



Taupō Future Road Network Assessment

Taupō District Council



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Quality Assurance Information

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Executive Summary

This report presents analysis of the future road network in Taupō and the potential impact on traffic volumes due to changes to the configuration of the Control Gate Bridge and the implementation of the Taupō Urban Commercial and Industrial Structure Plan (CISP).

This analysis utilised the Taupō Transportation Model to model possible infrastructure responses and the resulting effects on traffic volumes and routing choices. This included a deficiency analysis of the current transportation network for typical peak hour demands. The key observations from the deficiency analysis for typical weekday peak periods are:

- The northern access corridor using Wairakei Drive and the Control Gate Bridge experiences congestion in the tidal direction during both the morning and evening peak hours, this is forecast to deteriorate further in line with traffic growth on the corridor.
- Access from the south suffers from limited route choice and experiences congestion on Lake Terrace during peak hours. Turning onto Lake Terrace is difficult from many of the minor priority intersections, and this is forecast to worsen in line with traffic growth in the future.
- Access to Spa Road from side roads are experiencing lengthened delays and congestion in peak hours and during holiday seasonal peaks.

The findings and recommendations have been summarised into a high-level network plan showing the main considerations in terms of routing, corridor management and intersection improvement locations. The recommendations for each area are listed and shown in the figure provided below.

Control Gate Bridge

- The existing Control Bridge is operating at capacity at peak times and the need for additional capacity across the Waikato River is required in the next five years
- Several options have been explored assuming that there is a total of four lanes of capacity across the Waikato River in the medium-long term

Lake Terrace East of Titiraupenga Street

- Improved cycle provision
- Corridor Management Plan – managing intersections, consolidating access along the corridor, traffic management during events
- Intersection improvements at Titiraupenga Street as part of the new arterial

Lake Terrace West of Titiraupenga Street

- Reduced traffic priority (may be through narrowing of corridor, reduced speed limit)
- Greater pedestrian connectivity to the lakefront
- Improved cycle provision

Tongariro Street

- Reduced traffic capacity – two lanes down to one
- Reallocation of space to cycle lanes and enhanced pedestrian connectivity
- Enhanced bus hub (if location retained, or space reallocated to other modes and/or parking if new bus hub location selected)

Spa Road

- Corridor Management Plan – managing intersections, improving and consolidating access along the corridor
- Greater pedestrian connectivity
- Improved cycle provision

- Intersection upgrades (subject to preferred new bridge location) at Titiraupenga Street, Ruapehu Street, Nukuhau Street/Gascoigne Street, Tongariro Street/Spa Road

Titiraupenga Street

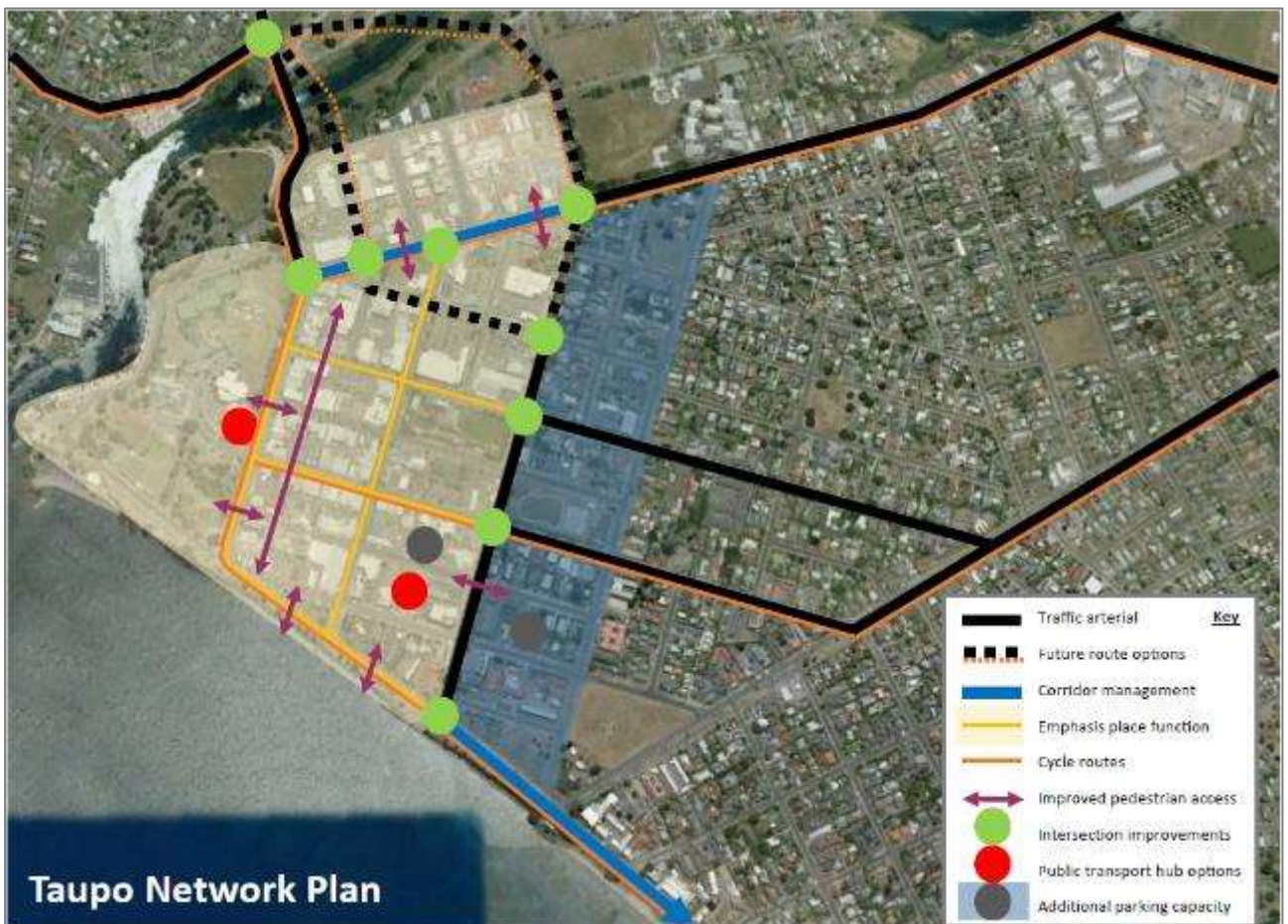
- Intersection upgrades as part of the new arterial route (for example changing priority to north/south)
- May require parking management review
- Improved pedestrian connectivity to areas where additional berm parking is provided east of Titiraupenga

Paora Hapi Street – dependent on arterial route and bridge location

- Improved connectivity and intersection upgrades on arterial route

Central business area

- Potential reduce speed limit
- Improved pedestrian connectivity – particularly for the laneways, to the lakefront and the Domain
- Potential new bus hub on Tuwharetoa Street (as part of the Council Office Building development)
- Potential parking building on Heuheu Street (long term)
- Additional berm parking east of Titiraupenga Street



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1. Introduction

1.1 Scope of Report

This report presents analysis of the future road network in Taupō and the potential impact on traffic volumes due to changes to the configuration of the Control Gate Bridge and the implementation of the Taupō Urban Commercial and Industrial Structure Plan (CISP).

The analysis in this report builds on the results presented in the report *'Taupō Transport Model 2018 Future Year Updates Deficiency Analysis Report'* dated 17 May 2019. The base year model has been updated as of 2016 by Traffic Design Group (TDG) and successfully passed a technical peer review at that time.

The performance of the current network is discussed and options to address deficiencies on the main corridors accessing the town centre are investigated.

The final sections of this report discuss the change in traffic volumes on Taupō's arterial network as a result of CISP implementation and some potential effects on the transport network.

1.2 Contents of Report

- Section 2 summarises the findings of the *'Taupō Transport Model 2018 Future Year Updates Deficiency Analysis Report'* dated 17 May 2019 and presents the results of a peak period demand sensitivity test.
- Section 3 presents the results of a high-level review of road safety performance in the Taupō urban centre and surrounding areas, including crash severity counts and locations.
- Section 4 discusses the future performance of Taupō's arterial network and options for increasing the capacity of the northern access corridor and Control Gate Bridge.
- Section 5 discusses the potential impacts of implementing the Taupō Urban Commercial and Industrial Structure Plan (CISP) on the urban centre, including impacts of increasing the capacity of the northern access corridor.

1.3 Historic Traffic Growth

This is a summary of the changes in traffic volumes and traffic growth rates discussed in the technical note *'Preliminary Review – Taupō Strategic Transport Model'* dated 4 April 2019.

Recent local traffic counts provided by Taupō DC were compared to the model growth between 2013 and 2021 for the morning and evening peak hours. All counts were converted to an equivalent percentage growth per year to allow comparison.

The model underestimates growth around the north and south of the town centre, with Poihipi Rd and Lake Terrace having actual traffic growth in excess of 10% per annum. The corresponding model growth rates are in line with the town centre links examined, at around 1–2% per annum. The observed growth rates for roads in and around the urban centre is shown in **Figure 1.1**.

Other key observations and recommendations are as follows:

- Traffic volumes in the model are generally growing at 1-3% per annum.
- The model is underestimating traffic growth along Lake Terrace and on Poihipi Road which are growing at around 11% per annum but provides a fair representation of growth elsewhere.
- An extensive range of September 2017 observed town centre traffic counts were compared against interpolated model flows and demonstrated the model is 3% and 8% lower than observed in the morning and evening peak respectively.
- Key outliers where the model is under or over-representing traffic flows include Lake Terrace and Spa Road.

It was recommended that the model be accepted "as is", however, the locations that have been identified with too much or not enough traffic should be flagged and addressed in the next census update.



Figure 1.1 Link Count Locations with Observed Growth Rates

2. Deficiency Analysis

2.1 Level of Service Definition and Thresholds

Level of Service (LoS) is a key metric for assessing the performance of the network, and is classified differently for links, priority intersections, roundabouts and signals, as described below.

The link LoS boundaries have been set based on US Transportation Board Highway Capacity Manual (HCM) data whereby the saturation flow has been sourced as a function of the free flow speed of a corridor. The LoS thresholds¹ are set as follows:

- LoS C is 50%-65% of saturation flow,
- LoS D is 65%-80% of saturation flow,
- LoS E is 80%-100% of saturation flow, and
- LoS F is 100% of saturation flow or greater (complete failure of the network to operate).

The resultant link LoS thresholds are shown in **Figure 2.1** and are consistent with those applied in the previous deficiency analysis.

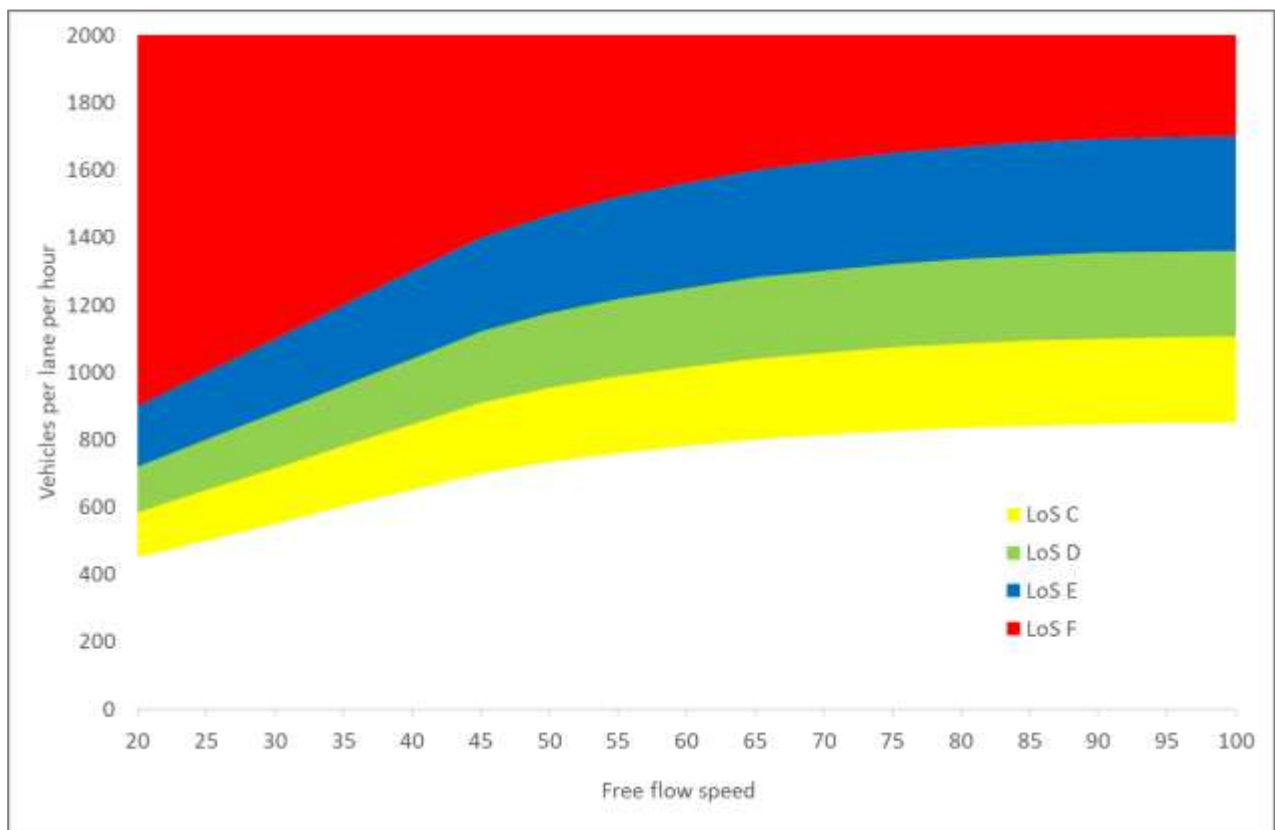


Figure 2.1 Link Level of Service boundaries by free flow speed

All intersection LoS thresholds are also consistent with the previous TDG assessment and have also been sourced from the HCM. The thresholds for priority control intersections are set out below:

- LoS C is 15 – 25 seconds of delay on worst approach,

¹ LoS A and B are not listed here or presented in this report as they represent largely free flow conditions with little or no delay

- LoS D is 25 – 35 seconds of delay on worst approach,
- LoS E is 35 – 50 seconds of delay on worst approach, and
- LoS F is 50 seconds of delay or greater on worst approach.

The LoS thresholds for roundabouts and signals are set as follows:

- LoS C is 20 – 35 seconds delay weighted average across all approaches,
- LoS D is 35 – 55 seconds delay weighted average across all approaches,
- LoS E is 55 – 80 seconds delay weighted average across all approaches, and
- LoS F is 80 seconds delay or greater weighted average across all approaches.

2.2 Locations of Concern

Current Locations - 2021

The 2021 future year model has been used as a proxy for the current network performance due to the base validated model being for the 2013 year. This is deemed appropriate as the recent traffic growth on both Lake Terrace and Spa Road has been significantly faster than transportation model trends would suggest. The model identified three corridors where the current performance of the network results in deteriorating LoS; Control Gate Bridge, Lake Terrace and Spa Road.

Traffic delays due to congestion around the Control Gate Bridge are significant, with LoS E in the tidal traffic flow direction in both the 2021 morning and evening peak hours. This is a result of lane merges both to the north and south of the bridge. However, the underlying issue is that the Control Gate Bridge itself has reached capacity and delays are expected to continue to increase in the future as growth continues to the north and west of the bridge.

Access to the town centre from the south is primarily via Lake Terrace. In 2021 morning and evening peaks there are several intersections along Lake Terrace where the minor road right turn onto Lake Terrace experiences poor level of service, including the intersections at Shepherd Road (LoS F in morning and PM) and Tremaine Avenue (LoS E in morning and LoS D in PM).

Performance of Lake Terrace is key as there is little route choice for traffic from the south for the section from Shepherd Avenue to Mere Road. The ability to increase the capacity of minor approaches on to Lake Terrace is also limited by available space and challenging geometry, especially for the smaller intersections at Shepherd Road, Hinerau Grove and Waipahihi Avenue.

There are also performance issues on Spa Road, one of the key arterial connections to the town centre from the east. The 2021 model shows a LoS C at intersections of Spa Road between Tongariro Street to the west and Titiraupenga Street to the east. Turning from the minor roads into Spa Road is anticipated to become harder as growth continues.

Link and intersection level of service for the 2021 year is shown in **Figure 2.1** for both the morning and evening peak hours.



Figure 2.1 2021 Morning Peak (left) and Evening Peak (right) Level of Service

Future Year Locations - 2041

The model includes a future year of 2041, representing 22 years of forward growth forecasts. As with any model forecasts it is important to note that there is a level of uncertainty around development, infrastructure and modal shift assumptions, and this should be considered in the interpretation of future model outputs. The intersections experiencing LoS C or worse in 2041 are shown in [Table 2.1](#) for the morning peak and

[Table 2.2](#) for the evening peak.

Delays turning on to Lake Terrace from both Shepherd Rd and Tremaine Ave are expected to increase with Lake Terrace / Shepherd Rd operating at LoS F in the 2021 future year and Lake Terrace / Tremaine Ave operating at LoS F in the 2041 future year. Operation in the evening peak is similar, with Lake Terrace / Shepherd Rd operating at LoS F in the 2021 model year and Lake Terrace / Tremaine Ave operating at LoS E in the 2041 model year.

Other intersections along Lake Terrace show similar increases in delay, with Lake Terrace / Napier-Taupō Rd operating at LoS E and Lake Terrace / Tui St operating at LoS D in the 2041 morning peak.

Table 2.1 Morning Peak LoS at Critical Locations

Location	2013 Morning Peak	2021 Morning Peak	2041 Morning Peak
Tongariro Street / Redoubt Street	D	D	D
Lake Terrace / Tui Street	B	C	D
Lake Terrace / Napier-Taupō Road	C	C	E

Lake Terrace / Shepherd Road	E	F	F
Lake Terrace / Tremaine Avenue	D	E	F

Table 2.2 Evening Peak LoS at Critical Locations

Location	2013 Evening Peak	2021 Evening Peak	2041 Evening Peak
Lake Terrace / Shepherd Road	E	F	F
Lake Terrace / Tremaine Avenue	D	D	E

Congestion around the Control Gate Bridge is expected to increase as growth continues in Nukuhau, Acacia Bay and Kinloch. This is evident with LoS F in the tidal traffic flow direction in both the 2041 morning and evening peak hours. This congestion will have a significant impact on residents who live to the north of the bridge, with the alternative route via the Taupō Bypass representing a much longer trip in terms of both distance and journey time.

Performance of the Lake Terrace corridor also continues to deteriorate in line with growth in the East Urban Lands area. Roads currently experiencing poor LoS continue to do so, especially the intersections at Shepherd Road and Tremaine Avenue. Other intersections on the corridor with poor LoS are Napier-Taupō Road (LoS E in morning peak) and Tui Street (LoS D in morning peak). The Lake Terrace segment between Napier-Taupō Road and Taharepa Road also shows significant congestion, with LoS E in the morning peak and LoS D in the evening peak in the tidal traffic flow direction.

The Spa Road corridor does not show significant degradation in performance in the 2041 model year, however, the increase in vehicle interactions and congestion around the Control Gate Bridge and the Wairakei Drive / Spa Road roundabout is likely to cause increased congestion and delays.

Link and intersection level of service for the 2041 future year is shown in **Figure 2.2** for both the morning and evening peak hours.



Figure 2.2 2041 Morning Peak (left) and Evening Peak (right) Level of Service

2.3 Peak Period Sensitivity Test

Concerns have been raised regarding the network performance during peak holiday periods. Taupō is popular as both a stop-over, and as a tourist destination. The increased holiday traffic results in a marked increase in congestion. This is especially of concern for infrastructure operating close to capacity, particularly the Control Gate Bridge to the north and Lake Terrace to the south.

State Highway Volume Changes

Hourly traffic volumes were analysed for the closest NZTA TMS telemetry site to Taupō, 01N00729 Halletts Bay, approximately 20km south of the Lake Terrace / Taupō East Arterial roundabout. Data was compared for non-holiday period weekdays and holiday period weekdays for the period covering December 2017 to May 2018. The average hourly flow for each hour in **Figure 2.3** shows a significant increase in holiday traffic for all hours between 8am and 11pm.

Overall, the average holiday weekday experiences around 40% greater volumes compared to the average non-holiday working day. The difference in traffic volumes is largest during the interpeak hours of 11am to 2pm where flows are 70-75% higher.

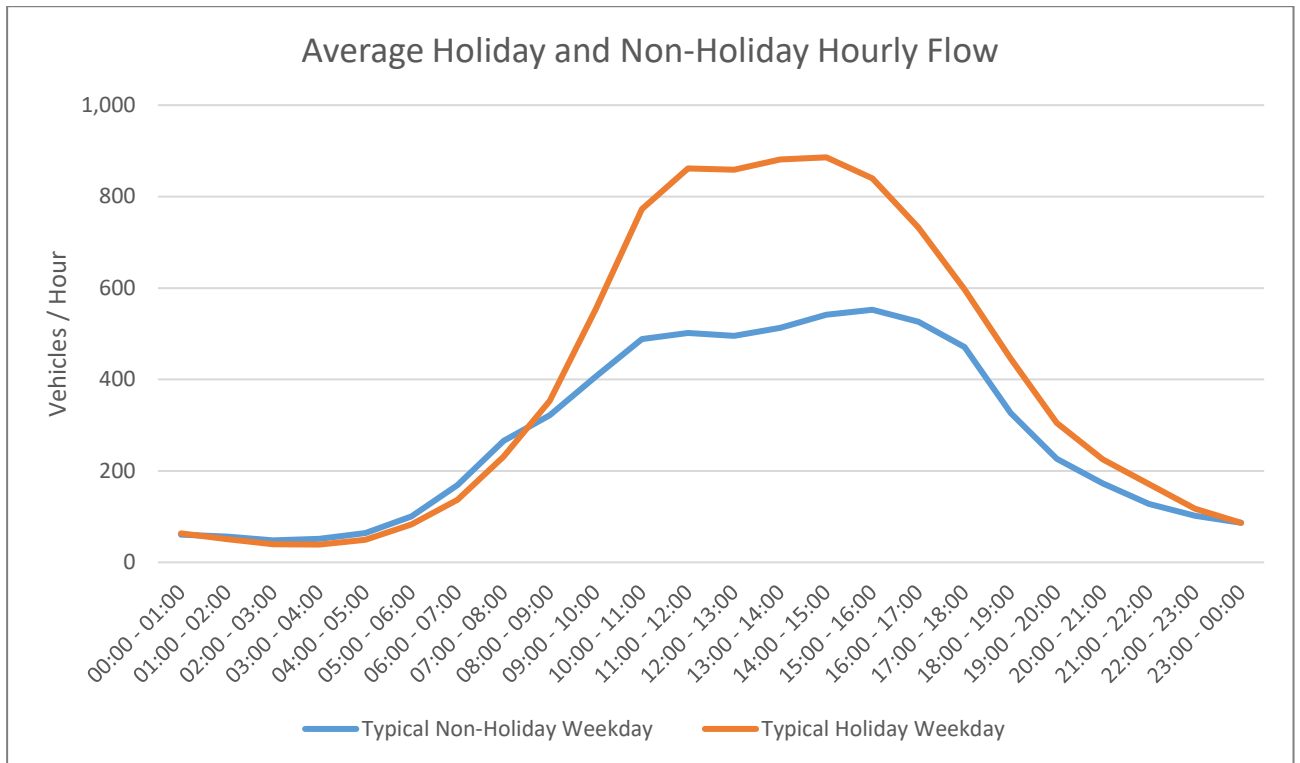


Figure 2.3 Average Hourly Traffic Volume – Halletts Bay Telemetry Site

Holiday Period Survey Findings

Metrocount data was provided by Council for surveys on Spa Road and Rifle Range Road covering the Easter holiday and ANZAC Day period of 17 – 28 April 2019 and the following week of 30 April – 10 May 2019. Data for the Tongariro Street / Heuheu Street signals was provided by the Wellington Traffic Operations Centre for the same period.

Comparing the flow of vehicles through the signals shows a similar pattern to Halletts Bay, with volumes highest in the interpeak period between 11am and 2pm with approximately 45% more traffic in the holiday period than a typical non-holiday weekday. The average hourly flow for each hour is shown in **Figure 2.4**.

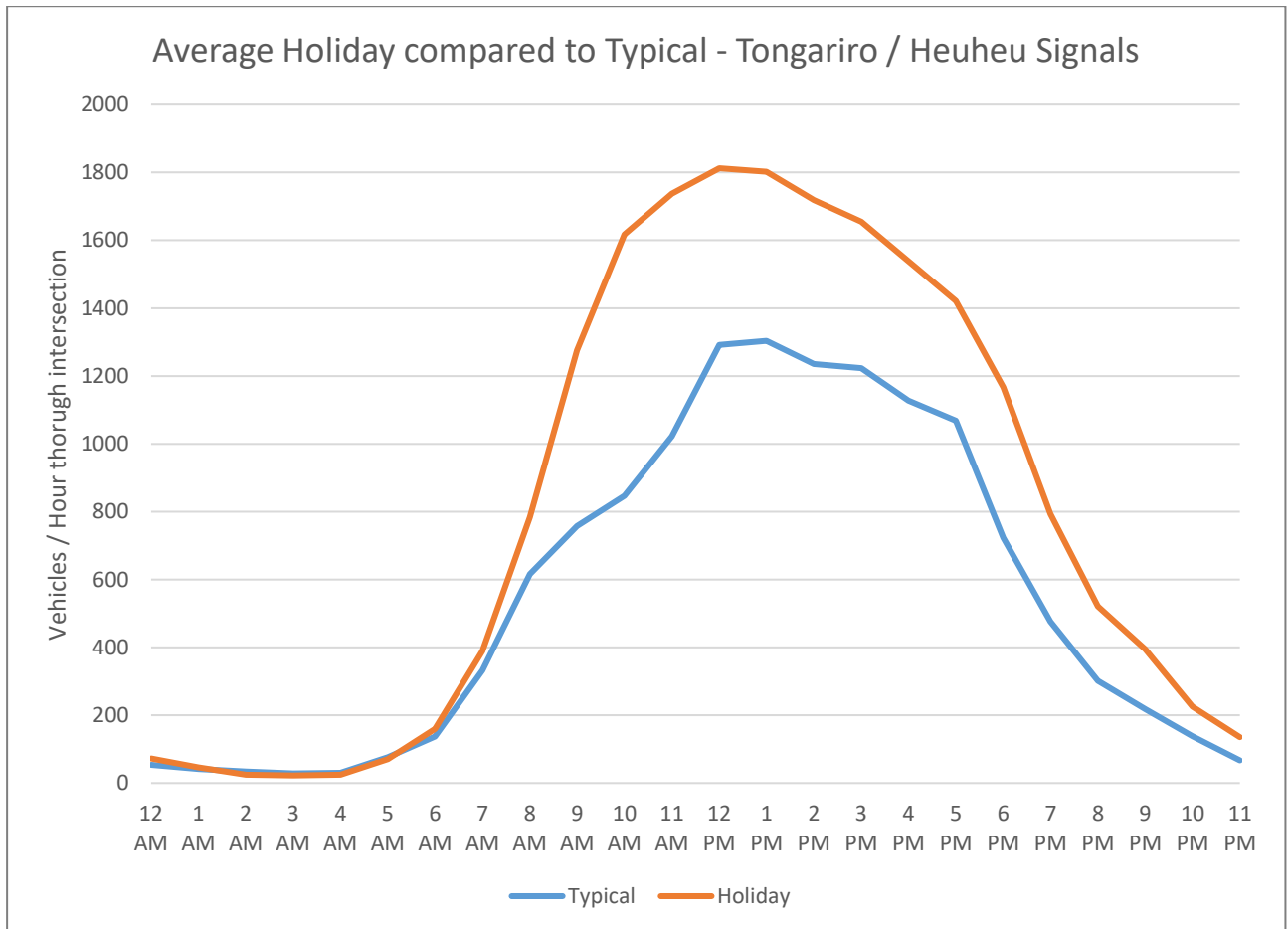


Figure 2.4 Average Hourly Traffic Volume – Tongariro / Heuheu Signals

Indicative Holiday Increase Factors and Impacts

The Metrocount data was compared for each direction to give factors for total traffic volume and directionality to and from the town centre. The overall traffic volume factor to convert a typical evening peak flow to an indicative holiday interpeak for Spa Road was calculated as 1.01 and for Rifle Range Road the factor was 0.85. The directionality factors were combined to give a ratio of 0.89 towards the town centre and 1.01 away from the town centre.

Signal data for the Tongariro Street / Story Place / Heuheu Street was provided by the Wellington Transport Operations Centre for the period of 17 April 2019 to 1 May 2019. The overall activity at the signals was compared for holiday and non-holiday peak periods and an increase of 60% was found for holiday peak periods compared to non-holiday peak hour. This increase factor of 1.61 was used as a proxy for activity on the north – south corridor and within the town centre.

The resultant estimated two-way flows at key network locations are shown in **Figure 2.5**. Network performance is similar to that in the evening peak with additional pressure on key corridors of Lake Terrace south of Rifle Range Road and Control Gate Bridge. Increasing flow eastbound on Spa Road could be indicative of capacity constraints at Control Gate Bridge causing vehicles to route along Spa Road to the Taupō Eastern Arterial due to congestion on Wairakei Drive. The estimated traffic volumes suggest that these corridors are approaching or at capacity in 2018 during seasonal holiday peaks, and performance in peak periods is expected to continue to worsen into the future.

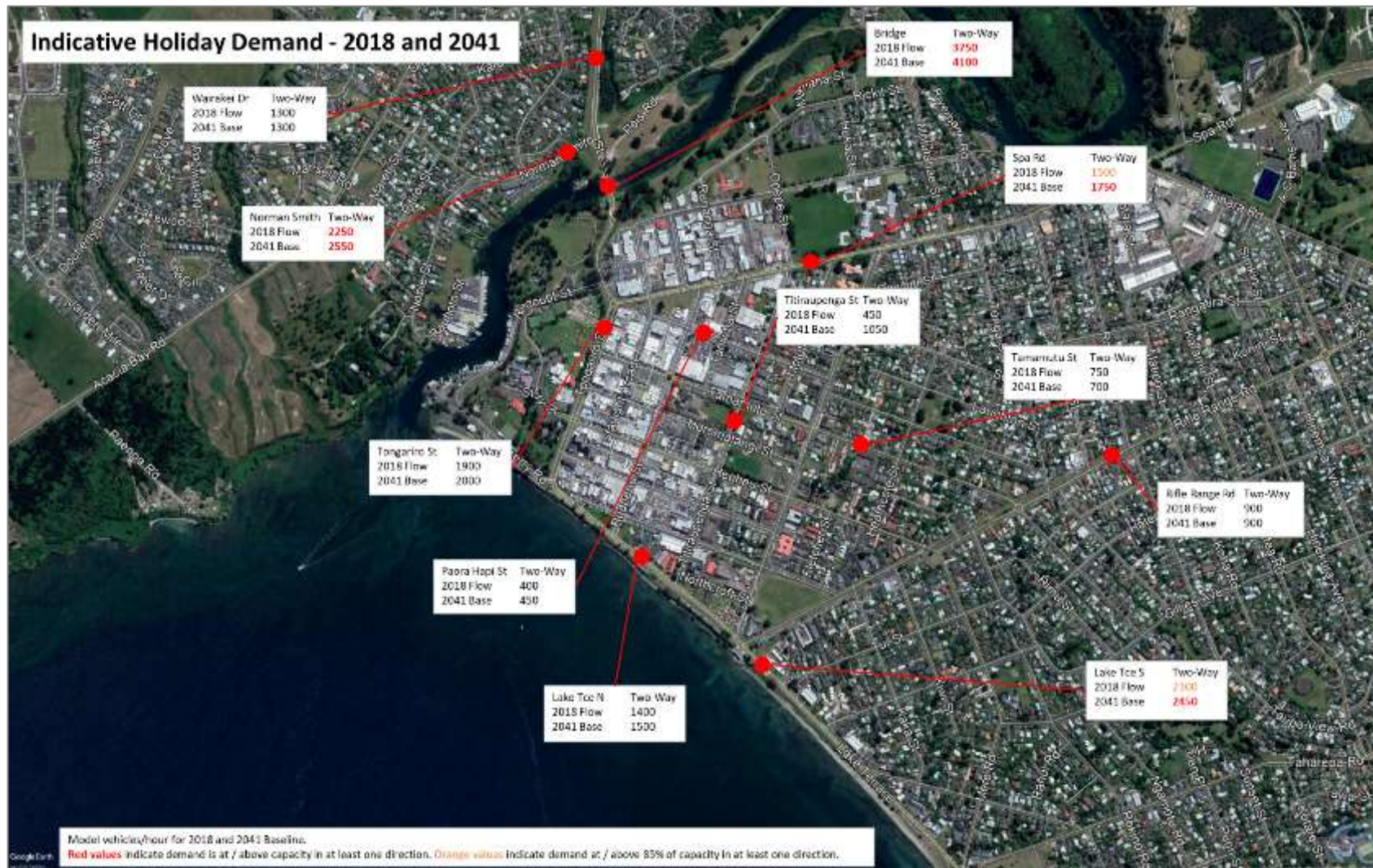


Figure 2.5 Holiday Demand at Key Network Points, 2018 and 2041

2.4 Accessibility to Key Locations

Key education and healthcare facility locations near the town centre are shown in **Figure 2.6**.

Education

There are several educational facilities located within the Taupō urban area, covering all levels of education from early childhood through to tertiary providers. Most of these locations are removed from the commercial core, with facilities grouped in several clusters around Spa Road (Taupō-nui-a-Tia College, Mountview School) or Taharepa Road (Tauhara Primary, Tauhara College, Taupō Intermediate and others). These locations are generally well connected to the arterial network and are in areas that are forecast to remain relatively uncongested. This provides an opportunity to improve connectivity and safety for pedestrians and cyclists without having a significant impact on traffic efficiency.

Taupō Primary School and Toi Ohomai Institute of Technology are located inside the commercial core and are the most likely locations to experience poor LoS as traffic volumes and congestion increase. Taupō Primary School is especially prone to increased severance as traffic grows on Tamamutu Street and Ruapehu Street and be exacerbated if the function of Titiraupenga Street is upgraded to an arterial connection as anticipated in the CISP. Taupō Primary School currently has access to angled berm parking on all four borders as well as bus parking on Titiraupenga Street, however active mode facilities are lacking, with only one pedestrian priority crossing over Tamamutu Street and no dedicated cycling facilities. It is recommended that these issues be addressed in the transport strategy.

Healthcare

The main healthcare facility in the urban area is Taupō Hospital, located on Kotare Street well outside the commercial core. Although this location means that there is limited connectivity to the arterial network, via Kotare Street and Taharepa Road, there is little or no congestion forecast in this vicinity, such that accessibility and travel time reliability will remain high. The hospital has relatively poor connectivity for all other modes.

Industrial

The main industrial areas in the urban area are located around Crown Road, to the east of the commercial core. This location provides good access to arterial connections and the Taupō Eastern Arterial along Tauhara Road and Napier-Taupō Road. Future industrial growth is forecast primarily as infill in the Crown Road area, with some growth around Taupō Airport and the industrial area north of Centennial Drive. Continued growth to the north of the Control Gate Bridge will increase pressure on east-west arterials, especially Spa Road, in peak times as there is little route choice for tidal commuter flows to and from the north.

2.5 Deficiency Analysis Summary

The key observations from the deficiency analysis for typical weekday peak periods are:

- The northern access corridor using Wairakei Drive and the Control Gate Bridge experiences congestion in the tidal direction during both the morning and evening peak hours, this is forecast to deteriorate beyond the current LoS E in line with traffic growth on the corridor.
- Access from the south suffers from limited route choice and experiences congestion on Lake Terrace during peak hours. Turning onto Lake Terrace is difficult from many of the minor priority intersections, and this is forecast to worsen in line with traffic growth in the future.
- Access to Spa Road from side roads are experiencing lengthened delays and congestion in peak hours. While this is not forecast to worsen significantly, it is noted that the Spa Road corridor has historically been under-represented in terms of traffic volume in the model.

The key observations from the deficiency analysis for peak holiday periods are:

- Large increases in demand in the town centre and north – south connections lead to increases in congestion on Wairakei Drive and Lake Terrace. As there is little effective route choice this congestion is likely to impact nearby intersections, especially around Control Gate Bridge and Lake Terrace from Mere Road to Napier-Taupō Road and further south.

- The estimated traffic volumes suggest that these locations are already at or over capacity in 2018 during the seasonal holiday peaks, and performance in holiday periods is expected to continue to worsen into the future.

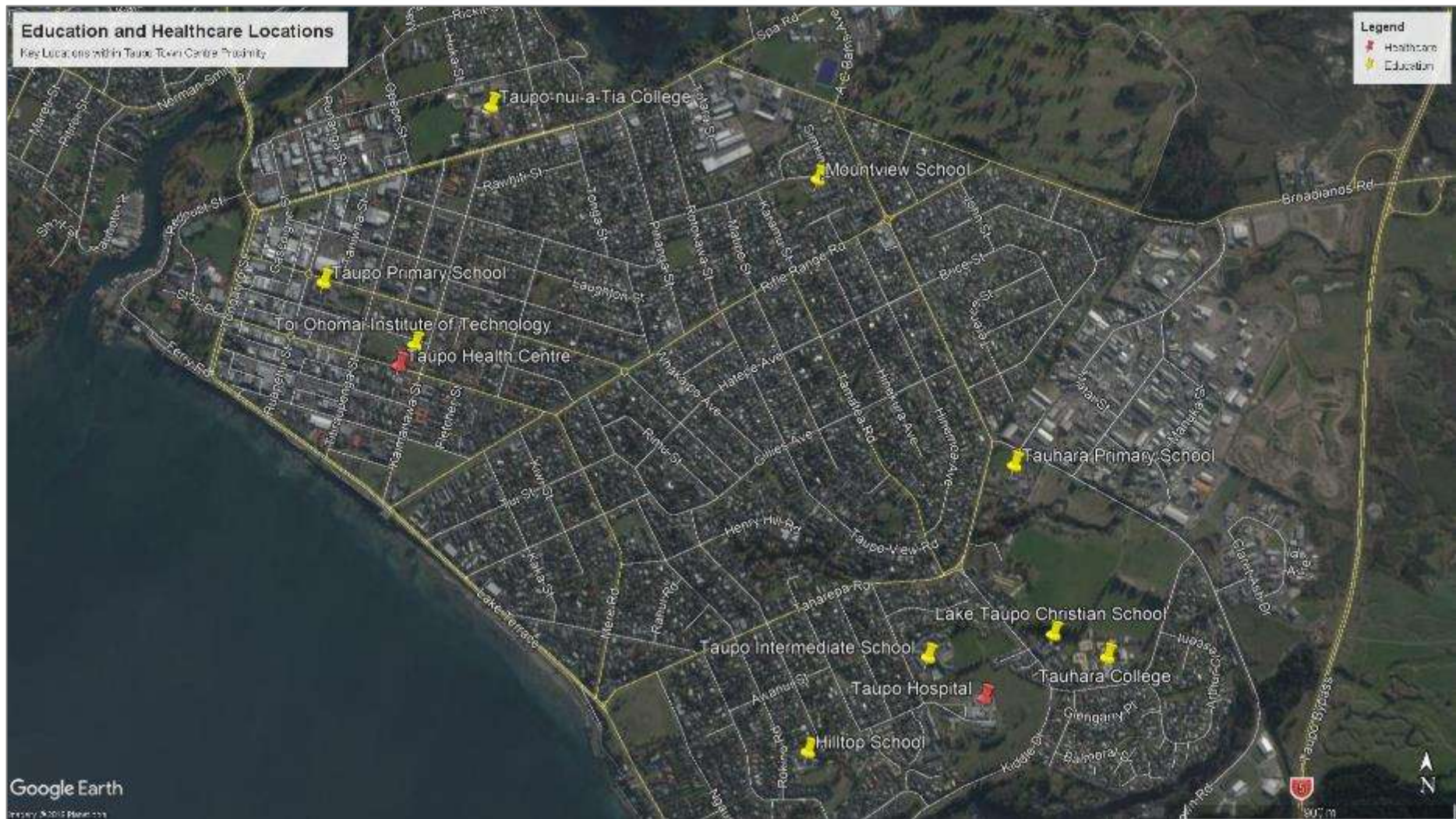


Figure 2.6 Education and Healthcare Locations within Taupō Urban Area

3. Road Safety Review

3.1 Crash Analysis – Town Centre

The NZ Transport Agency Crash Analysis System (CAS) is New Zealand’s primary tool for capturing where, when and why road crashes occur. CAS is used to analyse and map crashes in order to identify high-risk locations and monitor trends. CAS results are often used to inform transport policy and design, as well as guiding investment in road safety improvements.

An analysis of Taupō’s crash history was undertaken by extracting the crash records from CAS for the five-year period from 2015 to 2019. The urban subject area is bordered by Lake Terrace, Kaimanawa Street, Spa Road and Tongariro Street. The results are shown in **Table 3.1**.

Table 3.1 Crashes by Severity, Taupō Town Centre Area 2015 - 2019

Crash severity	Number of Crashes
Non-Injury	278
Minor	80
Serious	9
Fatal	0
Total	367

The CAS analysis identified:

- 236 of the crashes were at intersections.
- The dominant crash type (117 of the 367) is a right-angle crossing collision.
- The second most dominant crash type (48 of the 367) is a manoeuvring crash, for example parking, u-turns and exiting from accesses.
- Six of the nine severe crashes included pedestrians or bicycles.

Table 3.2 identifies the top five worst intersections in the town centre and the number of crashes that have occurred in the last five years. Note that the NZ Transport Agency Economic Evaluation Manual (EEM) allows for isolated intersection improvements to be undertaken when a site has a crash history of:

- Four or more non-injury crashes
- One injury and three or more non-injury crashes
- Two or more injury crashes

Based on these criteria, each of these locations would be excellent candidates for safety improvements, among others in Taupō.

Table 3.2 Intersections with Highest Crash Count, Taupō Urban Area 2015 - 2019

Intersection Name	Number crashes	Severe crashes
Tamamutu Street and Kaimanawa Street	25	0
Heuheu Street and Titiraupenga Street	24	1
Heuheu Street and Kaimanawa Street	20	0
Roberts Street and Titiraupenga Street	15	0
Spa Road and Gascoigne Street	13	0

For the Taupō town centre area, the corridor with the most severe crashes is Lake Terrace with five severe crashes in the last five years. Three of these crashes involved vehicles turning into cyclists and one involved a vehicle turning into a motorcycle. Investment into cycling amenity and safety is likely to have a high return on investment as a result of this. Another notable road is Kaimanawa Street which has two severe crashes.

Titiraupenga Street has two of the five most dangerous intersections in Taupō. The safety of these intersections will need to be considered if Titiraupenga Street becomes a major arterial as signalled under the CISP, as a higher traffic volume would generally result in heightened road safety risk. Similarly, the intersection of Spa Road and Gascoigne Street is on one of the potential routes for the second river crossing. If this route was selected the intersection would carry much higher traffic volumes and a higher safety risk.

3.2 Crash Analysis – Other Urban and Rural

The wider assessment area is bordered by State Highway 1, the Taupō Airport to the South and North of Acacia Bay up to SH5. This assessment does not include the area outlined as the town centre and discussed in Section 3.1. The crash history for the last five years is shown in **Table 3.3**.

Table 3.3 Crashes by Severity, Taupō Rural Area 2015 - 2019

Crash severity	Number of Crashes
Non-Injury	389
Minor	147
Serious	35
Fatal	3
Total	580

Key observations are:

- The dominant crash type, with 170 of the 580 crashes, is a right-angle crossing collision. This is likely a function of the high number of priority-controlled intersections in Taupō.
- The second most dominant crash type is a manoeuvring type crash with 69 of the 580 total crashes.
- The third most dominant crash type is a crossing collision with a turning vehicle, with 62 of the 941 total crashes this crash type.

The three fatal crashes occurred on Rifle Range Road, between Taharepa Road and Hinemoa Avenue, Acacia Heights Drive and on Wairakei Drive. Two of the crashes were run-off road crashes and the other involved a collision with a pedestrian on a marked pedestrian crossing.

3.3 Location of Crashes

The location of the 44 serious and 3 fatal crashes in the Taupō area noted in Section 3.1 and Section 3.2 are shown in **Figure 3.1**.

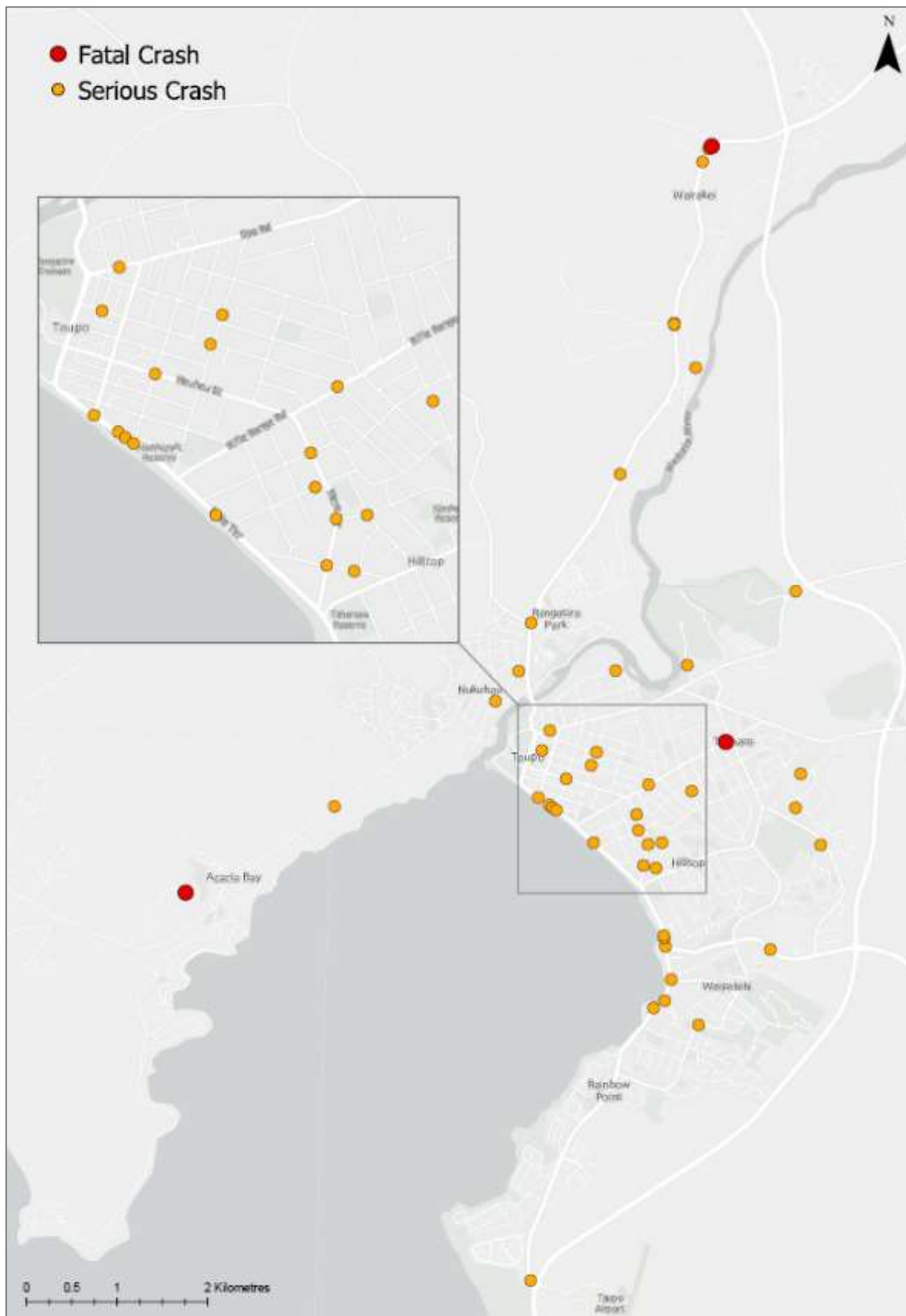


Figure 3.1 Serious and Fatal Crash Locations, Taupō 2015 – 2019

3.4 Crash Analysis – Pedestrian and Cyclist

An analysis of Taupō's crash history involving pedestrians and cyclists was undertaken by extracting the crash records from CAS for the five-year period from 2015 to 2019 for both the urban and rural areas. The crash history is shown in **Table 3.4**.

Table 3.4 Pedestrian and Cyclist Crashes by Severity, Taupō 2015 - 2019

Crash severity	Number of Crashes
Non-Injury	7
Minor	41
Serious	19
Fatal	1
Total	68

A total of 38 cyclist crashes and 30 pedestrian crashes were recorded during this period. The most dominant crash type, with 22 of the 68 crashes, is a crossing/turning collision. This is likely a function of the high number of priority-controlled intersections in Taupō.

The fatal crash occurred on Rifle Range Road and involved a collision with a pedestrian on a marked pedestrian crossing.

The location of the 19 serious and 1 fatal crash are shown in **Figure 3.2**.

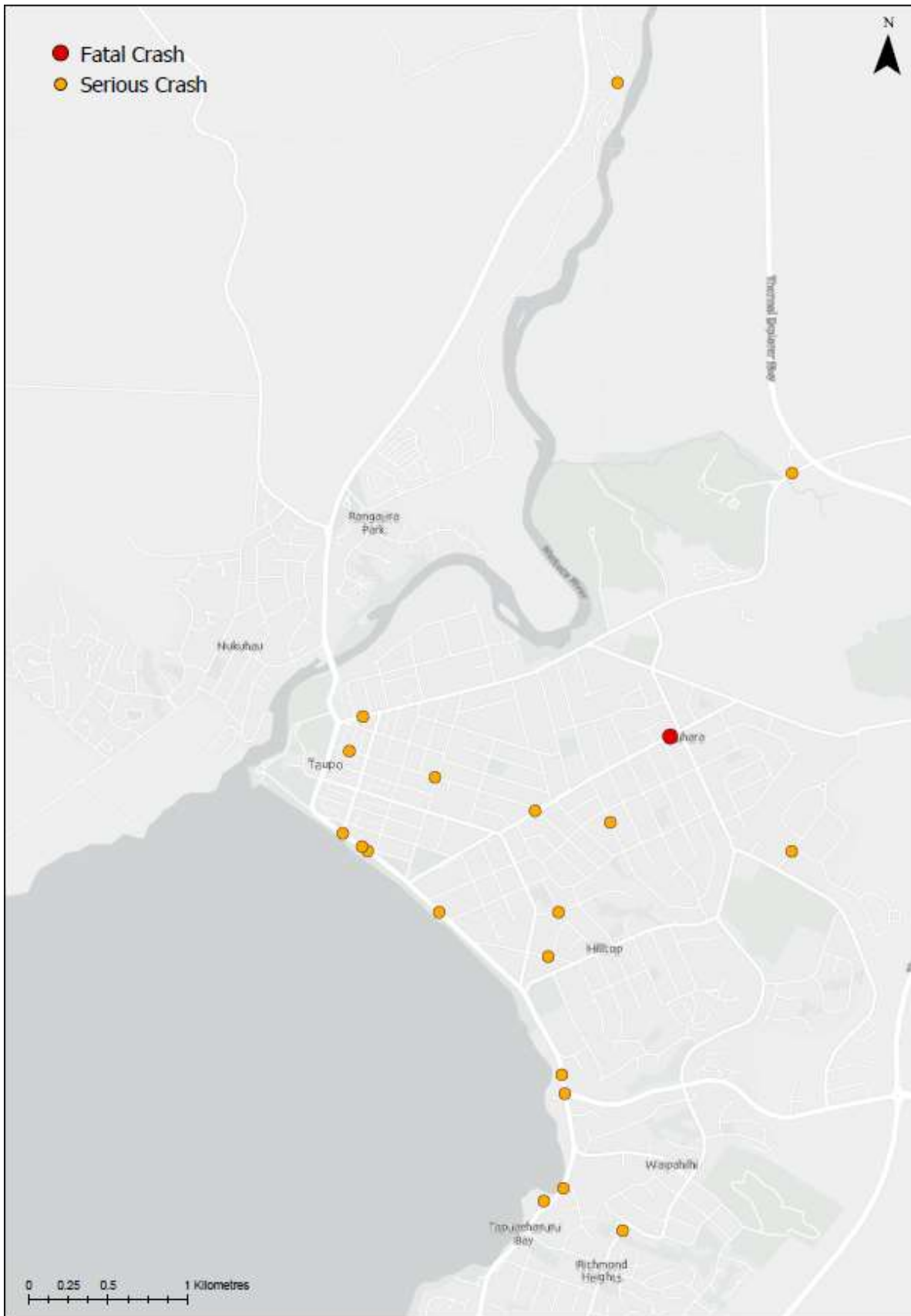


Figure 3.2 Pedestrian and Cyclist Serious and Fatal Crash Locations, Taupō 2015 – 2019

4. Taupō’s Arterial Network

4.1 Access into the Urban Centre

Vehicle access into the Taupō urban centre has three distinct corridors depending on the direction of travel; north, south and east/west. These paths are discussed in detail below, along with their performance in 2018 and the 2041 future year.

Northern Access

All vehicles from the northern suburbs of Nukuhau and Rangatira Park, as well as vehicles from the outer settlements of Acacia Bay and Kinloch, access the urban centre via the Control Gate Bridge. An alternate route is available via the Taupō Eastern Arterial, but this represents a significant increase in journey distance and is highly unlikely to be the preferred route unless the Control Gate Bridge is inoperable. The main roads included in the northern access corridor are shown in **Figure 4.1**.

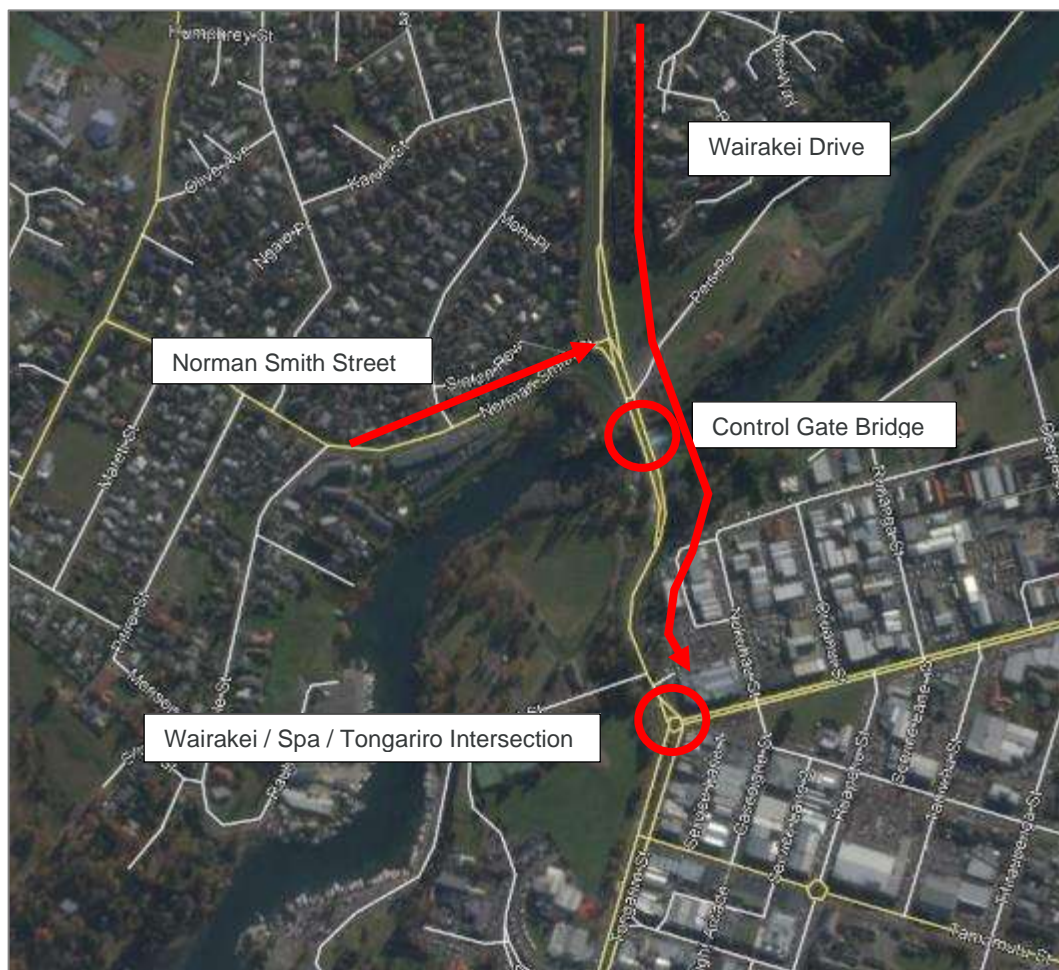


Figure 4.1 Main Points of Interest on Northern Access Corridor

Vehicles travelling to the town centre from State Highway 1 southbound at Wairakei will predominantly utilise Wairakei Drive due to wayfinding signage. If there is congestion at Control Gate Bridge the alternative route via Centennial Drive and Spa Road may become preferable, but only to familiar drivers.

There is an opportunity to utilise Variable Messaging Signs (VMS) to support wayfinding, by informing drivers of the relative travel time for each route, especially during periods of high demand. This could help to mitigate congestion at

Control Gate Bridge and Lake Terrace by rerouting some traffic via the Taupō Eastern Arterial and Spa Road. Potential locations for VMS displays are north of point 1 and south of point 3 as shown in **Figure 4.2**.

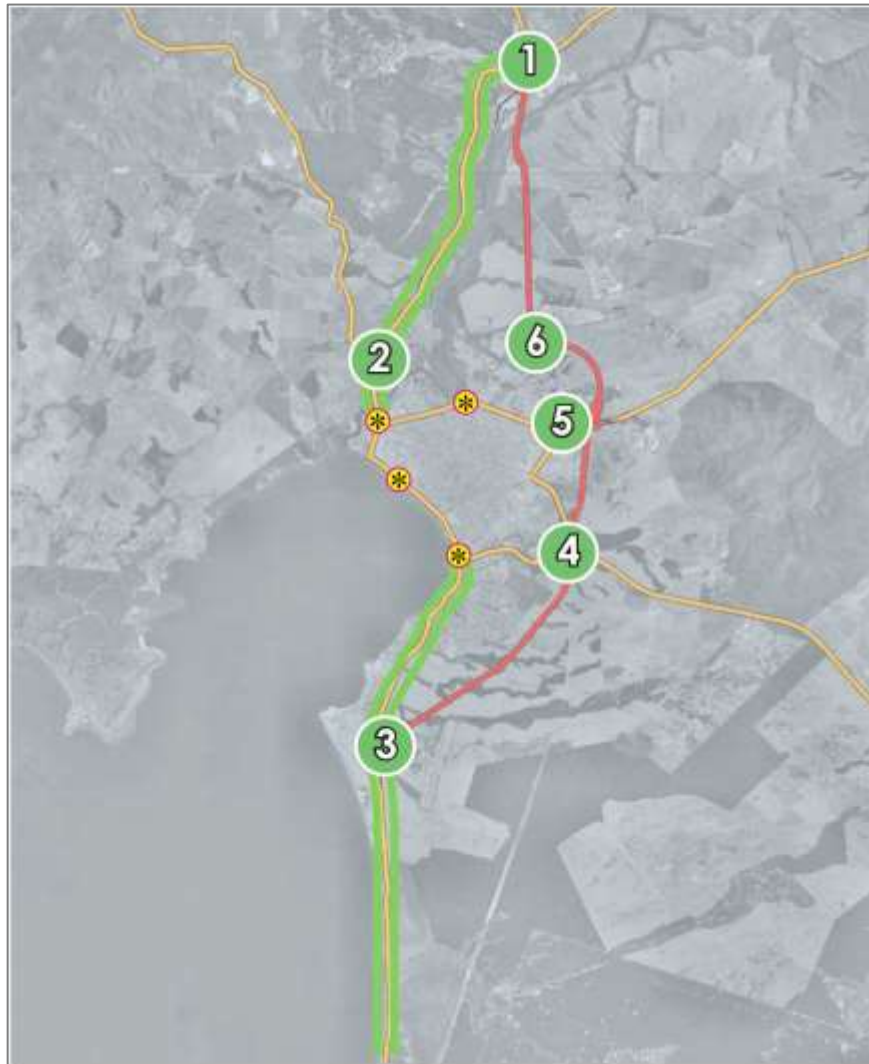


Figure 4.2 Entry Points into Taupō's Urban Area, CISP Part B

It is understood that options increasing the capacity of the northern access are to be assessed in upcoming work to be commissioned by Council, as the Control Gates Bridge is operating at and beyond the calculated capacity of 1200 vehicles per hour in peak periods as well as during the holiday peak, as shown in **Table 4.1**. Two preliminary options to increase capacity are discussed in section 4.2, along with the implications for intersection operation in the town centre.

Table 4.1 Peak Hourly Flow on Control Gate Bridge, 2018 and 2041

Control Gate Bridge	2018 Base (veh/hour)		2041 Future (veh/hour)	
	AM Peak	PM Peak	AM Peak	PM Peak
Capacity	1200 vehicles per hour		1200 vehicles per hour	
Northbound	650	1400	650	1500
Southbound	1400	950	1650	1000

Southern Access

Access to the town centre from the southern suburbs of Taupō is predominantly via Lake Terrace and then filtering north via the connecting roads of Kaimanawa Street, Titiraupenga Street and Ruapehu Street. Northbound through traffic generally exits via Lake Terrace and Tongariro Street to the Control Gate Bridge. The main roads included in this corridor are shown in **Figure 4.3**.



Figure 4.3 Main Points of Interest on Southern Access Corridor

As discussed in section 2.1, the section of Lake Terrace from Shepherd Road to Mere Road experiences some congestion during peak hours as shown in

Table 4.2, especially northbound during the morning peak period. There is little route choice to avoid this corridor, with the alternative route via Kiddle Drive to Tamatea Road or Taharepa Road being significantly longer for most trips. It is also noted that Tamatea Road has traffic calming measures to reduce speeds which also reduces the attractiveness of this as an alternate corridor.

Forecast growth along this corridor does not indicate the immediate need for four-laning, however it is recommended that a corridor management plan be put in place. This management plan should consider options such as consolidating off-street access and altering some minor intersections legs to left in – left out configurations to improve the efficiency of the through route.

Table 4.2 Peak Hourly Flow on Lake Terrace, 2018 and 2041

Lake Terrace S of Rifle Range Rd	2018 Base (veh/hour)		2041 Future (veh/hour)	
	AM Peak	PM Peak	AM Peak	PM Peak
Capacity	1200 vehicles per hour		1200 vehicles per hour	
Northbound	850	550	1150	650
Southbound	300	800	350	850

East – West Access

The east – west arterial connections link the urban centre with the eastern industrial areas around Crown Road and Centennial Drive. Sustained growth to the north of Taupō means that traffic volumes on Spa Road are likely to increase due to commuters from Nukuhau, Acacia Bay and Kinloch accessing industrial areas where employment growth is forecast. The main roads included in this corridor are shown in **Figure 4.4**.

Volumes along Spa Road are forecast to increase in both directions and peak periods as shown in **Table 4.3**, however the corridor is unlikely to reach the calculated capacity of 900 vehicles per hour until around 2041. Congestion will continue to increase, especially on the western end of the corridor from Wairakei Drive to Titiraupenga Street, due to the number of intersections (seven intersections in 550m) and the growing traffic volumes.

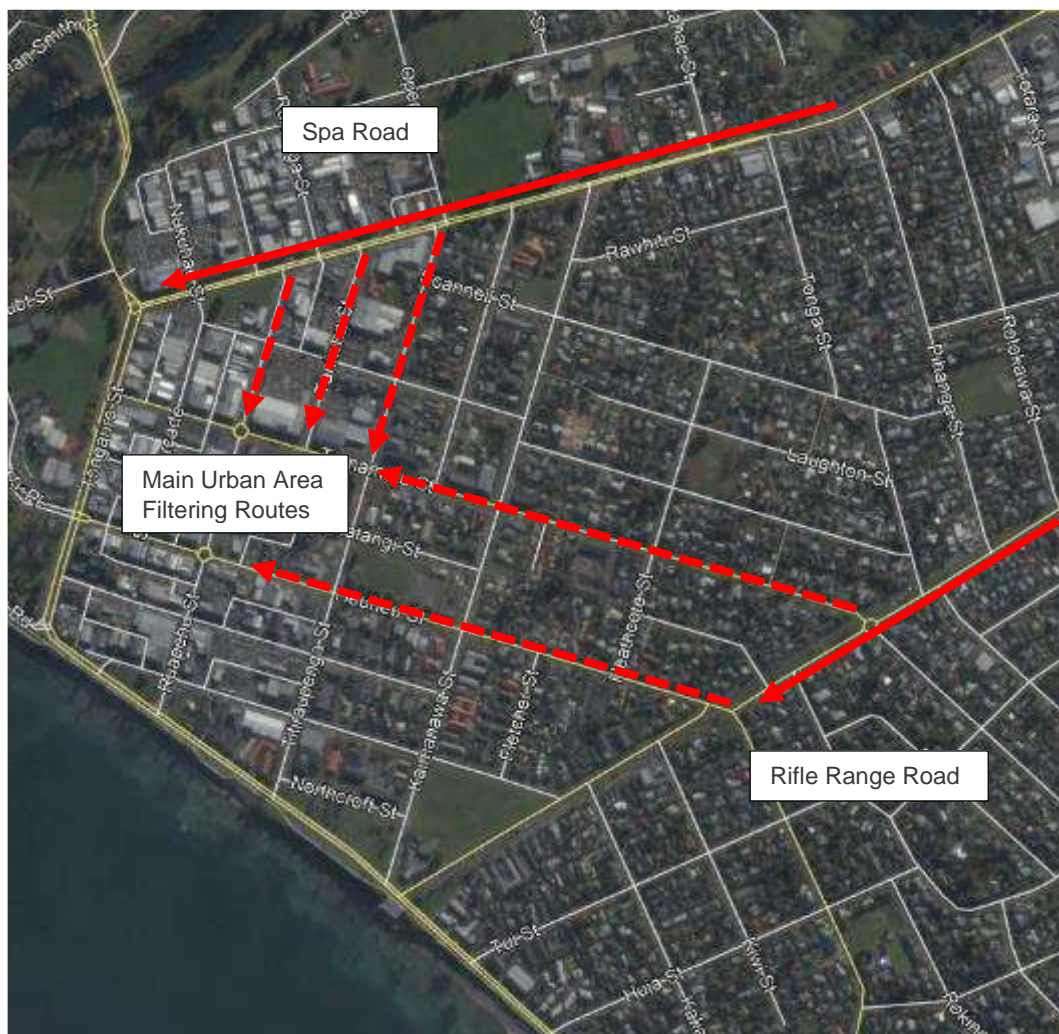


Figure 4.4 Main Points of Interest on East-West Access Corridor

Table 4.3 Peak Hourly Flow on Spa Road, 2018 and 2041

Spa Road E of Titiraupenga St	2018 Base (veh/hour)		2041 Future (veh/hour)	
	AM Peak	PM Peak	AM Peak	PM Peak
Capacity	900 vehicles per hour		900 vehicles per hour	
Eastbound	650	600	800	850
Westbound	650	750	850	950

Implementing the CISP strategy and expanding the capacity of the northern access corridor may both significantly affect the operation of Spa Road and management of the effects of these changes is key to retaining an acceptable level of service. This is discussed in detail in section 4.3.

Rifle Range Road is currently busy in the tidal direction in the morning and evening peaks but not experiencing poor level of service and unlikely to experience high growth. Volumes on Rifle Range Road may increase as a result of rerouting in the future if the performance of Spa Road degrades significantly due to congestion.

4.2 Options for Capacity Increase on Northern Connection

Two possible infrastructure responses to increase the capacity of the northern access corridor are detailed below. The 'do minimum' network to compare these options against is the 2041 future network assumed in the 'Model Update Deficiency Analysis' report dated 17 May 2019. Change diagrams for each option and period are attached as Appendix A. It is noted that these are only two conceptual options, and a greater number of potential candidate options may be feasible.

2041 Do Minimum Network

Several network coding changes have been implemented for the future model years compared to the 2013 base year:

- The intersection of Norman Smith Dr – Wairakei Dr has been signalised^[2].
- Priority reversed at the intersection of Arrowsmith / Kiddle / Napier-Taupō to move priority to the north – south movement on Arrowsmith / Kiddle.
- Priority reversed at the intersections of Titiraupenga / Tamamutu and Titiraupenga / Heuheu to move priority to the north – south movement on Titiraupenga St.
- Intersection of Redoubt / Wairakei converted to left in – left out in line with changes in December 2018.
- Speed limits over the network have been updated to be in line with the Speed Limit Bylaw^[3] dated December 2018. The main alterations due to this update are the section of Wairakei Dr reducing to 80kmh from the intersection with SH1 and to 50kmh from north of Huka Falls Rd to the Control Gate Bridge. Sections of Napier-Taupō Rd, Lake Terrace and Acacia Bay Rd have also been corrected to be in line with the current speed limits.
- Network for the East Urban Lands development has been added in two sections. The initial development from Lake Terrace to Tauhara Ridge Dr is included in both the 2021 and 2041 years, the secondary development from Tauhara Ridge Dr to the Napier-Taupō Rd – Crown Rd intersection is included only for the 2041 year.

Option 1 – Bridge Duplication via Nukuhau Street and Paora Hapi Street

This option is based around the construction of a duplicate bridge close to the existing Control Gate Bridge. The new bridge would carry two southbound lanes and the existing bridge would be converted to carry two northbound lanes. The modelled assumptions are as follows:

^[2] <https://www.Taupōdc.govt.nz/council/projects/northern-corridor-improvements>

^[3] Speed Limit Bylaw 2018, document number A2273031 provided by Taupō District Council

- Two southbound lanes from south of the Norman Smith / Wairakei intersection joining the northern end of Nukuhau Street.
- Upgrade of Nukuhau Street to carry two southbound lanes and one northbound lane.
- Conversion of Wairakei Drive to carry two northbound lanes and no southbound lanes from north of the Wairakei / Redoubt intersection to south of the Norman Smith / Wairakei intersection.
- Conversion of the existing roundabout at Wairakei / Tongariro / Spa to a priority intersection giving priority to the Wairakei / Spa movement.
- Intersection upgrades along Paora Hapi Street at Nukuhau / Spa / Paora Hapi and at Titiraupenga / Paora Hapi to accommodate the increased traffic volume.
- Priority changes to give priority to Titiraupenga Street from Paora Hapi Street to Lake Terrace, as in the do minimum network.

These changes are detailed in **Figure 4.5**.

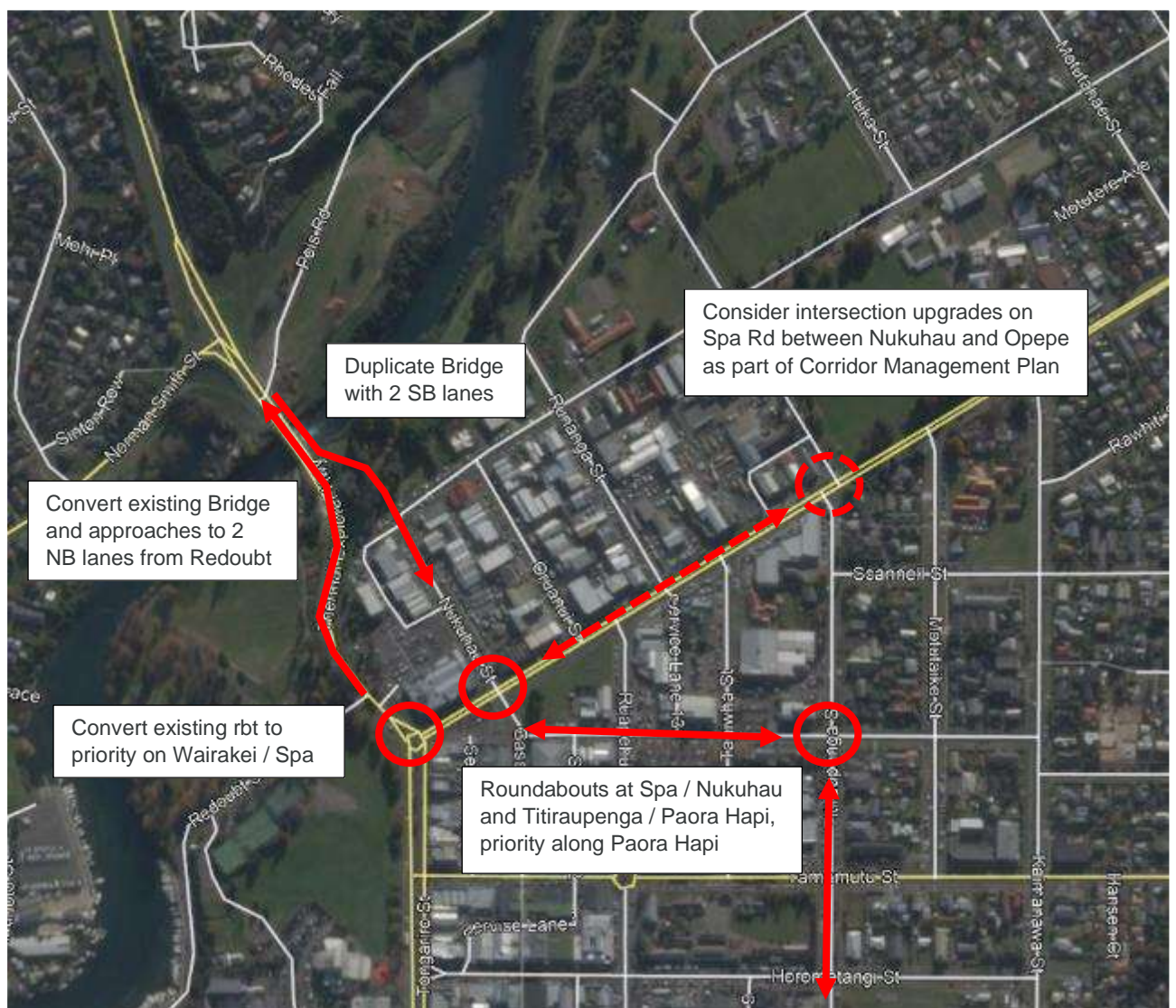


Figure 4.5 Infrastructure Changes for Bridge Duplication via Nukuhau Street

Option 2 – Eastern Bridge Connection via Opepe Street

This option is based around the construction of a fourth leg from the Norman Smith / Wairakei signalised intersection under construction at the time of writing, following the existing designation for Pois Road before bridging the Waikato River and joining the northern end of Opepe Street. Both the existing and new bridge would carry a northbound and southbound lane and the Norman Smith / Wairakei intersection would be reconfigured to allow east – west movements between Norman Smith Street and the new eastern leg.

The list of all modelled changes is as below:

- New two-way connection from Opepe Street along Pois Road to the Norman Smith / Wairakei intersection.
- Upgrade of Opepe Street in line with expected traffic volume increases.
- Realign approaches to Opepe / Spa / Titirapunga intersections to allow conversion from offset priority intersections to a controlled intersection.
- Priority changes to give priority to Titirapunga Street from Spa Road to Lake Terrace, as in do minimum network.

These changes are detailed in **Figure 4.6**.



Figure 4.6 Infrastructure Changes for Eastern Bridge Connection via Opepe Street

4.3 Effects on Spa Road Corridor

Change diagrams for each option and period are attached as Appendix A. In the following graphics only changes over 100 vehicles per hour are presented. A key for subsequent link and intersection level of service outputs is shown in **Figure 4.7**. Where the change in directional movements on a road are a similar magnitude they have been combined and are depicted by a two-headed arrow.

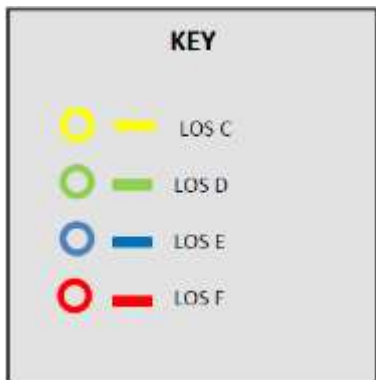


Figure 4.7 Key for Link and Intersection Level of Service

2041 Do Minimum Baseline

The Level of Service in the tidal direction over the Control Gate Bridge (southbound in the morning peak and northbound in the evening peak), is forecast to deteriorate to LoS F. This indicates severe congestion in peak hours and demonstrates the need for increased capacity on the northern access corridor to support continued development north and west of the Control Gate Bridge.

Minor legs at priority intersections accessing Spa Road operate at LoS C during both peak hours, however this may be conservatively low as the vehicle volumes on Spa Road are known to be underrepresented in the current model.

Link and intersection Level of Service at LoS C or worse for the 2041 morning and evening peak hours is shown in **Figure 4.8**.

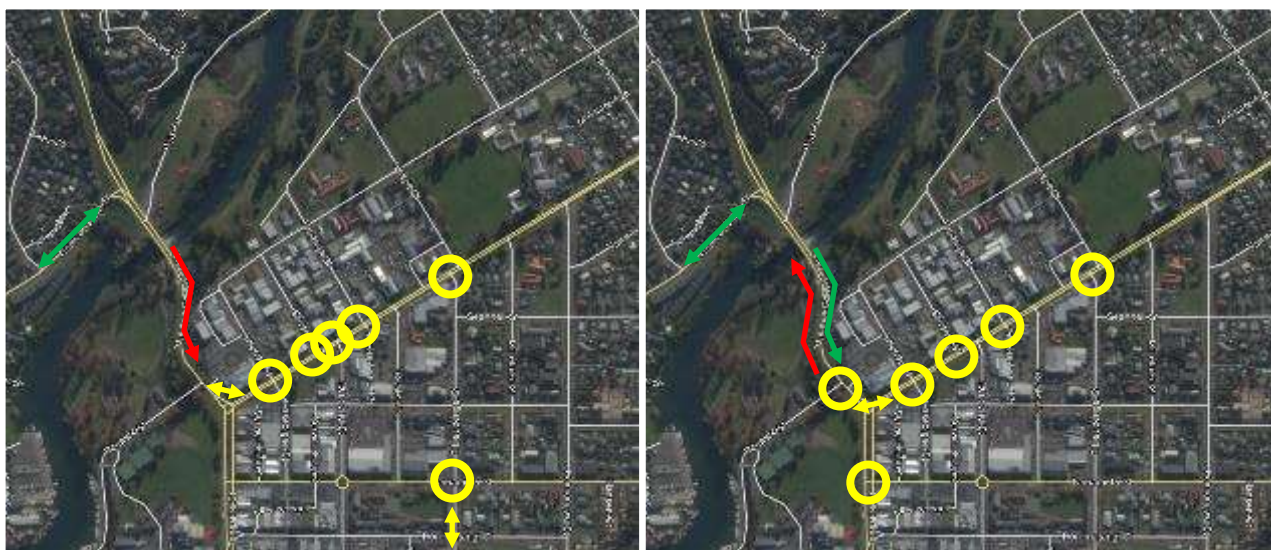


Figure 4.8 Baseline 2041 Morning Peak (left) and Evening Peak (Right) Level of Service - Spa Road View

Option 1 – Bridge Duplication via Nukuhau St

The change in volumes and level of service are shown in **Figure 4.9**.

Additional capacity in the form of duplicating the current Control Gate Bridge shows a marked decrease in congestion and improvement in Level of Service, with peak hour tidal congestion improving from LoS F to LoS C in both the morning and evening peak hours. This reroutes 1,650 southbound vehicles per hour from the control gate bridge to the new bridge.

Flows along the proposed new through route of Paora Hapi Street – Titiraupenga Street increase by around 800 vehicles per hour on Paora Hapi Street and around 350 vehicles per hour on Titiraupenga Street. Volumes also increase on the westbound section of Spa Road between Paora Hapi Street and Wairakei Drive as northbound vehicles reroute from Tongariro Street to Titiraupenga Street. Efficient operation of the intersections at Nukuhau Street / Spa Road and Spa Road / Wairakei Drive will be key to ensuring the smooth operation of the network in this vicinity.

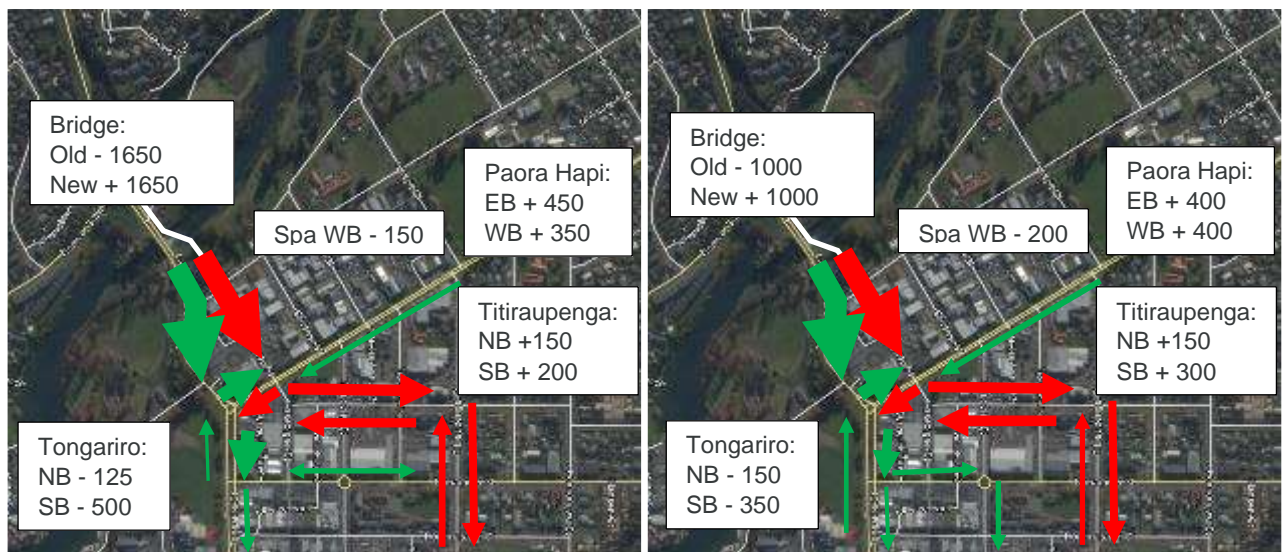


Figure 4.9 Option 1 Change in Volume Morning Peak (Left) and Evening Peak (Right) - Spa Road View

Option 2 – Eastern Bridge Connection via Opepe St

The change in volumes and level of service are shown in **Figure 4.10**.

The bridge connection via Opepe Street is less attractive than Option 1 as the proposed link is less direct. Vehicle using the new bridge will generally face greater travel time and distance costs such that this alignment is only attractive to those trips continuing eastbound along Spa Road and/or during times at which congestion is causing delays on the existing bridge. Trips terminating in the town centre and further south will generally prefer to use the existing Control Gate Bridge, however the relative attractiveness could be managed through signal timings and the impact of congestion on travel times at peak times.

In the northbound direction this extra distance cost is coupled with additional delay at the Norman Smith Street / Wairakei Drive signals, resulting in very few modelled northbound vehicles routing via the Opepe Street bridge. The lower number of vehicles rerouting means that congestion remains high on the Control Gate Bridge during peak hours, with LoS D southbound in the morning peak and LoS F northbound in the evening peak.



Figure 4.10 Option 2 Change in Volume Morning Peak (Left) and Evening Peak (Right) - Spa Road View

4.4 Effects on Southern Access Corridor

Change diagrams for each option and period are attached as Appendix A. In the following graphics only changes over 100 vehicles per hour are presented. Where the change in directional movements on a road are a similar magnitude they have been combined and are depicted by a two-headed arrow.

2041 Do Minimum Baseline

The key section on the Southern Access corridor is on Lake Terrace from Napier-Taupō Road (old SH5) to Mere Road. This is a critical corridor as there are limited alternative routing options for north-south traffic. By 2041 LoS is expected to worsen to LoS E northbound in the morning peak and LoS D southbound in the evening peak. Turning from Napier-Taupō Road onto Lake Terrace is also expected to worsen to LoS E in the morning peak, indicating major delays for vehicles waiting to turn. North of Mere Road, congestion is expected to lessen slightly as more route choice is available to access the town centre.

Link and intersection Level of Service at LoS C or worse for the 2041 morning and evening peak hours is shown in Figure 4.11.

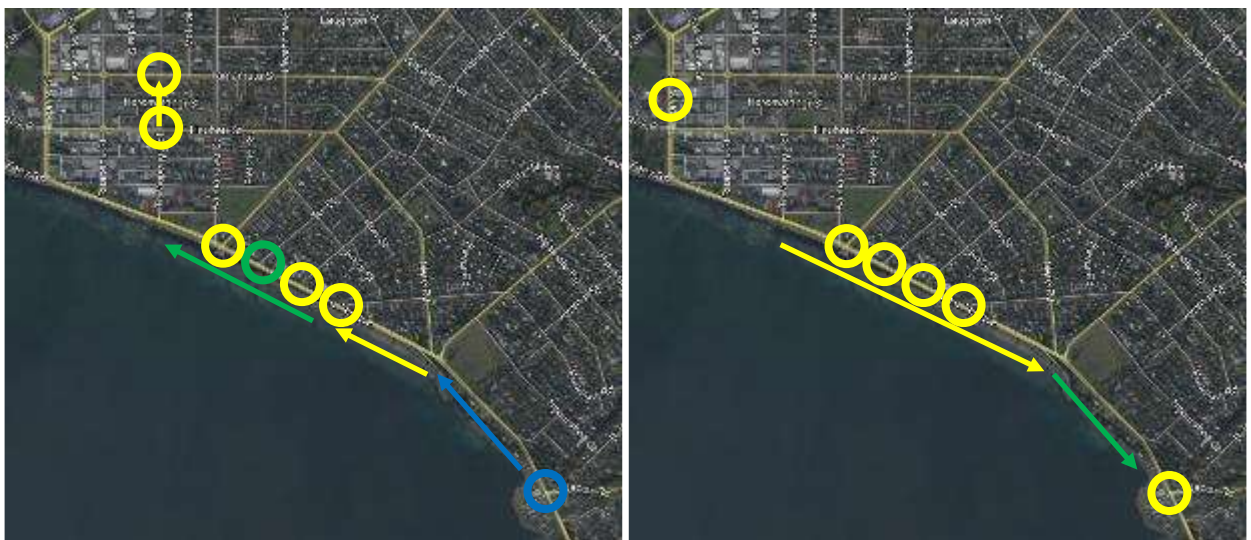


Figure 4.11 Baseline 2041 Morning Peak (Left) and Evening Peak (Right) Level of Service - Lake Tce View

Option 1 – Bridge Duplication via Nukuhau St

The change in volumes and level of service for this option are shown in **Figure 4.12**.

Changes in volumes on the southern corridor are limited to west of Titiraupenga Street with the arterial change routing vehicles via Titiraupenga Street in preference to continuing along Lake Terrace. The intersection of Lake Terrace / Titiraupenga Street operates at LoS C and other intersections operate at a similar level of service as the 2041 baseline.

Lake Terrace to the east of Titiraupenga does not change by more than 50 vehicles in either direction, however it is noted that the level of service is LoS D or LoS E along the corridor between Mere Road Titiraupenga Street. This corridor is expected to continue to operate satisfactorily and not required additional capacity.



Figure 4.12 Option 1 Change in Volume Morning Peak (Left) and Evening Peak (Right) - Lake Tce View

Option 2 – Eastern Bridge Connection via Opepe St

The change in volumes and level of service for this option are shown in **Figure 4.13**.

Similar to Option 1, changes in volumes on the southern corridor are limited to west of Titiraupenga Street with the arterial change routing vehicles via Titiraupenga Street in preference to continuing on Lake Terrace. All intersections along Lake Terrace operate at a similar level of service as the 2041 baseline.

There is a small increase northbound on Lake Terrace, with enough extra volume for the level of service to worsen to LoS D from Mere Road to Tui Street and LoS E from Tui Street to Titiraupenga Street. There is a slight decrease in volume southbound, with level of service remaining unchanged at LoS C from Titiraupenga Street to Mere Road and LoS D from Mere Road to Napier-Taupō Road.

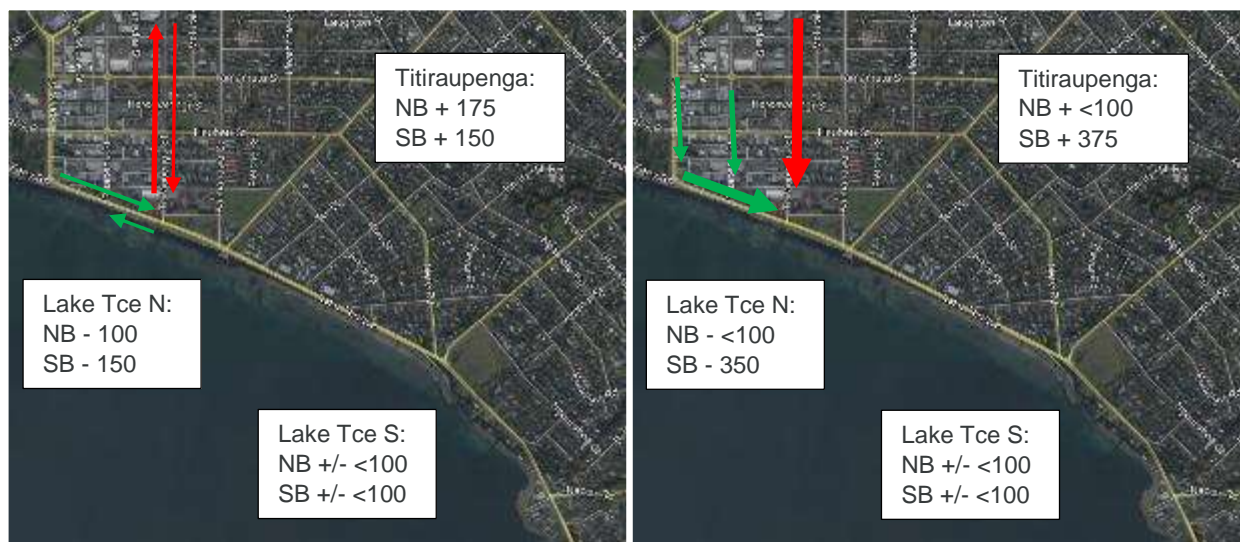


Figure 4.13 Option 2 Change in Volume Morning Peak (Left) and Evening Peak (Right) - Lake Tce View

4.5 Future Traffic Volumes at Key Locations

The two-way traffic volumes for each option alongside the 2018 and 2041 baseline volumes are shown in **Figure 4.14** for the morning peak and **Figure 4.15** for the evening peak.

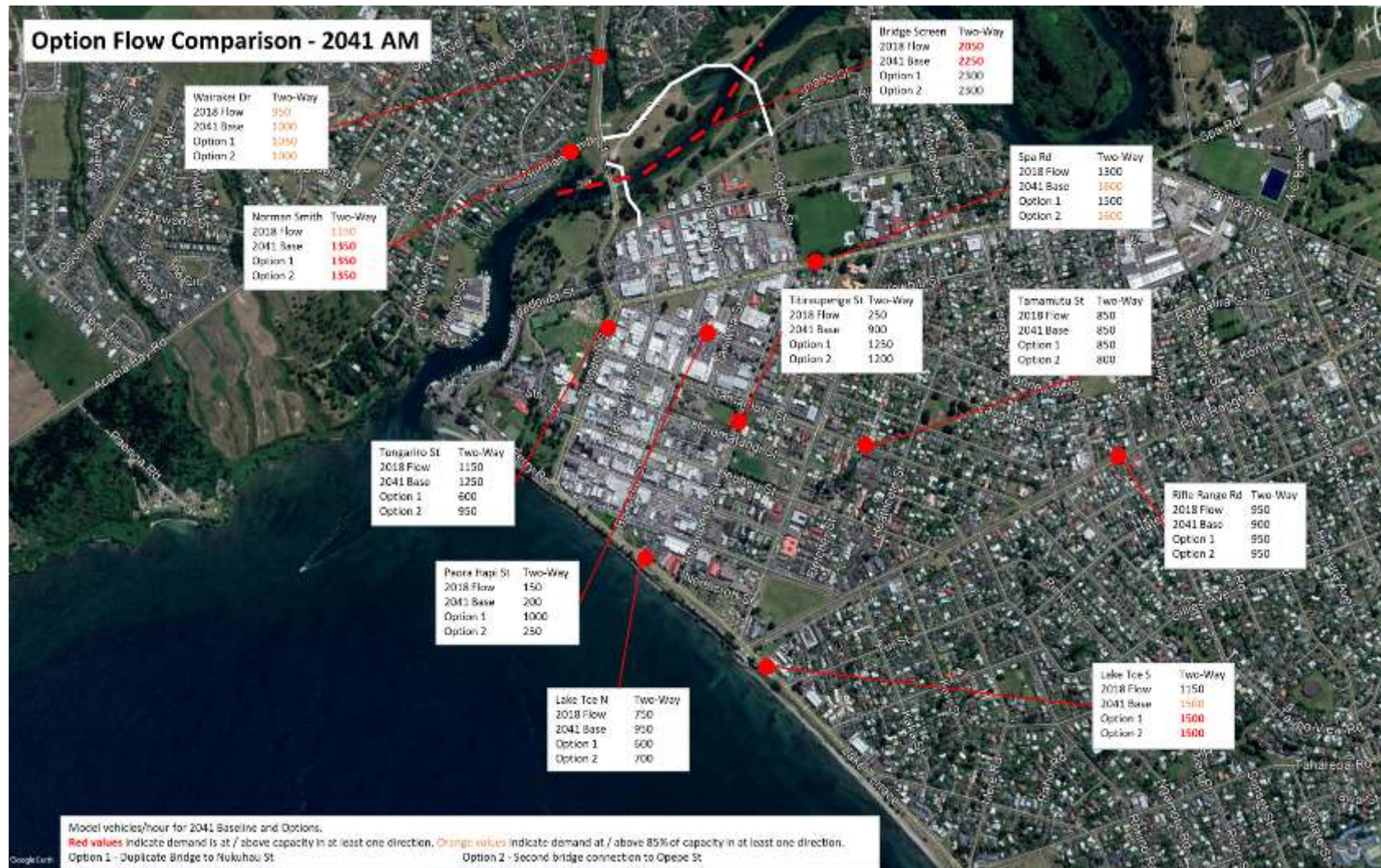


Figure 4.14 Traffic Volume Option Comparison at Key Locations - Morning Peak

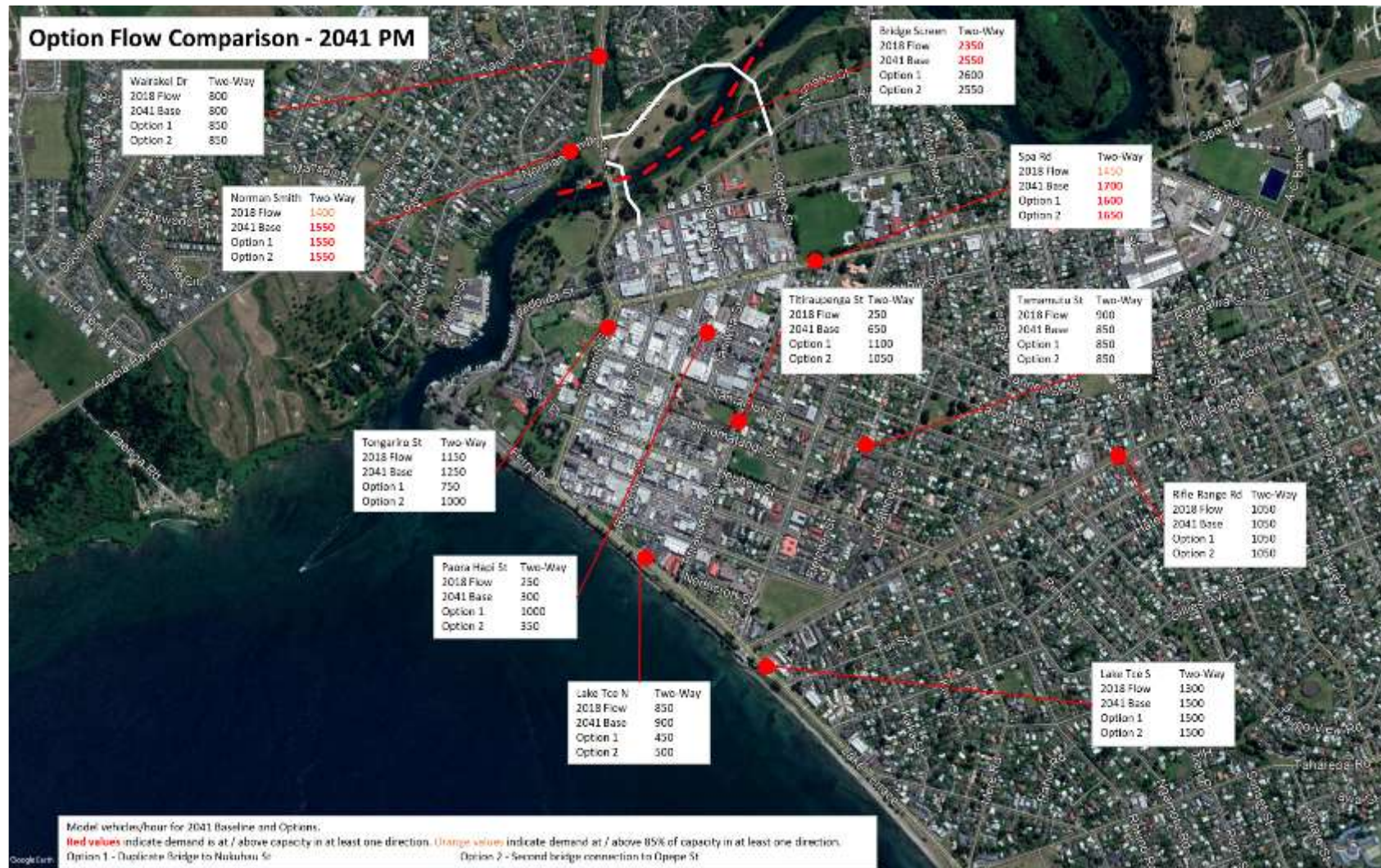


Figure 4.15 Traffic Volume Option Comparison at Key Locations - Evening Peak

4.6 Effects of Additional Traffic Calming in the Town Centre

The CISP strategy outlines intent to relocate the north-south arterial from Tongariro Street to Titiraupenga Street. This change presents opportunities to redefine the function of Tongariro Street and the surrounding roads within the town centre to improve amenity along the lakefront and provide better connections between the commercial centre and the lake, river and Tongariro Domain.

Some of the potential infrastructure changes include reducing Tongariro Street from four to two lanes (reallocating the space to some or all of public transport, parking, walking and cycling) and to reduce speed limits in the urban centre to 30kmh. The Option 1 and Option 2 models were analysed with these changes to understand effects on the wider transport network.

The area included in the traffic calming is shown in **Figure 4.16**.



Figure 4.16 Traffic Calming Changes for Option 1 (Left) and Option 2 (Right)

Key vehicle volume changes compared to the do minimum are shown in **Figure 4.17** and **Figure 4.18** for options 1 and 2 respectively.

Both options respond in a similar way, with volumes reducing slightly (100-150 vehicles in peak hour) northbound on Lake Terrace and Tongariro Street compared to the assessment without traffic calming presented in sections 4.3 and 4.4. These vehicles travel along the intended east – west link for each option, being Paora Hapi Street for Option 1 and Spa Road for Option 2. The increases on Spa Road in Option 2 are significant, with around 350 extra vehicles westbound from Taniwha Street to Wairakei Drive compared to the analysis without traffic calming in the town centre. This increase may impact on congestion with level of service on Spa Road worsening to LoS D.

Routing to the east of Titiraupenga Street is also similar in both options, with a decrease on Lake Terrace northbound from Napier-Taupō Road balanced by slight increases on Mere Road and the east-west connectors of Heuheu Street and Tamamutu Street. The link level of service along Lake Terrace improves slightly in the section between Mere Road and Titiraupenga Street with LoS C from Mere Road to Tui Street and LoS D from Tui Street to Titiraupenga Street. Performance of the Lake Terrace / Napier-Taupō Road intersection improves slightly to LoS D in both options as around 50 vehicles in peak hour shift to the Kiddle Drive corridor from Lake Terrace which reduces demand on the right turn from Napier-Taupō Road onto Lake Terrace.



Figure 4.17 Option 1 with Traffic Calming Change in Volume Morning Peak (Left) and Evening Peak (Right)

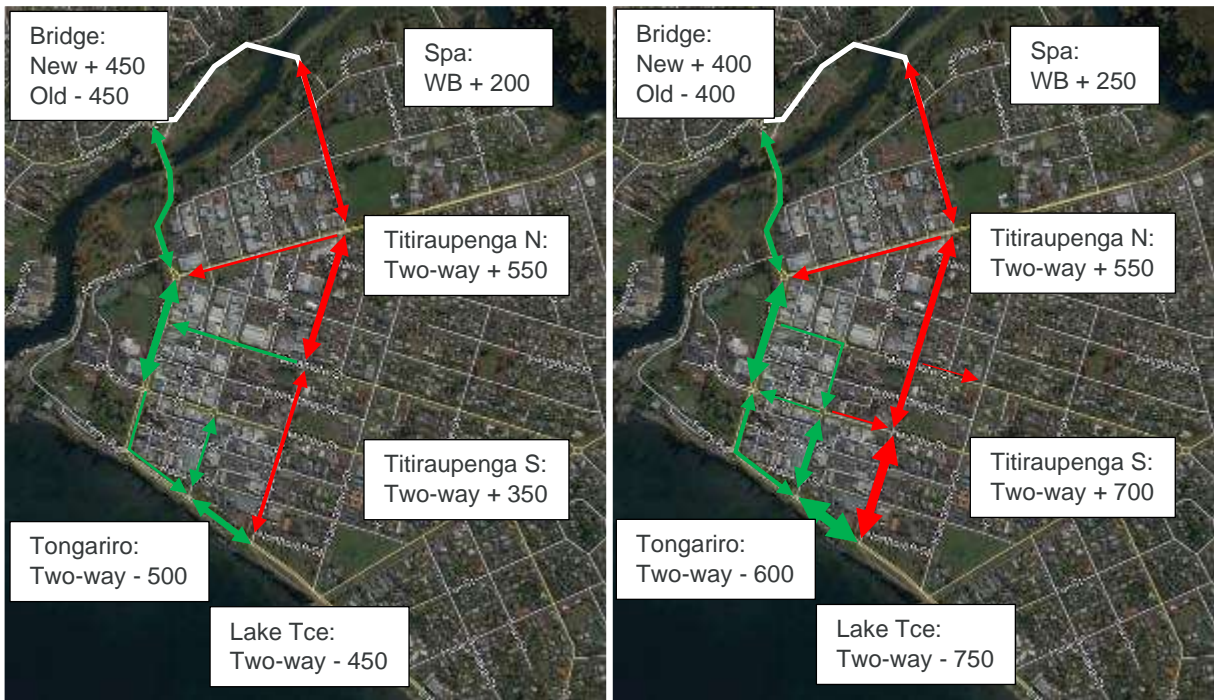


Figure 4.18 Option 2 with Traffic Calming Change in Volume Morning Peak (Left) and Evening Peak (Right)

4.7 Modal Impacts

There are currently few dedicated facilities for active modes to access the town centre. While progress has been made implementing the facilities proposed in 2005, shown in **Figure 4.19** including sections of the Lake Terrace shared path, the overall network remains relatively fragmented with limited connectivity between facilities.



Figure 4.19 Existing and Proposed Cycle Facilities in Taupō, 2005

There is access from the south via a shared path on the lake side of Lake Terrace, however connectivity is limited and there are no cycle facilities linking the path to other facilities to the east. As noted in Section 3.1, three serious crashes in the last five years have involved a cyclist on Lake Terrace which indicates a serious safety concern for cyclists using the corridor. Access from the east is currently on-road with no dedicated facilities. This means that the amenity value for cyclists is low and expected to reduce further as traffic volumes are expected to continue to increase across the network.

Northern access is limited due to space constraints on the Control Gate Bridge. There is an opportunity to remedy this lack of access as part of any capacity upgrade of the bridge. Due to the traffic levels and topography, separated facilities for walking and cycling would be highly recommended over on-road cycle lanes.

The potential change in function of Tongariro Street is also an opportunity to improve the level of service for walking and cycling in the town centre. This is especially true if volumes reduce significantly as evidenced in the option assessment and the number of traffic lanes is reduced from four to two.

Pedestrian routes and priority facilities through the urban centre have been identified in CISP as key improvements to be implemented. These improvements are not contingent on a low-speed road network, however there is greatly enhanced amenity for active modes as average vehicle speeds reduce. The CISP implementation document identifies primary and secondary pedestrian corridors, as well as pedestrian activity nodes and active street edges which are shown in **Figure 4.20**.

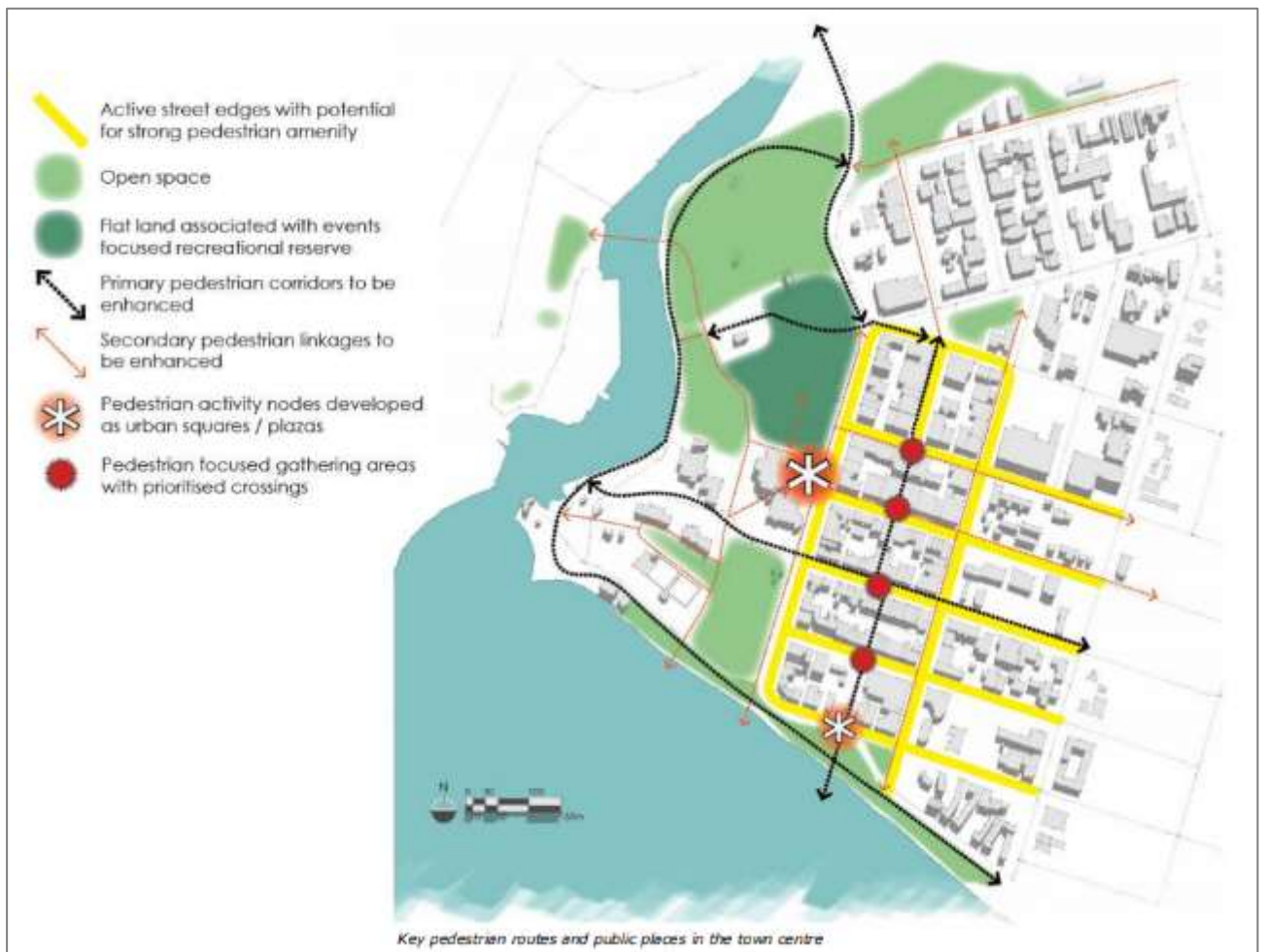


Figure 4.20 Key Pedestrian Routes in the Town Centre, CISP Part B

5. CISP Implementation and Effects

5.1 CISP Overview and Strategic Direction

The Taupō Urban Commercial and Industrial Structure Plan (CISP), adopted in 2011, sets direction for the future planning of the Taupō town centre and new industrial areas. The plan aims to enhance connections between the commercial areas, the lake and river, and Tongariro Domain and reduce severance exacerbated by high vehicle movement priority on Tongariro Street and Lake Terrace.

The key change which drives the reprioritisation of Tongariro Street and Lake Terrace is shifting the north-south arterial route from Tongariro Street two blocks east to Titiraupenga Street. This is intended to allow Tongariro Street and Lake Terrace to take on a much higher sense of place rather than being focussed on vehicle movement. Reprioritising the road reserve can then be focussed on increasing amenity and connectivity between the commercial area and the lakefront and recreational areas. The proposed development pattern for the town centre is shown in **Figure 5.1**.

Any detailed transport strategy developed should give effect to the strategic direction of CISP.



Figure 5.1 Proposed Development Pattern for the Town Centre, CISP Part B

5.2 Control Gate Bridge

As discussed in Section 4.2, the current Control Gate Bridge is at or near capacity during peak hours and holiday periods. This causes increased congestion, which is forecast to increase significantly as growth continues to the north of the Taupō town centre.

Options have been investigated for increasing vehicle capacity on the northern corridor by constructing a second river crossing. The two options modelled in this analysis were a duplication of the Control Gate Bridge connecting to Nukuhau Street or a second crossing to the east connecting to Opepe Street. The infrastructure changes involved in each option are discussed in detail in Section 4.2.

The preferred options should be investigated further as part of a detailed business case to test the merits of each option and it is understood that this work has been programmed in by Council. This business case should also consider the effects on implementing CISP and any adopted transport strategy.

The proposed future Taupō Network Plan as a key outcome of this report, presents the Control Gate Bridge options and associated improvements is shown in **Figure 5.2**. For the full proposed network plan refer to **Figure 5.6**.

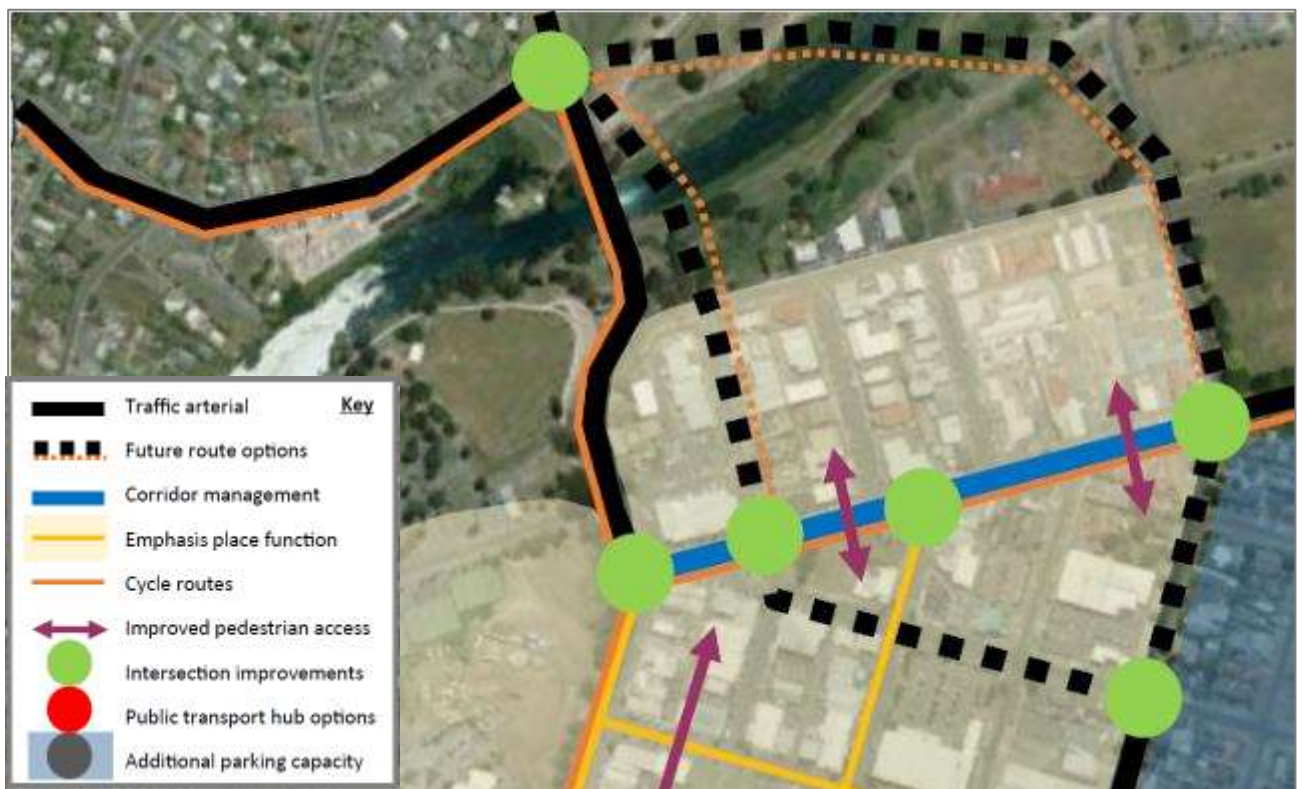


Figure 5.2 Proposed Network Plan - Control Gate Bridge

Option 1 – Bridge Duplication via Nukuhau St

This option includes a new southbound two lane bridge connecting to Nukuhau Street with through traffic encouraged to travel via Paora Hapi and Titiraupenga Streets. To move the estimated peak hour volumes of around 1650 vehicles requires two southbound lanes on Nukuhau Street which may require revising the parking provision on the street and potentially reviewing off-street accessways.

This option is effective at sharing available network capacity as the current Control Gate Bridge is converted to two lanes northbound and the new bridge to Nukuhau Street carries two lanes southbound. Traffic travelling westbound on Spa Road comes into conflict with southbound traffic on Nukuhau Street in order to continue north over the Control Gate Bridge, necessitating an intersection upgrade at Spa Road and Nukuhau Street.

The intersection of Nukuhau Street and Waikato Street would need to be reviewed and could be used to promote eastbound vehicles to utilise Waikato Street and Opepe Street rather than continuing to Spa Road. This would need to be aligned with any decisions made around minor intersections as part of the Spa Road corridor management plan.

From Nukuhau Street most vehicles entering the town centre will do so via the existing north-south connections of Ruapehu Street, Taniwha Street, Gascoigne Street and Titiraupenga Street depending on the desired destination or parking location. There will still be traffic accessing the town centre via Tongariro Street however depending on the traffic calming measures implemented, traffic volumes can be significantly reduced from current levels.

Option 2 – Eastern Bridge Connection via Opepe St

This option involves the addition of an eastern leg onto the current Norman Smith Street / Wairakei Drive signalised intersection. The new eastern roadway has been modelled to follow close to the existing Pois Road alignment before crossing the river and joining to the northern end of Opepe Street. Forecast volumes on Opepe Street mean that four-laning would not be required, however the road cross-section should be reviewed to ensure it is suitable.

The effectiveness of this option in offering an alternative route to Control Gate Bridge is sensitive to the relative travel time for vehicles travelling via either bridge. The route from Spa Road / Opepe Street intersection north over the new bridge and then west to the Norman Smith Street / Wairakei Drive intersection is significantly further in distance than the existing route via the Control Gate bridge. Careful attention needs to be paid to ensuring the delay on vehicles at the eastern approach Norman Smith / Wairakei Drive signals is minimised, while maintaining acceptable levels of service for the other approaches. This could be assisted by including left slip lanes on the northern approach to encourage vehicles to use the new route and avoid the Norman Smith Street / Wairakei Drive intersection.

Due to the significant extra distance and intersection delay faced by vehicles leaving the town centre it is unlikely that a large proportion will route via the Opepe Street route. This means that in peak periods there is still likely to be significant delays and congestion at the Control Gate Bridge.

As with Option 1, the intersection of Opepe Street and Waikato Street would need to be reviewed and could be used to promote westbound vehicles to utilise Waikato Street rather than continuing to Spa Road. The Opepe Street, Titiraupenga and Spa Road intersection would also require straightening and upgrading to a controlled intersection form. This would need to be aligned with any decisions made around minor intersections as part of the Spa Road corridor management plan.

5.3 Tongariro Street Corridor

The estimated two-way capacity and the range of future demands for Tongariro Street and the northern section of Lake Terrace (assuming a second Waikato River bridge is introduced) are summarised in **Table 5.1**. The range acknowledged that there are a range of bridge options that have been assessed including the implementation of traffic calming in the town centre.

Table 5.1 Capacity and Future Peak Hour Demands - Tongariro Street Corridor

Street	Capacity two-way	2018 Volume	Future Typical Demands	Future Peak Holiday Demands
Tongariro Street	3800 (four lanes) 2000 (two lanes)	1150	400 – 650	1000
Lake Tce N of Titiraupenga	1800	750 - 850	150 – 500	300

An extract from the proposed future Taupō Network Plan showing the Tongariro Street corridor is shown in **Figure 5.3**. For the full proposed network plan refer to **Figure 5.6**.

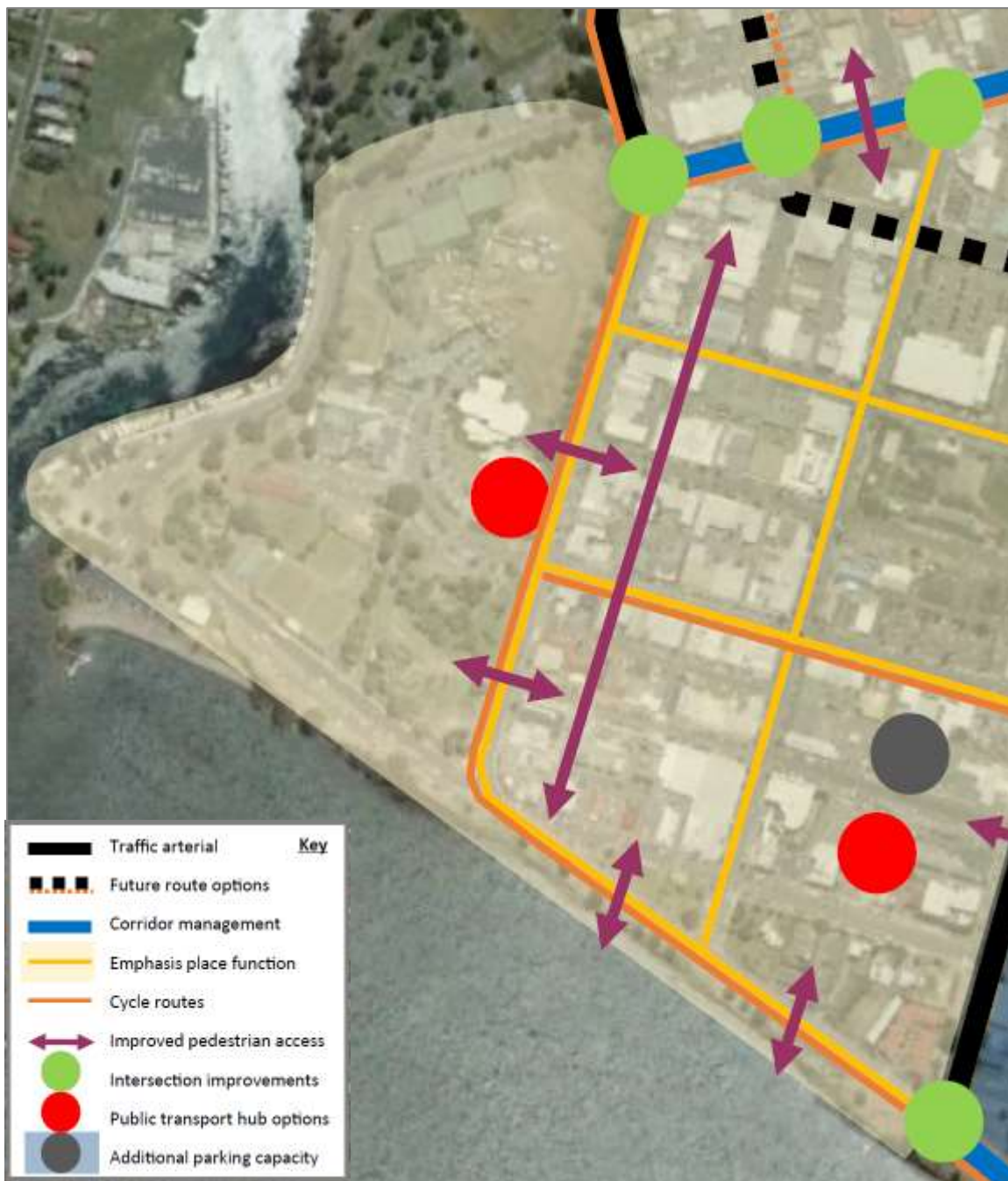


Figure 5.3 Proposed Network Plan - Tongariro Street Corridor

The future demands on Tongariro Street currently do not exceed the capacity of a two-lane road and are forecast to decrease further relative to current volumes as a result of the CISP implementation and implementation of additional traffic calming. The four lane Tongariro Street carries significantly less traffic volume than two lane sections of Spa Road and Lake Terrace which indicates that four lanes are not required for the appropriate functioning of this corridor. Peak holiday demands are still well within the capacity guidelines of a median separated two-lane road, so even with additional peak holiday activity and parking circulation two lanes is considered to provide sufficient vehicular capacity.

The reduction in traffic volume on Tongariro Street allows the street a higher 'place' function less 'movement' function. The additional road reserve can be repurposed to reduce severance and improve connectivity between the commercial

centre and the domain / lakefront. The opportunity to repurpose the road reserve space could also be used to give increased priority to public transport, for example a bus hub, parking and/or walking and cycling.

With the shift in traffic volumes the signal operation at Tongariro Street / Heuheu Street / Story Place may not be required. However, it may be desirable for these signals to remain in operation as they provide a safe pedestrian crossing facility. With the reprioritisation in road reserve space the dimensions of the intersection would need to be evaluated and crossing distances reduced.

5.4 Spa Road Corridor

The estimated two-way capacity and the range of future demands for Spa Road are summarised in **Table 5.2**.

Table 5.2 Capacity and Future Peak Hour Demands - Spa Road Corridor

Street	Capacity two-way	2018 Volume	Future Demands	Future Holiday Demands
Spa Road	1800	1300 - 1450	1500 - 1600	1750

An extract from the proposed future Taupō Network Plan showing the Tongariro Street corridor is shown in **Figure 5.4**. For the full proposed network plan refer to **Figure 5.6**.

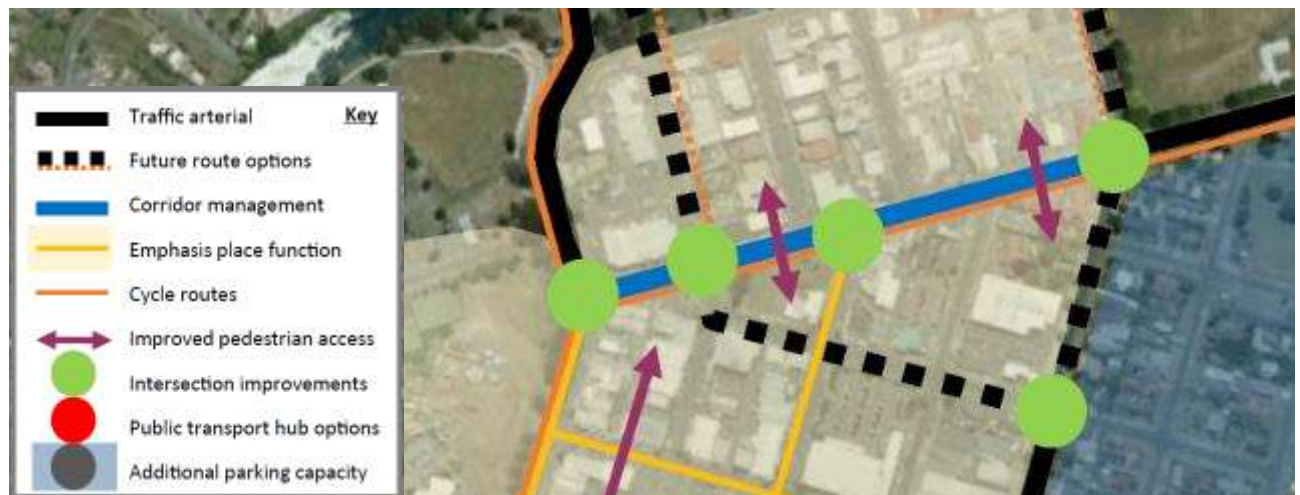


Figure 5.4 Proposed Network Plan - Spa Road Corridor

Expanding the capacity of Spa Road by four laning the section west of Titiraupenga Street is not required, however it is expected that peak holiday demands will cause some extra congestion on the corridor and careful consideration needs to be given to managing the competing demands on this corridor including through traffic, access to/from side streets, parking and catering for pedestrian and cycle movements.

The two northbound lanes on Wairakei Drive included as part of Option 1 should be extended back eastwards on Spa Road to the Spa Road / Nukuhau Street intersection to ensure an acceptable level of service for traffic continuing northbound on Wairakei Drive.

Although traffic volumes are not expected to require four laning the remainder of the Spa Road corridor, there will be some action required to ensure safe pedestrian crossing opportunities as well as opportunities to turn onto Spa Road from the side streets to the north and south. This requires a corridor management plan to be developed which may include a combination of several possible interventions:

- Realignment and some form of control at key intersections on Spa Road, including Spa Road / Nukuhau Street / Paora Hapi Street, Spa Road / Opepe Street / Titiraupenga Street and possibly Spa Road / Ruapehu Street. The form of control this takes has not been prescribed but should follow the advice detailed in the previously prepared Fact Sheets, especially Fact Sheets 5 – 7.

- Inclusion of raised medians with pedestrian refuges on key desire lines to provide safe crossing opportunities.
- Consolidation of side street access by possibly banning right turns (in and/or out of side roads), or by increasing the utilisation of Waikato Street and / or Paora Hapi Street to access the local roads along the north and south of the Spa Road corridor.

5.5 Titiraupenga Street and Paora Hapi Street

The estimated two-way capacity and the range of future demands for Titiraupenga Street and Paora Hapi Street are summarised in **Table 5.3**.

Table 5.3 Capacity and Future Peak Hour Demands - Titiraupenga Street and Paora Hapi Street

Street	Capacity two-way	2018 Volume	Future Demands	Future Holiday Demands
Titiraupenga Street	1800	250	1050 - 1100	1750
Paora Hapi Street	1800	150 – 250	Op1: 1150 Op2: 150 - 250	Op1: 1850 Op2: 400

An extract from the proposed future Taupō Network Plan showing Titiraupenga Street and Paora Hapi Street is shown in **Figure 5.5**. For the full proposed network plan refer to **Figure 5.6**.

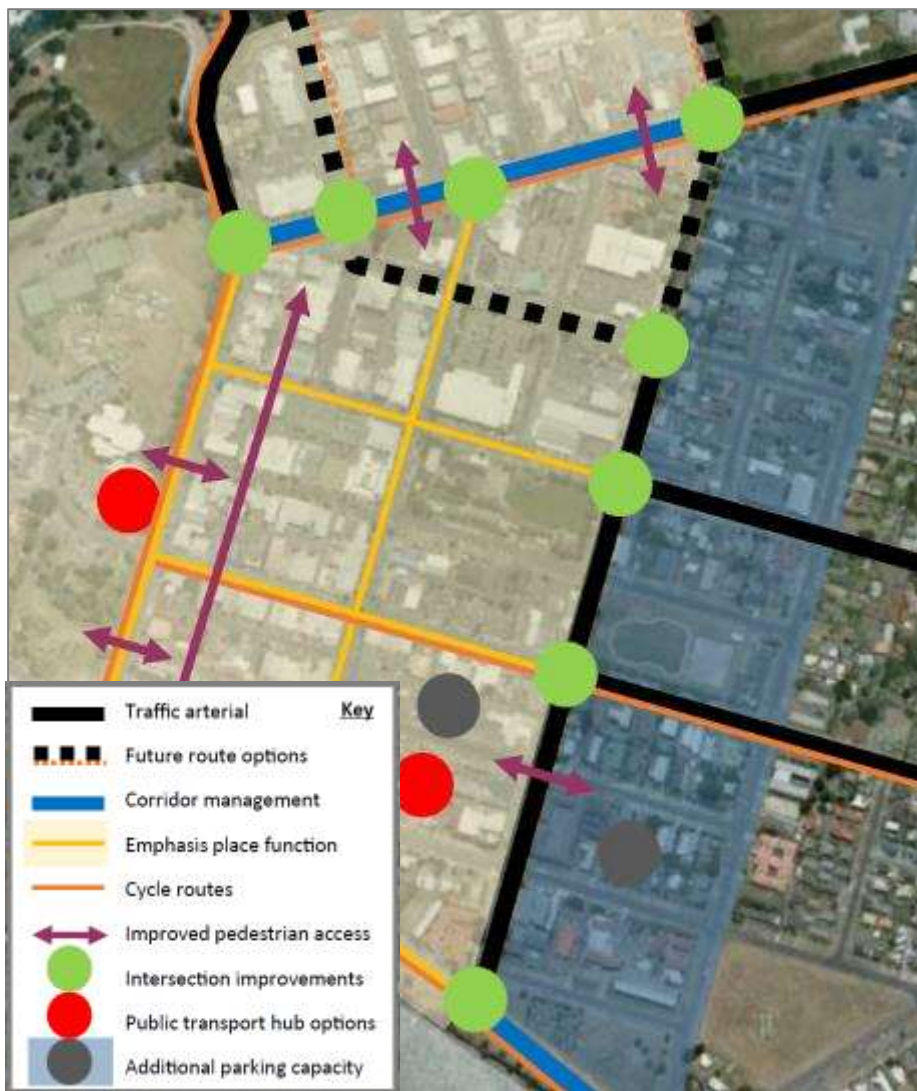


Figure 5.5 Proposed Network Plan - Titiraupenga Street

The north-south movement along Titiraupenga Street is the corridor which undergoes the largest change under the CISP implementation. As of 2018 Titiraupenga Street is a minor road with a low movement function. It gives priority to both east-west arterial connections and Tamamutu Street and Heuheu Street and carries relatively low traffic volumes.

The intended purpose under the CISP strategic direction is for Titiraupenga Street to function as the main north-south arterial connection, allowing efficient movement of through traffic in both directions and providing access to parking on the eastern edges of the town centre.

At a minimum this requires shifting priority to Titiraupenga Street at all main intersections from south of Spa Road to the intersection with Lake Terrace. This achieves the required efficiency for north-south through traffic, however if no other intersection upgrades are implemented increased traffic volumes may impact the level of service experienced by traffic moving in the east-west direction or attempting to turn onto Titiraupenga Street. Pedestrian and cyclists also need to be considered and may justify upgrades to controlled intersection forms at major intersections, especially those which currently have a poor safety record as highlighted in section 3.

Prioritisation of traffic along Paora Hapi Street is required if Option 1 were to be implemented, to efficiently move traffic from Nukuhau Street to Titiraupenga Street. Intersection control will be required at each end to manage the higher turning volumes, with the control form following the advice presented in Factsheets 5 – 7. The intersections along Paora

Hapi Street should be reviewed for form and function as part of the corridor management plan on Spa Road with attention paid to potentially banning right turn movements from some minor intersection approaches.

If Option 2 is implemented, prioritising traffic along Paora Hapi Street could have a negative effect on the overall efficiency of the transport network by encouraging northbound through traffic to utilise Paora Hapi Street and Wairakei Drive in preference to continuing along Titiraupenga Street and Opepe Street. The additional travel time and distance presented by the option 2 alignment compared to the Control Gate Bridge means that it is unlikely that the Opepe Street will be an attractive connection for many trips. This means that significant congestion is likely to continue on the approaches to the Control Gate Bridge and there may be low utilisation of the new connection.

It is recommended that intersection and signal timing changes are focussed on ensuring the level of service on the eastern leg of Norman Smith Street / Wairakei Drive intersection are as high as possible, with minimal additional intersection delay, and the role of the new alignment could be reinforced through wayfinding. It is also recommended that Paora Hapi Street is not prioritised if the Opepe Street (Option 2) alignment were to be implemented.

Prioritising the movement function of Titiraupenga Street may mean that cycle facilities for a north-south route would provide a higher amenity value on a parallel route such as Kaimanawa Street in addition to a facility on a repurposed Tongariro Street. There are currently no north-south cycle facility connections in place.

Both corridors also cater for angle parking and if they were to be elevated as arterials or include enhanced cycling facilities, care would need to be taken to ensure that vehicles reversing out of car parks do not come into conflict with vehicle and cycle through movements along the corridor.

5.6 Lake Terrace Corridor

The estimated two-way capacity and the range of future demands for the southern section of Lake Terrace are summarised in **Table 5.4**.

Table 5.4 Capacity and Future Peak Hour Demands - Lake Terrace Corridor

Street	Capacity two-way	2018 Volume	Future Demands	Future Holiday Demands
Lake Tce S of Rifle Range	1800	1300	1350 - 1450	2350

Similarly to Spa Road, the expected range of future demands on Lake Terrace from Tremaine Avenue to Titiraupenga Street are not excessive for a two lane arterial road and there is no pressing need to add lane capacity. It is recognised that during peak periods turning from minor intersection approaches onto Lake Terrace is difficult, with right turn delays forecast to increase in line with future traffic volume increases.

During peak holiday periods demands are forecast to increase past the estimated capacity, causing extra congestion and delays. For these high demand periods providing additional wayfinding and travel time information via VMS displays south of the intersection of Lake Terrace and the Taupō Eastern Arterial should be implemented to manage demands for traffic accessing the town centre between Lake Terrace and the East Arterial – Tauhara Road corridors.

Lake Terrace is the main arterial connection between south Taupō and the town centre, and as such has a high movement function. Many of the smaller priority intersections with Lake Terrace experience the same challenges in terms of alignment, gradient and a general lack of space for additional approach lanes or queueing space. For these reasons, it is recommended that a corridor management plan be developed to investigate potential for consolidating access onto Lake Terrace, by restricting movements including right turns in and/or out of minor roads and implementing intersection upgrades to increase capacity at major intersections.

As noted in Section 3, the most common crash type in the Taupō urban area is a right-angle crossing collision. This demonstrates the importance of providing safe facilities for turning from side streets into busy arterial roads at intersections such as Lake Terrace / Napier-Taupō Road. There is also the opportunity to include much higher quality separated facilities to reduce the likelihood of crashes involving pedestrians and cyclists along Lake Terrace.

It is also noted that prioritising or promoting Mere Road as an alternative route to access the town centre is not recommended. Mere Road runs through a predominantly residential neighbourhood with many side street intersections

and residential accessways. There are also limited options to increase capacity without a resulting decrease in safety. Thirdly, there is limited queueing space in the right turn bay from the southern approach of Lake Terrace into Mere Road, with few options to increase the queueing space due to conflicts with the nearby intersection with Taharepa Road. However there is scope to be able to consolidate the operation of these intersections given the close proximity of them and this warrants further consideration.

5.7 Proposed Taupō Network Plan

The findings and recommendations detailed in Sections 5.1 – 5.6 have been summarised into a high-level network plan showing the main considerations in terms of routing, corridor management and intersection improvement locations. This plan is shown for the Taupō town centre in **Figure 5.6** and the recommendations for each area are listed below.

Control Gate Bridge

- The existing Control Bridge is operating at capacity at peak times and the need for additional capacity across the Waikato River is required in the next five years
- Several options have been explored assuming that there is a total of four lanes of capacity across the Waikato River in the medium-long term

Lake Terrace east of Titiraupenga Street

- Improved cycle provision
- Corridor Management Plan – managing intersections, consolidating access along the corridor, traffic management during events
- Intersection improvements at Titiraupenga Street as part of the new arterial

Lake Terrace west of Titiraupenga Street

- Reduced traffic priority (may be through narrowing of corridor, reduced speed limit)
- Greater pedestrian connectivity to the lakefront
- Improved cycle provision

Tongariro Street

- Reduced traffic capacity – two lanes down to one
- Reallocation of space to cycle lanes and enhanced pedestrian connectivity
- Enhanced bus hub (if location retained, or space reallocated to other modes and/or parking if new bus hub location selected)

Spa Road

- Corridor Management Plan – managing intersections, improving and consolidating access along the corridor
- Greater pedestrian connectivity
- Improved cycle provision
- Intersection upgrades (subject to preferred new bridge location) at Titiraupenga Street, Ruapehu Street, Nukuhau Street/Gascoigne Street, Tongariro Street/Spa Road

Titiraupenga Street

- Intersection upgrades as part of the new arterial route (for example changing priority to north/south)
- May require parking management review
- Improved pedestrian connectivity to areas where additional berm parking is provided east of Titiraupenga

Paora Hapi Street – dependent on arterial route and bridge location

- Improved connectivity and intersection upgrades on arterial route

Central business area

- Potential reduce speed limit
- Improved pedestrian connectivity – particularly for the laneways, to the lakefront and the Domain
- Potential new bus hub on Tuwharetoa Street (as part of the Council Office Building development)
- Potential parking building on Heuheu Street (long term)
- Additional berm parking east of Titiraupenga Street

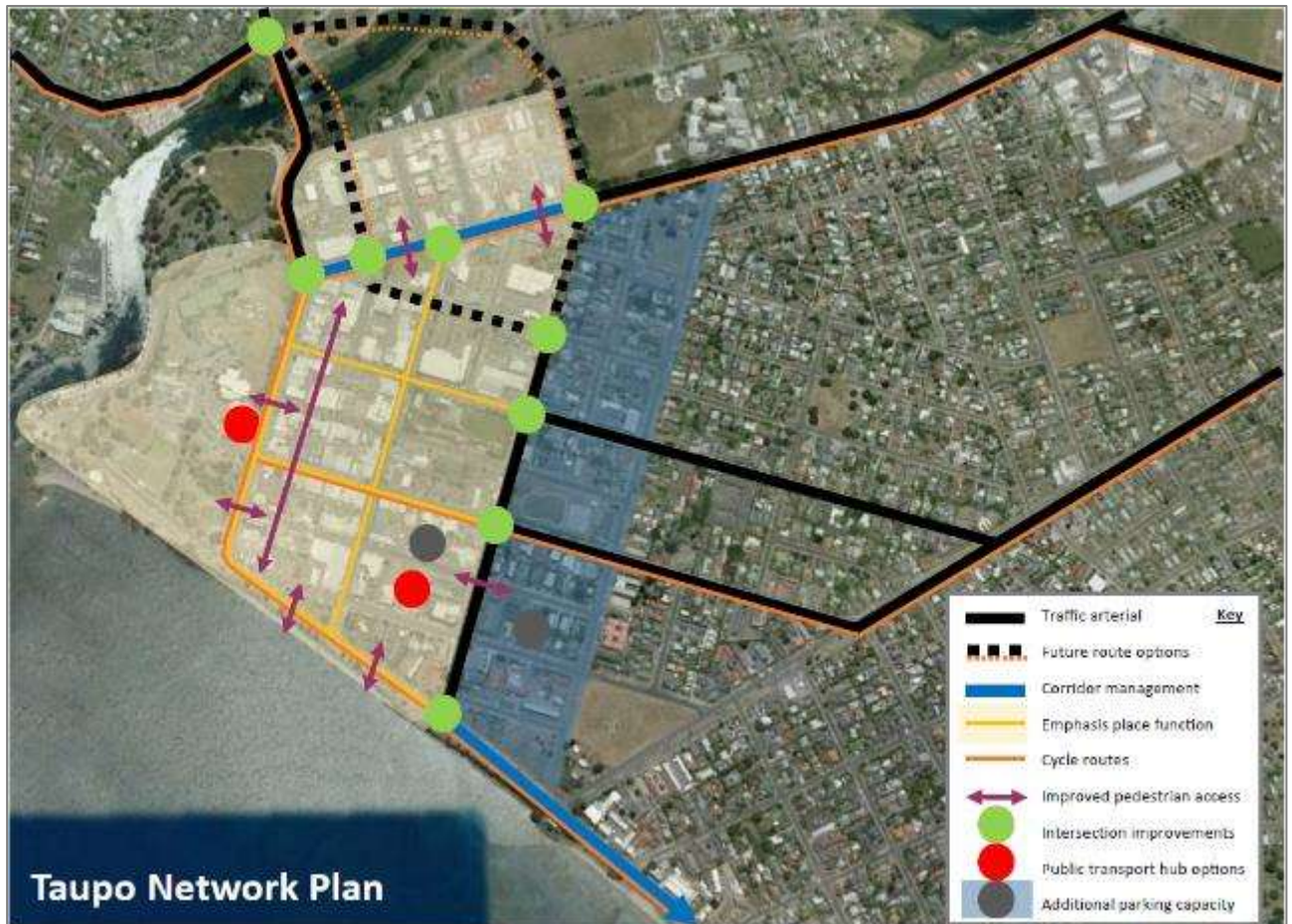


Figure 5.6 Proposed Taupō Network Plan

Appendix A Option Level of Service and Volume Change Plots



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