1. INTRODUCTION

This technical note explains the model development changes to the Waikato Regional Transport Model which have been carried out in mid 2012 to take the three step (vehicle driver only) model from version 3V1007, which was reported in technical notes 21, through to version 3V1010.

From 15th October 2012 the Version 10 base model should be used for all new work not continuing from previous projects.

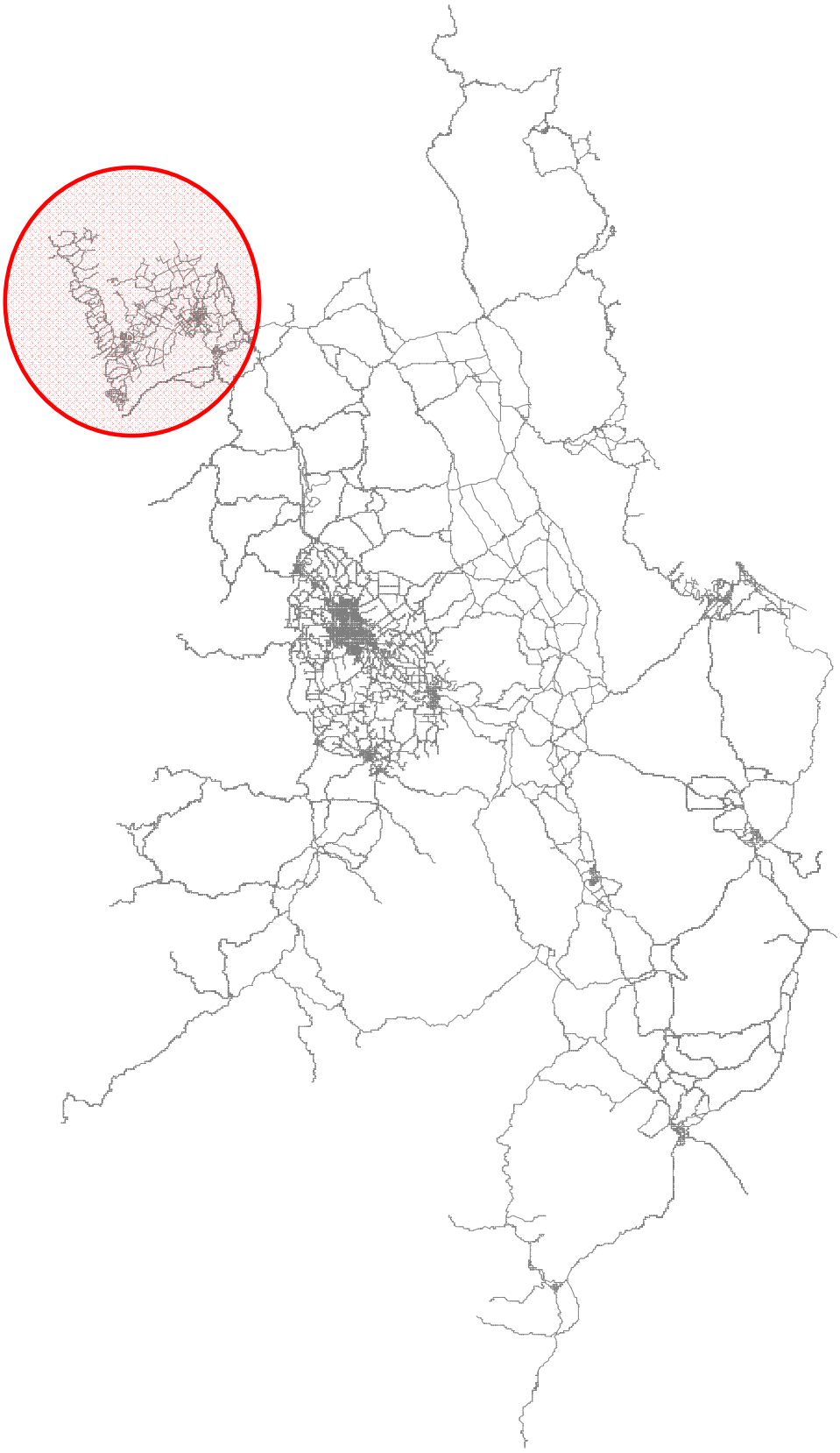
The primary reason for the upgrade was to incorporate the Franklin District area into the greater WRTM area so as to better represent the interaction between the original WRTM area with the northern regions including Franklin. The model was expanded from 900 zones up to 999 zones which included 87 zones representing Franklin (zones 890-976) and 10 additional external zones (zones 979-988) representing the new external roads in and out of Franklin.

The detailed Franklin model network was imported directly into the WRTM model. In order to maintain the same level of detail as that provided in the WRTM, some lower classification roads were removed. This was particularly necessary because the number of zones representing the Franklin land use in the detailed model were from reduced from 240 zones down to 87 as indicated above. The land use for the Franklin area of the expanded WRTM model is an aggregate of the land use used in the detailed model and is therefore directly related. All WRTM Franklin households, jobs and household characteristics are directly comparable with the detailed Franklin model.

Figure 1 shows the newly expanded WRTM model area with the additional Franklin area highlighted.

Another change involved in this upgrade was the modification of the attraction model for private home-based trip attractions to allow internal jobs to compete with jobs in "Auckland", which are filled by Waikato residents. This had to be updated to take into account the impact Franklin District has on the attraction of trips to external jobs. Some of the trips previously modelled as being attracted to northern externals are in the current expended model attracted internally to Franklin households and jobs.

The subsequent sections of this Technical Note document these changes and an overview of traffic validation results are also presented.



Waikato Regional Transportation Model	**Expanded WRTM Model Area**	**Figure 1**
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2. EXTERNAL ATTRACTION MODEL FOR AUCKLAND JOBS

External traffic is a mix of through traffic for the entire Waikato Model study area, Waikato residents with trip ends in Auckland, and Auckland residents with trip ends in the Waikato Region. The quantity of through traffic is already accurately reflected in the model based on Road Side Interview analysis; however it is evident that there is value in making a distinction for non–through traffic between that which is generated by Waikato residents and those generated externally.

Version 3V1007 of the WRTM introduced the concept of attracting internally generated trips to external jobs. The earlier model introduced trip rates in the internal attraction equations that attracted trips to "Auckland" jobs and therefore allowed direct competition between internal and external jobs.

With the application of these trip rates the additional resultant traffic generation then has been apportioned to a combination of internal and external attractions by modifying the modelled trip attraction equations. This modification has been reported in full in Technical Note 21. However, this process has had to be adjusted to take into account the impact of Franklin on internal trip distribution. Some of what was considered "Auckland" jobs in 3V1007 was in fact Franklin jobs.

The additional land use variable has been modified so that the model attracts a different number of trips to the northern externals. It is an estimate of the number of jobs to the north which are held by residents within the Study Area, based on census Journey to Work data and peak hour traffic flows. A total of 3773 jobs have been apportioned to the new northern externals of zones 979-981 with again approximately 75% of the jobs being placed at zone 980 (which represents State Highway One) and the remaining 25% located at zones 979 and 981 which represent the other external job locations.

The attraction coefficients were recalculated for the external jobs variable so that the external and internal jobs compete with each other. The coefficients used in the 3V1007 version of the model were adjusted to reflect the change in external attractiveness.

Further, initial attempts with the interpeak model found that too much traffic was being attracted around Hamilton resulting in high flows on the bridges. This was occurring due to the non-home based component treating urban and rural areas equally, resulting in the rural areas having proportionately fewer non-home based trips because of their outer location. As such the interpeak non-home based coefficients were tripled for rural areas so as to generate an adequate amount of rural non-home based traffic. This method was employed in version 1 (3V1001) of the model but had subsequently been taken out, however it become evident it was required with this latest model update.

The resultant attraction equations, which replace those published in Technical Note 21, are as follows:

Morning Peak Vehicle Trip Attractions		
HBW	=	0.302TOT + 0.200EXT
HBE	=	0.095SCH + 0.199TER + 0.372UNI + 0.050 EXT
HBB	=	0.104OFF + 0.020EXT
HBSh	=	0.211RET + 0.010EXT
HBSR	=	0.650RET + 0.215HH
HBO	=	0.142COM + 0.064HH + 0.287SCH + 0.152UNI + 0.020EXT
NHB	=	0.225WHOLE + 0.411 RET + 0.032HH + 0.077 SCH
Interpeak Vehicle Trip Attractions		
HBW	=	0.347TOT + 0.092HH + 0.110EXT
HBE	=	0.095SCH + 0.199TER + 0.372UNI + 0.020EXT
HBB	=	0.247OFF + 0.452COM + 0.065EXT
HBSh	=	3.046 RET + 0.125EXT
HBSR	=	0.589RET + 0.221HH + 0.090EXT
HBO	=	0.136HH + 0.308SCH + 0.266TER + 0.268UNI + 0.065EXT
NHB (urban)	=	3.806RET + 0.329HH + 0.485SCH + 0.268UNI
NHB (rural)	=	11.418RET + 0.987HH + 1.455SCH + 0.804UNI
Evening Peak Vehicle Trip Attractions		
HBW	=	0.294TOT + 0.530EXT
HBE	=	0.095SCH + 0.199TER + 0.372UNI + 0.350EXT
HBB	=	0.054OFF + 0.120COM + 0.030EXT
HBSh	=	1.018 RET + 0.040EXT
HBSR	=	0.166RET + 0.098COM + 0.010EXT
HBO	=	0.170COM+ 0.196RET + 0.072SCH + 0.080UNI + 0.050EXT
NHB	=	1.518RET + 0.207COM + 0.187HH

Where EXT are Jobs for Waikato Residents External to the Study Area and other variables are as before.

In addition to the external jobs added to the V10 zone file, external 2hr traffic flows have been added for each additional external location (zones 979-988). These flows represent the residual traffic flows entering and leaving the model area from each external and for each model period. These flows have the internally generated flow to the externals, detailed above, removed for both light and heavy vehicles so that double counting is eliminated. The flows represent the same 2hr period working week flows as those already used in the WRTM model. They have been adjusted to reflect the base 2006 March conditions using the same adjustment factors detailed in earlier Technical notes.

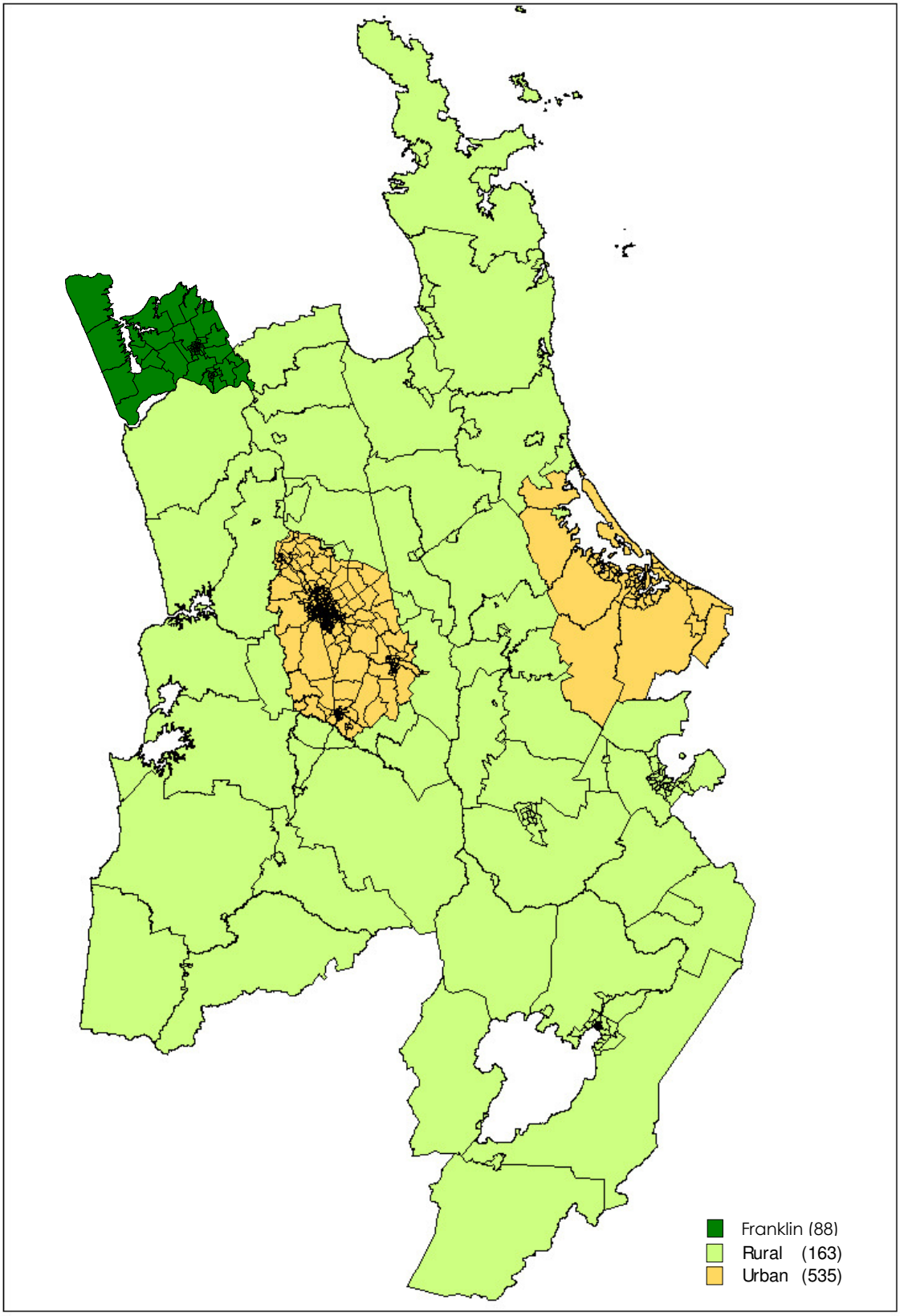
3. BIMODAL DISTRIBUTION MODEL

A bimodal distribution has been extracted whereby trips to/from the main urban area in the WRTM (defined as Region 2 in **Figure 2**) had a distribution model which was calibrated independently from those trips which had both trip ends outside of the main urban area (defined as Region 1 in **Figure 2**). This is the very same process that was incorporated into version 3 of the model as detailed in Tech Note 21 Three Step Model Upgrade from 3V1001 to 3V1003 other than the Franklin area, shown in green, has been included as additional rural area.

The distribution model coefficients for each region were calibrated by trip purpose in the same manner as the distribution model, which has been reported in WRTM Technical Note 11. In short the trips corresponding to the region were extracted from the HIS and assigned to the WRTM road network and compared against the model. The model coefficients were then carefully tuned to match the average trip lengths for Region 1 trips, and the process was repeated independently for Region 2 trips. Note that the Region 2 assessment included those trips between Region 1 and Region 2. The Region 1 assessment only included trips, which originated and terminated inside the Region 2 boundary. The resultant distribution model coefficients were presented for each purpose and time period in Tech Note 21 Three Step Model Upgrade from 3V1001 to 3V1003 Tables 1 and 2.

The version 10 model incorporates Franklin which altered the distribution for some of the purposes. This caused the trip length frequencies to change from those calibrated in Tech Note 21 and therefore the coefficients have had to be recalibrated to ensure the trip length frequencies are again consistent with the HIS data.

The means of trip lengths for HIS and model results are presented for each purpose and time period in **Table 1** (for Region 1 or rural trips) and **Table 2** (for Region 2 or urban and urban/rural trips). Note that these results do not include the Franklin area since the HIS does not include this area.



Waikato Regional Transportation Model	**Urban and Rural Regions in Waikato**	**Figure 2**
Gabites Porter Consultants		

Comparison of HIS and Modelled Trip Lengths – Region 1					Table 1
Period	Purpose	Trip Time		Trip Distance	
		Mean		Mean	
		HIS	Model	HIS	Model
Morning Peak	Home to Work	10.44	10.44	11.31	11.64
	Home to Education	13.96	12.86	14.71	14.74
	Home to Business	10.28	11.06	11.53	12.23
	Home to Shop	9.07	9.12	9.91	9.67
	Home to Social/Rec	3.95	3.89	3.27	3.30
	Home to Other	6.90	6.59	6.48	6.63
	Non Home Based	9.98	9.79	10.90	11.06
	Other to Home	5.42	5.25	4.88	4.98
	Work to Home*	1.99	10.04	1.31	11.16
	Education to Home*	12.30	13.73	15.98	15.92
	Business to Home	7.69	7.80	8.07	8.33
	Shop to Home	6.95	8.31	6.08	8.99
	Soc/Rec to Home	2.94	2.72	2.00	1.97
Interpeak	Home to Work	10.61	11.16	12.38	12.62
	Home to Education*	1.41	13.35	.71	15.32
	Home to Business*	10.74	9.91	10.38	10.55
	Home to Shop	9.75	9.49	10.44	10.22
	Home to Social/Rec	12.14	11.99	13.35	13.69
	Home to Other	5.06	5.98	4.99	5.95
	Non Home Based	9.31	10.53	10.39	11.94
	Other to Home	5.29	5.55	4.83	5.46
	Work to Home	10.95	11.08	12.32	12.52
	Education to Home*	1.57	11.83	.93	13.54
	Business to Home	8.88	8.54	8.62	9.26
	Shop to Home	10.22	10.39	11.26	11.49
	Soc/Rec to Home	7.70	7.92	8.18	8.43
Evening Peak	Home to Work	9.28	8.71	9.28	9.39
	Home to Education	18.60	19.26	23.13	24.37
	Home to Business*	2.47	4.43	1.76	4.17
	Home to Shop*	5.73	7.92	5.21	8.28
	Home to Social/Rec	7.41	7.22	7.47	7.28
	Home to Other	6.97	6.93	6.71	6.95
	Non Home Based	5.93	5.69	5.72	5.74
	Other to Home	9.08	9.23	9.13	9.70
	Work to Home	11.26	10.98	12.22	12.32
	Education to Home*	15.79	13.71	18.58	16.77
	Business to Home	11.10	12.32	12.21	13.65
	Shop to Home	11.59	10.90	11.92	11.84
	Soc/Rec to Home	8.41	7.96	8.21	8.35

* These purposes either had a low sample size or irregularities in the HIS data that contribute to possible erroneous results.

Comparison of HIS and Modelled Trip Lengths – Region 2					Table 2
Period	Purpose	Trip Time		Trip Distance	
		Mean		Mean	
		HIS	Model	HIS	Model
Morning Peak	Home to Work	15.12	14.57	13.51	13.62
	Home to Education	11.66	11.86	9.40	12.00
	Home to Business	12.14	11.15	9.68	10.28
	Home to Shop	10.77	9.95	8.58	8.79
	Home to Social/Rec	16.34	16.33	16.40	16.39
	Home to Other	10.15	9.64	8.17	8.13
	Non Home Based	10.96	10.23	8.90	8.76
	Other to Home	10.11	7.98	8.25	6.63
	Work to Home*	13.88	13.70	12.84	12.94
	Education to Home*	9.30	10.97	5.15	11.22
	Business to Home	27.33	26.28	29.55	29.21
	Shop to Home	5.96	7.23	4.20	6.37
	Soc/Rec to Home	11.52	10.61	10.10	9.89
Interpeak	Home to Work	13.74	12.74	11.85	11.92
	Home to Education*	15.99	12.40	13.30	13.45
	Home to Business*	17.77	15.72	17.09	15.97
	Home to Shop	11.33	10.47	9.64	9.71
	Home to Social/Rec	15.89	15.44	15.28	15.37
	Home to Other	10.14	10.63	8.74	9.73
	Non Home Based	11.76	13.12	10.35	12.75
	Other to Home	12.56	13.43	11.89	13.08
	Work to Home	11.34	10.36	9.19	9.19
	Education to Home*	13.88	12.85	10.82	13.92
	Business to Home	11.41	10.25	10.05	9.88
	Shop to Home	11.86	11.05	10.03	10.28
	Soc/Rec to Home	12.58	12.03	11.12	11.12
Evening Peak	Home to Work	13.93	13.90	12.81	12.72
	Home to Education	8.68	10.79	4.82	11.07
	Home to Business*	15.04	11.30	11.08	10.89
	Home to Shop*	8.76	8.10	6.55	7.16
	Home to Social/Rec	12.21	10.96	10.18	10.14
	Home to Other	11.50	9.99	8.93	8.90
	Non Home Based	12.90	12.06	10.63	10.53
	Other to Home	9.52	8.70	7.18	7.23
	Work to Home	15.88	15.40	13.98	14.00
	Education to Home*	11.91	11.71	8.25	11.54
	Business to Home	14.96	13.99	12.71	12.75
	Shop to Home	10.40	10.11	8.42	8.50
	Soc/Rec to Home	17.92	16.91	16.87	16.31

* These purposes either had a low sample size or irregularities in the HIS data that contribute to possible erroneous results.

4. SUMMARY OF TRAFFIC FLOW VALIDATION

An overview of the traffic flow validation has been prepared to show how well version 10 compares to the original model throughout the model study area. The cordon screenlines are shown in **Figure 3**, **Figure 4** and **Figure 5** below.

In addition the key period model statistics for each of the three periods are included in **Table 3**. These indicate that the inclusion of Franklin into the model has resulted in some changes from the original model but the model is still functioning well.

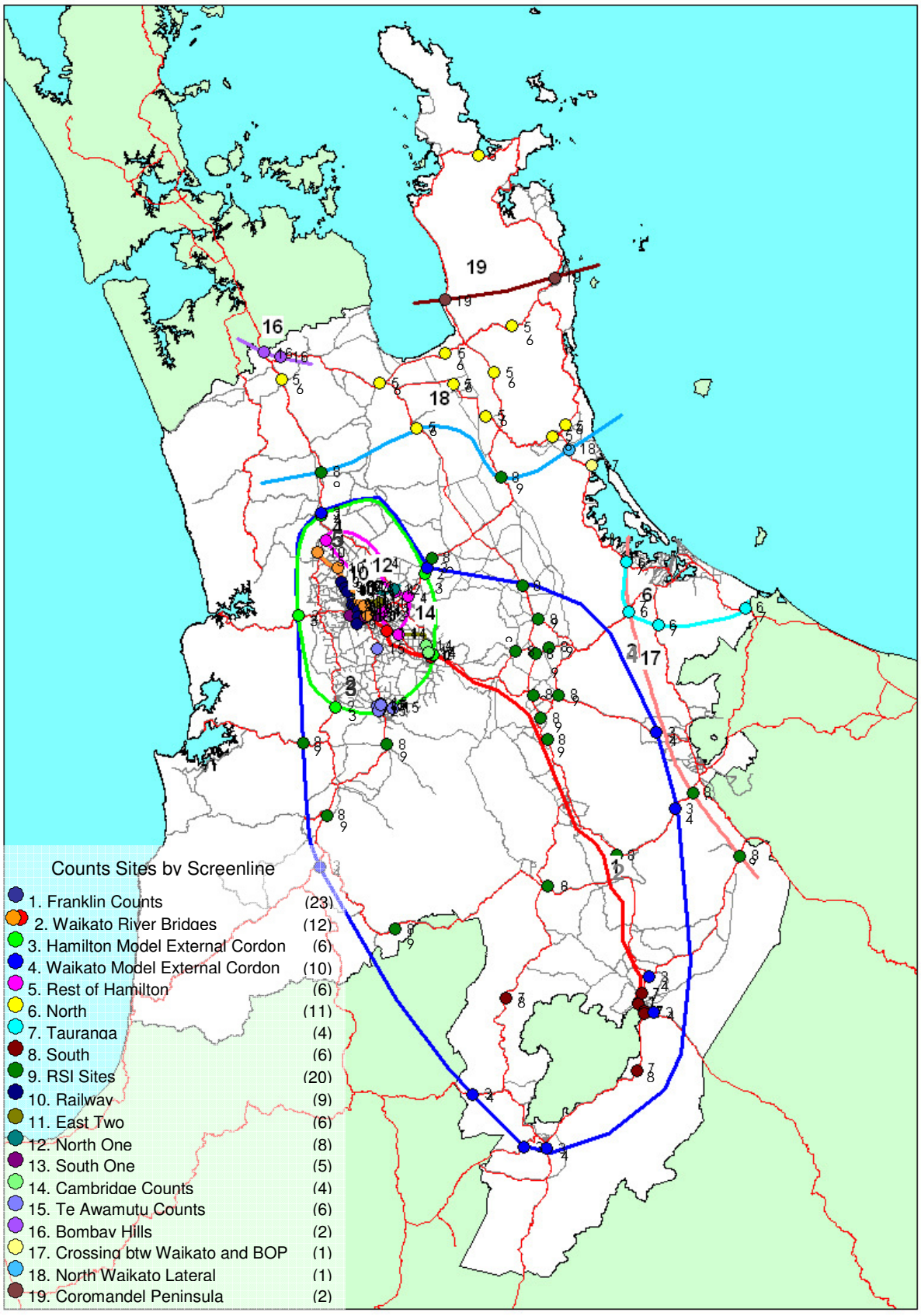
All Count Level of Correlation Between Model Versions						Table 3
	Model as %age of Survey		Correl Coeff		R-Squared	
Region	3V1001	3V1010	3V1001	3V1010	3V1001	3V1010
AM Peak	100%	100%	0.981	0.981	0.963	0.967
INT Peak	99%	102%	0.969	0.969	0.939	0.934
PM Peak	100%	99%	0.987	0.981	0.974	0.962

A comparison was also undertaken comparing each of the primary cordons used in the validation of the model. **Table 4, Table 5 and Table 6** indicate whether the screenlines in 3V1010 improved, remain the same or worsened compared to 3V1001. The tables again indicate that some movement in validation has occurred but the majority of screenlines are still within validation requirements.

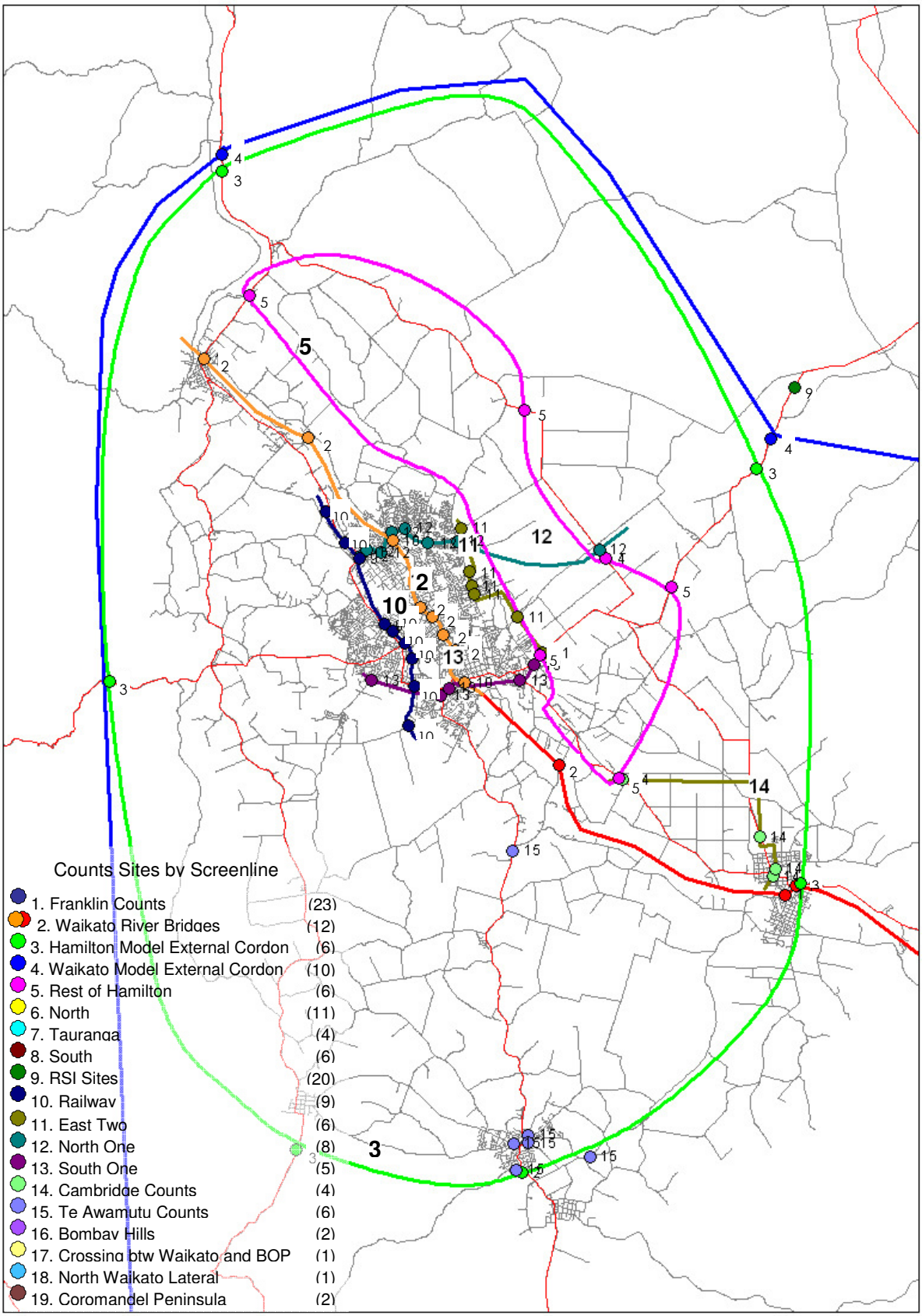
AM Peak Level of Correlation Between Model Versions			Table 4
		Screenline GEH (forward/back)	
	Cordon	3V1001	3V1010
1	Franklin Counts	N/A	2.1/0.3
2	Waikato River Bridge	2.9/0.5	0.4/1.8
3	Hamilton Model External Cordon	1.2/2.7	3.2/4.4
4	Waikato Model External Cordon	1.3/1.1	1.1/0.7
5	Rest of Hamilton	0.8/0.9	2.0/1.2
6	North	5.3/0.9	2.2/3.2
7	Tauranga	3.0/3.4	3.3/2.1
8	South	0.6/7.8	1.0/11.7
9	All RSI	3.2/0.1	2.4/1.7
10	Railway	3.3/5.0	7.5/10.6
11	East	0.8/0.8	6.8/1.1
12	North	1.0/3.4	4.7/3.9
13	South	1.1/2.2	0.8/0.4
14	Cambridge counts	3.1/1.7	2.7/0.1
15	Te Awamutu Counts	1.6/0.8	4.0/0.6
16	Bombay Hills	0.7/2.2	2.7/3.9
17	Crossing btw Waikato and BOP	1.6/1.3	7.6/2.0
18	North Waikato Lateral	2.2/2.5	1.1/9.1
19	Coromandel Peninsula	3.5/3.5	2.9/0.9
GEH of Over 4.0 or % Difference > +/- 10%		3 out of 36	8 out of 38

INT Peak Level of Correlation Between Model Versions			Table 5
		Screenline GEH (forward/back)	
	Cordon	3V1001	3V1010
1	Franklin Counts	N/A	3.5/2.5
2	Waikato River Bridge	4.4/1.1	2.9/6.2
3	Hamilton Model External Cordon	1.0/2.2	2.6/1.4
4	Waikato Model External Cordon	0.0/1.1	1.9/0.4
5	Rest of Hamilton	3.6/3.4	3.6/1.8
6	North	2.8/1.8	0.6/1.1
7	Tauranga	3.3/5.5	3.8/0.5
8	South	0.3/8.1	3.8/3.1
9	All RSI	1.1/1.9	3.5/3.7
10	Railway	6.4/7.5	5.2/9.7
11	East	1.3/2.2	3.4/2.5
12	North	2.6/3.3	1.7/1.3
13	South	3.6/2.6	1.7/12.1
14	Cambridge counts	3.8/0.6	6.9/3.0
15	Te Awamutu Counts	2.2/0.5	4.8/5.5
16	Bombay Hills	0.9/0.7	2.7/4.0
17	Crossing btw Waikato and BOP	2.4/4.4	2.0/3.0
18	North Waikato Lateral	2.4/1.7	3.7/2.2
19	Coromandel Peninsula	2.2/1.7	2.5/2.8
GEH of Over 4.0 or % Difference > +/- 10%		6 out of 36	7 out of 38

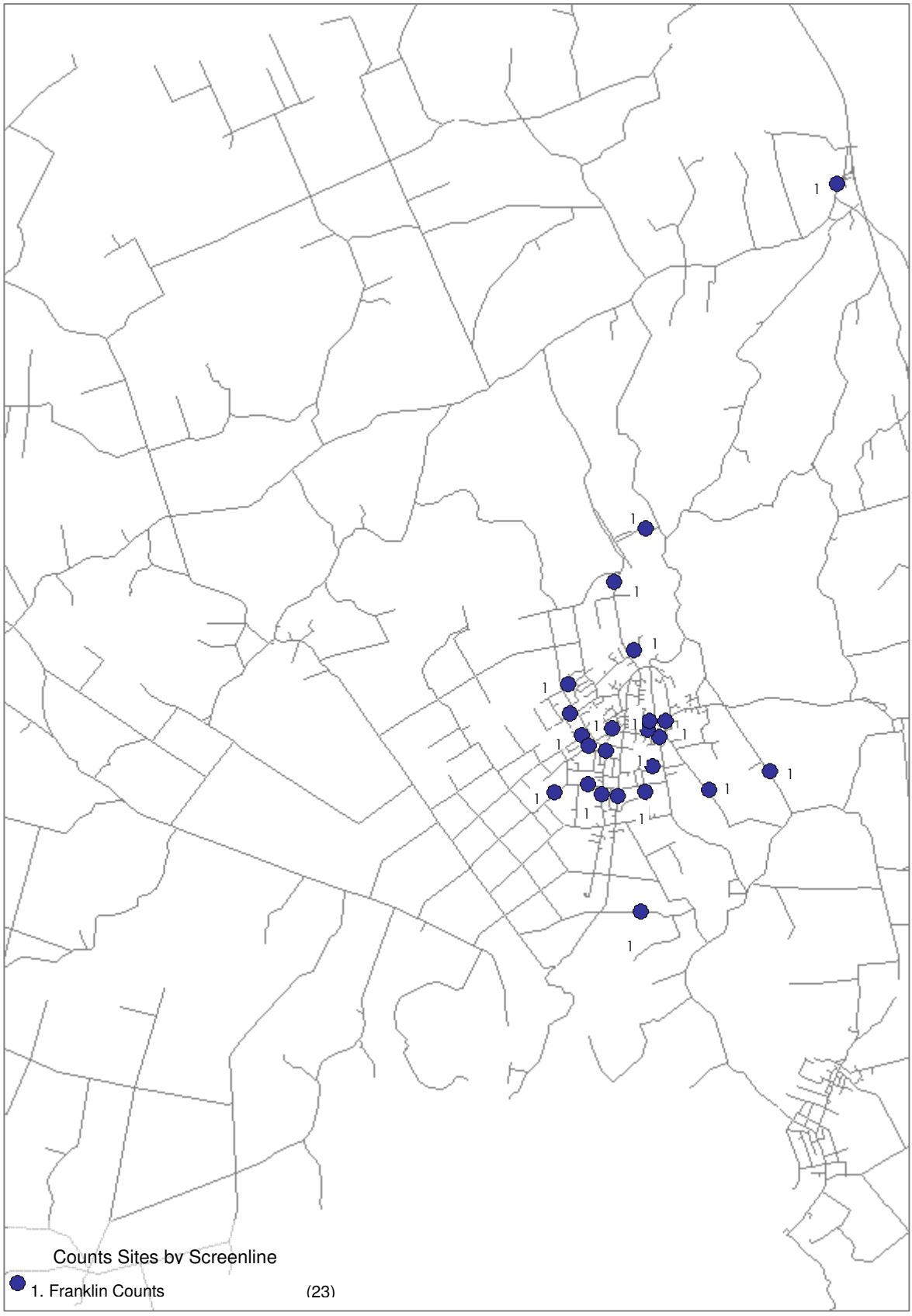
PM Peak Level of Correlation Between Model Versions			Table 6
		Screenline GEH (forward/back)	
	Cordon	3V1001	3V1010
1	Franklin Counts	N/A	3.3/3.9
2	Waikato River Bridge	5.0/5.2	3.5/4.9
3	Hamilton Model External Cordon	1.2/1.6	0.5/1.2
4	Waikato Model External Cordon	4.5/0.8	2.8/0.7
5	Rest of Hamilton	3.6/1.4	0.9/3.8
6	North	0.5/5.5	5.9/10.6
7	Tauranga	1.7/3.0	1.4/3.8
8	South	1.7/2.8	2.3/2.9
9	All RSI	2.0/7.9	3.8/2.3
10	Railway	2.1/4.7	0.6/9.3
11	East	0.5/3.5	2.9/3.1
12	North	1.2/6.1	1.4/8.0
13	South	1.8/1.0	0.3/3.2
14	Cambridge counts	2.2/2.1	0.5/2.2
15	Te Awamutu Counts	0.4/2.9	3.1/8.2
16	Bombay Hills	2.8/0.9	7.1/1.8
17	Crossing btw Waikato and BOP	2.7/2.0	1.9/3.0
18	North Waikato Lateral	2.5/2.8	1.7/0.0
19	Coromandel Peninsula	0.6/3.2	5.4/5.5
GEH of Over 4.0 or % Difference > +/- 10%		7 out of 36	9 out of 38



Waikato Regional Transportation Model	**Waikato Model Screenline Locations**	**Figure 3**
Gabites Porter Traffic Design Group		



Waikato Regional Transportation Model	**Waikato Model Screenline Locations Inset**	**Figure 4**
Gabites Porter Traffic Design Group		



Waikato Regional Transportation Model Gabites Porter Traffic Design Group	**Waikato Model Screenline Locations - Franklin**	**Figure 5**

5. VALIDATION AGAINST TRAFFIC COUNTS

Network Validation

Network flow comparisons are tested using a number of statistical measures. Traffic counts were grouped into cordons, or screenlines, and the following measures calculated:

- Comparisons of individual links
- Comparisons of total trips over each screenline
- Percentage difference
- Correlation coefficient
- % Root mean square
- GEH.

Guidelines for each of the above criteria were obtained from NZTA's Economic Evaluation Manual and listed in **Table 7.**

The correlation coefficient is a first order measure of the co-relation, using the formula:

$$P_{x,y} = \frac{\frac{1}{n} \Sigma (x_i - \bar{x_i})(y_i - \bar{y_i})}{\sigma_x \sigma_y}$$

Where:

Σ	=	Sum of…
X	=	Variable X (observed traffic)
Xi	=	The mean of variable x (observed traffic)
Y	=	Variable y (modelled traffic)
Yi	=	The mean of y (modelled traffic)
σ_x	=	The standard deviation of x (observed traffic)
σ_y	=	The standard deviation of y (modelled traffic)
n	=	Number in sample

The GEH is a form of the Chi-squared statistic that incorporates both relative and absolute errors. It is designed to be more tolerant of the large percentage differences in lower flows. The form of the statistic is:

$$GEH = \sqrt{\frac{2(m-o)^2}{m+o}}$$

Where **m** is the modelled flow and **o** is the observed count.

It should be noted that where the model assignments are other than one hour, the traffic volumes have been adjusted for GEH comparisons.

The available traffic counts have been arranged into screenlines where possible. In many cases there are roads on a screenline that have not been counted and hence these have had to be omitted. In other cases it was not been possible to create screenlines and hence the extra counts are grouped in the area in which they occur.

A summary of the cordon results can be found below in **Table 8**, **Table 9** and **Table 10** for the morning, inter and evening periods respectively. Corresponding scatterplots for all links in each period are shown in **Figure 6, Figure 7** and **Figure 8.**

Model Traffic Flow Validation Guidelines			Table 7
Screenline Totals			
Traffic Flow	± 10%		
Correlation Coefficient	>0.85		
% RMS	<30		
GEH	<4 in most cases		
Individual Links (vpd)	**24 Hour**	**1hr Period**	
0-10,000	± 60%	± 300	
10-20,000	± 40%	± 400	
20-30,000	± 30%	± 600	
30-50,000	± 20%	± 750	
50,000 +	± 20%	± 1,000	
GEH	<5	<10	<12
(Modified for 1hr flows only)	60%	95%	100%

Validation of cordon flows was generally good for all vehicles. The AM and PM periods are not quite as tightly validated as Version 1, as the interpeak is, however the screenline scatterplots show that there are few instances of major discrepancies and the general R^2 coefficient for each plot is good.

Several other individual screenlines did not meet criteria during individual periods but this may be more due to the 'holes' in the screenlines and as such represent flow within an area rather than a true screenline.

Areas the model has not validated particularly well and their reasons are:

- The railway crossings; this has always been a difficult area in the model and more focus has been placed on the bridges as being more important than the railway crossings in the model.
- Taupo; high in the northbound direction in the morning peak, due likely to large proportion of tourist population that doesn't get moving until later in the morning. Same pattern as in 3V1001 of the model.
- East; Puketaha Rd and Ruakura Rd 35% light in the eastbound direction in the morning peak period but offset by being slightly high in other periods.
- South; high in the northbound direction in the interpeak, due to the school at Temple View and high volume from southern Ohaupo Rd.

- Te Awamutu; high volume on Ohaupo Rd due to regional interaction with Hamilton, likely as a result of over performing bimodal distribution. This was corrected in 3V1005 of the model by introducing an additional distribution mode but this became ineffective with the introduction of the Franklin area. This issue could be explored further in a future update of the model.
- All other screenlines that do not have a GEH under 4.0 only have one count location that has either too high or too low volume, often in one period and direction only, so are relatively minor issues.

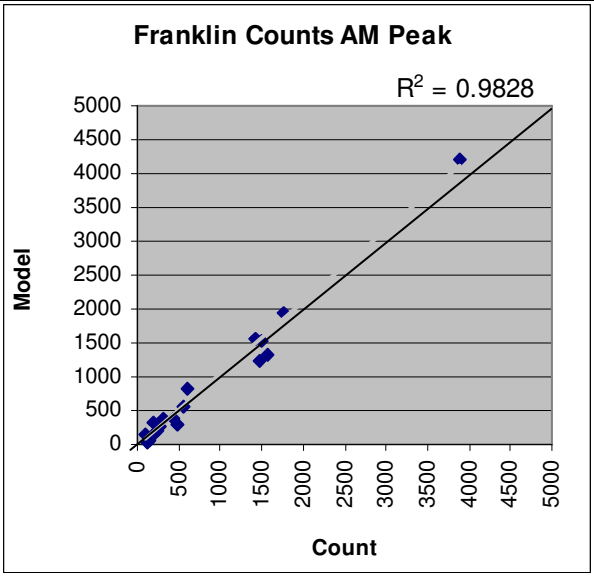
Morning Peak Network Screenline Validation			Table 8
Screenline 1 – Franklin Counts			
	Forward		Back
Count	8217		9156
Volume	8488		9203
Change	271		47
%	103		101
Correlation Coefficient	0.994		0.956
%RMS	17.02		33.17
GEH	2.1		0.3
GEH Total	1.7		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	90.9	97.7	100
Screenline 2 – Waikato River Bridges			
	Forward		Back
Count	15701		11225
Volume	15639		11497
Change	-62		272
%	100		102
Correlation Coefficient	0.992		0.987
%RMS	9.25		10.55
GEH	0.4		1.8
GEH Total	0.9		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	90.9	100	100
Screenline 3 – Hamilton Model External Cordon			
	Forward		Back
Count	4404		3792
Volume	4706		3423
Change	302		-369
%	107		90
Correlation Coefficient	0.990		0.986
%RMS	16.91		16.21
GEH	3.2		4.4
GEH Total	0.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	83.3	100	100
Screenline 4 – Waikato Model External Cordon			
	Forward		Back
Count	4578		4439
Volume	4681		4502
Change	103		63
%	102		101
Correlation Coefficient	0.979		0.934
%RMS	24.91		38.21
GEH	1.1		0.7
GEH Total	1.2		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	85.7	100	100

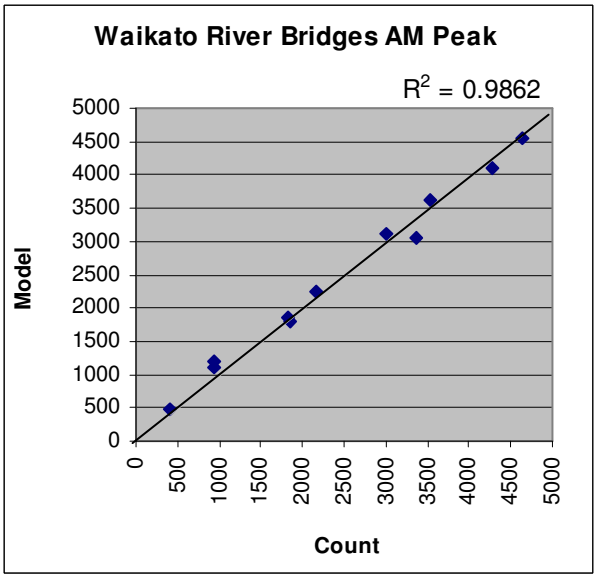
Morning Peak Network Screenline Validation			Table 8 Cont.
Screenline 5 – Rest of Hamilton			
	Forward	Back	
Count	3265	3881	
Volume	3426	3775	
Change	161	-106	
%	105	97	
Correlation Coefficient	0.925	0.987	
%RMS	32.83	16.27	
GEH	2.0	1.2	
GEH Total	0.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	83.3	91.7	100
Screenline 6 – North			
	Forward	Back	
Count	3440	3585	
Volume	3622	3857	
Change	182	272	
%	105	108	
Correlation Coefficient	0.986	0.994	
%RMS	23.80	32.61	
GEH	2.2	3.2	
GEH Total	3.8		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	95.5	100	100
Screenline 7 – Tauranga			
	Forward	Back	
Count	2732	3307	
Volume	2490	3134	
Change	-242	-173	
%	91	95	
Correlation Coefficient	0.848	0.989	
%RMS	34.14	13.80	
GEH	3.3	2.1	
GEH Total	3.9		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	75.0	100	100
Screenline 8 – South			
	Forward	Back	
Count	3664	3559	
Volume	3752	4615	
Change	88	1056	
%	102	130	
Correlation Coefficient	0.984	0.976	
%RMS	17.10	46.72	
GEH	1.0	11.7	
GEH Total	9.2		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	75.0	91.7	100

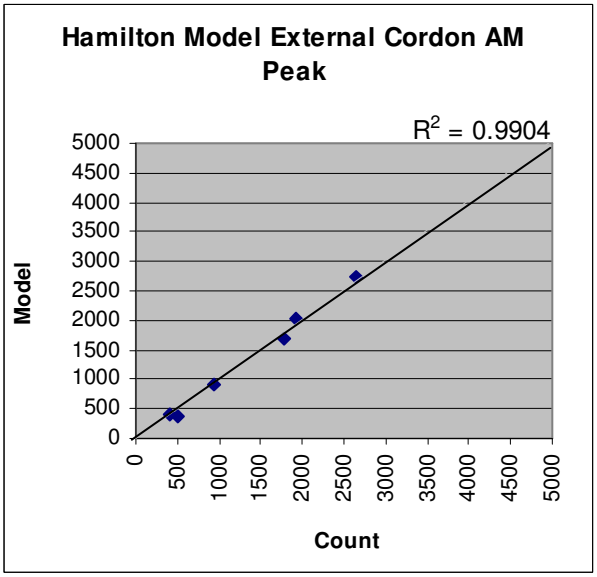
Morning Peak Network Screenline Validation			Table 8 Cont.
Screenline 9 – Total (All RSI)			
	Forward		Back
Count	41926		38389
Volume	42634		38862
Change	708		473
%	102		101
Correlation Coefficient	0.987		0.971
%RMS	18.41		22.53
GEH	2.4		1.7
GEH Total	2.9		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	88.5	98.6	100.0
Screenline 10 – Railway			
	Forward		Back
Count	11017		9091
Volume	9929		7719
Change	-1088		-1372
%	90		85
Correlation Coefficient	0.931		0.911
%RMS	27.67		33.30
GEH	7.5		10.6
GEH Total	12.7		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	50.0	88.9	94.4
Screenline 11 – East			
	Forward		Back
Count	1547		2581
Volume	1193		2661
Change	-354		80
%	77		103
Correlation Coefficient	0.969		0.955
%RMS	4072		22.02
GEH	6.8		1.1
GEH Total	3.1		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	83.3	100	100
Screenline 12 – North			
	Forward		Back
Count	5994		7568
Volume	5487		8061
Change	-507		493
%	92		107
Correlation Coefficient	0.979		0.896
%RMS	17.95		31.07
GEH	4.7		3.9
GEH Total	0.1		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	64.3	92.9	100.0

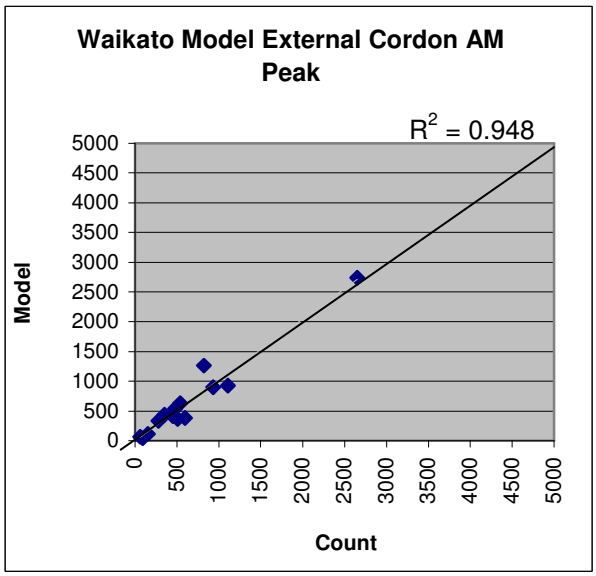
Morning Peak Network Screenline Validation			Table 8 Cont.
Screenline 13 – South			
	Forward		Back
Count	8037		4860
Volume	8135		4903
Change	98		43
%	101		101
Correlation Coefficient	0.960		0.948
%RMS	18.95		17.97
GEH	0.8		0.4
GEH Total	0.9		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	80.0	100	100
Screenline 14 – Cambridge Counts			
	Forward		Back
Count	3392		3558
Volume	3171		3570
Change	-221		12
%	93		100
Correlation Coefficient	0.999		1.000
%RMS	11.12		6.53
GEH	2.7		0.1
GEH Total	1.8		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
Screenline 15 – Te Awamutu Counts			
	Forward		Back
Count	3241		2784
Volume	3569		2830
Change	328		46
%	110		102
Correlation Coefficient	0.992		0.991
%RMS	22.39		13.09
GEH	4.0		0.6
GEH Total	3.4		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
Screenline 16 – Bombay Hills			
	Forward		Back
Count	2675		2495
Volume	2874		2776
Change	199		281
%	107		111
Correlation Coefficient	1.000		1.000
%RMS	11.90		16.51
GEH	2.7		3.9
GEH Total	4.6		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100

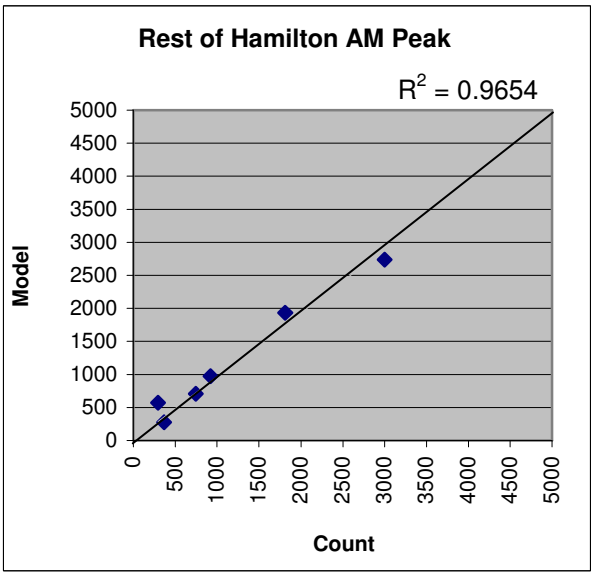
Morning Peak Network Screenline Validation			Table 8 Cont.
Screenline 17 – Crossing btw Waikato and BOP			
	Forward	Back	
Count	2421	2836	
Volume	1920	2687	
Change	-501	-149	
%	79	95	
Correlation Coefficient	0.948	0.958	
%RMS	39.13	25.07	
GEH	7.6	2.0	
GEH Total	6.6		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	70.0	100	100
Screenline 18 – North Waikato Lateral			
	Forward	Back	
Count	1790	1855	
Volume	1855	2451	
Change	65	596	
%	104	132	
Correlation Coefficient	0.982	0.999	
%RMS	15.04	61.57	
GEH	1.1	9.1	
GEH Total	7.4		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	87.5	100	100
Screenline 19 – Coromandel Peninsula			
	Forward	Back	
Count	284	440	
Volume	220	414	
Change	-64	-26	
%	77	94	
Correlation Coefficient	-1.000	1.000	
%RMS	52.59	17.55	
GEH	2.9	0.9	
	2.4		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
All WRTM Cordons			
	Forward	Back	
Count	79573	73199	
Volume	78944	73720	
Change	-629	521	
%	99	101	
Correlation Coefficient	0.979	0.957	
%RMS	21.30	25.98	
GEH	1.6	1.4	
	0.2		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	84.7	97.9	99.6

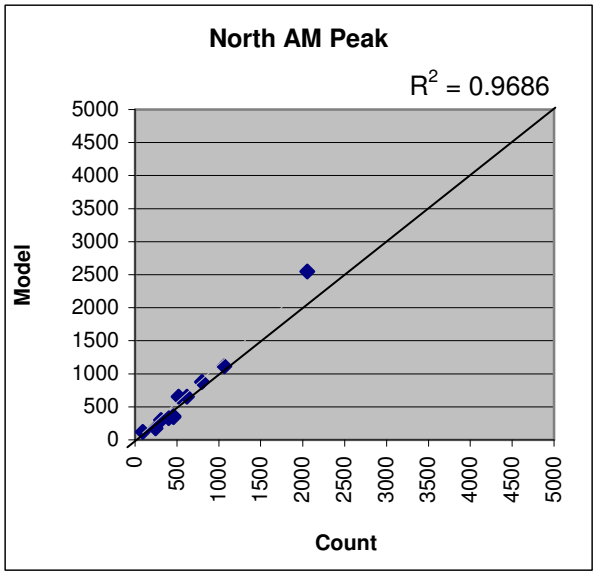












Waikato Regional Transportation Model	**Morning Peak Screenline Scatterplots**	**Figure 6**
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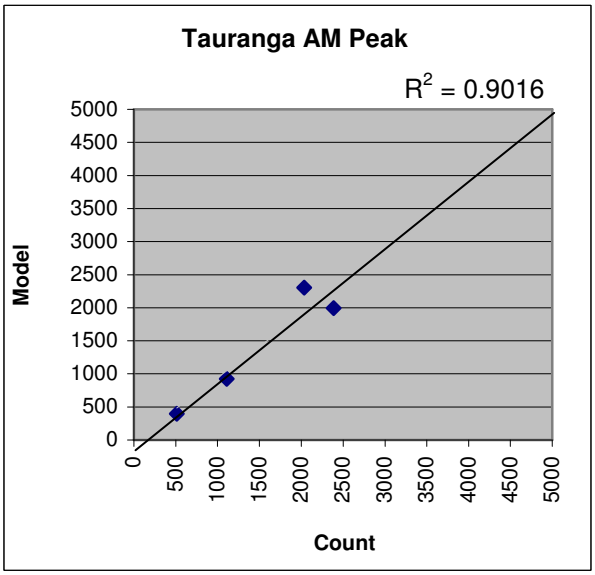
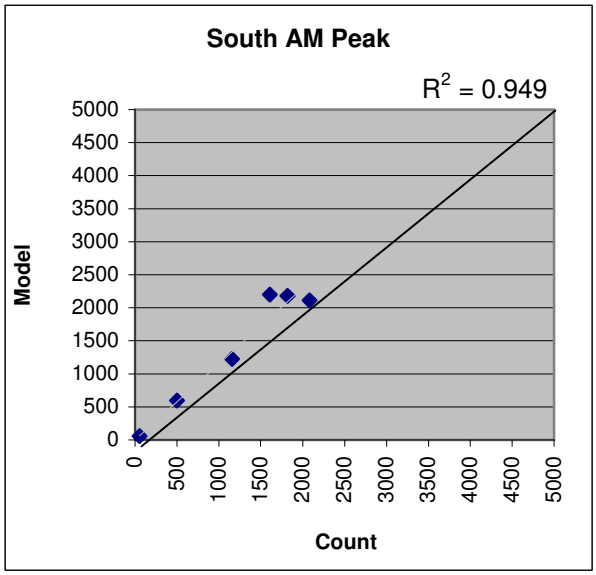
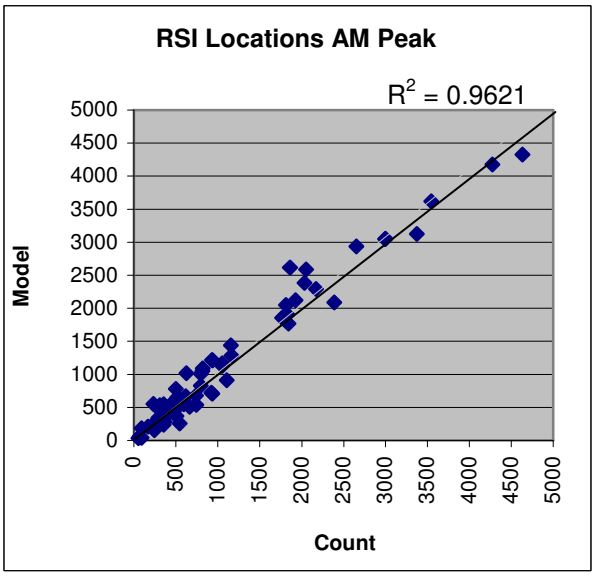
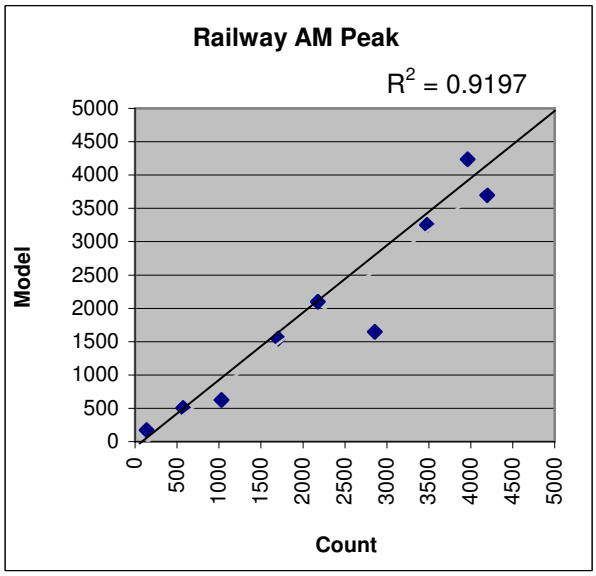
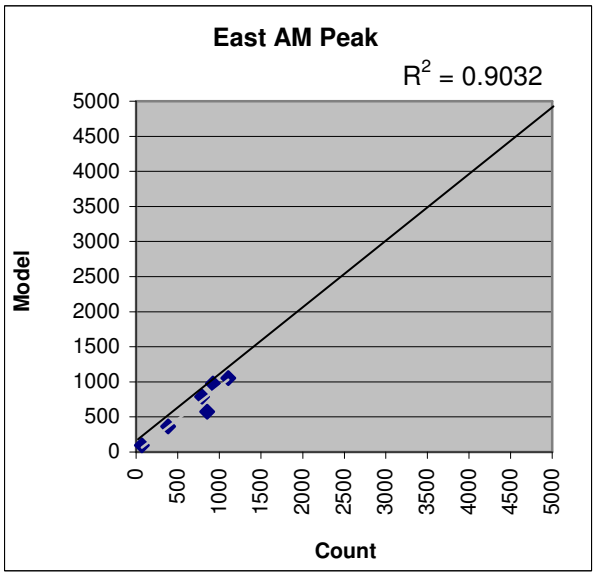
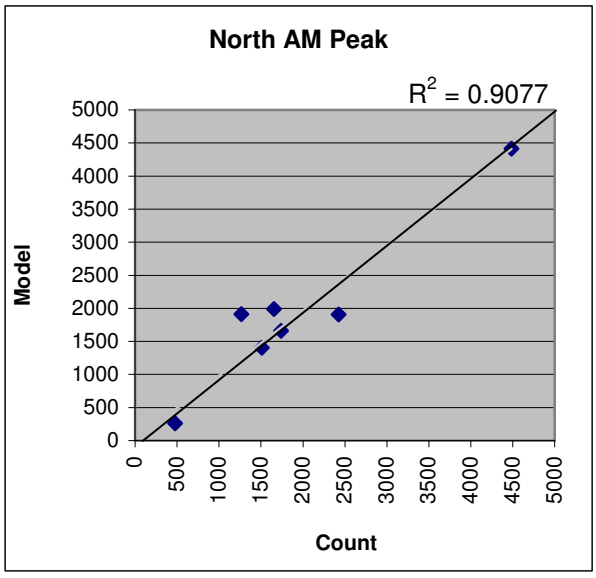




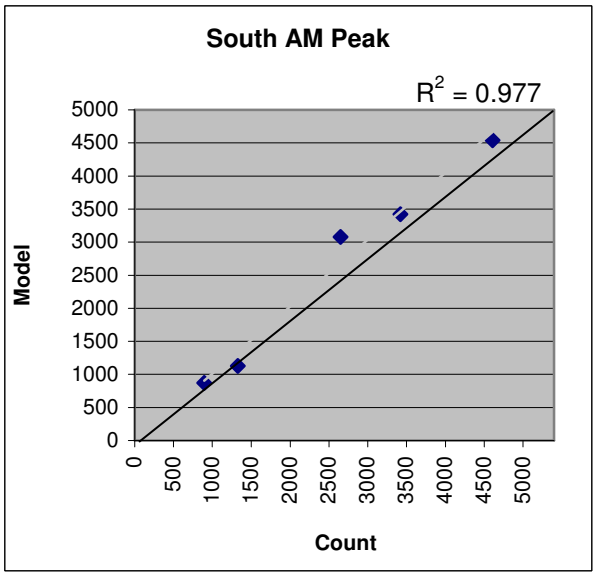


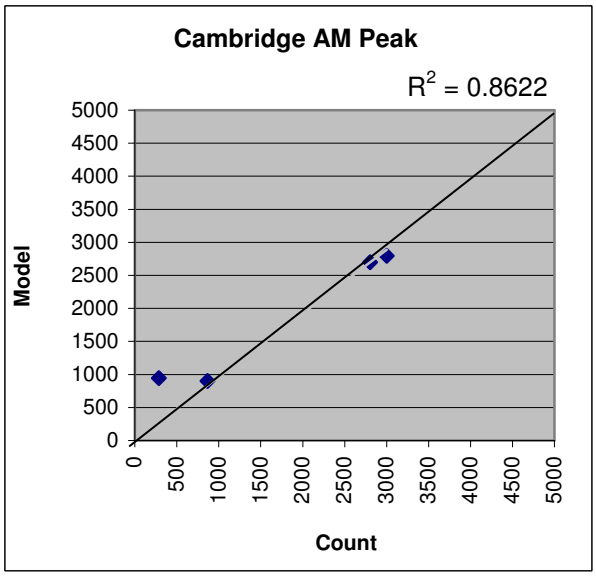


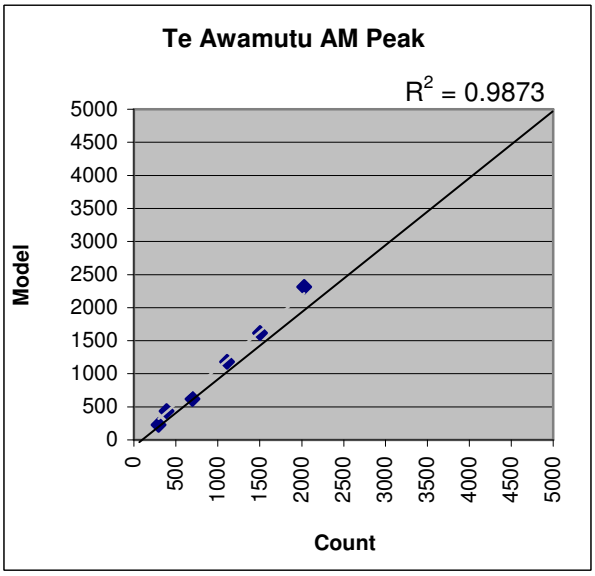


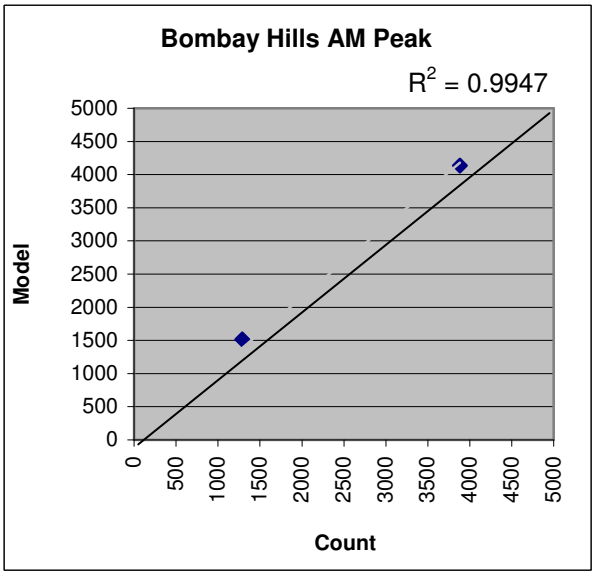


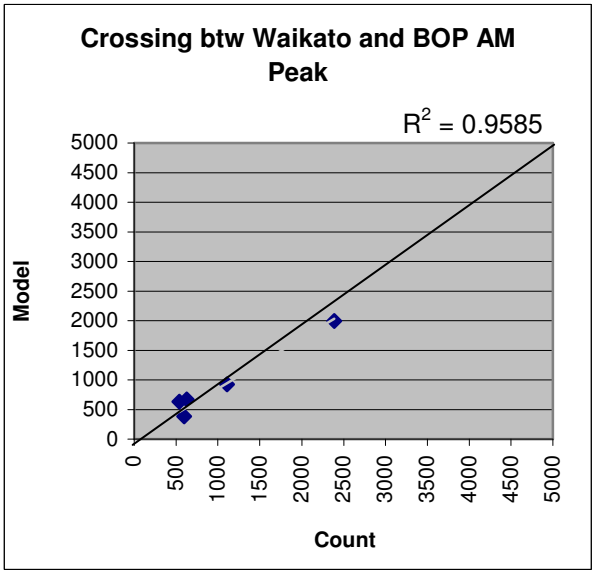
Waikato Regional Transportation Model Gabites Porter Consultants	**Morning Peak Screenline Scatterplots**	Figure 6 Cont.

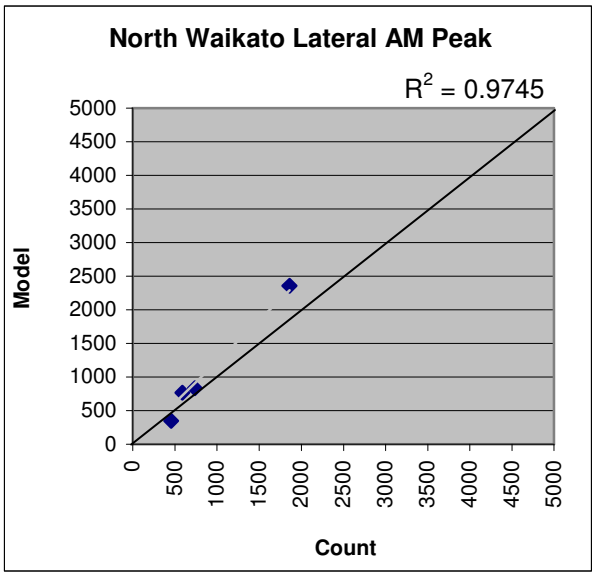




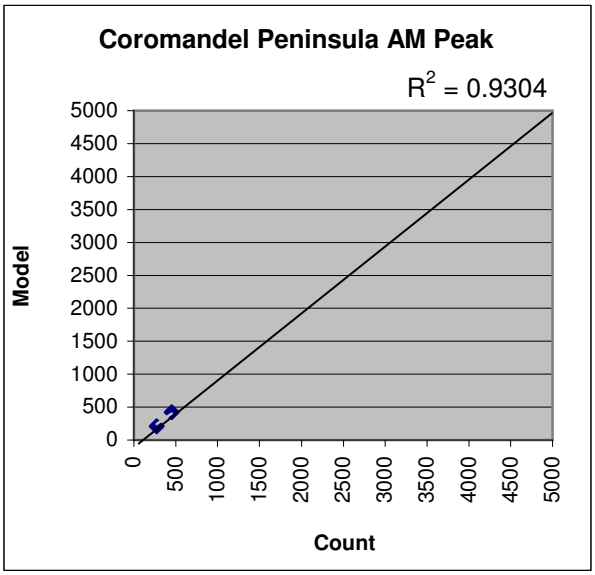








Waikato Regional Transportation Model Gabites Porter Consultants	**Morning Peak Screenline Scatterplots**	Figure 6 Cont.



Waikato Regional Transportation Model Gabites Porter Consultants	**Morning Peak Screenline Scatterplots**	Figure 6 Cont.

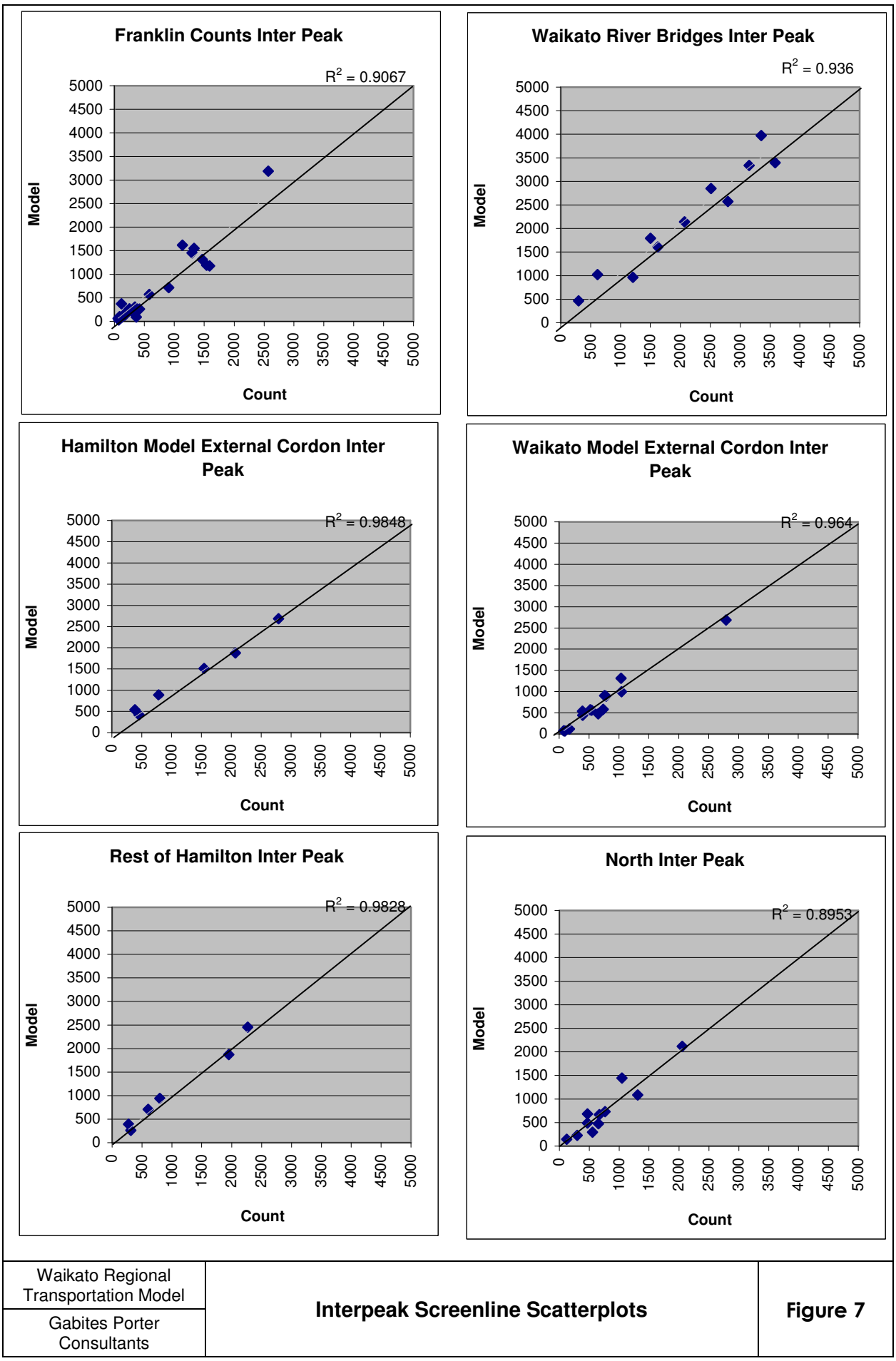
Interpeak Network Screenline Validation			Table 9
Screenline 1 – Franklin Counts			
	Forward		Back
Count	7483		7705
Volume	7061		8019
Change	-422		314
%	94		104
Correlation Coefficient	0.937		0.959
%RMS	41.58		34.35
GEH Total	3.5		2.5
GEH Total	0.6		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	77.3	97.7	100
Screenline 2 – Waikato River Bridges			
	Forward		Back
Count	11146		11579
Volume	11587		12540
Change	441		961
%	104		108
Correlation Coefficient	0.944		0.966
%RMS	17.79		18.44
GEH	2.9		6.2
GEH Total	6.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	68.2	100	100
Screenline 3 – Hamilton Model External Cordon			
	Forward		Back
Count	4049		3985
Volume	3817		4107
Change	-232		122
%	94		103
Correlation Coefficient	0.994		0.991
%RMS	12.44		11.89
GEH	2.6		1.4
GEH Total	0.9		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
Screenline 4 – Waikato Model External Cordon			
	Forward		Back
Count	4929		5065
Volume	5114		5103
Change	185		38
%	104		101
Correlation Coefficient	0.970		0.981
%RMS	22.94		18.67
GEH	1.9		0.4
GEH Total	1.6		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	92.9	100	100

Interpeak Network Screenline Validation			Table 9 Cont.
Screenline 5 – Rest of Hamilton			
	Forward		Back
Count	3057		3146
Volume	3340		3289
Change	283		143
%	109		105
Correlation Coefficient	0.983		0.996
%RMS	18.72		8.73
GEH	3.6		1.8
GEH Total	3.7		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
Screenline 6 – North			
	Forward		Back
Count	4061		4357
Volume	4111		4252
Change	50		-105
%	101		98
Correlation Coefficient	0.931		0.957
%RMS	31.04		21.47
GEH	0.6		1.1
GEH Total	0.4		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	81.8	100	100
Screenline 7 – Tauranga			
	Forward		Back
Count	2719		2685
Volume	3003		2720
Change	284		35
%	110		101
Correlation Coefficient	0.993		0.990
%RMS	17.28		8.66
GEH	3.8		0.5
GEH Total	3.0		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
Screenline 8 – South			
	Forward		Back
Count	4344		4878
Volume	4707		4579
Change	363		-299
%	108		94
Correlation Coefficient	0.953		0.996
%RMS	22.59		11.40
GEH	3.8		3.1
GEH Total	0.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	91.7	100	100

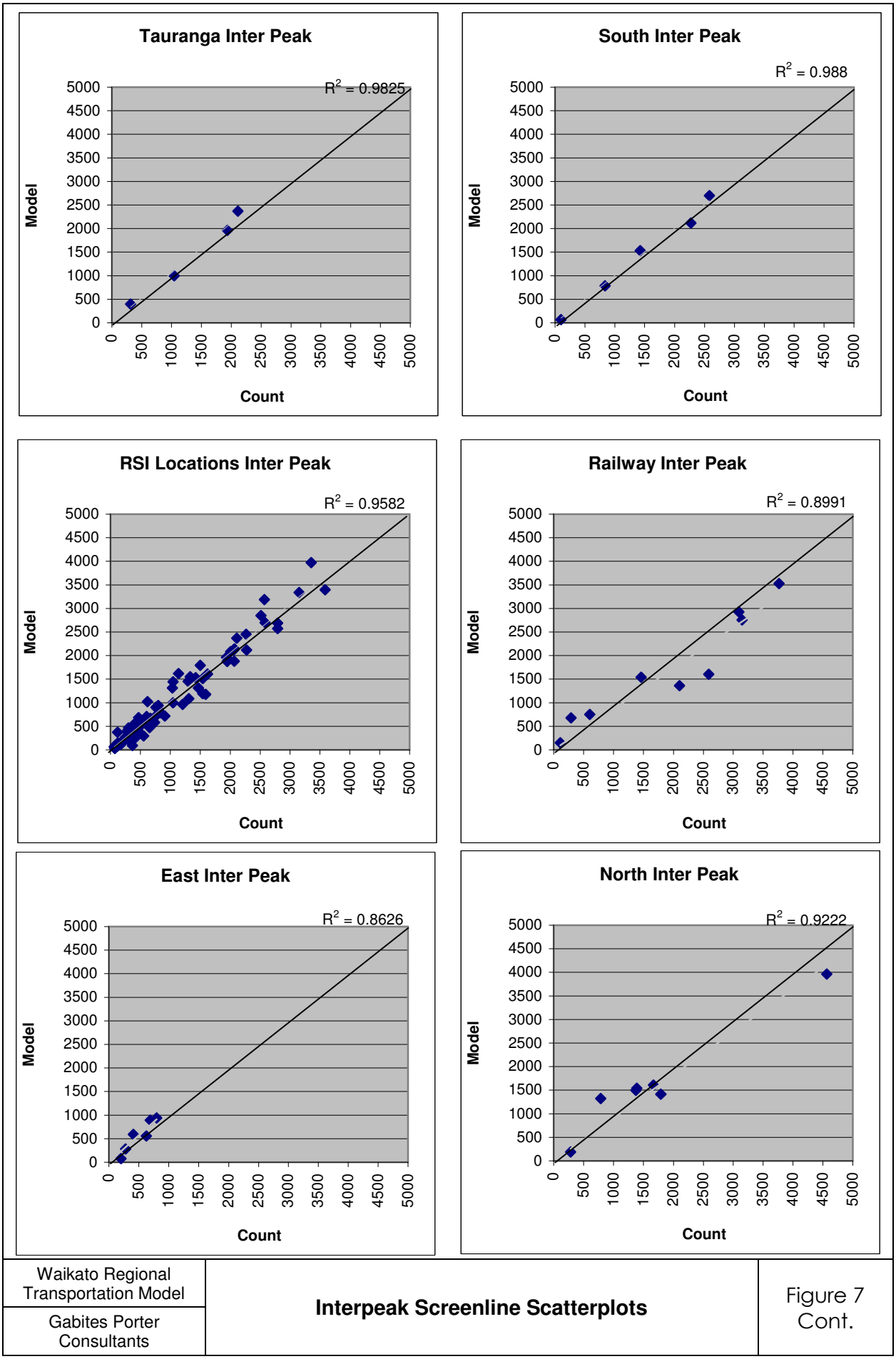
Interpeak Network Screenline Validation			Table 9 Cont.
Screenline 9 – Total (All RSI)			
	Forward		Back
Count	39279		40899
Volume	40263		41976
Change	984		1077
%	103		103
Correlation Coefficient	0.963		0.977
%RMS	24.57		20.10
GEH	3.5		3.7
GEH Total	5.1		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	84.2	99.3	100
Screenline 10 – Railway			
	Forward		Back
Count	8617		8554
Volume	7950		7336
Change	-667		-1218
%	92		86
Correlation Coefficient	0.907		0.956
%RMS	31.39		26.77
GEH	5.2		9.7
GEH Total	10.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	44.4	88.9	100
Screenline 11 – East			
	Forward		Back
Count	1475		1532
Volume	1664		1675
Change	189		143
%	113		109
Correlation Coefficient	0.876		0.970
%RMS	44.55		19.04
GEH	3.4		2.5
GEH Total	4.1		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	91.7	100	100
Screenline 12 – North			
	Forward		Back
Count	6233		5630
Volume	6044		5493
Change	-189		-137
%	97		98
Correlation Coefficient	0.980		0.964
%RMS	19.75		25.15
GEH	1.7		1.3
GEH Total	2.1		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	78.6	100	100

Inter Peak Network Screenline Validation			Table 9 Cont.
Screenline 13 – South			
	Forward		Back
Count	6253		4478
Volume	6059		5694
Change	-194		1216
%	97		127
Correlation Coefficient	0.963		0.919
%RMS	28.93		42.84
GEH	1.7		12.1
GEH Total	6.8		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	20.0	80.0	80.0
Screenline 14 – Cambridge Counts			
	Forward		Back
Count	2578		2808
Volume	3098		3035
Change	520		227
%	120		108
Correlation Coefficient	0.995		0.999
%RMS	25.71		10.33
GEH	6.9		3.0
GEH Total	6.9		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	87.5	100	100
Screenline 15 – Te Awamutu Counts			
	Forward		Back
Count	2520		2611
Volume	2870		3026
Change	350		415
%	114		116
Correlation Coefficient	0.926		0.907
%RMS	40.82		48.14
GEH	4.8		5.5
GEH Total	7.3		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	83.3	91.7	100
Screenline 16 – Bombay Hills			
	Forward		Back
Count	2837		2918
Volume	2636		2619
Change	-201		-299
%	93		90
Correlation Coefficient	1.000		1.000
%RMS	10.14		14.61
GEH	2.7		4.0
GEH Total	4.8		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100

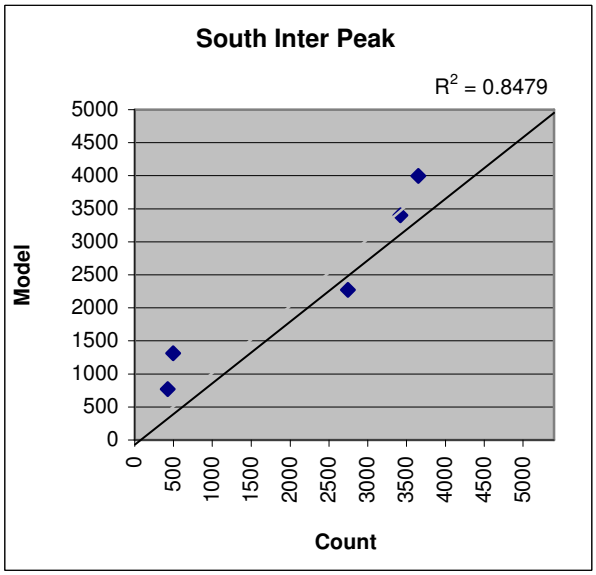
Inter Peak Network Screenline Validation			Table 9 Cont.
Screenline 17 - Crossing btw Waikato and BOP			
	Forward		Back
Count	2543		2505
Volume	2686		2720
Change	143		215
%	106		109
Correlation Coefficient	0.975		0.982
%RMS	16.27		27.25
GEH	2.0		3.0
GEH Total	3.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	80.0	100	100
Screenline 18 – North Waikato Lateral			
	Forward		Back
Count	2074		2053
Volume	2322		2195
Change	248		142
%	112		107
Correlation Coefficient	0.955		0.955
%RMS	28.77		23.14
GEH	3.7		2.2
GEH Total	4.2		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	62.5	100	100
Screenline 19 – Coromandel Peninsula			
	Forward		Back
Count	424		477
Volume	500		566
Change	76		89
%	118		119
Correlation Coefficient	1.000		1.000
%RMS	38.28		41.26
GEH	2.5		2.8
GEH Total	3.7		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
All WRTM Cordons			
	Forward		Back
Count	72010		71628
Volume	73124		73356
Change	1114		1728
%	102		102
Correlation Coefficient	0.956		0.960
%RMS	26.42		24.57
GEH	2.9		4.5
GEH Total	5.3		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	79.2	97.5	99.2

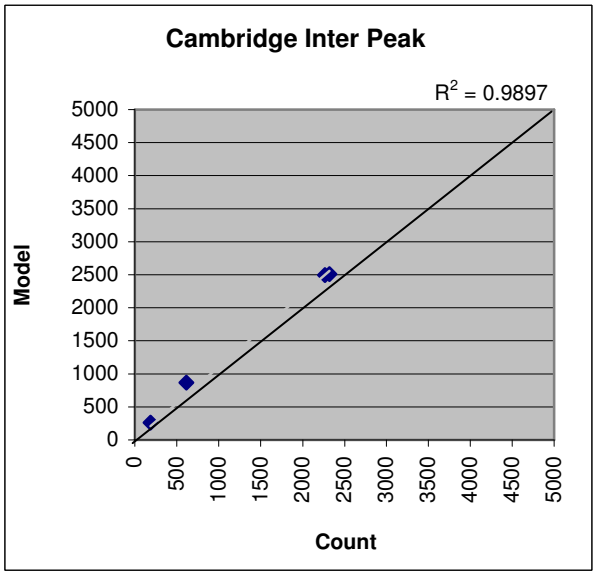


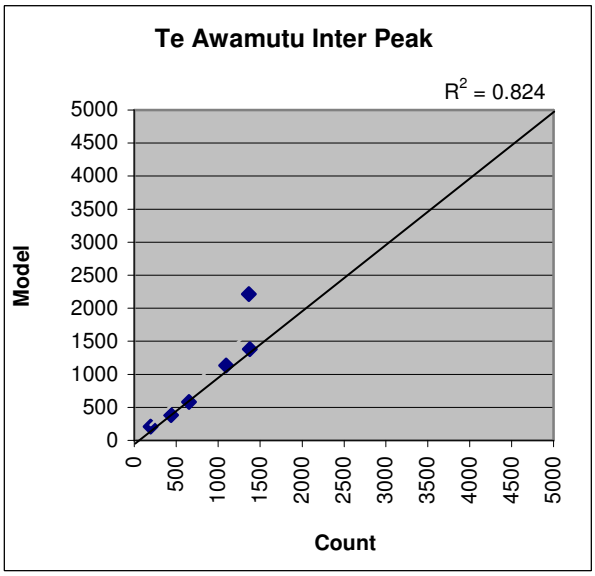
Waikato Regional Transportation Model Gabites Porter Consultants	**Interpeak Screenline Scatterplots**	**Figure 7**

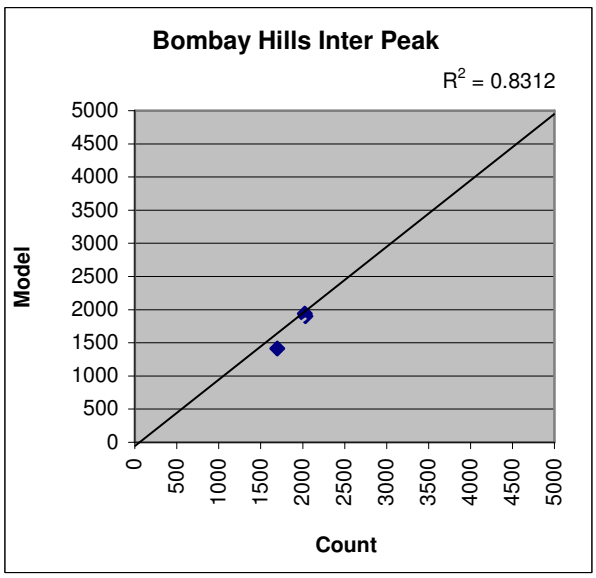


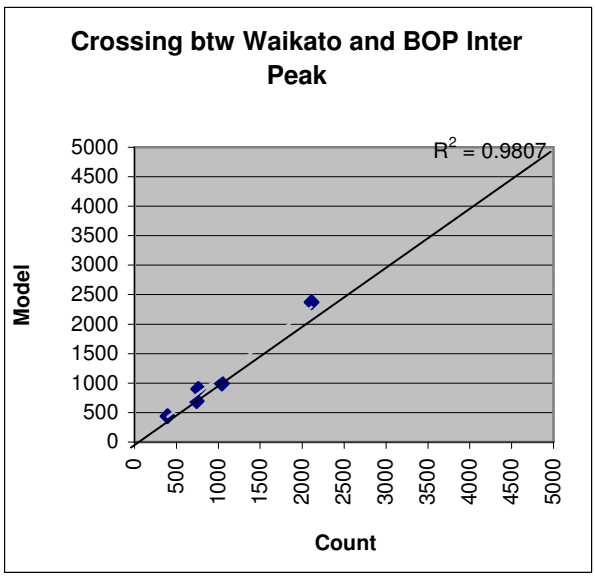
Waikato Regional Transportation Model Gabites Porter Consultants	**Interpeak Screenline Scatterplots**	Figure 7 Cont.

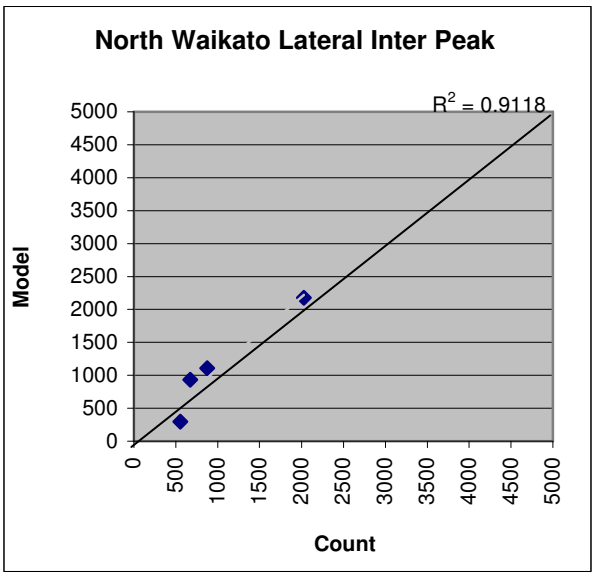




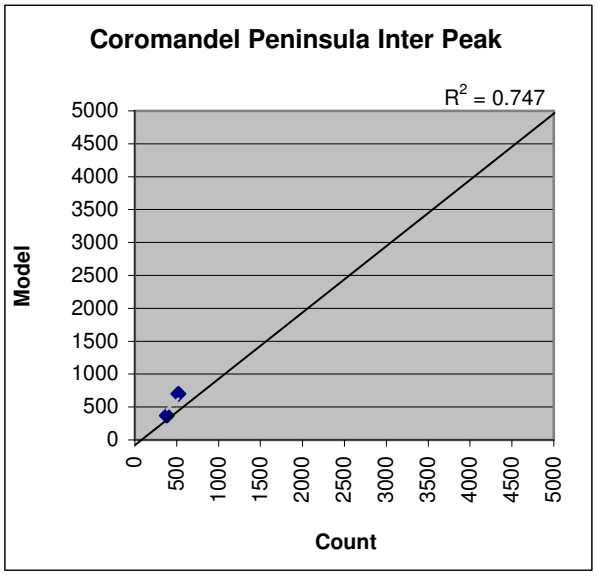








Waikato Regional Transportation Model Gabites Porter Consultants	**Interpeak Screenline Scatterplots**	Figure 7 Cont.



Waikato Regional Transportation Model Gabites Porter Consultants	**Interpeak Screenline Scatterplots**	Figure 7 Cont.

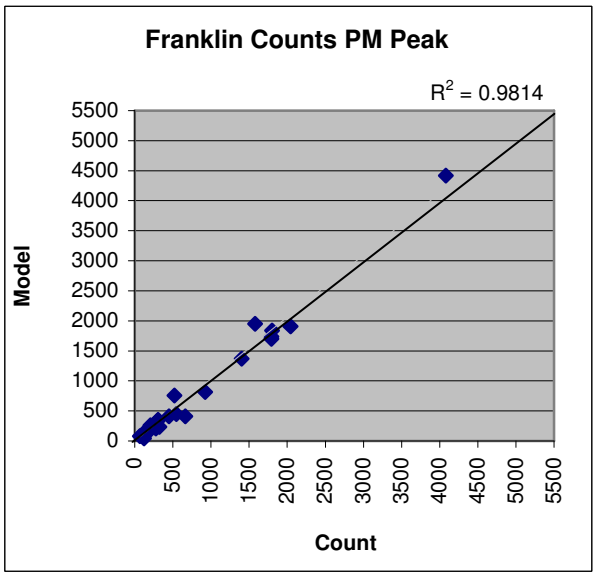
Evening Peak Network Screenline Validation			Table 10
Screenline 1 – Franklin Counts			
	Forward		Back
Count	9831		9958
Volume	9369		10513
Change	-462		555
%	95		106
Correlation Coefficient	0.961		0.991
%RMS	34.52		18.16
GEH	3.3		3.9
GEH Total	0.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	86.4	100	100
Screenline 2 – Waikato River Bridges			
	Forward		Back
Count	13753		17194
Volume	13181		18115
Change	-572		921
%	96		105
Correlation Coefficient	0.959		0.958
%RMS	15.13		19.82
GEH	3.5		4.9
GEH Total	1.4		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	72.7	100	100
Screenline 3 – Hamilton Model External Cordon			
	Forward		Back
Count	4904		5625
Volume	4855		5754
Change	-49		129
%	99		102
Correlation Coefficient	0.997		0.988
%RMS	8.66		10.65
GEH	0.5		1.2
GEH Total	0.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
Screenline 4 – Waikato Model External Cordon			
	Forward		Back
Count	5865		6116
Volume	6175		6040
Change	310		-76
%	105		99
Correlation Coefficient	0.955		0.968
%RMS	30.58		25.09
GEH	2.8		0.7
GEH Total	1.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	78.6	100	100

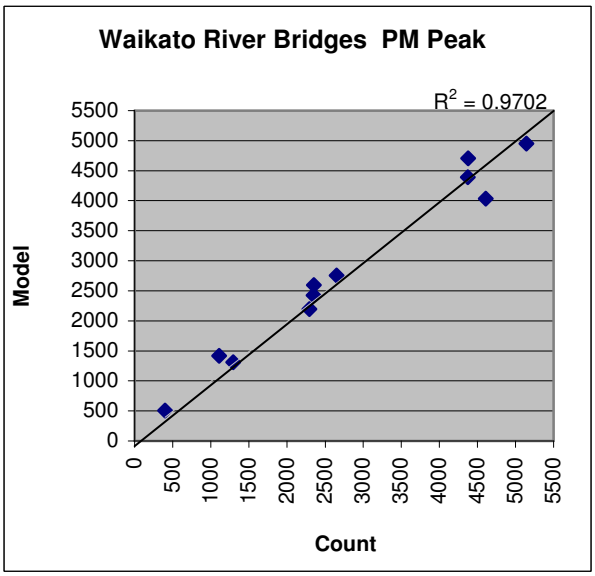
Evening Peak Network Screenline Validation			Table 10 Cont.
Screenline 5 – Rest of Hamilton			
	Forward		Back
Count	4666		3923
Volume	4754		4267
Change	88		344
%	102		109
Correlation Coefficient	0.986		0.994
%RMS	14.35		14.00
GEH	0.9		3.8
GEH Total	3.3		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	91.7	100	100
Screenline 6 – North			
	Forward		Back
Count	5005		4548
Volume	4433		3595
Change	-572		-953
%	89		79
Correlation Coefficient	0.984		0.985
%RMS	20.11		29.14
GEH	5.9		10.6
GEH Total	11.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	81.8	100	100
Screenline 7 – Tauranga			
	Forward		Back
Count	4110		3430
Volume	4241		3752
Change	131		322
%	103		109
Correlation Coefficient	0.967		0.957
%RMS	15.43		19.77
GEH	1.4		3.8
GEH Total	3.6		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	75.0	100	100
Screenline 8 – South			
	Forward		Back
Count	5454		5153
Volume	5697		4865
Change	243		-288
%	104		94
Correlation Coefficient	0.975		0.995
%RMS	17.84		9.75
GEH	2.3		2.9
GEH Total	0.3		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	91.7	100	100

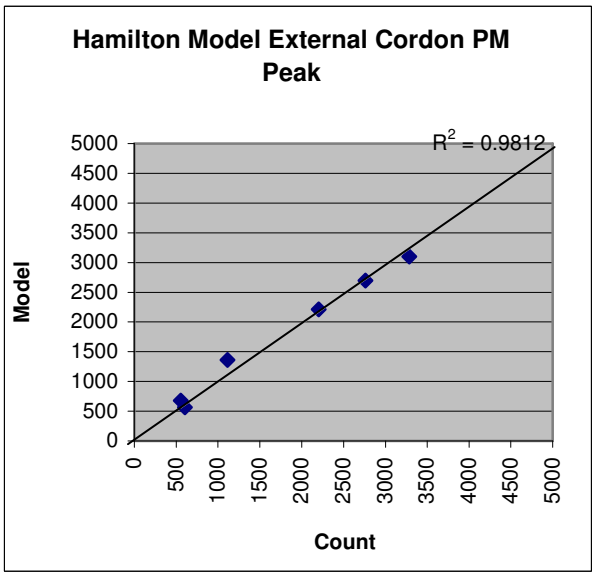
Evening Peak Network Screenline Validation			Table 10 Cont.
Screenline 9 – Total (All RSI)			
	Forward		Back
Count	50490		52559
Volume	49304		53319
Change	-1186		760
%	98		101
Correlation Coefficient	0.973		0.980
%RMS	20.31		20.65
GEH	3.8		2.3
GEH Total	0.9		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	84.2	100	100
Screenline 10 – Railway			
	Forward		Back
Count	10368		11603
Volume	10453		10224
Change	85		-1379
%	101		88
Correlation Coefficient	0.820		0.944
%RMS	39.85		24.66
GEH	0.6		9.3
GEH Total	6.3		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	55.6	83.3	83.3
Screenline 11 – East			
	Forward		Back
Count	2213		2451
Volume	2407		2240
Change	194		-211
%	109		91
Correlation Coefficient	0.984		0.928
%RMS	32.55		22.74
GEH	2.9		3.1
GEH Total	0.2		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	83.3	100	100
Screenline 12 – North			
	Forward		Back
Count	9054		7291
Volume	8864		6354
Change	-190		-937
%	98		87
Correlation Coefficient	0.978		0.979
%RMS	14.55		20.91
GEH	1.4		8.0
GEH Total	6.3		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	78.6	92.9	100

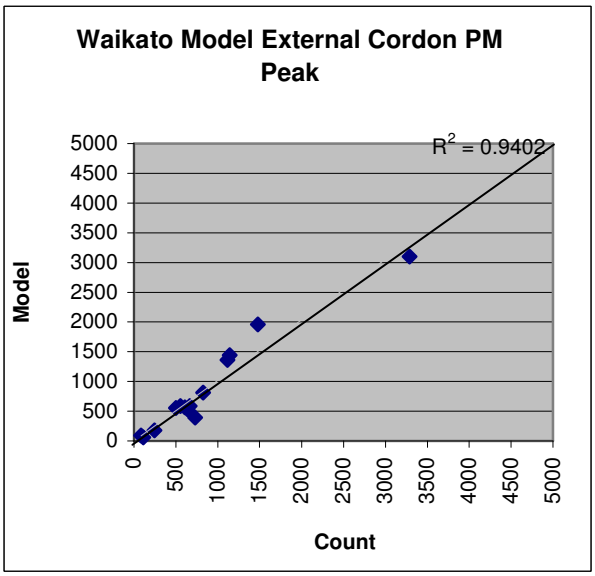
Evening Peak Network Screenline Validation			Table 10 Cont.
Screenline 13 – South			
	Forward		Back
Count	6182		8747
Volume	6155		9172
Change	-27		425
%	100		105
Correlation Coefficient	0.944		0.988
%RMS	22.80		12.54
GEH	0.3		3.2
GEH Total	2.3		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	70.0	100	100
Screenline 14 – Cambridge Counts			
	Forward		Back
Count	4069		3703
Volume	4112		3892
Change	43		189
%	101		105
Correlation Coefficient	0.996		0.983
%RMS	7.94		20.64
GEH	0.5		2.2
GEH Total	1.8		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	87.5	100	100
Screenline 15 – Te Awamutu Counts			
	Forward		Back
Count	3429		3729
Volume	3692		4469
Change	263		740
%	108		120
Correlation Coefficient	0.938		0.969
%RMS	39.89		49.04
GEH	3.1		8.2
GEH Total	8.1		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	75.0	91.7	100
Screenline 16 – Bombay Hills			
	Forward		Back
Count	3485		3737
Volume	2919		3584
Change	-566		-153
%	84		96
Correlation Coefficient	1.000		1.000
%RMS	38.28		7.07
GEH	7.1		1.8
GEH Total	6.1		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	75.0	100	100

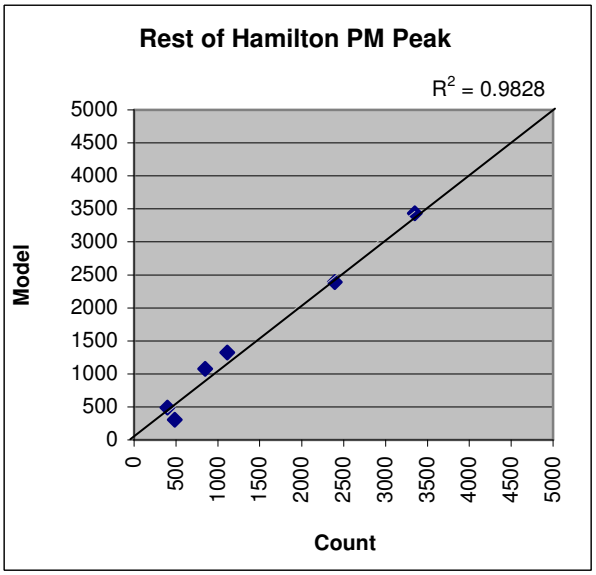
Evening Peak Network Screenline Validation			Table 10 Cont
Screenline 17 - Crossing btw Waikato and BOP			
	Forward	Back	
Count	3654	3116	
Volume	3814	2883	
Change	160	-233	
%	104	93	
Correlation Coefficient	0.968	0.913	
%RMS	22.32	28.29	
GEH	1.9	3.0	
GEH Total	0.6		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	60	100	100
Screenline 18 – North Waikato Lateral			
	Forward	Back	
Count	2558	2391	
Volume	2441	2388	
Change	-117	-3	
%	95	100	
Correlation Coefficient	0.963	0.993	
%RMS	19.85	13.21	
GEH	1.7	0.0	
GEH Total	1.2		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
Screenline 19 – Coromandel Peninsula			
	Forward	Back	
Count	577	430	
Volume	406	285	
Change	-171	-145	
%	70	66	
Correlation Coefficient	1.000	1.000	
%RMS	42.17	47.69	
GEH	5.4	5.5	
GEH Total	7.7		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	100	100	100
All WRTM Cordons			
	Forward	Back	
Count	91951	96339	
Volume	90064	95461	
Change	-1887	-878	
%	98	99	
Correlation Coefficient	0.956	0.975	
%RMS	25.03	21.41	
GEH	4.4	2.0	
GEH Total	4.5		
GEH Link Grouping	< 5	< 10	< 12
% in GEH Group	80.8	97.9	98.8

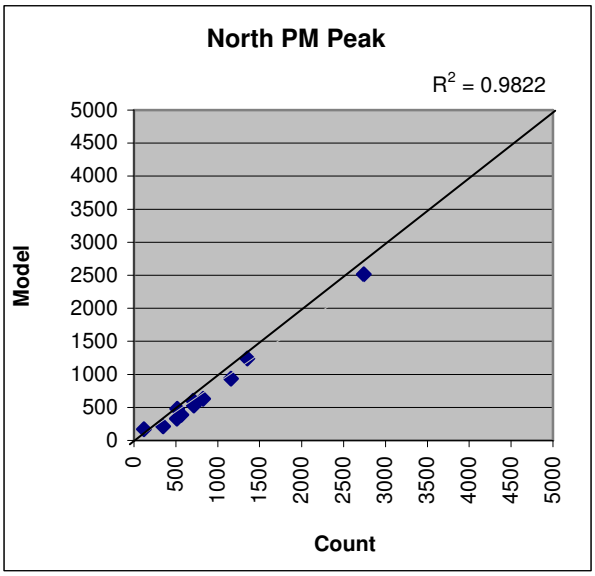




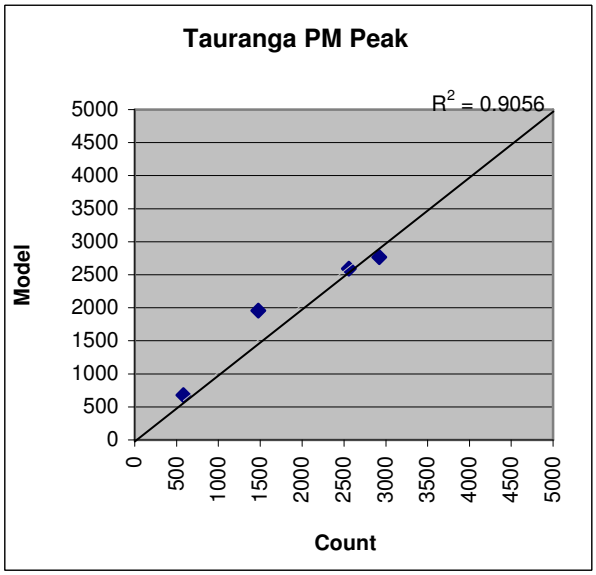


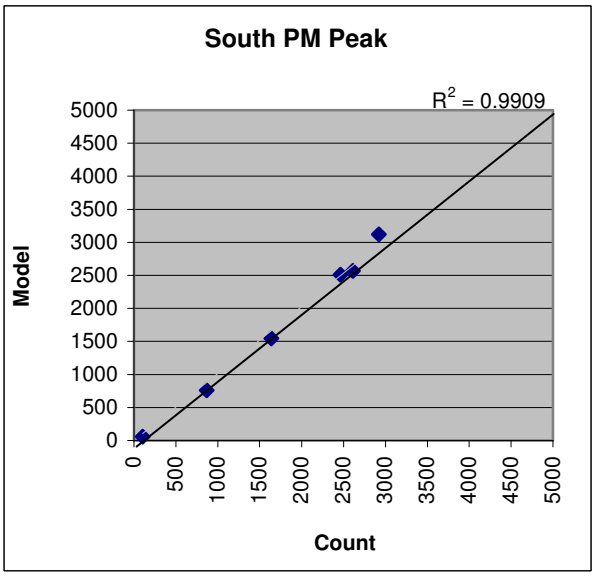


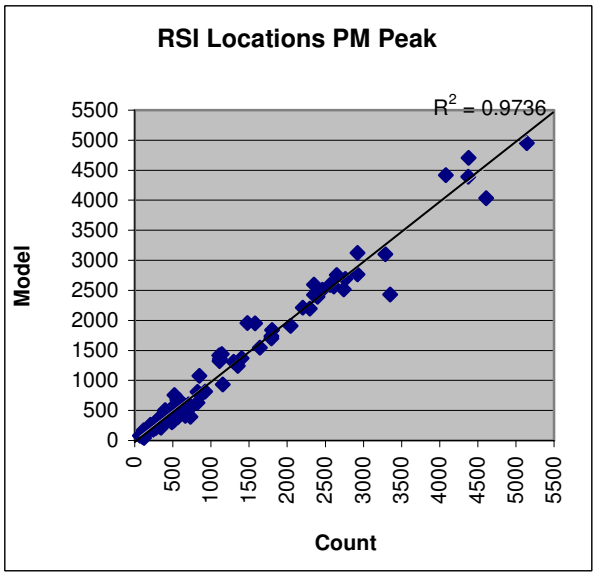


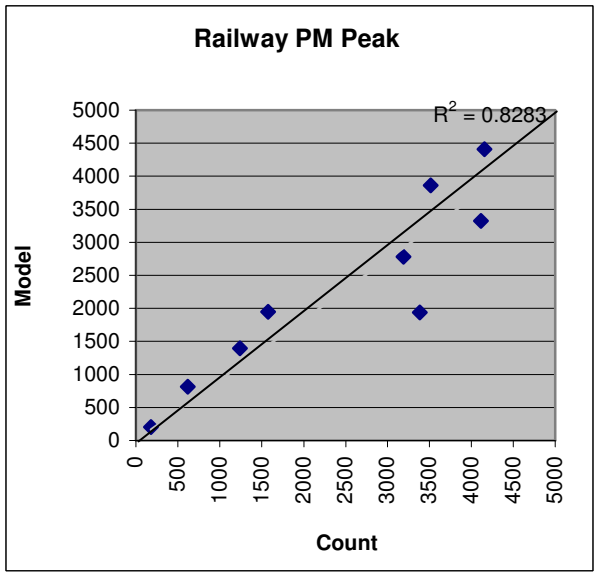


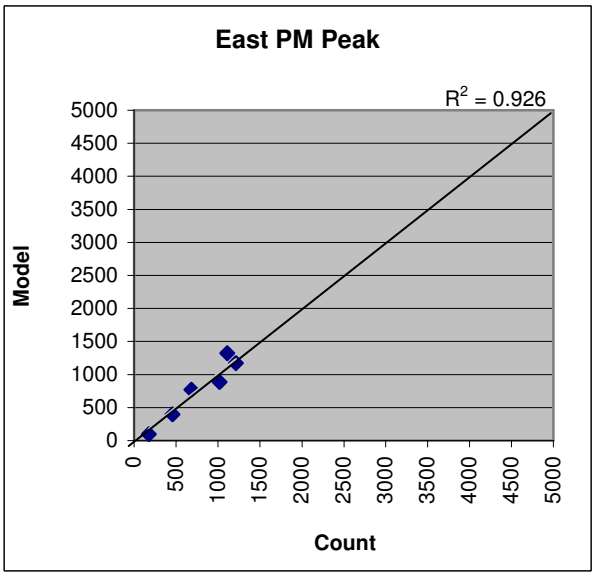
Waikato Regional Transportation Model Gabites Porter Consultants	**Evening Peak Screenline Scatterplots**	**Figure 8**

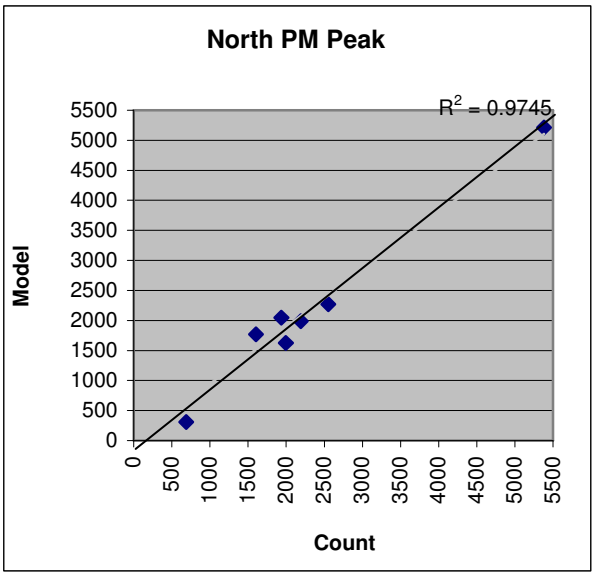




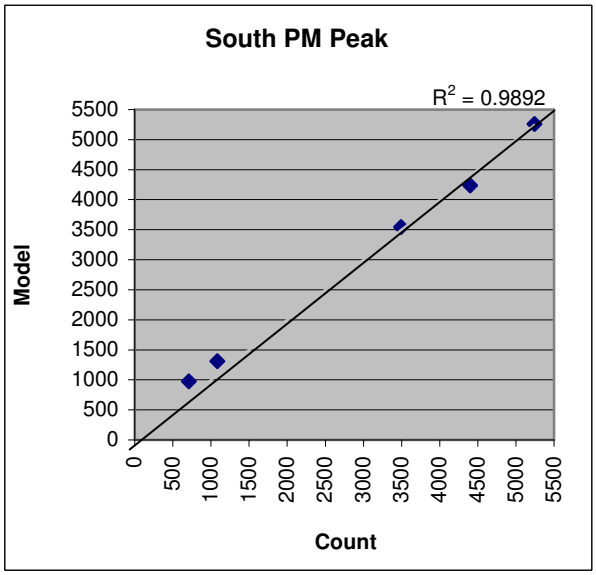


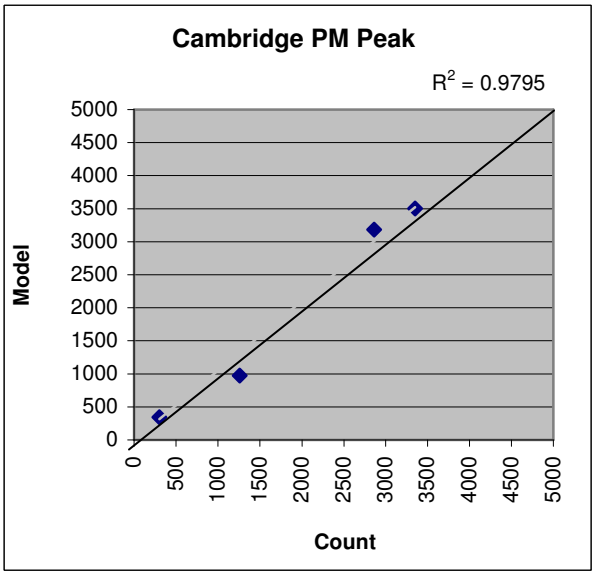


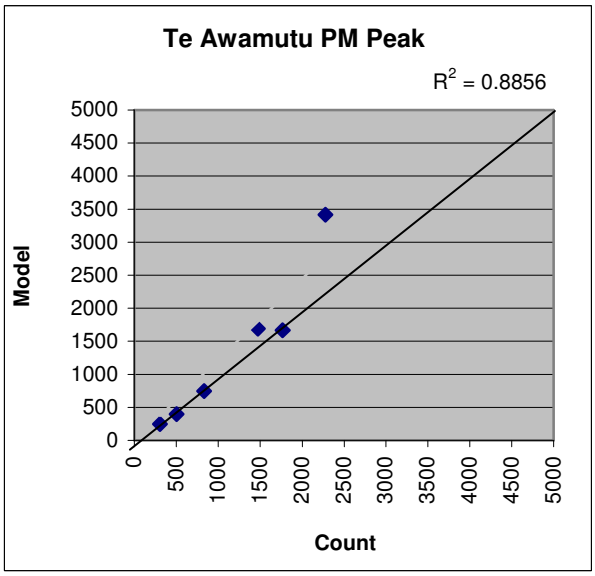


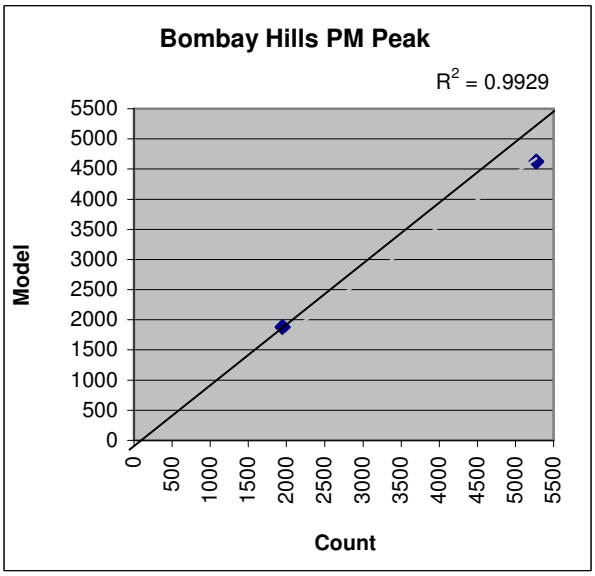


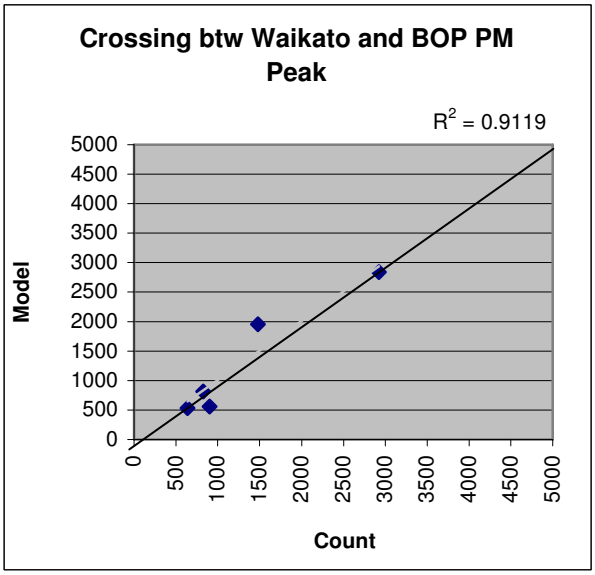
Waikato Regional Transportation Model Gabites Porter Consultants	**Evening Peak Screenline Scatterplots**	Figure 8 Cont.

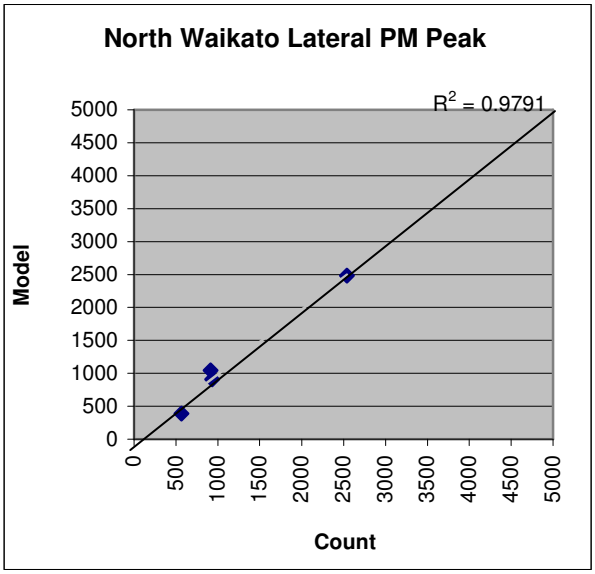




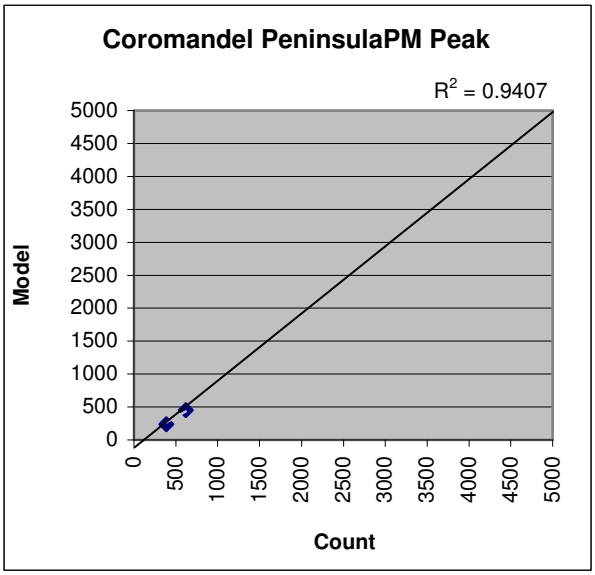








Waikato Regional Transportation Model Gabites Porter Consultants	**Evening Peak Screenline Scatterplots**	Figure 8 Cont.



Waikato Regional Transportation Model Gabites Porter Consultants	**Evening Peak Screenline Scatterplots**	Figure 8 Cont.

6. TRAVEL TIME VALIDATION

A comparison of the 3V1010 and 3V1001 modelled travel times for all urban and regional routes are presented in **Table 11** and **Table 12** respectively.

The travel time routes are shown in **Figure 9** and **Figure 10** below.

There is a slight improvement in validation quality overall in general with few instances of a lesser validation. In instances where travel times for 3V1010 are not as good as 3V1001, they still appear to be within survey error margins.

Urban Route Travel Time Validation Comparison — Table 11

AM PEAK — ACCUMULATED TIME (In Seconds)

Journey		OBSERVED Minimum	OBSERVED Average	OBSERVED Max	OBSERVED Std Dev	MODELLED (3V1010) Time	MODELLED (3V1010) Abs Diff	MODELLED (3V1010) % Diff	MODELLED (3V1001) Time	MODELLED (3V1001) Abs Diff	MODELLED (3V1001) % Diff
HAMILTON ROUTES	H1NB	1203	1379	1581	170	1438	59	4.11%	1443	64	4.45%
	H1SB	1113	1225	1399	135	1259	34	2.68%	1272	47	3.70%
	H2EB	1342	1838	2170	267	1725	113	6.54%	1713	125	7.27%
	H2WB	1520	1913	2440	344	1768	145	8.22%	1775	138	7.77%
	H3EB	545	609	693	60	611	2	0.28%	617	8	1.25%
	H3WB	642	747	1060	199	674	73	10.85%	662	85	12.81%
	H4EB	734	975	1422	273	938	37	3.94%	938	37	3.92%
	H4WB	723	824	971	100	967	143	14.77%	933	109	11.67%
	H5NB	501	612	715	84	648	36	5.59%	664	52	7.83%
	H5SB	570	631	702	55	590	41	6.91%	649	18	2.82%
	H6aEB	345	469	609	95	486	18	3.65%	442	27	6.02%
	H6aWB	281	518	755	209	562	45	7.94%	565	47	8.38%
	H6bNB	142	205	288	53	194	11	5.44%	201	4	1.84%
	H6bSB	200	212	224	19	179	33	18.26%	215	3	1.55%
	H6cEB	23	167	311	93	147	19	13.10%	146	21	14.04%
	H6cWB	100	250	310	59	218	32	14.79%	258	8	3.06%
						Mean Absolute Difference	52			49	

INTER PEAK

Journey		OBSERVED Minimum	OBSERVED Average	OBSERVED Max	OBSERVED Std Dev	MODELLED (3V1010) Time	MODELLED (3V1010) Abs Diff	MODELLED (3V1010) % Diff	MODELLED (3V1003) Time	MODELLED (3V1003) Abs Diff	MODELLED (3V1003) % Diff
HAMILTON ROUTES	H1NB	1087	1219	1325	99	1272	53	4.20%	1302	83	6.40%
	H1SB	1232	1264	1306	29	1307	43	3.32%	1239	25	2.02%
	H2EB	1601	1651	1715	47	1560	91	5.84%	1627	24	1.48%
	H2WB	1607	1797	2149	223	1595	202	12.69%	1644	153	9.32%
	H3EB	590	627	666	38	598	29	4.92%	582	45	7.71%
	H3WB	612	706	792	70	594	112	18.78%	627	79	12.52%
	H4EB	782	874	1074	120	909	35	3.87%	892	18	2.06%
	H4WB	721	772	815	36	885	113	12.78%	877	105	12.02%
	H5NB	549	663	737	79	572	91	15.94%	636	27	4.25%
	H5SB	587	650	733	63	556	95	17.04%	629	21	3.37%
	H6aEB	404	431	468	20	439	8	1.84%	430	1	0.23%
	H6aWB	379	383	387	7	430	47	11.01%	421	38	9.05%
	H6bNB	167	206	269	36	179	26	14.69%	211	6	2.61%
	H6bSB	232	257	282	38	230	28	11.98%	250	7	2.92%
	H6cEB	47	187	327	93	123	63	51.43%	153	34	22.08%
	H6cWB	144	216	324	44	201	15	7.44%	198	18	8.94%
						Mean Absolute Difference	66			43	

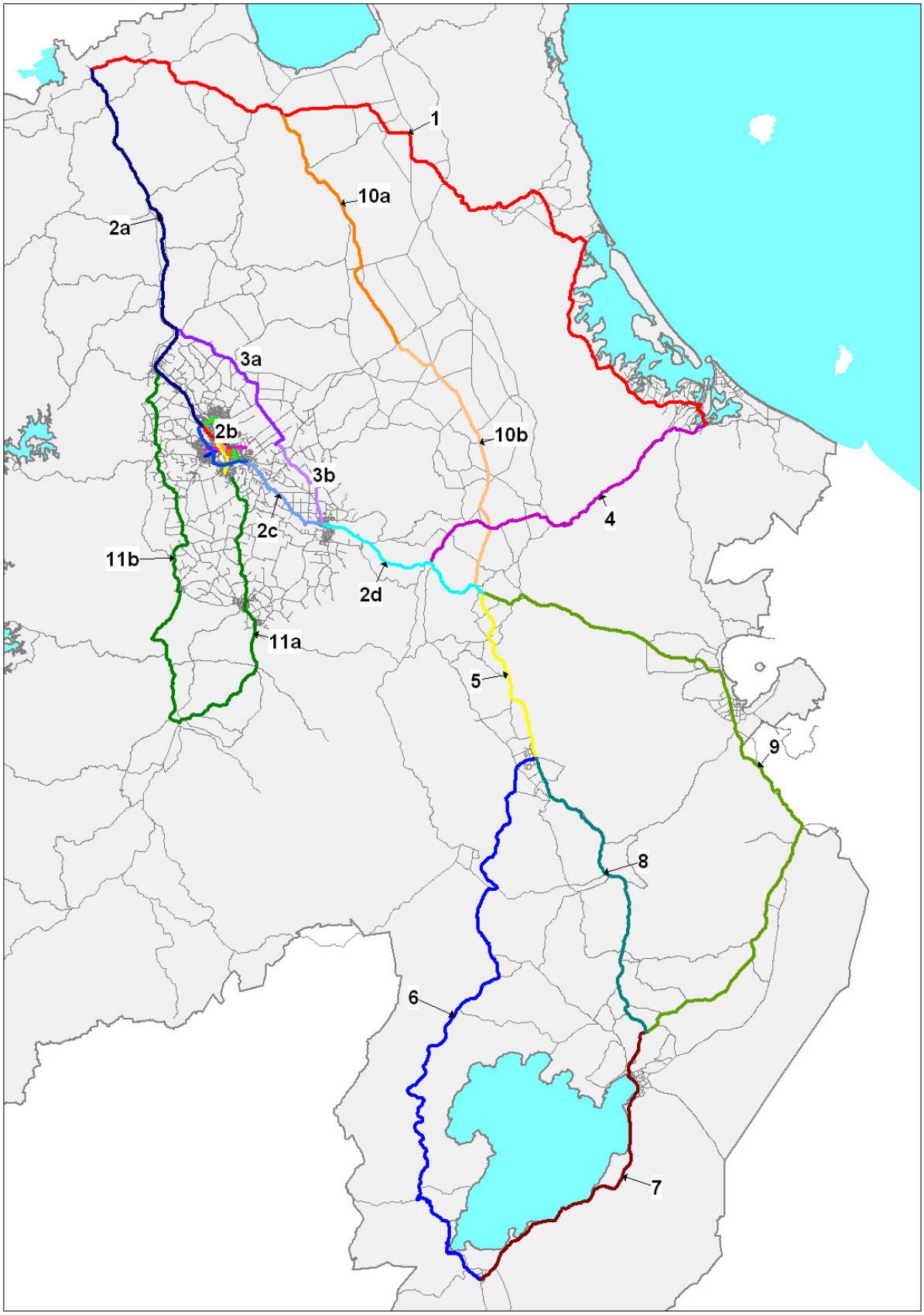
PM PEAK

Journey		OBSERVED Minimum	OBSERVED Average	OBSERVED Max	OBSERVED Std Dev	MODELLED (3V1010) Time	MODELLED (3V1010) Abs Diff	MODELLED (3V1010) % Diff	MODELLED (3V1003) Time	MODELLED (3V1003) Abs Diff	MODELLED (3V1003) % Diff
HAMILTON ROUTES	H1NB	1278	1550	1876	237	1406	144	10.22%	1467	83	5.66%
	H1SB	1362	1504	1708	158	1587	82	5.19%	1581	77	4.85%
	H2EB	1866	1926	1982	42	1824	102	5.59%	1837	89	4.86%
	H2WB	1883	2207	2591	300	1829	378	20.65%	1865	342	18.32%
	H3EB	655	767	929	112	778	11	1.39%	725	42	5.77%
	H3WB	703	787	871	71	708	79	11.12%	671	116	17.27%
	H4EB	1122	1346	1756	313	1167	180	15.41%	1175	171	14.58%
	H4WB	818	987	1074	112	1008	21	2.10%	1002	15	1.50%
	H5NB	617	703	769	63	672	31	4.58%	714	11	1.60%
	H5SB	626	714	802	65	648	67	10.30%	695	19	2.76%
	H6aEB	379	529	663	107	633	105	16.54%	656	127	19.42%
	H6aWB	615	686	783	90	514	172	33.39%	499	187	37.39%
	H6bNB	108	202	310	88	178	24	13.47%	196	6	3.21%
	H6bSB	181	218	271	47	237	19	7.88%	280	62	22.14%
	H6cEB	220	257	320	59	232	25	10.72%	237	20	8.61%
	H6cWB	161	224	303	43	203	21	10.48%	214	10	4.72%
						Mean Absolute Difference	91			86	

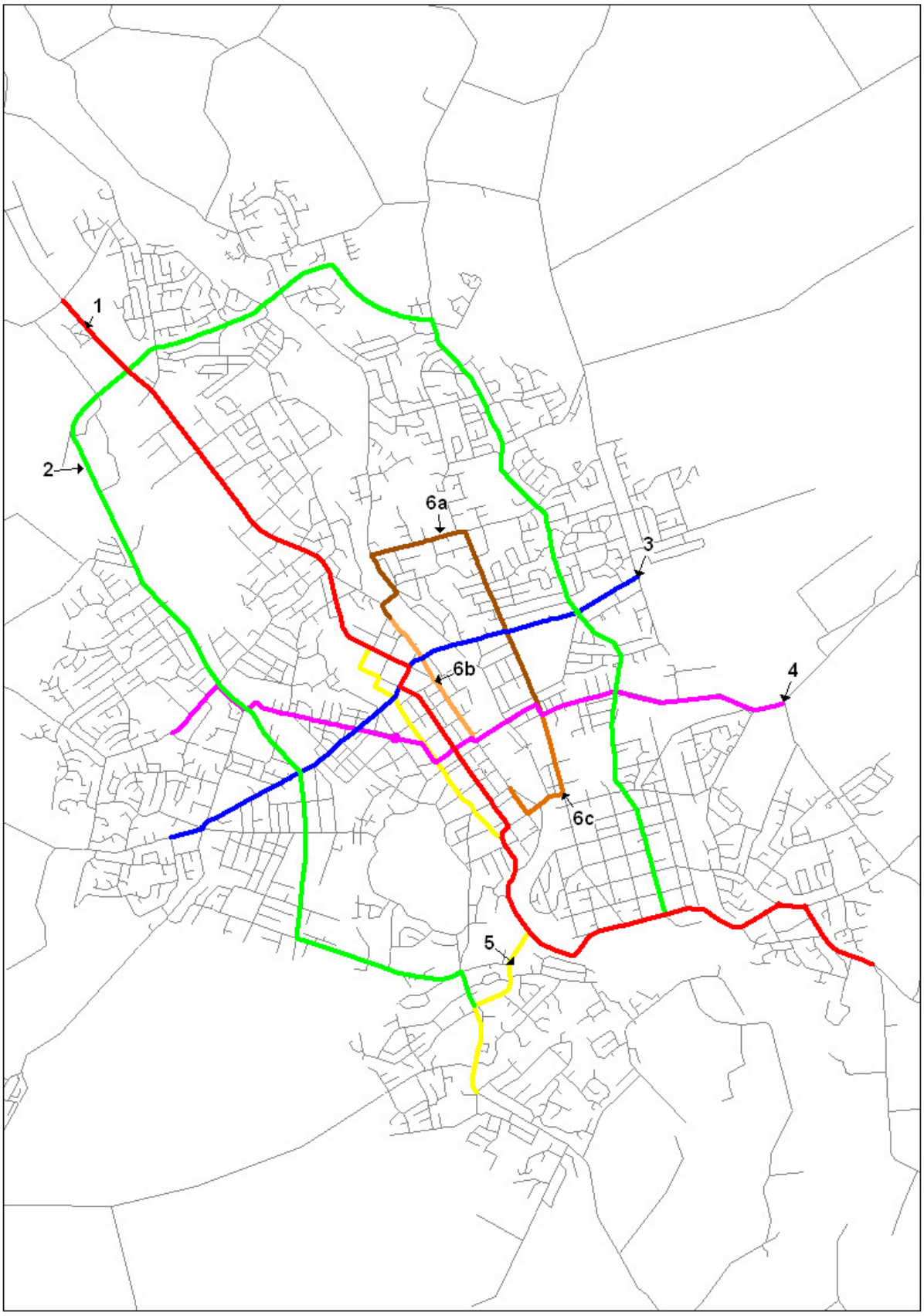
Regional Route Travel Time Validation Comparison — Table 12

24 HR Regional — **ACCUMULATED TIME (In Seconds)**

		OBSERVED				AM PEAK						INTER PEAK					
		24 HOUR				MODELLED (3V1010)			MODELLED (3V1001)			MODELLED (3V1010)			MODELLED (3V1001)		
	Journey	Minimum	Average	Max	Std Dev	TIME	ABS DIFF	% DIFF	TIME	ABS DIFF	% DIFF	TIME	ABS DIFF	% DIFF	TIME	ABS DIFF	% DIFF
REGIONAL ROUTES	R1EB SH2	6545	6904	7151	299	6895	9	0.13%	7007	103	1.49%	6839	65	0.94%	6926	22	0.32%
	R1WB SH2	6845	6869	6893	31	6964	95	1.37%	7035	166	2.42%	6845	24	0.35%	6926	57	0.84%
	R2aNB SH1	2842	2909	2964	61	2834	75	2.64%	2810	99	3.40%	2856	53	1.81%	2836	73	2.51%
	R2aSB SH1	2807	2903	2999	126	2921	17	0.59%	2816	87	3.01%	2849	54	1.86%	2811	92	3.18%
	R2cNB SH1	688	735	768	29	694	41	5.89%	712	23	3.12%	683	52	7.09%	696	39	5.30%
	R2cSB SH1	692	729	786	38	690	39	5.62%	692	37	5.02%	692	36	4.96%	689	40	5.44%
	R2dNB SH1	1225	1483	2045	201	1398	85	6.09%	1456	27	1.82%	1394	89	6.00%	1445	38	2.56%
	R2dSB SH1	1197	1465	1769	158	1335	130	9.72%	1441	24	1.63%	1391	74	5.02%	1437	28	1.90%
	R3aNB SH1B	1197	1264	1379	104	1290	26	2.00%	1340	76	6.01%	1293	29	2.31%	1341	77	6.09%
	R3aSB SH1B	1149	1253	1405	132	1284	31	2.44%	1351	98	7.82%	1275	22	1.79%	1346	93	7.42%
	R3bNB SH1B	769	816	862	56	757	59	7.77%	796	20	2.47%	758	58	7.14%	795	21	2.59%
	R4EB SH29	2583	2600	2617	24	2548	51	2.00%	2570	30	1.14%	2541	58	2.24%	2553	47	1.79%
	R4WB SH29	2430	2553	2772	184	2436	117	4.80%	2529	24	0.95%	2532	21	0.82%	2529	24	0.95%
	R5NB SH1	1308	1395	1538	105	1352	43	3.21%	1351	44	3.17%	1352	43	3.08%	1351	44	3.17%
	R5SB SH1	1268	1355	1510	91	1346	9	0.70%	1346	9	0.69%	1346	9	0.67%	1345	10	0.77%
	R6NB SH32	4682	5039	5358	338	5129	90	1.75%	5132	93	1.84%	5135	96	1.90%	5133	94	1.86%
	R6SB SH32	5020	5138	5256	165	5131	7	0.13%	5133	5	0.10%	5135	4	0.07%	5134	4	0.08%
	R7NB SH1	2665	2668	2671	2	2612	56	2.15%	2668	0	0.01%	2634	35	1.30%	2681	13	0.47%
	R7SB SH1	2508	2710	2863	95	2635	75	2.83%	2680	30	1.11%	2627	83	3.05%	2673	37	1.36%
	R8NB SH1	2076	2076	2076	0	2017	59	2.91%	2073	3	0.14%	2065	11	0.53%	2081	5	0.24%
	R9NB SH5	4865	5111	5357	336	5137	25	0.49%	5143	32	0.62%	5158	46	0.91%	5154	43	0.83%
	R9SB SH5	5052	5161	5332	142	5185	24	0.46%	5210	49	0.95%	5110	52	1.00%	5137	24	0.47%
	R10aNB SH27	1640	1731	1838	100	1699	31	1.84%	1702	29	1.66%	1703	28	1.59%	1706	25	1.43%
	R10aSB SH27	1663	1740	1869	113	1701	39	2.29%	1706	34	1.95%	1698	42	2.41%	1702	38	2.18%
	R10bNB SH27	1992	2079	2166	113	2016	63	3.14%	2081	2	0.10%	2018	61	2.95%	2080	1	0.05%
	R10bSB SH27	2030	2139	2284	118	1988	152	7.64%	2089	50	2.36%	1985	154	7.21%	2081	58	2.73%
	R11aNB SH3	2308	2415	2522	146	2370	44	1.88%	2396	19	0.78%	2354	61	2.54%	2374	41	1.69%
	R11aSB SH3	2319	2372	2423	52	2352	20	0.87%	2369	3	0.13%	2363	9	0.37%	2376	4	0.17%
	R11bNB SH39	2828	2876	2942	59	2924	48	1.66%	2880	4	0.14%	2925	49	1.70%	2881	5	0.18%
	R11bSB SH39	2903	2906	2909	4	2833	73	2.58%	2894	12	0.41%	2942	36	1.26%	2898	8	0.27%
						Mean Absolute Difference		54	n Absolute Difference		41			48			37



Waikato Regional Transportation Model Gabites Porter Consultants	**Regional Surveyed Travel Time Routes in Waikato Study Area (R1-R11B)**	**Figure 9**



Waikato Regional Transportation Model Gabites Porter Consultants	**Hamilton Surveyed Travel Time Routes (H1-H6c)**	**Figure 10**