# Hastings District Council

## Whakatu Arterial Link

## Transportation Assessment

June 2014

# Executive summary

*This report is subject to, and must be read in conjunction with, the limitations set out in Section 14 and the assumptions and qualifications contained throughout the Report.*

## Purpose

This Transportation Assessment describes how the proposed Whakatu Arterial Link (WAL) aligns with transport policy, its effects on the roading network and road users, and access arrangements to properties. An overview of the process of selection of the proposed alignment and the results of an economic evaluation to determine the economic viability of the WAL are also covered in this Transportation Assessment.

The Heretaunga Plains Transportation Study identified the need to provide a link between Whakatu and Pakowhai Road and remove HCVs from the SH2 route to the Port of Napier along Napier's Marine Parade. The study identified three options and the preferred option was developed through an Enquiry By Design process to the current design.

The WAL is to be a two lane single carriageway road from a new roundabout on State Highway 2 at its intersection with Napier Road to a new roundabout on Pakowhai Road to the north east of its intersection with Ruahapia Road. The new road will roughly follow the Karamu Stream. Pilcher Road is to be diverted to the proposed roundabout intersection of SH2 and the WAL. The WAL will cross the railway line at a new level crossing which has necessitated the need to close the existing railway crossing at Ruahapia Road splitting the road in to two sections.

The WAL aligns with Government policy on assisting economic development and improving the efficiency of movement of freight. The scheme is in the Hawke's Bay Regional Council's Regional Land Transport Programme for 2012-2015 as a priority scheme.

## Potential Effects

The WAL will remove a significant volume of traffic, including HCVs from residential roads in Whakatu and Clive transferring this on to Pakowhai Road which is predominantly rural in nature.

Without the WAL the existing intersections of Ruahapia Road and Pakowhai Road, SH2 and Pakowhai Road, Pilcher Road and SH2 and Station Road East onto SH2 will experience deteriorating Levels of Service (LoS). By 2025 these LoS are expected to drop to E, E, D and F respectively in the evening peak hour. The provision of the WAL will result in LoS of A and B at these intersections.

The closure of Ruahapia Road will necessitate detours of up to 2.6km for residents and business users on the southern end of Ruahapia Road if they wish to travel towards Napier using Pakowhai Road.

## Assessments Undertaken

The Heretaunga Plains Traffic Model has been used to model and determine deficiencies in the current roading network and to identify options for the WAL route that can resolve those deficiencies. The modelling work is based on 2006 Census data.

The existing crash rates have been obtained from the national CAS crash data base and traffic models from the NZ Transport Agency's Economic Evaluation Manual were used to predict the expected crash rate for the WAL.

## Results of Assessments

The Transportation Assessment has shown the WAL meets the strategies of the regional and local councils to encourage the use of the Hawke's Bay Expressway and remove heavy vehicles from Marine Parade. The WAL aligns with national and regional policy on promoting economic growth and improving road safety.

Results of traffic modelling has shown that the WAL will reduce traffic on SH2 by up to 3,750 vehicles per day in 2026. The level of service on the network will raise from a range of A to F to one of A to B as congestion will be relieved by the WAL.

The WAL will be designed to current standards and will provide for cyclists. The WAL will directly and indirectly address safety issues at 3 of New Zealands top 100 high risk intersections. The crash rate is expected to fall by around 2.8 crashes per year on the wider roading network that will be affected by the WAL.

For local residents and businesses to the west of the WAL route the closure of the Ruahapia Road level railway crossing will result in a detour length of up to 2.6 km if they wish to travel towards Napier using Pakowhai Road but as the WAL will remove peak hour delays this will result in shorter overall peak hour journey times. Pedestrians and cyclists will be able to use the existing cycleway bridge over the Karamu Stream to the WAL as an alternative route.

Traffic modelling and economic evaluation work has shown the WAL to have a BCR of 5.5 for a construction start in 2014.

## Suggested approach for effects identified

The Transportation Assessment has identified positive effects and recommends the construction of the WAL to reduce road crashes and improve the environment for residents and tourists along Railway Road, SH2 and Napier's Marine Parade, in addition to providing an efficient link for freight to the Port of Napier. The project will however result in detours of up to 2.6 kilometres for a number of properties to the west of Ruahapia Road due to the proposed closing of a level railway crossing on Ruahapia Road. This is not expected to increase travel time unduly.

# Table of contents

# Table index



# Figure index



# Appendices

# 1. Introduction

## 1.1 Introduction to the Scheme

This Transportation Assessment describes how the proposed Whakatu Arterial Link (WAL) aligns with transport policy, its effects on the roading network and road users, and access arrangements to properties. An overview of the process of selection of the proposed alignment and the results of an economic evaluation to determine the economic viability of the WAL are also covered in this Transportation Assessment.

The WAL will achieve a number of objectives, by providing a heavy vehicle route for freight between the Whakatu Industrial Area and the Port of Napier via Pakowhai Road to the Hawke's Bay Expressway (the Expressway). It will also provide improved access for individuals and freight to and from the wider Hawke's Bay Region and further afield.

The WAL will encourage traffic, particularly heavy commercial vehicles, to use the Expressway to travel between Whakatu and the Port of Napier rather than travel through the residential areas of Whakatu, Clive and along the Napier's Marine Parade. In addition it will provide convenient, efficient and safe access between Havelock North, the Hawke's Bay Airport and Napier's north western employment and residential areas.

Construction of the project is expected to take around 18 months (or two construction seasons) with works carried out concurrently at various locations to optimise the construction process while seeking to minimise disruption to existing road users, land owners and the local community.

This Transportation Assessment has been undertaken for the WAL as described in the Whakatu Arterial Project Description prepared by GHD (GHD 2014a).

## 1.2 Background

### 1.2.1 Proposal Development

In 2002 the Hawkes Bay Regional Council, the NZ Transport Agency, Hastings District Council (the Council) and Napier City Council commissioned a transport study of the Heretaunga Plains Area. This study, referred to as the 2004 Heretaunga Plains Transportation Study, identified the need for improved access between Whakatu and the Port of Napier. Since this study, the Government policy directives have been issued with a greater focus on growth and economic development. This resulted in a need to revise the study to take account of current Government policy.

In 2009 the NZ Transport Agency, along with the regional and district councils, commissioned the 2009 study, an update of the 2004 study using revised land use and growth forecasts in addition to the construction of a traffic model. The aim of the study is to:

> *"ensure that people and goods are moved to and from and with the study area with the least cost and for the most benefit to the region's economy while enhancing its social and cultural fabric and environmental condition".*

The 2009 Study confirmed the need for improved connectivity from Whakatu to Pakowhai Road and considered three route options for the WAL. .

### 1.2.2 Enquiry by Design Process

An Enquiry by Design (EBD) process was used by the Council to refine and determine the route options for the WAL based on a wider appreciation of values and impacts. The EBD process

was a collaborative, community driven design process to explore and test different design and development ideas and options based on a comprehensive understanding of local issues, opportunities and constraints.

A working group was established for the process involving community members, Council staff and consultants. The overall objective of this working group was to develop the WAL from an initial concept to a preferred route option ready for consideration by the full Council. The current proposal is a direct result of this consultative EBD process. The EBD process is fully explained in the Alternatives Assessment Report (EMS 2014b)

## 1.3 Notice of Requirement and Designation of Route

An application for a Notice of Requirement for the land along the WAL route to be designated as a public road is to be submitted to the Council, together with a number of regional consent application submitted to the Hawke's Bay Regional Council. This Transportation Assessment forms part of the application and associated Assessment of Environmental Effects (AEE).

# 2. Description of Proposal

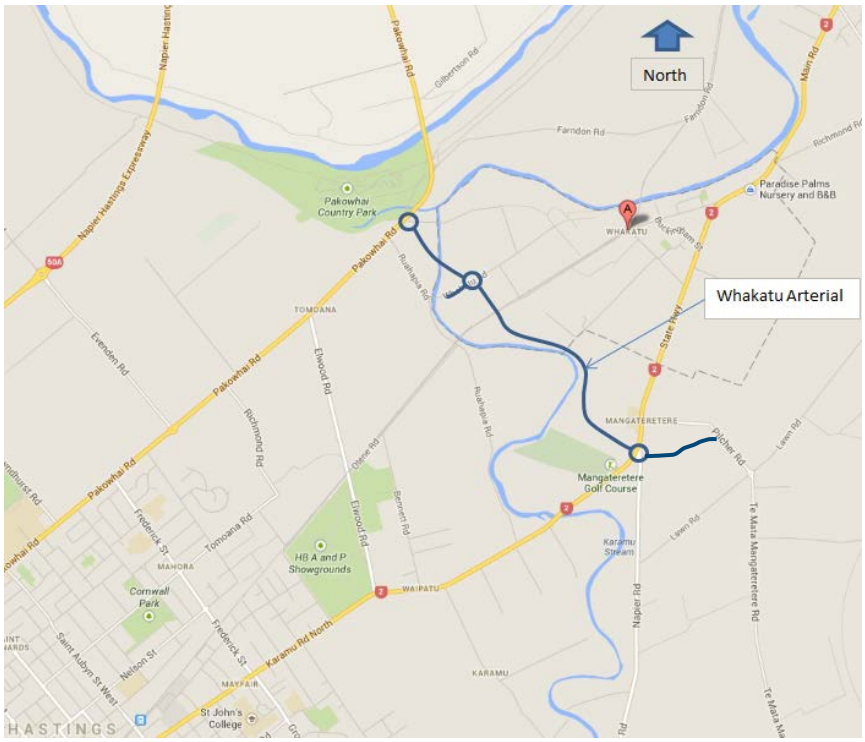
The proposed WAL is described in detail in the Project Description (GHD 2014a) and this transportation assessment has been conducted on the basis of the project as defined in that document.

The proposed route for the WAL is approximately 3,500m long and is orientated in a general north-west/south-east direction, extending from the west at Pakowhai Road near the closed off Rangitane Road through to the intersection of SH2 with Napier Road to the east (refer to Figure 1).

The WAL will cross the Karamu Stream via a new bridge to be constructed approximately 450 metres east of Pakowhai Road and from there will continue on the northern side of this stream.

The WAL intersects with one local road, Whakatu Road, with which there will be a roundabout intersection to provide connectivity to the Whakatu industrial area.

Figure 1 Route Alignment




The WAL will function as a District Arterial Road based on the Hastings District Plan classification criteria. It will have a two lane carriageway with a total construction footprint width of between 30 metres and 80 metres at the intersection approaches.

# 3. Policy

The WAL aligns with the policies of National, Regional and Local Government as described below. This ensures that the WAL will be eligible for funding enabling the successful delivery of the project.

## 3.1 National Context

At a national level the WAL project fits within a number of legislative documents, strategic initiatives and Government policy including:

- Land Transport Management Act 2003 (LTMA);
- Government Policy on Land Transport Funding (GPS) 2012/13; and
- New Zealand Transport Strategy (NZTS) 2008.

### 3.1.1 Land Transport Management Act 2003

The LTMA is the main statute for New Zealand's land transport planning and funding system. The purpose of the LTMA is to contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system. It also sets out five key transport objectives of:

- Assisting economic development (improving trip reliability and reducing journey times on critical routes);
- Assisting safety and personal security (reducing deaths and serious injuries as a result of road crashes);
- Improving access and mobility (increasing mode share of public transport, walking and cycling and other active modes);
- Protecting and promoting public health (reducing the number of people exposed to health endangering levels of noise and air pollution); and
- Ensuring environmental sustainability (reducing the use of non-renewable resources and carbon emissions).

The LTMA provides for three national level planning documents including the National Land Transport Strategy and the GPS to guide land transport planning and investment, and the National Land Transport Programme which is an operational document prepared by the NZ Transport Agency. At a regional level, the LTMA requires Regional Land Transport Strategies and Regional Land Transport Programmes.

A National Land Transport Strategy has never been issued. The previous government however issued the NZTS, which was last updated in 2008 to replace the original strategy published in 2002. The NZTS is non-statutory but has formed the context for the development of the GPS on Land Transport Funding. It sets the direction for the transport sector until 2040, by setting out targets under the five transport objectives listed in the LTMA.

### 3.1.2 New Zealand Transport Strategy 2008

The key aims of the NZTS relative to the WAL are:

- 'People and freight in New Zealand have access to an affordable, integrated, safe, responsive and sustainable transport system';

- Assisting economic development (improve reliability of journey times and reduce average journey times);
- Improving access and mobility (Increase walking and cycling); and
- Assisting safety and personal security (reduce road deaths and serious injuries).

The WAL is consistent with all of these aims, including in that it provides access for freight transport and provides for pedestrians and cyclists and is expected to reduce the crash rate.

### 3.1.3 Government Policy Statement on Land Transport Funding (2012/13)

The key aim of the GPS is to enable national economic growth and productivity through "an effective, efficient, safe, secure, accessible and resilient transport system that supports the growth of our country's economy in order to deliver greater prosperity, security and opportunities for all New Zealanders".

A network of priority roads that will improve journey time and reliability, and ease severe congestion, boosting the growth potential of key economic areas and improving transport efficiency, road safety and access to markets. Sea and air ports that are linked to transport network for movement of freight.

The Policy Statement has Focus Areas, amongst others, on:

- economic growth and productivity;
- value for money; and
- road safety.

The WAL supports the above three focus areas by providing an improved link between an industrial area and an international port. An economic evaluation has been undertaken showing the WAL will provide value for money and the replacement of existing intersections with safer roundabouts and improved infrastructure which is expected to improve road safety.

### 3.1.4 New Zealand Road Safety Strategy 2020

The aim of this strategy is 'A safe road system that is increasingly free of road deaths and serious injuries.' The design of the WAL to current road safety design standards will help towards the provision in the strategy of creating "Safer roads and roadsides". The contribution made by the WAL to this objective is discussed further in part 7 of this report.

## 3.2 Regional and District Context

### 3.2.1 Regional Land Transport Strategy and Programme

The Hawke's Bay Regional Council's Regional Land Transport Strategy 2012-2042 has the vision and aim of:

*"Our people are able to move around an integrated, safe, sustainable, resilient and safe transport network that enhances our economy and maintains our environment, health and lifestyle choices, and connects us to each other, the rest of New Zealand and the world."*

The Regional Land Transport Programme for 2012-2015 identifies the WAL as the top priority project for the region.

### 3.2.2 Hastings District Council Long Term Plan 2012/22

The Hastings District Council's Long Term Plan 2012/22 sets out the Council's plans and spending with one of the key aims being "efficient movement of goods" related to the WAL. The WAL forms one of the key actions of this Long Term Plan.

# 4. Existing Traffic Conditions

## 4.1 The Whakatu Area

Whakatu lies to the north east of Hastings and consists of a large industrial area with a smaller residential area to the south-east, bordering SH2. The settlement lies within the District of Hastings.

### 4.1.1 Residential Area

The main residential streets of Whakatu are:

- Railway Road;
- Station Street East; and
- Buckingham Street.

Railway Road provides access to a mixture of residential and industrial activities and it forms a convenient route for heavy traffic travelling from the Whakatu Industrial Area to the Port of Napier. There are therefore safety issues associated with heavy traffic driving through a residential area.

### 4.1.2 Industrial Area

To the north-west of the residential area is the main industrial area served by the following roads:

- Anderson Road;
- Johnston Way;
- Rangitane Road;
- Railway Road (mixed residential); and
- Whakatu Road.

The main distributor roads to the Industrial Area are Anderson Road and Whakatu Road, which leads to Ruahapia Road, from where the Expressway can be reached via Pakowhai Road.

## 4.2 Routes between Whakatu and Port of Napier

There are two routes from the Whakatu Industrial Area to the Port of Napier along either:

- Railway Road and onto SH2 via Clive and Napier's Marine Parade; or
- Ruahapia Road then Pakowhai Road and the Expressway.

### 4.2.1 Railway Road and SH2 Route

As mentioned above, Railway Road is a mix of residential and industrial properties and the routing of heavy traffic past residential areas is far from ideal. Further east, SH2 passes through Clive which has a number of residential properties along with leisure facilities (swimming pool and sports grounds) fronting it.

Within Napier the route HCVs take to reach the Port of Napier is along Marine Parade which is one of the main residential and tourist streets of Napier. This is also the main beach front with pedestrians frequently crossing from hotels and car parking areas to and from the beach. There are also numerous children's attractions along Marine Parade. The use of this road by HCVs is not therefore conducive to the image of a tourist area or the safety of a beachfront environment.

### 4.2.2 Pakowhai Road and Expressway Route

The route from Whakatu to the Expressway is predominantly through agricultural and horticultural land, although there is sporadic residential development on the route. These residential sections are much more spacious and less dense than the more tightly spaced sections in Whakatu. There is much less roadside activity and children are seldom, if at all, seen playing on the roadside.

The route via Ruahapia Road and Pakowhai Road requires the negotiation of two priority controlled intersections, where giving way to the priority route is required, in addition to the traffic signal intersection at the Expressway. Whilst the Level of Service (LOS) at these intersections is generally acceptable outside of peak hours the cumulative effect of a series of small delays (i.e. giving way to other traffic) at each intersection discourages heavy vehicles from using this route.

During peak periods there are traffic delays turning into Ruahapia Road and Pakowhai Road which further discourages HCV drivers from using this route.

### 4.2.3 Traffic Flows

Traffic flows for 2009 and a design year of 2026 have been modelled and are shown in Appendix A. A description of the traffic model is provided in Section 5.

#### *Pakowhai Road North of WAL*

The opening of the Hawke's Bay Expressway to the southwest of Pakowhai Road in the late 1990's has led to a significant reduction of traffic on Pakowhai Road. Traffic count data showing traffic flows on Pakowhai Road north of Farndon Road before completion of the Expressway and after opening together with current traffic flows are shown in Table 1

| Description | Count Date | ADT (vpd) |
|---|---|---|
| Before Expressway completed | 20/11/1993 | 12,801 |
| After completion of Expressway | 20/09/1999 | 9,000 |
| Current Traffic Flow | 15/07/2013 | 8,475 |

Table 1 Pakowhai Road North East of WAL - Traffic Flow Trends (ADT)

The recorded 12,801 vehicles per day along Pakowhai Road in 1993 dropped to 9,000 vehicles a day after the opening of the Expressway. Traffic counts in July 2013 show that traffic flows have not increased.

# 5. Heretaunga Plains Transportation Study and Cube Model

## 5.1 Heretaunga Plains Transportation Study

### 5.1.1 Purpose and History

The Heretaunga Plains Transportation Study of 2004 was commissioned in 2002 however the LTMA and subsequent government Policies led to the study becoming poorly aligned with newer policy requirements.

To provide a current development strategy the Heretaunga Plains Urban Development Strategic Study (HPUDS) has been undertaken by the regional and local councils to formulate sustainable development proposals for land use and infrastructure on the Heretaunga Plains from around 2020 to at least 2045.

As part of the longer term HPUDS, and to bring the HPTS of 2004 up to date, the 2009 Heretaunga Plains Transportation Study (HPTS) was completed.

The aim of the study was to:

> *"ensure that people and goods are moved to, from and within the study area with the least cost and for the most benefit to the region's economy while enhancing its social and cultural fabric and environmental condition".*

The 2009 HPTS has the primary objective of showing how future travel demand arising through development predicted to result from the strategies of Hastings District and Napier City Councils can be met and to provide transportation predictions required for the development of the HPUDS.

The objectives above are achieved through identifying deficiencies in the transport network and finding solutions that will provide for the medium and long term needs of the community. The 2009 HPTS also provides:

- evidence based data and analysis that can support funding applications for investment in the roading infrastructure;
- recommendations on long term form of the transport network and programme of forward works; and
- prioritised programmes to ensure economic efficiency of the network.

The HPTS was formally adopted by Hastings District Council in April 2012.

### 5.1.2 Methodology of Study

The study was undertaken in three stages:

- Construction of a four stage traffic model;
- Converting future land use forecasts into the traffic model zones; and
- Forecasting future traffic flows, identifying deficiencies and assessing alternative roading schemes.

### 5.1.3 Stakeholder Consultation and Outcomes

Stakeholders including key industries and producers, along with the Port Of Napier, were consulted during the study. One of the key themes generated from the stakeholder consultation

was that Marine Parade is an important residential and tourist corridor and correspondingly HCVs need to be moved on to the Expressway to access the Port of Napier.

#### 5.1.4 Further Information

A full description of the 2009 HTPS is provided in the GHD report “Heretaunga Plains Transportation Study, Study Report, Final” February 2012.

## 5.2 The Heretaunga Plains Transportation Model

#### 5.2.1 Model Description

The core element of the 2009 HPTS is the transportation model used to provide the predictions of the transportation effects of the projected development and related traffic scenarios. The 2009 HPTS has been developed using a CUBE software platform which covers both TRIPS and VOYGER traffic modelling software.

The 2009 HPTS CUBE traffic model has been developed using 2006 Census data along with trip rate generation formula that covers all transport modes including rail and walking. Current information on the road network and land development characteristics has been used to update earlier inputs in the original model into the 2009 model.

The model is a four staged model consisting of the following stages:

- Trip Generation;
- Trip Distribution;
- Mode Split; and
- Assignment.

The model is detailed with 366 internal traffic zones covering the Hastings District and Napier City Council areas and the trip generation is based on land use activities within each zone. Trip distribution is undertaken using a gravity model based on cost of travel and flow between zones. The mode split for walking and cycling is based on probability and travel distance whilst for bus patronage no change has been assumed. The assignment is undertaken with an incremental procedure until convergence is reached between route assignments.

A full description of the development of the HPTS CUBE traffic model is provided in the GHD Heretaunga Plains Transportation Model Calibration Report of December 2010.

#### 5.2.2 Time Periods Modelled

The model estimated hourly flows from land use data for the morning and evening peak hours and a representative off peak weekday hour. Factors were used to convert these hourly flows to daily flows. The modelled traffic flows for the existing and proposed road networks are shown in Appendix A.

## 5.3 WAL Problem Definition

#### 5.3.1 Deficiency Analysis – Levels of Service

The HPTS CUBE traffic model was used to determine the LOS on the existing network (without the WAL) for the years 2009, 2026 and 2046. The speed limits on the surrounding roading network have recently been reduced to 80 km/h and this has been taken into account in the modelling work to calculate the capacities for the Do Minimum network (referred to as “DA”).

The LOS has been calculated for both links and intersections based on a Highways Construction Manual (HCM) “average” level of service. As the (HCM) LOS is dependent on the road terrain, directional split, percentage of heavy vehicles and lane width, some typical values were used to determine the volumes at which the LOS conditions change. Furthermore, the HCM only provides LOS criteria based on traffic volumes for non-urban roads. Therefore the volumes for urban roads have been derived based on the 2004 HPTS and other urban network LOS criteria.

The plots provided in Appendix B are colour coded based on the approximate LOS and traffic volumes, as tabulated below:

Table 2 Deficiency Plots - Hourly Vehicle Flows Per Lane

| Link colour | LOS | 100 kph | 80 kph | 50 kph |
|---|---|---|---|---|
| Grey | A, B | < 500 vph | < 500 vph | < 430 vph |
| Green | C | 500-800 vph | 500-800 vph | 430-650 vph |
| Blue | D | 800-1450 vph | 800-1200 vph | 650-950 vph |
| Red | E and above | Over 1450 vph | Over 1200 vph | Over 950 vph |

The LOS for the intersections has been prepared based on the average delay on each approach of an intersection. As the model is a strategic model, the output intersection delays are not as accurate as they would be if the intersections were analysed in specific intersection analysis software, such as Sidra.

Table 3 Deficiency Plots – Average Intersection Approach Delay

| Link colour | LOS | Approach Delay |
|---|---|---|
| Green | B | >15 seconds per vehicle |
| Blue | C | >30 seconds per vehicle |
| Purple | D | >45 seconds per vehicle |
| Pink | E | >60 seconds per vehicle |
| Red | F | >120 seconds per vehicle |

It should be noted that the corresponding LOS for each flow band is approximate and should be used for comparative purposes only.

A level of service of E or F shows a significant capacity or delay problem on the network.

### 5.3.2 Predicted Deficiencies in Levels of Service

The LOS for the existing network with the recent 80km/h speed limits and potential restrictions preventing HCV access along Farndon Road have been calculated from running the HPTS traffic model for 2009 and 2026. The results of the LOS calculations at key intersections are shown in the table below. This shows the level of service on the approach arm (column 1 of the table) which has to “give way” the priority (main) road (shown in column 2 of the table). The LOS have been shown for intersection approaches as these LOS are lower than the LOS on the links between (and away from) the intersections. Printouts of the model runs showing the full network in the vicinity of the route of the WAL are provided in Appendix B.

Table 4 - Deficiencies in Do Minimum Network

| Intersection Approach Road | Entering priority road: | 2009 | | 2026 | |
|---|---|---|---|---|---|
| | | AM | PM | AM | PM |
| Whakatu Road | Ruahapia Road | B | C | C | E |

| Intersection Approach Road | Entering priority road: | 2009 | | 2026 | |
|---|---|---|---|---|---|
| | | AM | PM | AM | PM |
| Ruahapia Road | Pakowhai Road | B | B | B | E |
| Ruahapia Road | SH2 | B | C | B | C |
| Pilcher Road | SH2 | B | C | D | D |
| Station Road East | SH2 | B | D | B | F |

This modelling output for 2009 base year has been confirmed by on site observations of traffic queues on all the above approaches. The above table shows that if no roading improvements are undertaken there will be significant delays on the roading network by 2026.

### 5.3.3 Traffic Routing

The 2004 HPTS identified the need for improved connectivity from Whakatu to Pakowhai Road as the current access from the Whakatu industrial area to Pakowhai Road is poor and by default promotes the use of SH2 and Marine Parade for commercial traffic from the industrial estate to reach the Port of Napier. The use of SH2 as a route to the port is contrary to the aims of the study in taking heavy traffic away from Napier's Marine Parade and therefore improved access to Pakowhai Road is identified in the study.

### 5.3.4 Further Development

Hastings District Council has also identified the Tomoana-Whakatu corridor as an area for future industrial growth to be developed in stages over the next 20 years. This development will lead to extra commercial traffic between Whakatu and the Port of Napier, exacerbating the current situation.

## 5.4 Selection of Route Options

### 5.4.1 2004 HPTS Options

The 2004 study identified two potential options:

- Alignment A: a new link from Anderson Road to Pakowhai Road at its intersection with Anderson Road; and
- Alignment B: a new link as above but also continuing southwards to SH2 providing connectivity to Hastings and Havelock North.

The 2004 Study recommended Alignment B as it served both Whakatu and Havelock North traffic. Following further economic analysis at the time, this scheme was shown to not be needed due to the then proposed Northern Arterial.

### 5.4.2 2009 HPTS Options

The 2009 HPTS considered three options, (referred to as Options 22, 23 and 24), for an improved link between Whakatu and Pakowhai Road to improve access for freight from the growing industrial area at Whakatu along the Expressway to the Port of Napier. These options are shown in Figure 2. The three options considered in the 2009 Study were:

- Option 22: An improved route from Havelock North along St Georges Road then onto a new link road crossing SH2 and joining the northern half of Ruahapia Road and up to

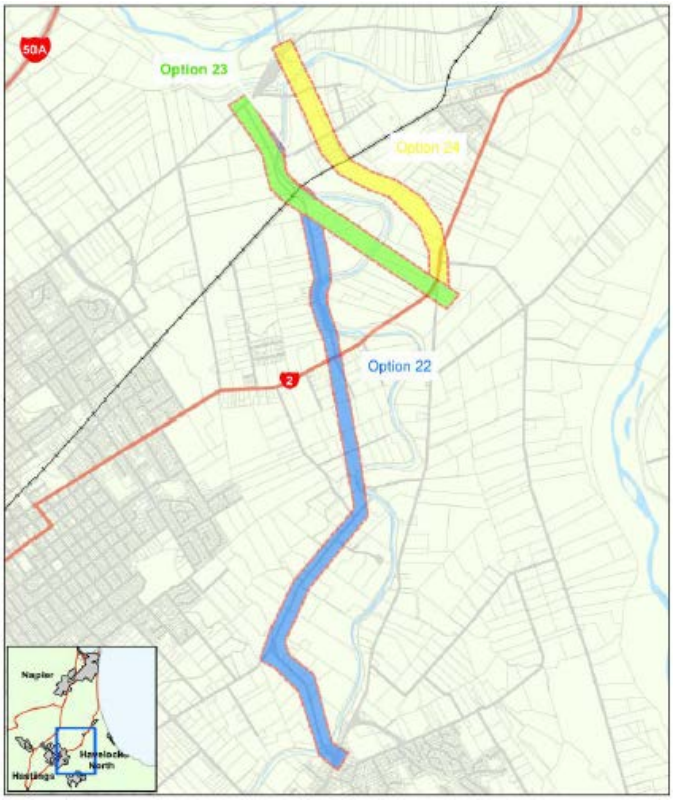
Pakowhai Road. New roundabout intersections at SH2 and Pakowhai Road intersections would be provided;

- Option 23: A link from Pakowhai Road along Ruahapia Road and then across the golf course to SH2 with a bridge across Karamu Stream; and
- Option 24: A new link from the Pakowhai Road and Farndon Road intersection running east of the Karamu Stream to the intersection of SH2 and Napier Road.

The three options were evaluated against economic and environmental factors. Option 24 formed the basis of the WAL.

Option 24 (indicated in yellow in Figure 2 below) was ultimately identified in the HPTS as the preferred option because it provides the most direct route between the SH2, the Napier Road roundabout and Pakowhai Road than the alternatives, being more attractive for traffic from Havelock North and more closely aligned with the strategic objectives of the arterial route.

### Figure 2: Route options identified in the HPTS




The traffic modelling in the 2009 HPTS showed that Option 24 would also be the most effective at diverting traffic off SH2 with an estimated 2,200 vehicle per day (vpd) diverting onto the Expressway whilst the other two options were estimated at only around 1,500vpd diverting off the SH2 route.

An economic evaluation of the options undertaken as part of the HPTS showed that Option 24 had a BCR of 5.1 compared to 4.5 and 5.2 for Options 22 and 23 respectively.[1] Option 23 is a cheaper option than Option 24 however as a consequence it also delivers fewer benefits. Although Option 23 costs $2.5M less it also delivers $5.1 less in benefits than Option 24 hence

[1] HBRC Heretaunga Plains Transportation Study, Study Report, February 2013, Table 66.

Option 24 selected as the most effective option, delivering greater benefits despite its nominally lower BCR than Option 23.

The 2009 HPTS identified the Whakatu Arterial as a priority project for the short term (2012-2017) HBRC transport programme.

### 5.4.3 Enquiry by Design Process

An Enquiry by Design process was initiated by the Council in 2012 to confirm a preferred route for the WAL based on a broader analysis of environmental, cultural, economic and social considerations. The recommended route developed by this process was ultimately similar to Option 24. This alignment was adopted by Council and proceeded to detailed design. This process is fully explained in the Alternatives Assessment Report (EMS 2014b)

## 5.5 Whakatu Road Intersection Options

During detailed design, a number of further sub-options concerning the route of Whakatu Road and level crossing closure were considered. In total seven options were investigated to understand the traffic effects of level crossing closures and turning restrictions on the WAL and surrounding network. The options investigated were:

- **Option W1** – left-in and out plus right-out at Whakatu Road West, left-in and out at Whakatu Road East, Anderson Road level crossing closed;
- **Option W2** – left-in and out plus right-out at Whakatu Road West, left-in and out at Whakatu Road East, Anderson Road level crossing open;
- **Option W3** – left-in and out plus right-out at Whakatu Road West, all movements at Whakatu Road East, Anderson Road level crossing closed;
- **Option W4** – left-in and out at Whakatu Road West, all movements at Whakatu Road East, Anderson Road level crossing closed;
- **Option W5** – Whakatu Road West closed, left-in and out at Whakatu Road East, Anderson Road level crossing open, Ruahapia Road level crossing closed;
- **Option W6** – Whakatu Road West closed, all movements at Whakatu Road East, Anderson Road level crossing open, Ruahapia Road level crossing closed; and
- **Option W7** - Whakatu Arterial - Whakatu/Anderson Open, 80 km/h Speed limit on Pakowhai Road.
- **Option W10A** – Whakatu Arterial – Whakatu/Anderson Open, Ruahapia Road level crossing closed, roundabout intersection of Whakatu Road and WAL (no Anderson Rd Link Road to WAL).

The options with Anderson Road being closed at the level crossing were discounted (W1, W3, and W4) along with options W6 and W7.

An economic evaluation was undertaken on options W2 and W5 which produced BCRs of 2.8 and 3.0 respectively. Option W5 was further developed into seven sub-options to take account of the Council's traffic proposals for the area. These seven proposals were:

a. 80km/h speed limit zones being implemented and HCV weight restrictions on Farndon Road Bridge;

b. As for proposal 'a' above but with an additional 80km/h speed limit introduced on SH2 between Clive and Napier;

c. As for proposal ‘b’ above but no weight restriction on Farndon Road;

d. No 80 km/h speed limit zones but with Farndon Road weight restrictions and 80 km/h speed limit between Clive and Napier on SH2;

e. 80 km/h speed limit zone only, no other restrictions;

f. Farndon Road Bridge weight restrictions only, no other restrictions; and

g. 80 km/h speed limit between Clive and Napier on SH2, no other restrictions.

Having considered the network options, scenario ‘a’ was selected as the preferred traffic measures. Option W5 was then developed into Option 5A in the modelling and cost benefit analysis taking account of the proposed traffic restrictions in ‘a’ above.

During further consultations a further option, Option W10A, was introduced. This option is similar to Option 5A except that in place of the roundabout with a link road from Anderson Road, a roundabout at the intersection of the WAL and Whakatu Road would be provided without any extension of Anderson Road. Revised modelling and cost benefit analysis has been undertaken for this option.

The economic evaluation for this current option, W10A provides a BCR of 5.5.

# 6. Impact of WAL

The HPTS Cube traffic model has been used to predict the changes in traffic flows on the surrounding roading network for the year 2026 and these are shown in Table 5 below. The Do Minimum option is the existing roading network with no major schemes in the vicinity other than routine maintenance and minor works. The Project column shows the traffic flows with the WAL open and the final column shows the difference in traffic levels for each of the routes.

Table 5 Do Minimum and Project 2026 ADTs (rounded to nearest 250vpd)

| Road and location | Do Min | Project | Change |
|---|---|---|---|
| Whakatu Arterial (southern end) | - | 9,750 | +9,750 |
| Whakatu Arterial (northern end) | - | 16,750 | +16,750 |
| Ruahapia Road (southern end) | 3,000 | 500 | -2,500 |
| Ruahapia Road (northern end) | 10,500 | - | -10,500 |
| Elwood Road (southern end) | 6,750 | 3,000 | -3,750 |
| Elwood Road (northern end) | 5,500 | 4,000 | -1,500 |
| Otene Road | 2,250 | 1,000 | -1,250 |
| Anderson Road | 10,500 | 5,250 | -5,250 |
| Railway Road (through Whakatu) | 3,000 | 2,000 | -1,000 |
| Pakowhai Road (north of Farndon Road) | 9,000 | 10,750 | +1,750 |
| Pakowhai Road (south of Whakatu Arterial) | 13,000 | 15,750 | +2,750 |
| Karamu Road (south of Whakatu Arterial) | 18,750 | 17,500 | -1,250 |
| SH2 (north of Whakatu Arterial) | 16,500 | 12,750 | -3,750 |
| SH2 (north of Clive) | 16,250 | 15,500 | -750 |
| Napier Road (south of SH2) | 4,000 | 6,000 | +2,000 |
| St Georges Road | 5,500 | 3,750 | -1,750 |

*Note: Values rounded to nearest 250 vehicles.*

### 6.1.1 Effects of Change in Traffic Flows

Table 5 shows that there will be a reduction of around a 750 vpd on SH2 north of Clive in 2026, including a proportion of HCVs which currently have adverse environmental effects on the residential areas of Clive and Napier's Marine Parade. There will also be significant traffic reductions on Otene Road and Elwood Road on the Hastings side of the WAL.

Increases in traffic flows will occur on Napier Road (2,000 vpd) to and from Havelock North. This increase in traffic will be compensated for by less traffic using the more circuitous St Georges Road in Hastings to reach Havelock North.

### *Pakowhai Road*

The current traffic count data (July 2013) reveals 8,500 vpd along the northern end of Pakowhai Road which with the predicted increase of 1,750 vpd from the traffic model will bring traffic flows to around 10,250 vpd. This is well below the 12,800 vpd previously experienced along the northern section of Pakowhai Road before completion of the Expressway (refer to Table 1, Section 4.2.3).

### 6.1.2 Impact on Levels of Service

The HPTS traffic model was also run to predict the LOS in 2026 on the roading network with the WAL in place. The results of this modelling work on key links in the roading network shown in Table 4 are shown in Table 6 below. Table 6 also shows, for comparison purposes, the theoretical impact of levels of service had the WAL been completed in the base year of 2009.

Table 6 WAL Levels of Service on Surrounding Network

| Road | Approach to | 2009 | | 2026 | |
|---|---|---|---|---|---|
| | | AM | PM | AM | PM |
| Anderson Road | Ruahapia Road | A | A | A | A |
| Ruahapia Road | Pakowhai Road | A | A | A | A |
| Ruahapia Road | SH2 | A | A | A | A |
| Pilcher Road | SH2 | A | A | A | A |
| Station Road East | SH2 | A | B | A | B |

Whilst not listed in Table 5, the LOS for the WAL is 'A'. Traffic flow diagrams with levels of service for the roading network in the vicinity of (and including) the WAL are shown in Appendix B.

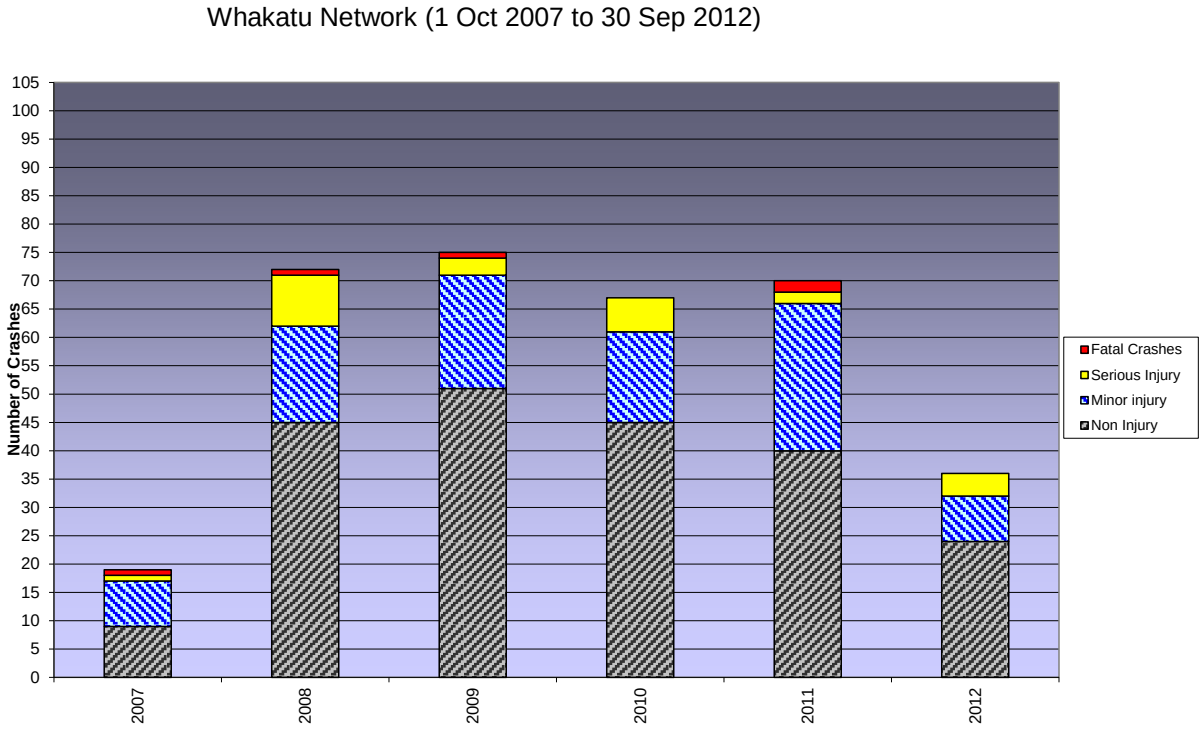
Compared to Table 4 showing the Do Minimum LOS, the WAL significantly improves the operation of the network with the LOS for traffic formerly using Ruahapia and Whakatu Roads enjoying a LOS of 'A' on the network in 2026.

# 7. Crash Analysis

### 7.1.1 Crash Records

With the exception of three intersections that are in the NZTA's list of top 100 crash sites (refer Section 7.3) the remainder of the network around Whakatu, as illustrated in Figure 4 below, has a good safety record with below average crash rates. In 2012 there were 36 recorded road crashes in the Whakatu area; fortunately none of these resulted in any deaths. The crash rates for the six year period to 2012 are shown in Figure 3.

Figure 3 Crash History on Road Network




## 7.2 Crash Rate Prediction

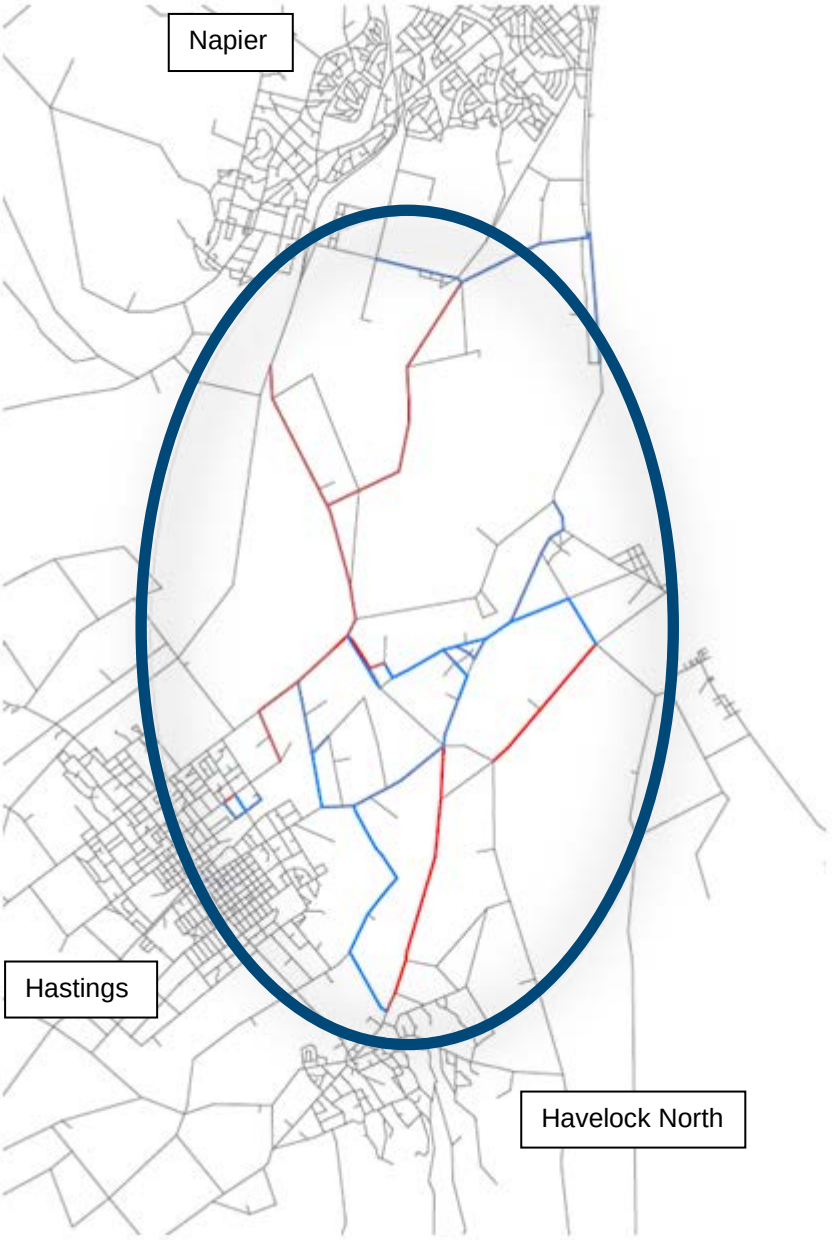
The opening of the WAL will result in a change in traffic flows which will affect the current crash rates on the existing road network. The expected crash rates have been calculated for the network, with and without the WAL, by obtaining traffic flows from the HPTS traffic model and using crash prediction models from Appendix A6 of the NZ Transport Agency's Economic Evaluation Manual[2].

Output from a refined HPTS traffic model was used to analyse annual average daily traffic (ADT) flow data and determine the key links and intersections where the most significant change in traffic volumes on the network will occur in the key years of 2009, 2026 and 2046. In order to focus on the major accident savings, only those links that experience a 10% or greater change in volumes have been captured in the assessment. A minimum ADT threshold of 500 vpd was also applied to the selection criteria to put a sensible limit on the number of links and intersections analysed.

[2] The typical mid-block crash rates were compared with the reported accident history for the five year period 2008 to 2012, and were adjusted to better represent observed crash rates when calculating overall accident costs.

Overall, 22 intersections and 34 mid-block sections were analysed totalling approximately 60 km of road. The level railway crossings at Elwood Road, Ruahapia Road and Whakatu Road were also included. The area of influence is shown in Figure 4.

Figure 4 Area of Crash Study




The results of the crash prediction analysis are summarised in Table 9 which shows the annual crash rates within the area of influence of the WAL. This network only includes key links affected by the WAL and is for a much smaller road length than that used for Figure 3 and hence the crash volumes are respectively lower.

Table 7 Predicted Crash Rates - Midblock

| Option | 2009 | 2026 | 2046 |
|---|---|---|---|
| Do Minimum Midblock | 13.7 | 17.2 | 19.7 |
| Project Midblock | 12.4 | 16.2 | 18.9 |

Table 8 Predicted Crash Rates - Intersections

| Option | 2009 | 2026 | 2046 |
|---|---|---|---|
| Do Minimum Intersections | 4.1 | 4.5 | 4.8 |
| Project Intersections | 2.3 | 2.7 | 2.9 |

Table 9 Predicted Crash Rates (Total)

| Option | 2009 | 2026 | 2046 |
|---|---|---|---|
| Do Minimum | 17.8 | 21.7 | 24.5 |
| Project | 14.7 | 18.9 | 21.8 |
| Difference | -3.1 | -2.8 | -2.7 |

This shows a reduction of around 2.8 crashes on average per year over the sections of roading network that will experience changes in traffic flows as a result of the WAL.

By applying the Economic Evaluation Manual (EEM) crash costs the economic value of the crash rates have been calculated in Table 10.

Table 10 Accident Cost Summary

| Accident costs | Do Minimum | | | Project | | |
|---|---|---|---|---|---|---|
| | 2009 | 2026 | 2046 | 2009 | 2026 | 2046 |
| Mid-Block | $7.11M | $8.96M | $10.26M | $6.35.M | $8.34M | $9.72M |
| Intersections | $2.66M | $2.92M | $3.15M | $1.77M | $2.01M | $2.17M |
| Total | $9.77M | $11.88M | $13.41M | $8.12M | $10.35M | $11.89M |

Mid-block crash savings mainly accrue from a significant amount of traffic transferring from local roads onto the safer arterial. The introduction of safer intersection controls (e.g. roundabouts) for traffic travelling to and from the Whakatu Industrial Area also results in positive safety benefits.

## 7.3 Road Safety

The WAL, corresponding intersections and associated link alterations are designed in accordance with Austroads, NZ Transport Agency and Hastings District Council's standards and guidelines. These design requirements will ensure that there are sufficient sight lines at the intersections and full stopping sight distance along the arterial link road to ensure the safety of all road users. Road alignment will be such that the road is self-explaining with no hidden or unexpected changes in alignment or curves that are inadequate for the posted speed limit.

Landscaping at the intersections and around curves will be managed to avoid conflict with intersection and stopping sight distances.

As outlined in the previous section this is expected to reduce the overall crash rate on the road network as a whole.

It should be noted that in March 2014 the NZ Transport Agency released a list of the top 100 high risk intersections in New Zealand based on the 10 year crash history (2003 – 2012). Three intersections that were listed will have improvements either directly or indirectly as a result of the WAL. The three intersections in question are:

1. SH50 (Napier – Hastings Expressway)/SH50 Links Road (No. 19 with 19 injury crashes)
2. Pakowhai Road/Ruahapia Road (No. 58 with 13 injury crashes)
3. SH2/Napier Road (No. 79 with 15 injury crashes)

The construction of the WAL will facilitate (as a later project funded by NZTA) the SH50/SH50 Links Road intersection upgrade which will involve the replacement of the traffic signals with a large diameter roundabout which will reduce the number and severity of crashes.

The existing Pakowhai Road/Ruahapia Road intersection will be closed. This intersection is currently a Tee intersection that is beyond capacity in the peak hours and has reduced sight distance due to the geometric layout. The WAL will replace this with a large diameter roundabout at the intersection of the WAL and Pakowhai Road which will significantly improve the level of service and geometric layout which will lead to a reduction in crashes.

The SH2/Napier Road intersection, which is currently a Tee intersection, will be replaced with a large diameter roundabout which will improve the level of service and improve the geometric layout which will provide a reduction in crashes.

# 8. Economic Evaluation

An economic evaluation based on an assessment of travel time, vehicle operating costs and safety has been undertaken in accordance with the NZ Transport Agency's EEM to determine the economic viability of the option.

For the evaluation, travel time and vehicle operating costs were estimated for 2009, 2026 and 2046 using outputs from the traffic models. Interpolation techniques were used to determine values for intermediate years. The crash savings were estimated from accident prediction models in the EEM as discussed in the previous section.

A discount rate of 6% has been used in the evaluation which covered a 40 year period. Earlier work has used an 8% discount rate over a period of 30 years.

The operating costs and benefits of the Do Minimum network (DA as discussed in Section 5.5 ) and the Project network (i.e. with WAL) were calculated and compared to give a Benefit Cost Ratio (BCR) for various construction start dates.

A summary of the analysis is given in Table 11. For a 2014 construction start the project has a BCR of 5.5, which shows that the WAL will deliver a good rate of return.

Table 11 Option W10A - Benefit Cost Ratio

| Construction Year | 2014 | 2018 | 2023 | 2028 | 2033 | 2038 | 2043 | 2048 |
|---|---|---|---|---|---|---|---|---|
| Travel time cost savings | $57.8M | $51.2M | $43.4M | $36.5M | $30.3M | $24.9M | $20.3M | $16.5M |
| VOC savings | $18.7M | $16.1M | $13.2M | $10.7M | $8.6M | $6.9M | $5.5M | $4.4M |
| Accident Savings | $26.2M | $20.5M | $15.2M | $11.3M | $8.4M | $6.3M | $4.7M | $3.5M |
| **PV total net benefits** | **$102.7M** | **$87.8M** | **$71.8M** | **$58.5M** | **$47.4M** | **$38.1M** | **$30.5M** | **$24.3M** |
| **PV total net costs** | **$18.6M** | **$14.8M** | **$11.0M** | **$8.2M** | **$6.2M** | **$4.6M** | **$3.4M** | **$2.6M** |
| **BCR** | **5.5** | **5.9** | **6.5** | **7.1** | **7.7** | **8.3** | **8.9** | **9.5** |
| FYRR | 0.22 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.24 |
| BCR (excl accidents) | 4.1 | 4.6 | 5.1 | 5.7 | 6.3 | 6.9 | 7.5 | 8.1 |

Key to : VOC – Vehicle Operating Costs, PV – Present Value, and BCR – Benefit Cost Ratio

The worksheets for the calculation of the BCR are shown in Appendix C. The existing, or Do Minimum network used in the analysis has been revised to include the recent reduction in speed limits to 80 km/h on the surrounding roading network and a potential weight restriction on Farndon Road as discussed in Section 5.5.

# 9. Cyclists and Pedestrians

## 9.1 Cycle Ways

The WAL crosses the Hastings to Clive cycleway at the proposed railway crossing. An analysis based on the NZ Transport Agency's Pedestrian Planning and Design Guide and Guidelines for the Selection of Pedestrian Crossing Facilities was undertaken. This analysis identified that a form of grade separation would be the most appropriate form of crossing.

Given that the WAL will need to accommodate over dimension vehicles the option of an overbridge was deemed inappropriate due to the considerable clearance required which would result in significant ramp lengths to provide access for young or elderly pedestrians and cyclists and to provide wheelchair access. Based on these factors, the installation of an underpass (approximately 60m in length) was deemed the most appropriate facility. The underpass will be lit to appropriate standards and designed to allow sightlines through to address personal security concerns.

Over the Karamu Stream bridge, pedestrian and cycle movements are catered for in the footpath and cycleway on the northern side of the proposed bridge. The road shoulders provide space for pedestrians and cyclists along the remainder of the route however it is anticipated that these users will use Ruahapia Road and Whakatu Road along with the Hasting to Clive Cycleway rather than the WAL.

It is understood that the Council has plans to promote the use of Ruahapia Road and to provide more off road connections to the adjacent network.

# 10. Bus Services

There are two bus services running in the vicinity of the WAL: Service Number 11 between Hastings and Napier via SH2; and Service Number 12 between Havelock North and Napier, which runs via Pakowhai Road. Service Number 11 only operates during the peak hours whilst Service Number 12 runs daily, running half hourly during weekdays.

Currently the buses do not have to give way to traffic at the intersection as they are on the main road, however with the introduction of a roundabout buses will have to give way to traffic on the roundabout which will result in a small delay to each journey. As the roundabouts have been designed to cope with predicted traffic flows there should not be any significant delays to the bus services.

# 11. Rail Transport

The industrial area of Whakatu is well served by the railway network with direct sidings into the larger company premises. There is also a freight yard for loading of freight from companies that do not have a direct siding. Rail services run to Wanganui via Palmerston North where there are connections to rail freight services serving the North and South Islands. The line also serves the Port of Napier to the north.

The WAL will also improve connectivity to the Whakatu railway yard for road freight from further afield. To eliminate the potential for an increase in train delays due to incidents with road users at road crossings, the existing railway crossing at Ruahapia Road will be closed when the new railway crossing on the WAL opens. This is fully explained in the Alternatives Assessment Report (EMS 2014b)

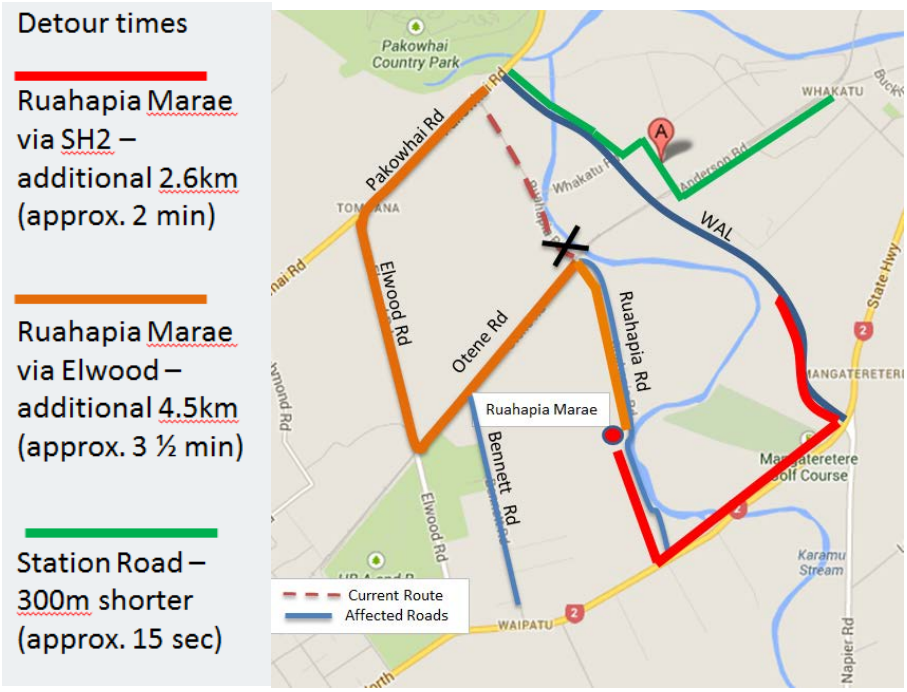
# 12. Effects On Properties

## 12.1 Ruahapia Road Closures

The closure of Ruahapia Road at the level railway crossing will affect residents and businesses to the south of the railway wishing to travel along Pakowhai Road to the Expressway by motor vehicle.

For properties accessed off Ruahapia Road and the north-eastern end of Otene Road the detour route will be along Otene Road, Elwood Road and Pakowhai Road, a total extra length of 2.6km if they are heading towards Pakowhai Road. There is an alternative detour route of travelling along SH2 to the WAL, which from Ruahapia Marae is 4.5 km longer. Motorists from the Whakatu end have a shorter route with the opening of the WAL. The key detour routes are shown in Figure 5 below together with the detour times.

Figure 5 Ruahapia Road Detour Routes




The properties on Bennett Road and cul-de-sacs leading off it will also be affected by the road closure but the detour route is much shorter at 600 metres additional length, with motorists diverting along Elwood Road to reach Pakowhai Road.

There are an estimated 12 residential dwellings accessed off the affected lengths of Ruahapia Road and Otene Road in addition to two Marae and numerous commercial and storage buildings and accesses associated with the agricultural and horticultural fields adjacent to the roads.

In addition to field accesses there are a further estimated 50 residential properties and 5 businesses served from Bennett Road that will be subjected to the shorter detour.

Whilst the detour will add to journey length, the improvement in LoS in the peak hours will lead to reduced journey times for local traffic affected by the road closure. Currently in the peak hour vehicles can experience up to a 10 minute delay at the intersection of Ruahapia Road and

Pakowhai Road. This will be reduced to less than a minute at the intersection of the WAL and Pakowahi Road.

Pedestrians and cyclists currently using the Ruahapia Road level crossing will be able to use the existing cycleway bridge over the Karamu Stream and access the WAL directly. Pedestrian and cycle access will be maintained over the Ruahapia Road level crossing following its closure to vehicular traffic.

## 12.2 Apollo Pac

The WAL passes through the Apollo Pac site which currently has access onto Whakatu Road where the WAL will cross. An alternative access onto Whakatu Road prior to its intersection with the WAL will need to be constructed. HDC is engaged with Apollo Pac to establish the location of this access to ensure that operational requirements are met.

## 12.3 Property and Land Acquisitions

The properties from which land will be required for the construction of the WAL are identified in the Land Requirement Plan in the Notice of Requirement for the WAL (HDC 2014a).

Table 12 provides a summary of these landowners. The alignment crosses 14 lots owned by private landowners and the remainder of the land is owned by either HDC, Hawke's Bay Regional Council or the Crown.

The proposed access to the severance areas is described in Table 12.

### Table 12: Summary of Total Land Requirements

| Property Reference Number | Claimant | Total Area to be Acquired(Ha) (road and severance) | Access to severance |
|---|---|---|---|
| 2 | Wedd, Ward & Bell | 0.0371 | N.A. |
| 3 | Wedd, Ward & Bell | 0.5548 | N.A. |
| 4 | Wedd, Ward & Bell | 1.3925 | N.A. |
| 5 | Wedd, Ward & Bell | 0.8875 | N.A. |
| 6 | Omahuri Orchards Limited | 0.9547 | N.A. |
| 7 | Mr Apple New Zealand Limited | 2.2071 | Not possible due to the height of the road |
| 8 | Haley | 0.0187 | N.A. |
| 9 | Mr Apple New Zealand Limited | 2.1616 | N.A. |
| 10 | ENZA Group Services Limited | 3.1479 | Left and right in, left out. Right turn bay provided since not adjacent to roundabout to assist access via left turn. |
| 12 | Apollo Pac Limited | 0.9432 | N.A. |
| 13 | Lucknow Holdings Limited | 1.8590 | Full onto Whakatu Road |
| 14, 15, 17, 18 | Hawke's Bay Regional Council | 0.7065 | N.A. |
| 16 | Crown (River Bed) | 0.1106 | N.A. |
| 19 | Andrew Bryan Dillon | 0.7625 | N.A. due to small land area not being usable |

| | | | |
|---|---|---|---|
| 20 | Lucknow Holdings Limited | 1.2831 | Left in and out. Close proximity to roundabout allows this configuration to provide access from all directions by using the roundabout to undertake u-turns |
| 22 | Hawke's Bay Regional Council (River Bed) | 0.0425 | N.A. |
| 23 | Hastings District Council | 0.0720 | N.A. |
| 24 | Hawke's Bay Regional Council | 0.0293 | N.A. |
| 25 | Silverfern Farms | 0.3480 | N.A. |
| 26 | Road Reserve (Hastings District Council) | 0.3378 | N.A |

Note that 38 Whakatu Road is not subject to land requirement, however the existing access will be affected by the construction of the Whakatu Road roundabout and will need to be realigned. Through consultation with the current owner of the site, a revised access configuration has been developed and this is attached as Appendix D.

# 13. Conclusion

The WAL will provide an efficient heavy vehicle route for the movement of freight between the Whakatu Industrial area and the Port of Napier, as well as further afield, via Pakowhai Road and the Expressway. It will also benefit traffic from Havelock North travelling to Napier.

The WAL will remove heavy traffic from the residential villages of Whakatu and Clive as well as from Napier's Marine Parade, bringing positive benefits to a large number of properties. Traffic modelling has shown a reduction in traffic levels along these roads.

The crash rate is expected to fall by around 2.8 crashes per year on the wider roading network that will be affected by the WAL. The WAL will be designed to current standards and will provide for cyclists and pedestrians.

There will be no adverse effects on public transport services and access to and from the rail freight network will be improved.

For local residents and businesses to the west of the WAL route, the closure of the Ruahapia Road level railway crossing will result in a detour length of up to 2.5 km, or about 2 minutes additional travel time, however that increase will be offset by reduced travel times at peak periods and improved intersection safety. Pedestrians and cyclists are well catered for, and will not be adversely impacted by the Ruahapia level crossing closure as they will be able to use the existing cycleway bridge over the Karamu Stream and cycle and pedestrian access will be maintained over the Ruahapia level crossing following its closure to vehicular traffic.

Traffic modelling and economic evaluation work has shown the WAL to have a BCR of 5.5 for a construction start in 2015.

# 14. Basis of Report

This report has been prepared by GHD for Hastings District Council and may only be used and relied on by Hastings District Council for the purpose agreed between GHD and the Hastings District Council as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Hastings District Council (and GHD's wider team of sub-consultants undertaken assessments on the basis of this report) arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was issued.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect

# Appendices

# Appendix A HPTS Model - Traffic Flows

Extracts from HPTS CUBE Traffic Model:

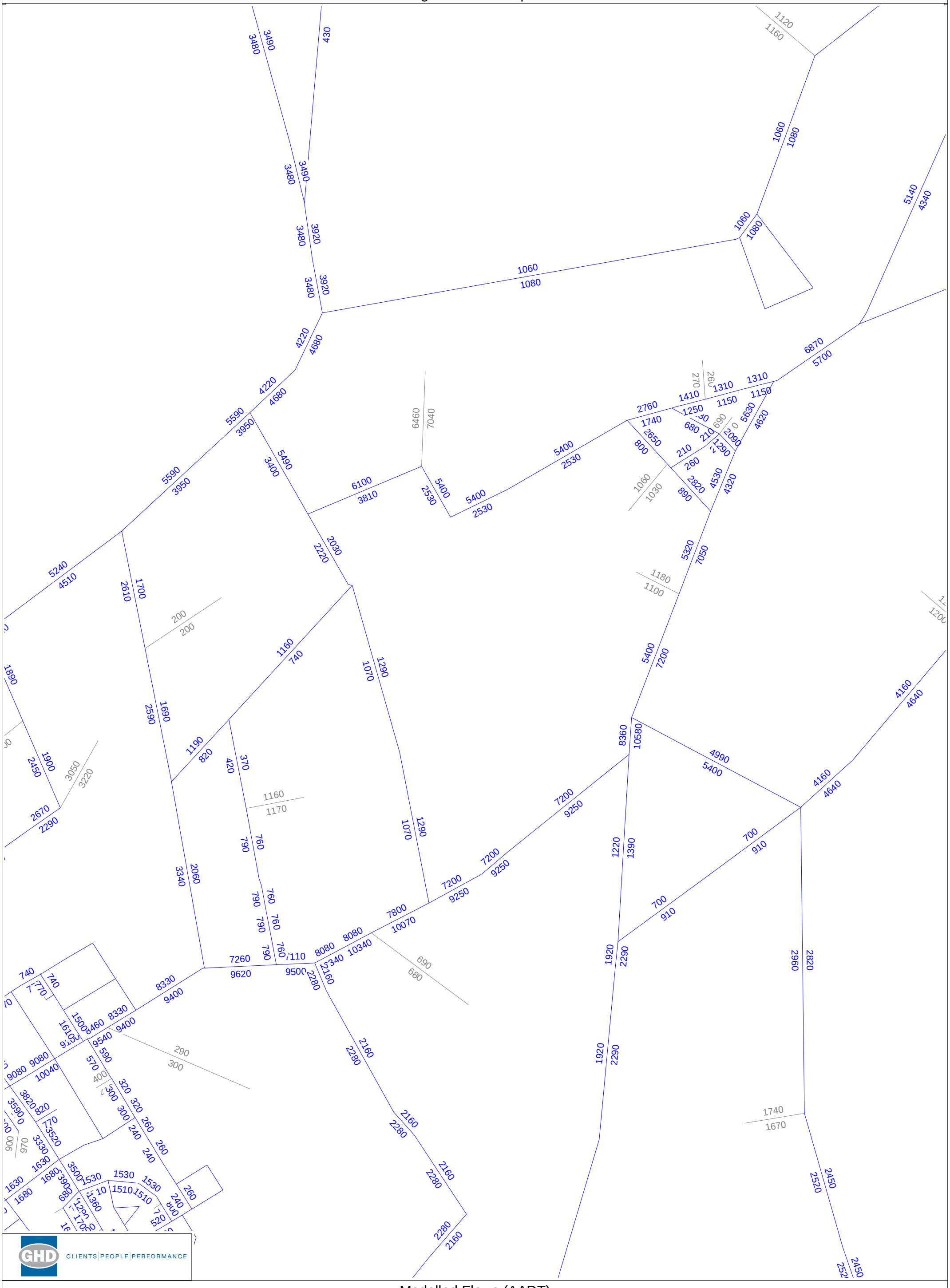
2009 Existing Daily Traffic Flows, Do Minimum (DA) Network

2026 Predicted Daily Traffic Flows, Do Minimum (DA) Network

2009 Predicted Daily Traffic Flows, Option W10A Network

2026 Predicted Daily Traffic Flows, Option W10A Network

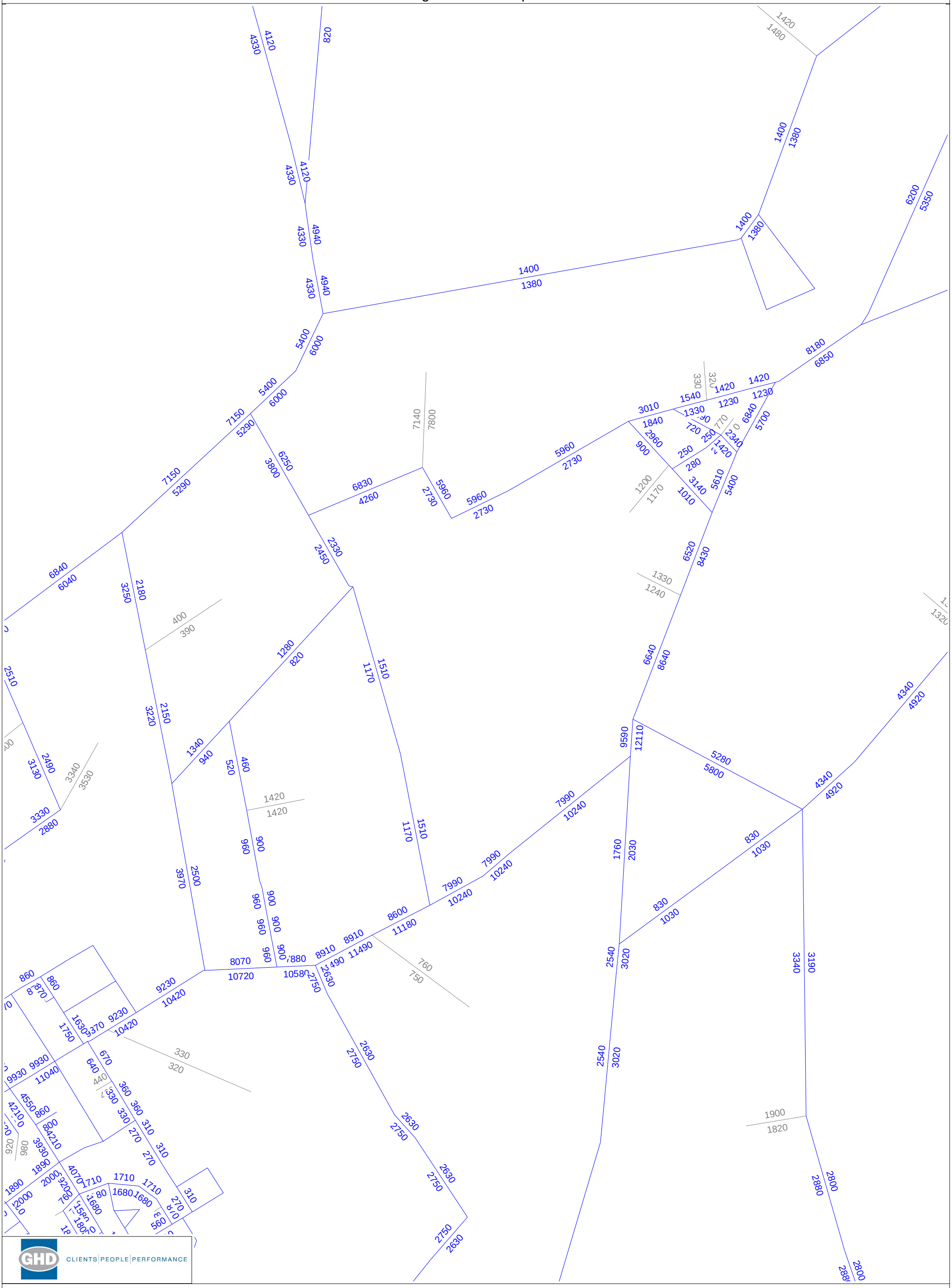
# Heretaunga Plains Transport Model




Modelled Flows (AADT)
Network = DA  Year = 09

cube

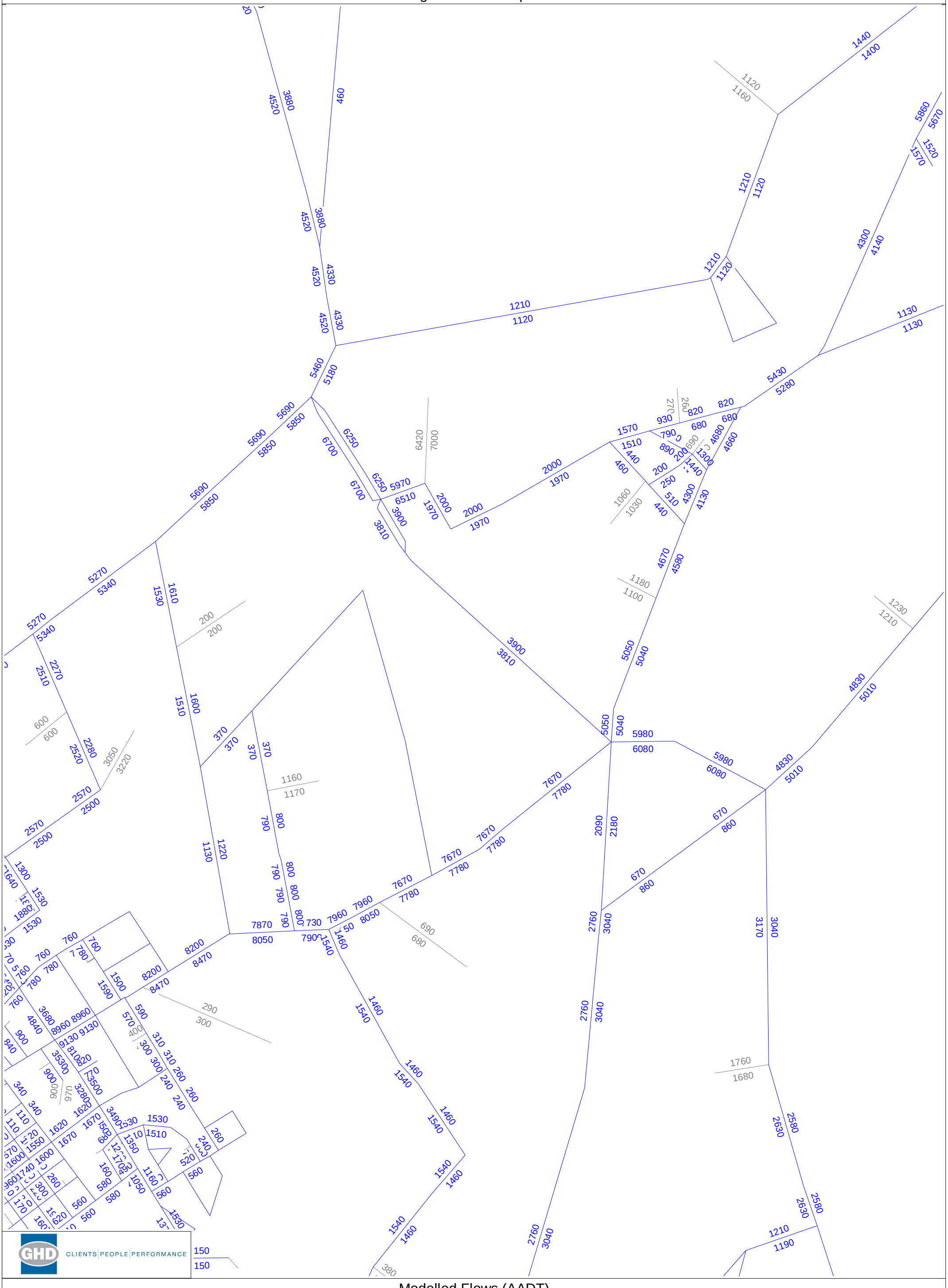
# Heretaunga Plains Transport Model




Modelled Flows (AADT)
Network = DA  Year = 26

cube

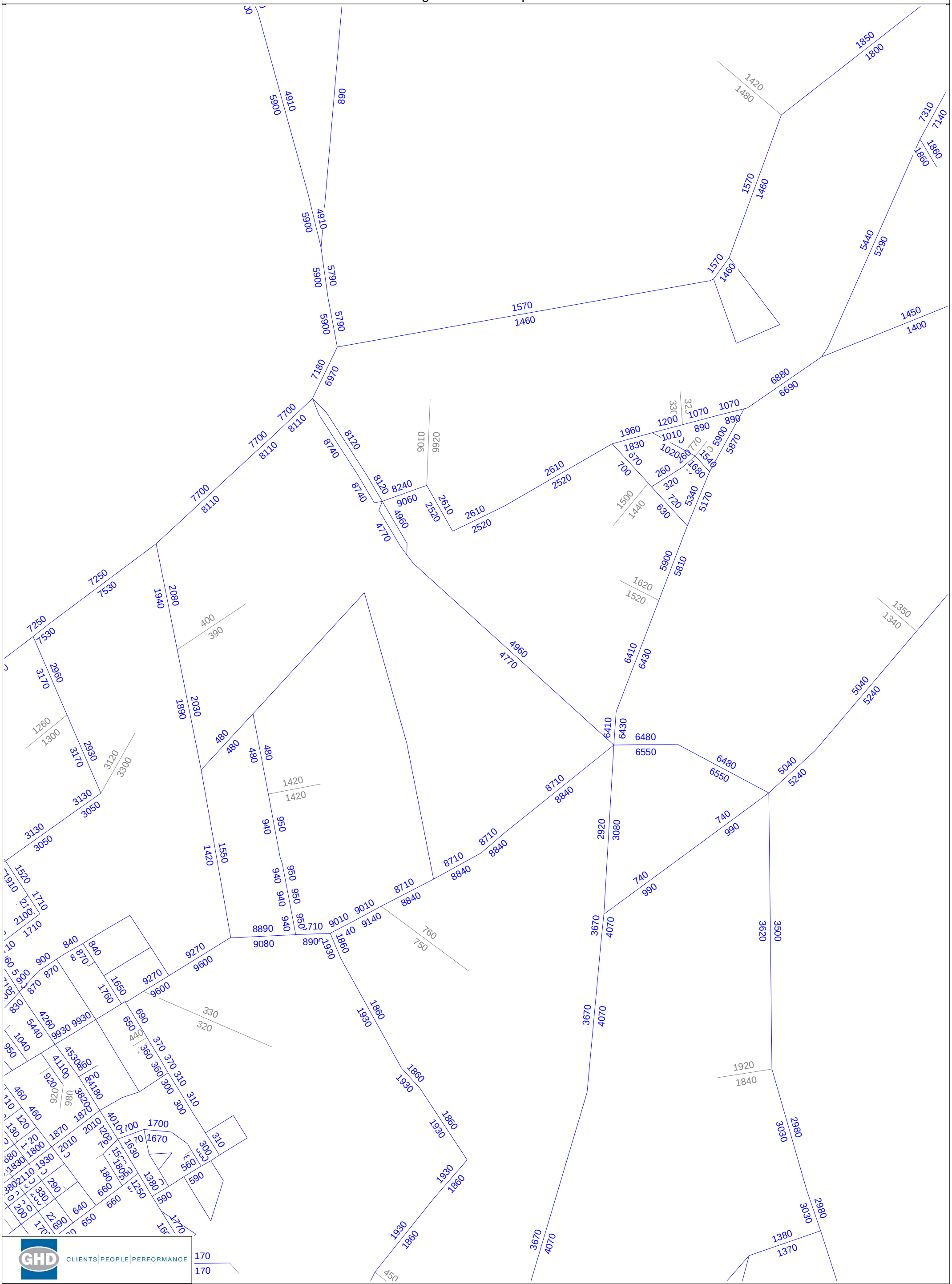
# Heretaunga Plains Transport Model




Modelled Flows (AADT)
Network = 10A  Year = 09

cube

# Heretaunga Plains Transport Model




Modelled Flows (AADT)

Network = 10A  Year = 2b

cube

# Appendix B HPTS Model - Deficiency Plots

Extracts from HPTS CUBE Traffic Model showing traffic flows and level of service for morning and evening peak hours.

**Do Minimum Network DA**

2009 Do Minimum Network (DA), AM Peak, Deficiency Plot

2009 Do Minimum Network (DA) PM Peak, Deficiency Plot

2026 Do Minimum Network (DA), AM Peak, Deficiency Plot

2026 Do Minimum Network (DA) PM Peak, Deficiency Plot

**WAL Network**

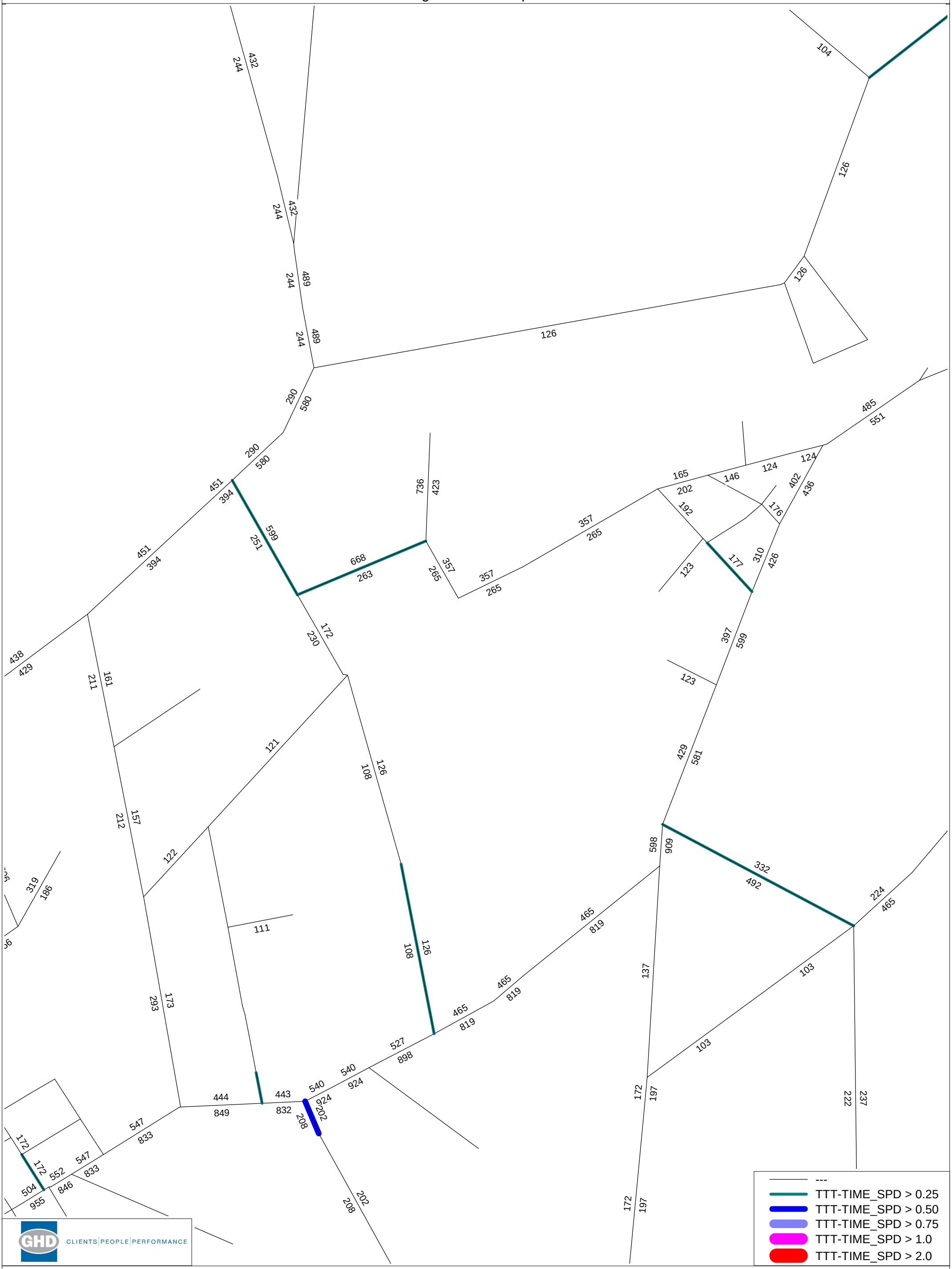
2009 Whakatu Arterial Network (W10A), AM Peak, Deficiency Plot

2009 Whakatu Arterial Network (W10A), PM Peak, Deficiency Plot

2026 Whakatu Arterial Network (W10A), AM Peak, Deficiency Plot

2026 Whakatu Arterial Network (W10A), PM Peak, Deficiency Plot

# Heretaunga Plains Transport Model



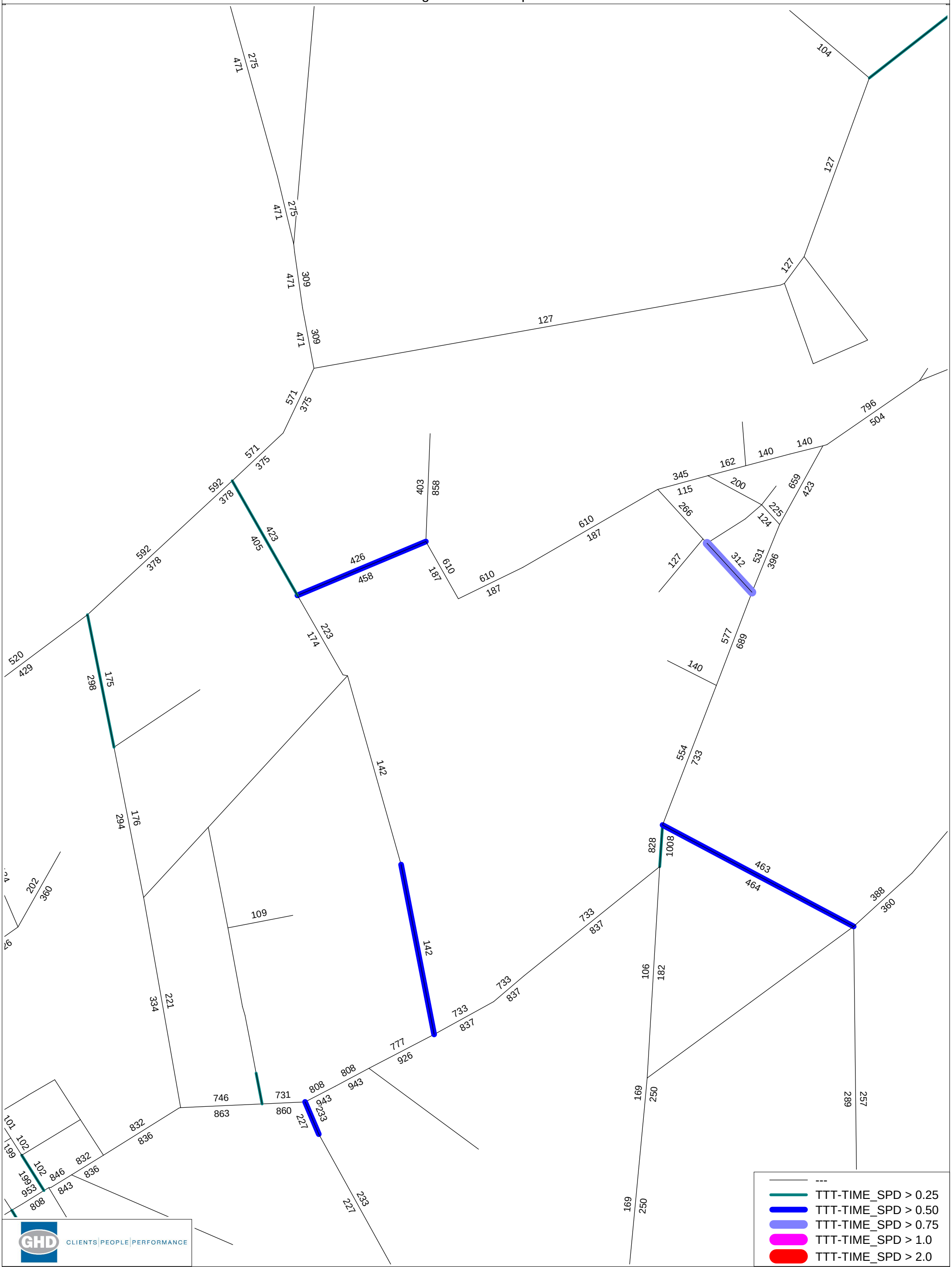

GHD CLIENTS | PEOPLE | PERFORMANCE

--- 
TTT-TIME_SPD > 0.25
TTT-TIME_SPD > 0.50
TTT-TIME_SPD > 0.75
TTT-TIME_SPD > 1.0
TTT-TIME_SPD > 2.0

Deficiency Plots
LOS
Network = DA  Year = 09  Time Periods = AM

cube

# Heretaunga Plains Transport Model



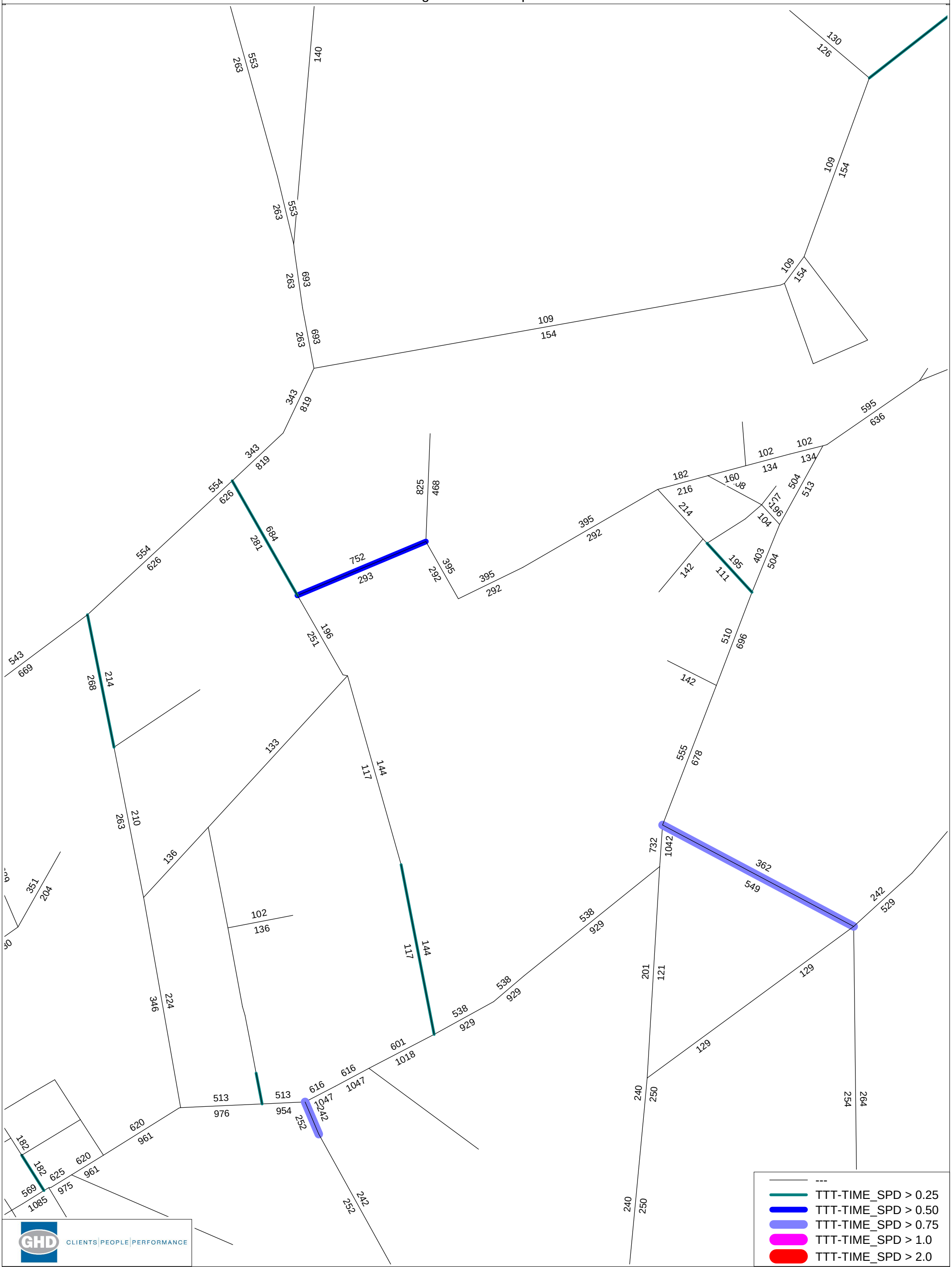

--- 
TTT-TIME_SPD > 0.25
TTT-TIME_SPD > 0.50
TTT-TIME_SPD > 0.75
TTT-TIME_SPD > 1.0
TTT-TIME_SPD > 2.0

GHD CLIENTS | PEOPLE | PERFORMANCE

Deficiency Plots
LOS
Network = DA  Year = 09  Time Periods = PM

cube

# Heretaunga Plains Transport Model



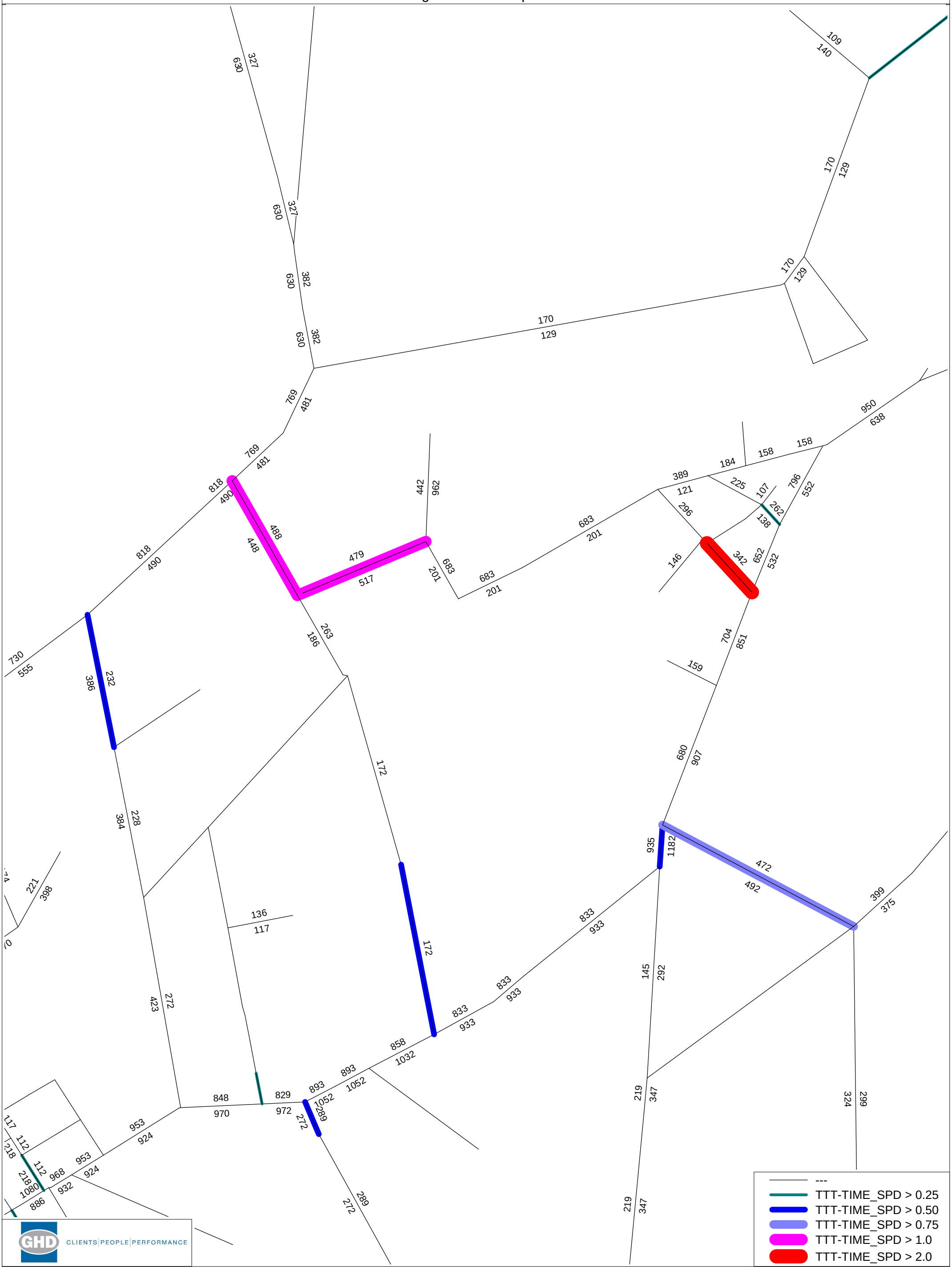

Deficiency Plots

LOS

Network = DA  Year = 26  Time Periods = AM

cube

# Heretaunga Plains Transport Model



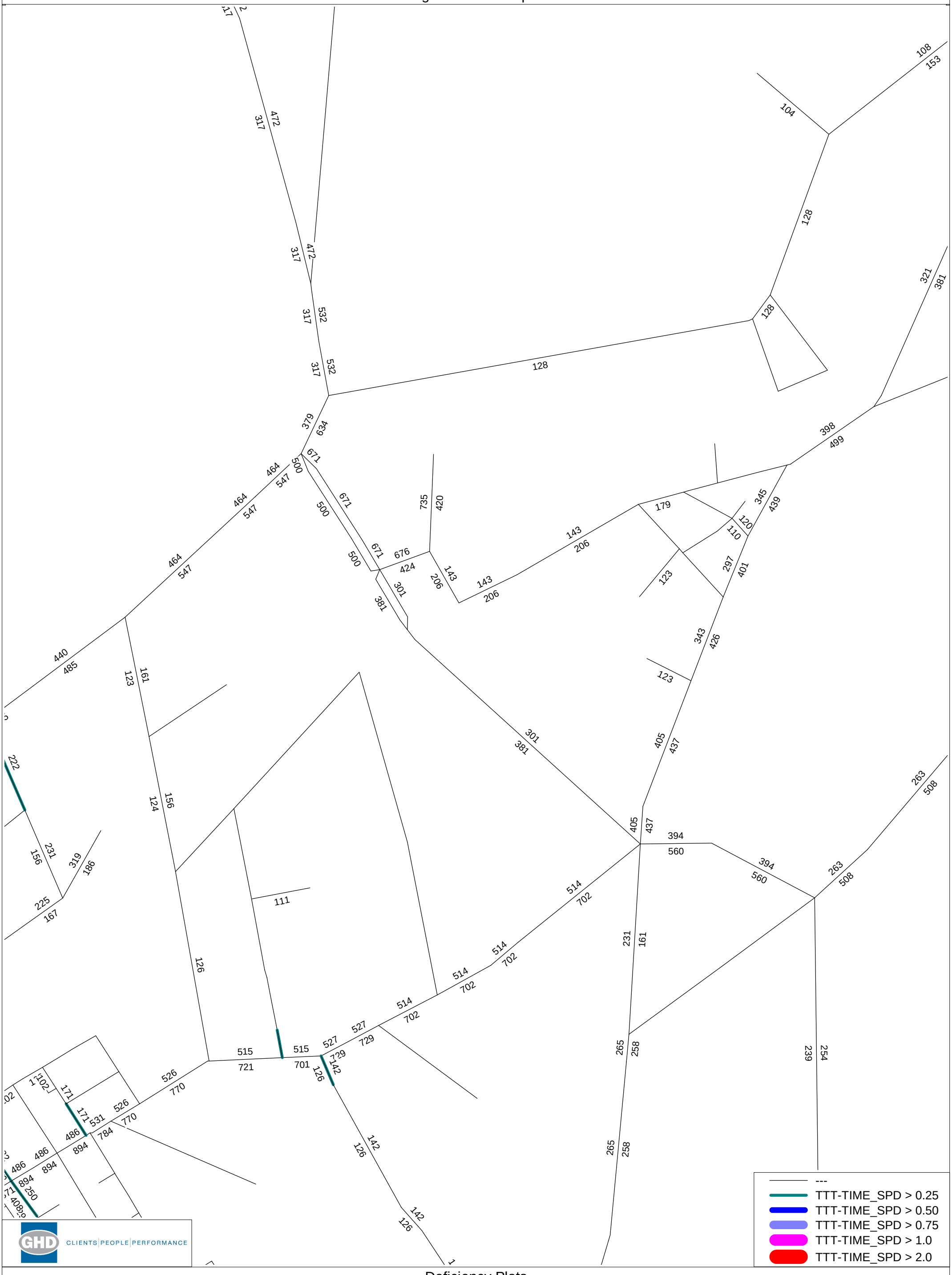

GHD CLIENTS | PEOPLE | PERFORMANCE

- --- 
- TTT-TIME_SPD > 0.25
- TTT-TIME_SPD > 0.50
- TTT-TIME_SPD > 0.75
- TTT-TIME_SPD > 1.0
- TTT-TIME_SPD > 2.0

Deficiency Plots
LOS
Network = DA  Year = 26  Time Periods = PM

cube

# Heretaunga Plains Transport Model




GHD CLIENTS | PEOPLE | PERFORMANCE

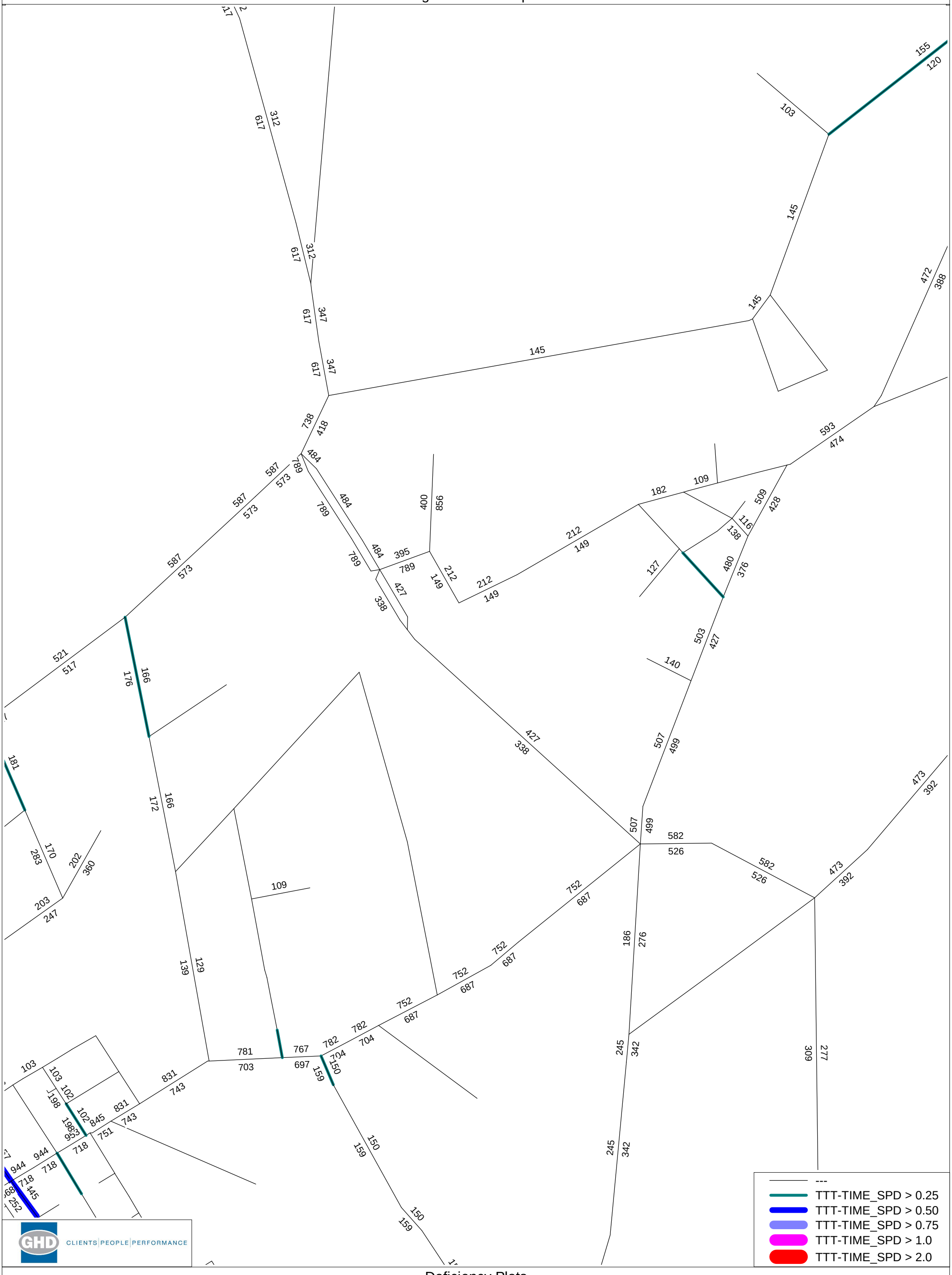
Deficiency Plots

LOS - Intersection Delay

Network = 10A  Year = 09  Time Periods = AM

cube

# Heretaunga Plains Transport Model



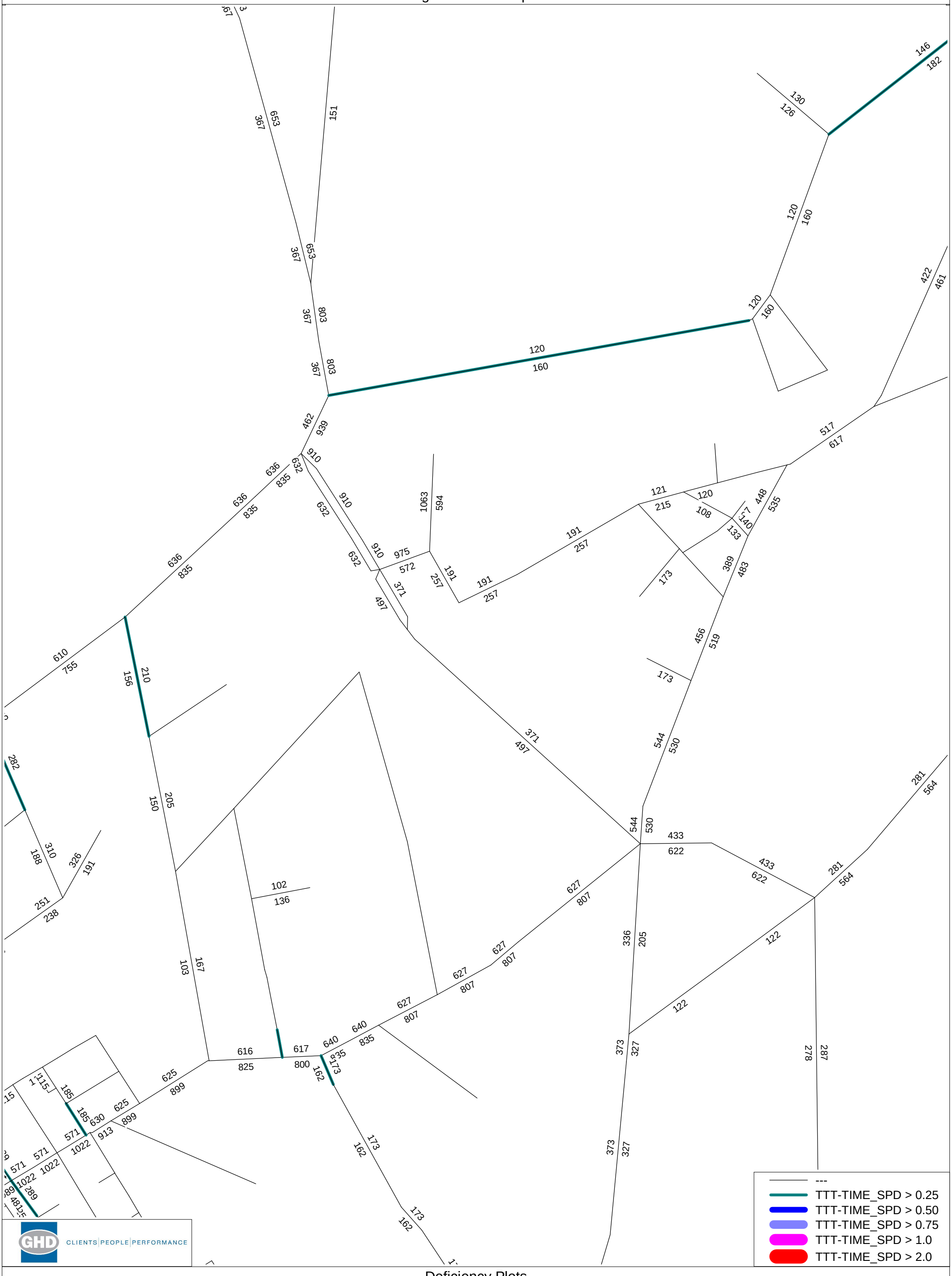

GHD CLIENTS | PEOPLE | PERFORMANCE

--- 
TTT-TIME_SPD > 0.25
TTT-TIME_SPD > 0.50
TTT-TIME_SPD > 0.75
TTT-TIME_SPD > 1.0
TTT-TIME_SPD > 2.0

Deficiency Plots
LOS - Intersection Delay
Network = 10A  Year = 09  Time Periods = PM

cube

# Heretaunga Plains Transport Model



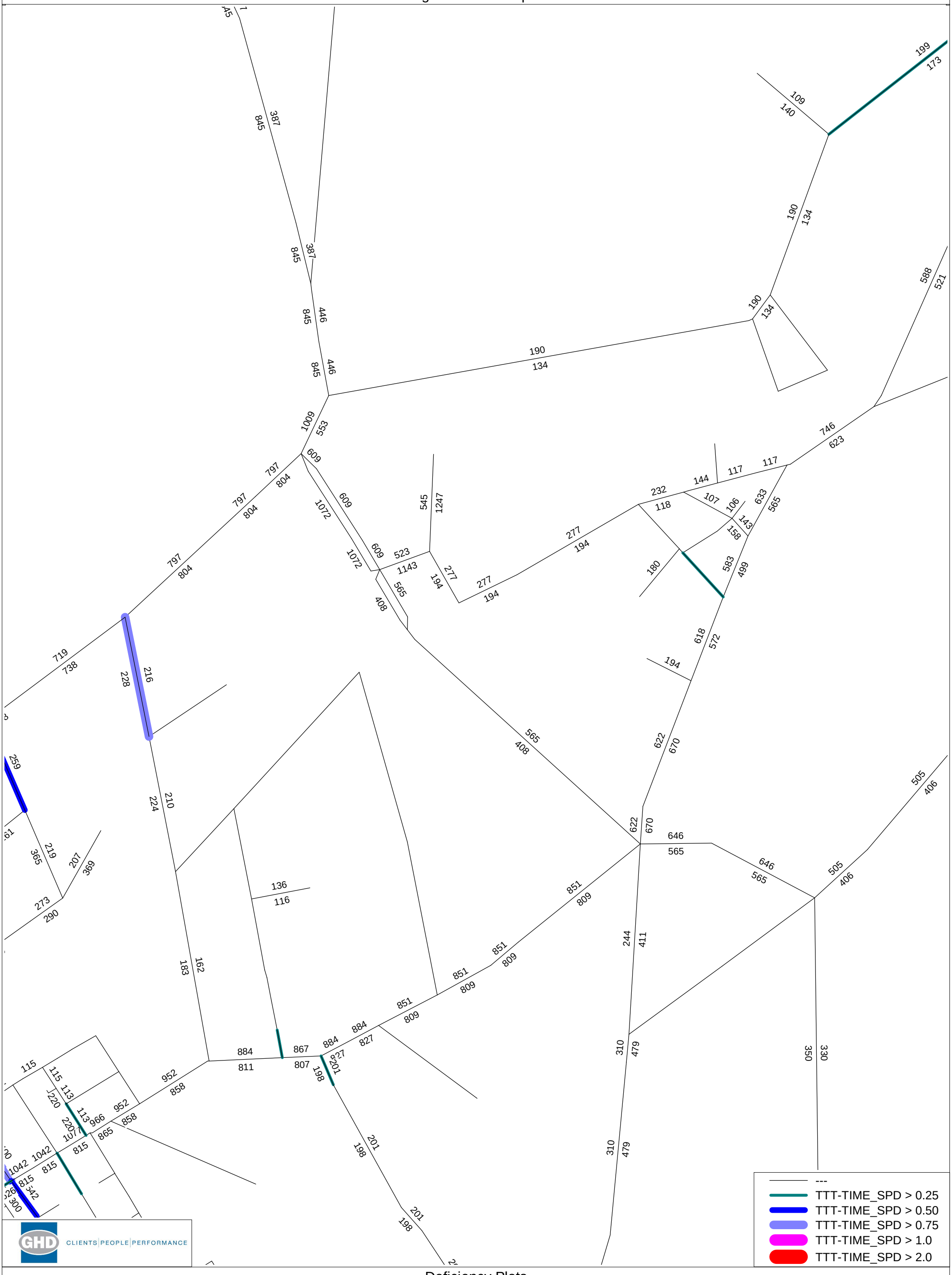

--- 
TTT-TIME_SPD > 0.25
TTT-TIME_SPD > 0.50
TTT-TIME_SPD > 0.75
TTT-TIME_SPD > 1.0
TTT-TIME_SPD > 2.0

GHD CLIENTS | PEOPLE | PERFORMANCE

Deficiency Plots
LOS - Intersection Delay
Network = 10A  Year = 2b  Time Periods = AM

cube

# Heretaunga Plains Transport Model




GHD CLIENTS | PEOPLE | PERFORMANCE

Deficiency Plots

LOS - Intersection Delay

Network = 10A  Year = 2b  Time Periods = PM

cube

# Appendix C Economic Evaluation Worksheets

Economic Evaluation Work Sheets:

Do Minimum Network (DA) and Option W10A Economic Evaluation

# Worksheet 1: Evaluation summary

| | |
|---|---|
| 1 Evaluator | Dumindu Sundarapperuma |
| Reviewer | Michael Thorne |
| 2 Project /package details | |
| Approved organisation name | Whakatu Arterial link |
| Project/package name | 25m internal diameter roundabout at Whakatu Rd / Whakatu Arterial. Two Lane Approach and exit on Whakatu Arterial. Single lane approach and exit for Whakatu Rd. Anderson Road link/roundabout removed. |
| Your reference | 51-31468 |
| 3 Location | |
| Brief description of location | Heretaunga Plains |
| 4 Alternatives and options | |
| Describe the do minimum | DM-A-Landuse B |
| Option A | W10-A-Landuse B |
| Option B | |
| Option C | |
| 5 Timing | |
| Earliest construction start date (mm/yyyy) | 2014 |
| Expected construction start data (mm/yyy) | |
| Expected duration of construction (months) | |
| 6 Economic efficiency | |
| Date economic evaluation completed (mm/yyyy) | |
| Time zero | 2013 |
| Base date for costs and benefits | 2013 |
| 7 BCR | 5.5 |

| Estimated Proprty Costs | | Estimated Construction Costs | |
|---|---|---|---|
| $ | 5,109,000 | $ | 14,639,000 |

## Worksheet 3: Benefit cost analysis

Project: 25m internal diameter roundabout at Whakatu Rd / Whakatu Arterial. Two Lane Approach and exit on Whakatu Arterial. Single lane approach and exit for Whakatu Rd. Anderson Road link / roundabout removed.

| **Benefits** | **PV of net benefits (PV option - PV do min benefits)** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Construction Year** | **2014** | **2018** | **2023** | **2028** | **2033** | **2038** | **2043** | **2048** |
| Travel time cost savings | $57,785,971 | $51,160,764 | $43,433,879 | $36,503,367 | $30,319,839 | $24,930,206 | $20,328,161 | $16,459,871 |
| VOC savings | $18,729,653 | $16,076,884 | $13,165,368 | $10,691,491 | $8,626,318 | $6,922,100 | $5,528,301 | $4,396,872 |
| Accident Savings | $26,167,977 | $20,516,155 | $15,197,533 | $11,316,636 | $8,433,538 | $6,284,910 | $4,683,657 | $3,490,341 |
| **PV total net benefits** | $102,683,601 | $87,753,803 | $71,796,780 | $58,511,493 | $47,379,695 | $38,137,216 | $30,540,119 | $24,347,084 |
| **Costs** | **PV of costs (PV Option - PV Do Min costs)** | | | | | | | |
| **PV total net costs** | $18,630,189 | $14,756,854 | $11,027,180 | $8,240,150 | $6,157,520 | $4,601,257 | $3,438,327 | $2,569,318 |
| **Benefit Cost Ratio for Alternative Construction Years** | | | | | | | | |
| **BCR** | 5.5 | 5.9 | 6.5 | 7.1 | 7.7 | 8.3 | 8.9 | 9.5 |
| **FYRR** | 0.22 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.24 |

# Worksheet A4: Travel time cost savings

Project: 25m internal diameter roundabout at Whakatu Rd / Whakatu Arterial. Two Lane Approach and exit on Whakatu Arterial. Single lane approach and exit for Whakatu Rd. Anderson Road link / roundabout removed.

| Option | Time period | Time periods per day | Days per year | Total travel time (Minutes) | Travel time cost ($/hour) | Total cost / year ($ / year / period) |
|---|---|---|---|---|---|---|
| DM-A-Landuse B | AM 2009 | 1.0 | 245 | 340423 | 15.13 | 21031617 |
| DM-A-Landuse B | IP 2009 | 9.5 | 245 | 285840 | 17.95 | 199033370 |
| DM-A-Landuse B | PM 2009 | 1.6 | 245 | 409646 | 14.96 | 40038254 |
| DM-A-Landuse B | ST 2009 | 9.2 | 120 | 285840 | 14.09 | 74314494 |
| DM-A-Landuse B | AM 2026 | 1.0 | 245 | 428323 | 15.13 | 26462152 |
| DM-A-Landuse B | IP 2026 | 9.5 | 245 | 353005 | 17.95 | 245801059 |
| DM-A-Landuse B | PM 2026 | 1.6 | 245 | 541838 | 14.96 | 52958524 |
| DM-A-Landuse B | ST 2026 | 9.2 | 120 | 353005 | 14.09 | 91776477 |
| DM-A-Landuse B | AM 2046 | 1.0 | 245 | 507422 | 15.13 | 31348954 |
| DM-A-Landuse B | IP 2046 | 9.5 | 245 | 414520 | 17.95 | 288634594 |
| DM-A-Landuse B | PM 2046 | 1.6 | 245 | 683006 | 14.96 | 66756096 |
| DM-A-Landuse B | ST 2046 | 9.2 | 120 | 414520 | 14.09 | 107769536 |
| W10-A-Landuse B | AM 2009 | 1.0 | 245 | 338858 | 15.13 | 20934930 |
| W10-A-Landuse B | IP 2009 | 9.5 | 245 | 284742 | 17.95 | 198268821 |
| W10-A-Landuse B | PM 2009 | 1.6 | 245 | 406382 | 14.96 | 39719235 |
| W10-A-Landuse B | ST 2009 | 9.2 | 120 | 284742 | 14.09 | 74029029 |
| W10-A-Landuse B | AM 2026 | 1.0 | 245 | 425037 | 15.13 | 26259140 |
| W10-A-Landuse B | IP 2026 | 9.5 | 245 | 351365 | 17.95 | 244659110 |
| W10-A-Landuse B | PM 2026 | 1.6 | 245 | 531062 | 14.96 | 51905292 |
| W10-A-Landuse B | ST 2026 | 9.2 | 120 | 351365 | 14.09 | 91350099 |
| W10-A-Landuse B | AM 2046 | 1.0 | 245 | 502358 | 15.13 | 31036096 |
| W10-A-Landuse B | IP 2046 | 9.5 | 245 | 412121 | 17.95 | 286964145 |
| W10-A-Landuse B | PM 2046 | 1.6 | 245 | 661282 | 14.96 | 64632821 |
| W10-A-Landuse B | ST 2046 | 9.2 | 120 | 412121 | 14.09 | 107145829 |

# Worksheet A5: Vehicle operating cost savings

Project: 25m internal diameter roundabout at Whakatu Rd / Whakatu Arterial. Two Lane Approach and exit on Whakatu Arterial. Single lane approach and exit for Whakatu Rd. Anderson Road link/roundabout removed.

| Option | Time period | Time periods per day | Days per year | Distance Travelled | Travel Cost | Total cost / year |
|---|---|---|---|---|---|---|
| DM-A-Landuse B | AM 2009 | 1.0 | 245 | 273850 | 0.2985 | 20028777 |
| DM-A-Landuse B | IP 2009 | 9.5 | 245 | 229994 | 0.2985 | 159797018 |
| DM-A-Landuse B | PM 2009 | 1.6 | 245 | 317800 | 0.3002 | 37395583 |
| DM-A-Landuse B | ST 2009 | 9.2 | 120 | 229994 | 0.2985 | 76009830 |
| DM-A-Landuse B | AM 2026 | 1.0 | 245 | 330762 | 0.3004 | 24344074 |
| DM-A-Landuse B | IP 2026 | 9.5 | 245 | 279786 | 0.2992 | 194818938 |
| DM-A-Landuse B | PM 2026 | 1.6 | 245 | 388748 | 0.3046 | 46421325 |
| DM-A-Landuse B | ST 2026 | 9.2 | 120 | 279786 | 0.2992 | 92668528 |
| DM-A-Landuse B | AM 2046 | 1.0 | 245 | 375964 | 0.3027 | 27877619 |
| DM-A-Landuse B | IP 2046 | 9.5 | 245 | 319497 | 0.3005 | 223463339 |
| DM-A-Landuse B | PM 2046 | 1.6 | 245 | 448198 | 0.3111 | 54655524 |
| DM-A-Landuse B | ST 2046 | 9.2 | 120 | 319497 | 0.3005 | 106293663 |
| W10-A-Landuse B | AM 2009 | 1.0 | 245 | 273257 | 0.2984 | 19978573 |
| W10-A-Landuse B | IP 2009 | 9.5 | 245 | 229501 | 0.2984 | 159416354 |
| W10-A-Landuse B | PM 2009 | 1.6 | 245 | 316669 | 0.3000 | 37235598 |
| W10-A-Landuse B | ST 2009 | 9.2 | 120 | 229501 | 0.2984 | 75828762 |
| W10-A-Landuse B | AM 2026 | 1.0 | 245 | 329942 | 0.3001 | 24262743 |
| W10-A-Landuse B | IP 2026 | 9.5 | 245 | 279113 | 0.2991 | 194285132 |
| W10-A-Landuse B | PM 2026 | 1.6 | 245 | 387009 | 0.3036 | 46064961 |
| W10-A-Landuse B | ST 2026 | 9.2 | 120 | 279113 | 0.2991 | 92414615 |
| W10-A-Landuse B | AM 2046 | 1.0 | 245 | 374952 | 0.3022 | 27763852 |
| W10-A-Landuse B | IP 2046 | 9.5 | 245 | 318725 | 0.3003 | 222797322 |
| W10-A-Landuse B | PM 2046 | 1.6 | 245 | 445966 | 0.3090 | 54010985 |
| W10-A-Landuse B | ST 2046 | 9.2 | 120 | 318725 | 0.3003 | 105976863 |

# Worksheet : Discounting

Project: 25m internal diameter roundabout at Whakatu Rd / Whakatu Arterial. Approach and exit on Whakatu Arterial. Single lane approach and exit for Anderson Road link / roundabout removed.

| | Year | NPV | DM-A-Landuse B | | | W10-A-Landus | |
|---|---|---|---|---|---|---|---|
| | | factor | Travel time savings | VOC savings | Accident Cost Savings | Travel time savings | VOC savings |
| 0 | 2009 | 1.0000 | 334417734 | 293231208 | 9,770,692 | 332952014 | 292459287 |
| 0 | 2010 | 1.0000 | 339275409 | 297056012 | 9894955 | 337729757 | 296257415 |
| 0 | 2011 | 1.0000 | 344133084 | 300880815 | 10019217 | 342507500 | 300055542 |
| 0 | 2012 | 1.0000 | 348990760 | 304705618 | 10143479 | 347285243 | 303853669 |
| 0 | 2013 | 1.0000 | 353848435 | 308530422 | 10267741 | 352062985 | 307651797 |
| 1 | 2014 | 0.9259 | 358706110 | 312355225 | 10392003 | 356840728 | 311449924 |
| 2 | 2015 | 0.8573 | 363563785 | 316180028 | 10516265 | 361618471 | 315248051 |
| 3 | 2016 | 0.7938 | 368421460 | 320004832 | 10640527 | 366396213 | 319046178 |
| 4 | 2017 | 0.7350 | 373279135 | 323829635 | 10764789 | 371173956 | 322844306 |
| 5 | 2018 | 0.6806 | 378136810 | 327654438 | 10889051 | 375951699 | 326642433 |
| 6 | 2019 | 0.6302 | 382994485 | 331479242 | 11013313 | 380729441 | 330440560 |
| 7 | 2020 | 0.5835 | 387852160 | 335304045 | 11137575 | 385507184 | 334238688 |
| 8 | 2021 | 0.5403 | 392709835 | 339128849 | 11261837 | 390284927 | 338036815 |
| 9 | 2022 | 0.5002 | 397567510 | 342953652 | 11386099 | 395062670 | 341834942 |
| 10 | 2023 | 0.4632 | 402425185 | 346778455 | 11510361 | 399840412 | 345633070 |
| 11 | 2024 | 0.4289 | 407282861 | 350603259 | 11634623 | 404618155 | 349431197 |
| 12 | 2025 | 0.3971 | 412140536 | 354428062 | 11758885 | 409395898 | 353229324 |
| 13 | 2026 | 0.3677 | 416998211 | 358252865 | 11883147 | 414173640 | 357027452 |
| 14 | 2027 | 0.3405 | 420873759 | 360954729 | 11959281 | 417953903 | 359703530 |
| 15 | 2028 | 0.3152 | 424749308 | 363656593 | 12035414 | 421734165 | 362379609 |
| 16 | 2029 | 0.2919 | 428624856 | 366358457 | 12111548 | 425514428 | 365055687 |
| 17 | 2030 | 0.2703 | 432500405 | 369060321 | 12187681 | 429294690 | 367731766 |
| 18 | 2031 | 0.2502 | 436375953 | 371762185 | 12263815 | 433074953 | 370407844 |
| 19 | 2032 | 0.2317 | 440251501 | 374464049 | 12339948 | 436855216 | 373083923 |
| 20 | 2033 | 0.2145 | 444127050 | 377165913 | 12416082 | 440635478 | 375760001 |
| 21 | 2034 | 0.1987 | 448002598 | 379867777 | 12492215 | 444415741 | 378436080 |
| 22 | 2035 | 0.1839 | 451878147 | 382569641 | 12568349 | 448196003 | 381112158 |
| 23 | 2036 | 0.1703 | 455753695 | 385271505 | 12644482 | 451976266 | 383788237 |
| 24 | 2037 | 0.1577 | 459629244 | 387973370 | 12720616 | 455756528 | 386464315 |
| 25 | 2038 | 0.1460 | 463504792 | 390675234 | 12796749 | 459536791 | 389140394 |
| 26 | 2039 | 0.1352 | 467380341 | 393377098 | 12872883 | 463317053 | 391816472 |
| 27 | 2040 | 0.1252 | 471255889 | 396078962 | 12949016 | 467097316 | 394492551 |
| 28 | 2041 | 0.1159 | 475131437 | 398780826 | 13025150 | 470877578 | 397168629 |
| 29 | 2042 | 0.1073 | 479006986 | 401482690 | 13101283 | 474657841 | 399844708 |
| 30 | 2043 | 0.0994 | 482882534 | 404184554 | 13177417 | 478438103 | 402520786 |
| 31 | 2044 | 0.0920 | 486758083 | 406886418 | 13253550 | 482218366 | 405196865 |
| 32 | 2045 | 0.0852 | 490633631 | 409588282 | 13329684 | 485998628 | 407872943 |
| 33 | 2046 | 0.0789 | 494509180 | 412290146 | 13405817 | 489778891 | 410549022 |
| 34 | 2047 | 0.0730 | 498384728 | 414992010 | 13481951 | 493559153 | 413225100 |
| 35 | 2048 | 0.0676 | 502260277 | 417693874 | 13558084 | 497339416 | 415901179 |
| 36 | 2049 | 0.0626 | 506135825 | 420395738 | 13634218 | 501119678 | 418577257 |
| 37 | 2050 | 0.0580 | 510011374 | 423097602 | 13710351 | 504899941 | 421253336 |
| 38 | 2051 | 0.0537 | 513886922 | 425799466 | 13786485 | 508680203 | 423929414 |
| 39 | 2052 | 0.0497 | 517762470 | 428501330 | 13862618 | 512460466 | 426605493 |
| 40 | 2053 | 0.0460 | 521638019 | 431203194 | 13938752 | 516240729 | 429281571 |
| 41 | 2054 | 0.0426 | 525513567 | 433905058 | 14014885 | 520020991 | 431957649 |
| 42 | 2055 | 0.0395 | 529389116 | 436606922 | 14091019 | 523801254 | 434633728 |

## Worksheet : Costs

Project: 25m internal diameter roundabout at Whakatu Rd / Whakatu Arterial. Two Lane Approach and exit on Whakatu Arterial. Single lane approach and exit for Whakatu Rd. Anderson Road link/roundabout removed.

| | Const. Year | NPV factor | DM-A-Landuse B | | W10-A-Landuse B | | Net Present Value | |
|---|---|---|---|---|---|---|---|---|
| | | | Property | Construction | Property | Construction | Do Minimum | W10-A-Landuse B |
| 1 | 2014 | 0.9434 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $18,630,189 |
| 5 | 2018 | 0.7473 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $14,756,854 |
| 10 | 2023 | 0.5584 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $11,027,180 |
| 15 | 2028 | 0.4173 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $8,240,150 |
| 20 | 2033 | 0.3118 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $6,157,520 |
| 25 | 2038 | 0.2330 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $4,601,257 |
| 30 | 2043 | 0.1741 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $3,438,327 |
| 35 | 2048 | 0.1301 | 0 | 0 | $5,109,000 | $14,639,000 | 0 | $2,569,318 |

## Worksheet : Net Present Value Benefits

Project: 25m internal diameter roundabout at Whakatu Rd / Whakatu Arterial. Two Lane Approach and exit on Whakatu Arterial. Single lane approach and exit for Whakatu Rd. Anderson Road link/roundabout removed.

| | Benefit Stream | | DM-A-Landuse B | | | W10-A-Landuse B | | |
|---|---|---|---|---|---|---|---|---|
| | Sart | End | Travel Time | VOC | Accident Cost | Travel Time | VOC | Accident Cost |
| | 2015 | 2043 | $8,079,736,216 | $5,345,176,103 | $199,804,954 | $8,021,950,245 | $5,326,446,450 | $173,636,977 |
| | 2019 | 2047 | $6,665,566,098 | $4,386,987,065 | $163,566,070 | $6,614,405,335 | $4,370,910,181 | $143,049,915 |
| | 2024 | 2052 | $5,218,168,988 | $3,411,605,331 | $126,711,634 | $5,174,735,110 | $3,398,439,963 | $111,514,101 |
| | 2029 | 2057 | $4,066,474,501 | $2,640,052,626 | $97,602,622 | $4,029,971,134 | $2,629,361,135 | $86,285,986 |
| | 2034 | 2062 | $3,162,449,336 | $2,039,548,610 | $75,063,594 | $3,132,129,497 | $2,030,922,293 | $66,630,056 |
| | 2039 | 2067 | $2,455,634,104 | $1,573,947,139 | $57,682,974 | $2,430,703,898 | $1,567,025,039 | $51,398,064 |
| | 2044 | 2072 | $1,904,090,116 | $1,213,416,436 | $44,293,029 | $1,883,761,955 | $1,207,888,134 | $39,609,372 |
| | 2049 | 2077 | $1,474,480,544 | $934,586,835 | $33,986,784 | $1,458,020,673 | $930,189,963 | $30,496,443 |

# Appendix D 38 Whakatu Road layout plan

GHD

134 Queen Street East
Hastings 4156
T: 64 6 870 9105 F: E:



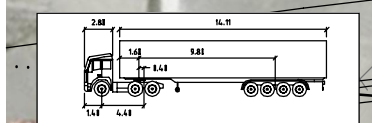
N:\NZ\Palmerston North\Projects\51\31468\WP\GHD AEE Inputs\Updates May 2014\C1 - Transportation Assessment - final 28-05-14.docx

Document Status

| Rev No. | Author | Reviewer | | Approved for Issue | | |
|---|---|---|---|---|---|---|
| | | Name | Signature | Name | Signature | Date |
| 6 | M Thorne | T Harrison | | T Harrison | | 12/05/14 |
| 7 | M Thorne | T Harrison | | T Harrison | | 15/05/14 |
| 8 | M Thorne | T Harrison | | T Harrison | | 16/05/14 |
| 9 | M Thorne | T Harrison | | T Harrison | | 28/05/14 |

## LEGEND

- VEHICLE BODY
- VEHICLE CLEARANCE (0.6m)
- FRONT TIRES
- REAR TIRES




SEMI-TRAILER — meters

| | | | |
|---|---|---|---|
| Tractor Width | : 2.58 | Lock to Lock Time | : 6.8 |
| Trailer Width | : 2.58 | Steering Angle | : 24.1 |
| Tractor Track | : 2.58 | Articulating Angle | : 18.8 |
| Trailer Track | : 2.58 | | |

SEMI-TRAILER
RTS 18 (NZ)

SEMI-TRAILER
RTS 18 (NZ)

SEMI-TRAILER
RTS 18 (NZ)

PRELIMINARY

| No | Revision | Drawn | Job Manager | Project Director | Date |
|---|---|---|---|---|---|
| A | PRELIMINARY | NM | | | |

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

HASTINGS DISTRICT COUNCIL

GHD
134 Queen Street East
Hastings 4156, New Zealand
T 64 6 870 9105 F 64 6 873 5281
W www.ghd.com



| | | | |
|---|---|---|---|
| Drawn | N. MACKIE | Designer | N. DEVERY |
| Drafting Check | | Design Check | |
| Approved (Project Director) | | | |
| Date | | | |
| Scale | 1:1000 | This Drawing must not be used for Construction unless signed as Approved | |

Client HASTINGS DISTRICT COUNCIL
Project WHAKATU ARTERIAL PROJECT
Title WHAKATU ROAD INTERSECTIONS LAYOUT
BEARSLEY - TRACKING PLAN

Original Size A1
Drawing No: 51-31468-SK066
Rev: A

Plot Date: 5 February 2014 - 1:19 p.m. Plotted by: Ajeshni Naiker
Cad File No: N:\NZ\Christchurch\Projects\51\31468 Whakatu\CADD\Drawings\51-31468-SK065_SK067.dwg

www.ghd.com