



Taupō Northern Outlet and CBD Investigation

Final Report

January 2018

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Prepared by:

Grant Smith

Principal Consultant



Reviewed by:

Dave Hunter

Senior Principal Transport Engineer



Approved for Issue by:

Grant Smith

Principal Consultant



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PO Box 256, Christchurch 8140
New Zealand

P: +64 3 348 3215

www.tdg.co.nz

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1. Introduction

The Northern Outlet and CBD Investigation project continues previous Taupō District Council (TDC) and community-led plans developed for Taupō, culminating in the 2011 Council adoption of the Taupō Urban Commercial and Industrial Structure Plan (CISP) for the Taupō CBD. The Eastern Taupō Arterial (ETA) was opened in 2010 and while there has been a reduction in the amount of traffic (particularly heavy traffic) passing through the CBD as a result of the ETA, a general improvement in the economy and increased local development has recently resulted in an increase in traffic both along the ETA, and into and through the CBD.

This investigation assesses the case for investment in options that improve traffic flow in the study area, which covers the corridor from Huka Falls Road to and including the CBD (see **Figure 1**). The section between the Norman Smith Street intersection and the Spa Road roundabout has been of particular focus.



Figure 1: Study Area

The investigation has applied the principles of the NZ Treasury Better Business Case process, which is designed to systematically assess whether an investment proposal:

- Is supported by a compelling case for change - the 'strategic case';
- Optimises value for money - the 'economic case';

- Is commercially viable - the 'commercial case';
- Is financially affordable - the 'financial case'; and
- Is achievable - the 'management case'.

The investigation focused on the identification and assessment of a range of short, medium and long-term options that respond to the investment objectives. It is therefore centred on the strategic and economic case components of the Better Business Case process, and will consequently:

- Confirm the strategic context and the fit of the investigation within that context;
- Confirm the need to invest and the case for change;
- Identify a wide range of potential options; and
- Determine the preferred option(s) that optimises value for money by undertaking a detailed analysis of the costs, benefits and risks of the short-listed options.

The investigation will also provide sufficient assessment of the financial and management cases to enable TDC decision-makers to determine an appropriate path forward. This will include high-level assessment of affordability and funding, and the management arrangements that will support implementation of the preferred option. It will not provide an assessment of the implementation-focused commercial case, which tends to be the final procurement-related step in transport projects.

The remainder of this document consists of the following sections:

- Section 2 provides strategic context;
- Section 3 describes the process and the identified stakeholders;
- Section 4 outlines the issues identified through stakeholder engagement;
- Section 5 discusses background research and modelling considerations;
- Section 6 presents the case for change, contrasting the perceived issues identified with the analytical data to determine the critical issues;
- Section 7 contains a long list of potential options/solutions to address the issues identified;
- Options are shortlisted in Sections 8 and 9, and discussed in Section 10;
- Shortlisted options are programmed in Section 11, and;
- Recommendations are provided in Section 12.

2. Strategic Context

The strategic context for the investigation is provided by three key strategic planning documents, the:

- Taupō Urban Commercial and Industrial Structure Plan (2011);
- Taupō District 2050 District Growth Management Strategy (2006); and
- Taupō District Long Term Plan 2015-25 (2015).

Each is described in the following sections, with supporting context.

2.1 Background

The Northern Outlet to Taupō essentially begins at Wairakei, where State Highway 1 and the ETA intersects with Wairakei Drive and State Highway 5 (the Thermal Explorer Highway). The ETA was primarily built to address the issue of heavy traffic passing through the Taupō CBD and along the concentration of tourist accommodation on Lake Terrace. It was also intended to provide an alternative to the Control Gates Bridge, which was approaching capacity during most peak periods and for extended parts of the day during holidays.

A second crossing of the river in the vicinity of the Control Gates Bridge was seen as an alternative to the ETA, but it did not meet the objective of minimising (or removing) heavy vehicles from the CBD and Lake Terrace. Even so it took almost 35 years from the time that the ETA was suggested until it was opened in 2010. At that time the design of a second bridge joining Wairakei Drive to Opepe Street, and then along Titiraupenga had been designed in some detail and was close to being ready for construction drawings to be begun.

That bridge design was put on hold after the decision to build the ETA was made, but the concept formed the basis of the transport component of the Taupō Urban Commercial and Industrial Structure Plan (CISP) adopted by Council in February 2011(although it is clear from the text that it was written prior to the opening of the ETA).

2.2 Taupō Urban Commercial and Industrial Structure Plan (CISP)

The 2011 CISP provides a 20-year future vision for the town centre and new industrial areas. It remains the guiding planning document for the immediate study area. Its goals are shown in **Table 1**.

Goal	Description
Character	To reinforce the distinct character of Taupō by embracing and integrating the natural and cultural qualities that define the town and district.
Land Use	To consolidate future commercial and industrial growth in a way that enhances the quality of life for the Taupō community and protects or improves environmental values.
Built Form	To achieve a sustainable and compact urban form that projects a distinct

Goal	Description
	image, promotes an active and vibrant street edge and improves architectural quality.
Circulation	To reconnect the town centre with the lakefront, the Waikato River and surrounding residential areas. To refocus towards pedestrians, cyclists and public transport. Connect existing & future commercial/industrial areas with sound transport links.
Public Space	To realise the untapped potential of Taupō's open space network and provide a diverse range of safe and functional public spaces from sheltered arcades through to squares and open-air events facilities.
Heritage and Culture	To protect and draw attention to Taupō's unique heritage and culture and provide an increased focus on events and the creative arts.
Economic Growth	To develop an economy with multiple opportunities for employment and economic investment that is able to leverage off Taupō's lifestyle and image to retain and attract a diversity of people and business interests.
Sustainability	To ensure that future growth is delivered in a sustainable manner, both in terms of delivering affordable, efficient infrastructural solutions and embracing Environmentally Sustainable Design principles in the landscape and built environment.

Table 1: CISP Goals

All of the CISP goals have some bearing on this investigation. However, the circulation and growth goals are most pertinent, suggesting a focus on initiatives that provide transport links that can accommodate future growth in a sustainable manner, accommodate other modes, and reconnect the town centre with the lakefront and river.

The CISP assumed that an alternative route would be constructed in order to enable changes to the function of Tongariro Street. However, the Opepe Street option was designed to cope with two functions – high flow on the existing bridge and a high number of heavy vehicles – and was expected to be part of State Highway 1 when constructed. The opening of the ETA has altered these requirements. If the current design is no longer appropriate, either in form or function then some designs and concepts in the CISP will therefore need to be revisited, although the overarching strategy is likely to remain.

2.3 Taupō District 2050 District Growth Management Strategy (TD2050)

The 2006 TD2050 describes the Taupō District's aspirations for growth. It contains twelve strategic directions, four of which are relevant to the investigation:

- 1. District Character
- 3. Settlement Patterns and Urban Form
- 8. Integrating Land Use, Infrastructure and Funding
- 9. Transport Modes and Connections

Each of the strategic directions are supported by a set of policies. Those that are most applicable to this investigation are:

- Strengthen Taupō Town's functions and its role as the primary business, retail, recreational, and entertainment hub for the District (Policy 1.2);
- Set clear limits to the outward development of all urban areas (Policy 3.1);
- Identify, enhance and protect gateways to urban areas (Policy 3.2);
- Ensure strategic transportation and network utility corridors are identified in the initial planning stages and protected from encroachment by incompatible land uses. (Policy 3.3);
- Coordinate and integrate planned infrastructure which supports the preferred settlement pattern and provides greater certainty for development. (Policy 8.2);
- Use best practice standards for the planning, design and operation of sewage and wastewater collection, transport, treatment, disposal and reuse (Policy 8.4);
- Maintain and enhance the District's strategic transport networks to link industries to markets, and move goods and people efficiently (Policy 9.1);
- Provide for a comprehensive and integrated range of present and future public and private transport options within the District (Policy 9.2);
- Manage the road system to achieve integration, choice and balance by developing an efficient and safe network and making the most of existing infrastructure (Policy 9.3);
- Facilitate the development and implementation of a corridor approach to transportation and integration with the pattern of land use (Policy 9.4);
- Consider a range of funding alternatives in respect of transportation provision in the District (Policy 9.5).

For this investigation, the key practical part of TD2050 is the future land use distribution that it identifies for the Northern Growth Area, which covers the area from Waitahanui to Kinloch. The Northern Growth Area is expected to account for 80% of Taupō's future growth. **Figure 2** shows the areas that are earmarked for development, including the focus areas north of the river that will contribute to future traffic growth within the study area.

It should be noted that the growth model has recently been reviewed, but the timing was such that the data could not be incorporated into the analysis used for this report.

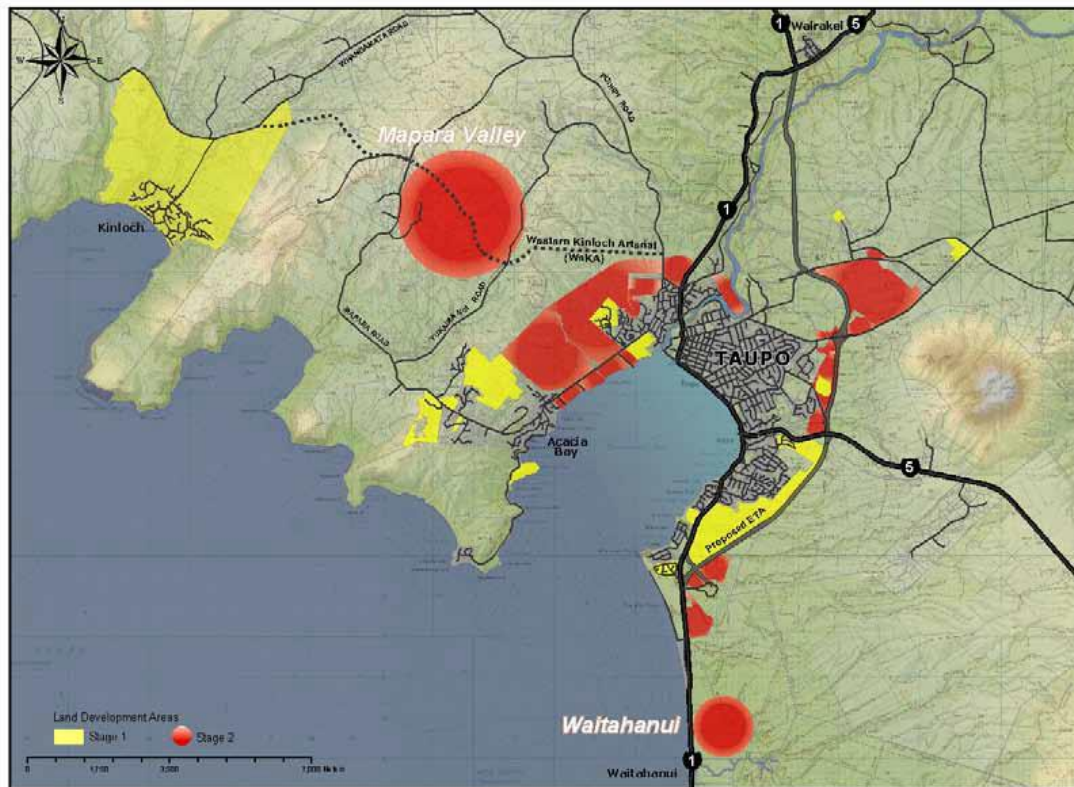


Figure 2: Northern Growth Area (Source: TD2050 Figure 2)

2.4 Taupō District Long Term Plan 2015-25 (LTP)

The 2015 LTP is TDC’s guiding document for the 10-year period to 2025. While the LTP does not make specific mention of this investigation nor the issues surrounding it, it does provide a long-term district strategy, which notes the following as goals:

- Ensure that the Taupō District remains a great place to live;
- Promote economic development;
- Protect our water resources and use them wisely;
- Maintain the quality infrastructure that we have; and
- Keep rates and debt affordable.

Each stage of the investigation will need to be cognisant of these goals.

The recommendations of the investigation will be incorporated into the next LTP, which covers the period from 2018 to 2028.

3. Process

3.1 Steps

The study has followed the Better Business Case procedure for Single Stage Light Business Case published by the New Zealand Treasury in 'Better Business Cases – Guide to developing the single Stage Business Case' February 2014.

Table 2 shows the steps to be taken in developing the Business Case abstracted from the guide.

PROCESS STAGES BY CASE AND BETTER BUSINESS CASE DELIVERABLE		
The Five Cases	Strategic Assessment	Single Stage Business Case
Strategic	Step 1: Outline strategic fit and the need to invest	Step 2: Make the case for change
Economic	-	Steps 3 and 4: Determine potential value for money
Commercial	-	Step 5: Prepare for the potential deal ¹
Financial	-	Step 6: Ascertain affordability and funding
Management	-	Step 7: Plan for successful delivery

Table 2: Key Process Steps

Figure 3 summarises the project process, showing the steps within the context of the business case process.

¹ Step 5 will not apply in the study as it is not moving into the delivery/implementation phase.

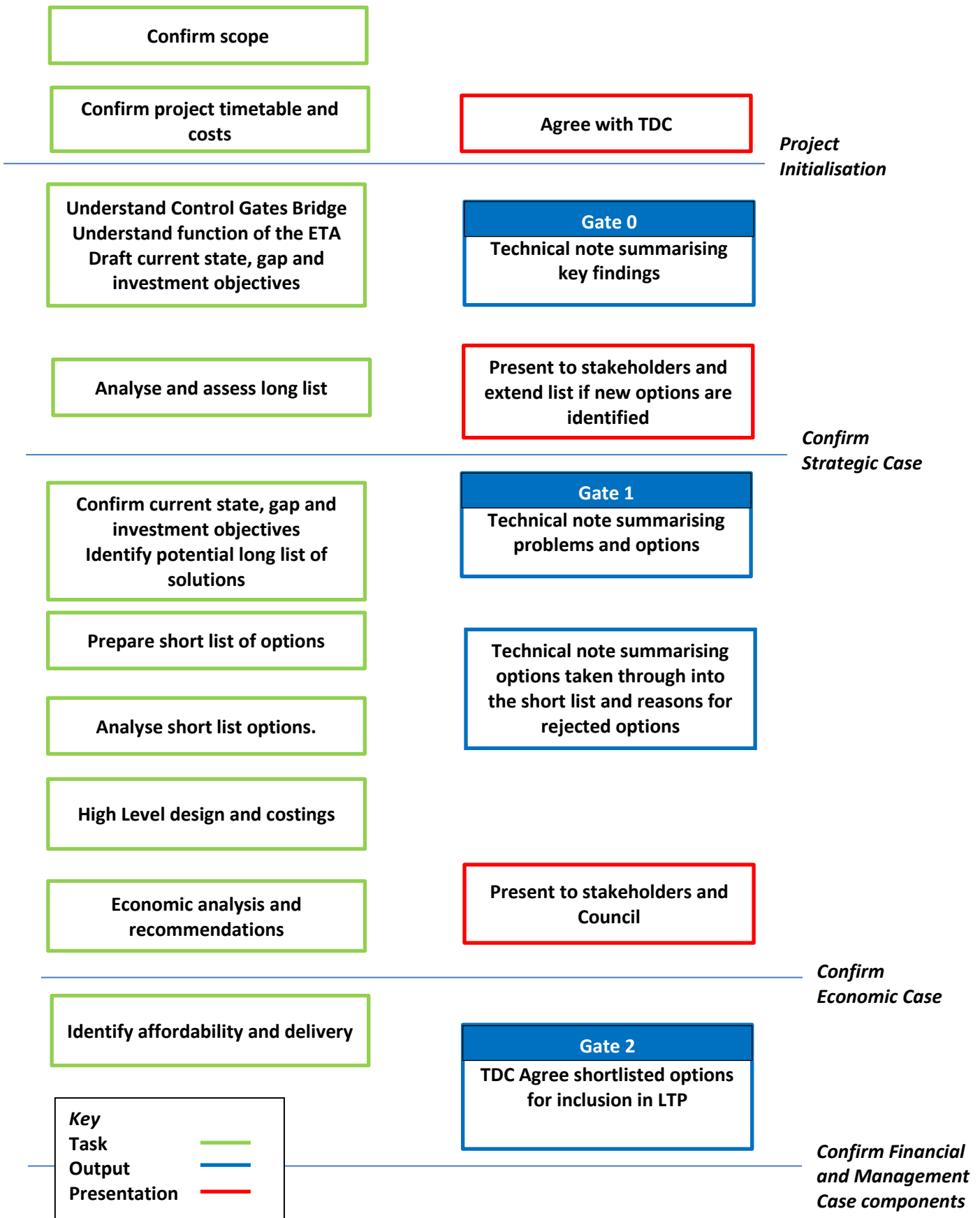


Figure 3: Schematic Process Diagram

3.2 Investment Objectives

The investment objectives specify the outcomes that are desired from any initiatives that emerge from the investigation. Options are assessed against these objectives and other criteria to determine those that are likely to be most effective.

The investment objectives respond to the issues and opportunities that will be identified through this investigation but are framed within the wider context of the CISP goals and TD2050 policies. They are to:

- Improve the connectivity of the transport network within the study area, so that it supports the preferred land use pattern, accommodates other modes, and reconnects the town centre with the lakefront and river; and
- Improve the efficiency of the transport network within the study area, so that it functions more efficiently and can accommodate future growth.

The investment objectives will be tested, changed if required, and confirmed as a first step.

3.3 The Taupō Traffic Models

One of the key analytical tools that will be used is the Taupō Traffic Model. This model, built on the Tracks software platform, was updated in 2016 and predicts changes in travel patterns based on different input land use and infrastructure options. The extent of the model is shown in **Figure 4**.

One of the initial tasks was to check the model is appropriately reflecting traffic counts in the study area shown in Figure 1 – commonly referred to as ‘local area validation.

In most cases the traffic model was sufficient to provide the data for confirmation of the strategic case and analysis of the economic case.

However, there were instances where more detailed modelling was required. In the simplest form, individual intersections were analysed using Sidra – as standalone intersection analysis model that is now incorporated into Tracks.

For more complex detailed analysis a Paramics microsimulation models was built. Examples of this were the operation Norman Smith Street/Wairakei Drive intersection and the interaction with the Tongariro Street/ Spa Road intersection and the difficulty of the right turns onto Spa Road.

Microsimulation is the representation of individual vehicles trips through the network. The vehicles interact with the road network, intersection controls and geometry, and other vehicles as they travel through the network in real-time.

The core purpose of microsimulation models is typically to measure the performance of the road network; the delays and queues at intersections and the travel times through the wider network, and to display these graphically as moving vehicles.

The part of the network covered by the microsimulation model is shown as **Figure 5**.



Figure 4: Extent of the Taupō Traffic Model



Figure 5: Extent of the Microsimulation Model

3.4 Stakeholders

Taupō District Council is the main stakeholder in this process. Other key stakeholders include:

- Town Centre Taupō;
- Taupō Chamber of Commerce;
- Tuwharetoa Maori Trust Board;
- Bike Taupō;
- Taupō Ratepayers Group;
- Acacia Bay Residents Association;
- Kinloch Community; and
- Mercury Energy.

4. Identification of Issues

4.1 Issue Identification Process

In developing the case for change, the first stage was identifying current transport issues. To achieve this, stakeholder workshops were held with invitations sent to:

- Taupō Town Centre and Chamber of Commerce, Wednesday 27 September 2017;
- Acacia Bay, Kinloch, and Taupō Residents Groups, and Taupō Rate Payers Association, Tuesday 17 October 2017.

The forum of these workshops was a brief presentation to establish context, an outline of a few potential issues to stimulate conversation, followed by an open floor discussion where attendees were asked to contribute transport issues within the study area and potential solutions. Solutions are discussed later in this report.

The first workshop was attended by approximately 40 people. Six people attended the second workshop in total, representing the Acacia Bay and Taupō Residents Group.

In addition to the workshops, individual meetings were held with Bike Taupō, and Access Taupō.

This section summarises the issues raised through the consultation process as well as those observed by the traffic consultant.

4.2 Issues Identified

The issues identified through the stakeholder engagement/workshop process and from observations by the traffic consultant are summarised in the table below, followed by commentary. The issues presented are as raised, and it has not been determined at this stage if the problems are real or perceived.

Issue Number	Mode	Issue
1	Vehicles	St Patrick's school on Acacia Bay Rd generating double crossings of the Control Gates Bridge and exacerbating traffic delays
2	Vehicles	Significant delays for eastbound traffic on Norman Smith St in morning peak
3	Vehicles	High speeds northbound on Wairakei Dr, limiting ability to turn out of Norman Smith St
4	Vehicles	Northbound traffic on Wairakei Dr move into left turn slip lane late and often do not indicate, limiting ability to turn out of Norman Smith St
5	Vehicles	Significant traffic volumes southbound on Wairakei Dr resulting in "flow breakdown" from vehicles braking
6	Vehicles	Industrial area traffic inappropriately using Control Gates Bridge
7	Vehicles	Significant queuing for southbound traffic on Spa Rd generated from

Issue Number	Mode	Issue
		the Tongariro Street roundabout
8	Vehicles	Southbound vehicles on Spa Rd turning right into Nukuhau St, through Countdown car park, left onto Tongariro St, then U-turning at roundabout with Spa Rd due to long delays for southbound traffic on Spa Rd towards Tongariro
9	Vehicles	U-turning traffic at the Spa Rd/Tongariro St roundabout generating additional delay due to low speeds of the manoeuvre
10	Vehicles	Southbound vehicles on Spa Rd U-turning at roundabout with Tongariro as cannot turn right from side roads onto Spa Road
11	Vehicles	Poor lane usage southbound on Tongariro St towards Spa Rd roundabout
12	Vehicles	Poor visibility southbound on Tongariro St towards Spa Rd roundabout from planting and signage
13	Vehicles	Need for clearer identification of car parking locations
14	Vehicles	Sufficient space for car parking on west bank if pedestrian bridge constructed across Boat Harbour
15	Pedestrians	Difficult/unsafe to cross Wairakei Dr at the Control Gates Bridge
16	Pedestrians	Safety issues for school children crossing Titiraupeka St from Taupō Primary School on west to playing fields on east
17	Pedestrians/Cyclists	General concern over pedestrian and cycle safety
18	Cyclists	Difficulty crossing Wairakei Dr/Tongariro Street
19	Cyclists	Cycleway on east side of Wairakei Dr, then steep uphill off-road link through to Nukuhau St. Gradient steep for cyclists but used to avoid Tongariro St (high vehicle flows, difficulty crossing).
20	Cyclists	Safety concerned raised biking on Norman Smith Street and then turning right into Wairakei Dr and needing to change lanes in heavy traffic
21	Cyclists	Safety concerned raised biking southbound on Spa Rd and then turning right onto Tongariro St
22	Cyclists	Safer cycling infrastructure
23	All	Impact of autonomous vehicles (AVs) and electric vehicles (EVs)
24	All	Increased development in the north increasing traffic on Control Gates Bridge and exacerbating delays

Table 3: List of Issues Identified

These issues are expanded upon below, moving north to south through the network.

4.3 Issues in the Nukuhau Area

St Patrick’s school is located on Acacia Bay Road in the north-west between Poihipi Street and Norman Smith Street. The issue of parents dropping their children at school and then returning home was raised. This was considered to produce additional traffic using the Control Gates Bridge, and worsening congestion.

The performance of the Norman Smith Street/Wairakei Drive intersection was raised, with delays for traffic turning out of Norman Smith Street in the morning peak anecdotally reaching 20 minutes. Local residents indicated the delays regularly occurred and were focused on the 8:30-9:00am period. If these delays are confirmed through data collection and analysis, they are excessive, and intervention would be warranted.

Rat-running to avoid or jump the queue on Norman Smith Street was raised as an issue. Some traffic from Acacia Bay continue north on Acacia Bay Road past Norman Smith Street, and then double back via Woodward Street to bypass two-thirds of the queued vehicles. The issue is increased traffic flows on residential streets in order to reduce the time spent queuing on Norman Smith Street.

Pedestrians, particularly children, are crossing from the residential areas on the west side of Tongariro Street to the east side. They cross just south of the Control Gates Bridge using the central island (which is not a pedestrian refuge), where they wait for gaps in the traffic. With significant traffic volumes, combined with vulnerable road users, the ability to safely cross Tongariro Street south of the Control Gates Bridge represents a potential safety issue.

Similar issues were raised for cyclists, and the steep gradient on the link to Nukuhau Street being inappropriate.

High speeds for northbound traffic on Wairakei Drive were raised. This restricted the opportunities for right turning traffic out of Norman Smith Drive, which experiences high delays in the morning peak.

Poor driver behaviour for northbound traffic on Wairakei Drive, with vehicles moving into the left turn slip lane late and not indicating was raised. This behaviour increased the delay for vehicles turning right out of Norman Smith Street as gaps in the traffic flow could not be utilised.

The volume of traffic on Wairakei Road, particularly southbound in the morning peak, is significant and any unexpected behaviour (such as braking suddenly) can cause a shock-wave and flow breakdown resulting in queues and delays. This represents potential safety issues.

In the second workshop, the question was asked whether traffic destined for the industrial area inappropriately use the Control Gates Bridge. If this was found to be the case, then the associated issue raised was congestion on Wairakei Drive from industrial traffic that should be using the ETA.

4.4 Issues Associated with Tongariro Street/Spa Road

Significant queuing on Spa Road for vehicles travelling southbound in the evening peak was raised. Anecdotally, queues are reported to regularly extend back as far as Taupō-nui-a-Tia College at Opepe Street. This problem then generates a raft of additional issues.

The first associated additional problem is that to avoid the queue, vehicles drive on the median road markings to turn right into Nukuhau Street, through the Countdown car park to the access way to the northern section of Tongariro Street. From here, they turn left onto Tongariro Street then make a U-turn at the roundabout. This manoeuvre represents several issues – reduced capacity of the Spa Road/Tongariro Street roundabout associated

with slow moving vehicles undertaking U-turns, safety concerns associated with driving on the median, increased traffic flows driving through a supermarket car park where vehicles and pedestrians regularly are in conflict.

Building on this rat-run, it has also been indicated that vehicles turn right into Opepe Street and along Waikato Street to undertake the same trip through the supermarket car park followed by U-turning at the roundabout. This generally happens between 5:30-6:00pm.

This reinforces the issue that southbound vehicles queuing on Spa Road results in rat-runs to avoid the queue, effectively exacerbating the problem and generating additional problems (such as increased traffic through a car park, increased usage of residential roads not designed for through traffic).

A separate issue raised is that it is extremely difficult to turn right onto Spa Road from any of the side roads in the CBD because of the volume of traffic and the lack of gaps in the traffic flow. From side roads to the south, instead of turning right onto Spa Road, vehicles will turn left and then U-turn at the roundabout. Again, this will reduce capacity of the roundabout and indicates a potential safety issue for right turning vehicles from side roads along Spa Road.

Poor lane utilisation of southbound traffic on Tongariro Street heading towards the roundabout with Spa Road was also raised in the first workshop and visibility issues (to the right) for the same movement was raised in the second. Visibility issues are particularly pertinent as this movement is uphill and curves to the left on approach to the roundabout with Spa Road. Local residents said that they were aware they might encounter vehicles exiting the access way from Countdown, and probably slowed in anticipation. The poor visibility was attributed to signage and planting. The issue was increased delays and queuing due to poor lane utilisation and restricted visibility.

4.5 Titiraupenga Street Issues

Taupō Primary School is located on the west side of Titiraupenga Street. There are play grounds on the east side and a concern was raised regarding the safety of children crossing Titiraupenga Street to and from the school and the playgrounds particularly at lunch time.

4.6 Boat Harbour

To encourage discussion, the possibility of a pedestrian and cycle bridge across the Boat Harbour was mooted. In response, the question was asked if there was sufficient space for car parking on the west bank if this linkage was constructed, since it could encourage park-and-walk. The issue therefore was there sufficient car parking space in the west bank area.

4.7 General Issues

The impact of electric vehicles and autonomous vehicles was raised as a concern.

General safety concerns for the more vulnerable road users, such as pedestrians and cyclists, were raised.

The need for more provisions for cyclists, such as cycle lanes was raised. However, this was more of a “wish list” than a specific issue.

4.8 Issue Summary

In a Business Case framework, the significance of the issues raised and the ramifications of not resolving them requires consideration. Whether the issues identified are real or perceived was confirmed following assembly and analysis of background data. The significance of issues is addressed in Section 6.

5. Background Research and Modelling Considerations

The issues and options discussed above need to be substantiated first and then analysed prior to the case for change being made. This was done by collation, collection and analysis of data on the existing situation using traffic counts and the Taupō Traffic model.

The surveys undertaken are described in section 5.1 below, and the results and findings from the data are described in subsequent sections.

5.1 Data and Surveys

5.1.1 Automatic Traffic Counts

While the model is a good source of traffic information there is no substitute for good quality count data.

There were a number of traffic counts already available, collected by TDC, with some 61 counts taken in 2016. The locations and dates are summarised in the appendix, both as a list and with the locations plotted.

However, TDC have not counted at the Control Gates Bridge, and the NZTA counts run only to 2015, and then only for about four weeks in the year. The historic counts have been accessed. The bridge is a critical issue, not only in terms of the final strategy, but also in terms of when it is going to be required. Obtaining an accurate picture of bridge flows now will assist with that and on-going monitoring will assist in determining when the second two lanes will be required.

The traffic survey firm, Matrix was commissioned to collect counts at specific locations to supplement the TDC counts.

Additional automatic traffic counts collected at:

- Wairakei Drive just north of the Control Gates Bridge;
- Taupō ETA South of Wairakei.

5.1.2 Intersection Counts

Turning movement counts at a number of intersections were also required, namely:

- Huka Falls Road / Wairakei Drive;
- Poihipi Road / Wairakei Drive;
- Tongariro Street / Redoubt Road;
- Tongariro Street / Spa Road;
- Spa Road / Ruapehu Street;
- Spa Road / Titiraupenga Street;
- Spa Road / Kaimanawa Street;
- Lake Terrace / Ruapehu Street;

- Lake Terrace / Titiraupenga Street;
- Lake Terrace / Kaimanawa Street; and
- ETA/Wairakei Drive.

The first three of these intersections were counted in June 2016, but the Tongariro Street/Spa Road count did not capture all movements and counts were repeated as it was better to have September counts rather than a set taken in mid-winter.

5.1.3 Video Recordings

There were four intersections where video capture of number plates was taken on 27th September for the morning peak period.

- Norman Smith Street/ Wairakei Drive capturing vehicles entering and leaving Norman Smith Street;
- Control gates bridge capturing vehicles in both directions;
- Spa Road/Titiraupenga Street capturing all movements;
- Lake Terrace/Titiraupenga Street capturing all movements.

With video, the paths of vehicles can be tracked using number plate recognition. This provided O/D information on vehicles that pass through the CBD, or which enter and leave the CBD within a short period, indicating a trip to drop off a passenger.

5.1.4 Drone Video

Drone video of the operation of Norman Smith Street and the Spa Road roundabout during the morning and evening peak periods was also obtained. Three half hour surveys sessions of filming were completed:

- Wednesday 20 September beginning at 8:15 am focussing on the Tongariro/Spa Road roundabout



In the morning peak during the 20 minutes of filming, there were no obvious queues on any leg of the intersection. Notable points were the lane utilisation of the northern approach to the roundabout. The traffic counts show that the left turn to Spa road and the through

movement to Tongariro Street are about equal, but the majority of traffic was using the left lane. Secondly there is a significant volume of traffic that leaves the Supermarket car park and performs a 'U' turn at the roundabout. The small central island means that manoeuvre is low speed and those vehicles disproportionately affect the capacity of the roundabout.

- Friday 22 December beginning at 8:23am focussing on the Norman Smith Street /Wairakei Drive intersection



This footage showed queues building on both Norman Smith Street, and on Wairakei Drive, with the Wairakei Drive queue, although always moving, often stretching back to Poihipi Road. The length of the queue on Norman Smith Street was not visible on the footage.

- Monday 25 September at 4:55pm concentrating on the Tongariro/Spa Road roundabout



As with the other footage of the roundabout, there were only minimal queues and delays showing on the video during the evening

5.1.5 Queues and Delays

The queues and delays at Norman Smith Street and the Spa road roundabout were also surveyed during the morning and evening peak periods. However, the effects seen in the drone video were not apparent on the survey day, raising questions as to the frequency that queues were forming. In order to check this, traffic counters that measured speeds were set up in November 2017 on Wairakei Drive, and Norman Smith Street, and recordings taken on Spa Road in July 2017 were also analysed.

The counter on Norman Smith Street was located between Mareti Street and Pitiroi Street, 575 m from the Intersection with Wairakei Drive. **Figure 6** shows the speeds of all vehicle passing over the counter between 8am and 9am on the weekdays from 6 November to 10 November 2017.

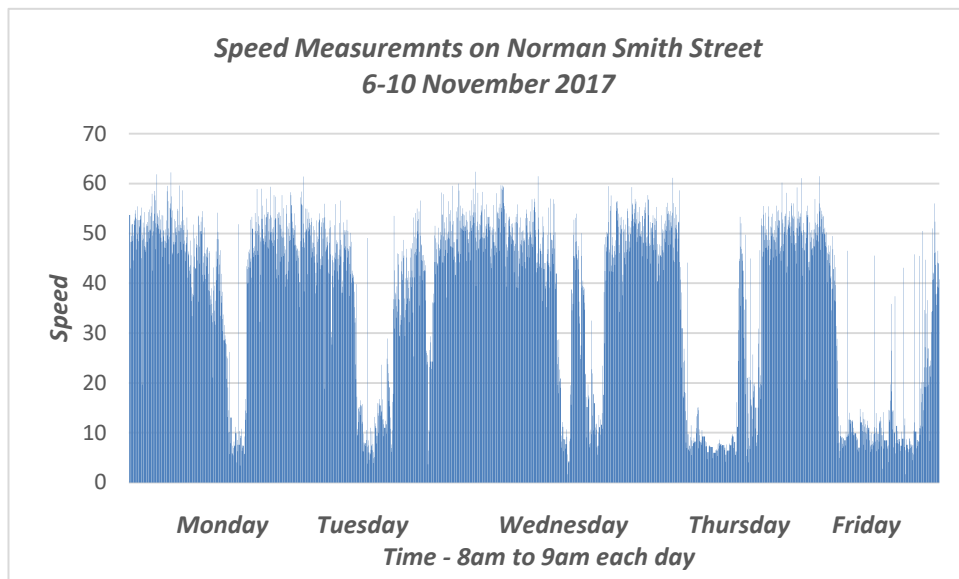


Figure 6: Speeds on Norman Smith Street – 8am-9am Each Day

As can be seen, the speed over the counter dropped to below 10km/hr for a period of time every day of that week. The duration was short on Monday and Tuesday but extended from 8:13am to 8:44am on Thursday 9 and from 8:13am to after 9:00am on Friday 10 November 2017.

The counter on Wairakei Drive was set about 320 m north of the Norman Smith Intersection for the same week. There were no queues on the Monday or Tuesday, on Wednesday the queue extended to the counter for about 10 minutes, and on Friday the queue existed for about 40 minutes from 8:21 to 9:00am – a little later than occurred on Norman Smith Street.

The counter on Spa Road was sited between Titiraupenga Street and Taniwha Street. The speed recordings show that the queue stretched back to that location for a period of about 10 minutes on the Thursday and Friday 27 and 28 July. A casual observation in September confirmed that. The queue does not appear to be stationary – just slow moving.

5.2 Wairakei Drive

The build-up of flows southbound in the morning peak on Wairakei Drive are interesting and instructive. At the SH1/SH5 roundabout at Wairakei, the peak hour south bound flow is just under 300 vehicles per hour (vph), but that drops to 200vph just north of Huka Falls Road. The flow then doubles as the Huka Falls Road traffic joins, and the doubles again as the right turn from Poihipi Road joins so that the flow just north of Norman Smith Street is 775vph. The right turn traffic from Norman Smith Street is about 740vph and these two merge to make the 1450vph on the bridge. That traffic then splits fairly evenly at the Spa Road roundabout, with 750vph turning left into Spa Road and 670vph travelling along Tongaririo Street.

The merge of Norman Smith right turning traffic with the southbound traffic on Wairakei Drive does not work as a true merge. From observations using the drone footage, and on site it is working more like a give way for the turning vehicles. The road markings do not help. The lane that the turning vehicles go into is marked with a dotted white line across the exit where that and the downhill lane merge. This give the impression that the through lane has priority.

5.3 The Control Gates Bridge

Traffic on the Control Gates bridge over the past 10 years has changed significantly. Between 2007 and 2009, flows were reasonably constant at 29,000-30,000 vehicles per day (vpd). In 2010 the ETA opened, and the flow dropped to just under 24,800vpd. There were no counts on the ETA at that time, but in 2013, the bridge flow was 25,700vpd and the ETA was 5,700vpd. Since then, both have been steadily increasing with the bridge flows averaging a 1% increase per year and the ETA averaging almost 9% per year. In September 2017 the average weekday flow at the bridge was 26,150vpd. No heavy vehicles were counted on the bridge but 5% of the traffic was classified as medium goods vehicles. On the ETA, 13% of the 7,700vpd weekday flow were classified as heavy goods vehicles, and a further 7% classified as medium goods vehicles. About half of the goods vehicles were B Trains.

The analysis and pre-ETA traffic counts showed the bridge running above capacity during extended holiday periods and often during peak non-holiday periods. In terms of daily traffic, the bridge will reach those numbers again in about 10 years using current growth rates. It should be noted however that the rate of residential development north of the river will have a significant bearing on this time frame.

However, the hourly flows are more indicative. In **Figures 7 and 8**, the hourly flows for a week in September 2017 are plotted for each week day. In that week, Thursday and Friday were days when schools were open, and the Monday, Tuesday and Wednesday were during the first week of the holiday.

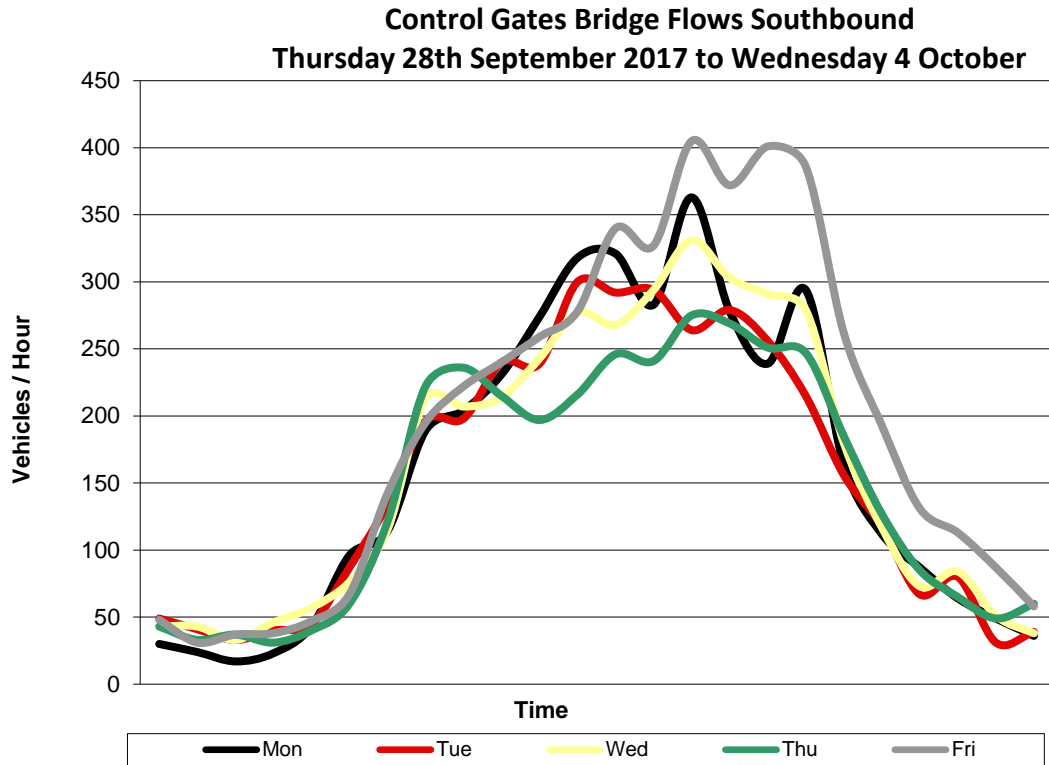


Figure 7: Weekday Flow on the Bridge - Southbound

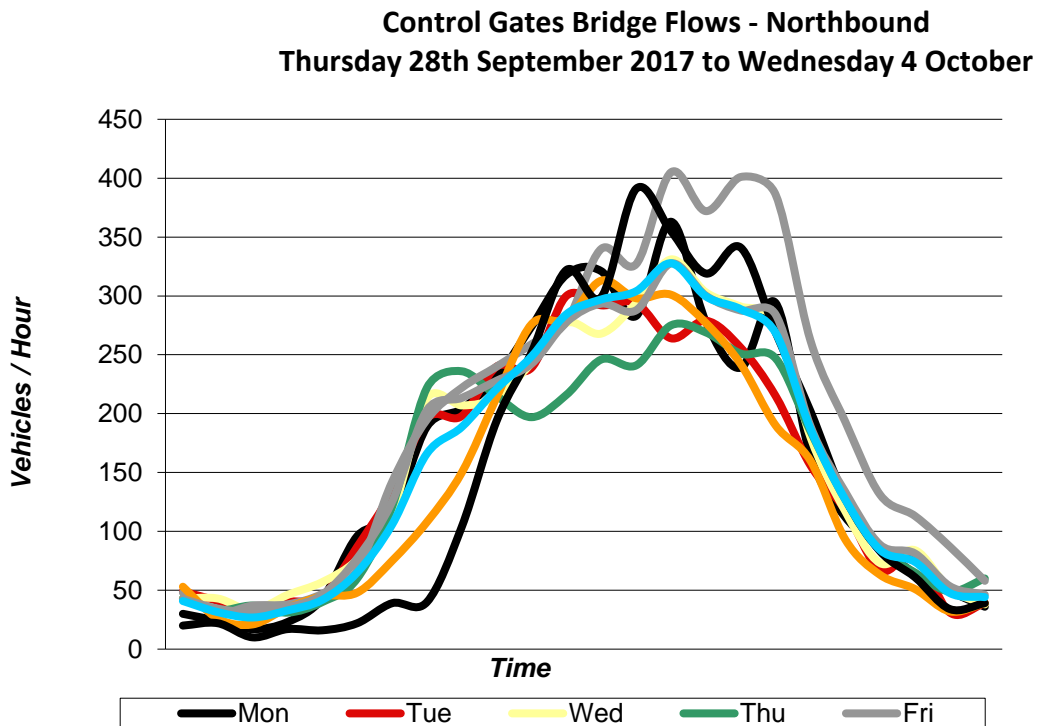


Figure 8: Weekday Flow on the Bridge - Northbound

There is a peak southbound flow of 1441vph that occurs between 8:00am and 9:00am in the morning when schools are in. In the following week these peak flows drop by about 20%. There is little difference in the pattern and flow over the other days, with all hours sitting between 850 and 1000vph.

The northbound direction shows little difference in flow between school and non-school days, but again the highest flow is 1460 per hour.

From this, it is apparent that the capacity of the bridge is about 1450 vph in either direction as this is the maximum that goes over the bridge before queues develop. At present, that level of flow occurs for an hour per day in each direction.

A final observation is that there is little variation in the total daily flow over the day, whether school is in or out. Combining both directions, the Friday flow is the highest at 27,700vpd, while the Monday flow is the lowest at 24,900vpd. These are $\pm 5\%$ from the average of 26,150vpd. The three mid-week days are only about $\pm 1.5\%$ from that figure.

5.4 Land Use

The future land use currently in the model is based on the TD 2050 land use, which estimates that the District will grow by some 28% by 2031. The estimate for growth north of the river is for the existing 2,639 households to grow by 33%, or slightly quicker than the district as a whole.

This translates to a modelled morning peak southbound flow on the bridge of 1620vph, and a northbound evening peak flow of 1,650vph. Both of these are almost 14% higher than the estimated maximum flows that the bridge can manage. (The model will put the flow on the bridge, even though it physically can't cope).

It may be prudent to limit development north of the river until such time as there are definite plans in place to build a second bridge.

The more recent growth model may shed a different light on the future flows, but the data used was the best information available at the time of the analysis.

6. Case for Change

In this section, the issues raised through the stakeholder engagement workshops and those identified by Council staff and the traffic consultant are reviewed in the context of the data collected to quantify issues that are genuine and enable perceived issues to be discarded.

In the following table, the issues are reported in conjunction with the outcome of the data analysis and observational surveys.

Options to address the issues are given in the next section of the report.

Issue Number	Mode	Issue	Supporting Data Analysis	Status
1	Vehicles	St Patrick's school on Acacia Bay Rd generating double crossings of the Control Gates Bridge and exacerbating traffic delays.	Number plate matching of vehicles on the bridge show that in the one-hour period between 0800 and 0900 643 vehicles travelled north over the bridge. Of these 104 or about 16% travelled back southbound over the bridge later in the hour. While this is not a large number, given the bridge is at or close to capacity southbound it is 104 vehicles that may be able to be shifted (7% of the hourly southbound flow).	Confirmed issue
2	Vehicles	Significant delays for eastbound traffic on Norman Smith St in morning peak.	Reported 20 min delay - measured to be 30 seconds which is generally acceptable. The maximum observed queue was 15 vehicles. However, traffic conditions on the day that the traffic was counted did not match the conditions seen on the drone footage. Measurements from that suggest an average delay in excess of 90 seconds which is not considered acceptable. The recent counts show that the queue on Norman Smith Street occurs every day. Observations confirm that "merge like a zip" for southbound Wairakei Dr traffic and Norman Smith St is not operating as a "zip" but with Norman Smith St traffic giving way from the dedicated lane.	Confirmed issue
3	Vehicles	High speeds northbound on Wairakei Dr, limiting ability to turn out of Norman Smith St.	Speeds from tube count confirmed that almost 80% of the vehicles between 7am and 9am were Vehicle to be in excess of the 50kph speed limit, with about 2% in excess of 70 kph. The 85 th Percentile speeds were just over 60kph. In the evening peak, speeds were a little slower.	Confirmed issue
4	Vehicles	Northbound traffic on Wairakei Dr move into left turn slip lane late and often do not indicate, limiting ability to turn out of Norman Smith St.	Video footage from Drone survey confirms this behaviour.	Confirmed issue
5	Vehicles	Significant traffic volumes southbound on Wairakei Dr resulting in "flow breakdown" from vehicles braking.	The traffic counts confirm that the bridge is operating at hourly flows that are close to or at capacity. Even a slight perturbation in flow at that level will cause breakdown. Observation confirms southbound vehicles slowing likely associated with visibility approaching the Spa Rd roundabout (uphill and around a curve).	Confirmed issue

Issue Number	Mode	Issue	Supporting Data Analysis	Status
6	Vehicles	Industrial area traffic inappropriately using Control Gates Bridge.	It is probably not an issue of inappropriate use of the bridge. It is more to do with vehicles leaving the Countdown car park and making a 'U' turn at the roundabout, with consequent reduction in capacity. There is anecdotal evidence that some traffic from Spa Road uses the carpark as a 'rat run' to avoid delays at the roundabout.	Confirmed issue
7	Vehicles	Significant queuing for southbound traffic on Spa Rd generated from the Tongariro Street roundabout.	The queueing and delay surveys did not show queues on the southbound approach to the roundabout but having said that the survey cameras were not set up to catch the full length of the queue. However, speed measurements taken just south of Titiraupenga street do confirm that a significant proportion of vehicles are travelling westbound at speeds less than 40kph, while the majority in the eastbound direction are around the 60kph mark, suggesting that a moving queue could be stretching that far back from the intersection. This was confirmed by other observations on different days.	Confirmed issue
8	Vehicles	Southbound vehicles on Spa Rd turning right into Nukuhau St, through Countdown car park, left onto Tongariro St, then U-turning at roundabout with Spa Rd due to long delays for southbound traffic on Spa Rd towards Tongariro.	Rat-run on Nukuhau St/Countdown/U-turn at Spa Rd roundabout confirmed visually from video footage from Drone survey.	Confirmed issue
9	Vehicles	U-turning traffic at the Spa Rd/Tongariro St roundabout generating additional delay due to low speeds of the manoeuvre.	Confirmed visually from video footage from Drone survey.	Confirmed issue
10	Vehicles	Southbound vehicles on Spa Rd U-turning at roundabout with Tongariro as cannot turn right from side roads onto Spa Road.	U-turns confirmed visually from video footage from Drone survey. Traffic counts confirm few right turning vehicles, but not possible to confirm inability. Flows on Spa Rd are significant which will reduce gaps and result in difficulty turning right across two traffic streams.	Confirmed issue
11	Vehicles	Poor lane usage southbound on Tongariro St towards Spa Rd roundabout.	Confirmed visually from video footage from Drone survey.	Confirmed issue

Issue Number	Mode	Issue	Supporting Data Analysis	Status
12	Vehicles	Poor visibility southbound on Tongariro St towards Spa Rd roundabout from planting and signage.	Visibility confirmed as limited based on uphill gradient and road curvature, but limitations from planting and signage does not seem to be an issue	Confirmed issue
13	Vehicles	Need for clearer identification of car parking locations.	Likely a peak season issue. Data collection and observation currently focused on typical period.	Unable to confirm
14	Vehicles	Sufficient space for car parking on west bank if pedestrian bridge constructed across Boat Harbour.	This was not so much an issue but a question. The need for parking would be monitored on an ongoing basis if the bridge is established.	Unable to confirm
15	Pedestrians	Difficult/unsafe to cross Wairakei Dr at the Control Gates Bridge.	Confirmed that pedestrians are crossing at this location and that this represents safety concerns.	Confirmed issue
16	Pedestrians	Safety issues for school children crossing Titiraupenga St from Taupō Primary School on west to playing fields on east.	Council staff confirm this occurs. Not confirmed if there are current safety issues but need to consider vulnerable road users in option development.	Confirmed consideration
17	Pedestrians/Cyclists	General concern over pedestrian and cycle safety.	Focus will be on specific issues raised, and in ensuring option development considers all modes of transport.	n/a
18	Cyclists	Difficulty crossing Wairakei Dr/Tongariro Street.	High traffic flows indicate this will be problematic. Observations of children crossing by foot a safety concern.	Confirmed issue
19	Cyclists	Cycleway on east side of Wairakei Dr, then steep uphill off-road link through to Nukuhau St. Gradient steep for cyclists but used to avoid Tongariro St (high vehicle flows, difficulty crossing).	As above.	Confirmed issue
20	Cyclists	Safety concerned raised biking on Norman Smith Street and then turning right into Wairakei Dr and needing to change lanes in heavy traffic.	High traffic flows indicate this is likely problematic at peak times.	Likely issue
21	Cyclists	Safety concerned raised biking southbound on Spa Rd and then turning right onto Tongariro St.	High traffic flows indicate this is likely problematic at peak times.	Likely issue

Issue Number	Mode	Issue	Supporting Data Analysis	Status
22	Cyclists	Safer cycling infrastructure.	Focus will be on specific issues raised, and in ensuring option development considers all modes of transport.	n/a
23	All	Impact of autonomous vehicles (AVs) and electric vehicles (EVs).	Professional judgement that EVs will not impact travel patterns or flows. International views on AVs are that these could lead to more trips (e.g. AVs returning home after dropping you at work) or less trips (e.g. no individual ownership but shared use business model). Likely to be very long term effects, out-of-scope for current investigation.	n/a
24	All	Increased development in the north increasing traffic on Control Gates Bridge and exacerbating delays.	Traffic volumes on Control Gates Bridge already almost reached capacity, particularly southbound.	Likely issue

Table 4: Confirmation of Transport Issues

7. Option Identification

In this section, options/solutions that may address the confirmed issues are tabulated including options put forward during the stakeholder engagement workshops. At this stage, the viability and performance of the options has not been taken into account.

The issues that each option may address are also tabulated by referring to the “Issue Number” from Table 4.

Options are grouped geographically using the following letters:

- A: Vicinity of Norman Smith Street and Wairakei Drive;
- B: Vicinity of Tongariro St and Spa Road;
- C: From Spa Road through to Lake Terrace;
- D: Non-infrastructure solutions.

Option Code	Option	Expected Benefits	Issue Numbers Addressed
A1	Change road markings on Wairakei Dr immediately south of Norman Smith St to promote “merge like a zip”. Slow Wairakei Dr SB traffic by shifting transition to 50kph further north. Add road markings to visually narrow carriageway and rumble strips (for example) to further encourage speed reduction. The northbound passing lane could also be removed.	Manage bottleneck at Norman Smith St/Wairakei Dr, increasing capacity and reducing queues/delays.	2
A2	Close Norman Smith St at Wairakei Dr and reroute traffic via Acacia Bay Rd and Poihipi Rd. May require roundabout or traffic signals at Poihipi Rd/Wairakei Dr.	Manage bottleneck at Norman Smith St/Wairakei Dr, increasing capacity and reducing queues/delays. A disbenefit of this option is that it will put more traffic on Acacia Bay Road and passed St Patrick’s School.	2
A3	Ramp-metering style signalisation of Norman Smith St/Wairakei Dr.	Manage bottleneck at Norman Smith St/Wairakei Dr while minimising delays.	2
A4	Full signalisation of Norman Smith St/Wairakei Dr.	Ability to control queuing at peak times. Provides safer pedestrian crossing.	2
A5	Roundabout at Norman Smith St/Wairakei Dr with southbound slip lane on Wairakei Dr.	Manage bottleneck at Norman Smith St/Wairakei Dr, increasing capacity and reducing queues/delays.	2
A6	Temporary Tongariro St pedestrian/cycle bridge south of Control Gates Bridge.	Safer crossing for pedestrians and cyclists.	18
A7	At grade pedestrian crossing of Tongariro St between Spa Rd and Norman Smith St (signals or zebra crossing).	Safer crossing for pedestrians and cyclists.	18
B1	Change roads markings on Tongariro St SB approach to Spa Rd roundabout to dedicated lanes for the left and right/ahead movements.	Improving lane utilisation at roundabout will increase capacity and reduce queues and delays.	11
B2	Ban right turn into Redoubt St to extend length of 2 lane approach to roundabout.	Banning turn into Redoubt frees up road space.	11
B3	Close access way from supermarket to Tongariro St.	Eliminate rat-run through supermarket car park Eliminate safety issues of for southbound vehicles on Tongariro St having a vehicle turn out of the access way in front of them.	8

Option Code	Option	Expected Benefits	Issue Numbers Addressed
		<p>Eliminate U-turns by northbound vehicles on Tongariro turning through the gaps in the tubular delineators to access the supermarket.</p> <p>Eliminate U-turns at roundabout by southbound vehicles exiting the supermarket.</p> <p>Increases roundabout capacity and improves safety.</p>	
B4	<p>Second crossing of Control Gates Bridge Including four laning of Wairakei Dr/Tongariro St from Norman Smith St to Spa Rd.</p>	<p>Additional capacity will reduce queuing and delays.</p> <p>Will facilitate better management of traffic using Norman Smith St, resulting in largest reduction in delays.</p>	
B5	<p>Extra deck above existing Control Gates Bridge Including four laning of Wairakei Dr/Tongariro St from Norman Smith St to Spa Rd.</p>	<p>Caters for long term growth in traffic flows into Taupō, providing long term capacity solution.</p> <p>Enables further residential development north on the Waikato River.</p>	<p>1,2,3,4,5,8,9,10 ,11,12,</p>
B6	<p>Remove Spa Rd roundabout and realign intersection with Tongariro St north connecting through parking area to Paora Hapi St.</p> <p>Left turn only onto Spa Rd, with Spa Rd SB traffic rerouting via Gascoigne St, or Ruapehu Street.</p> <p>Requires modified intersection control at Gascoigne St/Paora Hapi St (signals or roundabout), or at Ruapehu Street.</p> <p>Tee Tongariro St south onto realigned intersection with Give Way control.</p> <p>Tee Lake Terrace onto Titiraupenga St.</p>	<p>Reduce PM peak southbound queues and delays on Spa Rd.</p> <p>Increase southbound capacity on Tongariro St north.</p> <p>Reinforce Tongariro St south/Lake Terrace as minor road adjacent to Lake, enabling subsequent changes in urban form.</p>	<p>Consequent on B3, and to implement the CISP</p>
C1	<p>Signalise Spa Rd/Ruapehu St and Spa Rd/Titiraupenga St.</p>	<p>Introduce safe pedestrian crossing opportunities.</p> <p>Create gaps in traffic flow to enable vehicles to turn right out of side roads onto Spa Rd.</p>	<p>10</p>
C2	<p>Reverse priorities of intersections with Titiraupenga St between Spa Rd and Lake Terrace so that Titiraupenga St has priority.</p>	<p>Create alternative route to Tongariro St (south) and Lake Terrace to reduce traffic flows through the CBD, improving the amenity.</p>	<p>Consequent on B5 and to implement the CISP</p>

Option Code	Option	Expected Benefits	Issue Numbers Addressed
C3	Signalise Titiraupenga St/Tamamutu St and Titiraupenga St/Heuheu St.	Promote Titiraupenga St as alternative to Tongariro St (south) and Lake Terrace while safely enabling east-west traffic flows. Safe opportunities for pedestrians to cross Titiraupenga St.	Consequent on B5 and to implement the CISP
C4	Signalise Paora Hapi St/ Ruapehu St and Paora Hapi St /Gascoigne St.	Facilitate access into the CBD when the function of Paora Hapi is changed.	Consequent on B3 and B5
D1	Parking signage – further develop the existing parking map and investigate electronic signs.	Reduce number of vehicles circulating to look for a car park, particularly during peak tourist season.	13
D2	VMS sign on SH1 north of ETA/Thermal Explorer Highway/SH5 roundabout with travel times to Taupō CBD via ETA and Wairakei Dr.	Encourage use of ETA instead of Wairakei Dr reducing flows and delays on Wairakei Dr during peak times. Will only be successful at times when it is faster to use the ETA.	2
D3	Pedestrian/ Cycle crossing of the river in the boat harbour area.	Provide an alternative to the Control gates bridge for pedestrians and cyclists.	18
D4	Education campaign on good driving practice. For example, how to use the SB merge at Norman Smith St/Wairakei Dr and use of the left turn indicator for NB traffic on Wairakei Dr turning into Norman Smith St.	Increase opportunities to turn out of Norman Smith St, reducing delays. Reduce conflict for southbound merging traffic at Norman Smith St/Wairakei Dr.	2
D5	Investigate Private-Public Partnership for crossing additional to existing Control Gates Bridge.	Desired benefit of fast-tracking ability to fund construction of an additional crossing to the Control Gate Bridge.	
D6	Accommodation to provide access instructions by email using ETA for visitors.	Encourage use of ETA and reduce traffic flows on Wairakei Dr, reducing delays.	
D7	Signals at Huka Falls Road.	Create gaps in Wairakei Drive traffic.	

Table 5: Long List of Options

8. Option Shortlisting

8.1 Option A1. Wairakei Drive Lane Marking

This option has two components. The road marking where the right turn out of Norman Smith street merges with Wairakei Drive is such that it appears that the through movement has priority. Marking so that each lane has equal priority would encourage a more formal merge.

As observations have shown, the right turn works better when the traffic flow on Wairakei is high enough that speeds are slowed such that the turning traffic is permitted to enter the stream. At higher speeds, the turning traffic has to wait for a gap.

As a supplementary treatment there is an option to slow Wairakei Drive. One way to do this would be to shift the 50kph limit north of Huka Falls Road and establish a threshold there to 'tell' drivers that this is the entrance to the urban part of Taupō. There would probably be a need to mark the road with painted shoulders to give the impression that the lanes were narrow. Speed limits on Huka Falls Road would also need to be reviewed as part of this option

The option has been carried forward to the short list.

8.2 Option A2. Close Norman Smith Street

This option would require all traffic to the West of Wairakei Drive to drive up to Poihipi Road to access Wairakei. The diverted flows at Poihipi Road would result in about 1100vph attempting the right turn out from Poihipi as opposed to the existing 300vph with Norman Smith open. The queues on Poihipi Street would be longer than those currently on Norman Smith.

A roundabout was suggested at that intersection, but that simply transfers the queues and delays onto southbound vehicles on Wairakei Drive.

The option was rejected.

8.3 Option A3. Ramp-metering Style Signalisation of Norman Smith St/Wairakei Dr

While this option was suggested using the ramp metering system in Auckland as an example, it would require signals on both Wairakei Drive and Norman Smith Street as the volumes on each in the morning peak are similar.

It is, in effect, the same as following Option A4 and has been rejected.

8.4 Option A4. Full Signalisation of Norman Smith St/Wairakei Dr

The option of signalising the intersection is an obvious way to equalise the delays at the intersection, and potentially make the merge more efficient as turning traffic will not be conflicting with the southbound through traffic. One issue with incorporating any controls at the intersection is the speed of the downhill traffic. Over the day, the 95-percentile speed is between 67 kph and 73 kph – well within the 80 kph speed limit. However, speeds over 95kph have been recorded for many hours. A pre-requisite to including signals would be changing the speed limit to 50 kph as noted in Option A1.

The option has been carried forward to the short list.

8.5 Option A5. Roundabout at Norman Smith St/Wairakei Dr with Southbound Slip Lane on Wairakei Dr

An alternative to signals would be to incorporate a roundabout with a southbound slip lane, similar to that near Cambridge as shown alongside. Although obscured by trees, the through lane past the roundabout can be seen in the photo.

The option has some appeal, but indicative costing showed it to be some four times the cost of signals and does not assist with pedestrians crossing from Norman Smith Street to the east side of Wairakei Drive.

The option has not been taken through to the short list.



8.6 Option A6. Temporary Tongariro St Pedestrian/Cycle Bridge South of Control Gates Bridge



There are issues with pedestrians and cyclists crossing Tongariro Street or Wairakei between Norman Smith Street and Spa Road. There is a central refuge island just south of the Control Gates bridge but that is barely satisfactory. The option proposed was to construct a permanent bridge for cyclists and pedestrians in approximately the same location as the temporary bridge set up for the Cycle Race.

This option is not amenable to quantitative analysis but is a good option to enable cyclists and pedestrians to safely cross Tongariro street, particularly if Tongariro Street is 4-laned as discussed in following Option B3.

Having said that, if Tongariro Street is 4-laned, the Spa Road roundabout is removed and the section south of Spa road is made more 'pedestrian friendly' as envisaged by the CISP, then Tongariro Street would 'Tee' onto the through route. In this scenario, it may be better to bring cyclists and pedestrians to a crossing just south of the intersection.

The option has been included in the short list but needs to be considered in the light of a more comprehensive study of a Taupō walking and cycling network once decisions on other recommendations in this report are made.

8.7 Option A7. At Grade Pedestrian Crossing of Tongariro St Between Spa Rd and Norman Smith St (Signals or Zebra Crossing)

This option was designed to address the same issues as Option A6. The only safe possibility is to include pedestrian crossings at signals at Norman Smith Street on the northern and western legs as part of Option A4.

As such, this is not an option to be taken further in its own right.

8.8 Option B1. Change Roads Markings on Tongariro St SB Approach to Spa Rd Roundabout

Southbound traffic on Tongariro Street on the approach to the Spa road roundabout is approximately 50% turning left into Spa Road, and 50% travelling south along Tongariro Street in the morning peak, but most traffic uses the left-hand lane. An option to improve this would be to mark the left lane as a left turn only rather than the current left and through marking in an attempt to achieve better lane utilisation.

The option has been carried forward to the short list.

8.9 Option B2. Change Redoubt Street to Left-in, Left-out

Part of the reason for poor lane utilisation at Spa road discussed in Section 8.8 is that there is a right turn bay for traffic turning into Redoubt Street from Tongariro Street. Even though the second lane begins to develop 120m back from the Spa Road intersection 50 m of it can be taken up by the right turn into Redoubt Street. Banning that turn will allow the full 120 m to be used.

However, at present southbound Intercity buses make the right turn into Redoubt Street in order to be able to stop outside the i-site building. They then travel north and make a u-turn at the roundabout to continue south on Tongariro Street. There are 7 movements per day (all outside peak hours) and these buses would need to make a u-turn at the roundabout and a left turn into Redoubt Street.

The option has been carried forward to the short list.

8.10 Option B3. Close the Access from the Countdown Supermarket Car-park

There are a significant number of vehicles that exit from the Countdown access, turn left and then make a U turn at the roundabout to access the bridge. Some of these are Countdown customers, but some are vehicles that were travelling west on Spa Road but make a detour through the carpark in order to avoid the queue at the roundabout.

This has two detrimental effects. Firstly, the vehicles have to weave across a lane to make the turn, and secondly, the roundabout island has a small diameter (approximately 7.5m) which means that the U-turn speed is slow and produces about twice the delay effect of a simple turn.

One complication with this option is that the access services a drive to a house west of Morrell Motors. An alternative legal access to that house will need to be established. Also, clearly Countdown will have an interest in this option.

The option has been carried forward to the short list.

8.11 Option B4. Establish a Second Crossing of the River, Just Downstream from the Control Gates Bridge

Prior to the decision that the ETA was to be built, a second river crossing was a serious alternative. This bridge involved a new road from Norman Smith Street to Opepe Street, and a re-routing of the State Highway along Titiraupenga Street to Lake Terrace. That concept has formed the basis of long term planning in Taupō since then, but as noted in Section 2.1, it is no longer a design appropriate to the function of the road.

The CISP identified two locations for a second river crossing, with the one being the Opepe Street option. The other was a bridge alongside the existing Control gates bridge but linking with Nukuhau Street. It was rejected as a highway option because of grades when the ETA was being considered. The CISP saw this as a local road and a viable option as grades are not so much of an issue, but it would probably still involve cutting into Nukuhau Street with consequent access issues for adjoining properties.



A more obvious option is to build a new bridge downstream from the existing bridge. That would enable 4 lanes to be established from Norman Smith Street to the Tongariro Spa intersection. At the northern end, there would be one southbound lane for traffic travelling down the hill and the second lane would be for the right turn traffic out of Norman Smith Street. There would be no need for a merge – instead the whole length from Norma Smith Street to Spa Road would be available for a weave movement so that traffic is in the correct lane at Spa Road.

There are issues of land acquisition to be considered, and (as with the supermarket access issue – Option B3) alternative access to the house west of Morrell Motors would need to be established.

The option has been carried forward to the short list.

8.12 Option B5. Add a Deck Above the Existing Bridge

This is a variation on Option B4. It suffers from several shortfalls. Firstly, it is difficult to see how the road at either end would work, and secondly, it would need to be constructed in such a way as to be completely independent of the existing bridge. Finally, it is unlikely to be aesthetically acceptable.

The option was rejected.

8.13 Option B6. Redesign of the Spa Road/Tongariro Street Intersection and Establishment of an Alternative Through Route

The CISP envisaged an alternative route for through traffic that essentially diverted that traffic away from Tongariro Street to Titiraupenga Street. In that case, Tongariro Street would revert to be a local street, and could 'Tee' onto the existing Tongariro / Spa Road intersection. Assuming that Option B4 is chosen, then either Spa Road, (in conjunction with Option C3) or Paora Hapi Road (in conjunction with Option C4) could be used as the link from the intersection to Titiraupenga Street. Either would need to be combined with Option C3.

The option has been carried forward to the short list.

8.14 Option C1. Signalise Spa Rd/Ruapehu St and Spa Rd/Titiraupenga St

As discussed in the issues section, there are long queues on Spa Road, and at many times during the day, it is almost impossible to turn right into Spa Road. There are few options available to address this issue, other than installation of signals to facilitate the turns at the signalised intersection and create gaps for turning vehicles at other intersections. The intersections chosen for signalisation were Spa Road/Ruapehu Street and Spa Road/Titiraupenga Street. Ruapehu Street is and will continue to be a key access route into the CBD, while Titiraupenga Street forms part of the alternative route from the Control gates to Lake Terrace, as well as providing access to the southern parts of the CBD.

The option has been carried forward to the short list.

8.15 Option C2. Reverse Priorities on Titiraupenga St

The CISP plan to create an alternative through route relies on Titiraupenga Street having Priority. At present Tamamutu Street and Heuheu Street have priority and that would need to be changed. If that were to happen, there would be no clear east west route into and out of town.

The option has been rejected in favour of Option C3.

8.16 Option C3. Signalise Titiraupenga St/Tamamutu St and Titiraupenga St/Heuheu St

Tamamutu Street and Heuheu Street are the main arterial east/west routes, and as envisaged by the CISP, Titiraupenga Street will become the north/south arterial. Signals or roundabouts are the only means of ensuring the both roads at each intersection get a fair share of the available capacity. The morning and evening peaks exhibit a degree of tidal flow meaning the roundabouts will not function efficiently and will be more expensive than signals.

The option has been carried forward to the short list.

8.17 Option C4. Signalise Paora Hapi St/Ruapehu St and Paora Hapi/Gascoigne Street

If Paora Hapi Street is chosen as the primary east/ west street linking the bridge and Titiraupenga, then signals or roundabouts will be needed at Gascoigne Street and Ruapehu Street to facilitate access into the core area of the CBD. As with Titiraupenga Street, the roundabout option will not work efficiently in the peaks and will be about twice the cost of signals.

A variation on this might be to close the section of Gascoigne from Paora Hapi to Spa Road, and at face value this looks attractive and achievable as there is no property access over that section of the road.

The option has been carried forward to the short list.

9. Other Measures

There are several other measures that were put forward during the consultation process that are not directly related to issues, but which are useful to consider.

9.1 Option D1. Parking Signage

Electronic signs strategically placed around the CBD to indicate where parking is available, particularly during peak holiday periods would help reduce vehicles circulating and searching for parks. This will involve a specialist study to identify which parking areas should be included, and where the signage should be placed. It is beyond the scope of the present Study.

9.2 Option D2. VMS Signage on the Approaches to Wairakei Drive

During peak holiday periods, every opportunity should be taken to reduce the number of vehicles on Wairakei Drive and the bridge. One way of doing this is to have a VMS sign on the north (SH5) and west (SH1) approaches to the Wairakei roundabout suggesting that the ETA should be used as the way to access the CBD. This is an inexpensive but probably effective way of diverting traffic from Wairakei Drive.

9.3 Option D3. Pedestrian/Cycle Bridge in the Vicinity of the Boat Harbour

A bridge or ferry service in the vicinity of the boat harbour would provide a useful alternative to the control gates bridge for pedestrians and cyclists. A bridge would need to be able to be opened to enable high masted boats to pass through such as the Te Wero bridge in Viaduct harbour. There are issues that would need to be resolved in the event that an uncontrolled boat was drifting downstream while the bridge was down.

A ferry service is also an option, but it is questionable as to whether it could be commercially viable.

The option should be considered further but is beyond the scope of this present study.



9.4 Option D4. Education Campaign on Good Driving Practice

Two examples of poor driving practice came out during the consultation process. The first is that the merge of the Norman Smith right turn with Wairakei Drive southbound traffic does not work as a merge. The remarking of the lanes will help, but the signage on both legs

should use the 'merge like a zip' concept. The present sign on Norman Smith Street is a little misleading in that it appears that the Wairakei Drive traffic has right of way.



The second example is at the same intersection where northbound left turning vehicles often do not indicate that they are turning, which means right turn vehicles out of Norman Smith Street often have to wait unnecessarily.

A public education campaign would help.

9.5 Option D5. Investigate a Public-Private Partnership to Build the New Bridge

While at first glance this idea has merit, it is difficult to see where the return for the private part of the partnership would be. Generally, PPPs work in situations where tolls can be introduced, but in this case, that would not be appropriate, nor would it likely get Government approval. It is not considered worth pursuing.

9.6 Option D6. Hospitality Managers to Provide Access Instructions

This is an idea that would be relatively simple to implement. The managers and owners of hotels and motels should be encouraged to show access directions in their advertising material and websites that show the ETA as the route by which their premises should be accessed from the north and advise if and when large events are on at the time of their stay.

9.7 Option D7. Signals at Huka Falls Road

This option would only be valid if the eastern end of the West Kinloch Arterial (WEKA) were constructed, from Poihipi Road to Wairakei Drive through to a four-leg intersection with Huka Falls Road. It is unlikely that the full WEKA will now be built, but the eastern end could be built as part of a development. The Poihipi Road intersection with Wairakei Drive would be closed in this option.

Although this option does not address an issue, signals at that intersection would create gaps in Wairakei traffic that would assist the right turn out of Norman Smith Street, if Option A4 is not adopted.

The option is worth further investigation if either of those two conditions exist but has not been included in the short list at present.

10. Option Analysis

10.1 Option A1. Wairakei Drive Lane Marking

The remarking of the merge lane and addition of the merge signs is a low-cost option that can be implemented immediately. It is not readily amenable to quantitative analysis, but microsimulation modelling shows that there is a small benefit to Norman Smith traffic, and a small disbenefit to Wairakei Drive traffic.

10.2 Option A4. Full Signalisation of Norman Smith St/ Wairakei Drive

The option works well as demonstrated by the microsimulation modelling and demonstrated in the two snapshots. The figure alongside shows the queues in the bases – that is the situation that exists today.

There are still queues when the signals are installed, but nowhere near to the same extent, as shown in the second snapshot. The operation of the network is considerably improved with vehicle minutes in the morning peak decreasing by 4%.

In economic terms, the benefit in the Morning and Evening peaks is in the order of \$0.8m per year for a cost of \$0.435m, meaning that the signals would pay for themselves within the first year.



10.3 Option A6. Temporary Tongariro St Pedestrian/Cycle Bridge South of Control Gates Bridge

As noted above, this option is not amenable to quantitative analysis, but needs to be addressed in a more detailed study of cycling and walking facilities in Taupō, to be implemented as part of the changes envisioned by the CISP.

10.4 Option B1. Change Roads Markings on Tongariro St SB Approach to Spa Rd Roundabout; Option B2, Redoubt Street as Left-in Left-outs and Option B3 Closure of the Countdown Access

These re-markings are low cost easily implemented changes that will enable better lane utilisation at the roundabout and eliminate several conflict areas. Indications from the microsimulation model are that they will save about 11% of the total vehicle minutes in the system during the morning peak and about 16% in the evening peak.

10.5 Option B4. Establish a Second Crossing of the River, Just Downstream from the Control Gates Bridge

The option of building a new bridge and four laning from Norman Smith Street to Spa Road is obviously a longer-term proposal and need significant investigation before it can be confidently adopted. However, it has been provisionally costed to confirm that it is a serious alternative to the Opepe Street alignment. The current estimate is \$12.3m, but more work needs to be done in respect of geotechnical investigations, and bridge abutments.

Clearly, the bridge will need to be designed in conjunction with the requirements of Mercury Energy, and the status of the existing bridge will need to be established. There are also multiple services that are carried by the current bridge that may need to be transferred to a new bridge.

As noted above, there are potential land acquisition issues that need to be worked through once there is a provisional design, and there is the access issue for the house west of Morrell Motors.

Nevertheless, the current estimate is considerably less than the \$40m estimate for the Opepe Street bridge and is certainly worth exploring further. It will take time to prepare concept designs, confirm constructability, deal with the requirements of Mercury Energy, obtain any necessary consents and prepare detailed designs and costings. It may also be some years before the necessary funds could be made available.

The timing of the bridge also needs to be investigated in more detail, with particular reference to the extent of growth to the north of the bridge.

10.6 Option B6. Redesign of the Spa Road/Tongariro Street Intersection and Establishment of an Alternative Through Route

While this option would need to be implemented by the time that Option B4 is built, there is no reason why it could not be established earlier. Essentially, it involves removing the roundabout, 'teeing' Tongariro Street onto it and establishing a good link to Titiraupenga Street.

Although initially the option was conceived with the link being along Paora Hapi Street, there is also the option of using Spa Road to perform that function once signals have been installed on Spa Road (Option C1) and Titiraupenga Street (Option C3). Once that is done then the status of Tongariro Street can be downgraded, and the roundabout removed.

The option of using Paora Hapi Street as the link to Titiraupenga Street (Option C4) can be explored at a later time either in advance of the new bridge and four laning, or contemporaneously with them.

The additional cost of removing the roundabout and realigning the intersection has been estimated at \$150,000. The costs of the signals are included in the following sections.

10.7 Option C1. Signalise Spa Rd/Ruapehu St and Spa Rd/Titiraupenga St

Signals on Spa Road are designed to deal with the issue of traffic not being able to turn right into Spa Road. While the models can replicate this to some extent, no model can truly reflect the tortuous routes the drivers take to get onto Spa Road. The micro-simulation model does better than the traffic model, as can be seen from the queuing that occurs in the evening peak.



Figure 9. Existing Evening Peak Queues

When the signals are introduced the side road queues diminish significantly as do the vehicle minutes in the network.

The estimated cost for these signals is \$375,000 for the set at Ruapehu Street, and \$565,000 for the set at Titiraupenga Street.



Figure 10. Signals at Ruapehu and Titiraupenga Streets

10.8 Option C3. Signalise Titiraupenga St/Tamamutu St and Titiraupenga St/Heuheu St

There is little value in a quantitative analysis of these intersections as the signals are required to ensure that the north/south and east/west traffic get an adequate share of the available capacity. The intersections have been run through Sidra (a standalone intersection analysis model) and that confirms that they operate satisfactorily.

These signals have been costed at \$470,000 for Titiraupenga/Tamamutu, and \$451,000 for Titiraupenga/Heuheu.

10.9 Option C4. Signalise Paora Hapi St/Ruapehu St and Paora Hapi/Gascoigne Street and Paora Hapi

Although the combination of Options C1 and C4 will establish Titiraupenga as an alternative to Tongariro Street, it is rather less attractive for motorists than the alternative of using Paora Hapi as the link between Tongariro and Titiraupenga. However, the option is expensive at \$560,000 to reinstate Paora Hapi between Tongariro and Gascoigne, and installation of

signals at Gascoigne, Ruapehu and Titiraupenga – a total of some \$2.25m. It is likely to be a long-term option.

There are some 37 car parks that would be affected by this change, but some of those could be re-instated on the westbound lane of Spa Road which would be closed. If that section of Gascoigne Street were also closed additional spaces could be made available. This will become clearer at the time a design is undertaken.

11. Programming

11.1 Provisions in The Long-Term Plan

Taupō District Council is in the process of updating the Long-Term Plan (LTP) for the ten years from 2018 to 2028. Line items currently in that plan for works covered in this study total \$4.147m over the 10 years. At this stage, these are, to some extent, placeholders, but they will need to be confirmed. The items are shown in **Table 6**.

LINE ITEMS IN THE LTP				
Year	Northern Access Upgrade Project	Priority Changes on Titiraupenga	Second Bridge Crossing	Running Total
Year 1 (2018/19)	300,000			300,000
Year 2 (2019/20)	281,000	102,000		683,000
Year 3 (2020/21)		418,000		1,101,000
Year 4 (2021/22)		535,000		1,636,000
Year 5 (2022/23)	53,000			1,689,000
Year 6 (2023/24)	547,000			2,236,000
Year 7 (2024/25)	560,000			2,796,000
Year 8 (2025/26)				2,796,000
Year 9 (2026/27)	605,000			3,401,000
Year 10 (2027/28)	622,000		124,000	4,147,000

Table 6: Long Term Plan Budget Items

The options discussed in Section 10 fall naturally into one of four groups, given the budget items currently included in the LTP and they have been grouped to match as closely as possible to those items. The annual totals have been matched as closely as possible, but not necessarily to the individual projects.

The groups are:

- Immediate – options which can be implemented almost immediately;
- Short term – options which can be implemented within one to three years (2018-2021) that is before the end of Year 3;
- Medium term – options which could be implemented in three to six years (2021 to 2024);
- Long term – options which are unlikely to be implemented in under ten years.

The works included in the Section 10 sum to \$17.683m so clearly some will need to be deferred beyond the 10-year life of the plan. The suggested programme of works is discussed in the following sections.

11.2 Immediate Options

The **immediate** options are:

- Change the lane marking at the merge and install new 'merge like a zip' signs on Wairakei Drive;
- Change the lane disciplines at the northern approach to the Tongariro /Spa roundabout;
- Change Redoubt Road to left in, left out;
- Close the Countdown access to Tongariro Street, provided that this can be successfully negotiated with Countdown, and the alternative access to the house can be established;
- Change the speed limit to 50kph just north of Huka Falls Road including painted islands and shoulders. This could be done as part of the speed by-law review to be undertaken later in 2018;
- Design and install threshold treatment at the start of the 50kph zone to form a gateway into Taupō from the north.

Most of these are low cost and could be accommodated within the 2017/18 operational budgets. The threshold treatment north of Huka Falls Road is difficult to estimate as it will depend on the architectural and/or landscape designs that might be adopted, and that might need to fall into the 2018/19 financial year. Cost estimates for these items total \$127,000 with \$75,000 of that assumed for the Gateway.

11.3 Short Term Options

The **short-term** options are:

- Install signals at the Norman Smith/Wairakei Drive intersection;
- Install signals at the Spa Road/ Ruapehu Street intersection.

These two items total \$810,000, and with the gateway treatment, will take virtually the whole budget to the end of Year 3, or the 2020/21 financial year.

11.4 Medium Term Options

The three set of signals proposed for Titiraupenga Street comprise the medium-term options, including:

- Install signals at Titiraupenga Street and Spa Road;
- Install signals at Titiraupenga Street and Tamamutu Street;
- Install signals at Titiraupenga Street and Heuheu Street;
- Realign the Tongariro St /Spa Road intersection.

The three set of signals will cost \$1.486m and will take most of the budget from Years 4 to 6. However, once these signals are in operation, then the Tongariro St/Spa Road intersection can be re-aligned at an estimated cost of \$150,000

11.5 Long Term Options

The **long-term** options are:

- Four-lane from Norman Smith Street to the river;
- Construct a new bridge downstream from the Control Gates Bridge;
- Four-lane from the River to Spa Road;
- Create a through road from Tongariro Street to Titiraupenga Street using Paora Hapi Road, including signals at Gascoigne St, Ruapehu Street and Titiraupenga Street;
- Install signals at Huka Falls road in conjunction with developer led construction of the eastern end of the WEKA.

In total these options will cost over \$15m with the bridge and four laning taking up about \$13m of that. While the construction of these options is necessarily long-term, the initial design and feasibility work should proceed as soon as possible to give some certainty to the longer-term direction of the access, particularly as at current growth rates, indications are that the bridge will be beyond capacity within the next 10 years. This timing issue should form part of the feasibility studies.

The option of using Paora Hapi Street as the route between Tongariro Street and Titiraupenga Street may not be necessary if the Spa Road route operates well, but the model is indicating that Paora Hapi would be preferred. However, the reinstatement of the east end of Paora Hapi Street is expensive at just under \$1m.

11.6 Alignment with the LTP

Table 7 shows the LTP budgets and the sequence of option implementation.

LINE ITEMS IN THE LTP				
Year	Option	Cost	Option Running Total	LTP Running Total
Year 0 (2017/18)	Wairakei Drive Merge Lane marking Spa Road northern approach lane marking Redoubt Street left in and left out	\$52,000		
Year 1 (2018/19)	Shift \$50kph sign, design and build Gateway Second bridge feasibility study	\$75,000 \$100,000	\$175,000	\$300,000
Year 2 (2019/20)	Norman Smith/Wairakei signals	\$480,000	\$655,000	\$683,000
Year 3 (2020/21)	Spa/Ruapehu signals	\$415,000	\$1,070,000	\$1,101,000
Year 4 (2021/22)	Spa/Titiraupenga signals	\$565,000	\$1,635,000	\$1,636,000
Year 5 (2022/23)				\$1,689,000
Year 6 (2023/24)	Titiraupenga/Tamamutu signals Titiraupenga/Heuheu signals	\$470,000 \$451,000	\$2,556,000	\$2,236,000
Year 7 (2024/25)	Remove the Spa Road Roundabout and realign Tongariro Street	\$150,000	\$2,706,000	\$2,796,000

Table 7: Programming Options

This table is based on the existing LTP. If projects are to be brought forward – for example bringing the Norman Smith/Wairakei, and the Spa/Ruapehu signals into years 1 and 2, then the LTP would need to be altered accordingly.

12. Recommendations

The recommendations that emerge from the study include:

- (i) That the options identified as 'immediate' be implemented as soon as possible, including the use of VMS signs at the Wairakei roundabout to encourage holiday traffic to use the ETA;
- (ii) That the 50kph speed limit be transferred to north of Huka Falls Road, and a threshold design commissioned to form a Gateway to the urban area of Taupō;
- (iii) That initial design for the Norman Smith Street/Wairakei Drive signals be commissioned as soon as possible, with a view to having detailed designs and specifications completed for construction in the 2018/19 financial year;
- (iv) That consideration be given to altering the LTP allocations in years 2 and 3 to bring the Norman Smith Street/Wairakei Road and the Spa Road/Ruapehu Street signals into years 1 and 2;
- (v) That a feasibility study into a second bridge just downstream from the Control Gates and four laning of Wairakei Drive and Tongariro Street between Norman Smith Street and Spa road be commissioned early in 2018. This study should also consider the likely life of the existing bridge, with consideration being given to structural integrity, network resilience, and capacity;
- (vi) That an off-road pedestrian and cycle route between Norman Smith Street and Spa Road be investigated, a route which would take into account eventual four laning;
- (vii) That the feasibility of a bridge or ferry across the boat harbour be investigated.

13. Glossary of Terms

13.1 Acronyms

CBD: Central business District. The are generally bounded by Tongaririo Street, Lake Terrace, Titiraupenga Street and Spa Road.

ETA: Taupō Eastern Arterial – now State Highway 1

CISP: Taupō Urban Commercial and Industrial Structure Plan

TD2050: The Council’s 2006 Growth Plan to 2050.

TDC: Taupō District Council

WEKA: West Kinloch Arterial

VMS: variable message sign

13.2 Other terms

Rat Run: A circuitous route chosen by a driver to avoid congestion on the main route

U-Turn: A 180 degree turn usually at an intersection or Roundabout

Drone video: Video taken by a camera mounted on a radio-controlled helicopter

Merge: the joining of two lanes of traffic into one lane.

B-Train: A B-train consists of two trailers linked together by a fifth wheel

Vpd: Vehicles per day

Vph: Vehicles per hour

Bottleneck: Where two lanes join into one causing queuing

Ramp metering: Signal controlled entry to a roundabout or on a motorway ramp to limit the number of vehicles entering.