Waikato Regional Transport Model

Professional Services Contract WRTM-01

Survey Specification Report

June 2008

TRAFFIC DESIGN GROUP

GABITES PORTER

Waikato Regional Transport Model

Professional Services Contract WRTM-01: Survey Specification Report

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1. INTRODUCTION

Gabites Porter Consultants and Traffic Design Group has been retained by Local Authority Shared Services Ltd (LASS – a Council controlled organisation established to enable and/or deliver shared services for the 13 Council's of the Waikato Region) to develop the Waikato Regional Transport Model (WRTM).

The objective of the WRTM project is to construct a four stage multi-modal model of Hamilton, together with a three stage regional model for Waikato, capable of evaluating traffic and transportation issues associated with future growth and meeting the needs of the Land Transport Management Act. The specific objectives of the WRTM project are:

- to produce a Model in a timely and cost effective manner;
- to ensure the satisfactory calibration of the Model to household characteristics collected in the 2006 Census;
- to ensure the satisfactory validation of the Model to independent data sources;
- to assess the responsiveness of the Model by preparing forecasts for future years;
- to ensure that the Model is approved by a Peer Reviewer; and
- to provide ongoing model management and operate the model for the Client partners.

The model construction part of the project commenced on 11 October 2007 and will continue through to February 2009. This will be followed by a minimum three year term for model management and operations. The project is divided into eight main work streams, which are:

- Stage 1: Model Design and Specification
- Stage 2: Data Collection (Survey Design and Management)
- Stage 3: Development of Model Components and Input Preparation
- Stage 4: Calibration of Model Components
- Stage 5: Model Validation (Base Year)
- Stage 6: Model Implementation and Forecasting
- Stage 7: Model Reporting
- Stage 8: Model Management and Operations

The purpose of this report is to specify the data to be collected to enable the development of the WRTM. Specifically, it will address:

- Data to be collected and the required output formats;
- Methodology of collecting the data;
- Data processing and cleaning requirements, including quality control procedures;

This will illustrate the type and range of data to be collected to enable the model outlined in the Model Specification Report to be delivered.

2. TRAVEL DEMAND

2.1 Household Interview Survey

A Request For Tender (RFT) for undertaking the Waikato Household Interview Survey 2007 (WHIS) was prepared in November 2007. It was issued on 30 November 2007 to parties expressing interest, with tenders closing on 14 December 2007.

The aim of the Waikato Household Interview Survey (WHIS) is to collect information on the current travel patterns of residents of the Waikato Region for use in the development of the WRTM. The specific objectives of the WHIS study are:

- to collect and record household, vehicle ownership and person information and corresponding travel diary information from a representative household sample for the study area to enable creation and calibration of trip generation and distribution formulae as input to the WRTM;
- to check that data collected is of high quality with no missing trip segments; and
- to append expansion factors to represent the population as described by the 2006 Census.

The methodology includes:

- design of the sampling procedures and acquiring the sample frame;
- design (and printing) of the questionnaires;
- initial household contact including explanation of the survey;
- delivery of the survey forms including travel diaries;
- household interviews in person or collection of the questionnaires with face-to-face data checking; and
- data entry, checking and cleaning including follow-up contact for any missing information.

The RFT did not specify a minimum sample size. Instead, tenderers were requested to specify the sample that could be achieved for the allocated budget. A sample size in the range of 1000 to 1500 responding households is desired to develop the WRTM.

A responding household is defined as:

- A travel diary provided for each household member usually resident. (In this case a travel diary with "no trip made" is a valid diary);
- No missing data on "Key Items" of information. These Key Items were defined in the RFT for household, vehicle, person and travel data; and
- No more than 10% of missing responses for all variables other than those defined as Key Items.

A random household sample was requested, which will require stratification by geographic area. Sampling regions will be defined during the sample design process to reflect the different characteristics of the districts in the Waikato Region. The Districts to be surveyed are:

- Thames-Coromandel District
- Hauraki District
- Waikato District
- Matamata-Piako District
- Hamilton City
- Waipa District
- Otorohanga District
- South Waikato District
- Waitomo District
- Taupo District
- Western Bay of Plenty District
- Rotorua District

Travel days are Monday to Thursdays with school holidays and public holidays and the day before Good Friday specifically excluded. University holidays were also excluded for households within the greater Hamilton area.

Respondents are to be contacted in advance of their travel day to maximise response rates and the integrity of the data collected. Information on daily travel for all household occupants was required, excluding children under the age of five. Travel data is to be collected in the context of activities to which respondents are travelling and is to be trip stage based, defined as a single mode segment and a single journey purpose. Information on all modes of travel is to be recorded, including vehicle trips, public transport, cycling and walking.

The data collected is to be coded into relational databases. Codes enabling easy comparison with other databases are to be adopted. All destination locations are to be geocoded to x and y coordinates and to 2006 Census meshblock. Sufficient range and logic checks are to be conducted to ensure the integrity of the final data set, with a complete schedule of range and logic checks to be submitted to the Client in advance for approval. The survey processes, quality control procedures, survey results and coding frames are to be summarised in a Final Household Interview Survey Report.

In the following table, the survey content requirements specified in the RFT are shown, including data considered essential.

Home Interview Data				Table 1
Question	**Responses**	**Issues**	**Essential?**	**Action**
Trip Number	Eight digits made up of four digits from household number followed by two digits for person followed by two digits for trip		Yes	
Reason for trip	Home To go to work Work related business Education Shopping Social visit Recreation Sport – participate Sport – spectator Entertainment Personal business Medical/Dental Change mode of travel Holiday To accompany someone – their purpose To drop someone off – their purpose To pickup or deliver something Other		Yes	Reject trip
Reason if no trips were made on travel day		This is a prompt to reduce under-reporting	No	
Where was the travel day started	Survey address Work address Different address		Yes	Reject trip
Type of place travelled to	19 ANZSIC classes plus two sub classes.		Yes	Reject trip
Destination address	Place/business name Building name Street number Street name Nearest intersecting street Suburb Postcode		Yes	Reject trip
Time of starting trip	Time left Did not leave house	24 hour clock with AM or PM	Yes	Reject trip
Time of ending trip	Time arrived	24 hour clock with AM or PM. Include some checks on very short and very long journeys	Yes	Reject trip
Who else in household travelled with respondent?	First name will usually suffice however it each person needs to be able to be uniquely identified.	To identify car occupancy and for logic checks	No	

Mode	Car driver Car Passenger Truck/Van/ute driver Truck/Van/ute passenger Motorcycle Scooter School bus Other bus Ferry Taxi Walking Bicycle Other		Yes	Reject trip
Could you have made this trip using another mode?	*No* *By walking* *By cycling* *By public transport* *By car* *Other (specify)*	*Identify any modal captive trips* *How many do you choose?*	*No*	
For private vehicle trips				
Vehicle used	Was car listed on form Vehicle number Company/private/rental car		No	
Occupants in vehicle	Number of people in vehicle Number from household in vehicle Identification of household member occupants		No	
Type of car parking	On street Off street employer provided Off street public Off street private residential Off street private non residential Not parked		Yes	
Parking cost/type of payment	No fee paid/$ Short term Daily Weekly Monthly > Monthly		Yes	
For public transport trips				
Type of ticket	Cash BusIT card		Yes	
Bus numbers	Could be multiple responses if multiple transfers.		Yes	
Bus fares paid	Transfers may not require additional fares. Fare is to be paid for each individual leg	Transfer fare may be zero hence transfer ride has zero cost associated with it.	Yes	
Time at bus stops	<5 minutes 5 - 10 minutes 10 – 15 minutes >15 minutes		No	

The key dates specified in the RFT were completion of a pilot survey by 6th March 2008, completion of the main survey by 17th April 2008 and provision of a final database and report by 13 June 2008. The contract (WRTM-03) was offered with a total tendered sum of $325,000.

2.2 Roadside Interview Survey

A RFT for undertaking the Waikato Roadside Interview Survey 2007 (WRIS) was prepared in November 2007, distributed to Consultant's expressing interest on 16 November 2007, with tenders closing on 7 December 2007. Prior to distribution of the tender, Consultant's registered with Transit for "Traffic Surveys" were contacted to ascertain whether they were interested in receiving the RFT.

Roadside interview surveys will be used to supplement data on travel patterns collected though the household interview surveys as they are an effective mechanism to significantly increase the sampled vehicle trip making.

2.2.1 Objectives

The aim of the WRIS is to collect information on the current travel patterns at specific sites in the Waikato region, an integral component of determining the existing travel demands which will support the development of the WRTM. The specific objectives of the WRIS project are:

- to intercept randomly sampled vehicles travelling in the survey direction at the specified locations and obtain details of their current trip;
- to undertake manual classified counts of all vehicles for both directions of travel (sample survey and non-survey directions) at the same time as the sample surveys for data expansion;
- to undertake 7 day automatic traffic counts (ATC) in the vicinity of all survey sites to include the day of the interview survey;
- to conduct the surveys safely, without causing adverse delay; and
- to produce a database of the sampled trips, which must be "clean", include coordinates for all trip origins and trip destinations in a recognised coordinate system, with expansion factors by vehicle type and time period appended based on the manual classified counts.

2.2.2 Survey Methods

An RSI involves intercepting a random sample of vehicles travelling in the survey direction and collecting information from the drivers of these vehicles for that particular trip. This can normally be achieved by conducting face-to-face roadside interviews, by roadside distribution of reply-paid self-completion postcard questionnaires, or by video recording licence number-plates and following up registered owners with survey questions.

The exact methodology used at each site depends on the specific site conditions, to ensure that the survey is conducted safely, obtains the target sample rate while minimising survey bias, and is approved by the relevant Road Controlling Authorities. The preferred methodology is face-to-face surveys, followed by distribution of postcards, and lastly using video.

2.2.3 Survey Locations

The 18 locations where roadside interview surveys are to be conducted are shown in the table below. The exact location for each survey will be dependent on site conditions and is the responsibility of the Consultant retained to undertake the surveys.

Roadside Interview Sites — **Table 2**

Site No	Survey Site	Direction	Duration
1	SH 1 between Tregoweth Ln and SH 1B	Southbound	12 Hours
2	SH 26 between Kuranui Rd and Schollum Rd	Westbound	12 Hours
3	SH 1 between Shakespeare St and Hydro Rd	Westbound	12 Hours
4	SH 3 between Turere Ln and Herbert St	Northbound	12 Hours
5	SH 39 between Ngutunui Rd and Mangauika Rd	Northbound	12 Hours
6	SH 23 between Ohautira Rd and Fergson Rd	Eastbound	12 Hours
7	SH 27 between SH 26 and Wardville Rd	Southbound	12 Hours
8	SH 5 between Tapapa Rd (eastern intersection) and Maraeroa Rd	Westbound	12 Hours
9	SH 30 between SH 1 and Nichlson Rd	Westbound	12 Hours
10	SH 1 between SH 5 and Poihipi Rd	Northbound	12 Hours
11	SH 1 between Taupahi Rd and SH 46	Northbound	12 Hours
12	SH 3 between Grey St and SH 4	Northbound	12 Hours
13	Cobham Dr between Normandy Ave and Grey St	Westbound	6+ Hours
14	Bridge St between Grantham St and Memorial Dr	Westbound	6+ Hours
15	Claudelands Rd between Victoria St and River Rd	Westbound	6+ Hours

16	Boundary Rd between Victoria St and River Rd	Westbound	6+ Hours
17	Fairfield Bridge between Victoria St and River Rd	Westbound	6+ Hours
18	Wairere Dr between Delamare Rd and River Rd	Westbound	6+ Hours

The RFT also requested costs for three additional roadside interview surveys at the locations listed in the following table. These sites may be included at the discretion of the Technical Steering Group (TSG) and will be budget dependent.

Potential Additional Sites **Table 3**

Site No	Survey Site	Direction	Duration
A	SH 25 between Buchanan Rd and Hauraki Rd	Eastbound	12 Hours
B	SH1 between Litchfield and Putaruru	Northbound	12 Hours
C	SH 5 between Crown Rd and Matea Rd	Westbound	12 Hours

2.2.4 Survey Sample Rates

A random sample of vehicles passing the survey site in the survey direction will be collected, which includes equal sampling from all traffic lanes. All vehicles types are to be sampled, including medium and heavy commercial vehicles.

The survey sample rate is defined as the number of geocoded records for a period, as a percentage of the manual classified count in the survey direction during the same period. The minimum sample rates to be achieved are:

- 50% where the manual classified count in the survey direction is less than 200 vehicles per hour;
- 30% where the manual classified count in the survey direction is between 200 and 500 vehicles per hour; and
- 20% where the manual classified count in the survey direction is greater than 500 vehicles per hour.

2.2.5 Approvals

Approvals to establish the survey sites are required from the relevant statutory Road Controlling Authorities including the New Zealand Police and Land Transport New Zealand. Emergency services (Police, Fire, Ambulance) and public transport operators will also be advised in advance of the surveys to ensure they do not disrupt the survey and can make alternative arrangements if required.

A traffic management plan (TMP) will be required for each survey site. This includes site layout, proposed traffic management including all signage and any other requirements and requests from the approving authorities.

The TMPs shall be designed and prepared by an individual trained and qualified to the appropriate level specified by the relevant Road Controlling Authorities. TMPs shall follow the guidance set out in Transit's Code of Practice for Temporary Traffic Management (COPTTM).

The Consultant retained for the WRIS shall be responsible for the provision of all traffic management at the survey sites in accordance with the site's approved TMP and shall be responsible for the roadside safety of all personnel at the survey sites.

Prior to the survey the Consultant shall contact any properties fronting and adjacent to the interview site to explain the survey's objectives and to indicate that a survey site will be located near the premises.

2.2.6 Pilot Survey

A pilot survey for each type of survey approach proposed shall be undertaken to demonstrate the adequacy of the survey and coding method employed to meet the required response rate and the required accuracy of coding. The locations selected for pilot shall reflect a heavily trafficked road in the busiest anticipated period for each of the survey methods proposed. The pilot surveys should test all aspects of the survey process.

2.2.7 Key Dates and Price

The key dates set out in the RFT are:

Survey programme (including survey approach and site location)	Completed by 18th January 2008
Obtain required approvals to establish survey sites	Completed by 8th February 2008
Conduct pilot survey(s)	Completed by 14th February 2008
Conduct main survey fieldwork	Completed by 19th March 2008
Data coding, geocoding, cleaning and expansion	Completed by 11th June 2008
Survey Report	Completed by 23rd July 2008

The target tender price for the WRIS is $325,000.

2.3 Bus Passenger Interview Survey

The model specification includes a four stage model of Hamilton, which includes (by definition) a bus passenger assignment stage. The primary source of travel data for the WRTM update is the household interview survey. It is almost certain, however, that limited data on bus ridership will be collected through the HIS because of the low modal share of public transport in Hamilton. Supplementary surveys are therefore essential to obtain information on the travel patterns of bus passengers.

Data on bus passenger travel patterns is required, which is normally collected on a sample basis and expanded to represent the total population using control counts or other sources of information on total system usage. The approach for collecting the sample travel patterns is discussed in the following text, followed by the data requirements.

The recommended methodology for collecting travel patterns of bus passengers is on-board self-completion questionnaires. The use of self-completion questionnaires maximises the response rate for each surveyed route with minimal staff requirements. It also ensures passengers are offered some modicum of privacy to complete their travel details as opposed to conducting face-to-face interviews en-route. Control counts of boarding and alighting passengers at each bus stop for each surveyed route will also be required.

The survey approach must adopt procedures so that the following information is recorded for each returned questionnaire:

- Journey number/code (unique trip identifier);
- Route number;
- Route name;
- Route direction;
- Surveyor name;
- Day;
- Date;
- Scheduled departure time;
- Actual departure time; and
- Actual finish time.

The information to be collected for each sampled passenger trip includes:

- Where have you come from (origin location);
- What did you do there (purpose of origin);
- How did you get to the bus stop where you got on this bus (access mode);
- Boarding stop;
- Where are you going (destination location);

- What will you be doing there (purpose of destination);
- Alighting stop;
- How will you finish your journey when you get off this bus (egress mode);
- How often do you make this trip (daily/two or three times a week/weekly/seldom);
- Why did you decide to use the bus to make this trip;
- Gender;
- Do you have a drivers licence;
- How many motorised vehicles are available to your household;
- How many people live in your household; and
- Please add any suggestions or comments on the bus services in your area.

The questionnaires must be easy to manage and contain information on the reason for undertaking the survey. The questions must be clear and concise and follow a logical order. Where possible, tick boxes should be included for questions with limited choices (such as trip purpose, ticket type), which will streamline the data entry. Questionnaires must be uniquely numbered.

The method of recording the boarding and alighting stop is subject to the survey approach. The more robust approach would be to adopt a method where the surveyor records the boarding and alighting stop. This would be achieved by recording the unique numbers of distributed questionnaires for boarding locations, with alighting recorded by collating the collected questionnaires. Alternative survey approaches must ensure bus stops are uniquely identified.

The surveys should be conducted outside of school and public holiday periods. Passenger sampling must be representative of the morning peak period (7am to 9am), the evening peak period (4pm to 6pm) and the interpeak period (9am to 4pm). Passengers on all bus routes must be sampled in both directions of travel and in each of the three model periods (assuming the bus route operates in that period).

It is intended that all peak and interpeak bus services be surveyed, covering all scheduled services which start between the hours of 7am and 6pm. This will be achieved by assigning teams of surveyors to individual vehicles used on the survey day, rather than assigning teams to the services themselves. This will avoid the likelihood of missing services due to variation in travel times of poor quality bus schedule information. In order to facilitate this it will be necessary to liaise closely with the bus controllers.

Should it be logistically difficult to survey in this fashion or the available labour pool not permit such a comprehensive survey, a sample of all services will be surveyed. This sample will pick up at least 50% of all services between 7am and 6pm along each route. Electronic bus patronage data by route as collected by Environment Waikato can be used to scale up the sample survey results to represent the entire population.

The surveyed passenger trips must be entered into a database with each row containing all information relating to one particular passenger trip. The origins and destinations must be geocoded to the New Zealand Map Grid x and y coordinates and to 2006 Census meshblocks. Boarding and alighting stops must also be uniquely identified.

The dataset should not include any blank or missing fields. A series of range and logic checks must be developed and applied to the survey database. These should be designed to ensure the responses are reasonable and to identify any possible errors in the data processing stage. Errors include combinations of origins and destinations that lie significantly outside of the catchment of the sampled route.

Expansion factors by route and model time period must be appended to the database based on the patronage used to derive the sampling. Expansion factors must be provided to demonstrate that acceptable sample rates were achieved.

The final cleaned database and the coding frame must both be supplied in electronic format. The database must be developed using commercially available software.

2.4 Census Journey to Work Data

In the 2006 Census, some information on journey to work (JTW) was collected. The questions relating to work location and travel mode in the Census were:

- the address of the workplace where you worked the most hours; and
- the main way you travelled to work (i.e. mode) on the day of the Census (7 March 2006).

By cross tabulating the results of these two questions, a daily journey to work matrix by mode can be produced from the 2006 Census. The data is available at area unit level. Note that the data can also be purchased at meshblock level, but the application of Statistics New Zealand confidentiality rules results in suppression of the majority of the data.

The Census definition of JTW is different to that of home-based work in the WRTM. The Census questions on travel mode and work location do not necessarily refer to the same trip – work location is where you worked most, while travel mode refers to the day of the Census. Comparisons between the HIS and the Census for JTW by mode will therefore be based on a slightly different definition.

Census journey to work will include some trip chains, for example, people that drop off children at school on their way to work (home -> school -> work). While the WRTM will be a trip-based model, a database of home to work travel linking individual trips into trip chains will be produced from the HIS to facilitate comparison.

Although the Census JTW is not directly comparable with the WRTM HBW definition, the journey to work data from the Census will be used as a validation check during the development of the base year matrices for the WRTM.

3. CALIBRATION DATA

3.1 Automatic Traffic Counts

Automated Traffic counts will be used to create complete screenlines for the purposes of validating traffic flows at key locations in both the Hamilton City and regional models. The modelled versus surveyed counts will be compared against the traffic validation criteria published in Land Transport New Zealand's Economic Evaluation Manual.

All counts to be used will ideally be classified, directional and collected on an hourly basis for seven consecutive days. They should be collected outside of public and school holidays and should not coincide with significant local events which may have a noteworthy impact on traffic volumes (e.g. V8 Supercar race).

In the urban Hamilton area traffic counts have already been sourced from Hamilton City Council and have been requested from the neighbouring local authorities, namely Waipa District Council and Waikato District Council. Screenlines have been established for the urban area and are presented in Figure One of Appendix A. These screenlines will be expanded and/or supplemented by additional screenlines once traffic counts become available from Waipa and Waikato.

On a regional basis, traffic counts on the majority of arterial roads are collected as part of Transit New Zealand's regular counting program of the New Zealand State Highway network. The location of these counts in the Study Area is reproduced here as Figure Two in Appendix A.

Given the abundance of State Highway count stations a number of screenlines can be established, and counts are available on all external (boundary) arterial roads for the Regional Model study area. The proposed screenline locations are included on Figure Three in Appendix A.

In addition to the available counts from Transit New Zealand a number of non-State Highway locations have also been identified as critical to the model validation. All Local Authorities in the study area have been approached to gather all available count data however there has been no feedback from the Councils. If the locations listed below (which are mapped on Figure Four in Appendix A) are not already available they will be surveyed:

- Tauranga Road between SH29 and Matamata (Matamata-Piako District)
- Gordonton Road between SH1B and Hamilton urban boundary (Waikato District)
- Cambridge Road between urban boundaries of Cambridge and Te Awamutu (Waipa District)

- Whites Road between SH1 and SH5 (South Waikato District)

3.2 Turning Counts at Intersections

It is also important to consider traffic validation at a turning movement level at critical junctions in the Study Area. The critical intersections are those where traffic counts on all roads leading to and from the intersection do not provide an adequate indication of the split of traffic turning at the intersection; and the intersection is adjacent to or impacted upon by future roading projects which are likely to be studied using the model.

The turning movement volumes will be counted manually for the morning peak period of 7am to 9am, interpeak hours of 11am to 1pm and evening peak period of 4pm to 6pm. It will not be necessary to classify the counts as classified count data is already available from Transit on the State Highway network and on existing urban counts collected by Hamilton City Council. The manual counts will be recorded in five minute intervals so that the traffic profile across the two hours can be established at the intersection.

The proposed locations of fifteen manual intersection turning movement counts are depicted on Figure Five (for wider region) and Figure Six (for urban area) in Appendix A and are as follows:

- SH1/SH5 Taupo
- SH1/SH1B Cambridge
- SH1/Shakespeare Rd Cambridge
- SH3/SH21 Hamilton
- SH1 Te Rapa Road/Avalon Drive Hamilton
- SH3/Cambridge Road Te Awamutu
- SH1/SH2 interchange Pokeno
- SH1/SH1B Taupiri
- SH1 Cobham Drive/Normandy Avenue Hamilton
- SH3 Kahikatea drive/Lorne Street/Ohaupo Road Hamilton
- SH1/SH29 Piarere
- SH26/SH27
- SH26/Piako Road

3.3 Freight Special Generator Surveys

Special freight generators can be defined as focal points that attract a significant number of freight trips with unique travel patterns. Examples of freight special generators in the greater Hamilton area and Waikato region include the Airport, Port of Tauranga, and hubs of transport activity associated with industrial activities such as Fonterra's dairy manufacturing operations, forestry, mining and agriculture.

The range and number of special generators are extensive, particularly as there is not a widely accepted definition. Special freight generator surveys are the mechanism to collect travel data associated with the focal point. They are essential when the specified surveys will not collect travel patterns to/from the identified generator.

The household interview survey for the WRTM will sample trips at the home end but collect data for travel throughout the entire day. So the HIS will not collect travel data for the special generators listed above, aside from people travelling to and from their place of work.

Information on these activities should be collected by special surveys. In some cases interviews with operators would be beneficial to obtain information on vehicle fleets, use of different modes, travel patterns and any other relevant information. Some operators may have geographic information systems to optimise their transport operations and these could provide useful information if available.

3.4 Other Special Generator Survey

Other special generators not specifically associated with freight include the passenger-related elements of the Airport, particularly including out-of-town business trips and tourists, neither of which will be sampled at the home end through the HIS, the University of Waikato, Waikato Hospital and large shopping centres such as The Base. These types of generators have patterns that are atypical and will not be collected by the HIS.

Data relating to these special generators will become available from the Roadside Interview Survey however should this not provide adequate detail of the travel patterns specific to these locations, additional surveys can be considered to obtain supplementary information on travel patterns. Any data obtained can be used in combination with Origin-Destination data collected through the RSI's to improve the observed base year matrix.

4. VALIDATION DATA

4.1 Journey Time Surveys – Vehicles

The private vehicle travel time surveys will be floating car surveys whereby the survey vehicle travels at the same speed as the existing traffic stream whilst adhering to all safety considerations. The data will be collected using GPS data loggers that employ satellite technology to track the location of the vehicles on a periodic basis. The location of the vehicle will be recorded every 20 seconds for rural routes and every 2 seconds for urban routes. The data is stored on a memory card, which may then be downloaded into Fugawi software to map the route taken by the vehicle and analyse the timing data.

In addition to the automated data collection the driver will be asked to record the start and end time of each route and to record one or two key locations midway along the route. This acts as "back-up" data in the event that the data loggers fail. They are

reliable units but under some atmospheric and topographical conditions, the link between the unit and the satellite can be lost.

A total of 16 travel time routes have been identified of which ten are rural arterial routes and six are urban routes. They are discussed in turn in the following sections.

4.1.1 Rural

Ten key rural arterial routes have been identified for travel time analysis. These have been selected based on the likely roading improvement projects to be considered over the next five years. As such they largely concentrate on the links between Hamilton and the other major urban centres, but the arterial routes on either side of Lake Taupo and the State Highway routes between Pokeno and Tauranga, and between Rotorua and Taupo have also been included.

The ten routes and their respective lengths are presented in Figure Seven in Appendix A to this report. It is proposed that each route be traversed five times only. These five runs will be during the working day hours of 8am to 6pm and will include at least two runs in each direction.

Outside of the urban areas it is considered to be highly unlikely that there will be significant variations in travel times for different times of day and by direction. As such the five runs should be sufficient to calculate a tight confidence interval on the travel time for each route. If this is not the case up to five additional runs on the affected routes can be added.

The routes that do traverse the urban areas of Hamilton, Rotorua and Taupo, can be adjusted to account for the variation in travel times within the urban boundaries of all three centres. Gabites Porter have access to travel time data on the relevant State Highways as collected in 2006 in Rotorua and Taupo, and Hamilton data can be extracted from the urban surveys proposed in section 4.1.2 below.

4.1.2 Urban

Six key urban arterial routes have been identified for travel time analysis. These have been selected based on the likely roading improvement projects to be considered over the next five years.

The six routes are presented in Figure Eight in Appendix A to this report. It is proposed that each route be traversed five times in each direction between the hours of 7am and 9am (morning peak), and a further five times in each direction between 9am and 4pm (interpeak) and between 4pm and 6pm (evening peak).

4.2 Journey Time Surveys - Bus

Bus travel times are required to check that the modelled bus speeds are consistent with actual journey times and to ensure that the stop-start nature of buses compared with other vehicles on the road is reflected. These journey times represent an independent

data source for model validation and are therefore essential. In essence it is only the length of time buses spend boarding and alighting which needs to be established. If the bus system real time data collection polls the location of the vehicles on a regular basis, this data shall be used to calculate the length of time spent boarding and alighting at bus stops.

Should the real time data be inadequate, as with the private vehicle travel time surveys, the data will be collected using GPS data loggers that employ satellite technology to track the location of the vehicles on a periodic basis. The location of the vehicle will be recorded every 2 seconds for urban routes. The data is stored on a memory card, which may then be downloaded into Fugawi software to analyse the timing data.

It is intended that a GPS unit be placed on one bus for a week. The vehicle shall be carefully selected as one that is scheduled to traverse a variety of routes. The analysis of the GPS data will focus on the length of time that the bus is delayed in mid-block locations which correspond to bus stops. In addition to isolating the length of time spent boarding and alighting at bus stops the corresponding deceleration and acceleration time at each stop can also be extracted.

In previous studies of bus travel times with regularly placed stops, the quantity of time spent boarding and alighting is relatively constant at around 30% of the travel time.

5. NETWORK CALIBRATION DATA

The road network will be built up from GIS centreline data supplied through Terralink, which will then be consistent with the Environment Waikato GIS system. The Regional model will contain at least all roads to collector level, while the Hamilton sub-model will include all roads, including pedestrian only links. The intersection lane configurations and intersection operating parameters will also be coded in such that the model will be able to replicate the existing road network at a movement level.

5.1 Terralink

The GIS road centreline for the entire region is to be supplied by Terralink. The information to be supplied includes the number of link lanes, speed designation, status (i.e. is the road open and available to the public), road name, and a range of other attributes that can be included in to the transportation model road network.

In addition to link attributes the junction type for each intersection should be available.

This data is then extracted and exported from the GIS into the TRACKS modelling suite.

5.2 Aerial Photos

Recent aerial photographs of the region can be used to check road network coding, in particular the number of lanes on each link in the network and the intersection configuration. The photographs must be of sufficient resolution to identify road markings and the date upon which they were taken must be clearly identifiable.

All photographs can be placed behind the road network in the network editor program Nex, being part of the TRACKS modelling suite. In lieu of adequate aerial photographs being available, Google Earth provides sufficient detail in some parts of the Region. Where the Google Earth resolution is not adequate, ground checks of the network coding can be undertaken in any situations where there is uncertainty or ambiguity in the data imported from Terralink.

APPENDIX A

Figures

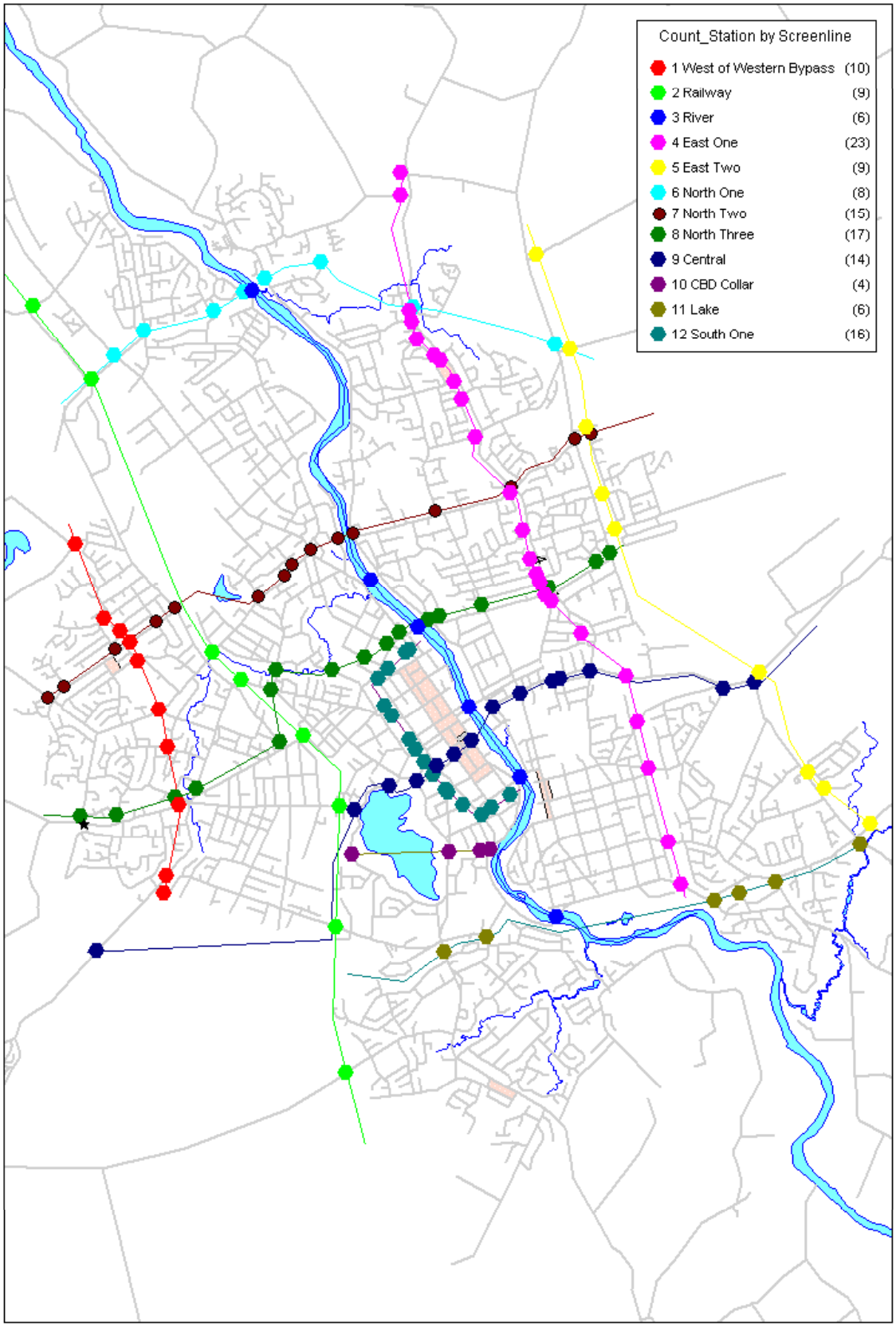

Figure One Proposed Hamilton Urban Count and Screenline Locations

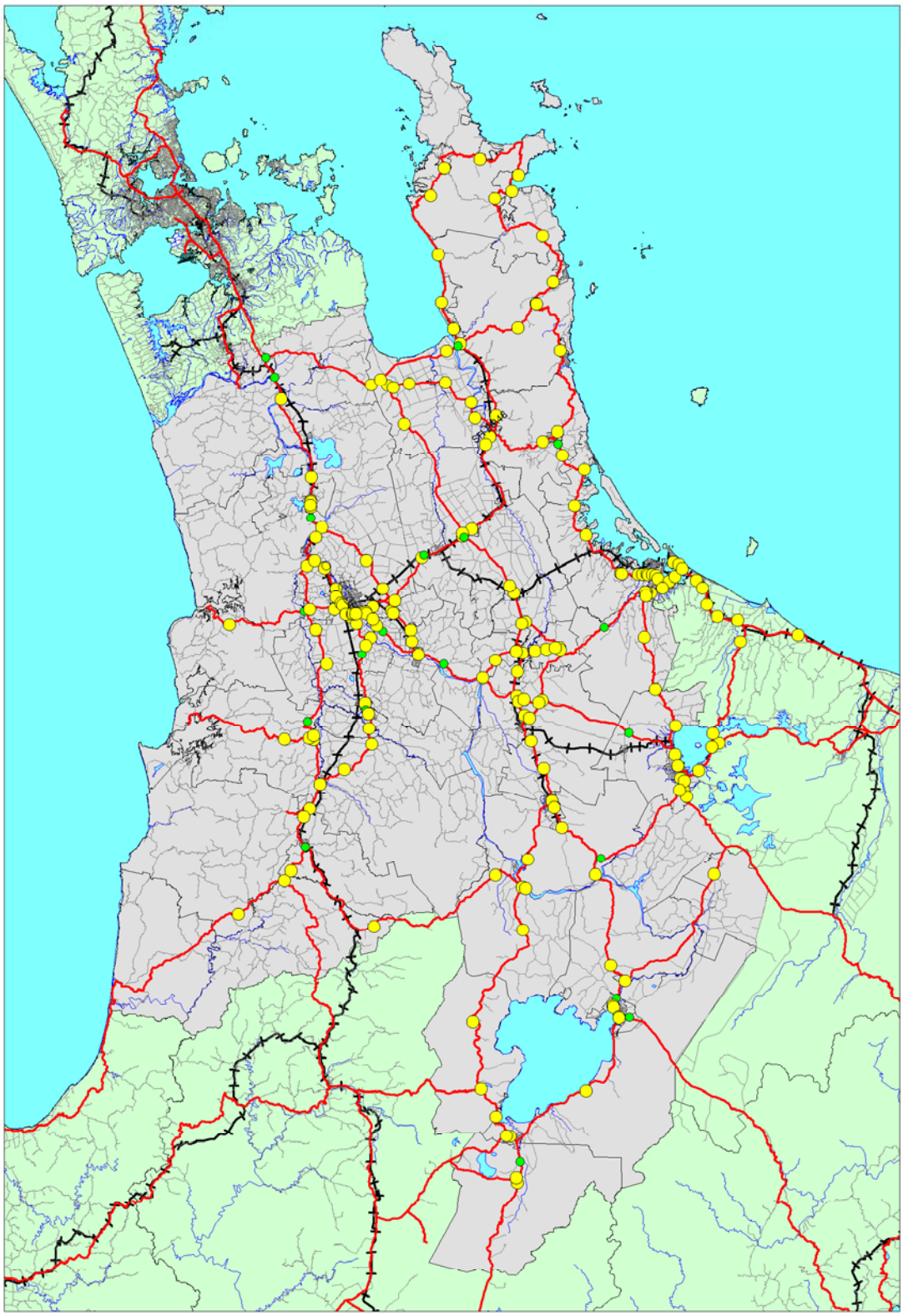

Figure Two Transit New Zealand State Highway Count Locations

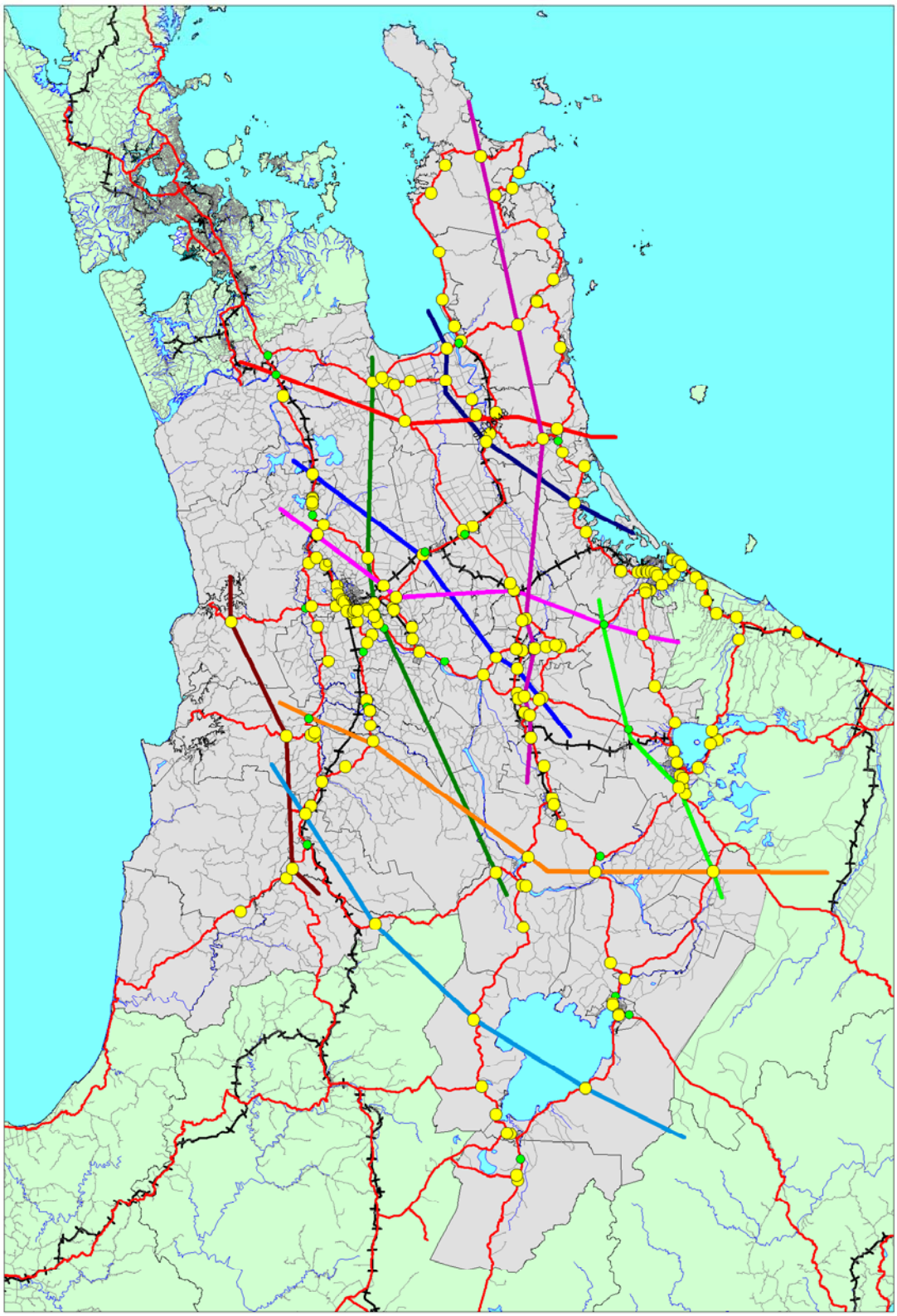

Figure Three Proposed Regional Screenline Locations

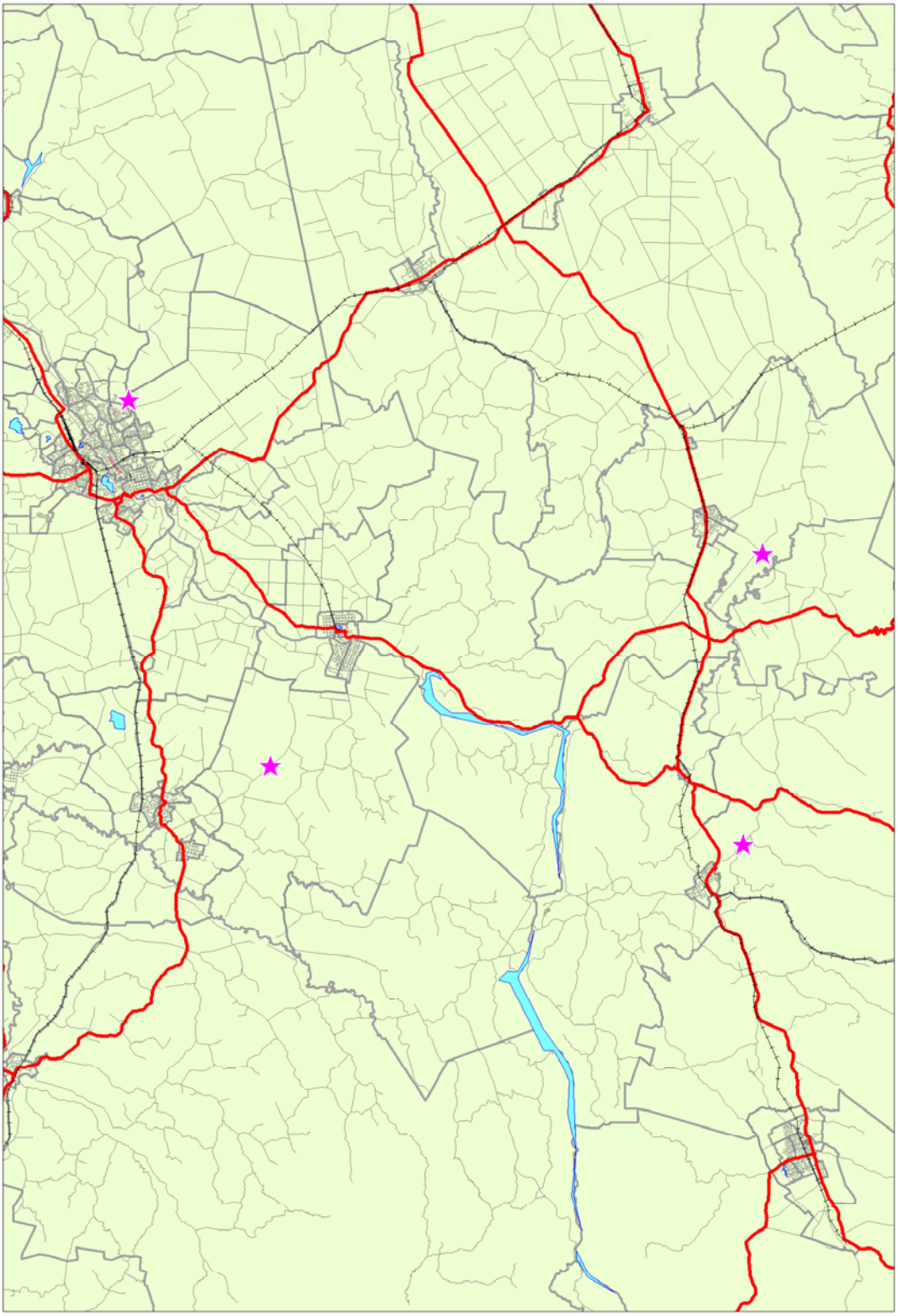

Figure Four Proposed Non-State Highway Regional Count Locations

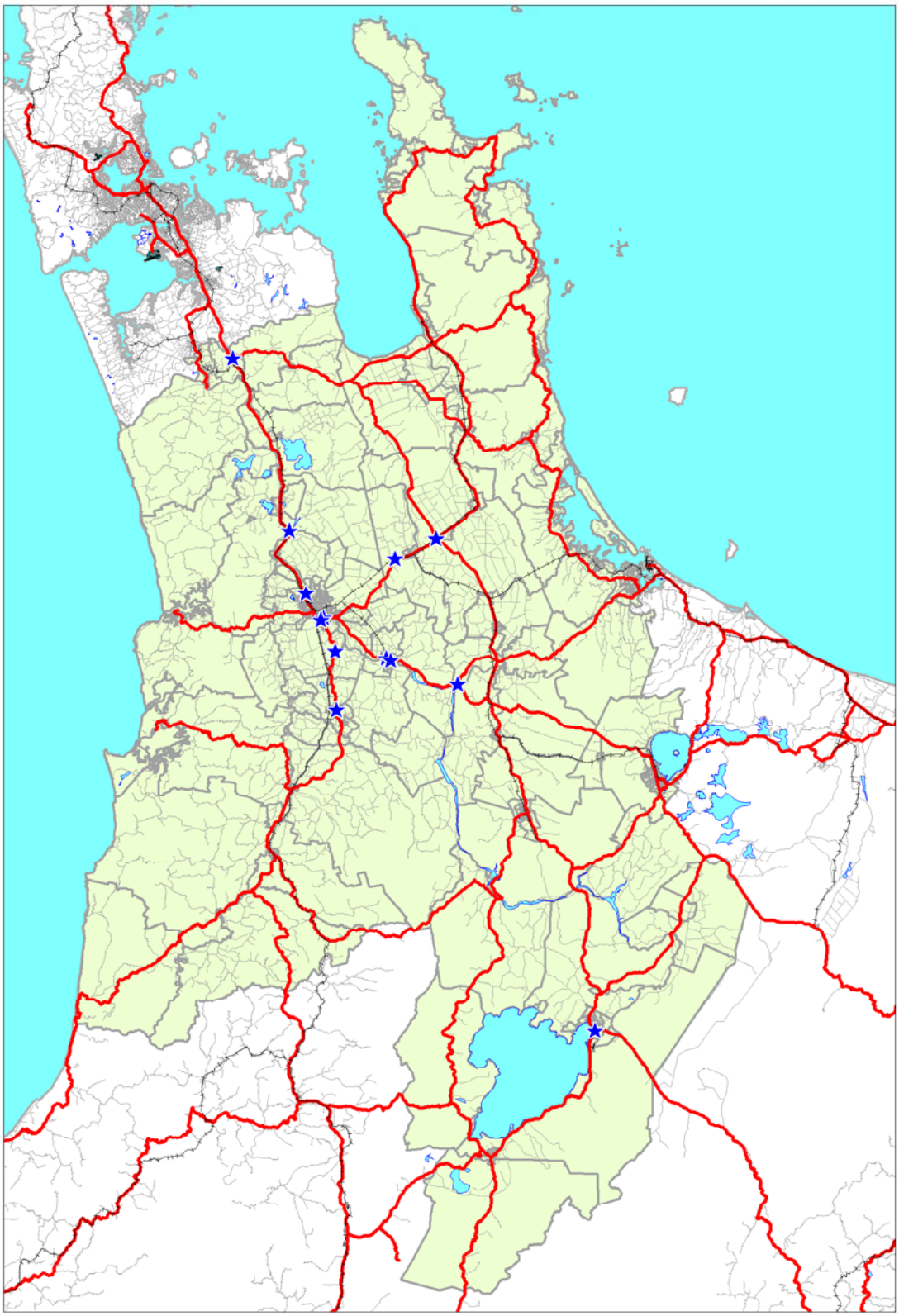

Figure Five Proposed Regional Intersection Movement Count Locations

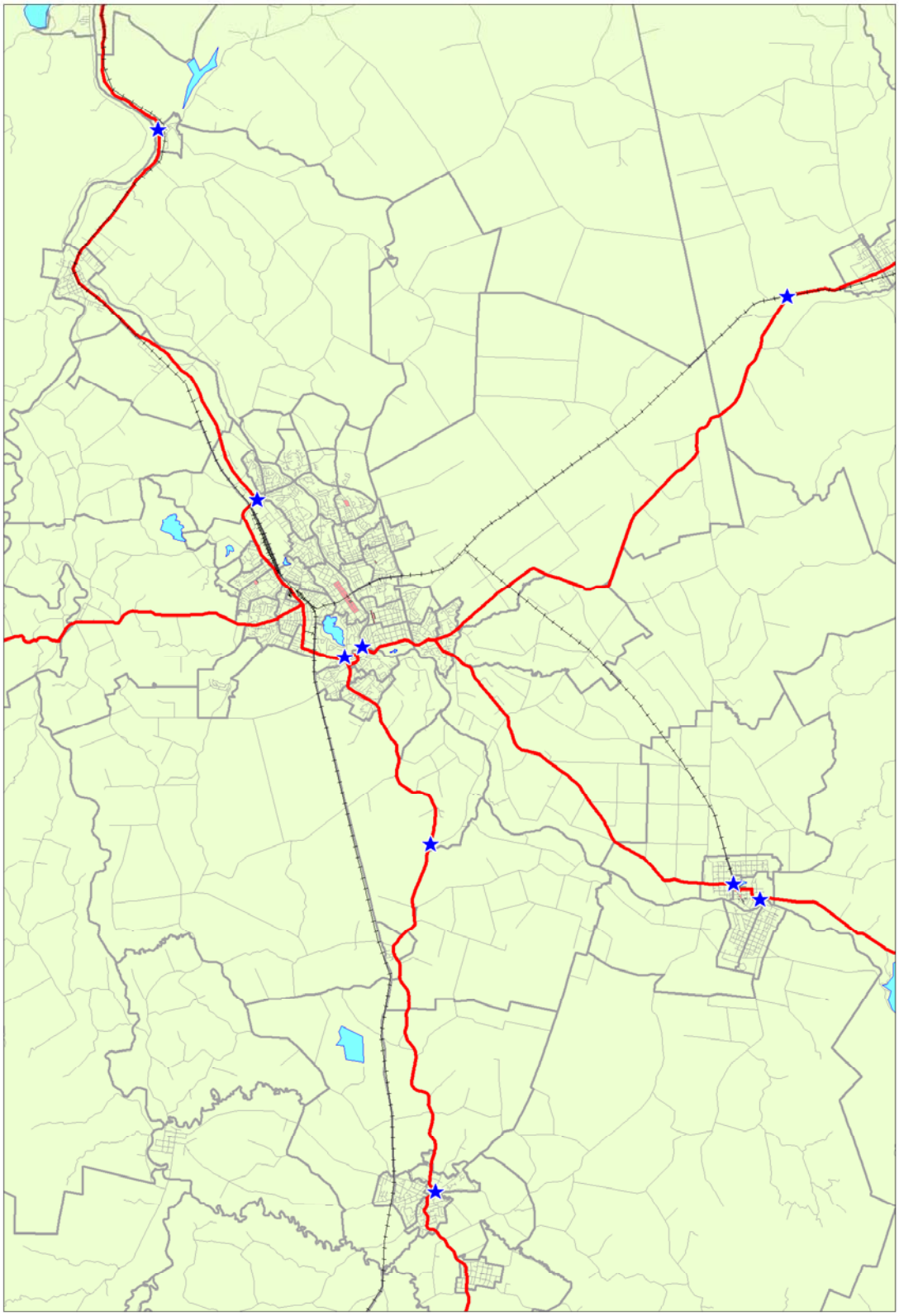

Figure Six Proposed Urban Intersection Movement Count Locations

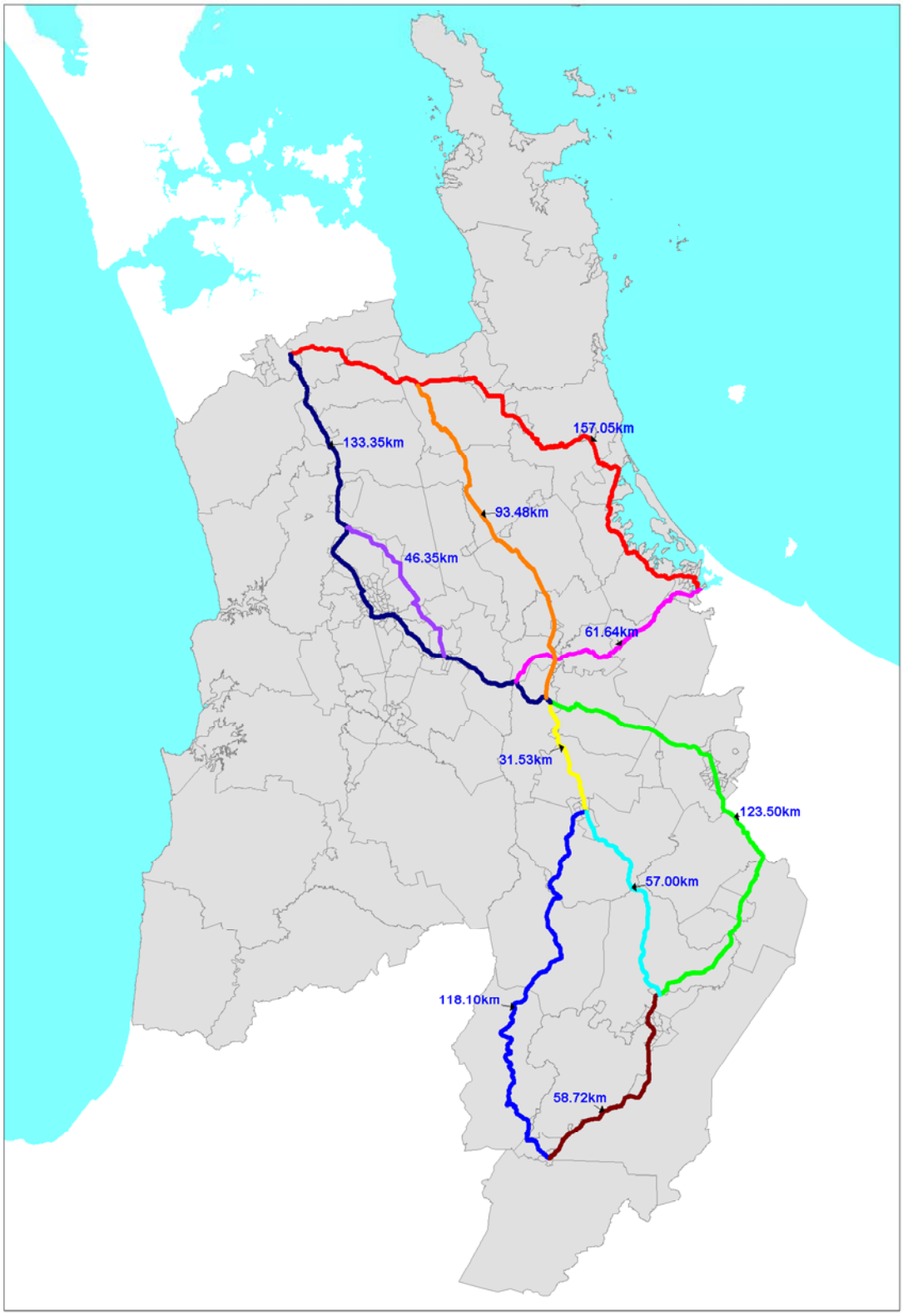

Figure Seven Proposed Regional Travel Time Survey Routes

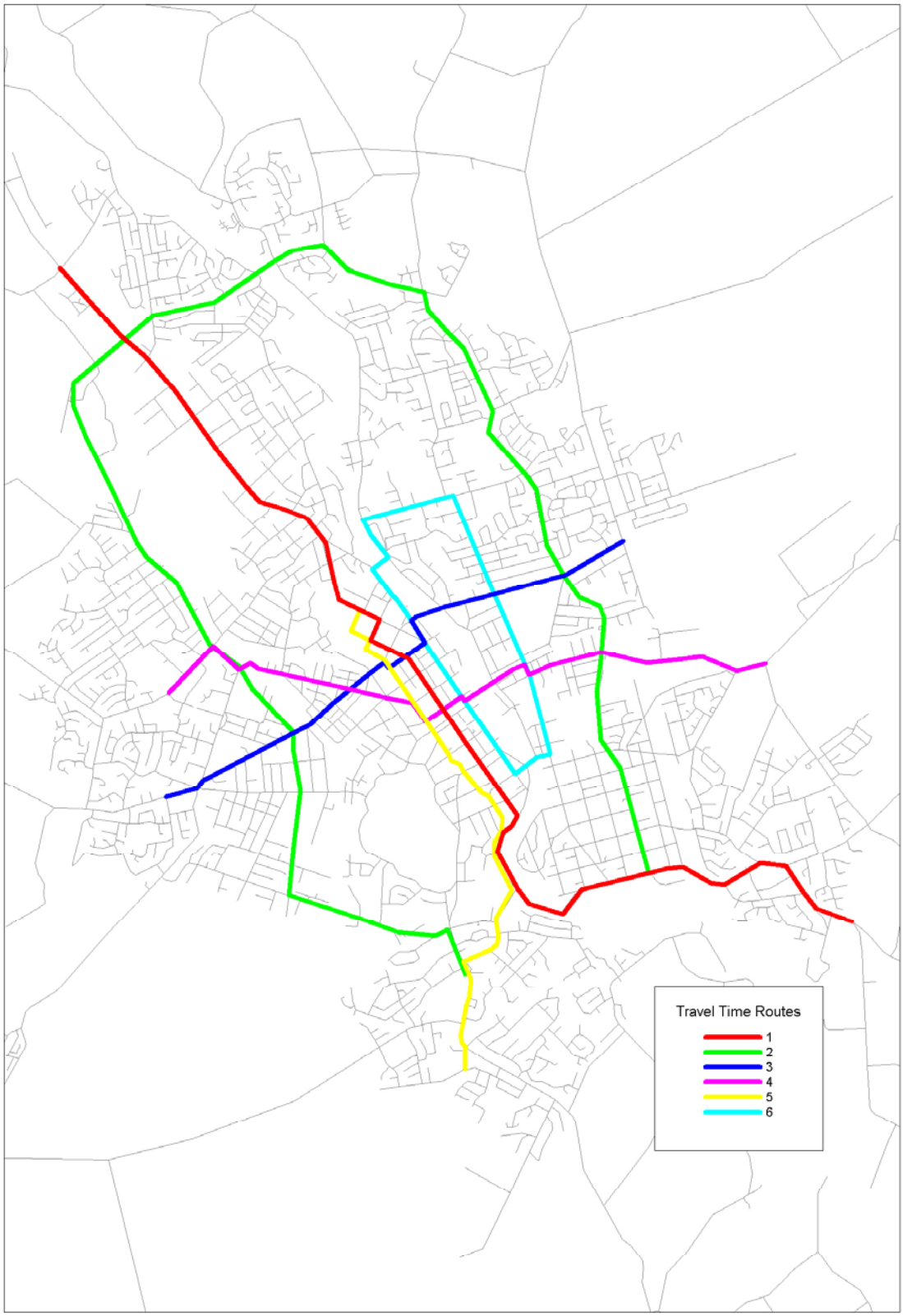

Figure Eight Proposed Urban Travel Time Survey Routes