235	262	24	19	22
Total 2-Dir		**727**	**292**	**490**	**388**	**377**	**412**	**425**	**415**	**464**	**37**	**38**	**52**
SH29 Between Hamilton and Tauranga	N	728	896	602	608	705	1,417	745	869	1,057	137	164	-360
SH29 Between Hamilton and Tauranga	S	753	956	640	616	698	1,666	777	1,046	1,300	161	348	-366
Total 2-Dir		**1,481**	**1,852**	**1,242**	**1,224**	**1,403**	**3,083**	**1,522**	**1,915**	**2,357**	**298**	**512**	**-726**
SH36 Between Tauranga and Rotorua	N	222	182	334	345	371	314	342	406	481	-3	35	167
SH36 Between Tauranga and Rotorua	S	217	254	204	242	238	226	193	230	293	-49	-8	67
Total 2-Dir		**440**	**436**	**538**	**587**	**609**	**540**	**535**	**636**	**774**	**-52**	**27**	**234**
SH1 Between Auckland and Hamilton (North of Huntly)	N	1,428	2,144	1,393	1,876	1,728	1,998	2,257	2,370	2,951	381	642	953
SH1 Between Auckland and Hamilton (North of Huntly)	S	1,461	2,070	1,456	1,941	1,968	2,495	2,439	2,523	3,227	498	555	732
Total 2-Dir		**2,889**	**4,214**	**2,849**	**3,817**	**3,696**	**4,493**	**4,696**	**4,893**	**6,178**	**879**	**1,197**	**1,685**
SH1 Between Auckland and Hamilton (North of Pōkeno)	N	2,910	3,247	3,178	3,806	3,710	4,421	4,381	4,699	5,838	575	989	1,417
SH1 Between Auckland and Hamilton (North of Pōkeno)	S	3,239	3,349	3,412	4,044	3,975	4,888	4,685	4,950	6,307	641	975	1,419
Total 2-Dir		**6,148**	**6,596**	**6,590**	**7,850**	**7,685**	**9,309**	**9,066**	**9,649**	**12,145**	**1,216**	**1,964**	**2,836**

Location	Direction	PM Peak											
		Observed		Modelled							Difference		
				Validated	Base			Test			Test - Base		
		2018	2023	2018	2025	2035	2055	2025	2035	2055	2025	2035	2055
SH1 South of Cambridge	N	1,621	1,805	1,117	1,878	3,410	4,055	1,389	1,624	2,102	-489	-1,786	-1,953
SH1 South of Cambridge	S	1,609	1,643	1,363	1,052	973	994	1,323	1,319	1,546	271	346	552
Total 2-Dir		**3,230**	**3,448**	**2,480**	**2,930**	**4,383**	**5,049**	**2,712**	**2,943**	**3,648**	**-218**	**-1,440**	**-1,401**
SH1 Between Hamilton and Taupo (South of Putāruru)	N	892	907	777	991	1,401	1,664	941	1,108	1,373	-50	-293	-291
SH1 Between Hamilton and Taupo (South of Putāruru)	S	821	750	703	665	591	592	676	638	667	11	47	75
Total 2-Dir		**1,713**	**1,658**	**1,480**	**1,656**	**1,992**	**2,256**	**1,617**	**1,746**	**2,040**	**-39**	**-246**	**-216**
SH1 Between Hamilton and Cambridge	W	1,313	1,483	1,306	1,109	1,777	2,907	941	1,148	1,444	-168	-629	-1,463
SH1 Between Hamilton and Cambridge	E	1,516	1,424	1,334	786	783	861	868	925	1,300	82	142	439
Total 2-Dir		**2,830**	**2,907**	**2,640**	**1,895**	**2,560**	**3,768**	**1,809**	**2,073**	**2,744**	**-86**	**-487**	**-1,024**
SH1 Between Hamilton and Cambridge	W	1,946	1,980	1,943	2,848	3,933	5,605	2,546	3,082	3,501	-302	-851	-2,104
SH1 Between Hamilton and Cambridge	E	2,365	1,619	1,982	2,216	2,215	2,493	2,349	2,474	3,177	133	259	684
Total 2-Dir		**4,311**	**3,599**	**3,925**	**5,064**	**6,148**	**8,098**	**4,895**	**5,556**	**6,678**	**-169**	**-592**	**-1,420**
SH2 Between Auckland and Tauranga (Auckland)	W	1,045	517	781	976	2,199	3,589	757	846	906	-219	-1,353	-2,683
SH2 Between Auckland and Tauranga (Auckland)	E	1,180	700	1,084	1,115	1,146	1,319	1,642	1,592	1,956	527	446	637
Total 2-Dir		**2,226**	**1,217**	**1,865**	**2,091**	**3,345**	**4,908**	**2,399**	**2,438**	**2,862**	**308**	**-907**	**-2,046**
SH2 Between Auckland and Tauranga (Thames)	W	781	564	726	974	2,332	3,516	464	525	495	-510	-1,807	-3,021
SH2 Between Auckland and Tauranga (Thames)	E	815	550	869	762	956	1,230	1,109	1,060	1,410	347	104	180
Total 2-Dir		**1,596**	**1,114**	**1,595**	**1,736**	**3,288**	**4,746**	**1,573**	**1,585**	**1,905**	**-163**	**-1,703**	**-2,841**
SH2 Between Auckland and Tauranga (Tauranga)	W	2,167	1,926	2,445	2,836	3,306	3,907	2,590	3,015	3,165	-246	-291	-742
SH2 Between Auckland and Tauranga (Tauranga)	E	1,566	1,455	1,265	1,530	1,329	939	1,892	1,746	1,658	362	417	719
Total 2-Dir		**3,733**	**3,381**	**3,710**	**4,366**	**4,635**	**4,846**	**4,482**	**4,761**	**4,823**	**116**	**126**	**-23**
SH5 Between Rotorua and Hamilton	W	463	517	367	452	733	2,251	406	426	618	-46	-307	-1,633
SH5 Between Rotorua and Hamilton	E	557	432	447	309	273	262	396	436	479	87	163	217
Total 2-Dir		**1,020**	**949**	**814**	**761**	**1,006**	**2,513**	**802**	**862**	**1,097**	**41**	**-144**	**-1,416**
SH27 Between Auckland and Tauranga	N	405	166	303	209	269	423	193	214	232	-16	-55	-191
SH27 Between Auckland and Tauranga	S	308	120	377	305	284	333	338	321	400	33	37	67
Total 2-Dir		**714**	**286**	**680**	**514**	**553**	**756**	**531**	**535**	**632**	**17**	**-18**	**-124**
SH29 Between Hamilton and Tauranga	N	1,056	993	1,159	749	550	449	1,459	1,462	1,603	710	912	1,154
SH29 Between Hamilton and Tauranga	S	902	900	645	903	1,918	3,159	635	689	1,041	-268	-1,229	-2,118
Total 2-Dir		**1,958**	**1,894**	**1,804**	**1,652**	**2,468**	**3,608**	**2,094**	**2,151**	**2,644**	**442**	**-317**	**-964**
SH36 Between Tauranga and Rotorua	N	358	302	281	359	336	265	452	597	819	93	261	554
SH36 Between Tauranga and Rotorua	S	430	331	492	529	536	1,310	347	312	309	-182	-224	-1,001
Total 2-Dir		**788**	**633**	**773**	**888**	**872**	**1,575**	**799**	**909**	**1,128**	**-89**	**37**	**-447**
SH1 Between Auckland and Hamilton (North of Huntly)	N	1,669	1,905	1,755	2,109	3,293	4,264	1,854	2,224	2,678	-255	-1,069	-1,586
SH1 Between Auckland and Hamilton (North of Huntly)	S	1,780	1,891	1,792	2,579	2,832	3,485	3,609	3,631	4,256	1,030	799	771
Total 2-Dir		**3,449**	**3,795**	**3,547**	**4,688**	**6,125**	**7,749**	**5,463**	**5,855**	**6,934**	**775**	**-270**	**-815**
SH1 Between Auckland and Hamilton (North of Pōkeno)	N	3,135	3,697	2,892	3,639	5,096	6,839	3,699	4,223	5,153	60	-873	-1,686
SH1 Between Auckland and Hamilton (North of Pōkeno)	S	3,881	3,837	4,085	5,091	4,860	5,892	6,527	6,735	7,433	1,436	1,875	1,541
Total 2-Dir		**7,016**	**7,534**	**6,977**	**8,730**	**9,956**	**12,731**	**10,226**	**10,958**	**12,586**	**1,496**	**1,002**	**-145**