Appendix K

Economics Evaluation

PP20 Scheme Assessment Report

Economics Note

December 2011

PP20 Scheme Assessment Report Economics Note

Prepared By
Andrew Martindale
Graduate Engineer

Reviewed By
William Wallace
Senior Traffic Engineer

Approved for Release By
David Dunlop – Transportation Team Leader

Opus International Consultants Limited
Wellington Office
Level 9, Majestic Centre, 100 Willis Street
PO Box 12 003, Wellington 6144,
New Zealand

Telephone: +64 4 471 7000
Facsimile: +64 4 471 1397

Date: December 2011
Reference: 5-C1814.36
Status: Final

Contents

1 PP2O Economics Calculation

1.1 Overview

The economic analysis for the PP2O project has been considered both as part of the wider Wellington Northern RoNS package and in isolation for the purposes of NZTA's Scheme Assessment Report Addendum (SARA) requirements. As a result there has been an attempt to create a consistent approach to economic assessment over the entire RoNS corridor (Levin to Wellington). However, as the RoNS projects are at different stages of development and have adopted a range of individualised assumptions, there remains some variation in the approach used for economic evaluation. As with all of the projects to the south of PP2O, the Wellington Transport Strategy Model (WTSM) has been utilised as the basis in which the PP2O project has been assessed. In addition to the use of WTSM there have been a number of project specific traffic models built for analysis including the PP2O Traffic Model (PP2OTM).

In this economic analysis, outputs of the project specific models have been incorporated into the total benefit calculations. For the PP2O project the benefit calculations have subsequently included: travel time savings, vehicle operating cost savings, reductions in CO2 emissions, crash costs and maintenance costs. Methodologies for quantifying these components are outlined in later chapters of this report. Other benefits including route reliability and security have not been calculated as they are likely to be relatively small. Such benefit components would result in very little change to either the total Wellington Northern RoNS package or the PP2O specific BCR.

Agglomeration benefits result from productivity gains associated with the construction of the whole Wellington Northern RoNS Corridor. It is not possible to associate these benefits with a specific section of the corridor such as PP2O. This is because agglomeration benefits are only truly realised once the whole corridor is constructed. Therefore, agglomeration benefits are not included in the economics for this specific corridor segment and will only be included when analysing the benefits associated with the entire Wellington Northern RoNS.

1.2 Wellington Northern RoNS Economic Assessment

Economic assessment of the entire Wellington Northern RoNS package was undertaken as part of a business case study in late 2009. This evaluation involved the development of a methodology to capture the benefits of each individual RoNS project (including PP2O) and then combine them to calculate an overall package BCR of 1.1. Wider economic/agglomeration benefits were also considered for the entire package as part of a sensitivity test. The application of these benefits increased the Wellington Northern RoNS package BCR from 1.1 to 1.4.

While the approach used for calculating each individual project BCR in isolation has been consistent it is important to note that some projects within the total corridor have a BCR below one while others have a BCR much greater than one. But in order to provide an Expressway from Levin to Wellington without the full package of works associated with each corridor project it would be difficult to achieve the RoNS objectives and recognise the wider economic/agglomeration benefits associated with the package.

1.3 Traditional PP2O Project Economic Assessment

The benefits for the PP2O project in isolation were determined by using the outputs of the PP2OTM (built in SATURN packages) in conjunction with the latest version of NZTA's Economic Evaluation Manual (EEM). The PPOTM has been derived from the base land use, future year land use and travel demand scenarios from WTSM. This has enabled the testing of a Do-minimum and Option network for the PP2O project during the AM, IP and PM peak hours.

The following sections detail the key traffic modelling assumptions that are fundamental in understanding how the models contribute towards determining an individual BCR for the PP2O project.

1.3.1 WTSM

The current WTSM land use and travel demand modelling uses a base case which was updated to a 2006 demand in 2008. Associated with this update was the forecasting of a medium, low and high land use and travel demand range. In agreement with NZTA and GWRC, the Wellington Northern RoNS assessment has used the medium trip matrices for modelling in SATURN, with some project specific updates adopted for the PP2O project to account for growth in Otaki. This includes the Riverbank Road development which is growing rapidly both now and in the future. Such development is not incorporated into the WTSM medium matrices for the Otaki area.

GWRC and NZTA are currently working on growth scenarios which include land development and employment that might be stimulated as a result of significant infrastructure investment and/or the commitment to such investment in the future. The Wellington Northern RoNS project is one such project that is aimed at stimulating economic growth and productivity. Once the RoNS Land Use scenario has been developed, the following WTSM scenarios can then be considered in the PP2OTM:

1. Medium Land Use / Do-Minimum Network
2. Medium Land Use / Option Network
3. RoNS Land Use / Do-Minimum Network
4. RoNS Land Use / Option Network

These land-use and traffic demands would then need to be transferred into SATURN runs for economic purposes.

1.3.2 PP2OTM (SATURN)

The PP2OTM has been validated based on 2010 traffic counts in the study area (refer Peka Peka to Otaki SATURN model validation report, 2010 in Appendix A). Using the WTSM land use and travel demand scenarios, a fixed matrix approach was adopted in order to compare the following Do-minimum and Option networks:

Do-Minimum Network

- Travel demands based on 2016 & 2026 WTSM medium growth demands;

- Including all RoNS scheme developments as part of the Wellington Northern RoNS project (based on the 2009 business case);
- Additional Kapiti development (Paraparaumu town centre, Waikanae north and 50% Aerodrome);
- Additional Riverbank Rd development in Otaki; and
- Current zebra crossing north of Arthur St upgraded to a signalised crossing before 2016.

Option Scenario (same as Do-Minimum plus):

- 4 lane Expressway with 100 km/h speed limit through the study area;
- New Local Arterial (existing SH1) speed reduction from 100 km/hr to 80km/hr for rural sections;
- North facing ramps located north of Otaki;
- Rahui Rd (east/west) bridge connection;
- Otaki Gorge Rd south facing ramps with a roundabout located on the western side of the interchange to join the New Local Arterial;
- Local Road link between Otaki Gorge Road and Old Hautere Road;
- Local road bridge over at Te Horo from Beach Road to School Road;
- North facing ramps at Peka Peka Rd and Hadfield Rd (consistent with MacKay's to Peka Peka design);
- Isolating traffic demand at the southern end of the model (South of Te Horo traffic stays on local Arterial and north of Te Horo traffic stays on the Expressway to/from the south); and
- Taylors Road at grade with safety and operational improvements.

Note that the assumption to have all other parts of the RoNS package included in the Do-minimum may result in an overestimation of the benefits. This assumption was identified and agreed to by NZTA. There has subsequently been no WTSM test undertaken to remove the PP2O project from the package. It is possible that the traffic induced by the PP2O section may instead come from changes in land use with the completion of the entire RoNS package.

Induced Trip Assessment

By reducing travel time through the PP2O study area it may induce new trips or redistribute trips. In the cases where induced or redistributed trips are expected to significantly affect the evaluation, a variable matrix approach should be adopted.

Variable matrix methods differ from conventional fixed trip matrix techniques in that demand in the option matrix is generally higher than that in the do minimum matrix for a given forecast year. The EEM states that variable trip matrix methods are to be used for all complex improvements, unless:

(a) It can be demonstrated that
    (i) The congestion level expected throughout the analysis period in the do-minimum or option will not be substantial, and
    (ii) The peak period PT mode share is less than 15%; or
(b) Preliminary evaluation show that the fixed trip matrix benefits are unlikely to differ by more than 10% from those from a variable trip matrix approach; or
(c) The NZTA approves the use of a fixed trip matrix approach for other reasons.

In order to establish whether there was a need to undertake a variable trip matrix approach for the PP2O project, a test was undertaken using a variable trip matrix approach as part of the M2PP Kapiti network model. It was identified that the Option resulted in less trips than the Do-minimum. This appears counter-intuitive; however this is understood to be largely due to the relatively uncongested operating conditions in the AM, interpeak and PM peak periods. Additionally this could be because of the change in accessibility associated with the Option at Peka Peka, impacting on trips between Peka Peka and Te Horo.

On the recommendations of the external peer reviewer, additional sensitivity tests have also been carried out using the elastic assignment in the PP2O model. This would further justify the fixed matrix approach. Table 1 below shows the study area network demands in AADT and the percentage change between Do-minimum and Option. It suggested the Option will only introduce 2% extra AADT traffic in 2026 due to the uncongested network. The fix trip assignment benefits are unlikely to differ by more than 10 percent from that of the elastic assignment.

Table 1: PP2O network demand AADT summary (vehicles)

PP2O Demand Summary		Fix MX		Elastic MX	
		AADT	Diff%	AADT	Diff%
2010	Base	30,111		30,111	
	Option	30,111	0%	30,112	0%
2016	Do-Minimum	39,092		38,431	
	Option	39,092	0%	38,975	1%
2026	Do-Minimum	42,875		41,727	
	Option	42,875	0%	42,701	2%

Table 2 summaries the total network delay in modelled peak periods between the fixed and elastic assignment methods. The differences are again considered to be marginal.

Table 2: PP2O network delay between fix and elastic assignments (seconds)

Delays (hrs)		Fix MX	Elastic MX	Actual Diff
2016 Do-Minimum	am	12.0	11.2	-0.8
	ip	6.5	6.1	-0.4
	pm	18.8	17.0	-1.8
2016 Option	am	0.5	0.5	0.0
	ip	0.4	0.4	0.0
	pm	0.8	0.8	0.0
2026 Do-Minimum	am	21.1	18.4	-2.7
	ip	10.6	9.7	-0.9
	pm	29.5	25.9	-3.6
2026 Option	am	0.9	0.9	0.0
	ip	0.6	0.5	-0.1
	pm	1.2	1.1	-0.1

For the above reasons, the PP2O project modelling has used a fixed trip matrix approach. The project team believe that a variable matrix approach is unnecessary based on the fact that congestion levels are not significant and the change in trips are less than 10%.

1.3.3 PP2OTM vs. M2PP SATURN Model

As discussed in section 1.1 earlier, the PP2OTM has been used for assessment of this project due to concerns held by the team over the levels of validation in the PP2O project area using the M2PP SATURN Model. This decision was agreed with NZTA for the purposes of the SARA phase of the project, with future consideration to be given to improving the M2PP model north of Peka Peka Road prior to the planning process.

The peer reviewer raised concerns over the route choice at the southern part of the model, which was based upon manual calculation of trip lengths and travel time. A comparison was undertaken between the PP2OTM (manual allocation of traffic by corridor) and the M2PP models to better understand the accuracy of the results. It should be noted that given the issues associated with the M2PP model north of Peka Peka Road the results this may not provide any more certainty than the manual calculation.

Table 3 below summarises the AADT differences between the two models in year 2026 under expressway option near Peka Peka Rd. The results showed the split using the two approaches (modelled and calculated) are actually very similar which addresses the concerns raised by the peer reviewer.

Table 3: Modelled PP2O southern traffic demand split (North of Peka Peka)

2026 traffic demand		Existing SH1	Expressway	Screen line
PP2OTM	AADT	3553	20752	24305
	Proportion	15%	85%	100%
M2PP	AADT	4160	17942	22102
	Proportion	19%	81%	100%

2 Economic Assumptions

Based on the WTSM and SATURN outputs/issues, the following key assumptions were used for the purposes of the economic analysis in the PP2O project:

- All the costs and benefits have been discounted to 01/07/2011 (Time zero);
- An 8% discount rate has been used to discount the costs and benefits to time zero;
- A 30 years benefit period starting from time of significant expenditure (01/07/2014);
- Opening year has been assumed to be July 2018;
- A four year construction period starting 01/07/2014 and finishing 30/06/2018 has been assumed for economic purposes. For discounting it was assumed that property costs will be paid at the start of the construction period. The remaining phases of construction would be paid at the midpoint of every six month cycle, with the final payment occurring on 01/04/2018
- Only Rural Strategic trips have been assumed within the modelled area.
- SATURN model outputs for year 2016 and 2026 (AM, Inter, PM and Weekend Peaks) have been used to forecast the travel time, vehicle operating and CO2 emission benefits. Benefits for intermediate years have been interpolated, and benefits have been extrapolated beyond 2026 due to this being a largely uncongested network;
- Weekend peak model has been factored from the inter peak model which has been based on the study area traffic flow profile;
- The crash benefits have been calculated in general accordance with the EEM procedures, utilising the existing crash history between 01/07/2005 and 01/07/2010;
- CO_2 emission costs are assumed to be 4% of the vehicle operating costs;
- No travel time reliability or incident benefits have been calculated; and
- No agglomeration benefits have been included in the evaluation.

The economics worksheets are contained in Appendix B. Detailed discussions in regards to each of the economic components listed above is documented within the remaining chapters of this report.

3 Benefit Time Stream

Total annual costs are estimated for future years for both the Do-Minimum and Option scenarios from the 2016 and 2026 PP2OTM. For years before 2026, values are obtained from the linear trend between 2016 and 2026 values (including back-extrapolation for years

before 2016); for years after 2026, values are extrapolated beyond the 2026 level. This is used to capture the 30 year benefit period from the start of construction.

4 Travel Time Assumptions

Total travel time for each scenario is the sum of all trips over the road network in vehicle-hours on each link and at each intersection. An additional value of time is also included for travel in congested conditions. Congested time on links is calculated for the AM, Inter and PM peaks. Intersection delay is also included in congested travel time for all time periods.

The EEM gives parameters for obtaining travel time costs from vehicle-hours for various road types and traffic composition. Travel time values recognise that there is a mixture of rural strategic and urban arterial traffic users within the modelled area. The EEM indicates the standard traffic composition for these two road classifications as:

- Urban Arterial: Cars/LCV = 95%, HCV's = 5%
- Rural Strategic: Cars/LCV = 88%, HCV's = 12%

NZTA's traffic count sites at North of Waitohu River Bridge, North of Waerenga Road and at Mary Crest indicate that an HCV composition of 12%, 10% and 11% can typically observed across each site respectively (refer to Chapter 8 for the detailed site and observation period information). These values are relatively close to the standard Rural Strategic mix. For such reasons, in the economic assessment of the PP2O project, the travel time and vehicle operating costs value for rural strategic road sections has been used. The EEM (pA4-3) gives composite value of travel time for the rural strategic road category.

Based on this assumption the results show that travel time accounts for around $57M benefits over 30 years. This equates to approximately 63% of the total project benefits. Note that of the travel time benefits, congestion relief values (CRV) account for around $1M benefits over the 30 year period, or around 1% of the total project benefits. CRV includes links where the VC ratio exceeds 70% and all turning movements.

The travel time benefits are directly related to the increased network capacity and the faster operating speed on the new expressway. The redistribution of the north/south through movement from the existing SH1 to the expressway creates better performance to and from local road intersections. To prove this, as a sensitivity the travel time benefits have been broken down on a geographical sector basis. The study area has been categorised into five sectors as shown in

Figure 1 below. The actual travel time savings for each modelled peak hour can be found in 4. Unsurprisingly the results indicate that approximately 90% of the travel time benefits are SH1 (sectors 1 and 5) related, regardless of the peak period being reviewed.

Figure 1: PP2O Sector Diagram

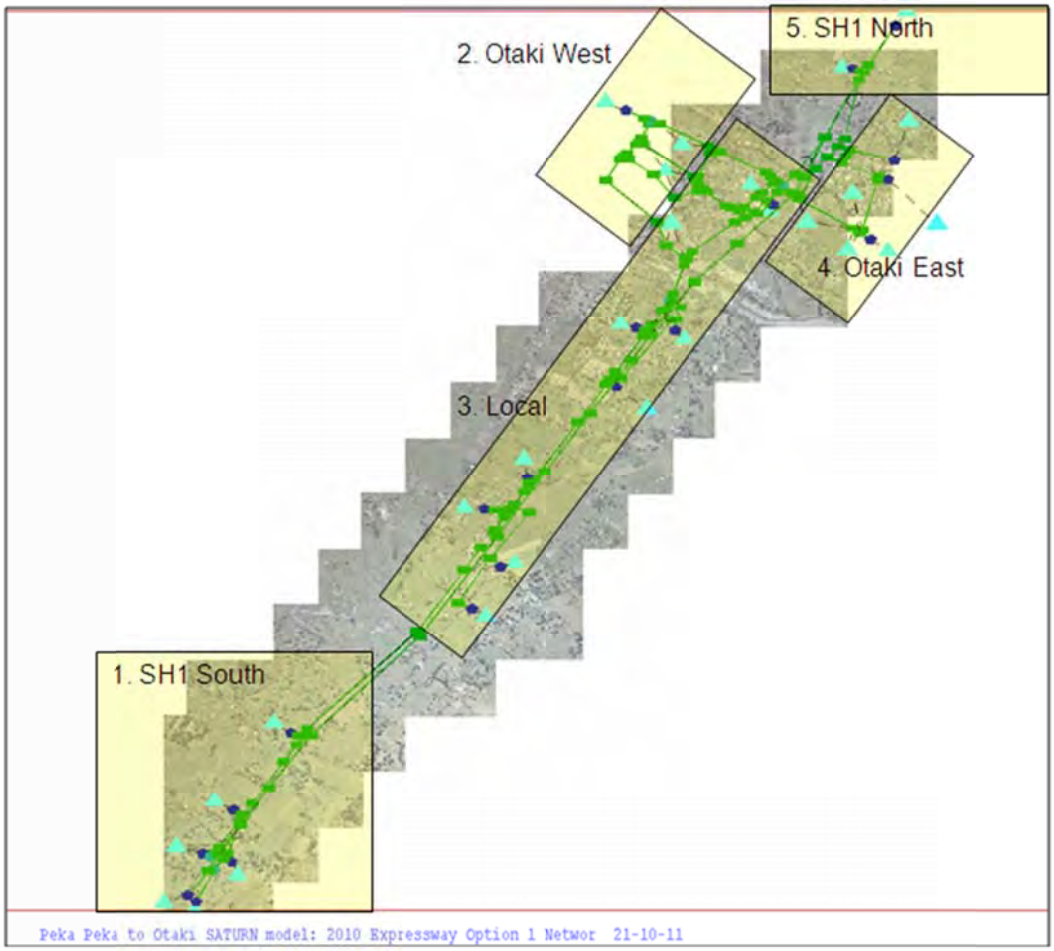


Table 4: Travel time saving in sectors

2026 Opt1 AM Savings (pcu*hrs/hr)						
Sectors	1	2	3	4	5	Total
1	0.0	1.9	0.3	0.7	17.9	**20.7**
2	3.7	0.0	0.4	0.1	1.1	**5.2**
3	1.0	0.1	0.1	0.1	1.1	**2.4**
4	1.2	0.1	0.4	0.0	0.1	**1.8**
5	24.2	0.2	0.7	0.0	0.0	**25.1**
Total	**30.0**	**2.3**	**1.8**	**0.9**	**20.2**	**55.1**
2026 Opt1 IP Savings (pcu*hrs/hr)						
Sectors	1	2	3	4	5	Total
1	-0.2	1.3	-0.9	0.5	14.8	**15.4**

2	1.9	0.0	0.0	0.1	1.0	**3.0**
3	-0.1	0.0	-0.4	0.1	1.5	**1.1**
4	0.5	0.1	0.0	0.0	0.1	**0.6**
5	16.2	0.1	0.1	0.0	0.0	**16.4**
Total	**18.3**	**1.4**	**-1.2**	**0.6**	**17.3**	**36.5**
2026 Opt1 PM Savings (pcu*hrs/hr)						
Sectors	1	2	3	4	5	Total
1	0.1	3.9	0.5	1.6	27.0	**33.1**
2	3.3	0.0	0.4	0.3	1.2	**5.1**
3	5.2	1.1	1.6	0.8	2.8	**11.7**
4	0.7	0.1	0.2	0.0	0.1	**1.1**
5	23.6	0.2	0.7	0.1	0.0	**24.6**
Total	**33.0**	**5.4**	**3.4**	**2.7**	**31.1**	**75.6**

5 Vehicle Operating & CO_2 Costs

Total travel distance for each scenario is the sum over the road network of the vehicle-kilometres on each link. And the total fuel consumption is the sum over the road network of the vehicle-litres on each link. Using the same rural strategic road category as the travel time calculations, the EEM gives parameters for obtaining vehicle operating costs from both vehicle kilometres and fuel costs in Table A5.9. CO_2 emission costs are estimated at 4% of vehicle operating costs (EEM A9.6).

The results showed there are annual disbenefits from vehicle operating cost. The reasons for the disbenefits include the following:

- Travel speeds on the network and the Expressway in particular result in additional fuel consumption, whereas improvements in VOC occur on the local arterial due to lower speeds and reduced congestion.
- Small increase in travel distance for southbound trips to and from Old Hautere Road, which was considered as part of the incremental analysis for this option.
- The Te Horo local road bridge will increase travel distance for movements to and from the existing SH1 (north and south), however it will reduce the distance between the communities on the east and west sides of the Te Horo. Travel times for both should be reduced due to the removal of SH1 through traffic.
- Based on travel time reductions on the Expressway, it has been calculated that the majority of road users in Te Horo north to Otaki Gorge Road will use the Expressway, resulting in additional travel distance and operating costs.

6 Crash Costs

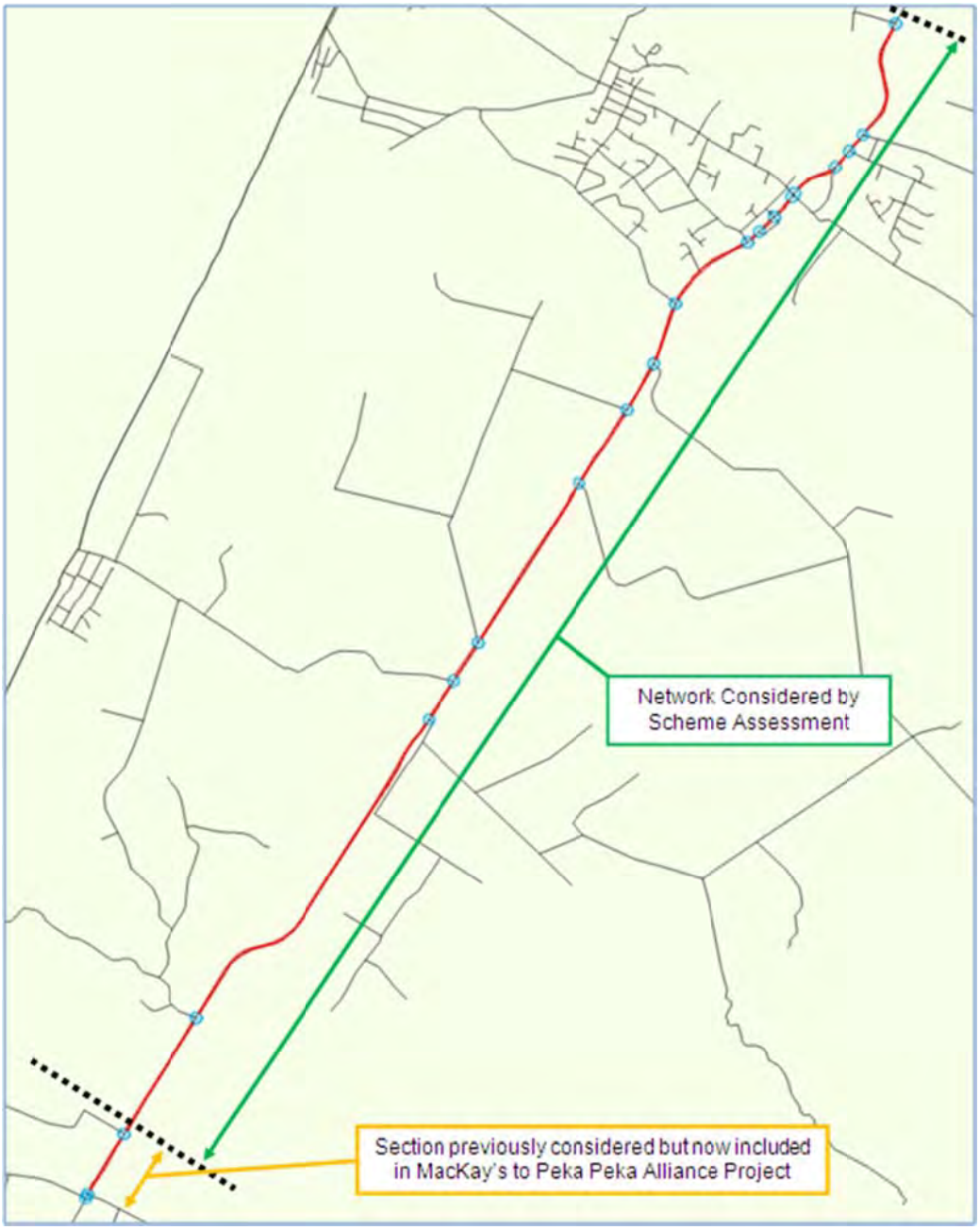
A crash model has been constructed to analyse the potential crash benefits/disbenefits associated with the construction of PP2O. The costs have been generated in accordance with Section A6 of the EEM.

The scope of the road network considered for the crash model is defined as the current SH1 alignment from the Taylors Road / SH1 priority-tee intersection (1N / 995 / 3.303) through to a location immediately to the north of the Te Kowhai / SH1 priority-tee intersection (1N / 995 / 15.373). Note that this differs from the route adopted during the PP2O scoping phase which went as far south as Peka Peka Road. The southern extension has now been included within the "MacKays to Peka Peka" RoNS project.

The analysis area is shown visually within Figure 2 of this document (overleaf). As can be seen all key intersection and midblock locations situated along the SH1 route are included within the crash model. These locations are those most likely to experience traffic volume changes as a result of the Otaki expressway option. For the purposes of this assessment, the option proposed is the same as that documented by the "Road Design Preferred Proposal Drawings" 5/2664/1/5504/1101-1108 issued on the 23rd of June 2011.

Note that elements of the local road network, particularly within Otaki were initially included in the early stages of the crash model's development. However, it became apparent on review of the existing crash history and modelled traffic volume comparisons that these local links and intersections could be excluded. In the majority of these locations there is no crash history and the volumes do not fluctuate between the do-minimum and option scenarios. For such reasons the crash model is considered a conservative and realistic estimate of the crash costs for the project.

Figure 2: Extent of the Do-Minimum Crash Model Analysis Study Area



6.1 Crash History

At each of the existing intersection and midblock locations specified in Figure 2, the crash history has been reviewed using the NZTA "Crash Analysis System" (CAS) for the period 01/07/2005 to 30/06/2010. Within CAS a 50m radius for intersections and a 10m radius for midblock locations was specified. Crash costs for each location could then be determined individually.

As the crash model was finalised at the end of December 2010, the full 2010 calendar year crash data was not available. This is because CAS is typically three to six months behind the current date. However for comparative purposes and completeness, Table 55 below provides a summary of the crash history on SH1 between Taylors Road and Peka Peka Road for the different analysis periods that are now possible to be analysed. As can be seen there is very little difference between the data used for the crash model and the most current information that is available. The crash model is therefore still representative of the existing situation.

Note that the analysis period crash history is markedly different to the 2004-2008 five year period used originally as part of the high level RoNS economic assessments. The analysis period used for the PP2O crash model shows a significant decrease in the number of serious injury crashes and one less fatal crash. This will have an impact on the magnitude of existing crash costs and the potential benefits possible from the expressway option.

Table 5: Crash history adopted within this analysis and that previously used in past RoNS appraisal

Year	Fatal	Serious	Minor	Non-injury	Total
01/07/2005 to 30/06/2010 (Current Analysis)	3	13	27	96	139
2004 to 2008 (Past RoNS work)	4	43	26	77	150
2006 to 2010 (Latest Possible)	3	13	32	104	152

6.2 Crash Model Assumptions

The crash model has assessed the “Do-minimum” and “Option” networks using the methods described by Section A6 of the EEM Volume 1. Slight variations have been made to the standard methodologies due to the scope of the area considered and because the majority of the existing State Highway network will see no fundamental change in the “Option”. These links will instead experience only changes in traffic volumes. For such reasons a dollar / vehicle / kilometre approach has been used in order to calculate the forecast year crash costs.

In combination with the existing crash history, the PP20TM has significantly contributed to the development of the crash cost benefits. As the PP20TM assesses the network across the AM, IP and PM peak hours, flow factors have subsequently been used to determine a 24 hour AADT value for the appropriate network sections and their turning movements. The AADT conversion factors adopted for the PP2OTM for the purposes of the crash analysis included a:

- 2 hour AM peak;
- 11.4 hour IP peak; and

- 2 hour PM peak;

The PP20TM has been used to forecast the shift in vehicles from the existing SH1 network onto the new expressway proposed as part of the option. Based on the traffic volumes determined from the PP2OTM and the existing crash history, the following assumptions were made for the “Do-minimum” and “Option” scenarios:

6.2.1 Do Minimum Analysis

The do-minimum crash costs have been determined using “Method A: Accident by Accident Analysis” as per the procedure outlined within the EEM. This method allows a dollar per vehicle per kilometre approach to be used, simplifying the forecast year analysis significantly. “Method A” relies on the existing crash history in the area defined by Figure 2. In addition the following assumptions have been required for each “Do-minimum” intersection and midblock element:

- Calculated with the use of the EEM analysis software to account for different crash movements and vehicle types;
- Time zero of 01/07/2011;
- 2% annual traffic growth;
- All posted speed limits for each network element as is on site;
- All midblock lengths as measured on-site;
- Mean speeds of vehicles:
    - 85km/h assumed for a 100km/h posted speed limit;
    - 70km/h assumed for a 80km/h posted speed limit;
    - 60km/h assumed for a 70km/h posted speed limit;
    - 50km/h assumed for a 50km/h posted speed limit;
- Passing lane sections not assessed independently;

Note that the 2% annual traffic growth value has been adopted to be conservative. NZTA count station data in the Otaki (Site:01N01001 "Nth of Waerenga Road”) indicated a 1.1% annual growth rate between 2001-2010. However in comparison, the SATURN flows forming the basis of the crash model, display an annual growth between 2010 and 2026 as approximately 3% once development is accounted for. Table A2.5 on Page A2-11 of the EEM was reviewed for the Wellington Region which states a 2% growth rate can be adopted for rural strategic roads. This value was hence adopted as it lies half way between the actual and predicted growth rate through Otaki.

6.2.2 Option

To calculate the option costs a mixture of "Method A: Accident by Accident Analysis" and "Method B: Accident Rate Analysis" has been adopted. For the majority of the existing SH1 network being considered there is no fundamental change between the "Do-Minimum" and "Option" as only traffic volumes will vary. For such elements the option crash cost has been calculated using the $/vehicle/km value determined in the "Do-minimum" analysis. The $/vehicle/km value was then multiplied by the new traffic volumes to generate an option cost.

The new road sections introduced as part of the expressway proposal were assessed using "Method B: Accident Rate Analysis". This has included both the new expressway structure and the fundamental changes being made to existing locations. To generate the "Option" crash cost values, the following general EEM accident prediction models have been used in conjunction with SATURN volume values when "Method B" was applied:

- (1) Urban cross and T-intersections (50 – 70km/h);
- (2) Urban roundabouts (50- 70km/h);
- (5) General urban mid-blocks 50-70 km/h;
- (7) High speed cross and T-intersections (>80km/h) priority and traffic signals;
- (11) Rural two-lane roads (80km/h);
- (13) Motorways and four-lane divided rural roads.

6.2.3 Alternative Method

At the request of the external peer reviewer, a sensitivity test on the crash model was conducted using the generic accident prediction models. This would allow comparison between the adopted crash model methodology using accident by accident procedures and that calculated using the EEM's prediction models. This would confirm the suitability of the crash model and the assumptions used. In assessing only the do-minimum intersections as the sensitivity check, it was found that when the prediction models are used, the crash cost value is 80% of that calculated using the accident by accident analysis. In general and as agreed with the peer reviewer, it can be concluded that there is a higher than average crash rate along this length of SH1. The adopted methodology is therefore appropriate.

6.3 Crash Savings

The crash model has indicated that once discounted over a 30 year period almost $42M in benefits is available. This accounts for approximately 46% of the total project benefits. It is acknowledged that the crash savings form a large component of the project benefits. However we believe this is intuitive. The option will see a substantial reduction in vehicles travelling along the existing SH1 route as traffic is shifted onto the new expressway. This will in-turn reduce the number of vehicle conflicts occurring on a daily basis along the existing SH1 route. The potential and probability of a crash occurring on the existing SH1 network will thus decrease due to a significant reduction in vehicle exposure. The adopted

methodology does place a strong emphasis on the existing crash history data. It therefore will not be surprising if the crash benefits calculated at this point in time fluctuate in the future if the crash model is re-calculated at another time. As has already occurred between the completion of crash analysis for the RoNS business case and the PP2O project, the longer the project continues to be delayed the potential for further reductions to the BCR is likely given that in the long term it is evident that the number of crashes occurring on the road network annually is displaying a decreasing trend.

7 Maintenance Costs

Annual and periodic maintenance costs have been accounted for within the economic analysis. The maintenance assumptions adopted for the Do-minimum and Option scenarios are documented below:

7.1 Do Minimum Maintenance Costs

The Do-minimum infrastructure has been assumed to include three existing SH1 bridges and all of the SH1 pavement structure within the extents of the PP2O project corridor. Annual pavement, surfacing and structural maintenance has therefore been included. For the Do-minimum maintenance costs it has been assumed that the existing SH1 pavement is currently 10 years through a 25 year lifespan as at time zero. The pavement is assumed to be on a re-seal cycle of every 8 years and a reconstruction cycle of every 25 years. No periodic costs have been assumed for the structural component of the existing bridge infrastructure.

7.2 Option Maintenance Costs

The Option infrastructure has assumed to include two of the three existing SH1 bridges, nine new bridges, the existing SH1 pavement and the new expressway / local road pavements. For the Option maintenance costs it has been assumed existing bridges maintain the same maintenance costs with no renewals within the analysis period. For the existing SH1 pavement being converted to local roads it is assumed that with a drop in all traffic types including the majority of HCV traffic, the existing pavement structure cannot be assumed to deteriorate at the same rate it does currently. Therefore no reconstruction costs are assumed for the existing pavement. The expressway pavement is assumed to have a reseal cycle of 8 years and a reconstruction cycle 25 years. It has been assumed that the first pavement reconstruction will replace the basecourse layer with an asphalt layer and the annual maintenance costs for the pavement will reduce.

8 Construction Costs

The latest expected cost estimates adopted for the PP2O project and their expected payment dates have been assumed in the economic analysis as detailed in Table 6 below:

Table 6: Expected Construction Cost & Payment Dates Assumed in Economic Analysis

Start Date	End Date	Comment	Months	Cost
1/07/2014	1/07/2014	Initial Property Purchase	0	$40,145,000
1/07/2014	31/12/2014	Design +Construction	6	$17,591,318
1/01/2015	30/06/2015	Construction	6	$16,576,955
1/07/2015	31/12/2015	Construction	6	$16,576,955
1/01/2016	30/06/2016	Construction	6	$16,576,955
1/07/2016	31/12/2016	Construction	6	$37,934,705
1/01/2017	30/06/2017	Construction	6	$35,337,705
1/07/2017	31/12/2017	Construction	6	$35,337,705
1/01/2018	1/07/2018	Construction	6	$35,337,705
		Totals	48	$251,415,000

9 Annualisation Factors

The annualisation factors used in the economic analysis have been calculated using NZTA's State Highway Traffic Data. Table 77 shows the three count sites within the PP2O project extent used for this purpose. Table8 shows the hourly time periods and annualisation factors calculated and adopted for use in the economic analysis. Note that it has been assumed that 245 weekdays and 120 weekend days (including public holidays) are included within a year.

Table 7: NZTA count stations used for annualisation factor calculations

Site Location	Site Reference	Count period
North of Waitohu River Bridge	01N00998	21st June 2010 to 27th June 2010
North of Waerenga Rd	01N01001	21st June 2010 to 27th June 2010
Marycrest	01N01011	27th February 2010 to 5th March 2010

Table8: Hourly time periods and Annualisation Factors

Time Period	Representative hrs/day in a week	Annualisation factor
Weekday AM Peak	2 (7:00am to 9:00am)	245
Weekday IP	6.5 hrs (9:00am to3:30pm)	245
Weekday PM peak	2 hrs (3:30pm to 5:30pm)	245
Weekday Off Peak/Night (0.52*IP)	13.5hrs (5:30pm to 7:00am)	245
Weekend/ Holiday Day time (1.47*IP)	7.5hrs	120
Weekend/ Holiday Night (0.38*IP)	16.5hrs	120

Figure 3 and Figure 4 show the average daily flow profile of Weekday and Weekend day for every 15 minute period across the three NZTA count stations within the project extent to give an indication of how the representative hours have been selected.

Figure 3: Peka Peka to Otaki North weekday daily flow profile (vehicles/15 min)

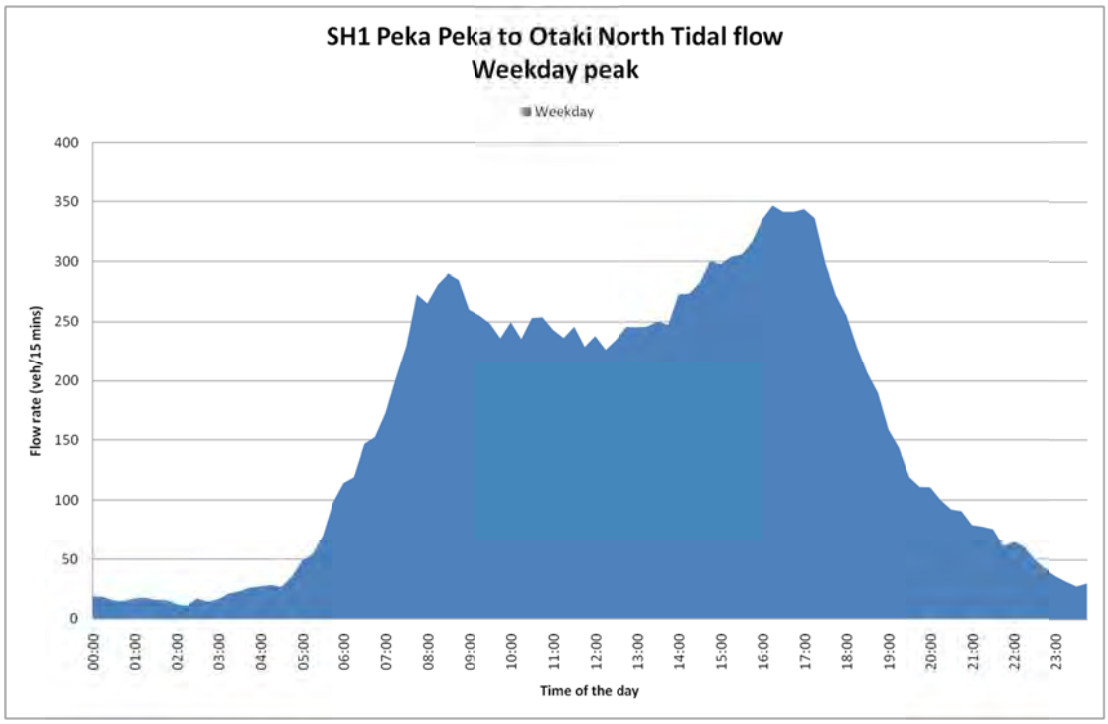
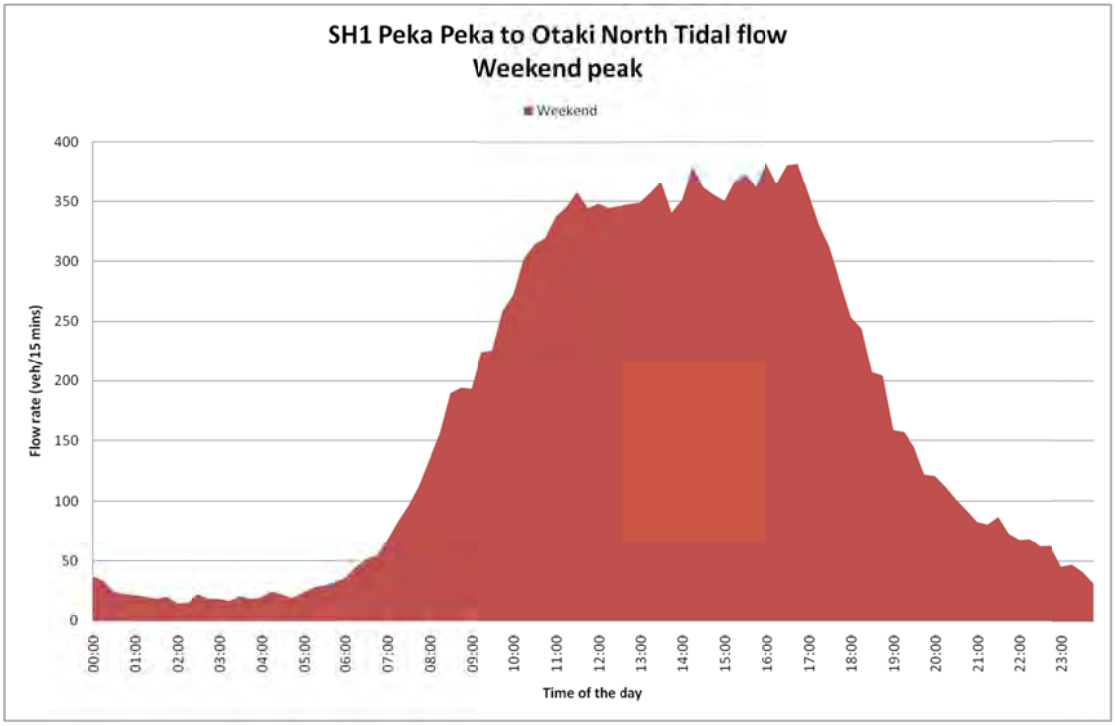


Figure 4: Peka Peka to Otaki North weekend daily flow profile (vehicles/15 min)



10 Update factors

The update factor for bringing travel time savings to 2011 values is 1.33 (EEM pA12-3). The equivalent factor for VOC (and therefore also CO2 emissions) is 1.04. Crash benefits have assumed an update factor of 1.17.

11 Benefit Summary

The expected discounted project benefits for the PP2O project are displayed in Table9 below. As discussed earlier, there are number of reasons why the project is resulting in a negative VOC benefit, however it should also be noted that the travel time benefits have included a factored interpeak to determine a weekend benefit due to this being the primary time of congestion on the network. Outside of these weekend peak periods the traffic demand on the network is relatively low and as a result there is very little congestion in the Do-minimum. A more refined assessment would require development of a weekend model.

Table9: NPV PP2O Project Benefits

Description	Benefits (NPV) ($m)
Travel Time	$57.30
VOC	-$8.16
CO_2	-$0.33
Crash Savings	$41.89
Total Benefits	**$90.71**

At the request of the external peer reviewer, the Travel Time, VOC and CO_2 transport benefits have also been reported by time period to confirm the emphasis on non-modelled period benefits. Table 10 below shows the emphasis of non-modelled period benefits is only 50%. Such results indicate that the analysis can be considered as being robust.

Table 10: 30 years NPV transportation benefits for each peak

Peak types	No. of hours per day	Benefits (NPV) ($m)	Proportion
Morning Peak	2	5.57	11%
Inter Peak	6.5	11.79	24%
Evening Peak	2	7.58	16%
Off Peak	13.5	12.73	26%
Weekend Peak	7.5	7.11	15%
Weekend off-peak	16.5	4.04	8%
Total Transportation benefits	**-**	**48.82**	**100%**

Subsequently given the above benefit streams, Table 1 has been provided to summarise the net present value (NPV) costs, benefits and an indicative BCR for the current PP2O Expressway Project as at the time of writing this report.

Table 11: NPV Costs, Benefits & Indicative BCR

Description	Costs (NPV) ($m)	Benefits (NPV) ($m)	BCR
PP2O Expressway Option 2 with Development (SC2)	$175.14	$90.71	0.5

12 Sensitivity Tests

For the purposes of this assessment, a number of sensitivity tests have been identified, some of which have been completed while others should be completed prior to finalising the SARA. The first sensitivity test completed looked at the effect of only using the WTSM medium growth matrices (excluding development). Further tests to look at changes to the construction costs have also been presented in Table 12 below.

Table 12: Sensitivity Tests

Description	Costs (NPV) ($m)	Benefits (NPV) ($m)	BCR
PP2O Expressway Option 1 WTSM medium growth (SC1)	$175.14	$63.77	0.4
10% increase in construction costs (SC2)	$192.38	$90.71	0.5
10% reduction in construction costs (SC2)	$155.10	$90.71	0.6
Neutral VOC outcome (SC2)	$175.14	$99.20	0.6
Un-calibrated Weekend Model Demands Included (SC2 + weekend)	$175.14	$109.94	0.6

The sensitivity tests that require inputs from the M2PP model or revised land use and growth forecasts from WTSM are dependent upon further work being undertaken by GWRC and NZTA. This additional work is known to be currently progressing.

13 Conclusions

The economic evaluation carried out for the PP2O project has utilised the PP2OTM SATURN model to capture transportation benefits, while a project specific crash model has also been built to determine crash cost savings. This has resulted in a BCR of 0.5 being calculated for the project. However the total BCR for the Wellington Northern RoNS package has been calculated at between 1.1 and 1.4 including wider economic benefits.

A number of sensitivity tests have been undertaken for the PP2O project, resulting in a BCR range of 0.4 to 0.6. However it should be noted that NZTA and GWRC are still working on a land use and economic growth scenario that takes account of the investment in infrastructure on the SH1 corridor. This new scenario will be used to determine what might happen to the overall package BCR and induced trips.

The transport benefits calculated have used similar assumptions to work undertaken previously to assess the PP2O project during preliminary feasibility studies. The 2009 Kapiti Strategy Study calculated a benefit stream of approximately $95m (NPV) using a manual calculation of the benefits, while the 2010 PP2O Scoping Report identified $96m used the PP2O transport model. The relative change and the refinement in the project costs from $215m, $296m and $251m respectively has resulted in a small change to the BCR, however it remains below 1 for the PP2O project in isolation.

The economics analysis documented within this memo has been externally peer reviewed by Darren Fidler (SKM). Darren was appointed by NZTA as the peer reviewer for this project and had been forwarded the transport modelling and associated economic information to undertake his review. A number of revisions and additional sensitivity tests have been completed for the study in order to make it a more robust economic assessment. A summary of the peer review correspondence is provided in the tracking sheets contained within Appendix C.

Darren is also involved in the review for the M2PP project and has been alerted to the issues associated with the use of the Do-minimum which includes the M2PP project and the land use assumptions adopted for the traffic modelling.

Appendix A

Peka Peka to Otaki SATURN model validation report

2010 Peka Peka to North Otaki Model

2010 Traffic Model Validation Report

2010 Peka Peka to North Otaki Model

2010 Traffic Model Validation Report

Opus International Consultants Limited
Wellington Office
Level 7 Majestic Centre,
100 Willis St, PO Box 12 003
Wellington, New Zealand

Telephone: +64 4 471 7000
Facsimile: +64 4 471 1397

Date: September 2010
Reference: 5-C1814.00
Status: Final

QA Status

File Location: p:\projects\5-c1814.00 peka peka to north otaki 440pn\800 modelling\810 saturn\report\peka peka to otaki saturn model validation report_v3lt_signed.docx

Revision No/Code	Date	Details
1st Issue	8th September 2010	Draft 2010 Traffic Model Validation Report
2nd Issue	22nd October 2010	Final 2010 Traffic Model Validation Report

Approval Process

Prepared By:	Hailin Hu	**Date:** 26/10/2010
Checked By:	Fraser Fleming	**Date:** 26/10/2010
Approved for Release:	David Dunlop	**Date:** 26/10/2010

Contents

Figures

Executive Summary

This document represents a key deliverable for the Peka Peka to North Otaki contract (440PN). A SATURN model has been developed for the study area initially based on the trip demands of Greater Wellington Regional Council's (GWRC), Wellington Transport Strategy Model (WTSM). This trip demand model was developed in EMME/2, with base year models for the weekday AM Peak, Inter peak and PM peak hours. The base year SATURN models has refined the zone structure to represent the existing land use in more detail than the representation in WTSM.

The matrices for the 2010 SATURN model are interpolated from cordon matrices extracted from the re-validated 2006 WTSM and the forecast WTSM 2011 model.

The models were calibrated to achieve the validation levels required by the New Zealand Transport Agency (NZTA) Economic Evaluation Manual (EEM) and the UK Design Manual for Roads and Bridges (DMRB). Validation of the model was conducted using the following categories:

- Turning flow differences – using absolute and percentage differences, regression, GEH statistics, and root mean squared error for the study area;
- Journey time differences; and
- Intersection turning delays;
- Select link analysis to check routing patterns;
- Model convergence and stability –the number of iterations to reach convergence, the percentage of assigned links with changes in flows over successive iterations of less than 5 % and variation between the minimum cost versus the real cost (the normalised cost – δ).

An extensive data collection exercise was undertaken in July 2010. This included light / HCV classified turning counts, side road delay surveys, travel time surveys on State Highway 1, origin destination number plate surveys in Otaki centre and video camera turning count surveys. All surveys where carried out for the peak hours of 07.00 to 09.00, 11.00 to 13.00 and 16.00 to 18.00.

The modelled flows show an excellent correlation with the observed data and meet criteria for the RMSE and regression analysis. The GEH statistic is used for comparison of individual link flows because it accounts for the variance in the differences as opposed to simply comparing magnitude of the difference to the observed flow. The SATURN models are meeting both EEM and DMRB criteria for the GEH statistic in each of the AM Peak, Inter peak and PM Peak models. The R^2 statistics exceed 85% for the study area. The RMSE statistic, which measures the variation over the whole data set, is less than 30 for each of the peak hour models where the EEM criterion is 30 or less. Turning delays match well with observed delays and routing in the model is logical.

The model shows a very good correlation with observed travel times on State Highway One.

In conclusion, this report has demonstrated that the models developed for the study fully conform to EEM and DMRB defined validation criteria, in terms of modelled traffic flows, delays and journey times and as such it is considered appropriate for use in the next stages of this project to forecast future years and option test various schemes. The models have been peer reviewed by SKM and their final report can be found in the Appendices.

1 Introduction

Opus International Consultants Ltd (Opus) was commissioned by the New Zealand Transport Agency (NZTA) to develop a State High One (SH1) corridor SATURN model for the study area as part of the Peka Peka Road to North Otaki, Road of National Significant (RoNs) project. This includes a base year model (2010) and forecast year models (2016 and 2026) for the purpose of existing traffic analysis and future improvement investigations.

1.1 Background

The 2010 Peka Peka to Otaki Traffic Model (PP2OTM) is built for two user classes (cars and HCV's separately based on passenger car units). Heavy Commercial Vehicles (HCVs) are defined as per the NZTA vehicle classification schedule and are considered to be classes three and above. Passenger car units are a single measure by which all vehicles types can be represented in the model. Cars or light vehicles take up less road space than HCVs and as such all HCVs are multiplied by a factor of two to convert them to passenger car units thus modelling their higher road space usage. In developing the 2010 model it was decided that HCV's would be modelled separately in the base and future year models to give better control of information used for the assessment of future year schemes.

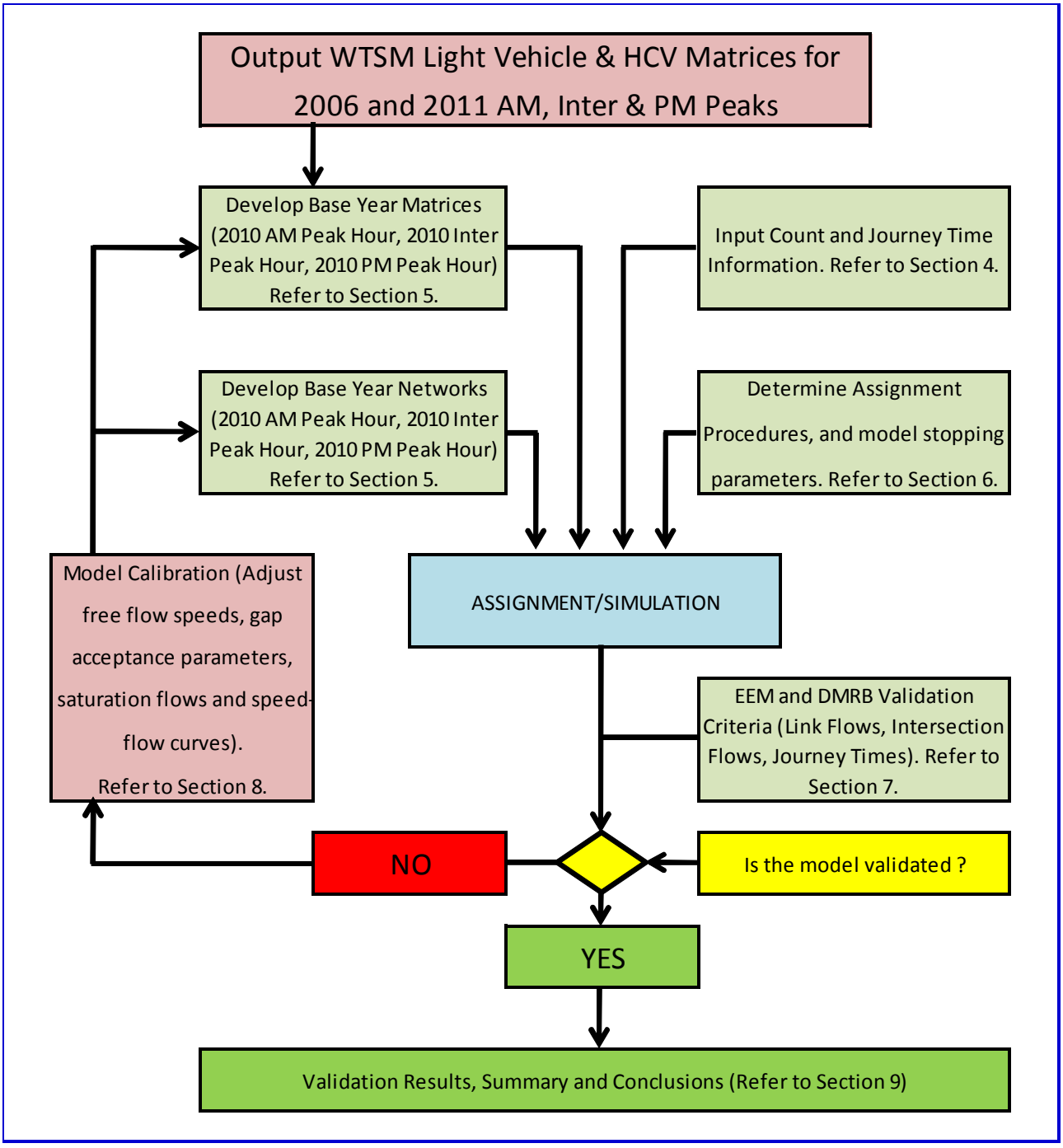
SATURN Model validation

The SATURN base models will be calibrated and validated against observed traffic flows, turning movements, turning delays and travel time data. As the model covers a relatively simplistic corridor and has limited route choice available it has been decided to validate the model to the tighter DMRB criteria as well as the EEM required by NZTA.

2 Method

The model created for this study was built using the SATURN suite of software and aimed to provide a more locally refined level of detail than WTSM. Figure 2-1 illustrates the basic process used to develop the base year models with a focus on providing a highly calibrated representation of current traffic patterns on the modelled network:

Figure 2-1: Basic Steps in Developing Base Year Models



WTSM has been cordoned down to cover the area of the PP2OTM. This cordoning process takes the larger WTSM trip matrices covering the whole of the Wellington Region from Miramar to Masterton and Otaki and reduces them down to cover only the study area from Peka Peka Road to north of Otaki. The relevant matrices have been output from WTSM for conversion to SATURN format. The conversion process has been carried out before as part of several previous studies and, as such, this has been readily accomplished for the PP2OTM 2010 model validation study. This process converted trips from EMME/2 to SATURN format; however, it resulted in a matrix based on the very coarse EMME/2 zoning system.

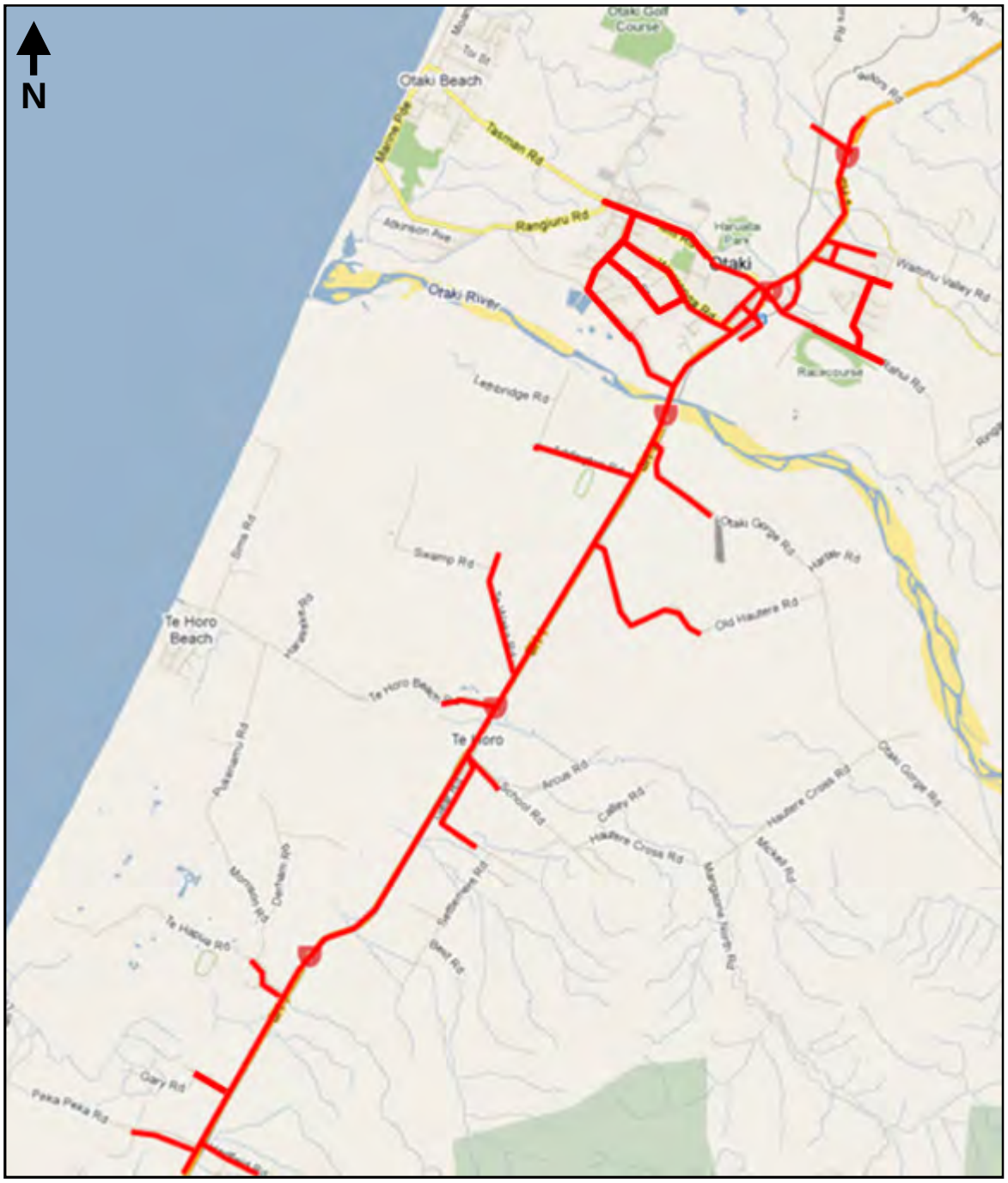
To convert the EMME/2 zoning system to the more refined SATURN zoning system an independent zone equivalence table for both light and HCV matrices was developed. This zone equivalence table relates the zones in WTSM to the zones in SATURN and divided the trips within the WTSM zones into the SATURN zones. This process of division for both the light and HCV matrices was done by a zone disaggregation process by means of a trip generation regression method which was developed by Sinclair Knight Merz (SKM). This is a linear regression model that takes consideration of mesh block land use information which can be generated from Geographical Intelligent System (GIS). The trips of each origin to destination pair in the WTSM zones have been accurately distributed to the more refined SATURN zones.

3 Model Structure

3.1 Study Area

The SATURN model includes the SH1 corridor from Peka Peka Road in the south to Taylors Road in the north. This has been based on a linkage with the Kapiti SATURN model in the south at Peka Peka Road and the northern extent of the study area at Taylors Road. This model will be used to focuses on the SH1 Roads of National Significance (RoNS) project, associated links east/west and alternative routes along the north/south corridor. This model extent will allow the testing of alternative intersection locations, intersection form, and connectivity options (see Figure 3-1).

Figure 3-1: Study Area



3.2 Model Platform

The project model has been developed using SATURN (Simulation and Assignment of Traffic to Urban Road Networks) version 10.9.17. SATURN is a suite of flexible network analysis programs developed at the Institute for Transport Studies, University of Leeds and distributed by WS Atkins since 1981.

SATURN can function as a conventional traffic assignment model and also as a pure intersection simulation model. For this particular project, SATURN is ideally suited as it is able to re-assign traffic due to demand changes and / or network changes and, at the same time, simulate the performance of the intersections within the study area.

The network is coded using "simulation" coding which allows the performance of the intersections to be modelled in addition to link capacities and link delays. The detail of the intersection modelling is key to the accuracy of the model. Most links have been coded assuming a fixed link speed (the traffic speed is independent of the volume on the link). The rural parts of SH1 have been coded with standard speed-flow curves thus simulating the impact of potential link delay on these routes.

The part with speed flow curves in particular is SH1 in both directions south of Riverbank Road and north of Waitohu Valley Road. Speed-flow curves have been applied at these locations as these links represent parts of the network where the free-flow link movements could potentially break down in the peaks due to congestion.

3.3 Demand Model

The Greater Wellington Regional Council's (GWRC) Wellington Transport Strategy Model (WTSM) has been used as the primary demand model for this project. WTSM has been updated to a base year of 2006 to coincide with the release of demographic data collected as part of the 2006 census. Two-hour separate light vehicle and heavy commercial vehicle (HCV) base year 2006 matrices and 2011 forecast matrices for the weekday morning peak, inter peak and evening peak periods were supplied by GWRC. These were subsequently disaggregated to the SATURN zoning system, using factors based on demographics within the zones for the light and HCV matrices.

The disaggregation of the WTSM zone system to the PP2OTM zone system is necessary due to the size of the zones in WTSM. WTSM is designed to be a strategic model to capture the main movements between urban areas but not necessarily the movements within urban areas. Consequently the zones in WTSM covering the study area are relatively large. In order to model those movements within urban areas the zone system in PP2OTM needs to be refined to allow for smaller zone areas thus allowing trips to move from zone to zone that previously would have been within a single WTSM zone.

3.4 Zone Structure

The matrices were extracted from WTSM and the links, which the matrices were 'cut' at, have become the traversal 'gates' or 'external zones'.

Within the study area there were 5 original 'coarse' WTSM zones. All these zones have been 'disaggregated' using factors developed from a comparison of WTSM demographic data and zoning into the PP2OTM zoning system. The resulting zones within the study area are shown in Figure 3-2 and the WTSM zone system can be found in Appendix A.

Figure 3-2: SATURN Zoning System

The SATURN model developed for this study has a total of 27 zones. This zone system has been devised to provide a better representation of the volume and location of traffic entering the road network. Where there was one large zone in the WTSM zoning system, the PP2OTM system has been refined to provide up to 8 smaller zones. With many of the new PP2OTM zones having more than one zone connector this produces a more detailed representation of the traffic origins and destinations within the modelled area and in particular the Otaki town area.

3.5 Basis of the Network Model

The base SATURN network is shown in Figure 3-3 and Figure 3-4

Figure 3-3: 2010 Base Year SATURN Network – Whole Network

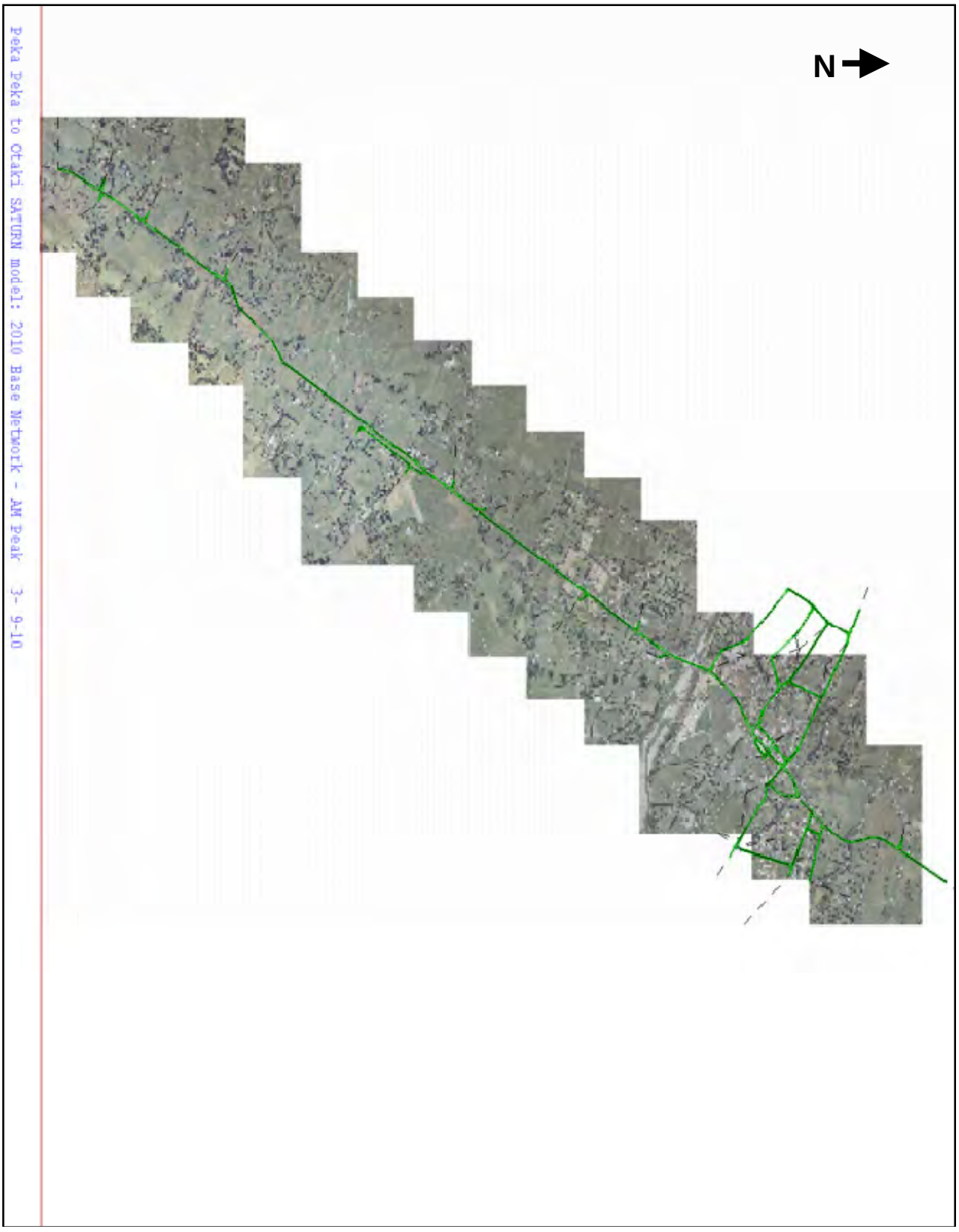


Figure 3-4: 2010 Base Year SATURN Network – Otaki Town Centre

4 Traffic Information

4.1 Traffic Counts

A relatively extensive data collection exercise was undertaken for the study area. This included:

- Light and HCV classified turning count surveys;
- Side road turning delay surveys;
- Travel time surveys;
- Origin and destination number plate surveys;
- Video camera surveys; and
- SH1 crossing pedestrian count.

Figure 4-1 below details the location of the various surveys undertaken. All data was adjusted for seasonality, producing an average flow for the year. The seasonality factor used is shown in following Table 4-1 and was taken from the WTSM report Technical Note 9.0 – Survey processing, Table 7.1 page 46.

Figure 4-1: Location of Traffic Count Information within Study Area

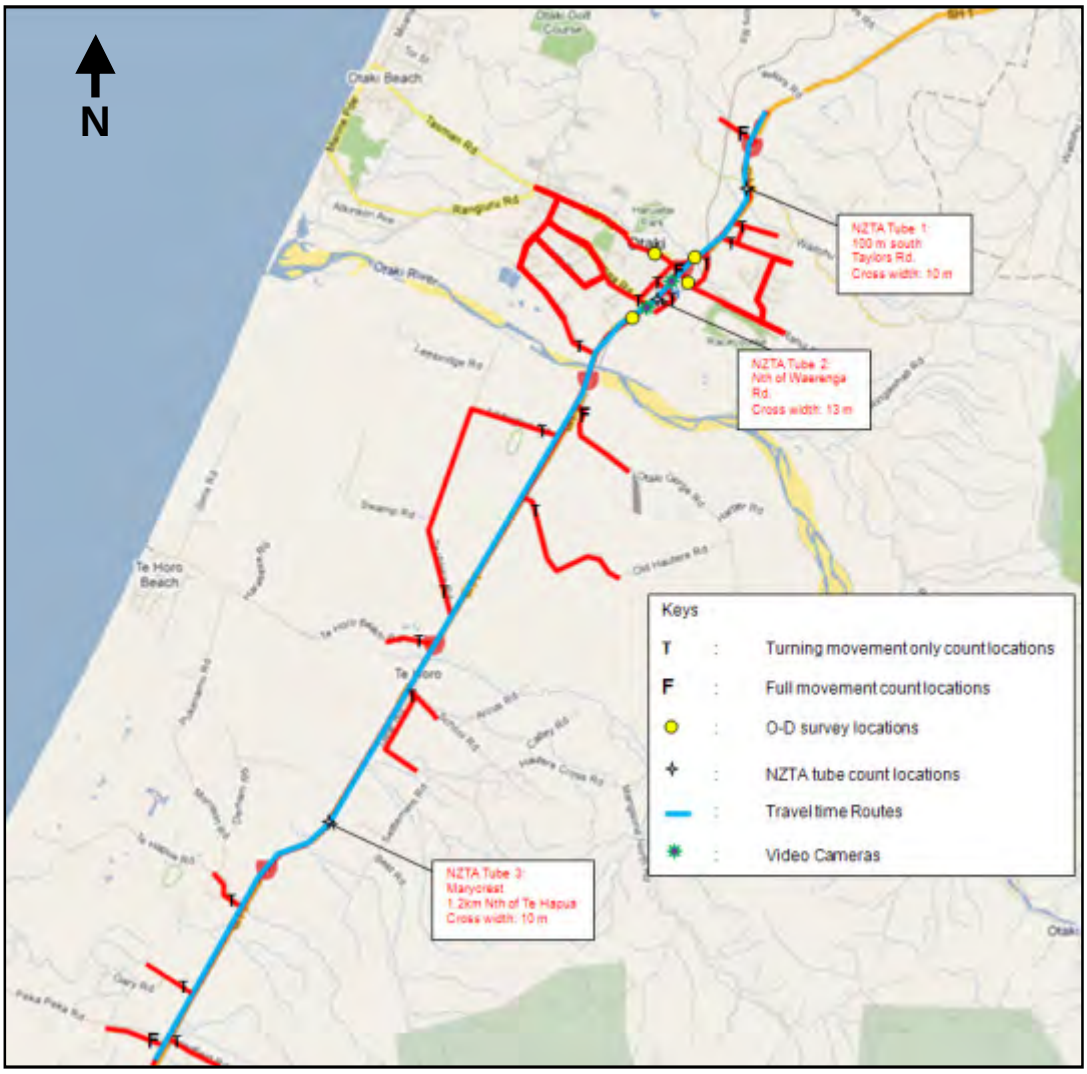


Table 4-1: Seasonal adjust factors (GWRC, 2003)

Month	Weekday Seasonal factor	Weekday	Weekend Day	Weekdays	Weekend	Days	Working Days Average
April	1.0240898	178,208	144,986	22	8	20	181,530
August	0.9974967	182,959	154,605	23	8	23	182,959
December	0.9899863	184,347	157,041	22	9	20	187,077
February	0.9905343	184,245	149,836	21	7	20	185,966
January	1.0960824	166,503	138,173	24	7	21	170,550
July	1.0016905	182,193	154,409	23	8	23	182,193
June	0.9904913	184,253	155,825	21	9	20	185,674
March	0.9770175	186,794	152,554	22	9	21	188,424
May	1.0015531	182,218	155,656	24	7	24	182,218
November	0.9485302	192,404	160,589	22	8	22	192,404
October	0.9995235	182,588	152,702	24	7	23	183,887
September	0.9862680	185,042	152,095	21	9	21	185,042
Average Whole Year		182,501	152,593	269	96	258	183,966
Survey Period		185,688	154,618	110	40	106	186,878

Average month count = manual count x 1.0016905 (July Seasonality factor)

4.2 Full Classified Turning Counts

Turning count surveys where undertaken throughout the modelled network. These observations were a mixture of full turning count surveys and turn only surveys (i.e. not observing the through movements). The turn only surveys where undertaken on the State Highway and were done in such a way as to enable the through movements to be calculated from adjacent full turning count locations. Turning count observations were made on Wednesday the 21st and Thursday the 22nd of July 2010 between the hours of 07.00 to 09.00, 11.00 to 1300 and 16.00 to 18.00 at the following locations:

- SH1 / Taylors Road (full);
- SH1 / Waitohu Valley road (turns only);
- SH1 / Te Manuao Road (turns only);
- SH1 / County Road (turns only);
- SH1 / Mill Road / Rahui Road (full);
- SH1 / Arthur Street (turns only);
- SH1 / Waerenga Road (turns only) ;
- SH1 / Riverbank Road (turns only);
- SH1 / Otaki Gorge Road (full);
- SH1 / Addington Road (turns only);
- SH1 / Old Hautere Road (turns only);
- SH1 / Te Waka Road (turns only);
- SH1 / Te Horo Beach Road (turns only);
- SH1 / School Road (turns only);
- SH1 / Te Hapue Road (turns only);
- SH1 / Te Kowhai Road (turns only);
- SH1 / Hadfield Road (turns only);

- SH1 / Peka Peka Road (full).

4.3 Side Road Turning Delay Surveys

Turning delays where measured on the side roads at the same time as the turning count information was completed. This was done for all the above intersections apart from Taylors Road, Otaki Gorge Road and Peka Peka Road. The measurement was based on the time that the first queuing vehicles waited at the stop line before exiting the side road.

4.4 Travel Time Surveys

Travel time surveys where undertaken on Tuesday the 20th and Thursday the 22nd of July 2010. Two cars where used in opposing directions to increase the number of observations obtained in the survey period. The route was:

- State Highway 1 – Peka Peka Road through Otaki up to and including Taylors Road;

In the AM peak six observations were made northbound and five southbound while in the inter peak seven observations were made in each direction. In the PM peak the nine observations where made northbound and ten southbound.

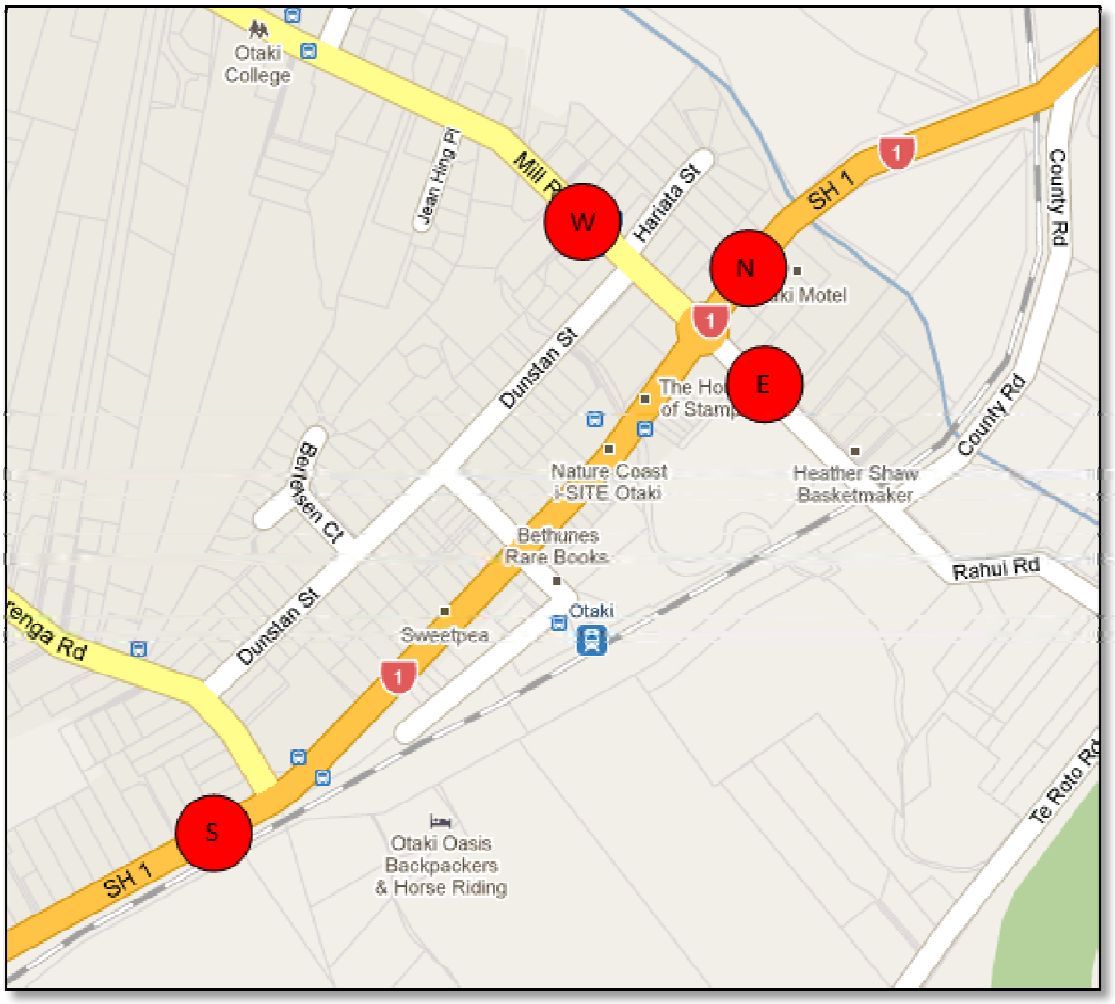
The travel time survey proved to be statistically robust in all peak periods and in each direction, with a 99% significant confidence level and an associated 5% precision level. Detailed calculations can be found in Appendix B.

4.5 Origin and Destination Number Plate Surveys

Number plate origin and destination surveys were undertaken on Tuesday the 30th of June for the peak periods of 07.00 to 09.00, 11.00 to 13.00 and 16.00 to 18.00.

The locations of observations were the eastern and northern arms of the Mill Road roundabout; west of Dunstan Street on Mill Road plus State Highway One south of Waerenga Road as shown in the following Figure 4-2. This enabled analysis to capture the level of through trips in Otaki.

Figure 4-2: Otaki town centre O-D survey location diagram



The number plate data was input to an Opus developed matching excel spreadsheet and initially the software gained a matching rate of 57% in the AM peak, 56% in the inter peak and 53% in the PM peak. Considering that the AM and PM peaks involved low light conditions with the surveys having happened in winter we considered this to be a reasonable result.

The software only unites exact matches and there are a number of situations in number plate observations which could be a match but have been inaccurately noted by the enumerator. Examples of this would include the number 0 and the letter O, the number 5 and the letter S etc. After manual adjustment of such enumerator errors the matching rate was increased to 78% in the AM peak, 86% in the inter peak and 79% in the PM peak.

4.6 Video Camera Surveys

Kapiti Coast District Council operates two video surveillance cameras in Otaki and Opus where given the use of both covering the survey periods. One camera was focused on the Mill Road roundabout and the other was focused on the Waerenga Road intersection with SH1. The cameras recorded between Monday the 20th and Thursday the 29th of July from before 07.00 till after 18.00.

Analysis of the data enabled turning counts to be checked. A comparison between the turning count day (the 20th of July) and the average weekday was analysed during the peak hours. The average weekday is summarised over the following 5 days:

- Tuesday 20th July 2010
- Wednesday 21st July 2010
- Thursday 22nd July 2010
- Tuesday 27th July 2010
- Wednesday 28th July 2010

The following summary Table 4-2 shows that the surveys have been undertaken on a representative weekday.

Table 4-2: Video survey and turning count survey comparison

Video Survey (No. of Vehs)		Direction	Manual Count	Average Weekday	99% Confidence Interval	Representative Day?
AM Peak	SH1 South of Waerenga Rd	SB	463	458	23	Yes
		NB	500	498	23	Yes
	SH1 North of Waerenga Rd	SB	483	472	24	Yes
		NB	493	504	20	Yes
	SH1 South of Mill Rd	SB	469	507	67	Yes
		NB	517	506	56	Yes
Inter Peak	SH1 South of Waerenga Rd	SB	446	473	32	Yes
		NB	429	443	20	Yes
	SH1 North of Waerenga Rd	SB	457	467	34	Yes
		NB	429	444	18	Yes
	SH1 South of Mill Rd	SB	457	491	61	Yes
		NB	429	447	28	Yes
PM Peak	SH1 South of Waerenga Rd	SB	652	655	18	Yes
		NB	617	624	28	Yes
	SH1 North of Waerenga Rd	SB	614	619	25	Yes
		NB	621	624	38	Yes
	SH1 South of Mill Rd	SB	614	639	56	Yes
		NB	621	693	72	Yes

Additional full turning movement delay was also obtained from the video survey data at Waerenga Rd/SH1 and Mill Rd/SH1 intersections. The data was collected for Tuesday the 20th and Wednesday the 21st of July 2010 during the peak periods 07.00 to 09.00, 11.00 to 13.00 and 16.00 to 18.00 and has been sued in the model validation process.

4.7 SH1 crossing Pedestrian Counts

Surveys of pedestrians crossing SH1 were undertaken within Otaki town centre. The numbers of pedestrians, who were crossing SH1 between Riverbank Road and Waitohu Valley Road, was recorded. Pedestrian count observations were made on Wednesday the 21st and Thursday the 22nd of July 2010 between the peak periods 07.00 to 09.00, 11.00 to 13.00 and 16.00 to 18.00. The following Table 4-3 summarised the total pedestrian demands of crossing SH1 during the peak periods.

Table 4-3: Pedestrian crossing SH1 demands summary in Otaki town centre

Otaki Town centre	No. of Pedestrians Crossing SH1
AM Peak (07:00 - 09:00)	71
Inter Peak (11:00 - 13:00)	177
PM Peak (16:00 - 18:00)	111

4.8 Future data collections

One of the key time periods for this network is at the weekend and on the Monday evening of a public holiday weekend. At this stage a model has not been developed for these periods but it could be considered for sensitivity testing. In order to do this the following data would need collecting:

- Typical weekend traffic flow, origin and destination data, travel time, turning delay and pedestrian demand etc,
- Public holiday weekend traffic flow, origin and destination data, travel time, turning delay and pedestrian demand etc,
- Retail demand patterns.

Some of the above data has already been collected for other studies in the area such as Friday and Monday public holiday turning counts at the Mill Road roundabout and travel times up and down SH1 between Waerenga Road and South Manakau Road. Car parking demand surveys were also completed for the bank holiday weekend.

5 Trip Matrices

5.1 WTSM Model Matrices

GWRC supplied the base year matrices from the validated 2006 WTSM model for the AM Peak, Inter peak and PM peak periods. GWRC also provided Opus with 2011 matrices developed in line with RLTS assumptions. From linear interpolation a 2010 WTSM matrix was developed. Details are given below of the conversion process from EMME to SATURN format and WTSM to PP2OTM zone systems.

The first process involved the conversion of the matrices from EMME/2 format to SATURN format for the three individual time periods to be modelled. This is a straight forward process that can be easily done using the SATURN module MX which is designed for matrix manipulation.

5.2 Traffic Flow Profiles

The second process was the conversion from the WTSM modelled time periods to the PP2OTM modelled time periods. The WTSM matrices relate to the following time periods:

- AM Peak: 07:00 - 09:00
- Inter peak: 2 hour average inter peak
- PM Peak: 16:00 - 18:00

For each time period being modelled the WTSM matrices were converted to single hour matrices. Analysis of traffic count information over the two hour WTSM period revealed the following factors for the peak single hour which were used to factor the WTSM 2 hour matrices to WTSM peak hour matrices:

- AM Peak hour – 0.55;
- Inter peak hour – 0.52; and
- PM Peak Hour – 0.54.

The models were therefore validated for the peak hour time periods listed below:

- AM Peak hour – 7:45am to 8:45am;
- Inter peak – 11.00am to 12.00pm; and
- PM Peak Hour – 16:30pm to 17:30pm.

These times were derived from the up to date count information in order to ascertain the peak hour for the state highway network and the local road network.

5.3 Disaggregation to Project Model Zones

5.3.1 Light Vehicles

The third step involved the conversion from the coarser WTSM zone system to the more refined PP2OTM zone system.

This methodology develops a correspondence between:

- The 2006 WTSM zone system;
- The 2010 PP2OTM zone system; and
- 2006 mesh blocks from Statistics New Zealand.

All of the 5 WTSM zones are in the PP2OTM simulation area. WTSM zones outside the PP2OTM zone system have been amalgamated in to the two external zones in PP2OTM - zone 1 (SH1 to the south) and zone 27 (SH1 to the north).

For each of the mesh blocks in the WTSM and PP2OTM zone systems New Zealand Statistical information was extracted in the form of employment and population data and grouped in to four categories:

- Emp 1 – retail and services employees in each mesh block;
- Emp 2 – manufacturing, transport and communications and other employees in each mesh block (includes those who lived and worked in the same mesh block);
- Pop 1 – employed population (either part time or full time) in each mesh block; and
- Pop 2 – unemployed population in each mesh block.

Each of these pieces of information for the mesh blocks was used in a linear regression formula below:

$$Trips = (m_1 \times X_1) + (m_2 \times X_2) + (m_3 \times X_3) + (m_4 \times X_4)$$

Where the *Trips* equals the number of vehicle movements to or from each mesh block, the X_i are the land use characteristics detailed above and the m_i are the coefficients calculated to give the closest fit between the land use data and trips between each mesh block in the simulation area for each time period. The coefficients are therefore calculated for the three time periods separately (AM, inter and PM), lights and HCV separately and for origin and destinations separately. The development of the coefficients was previously done by SKM for the Transmission Gully model and as such there was no requirement to update the information for this model.

The R^2 parameter is used to give an indication of the goodness of fit between the trips ends from WTSM and those calculated by the regression formula above. The R^2 was over 95% for all time periods, lights and HCV's and origins and destinations suggesting an excellent fit with the data.

The calculated coefficients for each mesh block were used to create a weighting. The weighting for each user class, time period and direction of travel where then summed in to WTSM zones giving a proportional split of movements within WTSM zones relating to each mesh block. The same was completed for PP2OTM zones and the proportional relationship between the weightings where used to produce splits from WTSM zone to PP2OTM zone.

The loading points for the new zones were chosen to reflect actual loading points on the existing local road network.

With the bigger zones in WTSM being split into smaller PP2OTM zones the issue of WTSM intra-zonals has been raised. Intra-zonal trips in WTSM (i.e. trips which have both an origin and a destination within a WTSM zone and therefore do not get assigned to the WTSM network) will become local trips between the PP2OTM zones that represent that larger WTSM zone. The disaggregation process discussed above allows for the introduction of PP2OTM intra-zonals by applying a percentage of the WTSM trips to each of the PP2OTM zones and thus creating trips to and from each of the PP2OTM zones and also between PP2OTM zones.

5.3.2 Commercial Vehicles

Commercial vehicles where disaggregated by the same methodology as the light vehicles. As with the light vehicle methodology the relationship involved data based on employment categories including retail, services, manufacturing, transport, communications and other employment categories. This allows for some element of HCV generation and attraction based on those employment land-uses. The HCV matrices are then multiplied by 2 in order to convert from number of vehicles to pcu's.

5.4 Matrix Estimation

The two external zones at the southern and northern extremities of the PP2OTM have been checked to ensure the correct level of traffic is entering and exiting the model. The figures in the model where not found to be replicating the existing traffic demand at the extremities of the model. The level of discrepancy between the observed and modelled figures was relatively high due to the coarse WTSM zone system in the study area and the average representation of the HCV's in particular in WTSM in the study area. The light vehicles need a factor of approximately 75% while the HCV needed factoring by approximately 30%. Table 5-1 below shows the matrix totals and the impact on the matrix totals that the adjustments has had.

Table 5-1: Matrix totals comparison between WTSM and PP2OTM.

Total Trips (pcu)		WTSM	PP2OTM	Change %
AM	Cars	2787.2	1990.8	71%
	HCVs	1055.6	287.1	27%
IP	Cars	2158.9	1690.1	78%
	HCVs	1020.9	352.4	35%
PM	Cars	3129.7	2469.6	79%
	HCVs	848.5	187.1	22%

In order to remove the inaccuracy of the two external zones, matrix estimation was used. Matrix estimation is a tool in the SATURN software package which has been applied to the disaggregated PP2OTM matrices based on the 2010 manual count. The matrix estimation was done in separated user classes (cars and HCVs) at the following locations:

- SH1 northbound at south of Peka Peka Rd,
- SH1 southbound at south of Peka Peka Rd,
- SH1 northbound at north of Taylors Rd,
- SH1 southbound at north of Taylors Rd.

The following Table 5-2 shows the link flow used for the matrix estimation.

Table 5-2: ME used manual count link flow

Trips for ME (pcu)		SH1 at south of Peka Peka Rd			SH1 at north of Taylors Rd		
Class	Direction	AM	IP	PM	AM	IP	PM
Light	Northbound	442	389	708	390	334	494
	Southbound	593	423	626	466	320	490
HCV	Northbound	106	92	44	70	98	48
	Southbound	74	100	50	80	120	72

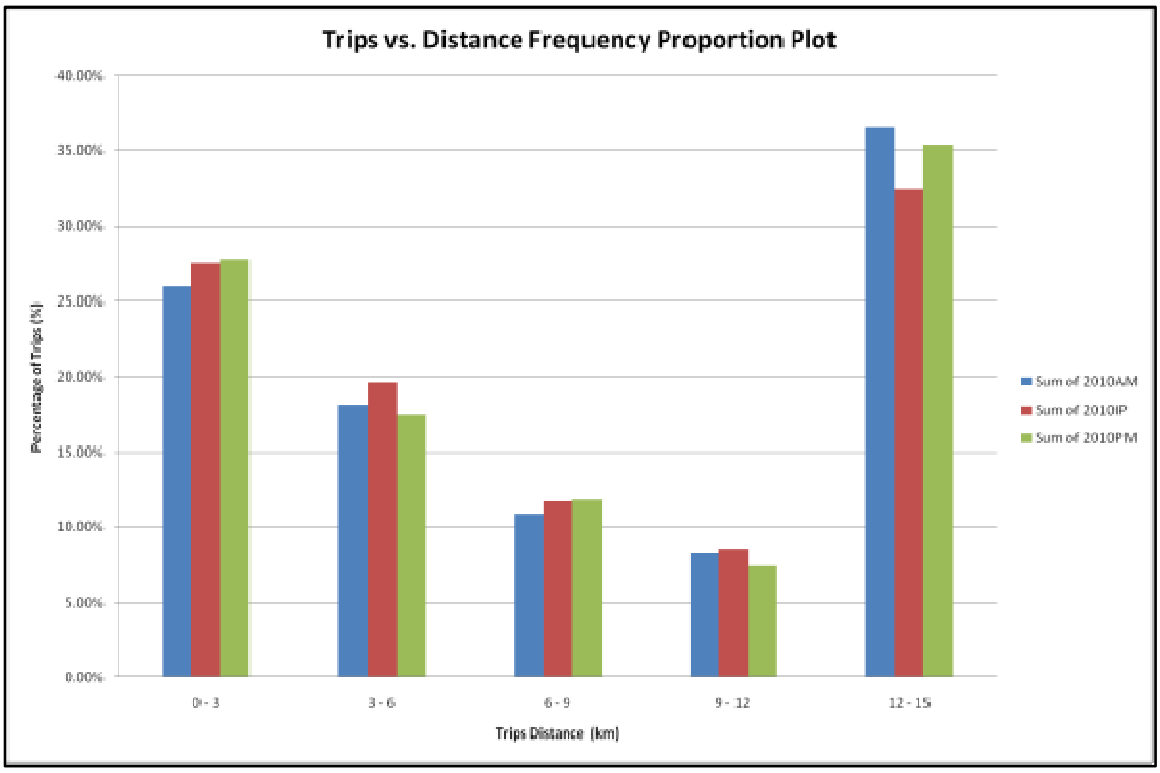
The comparison between the matrices disaggregated from WTSM and the post-ME matrices shows there was marginal difference in terms of the trips patterns. The ME process did not create an unexpected trip distribution, the only change will be the scale of the trips level.

The trip O-D profile plots for both the disaggregated WTSM matrices and the ME PP2OTM matrices can be found in Appendix C.

Trip distance frequencies have been checked and are shown in the following **Error! Reference source not found.**. The dominant movements in the model are the long distance (12km-15km) trips through the network which contributes to about one third for all peaks. The short distance trips (<3km), which are mainly driven by Otaki town centre movements, also contribute over 25% of the total trips. There is a larger proportion of town centre trips in the inter peak than the one in the morning, and a lower proportion of through trips in the inter peak than in the morning and afternoon peak.

Table 5-3: 2010 Base PP2OTM Trips-Distance Frequency proportion plot

Table 5-3: 2010 Base PP2OTM Trips-Distance Frequency proportion plot

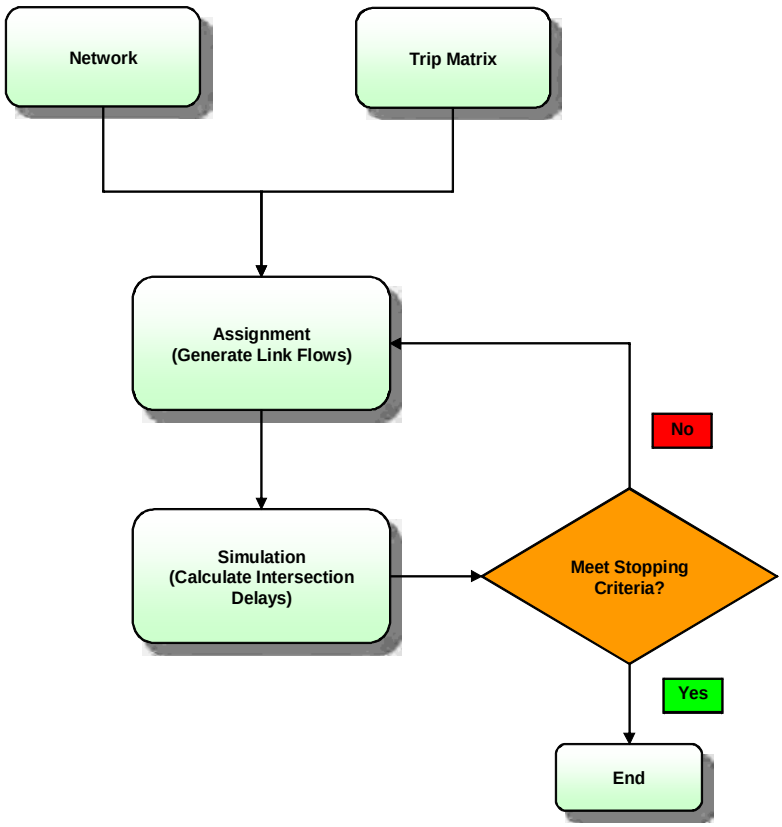


6 Assignment Procedure

6.1 Overview

The general form of the SATURN assignment procedure is shown schematically in Figure 6-1.

Figure 6-1: Assignment Procedure



6.2 Assignment Technique

The trip matrices have been assigned to the network using the Wardrop Equilibrium Assignment which is specifically designed for a congested network or a network without much route choice such as Peka Peka to Otaki State Highway corridor, and assumes that all users perceive travel cost in an identical manner.

Wardrop's Principle of traffic equilibrium may be stated as:

Traffic arranges itself on congested networks such that the cost of travel on all routes used between each O-D pair is equal to the minimum cost of travel and all unused routes have equal or greater cost.

Within each model run the traffic between any origin and destination pair can use several routes to get from A to B which is known as multi-routing. The cost of the traffic to use one route as compared to another route is calculated and is called the generalised cost. The generalised cost takes in to account values of time and distance and uses the number of vehicles on each route and the congestion and delays incurred on the two competing routes. The model is said to be converged when all possible routes between all origins and destinations have reached a level of equilibrium meaning that between A and B the two or more possible routes have the same generalised cost for the journey.

6.3 Generalised Cost Coefficients

The assignment technique adopted assumes that individual drivers seek to minimise their travel cost. The assumed "Cost" for the assignments is related to both travel time and distance, and as such is known as "Generalised Cost", as opposed to pure cost, which relates only to time. The Generalised Cost, as is used in the model assignments for the PP2OTM, in SATURN is calculated in the following general form:

$$C = a_1 T + a_2 D + \Sigma b_k d_k$$

Where	C	=	The cost on a link
	T	=	The link travel time in minutes
	D	=	The link distance in kilometre
	a_1	=	The value of time defined as cents per minute
	a_2	=	The value of distance defined as cents per kilometre
	$\Sigma b_k d_k$	=	An element of cost for road tolling (not used in the base assignments)

The Generalised Cost function used for all three SATURN base year models is:

G = 1x T + 0.3D for light vehicles and

G = 1x T + 0.6D for HCVs

These figures were derived for the Transmission Gully project and were thought to be equally applicable for the Peka Peka to Otaki Study area.

The travel time is the most influential factor in route selection in peak periods. This is because motorists, especially in peak hours tend to adopt a route that takes the shortest amount of time to get to their destination rather than taking the shortest route by distance. Using the values of time and cost defined above, means that two alternative routes for light vehicles would have similar travel costs, and therefore be assigned equal numbers of trips, if one route was 3.33 kilometres longer than the other but was one minute quicker. Similarly for the HCV's two alternative routes would have similar travel costs, and therefore be assigned equal numbers of trips, if one route was 1.66 kilometres longer than the other but was one minute quicker.

Although the ratio of the time / distance may vary depending on the peak period and time of the day, the same values were used for all peak periods in this project.

6.4 Stopping Criteria

The assignment process in SATURN is carried out for a variable number of iterations until one or more stopping criteria are satisfied. This ensures that the model has stabilised before proceeding into any further analysis. The following stopping criteria have been adopted:

- Maximum number of iterations equal to ninety nine; and
- 97% of assigned links whose assigned flow changes by less than 5% in the final assignment.

In each case the models were converging and stopping by meeting the second of the two criteria. The models have also been validated against the criteria presented in the EEM and the DMRB. This is discussed in Section 7.

7 Validation Criteria

The NZTA Economic Evaluation Manual provides a series of criteria that have been used to validate the base year SATURN model for each of the three time periods. The results of the model match with the criteria used are included in Section 9. They are categorised as follows:

- Link Flows – the modelled flows were compared against the observed flows for the study area, for each of the three time periods. The link flows were compared using the following:

  - GEH Statistic - The GEH statistic was assessed for each count in the study area. The GEH statistic is a form of the Chi-square measure of fit, and is defined as:

$$GEH = [(V2 - V1)^2 / (0.5 (V1 + V2)]^{0.5}$$

Where V1 = Observed flow (vehicle/ hour)

V2 = Modelled flow (vehicle/ hour)

The GEH figure is considered a more useful measure of the performance of a model in a particular area than absolute or percentage differences in flows. A small absolute difference may lead to a large percentage difference on a lightly trafficked road, and vice versa for roads with greater flows, whereas the GEH statistic "dampens" the effects of both absolute and percentage differences by accounting for the magnitude of the observed flow and the magnitude of the difference. The criteria adopted for this project are in accordance with the EEM and are defined below:

- ♦ At least 60% of individual link flows should have a GEH less than 5;
- ♦ At least 95% of individual link flows should have a GEH less than 10; and,
- ♦ All individual link flows should have GEH less than 12.

  - Scatter Plots and Regression analysis – scatter plots with the line for the coefficient of determination is a requirement in the EEM. The coefficient of determination (R^2) is also shown for each plot. The guidelines set out in the Economic Evaluation Manual (EEM) suggest that R^2 values should be generally greater than 0.85 across the study area. These were the criteria adopted for these models;

  - Root Mean Squared Error (RMSE) – unlike the GEH statistic that analyses each error relative to each observed count, the Root Mean Squared error looks at the error in relation to the total number of counts. The RMSE is defined as:

$$RMSE = \{ [\Sigma(V2 - V1)^2 /(Counts - 1)]^{0.5} / [\Sigma V1 /Counts]\}*100$$

Where V1 = Observed flow (vehicle/ hour)

V2 = modelled flow (vehicle/ hour)

The RMSE has been calculated for the study area for each of the three time periods. The criterion adopted was that the RMSE must be less than 30.

- Journey Times – the modelled journey times were compared against the observed journey times for the State Highway One route throughout the study area.

- Turning flows have been checked in the model validation process. The EEM criterion is that the modelled flows are within 30% of the observed flows.

- Model Convergence and Stability – the models are considered to be stable and suitable for modelling future options if they meet the criteria in the EEM. The criteria for model convergence included those stipulated in the EEM are presented below:

  - Number of iteration loops to reach convergence (as mentioned previously, the models converged well before the maximum number of iterations stipulated as one of the stopping criteria);

  - 97% of assigned links whose assigned flows changes by less than 5% in the final assignment; and

  - Normalised gap ( ) of less than 1% in the final assignment.

In the initial discussions with the peer reviewer it was agreed that a tighter level of validation could be applied as the model is strictly speaking a corridor model and is not complex with very limited route choice. The Design Manual for Roads and Bridges (DMRB) in the UK has a slightly tighter series of criteria to be met when validating traffic models. The DMRB criteria states:

More than 85% of cases of assigned hourly flows compared with observed flows must meet criteria 1, 2 and 3:

1) Individual flows within 15% for flows between 700 and 2,700 vehicles per hour;

2) Individual flows within 100 vehicles per hour for flows less than 700 vehicles per hour;

3) Individual flows within 400 vehicles per hour for flows greater than 2,700 vehicles per hour;

4) Total screen-line flows (normally more than 5 links) to be within 5% of observed flows (not applicable to this model as no screen-line available);

5) GEH statistics:

   i) More than 85% of cases on individual links must have a GEH less than 5;

   ii) All screen-line totals must have GEH less than 4 (not applicable to this model as no screen-line available);

6) 85% of modelled travel times must be within 15% (or 1 minute if higher) of the observed travel time.

This DMRB criterion has also been applied to this model.

8 Model Calibration

In order to better model the existing network the model was calibrated by:

- Adjusting speed-flow curves; and
- Adjusting the gap acceptance parameter.

Saturation flows have been derived according to:

- Approximate lane widths;
- Turn radii;
- Site observation
- Lane use (i.e. left turn only or shared straight and left etc); and
- Previous experience and standard practice.

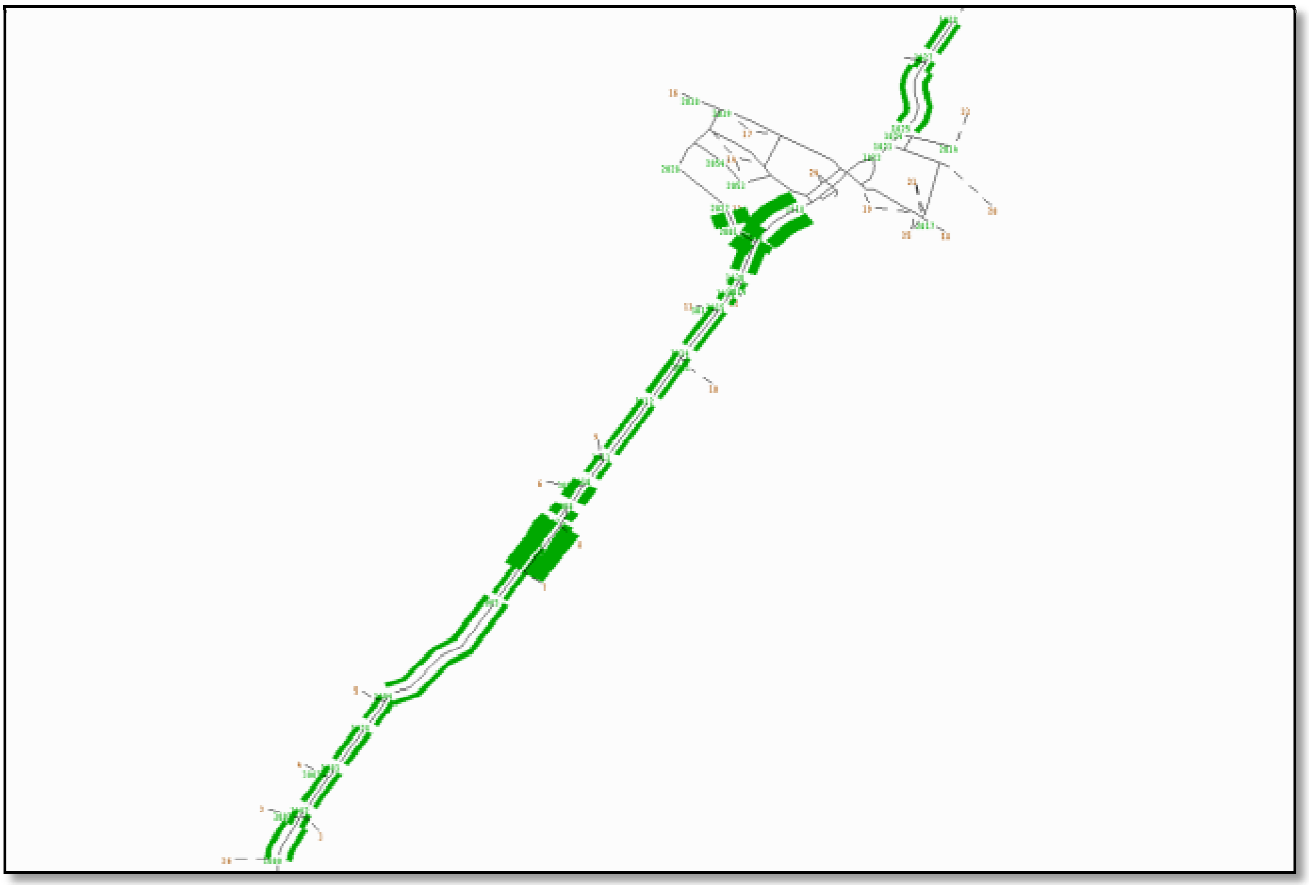
Modifications made to the coding to calibrate the base model include:

- Speed-flow curves have been applied in the model on rural parts of State Highway One and local roads. In both directions speed-flow curves have been used to try to replicate the link delays that occur between the intersections. These have been applied predominantly north of Waitohu Valley Road and south of Riverbank Road. In general Otaki town centre vehicle flow is controlled by intersections so no speed flow curve has been applied in this area. Where possible standard speed-flow curves were calculated based on the SATURN manual recommended values (see Table 8-1). The figure XX shows where the speed-flow curves had been applied in the PP2OTM.

Table 8-1: Speed-flow curves applied in PP2TOM

The "free-flow" speed	The "Intermediate" Break point Speed	The speed at capacity	The maximum flow at which free-flow condition hold	The capacity	A "Best-fit" value of the Power
S0=	S1=	S2=	F=	C=	n=
92	78	**45**	1250	**1800**	**3.71**
92	78	**45**	2500	**3600**	**3.71**
100	85	**45**	1350	**2000**	**3.93**
100	85	**45**	2700	**4000**	**3.93**
75	60	**35**	1100	**1800**	**2.68**
75	60	**35**	2200	**3600**	**2.68**
65	50	**35**	1250	**1800**	**2.27**
65	50	**35**	2500	**3600**	**2.27**
50	35	**25**	1250	**1800**	**1.94**
50	35	**25**	2500	**3600**	**1.94**

Table 8-2: Speed-flow curves locations applied in PP2OTM



- Changing some individual turning movement gap acceptances to replicate delays particularly at some right turning movements.
- Key origin and destination pairs were checked for the predominant route used in each of the time periods and all were found to be logical and using the main routes expected. Select links analysis around Otaki Town centre can be found in Appendix D.

9 Model Validation – EEM Criteria

The modelled turning flows were compared against observed turning counts for the study area using the validation criteria outlined in Section 7. The results are presented in the following sections.

9.1 Absolute and Percentage Differences

The summary of turn validation for the study area for the AM peak, Inter peak and PM Peak is provided in Appendix E. The first three tables in Appendix E show results for cars and HCV's added together when compared to observed volumes. The next three tables show results for cars only and the final three tables show results for HCV's only.

9.2 Scatter Plots

XY Scatter plots have been produced to determine the "goodness of fit" between the observed flows and the modelled flows. Scatter plots of modelled versus observed turning flows are provided in Appendix F. As with the tables in Appendix E the first three scatter plot diagrams in Appendix F show results for cars and HCV's together while the next three scatter plots are for cars only and the final there are for HCV's only. Table 9-1 summarises the regression statistics which is based on 120 counts for each of the three peak periods.

Table 9-1 : Summary of Regression Statistics for both user classes

R^2 Statistics	Study Area
Criteria	≥ 85%
AM Peak	99%
Inter Peak	99%
PM Peak	99%

These results indicate a very high level of correlation between the observed turn flows and the modelled turn flows. The base year SATURN models developed for this project exceed the requirements of the validation criteria of both the EEM and the DMRB.

The following Table 9-2 summarises the regression statistics in separated cars and HCVs user classes. These results indicate a very high level of correlation between the observed turn flows and the modelled turn flows in separated user classes. The base year SATURN models developed exceed the requirements of the validation criteria of both the EEM and the DMRB even in separate user classes.

Table 9-2: Summary of Regression Statistics for separate user classes

R^2 Statistics	Cars	HCVs
Criteria	≥ 85%	≥ 85%
AM Peak	99%	96%
Inter Peak	99%	96%
PM Peak	99%	91%

9.3 RMSE

The Root Mean Square Error (RMSE) was calculated for the turning volumes of the whole data set for each of the three peak periods. EEM guidelines suggested that RMSE values should be generally less than 30%. The results are presented in Table 9-3.

Table 9-3: Summary of RMSE for both user classes

RMSE	Study Area
Criteria	≤ 30
AM Peak	11
Inter peak	11
PM Peak	13

These results indicate that the criteria for the RMSE have been satisfied by the models for each of the time periods and that the performance of the models in terms of the difference between the observed and modelled flows are appropriate for the purpose for the study area.

The following Table 9-4 shows the RMSE value for each of the time periods in separate cars and HCVs user classes. These results indicate that the PP2OTM is satisfied by the criteria of RMSE apart from the HCVs' PM peak. Since other statistics shows the HCVs' PM peak is having a good correlation between the observed flow and the modelled flow, it still can be conclude that the HCVs' PM peak is well modelled for this project.

Table 9-4: Summary of RMSE for separate user classes

RMSE	Cars	HCVs
Criteria	≤ 30	≤ 30
AM Peak	15	28
Inter peak	12	27
PM Peak	13	42

9.4 GEH Statistic

Table 9-5 below summarises the GEH statistics for the three time periods.

Table 9-5: GEH Statistics for both user classes

Peak Period	% GEH ≤ 5	% GEH ≤ 10	% GEH < 12
Criteria	≥ 60%	≥ 95%	≥ 100%
AM Peak	98%	100%	100%
Inter Peak	96%	100%	100%
PM Peak	94%	100%	100%

In all time periods the GEH criteria are being met and exceeded. The above table indicates that the model provides a reasonable correlation between the modelled flows and the observed flows.

The following Table 9-6 and Table 9-7 show the GEH statistics for separate cars and HCVs user classes. These results indicate that the model provides a reasonable correlation between the modelled and the observed flows when look at separate user classes.

Table 9-6: GEH Statistics for Cars

Peak Period	% GEH ≤ 5	% GEH ≤ 10	% GEH < 12
Criteria	≥ 60%	≥ 95%	≥ 100%
AM Peak	95%	100%	100%
Inter Peak	97%	100%	100%
PM Peak	93%	100%	100%

Table 9-7: GEH Statistics for HCVs

Peak Period	% GEH ≤ 5	% GEH ≤ 10	% GEH < 12
Criteria	≥ 60%	≥ 95%	≥ 100%
AM Peak	100%	100%	100%
Inter Peak	99%	100%	100%
PM Peak	100%	100%	100%

9.5 Turn Delay Validation

Neither the EEM nor DMRB specify criteria for turn delay validation.

Comparing the modelled turning delay and the observed turning delay in absolute difference and percentage difference, the PP2OTM indicates a very high level of correlation.

There are only 2 turning movements out of 108 having a percentage difference greater than 30% between the modelled and observed delay in the AM peak, and neither of these is significant.

- SH1 (S) RT Waitohu Valley Rd (E) overestimates delay by 2 seconds.
- Waitohu Valley Rd (E) RT SH1 (N) overestimates delay by 4 seconds.

There is only one turning movement out of 110 having a percentage difference greater 30% between the modelled and observed delay in the Inter peak, and it is not significant.

- Riverbank Rd (W) LT SH1 (N) underestimates delay by 3.5 seconds.

There are only 2 turning movements having a percentage difference greater 30% in the AM peak, and neither of these is significant.

- Te Manuao Rd (E) RT SH1 (N) underestimates delay by 8 seconds.
- Waitohu Valley Rd (E) RT SH1 (N) underestimates delay by 7 seconds.

Appendix G shows the observed and modelled delays at the side roads along with the difference and the percentage difference.

9.6 Journey Time Comparisons

The graphical comparison of the modelled and observed journey times is given in Appendix H.

The model is replicating the travel times well when compared with the average observed travel times. Table 9-8 below shows the figures for average observed times, the modelled times and the difference between the average and modelled times expressed as both an absolute figure and a percentage of the average.

Table 9-8: Journey Time Validation (secs)

Route	Average observed	Modelled	Diff (secs)	% diff to avg
AM Peak				
SH1 Peka Peka Road to Taylors Road	593	589	-4	-0.7%
SH1 Taylors Road to Peka Peka Road	602	594	-8	-1.3%
Inter peak				
SH1 Peka Peka Road to Taylors Road	600	586	-13	-2.0%
SH1 Taylors Road to Peka Peka Road	604	588	-16	-2.6%
PM Peak				
SH1 Peka Peka Road to Taylors Road	588	598	10	1.7%
SH1 Taylors Road to Peka Peka Road	601	595	-6	-0.9%

State Highway 1

AM peak northbound – the total modelled journey time matches almost exactly with the average observed journey time over the complete route.

Inter peak northbound – the total modelled journey time matches almost exactly with the average observed journey time over the complete route although the model is very marginally faster than the observed average over north half of the route.

PM peak northbound – the total modelled journey time matches almost exactly with the average observed journey time over the complete route although the model is very marginally slower than the observed average over the majority of the route.

AM peak southbound – the total modelled journey time matches almost exactly with the average observed journey time over the complete route.

Inter peak southbound – the total modelled journey time matches almost exactly with the average observed journey time over the complete route although the model is very marginally faster than the observed average over the majority of the route.

PM peak southbound – the total modelled journey time matches almost exactly with the average observed journey time over the complete route.

Overall Summary

The modelled travel time matches the average observed travel time extremely well, meeting both the EEM and the DMRB criteria defined in Section 7 above.

9.7 Model Convergence and Stability

The model convergence statistics for each of the time-period models and the number of iteration for which the stopping criteria are satisfied is presented in Table 9-9.

Table 9-9: Model General Convergence Statistics

Peak Period	AM Peak				Inter peak				PM Peak			
Iteration # of Convergence	3	4	5	6	3	4	5	6	3	4	5	6
% of assigned links with less than 5% difference in flows in final iteration (Target = 97%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.2	100.0	100.0	100.0
in final iteration (Target < 1%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results in Table 9.5 above indicate that the models are stable and that they converge with respect to congestion because the number of links with less than 5% variation in flows between iterations is reached, rather than the maximum number of iterations was reached.

9.8 Origin to Destination Comparison

The O-D comparison diagram between the observed and the modelled has been attached in Appendix I. Both the change in percentage and the actual differences are showing in the diagrams

Comparing the O-D survey with the model output, the matching between the two is very good. The results show that:

- The total percentage for each approach does not add up to 100% due to trips that may have their origin or destination in the town centre.
- All the O-D differences between modelled and observed, apart from the through movements between south and north of SH1, are less than 50 pcus (or 15%) in all peak periods.
- The through movement between the south and north of SH1 has a maximum difference of 126 pcus during peak hour (Southbound PM peak), this is thought to be due to the manual O-D survey accuracy and affected by the heavy traffic demand.

10 Model Validation – DMRB Criteria

10.1 Individual flows within 15% for flows between 700 and 2,700 vehicles per hour

All flows in the AM and inter peak periods are below 700 vehicles per hour. In the PM peak three turning movements have flows above 700 vehicles and all three are around 5% difference from the observed volumes meeting the DMRB criteria.

10.2 Individual flows within 100 vehicles per hour for flows less than 700 vehicles per hour

No flows below 700 are modelled with a difference of more than 100 vehicles when compared to the observed volumes.

10.3 Individual flows within 400 vehicles per hour for flows greater than 2,700 vehicles per hour

No observed volumes are greater than 2,700 vehicles per hour.

10.4 GEH statistics

10.4.1 More than 85% of cases on individual links must have a GEH less than 5

In the AM peak 98% of movements have a GEH less than 5 while in the inter and PM peaks the same criteria is meet with 96% and 94% respectively, and are therefore considered fit for purpose.

11 Peer Review

The Peka Peka to North Otaki Traffic Model (PP2OTM) and documents have been peer reviewed and by Darren Fiddler from Sinclair Knight Merz Ltd (SKM). The Final peer review report has been attached in Appendix J.

12 Summary and Conclusions

The modelled flows show an excellent correlation with the observed data and meet the EEM and DMRB criteria for the RMSE and regression statistics. The GEH statistic is a more useful comparison of individual link flows because it accounts for the variance in the differences, as opposed to simply comparing the magnitude of the difference to the observed flow.

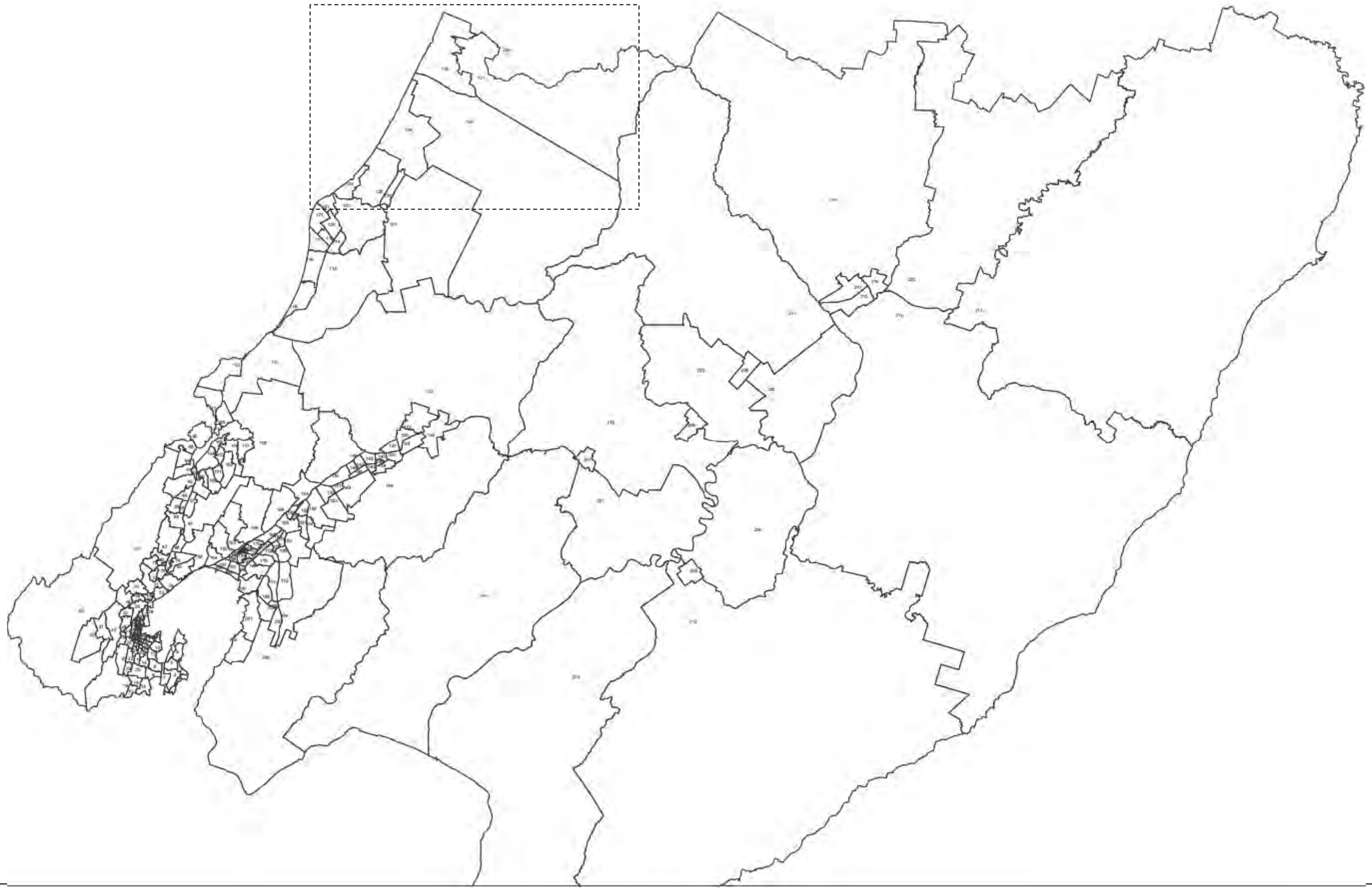
The SATURN models exceed both the EEM and DMRB criteria for the GEH statistic in the study area in each of the AM Peak, Inter peak and PM Peak models. The R^2 statistics exceed 85% for the study area. The RMSE statistic, which measures the variation over the whole data set, is less than 30 for each of the peak hour models.

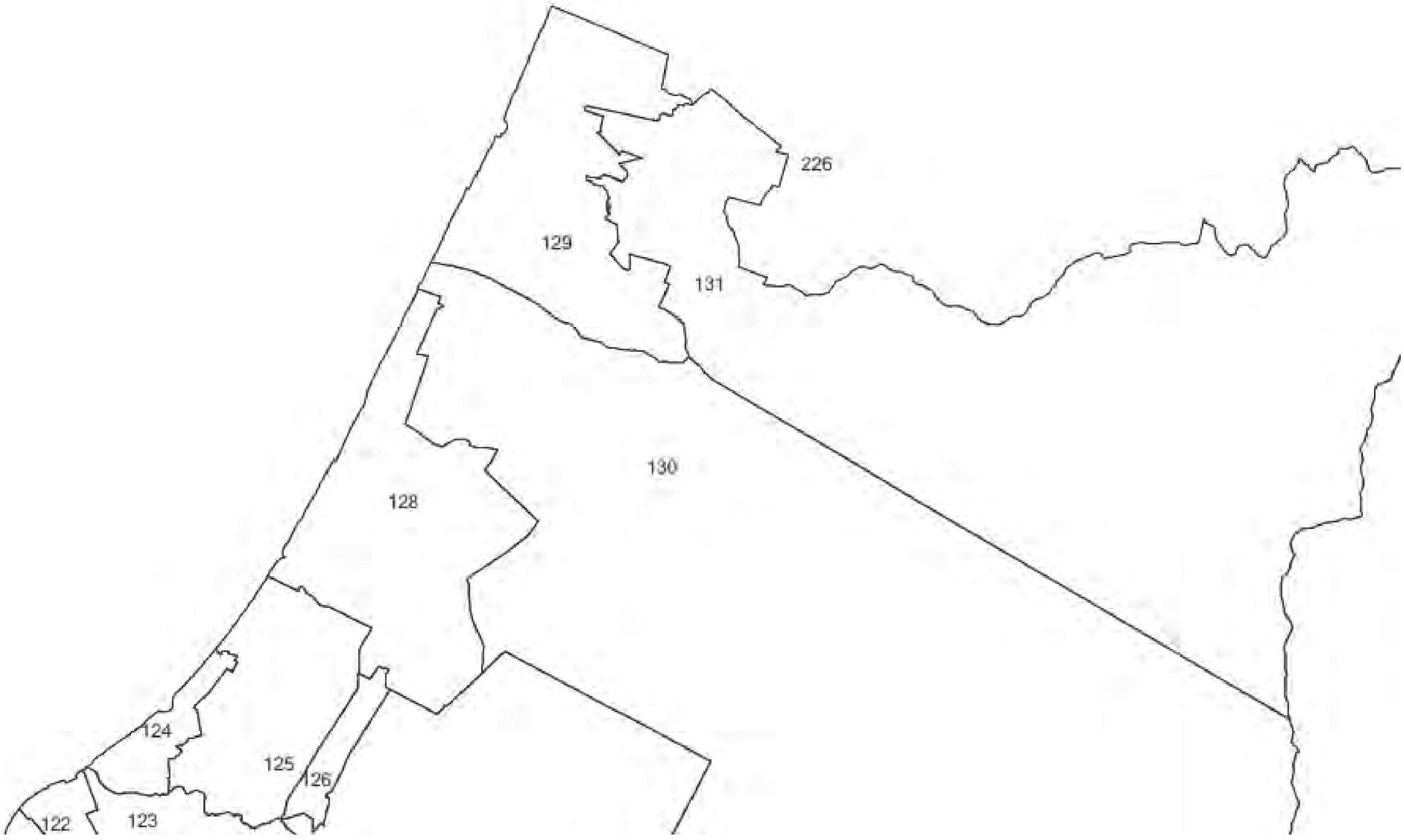
The model shows a very good correlation with observed average travel times on selected corridors. The models also show a good representation of side road delays in the study area.

In conclusion, this report has demonstrated that the models developed conform within EEM and DMRB defined validation criteria, in terms of modelled routings, traffic flows, side road delays and journey times. As a result, the model is considered to provide a satisfactory basis on which to proceed to forecasting future years and to test options for the Otaki area.

Appendix A

WTSM Zoning System




226
129
131
130
128
124
125
126
122
123

Appendix B

Travel time Convergence calculations

AM Peak (NB)					Confidence Interval				
Run No.	Mean JT (sec)	Mean	SD	T Stats	CI	Lower Bound	Upper Bound	No. of Runs Reqd	Confidence Achieved
1	580			0.010					
2	587	583.5	5.32	63.657	239.669	343.876	823.214	135	NO
3	613	593.4	17.53	9.925	100.453	492.977	693.883	34	NO
4	583	590.9	15.17	5.841	44.304	546.614	635.221	9	NO
5	600	592.8	13.78	4.604	28.365	564.407	621.137	5	YES
6	595	593.2	12.37	4.032	20.365	572.861	613.592	3	YES

Confidence	99%
Precision	5%
Summary Statistics	
Mean	593
SD	12
Min	580
Max	613
Range	33

AM Peak (SB)					Confidence Interval				
Run No.	Mean JT (sec)	Mean	SD	T Stats	CI	Lower Bound	Upper Bound	No. of Runs Reqd	Confidence Achieved
1	604			0.010					
2	609	606.4	3.39	63.657	152.459	453.969	758.886	51	NO
3	608	606.9	2.52	9.925	14.427	592.449	621.303	1	YES
4	588	602.1	9.84	5.841	28.724	573.343	630.790	4	YES
5	603	602.3	8.53	4.604	17.566	584.719	619.852	2	YES

Confidence	99%
Precision	5%
Summary Statistics	
Mean	602
SD	9
Min	588
Max	609
Range	21

Inter Peak (NB)					Confidence Interval				
Run No.	Mean JT (sec)	Mean	SD	T Stats	CI	Lower Bound	Upper Bound	No. of Runs Reqd	Confidence Achieved
1	587			0.010					
2	625	606.4	26.87	63.657	1209.483	-603.093	1815.873	3183	NO
3	615	609.2	19.64	9.925	112.513	496.737	721.763	41	NO
4	599	606.7	16.85	5.841	49.200	557.462	655.863	11	NO
5	591	603.5	16.22	4.604	33.394	570.100	636.888	6	NO
6	606	603.9	14.53	4.032	23.923	579.933	627.780	4	YES
7	577	600.0	16.80	3.707	23.532	576.432	623.496	4	YES

Confidence	99%
Precision	5%
Summary Statistics	
Mean	600
SD	17
Min	577
Max	625
Range	49

Inter Peak (SB)					Confidence Interval				
Run No.	Mean JT (sec)	Mean	SD	T Stats	CI	Lower Bound	Upper Bound	No. of Runs Reqd	Confidence Achieved
1	588			0.010					
2	606	597.1	12.33	63.657	554.813	42.327	1151.953	691	NO
3	577	590.6	14.33	9.925	82.129	508.442	672.699	23	NO
4	627	599.6	21.58	5.841	63.023	536.613	662.659	18	NO
5	617	603.0	20.16	4.604	41.502	561.512	644.515	9	NO
6	605	603.3	18.05	4.032	29.705	573.633	633.043	6	YES
7	606	603.7	16.50	3.707	23.112	580.544	626.767	4	YES

Confidence	99%
Precision	5%
Summary Statistics	
Mean	604
SD	16
Min	577
Max	627
Range	49

PM Peak (NB)					Confidence Interval				
Run No.	Mean JT (sec)	Mean	SD	T Stats	CI	Lower Bound	Upper Bound	No. of Runs Reqd	Confidence Achieved
1	586			0.010					
2	590	588.0	2.72	63.657	122.540	465.455	710.535	35	NO
3	595	590.5	4.67	9.925	26.746	563.704	617.196	2	YES
4	575	586.6	8.55	5.841	24.961	561.664	611.586	3	YES
5	569	583.1	10.83	4.604	22.297	560.793	605.387	3	YES
6	590	584.3	10.13	4.032	16.671	567.627	600.969	2	YES
7	609	587.8	13.15	3.707	18.421	569.410	606.253	3	YES
8	581	587.0	12.38	3.499	15.316	571.715	602.347	2	YES
9	596	588.0	11.94	3.355	13.354	574.647	601.355	2	YES

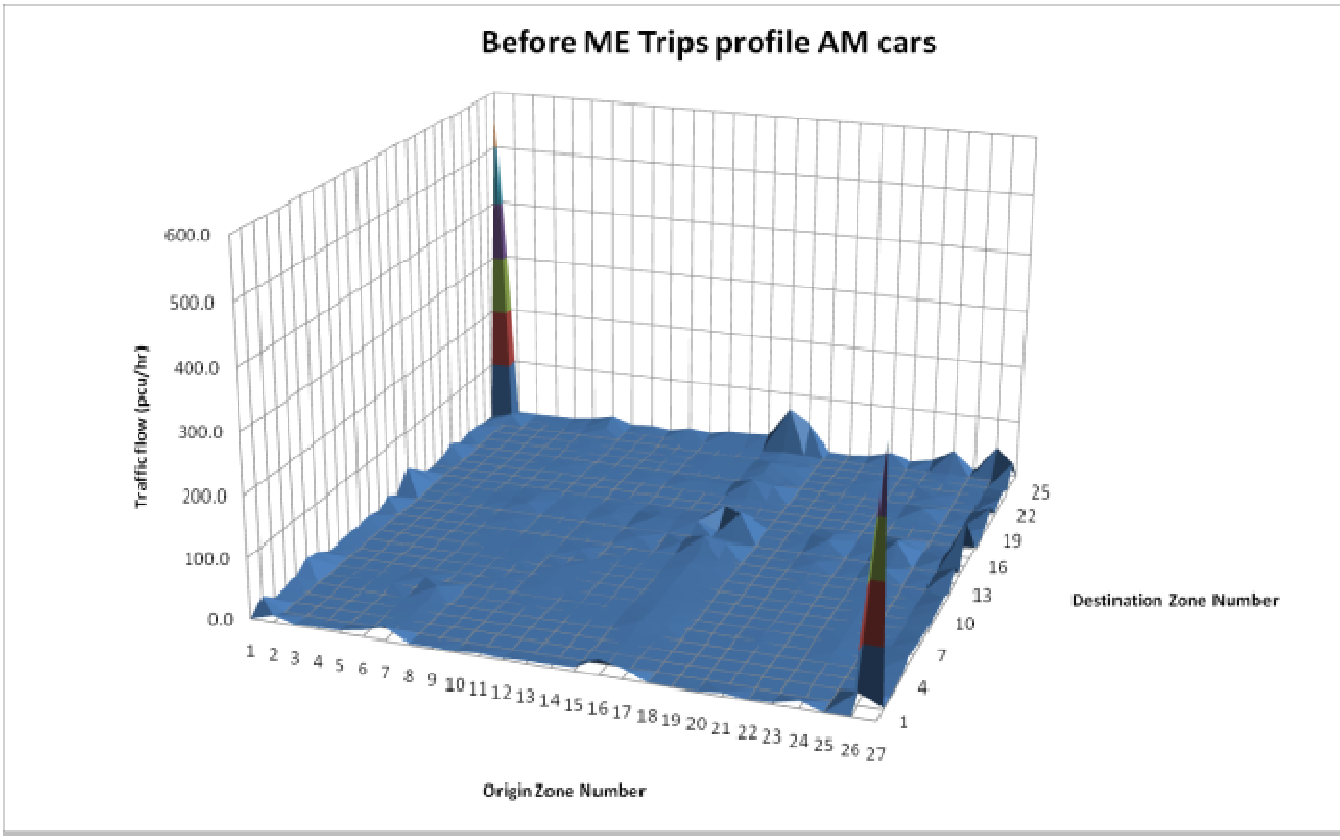
Confidence	99%
Precision	5%
Summary Statistics	
Mean	588
SD	12
Min	569
Max	609
Range	40

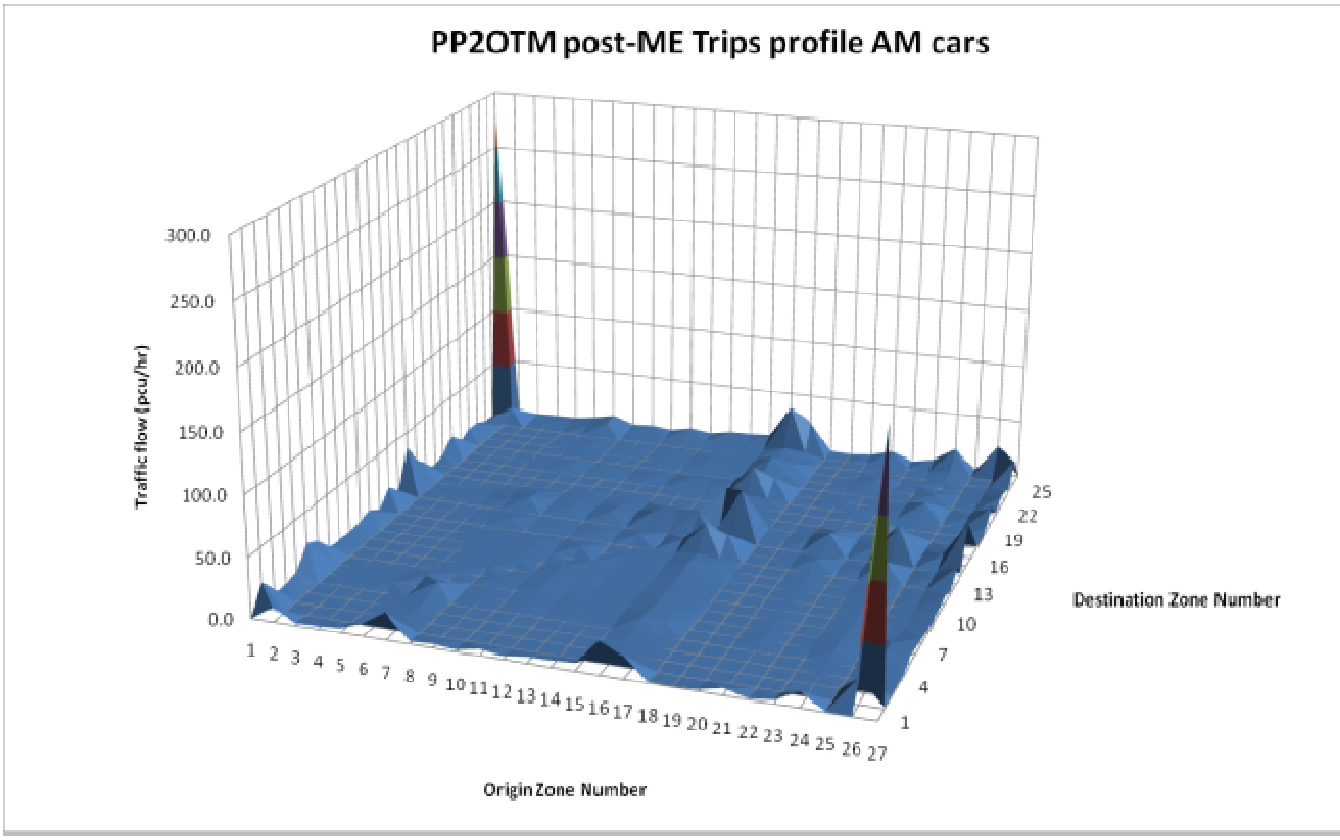
PM Peak (SB)					Confidence Interval				
Run No.	Mean JT (sec)	Mean	SD	T Stats	CI	Lower Bound	Upper Bound	No. of Runs Reqd	Confidence Achieved
1	603			0.010					
2	572	587.4	22.04	63.657	992.094	-404.654	1579.534	2282	NO
3	602	592.4	17.83	9.925	102.191	490.254	694.636	36	NO
4	593	592.6	14.56	5.841	42.534	550.053	635.122	8	NO
5	562	586.4	18.74	4.604	38.578	547.813	624.969	9	NO
6	652	597.3	31.64	4.032	52.079	545.267	649.426	18	NO
7	594	596.9	28.91	3.707	40.501	556.397	637.400	13	NO
8	596	596.8	26.76	3.499	33.107	563.741	629.956	10	NO
9	632	600.8	27.66	3.355	30.929	569.838	631.695	10	NO
10	620	602.7	26.80	3.25	27.539	575.181	630.259	8	YES

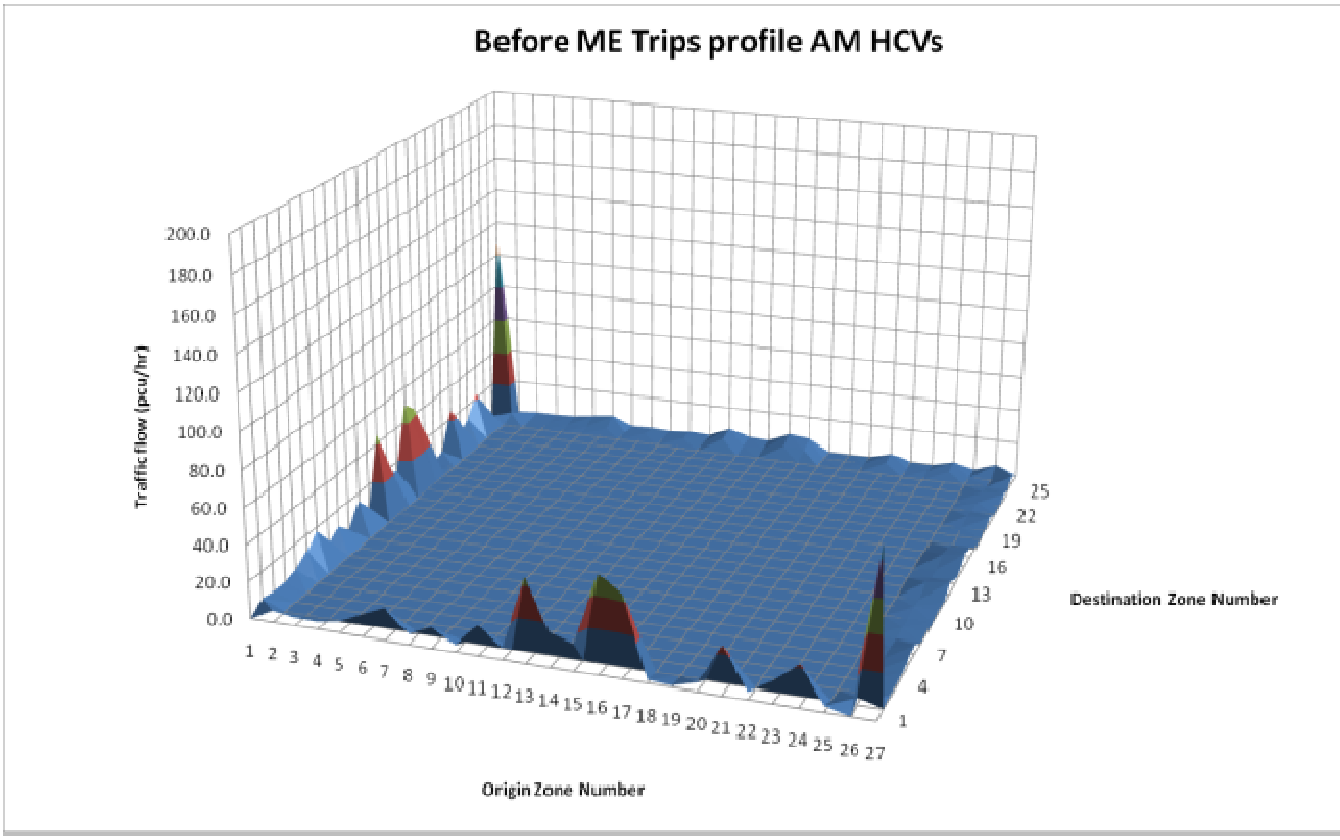
Confidence	99%
Precision	5%
Summary Statistics	
Mean	603
SD	27
Min	562
Max	652
Range	91

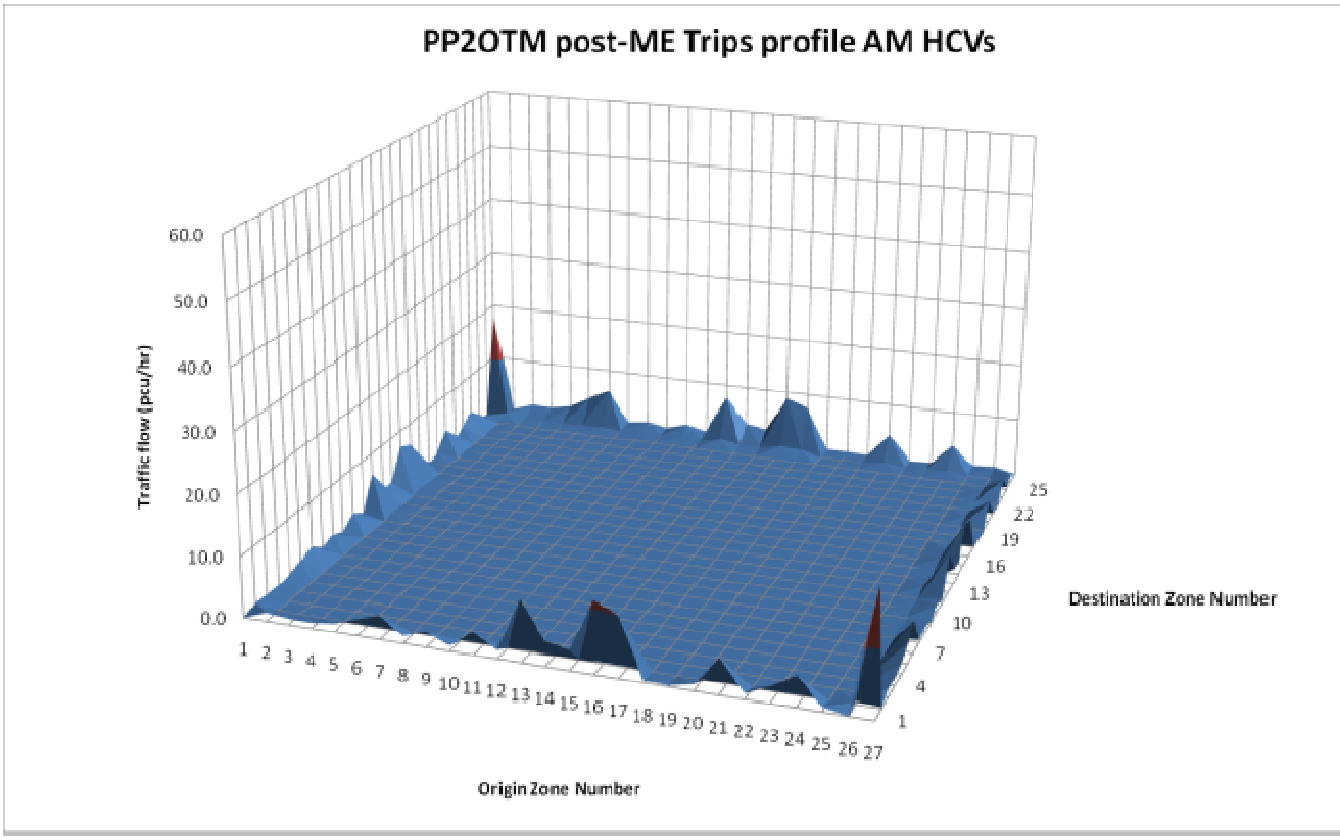
Appendix C

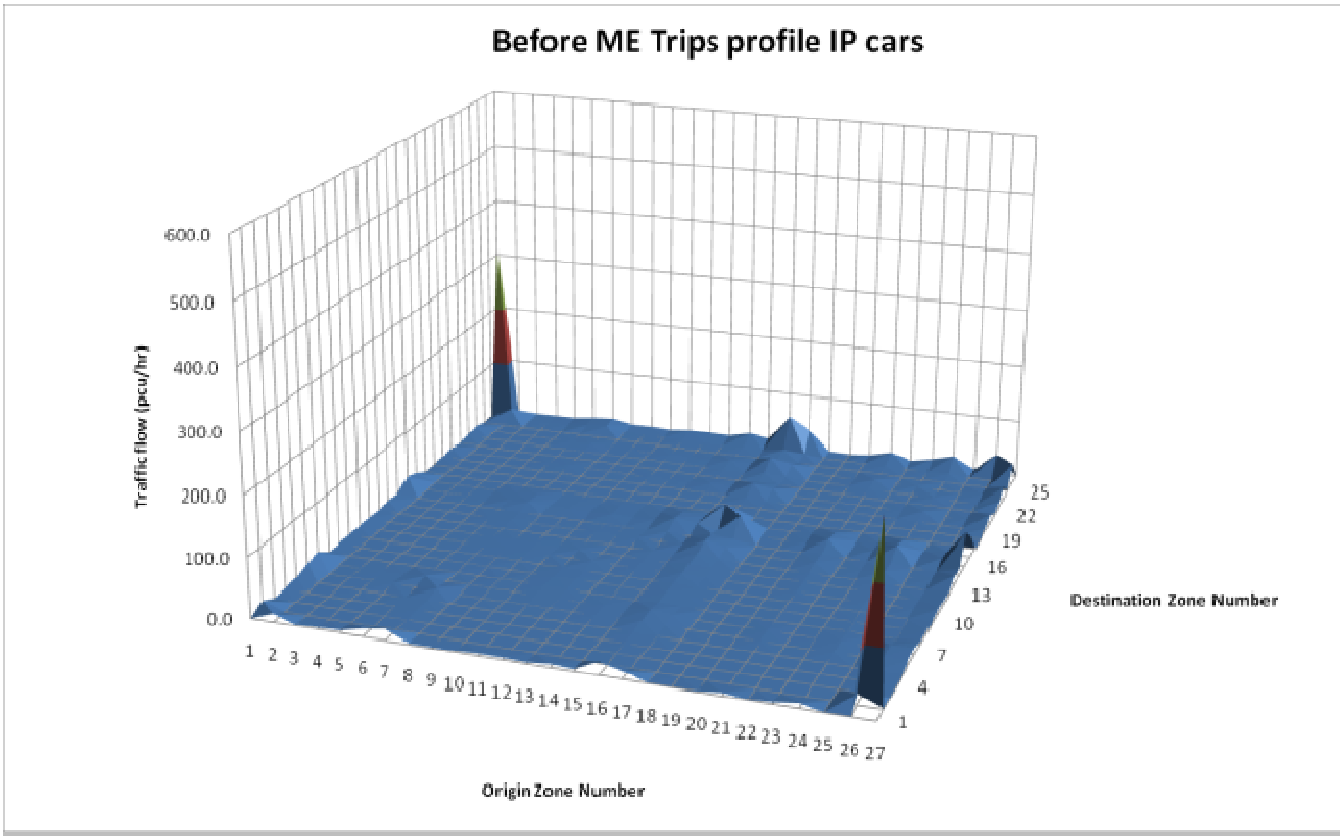
Pre and Post Matrix Estimation Trips profile plots

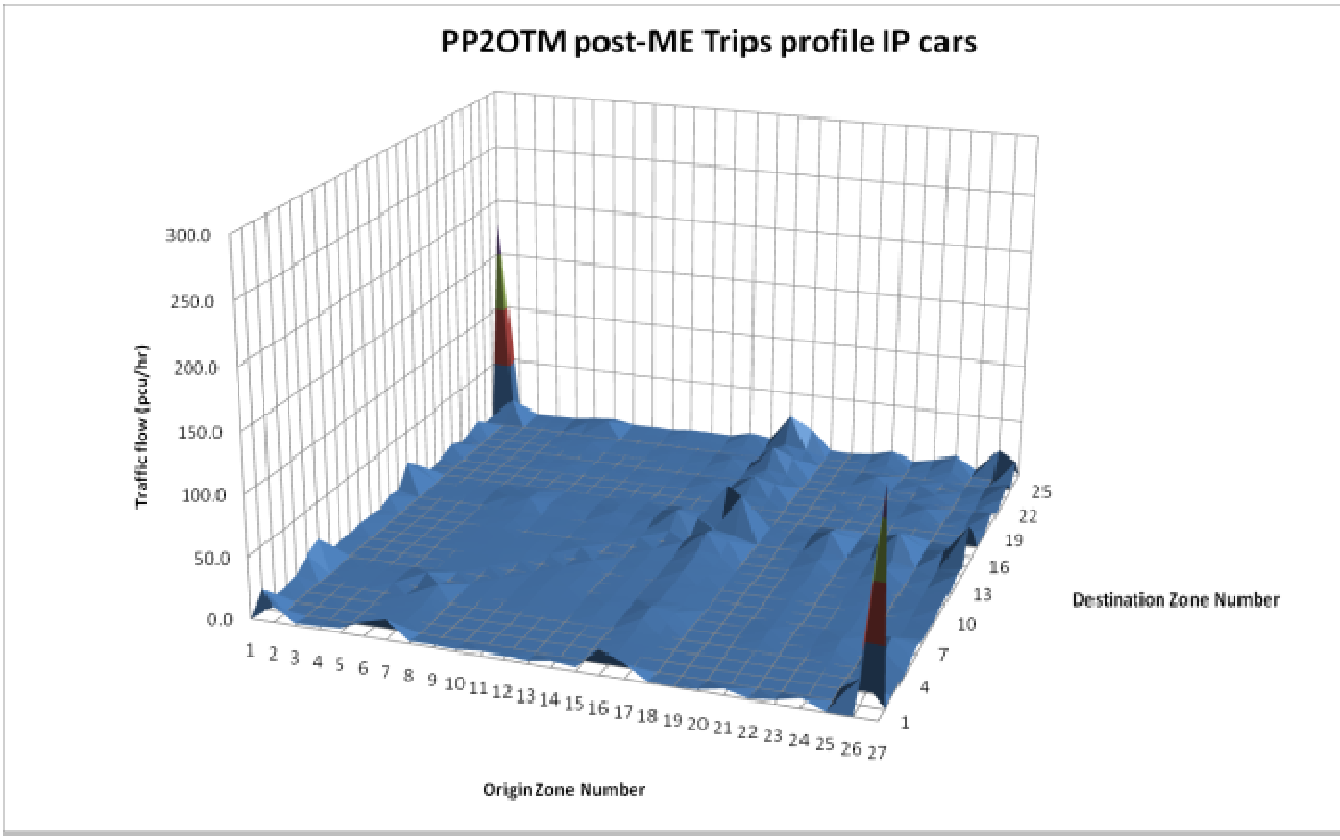

Before ME Trips profile AM cars
Traffic flow (pcu/hr)
600.0
500.0
400.0
300.0
200.0
100.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

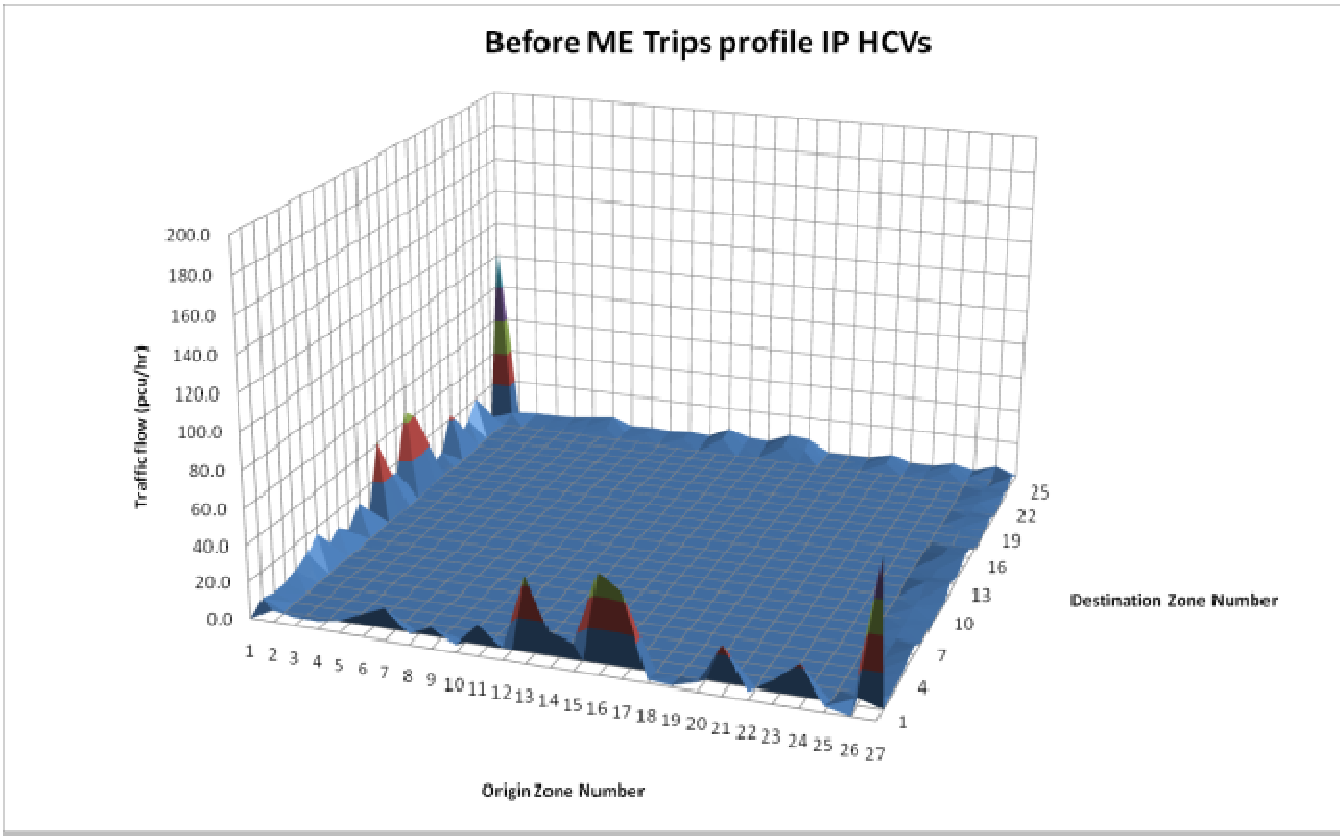

PP2OTM post-ME Trips profile AM cars
Traffic flow (pcu/hr)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

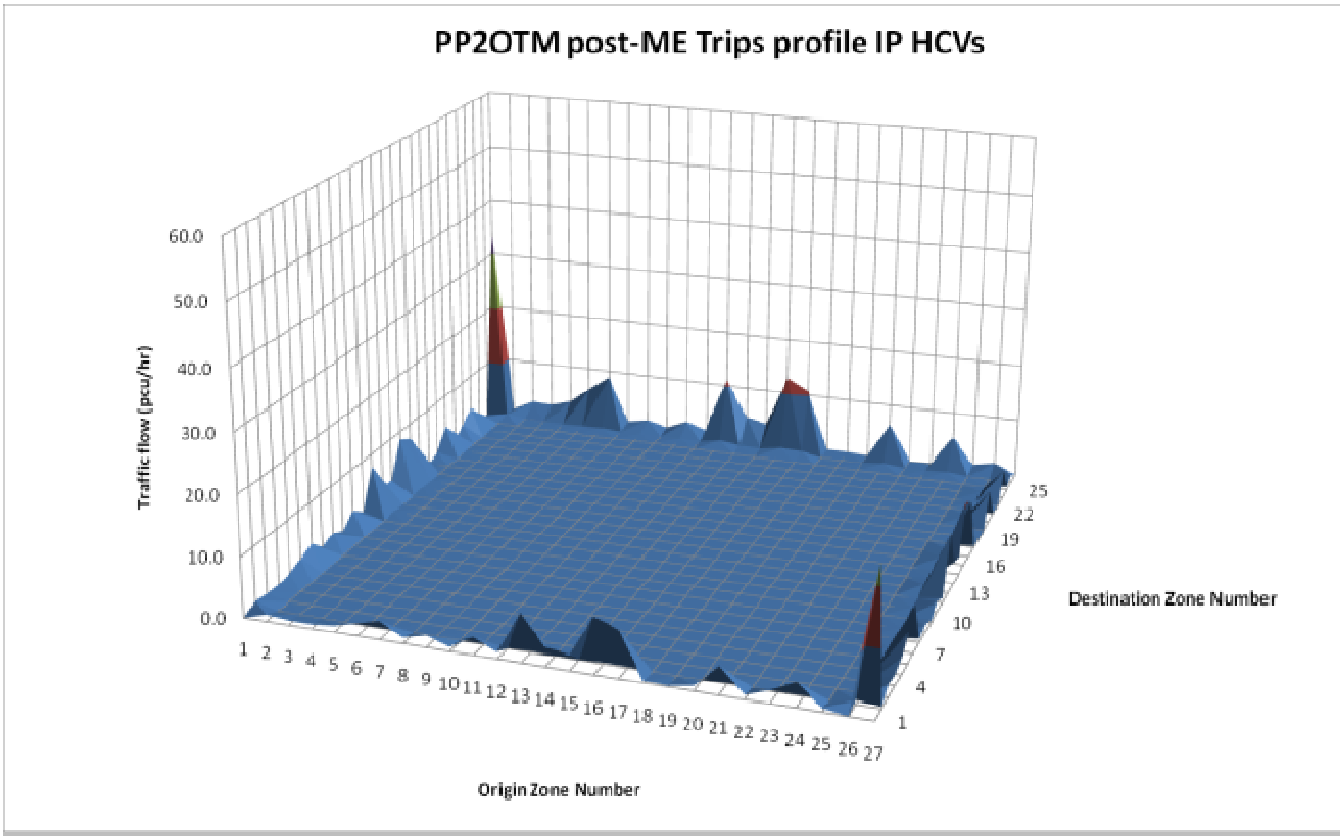

Before ME Trips profile AM HCVs
Traffic flow (pcu/hr)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

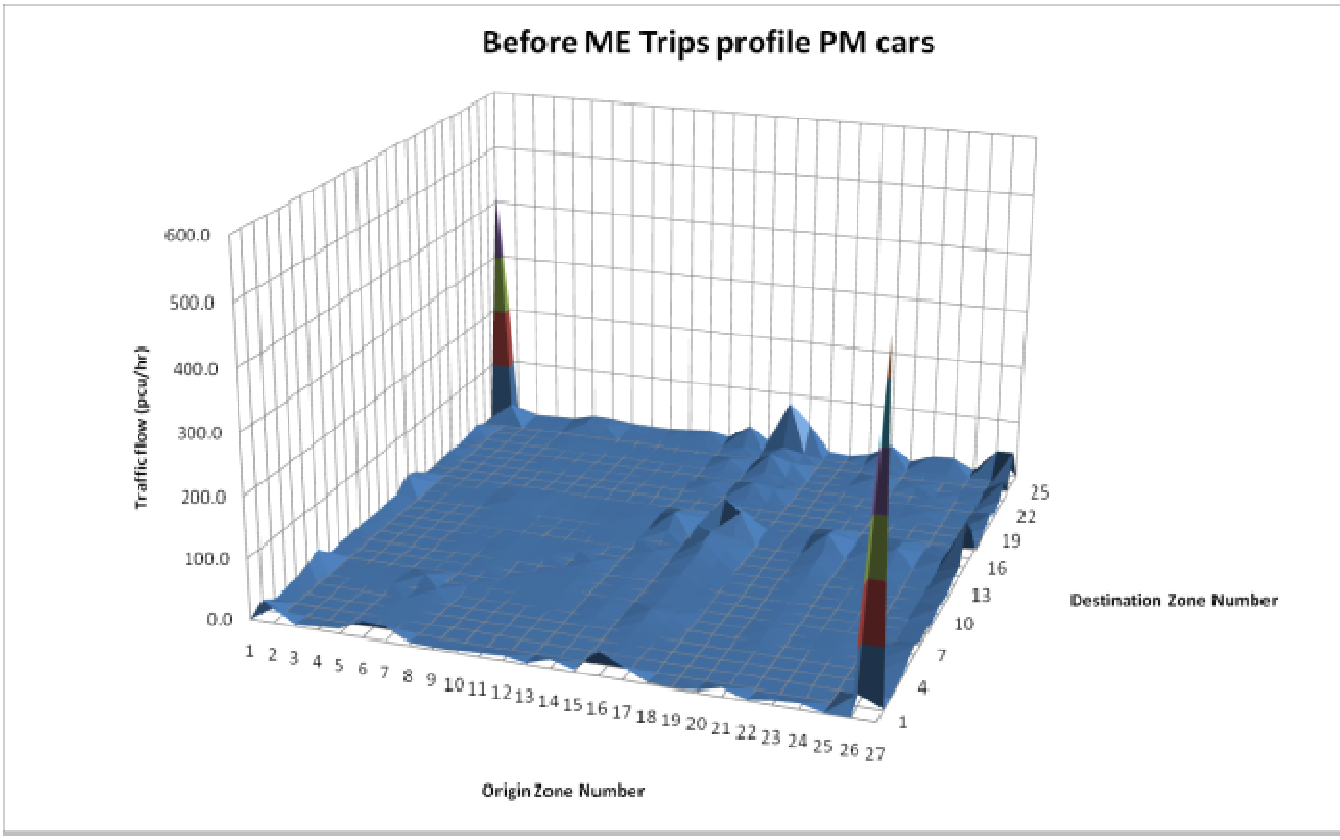

PP2OTM post-ME Trips profile AM HCVs
Traffic flow (pcu/hr)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

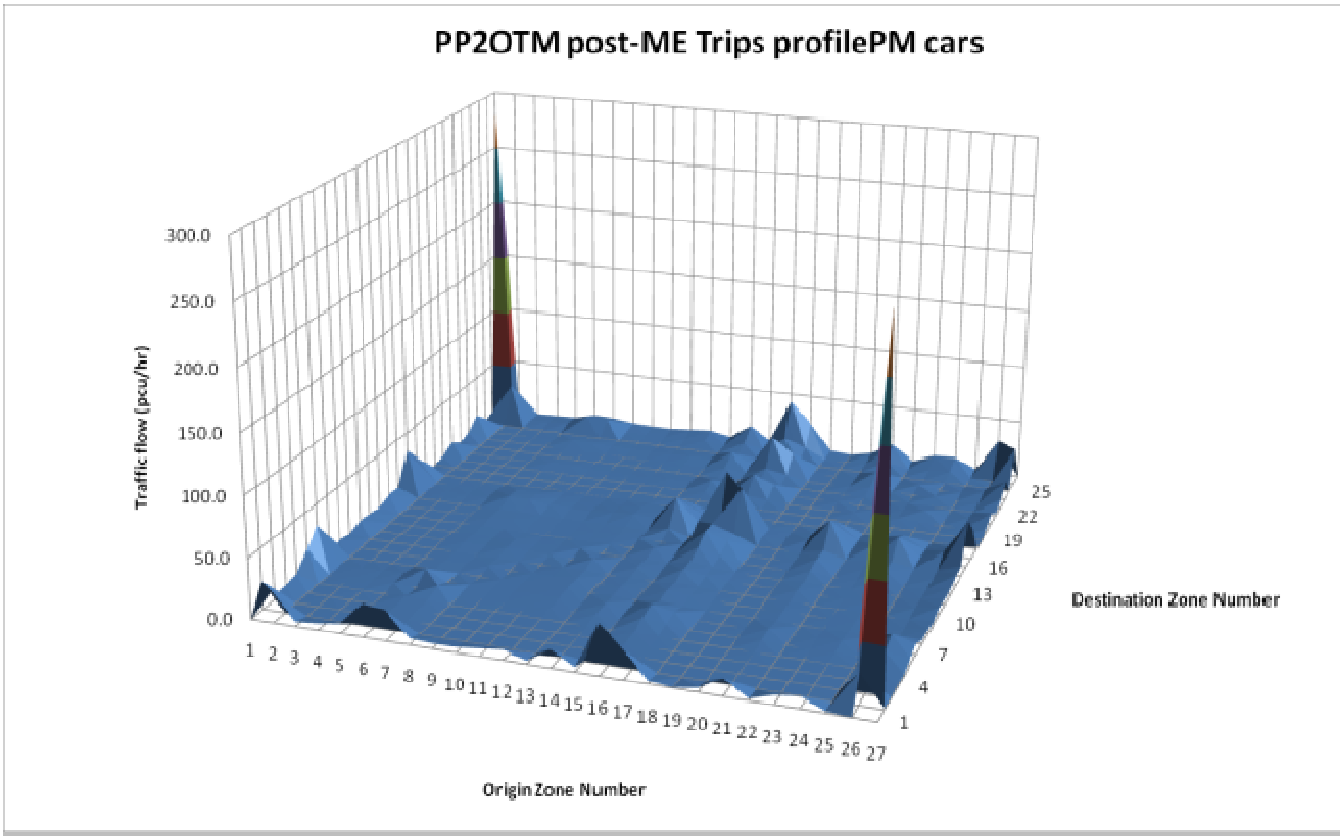

Before ME Trips profile IP cars
Traffic flow (pcu/hr)
600.0
500.0
400.0
300.0
200.0
100.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

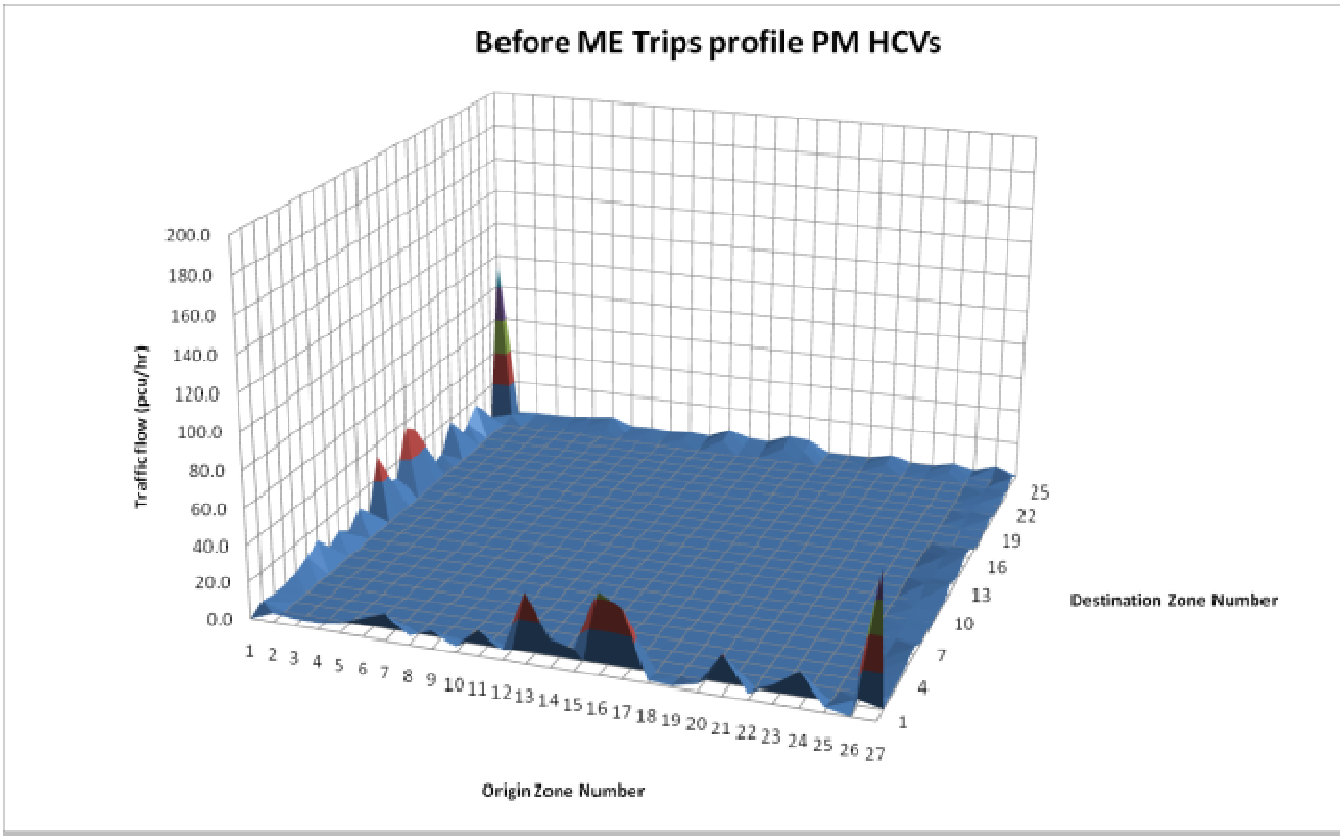

PP2OTM post-ME Trips profile IP cars
Traffic flow (pcu/hr)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

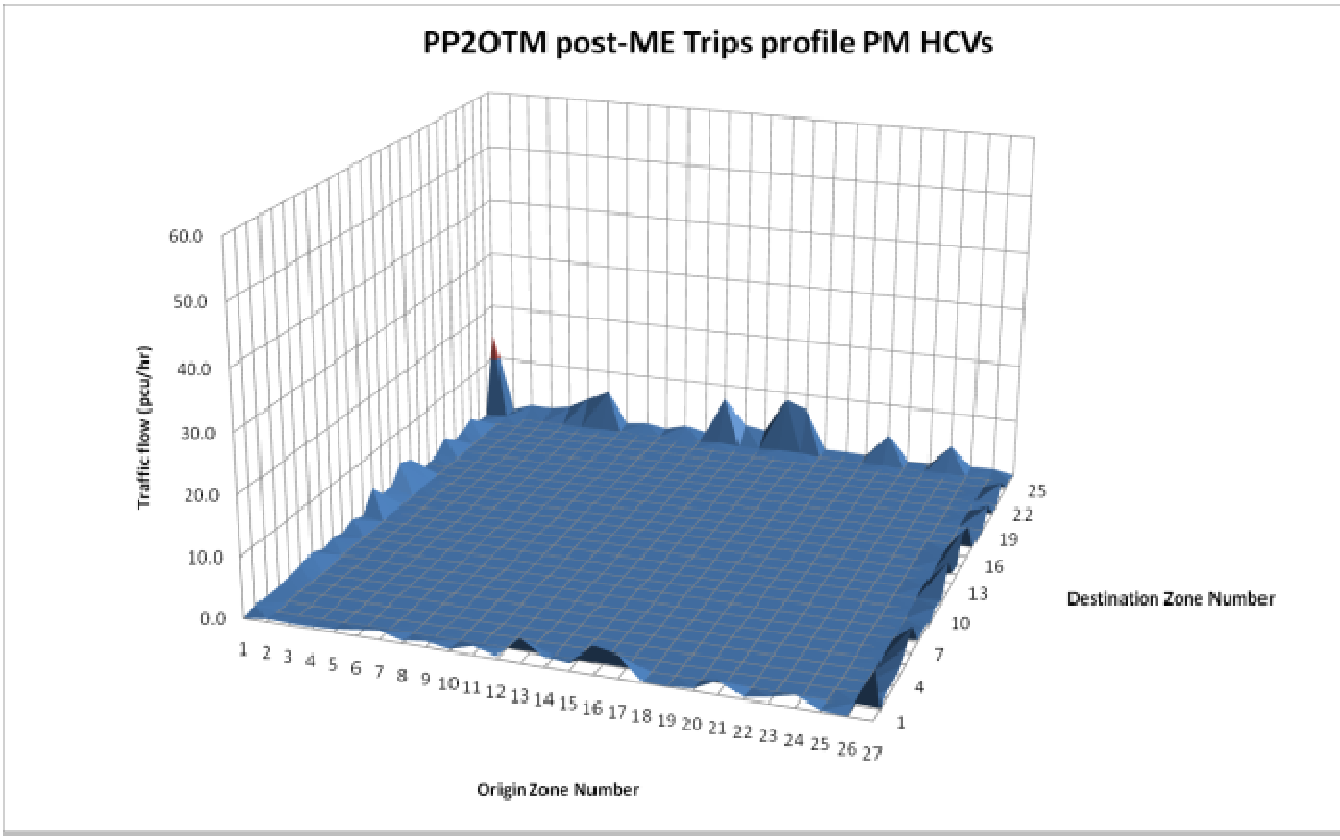

Before ME Trips profile IP HCVs
Traffic flow (pcu/hr)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number


PP2OTM post-ME Trips profile IP HCVs
Traffic flow (pcu/hr)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number


Before ME Trips profile PM cars
Traffic flow (pcu/hr)
600.0
500.0
400.0
300.0
200.0
100.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

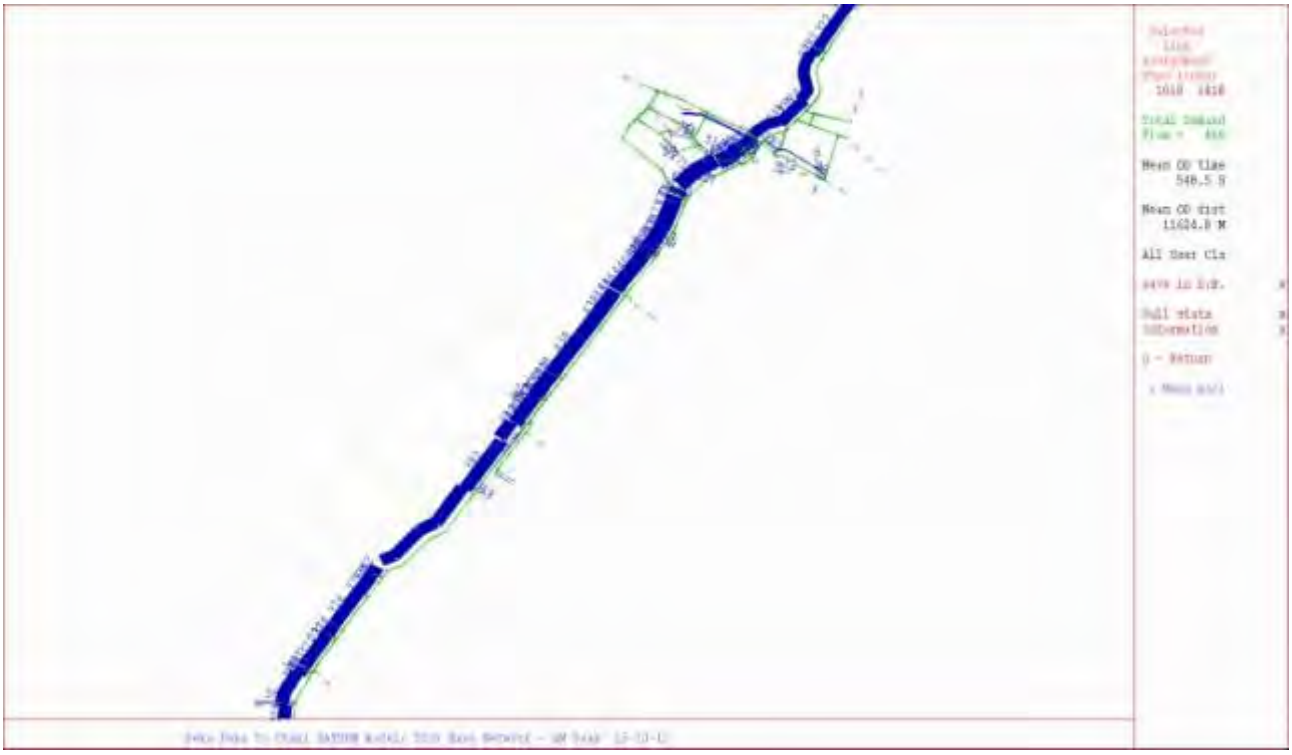

PP2OTM post-ME Trips profilePM cars
Traffic flow (pcu/hr)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number


Before ME Trips profile PM HCVs
Traffic flow (pcu/hr)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number


PP2OTM post-ME Trips profile PM HCVs
Traffic flow (pcu/hr)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Origin Zone Number
1 4 7 10 13 16 19 22 25
Destination Zone Number

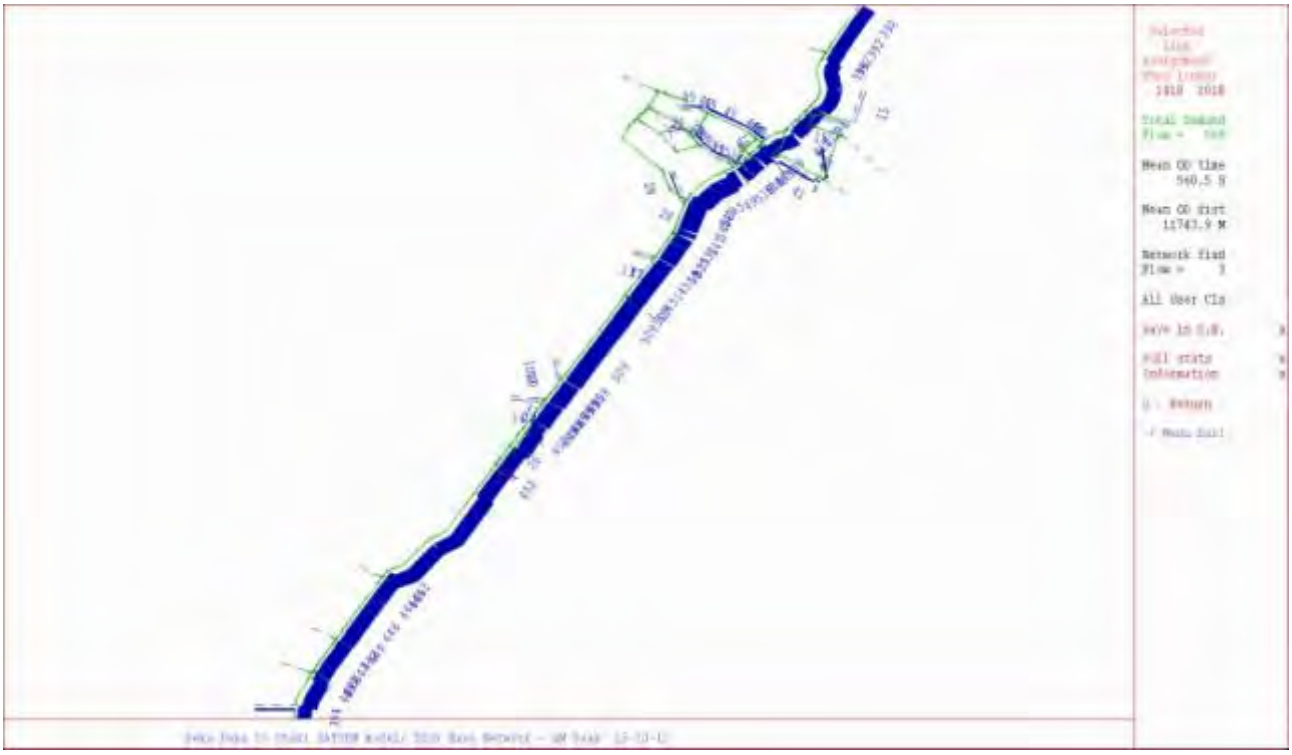
Appendix D

Select Link analysis plots



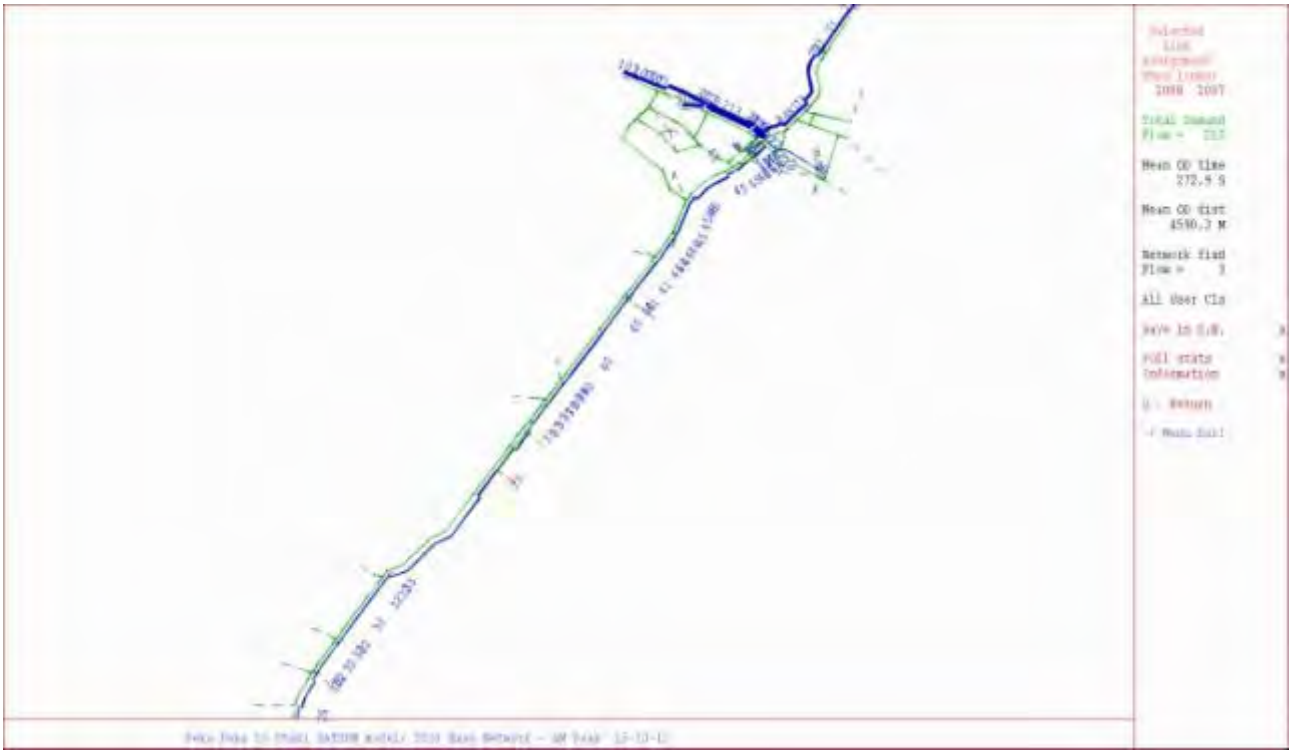
Otaki2010_SATURN Model_AM peak_Select Link_SH1 South of Waerenga Rd (NB)1

Otaki2010_SATURN Model_AM peak_Select Link_SH1 South of Waerenga Rd (NB)2



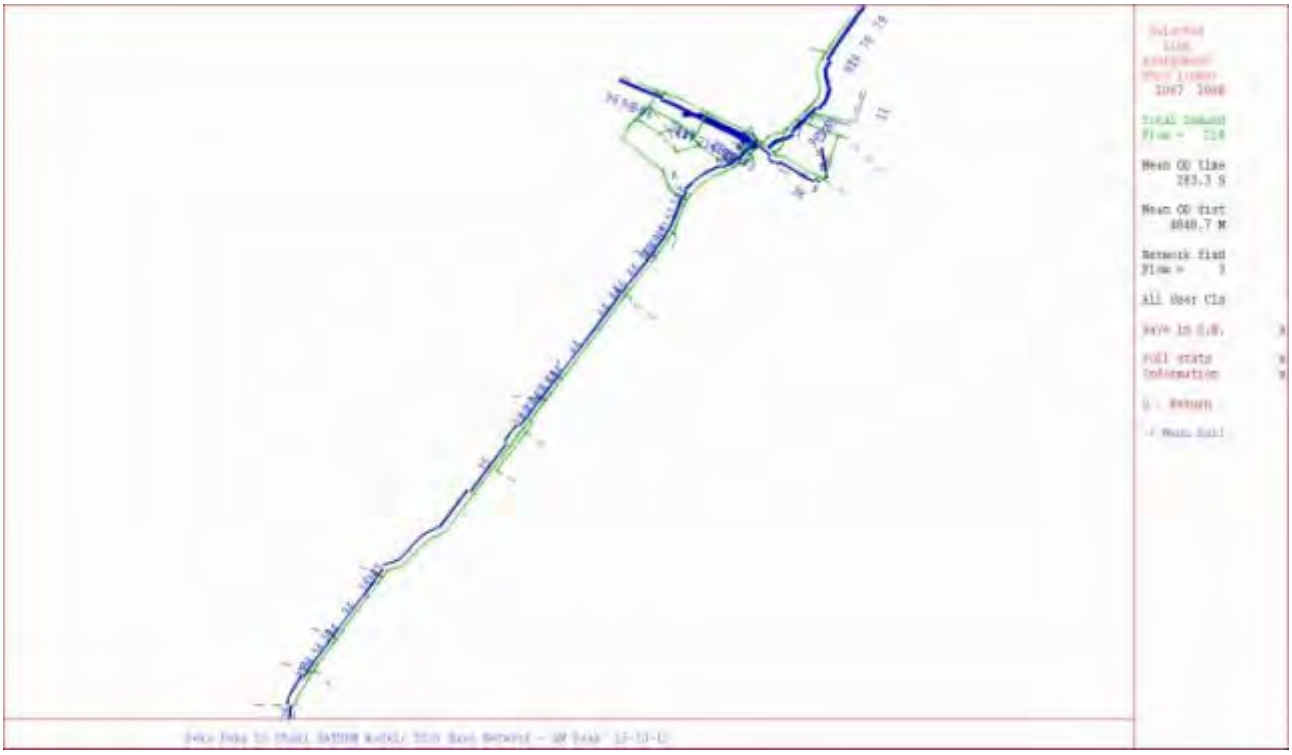
Otaki2010_SATURN Model_AM peak_Select Link_SH1 South of Waerenga Rd (SB)1

Otaki2010_SATURN Model_AM peak_Select Link_SH1 South of Waerenga Rd (SB)2



Otaki2010_SATURN Model_AM peak_Select Link_Mill Rd West of Dunstan Rd (EB)1

Otaki2010_SATURN Model_AM peak_Select Link_ Mill Rd West of Dunstan Rd (EB)2



Otaki2010_SATURN Model_AM peak_Select Link_ Mill Rd West of Dunstan Rd (WB)1

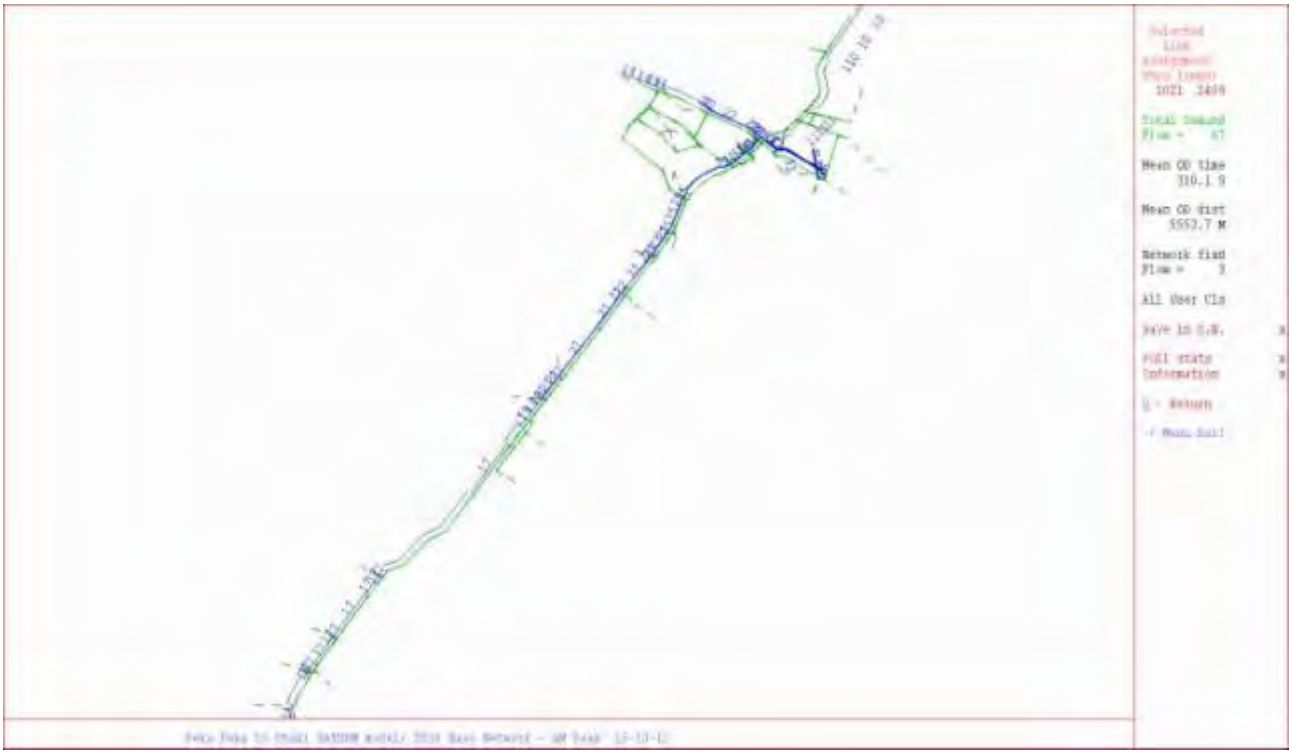
Otaki2010_SATURN Model_AM peak_Select Link_ Mill Rd West of Dunstan Rd (WB)2

Otaki2010_SATURN Model_AM peak_Select Link_SH1 North of Mill Rd (NB)1

Otaki2010_SATURN Model_AM peak_Select Link_SH1 North of Mill Rd (NB)2

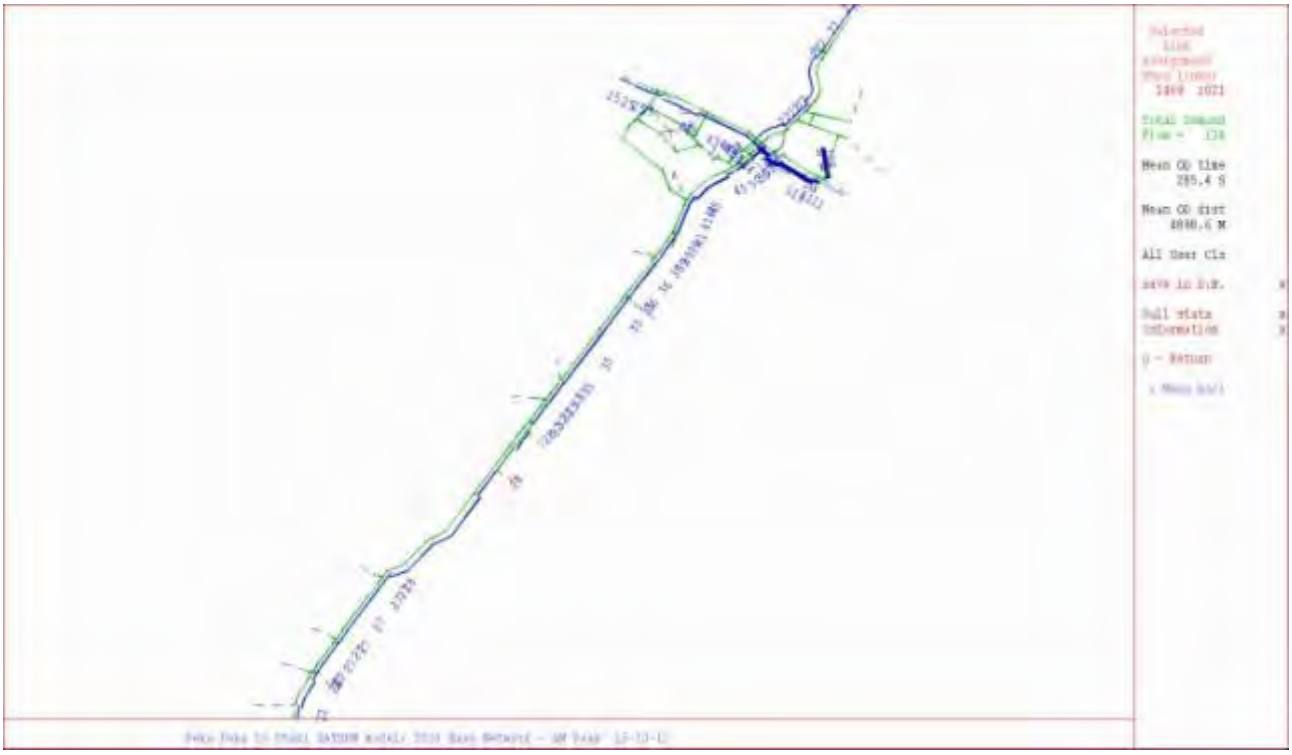
Otaki2010_SATURN Model_AM peak_Select Link_SH1 North of Mill Rd (SB)1

Otaki2010_SATURN Model_AM peak_Select Link_SH1 North of Mill Rd (SB)2



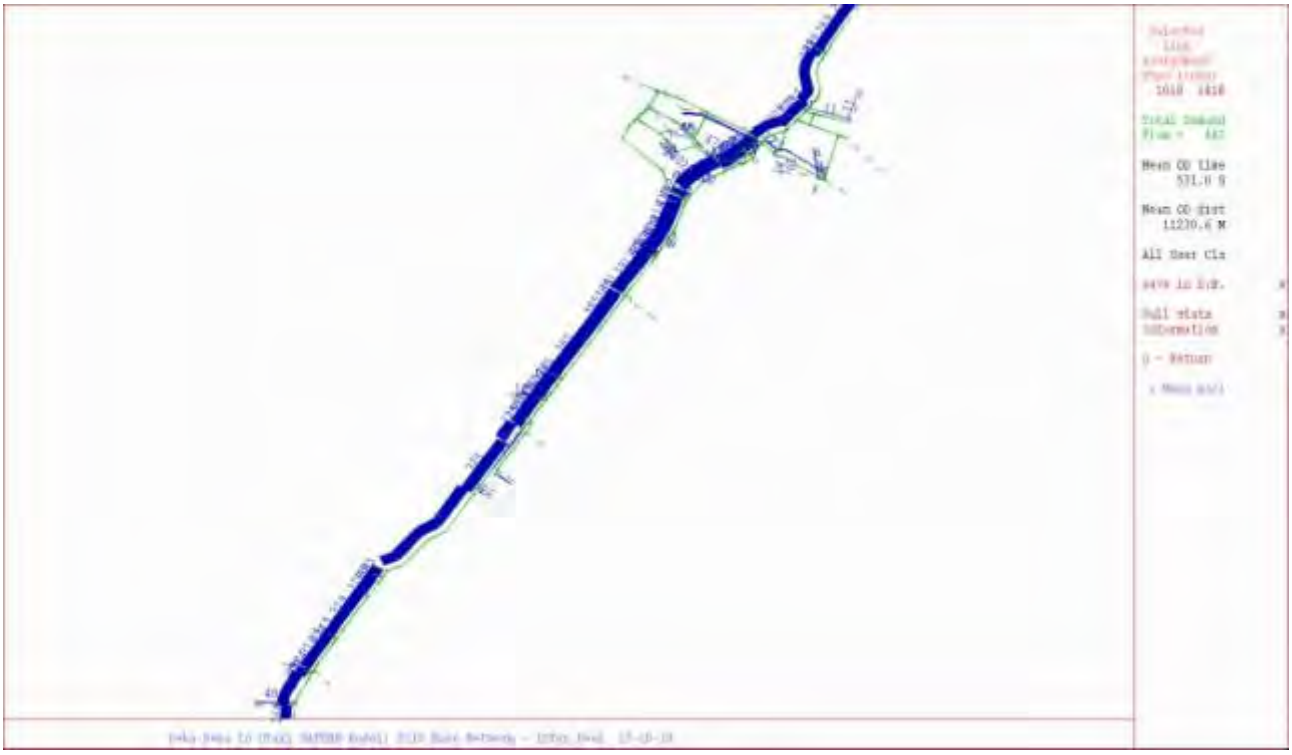
Otaki2010_SATURN Model_AM peak_Select Link_Rahui Rd East of SH1 (EB)1

Otaki2010_SATURN Model_AM peak_Select Link_ Rahui Rd East of SH1 (EB)2



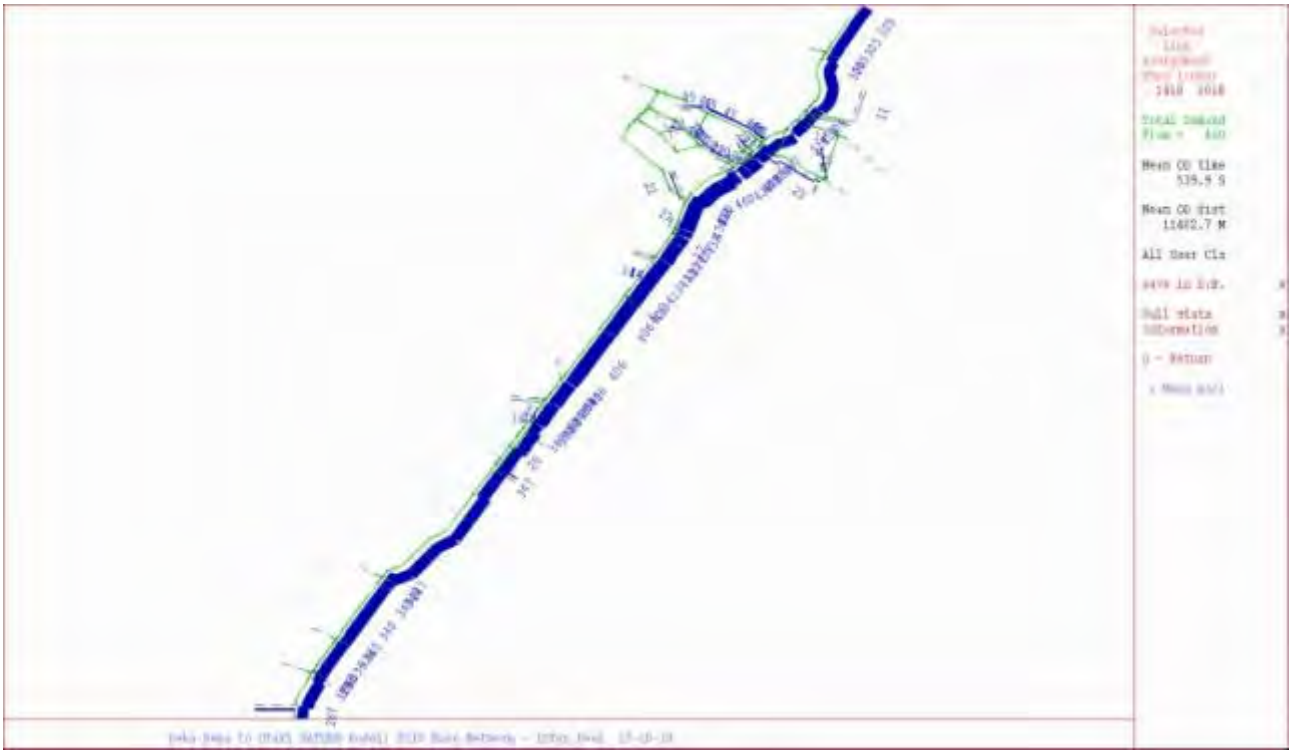
Otaki2010_SATURN Model_AM peak_Select Link_ Rahui Rd East of SH1 (WB)1

Otaki2010_SATURN Model_AM peak_Select Link_ Rahui Rd East of SH1 (WB)2



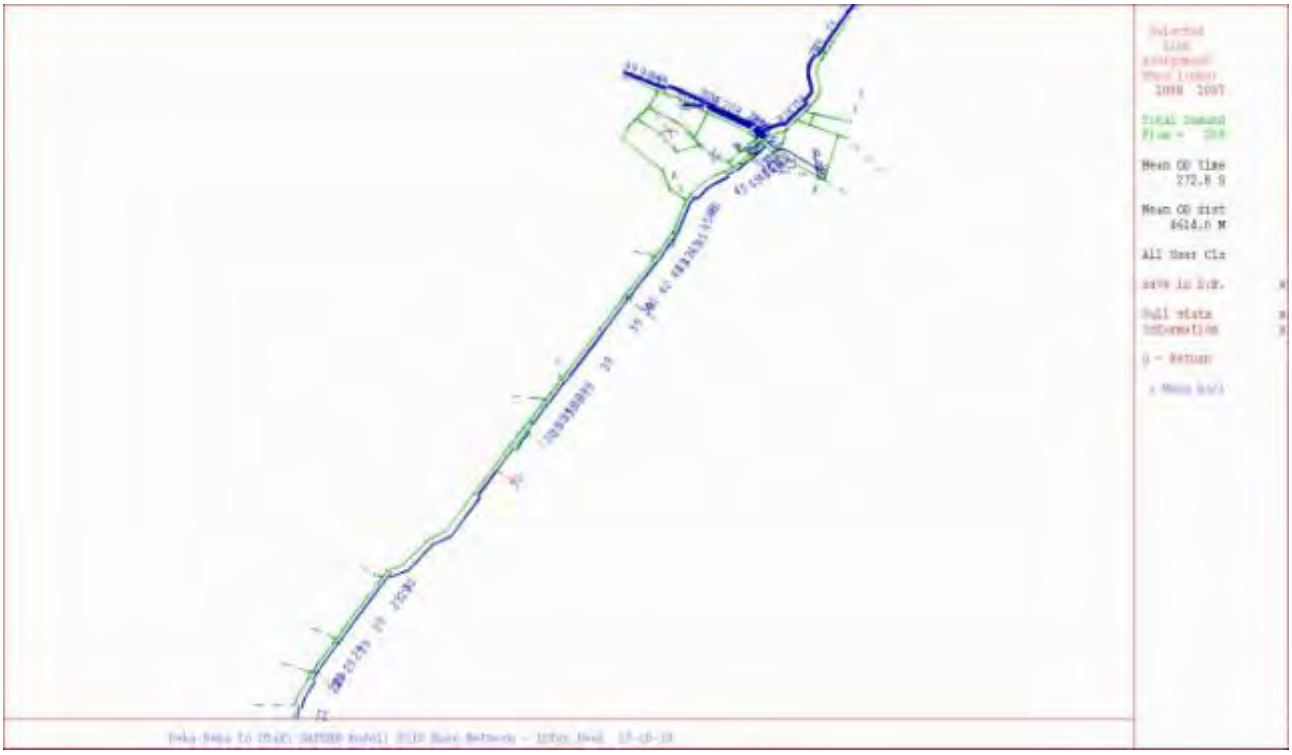
Otaki2010_SATURN Model_Inter peak_Select Link_SH1 South of Waerenga Rd (NB)1

Otaki2010_SATURN Model_Inter peak_Select Link_SH1 South of Waerenga Rd (NB)2



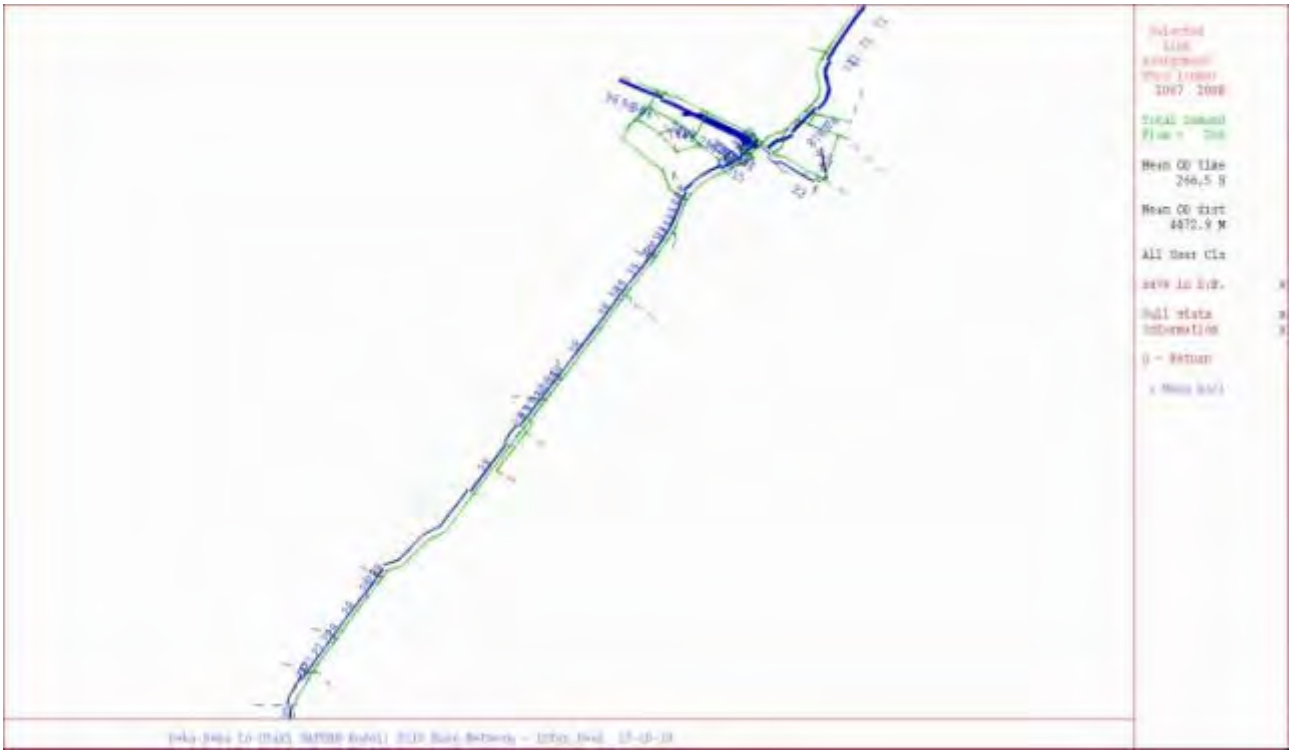
Otaki2010_SATURN Model_Inter peak_Select Link_SH1 South of Waerenga Rd (SB)1

Otaki2010_SATURN Model_Inter peak_Select Link_SH1 South of Waerenga Rd (SB)2



Otaki2010_SATURN Model_Inter peak_Select Link_Mill Rd West of Dunstan Rd (EB)1

Otaki2010_SATURN Model_Inter peak_Select Link_ Mill Rd West of Dunstan Rd (EB)2

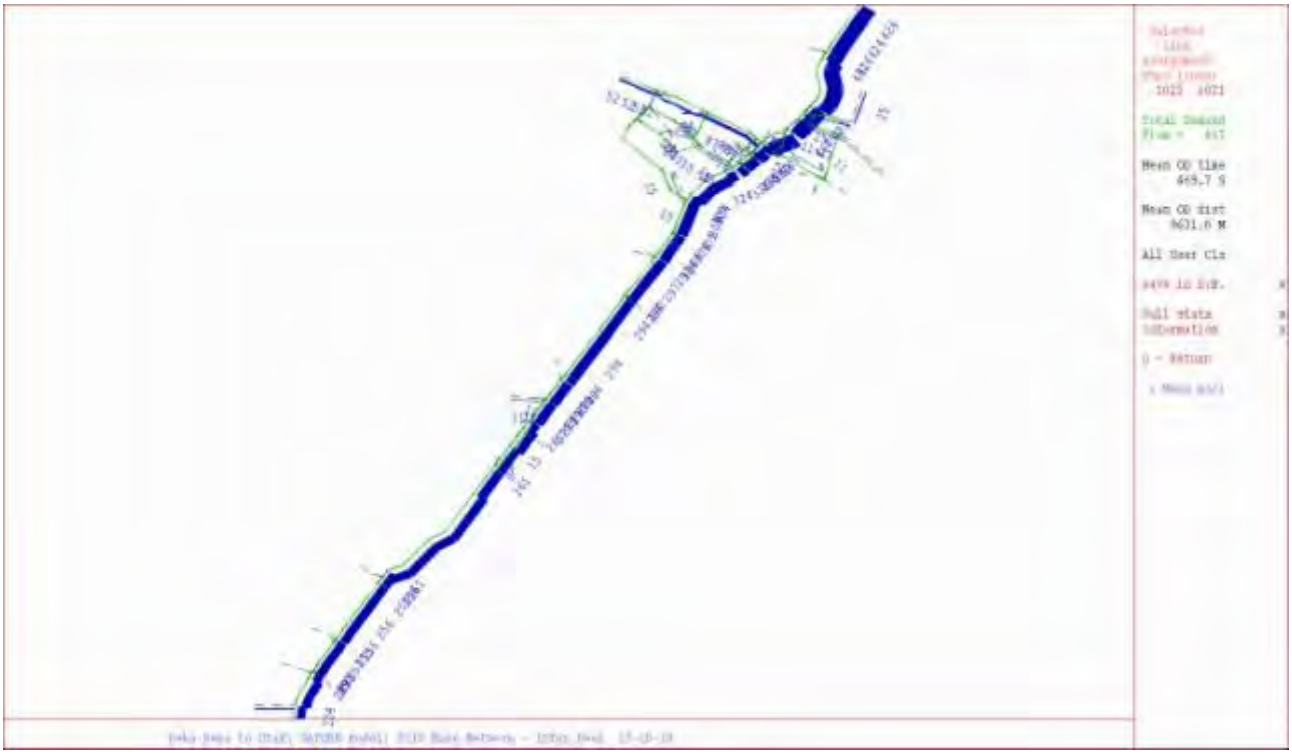


Otaki2010_SATURN Model_Inter peak_Select Link_ Mill Rd West of Dunstan Rd (WB)1

Otaki2010_SATURN Model_Inter peak_Select Link_ Mill Rd West of Dunstan Rd (WB)2

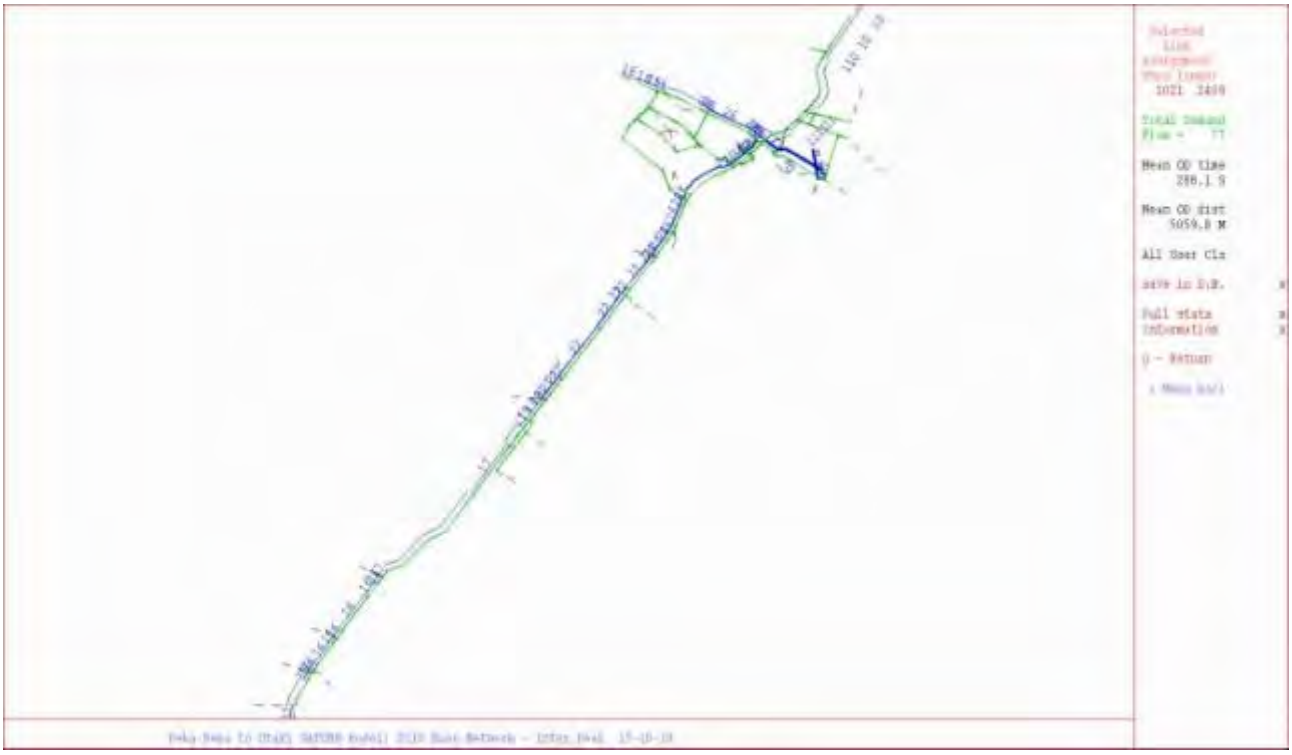
Otaki2010_SATURN Model_Inter peak_Select Link_SH1 North of Mill Rd (NB)1

Otaki2010_SATURN Model_Inter peak_Select Link_SH1 North of Mill Rd (NB)2



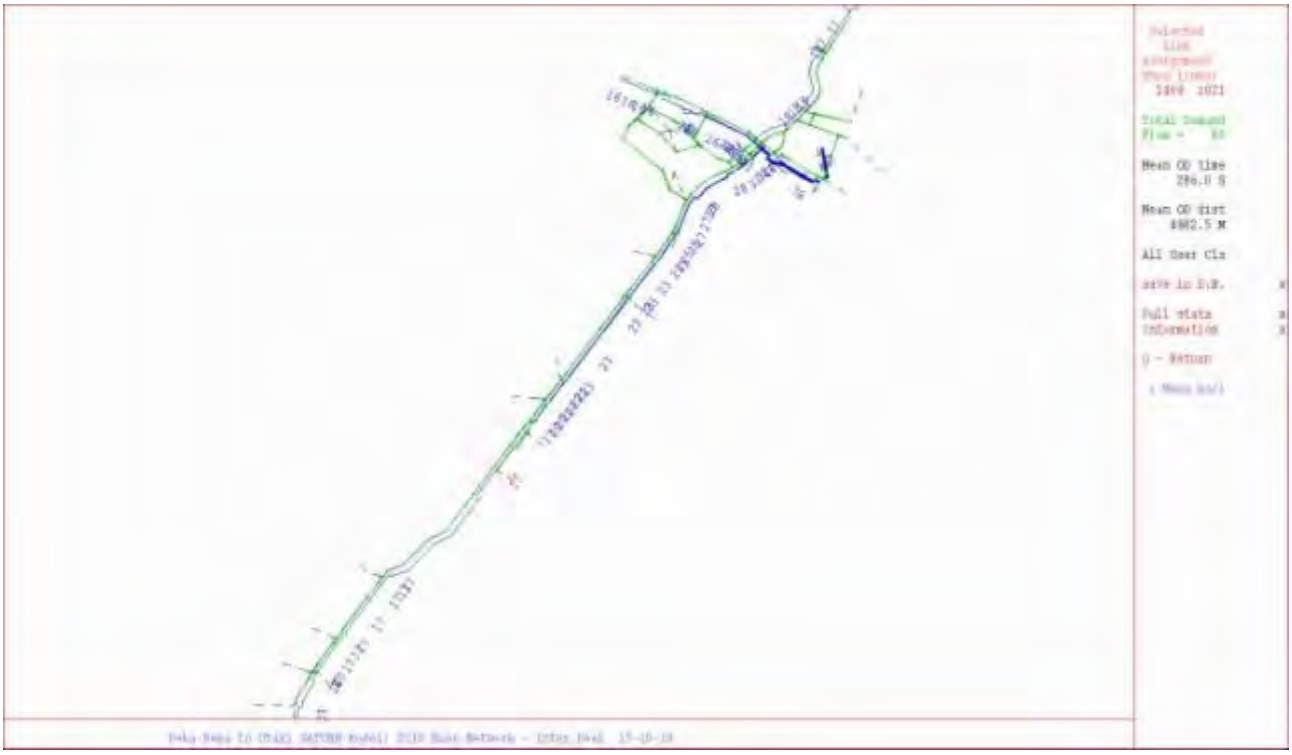
Otaki2010_SATURN Model_Inter peak_Select Link_SH1 North of Mill Rd (SB)1

Otaki2010_SATURN Model_Inter peak_Select Link_SH1 North of Mill Rd (SB)2



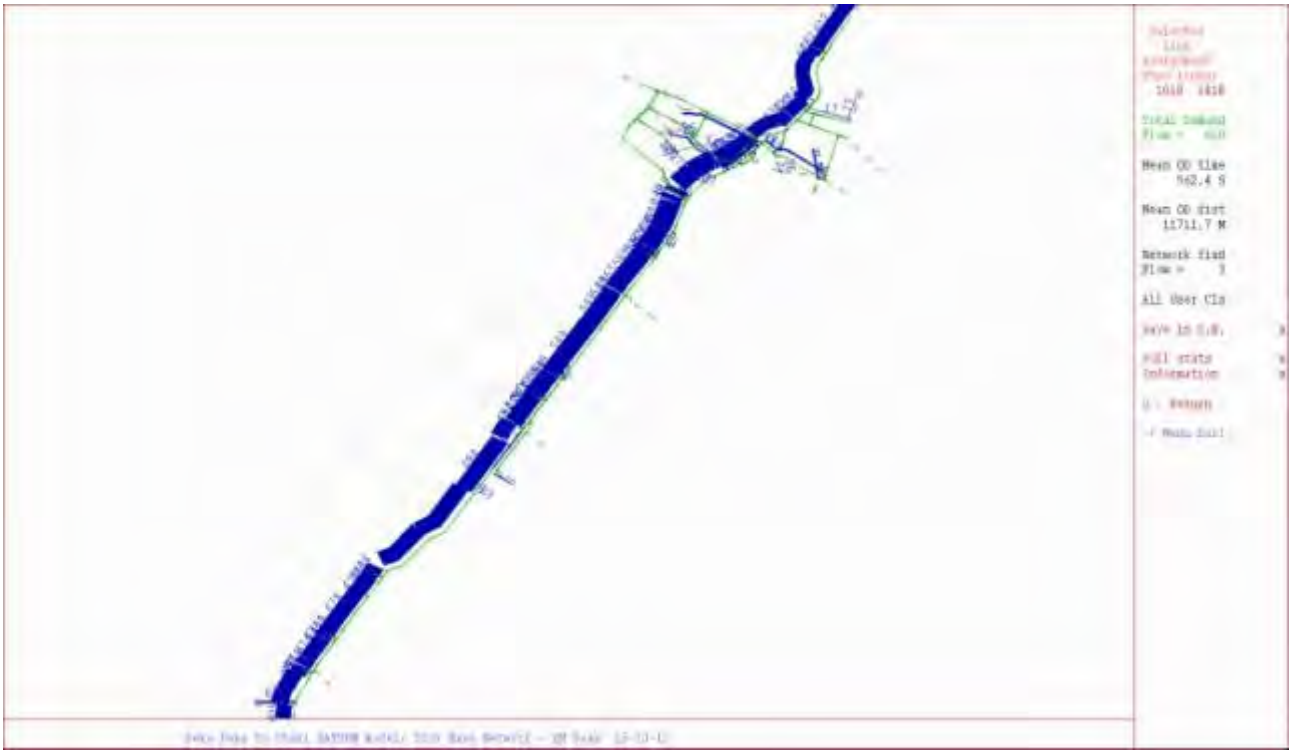
Otaki2010_SATURN Model_Inter peak_Select Link_Rahui Rd East of SH1 (EB)1

Otaki2010_SATURN Model_Inter peak_Select Link_ Rahui Rd East of SH1 (EB)2



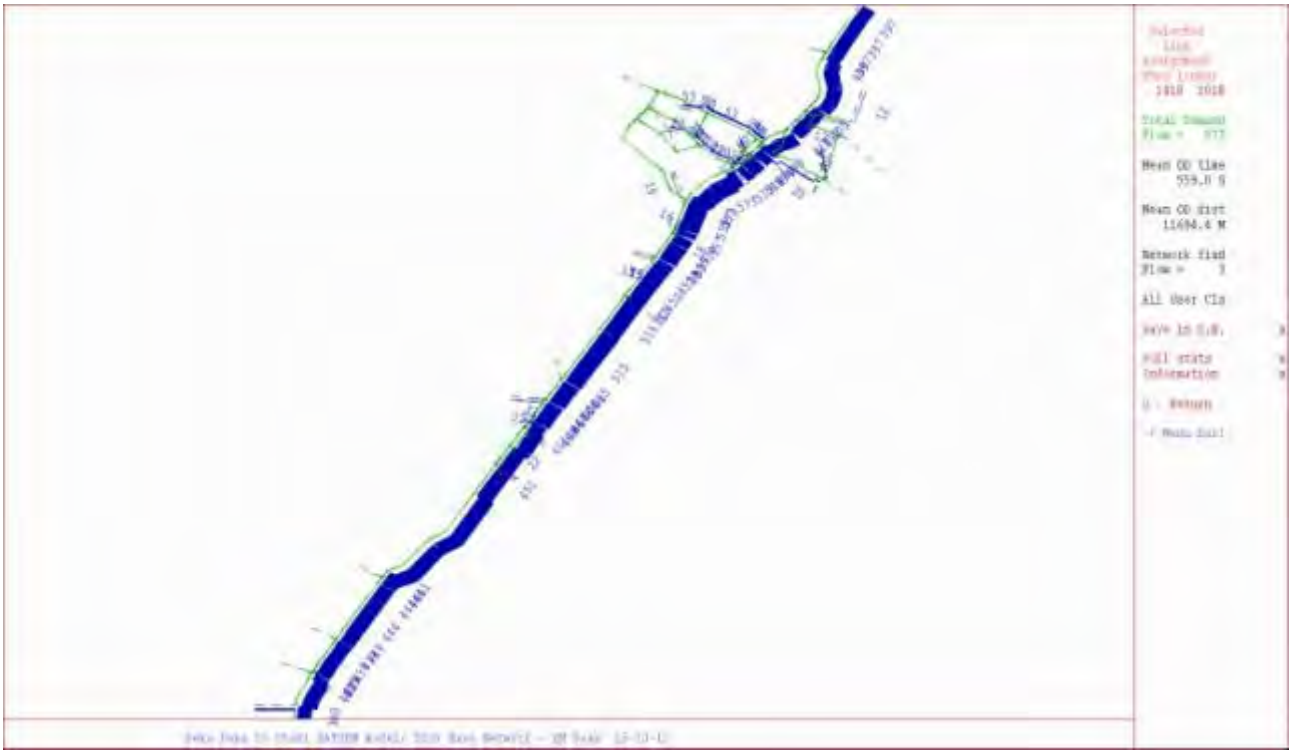
Otaki2010_SATURN Model_Inter peak_Select Link_ Rahui Rd East of SH1 (WB)1

Otaki2010_SATURN Model_Inter peak_Select Link_ Rahui Rd East of SH1 (WB)2



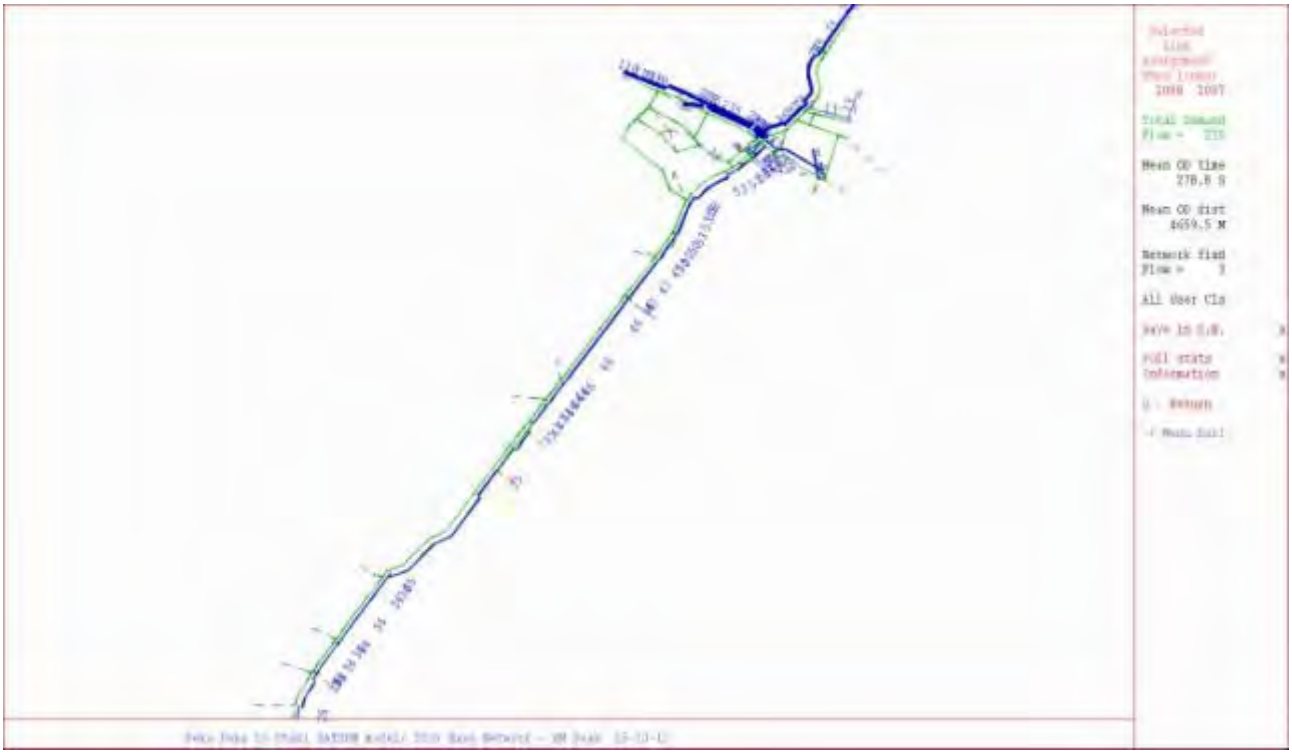
Otaki2010_SATURN Model_PM peak_Select Link_SH1 South of Waerenga Rd (NB)1

Otaki2010_SATURN Model_PM peak_Select Link_SH1 South of Waerenga Rd (NB)2



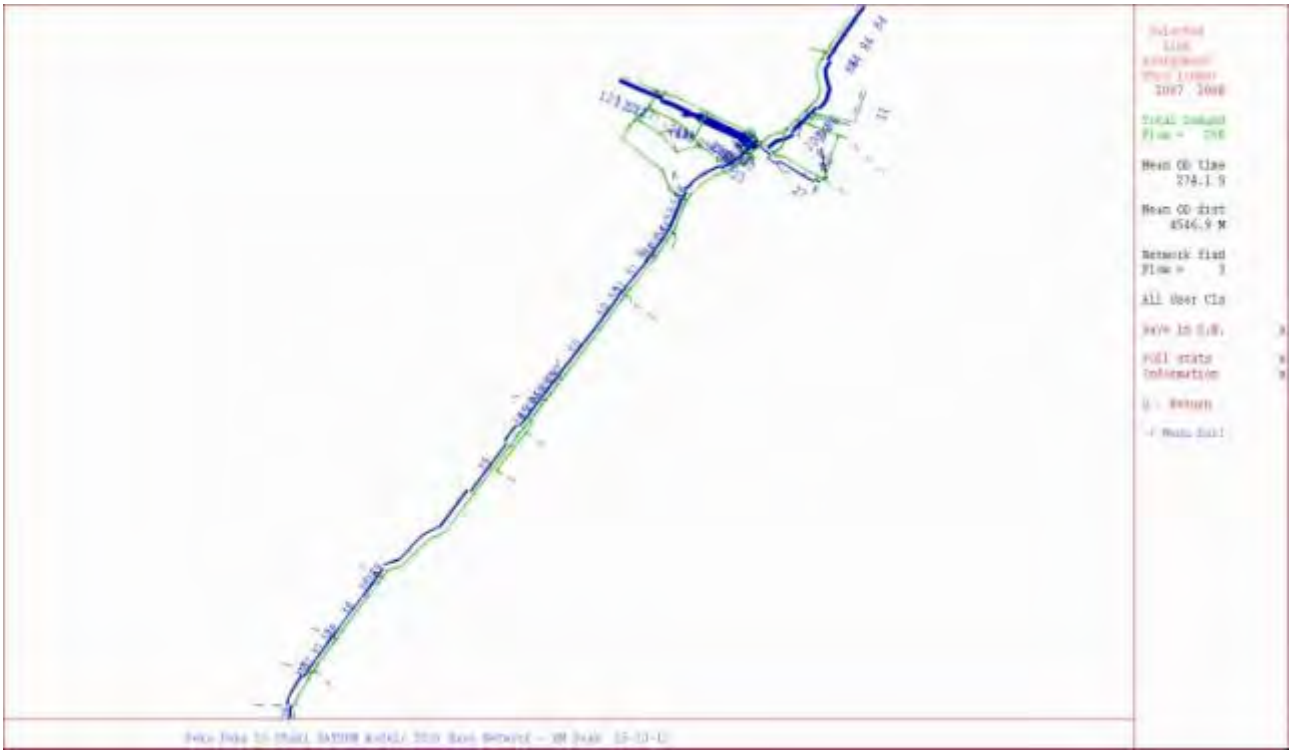
Otaki2010_SATURN Model_PM peak_Select Link_SH1 South of Waerenga Rd (SB)1

Otaki2010_SATURN Model_PM peak_Select Link_SH1 South of Waerenga Rd (SB)2



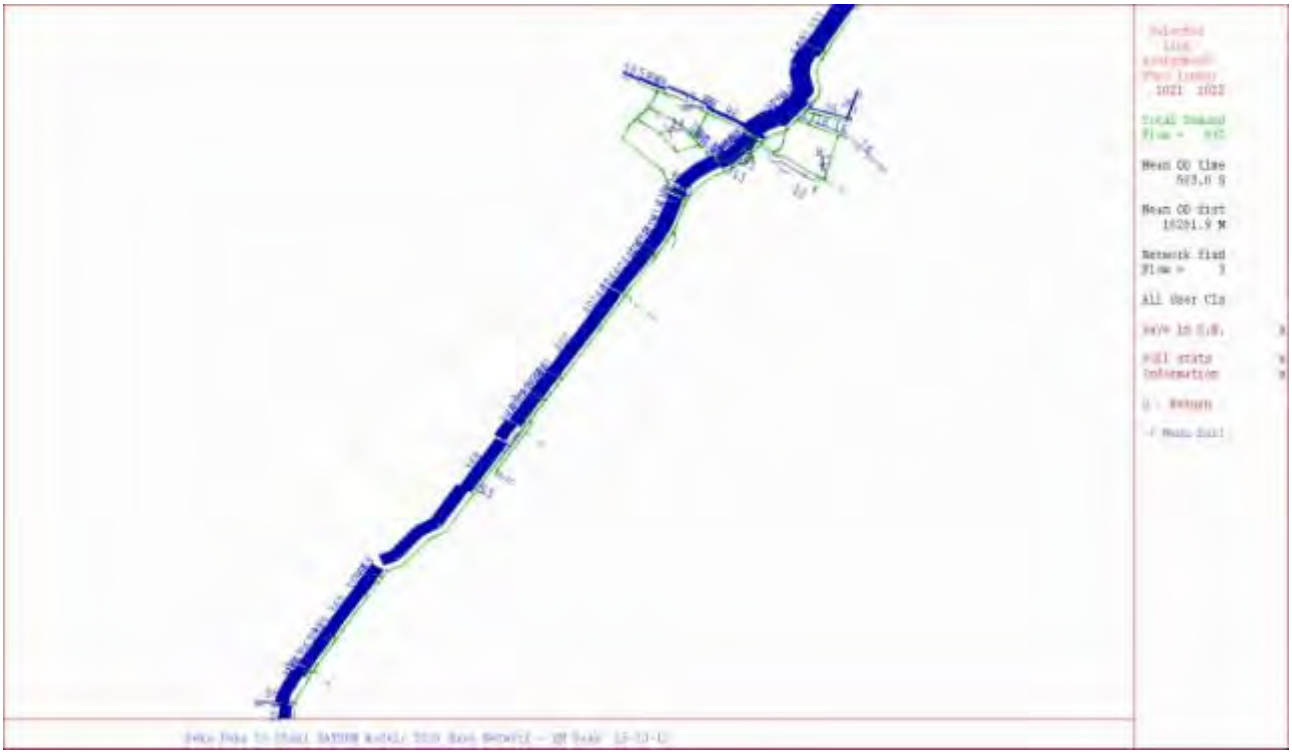
Otaki2010_SATURN Model_PM peak_Select Link_Mill Rd West of Dunstan Rd (EB)1

Otaki2010_SATURN Model_PM peak_Select Link_ Mill Rd West of Dunstan Rd (EB)2



Otaki2010_SATURN Model_PM peak_Select Link_ Mill Rd West of Dunstan Rd (WB)1

Otaki2010_SATURN Model_PM peak_Select Link_ Mill Rd West of Dunstan Rd (WB)2



Otaki2010_SATURN Model_PM peak_Select Link_SH1 North of Mill Rd (NB)1

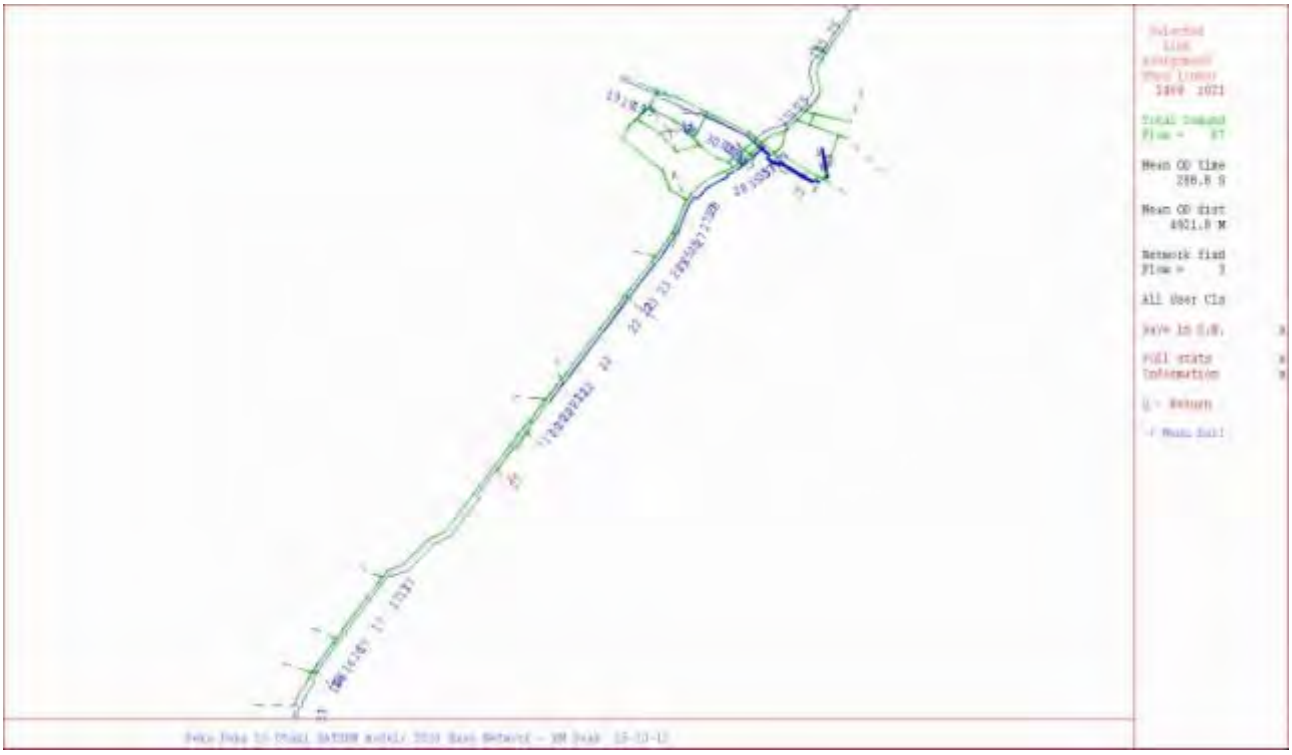
Otaki2010_SATURN Model_PM peak_Select Link_SH1 North of Mill Rd (NB)2

Otaki2010_SATURN Model_PM peak_Select Link_SH1 North of Mill Rd (SB)1

Otaki2010_SATURN Model_PM peak_Select Link_SH1 North of Mill Rd (SB)2

Otaki2010_SATURN Model_PM peak_Select Link_Rahui Rd East of SH1 (EB)1

Otaki2010_SATURN Model_PM peak_Select Link_ Rahui Rd East of SH1 (EB)2



Otaki2010_SATURN Model_PM peak_Select Link_ Rahui Rd East of SH1 (WB)1

Otaki2010_SATURN Model_PM peak_Select Link_ Rahui Rd East of SH1 (WB)2

Appendix E

Absolute Difference between Observed Flows and Modelled Flows

Turn Flow Comparison: 7:45-8:45 AM Peak Period

	NO.	ANODE	BNODE	CNODE	COUNT HCV	COUNT CARS	COUNT TOTAL	MODELLED	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	2	10	14	25	-11	-79.43	2.51
SH1 (S) TH SH1 (N)	2	1401	1001	1002	51	432	534	523	11	2.05	0.48
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	0	23	23	5	18	79.35	4.90
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	1	30	32	45	-13	-39.69	2.05
SH1 (N) TH SH1 (S)	5	1002	1001	1401	36	563	635	619	16	2.47	0.63
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	0	16	16	4	12	76.50	3.89
SH1 (S) TH SH1 (N)	7	1001	1002	1402	51	456	558	524	34	6.12	1.47
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	0	4	4	4	0	0.75	0.02
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0	1	1	6	-5	-509.00	2.70
SH1 (N) TH SH1 (S)	10	1402	1002	1001	36	581	653	618	35	5.36	1.39
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	0	3	3	5	-2	-69.33	1.03
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	0	0	0	7	-7	0.00	0.00
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0	1	1	5	-4	-361.00	2.16
SH1 (S) TH SH1 (N)	14	1431	1003	1403	51	455	557	526	31	5.56	1.33
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	0	2	2	9	-7	-333.50	2.89
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	0	5	5	7	-2	-38.00	0.78
SH1 (N) TH SH1 (S)	17	1403	1003	1431	36	577	649	617	32	4.90	1.27
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	0	1	1	7	-6	-576.00	2.92
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	0	11	11	7	4	34.73	1.27
SH1 (S) TH SH1 (N)	20	1429	1004	1404	51	446	548	528	21	3.74	0.88
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	0	6	6	13	-7	-110.17	2.17
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	0	65	65	11	54	83.69	8.85
SH1 (N) TH SH1 (S)	23	1404	1004	1429	36	513	585	613	-28	-4.84	1.16
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	1	5	7	10	-3	-39.29	0.95
SH1 (S) TH SH1 (N)	25	1407	1007	1008	51	413	515	496	19	3.64	0.83
SH1 (S) RT School Rd (E)	26	1407	1007	3408	0	39	39	44	-5	-12.44	0.75
SH1 (N) LT School Rd (E)	27	1008	1007	3408	1	53	55	56	-1	-2.02	0.15
SH1 (N) TH SH1 (S)	28	1008	1007	1407	37	462	536	587	-51	-9.60	2.17
School Rd (E) LT SH1 (S)	29	3408	1007	1407	0	56	56	36	20	36.45	3.02
School Rd (E) RT SH1 (N)	30	3408	1007	1008	1	38	40	45	-5	-12.88	0.79
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	0	11	11	23	-12	-111.91	2.97
SH1 (S) TH SH1 (N)	32	1409	1009	1410	52	440	544	518	26	4.76	1.12
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	4	26	34	28	6	17.76	1.09
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	1	15	17	44	-27	-156.35	4.83
SH1 (N) TH SH1 (S)	35	1410	1009	1409	37	500	574	600	-26	-4.53	1.07
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	3	6	12	19	-7	-57.17	1.75
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0	9	9	9	0	-0.22	0.01
SH1 (S) TH SH1 (N)	38	1411	1010	1011	55	458	568	537	31	5.47	1.32
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	0	14	14	13	1	8.21	0.31
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	0	26	26	8	18	70.12	4.39
SH1 (N) TH SH1 (S)	41	1011	1010	1411	48	473	568	611	-43	-7.53	1.76
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	0	10	10	17	-7	-73.20	1.98
SH1 (S) TH SH1 (N)	43	1412	1013	1014	58	464	580	545	35	5.96	1.46
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	1	4	6	5	1	20.67	0.53
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0	6	6	8	-2	-40.50	0.90
SH1 (N) TH SH1 (S)	46	1014	1013	1412	47	467	560	620	-60	-10.69	2.47
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	2	15	19	8	11	55.79	2.86
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	0	7	7	14	-7	-94.86	2.07
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0	2	2	18	-16	-786.50	5.01
SH1 (S) TH SH1 (N)	50	1414	1015	1415	58	469	585	541	44	7.46	1.84
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	1	8	10	17	-7	-67.70	1.85
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	0	3	3	14	-11	-351.67	3.67
SH1 (N) TH SH1 (S)	53	1415	1015	1414	47	470	563	615	-52	-9.19	2.13
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	1	21	23	25	-2	-9.61	0.45
SH1 (S) TH SH1 (N)	55	1416	1016	1430	58	468	584	547	37	6.30	1.55
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	1	9	11	11	0	0.73	0.02
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	1	16	18	13	5	29.89	1.37
SH1 (N) TH SH1 (S)	58	1430	1016	1416	48	483	578	620	-42	-7.22	1.71
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	0	8	8	20	-12	-153.00	3.26
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	1	23	25	21	4	14.68	0.76
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	7	108	122	95	27	22.36	2.62
SH1 (S) TH SH1 (N)	62	1417	1017	1018	48	387	483	474	9	1.96	0.43
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	1	27	29	12	17	58.10	3.71
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	12	79	103	89	14	13.71	1.44
SH1 (N) TH SH1 (S)	65	1018	1017	1417	35	421	492	544	-52	-10.53	2.28
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	6	37	49	28	21	42.39	3.34
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	0	39	39	17	22	56.44	4.16
SH1 (S) TH SH1 (N)	68	1418	1019	1419	49	375	473	469	4	0.83	0.18
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	0	59	59	31	28	46.85	4.11
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	1	36	38	53	-15	-39.29	2.21
SH1 (N) TH SH1 (S)	71	1419	1019	1418	40	422	503	519	-16	-3.26	0.72
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	1	40	42	18	24	55.98	4.27
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	2	9	13	35	-22	-165.46	4.41
SH1 (S) TH SH1 (N)	74	1419	1020	1420	23	437	483	441	42	8.65	1.94
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	1	11	13	24	-11	-86.38	2.60
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	0	7	7	14	-7	-102.71	2.21
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	0	2	2	3	-1	-26.00	0.35
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	0	2	2	0	2	100.00	2.00
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	1	12	14	42	-28	-197.29	5.24
SH1 (N) TH SH1 (S)	80	1420	1020	1419	27	469	522	529	-7	-1.39	0.32
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	0	8	8	0	8	100.00	4.00
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	0	6	6	8	-2	-34.50	0.78
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	0	4	4	2	2	59.50	1.42
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	0	2	2	12	-10	-483.50	3.70
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	1	86	88	57	31	35.11	3.63
SH1 (S) TH SH1 (N)	86	1421	1021	1022	20	335	375	376	-1	-0.24	0.05
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	2	25	29	34	-5	-18.28	0.94
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	2	84	88	84	4	4.35	0.41
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	0	17	17	25	-8	-44.18	1.65
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	2	89	93	67	26	28.45	2.96
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	0	31	31	11	20	64.97	4.40
SH1 (N) TH SH1 (S)	92	1022	1021	1421	25	365	416	448	-32	-7.68	1.54
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	3	141	147	126	21	14.33	1.80
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	0	35	35	57	-22	-61.86	3.20
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	0	35	35	54	-19	-55.54	2.91
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	0	19	19	22	-3	-18.05	0.75
SH1 (S) TH SH1 (N)	97	1021	1022	1023	22	438	482	482	0	-0.04	0.01
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0	4	4	0	4	100.00	2.83
SH1 (N) TH SH1 (S)	100	1023	1022	1021	29	537	594	585	10	1.61	0.40
County Rd (E) LT SH1 (S)	101	2019	1022	1021	0	0	0	0	0	0.00	0.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	0	0	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	103	1022	1023	1024	35	401	471	473	-3	-0.63	0.14
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	0	24	24	9	15	63.13	3.74
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0	3	3	7	-4	-134.00	1.80
SH1 (N) TH SH1 (S)	106	1024	1023	1022	41	496	579	567	11	1.94	0.47
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	1	31	33	17	16	47.33	3.11
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	0	3	3	4	-1	-38.67	0.61
SH1 (S) TH SH1 (N)	109	1023	1024	1025	35	384	454	457	-3	-0.69	0.15
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	0	20	20	21	-1	-5.00	0.22
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	1	11	13	6	7	53.08	2.23
SH1 (N) TH SH1 (S)	112	1025	1024	1023	39	460	539	543	-4	-0.79	0.18
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	2	39	43	32	11	26.63	1.88
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	0	9	9	9	0	-0.44	0.01
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0	3	3	7	-4	-132.33	1.78
SH1 (S) TH SH1 (N)	116	1026	1027	1427	35	390	460	459	1	0.17	0.04
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	0	0	0	2	-2	0.00	0.00
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	0	6	6	8	-2	-38.50	0.86
SH1 (N) TH SH1 (S)	119	1427	1027	1026	40	465	546	541	5	0.91	0.21
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	0	1	1	1	0	-44.00	0.40

Total no. of counts	120
Summation observed flows	21290.7834
Summation (modelled - flows)²	47660
% RMSE	11

GEH Summary	Total	%	R^2
GEH <2	75	63%	0.99
GEH <4	109	91%	
GEH <5	117	98%	
Total	120	0%	

Turn Flow Comparison: 11:00-12:00 Inter Peak Period

	NO.	ANODE	BNODE	CNODE	COUNT HCV	COUNT CARS	COUNT TOTAL	MODELLED	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	1	21	23	32	-9	-40.00	1.75
SH1 (S) TH SH1 (N)	2	1401	1001	1002	45	368	458	449	9	2.01	0.43
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	1	13	15	5	10	69.47	3.33
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	0	20	20	39	-19	-93.20	3.44
SH1 (N) TH SH1 (S)	5	1002	1001	1401	50	403	503	483	20	3.91	0.89
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	0	11	11	4	7	59.91	2.37
SH1 (S) TH SH1 (N)	7	1001	1002	1402	46	383	475	450	25	5.33	1.18
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	0	3	3	4	-1	-23.00	0.38
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0	3	3	7	-4	-125.00	1.70
SH1 (N) TH SH1 (S)	10	1402	1002	1001	50	412	512	484	28	5.53	1.27
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	0	7	7	4	3	41.86	1.25
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	3	0	6	7	-1	-10.83	0.26
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0	2	2	5	-3	-137.50	1.50
SH1 (S) TH SH1 (N)	14	1431	1003	1403	46	384	476	452	24	5.13	1.13
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	0	1	1	8	-7	-703.00	3.31
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	0	2	2	5	-3	-163.50	1.72
SH1 (N) TH SH1 (S)	17	1403	1003	1431	50	413	513	485	28	5.43	1.25
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	0	2	2	8	-6	-303.50	2.71
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	1	16	18	7	11	59.11	2.99
SH1 (S) TH SH1 (N)	20	1429	1004	1404	45	369	459	452	7	1.47	0.32
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	0	4	4	12	-8	-192.25	2.75
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	0	15	15	8	7	45.73	2.02
SH1 (N) TH SH1 (S)	23	1404	1004	1429	50	400	500	485	15	2.99	0.67
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	0	3	3	12	-9	-291.67	3.22
SH1 (S) TH SH1 (N)	25	1407	1007	1008	44	353	441	426	15	3.32	0.70
SH1 (S) RT School Rd (E)	26	1407	1007	3408	1	20	22	38	-16	-70.82	2.85
SH1 (N) LT School Rd (E)	27	1008	1007	3408	0	21	21	54	-33	-158.62	5.43
SH1 (N) TH SH1 (S)	28	1008	1007	1407	49	373	471	456	15	3.26	0.71
School Rd (E) LT SH1 (S)	29	3408	1007	1407	1	30	32	41	-9	-28.63	1.51
School Rd (E) RT SH1 (N)	30	3408	1007	1008	2	22	26	55	-29	-110.50	4.52
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	1	9	11	29	-18	-164.45	4.04
SH1 (S) TH SH1 (N)	32	1409	1009	1410	45	366	456	452	4	0.87	0.19
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	1	18	20	25	-5	-23.55	1.00
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	0	4	4	32	-28	-695.25	6.57
SH1 (N) TH SH1 (S)	35	1410	1009	1409	49	390	488	478	10	2.02	0.45
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	0	14	14	24	-10	-74.86	2.39
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0	9	9	7	2	20.33	0.64
SH1 (S) TH SH1 (N)	38	1411	1010	1011	45	376	466	470	-3	-0.74	0.16
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	0	18	18	14	4	20.72	0.93
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	0	17	17	7	10	56.24	2.73
SH1 (N) TH SH1 (S)	41	1011	1010	1411	64	372	500	495	4	0.89	0.20
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	0	10	10	14	-4	-41.70	1.20
SH1 (S) TH SH1 (N)	43	1412	1013	1014	61	376	498	478	20	3.94	0.89
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	1	1	3	5	-2	-78.67	1.15
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0	2	2	10	-8	-405.00	3.29
SH1 (N) TH SH1 (S)	46	1014	1013	1412	65	376	506	504	2	0.44	0.10
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	0	5	5	6	-1	-13.00	0.28
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	0	4	4	10	-6	-160.50	2.39
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0	7	7	14	-7	-99.57	2.15
SH1 (S) TH SH1 (N)	50	1414	1015	1415	61	373	495	475	20	4.08	0.92
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	0	9	9	21	-12	-128.89	3.02
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	0	4	4	14	-10	-260.00	3.43
SH1 (N) TH SH1 (S)	53	1415	1015	1414	65	374	504	499	5	0.89	0.20
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	0	12	12	20	-8	-70.00	2.09
SH1 (S) TH SH1 (N)	55	1416	1016	1430	61	374	496	482	14	2.76	0.62
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	0	8	8	13	-5	-63.88	1.57
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	5	27	37	16	21	57.51	4.14
SH1 (N) TH SH1 (S)	58	1430	1016	1416	65	380	510	506	4	0.75	0.17
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	0	6	6	14	-8	-128.83	2.46
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	7	26	40	16	24	59.23	4.46
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	17	70	104	81	23	22.30	2.41
SH1 (S) TH SH1 (N)	62	1417	1017	1018	48	333	429	418	11	2.67	0.56
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	16	49	81	24	57	70.80	7.93
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	16	65	97	84	13	13.90	1.42
SH1 (N) TH SH1 (S)	65	1018	1017	1417	49	347	445	438	6	1.40	0.30
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	9	24	42	21	21	49.33	3.68
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	4	39	47	20	27	58.32	4.75
SH1 (S) TH SH1 (N)	68	1418	1019	1419	60	343	463	422	41	8.91	1.96
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	2	52	56	22	34	60.88	5.46
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	2	43	47	20	27	56.64	4.59
SH1 (N) TH SH1 (S)	71	1419	1019	1418	55	329	439	439	0	-0.05	0.01
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	4	41	49	21	28	56.55	4.67
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	3	16	22	27	-5	-22.55	1.00
SH1 (S) TH SH1 (N)	74	1419	1020	1420	60	364	484	401	84	17.28	3.98
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	1	13	15	16	-1	-8.67	0.33
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	0	15	15	27	-12	-76.73	2.53
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	0	2	2	3	-1	-71.00	0.86
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	0	8	8	28	-20	-247.88	4.69
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	1	37	39	29	10	26.41	1.77
SH1 (N) TH SH1 (S)	80	1420	1020	1419	49	358	456	416	40	8.69	1.90
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	1	12	14	20	-6	-45.07	1.52
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	0	14	14	17	-3	-18.79	0.67
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	0	2	2	3	-1	-70.00	0.85
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	1	22	24	29	-5	-19.46	0.91
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	6	74	86	62	24	27.93	2.79
SH1 (S) TH SH1 (N)	86	1421	1021	1022	54	273	381	354	27	7.10	1.41
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	1	54	56	40	16	28.52	2.30
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	2	78	82	91	-9	-10.89	0.96
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	0	15	15	26	-11	-71.67	2.38
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	0	122	122	60	62	50.50	6.45
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	2	20	24	11	13	54.63	3.14
SH1 (N) TH SH1 (S)	92	1022	1021	1421	50	260	360	363	-4	-1.08	0.20
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	3	82	88	93	-5	-5.18	0.48
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	0	26	26	41	-15	-58.62	2.63
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	0	24	24	26	-2	-8.87	0.43
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	0	23	23	18	5	23.35	1.19
SH1 (S) TH SH1 (N)	97	1021	1022	1023	57	373	487	462	24	4.96	1.11
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0	3	3	0	3	100.00	2.45
SH1 (N) TH SH1 (S)	100	1023	1022	1021	55	361	471	467	4	0.94	0.20
County Rd (E) LT SH1 (S)	101	2019	1022	1021	1	0	2	0	2	100.00	2.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	1	0	2	0	2	100.00	2.00
SH1 (S) TH SH1 (N)	103	1022	1023	1024	50	356	456	452	4	0.96	0.21
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	2	23	27	11	16	60.30	3.75
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0	4	4	9	-5	-123.75	1.95
SH1 (N) TH SH1 (S)	106	1024	1023	1022	63	334	460	456	4	0.95	0.21
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	0	22	22	11	11	49.91	2.70
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	0	1	1	3	-2	-193.00	1.38
SH1 (S) TH SH1 (N)	109	1023	1024	1025	46	332	424	430	-6	-1.45	0.30
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	4	25	33	24	9	26.06	1.61
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	0	3	3	6	-3	-93.00	1.33
SH1 (N) TH SH1 (S)	112	1025	1024	1023	60	320	440	440	0	0.11	0.02
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	3	18	24	25	-1	-4.33	0.21
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	0	7	7	7	0	6.29	0.17
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0	5	5	7	-2	-36.60	0.75
SH1 (S) TH SH1 (N)	116	1026	1027	1427	46	334	426	430	-4	-0.91	0.19
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	3	0	6	1	5	77.00	2.41
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	0	4	4	7	-3	-74.00	1.26
SH1 (N) TH SH1 (S)	119	1427	1027	1026	60	319	439	439	1	0.15	0.03
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	0	1	1	1	0	-21.00	0.20

Total no. of counts	120
Summation observed flows	18631.0273
Summation (modelled - flows)²	37643
% RMSE	11

GEH Summary	Total	%	R^2
GEH <2	75	63%	0.99
GEH <4	107	89%	
GEH <5	115	96%	
Total	120	0%	

Turn Flow Comparison: 16:30-17:30 PM Peak Period

	NO.	ANODE	BNODE	CNODE	COUNT HCV	COUNT CARS	COUNT TOTAL	MODELLED	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	0	35	35	60	-25	-70.31	3.58
SH1 (S) TH SH1 (N)	2	1401	1001	1002	22	673	717	689	28	3.86	1.04
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	1	14	16	5	11	68.25	3.36
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	2	16	20	51	-31	-153.65	5.17
SH1 (N) TH SH1 (S)	5	1002	1001	1401	23	610	656	622	33	5.07	1.31
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	1	21	23	5	18	77.39	4.74
SH1 (S) TH SH1 (N)	7	1001	1002	1402	23	687	733	688	45	6.12	1.68
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	0	5	5	6	-1	-24.40	0.52
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0	2	2	8	-6	-293.50	2.64
SH1 (N) TH SH1 (S)	10	1402	1002	1001	24	630	677	623	55	8.10	2.15
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	0	6	6	5	1	18.67	0.48
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	1	0	2	7	-5	-242.00	2.30
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0	11	11	9	2	21.64	0.76
SH1 (S) TH SH1 (N)	14	1431	1003	1403	23	677	723	687	37	5.06	1.38
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	0	0	0	8	-8	0.00	0.00
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	0	6	6	6	0	-6.17	0.15
SH1 (N) TH SH1 (S)	17	1403	1003	1431	24	626	673	624	49	7.33	1.94
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	0	2	2	10	-8	-402.00	3.28
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	0	49	49	13	36	72.92	6.40
SH1 (S) TH SH1 (N)	20	1429	1004	1404	23	628	674	682	-7	-1.08	0.28
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	0	7	7	12	-5	-70.57	1.61
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	0	21	21	10	11	52.86	2.82
SH1 (N) TH SH1 (S)	23	1404	1004	1429	24	607	654	624	30	4.62	1.19
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	0	9	9	15	-6	-61.56	1.61
SH1 (S) TH SH1 (N)	25	1407	1007	1008	22	591	635	644	-9	-1.34	0.34
SH1 (S) RT School Rd (E)	26	1407	1007	3408	1	44	46	50	-4	-8.07	0.54
SH1 (N) LT School Rd (E)	27	1008	1007	3408	1	23	25	56	-31	-123.80	4.86
SH1 (N) TH SH1 (S)	28	1008	1007	1407	23	583	628	580	49	7.73	1.98
School Rd (E) LT SH1 (S)	29	3408	1007	1407	1	33	35	59	-24	-68.40	3.49
School Rd (E) RT SH1 (N)	30	3408	1007	1008	2	45	49	67	-18	-37.08	2.38
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	1	16	18	55	-37	-205.61	6.13
SH1 (S) TH SH1 (N)	32	1409	1009	1410	23	620	666	656	10	1.55	0.40
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	1	14	16	25	-9	-54.75	1.94
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	0	4	4	37	-33	-833.75	7.33
SH1 (N) TH SH1 (S)	35	1410	1009	1409	24	602	649	598	51	7.85	2.04
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	0	19	19	31	-12	-61.47	2.34
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0	1	1	9	-8	-795.00	3.56
SH1 (S) TH SH1 (N)	38	1411	1010	1011	24	633	681	672	10	1.40	0.37
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	0	41	41	19	22	53.99	4.04
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	0	17	17	9	8	45.57	2.12
SH1 (N) TH SH1 (S)	41	1011	1010	1411	46	582	674	620	54	8.02	2.12
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	0	2	2	16	-14	-691.50	4.63
SH1 (S) TH SH1 (N)	43	1412	1013	1014	23	664	710	681	29	4.15	1.12
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	0	11	11	10	1	11.00	0.38
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0	5	5	15	-10	-206.80	3.24
SH1 (N) TH SH1 (S)	46	1014	1013	1412	46	580	672	629	43	6.37	1.68
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	0	4	4	7	-3	-63.25	1.10
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	0	6	6	12	-6	-97.50	1.96
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0	4	4	17	-13	-317.50	3.95
SH1 (S) TH SH1 (N)	50	1414	1015	1415	23	666	712	676	36	5.10	1.38
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	1	16	18	27	-9	-51.94	1.96
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	0	4	4	19	-15	-369.50	4.38
SH1 (N) TH SH1 (S)	53	1415	1015	1414	46	581	673	626	47	7.02	1.85
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	0	24	24	21	3	12.08	0.61
SH1 (S) TH SH1 (N)	55	1416	1016	1430	24	671	719	679	40	5.55	1.51
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	0	11	11	24	-13	-117.36	3.09
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	0	43	43	24	19	45.28	3.38
SH1 (N) TH SH1 (S)	58	1430	1016	1416	46	598	690	631	59	8.56	2.30
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	0	7	7	16	-9	-127.14	2.63
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	0	27	27	18	9	33.81	1.93
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	16	99	131	106	25	18.73	2.25
SH1 (S) TH SH1 (N)	62	1417	1017	1018	25	582	632	591	41	6.48	1.65
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	6	39	51	22	29	56.47	4.76
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	8	79	95	95	0	0.01	0.00
SH1 (N) TH SH1 (S)	65	1018	1017	1417	33	567	633	560	73	11.53	2.99
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	3	14	20	16	4	20.15	0.95
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	1	85	87	37	50	57.01	6.29
SH1 (S) TH SH1 (N)	68	1418	1019	1419	30	536	596	576	20	3.36	0.83
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	1	47	49	22	27	55.24	4.55
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	0	49	49	55	-6	-13.24	0.90
SH1 (N) TH SH1 (S)	71	1419	1019	1418	36	533	604	520	83	13.81	3.52
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	1	52	54	35	19	35.98	2.92
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	1	18	20	26	-6	-30.95	1.29
SH1 (S) TH SH1 (N)	74	1419	1020	1420	22	560	604	559	45	7.44	1.86
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	0	13	13	13	0	2.31	0.08
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	0	18	18	36	-18	-99.00	3.44
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	0	6	6	3	3	53.00	1.51
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	1	8	10	0	10	100.00	4.47
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	0	13	13	21	-8	-60.23	1.90
SH1 (N) TH SH1 (S)	80	1420	1020	1419	35	561	631	531	100	15.81	4.14
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	0	11	11	0	11	100.00	4.69
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	0	16	16	22	-6	-36.88	1.36
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	0	6	6	4	2	41.50	1.14
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	0	10	10	41	-31	-314.70	6.20
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	1	62	64	79	-15	-24.08	1.82
SH1 (S) TH SH1 (N)	86	1421	1021	1022	19	476	514	484	31	5.95	1.37
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	1	51	53	73	-20	-37.15	2.48
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	0	98	98	96	2	1.86	0.18
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	0	41	41	50	-9	-21.07	1.28
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	3	141	147	64	83	56.18	8.03
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	0	33	33	20	13	40.15	2.58
SH1 (N) TH SH1 (S)	92	1022	1021	1421	31	403	465	451	14	3.07	0.67
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	2	113	117	120	-3	-2.14	0.23
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	1	41	43	37	6	14.26	0.97
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	0	35	35	38	-3	-7.34	0.43
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	0	13	13	15	-2	-16.15	0.56
SH1 (S) TH SH1 (N)	97	1021	1022	1023	20	586	626	595	31	4.89	1.24
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0	8	8	0	8	100.00	4.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	33	549	615	590	25	4.06	1.02
County Rd (E) LT SH1 (S)	101	2019	1022	1021	0	0	0	0	0	0.00	0.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	2	0	4	0	4	100.00	2.83
SH1 (S) TH SH1 (N)	103	1022	1023	1024	22	540	584	576	8	1.33	0.32
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	0	46	46	19	27	58.02	4.67
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0	6	6	9	-3	-48.83	1.07
SH1 (N) TH SH1 (S)	106	1024	1023	1022	37	519	593	575	18	3.07	0.75
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	0	34	34	15	19	54.50	3.73
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	0	8	8	3	5	57.00	1.91
SH1 (S) TH SH1 (N)	109	1023	1024	1025	21	504	546	543	3	0.60	0.14
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	0	45	45	36	9	19.91	1.41
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	0	4	4	10	-6	-154.50	2.32
SH1 (N) TH SH1 (S)	112	1025	1024	1023	37	491	565	555	10	1.69	0.40
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	0	34	34	28	6	16.79	1.02
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	0	1	1	8	-7	-675.00	3.23
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0	11	11	10	1	13.36	0.46
SH1 (S) TH SH1 (N)	116	1026	1027	1427	21	494	536	541	-5	-0.93	0.21
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	3	0	6	2	4	72.00	2.20
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	0	8	8	8	0	-5.50	0.15
SH1 (N) TH SH1 (S)	119	1427	1027	1026	37	487	561	557	4	0.68	0.16
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	0	3	3	2	1	29.33	0.55

Total no. of counts	120
Summation observed flows	25095.9609
Summation (modelled - flows)^2	86897
% RMSE	13

GEH Summary	Total	%	R^2
GEH <2	69	58%	0.99
GEH <4	102	85%	
GEH <5	113	94%	
Total	120	0%	

Turn Flow Comparison: 7:45-8:45 AM Peak Period									
	NO.	ANODE	BNODE	CNODE	COUNT CARS (pcu)	MODELLED (pcu)	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	10	23	-13	-128.70	3.17
SH1 (S) TH SH1 (N)	2	1401	1001	1002	432	419	13	2.98	0.62
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	23	3	20	85.83	5.45
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	30	43	-13	-44.37	2.20
SH1 (N) TH SH1 (S)	5	1002	1001	1401	563	547	16	2.90	0.69
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	16	2	14	86.25	4.57
SH1 (S) TH SH1 (N)	7	1001	1002	1402	456	420	36	8.00	1.74
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	4	3	1	28.25	0.61
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	1	5	-4	-352.00	2.12
SH1 (N) TH SH1 (S)	10	1402	1002	1001	581	545	37	6.28	1.54
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	3	4	-1	-46.33	0.72
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	0	5	-5	0.00	0.00
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	1	4	-3	-257.00	1.70
SH1 (S) TH SH1 (N)	14	1431	1003	1403	455	421	34	7.38	1.60
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	2	7	-5	-271.50	2.50
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	5	6	-1	-25.00	0.53
SH1 (N) TH SH1 (S)	17	1403	1003	1431	577	543	34	5.93	1.45
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	1	5	-4	-427.00	2.41
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	11	6	5	48.91	1.87
SH1 (S) TH SH1 (N)	20	1429	1004	1404	446	423	23	5.11	1.09
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	6	11	-5	-79.17	1.64
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	65	10	55	85.18	9.06
SH1 (N) TH SH1 (S)	23	1404	1004	1429	513	538	-25	-4.95	1.11
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	5	8	-3	-50.40	1.01
SH1 (S) TH SH1 (N)	25	1407	1007	1008	413	396	17	4.16	0.85
SH1 (S) RT School Rd (E)	26	1407	1007	3408	39	38	1	2.18	0.14
SH1 (N) LT School Rd (E)	27	1008	1007	3408	53	49	4	6.77	0.50
SH1 (N) TH SH1 (S)	28	1008	1007	1407	462	514	-52	-11.24	2.35
School Rd (E) LT SH1 (S)	29	3408	1007	1407	56	32	24	42.86	3.62
School Rd (E) RT SH1 (N)	30	3408	1007	1008	38	39	-1	-3.89	0.24
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	11	20	-9	-84.55	2.35
SH1 (S) TH SH1 (N)	32	1409	1009	1410	440	415	25	5.68	1.21
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	26	25	1	5.69	0.29
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	15	42	-27	-178.40	5.02
SH1 (N) TH SH1 (S)	35	1410	1009	1409	500	522	-22	-4.32	0.95
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	6	15	-9	-143.17	2.68
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	9	6	3	29.78	0.97
SH1 (S) TH SH1 (N)	38	1411	1010	1011	458	433	25	5.38	1.17
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	14	12	2	14.29	0.55
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	26	6	20	76.82	4.94
SH1 (N) TH SH1 (S)	41	1011	1010	1411	473	530	-58	-12.21	2.58
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	10	16	-6	-63.10	1.74
SH1 (S) TH SH1 (N)	43	1412	1013	1014	464	441	23	4.93	1.07
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	4	4	0	6.00	0.12
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	6	8	-2	-34.33	0.78
SH1 (N) TH SH1 (S)	46	1014	1013	1412	467	539	-72	-15.44	3.21
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	15	8	7	48.07	2.14
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	7	13	-6	-90.57	1.99
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	2	14	-12	-585.00	4.18
SH1 (S) TH SH1 (N)	50	1414	1015	1415	469	441	28	6.02	1.32
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	8	16	-8	-93.75	2.19
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	3	11	-8	-266.33	3.02
SH1 (N) TH SH1 (S)	53	1415	1015	1414	470	536	-66	-14.08	2.95
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	21	24	-3	-12.90	0.57
SH1 (S) TH SH1 (N)	55	1416	1016	1430	468	447	21	4.49	0.98
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	9	9	0	-3.00	0.09
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	16	12	4	24.94	1.07
SH1 (N) TH SH1 (S)	58	1430	1016	1416	483	540	-58	-11.93	2.55
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	8	19	-11	-140.38	3.04
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	23	21	2	9.43	0.46
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	108	70	38	34.74	3.97
SH1 (S) TH SH1 (N)	62	1417	1017	1018	387	398	-11	-2.75	0.54
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	27	6	21	79.11	5.29
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	79	74	5	6.80	0.61
SH1 (N) TH SH1 (S)	65	1018	1017	1417	421	479	-58	-13.70	2.72
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	37	21	16	44.35	3.06
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	39	12	27	67.97	5.22
SH1 (S) TH SH1 (N)	68	1418	1019	1419	375	391	-15	-4.11	0.79
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	59	29	30	50.97	4.54
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	36	47	-11	-29.47	1.65
SH1 (N) TH SH1 (S)	71	1419	1019	1418	422	453	-30	-7.19	1.45
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	40	15	25	61.43	4.67
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	9	29	-20	-221.22	4.57
SH1 (S) TH SH1 (N)	74	1419	1020	1420	437	370	67	15.26	3.32
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	11	21	-10	-87.09	2.41
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	7	11	-4	-56.14	1.31
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	2	3	-1	-26.00	0.35
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	2	0	2	100.00	2.00
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	12	39	-27	-226.17	5.37
SH1 (N) TH SH1 (S)	80	1420	1020	1419	469	462	6	1.35	0.29
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	8	0	8	100.00	4.00
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	6	6	0	5.33	0.13
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	4	2	2	59.50	1.42
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	2	10	-8	-376.00	3.13
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	86	46	40	46.36	4.91
SH1 (S) TH SH1 (N)	86	1421	1021	1022	335	318	17	5.05	0.94
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	25	26	-1	-5.40	0.27
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	84	71	13	15.77	1.51
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	17	22	-5	-26.53	1.03
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	89	60	29	33.00	3.41
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	31	10	21	67.74	4.64
SH1 (N) TH SH1 (S)	92	1022	1021	1421	365	390	-25	-6.88	1.29
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	141	103	38	27.08	3.46
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	35	52	-17	-47.97	2.55
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	35	54	-19	-55.54	2.91
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	19	18	1	4.42	0.19
SH1 (S) TH SH1 (N)	97	1021	1022	1023	438	407	31	7.02	1.49
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	4	0	4	100.00	2.83
SH1 (N) TH SH1 (S)	100	1023	1022	1021	537	503	34	6.29	1.48
County Rd (E) LT SH1 (S)	101	2019	1022	1021	0	0	0	0.00	0.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	103	1022	1023	1024	401	399	2	0.50	0.10
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	24	8	16	68.00	4.10
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	3	3	0	13.33	0.24
SH1 (N) TH SH1 (S)	106	1024	1023	1022	496	489	7	1.44	0.32
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	31	14	17	55.94	3.67
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	3	4	-1	-38.67	0.61
SH1 (S) TH SH1 (N)	109	1023	1024	1025	384	386	-1	-0.29	0.06
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	20	18	2	9.90	0.45
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	11	6	5	44.64	1.68
SH1 (N) TH SH1 (S)	112	1025	1024	1023	460	462	-2	-0.39	0.08
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	39	30	9	23.90	1.59
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	9	9	0	-0.33	0.01
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	3	6	-3	-97.33	1.38
SH1 (S) TH SH1 (N)	116	1026	1027	1427	390	389	2	0.45	0.09
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	0	2	-2	0.00	0.00
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	6	8	-2	-27.33	0.63
SH1 (N) TH SH1 (S)	119	1427	1027	1026	465	461	5	1.02	0.22
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	1	1	0	-44.00	0.40

Turn Flow Comparison: 11:00-12:00 Inter Peak Period									
	NO.	ANODE	BNODE	CNODE	COUNT CARS (pcu)	MODELLED (pcu)	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	21	30	-9	-44.57	1.85
SH1 (S) TH SH1 (N)	2	1401	1001	1002	368	359	9	2.54	0.49
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	13	3	10	77.54	3.57
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	20	37	-17	-83.50	3.14
SH1 (N) TH SH1 (S)	5	1002	1001	1401	403	385	18	4.40	0.89
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	11	3	8	75.82	3.19
SH1 (S) TH SH1 (N)	7	1001	1002	1402	383	359	24	6.33	1.26
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	3	3	0	6.00	0.11
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	3	4	-1	-49.67	0.77
SH1 (N) TH SH1 (S)	10	1402	1002	1001	412	385	27	6.62	1.37
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	7	3	4	54.00	1.67
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	0	5	-5	0.00	0.00
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	2	4	-2	-96.00	1.12
SH1 (S) TH SH1 (N)	14	1431	1003	1403	384	359	25	6.38	1.27
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	1	6	-5	-518.00	2.73
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	2	4	-2	-124.00	1.38
SH1 (N) TH SH1 (S)	17	1403	1003	1431	413	385	28	6.85	1.42
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	2	6	-4	-196.00	1.97
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	16	6	10	61.75	2.97
SH1 (S) TH SH1 (N)	20	1429	1004	1404	369	360	9	2.56	0.50
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	4	9	-5	-122.75	1.93
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	15	7	8	53.67	2.43
SH1 (N) TH SH1 (S)	23	1404	1004	1429	400	384	16	4.08	0.82
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	3	9	-6	-184.33	2.30
SH1 (S) TH SH1 (N)	25	1407	1007	1008	353	335	18	4.99	0.95
SH1 (S) RT School Rd (E)	26	1407	1007	3408	20	33	-13	-65.30	2.54
SH1 (N) LT School Rd (E)	27	1008	1007	3408	21	45	-24	-112.62	4.13
SH1 (N) TH SH1 (S)	28	1008	1007	1407	373	355	18	4.71	0.92
School Rd (E) LT SH1 (S)	29	3408	1007	1407	30	37	-7	-22.57	1.17
School Rd (E) RT SH1 (N)	30	3408	1007	1008	22	46	-24	-110.23	4.15
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	9	27	-18	-196.78	4.19
SH1 (S) TH SH1 (N)	32	1409	1009	1410	366	355	11	3.02	0.58
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	18	20	-2	-8.67	0.36
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	4	30	-26	-639.75	6.24
SH1 (N) TH SH1 (S)	35	1410	1009	1409	390	371	19	5.00	1.00
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	14	18	-4	-30.93	1.08
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	9	5	4	44.22	1.50
SH1 (S) TH SH1 (N)	38	1411	1010	1011	376	369	6	1.69	0.33
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	18	13	5	27.78	1.27
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	17	5	12	68.53	3.48
SH1 (N) TH SH1 (S)	41	1011	1010	1411	372	384	-11	-2.99	0.57
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	10	13	-3	-27.20	0.81
SH1 (S) TH SH1 (N)	43	1412	1013	1014	376	378	-2	-0.54	0.11
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	1	5	-4	-357.00	2.14
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	2	10	-8	-378.50	3.15
SH1 (N) TH SH1 (S)	46	1014	1013	1412	376	391	-15	-4.05	0.78
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	5	5	0	1.80	0.04
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	4	10	-6	-149.25	2.26
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	7	11	-4	-53.86	1.26
SH1 (S) TH SH1 (N)	50	1414	1015	1415	373	377	-4	-1.14	0.22
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	9	19	-10	-107.89	2.61
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	4	11	-7	-182.00	2.63
SH1 (N) TH SH1 (S)	53	1415	1015	1414	374	390	-16	-4.15	0.79
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	12	18	-6	-52.08	1.61
SH1 (S) TH SH1 (N)	55	1416	1016	1430	374	384	-10	-2.72	0.52
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	8	12	-4	-47.50	1.21
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	27	15	12	45.04	2.66
SH1 (N) TH SH1 (S)	58	1430	1016	1416	380	395	-15	-4.03	0.78
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	6	13	-7	-108.33	2.14
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	26	16	10	40.12	2.29
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	70	62	8	12.07	1.04
SH1 (S) TH SH1 (N)	62	1417	1017	1018	333	338	-5	-1.63	0.30
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	49	14	35	71.71	6.27
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	65	65	0	0.15	0.01
SH1 (N) TH SH1 (S)	65	1018	1017	1417	347	345	2	0.61	0.11
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	24	10	14	57.33	3.33
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	39	16	23	58.92	4.38
SH1 (S) TH SH1 (N)	68	1418	1019	1419	343	336	7	2.00	0.37
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	52	18	34	64.87	5.69
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	43	17	26	60.26	4.73
SH1 (N) TH SH1 (S)	71	1419	1019	1418	329	338	-9	-2.87	0.52
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	41	17	24	58.85	4.49
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	16	23	-7	-40.69	1.48
SH1 (S) TH SH1 (N)	74	1419	1020	1420	364	318	45	12.50	2.46
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	13	13	0	-3.08	0.11
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	15	22	-7	-44.07	1.54
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	2	3	-1	-71.00	0.86
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	8	23	-15	-192.50	3.89
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	37	25	12	32.14	2.13
SH1 (N) TH SH1 (S)	80	1420	1020	1419	358	318	40	11.20	2.18
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	12	20	-8	-69.25	2.07
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	14	14	0	2.07	0.08
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	2	3	-1	-70.00	0.85
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	22	25	-3	-15.64	0.71
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	74	53	21	28.03	2.60
SH1 (S) TH SH1 (N)	86	1421	1021	1022	273	278	-5	-1.91	0.31
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	54	34	20	37.57	3.06
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	78	71	7	9.26	0.84
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	15	26	-11	-71.67	2.38
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	122	52	70	57.42	7.51
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	20	10	10	51.75	2.69
SH1 (N) TH SH1 (S)	92	1022	1021	1421	260	276	-16	-6.10	0.97
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	82	64	19	22.56	2.17
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	26	35	-9	-35.77	1.68
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	24	26	-2	-8.87	0.43
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	23	11	12	51.22	2.85
SH1 (S) TH SH1 (N)	97	1021	1022	1023	373	360	13	3.52	0.69
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	3	0	3	100.00	2.45
SH1 (N) TH SH1 (S)	100	1023	1022	1021	361	350	11	3.11	0.59
County Rd (E) LT SH1 (S)	101	2019	1022	1021	0	0	0	0.00	0.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	103	1022	1023	1024	356	351	5	1.53	0.29
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	23	10	13	57.43	3.26
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	4	3	1	35.75	0.79
SH1 (N) TH SH1 (S)	106	1024	1023	1022	334	339	-6	-1.68	0.31
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	22	10	12	53.91	2.96
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	1	3	-2	-192.00	1.37
SH1 (S) TH SH1 (N)	109	1023	1024	1025	332	331	1	0.16	0.03
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	25	22	3	11.88	0.61
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	3	6	-3	-92.33	1.32
SH1 (N) TH SH1 (S)	112	1025	1024	1023	320	319	1	0.19	0.03
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	18	23	-5	-26.44	1.05
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	7	7	0	6.43	0.17
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	5	6	-1	-20.00	0.43
SH1 (S) TH SH1 (N)	116	1026	1027	1427	334	332	2	0.59	0.11
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	0	1	-1	0.00	0.00
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	4	6	-2	-53.75	0.95
SH1 (N) TH SH1 (S)	119	1427	1027	1026	319	319	0	0.00	0.00
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	1	1	0	-21.00	0.20

Turn Flow Comparison: 16:30-17:30 PM Peak Period									
	NO.	ANODE	BNODE	CNODE	COUNT CARS (pcu)	MODELLED (pcu)	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	35	59	-24	-67.91	3.47
SH1 (S) TH SH1 (N)	2	1401	1001	1002	673	646	27	3.98	1.04
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	14	4	10	72.14	3.38
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	16	50	-34	-211.31	5.89
SH1 (N) TH SH1 (S)	5	1002	1001	1401	610	573	37	6.02	1.51
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	21	4	17	81.33	4.84
SH1 (S) TH SH1 (N)	7	1001	1002	1402	687	644	43	6.21	1.65
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	5	6	-1	-15.80	0.34
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	2	6	-4	-217.00	2.13
SH1 (N) TH SH1 (S)	10	1402	1002	1001	630	573	57	9.09	2.33
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	6	4	2	25.67	0.67
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	0	6	-6	0.00	0.00
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	11	8	3	25.36	0.90
SH1 (S) TH SH1 (N)	14	1431	1003	1403	677	642	35	5.19	1.37
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	0	7	-7	0.00	0.00
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	6	6	0	0.50	0.01
SH1 (N) TH SH1 (S)	17	1403	1003	1431	626	573	53	8.45	2.16
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	2	9	-7	-329.50	2.86
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	49	13	36	74.16	6.54
SH1 (S) TH SH1 (N)	20	1429	1004	1404	628	637	-9	-1.37	0.34
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	7	10	-3	-48.86	1.16
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	21	9	12	55.71	3.01
SH1 (N) TH SH1 (S)	23	1404	1004	1429	607	572	35	5.71	1.43
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	9	12	-3	-37.44	1.03
SH1 (S) TH SH1 (N)	25	1407	1007	1008	591	599	-9	-1.45	0.35
SH1 (S) RT School Rd (E)	26	1407	1007	3408	44	47	-3	-7.89	0.51
SH1 (N) LT School Rd (E)	27	1008	1007	3408	23	49	-26	-114.96	4.39
SH1 (N) TH SH1 (S)	28	1008	1007	1407	583	528	55	9.43	2.33
School Rd (E) LT SH1 (S)	29	3408	1007	1407	33	57	-24	-71.94	3.54
School Rd (E) RT SH1 (N)	30	3408	1007	1008	45	63	-18	-38.96	2.39
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	16	54	-38	-236.44	6.40
SH1 (S) TH SH1 (N)	32	1409	1009	1410	620	608	12	1.89	0.47
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	14	22	-8	-56.71	1.87
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	4	36	-32	-806.00	7.19
SH1 (N) TH SH1 (S)	35	1410	1009	1409	602	541	61	10.10	2.54
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	19	27	-8	-39.63	1.58
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	1	8	-7	-688.00	3.27
SH1 (S) TH SH1 (N)	38	1411	1010	1011	633	622	11	1.68	0.43
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	41	18	23	55.70	4.19
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	17	8	9	51.86	2.46
SH1 (N) TH SH1 (S)	41	1011	1010	1411	582	560	22	3.83	0.93
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	2	15	-13	-642.50	4.43
SH1 (S) TH SH1 (N)	43	1412	1013	1014	664	631	33	4.94	1.29
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	11	9	2	14.55	0.50
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	5	15	-10	-199.60	3.16
SH1 (N) TH SH1 (S)	46	1014	1013	1412	580	568	12	1.99	0.48
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	4	6	-2	-54.00	0.96
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	6	12	-6	-93.33	1.89
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	4	15	-11	-277.75	3.59
SH1 (S) TH SH1 (N)	50	1414	1015	1415	666	627	38	5.75	1.51
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	16	26	-10	-64.44	2.24
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	4	17	-13	-330.25	4.06
SH1 (N) TH SH1 (S)	53	1415	1015	1414	581	566	15	2.54	0.62
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	24	20	4	18.13	0.93
SH1 (S) TH SH1 (N)	55	1416	1016	1430	671	630	40	5.99	1.58
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	11	23	-12	-111.45	2.96
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	43	23	20	46.65	3.49
SH1 (N) TH SH1 (S)	58	1430	1016	1416	598	570	27	4.58	1.13
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	7	15	-8	-118.29	2.48
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	27	17	10	35.33	2.02
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	99	97	2	2.14	0.21
SH1 (S) TH SH1 (N)	62	1417	1017	1018	582	551	31	5.36	1.31
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	39	17	22	56.77	4.19
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	79	86	-7	-8.42	0.73
SH1 (N) TH SH1 (S)	65	1018	1017	1417	567	508	60	10.51	2.57
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	14	9	5	39.07	1.63
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	85	36	49	58.09	6.36
SH1 (S) TH SH1 (N)	68	1418	1019	1419	536	532	4	0.76	0.18
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	47	20	27	57.55	4.68
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	49	52	-3	-5.35	0.37
SH1 (N) TH SH1 (S)	71	1419	1019	1418	533	465	68	12.74	3.04
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	52	32	20	39.25	3.16
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	18	24	-6	-33.22	1.31
SH1 (S) TH SH1 (N)	74	1419	1020	1420	560	517	43	7.75	1.87
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	13	11	2	13.38	0.50
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	18	33	-15	-84.11	2.99
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	6	3	3	53.00	1.51
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	8	0	8	100.00	4.00
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	13	18	-5	-41.62	1.37
SH1 (N) TH SH1 (S)	80	1420	1020	1419	561	474	87	15.42	3.80
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	11	0	11	100.00	4.69
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	16	22	-6	-36.88	1.36
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	6	4	2	41.50	1.14
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	10	40	-30	-297.10	5.96
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	62	75	-13	-21.08	1.58
SH1 (S) TH SH1 (N)	86	1421	1021	1022	476	445	30	6.38	1.41
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	51	70	-19	-36.37	2.39
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	98	85	13	13.07	1.34
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	41	47	-6	-13.76	0.85
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	141	60	81	57.31	8.06
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	33	19	14	42.70	2.77
SH1 (N) TH SH1 (S)	92	1022	1021	1421	403	399	4	1.03	0.21
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	113	100	13	11.58	1.27
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	41	34	7	17.34	1.16
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	35	35	0	1.23	0.07
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	13	12	1	10.69	0.40
SH1 (S) TH SH1 (N)	97	1021	1022	1023	586	542	44	7.55	1.86
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	8	0	8	100.00	4.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	549	518	31	5.71	1.36
County Rd (E) LT SH1 (S)	101	2019	1022	1021	0	0	0	0.00	0.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	103	1022	1023	1024	540	526	14	2.64	0.62
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	46	16	30	65.54	5.42
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	6	5	1	22.83	0.59
SH1 (N) TH SH1 (S)	106	1024	1023	1022	519	506	14	2.63	0.60
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	34	12	22	64.65	4.58
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	8	3	5	57.00	1.91
SH1 (S) TH SH1 (N)	109	1023	1024	1025	504	495	9	1.74	0.39
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	45	35	10	22.53	1.60
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	4	10	-6	-154.25	2.32
SH1 (N) TH SH1 (S)	112	1025	1024	1023	491	483	8	1.66	0.37
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	34	27	7	20.18	1.24
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	1	8	-7	-674.00	3.22
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	11	9	2	17.18	0.60
SH1 (S) TH SH1 (N)	116	1026	1027	1427	494	493	0	0.04	0.01
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	0	2	-2	0.00	0.00
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	8	8	0	-0.37	0.01
SH1 (N) TH SH1 (S)	119	1427	1027	1026	487	485	2	0.41	0.09
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	3	2	1	29.33	0.55

Turn Flow Comparison: 7:45-8:45 AM Peak Period									
	NO.	ANODE	BNODE	CNODE	COUNT HCV (pcu)	MODELLED (pcu)	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	4	2	2	43.75	0.99
SH1 (S) TH SH1 (N)	2	1401	1001	1002	102	104	-2	-1.88	0.19
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	0	1	-1	0.00	0.00
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	2	1	1	30.50	0.47
SH1 (N) TH SH1 (S)	5	1002	1001	1401	72	73	-1	-0.85	0.07
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	0	2	-2	0.00	0.00
SH1 (S) TH SH1 (N)	7	1001	1002	1402	102	104	-2	-2.26	0.23
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	0	1	-1	0.00	0.00
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	10	1402	1002	1001	72	73	-1	-2.06	0.17
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	0	1	-1	0.00	0.00
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	0	1	-1	0.00	0.00
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	14	1431	1003	1403	102	105	-3	-2.54	0.25
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	0	1	-1	0.00	0.00
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	17	1403	1003	1431	72	74	-2	-3.33	0.28
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	0	1	-1	0.00	0.00
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	0	2	-2	0.00	0.00
SH1 (S) TH SH1 (N)	20	1429	1004	1404	102	104	-2	-2.23	0.22
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	0	2	-2	0.00	0.00
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	23	1404	1004	1429	72	75	-3	-4.04	0.34
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	2	2	0	-11.50	0.16
SH1 (S) TH SH1 (N)	25	1407	1007	1008	102	100	2	1.55	0.16
SH1 (S) RT School Rd (E)	26	1407	1007	3408	0	6	-6	0.00	0.00
SH1 (N) LT School Rd (E)	27	1008	1007	3408	2	7	-5	-235.00	2.25
SH1 (N) TH SH1 (S)	28	1008	1007	1407	74	74	0	0.59	0.05
School Rd (E) LT SH1 (S)	29	3408	1007	1407	0	4	-4	0.00	0.00
School Rd (E) RT SH1 (N)	30	3408	1007	1008	2	6	-4	-183.50	1.87
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	0	3	-3	0.00	0.00
SH1 (S) TH SH1 (N)	32	1409	1009	1410	104	103	1	0.88	0.09
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	8	3	5	57.00	1.91
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	2	2	0	9.00	0.13
SH1 (N) TH SH1 (S)	35	1410	1009	1409	74	78	-4	-6.00	0.51
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	6	4	2	28.83	0.76
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0	3	-3	0.00	0.00
SH1 (S) TH SH1 (N)	38	1411	1010	1011	110	104	6	5.86	0.62
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	0	1	-1	0.00	0.00
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	41	1011	1010	1411	96	81	15	15.50	1.58
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	43	1412	1013	1014	115	104	12	10.10	1.11
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	2	1	1	50.00	0.82
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	46	1014	1013	1412	94	81	12	12.98	1.30
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	4	1	3	84.75	2.23
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	0	0	0	0.00	0.00
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0	4	-4	0.00	0.00
SH1 (S) TH SH1 (N)	50	1414	1015	1415	115	100	15	13.32	1.48
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	2	1	1	36.50	0.57
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	0	3	-3	0.00	0.00
SH1 (N) TH SH1 (S)	53	1415	1015	1414	94	79	14	15.33	1.54
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	2	2	1	25.00	0.38
SH1 (S) TH SH1 (N)	55	1416	1016	1430	115	100	16	13.66	1.52
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	2	2	0	17.50	0.26
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	2	1	1	69.50	1.22
SH1 (N) TH SH1 (S)	58	1430	1016	1416	96	80	16	16.60	1.70
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	0	1	-1	0.00	0.00
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	2	1	2	75.00	1.34
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	14	24	-10	-73.14	2.34
SH1 (S) TH SH1 (N)	62	1417	1017	1018	96	76	20	20.95	2.17
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	2	7	-5	-225.50	2.19
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	24	15	9	36.46	1.98
SH1 (N) TH SH1 (S)	65	1018	1017	1417	71	65	6	8.29	0.71
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	12	8	4	36.33	1.39
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	0	5	-5	0.00	0.00
SH1 (S) TH SH1 (N)	68	1418	1019	1419	97	78	19	19.93	2.07
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	0	2	-2	0.00	0.00
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	2	6	-4	-216.00	2.12
SH1 (N) TH SH1 (S)	71	1419	1019	1418	80	66	14	17.39	1.63
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	2	3	-1	-53.00	0.67
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	4	6	-2	-40.00	0.73
SH1 (S) TH SH1 (N)	74	1419	1020	1420	46	71	-25	-54.06	3.26
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	2	4	-2	-82.50	0.98
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	0	3	-3	0.00	0.00
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	0	0	0	0.00	0.00
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	0	0	0	0.00	0.00
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	2	2	0	-24.00	0.32
SH1 (N) TH SH1 (S)	80	1420	1020	1419	53	67	-14	-25.41	1.75
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	0	0	0	0.00	0.00
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	0	2	-2	0.00	0.00
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	0	0	0	0.00	0.00
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	0	2	-2	0.00	0.00
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	2	11	-9	-448.50	3.52
SH1 (S) TH SH1 (N)	86	1421	1021	1022	40	57	-18	-45.01	2.56
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	4	8	-4	-98.75	1.62
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	4	13	-9	-235.50	3.19
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	0	3	-3	0.00	0.00
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	4	7	-3	-72.75	1.25
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	92	1022	1021	1421	51	58	-7	-13.40	0.93
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	6	23	-17	-285.33	4.49
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	0	5	-5	0.00	0.00
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	0	0	0	0.00	0.00
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	0	4	-4	0.00	0.00
SH1 (S) TH SH1 (N)	97	1021	1022	1023	44	75	-31	-69.90	4.00
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	58	82	-24	-41.91	2.89
County Rd (E) LT SH1 (S)	101	2019	1022	1021	0	0	0	0.00	0.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	103	1022	1023	1024	69	74	-5	-7.18	0.59
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	0	1	-1	0.00	0.00
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0	4	-4	0.00	0.00
SH1 (N) TH SH1 (S)	106	1024	1023	1022	82	78	4	4.91	0.45
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	2	4	-2	-86.00	1.02
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	109	1023	1024	1025	69	71	-2	-2.92	0.24
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	0	3	-3	0.00	0.00
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	2	0	2	99.50	1.99
SH1 (N) TH SH1 (S)	112	1025	1024	1023	78	81	-2	-3.16	0.28
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	4	2	2	53.25	1.24
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	0	0	0	0.00	0.00
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	116	1026	1027	1427	69	70	-1	-1.41	0.12
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	0	0	0	0.00	0.00
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	119	1427	1027	1026	80	80	0	0.27	0.02
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	0	0	0	0.00	0.00

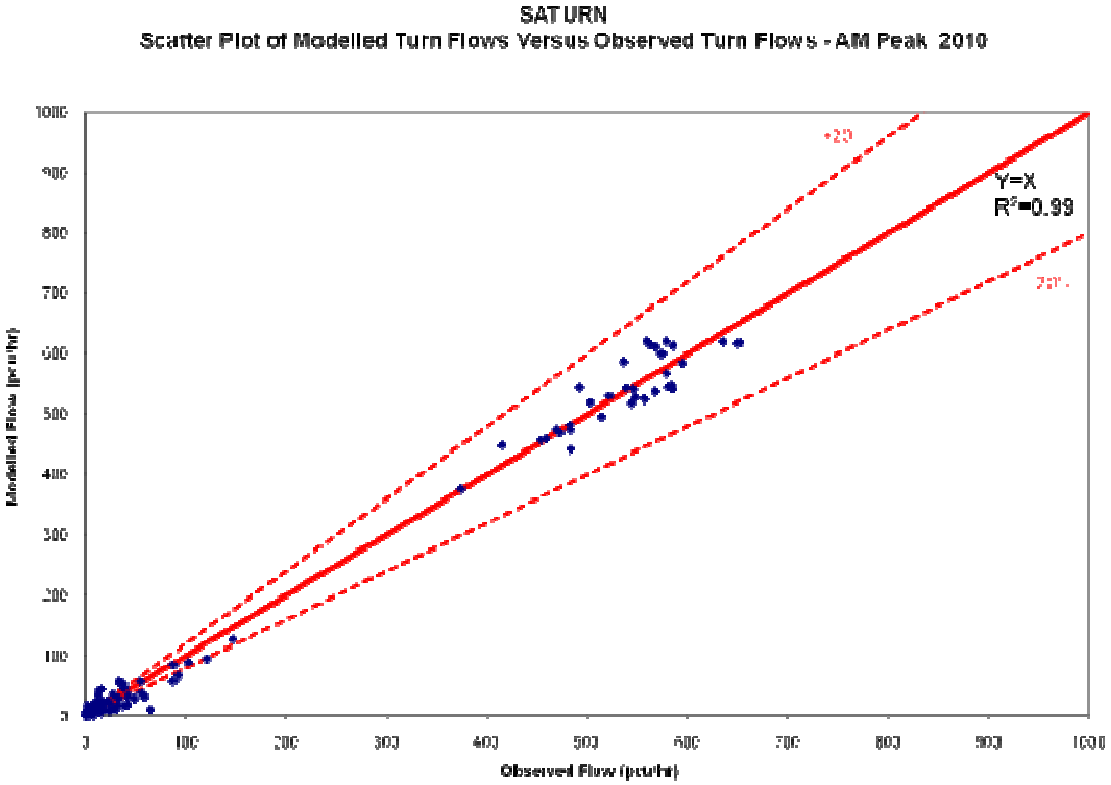
Turn Flow Comparison: 11:00-12:00 Inter Peak Period									
	NO.	ANODE	BNODE	CNODE	COUNT HCV (pcu)	MODELLED (pcu)	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	2	2	0	8.00	0.12
SH1 (S) TH SH1 (N)	2	1401	1001	1002	90	90	0	-0.18	0.02
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	2	2	0	17.00	0.25
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	5	1002	1001	1401	100	98	2	1.94	0.19
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	0	2	-2	0.00	0.00
SH1 (S) TH SH1 (N)	7	1001	1002	1402	92	91	1	1.14	0.11
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	0	1	-1	0.00	0.00
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	10	1402	1002	1001	100	99	1	1.04	0.10
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	0	1	-1	0.00	0.00
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	6	2	4	67.00	2.01
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	14	1431	1003	1403	92	92	0	-0.11	0.01
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	0	2	-2	0.00	0.00
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	17	1403	1003	1431	100	100	0	-0.43	0.04
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	0	2	-2	0.00	0.00
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	2	1	1	38.00	0.60
SH1 (S) TH SH1 (N)	20	1429	1004	1404	90	93	-3	-3.02	0.28
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	0	3	-3	0.00	0.00
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	23	1404	1004	1429	100	101	-1	-1.38	0.14
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	0	3	-3	0.00	0.00
SH1 (S) TH SH1 (N)	25	1407	1007	1008	88	91	-3	-3.39	0.32
SH1 (S) RT School Rd (E)	26	1407	1007	3408	2	5	-3	-126.00	1.40
SH1 (N) LT School Rd (E)	27	1008	1007	3408	0	10	-10	0.00	0.00
SH1 (N) TH SH1 (S)	28	1008	1007	1407	98	100	-2	-2.26	0.22
School Rd (E) LT SH1 (S)	29	3408	1007	1407	2	4	-2	-119.50	1.34
School Rd (E) RT SH1 (N)	30	3408	1007	1008	4	8	-4	-112.00	1.79
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	2	2	0	-19.00	0.26
SH1 (S) TH SH1 (N)	32	1409	1009	1410	90	97	-7	-7.87	0.73
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	2	5	-3	-157.50	1.67
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	35	1410	1009	1409	98	108	-10	-9.84	0.95
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	0	6	-6	0.00	0.00
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0	2	-2	0.00	0.00
SH1 (S) TH SH1 (N)	38	1411	1010	1011	90	100	-10	-10.85	1.00
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	0	1	-1	0.00	0.00
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	41	1011	1010	1411	127	112	16	12.24	1.42
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	43	1412	1013	1014	122	101	22	17.73	2.05
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	2	1	1	60.50	1.02
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	46	1014	1013	1412	130	112	17	13.45	1.59
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	0	1	-1	0.00	0.00
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	0	0	0	0.00	0.00
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0	3	-3	0.00	0.00
SH1 (S) TH SH1 (N)	50	1414	1015	1415	122	98	24	19.99	2.33
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	0	2	-2	0.00	0.00
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	0	3	-3	0.00	0.00
SH1 (N) TH SH1 (S)	53	1415	1015	1414	130	110	20	15.43	1.83
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	0	2	-2	0.00	0.00
SH1 (S) TH SH1 (N)	55	1416	1016	1430	122	98	24	19.52	2.27
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	0	1	-1	0.00	0.00
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	10	1	9	91.20	3.91
SH1 (N) TH SH1 (S)	58	1430	1016	1416	130	111	19	14.75	1.75
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	0	1	-1	0.00	0.00
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	14	1	13	94.71	4.88
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	34	19	15	43.35	2.86
SH1 (S) TH SH1 (N)	62	1417	1017	1018	97	80	17	17.43	1.79
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	32	10	22	69.41	4.86
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	32	19	13	41.81	2.66
SH1 (N) TH SH1 (S)	65	1018	1017	1417	97	93	4	4.24	0.42
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	18	11	7	38.67	1.83
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	8	4	4	55.38	1.84
SH1 (S) TH SH1 (N)	68	1418	1019	1419	121	86	34	28.56	3.39
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	4	4	0	9.00	0.18
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	4	3	1	17.75	0.37
SH1 (N) TH SH1 (S)	71	1419	1019	1418	110	101	9	8.38	0.90
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	8	4	4	44.75	1.44
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	6	4	2	25.83	0.68
SH1 (S) TH SH1 (N)	74	1419	1020	1420	121	82	38	31.69	3.79
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	2	3	-1	-45.00	0.57
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	0	5	-5	0.00	0.00
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	0	0	0	0.00	0.00
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	0	4	-4	0.00	0.00
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	2	4	-2	-79.50	0.95
SH1 (N) TH SH1 (S)	80	1420	1020	1419	97	98	-1	-0.54	0.05
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	2	0	2	100.00	2.00
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	0	3	-3	0.00	0.00
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	0	0	0	0.00	0.00
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	2	3	-1	-61.50	0.76
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	12	9	3	27.33	1.02
SH1 (S) TH SH1 (N)	86	1421	1021	1022	108	75	32	29.95	3.37
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	2	6	-4	-216.00	2.12
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	4	20	-16	-403.75	4.65
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	0	0	0	0.00	0.00
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	0	8	-8	0.00	0.00
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	4	1	3	69.00	1.71
SH1 (N) TH SH1 (S)	92	1022	1021	1421	99	87	12	12.13	1.25
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	6	29	-23	-384.33	5.51
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	0	6	-6	0.00	0.00
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	0	0	0	0.00	0.00
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	0	6	-6	0.00	0.00
SH1 (S) TH SH1 (N)	97	1021	1022	1023	113	102	11	9.72	1.06
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	111	117	-7	-6.13	0.64
County Rd (E) LT SH1 (S)	101	2019	1022	1021	2	0	2	100.00	2.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	2	0	2	100.00	2.00
SH1 (S) TH SH1 (N)	103	1022	1023	1024	100	101	-1	-1.06	0.11
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	4	1	3	76.75	1.96
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0	6	-6	0.00	0.00
SH1 (N) TH SH1 (S)	106	1024	1023	1022	126	116	10	7.91	0.91
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	0	1	-1	0.00	0.00
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	109	1023	1024	1025	92	99	-7	-7.25	0.68
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	8	2	6	70.38	2.47
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	112	1025	1024	1023	120	121	0	-0.10	0.01
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	6	2	4	62.00	1.83
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	0	0	0	0.00	0.00
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	116	1026	1027	1427	92	98	-6	-6.35	0.60
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	6	0	6	100.00	3.46
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	119	1427	1027	1026	120	120	1	0.57	0.06
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	0	0	0	0.00	0.00

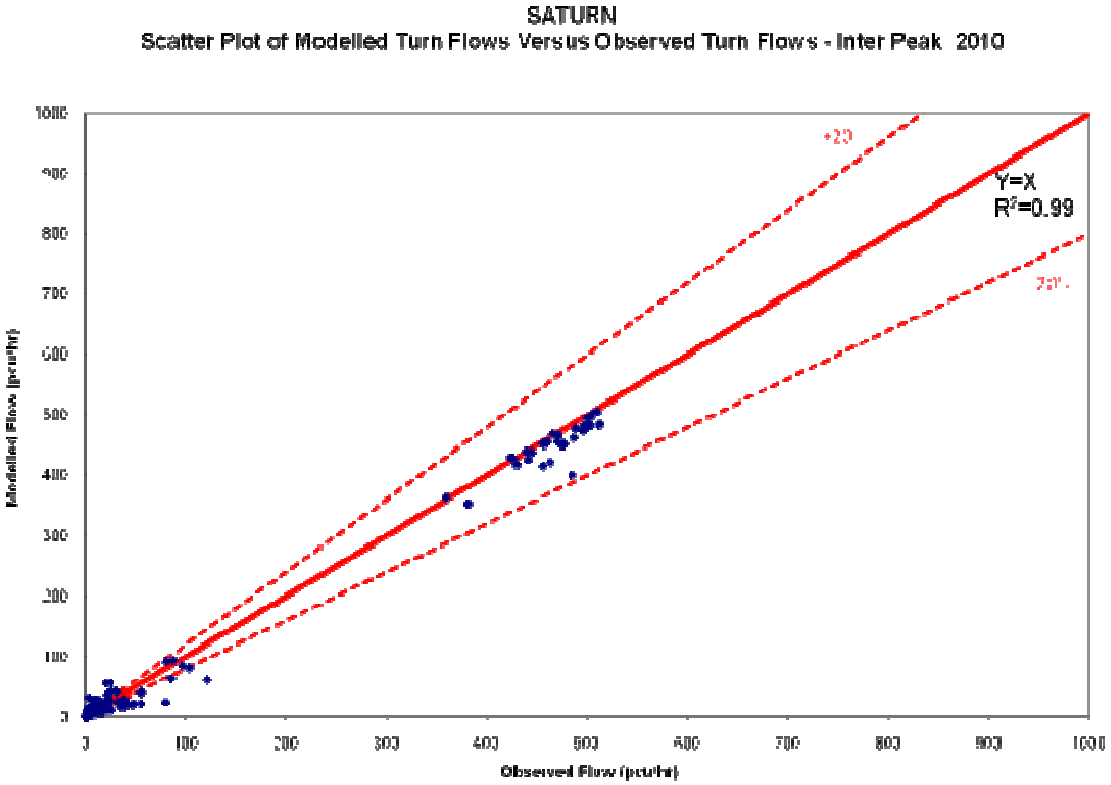
Turn Flow Comparison: 16:30-17:30 PM Peak Period									
	NO.	ANODE	BNODE	CNODE	COUNT HCV (pcu)	MODELLED (pcu)	DIFFER-	% Diff	GEH
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	2	1401	1001	1002	44	43	1	1.93	0.13
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002	2	1	1	41.00	0.65
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401	4	1	3	77.00	1.96
SH1 (N) TH SH1 (S)	5	1002	1001	1401	46	49	-3	-7.63	0.51
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401	2	1	1	36.00	0.56
SH1 (S) TH SH1 (N)	7	1001	1002	1402	46	44	2	4.66	0.32
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	0	0	0	0.00	0.00
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	10	1402	1002	1001	48	50	-2	-4.97	0.34
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	0	0	0	0.00	0.00
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	2	1	1	46.00	0.74
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	14	1431	1003	1403	46	45	2	3.26	0.22
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	0	1	-1	0.00	0.00
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	17	1403	1003	1431	48	51	-4	-7.38	0.50
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	0	1	-1	0.00	0.00
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	20	1429	1004	1404	46	45	1	2.75	0.19
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	0	2	-2	0.00	0.00
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	23	1404	1004	1429	47	52	-4	-9.32	0.63
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	0	2	-2	0.00	0.00
SH1 (S) TH SH1 (N)	25	1407	1007	1008	44	44	0	0.11	0.01
SH1 (S) RT School Rd (E)	26	1407	1007	3408	2	2	0	-12.00	0.16
SH1 (N) LT School Rd (E)	27	1008	1007	3408	2	7	-5	-225.50	2.19
SH1 (N) TH SH1 (S)	28	1008	1007	1407	45	52	-6	-14.05	0.92
School Rd (E) LT SH1 (S)	29	3408	1007	1407	2	2	0	-10.00	0.14
School Rd (E) RT SH1 (N)	30	3408	1007	1008	4	5	-1	-16.00	0.31
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	2	1	1	41.00	0.65
SH1 (S) TH SH1 (N)	32	1409	1009	1410	46	48	-1	-3.07	0.21
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	2	3	-1	-41.00	0.53
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	35	1410	1009	1409	47	57	-10	-20.68	1.36
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	0	4	-4	0.00	0.00
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	38	1411	1010	1011	48	50	-1	-2.31	0.16
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	0	1	-1	0.00	0.00
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	41	1011	1010	1411	92	60	32	34.46	3.64
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	43	1412	1013	1014	47	50	-3	-7.05	0.47
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	0	0	0	0.00	0.00
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	46	1014	1013	1412	92	61	31	33.91	3.57
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	0	0	0	0.00	0.00
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	0	0	0	0.00	0.00
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0	2	-2	0.00	0.00
SH1 (S) TH SH1 (N)	50	1414	1015	1415	47	49	-2	-4.19	0.28
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	2	1	1	48.00	0.78
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	53	1415	1015	1414	92	60	33	35.22	3.73
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	0	1	-1	0.00	0.00
SH1 (S) TH SH1 (N)	55	1416	1016	1430	49	49	0	-0.49	0.03
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414	0	1	-1	0.00	0.00
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	58	1430	1016	1416	92	61	32	34.30	3.62
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416	0	1	-1	0.00	0.00
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430	0	0	0	0.00	0.00
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	32	10	22	70.06	4.92
SH1 (S) TH SH1 (N)	62	1417	1017	1018	49	40	10	19.64	1.45
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	12	5	7	55.50	2.26
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	16	9	7	41.63	1.87
SH1 (N) TH SH1 (S)	65	1018	1017	1417	65	52	13	20.35	1.73
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	6	7	-1	-24.00	0.56
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	2	2	0	11.00	0.16
SH1 (S) TH SH1 (N)	68	1418	1019	1419	59	43	16	26.96	2.23
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	2	2	0	1.00	0.01
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	0	4	-4	0.00	0.00
SH1 (N) TH SH1 (S)	71	1419	1019	1418	71	55	16	21.90	1.96
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	2	3	-1	-49.00	0.62
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	2	2	0	-10.50	0.14
SH1 (S) TH SH1 (N)	74	1419	1020	1420	43	42	1	3.33	0.22
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	0	1	-1	0.00	0.00
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	0	3	-3	0.00	0.00
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	0	0	0	0.00	0.00
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	2	0	2	100.00	2.00
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	0	2	-2	0.00	0.00
SH1 (N) TH SH1 (S)	80	1420	1020	1419	70	57	13	18.89	1.66
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	0	0	0	0.00	0.00
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	0	0	0	0.00	0.00
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	0	0	0	0.00	0.00
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	0	2	-2	0.00	0.00
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	2	4	-2	-117.00	1.31
SH1 (S) TH SH1 (N)	86	1421	1021	1022	39	39	0	0.75	0.05
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	2	3	-1	-57.00	0.71
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	0	11	-11	0.00	0.00
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	0	3	-3	0.00	0.00
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	6	4	2	29.50	0.78
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	0	1	-1	0.00	0.00
SH1 (N) TH SH1 (S)	92	1022	1021	1421	62	52	10	16.23	1.34
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	4	20	-16	-389.75	4.54
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	2	3	-1	-49.00	0.62
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	0	3	-3	0.00	0.00
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	0	3	-3	0.00	0.00
SH1 (S) TH SH1 (N)	97	1021	1022	1023	39	53	-14	-34.65	2.01
SH1 (S) RT County Rd (E)	98	1021	1022	2019	0	0	0	0.00	0.00
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	66	73	-6	-9.64	0.77
County Rd (E) LT SH1 (S)	101	2019	1022	1021	0	0	0	0.00	0.00
County Rd (E) RT SH1 (N)	102	2019	1022	1023	4	0	4	100.00	2.83
SH1 (S) TH SH1 (N)	103	1022	1023	1024	43	50	-7	-15.09	0.96
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	0	3	-3	0.00	0.00
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0	4	-4	0.00	0.00
SH1 (N) TH SH1 (S)	106	1024	1023	1022	74	69	5	6.20	0.54
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	0	3	-3	0.00	0.00
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	109	1023	1024	1025	43	48	-6	-12.86	0.82
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	0	1	-1	0.00	0.00
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	112	1025	1024	1023	74	72	1	1.91	0.17
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	0	1	-1	0.00	0.00
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	0	0	0	0.00	0.00
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0	0	0	0.00	0.00
SH1 (S) TH SH1 (N)	116	1026	1027	1427	43	48	-5	-12.05	0.77
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427	6	0	6	100.00	3.46
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026	0	0	0	0.00	0.00
SH1 (N) TH SH1 (S)	119	1427	1027	1026	74	72	2	2.45	0.21
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416	0	0	0	0.00	0.00

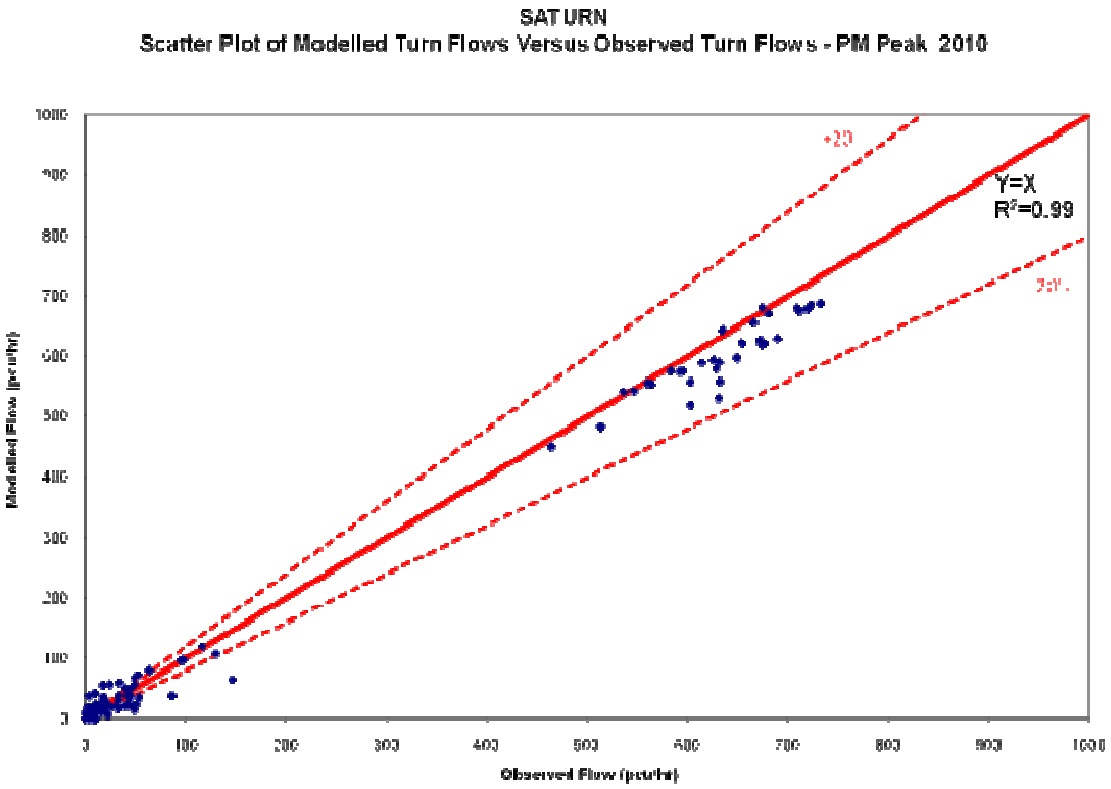
Appendix F

Scatter Plots

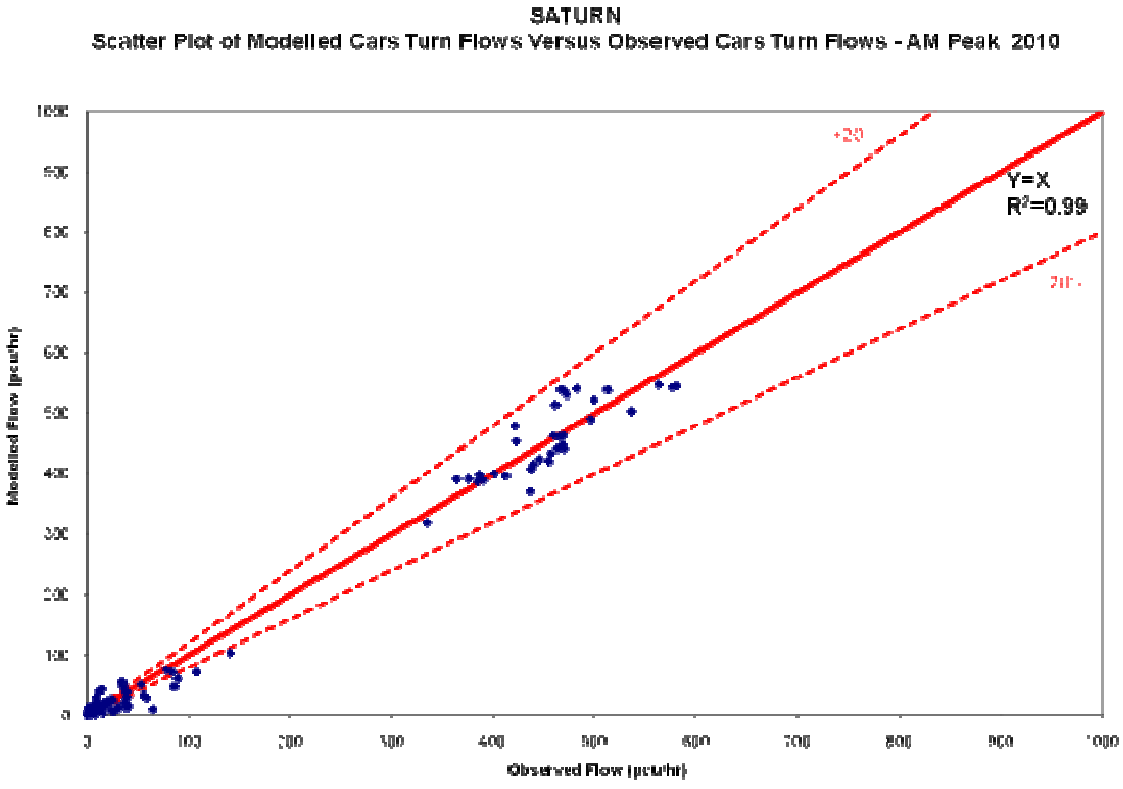
Turning validation Plots – Both user classes (Cars and HCVs)

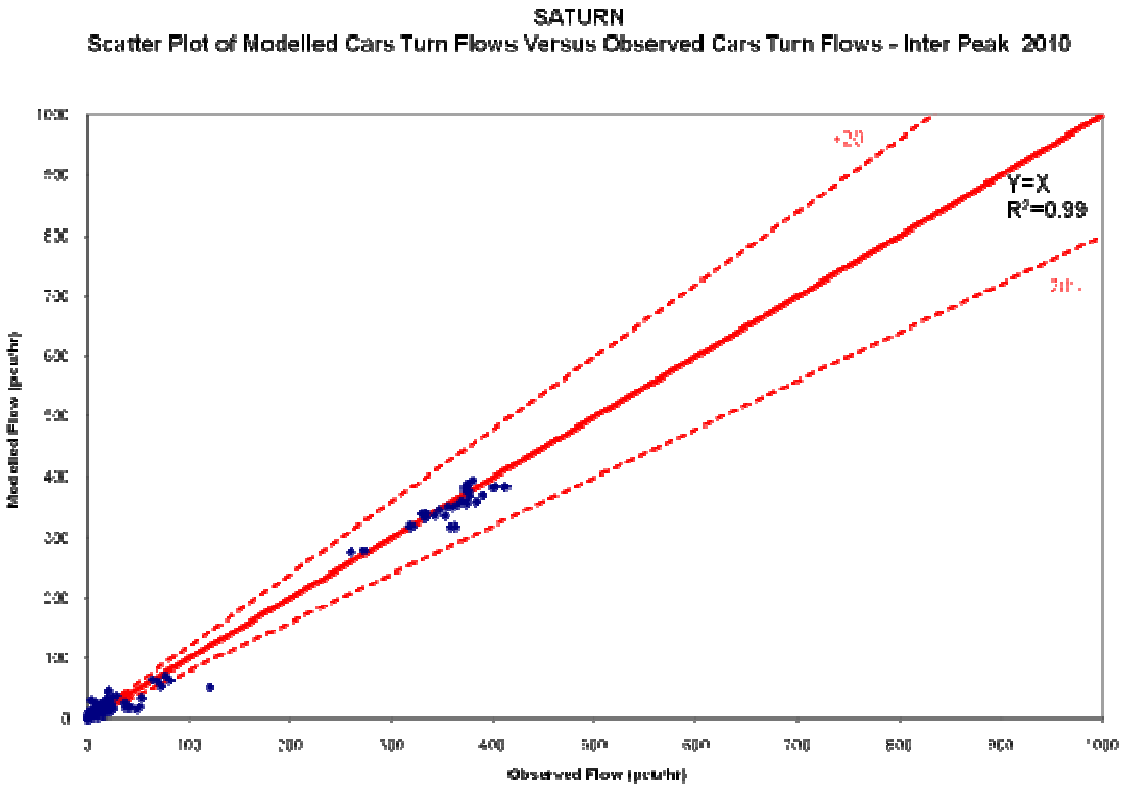


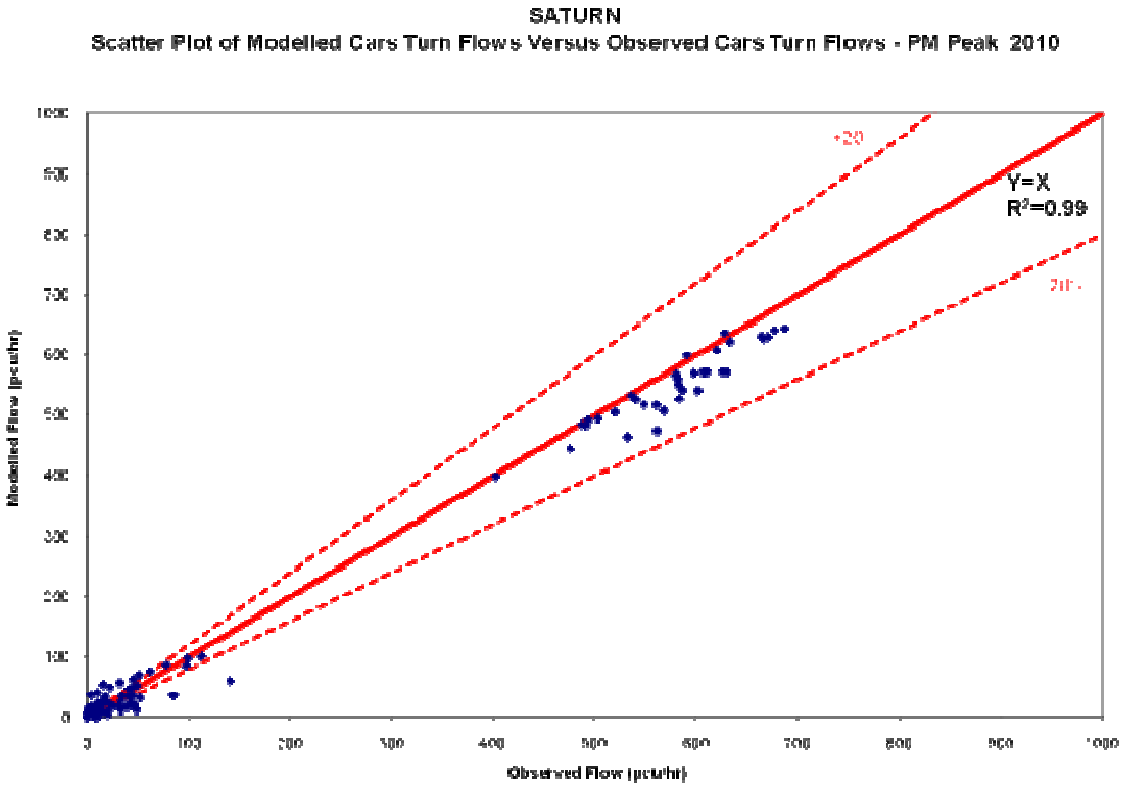




Turning validation Plots – Cars

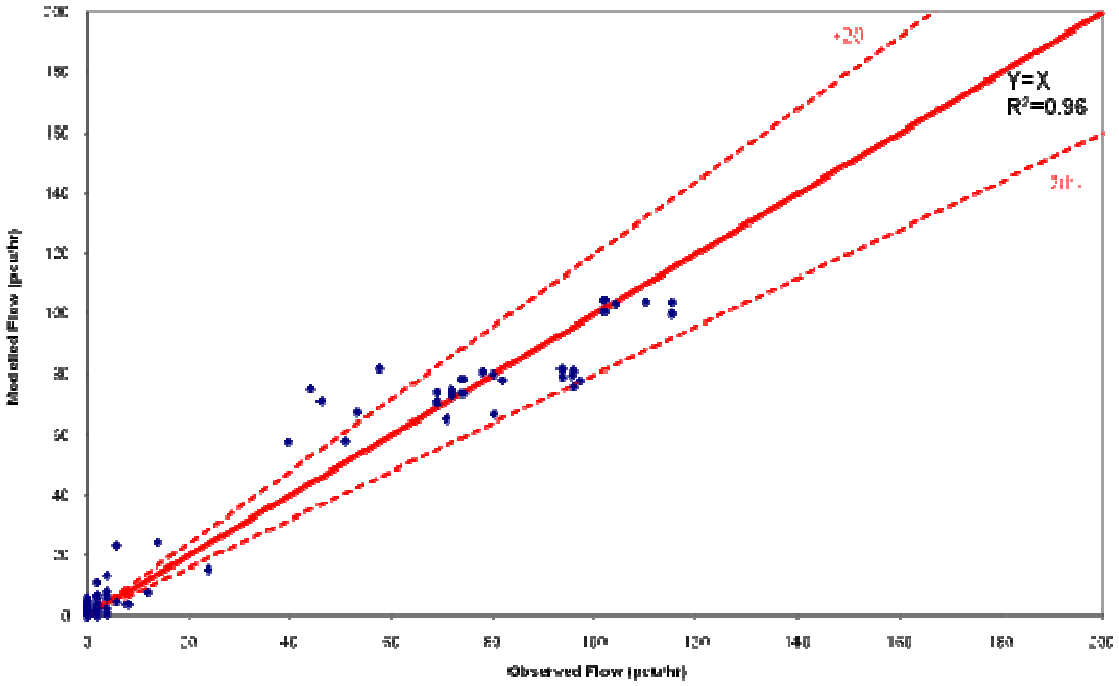




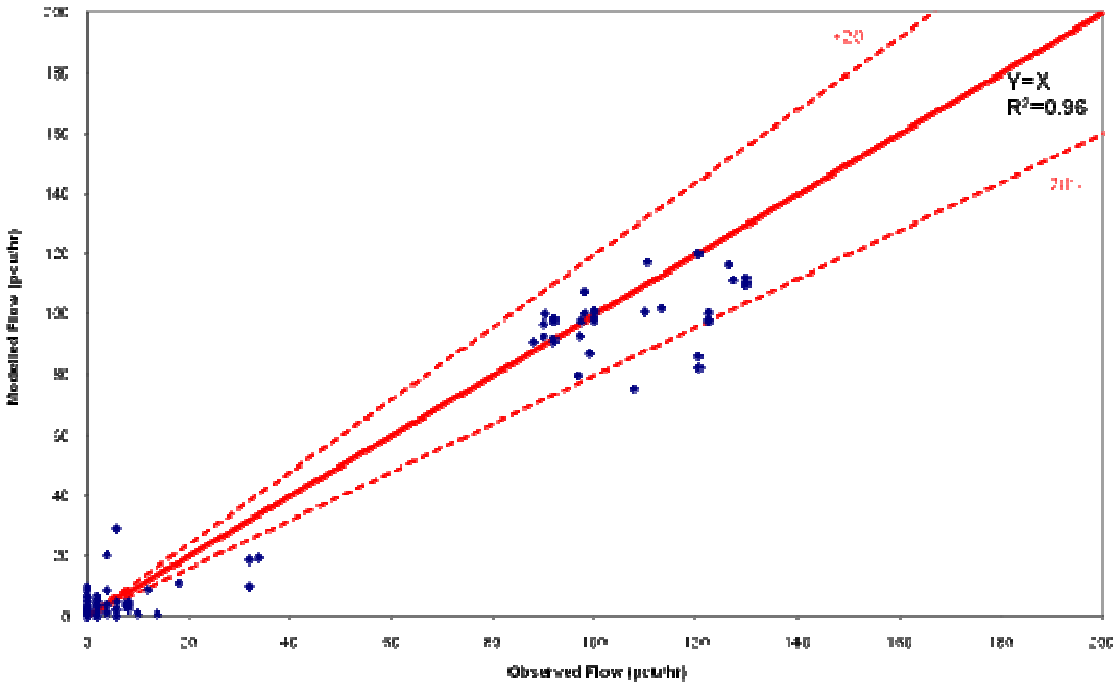


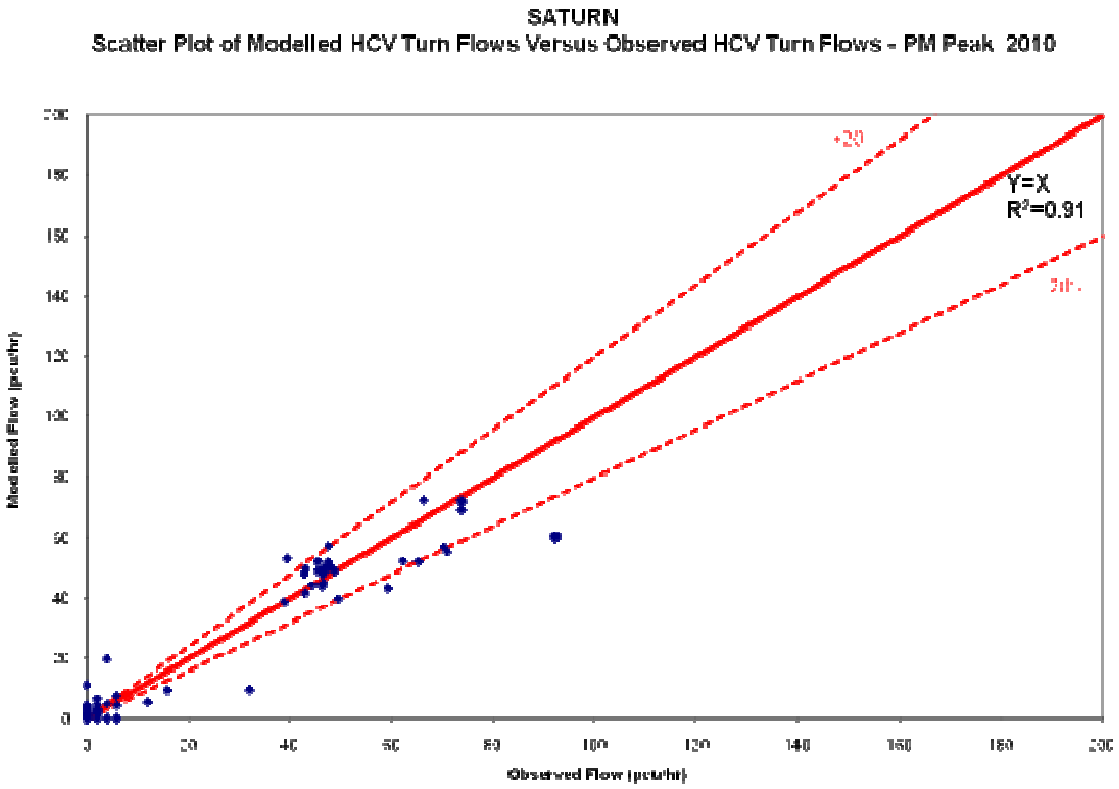
Turning validation Plots – HCVs

SATURN
Scatter Plot of Modelled HCV Turn Flows Versus Observed HCV Turn Flows – AM Peak 2010



SATURN
Scatter Plot of Modelled HCV Turn Flows Versus Observed HCV Turn Flows - Inter Peak 2010




SATURN
Scatter Plot of Modelled HCV Turn Flows Versus Observed HCV Turn Flows - PM Peak 2010
Y=X
R²=0.91
+20
Modelled Flow (pcu/hr)
Observed Flow (pcu/hr)

Appendix G

Absolute Difference between Observed Delays and Modelled Delays

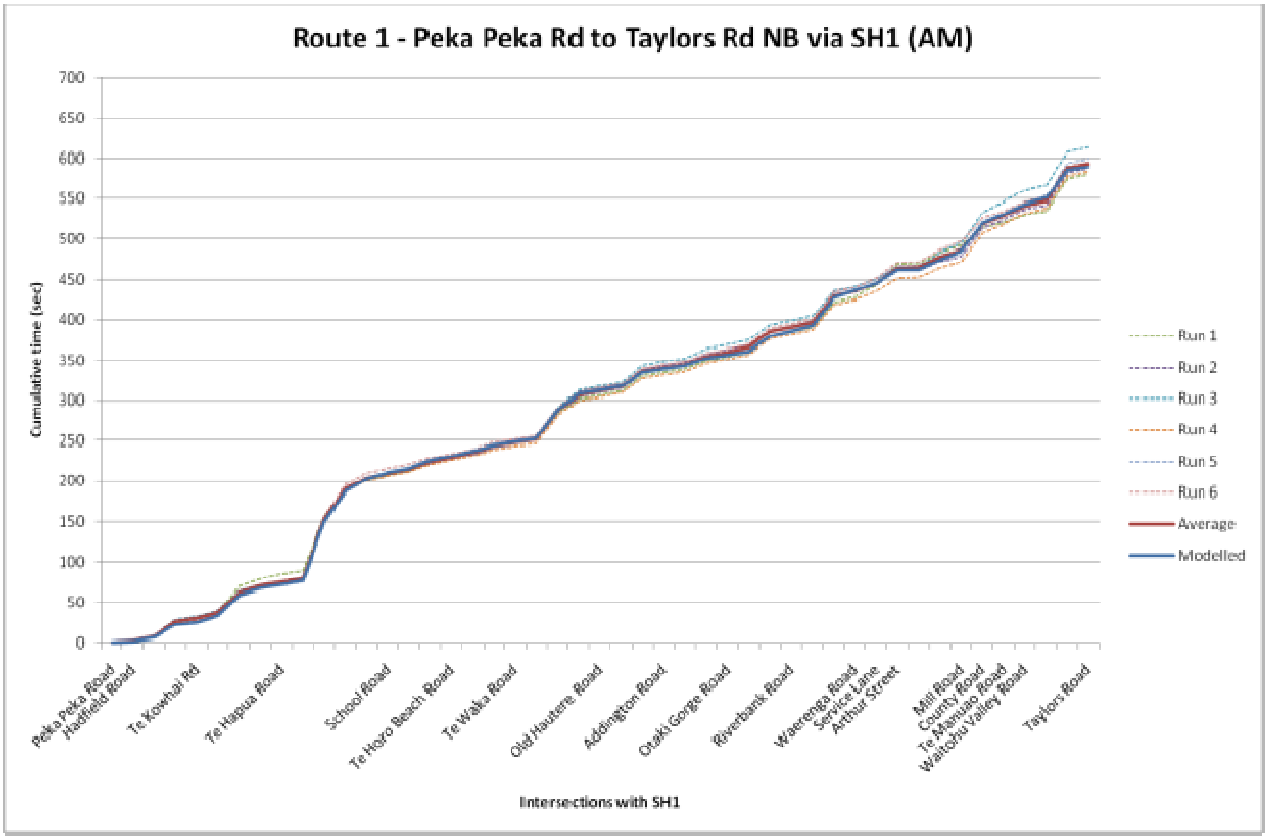
Turn Delay Comparison: 7:45-8:45 AM Peak Period								
	NO.	ANODE	BNODE	CNODE	COUNT (sec)	MODELLED (sec)	DIFFER-	% Diff
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	2	1401	1001	1002	0.0	0	0	0.00
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002				
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401				
SH1 (N) TH SH1 (S)	5	1002	1001	1401	0.0	0	0	0.00
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401				
SH1 (S) TH SH1 (N)	7	1001	1002	1402	0.0	0	0	0.00
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	7.7	8	0	2.04
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	10	1402	1002	1001	0.0	0	0	0.00
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	5.3	6	-1	-10.67
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	7.0	8	-1	-8.14
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	14	1431	1003	1403	0.0	0	0	0.00
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	4.0	4	0	1.50
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	17.8	15	3	15.96
SH1 (N) TH SH1 (S)	17	1403	1003	1431	0.0	0	0	0.00
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	6.0	6	0	2.83
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	20	1429	1004	1404	0.0	0	0	0.00
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	4.6	5	-1	-12.61
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	8.7	7	2	24.83
SH1 (N) TH SH1 (S)	23	1404	1004	1429	0.0	0	0	0.00
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	6.5	6	0	0.15
SH1 (S) TH SH1 (N)	25	1407	1007	1008	0.0	0	0	0.00
SH1 (S) RT School Rd (E)	26	1407	1007	3408	9.3	11	-1	-15.18
SH1 (N) LT School Rd (E)	27	1008	1007	3408	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	28	1008	1007	1407	0.0	0	0	0.00
School Rd (E) LT SH1 (S)	29	3408	1007	1407	9.4	8	2	19.50
School Rd (E) RT SH1 (N)	30	3408	1007	1008	14.3	12	3	18.68
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	32	1409	1009	1410	0.0	0	0	0.00
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	10.0	7	3	28.33
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	14.2	10	4	26.56
SH1 (N) TH SH1 (S)	35	1410	1009	1409	0.0	0	0	0.00
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	7.5	10	-2	-28.53
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	38	1411	1010	1011	0.0	0	0	0.00
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	4.0	4	0	0.75
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	17.8	15	3	14.27
SH1 (N) TH SH1 (S)	41	1011	1010	1411	0.0	0	0	0.00
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	6.0	6	0	0.50
SH1 (S) TH SH1 (N)	43	1412	1013	1014	0.0	0	0	0.00
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	10.3	12	-2	-17.96
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	46	1014	1013	1412	0.0	0	0	0.00
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	10.5	9	2	16.46
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	19.3	16	4	18.49
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	50	1414	1015	1415	0.0	0	0	0.00
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	11.4	10	1	10.92
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	17.9	15	3	16.88
SH1 (N) TH SH1 (S)	53	1415	1015	1414	0.0	0	0	0.00
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	5.3	7	-1	-28.25
SH1 (S) TH SH1 (N)	55	1416	1016	1430	0.0	0	0	0.00
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414				
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	58	1430	1016	1416	0.0	0	0	0.00
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416				
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430				
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	62	1417	1017	1018	0.0	0	0	0.00
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	11.3	8	3	28.71
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	18.6	14	4	23.81
SH1 (N) TH SH1 (S)	65	1018	1017	1417	0.0	0	0	0.00
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	12.7	11	1	9.45
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	68	1418	1019	1419	0.0	0	0	0.00
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	7.0	6	1	7.99
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	12.0	9	3	22.42
SH1 (N) TH SH1 (S)	71	1419	1019	1418	0.0	0	0	0.00
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	6.9	6	1	13.66
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	74	1419	1020	1420	0.0	0	0	0.00
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	12.3	14	-1	-9.78
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	10.0	9	1	5.70
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	23.5	19	4	17.77
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	24.5	20	5	20.12
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	80	1420	1020	1419	0.0	0	0	0.00
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	13.0	10	3	23.85
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	10.3	12	-2	-14.58
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	17.3	19	-1	-8.00
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	21.7	20	1	5.62
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	3.9	3	1	14.50
SH1 (S) TH SH1 (N)	86	1421	1021	1022	3.9	3	1	14.50
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	3.9	3	1	14.50
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	4.9	5	0	0.82
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	4.9	5	0	0.82
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	4.9	5	0	0.82
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	3.9	3	1	18.07
SH1 (N) TH SH1 (S)	92	1022	1021	1421	3.9	3	1	18.07
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	3.9	3	1	18.07
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	4.9	6	-1	-28.40
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	4.9	6	-1	-28.40
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	4.9	6	-1	-28.40
SH1 (S) TH SH1 (N)	97	1021	1022	1023	0.0	0	0	0.00
SH1 (S) RT County Rd (E)	98	1021	1022	2019				
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	0.0	0	0	0.00
County Rd (E) LT SH1 (S)	101	2019	1022	1021				
County Rd (E) RT SH1 (N)	102	2019	1022	1023				
SH1 (S) TH SH1 (N)	103	1022	1023	1024	0.0	0	0	0.00
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	17.7	15	3	17.01
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	106	1024	1023	1022	0.0	0	0	0.00
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	12.3	10	2	15.92
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	14.8	15	0	-0.27
SH1 (S) TH SH1 (N)	109	1023	1024	1025	0.0	0	0	0.00
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	5.1	7	-1.6	-31.51
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	112	1025	1024	1023	0.0	0	0	0.00
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	6.5	5	1	18.36
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	10.0	14	-4.3	-42.50
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	116	1026	1027	1427	0.0	0	0	0.00
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427				
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026				
SH1 (N) TH SH1 (S)	119	1427	1027	1026	0.0	0	0	0.00
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416				

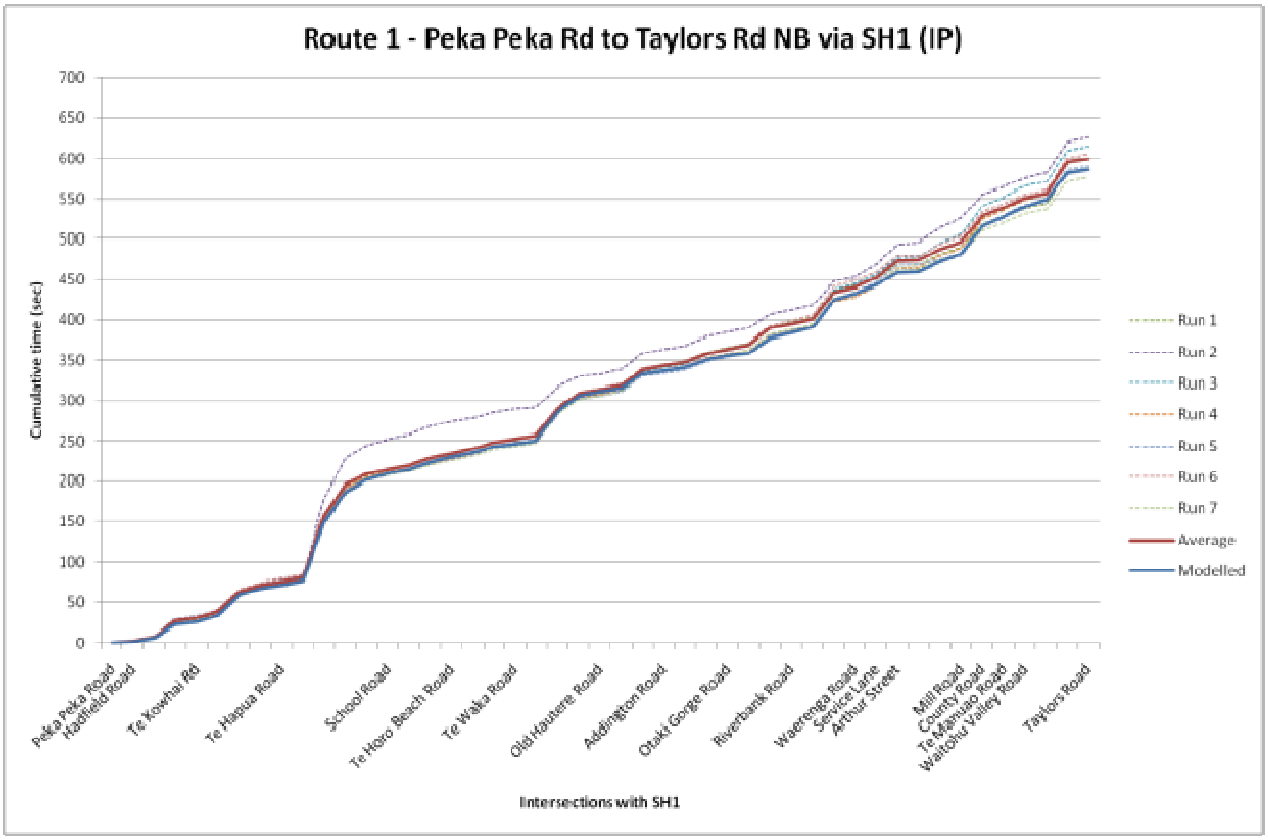
Turn Delay Comparison: 11:00-12:00 Inter Peak Period								
	NO.	ANODE	BNODE	CNODE	COUNT (sec)	MODELLED (sec)	DIFFER-	% Diff
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	2	1401	1001	1002	0.0	0	0	0.00
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002				
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401				
SH1 (N) TH SH1 (S)	5	1002	1001	1401	0.0	0	0	0.00
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401				
SH1 (S) TH SH1 (N)	7	1001	1002	1402	0.0	0	0	0.00
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	6.7	6	1	9.70
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	10	1402	1002	1001	0.0	0	0	0.00
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	4.3	5	-1	-14.82
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	6.0	6	0	-1.00
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	14	1431	1003	1403	0.0	0	0	0.00
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	3.0	4	-1	-25.33
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	12.0	11	1	9.17
SH1 (N) TH SH1 (S)	17	1403	1003	1431	0.0	0	0	0.00
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	6.0	5	1	12.33
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	20	1429	1004	1404	0.0	0	0	0.00
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	5.0	5	0	5.60
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	5.2	6	-1	-12.12
SH1 (N) TH SH1 (S)	23	1404	1004	1429	0.0	0	0	0.00
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	6.9	6	1	16.07
SH1 (S) TH SH1 (N)	25	1407	1007	1008	0.0	0	0	0.00
SH1 (S) RT School Rd (E)	26	1407	1007	3408	8.0	8	0	2.88
SH1 (N) LT School Rd (E)	27	1008	1007	3408	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	28	1008	1007	1407	0.0	0	0	0.00
School Rd (E) LT SH1 (S)	29	3408	1007	1407	7.2	6	1	17.40
School Rd (E) RT SH1 (N)	30	3408	1007	1008	11.3	9	3	25.10
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	32	1409	1009	1410	0.0	0	0	0.00
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	7.3	6	1	14.22
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	10.3	9	2	15.03
SH1 (N) TH SH1 (S)	35	1410	1009	1409	0.0	0	0	0.00
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	8.6	8	0	3.95
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	38	1411	1010	1011	0.0	0	0	0.00
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	3.0	4	-1	-26.67
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	12.0	11	1	4.33
SH1 (N) TH SH1 (S)	41	1011	1010	1411	0.0	0	0	0.00
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	6.0	5	1	9.83
SH1 (S) TH SH1 (N)	43	1412	1013	1014	0.0	0	0	0.00
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	8.5	9	-1	-7.18
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	46	1014	1013	1412	0.0	0	0	0.00
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	8.2	7	1	17.07
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	16.4	12	5	28.61
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	50	1414	1015	1415	0.0	0	0	0.00
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	8.2	8	0	-2.52
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	13.3	12	1	9.36
SH1 (N) TH SH1 (S)	53	1415	1015	1414	0.0	0	0	0.00
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	7.5	6	2	20.16
SH1 (S) TH SH1 (N)	55	1416	1016	1430	0.0	0	0	0.00
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414				
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	58	1430	1016	1416	0.0	0	0	0.00
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416				
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430				
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	62	1417	1017	1018	0.0	0	0	0.00
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	10.6	7	3.5	33.40
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	16.0	11	5	29.13
SH1 (N) TH SH1 (S)	65	1018	1017	1417	0.0	0	0	0.00
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	12.6	10	3	23.97
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	68	1418	1019	1419	0.0	0	0	0.00
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	6.3	6	0	7.38
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	9.6	8	2	16.94
SH1 (N) TH SH1 (S)	71	1419	1019	1418	0.0	0	0	0.00
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	4.4	6	-1	-25.91
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	74	1419	1020	1420	0.0	0	0	0.00
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	10.7	9	1	11.80
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	10.7	9	2	18.71
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	16.4	14	2	14.35
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	17.1	16	1	6.96
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	80	1420	1020	1419	0.0	0	0	0.00
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	11.0	9	2	17.36
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	9.5	9	1	5.68
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	16.5	14	3	16.18
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	20.6	16	4	21.81
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	4.2	3	1	22.41
SH1 (S) TH SH1 (N)	86	1421	1021	1022	4.2	3	1	22.41
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	4.2	3	1	22.41
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	4.7	5	0	-0.86
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	4.7	5	0	-0.86
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	4.7	5	0	-0.86
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	4.2	3	1	22.65
SH1 (N) TH SH1 (S)	92	1022	1021	1421	4.2	3	1	22.65
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	4.2	3	1	22.65
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	4.7	5	0	-10.30
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	4.7	5	0	-10.30
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	4.7	5	0	-10.30
SH1 (S) TH SH1 (N)	97	1021	1022	1023	0.0	0	0	0.00
SH1 (S) RT County Rd (E)	98	1021	1022	2019				
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	0.0	0	0	0.00
County Rd (E) LT SH1 (S)	101	2019	1022	1021	15.0	18	-3	-22.67
County Rd (E) RT SH1 (N)	102	2019	1022	1023	14.0	11	3	24.43
SH1 (S) TH SH1 (N)	103	1022	1023	1024	0.0	0	0	0.00
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	13.0	11	2	19.08
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	106	1024	1023	1022	0.0	0	0	0.00
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	10.3	8	3	25.53
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	12.5	11	2	15.04
SH1 (S) TH SH1 (N)	109	1023	1024	1025	0.0	0	0	0.00
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	4.4	6	-1	-28.48
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	112	1025	1024	1023	0.0	0	0	0.00
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	4.8	5	0	1.89
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	12.4	11	2	15.07
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	116	1026	1027	1427	0.0	0	0	0.00
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427				
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026				
SH1 (N) TH SH1 (S)	119	1427	1027	1026	0.0	0	0	0.00
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416				

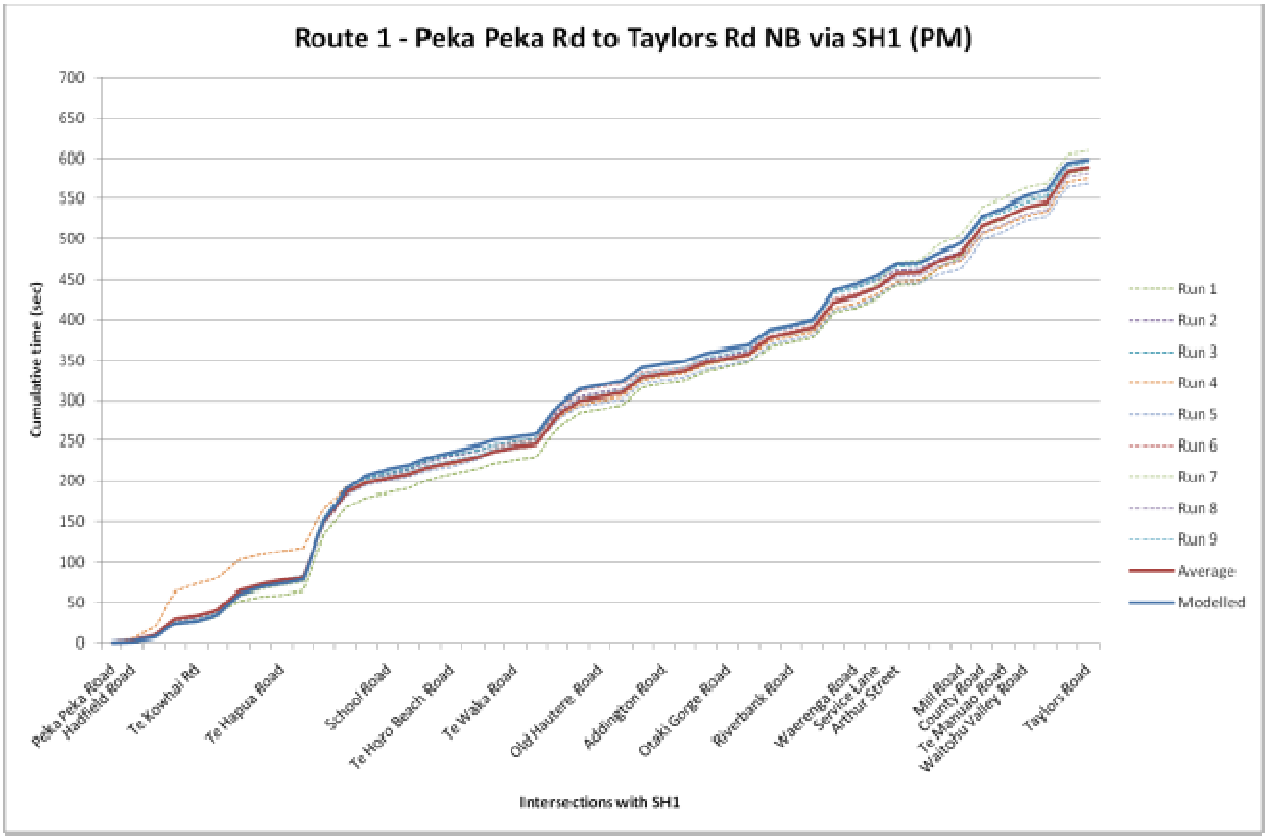
Turn Delay Comparison: 16:30-17:30 PM Peak Period								
	NO.	ANODE	BNODE	CNODE	COUNT (sec)	MODELLED	DIFFER-	% Diff
SH1 (S) LT Peka Peka Rd (W)	1	1401	1001	3401	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	2	1401	1001	1002	0.0	0	0	0.00
Peka Peka Rd (W) LT SH1 (N)	3	3401	1001	1002				
Peka Peka Rd (W) RT SH1 (S)	4	3401	1001	1401				
SH1 (N) TH SH1 (S)	5	1002	1001	1401	0.0	0	0	0.00
SH1 (N) RT Peka Peka Rd (W)	6	1002	1001	3401				
SH1 (S) TH SH1 (N)	7	1001	1002	1402	0.0	0	0	0.00
SH1 (S) RT Hadfield Rd (E)	8	1001	1002	3402	7.7	8	0	1.00
SH1 (N) LT Hadfield Rd (E)	9	1402	1002	3402	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	10	1402	1002	1001	0.0	0	0	0.00
Hadfield Rd (E) LT SH1 (S)	11	3402	1002	1001	5.3	6	-1	-11.43
Hadfield Rd (E) RT SH1 (N)	12	3402	1002	1402	7.0	8	-1	-9.29
SH1 (S) LT Te Kowhai Rd (W)	13	1431	1003	3403	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	14	1431	1003	1403	0.0	0	0	0.00
Te Kowhai Rd (W) LT SH1 (N)	15	3403	1003	1403	5.5	4	1	20.00
Te Kowhai Rd (W) RT SH1 (S)	16	3403	1003	1431	19.5	20	0	-0.36
SH1 (N) TH SH1 (S)	17	1403	1003	1431	0.0	0	0	0.00
SH1 (N) RT Te Kowhai Rd (W)	18	1403	1003	3403	6.5	7	-1	-14.31
SH1 (S) LT Te Hapua Rd (W)	19	1429	1004	3404	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	20	1429	1004	1404	0.0	0	0	0.00
Te Hapua Rd (W) LT SH1 (N)	21	3404	1004	1404	6.3	6	0	-1.82
Te Hapua Rd (W) RT SH1 (S)	22	3404	1004	1429	8.4	9	0	-2.69
SH1 (N) TH SH1 (S)	23	1404	1004	1429	0.0	0	0	0.00
SH1 (N) RT Te Hapua Rd (W)	24	1404	1004	3404	7.3	9	-1	-16.18
SH1 (S) TH SH1 (N)	25	1407	1007	1008	0.0	0	0	0.00
SH1 (S) RT School Rd (E)	26	1407	1007	3408	15.0	11	4	28.93
SH1 (N) LT School Rd (E)	27	1008	1007	3408	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	28	1008	1007	1407	0.0	0	0	0.00
School Rd (E) LT SH1 (S)	29	3408	1007	1407	7.0	8	-1	-9.29
School Rd (E) RT SH1 (N)	30	3408	1007	1008	13.3	12	1	8.91
SH1 (S) LT Te Horo Beach Rd (W)	31	1409	1009	3409	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	32	1409	1009	1410	0.0	0	0	0.00
Te Horo Beach Rd (W) LT SH1 (N)	33	3409	1009	1410	9.4	10	0	-2.88
Te Horo Beach Rd (W) RT SH1 (S)	34	3409	1009	1409	17.7	15	2	13.51
SH1 (N) TH SH1 (S)	35	1410	1009	1409	0.0	0	0	0.00
SH1 (N) RT Te Horo Beach Rd (W)	36	1410	1009	3409	13.0	14	-1	-9.23
SH1 (S) LT Te Waka Rd (W)	37	1411	1010	3410	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	38	1411	1010	1011	0.0	0	0	0.00
Te Waka Rd (W) LT SH1 (N)	39	3410	1010	1011	5.5	4	1	20.73
Te Waka Rd (W) RT SH1 (S)	40	3410	1010	1411	19.5	19	0	1.28
SH1 (N) TH SH1 (S)	41	1011	1010	1411	0.0	0	0	0.00
SH1 (N) RT Te Waka Rd (W)	42	1011	1010	3410	6.5	7	-1	-12.46
SH1 (S) TH SH1 (N)	43	1412	1013	1014	0.0	0	0	0.00
SH1 (S) RT Old Hautere Rd (E)	44	1412	1013	3411	13.1	13	0	3.69
SH1 (N) LT Old Hautere Rd (E)	45	1014	1013	3411	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	46	1014	1013	1412	0.0	0	0	0.00
Old Hautere Rd (E) LT SH1 (S)	47	3411	1013	1412	8.5	9	0	-4.59
Old Hautere Rd (E) RT SH1 (N)	48	3411	1013	1014	17.2	20	-3	-15.86
SH1 (S) LT Addington Rd (W)	49	1414	1015	3412	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	50	1414	1015	1415	0.0	0	0	0.00
Addington Rd (W) LT SH1 (N)	51	3412	1015	1415	15.9	17	-1	-6.89
Addington Rd (W) RT SH1 (S)	52	3412	1015	1414	24.7	24	1	4.25
SH1 (N) TH SH1 (S)	53	1415	1015	1414	0.0	0	0	0.00
SH1 (N) RT Addington Rd (W)	54	1415	1015	3412	8.4	9	0	-0.90
SH1 (S) TH SH1 (N)	55	1416	1016	1430	0.0	0	0	0.00
SH1 (S) RT Otaki Gorge Rd (E)	56	1416	1016	3414				
SH1 (N) LT Otaki Gorge Rd (E)	57	1430	1016	3414	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	58	1430	1016	1416	0.0	0	0	0.00
Otaki Gorge Rd (E) LT SH1 (S)	59	3414	1016	1416				
Otaki Gorge Rd (E) RT SH1 (N)	60	3414	1016	1430				
SH1 (S) LT Riverbank Rd (W)	61	1417	1017	2401	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	62	1417	1017	1018	0.0	0	0	0.00
Riverbank Rd (W) LT SH1 (N)	63	2401	1017	1018	11.0	11	0	-1.64
Riverbank Rd (W) RT SH1 (S)	64	2401	1017	1417	21.4	22	-1	-2.60
SH1 (N) TH SH1 (S)	65	1018	1017	1417	0.0	0	0	0.00
SH1 (N) RT Riverbank Rd (W)	66	1018	1017	2401	14.0	16	-2	-15.14
SH1 (S) LT Waerenga Rd (W)	67	1418	1019	2002	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	68	1418	1019	1419	0.0	0	0	0.00
Waerenga Rd (W) LT SH1 (N)	69	2002	1019	1419	7.9	8	0	-1.82
Waerenga Rd (W) RT SH1 (S)	70	2002	1019	1418	12.4	13	0	-3.87
SH1 (N) TH SH1 (S)	71	1419	1019	1418	0.0	0	0	0.00
SH1 (N) RT Waerenga Rd (W)	72	1419	1019	2002	6.8	7	0	-5.67
SH1 (S) LT Arthur St (W)	73	1419	1020	2004	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	74	1419	1020	1420	0.0	0	0	0.00
SH1 (S) RT Arthur St (E)	75	1419	1020	2005	14.0	13	1	5.29
Arthur St (W) LT SH1 (N)	76	2004	1020	1420	13.6	15	-1	-7.43
Arthur St (W) TH Arthur St (E)	77	2004	1020	2005	25.8	27	-1	-3.45
Arthur St (W) RT SH1 (S)	78	2004	1020	1419	26.8	25	2	7.73
SH1 (N) LT Arthur St (E)	79	1420	1020	2005	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	80	1420	1020	1419	0.0	0	0	0.00
SH1 (N) RT Arthur St (W)	81	1420	1020	2004	17.0	14	3	17.71
Arthur St (E) LT SH1 (S)	82	2005	1020	1419	12.5	12	0	0.64
Arthur St (E) TH Arthur St (W)	83	2005	1020	2004	22.5	25	-3	-11.30
Arthur St (E) RT SH1 (N)	84	2005	1020	1420	28.1	30	-2	-6.67
SH1 (S) LT Mill Rd (W)	85	1421	1021	2007	4.6	3	1	27.35
SH1 (S) TH SH1 (N)	86	1421	1021	1022	4.6	3	1	27.35
SH1 (S) RT Rahui Rd (E)	87	1421	1021	2409	4.6	3	1	27.35
Mill Rd (W) LT SH1 (N)	88	2007	1021	1022	5.3	6	-1	-11.80
Mill Rd (W) TH Rahui Rd (E)	89	2007	1021	2409	5.3	6	-1	-11.80
Mill Rd (W) RT SH1 (S)	90	2007	1021	1421	5.3	6	-1	-11.80
SH1 (N) LT Rahui Rd (E)	91	1022	1021	2409	4.6	3	1	26.91
SH1 (N) TH SH1 (S)	92	1022	1021	1421	4.6	3	1	26.91
SH1 (N) RT Mill Rd (W)	93	1022	1021	2007	4.6	3	1	26.91
Rahui Rd (E) LT SH1 (S)	94	2409	1021	1421	5.3	6	-1	-12.55
Rahui Rd (E) TH Mill Rd (W)	95	2409	1021	2007	5.3	6	-1	-12.55
Rahui Rd (E) RT SH1 (N)	96	2409	1021	1022	5.3	6	-1	-12.55
SH1 (S) TH SH1 (N)	97	1021	1022	1023	0.0	0	0	0.00
SH1 (S) RT County Rd (E)	98	1021	1022	2019				
SH1 (N) LT County Rd (E)	99	1023	1022	2019	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	100	1023	1022	1021	0.0	0	0	0.00
County Rd (E) LT SH1 (S)	101	2019	1022	1021	29.5	27	3	9.22
County Rd (E) RT SH1 (N)	102	2019	1022	1023	17.0	16	1	8.65
SH1 (S) TH SH1 (N)	103	1022	1023	1024	0.0	0	0	0.00
SH1 (S) RT Te Manuao Rd (E)	104	1022	1023	2011	16.3	15	1	5.06
SH1 (N) LT Te Manuao Rd (E)	105	1024	1023	2011	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	106	1024	1023	1022	0.0	0	0	0.00
Te Manuao Rd (E) LT SH1 (S)	107	2011	1023	1022	14.8	11	4	28.81
Te Manuao Rd (E) RT SH1 (N)	108	2011	1023	1024	23.3	15	7.9	33.83
SH1 (S) TH SH1 (N)	109	1023	1024	1025	0.0	0	0	0.00
SH1 (S) RT Waitohu Valley Rd (E)	110	1023	1024	2012	6.8	7	0	-2.44
SH1 (N) LT Waitohu Valley Rd (E)	111	1025	1024	2012	0.0	0	0	0.00
SH1 (N) TH SH1 (S)	112	1025	1024	1023	0.0	0	0	0.00
Waitohu Valley Rd (E) LT SH1 (S)	113	2012	1024	1023	4.4	5	-1	-22.16
Waitohu Valley Rd (E) RT SH1 (N)	114	2012	1024	1025	22.6	15	7.3	32.48
SH1 (S) LT Taylors Rd (W)	115	1026	1027	2416	0.0	0	0	0.00
SH1 (S) TH SH1 (N)	116	1026	1027	1427	0.0	0	0	0.00
Taylors Rd (W) LT SH1 (N)	117	2416	1027	1427				
Taylors Rd (W) RT SH1 (S)	118	2416	1027	1026				
SH1 (N) TH SH1 (S)	119	1427	1027	1026	0.0	0	0	0.00
SH1 (N) RT Taylors Rd (W)	120	1427	1027	2416				

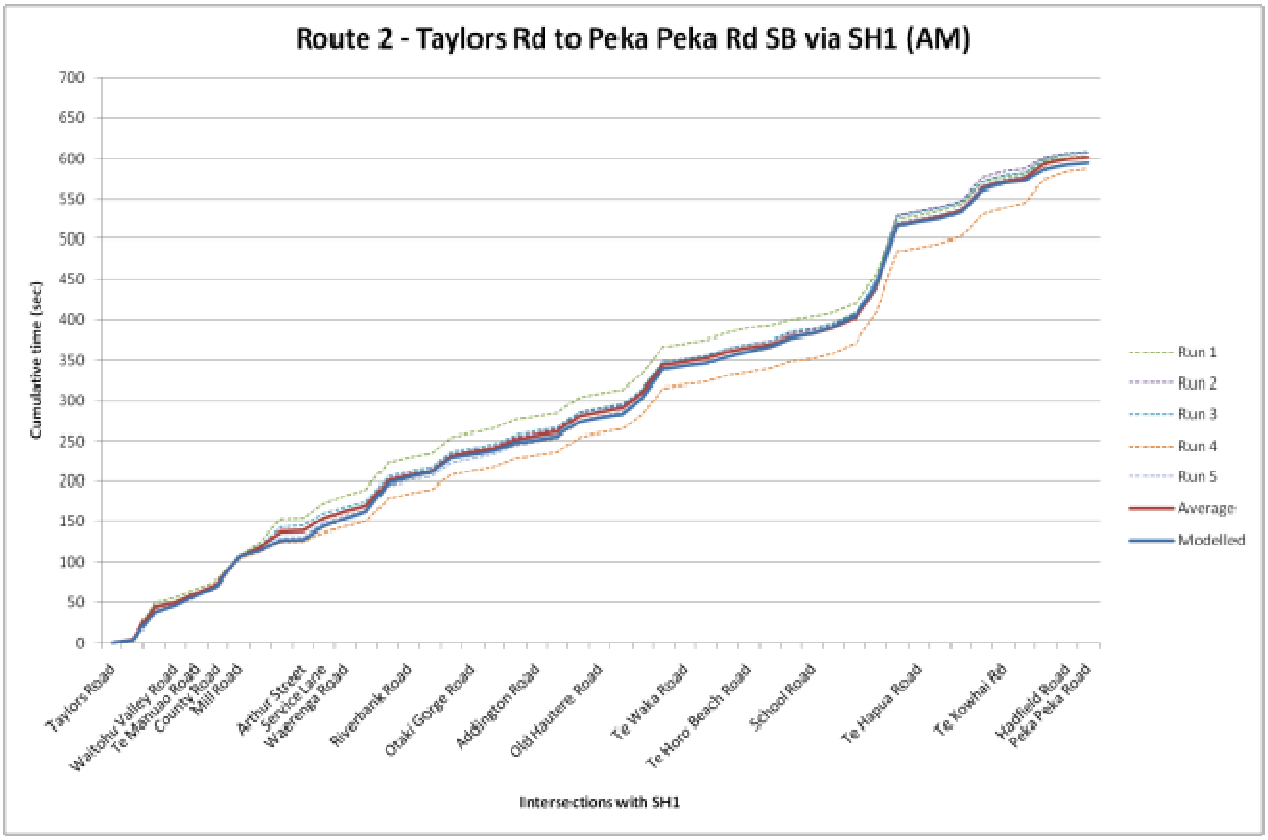
Appendix H

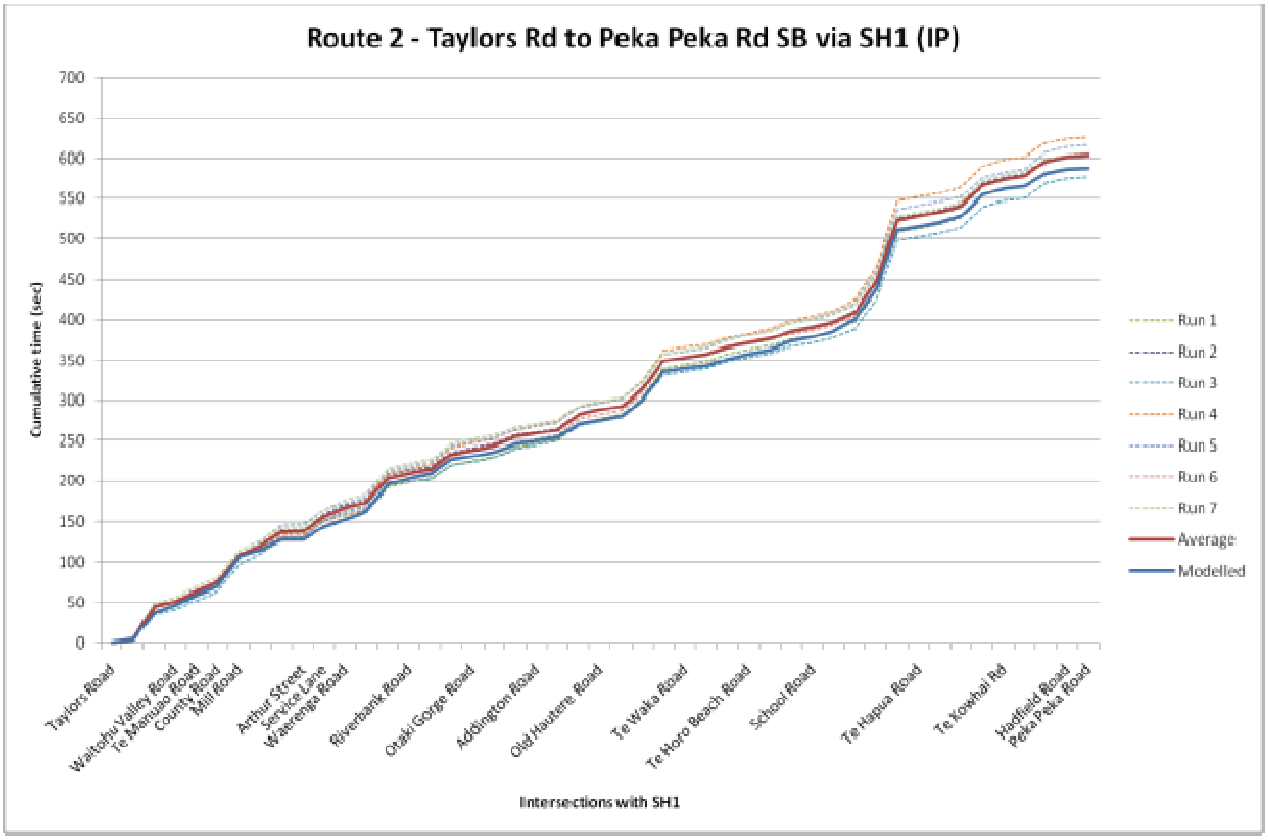
Journey Time Comparisons

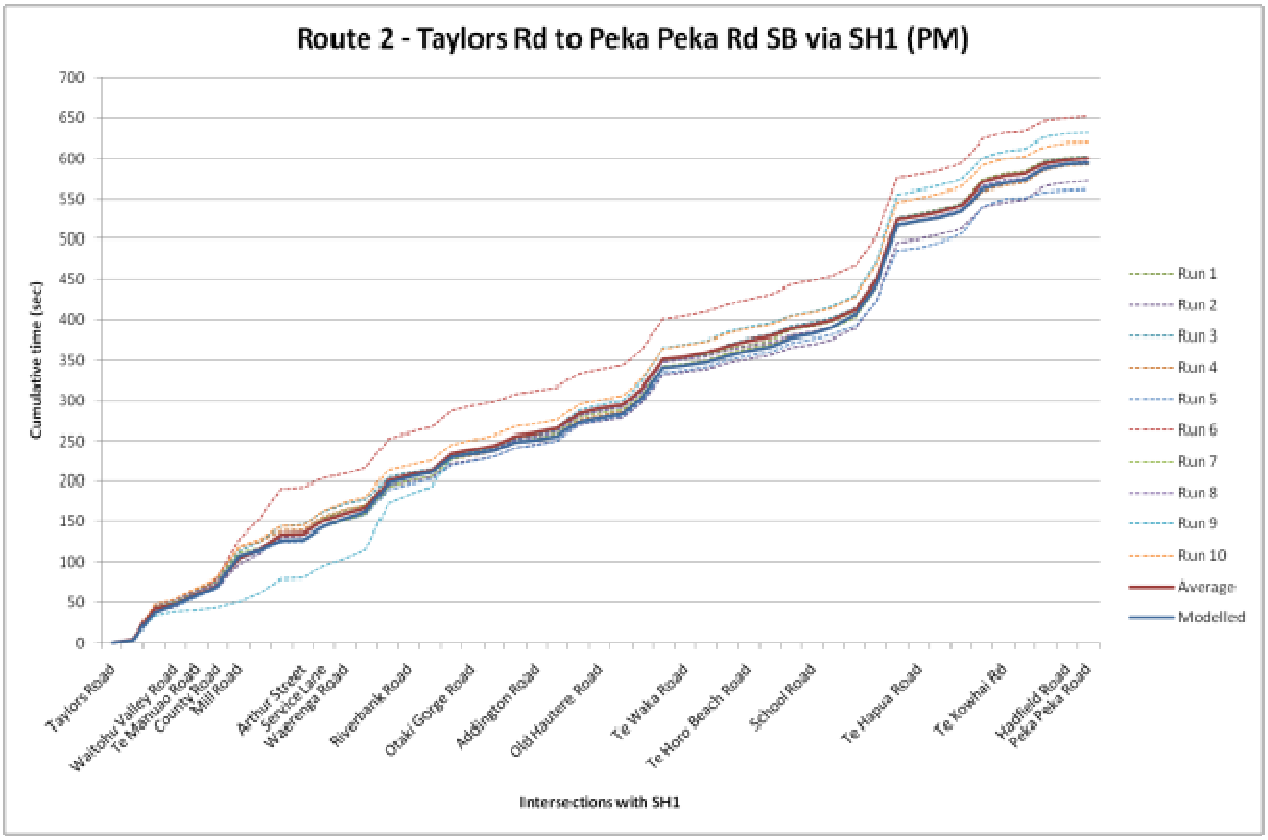

Route 1 - Peka Peka Rd to Taylors Rd NB via SH1 (AM)
Cumulative time (sec)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Peka Peka Road
Hadfield Road
Te Kowhai Rd
Te Hapua Road
School Road
Te Horo Beach Road
Te Waka Road
Old Hautere Road
Addington Road
Otaki Gorge Road
Riverbank Road
Waerenga Road
Service Lane
Arthur Street
Mill Road
County Road
Te Manuao Road
Waitohu Valley Road
Taylors Road
Intersections with SH1
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Average
Modelled


Route 1 - Peka Peka Rd to Taylors Rd NB via SH1 (IP)
Cumulative time (sec)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Peka Peka Road
Hadfield Road
Te Kowhai Rd
Te Hapua Road
School Road
Te Horo Beach Road
Te Waka Road
Old Hautere Road
Addington Road
Otaki Gorge Road
Riverbank Road
Waerenga Road
Service Lane
Arthur Street
Mill Road
County Road
Te Manuao Road
Waitohu Valley Road
Taylors Road
Intersections with SH1
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Average
Modelled


Route 1 - Peka Peka Rd to Taylors Rd NB via SH1 (PM)
Cumulative time (sec)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Peka Peka Road
Hadfield Road
Te Kowhai Rd
Te Hapua Road
School Road
Te Horo Beach Road
Te Waka Road
Old Hautere Road
Addington Road
Otaki Gorge Road
Riverbank Road
Waerenga Road
Service Lane
Arthur Street
Mill Road
County Road
Te Manuao Road
Waitohu Valley Road
Taylors Road
Intersections with SH1
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Run 8
Run 9
Average
Modelled

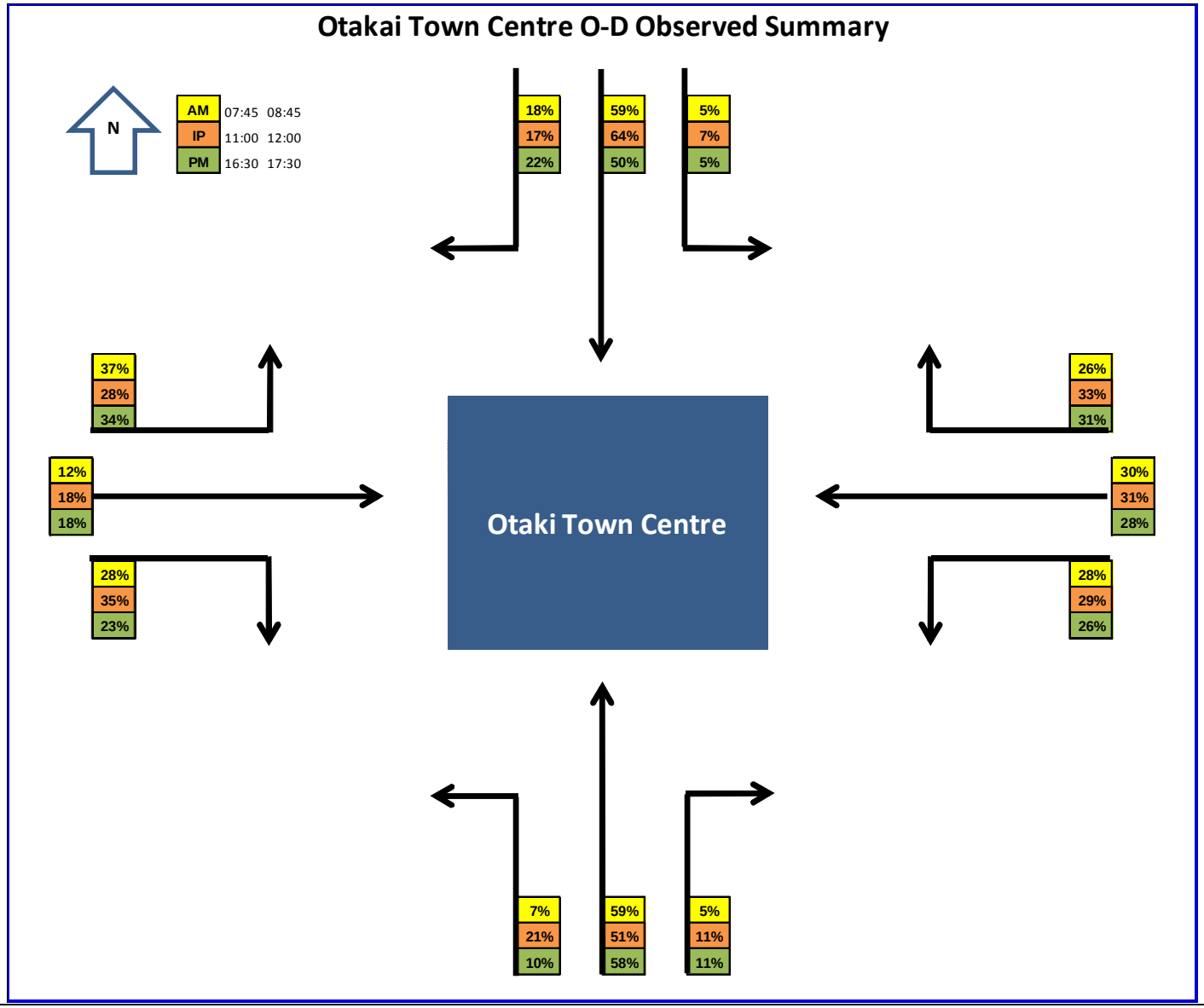

Route 2 - Taylors Rd to Peka Peka Rd SB via SH1 (AM)
Cumulative time (sec)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Taylors Road
Waitohu Valley Road
Te Manuao Road
County Road
Mill Road
Arthur Street
Service Lane
Waerenga Road
Riverbank Road
Otaki Gorge Road
Addington Road
Old Hautere Road
Te Waka Road
Te Horo Beach Road
School Road
Te Hapua Road
Te Kowhai Rd
Hadfield Road
Peka Peka Road
Intersections with SH1
Run 1
Run 2
Run 3
Run 4
Run 5
Average
Modelled

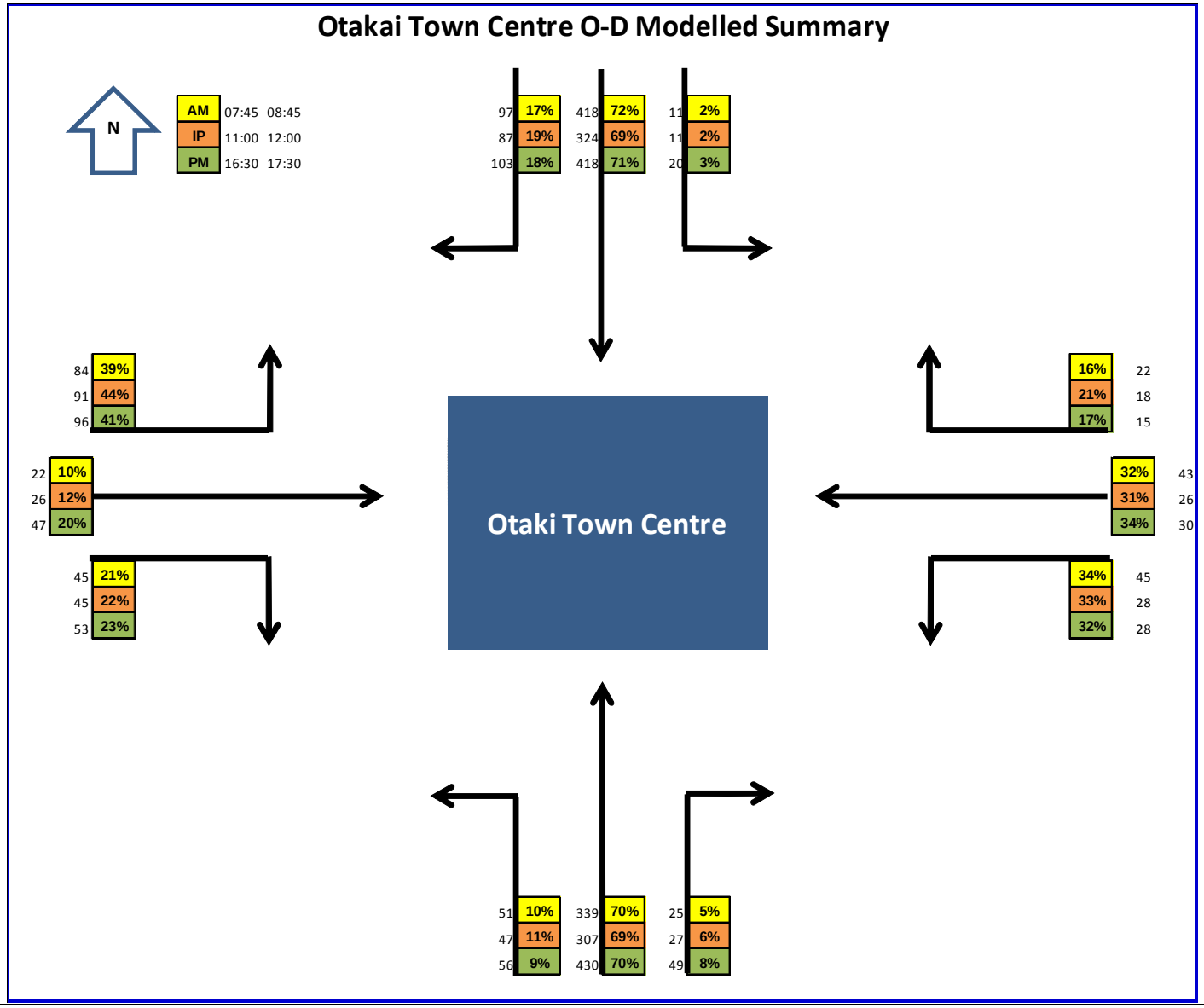

Route 2 - Taylors Rd to Peka Peka Rd SB via SH1 (IP)
Cumulative time (sec)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Taylors Road
Waitohu Valley Road
Te Maniuao Road
County Road
Mill Road
Arthur Street
Service Lane
Waerenga Road
Riverbank Road
Otaki Gorge Road
Addington Road
Old Hautere Road
Te Waka Road
Te Horo Beach Road
School Road
Te Hapua Road
Te Kowhai Rd
Wadfield Road
Peka Peka Road
Intersections with SH1
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Average
Modelled

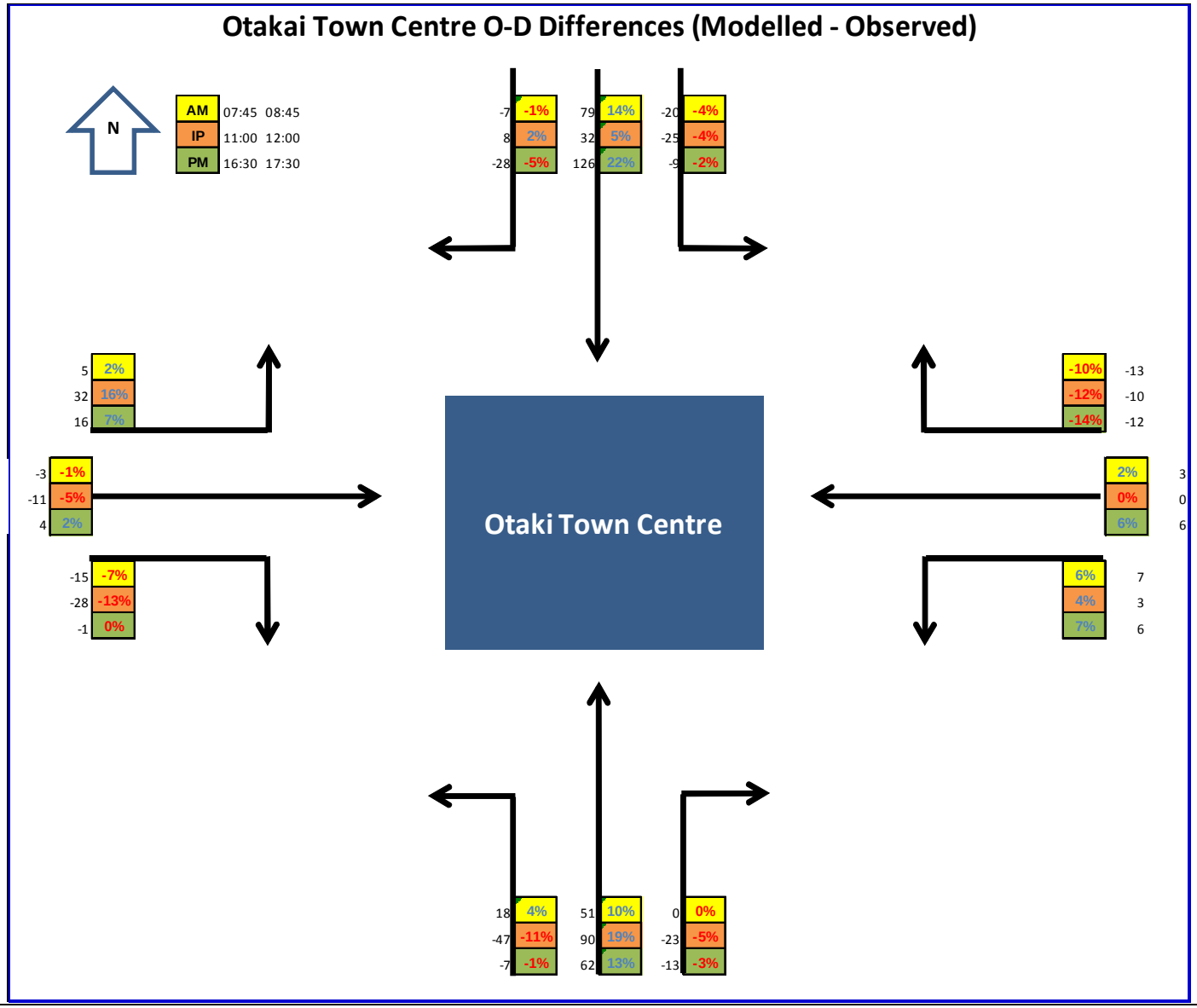

Route 2 - Taylors Rd to Peka Peka Rd SB via SH1 (PM)
Cumulative time (sec)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Taylors Road
Waitohu Valley Road
Te Maniuao Road
County Road
Mill Road
Arthur Street
Service Lane
Waerenga Road
Riverbank Road
Otaki Gorge Road
Addington Road
Old Hautere Road
Te Waka Road
Te Horo Beach Road
School Road
Te Hapua Road
Te Kowhai Rd
Wadfield Road
Peka Peka Road
Intersections with SH1
Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Run 8
Run 9
Run 10
Average
Modelled

Appendix I

Origin to Destination Comparisons


Otakai Town Centre O-D Observed Summary
N
AM 07:45 08:45
IP 11:00 12:00
PM 16:30 17:30
18% 17% 22%
59% 64% 50%
5% 7% 5%
37% 28% 34%
26% 33% 31%
12% 18% 18%
30% 31% 28%
28% 35% 23%
28% 29% 26%
Otaki Town Centre
7% 21% 10%
59% 51% 58%
5% 11% 11%


Otakai Town Centre O-D Modelled Summary
N
AM 07:45 08:45
IP 11:00 12:00
PM 16:30 17:30
97 17% 418 72% 11 2%
87 19% 324 69% 11 2%
103 18% 418 71% 20 3%
84 39%
91 44%
96 41%
22 10%
26 12%
47 20%
45 21%
45 22%
53 23%
16% 22
21% 18
17% 15
32% 43
31% 26
34% 30
34% 45
33% 28
32% 28
Otaki Town Centre
51 10% 339 70% 25 5%
47 11% 307 69% 27 6%
56 9% 430 70% 49 8%


Otakai Town Centre O-D Differences (Modelled - Observed)
N
AM 07:45 08:45
IP 11:00 12:00
PM 16:30 17:30
-7 -1% 79 14% -20 -4%
8 2% 32 5% -25 -4%
-28 -5% 126 22% -9 -2%
5 2% 32 16% 16 7%
-3 -1% -11 -5% 4 2%
-15 -7% -28 -13% -1 0%
-10% -12% -14%
-13 -10 -12
2% 0% 6%
3 0 6
6% 4% 7%
7 3 6
Otaki Town Centre
18 4% 51 10% 0 0%
-47 -11% 90 19% -23 -5%
-7 -1% 62 13% -13 -3%

Appendix J

Final Peer Review Report

File Note

Date	22 October 2010
Project No	ZB01116
Subject	**Review of Final Peka Peka to North Otaki Model: 2010 Traffic Model Validation Report**

1. Introduction

The New Zealand Transport Agency (NZTA) have appointed Sinclair Knight Merz Ltd (SKM) as reviewers of the traffic modelling undertaken by Opus International Consultants (Opus) for the Peka Peka to North Otaki Road of National Significance (RoNS) in the software package SATURN (Simulation and Assignment of Traffic to Urban Road Networks). The SATURN model developed is referred to as the Peka Peka to North Otaki Traffic Model (PP2OTM).

The first stage of this process was the review of the following scoping report:

- "Draft Peka Peka to North Otaki - modelling methodology", dated 22nd July 2010, received by email from Fraser Fleming

This was reviewed and a draft version of this review supplied to Opus. An email response to the draft review was received on 3rd August 2010 and review finding documented in the following SKM file note:

- "Peka Peka to North Otaki – Draft modelling methodology review", 4th August 2010

The following document was received by email from Fraser Fleming of Opus on 14th September 2010 has been reviewed:

- "2010 Peka Peka to North Otaki Model: 2010 Traffic Model Validation Report", September 2010

This was reviewed and a draft version of this review supplied to Opus on 16th September 2010. The following response to the draft review was received on Friday 24th September:

- "PP2O SATURN Traffic Model – Peer Review Comments – Opus Responses", 14th September 2010

After phone conversations between Darren Fidler (SKM), Fraser Fleming (Opus) and Hailin Hu (Opus) on 30th September and 1st October 2010, the following additional information was provided:

- "PP2O SATURN Traffic Model - Peer Review Comments - Opus Responses 2", 1st October 2010

On 4th October, the SKM report: "Final review of Peka Peka to North Otaki Model: 2010 Traffic Model Validation Report" was issued with 4 points outstanding. In order to address these points, Opus produced a 2nd issue of the validation report:

- "Final 2010 Traffic Model Validation Report", 22nd October 2010

The above 22nd October report is the one which is reviewed here.

The original issues raised in the review document were classified into:

- **INFORMATION REQUIRED**: *additional information should be supplied in the calibration report to justify modelling assumptions made;* and
- **POTENTIAL LIMITATION/RISK:** *comment is provided on potential future limitations of the model. Note that this does not indicate that the model is unsuitable for use, merely that caution needs to be exercised when using the model and there is a risk in doing this.*

In this document, the issue raised is numbered below, with the Opus response and comment on this response provided underneath. If no further action is required then the issue is noted as RESOLVED. If it is still considered that there are implications on model usage (which may be acceptable limitations) then this is noted.

In summary the issues which we consider to have a significant impact on model usage are:

a) The information provided indicates that the absolute totals of WTSM intra zonal trips that become PP2O SATURN model inter zonal trips is low except for WTSM zone 129 where approximately 400 additional trips per hour are assigned in each of the three peaks modelled.

   Zone 129 is shown in Figure 2-1. It is possible that the model is not accurately reflecting the distribution of these 400 trips per hour and so over or underestimating the traffic crossing SH1. This risk is mitigated through the validation to turn counts on SH1.

b) The speed flow curve naming convention and COBA reference has been supplied. It is noted that the capacity of all links is assumed to be 1800-2000 PCU per hour per lane. This is consistent with good quality rural links or suburban with slight development. For typical rural links or suburban links with typical development the link capacities are lower (1270-1660 PCU per hour per lane). The application of speed flow curves to road types can be subjective so it is recommended that a sensitivity test is carried out with lower

capacities on the rural links in the future models to establish whether this effects route choice and benefit levels.

c) The sensitivity tests are extremely useful in demonstrating the network reaction to increases in traffic volumes. It appears from Attachment 8 that the only significant increase in travel time with three times the existing traffic volumes is between Te Hapua Road and School Road in a northbound direction and at the Mill Road roundabout in the southbound direction.

   This indicates that the applied speed flow curves have a relatively small impact on vehicle speeds on the rest of the corridor when traffic volumes are three times those in the base model. This means that potential travel time savings on the corridor are heavily dependent on the speed flow curve assumptions. With the currently assumed speed flow curves, it is likely that the model would forecast very limited benefit to through traffic with significantly increased traffic volumes and the majority of and travel time benefits of an effective bypass would come from reductions in delay at the minor arms of intersections.

It is not considered that these risks fundamentally affect the use of the model for assessing the likely connections for a Peka Peka to Otaki off line highway link. However, it is considered that these risks in conjunction with those issues highlighted in the remainder of this document should be taken into consideration in the use of the PP2O SATURN model.

2. Issues raised

1) **RESOLVED:** It may not be possible to appropriately model route choice at the southern end of the scheme appropriately if any proposed scheme is not entirely within the model area.

With no south facing connections to the Expressway at either School Road or Peka Peka Road, it is considered an appropriate approximation to assumed that all of the traffic south of School Road will use the existing SH1. It is recommended that this is confirmed once a modelling tool becomes available which incorporates the full length of the scheme between Mil Road and Poplar Avenue

2) **RESOLVED:** The use of multiple zone connectors can result in vehicles originating from a zone using a connector dependent on their destination zone rather than their location within the origin zone.

It is agreed that the placement of zone 14 where this is an issue is unlikely to be directly affected by the expressway scheme. It is recommended that intersection outputs from the Bell Street / Waerenga Road intersection are not used.

3) **RESOLVED:** It should be demonstrated that the video survey period is sufficiently long to capture typical variability in traffic levels to ensure that the days on which turn counts were collected were representative of the "typical" peak period that is being modelled.

It is stated that the video survey data is from 5 days (Wednesdays and Thursdays in July 2010) which is considered sufficient to demonstrate the variability in observed data. It is noted that this information is not provided with Table 4-2 of the original report in order to enable this assessment to be made.

4) **RESOLVED:** It would be useful to provide information on desire lines for pedestrians to establish whether any potential pedestrian crossings are likely to be utilised.

The information provided in Attachment A1 demonstrates intersections where there is significant pedestrian demand. Whilst it is stated that pedestrian activity is a controlling factor for vehicle flows in Otaki town centre, the additional information provided indicates that this is not the case. It is considered that pedestrian activity should be modelled in the future if development in this area indicates that pedestrian crossings are likely to be used to a sufficient extent to delay traffic.

5) **POTENTIAL LIMITATION/RISK:** It does not appear that a gravity model has been used to establish the distribution of inter zonal trips that were intra zonal trips in WTSM. The number of these trips should be documented to establish whether this is a significant issue or not.

The information provided indicates that the absolute totals of WTSM intra zonal trips that become PP2O SATURN model inter zonal trips is low except for WTSM zone 129 where approximately 400 additional trips per hour are assigned in each of the three peaks modelled.

Zone 129 is shown in Figure 2-1. It is possible that the model is not accurately reflecting the distribution of these 400 trips per hour and so over or underestimating the traffic crossing SH1. This risk is mitigated through the validation to turn counts on SH1.

- **Figure 2-1 WTSM zone 129**

6) **RESOLVED:** It would be useful to provide absolute values in this adjustment process to establish how significant these adjustments are.

The significant adjustment that have been necessary to reflect observed traffic demands on SH1 indicate that the WTSM model is over reflecting traffic in this area. This means that the way in which demand changes made as part of the calibration process are carried forward into future forecast demands is critical.

7) **RESOLVED:** It is recommended that a sensitivity test is carried out with a larger weighting on distance to establish the sensitivity of the model assignment to the cost function.

The choice of cost function appears to have little impact on the base model. It is recommended that these sensitivity tests are also completed in future option modelling where route choice between SH1 and any parallel route may be significantly impacted by the choice of generalised cost function.

8) **RESOLVED:** The number of iterations for which the stopping criteria are satisfied should be documented.

The model is considered suitably converged.

9) **POTENTIAL LIMITATION/RISK:** Referencing for the speed flow curves implemented should be provided.

The speed flow curve naming convention and COBA reference has been supplied. It is noted that the capacity of all links is assumed to be 1800-2000 PCU per hour per lane. This is consistent with good quality rural links or suburban with slight development. For typical rural links or suburban links with typical development the link capacities are lower (1270-1660 PCU per hour per lane). The application of speed flow curves to road types can be subjective so it is recommended that a sensitivity test is carried out with lower capacities on the rural links in the future models to establish whether this effects route choice and benefit levels.

10) **RESOLVED:** It would be useful to provide a comparison with the OD surveys at this point to verify trip distributions in each peak.

The model appears to be generally overestimating the north-south through traffic by between 50 and 100 PCU per hour in all three periods and generally underestimating turning traffic. This means that turning traffic delays (which typically experience higher delays than through traffic) are likely to be slightly underestimated in the model.

11) **RESOLVED:** The units of the comparison should be clarified. Calibration statistics should be produced for HCVs separately to establish how closely the model is reflecting HCV movements.

In the final revision of the validation report it is stated that matrix estimation has been used to adjust the SATURN model matrices to more closely reflect observed traffic volumes. The GEH statistics and R^2 plots in Appendix F indicate that the model is reflecting observed traffic volumes for both light and heavy vehicles.

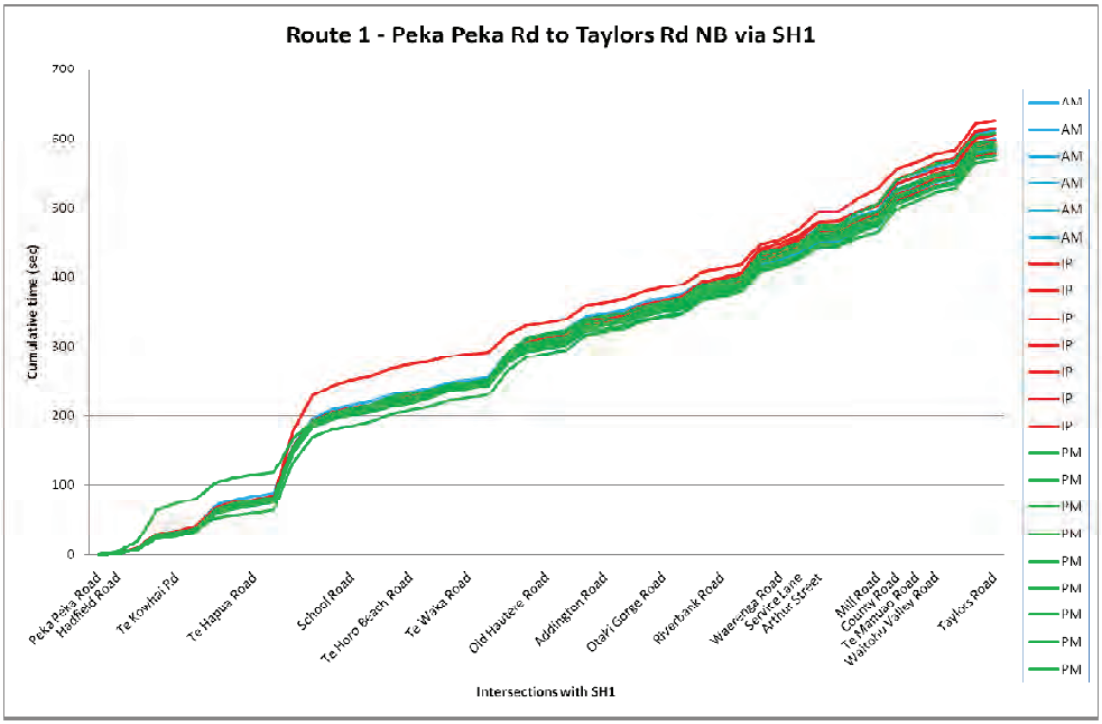
12) **RESOLVED:** A modelled plot of intersection delays would be useful to demonstrate areas where there are existing observed and modelled delays in the model area.

The levels of intersection delay appear to be of a reasonable order.

13) **RESOLVED:** Additional information is required to establish why the inter peak observed travel times are slowest in the inter peak, but this is the fastest period in the model. This may be due to an element of period dependent side friction which the model is not reflecting appropriately.

Whilst a statistical test has been used to demonstrate that there is no difference in observed travel times between the peaks, the travel time plots provided appear to indicate that the inter peak is slightly more congested in the northbound direction (see Figure 2-2).

- **Figure 2-2 Northbound observed travel time data**



It is acknowledged that a large amount of data may be required to pick up any observed differences in travel time between the peaks, but the model is indicating that congestion is greater in the AM and PM peaks which is not reflecting the consistent observed time (albeit very minor differences).

14) **POTENTIAL LIMITATION / RISK:** It is noted that with very limited congestion in all periods, it is not possible to calibrate speed flow curves or intersection capacities / gap acceptances under congested conditions. It is recommended that sensitivity testing is undertaken to establish if the model network reacts appropriately when congested.

The sensitivity tests are extremely useful in demonstrating the network reaction to increases in traffic volumes. It appears from Appendix J 8 that the only significant increase in travel time with three times the existing traffic volumes is between Te Hapua Road and School Road in a northbound direction with more widespread increases in the southbound direction.

This indicates that the applied speed flow curves have a relatively small impact on vehicle speeds on the rest of the corridor when traffic volumes are three times those in the base model. This means that potential travel time savings on the corridor are heavily dependent on the speed flow curve assumptions. With the currently assumed speed flow curves, it is likely that

the model would forecast very limited benefit to through traffic with significantly increased traffic volumes and the majority of and travel time benefits of an effective bypass would come from reductions in delay at the minor arms of intersections.

Appendix A: Peka Peka to North Otaki – Draft modelling methodology review

ZB01116C0002.pdf

Appendix B: Draft review of Peka Peka to North Otaki Model: 2010 Traffic Model Validation Report

ZB01116C0003.pdf

Appendix C: PP2O SATURN Traffic Model – Peer Review Comments – Opus Responses

Draft peer review responses 24-09-2010.pdf

Appendix D: PP2O SATURN Traffic Model – Peer Review Comments – Opus Responses 2

Draft peer review responses2 01-10-2010.docx

Appendix B

Economic Results Spreadsheets

Transport Economics Analysis Summary

		Scenario 2 - Do Minimum	Scenario 2 - Expressway Option 1
	Capital Costs	N/A	172,332,870
	Maintenance Costs	4,623,047	7,434,319
1	**Total Costs**	**4,623,047**	**179,767,190**
	Transport Costs		
	Travel Time Costs	446,959,824	389,656,577
	Vehicle Operating Costs	235,596,341	243,753,795
	Accidents	73,469,291	31,574,969
	Seal Extn / Passing Lane		
	Carbon Dioxide (4% of VOC)	9,423,854	9,750,152
2	**Total Transport Costs**	**691,980,019**	**674,735,493**
	Tangible Benefits		
	Travel Time Benefits	N/A	57,303,247
	Vehicle Operating Benefits	N/A	-8,157,454
	Accidents	N/A	41,894,321
	Seal Extn / Passing Lane Benefits	N/A	
	Carbon Dioxide Benefits	N/A	-326,298
3	**Tangible Benefits**	**N/A**	**90,713,816**
4	Tangible B/C Ratio	N/A	0.5

TIMINGS				TRAVEL TIME					CRV TRAVEL TIME			VEHICLE OPERATING COSTS							
OPTION and YEAR	PERIOD	TIME PERIODS PER DAY (hrs/day)	DAYS PER YEAR (days/year)	TOTAL SATURN TT on links (hours)	TOTAL SATURN TT on turns (hours)	TOTAL TT (hours)	VALUE OF TIME ($/veh.hr)	ANNUAL TRAVEL TIME COST ($/year)	TOTAL CONGESTION on links and turns SATURN (veh.hrs/hr)	CONGESTION VALUE ($/hour)	ANNUAL CONGESTION COST ($/year)	TOTAL SATURN (veh.km/h)	MEAN SPEED (km/h)	MEAN SPEED ROUNDED (km/h)	Fuel consumption (Ltr/hr)	OPERATING COST ($/Ltr)	OPERATING COST ($/veh.km)	FUEL COST WHILE STOPPED (cents/min)	ANNUAL VEHICLE OPERATING COST ($/year)
Scenario 2 - Do Minimum																			
Base 2010	Morning Peak	2	245	238	5	242	$33.70	$4,001,244	5	$5.63	$13,016	17518	72	72.0	1247	1.49	0.38		$2,056,223
Base 2010	Inter Peak	6.5	245	201	4	206	$33.70	$11,030,551	4	$5.63	$36,713	14864	72	72.0	1058	1.49	0.38	0.000	$5,670,328
Base 2010	Evening Peak	2	245	272	7	279	$33.70	$4,604,165	7	$5.63	$17,938	19919	71	71.0	1421	1.49	0.38	0.000	$2,334,778
Base 2010	Off Peak	13.5	245	105	2	107	$33.70	$11,912,996	2	$5.63	$39,650	7729	72	72.0	550	1.49	0.38	0.000	$6,123,954
Base 2010	Weekend Peak	7.5	120	296	6	302	$25.55	$6,947,017	6	$6.94	$37,638	21849	72	72.0	1555	1.49	0.38	0.000	$4,710,734
Base 2010	Weekend off-peak	16.5	120	77	2	78	$25.55	$3,950,821	2	$6.94	$21,405	5648	72	72.0	402	1.49	0.38	0.000	$2,679,030
2010 Total								**$42,446,794**			**$166,360**								**$23,575,046**
Do min 2016	Morning Peak	2	245	322	10	332	$33.70	$5,486,067	10	$5.63	$28,870	23202	70	70.0	1668	1.49	0.38	0.000	$2,714,743
Do min 2016	Inter Peak	6.5	245	277	9	285	$33.70	$15,320,634	9	$5.63	$77,316	20201	71	71.0	1451	1.49	0.38	0.000	$7,695,691
Do min 2016	Evening Peak	2	245	365	15	380	$33.70	$6,271,840	15	$5.63	$41,822	25870	68	68.0	1869	1.49	0.37	0.000	$3,020,168
Do min 2016	Off Peak	13.5	245	144	4	148	$33.70	$16,546,285	4	$5.63	$83,501	10504	71	71.0	755	1.49	0.38	0.000	$8,311,346
Do min 2016	Weekend Peak	7.5	120	407	13	420	$25.55	$9,648,902	13	$6.94	$79,264	29695	71	71.0	2133	1.49	0.38	0.000	$6,393,343
Do min 2016	Weekend off-peak	16.5	120	105	3	108	$25.55	$5,487,403	3	$6.94	$45,078	7676	71	71.0	551	1.49	0.38	0.000	$3,635,942
2016 Total								**$58,761,131**			**$355,850**								**$31,771,233**
Do Min 2026	Morning Peak	2	245	370	14	384	$33.70	$6,346,657	14	$5.63	$38,467	26281	68	68.0	1893	1.49	0.37	0.000	$3,067,842
Do Min 2026	Inter Peak	6.5	245	313	11	324	$33.70	$17,390,328	11	$5.63	$97,566	22654	70	70.0	1631	1.49	0.38	0.000	$8,618,988
Do Min 2026	Evening Peak	2	245	412	25	437	$33.70	$7,213,486	25	$5.63	$67,781	28686	66	66.0	2084	1.49	0.37	0.000	$3,339,465
Do Min 2026	Off Peak	13.5	245	163	6	168	$33.70	$18,781,554	6	$5.63	$105,371	11780	70	70.0	848	1.49	0.38	0.000	$9,308,507
Do Min 2026	Weekend Peak	7.5	120	460	16	476	$25.55	$10,952,391	16	$6.94	$100,025	33302	70	70.0	2397	1.49	0.38	0.000	$7,160,390
Do Min 2026	Weekend off-peak	16.5	120	119	4	123	$25.55	$6,228,706	4	$6.94	$56,885	8609	70	70.0	620	1.49	0.38	0.000	$4,072,167
2026 Total								**$66,913,122**			**$466,095**								**$35,567,360**
Scenario 2 - Expressway Option 1																			
Option 1 2010	Morning Peak	2	245	213	4	218	$33.70	$3,598,416	4	$5.63	$12,300	17680	81	81.0	1250	1.49	0.39	0.000	$2,122,704
Option 1 2010	Inter Peak	6.5	245	184	4	188	$33.70	$10,111,346	4	$5.63	$37,201	15034	80	80.0	1064	1.49	0.39	0.000	$5,843,313
Option 1 2010	Evening Peak	2	245	244	5	250	$33.70	$4,122,014	5	$5.63	$14,616	20137	81	81.0	1426	1.49	0.39	0.000	$2,414,767
Option 1 2010	Off Peak	13.5	245	96	2	98	$33.70	$10,920,254	2	$5.63	$40,177	7818	80	80.0	553	1.49	0.39	0.000	$6,310,778
Option 1 2010	Weekend Peak	7.5	120	271	6	277	$25.55	$6,368,104	6	$6.94	$38,138	22100	80	80.0	1564	1.49	0.39	0.000	$4,854,445
Option 1 2010	Weekend off-peak	16.5	120	70	2	72	$25.55	$3,621,588	2	$6.94	$21,689	5713	80	80.0	404	1.49	0.39	0.000	$2,760,759
2010 Total								**$38,741,721**			**$164,121**								**$24,306,765**
Option 1 2016	Morning Peak	2	245	283	7	290	$33.70	$4,791,266	7	$5.63	$19,528	23386	81	81.0	1661	1.49	0.39	0.000	$2,805,951
Option 1 2016	Inter Peak	6.5	245	249	7	255	$33.70	$13,698,762	7	$5.63	$58,744	20401	80	80.0	1450	1.49	0.39	0.000	$7,940,319
Option 1 2016	Evening Peak	2	245	317	8	325	$33.70	$5,362,678	8	$5.63	$22,582	26064	80	80.0	1854	1.49	0.39	0.000	$3,124,828
Option 1 2016	Off Peak	13.5	245	129	3	133	$33.70	$14,794,662	3	$5.63	$63,444	10609	80	80.0	754	1.49	0.39	0.000	$8,575,545
Option 1 2016	Weekend Peak	7.5	120	366	10	375	$25.55	$8,627,450	10	$6.94	$60,225	29990	80	80.0	2132	1.49	0.39	0.000	$6,596,573
Option 1 2016	Weekend off-peak	16.5	120	94	2	97	$25.55	$4,906,496	2	$6.94	$34,250	7752	80	80.0	551	1.49	0.39	0.000	$3,751,520
2016 Total								**$52,181,315**			**$258,774**								**$32,794,736**
Option 1 2026	Morning Peak	2	245	320	8	328	$33.70	$5,416,564	8	$5.63	$22,832	26483	81	81.0	1883	1.49	0.39	0.000	$3,179,459
Option 1 2026	Inter Peak	6.5	245	279	8	286	$33.70	$15,359,843	8	$5.63	$67,642	22876	80	80.0	1627	1.49	0.39	0.000	$8,905,416
Option 1 2026	Evening Peak	2	245	353	9	362	$33.70	$5,978,274	9	$5.63	$25,795	29055	80	80.0	2068	1.49	0.39	0.000	$3,483,880
Option 1 2026	Off Peak	13.5	245	145	4	149	$33.70	$16,588,631	4	$5.63	$73,053	11896	80	80.0	846	1.49	0.39	0.000	$9,617,849
Option 1 2026	Weekend Peak	7.5	120	410	11	421	$25.55	$9,673,596	11	$6.94	$69,347	33628	80	80.0	2392	1.49	0.39	0.000	$7,398,345
Option 1 2026	Weekend off-peak	16.5	120	106	3	109	$25.55	$5,501,446	3	$6.94	$39,438	8693	80	80.0	618	1.49	0.39	0.000	$4,207,494
2026 Total								**$58,518,354**			**$298,107**								**$36,792,444**

Peka Peka to Otaki North
Four lanes Expressway

Option	Scenario 2 - Do Minimum	
Time Zero	01/07/11	
Year of Estimate	2011	
Construction Period	4	Years
Benefit period	26	
Construction Start	1/7/2014	
Construction payment		

Scenario 2 - Do Minimum

TRAVEL TIME COSTS

Calendar Year	Time Stream Year	Discount Factor	$0.00 $0.00 Amount	Interpolated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.925926				
2013	2	0.857339				
2014	3	0.793832		$57,130,732.76	$45,352,217.61	
2015	4	0.73503		$57,945,931.87	$42,591,989.77	
2016	5	0.680583	$58,761,130.98	$58,761,130.98	$39,991,838.39	
2017	6	0.63017		$59,576,330.10	$37,543,193.71	
2018	7	0.58349		$60,391,529.21	$35,237,877.25	$17,618,938.63
2019	8	0.540269		$61,206,728.33	$33,068,090.84	$33,068,090.84
2020	9	0.500249		$62,021,927.44	$31,026,405.14	$31,026,405.14
2021	10	0.463193		$62,837,126.56	$29,105,747.83	$29,105,747.83
2022	11	0.428883		$63,652,325.67	$27,299,391.44	$27,299,391.44
2023	12	0.397114		$64,467,524.78	$25,600,941.08	$25,600,941.08
2024	13	0.367698		$65,282,723.90	$24,004,322.09	$24,004,322.09
2025	14	0.340461		$66,097,923.01	$22,503,767.70	$22,503,767.70
2026	15	0.315242	$66,913,122.13	$66,913,122.13	$21,093,806.70	$21,093,806.70
2027	16	0.29189		$67,728,321.24	$19,769,251.35	$19,769,251.35
2028	17	0.270269		$68,543,520.36	$18,525,185.37	$18,525,185.37
2029	18	0.250249		$69,358,719.47	$17,356,952.21	$17,356,952.21
2030	19	0.231712		$70,173,918.58	$16,260,143.51	$16,260,143.51
2031	20	0.214548		$70,989,117.70	$15,230,587.95	$15,230,587.95
2032	21	0.198656		$71,804,316.81	$14,264,340.24	$14,264,340.24
2033	22	0.183941		$72,619,515.93	$13,357,670.58	$13,357,670.58
2034	23	0.170315		$73,434,715.04	$12,507,054.37	$12,507,054.37
2035	24	0.157699		$74,249,914.16	$11,709,162.26	$11,709,162.26
2036	25	0.146018		$75,065,113.27	$10,960,850.57	$10,960,850.57
2037	26	0.135202		$75,880,312.38	$10,259,152.07	$10,259,152.07
2038	27	0.125187		$76,695,511.50	$9,601,267.07	$9,601,267.07
2039	28	0.115914		$77,510,710.61	$8,984,554.86	$8,984,554.86
2040	29	0.107328		$78,325,909.73	$8,406,525.58	$8,406,525.58
2041	30	0.099377		$79,141,108.84	$7,864,832.29	$7,864,832.29
2042	31	0.092016		$79,956,307.95	$7,357,263.52	$7,357,263.52
2043	32	0.0852		$80,771,507.07	$6,881,736.04	$6,881,736.04
2044	33	0.078889		$81,586,706.18	$6,436,288.00	$3,218,144.00
2045	34	0.073045				
2046	35	0.067635				
						$443,836,085

CONGESTION RELIEF VALUES

Calendar Year	Time Stream Year	Discount Factor	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Discounted Annual Amount
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.92592593				
2013	2	0.85733882				
2014	3	0.79383224		$333,801.19	$264,982.14	
2015	4	0.73502985		$344,825.66	$253,457.15	
2016	5	0.6805832	$355,850.14	$355,850.14	$242,185.62	
2017	6	0.63016963		$366,874.61	$231,193.24	
2018	7	0.5834904		$377,899.09	$220,500.49	$110,250.24
2019	8	0.54026888		$388,923.56	$210,123.30	$210,123.30
2020	9	0.50024897		$399,948.04	$200,073.59	$200,073.59
2021	10	0.46319349		$410,972.51	$190,359.79	$190,359.79
2022	11	0.42888286		$421,996.99	$180,987.27	$180,987.27
2023	12	0.39711376		$433,021.46	$171,958.78	$171,958.78
2024	13	0.36769792		$444,045.94	$163,274.77	$163,274.77
2025	14	0.34046104		$455,070.41	$154,933.75	$154,933.75
2026	15	0.3152417	$466,094.89	$466,094.89	$146,932.55	$146,932.55
2027	16	0.29189047		$477,119.36	$139,266.59	$139,266.59
2028	17	0.27026895		$488,143.84	$131,930.12	$131,930.12
2029	18	0.25024903		$499,168.31	$124,916.39	$124,916.39
2030	19	0.23171206		$510,192.79	$118,217.82	$118,217.82
2031	20	0.21454821		$521,217.26	$111,826.23	$111,826.23
2032	21	0.19865575		$532,241.74	$105,732.88	$105,732.88
2033	22	0.18394051		$543,266.21	$99,928.66	$99,928.66
2034	23	0.17031528		$554,290.69	$94,404.18	$94,404.18
2035	24	0.15769934		$565,315.16	$89,149.83	$89,149.83
2036	25	0.1460179		$576,339.64	$84,155.91	$84,155.91
2037	26	0.13520176		$587,364.11	$79,412.66	$79,412.66
2038	27	0.12518682		$598,388.59	$74,910.36	$74,910.36
2039	28	0.11591372		$609,413.06	$70,639.34	$70,639.34
2040	29	0.10732752		$620,437.54	$66,590.02	$66,590.02
2041	30	0.09937733		$631,462.01	$62,753.01	$62,753.01
2042	31	0.09201605		$642,486.49	$59,119.07	$59,119.07
2043	32	0.08520005		$653,510.96	$55,679.16	$55,679.16
2044	33	0.07888893		$664,535.44	$52,424.49	$26,212.24
2045	34	0.07304531				
2046	35	0.06763454				
						$3,123,739

VEHICLE OPERATING COSTS

Calendar Year	Time Stream Year	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.92592593				
2013	2	0.85733882				
2014	3	0.79383224		$31,012,007.10	$24,618,331.09	
2015	4	0.73502985		$31,391,619.81	$23,073,777.69	
2016	5	0.6805832	$31,771,233	$31,771,232.53	$21,622,967.01	
2017	6	0.63016963		$32,150,845.25	$20,260,486.16	
2018	7	0.5834904		$32,530,457.97	$18,981,209.78	$9,490,604.89
2019	8	0.54026888		$32,910,070.69	$17,780,287.18	$17,780,287.18
2020	9	0.50024897		$33,289,683.41	$16,653,129.74	$16,653,129.74
2021	10	0.46319349		$33,669,296.12	$15,595,398.71	$15,595,398.71
2022	11	0.42888286		$34,048,908.84	$14,602,993.38	$14,602,993.38
2023	12	0.39711376		$34,428,521.56	$13,672,039.60	$13,672,039.60
2024	13	0.36769792		$34,808,134.28	$12,798,878.74	$12,798,878.74
2025	14	0.34046104		$35,187,747.00	$11,980,056.99	$11,980,056.99
2026	15	0.3152417	$35,567,360	$35,567,359.72	$11,212,315.12	$11,212,315.12
2027	16	0.29189047		$35,946,972.43	$10,492,578.59	$10,492,578.59
2028	17	0.27026895		$36,326,585.15	$9,817,948.08	$9,817,948.08
2029	18	0.25024903		$36,706,197.87	$9,185,690.38	$9,185,690.38
2030	19	0.23171206		$37,085,810.59	$8,593,229.72	$8,593,229.72
2031	20	0.21454821		$37,465,423.31	$8,038,139.41	$8,038,139.41
2032	21	0.19865575		$37,845,036.03	$7,518,133.92	$7,518,133.92
2033	22	0.18394051		$38,224,648.74	$7,031,061.27	$7,031,061.27
2034	23	0.17031528		$38,604,261.46	$6,574,895.77	$6,574,895.77
2035	24	0.15769934		$38,983,874.18	$6,147,731.12	$6,147,731.12
2036	25	0.1460179		$39,363,486.90	$5,747,773.89	$5,747,773.89
2037	26	0.13520176		$39,743,099.62	$5,373,337.17	$5,373,337.17
2038	27	0.12518682		$40,122,712.34	$5,022,834.70	$5,022,834.70
2039	28	0.11591372		$40,502,325.05	$4,694,775.19	$4,694,775.19
2040	29	0.10732752		$40,881,937.77	$4,387,756.96	$4,387,756.96
2041	30	0.09937733		$41,261,550.49	$4,100,462.82	$4,100,462.82
2042	31	0.09201605		$41,641,163.21	$3,831,655.30	$3,831,655.30
2043	32	0.08520005		$42,020,775.93	$3,580,172.00	$3,580,172.00
2044	33	0.07888893		$42,400,388.65	$3,344,921.32	$1,672,460.66
2045	34	0.07304531				
2046	35	0.06763454				
						$235,596,341

CO2 COSTS

Calendar Year	Time Stream Year	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.925925926				
2013	2	0.85733882				
2014	3	0.793832241		$1,240,480.28	$984,733.24	
2015	4	0.735029853		$1,255,664.79	$922,951.11	
2016	5	0.680583197	$1,270,849	$1,270,849.30	$864,918.68	
2017	6	0.630169627		$1,286,033.81	$810,419.45	
2018	7	0.583490395		$1,301,218.32	$759,248.39	$379,624.20
2019	8	0.540268885		$1,316,402.83	$711,211.49	$711,211.49
2020	9	0.500248967		$1,331,587.34	$666,125.19	$666,125.19
2021	10	0.463193488		$1,346,771.84	$623,815.95	$623,815.95
2022	11	0.428882859		$1,361,956.35	$584,119.74	$584,119.74
2023	12	0.397113759		$1,377,140.86	$546,881.58	$546,881.58
2024	13	0.367697925		$1,392,325.37	$511,955.15	$511,955.15
2025	14	0.340461041		$1,407,509.88	$479,202.28	$479,202.28
2026	15	0.315241705	$1,422,694	$1,422,694.39	$448,492.60	$448,492.60
2027	16	0.291890468		$1,437,878.90	$419,703.14	$419,703.14
2028	17	0.270268951		$1,453,063.41	$392,717.92	$392,717.92
2029	18	0.250249029		$1,468,247.91	$367,427.62	$367,427.62
2030	19	0.231712064		$1,483,432.42	$343,729.19	$343,729.19
2031	20	0.214548207		$1,498,616.93	$321,525.58	$321,525.58
2032	21	0.198655748		$1,513,801.44	$300,725.36	$300,725.36
2033	22	0.183940507		$1,528,985.95	$281,242.45	$281,242.45
2034	23	0.170315284		$1,544,170.46	$262,995.83	$262,995.83
2035	24	0.157699337		$1,559,354.97	$245,909.24	$245,909.24
2036	25	0.146017905		$1,574,539.48	$229,910.96	$229,910.96
2037	26	0.135201764		$1,589,723.98	$214,933.49	$214,933.49
2038	27	0.125186818		$1,604,908.49	$200,913.39	$200,913.39
2039	28	0.115913721		$1,620,093.00	$187,791.01	$187,791.01
2040	29	0.107327519		$1,635,277.51	$175,510.28	$175,510.28
2041	30	0.099377333		$1,650,462.02	$164,018.51	$164,018.51
2042	31	0.092016049		$1,665,646.53	$153,266.21	$153,266.21
2043	32	0.085200045		$1,680,831.04	$143,206.88	$143,206.88
2044	33	0.078888931		$1,696,015.55	$133,796.85	$66,898.43
2045	34	0.073045306				
2046	35	0.067634543				
						$9,423,854

ACCIDENT COSTS

A6.1 (b) 1.0% — Update Factor 1.17

Calendar Year	Time Stream Year	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Growth Rate adjusted Annual Amount (incl. update factor)	Discounted Annual Amount	Amount Included in Benefit Period
2006							
2007							
2008							
2009							
2010							
2011	0	1					
2012	1	0.925925926					
2013	2	0.85733882					
2014	3	0.793832241		$6,026,477.33	$7,262,507.83	$6,745,299.06	
2015	4	0.735029853		$6,143,837.67	$7,475,821.67	$6,429,093.96	
2016	5	0.680583197	$6,261,198	$6,261,198.00	$7,691,881.74	$6,124,909.60	
2017	6	0.630169627		$6,331,614.20	$7,852,467.93	$5,789,612.54	
2018	7	0.583490395		$6,402,030.40	$8,014,701.86	$5,471,506.82	$2,735,753.41
2019	8	0.540268885		$6,472,446.60	$8,178,583.52	$5,169,802.01	$5,169,802.01
2020	9	0.500248967		$6,542,862.80	$8,344,112.93	$4,883,736.63	$4,883,736.63
2021	10	0.463193488		$6,613,279.00	$8,511,290.07	$4,612,577.74	$4,612,577.74
2022	11	0.428882859		$6,683,695.20	$8,680,114.96	$4,355,620.45	$4,355,620.45
2023	12	0.397113759		$6,754,111.40	$8,850,587.58	$4,112,187.42	$4,112,187.42
2024	13	0.367697925		$6,824,527.60	$9,022,707.94	$3,881,628.25	$3,881,628.25
2025	14	0.340461041		$6,894,943.80	$9,196,476.04	$3,663,318.92	$3,663,318.92
2026	15	0.315241705	$6,965,360	$6,965,360.00	$9,371,891.88	$3,456,661.07	$3,456,661.07
2027	16	0.291890468		$7,035,776.20	$9,548,955.46	$3,261,081.42	$3,261,081.42
2028	17	0.270268951		$7,106,192.40	$9,727,666.78	$3,076,030.97	$3,076,030.97
2029	18	0.250249029		$7,176,608.60	$9,908,025.83	$2,900,984.40	$2,900,984.40
2030	19	0.231712064		$7,247,024.80	$10,090,032.63	$2,735,439.27	$2,735,439.27
2031	20	0.214548207		$7,317,441.00	$10,273,687.16	$2,578,915.36	$2,578,915.36
2032	21	0.198655748		$7,387,857.20	$10,458,989.44	$2,430,953.89	$2,430,953.89
2033	22	0.183940507		$7,458,273.40	$10,645,939.45	$2,291,116.82	$2,291,116.82
2034	23	0.170315284		$7,528,689.60	$10,834,537.20	$2,158,986.12	$2,158,986.12
2035	24	0.157699337		$7,599,105.80	$11,024,782.69	$2,034,163.08	$2,034,163.08
2036	25	0.146017905		$7,669,522.00	$11,216,675.93	$1,916,267.56	$1,916,267.56
2037	26	0.135201764		$7,739,938.20	$11,410,216.89	$1,804,937.30	$1,804,937.30
2038	27	0.125186818		$7,810,354.40	$11,605,405.60	$1,699,827.25	$1,699,827.25
2039	28	0.115913721		$7,880,770.60	$11,802,242.05	$1,600,608.89	$1,600,608.89
2040	29	0.107327519		$7,951,186.80	$12,000,726.24	$1,506,969.56	$1,506,969.56
2041	30	0.099377333		$8,021,603.00	$12,200,858.16	$1,418,611.82	$1,418,611.82
2042	31	0.092016049		$8,092,019.20	$12,402,637.83	$1,335,252.82	$1,335,252.82
2043	32	0.085200045		$8,162,435.40	$12,606,065.23	$1,256,623.67	$1,256,623.67
2044	33	0.078888931		$8,232,851.60	$12,811,140.37	$1,182,468.88	$591,234.44
2045	34	0.073045306					
2046	35	0.067634543					
							$73,469,291

MAINTENANCE and PERIODIC COSTS

Calendar Year Payment	Time Stream Year	Discount Factor	Calculated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
1/01/2012	0.5	0.962250449			
1/01/2013	1.5	0.890972638			
1/01/2014	2.5	0.824974664			
1/01/2015	3.5	0.76386543	$64,600.00	$49,345.71	
1/01/2016	4.5	0.707282806	$64,600.00	$45,690.47	
1/01/2017	5.5	0.654891487	$64,600.00	$42,305.99	
1/01/2018	6.5	0.606381006	$64,600.00	$39,172.21	
1/01/2019	7.5	0.561463895	$64,600.00	$36,270.57	$36,270.57
1/01/2020	8.5	0.519873977	$796,600.00	$414,131.61	$414,131.61
1/01/2021	9.5	0.481364793	$64,600.00	$31,096.17	$31,096.17
1/01/2022	10.5	0.445708142	$64,600.00	$28,792.75	$28,792.75
1/01/2023	11.5	0.412692724	$64,600.00	$26,659.95	$26,659.95
1/01/2024	12.5	0.382122892	$64,600.00	$24,685.14	$24,685.14
1/01/2025	13.5	0.353817493	$64,600.00	$22,856.61	$22,856.61
1/01/2026	14.5	0.32760879	$64,600.00	$21,163.53	$21,163.53
1/01/2027	15.5	0.303341472	$12,215,800.00	$3,705,558.75	$3,705,558.75
1/01/2028	16.5	0.280871733	$64,600.00	$18,144.31	$18,144.31
1/01/2029	17.5	0.26006642	$64,600.00	$16,800.29	$16,800.29
1/01/2030	18.5	0.240802241	$64,600.00	$15,555.82	$15,555.82
1/01/2031	19.5	0.222965038	$64,600.00	$14,403.54	$14,403.54
1/01/2032	20.5	0.206449109	$64,600.00	$13,336.61	$13,336.61
1/01/2033	21.5	0.191156582	$64,600.00	$12,348.72	$12,348.72
1/01/2034	22.5	0.176996835	$64,600.00	$11,434.00	$11,434.00
1/01/2035	23.5	0.163885959	$64,600.00	$10,587.03	$10,587.03
1/01/2036	24.5	0.151746258	$64,600.00	$9,802.81	$9,802.81
1/01/2037	25.5	0.140505795	$796,600.00	$111,926.92	$111,926.92
1/01/2038	26.5	0.130097958	$64,600.00	$8,404.33	$8,404.33
1/01/2039	27.5	0.120461072	$64,600.00	$7,781.79	$7,781.79
1/01/2040	28.5	0.11153803	$64,600.00	$7,205.36	$7,205.36
1/01/2041	29.5	0.103275953	$64,600.00	$6,671.63	$6,671.63
1/01/2042	30.5	0.095625883	$64,600.00	$6,177.43	$6,177.43
1/01/2043	31.5	0.088542484	$64,600.00	$5,719.84	$5,719.84
1/01/2044	32.5	0.081983782	$64,600.00	$5,296.15	$5,296.15
1/01/2045	33.5	0.075910909	$796,600.00	$60,470.63	$30,235.32
1/01/2046	34.5	0.070287879			
1/01/2047	35.5	0.065081369			
					$4,623,046.96

Peka Peka to Otaki North
Four lanes Expressway

Scenario 2 - Expressway Option 1

Option	Scenario 2 - Expressway Option 1
Time Zero	01/07/11
Year of Estimate	2011
Construction Period	4 Years
Benefit period	26
Construction Start	1/7/2014
Construction payment	

TRAVEL TIME COSTS

Calendar Year	Time Stream Year	Discount Factor	$0.00 $0.00 Amount	Interpolated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.9 25926				
2013	2	0.857339				
2014	3	0.7 93832		$5,913,908.68	$40,417,100.64	
2015	4	0.73903		$51,547,610.65	$37,889,032.66	
2016	5	0.6 80583	$5,2 181,314.61	$52,181,314.61	$35,513,725.92	
2017	6	0.63017		$52,815,018.57	$33,282,420.35	
2018	7	0.58349		$53,448,722.53	$31,186,816.24	$15,593,408.12
2019	8	0.5 40269		$54,082,426.49	$29,219,052.23	$29,219,052.23
2020	9	0.5 00249		$54,716,130.46	$27,371,697.79	$27,371,697.79
2021	10	0.463193		$55,349,834.42	$25,637,682.87	$25,637,682.87
2022	11	0.428883		$55,983,538.38	$24,011,039.02	$24,011,039.02
2023	12	0.397114		$56,617,242.34	$22,483,485.91	$22,483,485.91
2024	13	0.367698		$57,250,946.30	$21,051,054.14	$21,051,054.14
2025	14	0.340461		$57,884,650.27	$19,707,468.31	$19,707,468.31
2026	15	0.315242	$5,5 18,354.23	$58,518,354.23	$18,447,425.76	$18,447,425.76
2027	16	0.29189		$59,152,058.19	$17,265,921.92	$17,265,921.92
2028	17	0.270269		$59,785,762.15	$16,158,235.25	$16,158,235.25
2029	18	0.250249		$60,419,466.11	$15,119,912.73	$15,119,912.73
2030	19	0.231712		$61,053,170.08	$14,146,756.05	$14,146,756.05
2031	20	0.214548		$61,686,874.04	$13,234,808.25	$13,234,808.25
2032	21	0.198656		$62,320,578.00	$12,380,341.01	$12,380,341.01
2033	22	0.183941		$62,954,281.96	$11,579,942.54	$11,579,942.54
2034	23	0.170315		$63,587,985.92	$10,830,005.90	$10,830,005.90
2035	24	0.157699		$64,221,689.89	$10,127,717.94	$10,127,717.94
2036	25	0.146018		$64,855,393.85	$9,470,048.73	$9,470,048.73
2037	26	0.135202		$65,489,097.81	$8,854,241.53	$8,854,241.53
2038	27	0.125187		$66,122,801.77	$8,277,703.17	$8,277,703.17
2039	28	0.115914		$66,756,505.74	$7,737,994.99	$7,737,994.99
2040	29	0.107328		$67,390,209.70	$7,232,824.02	$7,232,824.02
2041	30	0.099377		$68,023,913.66	$6,760,035.09	$6,760,035.09
2042	31	0.092016		$68,657,617.62	$6,317,932.69	$6,317,932.69
2043	32	0.0852		$69,291,321.58	$5,903,623.72	$5,903,623.72
2044	33	0.078889		$69,925,025.55	$5,514,310.49	$2,758,155.24
2045	34	0.073045				
2046	35	0.067635				
						$387,677,415

CONGESTION RELIEF VALUES

Calendar Year	Time Stream Year	Discount Factor	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Discounted Annual Amount
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.925 92593				
2013	2	0.857 33882				
2014	3	0.793 83234		$250,997.45	$198,178.42	
2015	4	0.735 02985		$254,840.74	$187,315.55	
2016	5	0.68 09832	$258,774.04	$258,774.04	$176,117.26	
2017	6	0.6301 9963		$262,707.33	$165,553.19	
2018	7	0.5834 904		$266,640.62	$155,582.24	$77,791.12
2019	8	0.5402 6888		$270,573.91	$146,182.66	$146,182.66
2020	9	0.5002 4897		$274,507.20	$137,321.94	$137,321.94
2021	10	0.4631 9349		$278,440.49	$128,971.82	$128,971.82
2022	11	0.4288 8286		$282,373.78	$121,105.28	$121,105.28
2023	12	0.3971 1376		$286,307.08	$113,696.48	$113,696.48
2024	13	0.3676 9792		$290,240.37	$106,720.76	$106,720.76
2025	14	0.3404 6104		$294,173.66	$100,154.67	$100,154.67
2026	15	0.3152 417	$298,106.95	$298,106.95	$93,975.74	$93,975.74
2027	16	0.2918 9047		$302,040.24	$88,162.67	$88,162.67
2028	17	0.2702 6895		$305,973.53	$82,695.15	$82,695.15
2029	18	0.2502 4903		$309,906.83	$77,553.88	$77,553.88
2030	19	0.2317 1206		$313,840.12	$72,720.54	$72,720.54
2031	20	0.2145 4821		$317,773.41	$68,177.72	$68,177.72
2032	21	0.1986 5575		$321,706.70	$63,908.89	$63,908.89
2033	22	0.1839 4051		$325,639.99	$59,898.38	$59,898.38
2034	23	0.1703 1528		$329,573.28	$56,131.37	$56,131.37
2035	24	0.1576 9834		$333,506.58	$52,593.77	$52,593.77
2036	25	0.1460 1179		$337,439.87	$49,272.26	$49,272.26
2037	26	0.1352 0176		$341,373.16	$46,154.25	$46,154.25
2038	27	0.1251 8682		$345,306.45	$43,227.82	$43,227.82
2039	28	0.1159 1372		$349,239.74	$40,481.68	$40,481.68
2040	29	0.1073 2752		$353,173.03	$37,905.19	$37,905.19
2041	30	0.0993 7733		$357,106.33	$35,488.27	$35,488.27
2042	31	0.0920 1935		$361,039.62	$33,221.44	$33,221.44
2043	32	0.0852 0005		$364,972.91	$31,095.71	$31,095.71
2044	33	0.0788 8993		$368,906.20	$29,102.62	$14,551.31
2045	34	0.0730 4531				
2046	35	0.0676 3454				
						$1,979,185

VEHICLE OPERATING COSTS

Calendar Year	Time Stream Year	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.92592593				
2013	2	0.85733882				
2014	3	0.79383234		$31,995,194.06	$25,398,816.61	
2015	4	0.73502985		$32,394,964.93	$23,811,266.30	
2016	5	0.6805832	$32,794,735.80	$32,794,735.80	$22,319,546.13	
2017	6	0.6301 9963		$33,194,506.66	$20,918,169.86	
2018	7	0.5834 904		$33,594,277.53	$19,601,938.27	$9,800,969.14
2019	8	0.5402 6888		$33,994,048.39	$18,365,926.61	$18,365,926.61
2020	9	0.5002 4897		$34,393,819.26	$17,205,472.56	$17,205,472.56
2021	10	0.4631 9349		$34,793,590.13	$16,116,164.37	$16,116,164.37
2022	11	0.4288 8286		$35,193,360.99	$15,093,829.29	$15,093,829.29
2023	12	0.3971 1376		$35,593,131.86	$14,134,522.37	$14,134,522.37
2024	13	0.3676 9792		$35,992,902.72	$13,234,515.63	$13,234,515.63
2025	14	0.3404 6104		$36,392,673.59	$12,390,287.55	$12,390,287.55
2026	15	0.3152 417	$36,792,444.46	$36,792,444.46	$11,596,512.92	$11,596,512.92
2027	16	0.2918 9047		$37,192,215.32	$10,856,053.12	$10,856,053.12
2028	17	0.2702 6895		$37,591,986.19	$10,159,946.69	$10,159,946.69
2029	18	0.2502 4903		$37,991,757.05	$9,507,400.32	$9,507,400.32
2030	19	0.2317 1206		$38,391,527.92	$8,895,780.17	$8,895,780.17
2031	20	0.2145 4821		$38,791,298.79	$8,322,603.62	$8,322,603.62
2032	21	0.1986 5575		$39,191,069.65	$7,785,531.24	$7,785,531.24
2033	22	0.1839 4051		$39,590,840.52	$7,282,359.28	$7,282,359.28
2034	23	0.1703 1528		$39,990,611.38	$6,811,012.35	$6,811,012.35
2035	24	0.1576 9834		$40,390,382.25	$6,369,536.51	$6,369,536.51
2036	25	0.1460 1179		$40,790,153.11	$5,956,092.70	$5,956,092.70
2037	26	0.1352 0176		$41,189,923.98	$5,568,950.37	$5,568,950.37
2038	27	0.1251 8682		$41,589,694.85	$5,206,481.57	$5,206,481.57
2039	28	0.1159 1372		$41,989,465.71	$4,867,155.20	$4,867,155.20
2040	29	0.1073 2752		$42,389,236.58	$4,549,531.60	$4,549,531.60
2041	30	0.0993 7733		$42,789,007.44	$4,252,257.42	$4,252,257.42
2042	31	0.0920 1935		$43,188,778.31	$3,974,060.73	$3,974,060.73
2043	32	0.0852 0005		$43,588,549.18	$3,713,746.35	$3,713,746.35
2044	33	0.0788 8993		$43,988,320.04	$3,470,191.53	$1,735,095.76
2045	34	0.0730 4531				
2046	35	0.0676 3454				
						$243,793,793

CO2 COSTS

Calendar Year	Time Stream Year	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
2006						
2007						
2008						
2009						
2010						
2011	0	1				
2012	1	0.92592926				
2013	2	0.8573 3882				
2014	3	0.7938 3234		$1,278,807.76	$1,015,952.66	
2015	4	0.7350 29853		$1,295,798.60	$952,450.65	
2016	5	0.6805 83197	$1,311,789.43	$1,311,789.43	$892,781.85	
2017	6	0.6301 69627		$1,327,780.27	$836,726.60	
2018	7	0.5834 90395		$1,343,771.10	$784,077.53	$392,038.77
2019	8	0.5402 68885		$1,359,761.94	$734,637.06	$734,637.06
2020	9	0.5002 48907		$1,375,752.77	$688,218.90	$688,218.90
2021	10	0.4631 93488		$1,391,743.61	$644,646.57	$644,646.57
2022	11	0.4288 82859		$1,407,734.44	$603,753.17	$603,753.17
2023	12	0.3971 11759		$1,423,725.27	$565,380.89	$565,380.89
2024	13	0.3676 97925		$1,439,716.11	$529,380.63	$529,380.63
2025	14	0.3404 61041		$1,455,706.94	$495,611.50	$495,611.50
2026	15	0.3152 41705	$1,471,697.78	$1,471,697.78	$463,940.52	$463,940.52
2027	16	0.291 890468		$1,487,688.61	$434,242.12	$434,242.12
2028	17	0.2702 69951		$1,503,679.45	$406,397.87	$406,397.87
2029	18	0.2502 49029		$1,519,670.28	$380,296.01	$380,296.01
2030	19	0.2317 12064		$1,535,661.12	$355,831.21	$355,831.21
2031	20	0.2145 48207		$1,551,651.95	$332,904.14	$332,904.14
2032	21	0.1986 57048		$1,567,642.79	$311,421.25	$311,421.25
2033	22	0.1839 40507		$1,583,633.62	$291,294.37	$291,294.37
2034	23	0.1703 15284		$1,599,624.46	$272,440.49	$272,440.49
2035	24	0.1577 69037		$1,615,615.29	$254,781.46	$254,781.46
2036	25	0.1460 17905		$1,631,606.12	$238,240.71	$238,240.71
2037	26	0.1352 01764		$1,647,596.96	$222,759.01	$222,759.01
2038	27	0.1251 86818		$1,663,587.79	$208,259.26	$208,259.26
2039	28	0.1159 13721		$1,679,578.63	$194,686.21	$194,686.21
2040	29	0.1073 27519		$1,695,569.46	$181,991.26	$181,991.26
2041	30	0.0993 77333		$1,711,560.30	$170,090.30	$170,090.30
2042	31	0.0920 19349		$1,727,551.13	$158,962.43	$158,962.43
2043	32	0.0852 00045		$1,743,541.97	$148,549.85	$148,549.85
2044	33	0.0788 89931		$1,759,532.80	$138,807.66	$69,403.83
2045	34	0.0730 45306				
2046	35	0.0676 34543				
						$9,790,192

ACCIDENT COSTS

A6.1 (b) 1.0%

Update Factor 1.17

Calendar Year	Time Stream Year	Discount Factor	Calculated Annual Amount	Interpolated Annual Amount	Growth Rate adjusted Annual Amount (incl. update factor)	Discounted Annual Amount	Amount Included in Benefit Period
2006							
2007							
2008							
2009							
2010							
2011	0	1					
2012	1	0.92592926					
2013	2	0.8573 3882					
2014	3	0.7938 3241		$2,541,485.33	$3,062,749.98	$2,844,826.75	
2015	4	0.7352 9853		$2,597,442.17	$3,160,567.63	$2,718,040.52	
2016	5	0.6805 83197	$2,653,399	$2,653,399.00	$3,259,700.67	$2,595,642.08	
2017	6	0.6301 69627		$2,689,679.10	$3,332,394.04	$2,456,961.63	
2018	7	0.5834 90395		$2,725,647.20	$3,405,853.04	$2,325,120.57	$1,162,560.28
2019	8	0.5402 68885		$2,761,615.30	$3,480,107.67	$2,199,826.85	$2,199,826.85
2020	9	0.5002 48907		$2,797,583.40	$3,555,147.94	$2,080,767.13	$2,080,767.13
2021	10	0.4631 93488		$2,833,551.50	$3,630,973.85	$1,967,756.83	$1,967,756.83
2022	11	0.4288 82859		$2,869,519.60	$3,707,585.38	$1,860,440.19	$1,860,440.19
2023	12	0.3971 11759		$2,905,487.70	$3,784,982.55	$1,758,590.33	$1,758,590.33
2024	13	0.3676 97925		$2,941,455.80	$3,863,165.36	$1,661,959.13	$1,661,959.13
2025	14	0.3404 61041		$2,977,423.90	$3,942,133.80	$1,570,307.28	$1,570,307.28
2026	15	0.3152 41705	$2,989,140	$2,989,140.00	$4,021,897.87	$1,483,404.14	$1,483,404.14
2027	16	0.2918 90468		$3,022,714.10	$4,102,427.58	$1,401,027.62	$1,401,027.62
2028	17	0.2702 69951		$3,056,288.20	$4,183,752.92	$1,322,964.06	$1,322,964.06
2029	18	0.2502 49029		$3,089,862.30	$4,265,863.89	$1,249,008.11	$1,249,008.11
2030	19	0.2317 12064		$3,123,436.40	$4,348,760.50	$1,178,962.52	$1,178,962.52
2031	20	0.2145 48207		$3,157,010.50	$4,432,442.74	$1,112,637.99	$1,112,637.99
2032	21	0.1986 57048		$3,190,584.60	$4,516,910.62	$1,049,853.00	$1,049,853.00
2033	22	0.1839 40507		$3,224,158.70	$4,602,164.13	$990,433.55	$990,433.55
2034	23	0.1703 15284		$3,257,732.80	$4,688,203.27	$934,213.03	$934,213.03
2035	24	0.1577 69037		$3,291,306.90	$4,775,028.05	$881,031.95	$881,031.95
2036	25	0.1460 17905		$3,324,881.00	$4,862,638.46	$830,737.77	$830,737.77
2037	26	0.1352 01764		$3,358,455.10	$4,951,034.51	$783,184.66	$783,184.66
2038	27	0.1251 86818		$3,392,029.20	$5,040,216.19	$738,233.30	$738,233.30
2039	28	0.1159 13721		$3,425,603.30	$5,130,183.50	$695,750.63	$695,750.63
2040	29	0.1073 27519		$3,459,177.40	$5,220,936.45	$655,609.68	$655,609.68
2041	30	0.0993 77333		$3,492,751.50	$5,312,475.03	$617,689.33	$617,689.33
2042	31	0.0920 19349		$3,526,325.60	$5,404,799.25	$581,874.08	$581,874.08
2043	32	0.0852 00045		$3,559,899.70	$5,497,909.10	$548,053.86	$548,053.86
2044	33	0.0788 89931		$3,593,473.80	$5,591,804.58	$516,123.84	$258,061.92
2045	34	0.0730 45306					
2046	35	0.0676 34543					
							$31,574,983

MAINTENANCE and PERIODIC COSTS

Calendar Year	Time Stream Year	Discount Factor	Calculated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
1/01/2012	0.5	0.962250449	$64,600		
1/01/2013	1.5	0.89 0972618	$64,600.00		
1/01/2014	2.5	0.82 4974664	$64,600		
1/01/2015	3.5	0.7 6396543	$64,600.00	$49,345.71	
1/01/2016	4.5	0.70 7282306	$64,600.00	$45,690.47	
1/01/2017	5.5	0.65 4991487	$64,600.00	$42,305.99	
1/01/2018	6.5	0.60 6381036	$64,600.00	$39,172.21	
1/01/2019	7.5	0.561 463895	$64,359.27	$36,074.57	$102,287.29
1/01/2020	8.5	0.5197 73977	$948,509.27	$493,105.29	$493,105.29
1/01/2021	9.5	0.481 364793	$64,359.27	$173,399.72	$173,399.72
1/01/2022	10.5	0.445 708142	$64,359.27	$162,397.89	$162,397.89
1/01/2023	11.5	0.412 692724	$64,359.27	$153,068.42	$153,068.42
1/01/2024	12.5	0.382 123992	$64,359.27	$119,230.02	$119,230.02
1/01/2025	13.5	0.35 391 7493	$64,359.27	$128,916.68	$128,916.68
1/01/2026	14.5	0.32760979	$64,359.27	$119,367.30	$119,367.30
1/01/2027	15.5	0.30 3341472	$3,876,419.27	$1,175,878.73	$1,175,878.73
1/01/2028	16.5	0.28 0971753	$64,359.27	$102,338.32	$102,238.25
1/01/2029	17.5	0.2 6000642	$948,509.27	$246,675.41	$244,675.41
1/01/2030	18.5	0.24 0802241	$64,359.27	$97,738.53	$97,738.53
1/01/2031	19.5	0.22 2965338	$64,359.27	$81,239.38	$81,239.38
1/01/2032	20.5	0.206 449109	$64,359.27	$75,221.65	$75,221.65
1/01/2033	21.5	0.191 156592	$64,359.27	$69,646.67	$69,646.67
1/01/2034	22.5	0.176 996835	$64,359.27	$64,490.44	$64,490.44
1/01/2035	23.5	0.163 885959	$3,876,419.27	$635,290.69	$635,290.69
1/01/2036	24.5	0.151 746258	$64,359.27	$5,290.16	$5,290.16
1/01/2037	24.5	0.140 505795	$948,509.27	$133,271.05	$133,271.05
1/01/2038	26.5	0.130 097958	$64,359.27	$47,402.40	$47,402.40
1/01/2039	27.5	0.120 461072	$64,359.27	$43,891.11	$43,891.11
1/01/2040	28.5	0.111 533803	$64,359.27	$40,639.92	$40,639.92
1/01/2041	29.5	0.103 275963	$64,359.27	$37,629.55	$37,629.55
1/01/2042	30.5	0.095 625893	$64,359.27	$34,842.18	$34,842.18
1/01/2043	31.5	0.088 542484	$64,359.27	$32,261.27	$32,261.27
1/01/2044	32.5	0.081 983782	$16,154,997.04	$2,964,123.38	$2,964,123.38
1/01/2045	33.5	0.075 910909	$922,021.04	$70,765.75	$53,082.87
1/01/2046	34.5	0.07 0287879			
1/01/2047	35.5	0.06 5081369			
					$7,414,319.20

CONSTRUCTION COSTS

Calendar Payment	Time Stream Year	Discount Factor	Calculated Annual Amount	Discounted Annual Amount	Amount Included in Benefit Period
				$ 251,415,000	
1 6/7/2014	3	0.79 3832	$40,145,000		$31,868,395
1 1/0 2014	3.25	0.778705	$12,591,338		$13,698,443
1 0/4 2015	3.75	0.746009	$16,576,955		$12,421,269
1 1/0 2015	4.25	0.721023	$16,576,955		$11,952,363
1 0/4 2016	4.75	0.693805	$16,576,955		$11,501,167
1 1/0 2016	5.25	0.667614	$37,934,705		$25,325,731
1 0/4 2017	5.75	0.642412	$35,337,705		$22,701,353
1 1/0 2017	6.25	0.618161	$35,337,705		$21,844,387
1 0/4 2018	6.75	0.594826	$35,337,705		$21,019,771
					$172,332,670.32

CRASH MODEL SUMMARY

Section	Name	Intersection/Midblock	2010 Do-Min Annual Crash Cost	2010 Option Annual Crash Cost	2016 Do-Min Annual Crash Cost	2016 option Annual Crash Cost	2026 Do-Min Annual Crash Cost	2026 Option Annual Crash Cost
4	SH1 Te Haupua Priority Tee	Intersection	$60,851	$11,277	$78,203	$12,704	$88,188	$14,678
5	SH1 Gear/School Road Priority Tee	Intersection	$107,667		$136,885		$153,408	
7	SH1 Te Horo Beach Road Priority Tee	Intersection	$64,493	$18,907	$82,319	$21,236	$91,777	$23,584
8	SH1 Te Waka Road Priority Tee	Intersection	$0	$0	$0	$0	$0	$0
9	SH1 Old Hautere Priority Tee	Intersection	$8,610		$11,019		$12,241	
10	SH1 Addington Priority Tee	Intersection	$38,336	$9,019	$48,880	$10,141	$54,211	$10,874
11	SH1 Otaki Gorge Priority Tee	Intersection	$48,110		$61,261		$67,789	
12	SH1 Riverbank Priority Tee	Intersection	$3,001	$1,573	$4,175	$2,486	$4,564	$2,725
19	SH1 Waeranga Priority Tee	Intersection	$4,007	$1,866	$5,319	$2,725	$5,926	$2,980
20	SH1 Service Lane Priority Tee	Intersection	$17,282	$7,679	$22,217	$11,202	$24,506	$12,239
22	SH1 Arthur Priority Cross Roads	Intersection	$25,297	$12,937	$30,366	$17,788	$33,368	$19,291
26	SH1 Mill Roundabout	Intersection	$58,483	$33,446	$72,619	$42,631	$79,467	$46,181
29	SH1 County Priority Tee	Intersection	$0	$0	$0	$0	$0	$0
30	SH1 TeManuao	Intersection	$172,815	$47,625	$216,944	$60,439	$236,376	$65,881
32	SH1 Waitohu Valley Road	Intersection	$36,568	$9,362	$45,914	$11,969	$49,998	$13,033
34	SH1 Taylors Road	Intersection	$302,047	$302,047	$380,728	$380,728	$414,261	$414,261
36	SH1 TeKowahi to TeHaupu 100 MB	Midblock	$60,428	$10,098	$77,869	$11,371	$87,922	$13,289
37	SH1 TeHaupu to Gear 100 MB	Midblock	$1,701,639	$292,341	$2,191,140	$329,146	$2,469,467	$379,733
38	SH1 TeHaupu to Gear 80 MB	Midblock	$271,417	$46,629	$349,494	$52,500	$393,888	$60,569
39	SH1 Gear to Te Horo Beach Road	Midblock	$0	$0	$0	$0	$0	$0
40	SH1 Te Horo Beach Road to Te Waka Road	Midblock	$0	$0	$0	$0	$0	$0
41	SH1 Te Waka Road to Old Hautere	Midblock	$27,944	$5,257	$35,865	$5,890	$39,878	$6,245
42	SH1 Old Hautere to Addington	Midblock	$478,375	$89,080	$613,136	$99,806	$680,902	$105,821
43	SH1 Addington to Otaki Gorge Road	Midblock	$16,901	$3,916	$21,610	$4,414	$23,943	$4,734
44	SH1 Otaki Gorge to Riverbank Road	Midblock	$80,327	$40,705	$102,668	$54,182	$113,533	$60,760
45	SH1 Riverbank to Waeranga 70	Midblock	$512,844	$225,616	$685,020	$338,108	$764,521	$370,234
46	SH1 Waeranga to Service Lane	Midblock	$7,263	$3,227	$9,337	$4,708	$10,285	$5,144
47	SH1 Service Lane to Arthur	Midblock	$2,505	$1,113	$3,152	$1,624	$3,486	$1,774
48	SH1 Arthur to Mill	Midblock	$44,046	$20,206	$54,510	$27,698	$59,731	$29,946
49	SH1 Mill to County	Midblock	$0	$0	$0	$0	$0	$0
50	SH1 County to TeManuoa	Midblock	$0	$0	$0	$0	$0	$0
51	SH1 TeManuoa to Waihatoa Valley Road	Midblock	$0	$0	$0	$0	$0	$0
52	SH1 Waihatoa Valley to Taylor	Midblock	$729,982		$920,548		$1,001,725	
O.4	Te Horo Beach / Gear Road Priority Tee	Intersection		$40,531		$44,167		$47,573
O.5	Expressway NB offramp / Otaki Gorge priority tee	Intersection		$49,773		$66,972		$74,924
O.6	SH1 / Otaki Gorge Roundabout	Intersection		$60,723		$70,928		$75,718
O.7	Expressway SB onramp / Otaki Gorge Priority Tee	Intersection		$35,047		$39,307		$42,410
O.11	Expressway Te Kowhai to Otaki Gorge off-ramps NB	Midblock		$219,690		$324,298		$385,760
O.12	Expressway Te Kowhai to Otaki Gorge off-ramps SB	Midblock		$203,349		$309,187		$364,995
O.13	Expressway Otaki Gorge to North of Otaki On-ramp NB	Midblock		$44,614		$61,633		$70,394
O.14	Expressway Otaki Gorge to North of Otaki On-ramp SB	Midblock		$44,614		$57,951		$65,576
O.15	Expressway North Otaki on-ramp to SB off ramp NB	Midblock		$29,391		$16,388		$18,718
O.16	Expressway North Otaki on-ramp to SB off ramp SB	Midblock		$37,125		$35,459		$39,875
O.19	Otaki Gorge NB off-ramp	Midblock		$1,278		$2,311		$2,884
O.20	Otaki Gorge SB on-ramp	Midblock		$4,103		$7,134		$8,963
O.21	North of Otaki NB on-ramp	Midblock		$9,323		$13,775		$15,367
O.22	North of Otaki SB off-ramp	Midblock		$24,713		$32,776		$37,435
O.24	Gear to Te Horo Beach connection	Midblock		$53,316		$59,772		$65,978
O.25	Old Hautere Service Road	Midblock		$7,055		$7,844		$8,594
			$4,881,238	$2,058,573	$6,261,198	$2,653,399	$6,965,360	$2,989,140

DO-MINIMUM ACCIDENT BY ACCIDENT ANALYSIS

Section	Name	Intersection/Midblock	EEM Road Type	Speed Limit (km/h)	Midblock Distance (km)	Crashes				2010 Base Twoway-AADT	2016 DM Twoway-AADT	2026 DM Twoway-AADT	2010 Do-Min Annual Crash Cost (From EEM Software)	2016 Do-Min Annual Crash Cost ($/veh/km update factor)	2026 Do-Min Annual Crash Cost ($/veh/km update factor)
						Fatal	Serious	Minor	Non-Injury						
1	SH1 PekaPeka Priority Tee	Intersection	Rural Strategic	100	0	0	0	0	2	15444	19770	22440	$36,026	$46,117	$52,345
2	SH1 Hadfield Priority Tee	Intersection	Rural Strategic	100	0	1	0	1	0	14482	18657	21101	$263,213	$339,091	$383,508
3	SH1 Te Kowahi Priority Tee	Intersection	Rural Strategic	100	0	0	1	2	0	14589	18775	21208	$270,771	$348,474	$393,625
4	SH1 Te Haupua Priority Tee	Intersection	Rural Strategic	100	0	0	0	2	2	14756	18964	21385	$60,851	$78,203	$88,188
5	SH1 Gear/School Road Priority Tee	Intersection	Rural Strategic	80	0	0	0	3	3	16079	20442	22909	$107,667	$136,885	$153,408
7	SH1 Te Horo Beach Road Priority Tee	Intersection	Rural Strategic	80	0	0	0	2	3	15556	19856	22137	$64,493	$82,319	$91,777
8	SH1 Te Waka Road Priority Tee	Intersection	Rural Strategic	100	0	0	0	0	0	15012	19242	21410	$0	$0	0
9	SH1 Old Hautere Priority Tee	Intersection	Rural Strategic	100	0	0	0	0	1	15132	19366	21515	$8,610	$11,019	$12,241
10	SH1 Addington Priority Tee	Intersection	Rural Strategic	100	0	0	0	1	2	15578	19863	22029	$38,336	$48,880	$54,211
11	SH1 Otaki Gorge Priority Tee	Intersection	Rural Strategic	100	0	0	0	0	6	15672	19956	22082	$48,110	$61,261	$67,789
12	SH1 Riverbank Priority Tee	Intersection	Rural Strategic	70	0	0	0	0	1	15766	21934	23978	$3,001	$4,175	$4,564
19	SH1 Waeranga Priority Tee	Intersection	Urban Arterial	50	0	0	0	0	2	14047	18647	20775	$4,007	$5,319	$5,926
20	SH1 Service Lane Priority Tee	Intersection	Urban Arterial	50	0	0	0	0	5	13322	17126	18891	$17,282	$22,217	$24,506
22	SH1 Arthur Priority Cross Roads	Intersection	Urban Arterial	50	0	0	0	1	4	14855	17832	19594	$25,297	$30,366	$33,368
26	SH1 Mill Roundabout	Intersection	Urban Arterial	50	0	0	0	1	15	17529	21766	23818	$58,483	$72,619	$79,467
29	SH1 County Priority Tee	Intersection	Urban Arterial	50	0	0	0	0	0	13564	17044	18561		$0	$0
30	SH1 TeManuao	Intersection	Urban Arterial	50	0	0	1	0	4	13701	17200	18741	$172,815	$216,944	$236,376
32	SH1 Waitohu Valley Road	Intersection	Urban Other	50	0	0	0	3	3	13551	17015	18528	$36,568	$45,914	$49,998
34	SH1 Taylors Road	Intersection	Rural Strategic	100	0	0	1	0	4	12832	16175	17600	$302,047	$380,728	$414,261
35	SH1 Hadfield to TeKowhai 100 MB	Midblock	Rural Strategic	100	0.505	1	1	0	4	14366	18523	20943	$891,193	$1,149,098	$1,299,171
36	SH1 TeKowahi to TeHaupu 100 MB	Midblock	Rural Strategic	100	1.1	0	0	1	3	14433	18599	21001	$60,428	$77,869	$87,922
37	SH1 TeHaupu to Gear 100 MB	Midblock	Rural Strategic	100	2.9	0	4	3	7	14515	18691	21065	$1,701,639	$2,191,140	$2,469,467
38	SH1 TeHaupu to Gear 80 MB	Midblock	Rural Strategic	80	0.37	1	0	0	1	14515	18691	21065	$271,417	$349,494	$393,888
39	SH1 Gear to Te Horo Beach Road	Midblock	Rural Strategic	80	0.35	0	0	0	0	14870	19086	21326	$0	$0	$0
40	SH1 Te Horo Beach Road to Te Waka Road	Midblock	Rural Strategic	80	0.36	0	0	0	0	14578	18759	20892	$0	$0	$0
41	SH1 Te Waka Road to Old Hautere	Midblock	Rural Strategic	100	1.52	0	0	1	1	14807	19004	21130	$27,944	$35,865	$39,878
42	SH1 Old Hautere to Addington	Midblock	Rural Strategic	100	0.66	0	1	0	6	14959	19173	21292	$478,375	$613,136	$680,902
43	SH1 Addington to Otaki Gorge Road	Midblock	Rural Strategic	100	0.37	0	0	1	0	15168	19393	21488	$16,901	$21,610	$23,943
44	SH1 Otaki Gorge to Riverbank Road	Midblock	Rural Strategic	100	0.47	0	0	2	3	15243	19482	21544	$80,327	$102,668	$113,533
45	SH1 Riverbank to Waeranga 70	Midblock	Urban Arterial	70	0.67	0	2	0	2	13399	17897	19974	$512,844	$685,020	$764,521
46	SH1 Waeranga to Service Lane	Midblock	Urban Arterial	50	0.07	0	0	0	1	13322	17126	18866	$7,263	$9,337	$10,285
47	SH1 Service Lane to Arthur	Midblock	Urban Arterial	50	0.1	0	0	0	1	13321	16762	18536	$2,505	$3,152	$3,486
48	SH1 Arthur to Mill	Midblock	Urban Arterial	50	0.15	0	0	2	6	13602	16833	18445	$44,046	$54,510	$59,731
49	SH1 Mill to County	Midblock	Urban Arterial	50	0.37	0	0	0	0	13564	17044	18561	$0	$0	$0
50	SH1 County to TeManuoa	Midblock	Urban Arterial	50	0.06	0	0	0	0	13564	17044	18561	$0	$0	$0
51	SH1 TeManuoa to Waihatoa Valley Road	Midblock	Urban Arterial	50	0.08	0	0	0	0	13345	16789	18290	$0	$0	$0
52	SH1 Waihatoa Valley to Taylor	Midblock	Rural Strategic	100	0.95	0	2	1	4	12788	16127	17549	$729,982	$920,548	$1,001,725
												Total	**$6,342,441**	**$8,143,978**	**$9,094,009**
												Total with update factor	$7,293,807	$9,365,575	$10,458,111

Otaki RoNS Midblock Option Assessment - Method B only

Method B - 2010 Accident Rate Anlaysis (Expressway and local road components)

										AADT For Year		2010										
Map Ref #.	Section Name	From	To	Length (km)	Speed (km/hr)	Lanes	Assumed Road classification for crash analysis	If Commercial, Land use type?	Accident Model Code	Northbound	Southbound	2 Way AADT	Traffic Growth rate	Grade	Time Zero	Exposure per 100M VKT	$A_{T\ unadjusted}$	Accident Trend adjustment factor for adjsuting typical Accident rate(Append. A6.4)	Adj. for Accident trend [(1+ accident trend factor*(time zero-2006)]	Typical Accident rate A_{Tref} adjsuted for accident trends	Cost per reported injury	Total Accident Cost Per Year
O.11	Expressway Te Kowhai to Otaki Gorge off-ramps NB	Peka Peka on/off ramps	Otaki Gorge on/offramps	7.7	100	2	Rural midblock	Other	4LD	6171			2.00%	0	2011	0.173432796	0.8565	-0.01	0.95	0.814	$270,000	$219,690
O.12	Expressway Te Kowhai to Otaki Gorge off-ramps SB	Otaki Gorge on/offramps	Peka Peka on/off ramps	7.7	100	2	Rural midblock	Other	4LD		5851		2.00%	0	2011	0.164430072	0.7928	-0.01	0.95	0.753	$270,000	$203,349
O.13	Expressway Otaki Gorge to North of Otaki On-ramp NB	Otaki Gorge on/offramps	North of Otaki onramp	3.208	100	2	Rural midblock	Other	4LD	3759			2.00%	0	2011	0.044019245	0.1739	-0.01	0.95	0.165	$270,000	$44,614
O.14	Expressway Otaki Gorge to North of Otaki On-ramp SB	North of Otaki onramp	Otaki Gorge on/offramps	3.208	100	2	Rural midblock	Other	4LD		3759		2.00%	0	2011	0.044019245	0.1739	-0.01	0.95	0.165	$270,000	$44,614
O.15	Expressway North Otaki on-ramp to SB off ramp NB	North of Otaki onramp	SB off ramp	0.853	100	2	Rural midblock	Other	4LD	7029			2.00%	0	2011	0.021883	0.1146	-0.01	0.95	0.109	$270,000	$29,391
O.16	Expressway North Otaki on-ramp to SB off ramp SB	SB off ramp	North of Otaki onramp	0.853	100	2	Rural midblock	Other	4LD		8257		2.00%	0	2011	0.025708031	0.1447	-0.01	0.95	0.137	$270,000	$37,125
O.19	Otaki Gorge NB off-ramp	Expressway	Otaki Gorge	0.1	100	2	Rural midblock	Other	4LD	2199			2.00%	0	2011	0.000802485	0.0025	-0.01	0.95	0.005	$270,000	$1,278
O.20	Otaki Gorge SB on-ramp	Otaki Gorge	Expressway	0.3	100	2	Rural midblock	Other	4LD		2304		2.00%	0	2011	0.002522985	0.0080	-0.01	0.95	0.015	$270,000	$4,103
O.21	North of Otaki NB on-ramp	Otaki	Expressway	0.55	100	2	Rural midblock	Other	4LD	2672			2.00%	0	2011	0.005363421	0.0182	-0.01	0.95	0.035	$270,000	$9,323
O.22	North of Otaki SB off-ramp	Expressway	Otaki	0.853	100	2	Rural midblock	Other	4LD		3867		2.00%	0	2011	0.012038646	0.0482	-0.01	0.95	0.092	$270,000	$24,713
O.24	Gear to Te Horo Beach connection	Gear	Te Horo Beach	1.21	80	2	Rural midblock	Other	RM2			2772	2.00%	0	2011	0.012240509	0.1198	-0.01	0.95	0.114	$468,333	$53,316
O.25	Old Hautere Service Road	Otaki Gorge Road	Te Horo Beach	0.89	80	2	Rural midblock	Other	RM2			499	2.00%	0	2011	0.001619758	0.0159	-0.01	0.95	0.015	$468,333	$7,055

Method B - 2016 Accident Rate Anlaysis (Expressway and local road components)

										AADT For Year		2016										
Map Ref #.	Section Name	From	To	Length (km)	Speed (km/hr)	Lanes	Assumed Road classification for crash analysis	If Commercial, Land use type?	Accident Model Code	Northbound	Southbound	2 Way AADT	Traffic Growth rate	Grade	Time Zero	Exposure per 100M VKT	$A_{T\ unadjusted}$	Accident Trend adjustment factor for adjsuting typical Accident rate(Append. A6.4)	Adj. for Accident trend [(1+ accident trend factor*(time zero-2006)]	Typical Accident rate A_{Tref} adjsuted for accident trends	Cost per reported injury	Total Accident Cost Per Year
O.11	Expressway Te Kowhai to Otaki Gorge off-ramps NB	Peka Peka on/off ramps	Otaki Gorge on/offramps	7.7	100	2	Rural midblock	Other	4LD	8072			2.00%	0	2011	0.22686911	1.2643	-0.01	0.95	1.201	$270,000	$324,298
O.12	Expressway Te Kowhai to Otaki Gorge off-ramps SB	Otaki Gorge on/offramps	Peka Peka on/off ramps	7.7	100	2	Rural midblock	Other	4LD		7811		2.00%	0	2011	0.219524654	1.2054	-0.01	0.95	1.145	$270,000	$309,187
O.13	Expressway Otaki Gorge to North of Otaki On-ramp NB	Otaki Gorge on/offramps	North of Otaki onramp	3.208	100	2	Rural midblock	Other	4LD	4698			2.00%	0	2011	0.055009133	0.2403	-0.01	0.95	0.228	$270,000	$61,633
O.14	Expressway Otaki Gorge to North of Otaki On-ramp SB	North of Otaki onramp	Otaki Gorge on/offramps	3.208	100	2	Rural midblock	Other	4LD		4503		2.00%	0	2011	0.052720744	0.2259	-0.01	0.95	0.215	$270,000	$57,951
O.15	Expressway North Otaki on-ramp to SB off ramp NB	North of Otaki onramp	SB off ramp	0.853	100	2	Rural midblock	Other	4LD	4698			2.00%	0	2011	0.014626805	0.0639	-0.01	0.95	0.061	$270,000	$16,388
O.16	Expressway North Otaki on-ramp to SB off ramp SB	SB off ramp	North of Otaki onramp	0.853	100	2	Rural midblock	Other	4LD		8000		2.00%	0	2011	0.02490687	0.1382	-0.01	0.95	0.131	$270,000	$35,459
O.19	Otaki Gorge NB off-ramp	Expressway	Otaki Gorge	0.1	100	2	Rural midblock	Other	4LD	3308			2.00%	0	2011	0.001207538	0.0045	-0.01	0.95	0.009	$270,000	$2,311
O.20	Otaki Gorge SB on-ramp	Otaki Gorge	Expressway	0.3	100	2	Rural midblock	Other	4LD		3374		2.00%	0	2011	0.003694833	0.0139	-0.01	0.95	0.026	$270,000	$7,134
O.21	North of Otaki NB on-ramp	Otaki	Expressway	0.55	100	2	Rural midblock	Other	4LD	3497			2.00%	0	2011	0.007020674	0.0269	-0.01	0.95	0.051	$270,000	$13,775
O.22	North of Otaki SB off-ramp	Expressway	Otaki	0.853	100	2	Rural midblock	Other	4LD		4698		2.00%	0	2011	0.014626805	0.0639	-0.01	0.95	0.121	$270,000	$32,776
O.24	Gear to Te Horo Beach connection	Gear	Te Horo Beach	1.21	80	2	Rural midblock	Other	RM2			3107	2.00%	0	2011	0.013722686	0.1343	-0.01	0.95	0.128	$468,333	$59,772
O.25	Old Hautere Service Road	Otaki Gorge Road	Te Horo Beach	0.89	80	2	Rural midblock	Other	RM2			554	2.00%	0	2011	0.001800816	0.0176	-0.01	0.95	0.017	$468,333	$7,844

Method B - 2026 Accident Rate Anlaysis (Expressway and local road components)

										AADT For Year		2026										
Map Ref #.	Section Name	From	To	Length (km)	Speed (km/hr)	Lanes	Assumed Road classification for crash analysis	If Commercial, Land use type?	Accident Model Code	Northbound	Southbound	2 Way AADT	Traffic Growth rate	Grade	Time Zero	Exposure per 100M VKT	$A_{T\ unadjusted}$	Accident Trend adjustment factor for adjsuting typical Accident rate(Append. A6.4)	Adj. for Accident trend [(1+ accident trend factor*(time zero-2006)]	Typical Accident rate A_{Tref} adjsuted for accident trends	Cost per reported injury	Total Accident Cost Per Year
O.11	Expressway Te Kowhai to Otaki Gorge off-ramps NB	Peka Peka on/off ramps	Otaki Gorge on/offramps	7.7	100	2	Rural midblock	Other	4LD	9099			2.00%	0	2011	0.255715041	1.5039	-0.01	0.95	1.429	$270,000	$385,760
O.12	Expressway Te Kowhai to Otaki Gorge off-ramps SB	Otaki Gorge on/offramps	Peka Peka on/off ramps	7.7	100	2	Rural midblock	Other	4LD		8758		2.00%	0	2011	0.246141142	1.4230	-0.01	0.95	1.352	$270,000	$364,995
O.13	Expressway Otaki Gorge to North of Otaki On-ramp NB	Otaki Gorge on/offramps	North of Otaki onramp	3.208	100	2	Rural midblock	Other	4LD	5149			2.00%	0	2011	0.060289395	0.2744	-0.01	0.95	0.261	$270,000	$70,394
O.14	Expressway Otaki Gorge to North of Otaki On-ramp SB	North of Otaki onramp	Otaki Gorge on/offramps	3.208	100	2	Rural midblock	Other	4LD		4903		2.00%	0	2011	0.057412488	0.2557	-0.01	0.95	0.243	$270,000	$65,576
O.15	Expressway North Otaki on-ramp to SB off ramp NB	North of Otaki onramp	SB off ramp	0.853	100	2	Rural midblock	Other	4LD	5149			2.00%	0	2011	0.016030815	0.0730	-0.01	0.95	0.069	$270,000	$18,718
O.16	Expressway North Otaki on-ramp to SB off ramp SB	SB off ramp	North of Otaki onramp	0.853	100	2	Rural midblock	Other	4LD		8674		2.00%	0	2011	0.027006726	0.1555	-0.01	0.95	0.148	$270,000	$39,875
O.19	Otaki Gorge NB off-ramp	Expressway	Otaki Gorge	0.1	100	2	Rural midblock	Other	4LD	3855			2.00%	0	2011	0.001406993	0.0056	-0.01	0.95	0.011	$270,000	$2,884
O.20	Otaki Gorge SB on-ramp	Otaki Gorge	Expressway	0.3	100	2	Rural midblock	Other	4LD		3950		2.00%	0	2011	0.004324741	0.0175	-0.01	0.95	0.033	$270,000	$8,963
O.21	North of Otaki NB on-ramp	Otaki	Expressway	0.55	100	2	Rural midblock	Other	4LD	3771			2.00%	0	2011	0.007570452	0.0300	-0.01	0.95	0.057	$270,000	$15,367
O.22	North of Otaki SB off-ramp	Expressway	Otaki	0.853	100	2	Rural midblock	Other	4LD		5149		2.00%	0	2011	0.016030815	0.0730	-0.01	0.95	0.139	$270,000	$37,435
O.24	Gear to Te Horo Beach connection	Gear	Te Horo Beach	1.21	80	2	Rural midblock	Other	RM2			3430	2.00%	0	2011	0.015147435	0.1483	-0.01	0.95	0.141	$468,333	$65,978
O.25	Old Hautere Service Road	Otaki Gorge Road	Te Horo Beach	0.89	80	2	Rural midblock	Other	RM2			607	2.00%	0	2011	0.001973071	0.0193	-0.01	0.95	0.018	$468,333	$8,594

OPTION INTERSECTIONS 2010

Method B Anlaysis - General Models Only

						AADT For Year	2010								
# REF	Name	Intersection type	Posted Speed Limit	Assumed typical prediction model no.	Name	Traffic Volumes	AADT	Traffic Growth rate	Time Zero	$A_{T\ unadjusted}$	Accident Trend adjustment factor for	Adj. for Accident trend [(1+ accident trend	Typical Accident rate A_T adjsuted for accident trends	Cost per injury accident	Total Accident Cost Per Year
O.4	Te Horo Beach / Gear Road Priority Tee	Priority - T	80	7	General High Speed X-T	Q_{major} Q_{minor}	4071 1664	2.00%	2011	0.124567429	-0.01	0.95	0.118339058	$ 342,500	$40,531
O.5	Expressway NB offramp / Otaki Gorge priority tee	Priority - T	80	7	General High Speed X-T	Q_{major} Q_{minor}	5274 2199	2.00%	2011	0.152970801	-0.01	0.95	0.145322261	$ 342,500	$49,773
O.6	SH1 / Otaki Gorge Roundabout	Roundabout	80	2.1	Single Lane Roundabout Single Lane Roundabout Single Lane Roundabout	Q_{SH1S} Q_{SH1N} $Q_{otakiGorge}$	3515 7724 5274	2.00%	2011 2011 2011	0.063 0.100 0.080	-0.01 -0.01 -0.01	0.95 0.95 0.95	0.060174572 0.095005667 0.076144403	$ 262,500 $ 262,500 $ 262,500	$15,796 $24,939 $19,988
O.7	Expressway Te Kowhai to Otaki Gorge off-ramps NB	Priority - T	80	7	General High Speed X-T	Q_{major} Q_{minor}	3361 1370	2.00%	2011	0.107714128	-0.01	0.95	0.102328421	$ 342,500	$35,047

OPTION INTERSECTIONS 2016

Method B Anlaysis - General Models Only

						AADT For Year	2016								
# REF	Name	Intersection type	Posted Speed Limit	Assumed typical prediction model no.	Name	Traffic Volumes	AADT	Traffic Growth rate	Time Zero	$A_{T\ unadjusted}$	Accident Trend adjustment factor for	Adj. for Accident trend [(1+ accident trend	Typical Accident rate A_T adjsuted for accident trends	Cost per injury accident	Total Accident Cost Per Year
O.4	Te Horo Beach / Gear Road Priority Tee	Priority - T	80	7	General High Speed X-T	Q_{major}	4561	2.00%	2011	0.135740571	-0.01	0.95	0.128953543	$ 342,500	$44,167
						Q_{minor}	1867								
O.5	Expressway NB offramp / Otaki Gorge priority tee	Priority - T	80	7	General High Speed X-T	Q_{major}	7522	2.00%	2011	0.205829047	-0.01	0.95	0.195537594	$ 342,500	$66,972
						Q_{minor}	3308								
O.6	SH1 / Otaki Gorge Roundabout	Roundabout	80	2.1	Single Lane Roundabout	Q_{SH1S}	3961	2.00%	2011	0.068	-0.01	0.95	0.064498272	$ 262,500	$16,931
					Single Lane Roundabout	Q_{SH1N}	10282		2011	0.118	-0.01	0.95	0.112148025	$ 262,500	$29,439
					Single Lane Roundabout	$Q_{OtakiGorge}$	7522		2011	0.098	-0.01	0.95	0.093554958	$ 262,500	$24,558
O.7	Expressway Te Kowhai to Otaki Gorge off-ramps NB	Priority - T	80	7	General High Speed X-T	Q_{major}	4546	2.00%	2011	0.120804631	-0.01	0.95	0.114764399	$ 342,500	$39,307
						Q_{minor}	1523		2011		-0.01	0.95			

OPTION INTERSECTIONS 2026

Method B Anlaysis - General Models Only

						AADT For Year	2026								
# REF	Name	Intersection type	Posted Speed Limit	Assumed typical prediction model no.	Name	Traffic Volumes	AADT	Traffic Growth rate	Time Zero	$A_{T\ unadjusted}$	Accident Trend adjustment factor for	Adj. for Accident trend [(1+ accident trend	Typical Accident rate A_T adjsuted for accident trends	Cost per injury accident	Total Accident Cost Per Year
O.4	Te Horo Beach / Gear Road Priority Tee	Priority - T	80	7	General High Speed X-T	Q_{major}	5068	2.00%	2011	0.146209605	-0.01	0.95	0.138899124	$ 342,500	$47,573
						Q_{minor}	2057								
O.5	Expressway NB offramp / Otaki Gorge priority tee	Priority - T	80	7	General High Speed X-T	Q_{major}	8646	2.00%	2011	0.230270834	-0.01	0.95	0.218757293	$ 342,500	$74,924
						Q_{minor}	3855								
O.6	SH1 / Otaki Gorge Roundabout	Roundabout	80	2.1	Single Lane Roundabout	Q_{SH1S}	4249	2.00%	2011	0.071	-0.01	0.95	0.067170549	$ 262,500	$17,632
					Single Lane Roundabout	Q_{SH1N}	11529		2011	0.126	-0.01	0.95	0.119852705	$ 262,500	$31,461
					Single Lane Roundabout	$Q_{OtakiGorge}$	8646		2011	0.107	-0.01	0.95	0.101424806	$ 262,500	$26,624
O.7	Expressway Te Kowhai to Otaki Gorge off-ramps NB	Priority - T	80	7	General High Speed X-T	Q_{major}	5192	2.00%	2011	0.130341825	-0.01	0.95	0.123824733	$ 342,500	$42,410
						Q_{minor}	1669		2011		-0.01	0.95			

Appendix C

External Peer Review Tracking Sheet

						
	PP2O Scheme Assessment Report – Economics Note					
Project Title	PP2O Scheme Assessment Report					
Report Title	Economics Note (Draft)					
Author	Andrew Martindale / Hailin Hu / William Wallace & David Dunlop (Opus International Consultants)					
Project Manager	Tony Coulman					
Peer Reviewer	Darren Fidler (Sinclair Knight Merz)					
Report	Reference (Chapter number)	Reviewer Initial Comments	Action/direction for the team/report writer	Reviewer second round of comments	Designers Response	NZTA notes
Economics Note (Draft)	1.2	It would be useful to report what the BCR for the project was without the WEBs for consistency with the approach outlined for the assessment of the PP2O section of the RoNS	We will add text to clarify that the approach used for calculating the BCR for this project is consistent with that used for other parts of the Wellington Northern RoNS project and WEB's have only been applied to the full package. The application of WEB's to the full package resulted in an increase from 1.1 to 1.4.	Addition of text to report considered appropriate.	Issue addressed - text added to final economics report.	
	1.2	Land use input assumptions should be agreed with NZTA and GWRC	Land use assumptions have been agreed with NZTA and GWRC to use the medium growth matrices for this project with additional growth applied to the Riverbank area of Otaki. These numbers have been cross checked with the M2PP medium growth modelling undertaken and are	The above information should be added to the final economics	Issue addressed – text added to final economics report.	

			comparable – this has been discussed further under section 1.3 comments below. It should also be noted that a sensitivity test was undertaken to document the impact of removing other permitted development in Section 12 of the report. It should be noted that the Riverside Development is growing rapidly and predicted to continue growing (which is not included in the WTSM medium matrices for this area).			
	1.3	Having all other section of the RoNS in the DM may result in a overestimation of the benefits of this section of the RoNS relative to the others, this should be documented.	This assumption was identified by NZTA and agreed. There has been no WTSM test undertaken to remove the Otaki project from the package, however based on other work undertaken to look at variable trip matrices, that impact of the project is likely to be very small due the fact that little or no congestion exists during peak periods.	Text should be added to the report to outline this assumption. It is possible that the traffic induced by the final section of the RoNS may come from changes in land use with the completion of the corridor.	Issue Addressed – text added to final report.	
	1.3	The use of the PP2O SATURN model rather than the M2PP SATURN model means that the critical route choice for traffic using the RoNS is an input assumption rather than a result of a modelling exercise which would be more defensible. The use of the PP2O model should be justified.	As agreed with NZTA the M2PP model has been checked and significant differences between observed and modelled speeds significantly impact on the ability to use the model effectively for the PP2O project – it has been suggested to NZTA that the M2PP model be refined to allow use going forward.	The information provided in Table 1 of the response letter should be included for each peak period modelled as this is the level at which induced traffic would be generated, not at the daily level.	Numbers presented in the final economics report.	
	1.3	The use of a fixed trip matrix assessment should be justified in terms of congestion rather than traffic volumes.	Opus provided a series of sensitivity tests using elastic assignment in the PP2O model to compare both traffic volumes and network delay.	It is likely that any changes to demand and delay levels for the north-south through movements may have a significant impact on levels of benefit.	Issue Acknowledged. Sensitivity tests to be included in final economics report.	
	1.3	Benefits should be reported by geographical	Opus provided the travel time savings	Addition of text and tables to	Issue Addressed – text, tables,	

		sector to demonstrated the sensibility of these to be assessed.	according to geographic regions. The majority of the travel time savings came from North / South SH1 movements.	report considered appropriate.	figures and analysis added to final report.	
	2	Benefits should be reported by year and time period to enable the sensibility of the annualisation, interpolation and extrapolation of results to be assessed.	Opus provided a revised set of full economic outputs.	Addition of full economic outputs to report considered appropriate	Issue Addressed – Latest economic figures included in Appendix B of final economics report.	
	4	The derivation of congested travel time and the contribution of this to total benefits should be clarified.	Opus provided the CRV values and assumptions.	Addition of the above text to the report considered appropriate.	Issue Addressed – text added to final economics report	
	4	The impact of lower HCVs on local roads should be assessed. This may be informed through the geographical breakdown of benefits.	Based on the additional geographic sensitivity work completed for travel time benefits, Opus believes the HCV assumptions is valid.	As suggested, since the majority of benefits are from through movements on SH1, therefore the current HCV assumption is valid.	Issue addressed.	
	6.1	It is unclear why CAS data has not been used in 2011. It would be useful to document what differences there are in crash data between 2005 and 2011 to establish whether this is likely to have an impact on the crash benefit	Opus provided additional crash information and explanations.	Addition of text and table to the report considered appropriate.	Issue Addressed – text and tables added to final economics report	
	6.2	The 2% growth rate should be clarified and justified, whether this be an increase in traffic volumes or accidents	The 2% traffic volume growth rate is an input variable required in the crash cost calculations. A value of 2% was adopted to consistent with Table A2.5 on Page A2-11 of the EEM. This corresponds to the typical growth rate that can be assumed for the different traffic composition mixes such as “Rural Strategic” in the Wellington Region.	The traffic growth rate of 2% should be checked against observed traffic volumes in line with Section A2.7 of the EEM:	Existing traffic count data was reviewed from NZTA count-stations. Annual growth rate was determined to be ~1%. SATURN flows were also assessed to determine growth between 2010 and 2026 SH1 flows – 3% annual growth found. 2% is conservatively in the middle of these two estimates and has been maintained for analysis purposes	

	6.2	Section 6.2: The adjustment of crash incidences due to changes in traffic volumes is consistent with EEM A6.4. This implicitly assumes that the number of accidents in linearly correlated to traffic volumes on the existing network. Justification for the assumed crash reduction on the existing network should be provided. The data provided in the appendices appears to be Incomplete. Additional Information to be provided for completeness	The crash model is a function of the changes in SATURN flows of the option compared to the do-minimum network. In the option significant traffic volumes are forecast to shift from the existing SH1 network onto the new expressway. Additional information has been provided in the crash model sheets to make this more evident.	The data provided should be included in the final reporting.	Issue addressed, data is included in final economics report.	
	6.2	It would be useful to report the differences between the accident by accident analysis and accident prediction model for existing intersections to confirm the suitability of the accident prediction model at these locations.	Opus provided a sensitivity test using the prediction models. It can be seen that the prediction models have resulted in a total do-minimum intersection crash cost value 80% of those calculated by the accident by accident analysis.	Addition of the above text to the report is considered appropriate.	Issue addressed, data and analysis included in the final economics report.	
	6.3	The large proportion of total scheme benefits which is attributable to accident savings places significant emphasis on assumption regarding accidents on the existing road network and so these should be justified	Opus acknowledges that the crash savings form a large component of the project benefits. However we believe this is intuitive. The option will see a substantial reduction in vehicles travelling along the existing SH1 route as traffic is shifted onto the new expressway. This will in-turn reduce the number of vehicle conflicts occurring on a daily basis along the existing SH1 route. The potential and probability of a crash occurring on the existing SH1 network will thus decrease due to a significant reduction in vehicle exposure.	The more complete crash data provided addresses the concerns regarding the crash analysis.	Issue addressed. No additional work required.	
	7.2	Justification for the extension of the pavement life with reduced traffic volumes should be	SH1 will see a significant reduction in the number of vehicles using it as vehicles re-	Addition of the above text to the report is considered	Issue addressed. Text added to final economics report.	

		provided.	route onto the new expressway. With a drop in all traffic types including the majority of HCV traffic, the existing pavement structure cannot be assumed to deteriorate at the same rate it does currently. For such reasons we have conservatively estimated that the pavement life can be extended.	appropriate		
	9	Benefits should be reported by time period to confirm the emphasis on non-modelled period benefits.	Opus provided the additional benefits information as requested.	The above text and tables should be added to the final reporting in order for a transparent appraisal of the analysis to be undertaken and to provide a range of likely benefits for the scheme, both with and without the non-modelled periods included.	Issue Addressed – text and tables entered into final economics report.	


OPUS