



Appendix C

Transport Economic Efficiency Forecasts -North of Otaki to Peka Peka Road

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Introduction

The New Zealand Transport Agency (NZTA) has commissioned Opus to undertake a strategy study for the upgrading of State Highway 1 (SH1) in the Kapiti Coast District. SH1 in this area is currently an undivided single carriageway highway which is proposed to be upgraded to a four lane (two in each direction) expressway.

This appendix outlines our preliminary assessment of the economic benefits of the scheme between Peka Peka and north of Otaki. This incorporates two sections as shown in Figure 1, being:

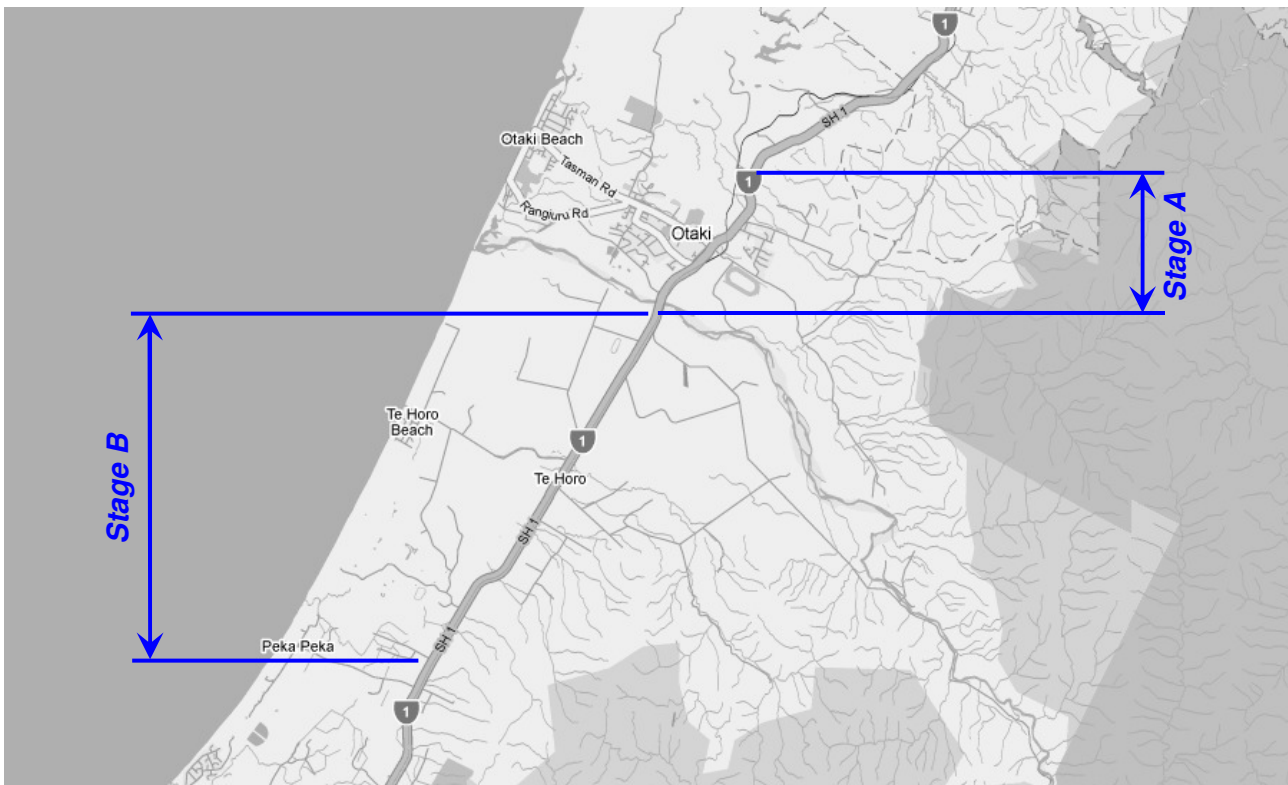
- Stage A: North of Otaki to Addington / Otaki Gorge Road – This 4.3km section includes a lower speed zone through Otaki township; and
- Stage B: Addington Road to Peka Peka – A rural section of 8.4km.

Input Data

Input data collated for this evaluation includes:

- Classified, directional and hourly traffic count information from the NZTA's monitoring database;
- Base and forecast year traffic demands, modelled speeds and capacities from the Wellington Transport Strategy Model (WSTM) and Kapiti Coast SATURN Model;
- Feasibility cost estimates and construction timeline for the scheme from the Opus project team;
- Five years of crash history for the existing highway from the NZTA Crash Analysis System;
- Weekend peak period journey time surveys; and
- Journey time surveys along the study area in the AM, Inter and PM Peak periods.

Figure 1 – Peka Peka to North of Otaki Location Plan



Development of Spreadsheet Model

There is very little traffic model information for the study area that can be used to forecast any benefits from the scheme. The study area does lie on the edge of WSTM, however as advised by Greater Wellington Regional Council the model would not be suitable as a detailed forecasting tool.

As a result, Opus developed a spreadsheet model to assess relevant performance statistics as a result of the scheme based on journey time surveys and other available data. As viable alternative routes to SH1 are not feasible in this area, this approach was considered to be acceptable for this assessment. The spreadsheet model is detailed in the following sections.

Modelled Periods

Stage A and B costs were calculated for the Do Minimum (existing) and Option 1 (four lane expressway) models based on the journey time surveys, measured distances and available count data. Specifically, costs were developed for travel time, congestion relief and vehicle operating costs for 2009, 2016 and 2026 for the following model periods:

- AM Peak (average hour 07:00 to 09:00);
- Inter Peak (average hour 12:00 to 14:00);
- PM Peak (average hour 16:00 to 18:00);
- Thursday/Friday Holiday PM Peak Northbound (average hour 14:00 to 18:00); and

- Sunday/Monday Holiday PM Peak Southbound (average hour 13:00 to 17:00).

The following performance statistics were calculated:

- Traffic Flow (Veh/h);
- Journey Time (seconds);
- Speed (km/h);
- Travel Time (Veh-hrs/h);
- Congestion Relief (Veh-hrs/h); and
- Travel Distance (Veh-km/h).

Congestion relief costs were estimated based on observed variation from Inter Peak journey times, on the assumed basis that any additional travel time from 'normal' conditions would be a source of frustration. This is a crude assumption, but only a small proportion of benefits were produced using this methodology (approximately 2% of travel time benefits for the combined Stages A and B).

The performance results for 2009, 2016 and 2026 for Stages A and B are included in Addendum A for reference.

Demand Growth Assumptions

Average forecast traffic demand growth was assessed from the WSTM and recently re-forecast Kapiti Coast SATURN Model for Sections A and B as shown in Table 1. The Kapiti Coast Model runs north to Peka Peka, being the southernmost portion of Stage B.

Table 1 – Annual Growth Forecasts on State Highway 1

Section Description	Annual Growth Forecasts	
	2006 to 2016 (%)	2016 to 2026 (%)
WTSM Stage A	1.3	0.7
WTSM Stage B	1.2	0.6
Kapiti SATURN Stage B	2.2	0.9

Following the advice of GWRC, the SATURN forecasts were considered to be the most appropriate and based on the most up to date information. These forecasts at Peka Peka were adopted for both Sections A and B for this assessment, based on the assumption that traffic growth north of Otaki will be proportional to south of Otaki.

To put this into context, Table A2.5 of the EEM recommends the use of 2% per annum for a rural strategic highway in the Wellington Region. The effect of this assumption on the economic efficiency of the project is examined in sensitivity test 3.

The full calculations are included in Addendum B for reference.

Journey Time Estimation

2009 Do Minimum (existing) performance statistics were based on the observed average journey time surveys (October 2008 and June 2009) and NZTA counts from April 2009. The journey times include all current delays to traffic as a result of slow moving Heavy Commercial Vehicles (HCV), speed limits and traffic congestion etc. Average operating speeds were calculated from measured distances. The April 2009 NZTA counts were the most recent representative period of available data on both sections, which also included HCV counts. The counts are also the most reflective of the journey time survey operating conditions.

Vehicle speeds and corresponding journey times are commonly related to vehicle flow in strategic modelling software such as SATURN for highway link sections. Observed levels of flow and average speed were plotted for each of the two modelled sections. Rough empirical approximations of this speed-flow relationship were developed from the plots as included in Addendum C using SATURN based formulae.

It should be noted that the relationships developed represent average speed and flow over the whole highway section. These forecasts were then used to predict average operating speeds in the forecast years of 2016 and 2026 based on the predicted traffic flows. This works reasonably well for Section B where intersection delays are minimal, but is not very accurate for Section A due to the presence of lower speed limits, side friction due to development accesses, and intersection delays within Otaki. Therefore the assumed curve for Stage A is more conservative (predicts a higher speed) than would be expected in reality, as the capacity of the intersections / accesses / side friction and the delay due to turning interactions are more complex than can be accurately reflected using this method. This is particularly apparent for the holiday peak southbound journey times, which show a significantly slower travel time than is explained by the speed/flow relationship – in this instance a correction offset was applied to the predicted speed.

All forecast Option 1 performance statistics were based on assumed average operating speeds for the expressway of 105km/h. This makes the assumption that the new expressway will be well within capacity in all time periods and years, and that vehicles will travel at their desired speeds and overtake slower vehicles at will. The travel distance for Option 1 was assumed to be the same as for the existing highway, which is another source of conservatism in the analysis.

Crash History

Five years (2004-2008) of crash history for the existing highway was obtained from the NZTA Crash Analysis System (CAS) for each of the two sections. Addington Road crashes have been assumed to reside in Stage A for the purposes of this assessment. A summary of the accident history is presented in Table 2.

Table 2 – Accident History 2004 to 2008

Crash Severity	CAS Accident History	
	Stage A	Stage B
Fatal	2	2
Serious	15	28
Minor	14	12
Non-Injury	41	36
Total	72	78

Table 2 shows that there is a significant crash history for the study area with a number of serious and fatal accidents. Each section has had two fatal accidents in the last five years.

The CAS coded accident listings and collision diagrams are included in Addendum D for reference.

Economic Evaluation

Economic benefits for Option 1 have been calculated in accordance with NZTA Economic Evaluation Manual procedures to generate a Benefit / Cost Ratio (BCR) and First Year Rate of Return (FYRR). This assessment has been based on the spreadsheet model estimates of travel time, congestion relief, vehicle operating costs, CO₂ emissions and accident benefits.

Evaluation Assumptions

Evaluation assumptions for this assessment are as follows:

- Base Date: 1 July 2009;
- Time Zero: 1 July 2009;
- Construction: Commences 1 July 2012 for a duration of four years completing 1 July 2016;
- First Year of Benefits: 1 July 2016 to 1 July 2017 (Midpoint Year 7.5);
- Benefit Period: 26 Years (Year 7 to Year 33); and
- Discount Rate: 8%.

All update factors, base value of travel times, and values of travel cost are based on estimates for a Rural Strategic Highway from NZTA's EEM Vol 1 Amendment 2 (Updated on September 2008).

All cost and benefit estimations have been based on an extrapolation of the peak traffic models, using the following annualisation factors:

- AM Peak: 245 days at 2 hours per day (07:00-09:00);
- Inter Peak: 245 days at 8 hours per day (09:00-16:00 & 18:00-19:00);
- PM Peak: 240 days at 2 hours per day (16:00-18:00);
- Off Peak: 245 days at 10 hours per day (19:00-07:00) at 0.193 (Stage A) or 0.204 (Stage B) x Inter Peak;
- Weekend Inter Peak: 118 days at 10 hours per day (10:00-20:00) at 1.162 (Stage A) or 1.168 (Stage B) x Inter Peak;
- Thursday/Friday Holiday PM Peak Northbound: 5 days at 4 hours per day (14:00-18:00); and
- Sunday/Monday Holiday PM Peak Southbound: 5 days at 4 hours per day (13:00-17:00).

Weekend Off Peak costs have not been assessed – this is a slightly conservative assumption.

The above factors are based on profiles developed from the NZTA count database as shown in Addendum E for reference.

Accident Analysis

A simplified accident analysis was undertaken for the two sections, based on the available accident history outlined above. As this is only a very high level assessment of the benefits of the scheme, it was considered inappropriate to perform a detailed crash analysis. The two sections have a high accident history, which qualifies for an accident by accident assessment of the Do Minimum in the EEM as opposed to an accident rate analysis.

For the Option crash costs, applying an accident rate for a four lane expressway is not conservative as this is mid-block only and ignores any intersection crashes. Therefore the proposed methodology was to apply a range of crash reduction percentages on an accident by accident basis to estimate crash benefits. Conservative accident reduction assumptions applied to both Stages A and B of the scheme are as follows, based on the assumption of a limited access rural expressway standard road for Option 1:

- 100% Head On;
- 100% U-Turn;
- 40% Fatal, 30% Serious, 10% Minor, 10% Non-Injury for Loss of Control, Changing Lanes, Overtaking;
- 100% Pedestrian (only 1 minor pedestrian crash observed);
- 100% Train Related;
- 100% Parking Related;
- 25% Reduction for miscellaneous (trailer loss of control/hitting misc. objects) due to improved geometrics; and
- 50% Manoeuvring, Turning, Rear-End.

The annual accident costs for the Do Minimum and Option 1 are shown below in Table 3.

Table 3 – Annual Accident Costs

Description	Annual Accident Costs		
	Stage A	Stage B	Both
Do Minimum Costs	\$3.4m	\$10.2m	\$13.6m
Option 1 Costs	\$1.2m	\$4.4m	\$5.6m
Total Annual Benefits	\$2.2m	\$5.8m	\$8.0m

Table 3 shows that significant accident benefits can be attributed to the scheme using the conservative reductions assumed. If accident rates were used, the benefits would be considerably higher as shown in Table 4.

Table 4 – Accident Rate Annual Accident Costs

Description	Annual Accident Costs		
	Stage A	Stage B	Both
Do Minimum Costs	\$3.4m	\$10.2m	\$13.6m
Option 1 Accident Rate Costs	\$0.46m	\$1.2m	\$1.7m
Total Annual Benefits	\$2.9m	\$9.0m	\$11.9m

Therefore Table 4 shows that using the accident by accident methodology for Option 1 is conservative by around \$3m per annum on the combined scheme.

Costs

Construction has been assumed to commence on 1 July 2012 for a duration of four years completing on 1 July 2016, and costs have been assumed to be incurred evenly over this period. Table 5 shows the construction and discounted (NPV) costs for each stage.

Table 5 – Peka Peka to North of Otaki Construction Costs

Description	NPV Construction Costs		
	Stage A	Stage B	Both
Construction Costs	\$105m	\$110m	\$215m
Net Present Value Costs	\$71.8m	\$75.2m	\$147m

Table 5 shows that the NPV cost for the entire Option 1 scheme is \$147m.

No maintenance costs have been assumed for this assessment.

Benefits

Economic benefits for Option 1 have been calculated for travel time, congestion relief, vehicle operating costs, CO₂ emissions and accident benefits.

Net present value (NPV) benefits for the project are shown in Table 6.

Table 6 – Peka Peka to North of Otaki NPV Benefits

Description	NPV Benefits		
	Stage A	Stage B	Both
Travel Time	\$37.5m	\$23.0m	\$60.5m
Congestion Relief	\$0.5m	\$0.8m	\$1.3m
Vehicle Operating	-\$11.3m	-\$14.0m	-\$25.3m
Accidents	\$15.1m	\$40.9m	\$56.0m
Carbon Dioxide (4% of VOC)	-\$0.45m	-\$0.56m	-\$1.0m
Total NPV Benefits	\$41.4m	\$50.2m	\$91.5m

Table 6 shows that the NPV benefits for the Option 1 scheme are \$92m.

The majority of benefits for Stage A come from improving travel times through the corridor around Otaki to the desired operating speed. In Stage B this is not so pronounced as the average speed for the Do Minimum is higher. A significant benefit is forecast for accident benefits for both sections, but this makes up the bulk of benefits for Stage B.

Dis-benefits for vehicle operating costs are expected for both sections in this situation as a result of high speed travel costing more than low speed travel.

Evaluation Results

Benefit / Cost Ratio (BCR) and First Year Rate of Return (FYRR) results are presented in Table 7.

Table 7 – Peka Peka to North of Otaki BCR and FYRR Results

Results	Evaluation Results		
	Stage A	Stage B	Both
Benefit / Cost Ratio (BCR)	0.6	0.9	0.7
First Year Rate of Return (FYRR)	5%	7%	6%

The overall BCR result of 0.7 forecast significant benefits for the scheme, but not enough to cover the high expected costs. Stage B is forecast to have a higher economic efficiency than Stage A.

Full EEM worksheets for all BCR results are documented within Addendum F.

Sensitivity Tests

Three sensitivity tests were undertaken to examine how volatile the BCR is to changing assumptions in the assessment as follows:

- Test 1: This test assumes that only the stated accident reductions for Head On, U Turns, and Loss of Control/Lane Changing/Overtaking were applied. This gives a very conservative accident reduction for the scheme;
- Test 2: The assumed desire speed of the expressway has been reduced to 95km/h instead of 105km/h; and
- Test 3: Traffic growth has been assumed to be the EEM default of 2% per annum for Wellington Region highways. This is lower than the 2.2% assumed in the early years to 2016, but greater than the 0.9% assumed thereafter in the main assessment.

The BCR results for these tests are presented in Table 8.

Table 8 – Peka Peka to North of Otaki BCR Sensitivity Tests

Benefit / Cost Ratio (BCR)	Sensitivity Test Results		
	Stage A	Stage B	Both
Test 1: Low Crash Reductions	0.6	0.7	0.6
Test 2: 95km/h Desired Speed	0.6	0.8	0.7
Test 3: EEM 2% Growth	0.7	0.9	0.8

The sensitivity tests show that the modification of assumptions in the modelling has a limited effect on the economic viability of the scheme, although Stage B comes very close to having a 'low' economic efficiency of 1.

Summary

The main conclusions from the assessment are as follows:

- Both sections have a significant crash record, including two fatal crashes each;
- Significant crash benefits can be attributed to the scheme using the conservative reductions assumed. In particular, most of the benefits for Stage B come from crash savings;
- The overall BCR result of 0.7 forecasts significant benefits for the scheme, but not enough to cover the high expected costs;

- The FYRR of 6% shows that the project will provide a significant benefit in the opening year; and
- The presented sensitivity tests show that the modification of assumptions in the modelling has a limited effect on the economic viability of the scheme.

1 Addendum A – Performance Calculations

1.1 Stage A: North of Otaki to Addington / Otaki Gorge Road

Stage A North of Otaki to Addington / Otaki Gorge Road

Do Minimum	2009										2016										2026									
	Flow (Veh/hr)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)		
NB	AM Peak	453	4335	252	62	31.7	0.0	1965	523	4335	251	62	36.4	0.0	2268	570	4335	253	62	40.0	0.0	2472	570	4335	253	62	40.0	0.0	2472	
	Inter Peak	510	4335	269	58	38.0	0.0	2209	588	4335	271	58	44.3	0.0	2550	641	4335	274	57	48.9	1.1	2779	641	4335	274	57	48.9	1.1	2779	
	PM Peak	644	4335	248	63	44.4	0.0	2790	743	4335	263	59	54.3	0.0	3220	810	4335	269	58	60.6	0.2	3510	810	4335	269	58	60.6	0.2	3510	
SB	Holiday PM	821	4335	268	58	61.1	0.0	3561	948	4335	285	55	75.0	4.3	4109	1033	4335	296	53	85.0	8.0	4479	1033	4335	296	53	85.0	8.0	4479	
	AM Peak	439	4335	251	62	30.6	0.2	1903	507	4335	250	62	35.2	0.1	2196	552	4335	252	62	38.6	0.4	2384	552	4335	252	62	38.6	0.4	2384	
	Inter Peak	492	4335	249	63	34.1	0.0	2134	568	4335	253	62	39.9	0.5	2462	619	4335	255	61	43.9	1.0	2684	619	4335	255	61	43.9	1.0	2684	
Both	PM Peak	665	4335	252	62	46.6	0.5	2883	768	4335	266	59	56.7	3.5	3328	837	4335	272	57	63.3	5.3	3627	837	4335	272	57	63.3	5.3	3627	
	Holiday PM	901	4335	595	28	148.9	86.5	3905	1040	4335	697	22	201.2	129.2	4507	1133	4335	766	20	247.5	169.1	4913	1133	4335	766	20	247.5	169.1	4913	
	AM Peak	892	4335	252	62	62.4	0.2	3868	1030	4335	697	22	201.2	129.2	4507	1133	4335	766	20	247.5	169.1	4913	1133	4335	766	20	247.5	169.1	4913	
Both	Inter Peak	1002	4335	252	60	72.1	0.0	4343	1156	4335	697	22	201.2	129.2	4507	1133	4335	766	20	247.5	169.1	4913	1133	4335	766	20	247.5	169.1	4913	
	PM Peak	1309	4335	252	62	91.0	0.5	5674	1510	4335	697	22	201.2	129.2	4507	1133	4335	766	20	247.5	169.1	4913	1133	4335	766	20	247.5	169.1	4913	
	Holiday PM	1722	4335	252	42	210.0	86.5	7466	1987	4335	697	22	201.2	129.2	4507	1133	4335	766	20	247.5	169.1	4913	1133	4335	766	20	247.5	169.1	4913	

Option 1	2009										2016										2026									
	Flow (Veh/hr)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hrs/hr)	CRV (Veh-hrs/hr)	Distance (Veh-km/hr)		
NB	AM Peak	453	4335	149	105	16.7	0.0	1965	523	4335	149	105	21.6	0.0	2268	570	4335	149	105	23.5	0.0	2472	570	4335	149	105	23.5	0.0	2472	
	Inter Peak	510	4335	149	105	21.0	0.0	2209	588	4335	149	105	24.3	0.0	2550	641	4335	149	105	26.5	0.0	2779	641	4335	149	105	26.5	0.0	2779	
	PM Peak	644	4335	149	105	26.6	0.0	2790	743	4335	149	105	30.7	0.0	3220	810	4335	149	105	33.4	0.0	3510	810	4335	149	105	33.4	0.0	3510	
SB	Holiday PM	821	4335	149	105	33.9	0.0	3561	948	4335	149	105	39.1	0.0	4109	1033	4335	149	105	42.7	0.0	4479	1033	4335	149	105	42.7	0.0	4479	
	AM Peak	439	4335	149	105	18.1	0.0	1903	507	4335	149	105	20.9	0.0	2196	552	4335	149	105	22.8	0.0	2384	552	4335	149	105	22.8	0.0	2384	
	Inter Peak	492	4335	149	105	20.3	0.0	2134	568	4335	149	105	23.4	0.0	2462	619	4335	149	105	25.6	0.0	2684	619	4335	149	105	25.6	0.0	2684	
Both	PM Peak	665	4335	149	105	27.5	0.0	2883	768	4335	149	105	31.7	0.0	3328	837	4335	149	105	34.5	0.0	3627	837	4335	149	105	34.5	0.0	3627	
	Holiday PM	901	4335	149	105	37.2	0.0	3905	1040	4335	149	105	42.9	0.0	4507	1133	4335	149	105	46.8	0.0	4913	1133	4335	149	105	46.8	0.0	4913	
	AM Peak	892	4335	149	105	36.8	0.0	3868	1030	4335	149	105	42.5	0.0	4464	1122	4335	149	105	46.3	0.0	4866	1122	4335	149	105	46.3	0.0	4866	
Both	Inter Peak	1002	4335	149	105	41.4	0.0	4343	1156	4335	149	105	47.7	0.0	5012	1260	4335	149	105	52.0	0.0	5463	1260	4335	149	105	52.0	0.0	5463	
	PM Peak	1309	4335	149	105	54.0	0.0	5674	1510	4335	149	105	62.4	0.0	6548	1646	4335	149	105	68.0	0.0	7137	1646	4335	149	105	68.0	0.0	7137	
	Holiday PM	1722	4335	149	105	71.1	0.0	7466	1987	4335	149	105	82.1	0.0	8616	2166	4335	149	105	89.4	0.0	9391	2166	4335	149	105	89.4	0.0	9391	

1.2 Stage B: Addington Road to Peka Peka

Stage B Addington Road to Peka Peka

Do Minimum	2009										2016										2026									
	Flow (Veh/hr)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)		
NB	AM Peak	598	8408	344	88	57.2	1.4	5024	690	8408	342	88	65.5	1.2	5797	752	8408	346	87	72.3	2.2	6319	8408	346	87	72.3	2.2	6319		
	Inter Peak	560	8408	336	90	52.3	0.0	4711	647	8408	340	89	61.0	0.7	5437	705	8408	343	88	67.1	1.4	5926	8408	343	88	67.1	1.4	5926		
	PM Peak	775	8408	353	86	76.0	3.7	6513	894	8408	361	84	89.6	6.2	7516	974	8408	372	81	100.7	9.8	8193	8408	372	81	100.7	9.8	8193		
SB	Holiday PM	960	8408	353	86	94.1	4.6	8068	1107	8408	398	76	122.4	19.1	9311	1207	8408	422	72	141.5	26.0	10149	8408	422	72	141.5	26.0	10149		
	AM Peak	511	8408	340	89	48.2	0.2	4296	590	8408	340	83	55.7	0.3	4958	643	8408	343	88	61.2	0.7	5404	8408	343	88	61.2	0.7	5404		
	Inter Peak	599	8408	339	89	56.3	0.0	5035	691	8408	342	88	65.7	0.6	5810	753	8408	346	87	72.5	1.6	6333	8408	346	87	72.5	1.6	6333		
Both	PM Peak	828	8408	348	87	80.0	2.0	6965	956	8408	370	82	96.4	3.4	8038	1042	8408	384	79	111.1	13.1	8761	8408	384	79	111.1	13.1	8761		
	Holiday PM	736	8408	348	87	71.1	1.8	6187	849	8408	356	85	84.0	4.1	7140	926	8408	366	83	94.1	7.0	7783	8408	366	83	94.1	7.0	7783		
	AM Peak	1109			88	105.4	1.6	9320	1279			89	121.3	1.5	10756	1394			88	133.6	3.0	11724								
Option 1	Inter Peak	1159			90	108.6	0.0	9746	1338			89	126.7	1.3	11247	1458			88	139.6	3.0	12259								
	PM Peak	1603			86	156.0	5.8	13478	1850			83	188.0	14.6	15554	2016			80	211.8	22.9	16954								
	Holiday PM	1695			86	165.2	6.4	14256	1957			80	206.4	23.2	16451	2133			76	235.7	36.0	17932								
Option 1	2009										2016										2026									
	Flow (Veh/hr)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)	Flow (Vehs)	Distance (m)	JT (s)	Speed (km/h)	TT (Veh-hs/hr)	CRV	Distance (Veh-km/hr)		
	AM Peak	586	8408	288	105	47.8	0.0	5024	650	8408	288	105	55.2	0.0	5797	752	8408	288	105	60.2	0.0	6319	8408	288	105	60.2	0.0	6319		
Inter Peak	560	8408	288	105	44.9	0.0	4711	647	8408	288	105	51.8	0.0	5437	705	8408	288	105	56.4	0.0	5926	8408	288	105	56.4	0.0	5926			
PM Peak	775	8408	288	105	62.0	0.0	6513	894	8408	288	105	71.6	0.0	7516	974	8408	288	105	78.0	0.0	8193	8408	288	105	78.0	0.0	8193			
NB	Holiday PM	960	8408	288	105	76.8	0.0	8068	1107	8408	288	105	88.7	0.0	9311	1207	8408	288	105	96.7	0.0	10149	8408	288	105	96.7	0.0	10149		
	AM Peak	511	8408	288	105	40.9	0.0	4296	590	8408	288	105	47.2	0.0	4958	643	8408	288	105	51.5	0.0	5404	8408	288	105	51.5	0.0	5404		
	Inter Peak	599	8408	288	105	48.0	0.0	5035	691	8408	288	105	55.3	0.0	5810	753	8408	288	105	60.3	0.0	6333	8408	288	105	60.3	0.0	6333		
SB	PM Peak	828	8408	288	105	66.3	0.0	6965	956	8408	288	105	76.5	0.0	8038	1042	8408	288	105	83.4	0.0	8761	8408	288	105	83.4	0.0	8761		
	Holiday PM	736	8408	288	105	58.9	0.0	6187	849	8408	288	105	66.0	0.0	7140	926	8408	288	105	74.1	0.0	7783	8408	288	105	74.1	0.0	7783		
	AM Peak	1109			105	88.8	0.0	9320	1279			105	102.4	0.0	10756	1394			105	111.7	0.0	11724								
Both	Inter Peak	1159			105	92.8	0.0	9746	1338			105	107.1	0.0	11247	1458			105	116.8	0.0	12259								
	PM Peak	1603			105	128.4	0.0	13478	1850			105	148.1	0.0	15554	2016			105	161.5	0.0	16954								
	Holiday PM	1695			105	135.8	0.0	14256	1957			105	156.7	0.0	16451	2133			105	170.8	0.0	17932								

2 Addendum B – Forecast Growth Analysis

WTSM Stage A: North of Otaki

	AM Peak		Rate		Inter Peak		Rate		PM Peak		Rate	
	2006	2016	2026	06-16%	2006	2016	2026	06-16%	2006	2016	2026	06-16%
Cars	484	538	577	1.1%	403	445	478	1.0%	645	704	742	0.9%
HCVs	55	76	81	3.9%	55	77	83	3.9%	48	67	70	4.0%
Total	539	614	658	1.4%	458	522	560	1.4%	693	771	812	1.1%
Cars	590	645	681	0.9%	403	444	477	1.0%	557	614	660	1.0%
HCVs	56	78	82	4.0%	56	78	82	4.0%	49	69	71	4.0%
Total	646	722	763	1.2%	459	522	559	1.4%	606	683	730	1.3%

	Rate	Rate
	06-16%	16-26%
Cars	1.0%	0.7%
HCVs	4.0%	0.6%
Total	1.3%	0.7%

WTSM Stage B: North of Peeka Peka

	AM Peak		Rate		Inter Peak		Rate		PM Peak		Rate	
	2006	2016	2026	06-16%	2006	2016	2026	06-16%	2006	2016	2026	06-16%
Cars	405	397	431	-0.2%	376	383	412	0.2%	649	658	692	0.1%
HCVs	169	243	260	4.4%	179	258	278	4.4%	143	207	215	4.4%
Total	573	640	691	1.2%	555	640	690	1.5%	792	865	907	0.9%
Cars	571	570	596	0.0%	369	374	403	0.1%	456	451	484	-0.1%
HCVs	165	238	252	4.4%	163	234	248	4.4%	128	184	190	4.4%
Total	735	808	848	1.0%	531	608	651	1.4%	584	635	674	0.9%

	Rate	Rate
	06-16%	16-26%
Cars	0.0%	0.7%
HCVs	4.4%	0.6%
Total	1.2%	0.6%

Kapiti SATURN Model Stage B: North of Peeka Peka

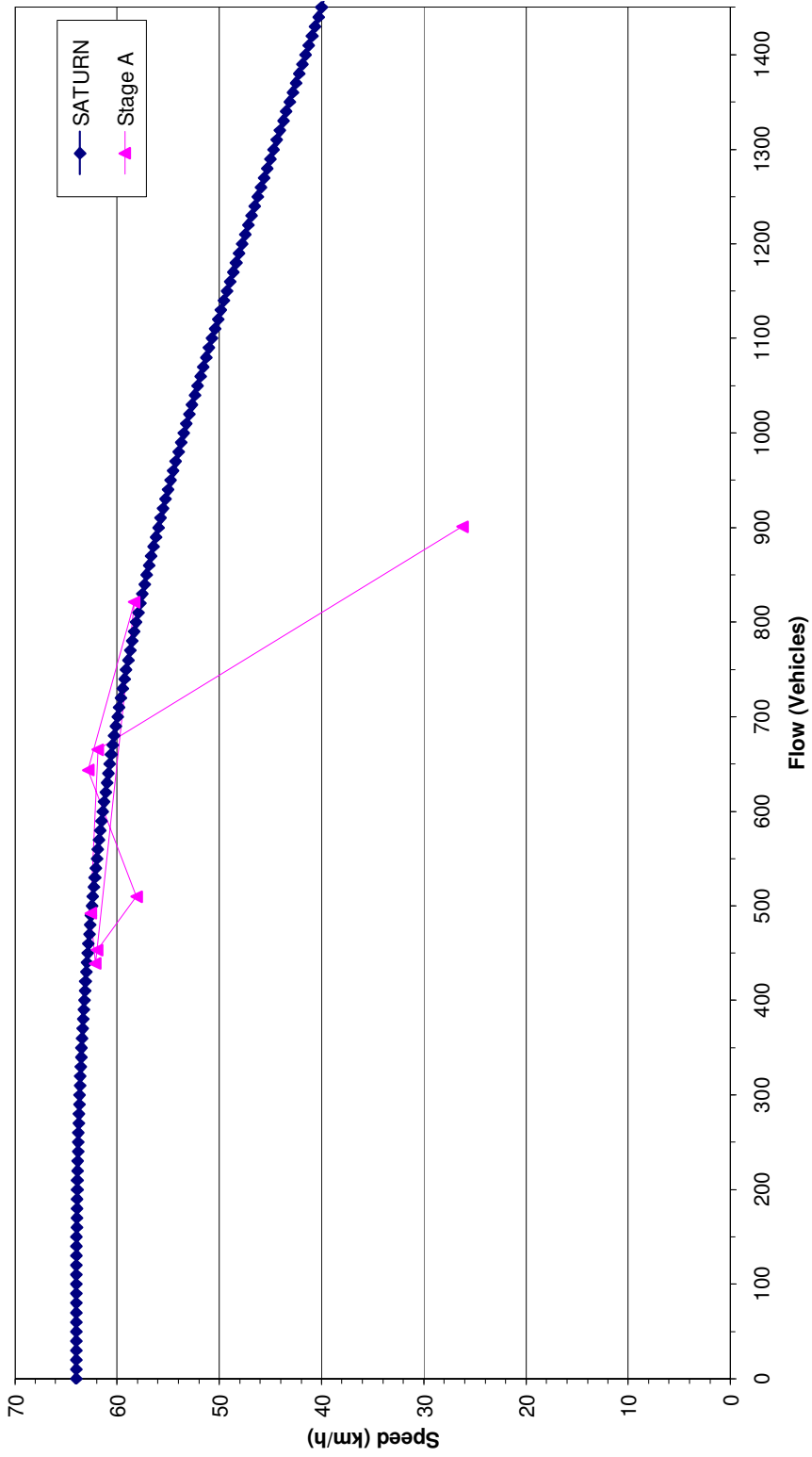
	AM Peak		Rate		Inter Peak		Rate		PM Peak		Rate	
	2006	2016	2026	06-16%	2006	2016	2026	06-16%	2006	2016	2026	06-16%
Cars	642	724	773	1.3%	541	618	672	1.4%	736	876	954	1.9%
HCVs	24	57	65	14.0%	30	66	74	11.8%	49	96	110	9.8%
Total	666	781	838	1.7%	571	684	746	2.0%	785	972	1064	2.4%
Cars	604	705	765	1.7%	536	601	647	1.2%	526	618	656	1.7%
HCVs	65	123	143	8.9%	32	68	76	11.6%	25	89	117	26.1%
Total	669	828	908	2.4%	568	669	723	1.8%	551	707	773	2.8%

	Rate	Rate
	06-16%	16-26%
Cars	1.5%	0.8%
HCVs	13.7%	1.7%
Total	2.2%	0.9%

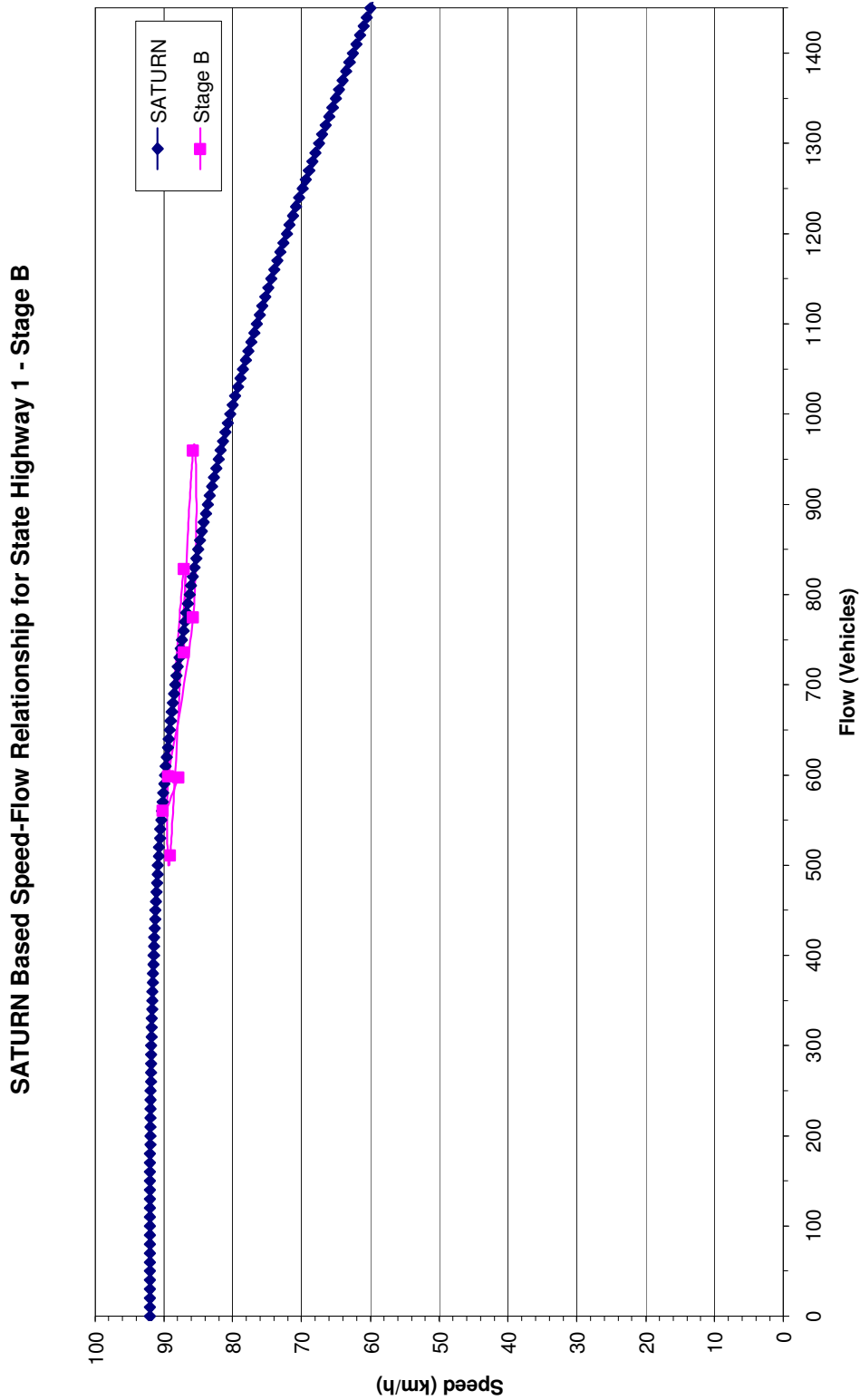
3 Addendum C – Speed-Flow Relationships

3.1 Stage A: North of Otaki to Addington / Otaki Gorge Road

SATURN Based Speed-Flow Relationship for State Highway 1 - Stage A



3.2 Stage B: Addington Road to Peka Peka



4 Addendum D – CAS Outputs

4.1 Stage A: North of Otaki to Addington / Otaki Gorge Road



Coded Crash report, run on 24-06-2009, Page 1

First Street	D / I for landmark	Second street	Crash Number	Date	Day Time	Factors and Roles	O C M L W J C M S	Total P C	Inj E Y	D C	F S M A A	A E I G G	T R N e e
	R					M D A is for vehicle 1 V R B is for veh 2 etc M VN VVV							
		Distance		DD/MM/YYYY	DD HHMM	T 1 234							
IN/995/7.643	I	ADDINGTON ROAD	2856691	30/12/2008	Tue	1143 FDCNIC	331A 351A						
IN/995/5.135	I	MILL ROAD	2856683	19/12/2008	Fri	1100 AOCNIT	150A						
IN/995/5.539	I	ARTHUR ST	2857391	21/11/2008	Fri	1730 MOCNIC	387A						
IN/995/5.223	I	MILL ROAD	2856382	20/09/2008	Sun	1530 AA7SIC	387A						
IN/995/5.185	I	RAHUI ROAD	2855648	07/09/2008	Sun	1400 KBCSIM	302A 375A						
IN/995/5.676	I	WAEARENGA ROAD	2855120	15/08/2008	Fri	0820 GDT814	101A 386A 927						
IN/995/5.208	I	MILL ROAD	2855398	11/08/2008	Mon	1815 FBCNIC	331A						
IN/995/3.302	I	TAYLORS ROAD	2812784	10/08/2008	Sun	1610 GDCNIC	332A 360A 902						
IN/995/6.939	I	OTAKI RIV BR S	2812646	30/07/2008	Wed	1623 CAS81	105A						
IN/995/5.676	I	WAEARENGA ROAD	2853559	12/06/2008	Thu	1035 FDCNIC	331A						
IN/995/5.508	I	ARTHUR ST	2852769	25/05/2008	Thu	1200 GDCNIC	129A						
IN/995/3.302	I	TAYLORS ROAD	2853253	02/05/2008	Fri	1040 Q9CNIC	682A						
ARTHUR ST	I	20W SH IN	2852159	29/04/2008	Tue	1100 MDTEIC	371A 920						
OTAKI GORGE ROAD	I	20E SH IN	2851744	07/04/2008	Mon	2130 DACSI	101A 101						
IN/995/4.423	I	WAITOHU VALLEY ROAD	2851090	29/02/2008	Fri	1720 FDCNIC	181A						
IN/995/5.276	I	WAEARENGA ROAD	2850344	31/01/2008	Thu	1450 MACNIC	181A						
IN/995/7.22	I	OTAKI GORGE ROAD	2850077	22/01/2008	Tue	0856 FDCNIC	181A						
IN/995/4.173	I	WAITOHU VALLEY ROAD	2851611	16/01/2008	Wed	1340 FD4NIC	181A						
IN/995/3.402	I	TAYLORS ROAD	2714096	01/10/2007	Mon	0320 DBCN1	134A 402A 900						
IN/995/7.19	I	OTAKI GORGE ROAD	2755838	30/09/2007	Sun	1800 KB4NIC	176B 301B						
IN/995/3.282	I	TAYLORS ROAD	2756427	30/09/2007	Sun	1500 FDCNIC	181A						
IN/995/4.559	I	TE MANUAO ROAD	2755386	22/09/2007	Sat	1400 KBVNI4	176B 302B 375B						
IN/995/5.608	I	ARTHUR ST	2754155	25/07/2007	Wed	1240 JACNIC	308B 423B 922						
E FCT MOBIL	I	50N SH IN/ARTHUR	2712907	13/07/2007	Fri	1900 MD4NIC	103A 517A 512B						
IN/995/4.073	I	WAITOHU VALLEY ROAD	2712441	18/06/2007	Mon	0810 BCVNIC	121A 410A						
IN/995/6.973	I	RIVERBANK ROAD	2751574	24/03/2007	Sat	0415 EAT81V	386A						
IN/995/6.423	I	RIVERBANK ROAD	2711630	21/03/2007	Wed	2200 DAVNI	410A						
IN/995/4.383	I	WAITOHU VALLEY ROAD	2711376	26/02/2007	Mon	0534 CBCNI	410A						
IN/995/7.19	I	OTAKI GORGE ROAD	2750533	11/02/2007	Sun	1445 LB8NIC	303B 404B						
IN/995/4.363	I	WAITOHU VALLEY ROAD	2711002	03/01/2007	Wed	1614 FDCNIC	331A 351A						
IN/995/3.402	I	TAYLORS ROAD	2656712	27/12/2006	Wed	1639 FDCNIC	112A 331A 337A						
WAEARENGA ROAD	I	50W SH IN	2656320	02/12/2006	Sat	0400 DACEL	103A 111A						
IN/995/3.502	I	TAYLORS ROAD	2613427	19/11/2006	Sun	1140 DACNIC	372A 501A						
OTAKI GORGE ROAD	I	IN/995/7.19	2656653	18/11/2006	Sat	1910 M94WIV	512B						
IN/995/4.373	I	WAITOHU VALLEY ROAD	2655032	14/10/2006	Sat	1507 CBCVNI	410A						
IN/995/4.529	I	TE MANUAO ROAD	2655122	06/10/2006	Fri	1750 GB4SIC	112A 158A 175B 929						
IN/995/4.579	I	TE MANUAO ROAD	2653817	04/08/2006	Fri	1500 FDC814	359A						

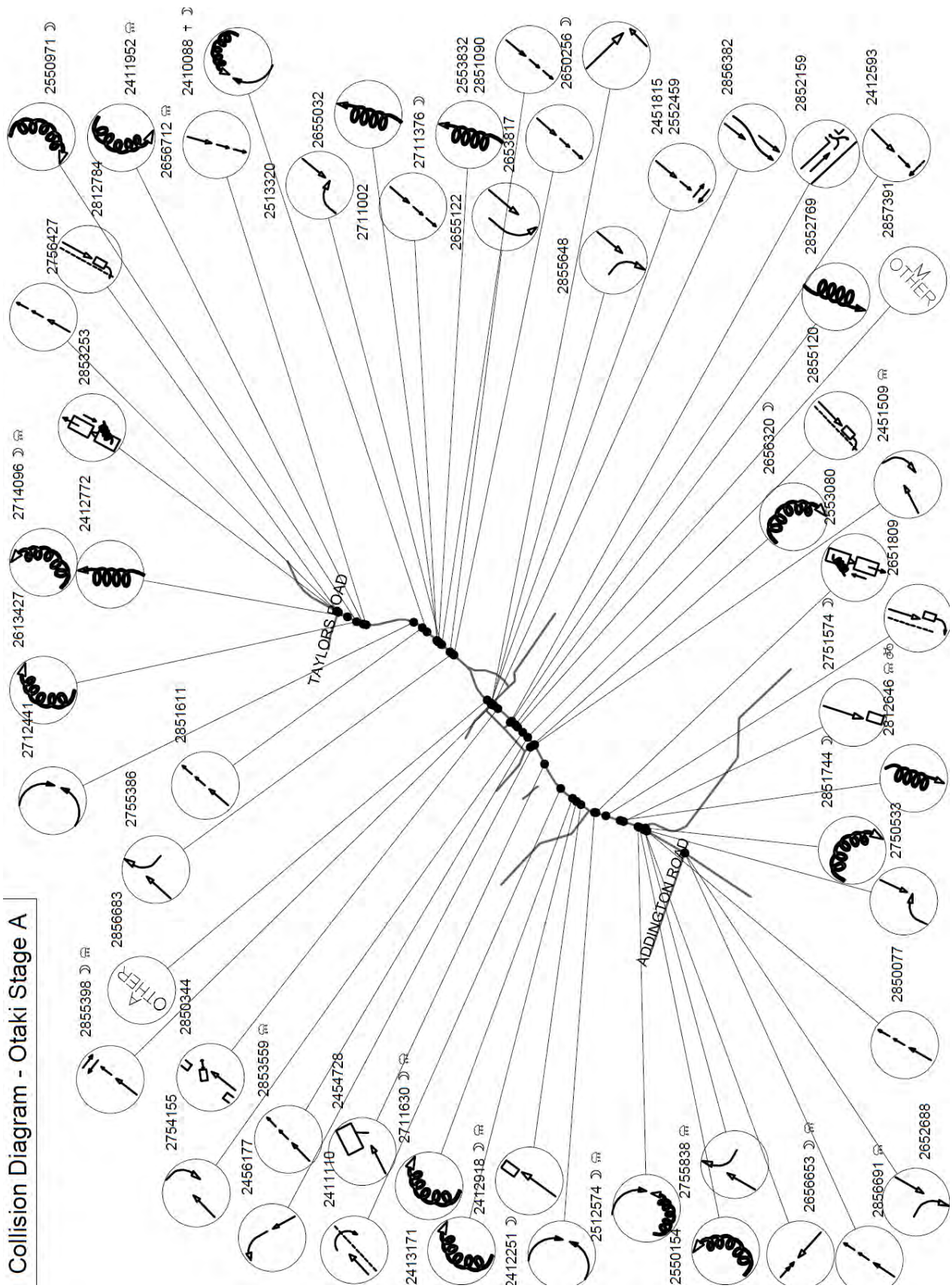


Coded Crash report, run on 24-06-2009, Page 2

First Street	D / I for landmark	Second street	Crash Number	Date	Day Time	Factors and Roles	O C M L W J C M S	Total P C	Inj E Y	D C	F S M A A	A E I G G	T R N e e
	R					M D A is for vehicle 1 V R B is for veh 2 etc M VN VVV							
		Distance		DD/MM/YYYY	DD HHMM	T 1 234							
IN/995/7.642	I	ADDINGTON ROAD	2652689	17/05/2006	Wed	0840 KBCS14	125A 302B 382B						
IN/995/6.793	I	RIVERBANK ROAD	2651809	19/04/2006	Wed	1315 GDCNIC	145B 300B 372B 920						
IN/995/5.196	I	MILL ROAD	2650256	23/01/2006	Mon	2235 HACE2C	103A 205A 302A						
E DWAY SH IN	I	130W WAEARENGA ROAD	2513697	13/12/2005	Tue	0855 QC 481	370A						
IN/995/4.413	I	WAITOHU VALLEY ROAD	2513320	27/11/2005	Sun	1745 LBMSIC	303A 377A 151B 929						
E FCT CALTEX OTAKI	I	28 SH IN	2512385	21/07/2005	Thu	1220 DACNIC	504A 923						
IN/995/4.423	I	WAITOHU VALLEY ROAD	2553832	10/07/2005	Sun	1549 FDCV81V	331A 353A						
IN/995/6.693	I	RIVERBANK ROAD	2553080	01/07/2005	Fri	0905 QGV81	660A						
IN/995/5.184	I	RAHUI ROAD	2552459	27/05/2005	Fri	1250 FBCNIC	181A						
IN/995/3.502	I	TAYLORS ROAD	2550971	02/03/2005	Wed	0625 DACS1	410A 504A						
IN/995/7.123	I	RIVERBANK ROAD	2512574	11/02/2005	Fri	1927 BFCNIC	137A 407A						
IN/995/7.14	I	OTAKI GORGE ROAD	2550154	26/01/2005	Wed	0830 DBVNI	130A 410A						
WAEARENGA ROAD	I	10W SH IN	2456177	12/12/2004	Sun	0920 GAVNIC	331A 350A 930						
IN/995/6.465	I	RIVERBANK ROAD	2413171	12/11/2004	Fri	2015 DACNI	129A 330A						
IN/995/4.233	I	WAITOHU VALLEY ROAD	2410088	25/10/2004	Mon	2150 BFC81V	106A 120A 410A						
IN/995/6.515	I	RIVERBANK ROAD	2412918	18/10/2004	Mon	0445 EAVNIV	129A 359A						
IN/995/5.196	I	MILL ROAD	2455003	06/10/2004	Wed	2138 JACNIC	103B 302B 375B						
IN/995/5.978	I	WAEARENGA ROAD	2454729	03/10/2004	Sun	0715 E8CNIC	374B						
IN/995/3.402	I	TAYLORS ROAD	2412772	29/08/2004	Sun	1425 CBCMNI	104A 330A						
IN/995/5.458	I	ARTHUR ST	2412593	12/08/2004	Thu	1400 FCWCICE	331A						
IN/995/5.184	I	RAHUI ROAD	2451815	06/05/2004	Thu	1200 FBCNIC	101A 331A						
IN/995/5.768	I	WAEARENGA ROAD	2451509	27/04/2004	Tue	1420 JAVNIC	302B 375B 901						
IN/995/3.573	I	WAITOHU VALLEY ROAD	2411952	02/04/2004	Fri	0910 DBCS1	103A 332A						
IN/995/6.077	I	OTAKI RIV BR N	2412251	04/03/2004	Thu	2140 BCCNIC	103A						
IN/995/6.265	I	RIVERBANK ROAD	2411110	17/01/2004	Sat	1020 MCMNIC	151A 372B						



Collision Diagram - Otaki Stage A



4.2 Stage B: Addington Road to Peka Peka



Stage B - Coded Crash Report (Date)
Coded Crash report, run on 24-06-2009, Page 1

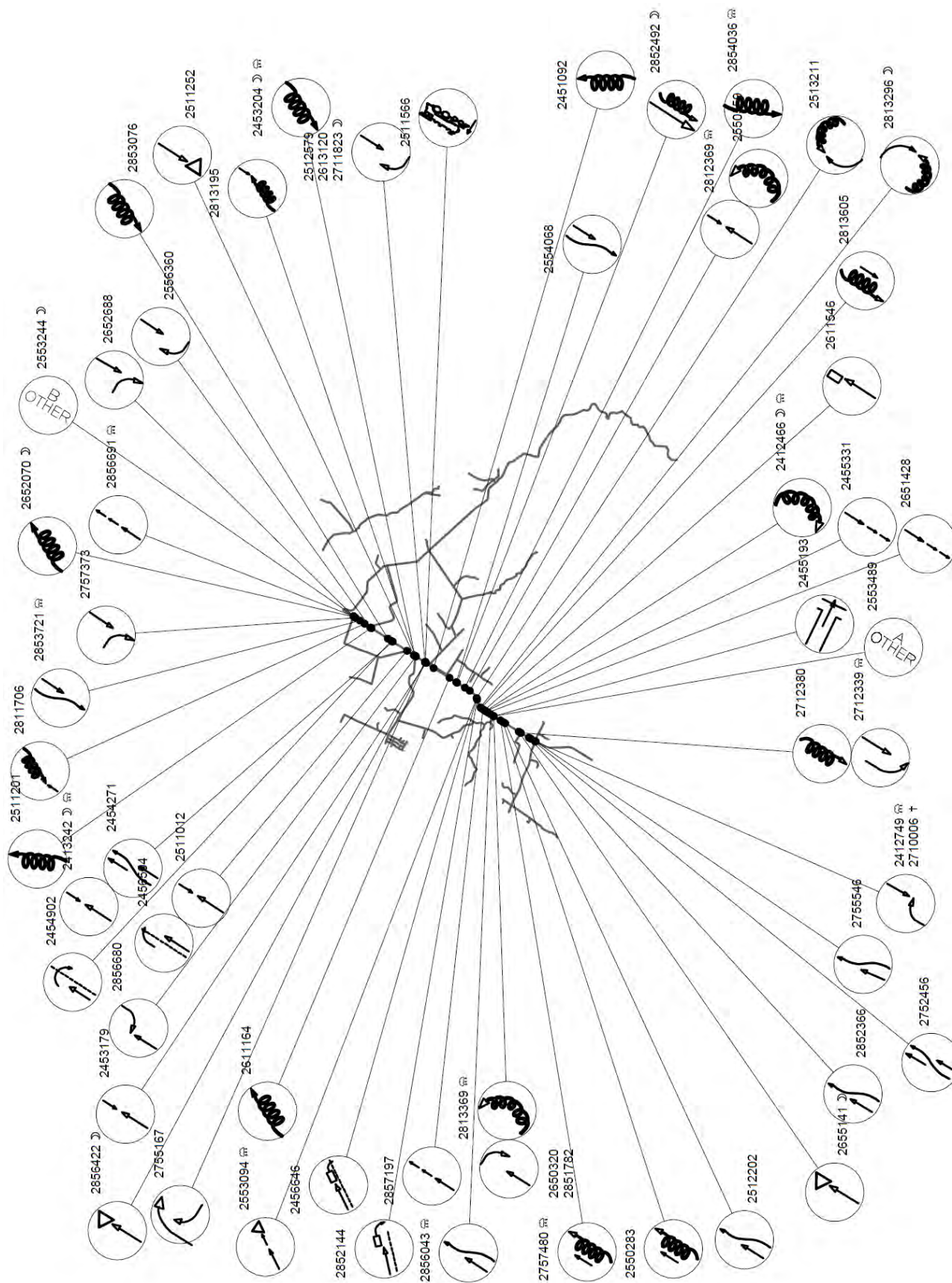
First Street	D Second street I of landmark R Distance	Crash Date Number DD/MM/YYYY	Day Time DDMM T 234	Factors and Roles M D A is for vehicle 1 V R B is for veh 2 etc M VN VVV	O C W L W J C M S Total P C B U E I E U O A P Inj E Y J R T G T N N R D D C E V N H H C T K L F S M a a C E E T E T R S M A E I g g T S R L T T R N e e		
1N/995/7.443	I ADDINGTON ROAD	2856691	30/12/2008	Tue 1143	FDCNIC	331A 351A	R W O L T N C 100
1N/995/13.734	500N TE HAPUA ROAD	2857197	26/12/2008	Fri 1235	FDCNIC	181A	R D B F N C 100
1N/995/10.446	I TE HORO BEACH ROAD	2856680	26/12/2008	Fri 1114	LBMMIC	157A 158A 377A	R D B F T G P 080
1N/995/13.674	560N TE HAPUA ROAD	2813605	22/11/2008	Sat 1803	ADMSIC	104A 132A 156A	E D B F N C 100 1
1N/995/10.853	I SCHOOL ROAD	2854422	18/11/2008	Tue 2300	EC TNI	911	W R D DO F T S C 080
1N/995/14.084	150N TE HAPUA ROAD	2856043	06/11/2008	Thu 1821	ACTNIT	159A 381A 137B	G R W O L N C 100
1N/995/14.234	I TE HAPUA ROAD	2813369	01/11/2008	Sat 1340	DBCNIC	111A	R W O L T S C 100 1
1N/995/13.634	600N TE HAPUA ROAD	2813296	30/10/2008	Thu 2153	BFCNIC	101A 111A 514A	M D IN F N C 100 2 1
1N/995/10.406	40N TE HORO BEACH ROAD	2813195	10/10/2008	Fri 1150	BECHNIC	500A	R D B F N L 080 2
1N/995/12.634	1600N TE HAPUA ROAD	2854036	06/08/2008	Wed 1210	CBTS1	137A 197A	V R W B F N L 100
1N/995/12.853	2000S SCHOOL ROAD	2812369	27/06/2008	Fri 0800	BACNIC	125A 150A	R W O H N C 100 1
1N/995/7.942	300S ADDINGTON ROAD	2853721	07/06/2008	Sat 1025	ACB8IC	145A 372A 387B 927	R W O L D N L 100
1N/995/15.777	300N PEKA PEKA ROAD	2852366	22/05/2008	Thu 1555	ACCHNIC	103A 351A	R D O F N L 100
1N/995/9.19	2000S OTAKI GORGE ROAD	2853076	18/05/2008	Sun 1630	CCCS1	410A	F R D B F N L 100
1N/995/12.293	1440S SCHOOL ROAD	2852492	08/05/2008	Thu 2121	AFCSIC	197A 400A 632A 156B	V R D IN F N L 100
1N/995/13.304	930N TE HAPUA ROAD	2852144	26/04/2008	Sat 1035	GCCHNIC	372B 929	G E D B F D N C 100
1N/995/14.234	I TE HAPUA ROAD	2851782	25/04/2008	Fri 1200	JACHNIC	301B 352B	R D B F T S C 100
1N/995/8.152	510S ADDINGTON ROAD	2811706	27/03/2008	Thu 1615	BECHNIC	137A 331A 927	R D B F D N L 100 1 3
1N/995/14.534	300S TE HAPUA ROAD	2757480	25/12/2007	Tue 1755	ADCHNIC	135A 402A	G R W O L N L 100
1N/995/7.742	100S ADDINGTON ROAD	2757373	13/12/2007	Thu 1148	KBCHNIC	308B 375B 929	R D O F D N L 100
1N/1012/0	I PEKA PEKA ROAD	2755546	12/09/2007	Wed 1643	ACCHNIC	159A 173A	R D O F X N P 100
1N/995/10.852	I SCHOOL ROAD	2755167	28/08/2007	Tue 1725	JCCHNIC	302A 360A 375A	R D B F T G P 100
1N/995/15.429	I TE KOWHAI ROAD	2712380	07/07/2007	Sat 1200	CAMS1	136A 610A	R D O F T G C 100 1
1N/995/15.429	I TE KOWHAI ROAD	2712339	21/06/2007	Thu 1104	GBT81VC	145B 372B	R W O H T G L 100 4
1N/995/10.852	I SCHOOL ROAD	2711823	27/04/2007	Fri 1708	JACHNIC	302B 377B	R D TO F T G C 080 1
1N/995/15.077	200N PEKA PEKA ROAD	2752456	05/04/2007	Thu 1600	AACHNIC	372A	F R D B F N L 100
1N/995/16.041	I HADFIELD ROAD	2710006	16/01/2007	Tue 1620	LB481CO	303B 532B	M R D B F T G P 100 1 1
1N/995/10.852	I SCHOOL ROAD	2613120	06/10/2006	Fri 0918	JACHNIC	302B 377B	R D O F T G L 080 2
1N/995/15.341	700N HADFIELD ROAD	2655141	25/09/2006	Mon 2010	ECTNI	912	W R D IN F N L 100
1N/995/7.642	I ADDINGTON ROAD	2652680	17/05/2006	Wed 0840	KBCHNIC	125A 302B 382B	R D B F T G C 100
1N/995/7.684	50S ADDINGTON ROAD	2652070	06/05/2006	Sat 0416	CCVNI	101A 517A 524A	R D IN F N C 100
1N/995/13.814	420N TE HAPUA ROAD	2611546	30/03/2006	Thu 1300	EAVNI0	330A 443B 668B	M E D B F N L 100 1
1N/995/13.974	260N TE HAPUA ROAD	2651429	26/03/2006	Sun 0820	FBCHNIC	181A 378A 931	R D B F N C 100
1N/995/11.953	1100S SCHOOL ROAD	2611164	22/02/2006	Wed 0918	CCCHNIC	125A 504A	F R D B F N L 100 1
1N/995/14.226	I TE HAPUA ROAD	2650320	04/02/2006	Sat 1315	JACHNIC	301B 375B	R D B F T S L 100
1N/995/8.403	I OLD HAUTERE ROAD	2556360	18/11/2005	Fri 1235	JACHNIC	303B 375B	R D B F T N L 100
1N/995/13.234	1000N TE HAPUA ROAD	2513211	08/11/2005	Tue 1400	BV814	137A 170A 410A	E D B F N C 100 1 1



Stage B - Coded Crash Report (Date)
Coded Crash report, run on 24-06-2009, Page 2

First Street	D Second street I of landmark R Distance	Crash Date Number DD/MM/YYYY	Day Time DDMM T 234	Factors and Roles M D A is for vehicle 1 V R B is for veh 2 etc M VN VVV	O C W L W J C M S Total P C B U E I E U O A P Inj E Y J R T G T N N R D D C E V N H H C T K L F S M a a C E E T E T R S M A E I g g T S R L T T R N e e		
1N/995/10.844	I SCHOOL ROAD	2512579	03/08/2005	Wed 0753	JAV81C	302B 360B 377B	R D B F T G P 100 1
1N/995/13.234	1000N TE HAPUA ROAD	2553094	22/06/2005	Wed 1020	FFVNIC	181A	R W O F N C 100
1N/995/12.253	1400S SCHOOL ROAD	2554068	22/06/2005	Wed 1000	ACCS1C	381A 386A	R D O F N L 100
1N/995/14.234	I TE HAPUA ROAD	2553489	18/06/2005	Sat 1125	AOCHNIC	156A 197A	R D O F T S P 100
1N/995/8.453	50S OLD HAUTERE ROAD	2553244	09/06/2005	Thu 2025	BOCHNIC	120A 197B	F R D IN F N L 100
1N/995/12.853	2000S SCHOOL ROAD	2550559	03/03/2005	Thu 1722	DBCHNIC	136A 622A	F E D O F N C 100
1N/995/14.726	500S TE HAPUA ROAD	2512202	27/02/2005	Sun 0724	ACCHNIC	103A 159A 386A 532B	R D O F N C 100 1
1N/995/10.344	500N SCHOOL ROAD	2511252	26/02/2005	Sat 1059	ECCHNIC	158A 178A 357A	V R D B F N C 080 2
SCHOOL ROAD	20E SH IN	2511566	26/02/2005	Sat 1004	QCCHNIC	300A 326A	NP R D B F T N 080 2
1N/995/8.438	2000N TE HORO BEACH ROAD	2511201	17/02/2005	Thu 1730	CBMNI	130A 682A	R D O F N C 100 1
1N/995/14.626	400S TE HAPUA ROAD	2550283	31/01/2005	Mon 0900	ADCHNIC	150A 386A	R D B F N L 100
1N/995/10.043	I TE WAKA ROAD	2511012	09/01/2005	Sun 1245	BACNIC	125A 410A	R D B F X H C 100 1 1
1N/995/10.043	I TE WAKA ROAD	2456504	24/12/2004	Fri 0915	OECHNIC	155A 160A 929	R D B F D G L 100
1N/995/9.403	1000S OLD HAUTERE ROAD	2413242	29/11/2004	Mon 0600	BACHNIC	412A	R W T L N L 100 1 1
1N/995/13.253	2400S SCHOOL ROAD	2456646	16/11/2004	Tue 1350	ODCHNIC	333A 370A 929	E D B F D N C 100
1N/995/13.884	350N TE HAPUA ROAD	2455331	30/10/2004	Sat 1650	FDCHNIC	331A 353A	R D B F N C 100
1N/995/14.234	I TE HAPUA ROAD	2455193	19/10/2004	Tue 0815	DCCE2	335A 354A	C R D B F T G C 100
1N/995/16.033	I HADFIELD ROAD	2412749	16/09/2004	Thu 1541	LB781V	692A 303B 387B	R D O F T G R 100 1 2
1N/995/9.403	1000S OLD HAUTERE ROAD	2454271	11/09/2004	Sat 1915	AACHNIC	372B	R D O F N P 100
1N/995/9.343	700N TE WAKA ROAD	2454902	14/08/2004	Sat 1345	MCCHNIC	372B	R D O F H L 100
1N/995/10.388	50N TE HORO BEACH ROAD	2453204	15/07/2004	Thu 0240	CCCS1	112A	F R W DO L N C 100
1N/995/10.903	50S SCHOOL ROAD	2453179	04/07/2004	Sun 1230	BAVNIC	129A 370A 927	R D B F D N P 080
1N/995/13.864	370N TE HAPUA ROAD	2412466	02/04/2004	Fri 0335	DAV81	359A	EPV E W DN L N C 100 2
1N/995/11.253	400S SCHOOL ROAD	2451092	17/03/2004	Wed 1800	CBCHNIC	410A	EV R D O F H L 100



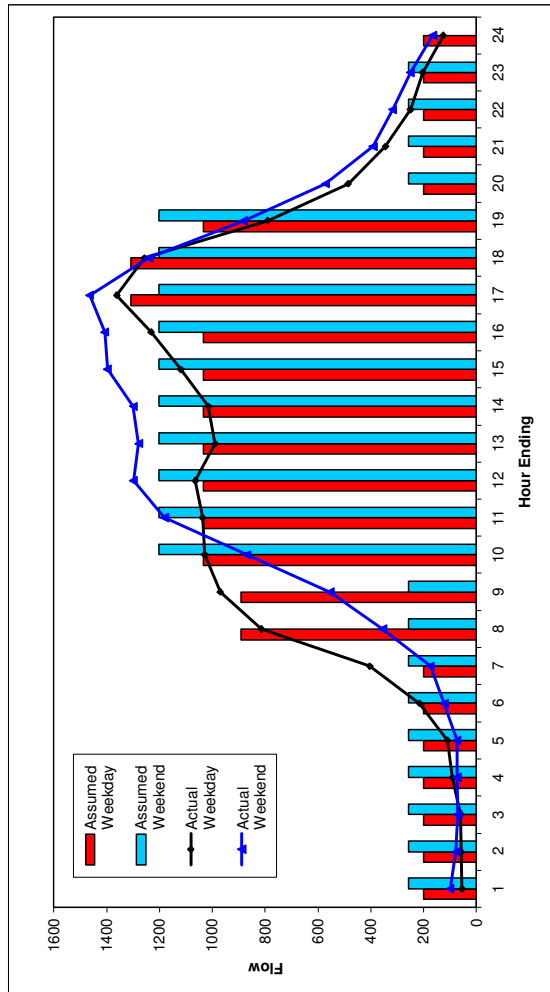


5 Addendum E – Annualisation Factors

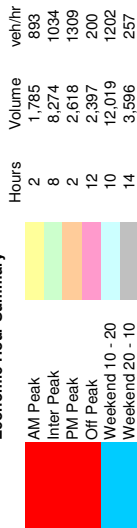
5.1 Stage A: North of Otaki to Addington / Otaki Gorge Road

Otaki Stage A 01N00998 - Economic Flow Profile April 2009

Time	5 Day ADT		Weekend	
	Actual Weekday	Assumed Weekday	Actual Weekend	Assumed Weekend
01:00	54	200	100	257
02:00	58	200	77	257
03:00	59	200	71	257
04:00	90	200	73	257
05:00	110	200	74	257
06:00	214	200	122	257
07:00	404	200	175	257
08:00	815	893	355	257
09:00	970	893	554	257
10:00	1028	1,034	871	257
11:00	1037	1,034	1181	1,202
12:00	1064	1,034	1298	1,202
13:00	989	1,034	1279	1,202
14:00	1015	1,034	1299	1,202
15:00	1119	1,034	1397	1,202
16:00	1231	1,034	1407	1,202
17:00	1361	1,309	1700	1,464
18:00	1257	1,309	1800	1,202
19:00	791	1,034	882	1,202
20:00	485	200	572	1,202
21:00	344	200	391	257
22:00	249	200	317	257
23:00	204	200	250	257
00:00	126	200	166	257
Total	15,074	15,074	15,615	15,615



Economic Hour Summary



Off Peak Proportion of the Inter Peak

Interpeak	8	8,274	1034
Offpeak	12	2,397	200
% of Interpeak	12		19.3%

Weekend Proportion of the Inter Peak

Inter Peak	8	8274	1034
Weekend 10 - 20	10	12019	1202
% of Interpeak	10		116.2%

Weekend Off Peak Proportion of the Inter Peak

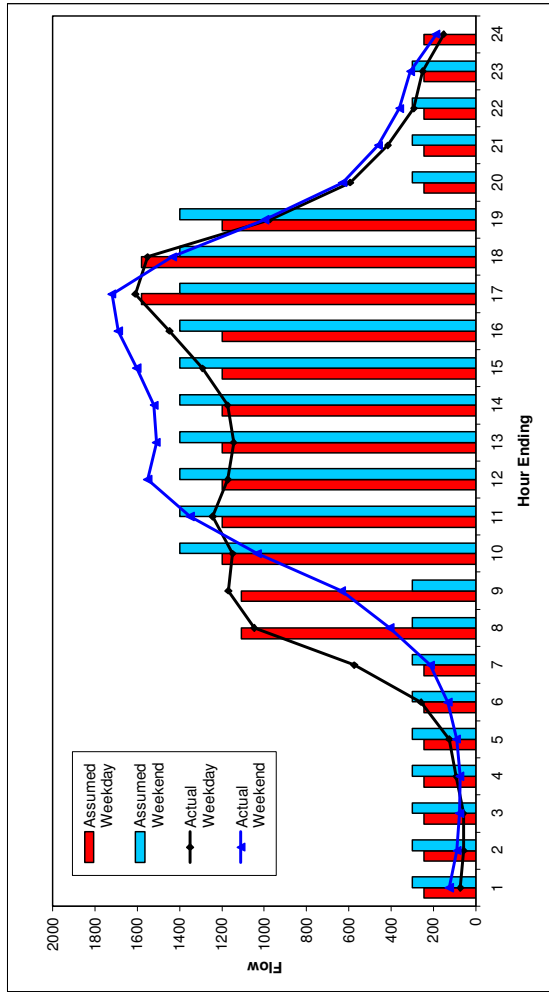
Interpeak	8	8,274	1034
Weekend 20 - 10	14	3,596	257
% of Interpeak	14		24.8%

C:\Work\Otaki Bypass\Kapiti SH1 Strategy - Otaki Economics\2008 traffic data Ohau.xls\Summary Sunday

5.2 Stage B: Addington Road to Peka Peka

Otaki Stage B 01N01011 - Economic Flow Profile April 2009

Time	5 Day ADT		Weekend	
	Actual Weekday	Assumed Weekday	Actual Weekend	Assumed Weekend
01:00	72	245	125	299
02:00	56	245	88	299
03:00	59	245	76	299
04:00	92	245	74	299
05:00	125	245	90	299
06:00	259	245	131	299
07:00	575	245	214	299
08:00	1047	1,109	407	299
09:00	1170	1,109	633	299
10:00	1150	1,200	1034	299
11:00	1244	1,200	1351	1,401
12:00	1172	1,200	1551	1,401
13:00	1144	1,200	1511	1,401
14:00	1174	1,200	1521	1,401
15:00	1292	1,200	1604	1,401
16:00	1448	1,200	1690	1,401
17:00	1610	1,582	1721	1,401
18:00	1553	1,582	1434	1,401
19:00	974	1,200	997	1,401
20:00	594	245	630	1,401
21:00	416	245	460	299
22:00	292	245	360	299
23:00	250	245	308	299
00:00	152	245	187	299
Total	17,920	17,920	18,197	18,197



Economic Hour Summary

Category	Hours	Volume	veh/hr
AM Peak	2	2,217	1109
Inter Peak	8	9,598	1200
PM Peak	2	3,163	1582
Off Peak	12	2,942	245
Weekend 10 - 20	10	14,010	1401
Weekend 20 - 10	14	4,187	299

Off Peak Proportion of the Inter Peak

Interpeak	8	9,598	1200
Offpeak	12	2,942	245
% of Interpeak	12		20.4%

Weekend Proportion of the Inter Peak

Inter Peak	8	9598	1200
Weekend 10 - 20	10	14010	1401
% of Interpeak	10		116.8%

Weekend Off Peak Proportion of the Inter Peak

Interpeak	8	9,598	1200
Weekend 20 - 10	14	4,187	299
% of Interpeak	14		24.9%

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6 Addendum F – BCR and FYRR Results

6.1 Stage A: North of Otaki to Addington / Otaki Gorge Road

WORKSHEET 3

COST-BENEFIT ANALYSIS

1. Project Options	Do Minimum	Option 1 - Expressway	Option 1 - Expressway
DISCOUNTED COSTS:			
2. Construction Costs	\$0.00	\$71,779,154.86	\$71,779,154.86
3. Maintenance Costs	\$0.00	\$0.00	\$0.00
4. Design Costs (7% of Construction)	\$0.00	\$0.00	\$0.00
5. Total Costs (2) to (4)	\$0.00	\$71,779,154.86	\$71,779,154.86
DISCOUNTED BENEFITS:			
6. Travel Time Costs	\$85,464,919.03	\$47,492,610.69	\$37,972,308.34
7. Vehicle Operating Costs	\$63,031,503.77	\$74,318,275.69	-\$11,286,771.92
8. Accident Costs	\$23,790,398.66	\$5,726,325.56	\$18,064,073.10
9. Seal Ext. / Passing Lane			\$0.00
10. Carbon Dioxide (4% of VOC)	\$2,521,260.15	\$2,972,731.03	-\$451,470.88
11. Total Benefits (6) to (10)	\$174,808,081.61	\$130,509,942.96	\$44,298,138.65
12. B/C Ratio (11) / (5)			0.6

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FIRST YEAR RATE OF RETURN

WORKSHEET 5

- 1 Preferred Project Option
- 2 Present Value of Total Net Costs
- 3 Mid Point of First Year of Benefits (Relative to Time Zero)
- 4 Discount Factor (SPPWF) for First Year of Benefits

Option 1 - Expressway	
	71,779,155
	7.50
	0.5615

	Net Annual Benefit (at Time Zero) (5)	Growth Rate (as a decimal) (6)	PV of Benefits in First Year $(1.0 + (3)^*(6))^{-(4)^*(5)}$ (7)
Travel Time Savings			\$2,935,566.12
Vehicle Operating Costs			-\$900,045.35
Accident Costs			\$1,486,826.31
Seal Extn Benefits			\$0.00
Passing Lane Benefits			\$0.00
Carbon Dioxide (@ 4% of VOC)			-\$36,001.81
Other Monetised Factors			\$0.00
9 Present Value of Tangible Benefits in First Year			\$3,486,345.26
10 First Year Rate of Return (9)/(2)			5%

6.2 Stage B: Addington Road to Peka Peka

WORKSHEET 3

COST-BENEFIT ANALYSIS

1. Project Options	Do Minimum	Option 1 - Expressway	Option 1 - Expressway
DISCOUNTED COSTS:			
2. Construction Costs	\$0.00	\$75,197,209.86	\$75,197,209.86
3. Maintenance Costs	\$0.00	\$0.00	\$0.00
4. Design Costs (7% of Construction)	\$0.00	\$0.00	\$0.00
5. Total Costs (2) to (4)	\$0.00	\$75,197,209.86	\$75,197,209.86
DISCOUNTED BENEFITS:			
6. Travel Time Costs	\$132,726,566.15	\$108,931,109.50	\$23,795,456.65
7. Vehicle Operating Costs	\$156,304,591.15	\$170,291,376.66	-\$13,986,785.51
8. Accident Costs	\$72,366,783.41	\$16,926,763.74	\$55,440,019.67
9. Seal Ext. / Passing Lane			\$0.00
10. Carbon Dioxide (4% of VOC)	\$6,252,183.65	\$6,811,655.07	-\$559,471.42
11. Total Benefits (6) to (10)	\$367,650,124.36	\$302,960,904.97	\$64,689,219.39
12. B/C Ratio (11) / (5)			0.9

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FIRST YEAR RATE OF RETURN

WORKSHEET 5

- 1 Preferred Project Option
- 2 Present Value of Total Net Costs
- 3 Mid Point of First Year of Benefits (Relative to Time Zero)
- 4 Discount Factor (SPPWF) for First Year of Benefits

Option 1 - Expressway	
	75,197,210
	7.50
	0.5615

	Net Annual Benefit (at Time Zero) (5)	Growth Rate (as a decimal) (6)	PV of Benefits in First Year $(1.0 + (3) \times (6)) \times (4) \times (5)$ (7)
Travel Time Savings			\$1,742,813.56
Vehicle Operating Costs			-\$1,058,039.60
Accident Costs			\$4,563,183.46
Seal Extn Benefits			\$0.00
Passing Lane Benefits			\$0.00
Carbon Dioxide (@ 4% of VOC)			-\$42,321.58
Other Monetised Factors			\$0.00
9 Present Value of Tangible Benefits in First Year			\$5,205,635.84
10 First Year Rate of Return (9)/(2)			7%

6.3 Stages A & B: North of Otaki to Peka Peka

WORKSHEET 3

COST-BENEFIT ANALYSIS

1. Project Options	Do Minimum	Option 1 - Expressway	Option 1 - Expressway
DISCOUNTED COSTS:			
2. Construction Costs	\$0.00	\$146,976,364.72	\$146,976,364.72
3. Maintenance Costs	\$0.00	\$0.00	\$0.00
4. Design Costs (7% of Construction)	\$0.00	\$0.00	\$0.00
5. Total Costs (2) to (4)	\$0.00	\$146,976,364.72	\$146,976,364.72
DISCOUNTED BENEFITS:			
6. Travel Time Costs	\$218,191,485.18	\$156,423,720.19	\$61,767,764.99
7. Vehicle Operating Costs	\$219,336,094.92	\$244,609,652.35	-\$25,273,557.42
8. Accident Costs	\$96,157,182.07	\$22,653,089.30	\$73,504,092.77
9. Seal Ext. / Passing Lane			\$0.00
10. Carbon Dioxide (4% of VOC)	\$8,773,443.80	\$9,784,386.09	-\$1,010,942.30
11. Total Benefits (6) to (10)	\$542,458,205.97	\$433,470,847.93	\$108,987,358.04
12. B/C Ratio (11) / (5)			0.7

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FIRST YEAR RATE OF RETURN

WORKSHEET 5

- 1 Preferred Project Option
- 2 Present Value of Total Net Costs
- 3 Mid Point of First Year of Benefits (Relative to Time Zero)
- 4 Discount Factor (SPPWF) for First Year of Benefits

Option 1 - Expressway	
	146,976,365
	7.50
	0.5615

	Net Annual Benefit (at Time Zero) (5)	Growth Rate (as a decimal) (6)	PV of Benefits in First Year $(1.0 + (3) \times (6)) \times (4) \times (5)$ (7)
Travel Time Savings Vehicle Operating Costs Accident Costs Seal Extn Benefits Passing Lane Benefits Carbon Dioxide (@ 4% of VOC) Other Monetised Factors			\$4,678,379.68 -\$1,958,084.95 \$6,050,009.77 \$0.00 \$0.00 -\$78,323.40 \$0.00
9 Present Value of Tangible Benefits in First Year			\$8,691,981.10
10 First Year Rate of Return (9)/(2)			6%