1. INTRODUCTION

This technical note outlines the process for calculating category model variables in the 2021 and 2041 Waikato Regional Transport Model future landuse files.

The three category model landuse variables are:

- -persons per household
- -number of employed persons per household
- -number of vehicles available to each household

This note also includes the analysis to determine external traffic growth and provides a summary of the future landuse totals. All other aspects of the future landuse development process have been managed by Latitude Planning Services and have not been reported herein.

The do minimum roading works to be included in the future models, as supplied by the Client have also be reported herein.

2. PERSONS PER HOUSEHOLD

The derivation of the number of persons per household is based exclusively on occupied household and usually resident population targets for each Territorial Local Authority (TLA) as supplied by Latitude Planning Services.

The following procedure is then applied to each TLA are as follows:

1. Calculate the target number of persons per household for the future year based on the target number of persons and households as supplied.

2. For households which existed in 2006 in each zone in the subregion, factor the 2006 number of persons per household up or down (on a zone by zone basis) by multiplying by the future year target persons per HH (i.e. the target for the entire sub-region) and then divide by the base year persons per HH (i.e. for the entire sub-region). A check has then applied to ensure that for existing households added up across all zones, the total number of persons per household matches the corresponding future year target.

3. For all new households in each zone in the subregion, apply the future year target persons per HH (i.e. the target for the entire sub-region).

4. For each zone calculate the final persons per household value for the future year, which is weighted sum of the existing households (from step 2) and new households (from step 3). A check has then applied to ensure that for all households added up across all zones, the total number of persons matches the corresponding future year target.

3.   EMPLOYEES PER HOUSEHOLD

The derivation of the number of employees per household has been based on the assumption that the number of employed persons per job in the future years is in the same ratio as the number of employed persons per job in 2006. This implies the same level of 'self-sufficiency' in terms of employment.

This constant ratio of employees per job over time has been applied on a sub-regional basis. The six sub-regions were defined by Latitude Planning Services as follows:

1. Waikato, Waipa, Hamilton, Franklin
2. MPDC, Hauraki, TCDC
3. Oto, Waitomo
4. Sth Waikato, Taupo
5. Rotorua District
6. Rest of BOP in study area

The steps involved in calculating the number of employees per household at a zonal level for each sub-region are as follows:

1. Calculate the number of employees you expect in a subregion based on the number of jobs to keep a constant ratio of employees to jobs

2. Convert this to an employees per household target for the sub-region by dividing by the projected number of households in the corresponding future year

3. For households which existed in 2006 in each zone in the subregion, factor the 2006 number of employees per household up or down (on a zone by zone basis) by multiplying by the future year target employees per HH (i.e. the target for the entire sub-region) and then divide by the base year employees per HH (i.e. for the entire sub-region). A check has then applied to ensure that for existing households added up across all zones, the total number of employed persons matches the corresponding future year target.

4. For all new households in each zone in the subregion, apply the future year target employees per HH (i.e. the target for the entire sub-region).

5. For each zone calculate the final employees per household value for the future year which is weighted sum of the existing households (from step 3) and new households (from step 4). A check has then applied to ensure that for all households added up across all zones, the total number of employed persons matches the corresponding future year target.

4.   VEHICLES PER HOUSEHOLD

To establish future targets for vehicles ownership in the future, vehicle registration records from the Ministry of Transport (MoT) and Population records from Statistics New Zealand were plotted to establish the trend in vehicle ownership since 1980. These values were then adjusted up to account for the imbalance between the number of registered vehicles from MoT records and the number of available vehicles reported in census. The MoT figures were increased by 4.8% based on there being 0.562 registered vehicles per person and 0.589 available vehicles per person.

The resultant number of vehicles available per person over time is shown here **Figure 1**.

Figure 1
Vehicle Ownership per Person in NZ
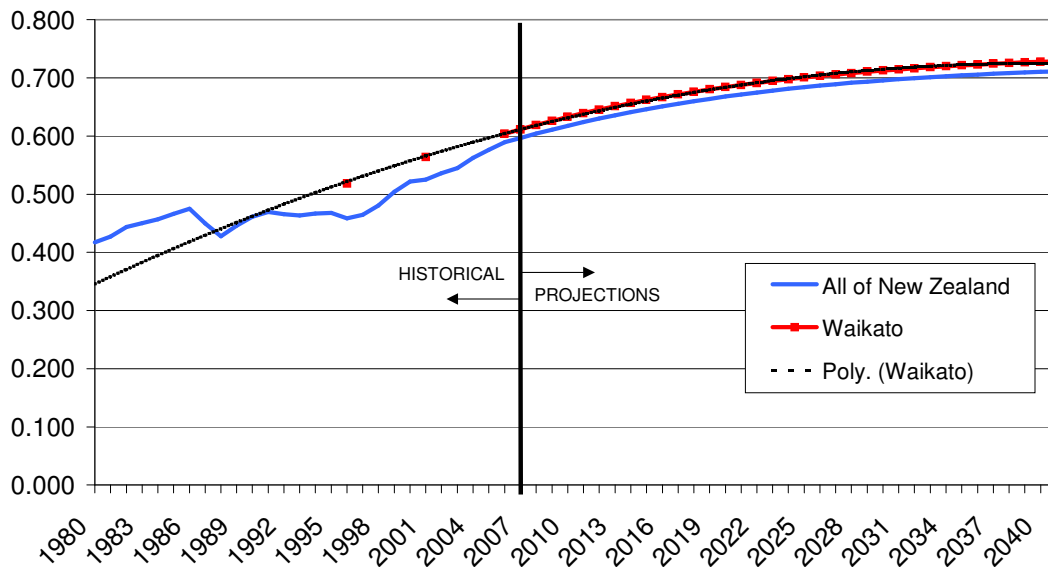
Census records for just the Waikato Region were also extracted for 1996, 2001 and 2006 and have also been included in **Figure 1**. These indicate that the Waikato Region has vehicle ownership rates are consistently above the national average, and in 2006, Waikato had a rate of 0.604 vehicles per person which was 2.5% higher than the average for New Zealand.

A set of asymptotes at 0.025 vehicle per household intervals were then selected and graphed to provide an upper limit on the rate of vehicles ownership in the distant future. The path of the resultant projected ownership rates were compared to a polynomial trend on the available Waikato data, and were also compared against the nationwide data. The best fit was an asymptote of 0.725 vehicles per household, which implies that the rate of vehicle ownership will continue to head towards but never quite reach 725 vehicles per 1000 persons in New Zealand.

This preferred asymptote corresponds to a rate of 0.671 and 0.711 vehicles per household in 2021 and 2041 respectively. Acknowledging that Waikato data is 2.5% higher than the national average, whilst some consideration was give to scaled these rates up by 2.5% to 0.688 and 0.729 respectively as targets for the Waikato Regional Model the rates of 0.671 and 0.711 are maintained to be conservative. It is also plausible in the future that as vehicle ownership increases there will be an evening out across the country of vehicle ownership rates.

Based on the persons and households targets across the study area as supplied by Latitude Planning Services, the base year value of 1.655 vehicles per household, subsequently increases to 1.765 and 1.814 vehicles per household in 2021 and 2041 respectively. This is an increase of 6.6% and 9.6% in vehicle ownership rates per household. A summary of these results is shown in **Table 1** below.
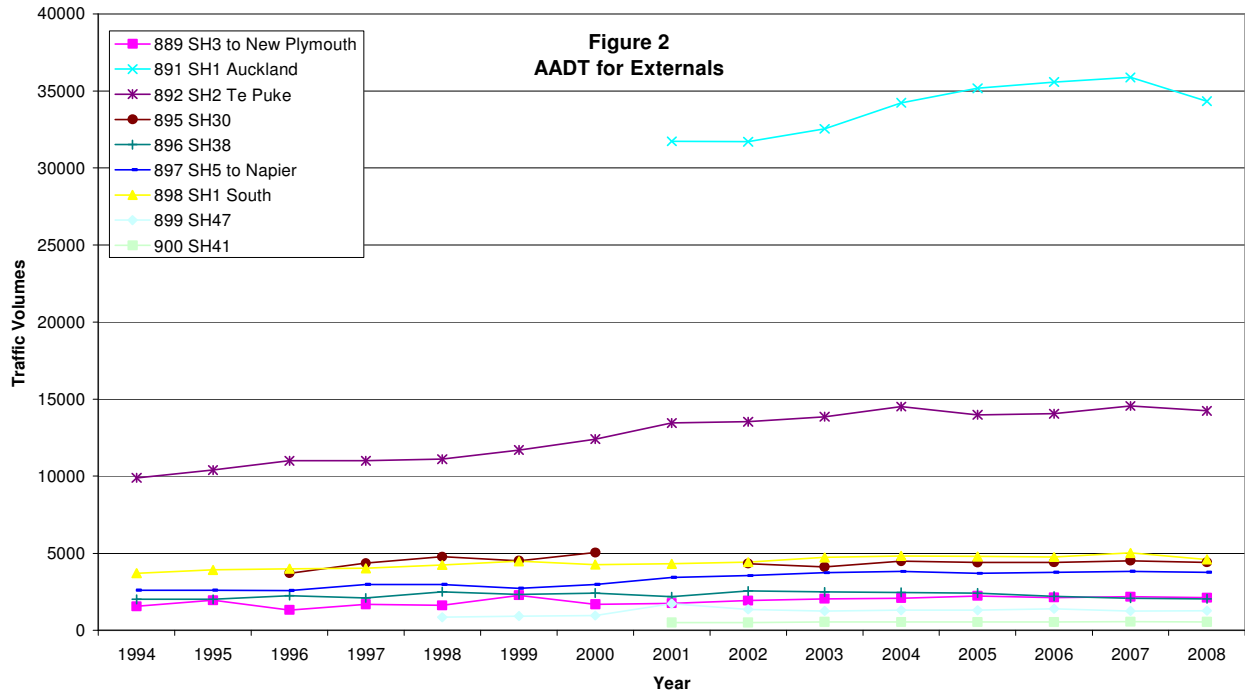
Future Vehicle Ownership Targets						Table 1
Year	Target Veh/1000 Pop	HH	PERSONS	VEH/HH	Factor	Total Cars
2006	604	210393	575191	1.655		348296
2011	624					
2016	651					
2021	671	278655	732560	1.765	1.066	491749
2026	686					
2031	697					
2036	705					
2041	711	344861	879652	1.814	1.096	625553
2046	715					
2051	718					

The derivation of the number of vehicles per household at a zone by zone level is then derived from these target values as follows:

1. For households which existed in 2006 in each zone in the subregion, factor the 2006 number of vehicles per household up or down (on a zone by zone basis) by multiplying by the future year target vehicles per HH (i.e. the target for the entire study area) and then divide by the base year vehicles per HH (i.e. for the entire study area). More specifically the values at a zone-by-zone level get scaled up by 6.8% for 2021 and 10.7% for 2041. A check has then applied to ensure that for existing households added up across all zones, the total number of vehicles per household matches the corresponding future year target.

2. For all new households in each zone in the study area, apply the future year target vehicles per HH (i.e. the target for the entire study area).

3. For each zone calculate the final vehicles per household value for the future year, which is weighted sum of the existing households (from step 1) and new households (from step 2. A check has then applied to ensure that for all households added up across all zones, the total number of vehicles per household matches the corresponding future year targets of 1.765 and 1.814 for 2021 and 2041 respectively.

5.   EXTERNAL TRAFFIC GROWTH

The derivation of future traffic volume has been based on the growth of traffic volume from the period 1994-2008. Using the Average Annual Daily Traffic (AADT) volumes on each of the externals - taken from NZ Transport Agency (NZTA) State Highway Traffic Data traffic volumes have been graphed in **Figure 2**.

Figure 2
AADT for Externals

Legend:
- 889 SH3 to New Plymouth
- 891 SH1 Auckland
- 892 SH2 Te Puke
- 895 SH30
- 896 SH38
- 897 SH5 to Napier
- 898 SH1 South
- 899 SH47
- 900 SH41

Linear Regression has been used to obtain a per annum growth rate (relative to 2006 volume) for each external and from this the growth rate for the period 1994-2008 has been established. Based on this, a future traffic volume growth rate has been derived. A summary of these results is shown in **Table 3,** with the volume in the %age Growth pa column being applied to the WRTM.

		Growth per annum	2006 Count	%age. Growth pa	NZTA Site Location
	Growth Rates				**Table 3**
888	**SH4**	2	1,674	0.13%	400044
889	**SH3 to New Plymouth**	45	2,127	2.13%	300093
890	**Old SH22 Auckland**			1.65%	use same as 891
891	**SH1 Auckland**	586	35,575	1.65%	01N10474/01N20474
892	**SH2 Te Puke**	351	14,053	2.50%	200187
895	**SH30**	10	4,411	0.22%	3000160
896	**SH38**	8	2,208	0.35%	3800000
897	**SH5 to Napier**	105	3,755	2.78%	500138
898	**SH1 South of Turangi**	79	4,755	1.66%	01N00827
899	**SH47**	35	1,393	2.51%	4700046
900	**SH41**	6	535	1.12%	4100029
	All	1,185	68,558	1.73%	

6. LAND USE VARIABLES

A summary of future land use variables appears below in Table 2. Totals for each variable category are listed as well as absolute and percentage growth figures

Three appendices have been included with this Technical Note. These are as follows:

- Appendix A – Zone Boundaries – this is a repeat of what has been included in the zone system technical note but is included for completeness sake and to allow for easier interpretation of Appendix B and Appendix C.

- Appendix B – Households by Zone – this is a histogram plot which displays the number of households in the WRTM model at 2006, 2021 and 2041 for each zone. The plots do not include the disaggregation of the two high growth areas (Peacockes and Rototuna) in Hamilton, which is documented in section 7 of this technical note but displays the high growth areas in terms of the base year landuse zone system.

- Appendix C – Households by Zone – this is a histogram plot which displays the number of households in the WRTM model at 2006, 2021 and 2041 for each zone. The plots do not include the disaggregation of the two high growth areas (Peacockes and Rototuna) in Hamilton, which is documented in section 7 of this technical note but displays the high growth areas in terms of the base year landuse zone system.

Future Land Use Variable Totals												Table 2
	PERSONS	EMP	CARS	HOUSEHOLDS	SCHOOL ROLLS	TERTIARY EFTS	RETAIL JOBS	WHOLESALE JOBS	OFFICE JOBS	COMMUNITY JOBS	TOTAL JOBS	ANZSIC CATEGORY ABCDE JOBS	TOTAL ABCDE JOBS
TOTALS 2006	575191	262188	348296	210393	111762	28373	28430	10193	46464	38192	271795	84127	187674
TOTALS 2021	732560	292987	491262	278655	120835	34274	31878	11813	52453	42945	303427	93130	210297
TOTALS 2041	879652	328758	625553	344861	124100	36739	36040	13205	59194	48589	340276	103055	237221
Growth 06-21	157369	30799	142965	68262	9073	5901	3448	1620	5989	4753	31632	9003	22623
Growth 06-41	304462	66570	277257	134468	12338	8366	7610	3012	12730	10397	68481	18928	49547
Growth 21-41	147092	35771	134292	66205	3265	2465	4161	1392	6741	5645	36849	9925	26924
% Growth 06-21	27%	12%	41%	32%	8%	21%	12%	16%	13%	12%	12%	11%	12%
% Growth 06-41	53%	25%	80%	64%	11%	29%	27%	30%	27%	27%	25%	22%	26%
% Growth 21-41	26%	14%	39%	31%	3%	9%	15%	14%	15%	15%	14%	12%	14%
% PA Growth 06-21	1.8%	0.8%	2.7%	2.2%	0.5%	1.4%	0.8%	1.1%	0.9%	0.8%	0.8%	0.7%	0.8%
% PA Growth 06-41	1.5%	0.7%	2.3%	1.8%	0.3%	0.8%	0.8%	0.8%	0.8%	0.8%	0.7%	0.6%	0.8%
% PA Growth 21-41	1.3%	0.7%	1.9%	1.6%	0.1%	0.4%	0.7%	0.7%	0.7%	0.7%	0.7%	0.6%	0.7%

7.   DISAGGREGATION OF GROWTH AREAS - HAMILTON

Hamilton has two large future development areas:

1. Peacockes   South Hamilton   Zone 136

2. Rototuna   North Hamilton   Zones 218 and 363

These zones have been disaggregated in the future networks to reflect the development and allow the traffic to be loaded more evenly onto the network. The improved distribution of traffic gives a better idea of the impact on the wider network.

Peacockes – Break up of Zone 136				Table 3
	2021		**2041**	
New Zone	HH	Jobs	HH	Jobs
136	156	119	156	119
397	0	0	850	50
398	0	0	1000	50
399	0	0	900	50
400	0	0	700	50
401	0	0	0	534
402	0	0	1294	50
403	0	0	1100	50
404	304	25	1200	250
405	0	0	800	50
Total	460	144	8000	1253

Peacockes Structure Plan and Zone System – Figure 3
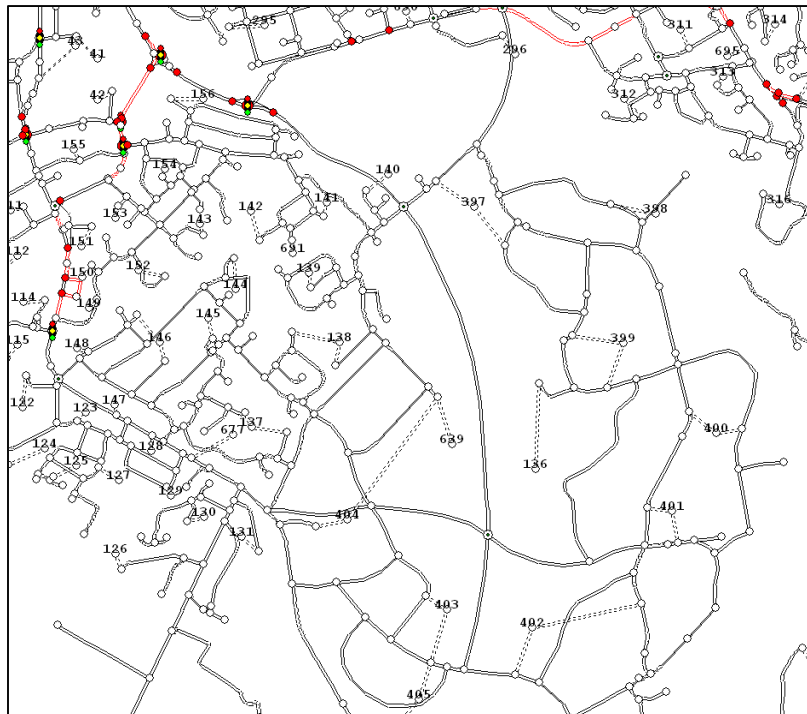
Rototuna – Break up of Zones 218 & 363				Table 4
	2021		**2041**	
New Zone	HH	Jobs	HH	Jobs
218	1001	69	1007	109
377	987	0	999	40
378	622	0	625	100
379	114	47	115	1214
381	710	0	950	40
382	737	0	750	100
383	0	0	680	40
363	669	153	670	193
Total	4840	269	5796	1836

**Rototuna Structure Plan and Zone System – Figure 4**

8.   2021 DO MINIMUM PROJECTS

The following projects have been included in the Do Minimum options of the future networks. The location of these works are marked on the network diagram in **Figure 5** below.

A. Avalon Drive Bypass

B. Church to Avalon Drive

C. Mercer to Long Swamp

D. Mangatawhiri Township Deviation

E. Piarere-Oak Tree Bend Realign

F. Kopu Bridge Replacement (SH25)

G. Tararu Stream Bridge Replacement

H. Te Puru Stream Bridge Replacement

I.   Tahuna Road Roundabout

J. Harbour Link

K. Pyes Pa Bypass

L. Fairy Springs 4L Stage 2

M. Mangorewa Stream North & South Bridge Widening

N. Mill Street Intersection upgrade

O. East Taupo Arterial

P. Malfroy/Randolf Roundabout

Note that G, H and M are essentially upgrades to existing corridors, which do not add significant capacity. As such they have not been coded in the model but have been noted here for completeness.
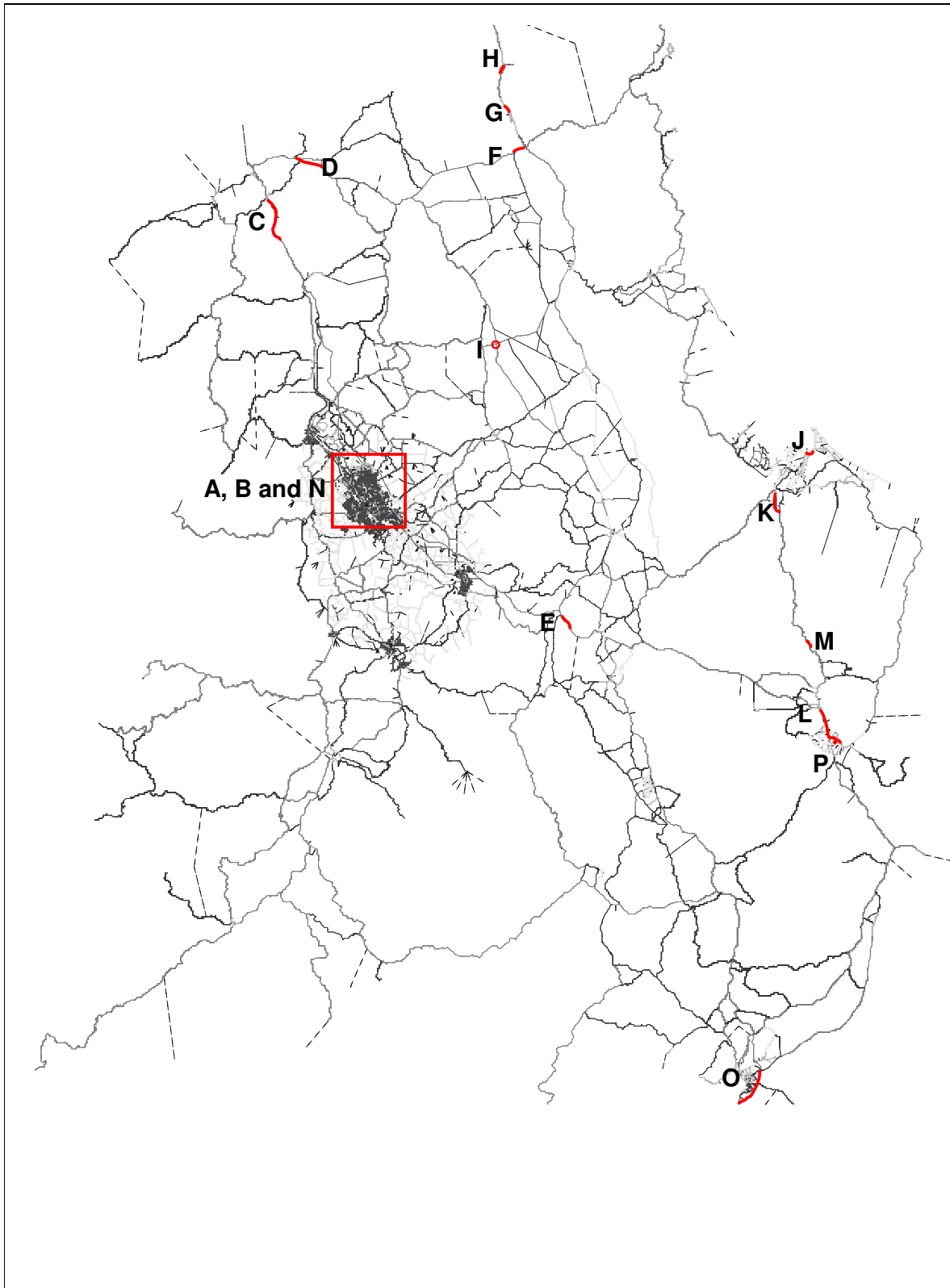
Waikato Regional Transportation Model	Do Minimum Works	Figure 5
Gabites Porter Traffic Design Group		

TRAFFIC DESIGN GROUP

GABITES PORTER