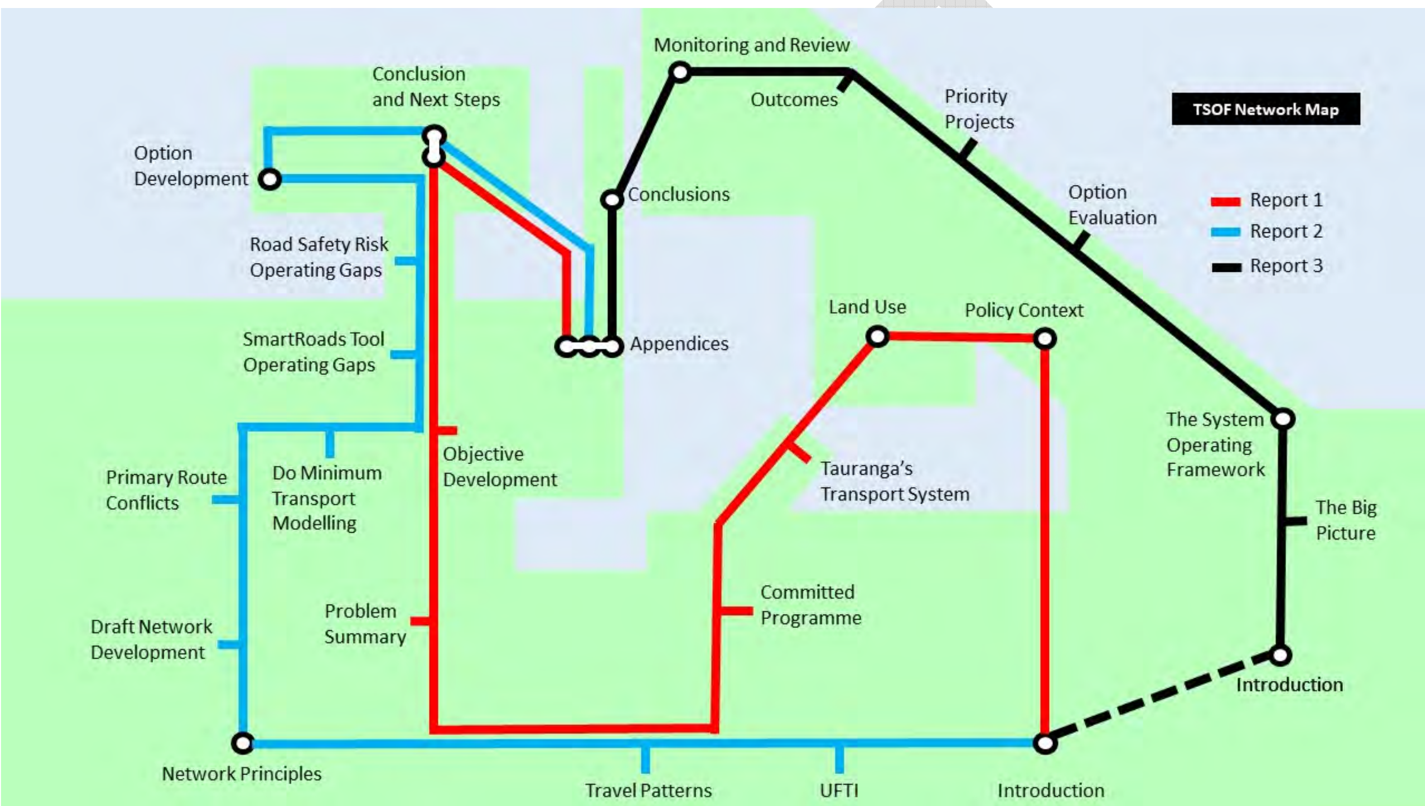
transport system plan

Western BOP Transport System Operating Framework

Report 3: Option Evaluation and Recommendations

9 October 2020



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Appendices

Key to the Golden Threads

Look for these icons through the report to highlight the golden threads of key themes followed in the TSP.

Government Policy Statement for Transport (GPS)

Connected Centres (UFTI)

The four well-beings of social, economic, environmental and cultural.

Revision History

Revision Nº	Prepared By	Description	Date
1	Craig Richards	Draft	18 September 2020
2	Craig Richards	Revised draft addressing feedback from Tauranga City Council (TCC), Bay of Plenty Regional Council (BOPRC), Waka Kotahi NZ Transport Agency (Waka Kotahi), Challenge Team and Peer Review team	09 October 2020

Executive Summary

Background

The Western Bay of Plenty Transport Partners[1] (Transport Partners) are leading the development of the Western Bay of Plenty Transport System Plan (TSP). The first stage of the TSP is to develop a Transport System Operating Framework (TSOF). The framework is intended to guide the development and implementation of projects under the Urban Form and Transport Initiative (UFTI) Programme Business Case.

This report should be read in conjunction with TSOF Report 1 (background and objective setting) and Report 2 (network evaluation and option development). The TSOF has been developed over a five-step process illustrated in the diagram below. The boxed steps are described in this report.

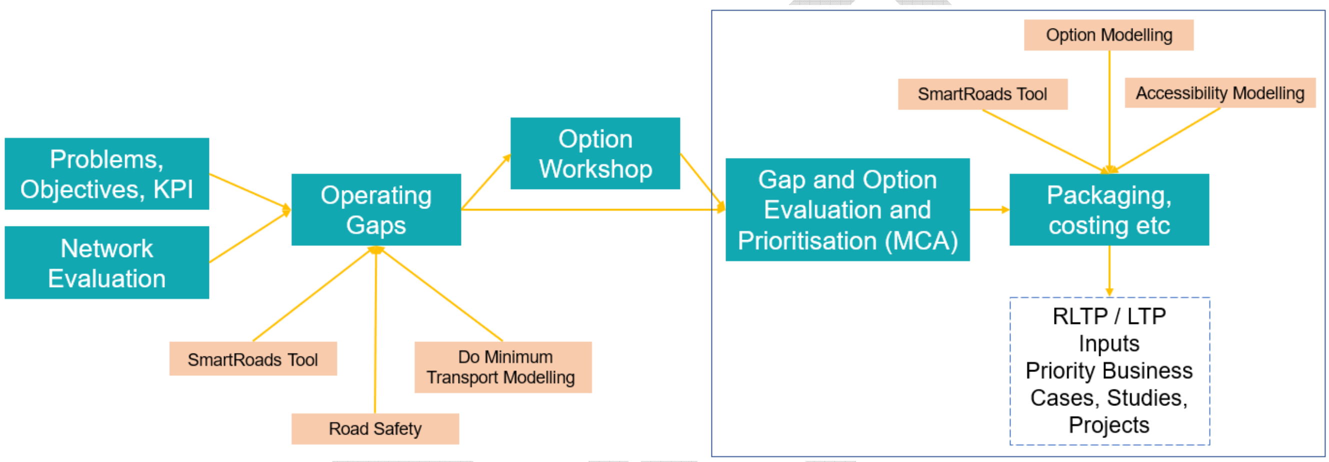


Figure 1: TSOF Five-Step Process

UFTI

The Urban Form and Transport Initiative (UFTI) defines the long-term land use and transport vision for the Western Bay of Plenty sub-region. UFTI is a Programme Business Case under which the TSOF sets out prioritised transport activities. The land use aspects of UFTI are enacted through the SmartGrowth Spatial Plan review. The UFTI 'Connected Centres' land use and transport programme is based around the concept of higher density residential neighbourhoods and a multimodal transport system collectively delivering improved accessibility to social and economic opportunities. The multimodal transport system is necessary as "we cannot afford to, nor do we have the space within the sub-region and city, to build roading necessary to cater for the expected future demand"[2]. The table in Appendix F of this report shows how the TSOF delivers or supports each of the UFTI Programme Business Case Key Moves.

[1] Tauranga City Council, Waka Kotahi, Bay of Plenty Regional Council, Western Bay of Plenty District Council, Port of Tauranga, Iwi and Priority One.

[2] UFTI Final Report

Challenges

UFTI defines three key challenges facing the region in terms of land use and transport;

- Lack of housing and transport choice
- Access to community facilities and infrastructure levels of service not aligned with community expectations and needs
- Dispersed land use and increasing traffic will impact on the safe and efficient movement of people and goods.

A holistic solution is needed to improve transport choice, accessibility and reduce the environmental impact of transport. Demand needs to be managed through macro trends such as town planning (as directed by the UFTI Connected Centres programme), improved public transport (PT), walking and cycling facilities that maximise uptake, flexible/remote working initiatives, and the carbon efficiency of travel will need to improve with the uptake of electric and hydrogen vehicles (cars, buses and trucks), active transport and micro-mobility.

Opportunities

In recent years the rise of personal mobility and use of technology has influenced travel demand and choice. Transport options are becoming 'cleaner' and the personal mobility movement has influenced the rise of the '15-minute city', promoted by UFTI and similar land use and transport strategies around the world. Technology is improving access to and the attractiveness of PT. Electric bikes are extending the reach of cycling in terms of distance and users. Other emerging trends that could dramatically change the transport system in future include:

- More advanced batteries, lasting longer and with less environmental impact accelerate electric vehicle (EV) uptake.
- Data availability and personalised transport such as on demand buses, mobility as a service etc.

We need to plan for the future based on the transport system of today, but also be cognisant of how things could change in future and build adaptability into system planning and design.

The System Operating Framework

A great transport system supports the people and businesses that depend on it, supports urban growth in a sustainable manner and enhances the places we value and enjoy. Our existing transport system has evolved with an emphasis on single private vehicle use, rather than multimodal transport prioritisation.

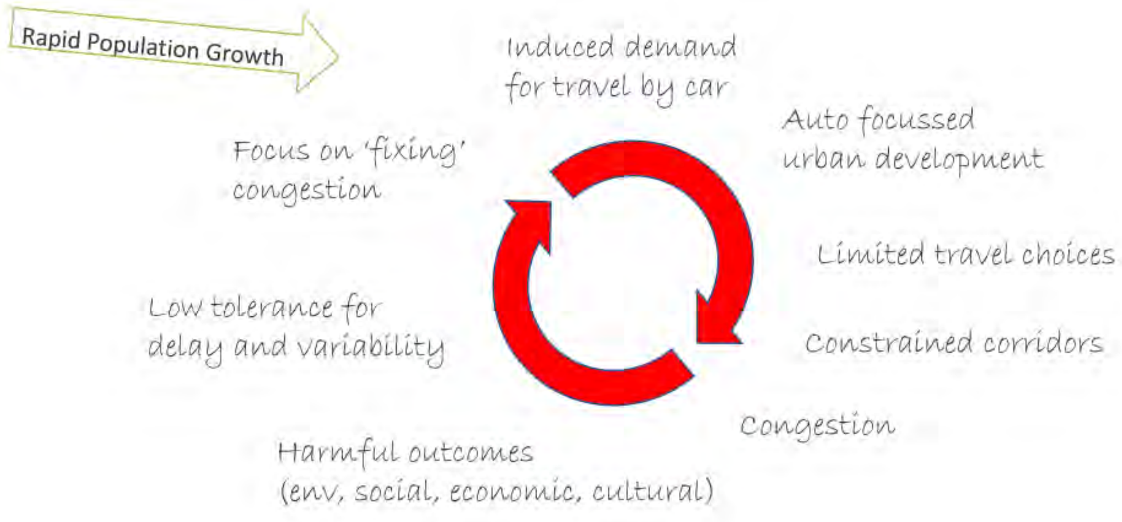


Figure 2: Existing Transport Cycle

The overarching priority for the early phases (0-3 years) of the TSOF is optimisation of the system to 'flatten the curve' by reducing the volume of traffic using roads in peak periods and increasing throughput without creating significant new capacity. The optimisation model considers network management and travel behaviour change before (targeted) capacity creation.

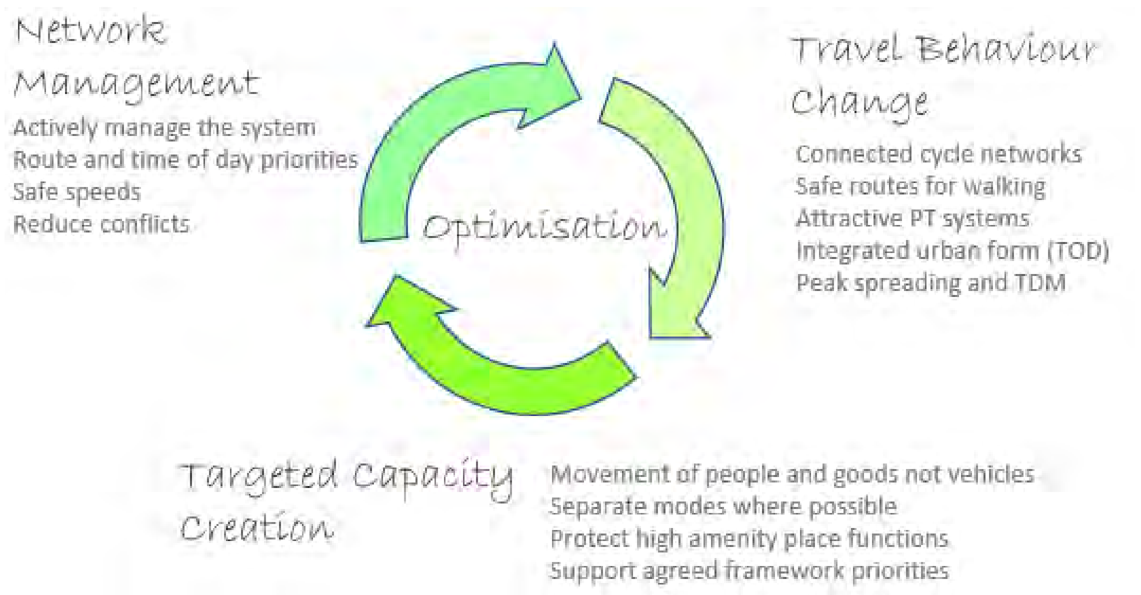


Figure 3: Optimisation Model

A network of primary routes that connect activity centres were defined with the Transport Partners thorough the TSOF development, as described in TSOF Report 2. The primary routes for each mode were defined based on network principles and draw upon evidence such as origin / destination travel patterns and the UFTI strategic journeys. Higher amenity, more placemaking and lower movement priority is promoted within activity centres. Primary traffic and freight routes follow State Highways as these provide for longer distance movement and generally avoid land use conflicts, within activity centres for example. The objective being to reduce traffic and freight volumes within residential and higher amenity areas. Primary PT and cycle routes connect suburbs with centres and improve accessibility to opportunities such as schools, recreation, social activities and jobs via safe and direct routes.

Figure 4: Primary Routes and Centres

Illustrations are provided below to show indicatively what a primary route for different modes may include in terms of multimodal movement and parking, access facilities and amenity features. The actual outcomes will depend on constraints and access requirements, trade-offs over space allocation between modes will be required due to the limited road corridor widths in some places. The mode priorities will support this decision making.

Figure 5: Illustration Showing the Features that Could Make up a Primary Cycle Route with Bus Access

The TSOF sets a framework for managing travel demands across the network. The proposed managed lane (HOV) priority on the Takitimu North Link presents an opportunity to increase vehicle occupancy, and reduce traffic volumes, that could be enhanced through wider application across the network. Applying some form of HOV priority on the 15th Avenue corridor, as opposed to SH2 or SH29, appears more feasible and aligns with the UFTI strategic journey for this route, however the application and design of this outcome will need to be confirmed through a subsequent business case.

Option Evaluation and the Programme of Activities

The overarching priority for the early implementation phases (0-3 years) of the TSOF is optimisation of the system to 'flatten the curve' by reducing the volume of traffic using roads in peak periods and increasing throughput of the existing system without creating significant new capacity. This will mean that the transport system will better support movement by all modes, while business case projects to define the need for longer term improvements are completed.

Engagement Platform

A gap and option engagement platform was created to assist with the prioritisation of projects into 0-3, 3-10 and 10-30 year timeframes. The platform has several valuable attributes including;

- It follows a sequential process that shows how the TSOF considers the potential impact of the gaps and the potential benefit of each option, to derive at a combined gap and option evaluation.
- The platform is adjustable, if new gaps are identified and/or new options are developed these can be added and evaluated against the existing gaps and options at any time. If priorities change, e.g. a change in GPS or regional / local policy, the criteria can be changed, and the gaps and options can be re-evaluated.

The platform allows the consultant and partner technical staff to compare gaps and options to inform subsequent prioritisation. Prioritisation by the team considers other factors, for example affordability, sequencing and potential for construction disruption.

List of Activities

The key activities prioritised in the 0 to 3-year period are summarised below. The full programme of activities is provided in Appendix D.

At this stage the list of activities is unconstrained in terms of affordability and deliverability. The list of activities will be reviewed by each of the Partner organisations through the Regional Land Transport Plan (RLTP) and Long Term Plan (LTP) processes. It is likely that some activities in the 0-3 year period will shift into the 4-10 year period and some activities in the 4-10 year period will shift into the 10-30 year period.

Table 1: 0-3 Year Action Plan Summary

Activity	Objective	UFTI Alignment
Strategy, policy and programme development as recommended in the full programme of activities.	Support the TSOF objectives (safety, accessibility, mode shift and freight reliability).	The sub-regional PT, mode shift, and emission reduction initiatives package
Optimise bus services and frequencies city wide, short term improvements.	Continual improvement of the bus system to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package
Improve bus infrastructure city wide, short term improvements including stops and associated facilities.	Continual improvement of the bus system to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package
City wide PT real-time information.	Support PT use through data availability at stops and via personal devices.	The sub-regional PT, mode shift, and emission reduction initiatives package
Deliver minor / low cost optimisation, safety and placemaking activities in the 2020 to 2023 period as described in full list of activities (refs 5-7 & 16-26).	Improve access to centres, support travel time reliability, improve safety.	Various including; CBD mount, freight, mode shift, eastern corridor packages and movement, environment, prosperity KPI.

Activity	Objective	UFTI Alignment
Papamoa East Interchange and Wairakei/Te Tumu transport infrastructure.	Support quality urban growth and accessibility in eastern suburbs.	Eastern corridor package
Combined preferred scenario bus services and supporting infrastructure (access facilities, dedicated connections, park and ride, bus priority etc) business case.	Frequent and reliable PT services, priority and access facilities to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package
Priority area cycle route facilities (Accessible Streets programme - Area A Mount/Papamoa/CBD and Area B Otumoetai/Bellevue/Brookfield)	Address safety and mode conflict gaps to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package
Hewletts sub area single stage business case including Totara St, Golf Rd, Maunganui Rd.	Improve accessibility, safety and access to Port of Tauranga support UFTI Strategic Journey.	Freight access to the Port and the upper north island package
Turret / 15th Ave multimodal improvements business case including Welcome Bay Road.	Improve accessibility and travel time reliability for all modes support UFTI Strategic Journey.	The central corridor urban form and transport corridor package
SH29 Tauriko complete long-term business case and implement Enabling works business case	Support quality urban growth, improve safety and improve travel time reliability.	The western corridor package
Tauriko West and Tauriko Business Estate internal transport networks	Support quality urban growth and accessibility within planned urban growth areas	Supports planned urban growth within UFTI
Western Corridor ring route (SH29 – SH36 section) staged to align with planned urban growth	Multimodal transport facilities to support planned urban growth in the western corridor	The western corridor package
Te Papa Indicative Business Case recommended programme	Support quality urban growth and accessibility in an activity centre.	The central corridor urban form and transport corridor package
Otumoetai, Brookfield, Bellevue area multimodal improvements to support spatial planning	Improve accessibility, safety and support mode shift.	The central corridor urban form and transport corridor package

A high level, indicative cost estimate for the framework phase has been undertaken to understand the potential scale of costs associated with the activities. As the detail of the activities is unknown at this stage (to be determined through the subsequent business cases), the cost estimate is also uncertain and indicative only.

The estimated cost of the programme (as at 09 October 2020) is shown in Table 2. The affordability and deliverability assessment subsequent to the TSOF is likely to change the period some activities and associated costs fall within, e.g. some activities and costs will shift from the 0-3-year period to the 4-10-year and some from the 4-10 to the 11-30-year period.

Table 2: Programme of Activities Indicative Cost Estimate

	Years 0-3	Years 4-10	Years 11-30	Total
Bus Opex	$78.5M	$220M	$679	$978M
Capex	$218M	$384M	$878	$1.47B

	Years 0-3	Years 4-10	Years 11-30	Total
Total	$297M	$604M	$1.56B	$2.45B

Benefits of Investment

The transport benefits of the investment have been assessed using the Tauranga Transport Model (TTM), accessibility model, SmartRoads tool and a review of safety interventions against the risk areas. More detail on these analytical tools is provided in TSOF Report 2.

The TTM models travel by car, bus, truck and cycle under various land use and transport system scenarios. The land use adopted for the TSOF transport modelling aligns with the UFTI land use pattern. The TTM compares options identified in the TSOF with a ‘reference scenario’ that includes only projects assumed to be proceeding regardless of TSOF, e.g. Takitimu North Link.

The transport modelling has considered a number of sensitivity tests including different timing of activities and different application of parking and PT costs and attractiveness factors. Details of which are described in the separate modelling report.

Across the whole system, the following key outcomes are noted from the transport modelling:

- The high population growth and constrained typography create a very dynamic transport system, with changes in one part of the network impacting other locations, through upstream/downstream traffic-release effects, trip diversion or mode shift.
- The overall predicted mode shift to cycling is of a similar scale to that for PT, however they differ in their coverage and locations. While the cycling uptake is quite widely spread (and a function of local network upgrades), the PT shift is more focussed on longer-distance travel and key destinations.
- Although the overall PT mode share is low when averaged across the whole region, critically however, it is predicted to be high on key corridors or movements.
- Detailed modelling in the Tauranga Transport Hybrid Model (macroscopic model)
- The addition of Travel Demand Management measures (parking pricing, bus fares, toll location and pricing) show reduced levels of car travel, increased PT mode share and improved system level of service. Such measures help lock-in the network performance gains that may otherwise be eroded by induced car travel.

Further key findings from the transport modelling are outlined below.

- PT mode share increases from around 2% up to potentially 10%, but the scale of shift is dependent on application of Travel Demand Management (TDM) policies e.g. parking management and bus fares. Modelled PT mode share is higher on a corridor basis as shown in the table below (AM peak citybound). Mode share is a function of both bus patronage and traffic volume in these particular locations. Where PT mode share reduces in a particular location, this is because traffic volumes increase on the route due to growth and the proportion of travel by bus is lower.

Table 3: PT Mode Share by Corridor City Bound (Ranges Indicate Differences in TDM Sensitivity Tests)

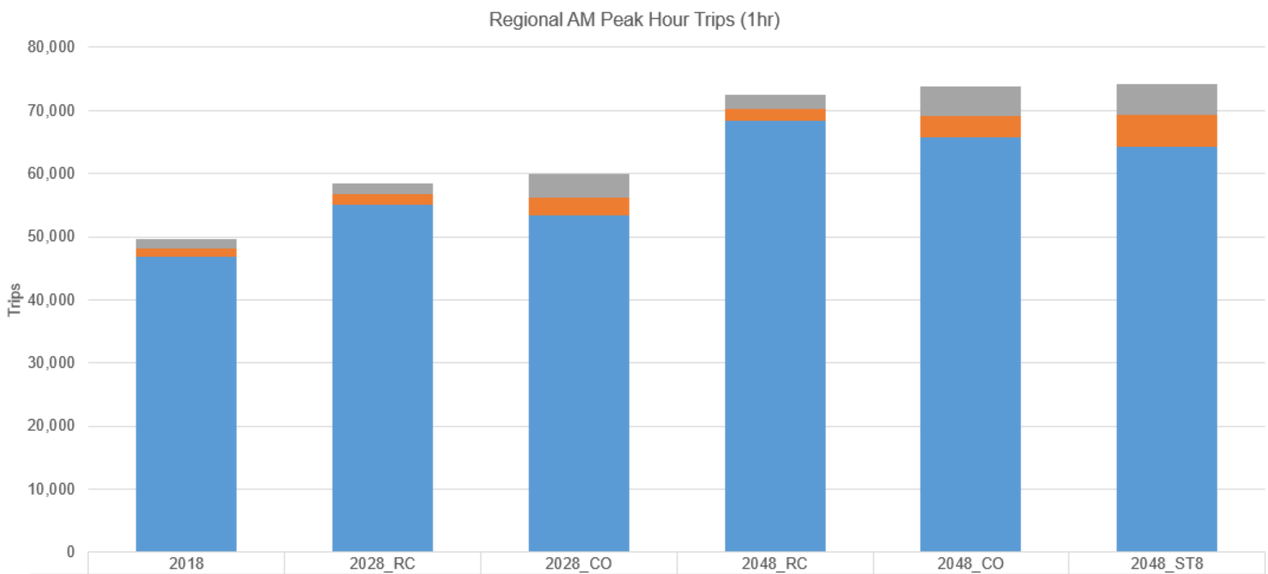
Location	2018	2028	2048
Cameron Road (CBD end)	7%	22%	22-28%
Cameron Road (Greerton end)	12%	30%	39-47%
15th Avenue	13%	13%	17-19%
Existing SH2 (Bethlehem)	1%	18%	14-18%
Wairakei Town Center	0%	37%	30%
Gravatt Road	10%	21%	23%

Location	2018	2028	2048
Maunganui Road	3%	9%	10-13%
Chapel Street	5%	9%	7-10%

- Mode share for cycling increases under the recommended programme from around 3% to approximately 7% during the AM peak hour for trips within Tauranga.
- Gains in PT and cycling mode share are most significant in the first 10 years. Over this time monitoring and review will enable further improvements to be made, adapting to change, and the outcome for mode share could be higher than envisioned at this stage.
- A process was developed to estimate level of service for general traffic within the Tauranga Transport Hybrid Model (macroscopic model). This is an indicator with no associated targets within the TSP KPI. In 2028, there are improvements in levels of service along Ocean Beach Road northbound, Totara Street southbound, Turret Road Bridge inbound and SH36 northbound in the Tauriko area. However, there appears to be a degradation in levels of service along SH29A westbound. In 2048, there are improvements along Ocean Beach Road northbound, SH29A southbound approaching Turret Rd / Welcome Bay, along Ohauiti Road and Poike Road, on Takitimu Drive at the Elizabeth Street intersection, southbound on Takitimu Drive approaching SH29 and along Maunganui Road / SH2 northbound between Girven Road and Hewletts Road. However, there appears to be a degradation on SH36 northbound in Tauriko and along SH29A westbound towards Barkes Corner. Modelling of a city-wide programme with significant uncertainty in terms of the outcomes and timing of projects has to make significant assumptions that influence findings especially at a macroscopic level. These findings are indicative only and further work will be required in future to continue to analyse the programme as project details and timings are confirmed.
- Travel time analysis shows despite significant increases in travel demand, travel times on key strategic journey's do not increase substantially. Travel times by bus reduce significantly from current levels, providing a closer travel time differential between modes. Travel times on primary freight routes to the Port are relatively maintained as per the TSP objective despite increased demands.
- Transport modelling indicates that by reducing traffic growth the cost of crashes can be reduced compared with the reference case. Additional crash cost savings will be achieved through measures to support safety of vulnerable road users such as cycleways, intersection treatments and general safety improvements in high risk areas. The safety benefit of these would be quantified in the business case phase.

With assumed uptake in electric vehicles supported by the EV strategy and mode shift supported by activities in the programme, vehicle tailpipe carbon emissions reduce by 50% (2028) and 90% (2048). However, considering holistic carbon creation in electricity generation and infrastructure, wider and national level intervention is necessary to achieve the net zero carbon outcome by 2050 as described in the emissions report within Appendix A.

The following figure shows the change in modelled AM peak hour trips by mode for 2018, 2028 and 2048 scenarios.



	2018	2028_RC	2028_CO	2048_RC	2048_CO	2048_ST8
Cycle	1,500	1,800	3,800	2,400	4,700	4,700
PT	1,400	1,700	2,800	1,900	3,400	5,200
Veh	46,800	55,000	53,400	68,300	65,800	64,200

Figure 6: Transport Model AM Peak Hour Mode Share (RC= reference case, CO= option, ST= sensitivity test)

Accessibility Modelling

An accessibility model was developed for the TSOF to provide an indication on how accessibility to opportunities (employment, education, recreation etc.) changes under the recommended programme. The accessibility model evaluates the change in travel time between different origins and destinations by mode with regard to specific performance indicators. The accessibility model findings are summarised below, and a detailed accessibility modelling report is provided separately.

Performance indicator: Percent and number of jobs accessible from all population within travel time thresholds by PT (45 minutes), cycle (15 and 30 minutes) and private vehicles (30 minutes):

- Car – Some localised accessibility improvements. Overall, no significant change between the reference and option scenarios, generally remains the most accessible mode
- Cycle – There is over 20% more jobs accessible in the Option than in the Reference scenario, this represents between 2% (15-minute threshold) and 5% (30-minute threshold) of total employment
- PT – A significant improvement in the number of jobs accessible is indicated with the Option scenario, which represents more than 15% of total employment in 2028 and 2048.

Performance indicator: Percent and number of population within the objective travel time thresholds of 'key destinations' including CBD, town centres, secondary schools, major parks/reserves and universities by all modes.

- Car – Generally no significant difference between reference and option scenarios, noting car remains at the highest level
- Cycle – Increases are particularly significant for all key destinations around the CBD area. The highest increases are from Waikato University Tauranga CBD Campus with around 6900 and 8400 more population within the cycle travel time threshold under 2028 and 2048 option scenarios
- PT – There are significant improvements in the numbers of population accessible, and most increase by more than 10% of the total population compared with reference scenarios. The increase to the CBD destination in 2048 nearly doubles with the Option, exceeding the accessibility by car.

Performance indicator: Percentage of population and employment within 500m buffer of frequent PT Service (combined 15 mins headway or less):

- There is significant improvement in the population accessible to high frequency bus stops in the Option scenario, the proportion of population accessible more than doubles the reference scenario in 2028 and 2048 (from around 30% to over 60% of the population is accessible to high frequency bus services).

Performance indicator: Percentage of population and employment within 500m cycle buffer distance of high quality (AAA) cycle facility to key destinations:

- There is significant improvement in the population accessible to high quality cycle facilities in the Option scenario, the proportion of population accessible to high quality cycle facilities increases from 25% to 41% in 2028 and from 26% to 47% in 2048 comparing the reference and option scenarios.

A detailed standalone accessibility modelling report has been provided separately.

Land Use Benefits

The land use benefits of the TSOF are consistent with and aligned to those identified by UFTI. The SOF is one of the key tools used to translate UFTIs strategic direction on urban form and transport, known as the 'Connected Centres' programme, into implementation. This programme includes catering for approximately 200,000 additional people, 95,000 new homes, and two million additional transport movements per day expected within the next 30 to 70 plus years across the Western Bay of Plenty sub-region.

The TSOF has had a particular focus on the first 30-year period of the UFTI programme. It has considered the demands from the projected growth and employment and how to support this from a transport system perspective in a way that achieves agreed benefits aligned to the UFTI programme. This has included how to deliver the function of the strategic network from a network form (e.g. mode priority) perspective. In undertaking this analysis, the SOF has been able to further define the activities identified by UFTI to implement the Connected Centres programme. In achieving this, the SOF supports planned land use in existing areas of Tauranga City like Te Papa and growth areas like Te Tumu, Tauriko and Omokoroa in ways that support increased intensification, multimodal and environmental outcomes and the benefits identified by UFTI.

Economic Benefits

A high-level economic assessment of the programme has been undertaken to consider the potential economic benefits against the costs. At this framework stage, the economic assessment is high-level as the actual benefits and costs of the projects will be determined through the subsequent business cases. The economic cost below is not the same as the total programme cost as activities which do not have significant benefits or costs are not included in this high level economic analysis, and the total cost below is discounted to present day cost where the programme cost is not at this stage. Three main benefits were estimated using the TTM:

- Travel time, vehicle operating cost and crash cost benefits
- PT benefits
- Cycle benefits.

The economic evaluation is summarised as follows:

Table 4 : Economic Evaluation Summary

Item	Value
Capital Cost (years 0-3), $m	$514 m
Capital Cost (years 4-30), $m	$815 m
Annual PT operating cost in 2028, $m	$25 m
Annual PT operating cost in 2048, $m	$34 m
Discounted Capital $ Operating Costs, $m PV	$1264 m PV

Item	Value
Discounted Benefits, $m PV	$3,402 m PV
Benefit/Cost Ratio	2.7

Monitoring and Review

A plan to monitor the TSOF over time is supported by detailed key performance indicators and targets is included and will be a subset of UFTI monitoring. Improved data collection and analysis is essential to effective monitoring and evaluation / reporting to sponsors and communities.

The next step beyond the TSOF phase is for the TSP governance group to endorse the programme, supported by the findings in this report, and for this to inform RLTP and LTP submissions for the 2021 planning cycle. Affordability and deliverability of the programme will be considered through this phase and is likely to change the programme in terms of the activities included within each of the time periods. A Shared Tactical Implementation Plan will be completed based on the TSOF to summarise the programme and activities that the Transport Partner organisations agree to contribute toward.

The TSOF provides a system operating framework that refines the transport components of the UFTI Programme Business Case to inform subsequent RLTP and LTP processes. Key to realising anticipated benefits, is engagement and collaboration through the next steps of the TSP process.

1 Introduction

This report follows the route set out below. Within the report, yellow dots show the current chapter.

The Western Bay of Plenty Transport Partners[3] (Transport Partners) are leading the development of the Western Bay of Plenty Transport System Plan (TSP).

The purpose of the TSP is to determine how the Transport Partners can translate the Urban Form and Transport Initiative (UFTI) into implementation. UFTI forms the Programme Business Case for transport and land-use in the Western Bay of Plenty sub-region.

The first stage of the TSP is to develop a Transport System Operating Framework (TSOF) to guide the development of projects over a 30-year outlook. The outcome of the TSOF is a multimodal network plan and a recommended programme of improvements to deliver the transport system operating framework. The actual timing and implementation of the activities defined in the TSOF will be subject to the RLTP, LTP and subsequent business case phases.

This report has been prepared during the option evaluation stage of the TSOF development, see Figure 7. This report should be read in conjunction with TSOF Report 1 (background and objective setting) and Report 2 (network evaluation and option development).

TSOF Step	Objective	We are here
1	Establish context and set strategic objectives	
2	Define network attributes and key performance indicators	
3	Identify priority networks and places	
4	Identify network gaps and develop options	
5	Evaluate options and determine recommended programme	★

Figure 7: TSOF Five Step Process

The aim of this process has been to create the best possible transport system framework for the Western Bay subregion. The TSOF development has included regular involvement and engagement across the TSP Transport Partners, a peer review team and challenge team delivering a robust, evidence based and repeatable process that sets strong foundations for wider engagement through the RLTP and LTP phase. This wider engagement is a key next step to deliver outcomes that are for the people by the people, engagement and involvement is a key theme to the longevity and success of the TSP going forward.

[3] Tauranga City Council, Waka Kotahi, Bay of Plenty Regional Council, Western Bay of Plenty District Council, Port of Tauranga, Iwi and Priority One.

The TSOF is a major first step in the TSP process. Translating the TSOF into the RLTP and LTP with associated wider engagement and feedback is the next step. This will enable work to start on delivering the Framework through the studies, quick win projects and priority business cases defined in this report.

2 The Big Picture

This chapter describes the strategic direction and influences that inform the development of the transport system operating framework.

A great transport system supports the people and businesses that depend on it, supports urban growth in a sustainable manner and enhances the places we enjoy. Many of the policies described below promote these key outcomes.

2.1 Guiding Policy

Urban Form and Transport Initiative

The TSP is one of the delivery mechanisms for transport outcomes directed by the UFTI Programme Business Case. The relationship between the TSP and other relevant policy and delivery documents is described in TSOF Report 1, which includes the diagram below.

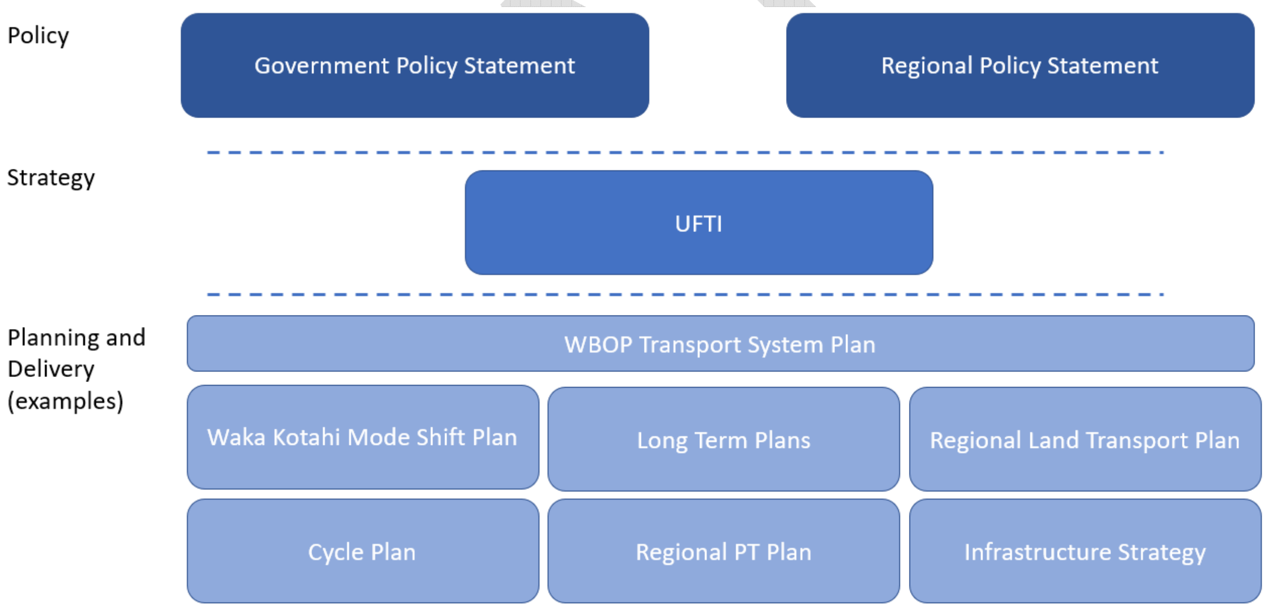


Figure 8: TSP Guiding Policy and Strategies

The UFTI Connected Centres vision, as described in TSOF Report 2, has guided the development of the TSOF that aims to deliver multimodal transport connections between centres as well as improving spaces for people within these centres.

The UFTI programme business case sets out Packages and Key Moves recommended to deliver the UFTI vision. Completing the TSOF is one of these key moves. The key moves have guided the TSOF optioneering and packaging of projects, for example the following UFTI key moves are prioritised in the TSOF programme (examples only, all of the TSOF activities align with one or more UFTI key moves or support achieving the UFTI key performance indicators):

- Confirm locations for PT Hubs and Interchanges – The TSOF sets the framework for PT routes showing where hubs, interchanges and park and ride sites could be delivered, a PT infrastructure business case is a priority project to define the timing, concept and funding for these key system components.
- Design the Hewletts Road optimisation package and complete Hewletts Road sub area single stage business case – both of these activities are prioritised in the 0-3-year period of the TSP delivery.
- Plan and facilitate the uptake of low carbon transport – the TSOF programme includes a project to define and implement a strategy on how the Transport Partners can influence uptake of electric and hydrogen vehicles.
- 15th Avenue / Turret Road improvements – Improved multi-modal access, safety, better travel choices, and Te Papa placemaking – this business case is prioritised through the TSOF
- Tauriko, Te Tumu, Te Papa business case activity – respective business cases to guide agreed and current UFTI planned growth for next 30 years of development prioritised through the TSOF.

The table provided in **Appendix F** shows how the TSOF aligns with each of the UFTI key moves.

UFTI emphasises the need for collaboration and engagement as essential in weaving transport and land use together. The UFTI He Manukura report highlights the concept of 'Connection', weaving together the issues, concerns and aspirations of iwi and hapū and integrating those into the broader story for the sub-region that connects across all elements of cultural, spiritual, environmental and economic wellbeing.

Transport Outcomes Framework and the Government Policy Statement for Transport

The Ministry of Transport (MoT) Transport Outcomes Framework identifies what the government is aiming to achieve through the transport system. The overall purpose of the transport system is to improve people's wellbeing and the liveability of places. This is measured through five key outcomes as depicted below.

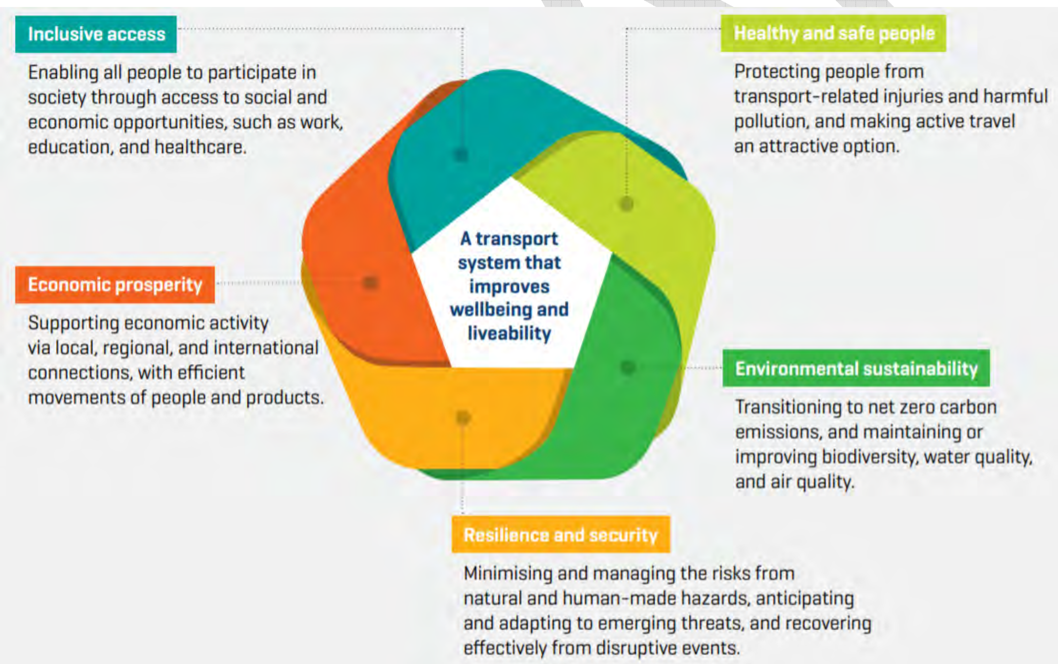


Figure 9: MOT Transport Outcomes Framework (Source MOT).

The TSOF is strongly aligned to achieving the outcomes sought through the Outcomes Framework:

- Inclusive access is enhanced through improved accessibility to economic and social opportunities delivered by the programme as described in this report and the associated accessibility modelling.
- Safety is improved through investment in high road safety risk areas. Safety is one of four investment objectives on which the TSOF programme has been evaluated.

- Economic prosperity is supported through the freight access investment objective. In particular, the TSOF programme supports movement of freight to and from Port of Tauranga, New Zealand's largest Port by freight volume and a key economic hub for the upper north island.
- Environmental sustainability is enhanced by the strong emphasis on mode shift to low / zero emission modes. A specific emissions study has been undertaken to consider how the local transport sector can contribute to the New Zealand target of net zero carbon emissions by 2050, the recommendations are discussed in this report.
- The TSOF supports a more resilient transport system by extending transport connections into new growth areas increasing the routes available in the case of an emergency. Any new projects delivered as a result of UFTI / TSOF will be built to modern standards with improved resilience to natural hazards.

The Government Policy Statement for Transport (GPS) 2021 guides transport investment to achieve the outcomes described above. The GPS 2021 promotes a land transport system that delivers safe multimodal access opportunities, supports economic development and has lower environmental impacts.

The TSOF has a strong alignment with the GPS. The four objectives of the TSP; safety, mode shift to low emission transport choices, accessibility and freight reliability, align directly to the GPS outcomes. The more detailed key performance indicators described in this report show how the TSP will monitor the effectiveness of delivery so that in future the project partners[4] (Project Partners) will have clear accountability linking back to the GPS via the UFTI programme business case. The Living Standards Framework

The living standards framework (LSF) provides guidance in considering the collective impact of policies on sustainable intergenerational wellbeing. The framework defines four capitals that translate into the four wellbeing's that are incorporated within the Local Government Act. The TSOF positively contributes to each of the four wellbeing's as described below.

Table 5: TSOF Contribution to Wellbeing Indicators

Wellbeing Indicator	How the TSP Positively Contributes to the Indicator
Environmental	The TSP prioritises mode shift to no / low emission transport choices, uptake in electric vehicles and freight mode shift to rail and costal shipping. The outcome will be lower emissions and lower environmental impact of transport.
Cultural	The TSP recognises Iwi guardianship of natural resources and as Partners on this journey. This is a long term process and both UFTI and the TSP promote more inclusive decision making with Iwi and local Hapu going forward. It also recognises that cultural wellbeing encapsulates the holistic view of environmental, social and economic wellbeing.
Social	The Connected Centres theme from UFTI is delivered through the TSP. This will improve access to social, recreational, health and economic opportunities and

[4] Tauranga City Council, Bay of Plenty Regional Council, Western Bay of Plenty District Council, Waka Kotahi, KiwiRail, Port of Tauranga

Wellbeing Indicator	How the TSP Positively Contributes to the Indicator
	improve the social capital of the people that relay on the transport system.
Economic	Commercial vehicle movement will be more reliable, have less travel time variability, so businesses can rely on getting product where it needs to be on time. Supporting access to Port of Tauranga is a high priority. Improved accessibility to jobs and improved access to activity centres where people shop and trade will also support improved economic outcomes.

2.2 Challenges

The challenges facing the subregion in regard to transport and land use planning are documented in UFTI as:

- Lack of housing and transport choice
- Access to community facilities and infrastructure levels of service not aligned with community expectations and needs

Dispersed land use and increasing traffic will impact on the safe and efficient movement of people and goods. Transport challenges have arisen through the long-term growth issues that the sub-region is facing now and will continue to face. Growth and demand for people and goods movement has been accompanied with an imbalanced prioritisation and investment in the transport system. This has resulted in a cycle of both private vehicle reliance and vehicle orientated development, rather than people focused urban form.

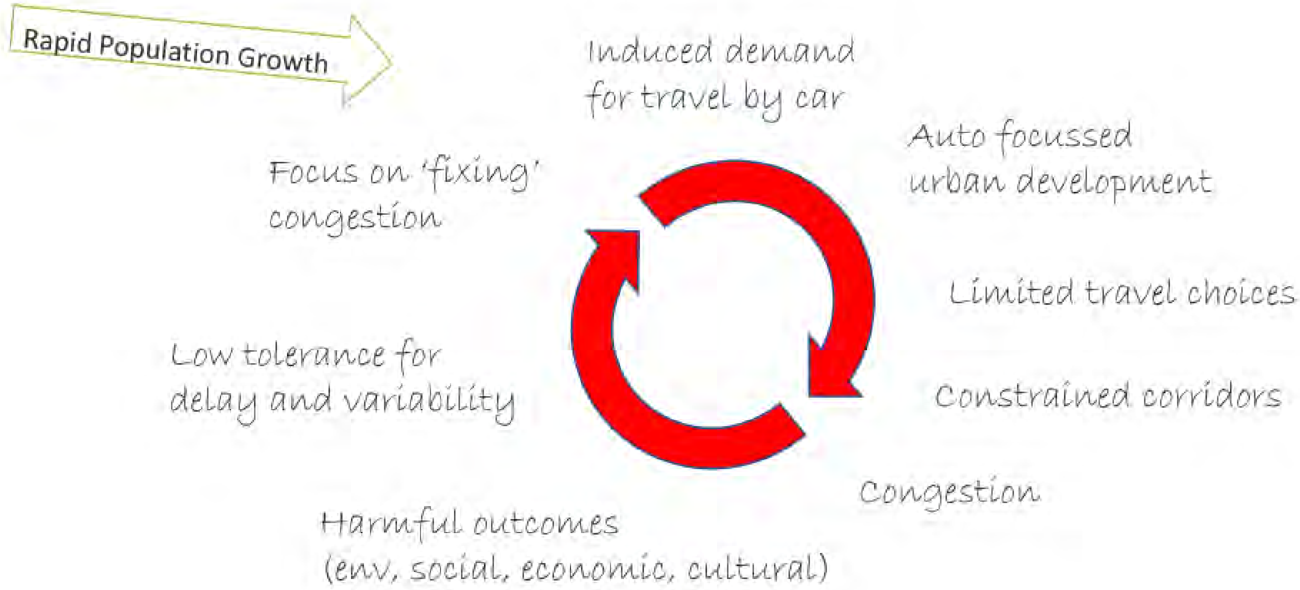


Figure 10: Mode Biased Transport Planning Cycle

Emissions

The transport sector produces around 60% of the regions carbon emissions, with the majority of this from road transport and the use of petrol, diesel and LPG. New Zealand has a target to achieve net zero carbon emissions by 2050. The TSOF has a role to contribute to this outcome by identifying interventions that reduce emissions associated with transport. A shift to non-fossil fuelled vehicles is an important aspect of this, but other levers will need to be applied as well at a local, regional and national level for the target to be realised. This is the finding of a specific emissions study is provided in **Appendix A**.

For transport emissions to be in line with the zero-carbon trajectory (as depicted by the grey line in the graph below), a 40% reduction from business-as-usual emissions is needed in 2028 (shown by the purple bar in the graph). By only reducing private petrol and diesel vehicle kilometres travelled (to determine the amount of mode shift required away from private vehicle use), the 40% emissions reduction is equivalent to a 75% reduction in private petrol and diesel vehicle kilometres travelled (i.e. internal combustion engine or ICE). This is obviously unachievable and signals that, even with substantial electric vehicle uptake, due to rising demand in travel and transport, a more holistic solution is needed to reduce transport emissions.

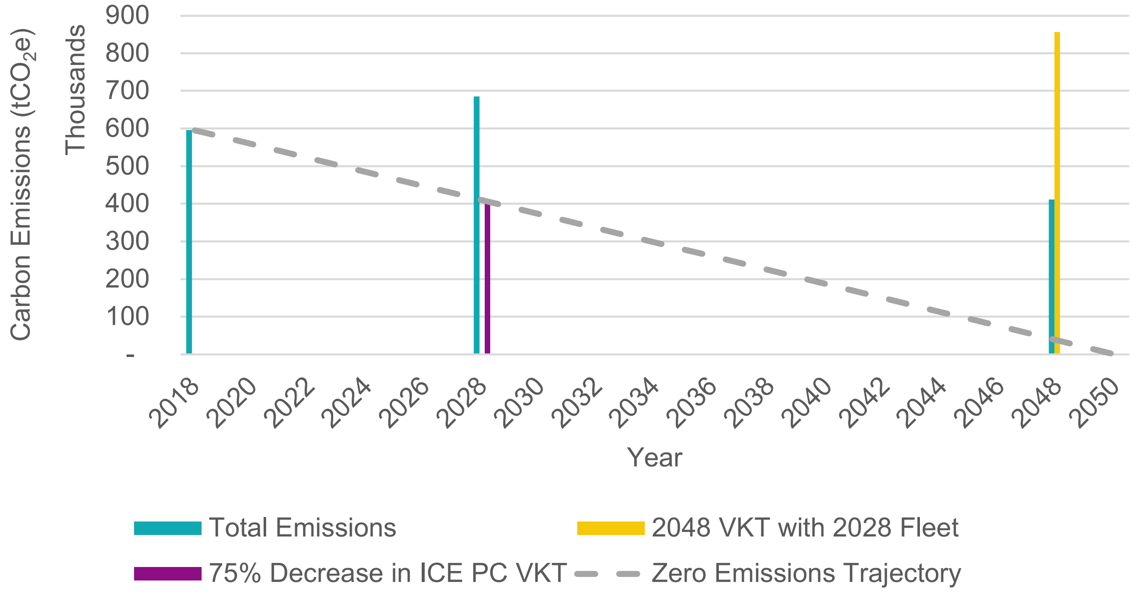


Figure 11. Emissions Reduction Required from BAU Transport Scenarios to Reach Zero Carbon Emissions

The emissions study concludes that travel demand will need to be managed through macro trends such as town planning (as directed by UFTI) and flexible/remote working initiatives, and the carbon efficiency of travel will need to improve with the potential uptake of electric and hydrogen buses and vehicles, active transport and micro-mobility. Carbon offsets will still be needed as even with a fully electric vehicle fleet, there are likely to be emissions associated with 100% renewable generation of electricity.

2.3 Transport Trends

No one should expect that the transport system in 30 years' time will be the same one we have today. In recent years the rise of personal mobility; e-bikes and e-scooters, has begun to change the way people move around.

Covid-19 has accelerated the use of technology and increased working from home and online collaboration. Eventually a personal mobility option that overcomes concerns about safety and comfort will be available (i.e. a small electric bike with weather protection, storage and safety features). This could significantly increase uptake and reduce the use of space and energy inefficient options, like driving a full-size car with one occupant (and leaving it parked 95% of the time). Transport options are becoming 'cleaner' and the acceptance that mitigating transport impact on the environment is a priority will push uptake of non-fossil fuelled options such as electric and hydrogen powered vehicles. The personal mobility movement has influenced the rise of the '15-minute city' concept, promoted by UFTI and similar land used and transport strategies around the world. Population growth and an increasing demand for people and goods movement that has been sustained over the last decade is projected to continue.

Other emerging trends that could dramatically change the transport system in future include:

- Batteries are becoming lighter, lasting longer and have less environmental impact
- Data availability and personalised transport such as on demand buses, mobility as a service etc.
- .

We need to plan for the future based on the transport system of today but we have to also be cognisant of how things could change and build adaptability into system planning and design.

Some of these changes will likely require intervention at a national level.

Related to this, environmental influences such as sea level rise, increases in storm intensity and frequency, and considerations about hazards such as earthquakes or tsunamis is important in transport system design and delivery. Tauranga City Council has a specific programme considering the susceptibility of assets and the community to natural hazards. The detailed planning and design of projects through the business case phase of the TSP will bring together the network planning / deliver and the resilience planning so that any upgrades consider the need to improve hazard defences where necessary.

The TSOF is an opportunity to deliver the UFTI vision and contribute to the continued success of the Western Bay of Plenty. We have challenges and opportunities ahead of us, success relies on collaboration, engagement and a steadfast focus on outcomes.

3 The System Operating Framework

3.1 Overview

The TSOF defines how the Western Bay of Plenty transport system will support the movement of people and goods across the network and where placemaking may be prioritised over ease of movement.

UFTI found that it is neither practical or affordable to provide disruption free movement for all modes on all routes at all times of the day. Therefore trade-offs must be made so that routes can support safe and reliable journeys for the modes that most need to utilise each route. In some places, it is desirable to provide for activity around, rather than movement along, a route. The operating framework recognises the place-based aspects of transport, in particular considering the UFTI Connected Centres vision, and that building great cities is about providing for people first.

The following map shows key activity centres throughout the Western Bay and how the network of primary routes for each mode connect these centres. This network caters for all types of user connecting places of employment, schools, shopping centres and key tourist destinations. Primary freight and traffic routes follow the State Highway in recognition this provides for longer distance movement of people and goods. These routes avoid land use conflicts such as activity centres, schools and the like, as described in TSOF Report 2. Primary PT and cycle routes connect residential catchments with centres along routes that will provide high amenity, priority and safety, also as described in TSOF Report 2.

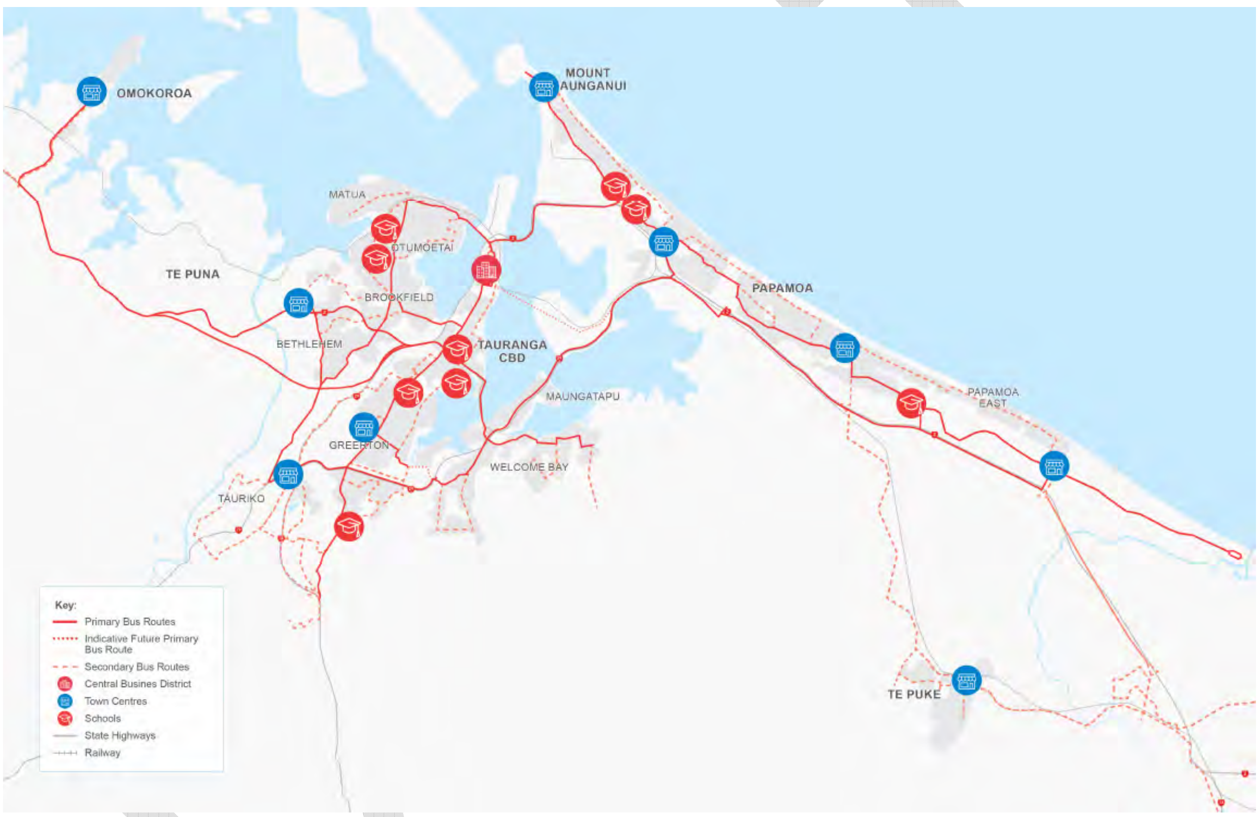
Figure 12: Primary Route and Centres Map

Safe movement will be prioritised for the respective modes and within centres placemaking will have a higher priority than movement so that these places can be enjoyed, valued and support economic growth. Ultimately, within the 30-year aspiration of the TSP, each primary route will provide safe and reliable journeys for the right modes in the right places.

A network of secondary routes will provide important connections between primary routes and to local origins and destinations for lower volumes of users.

A network perspective is provided for each mode as a network is more valuable than the sum of its parts. Although it will not be possible to deliver the infrastructure to achieve the networks overnight, the operating framework defines the priority areas to start delivering improvements that will ultimately deliver the connected network outcome.

Network maps for PT and cycling are shown below and at a larger scale in **Appendix B**.



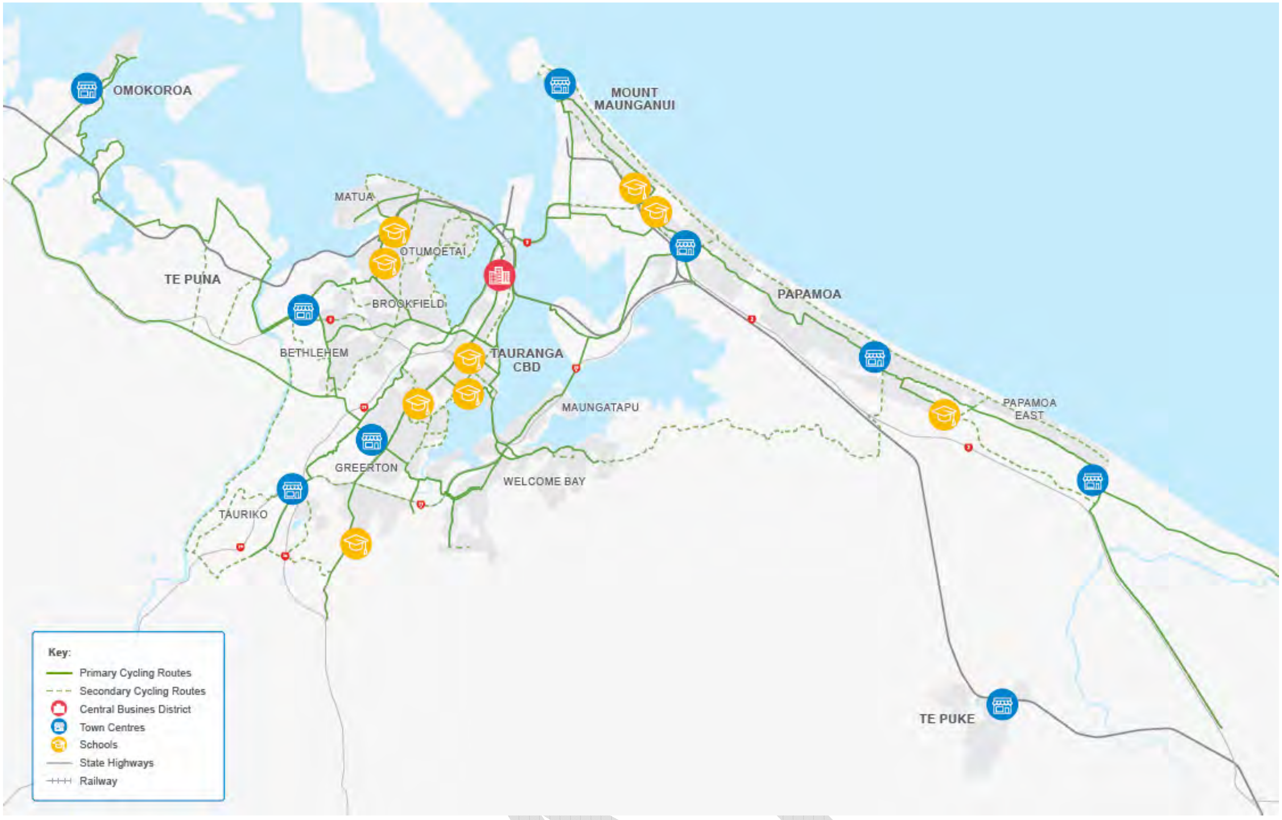


Figure 13: Network Plans for PT (top) and Cycling (bottom), larger versions are provided in Appendix B.

The primary and secondary routes will be complemented by other components of the transport system, e.g.;

- PT hubs that allow efficient, safe and welcoming interchange between modes (bus, cycle, walking, micro mobility especially)
- park and ride sites that extend the catchment of frequent and prioritised PT services into wider sub regional areas
- information provision and data that provides customers real time information on transport options and system conditions to inform journey making.

The recommended programme of activities defined in this TSOF report provides a pathway to delivering the framework outcomes over the next 30 years.

3.2 Illustrative Sections

Illustrations are provided below to show indicatively what a primary route for different modes may include in terms of multimodal movement and parking, access facilities and amenity features. What can actually be achieved will depend on access, turning and corridor width and trade-offs between modes for space allocation within routes will be necessary.

Actual design specifications including specific details on cross section widths are to be detailed in future investigations and business case development.

Figure 14: Illustration Of Components That Could Be Provided On A Primary Bus Route With Bus Lanes

Figure 15: Illustration Of Components That Could Be Provided On A Primary Bus Route Where Bus Lanes Are Not Required

Figure 16: Illustration Of The Components That Could Be Provided On A Primary Bus And Cycle Route With Bus Lanes

Figure 17: Illustration Of The Components That Could Be Provided On A Primary Cycle Route With Cycling On Both Sides Of The Road

Figure 18: Illustration Of The Components That Could Be Provided On A Primary Cycle Route With Cycling On One Side Of The Road

Figure 19: Illustration Of The Components That Could Be Provided On A Managed Lane And Primary Cycle Route With Cycling On Both Sides Of The Road

3.3 Operational Strategy

The overarching priority for the early phases (0-3 years) of the TSOF delivery is optimisation of the system to ‘flatten the curve’ by reducing the volume of traffic using roads in peak periods and increasing throughput without creating significant new capacity. This will mean that the transport system can better support movement by all modes while business case projects are completed to define the need for, concept and timing of longer term improvements.

Figure 20: TSP Optimisation Model (adapted from Auckland Transport / Waka Kotahi)

Time of Day Operations

The TSOF prioritises the modes that most need to use each route by location and time of the day.

During weekday morning and evening peak periods, when there is high demand on the transport system and it is not possible to provide disruption free movement for all modes, the effective movement of people across the network will be a priority. Modes that move people efficiently within less corridor space such as PT, high occupancy vehicles and cycling will be prioritised. System operation will aim to achieve consistent, rather than short, travel times during morning and evening peak periods.

UFTI found that Tauranga's transport system is susceptible to disruption during peak periods due to a lack of alternative routes. Information extraction and supply, e.g. alerting customers of incidents so they can delay, reroute or not travel is important in the Tauranga context and is a priority of the TSP.

Safety is a priority at all times and the transport system will prioritise safety over movement.

On weekdays, outside of peak times the movement of people and goods will be prioritised, particularly on primary routes for freight and general traffic. The Port of Tauranga provides a national scale economic facility that supports business, job creation and economic prosperity across the subregion and beyond. Prioritising movement to and from the Port is recognised a priority during interpeak times by UFTI and the TSP. Freight has less priority on weekends when the movement of people by the relative primary modes e.g. cycling, or PT, which can provide access to activity centres and recreation opportunities, will be prioritised.

Place Based Considerations

UFTI sets a vision for 15-minute local access and 45-minute regional accessibility by all modes. The TSP supports this by defining access priorities between activity centres and catchments within which accessibility will be prioritised. Key performance indicators described in Chapter 7 define 15- and 30-minute catchments for walking and cycling and 30- and 45-minute catchments for PT and car access. The evolution of eBikes and small personalised eVehicles will likely extend the travel time catchments for these modes in future.

Within pedestrian activity centres such as the central business district (CBD), along Cameron Road and sub regional town centres, people should be able to move around safely and conveniently without needing a car, and this includes mobility impaired users. Providing for safe movement of people and quality amenity within spaces to meet, engage and relax within activity centres is a priority of the TSP.

Schools and sub regional parks and reserves are also key destinations and access via walking and cycling is a priority within catchments serving these locations.

Between activity centres the transport system will need to provide a balance between movement and placemaking depending on the surrounding environment and transport priorities.

Figure 21: Illustration Of The Features That Could Be Provided On A Bus And Cycle Primary Route

Managing Network Demands

Around vs Across the Harbour

Tauranga City has two key State Highway corridors (SH2 and SH29a) that are defined by UFTI as providing for the movement of people and goods. The SH2 route (across the harbour) is a primary freight route and as such movement of goods to and from the Port is a high priority. SH29a is a secondary freight route so has a freight movement function but without as high priority as SH2. Both routes are primary general traffic routes due to their function providing for sub-regional movement and the opportunity these routes provide in terms of reducing traffic on other parts of the network, such as along Cameron Road and 15th Avenue.

Transport modelling described in this report shows that the SH29 (around the harbour) route can deliver a bypass function that reduces general traffic demands on the SH2 route, which has a higher freight priority.

In order to provide reliable travel times on SH2 and support the TSP objective of supporting freight movement to the Port, the TSP recognises the SH29a route as providing an opportunity to attract traffic away from the SH2 route and local roads. Upgrades on both SH2 and SH29a are included in the TSP programme of activities over the 30-year programme. The Tauranga Urban Network Study came to the same conclusion in 2013 and concluded that “developing one route to the exclusion of the other is not a viable option”.

UFTI identifies that any future additional significant crossing of the harbour would be limited to a dedicated rail, PT, walking and cycling crossing.

Managed Lane Network

The Takitimu North Link is currently proposed by Waka Kotahi to provide one managed lane and one general traffic lane in each direction between Omokoroa Road and Takitimu Drive. Transport modelling described later in this report indicates that there is sufficient capacity within the one managed lane in each direction for this to accommodate buses, freight and private cars with two or more occupants (HOV). Allowing EVs in this lane would also support the UFTI environmental objectives.

The HOV component of the Takitimu North Link presents a need and opportunity to define the onward connections for HOV across the network to maximise the benefit and encourage ride sharing.

City side of the of Takitimu North Link there are three potential routes to deliver continued HOV priority; the SH2 across the harbour route, the SH29 around the harbour route or via 15th Avenue.

Based on high level analysis at this framework stage, 15th Avenue would appear to be the preferred route to support onward HOV journeys (for HOV, EVs and buses, not freight). The reasons for this are as follows:

- Transport modelling indicates that providing HOV priority on SH2 north of Takitimu Drive would need to be in addition to the existing two lanes each way to not compromise the objective of supporting movement to and from the Port, i.e. converting an existing lane to HOV would cause significant network disruption. Adding additional lanes to this route would have a very high cost and impact.
- Transport modelling shows that by upgrading the SH29a route and prioritising HOV movement on 15th Avenue, the 'around the harbour' (SH29a) route is preferred for interregional movement over the 15th Avenue through route. This reduces traffic volumes on 15th Avenue and supports the UFTI priority of 15th Avenue being an urban multimodal collector rather than a through route.
- 15th Avenue provides an entry to the CBD area that could encourage commuters to car share, and thus reduce network and parking demands.
- The eastern end of 15th Avenue presents an opportunity to apply HOV access and provide for the continued journey onto SH29a, and possibly onward toward Papamoa and Te Puke if some level of priority can be provided on SH29a, as well as improving accessibility from Welcome Bay and surrounding areas.
- The concept of HOV access to 15th Avenue in peak periods aligns with the UFTI strategic journey for this route.
- The capacity created on the existing SH2 route north of Bethlehem when the Takitimu North Link is completed could be converted to HOV and Bus priority and also connect to 15th Ave.
- 15th Ave connects to Cameron Road where bus lanes are to be delivered as part of the Cameron Road Multi Modal stage 1 business case. HOV lanes connecting to Cameron Road will provide priority for express buses from the north and Tauriko and buses to/from Welcome Bay.

Onward HOV priority from Takitimu North Link will need to be assessed in detail and confirmed through subsequent business case processes, e.g. the 15th Avenue or SH29a business case. The TSOF provides a framework level indication to guide subsequent planning and design. A detailed transport modelling memo considering the network opportunities presented by the Takitimu North Link is provided in **Appendix E**.

Figure 22: Priority Managed Lane Routes (HOV, Buses, Freight and EV priority on Takitimu North Link. HOV, Buses and EV priority on other routes)

The TSOF builds on the UFTI foundation for delivering a connected movement and place outcome. Key to realising this will be sticking to the plan, monitoring delivery over time and lead organisations being accountable for funding and delivery.

4 Option Evaluation

This chapter describes the process of taking the operating gaps and draft list of interventions defined in Report 2 of the TSOF and turning this into a recommended programme of projects that contribute to delivering the framework.

4.1 Gap and Option Engagement Platform

A gap and option engagement platform was created as part of the TSOF to assist with the prioritisation of projects into 0-3, 3-10 and 10-30 year timeframes. The platform has several valuable attributes;

- It follows a sequential process that shows how the TSOF considers the potential impact of the gaps and the potential benefit of each option, to derive at a combined gap and option evaluation.
- Criteria weightings are adjustable to test how different priorities might influence gap ranking and project benefits. This allows sensitivity testing of outputs to check if the same projects are consistently ranked high. It allows stakeholders to see how a higher weighting for different priorities can influence outcomes.
- The platform is easily adjustable, if new gaps are identified and/or new options are developed these can be added to the tool and evaluated against the existing gaps and options to slot into the process at any time. If priorities change, e.g. a change in GPS or regional / local policy, the criteria can be changed, and the gaps and options can be re-evaluated against new criteria.

The platform does not define the packages of options, but it allows the TSOF to compare gaps and options to inform subsequent packaging. Packaging then considers other factors, for example affordability, sequencing and potential for construction disruption. An important feature of the framework is that it first rates the importance of the problem (the operating gap), before assessing the effectiveness of the options. This allows consideration of the issues from multiple perspectives and identification of priority projects that seek to address the most number and highest priority of issues. It has also been an effective stakeholder and partner engagement tool to demonstrate how the various perspectives and issues have been addressed and co-ordinated into recommended packages.

The platform allows users to work through a gap prioritisation and option evaluation process, as shown in the following diagram.

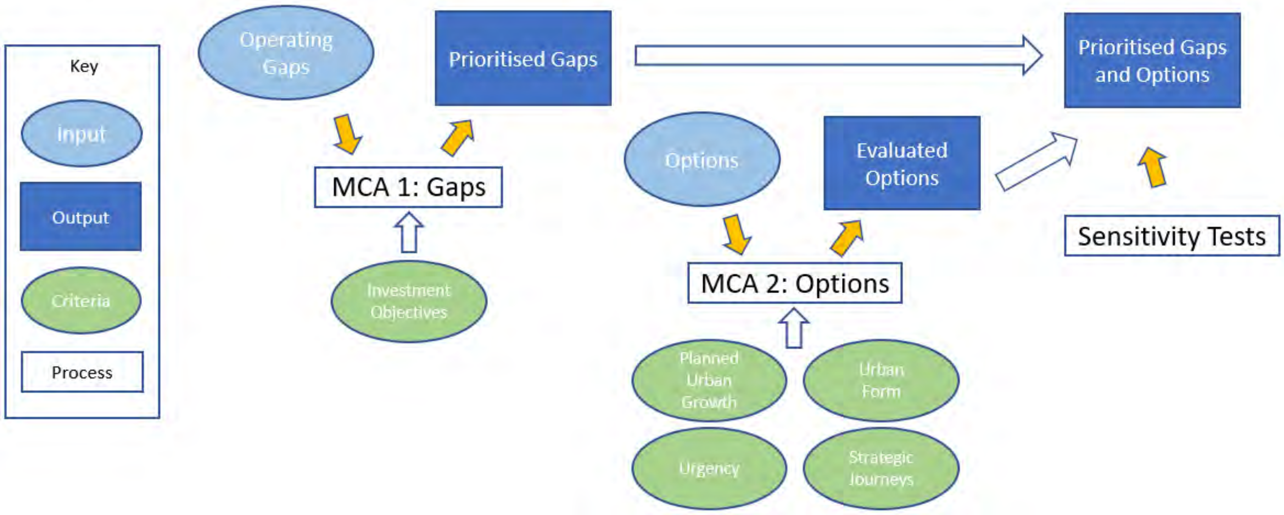


Figure 23: Gap and Option Evaluation Platform Workflow

Evaluation Criteria and Weightings

Gaps

Gaps are evaluated in the platform based on the expected impact that the gap has against the TSP Investment Objectives (safety, accessibility, mode shift and freight reliability). Each gap is given a rating from 1 (low) to 3 (high) in terms of the anticipated level of impact.

The following considerations are given to inform the evaluation of gap impact:

- Potential volume of users impacted; e.g. primary routes will have higher potential volumes
- Scale of operating gap, e.g. the size of the pie in SmartRoads, LOS rating or safety risk
- Period weighting, gaps appearing in early 0-3, 3-10 higher impact than later periods.

Table 6: Gap Evaluation Criteria

Criteria		Initial Weighting	Description
Investment Objectives	Investment objective – safety	**25% each**	How significantly does the gap impact on the project objective?
	Investment objective – accessibility		How significantly does the gap impact on the project objective?
	Investment objective – mode shift		How significantly does the gap impact on the project objective?
	Investment objective – freight		How significantly does the gap impact on the project objective?

Options

Options are evaluated in the platform in terms of the potential benefit each option could deliver against the criteria. The benefits are rated from 0 = no benefit, to 3 = high benefit.

The considerations for the option evaluation are shown in the following table.

Table 7: Option Evaluation Criteria

Criteria		Initial Weighting	Description
Gap Impact	Gap impact rating from gap evaluation	**14%**	Brings through the impact of the gap into the option priority
Alignment with UFTI	Support planned urban growth / development	**14% each**	How well does the project contribute to supporting urban growth / development as per the UFTI land use pattern?
	Support UFTI urban form outcomes		Will the project have a positive benefit to improving the quality of urban form?
	Support strategic journeys		How well does the project align with and contribute to the UFTI strategic journeys?
Urgency	Delivery timeframe	**14% each**	How long would it take to plan, design, deliver the project? (shorter term score higher)
	System enabling		Does the project help/enable future projects or increase collective benefit? (Sequencing)
	Value for money		How significantly are the potential benefits expected to surpass the potential cost?

Sensitivity Tests

The platform allows sensitivity testing of the gap raking and the option impact scores by adjusting the criteria weightings. For example, to consider a higher safety priority the safety weighting can be increased, and other weightings reduced (so a 100% total is maintained). Sensitivity tests on options is performed the same way, for example by increasing the urgency weightings and reducing the other weightings (again to maintain 100%).

4.2 Evaluation Process

Members of the TSOF A, Peer Review and the Challenge Team worked through a first pass ranking of each gap and option in the prioritisation platform. This version of the tool (version 3) was issued to the Project Partners technical staff for review. A workshop was held with the project team to discuss and decide on changes from the first pass. This input from multiple specialists and technical staff reduces the subjectivity of the evaluation as individual views are diluted. Each score / ranking was discussed in order to deliver a consensus view of the scores.

Some assumptions had to be made by the team in the gap and option evaluation, including:

- It was assumed the options are feasible, the business case stage will determine the actual option design and feasibility, but for this stage it is necessary to assume a feasible option exists.
- Assumptions had to be made about the scale of the intervention, some assistance is provided in the option description, e.g. 'optimisation' vs 'multimodal upgrade', but the scale within these could still be significant.
- The above influences the 'value for money' rating. Assumption is necessary on both the cost and potential benefit side, but the benefit can be informed by the potential volume of users considering the priority (primary, secondary) nature of the route the option improves.
- Support for urban growth includes supporting existing urban areas, not just new areas.
- Where strategies are included in the options, it is assumed the strategy results in tangible outcomes without overinflating the potential benefit.

- During this process the Government announced ‘committed’ work for the region, such as Cameron Road multimodal and to a degree SH29 Detailed Business Case, these are still evaluated in the platform so they can be compared alongside other projects.
- Some projects have more certainty of design and cost based on work completed to date, and therefore can be evaluated more easily than others, care was taken that this doesn’t bias (positively or negatively) the option evaluation.

4.3 Outputs

Gaps

Evaluation of operating gaps against the TSP investment objectives resulted in a prioritised list of gaps as shown in Figure 24.

Significant operating gaps that impact a large number of customers and appear in the immediate or short term have a high priority such as Hewletts Road, Totara Street, Turret Road and SH29 Tauriko / Cambridge Road.

The operating gaps are a combination of poor level of service, poor accessibility, and poor safety gaps (including where mode conflicts may lead to an unsafe outcome).

The prioritised list of gaps is the basis of prioritising options against each gap.

Gap Priority	Gap Description
High	Hewletts Rd poor LOS and all day
	Totara St poor LOS peak periods
	Golf Rd roundabout LOS and safety risk
	Turret Rd / 15th Ave poor LOS peak periods
	SH29 Tauriko Cambridge Rd poor LOS
	Welcome Bay Rd poor LOS
	Poor accessibility all modes from east suburbs
	Totara St primary route mode conflict
	Cameron Rd primary route mode conflict
	Cameron Rd poor LOS peak periods
	SH29A poor LOS on a primary route peak periods
	SH29A LOS worsening by 2048
	Welcome Bay Rd primary route mode conflict
	Safety risk on existing SH2 north (also primary bus route)
	SH2 / Elizabeth Street poor LOS AM peak
	Takitimu Dr / SH2 poor LOS
	CBD area poor LOS all periods
	Primary cycle routes east west poor LOS for cycling
	Welcome Bay area poor accessibility (all modes)
	Farm St / Links Ave primary route mode conflict
	Primary cycle routes east poor LOS for cycling
	Arataki area high road safety risk
	Poor accessibility from northern areas
	Brookfield roundabouts poor LOS AM Peak
	Waihi Rd poor LOS AM Peak
	SH2 harbour bridge poor LOS peak periods
	Primary cycle routes central poor LOS for cycling
	Fraser Chadwick poor LOS on a primary route
	Turret Rd / 15th Ave primary route mode conflict
	Te Papa area high safety risk
	SH29A mode conflicts (Tauriko to Oropi Rd)
	Welcome Bay Rd high road safety risk
	Mount Maunganui poor LOS within an activity centre
	Grenada St primary route mode conflict
	Girven Rd poor LOS and safety risk within an activity centre
	Maunganui Rd /SH2 poor LOS for freight on primary freight route
	Oceanbeach Rd poor LOS and safety risks
	Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict
	Primary cycle routes northern poor LOS for cycling
	SH29A primary general traffic and cycle crossing conflicts (Oropi)
	Omokoroa Rd poor LOS
	Moffatt Rd and Bethlehem Rd primary route mode conflict
	Pyes Pa Rd primary route mode conflict
	Poike Rd poor LOS
	Maungatapu Rd primary route mode conflict
	Kaitemako Rd high road safety risk
	Maunganui Rd poor LOS for buses on primary bus route
	Doncaster Dr primary route mode conflict
Low	

Figure 24: Prioritised Gaps

Options

Options to address each gap were defined in the option development workshop with some new options added to the platform following the workshop through subsequent input by the Project Partners.

Options were categorised by the alignment with the intervention hierarchy (e.g. integrated management and demand before new infrastructure) to inform the evaluation. Evaluation of the options against the key criteria results in an ‘option rating’ score out of 100%.

A decision on whether to ‘progress, defer or discount’ each option was made by the evaluation team. This decision was informed by the gap priority and option rating. Generally, if options scored highly in the evaluation these were rated as ‘progress’. Some options that scored lowly in the evaluation process could still have achieved a ‘progress’ outcome rating for various reasons. For example, an optimisation project for Hewlett’s Road attained a

33% rating but was categorised as progress, this is because the project has potential to deliver some benefit in the short term while the larger business case project for Hewletts Road, which is also categorised as progress, is developed.

Some projects were deferred on the basis they do not provide much benefit for the TSOF objectives and priorities, but they may still be warranted as part of other projects. Ferries are an example of this, transport modelling indicates that ferries (from Mount Maunganui or Omokoroa) do not compete with other modes on travel time, cost or catchment, therefore these are not progressed in the TSOF programme. However, there may be other reasons to provide a ferry service, for tourism for example, so the option was deferred rather than discounted.

Prioritisation

As a result of the evaluation, 63 unique options were taken forward to be prioritised into the TSOF 0-3, 3 to 10 and 10 to 30-year time periods.

The platform allows the specialists and the Project Partners to make an informed decision on project prioritisation, but there are other factors to consider and this is achieved through engagement and collaboration supported by the platform. The other factors considered by specialists outside the tool include matters such as deliverability, transport system interdependencies and operational considerations like avoiding major disruption on significant parallel routes at the same time.

For example, there were several options taken forward as 'progress' in the platform that contribute to mitigating the highest priority gap (Hewletts Road). These options included optimisation changes, a large-scale multimodal improvement project and travel demand management with the possibility of applying tolls to reduce peak period demands. The specialist team went through a packaging exercise informed by guiding strategies such as UFTI and the Intervention Hierarchy (Figure 25) to define which options should be delivered in which time period. In this example, the optimisation activity was prioritised early to get the best from the system (aligning with the Intervention Hierarchy), the larger scale project was allocated to the 3 to 10 year period (with a business case in the 0-3 period) as this will take longer to design and deliver, and the TDM activity was allocated in the 10 to 30 year period as this will require a change in legislation that will need to be considered at a national level before local implementation could take place.

Multiple specialists collaborated on the initial packaging exercise to derive the technical teams prioritised list of projects. The list was then circulated to the Project Partners technical staff, peer review and challenge team members and discussed at a technical workshop to agree the draft packaging of options.

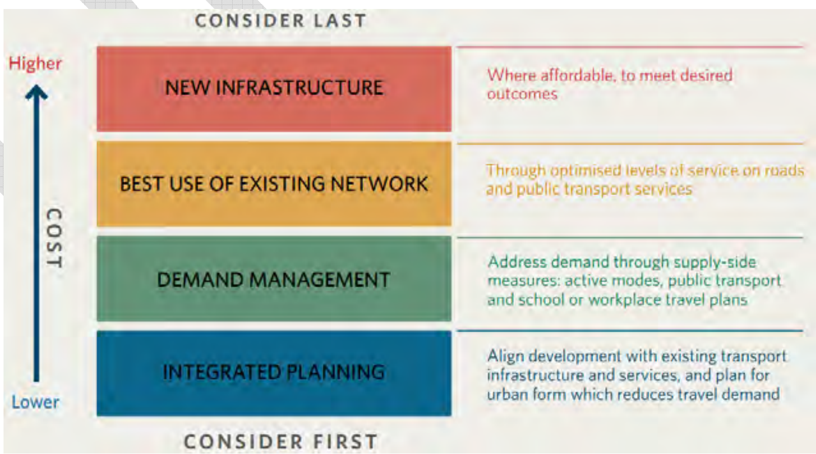


Figure 25: Intervention Hierarchy

A full output from the option evaluation table in the platform is provided in **Appendix C**.

Sensitivity Tests

Sensitivity testing was conducted in the platform to test the outcome on both the gap prioritisation and option rating. The platform allows the weightings given to the criteria to be adjusted for this sensitivity testing purpose. The key consideration in the sensitivity testing was the change in priority or rating given to each project as a result of each test and whether this should change the packaging of projects. The following figures show the outputs of various sensitivity test for gaps and options. The following sensitivity tests were undertaken:

- Gaps
  - Higher mode shift priority (40% mode shift 20% others)
  - Higher accessibility priority (40% accessibility 20% others)
  - Higher safety (40% safety 20% others)
  - Higher freight (40% freight 20% others)
  - Mode shift, accessibility and safety only (excludes freight)
  - All safety
  - All accessibility
  - All mode share
  - All freight
  - Exclude gaps without scores of 3 (puts gaps that received a score of 3 (significant) above gaps that scored only 2 or 1 ratings.
- Options
  - UFTI only
  - Urgency only
  - Gap only
  - Value for money only
  - Delivery timeframe priority
  - Gap, timeframe and value for money priorities.

The figure below displays the gap sensitivity test outcomes. The ‘base priority’ column is the original ranking of the gaps with the top 10 gaps highlighted. In the sensitivity tests alongside this, the top 10 gaps are also highlighted. This shows which gaps move in and out of the top 10 in each of the sensitivity tests.

Gap Description	Base priority	High mode shift	High accessibility	High safety	High freight	Exclude freight	All safety	All Accessibility	All mode share	All freight	All 3's
Hewletts Rd poor LOS and all day	1	4	1	1	1	7	8	2	34	1	1
Totara St poor LOS peak periods	2	1	2	2	2	8	9	11	11	2	2
Golf Rd roundabout LOS and safety risk	3	5	6	4	4	10	11	13	13	9	3
Turret Rd / 15th Ave poor LOS peak periods	4	7	3	6	6	3	14	4	17	15	4
SH29 Tauriko Cambridge Rd poor LOS	5	10	7	7	3	22	15	19	38	3	5
Welcome Bay Rd poor LOS	6	2	4	8	13	1	19	6	3	35	20
Poor accessibility all modes from east suburbs	7	3	5	11	8	5	47	8	4	16	6
Totara St primary route mode conflict	8	8	16	3	9	9	1	29	12	13	21
Cameron Rd primary route mode conflict	9	6	10	9	16	2	12	15	2	24	22
Cameron Rd poor LOS peak periods	10	15	11	5	12	12	2	16	36	14	23
SH29A poor LOS on a primary route peak periods	11	11	12	16	7	24	38	20	19	10	24
SH29A LOS worsening by 2048	12	12	19	17	5	38	39	35	21	4	25
Welcome Bay Rd primary route mode conflict	13	13	8	10	17	4	18	5	22	34	7
Safety risk on existing SH2 north (also primary bus route)	14	14	15	13	20	6	7	10	10	22	8
SH2 / Elizabeth Street poor LOS AM peak	15	36	9	22	10	35	33	3	46	7	9
Takitimu Dr / SH2 poor LOS	16	37	17	14	11	36	10	12	47	8	10
CBD area poor LOS all periods	17	9	18	23	21	11	34	14	1	23	26
Primary cycle routes east west poor LOS for cycling	18	16	20	18	22	13	20	21	23	36	11
Welcome Bay area poor accessibility (all modes)	19	17	13	26	23	14	42	7	24	37	27
Farm St / Links Ave primary route mode conflict	20	18	21	20	24	15	23	23	28	43	28
Primary cycle routes east poor LOS for cycling	21	19	22	21	25	16	26	25	30	47	29
Arataki area high road safety risk	22	20	28	12	26	17	5	42	31	48	30
Poor accessibility from northern areas	23	21	14	39	27	18	48	1	5	18	12
Brookfield roundabouts poor LOS AM Peak	24	22	29	31	18	32	29	27	8	11	13
Waihi Rd poor LOS AM Peak	25	33	23	32	19	33	30	9	33	12	31
SH2 harbour bridge poor LOS peak periods	26	35	30	33	15	41	32	30	35	6	32
Primary cycle routes central poor LOS for cycling	27	23	31	24	28	19	13	31	14	25	33
Fraser Chadwick poor LOS on a primary route	28	24	24	34	29	20	35	17	15	26	34
Turret Rd / 15th Ave primary route mode conflict	29	25	25	35	30	21	36	18	16	27	14
Te Papa area high safety risk	30	26	37	15	31	23	3	45	18	29	35
SH29A mode conflicts (Tauriko to Oropi Rd)	31	27	32	25	32	25	17	34	20	31	36
Welcome Bay Rd high road safety risk	32	28	39	19	33	26	4	46	25	38	37
Mount Maunganui poor LOS within an activity centre	33	29	26	37	34	27	43	22	26	40	38
Grenada St primary route mode conflict	34	30	33	27	35	28	22	38	27	42	15
Girven Rd poor LOS and safety risk within an activity centre	35	38	27	28	36	29	24	24	44	44	16
Maunganui Rd /SH2 poor LOS for freight on primary freight route	36	41	34	38	14	48	46	40	48	5	39
Oceanbeach Rd poor LOS and safety risks	37	31	35	29	37	30	25	41	29	46	17
Otumoetai loop (Chapel - Ngati - Waihi) primary route mode conflic	38	32	41	30	38	31	6	44	7	20	18
Primary cycle routes northern poor LOS for cycling	39	34	36	40	39	34	31	28	9	21	40
SH29A primary general traffic and cycle crossing conflicts (Oropi)	40	40	38	36	40	37	16	33	39	30	41
Omokoroa Rd poor LOS	41	42	40	42	41	39	27	26	32	17	42
Moffatt Rd and Bethlehem Rd primary route mode conflict	42	39	46	43	42	40	28	43	6	19	43
Pyes Pa Rd primary route mode conflict	43	43	42	44	43	42	37	32	37	28	44
Poike Rd poor LOS	44	44	43	45	44	43	40	36	40	32	45
Maungatapu Rd primary route mode conflict	45	45	44	46	45	44	41	37	41	33	46
Kaitemako Rd high road safety risk	46	46	47	41	46	45	21	47	42	39	47
Maunganui Rd poor LOS for buses on primary bus route	47	47	45	47	47	46	45	39	45	45	48
Doncaster Dr primary route mode conflict	48	48	48	48	48	47	44	48	43	41	49

Figure 26: Gap Sensitivity Testing With The 10 Highest Rated Gaps Highlighted Under Each Sensitivity Test

The following figure shows an example of the option sensitivity tests for the northern sub area. In this sensitivity test options with a rating of 75% or higher in terms of anticipated benefit are highlighted. This shows how the benefit varies between each of the sensitivity tests.

Gap	Option	Base Impact Score	Sensitivity Tests					
Northern Sub Area			UFTI Only	Urgency Only	Gap Only	Value for money only	Delivery timeframe	Gap, timeframe, value
Omokoroa Rd poor LOS	Omokoroa Road multimodal upgrade	37%	44%	33%	33%	33%	33%	33%
Poor accessibility from northern areas	Park and ride sites	65%	44%	88%	33%	67%	100%	63%
Poor accessibility from northern areas	Ferry	47%	44%	44%	33%	33%	67%	43%
Poor accessibility from northern areas	Improve bus services	79%	88%	77%	33%	67%	100%	63%
Poor accessibility from northern areas	Improved bus priority facilities on existing SH2	79%	88%	77%	33%	100%	67%	63%
Poor accessibility from northern areas	Local road connections to the TNL and SH2	51%	33%	66%	33%	67%	100%	63%
Poor accessibility from northern areas	Western Bay local road upgrades	51%	33%	66%	33%	67%	100%	63%
Poor accessibility from northern areas	Brookfield intersection and interchange upgrade	56%	55%	55%	33%	67%	33%	43%
Poor accessibility from northern areas	Bethlehem PT interchange	75%	77%	77%	33%	67%	67%	53%
Otumoetai loop (Chapel - Ngati - Waihi) primary route mode confli	Waihi Rd multimodal upgrade	47%	55%	33%	67%	33%	33%	47%
Omokoroa Rd poor LOS	Otumoetai cycleways	56%	66%	55%	33%	33%	67%	43%
Otumoetai loop (Chapel - Ngati - Waihi) primary route mode confli	Otumoetai cycleways	56%	66%	55%	33%	33%	67%	43%
Otumoetai loop (Chapel - Ngati - Waihi) primary route mode confli	Otumoetai / Bellview multimodal improvements	61%	66%	55%	33%	67%	67%	53%
Moffatt Rd and Bethlehem Rd primary route mode conflict	Brookfield intersection and interchange upgrade	56%	55%	55%	33%	67%	33%	43%
Brookfield roundabouts poor LOS AM Peak	Otumoetai cycleways	56%	66%	55%	33%	33%	67%	43%
Safety risk on existing SH2 north (also primary bus route)	Existing SH2 upgrade to improve safety and accessibility	61%	66%	55%	33%	33%	67%	43%
Safety risk on existing SH2 north (also primary bus route)	Standard interventions for active modes	19%	11%	11%	33%	0%	33%	23%

Figure 27: Example From Option Sensitivity Testing With Scores Over 75% Highlighted Under Each Sensitivity Test

The following key findings were derived from the sensitivity testing:

- In the gap sensitivity tests, the gap priority does not change significantly across the sensitivity tests that increase the weighting for safety, mode shift, accessibility or freight compared to the base.
- Excluding the freight weighting (only weighting safety, mode shift and accessibility), also does not significantly change the gap ranking, eight of the top 10 remain in the top 10 and only two new projects enter the top 10. The gaps that enter the top 10 are Welcome Bay Road mode conflicts and the SH2 north (existing) safety risk.
- Sensitivity tests that only weighted on one criteria, e.g. all safety or all freight, resulted in higher variability in gap priority. This reinforces the benefit of multi-criteria analysis in that it provides a much more balanced outcome than ranking based on a single priority.
- The option sensitivity tests show more variability in scores that is influenced by the number of criteria (seven compared with four used to assess the gaps), so sensitivity tests that focus on one criteria and exclude others can have a significant impact on the score.
- Checking of the option sensitivity tests found that all options which scored higher in more than two sensitivity tests compared with the base rating were all already progressed based on the base rating, i.e. there were no options that scored highly in the majority of the sensitivity tests which were not taken forward based on the base rating.

The engagement platform provides a repeatable and adaptable tool that can be re-used over time. For example, new gaps and options can be added to the tool and evaluated alongside existing gaps and options quickly and consistently. If priorities change, e.g. a change in government or change in local priorities, the criteria and weightings can be adjusted, and the gaps and options re-evaluated at any time.

5 Priority Projects

This chapter defines the strategies, projects and business cases recommended to deliver the TSOF.

The TSOF programme is predominantly optimisation activities in the first three years to get the best from existing infrastructure, with the proposed business case processes to determine the need for timing and design of future changes. This optimisation includes minor network improvements such as potential interim bus facilities (while business cases for longer term facilities are progressed), minor network changes to increase throughput and behaviour change initiatives such as improving bus services and cycling facilities to 'flatten the curve'. Development of business cases for priority areas will also take place in the first three years to define the timing and scope of interventions required beyond the optimisation activities. The optimisation activities include; PT service enhancements, cycle network enhancements to encourage mode shift and minor changes to the road network to improve reliability for priority modes.

In addition to the optimisation and business case activities, other key interventions in the early periods of the TSOF deliver access for planned urban growth areas (e.g. Papamoa East Interchange, SH29 Tauriko West) or address high road safety risk areas (e.g. Arataki, Welcome Bay and SH29 / Cambridge Road).

The recommended programme was reviewed in early draft by the Project Partners technical staff and presented in draft to elected members of the three Partner councils. Feedback from these engagement activities has informed the current version of the programme described below.

5.1 Recommended Programme (0-3, 3-10- and 10-30-year periods)

Strategies and Policy Interventions

Several strategies and policy interventions are recommended to support the effective operation of the transport system. These will be developed in the first three years and implemented on an ongoing basis:

- Regional mode shift plan – complete and implement.
- EV and hydrogen uptake strategy, e.g. parking incentives and policy to support EV's, charging infrastructure to support EV's, fleet vehicle policies etc.
- Bus fare and parking management policies to support mode shift and reduce peak period road network demands.
- Freight mode shift strategy to support road to rail or costal shipping and reduce road network demands.
- Emerging transport technologies strategy, e.g. data analytics and application to optimise transport systems (including technology to monitor and enforce the use of managed lanes).
- Travel demand management strategy, e.g. reduce the need to travel, reduce peak travel demand and encourage mode shift to sustainable modes (note any future tolling strategy as part of this would require national level policy changes).
- Travel behaviour change programme, e.g. customer and community insight into travel behaviour and approaches to encourage and support mode shift.

Cycle Routes and Facilities

Operating gaps were identified across the primary cycle routes as the quality and safety of these routes does not achieve desired level of service for a primary route as described in TSOF report 2.

The TSOF programme of activities prioritises the implementation of the Tauranga Accessible Streets (cycle plan) programme beginning with the priority areas of Otumoetai / Brookfield 0-3 year period implementation and Mt Maunganui / Arataki implementation in the early 4-10 year period and connecting these with improvements planned within the Te Papa Peninsular through the Te Papa IBC.

This implementation will flow through to the staged completion of a Connected Cycle network delivering the primary cycle routes of the TSOF over the 10-year and 30-year horizons. It will be essential for the implementation of the initial phases of the cycle network to consider safe and convenient connections, such that this initial phase delivers an attractive, albeit partial network.

Figure 28: Primary Cycle Route Map Showing Committed Routes (Black) And TCC Priority Routes For The First Three Years (Red). Note The Actual Route Alignment Will Be Determined In The Route Selection And Business Case Processes.

PT Routes and Services Medium Scenario

The TSOF activities include optimisation of the existing bus services and facilities within the first three years. This will include changes to routes and frequencies to support and encourage travel by bus as well as optimisation of supporting infrastructure such as improving stops, park and ride and information provision.

In the longer term a 'medium' scenario of bus routes and frequencies has been developed by the BOPRC with input of the TSOF technical teams. The medium scenario provides higher frequency services routing along key corridors that connect centres and places of activity such as reserves, employment areas and schools. The medium scenario service provision will need to be complemented with associated facilities and infrastructure such as access and interchange facilities, bus priority, park and ride etc. A combined services and facilities business case is prioritised in the first three years.

Generally, it is envisaged that high frequency and express services follow primary PT routes and lower frequency collector services follow the secondary PT routes.

The BOPRC hierarchy of services is further explained below.

Services	Express	Primary	Connector	Local/Regional
Role	Generally in peak times	All Day Network		Supporting Network
Minimum Hours of Operation	6am – 10am; 3pm – 7pm	6am – 10pm	6am-8pm	No minimum
Minimum Frequency	10-30 minutes (peak)	10-15 minutes	15-30 minutes	Driven by need
Prioritisation measures to achieve efficiency and reliability	Priority measures including priority lanes	Priority measures including priority lanes	Priority measures	Limited priority measures

Figure 29: BOPRC Hierarchy of Services. Express and Primary services generally utilise Primary PT Routes

Programme of Activities

The following table summarises the key activities recommended in the first three years of the TSOF. A full table of recommended activities is provided in **Appendix D**.

Along with the optimisation activities, work on two priority business cases will begin to determine the need, design, timing and funding for more substantial changes to address two areas of significant operating gaps; the Hewletts Road sub area and the 15th Ave / Turret Road to Hairini Business Case (Te Papa East Access). Short term optimisation projects are included for both of these routes to gain some benefits while the businesses cases for more significant changes are developed.

At this stage the programme of activities is unconstrained in terms of affordability and deliverability. During the LTP and RLTP processes the programme will be refined to the highest priority projects that are both affordable and deliverable in the respective timeframes. It is anticipated that this will result in some activities within the 0-3-year period shifting to the 4-10-year period and some activities in the 4-10-year period shifting to the 10-30-year period.

Table 8: 0-3 Year Action Plan Summary Activities, The Full Programme Is Provided In Appendix D

Activity	Objective	UFTI Alignment	Indicative Cost	Way Forward	Lead Organisations
Strategy, policy and programme development as recommended below.	Support the TSP objectives.	The sub-regional PT, mode shift, and emission reduction initiatives package	<$2M development cost, implementation to be defined in strategies	Develop and implement	All
Optimise bus services and frequencies city wide, short term improvements.	Continual improvement of the bus system to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package	$24M-29M p/a (existing approx. $19M)	PT Blueprint	BOPRC
Improve bus infrastructure city wide, short term improvements including stops and associated facilities.	Continual improvement of the bus system to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package	$8M over 3 years	Low cost low risk	TCC
City wide PT real-time information.	Support PT use through data availability at stops and via personal devices.	The sub-regional PT, mode shift, and emission reduction initiatives package	<$2M per year	Low cost low risk	TCC

Activity	Objective	UFTI Alignment	Indicative Cost	Way Forward	Lead Organisations
Deliver minor / low cost optimisation, safety and placemaking activities in the 2020 to 2023 period as described in full list of activities (refs 5-7 & 16-26).	Improve access to centres, support travel time reliability, improve safety.	Various including; CBD mount, freight, mode shift, eastern corridor packages and movement, environment, prosperity KPI.	$56M	Low cost low risk and SSBC Light as defined in full programme	Waka Kotahi, TCC, WBOPDC
Papamoa East Interchange and Wairakei/Te Tumu transport infrastructure.	Support quality urban growth and accessibility in eastern suburbs.	Eastern corridor package	$80.5M (PEI), $140M (transport infrastructure across 10 years+)	Design and construct	TCC, Waka Kotahi
Combined preferred scenario bus services and supporting infrastructure (access facilities, dedicated connections, park and ride, bus priority etc) business case.	Frequent and reliable PT services, priority and access facilities to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package	$700K (business case cost only)	Planning and SSBC	BOPRC
Priority area cycle route facilities (Accessible Streets programme - Area A Mount/Papamoa/CBD and Area B Otumoetai /Bellevue/ Brookfield)	Address safety and mode conflict gaps to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package	$45M (of $90M total cost over 10 years)	Area based SSBCs	TCC
Hewletts sub area single stage business case including Totara St, Golf Rd, Maunganui Rd.	Improve accessibility, safety and access to Port of Tauranga support UFTI Strategic Journey.	Freight access to the Port and the upper north island package	$1-2M (business case cost only)	SSBC	Waka Kotahi, Port of Tauranga, TCC, BOPRC
Turret / 15th Ave multimodal improvements business case including Welcome Bay Road.	Improve accessibility and travel time reliability for all modes support UFTI Strategic Journey.	The central corridor urban form and transport corridor package	$1-2M (business case cost only)	SSBC	TCC, BOPRC, Waka Kotahi

Activity	Objective	UFTI Alignment	Indicative Cost	Way Forward	Lead Organisations
SH29 Tauriko complete long-term business case and implement Enabling works business case	Support quality urban growth, improve safety and improve travel time reliability.	The western corridor package	Long term business case $1.05-1.5B. Early works $42M	Complete long term DBC, implement early works	Waka Kotahi, TCC, BOPRC
Tauriko West and Tauriko Business Estate internal transport networks	Support quality urban growth and accessibility within planned urban growth areas	Supports planned urban growth within UFTI	Developer costs to be agreed	Design and implement with urban growth	TCC
Western Corridor ring route (SH29 – SH36 section) staged to align with planned urban growth	Multimodal transport facilities to support planned urban growth in the western corridor	The western corridor package	Developer costs to be agreed	Implement in stages to align with urban growth	TCC
Te Papa IBC recommended programme	Support quality urban growth and accessibility in an activity centre.	The central corridor urban form and transport corridor package	$40M	As recommended in IBC	TCC
Otumoetai, Brookfield, Bellevue area multimodal improvements to support spatial planning	Improve accessibility, safety and support mode shift.	The central corridor urban form and transport corridor package	<$5M	SSBC Light	TCC

A high level, indicative cost estimate of the programme has been undertaken to understand the potential scale of costs associated with the activities. As the detail of the activities is unknown at this stage (to be determined through the subsequent business cases), the cost estimate is also uncertain and indicative only.

The estimated indicative cost of the programme is shown in the following table (as of 09 October 2020). The affordability and deliverability assessment subsequent to the TSOF will change the period some activities and associated costs fall within, e.g. shift some activities and costs from the 0-3-year period to the 4-10 and some from the 4-10 to the 11-30 year period.

Table 9: Programme of Activities Indicative Cost Estimate

	Years 0-3	Years 4-10	Years 11-30	Total
Bus Opex	$78.5M	$220M	$679	$978M
Capex	$218M	$384M	$878	$1.47B
Total	$297M	$604M	$1.56B	$2.45B

The priority activity list has been defined by evaluating a range of options against anticipated outcomes and priorities and with input from multiple specialists and Partner staff to minimise subjectivity. The list presents the technical team recommended programme to inform the forthcoming RLTP and LTP submissions.

6 Outcomes

This chapter describes the anticipated benefits of delivering the TSOF programme.

Quantifiable benefits are described below such as; mode shift, journey times, emissions and operating gaps. Many less quantifiable benefits exist, such as how the transport system supports urban growth through supporting intensification within Te Papa and connecting the growth areas of Omokoroa, Tauriko and Te Tumu with the existing transport networks. Other less quantifiable benefits include; the human health improvements through increased active mode travel; reduced emissions; and support for the general wellbeing of people being more connected to their communities, employment, schools and recreational opportunities.

6.1 Transport Benefits

The benefits of delivering the TSOF programme link back to the investment objectives defined at the outset of the TSOF process; safety, accessibility (linking to supporting quality urban growth), mode share (linking to reducing environmental impact) and freight reliability. The benefits derived against these objectives have been quantified using the analytical tools that were used to define the worst case ‘do minimum’ scenario described in Report 2:

- Tauranga Transport Model (TTM)
- Accessibility modelling
- SmartRoads tool
- Safety risk analysis.

There is a degree of uncertainty in transport modelling of the long-term (30 year) scenario in particular, given how people’s travel choices and behaviours will change over time and how current and future technology will influence our movement choices and options. Modelling of the programme provides an indication of potential outcomes in the future to be refined and analysed in more detail during the business case phase of the TSP.

Transport Modelling Summary of Findings

Transport modelling of the programme was undertaken to provide an indication of potential transport outcomes with the recommended programme in place. A detailed transport modelling report has been prepared and issued separately.

The transport modelling compares outcomes of the recommended programme with a ‘reference case’. The reference case is a variation on a ‘do minimum’ scenario with only projects assumed to be proceeding regardless of the TSOF included. This allows the programme to be compared ‘with and without’ improvements.

- **Sector to Sector Mechanised Mode Share:** Relative to the Reference Case, the Option nearly doubles the regional PT mode share, and almost triples it to key destinations such as the CBD. While the overall mode share across the whole sub-regional system remains low at some 4%, the PT share for some key movements and corridors is approaching or exceeding 30%. Daily PT trips on Cameron Road (north of 15th Avenue intersection) are predicted to be approximately 5,400 trips in 2028 and 6,700 trips in 2048 Option, when compared to 1,700 daily PT trips in 2018.
- **Total Network Vehicle Statistics:** This includes key statistics such as vehicle kilometres travelled (VKT) and vehicle

hours travelled (VHT). Changes in VKT when compared to 2018, are similar in 2028 for both Reference Case and Option. VKT in 2048 Core Option is slightly higher than the Reference Case. VHT for 2028 and 2048 Core Options are less when compared to Reference Case. This indicates that the mode shift effects are broadly mitigating the induced traffic effects. Sensitivity tests with stronger demand management interventions show a net reduction in VKT is possible.

- **Vehicle Emissions:** The Waka Kotahi Vehicle Emission Prediction Model version 6 (released in July 2019) was adopted for this study. Some 40% reduction in CO_2 is predicted between 2018 and 2048, which is mainly attributed to reduced rates due to changes in vehicle fleet composition between these years. The 2028 Core option indicated a small reduction in CO_2; however, the 2048 Core Option showed a small increase relative to the Reference Case. Adding the more aggressive demand management interventions showed a net reduction in CO_2 for the Core Option.
- **Journey Times**: Despite a predicted increase in vehicle trips between 2018 and 2028/ 2048 Options, journey times between centres are generally maintained. Travel times by bus are significantly improved, and thus the travel time differential between car and bus travel are reduced in both Reference Case and Core Option when compared to 2018. Improved frequencies, coverage and PT infrastructures are the main contributors to the bus travel time improvements.
- For freight, modelled travelled times remained similar between the Reference Case and Core Option of future years except for the in the 2048 Reference case between Tauriko and both ports. This scenario has a much higher travel time (and much higher variability in travel time). This is due to the SH2 Takitimu Drive / Elizabeth Street intersection. With the growth in traffic for 2048 and no improvements to the SH2 through movement at Elizabeth Street in the Reference case, there is significant conflicting flows at this intersection, resulting in large delays on SH2. The Core Option includes a project to improve the southbound SH2 through movement and this significantly reduces the delays at this location, improving the mean freight travel time and the variability on SH2.
- **Vehicle Levels of Service (LOS)**: A process was developed using the simulated speed / maximum section speed ratio to estimate level of service on the modelled network. In 2028, there are improvements in LOS along Ocean Beach Road northbound, Totara Street southbound, Turret Road Bridge inbound and SH36 northbound in the Tauriko area. However, there appears to be a degradation in the LOS along SH29A westbound. In 2048, there are improvements in LOS along Ocean Beach Road northbound, SH29A southbound approaching Turret Rd / Welcome Bay, along Ohauiti Road and Poike Road, at the Takitimu Drive / Elizabeth Street intersection, southbound on Takitimu Drive approaching SH29 and along Maunganui Road / SH2 northbound between Girven Road and Hewletts Road. However, there appears to be a degradation in LOS on SH36 northbound in Tauriko and along SH29A westbound towards Barkes Corner.

Across the whole system, the following key outcomes are noted:

- The high population growth and constrained typography create a very dynamic transport system, with changes in one part of the network impacting other locations, through upstream/downstream traffic-release effects, trip diversion or mode shift.
- The overall predicted mode shift to cycling is of a similar scale to that for PT, however they differ in their coverage and locations. While the cycling uptake is quite widely spread (and a function of local network upgrades), the PT shift is more focussed on longer-distance travel and key destinations.
- Although the overall PT mode share is low when averaged across the whole region, critically, it is predicted to be high on key corridors or movements.
- The addition of road capacity to the congested Reference networks is predicted to improve the LOS at key locations, the reduced travel times do induce more car travel. Overall, the PT and cycle mode shift offsets the increased car travel providing a net reduction in car trips.
- The addition of TDM measures (parking pricing, bus fares, toll location and pricing) show reduced levels of car travel, increased PT share and improved system LOS. Such measures help lock-in the network

performance gains that may otherwise be eroded by induced car travel.

Mode Share

Transport modelling shows that the programme could increase the AM peak PT mode share in Tauranga from around 3% to around 7%. Application of parking management and bus fare policies that influence travel behavior is necessary to achieve the higher PT mode share.

Proportionally larger increases in PT are seen in the first 10 years of the programme with the increased level of investment in services and infrastructure. Ongoing review and optimisation of the bus service and supporting initiatives such as travel behavior change and parking management could see patronage increase beyond the current transport model estimates. Figure 30 shows the modelled increase in AM peak hour bus patronage between the base (2018) and future year scenarios.

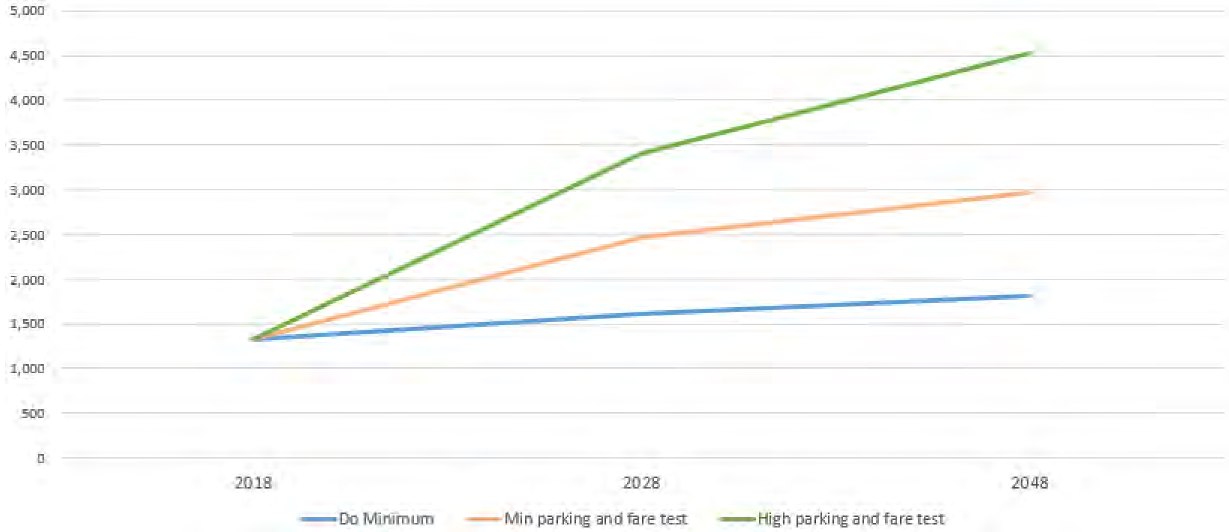


Figure 30: AM Peak Hour Bus Trips Tauranga Urban Area Do Minimum vs Min And High Parking And Fare Scenarios

PT mode share is higher on a corridor basis. The following table shows modelled PT mode share on key routes into Tauranga City during the AM peak (all figures are from the transport model, ranges show variability between pricing sensitivity tests, detail provided in modelling technical report).

Table 10: PT mode share on key city corridors

Location	2018	2028	2048
Cameron Road (CBD end)	7%	22%	22-28%
Cameron Road (Greerton end)	12%	30%	39-47%
15th Avenue	13%	13%	17-19%
Existing SH2 (Bethlehem)	1%	18%	14-18%
Wairakei Town Center	0%	37%	30%
Gravatt Road	10%	21%	23%
Maunganui Road	3%	9%	10-13%
Chapel Street	5%	9%	7-10%

The business case recommended in the TSOF programme to determine the longer-term PT routes and services will refine the mode share, cost and benefit analysis for PT linking back to the TSP objectives.

Mode share for cycling also increases based on transport model analysis of the recommended programme. The base AM peak hour cycling mode share increases from 3% to around 7%. Figure 31 shows the modelled increase in cycling trips during the weekday AM peak hour from the base (2018) to future years.

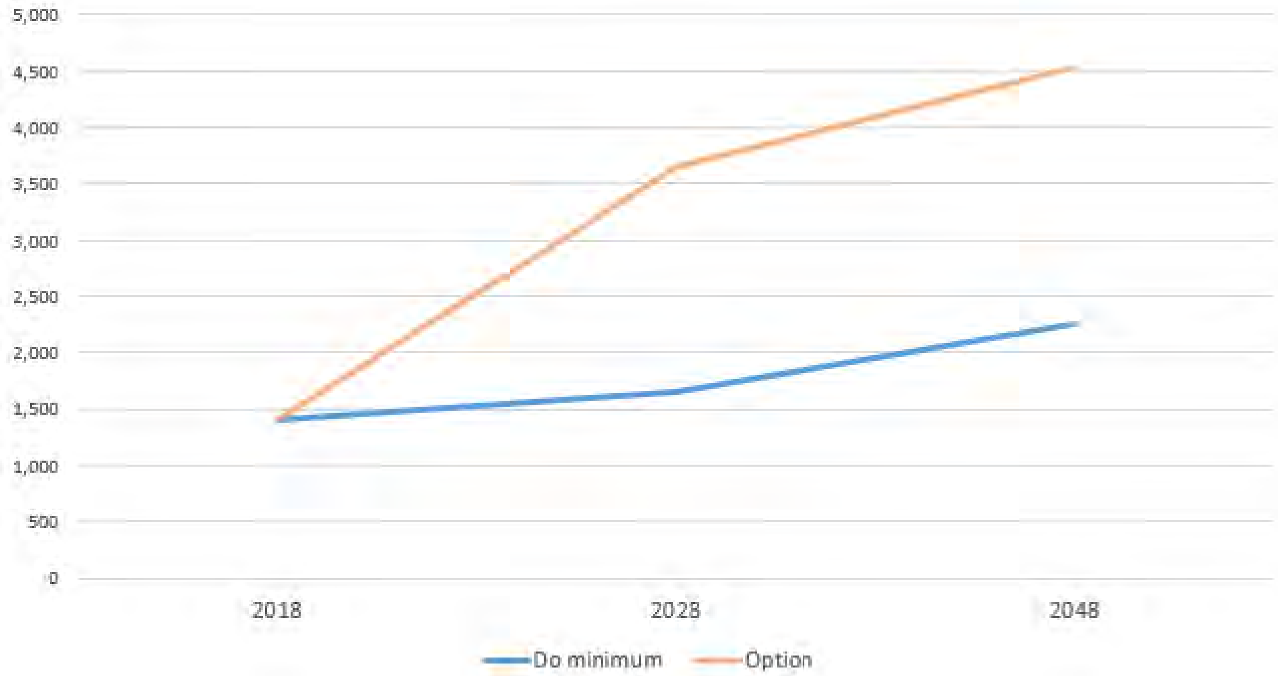


Figure 31: AM Peak Hour Cycling Mode Share Do Minimum vs Option

Journey Times

Journey times between centres (modelled travel times) indicates that despite traffic volume increases of around 46% between 2018 and 2048, journey times for car travel do not increase significantly. Whilst car journey times remain relatively consistent, travel times by bus are significantly improved, and thus the travel time differential between car and bus travel is reduced. The following tables show average journey times within the peak hour from the strategic transport model and include in vehicle time and access (walk) time. See modelling report for more details.

Table 11: Key Journey Time Analysis Car Journeys (AM Peak Hour, Minutes, Includes Walk Time)

Description	2018	2028 Reference Case	2028 Option	2048 Reference Case	2048 Option
Welcome Bay to CBD	19	21	18	23	18
Pyes Pa to CBD	19	20	20	23	18
Omokoroa to CBD	39	22	22	24	25
Papamoa East/TeTumu to CBD	36	32	29	35	30
Papamoa East/TeTumu to Mt Maunganui	30	26	26	27	27

Table 12: Key Journey Time Analysis Bus Journeys (AM Peak Hour, Minutes, Includes Walk / Wait Time)

Description	2018	2028 Reference Case	2028 Option	2048 Reference Case	2048 Option
Welcome Bay to CBD	59	37	33	49	25
Pyes Pa to CBD	38	37	33	40	34
Omokoroa to CBD	68	46	37	47	36
Papamoa East/TeTumu to CBD	73	59	47	60	38
Papamoa East/TeTumu to Mt Maunganui	81	64	53	64	53

Key freight journey times along SH2 connecting with the Port of Tauranga also maintain relative consistency (in modelled travel time) despite the increase in volumes over the next 30 years.

The following table shows interpeak (weekday 9am to 4pm period) travel times as per the TSP objective. AM and PM peak travel times show similar consistency in modelled commercial vehicle travel times.

Table 13: Key Journey Times for Freight Movements on Primary Freight Routes

Description	2018	2028 Reference Case	2028 Core Option	2048 Reference Case	2048 Core Option
Tauriko to Port Sulphur Point	12	13	13	17	13
Tauriko to Port Totara / Hull	14	16	16	21	16
Port Sulphur Point to Tauriko	14	15	15	18	15
Port Totara / Hull to Tauriko	16	17	18	21	18
Rangiuru Business Estate to Port Sulphur Point	27	22	21	24	22
Rangiuru Business Estate to Port Totara / Hull	24	18	18	18	19
Port Sulphur Point to Rangiuru Business Estate	27	22	21	23	22
Port Totara / Hull to Rangiuru Business Estate	25	19	19	19	19

Aimsun Mesoscopic Level Modelling

The Tauranga Transport Hybrid Model (TTHM) was utilised for more detailed testing of the programme. The findings are described in the transport modelling technical report and summarised below.

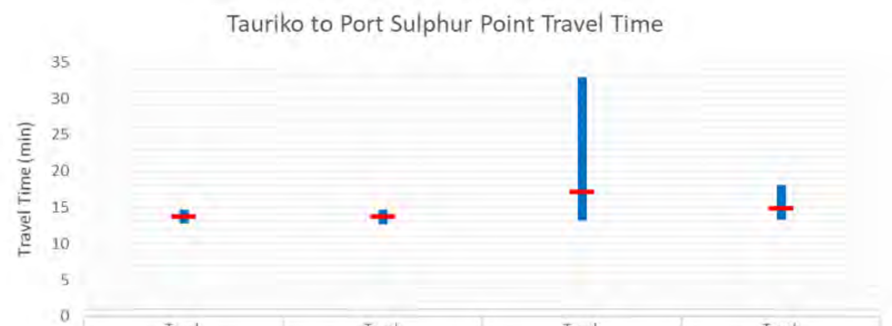
The TTHM is a simulation model. Simulation models require significant additional network detail compared to the strategic model. For example, adding a high occupancy vehicle lane requires more details than adding an additional capacity to the section, aspects such as where the high occupancy lane starts and ends is important, how far ahead drivers become aware of the reserved lane and therefore change lanes accordingly is important to the performance of the scheme. The simulation model is sensitive to details such as this and other aspects such as traffic signal timings, merge lengths and more. This level of detail for the proposed projects in both the reference scenarios and the option scenarios is not available at this stage of the TSP study.

Added to this is that a very high proportion of origin-destination pairs have a trip value of less than one. In TTHM when a trip value is less than one the probability of a vehicle being released is based on the trip value. For example, if a trip value is 0.5, there is a 50% chance that a trip is released. This means that analysis of origin-destination travel time should be treated with care and aggregating or ensuring there is a good sample size is important. An issue identified was that destinations that were adjacent to each other could have travel times from the same origin that are vastly different to each other, all dependent on the time in the modelled period that a vehicle is released.

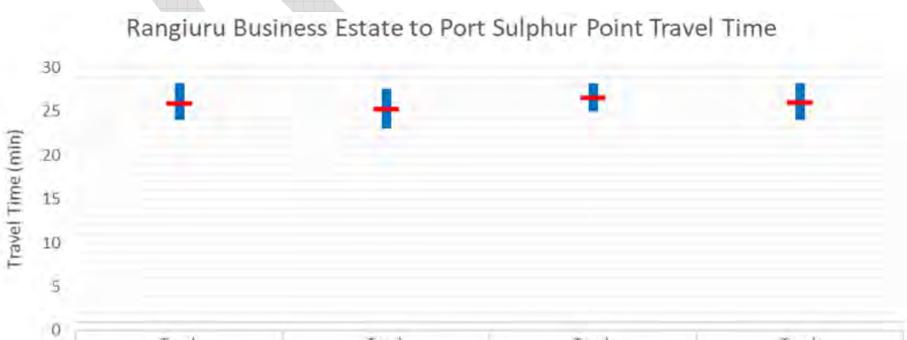
Therefore, the results presented below should be considered in light of the limitations described above.

- **Journey times for Car and Freight Vehicles to and from key centres:** Modelled travelled times from TTHM were examined for car (light occupancy vehicles and high occupancy vehicles) between key centres, and for trucks on primary freight routes.
  - HOV lanes provided along the journeys between Welcome Bay to CBD (2048 Core Option), Omokoroa to CBD along Takitimu North Link (2028 and 2048 Core Option) and Papamoa to CBD (2048 Core Option) improves travel time for HOVs.
  - For freight, modelled travelled times remained similar between the Reference Case and Core Option of future years except for the in the 2048 Reference case between Tauriko and both ports. This scenario has a much higher travel time (and much higher variability in travel time). This is due to the SH2 Takitimu Drive / Elizabeth Street intersection. With the growth in traffic for 2048 and no improvements to the SH2 through movement at Elizabeth Street in the Reference case, there is significant conflicting flows at this intersection, resulting in large delays on SH2. The Core Option includes a project to improve the southbound SH2 through movement and this significantly reduces the delays at this location, improving the mean freight travel time and the variability on SH2.

The following graphs show the change in travel time and variability for freight travel to the Port which is a specific KPI of the TSP, analysis of travel times between other origins and destinations is provided in the full transport modelling report. The option in 2048 significantly improves variability for freight movements to the Port when compared with the reference case scenario.



	Truck IP Reference 2028	Truck IP Option 2028	Truck IP Reference 2048	Truck IP Option 2048
max	15	15	33	18
min	13	13	13	13
– mean	14	14	17	15



	Truck IP Reference 2028	Truck IP Option 2028	Truck IP Reference 2048	Truck IP Option 2048
max	28	28	28	28
min	24	23	25	24
– mean	26	25	26	26

Figure 32: TTHM Modelled Travel Time and Variability for Movements to Port of Tauranga

- **TTHM General Traffic Levels of Service (LOS):** A process was developed using the simulated speed / maximum section speed ratio to estimate level of service for general traffic on the modelled network. This is an indicator with no associated targets within the TSP KPI. The level of service criteria was adopted from the Highway Capacity Manual. In 2028, there are improvements in LOS along Ocean Beach Road northbound, Totara Street southbound, Turret Road Bridge inbound and SH36 northbound in the Tauriko area. However, there appears to be a degradation in the LOS along SH29A westbound. In 2048, there are improvements in LOS along Ocean Beach Road northbound, SH29A southbound approaching Turret Rd / Welcome Bay, along Ohauiti Road and Poike Road, on Takitimu Drive at the Elizabeth Street intersection, southbound on Takitimu Drive approaching SH29 and along Maunganui Road / SH2 northbound between Girven Road and Hewletts Road. However, there appears to be a degradation in LOS on SH36 northbound in Tauriko and along SH29A westbound towards Barkes Corner.

Strategic Route Analysis

Strategic transport modelling shows that improving the 'around the harbour' route (between Tauriko and Baypark via SH29a) reduces traffic volumes in other locations that are more sensitive in terms of land use conflict, e.g. within Te Papa Peninsular and on Cambridge Road. It also reduces traffic on the Hewletts Road across the harbour route which is constrained by the capacity of the Harbour Bridge. This is beneficial in regard to attracting the right trips onto the preferred routes, i.e. longer trips onto the State Highway.

The following figure, from the strategic transport model, shows where traffic volumes increase (blue) and decrease (red) as a result of the SH29a longer term improvements in the recommended programme. Implementing the SH29a longer term improvements as recommended in UFTI reverses this and reduces traffic on Cameron Road, Fraser Street, 15th Avenue, Hewletts Road and Cambridge Road. The business case recommended in the programme would confirm the timing and form of this improvement.

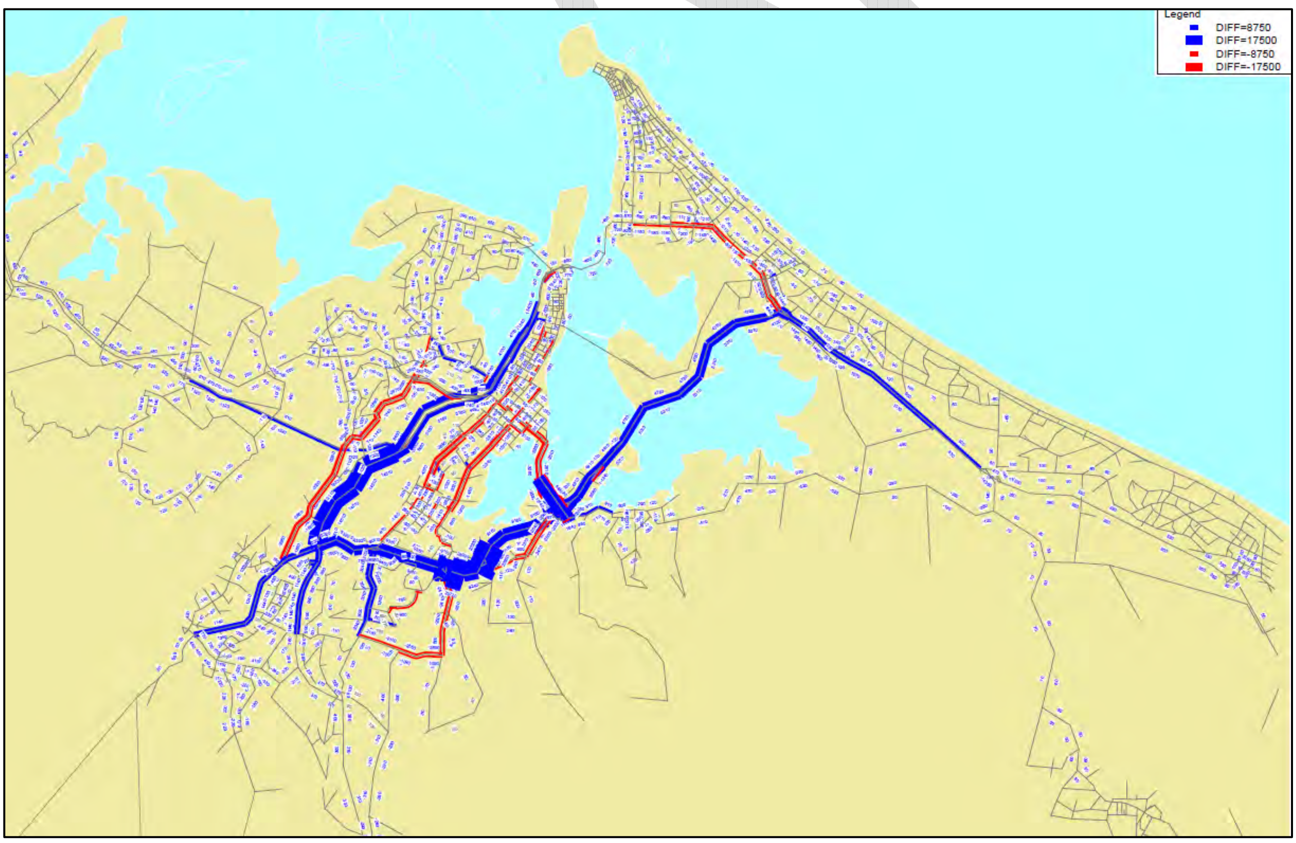


Figure 33: Change in Traffic Volumes (blue increase, red decrease) with SH29a improvements

Accessibility

An accessibility model was developed to examine the change in accessibility to key opportunities and destinations within the subregion, as a result of the TSP programme.

The accessibility model was utilised to examine the benefit of the programme against four of the TSP Key Performance Indicators (KPI) as below:

1. Percent and number of jobs that are accessible from all population within the objective travel time thresholds by PT (45 minutes), cycle (15 minutes) and private vehicles (30 minutes)
2. Percent and number of population within the objective travel time thresholds of 'key destinations' including CBD, town centres, secondary school, major parks/reserves and universities by all modes
3. Percentage of population and employment within 500m buffer distance of frequent PT Service (combined 15 minutes headway or less)
4. Percentage of population and employment within 500m cycle buffer distance of high quality (AAA) cycle facility to key destinations.

The key findings of the accessibility modelling are:

KPI: Percent and number of jobs accessible from all population within travel time thresholds by PT (45 minutes), cycle (15 and 30 minutes) and private vehicles (30 minutes):

- Car – Some localised accessibility improvements. Overall, no significant change between the reference and option scenarios, generally remains the most accessible mode
- Cycle – There is over 20% more jobs accessible in the Option than in the Reference scenario, this represents between 2% (15-minute threshold) and 5% (30-minute threshold) of total employment
- PT – A significant improvement in the number of jobs accessible is indicated with the Option scenario, which represents more than 15% of total employment in 2028 and 2048.

KPI: Percent and number of population within the objective travel time thresholds of 'key destinations' including CBD, town centres, secondary schools, major parks/reserves and universities by all modes.

- Car – Generally no significant difference between reference and option scenarios, noting car remains at the highest level
- Cycle – Increases are particularly significant for all key destinations around the CBD area. The highest increases are from Waikato University Tauranga CBD Campus with around 6900 and 8400 more population within the cycle travel time threshold under 2028 and 2048 option scenarios
- PT – There are significant improvements in the numbers of population accessible, and most increase by more than 10% of the total population compared with reference scenarios. The increase to the CBD destination in 2048 nearly doubles with the Option, exceeding the accessibility by car.

KPI: Percentage of population and employment within 500m buffer of frequent PT Service (combined 15 minutes headway or less):

- There is significant improvement in the population accessible to high frequent bus stops in the Option scenario, the proportion of population accessible more than doubles the reference scenario in 2028 and 2048 (from around 30% to over 60% of the population is accessible to high frequency bus services).

KPI: Percentage of population and employment within 500m cycle buffer distance of high quality (AAA) cycle facility to key destinations

- There is also significant improvement in the population accessible to high quality cycle facilities in the Option scenario, the proportion of population accessible to high quality cycle facilities increases from 25% to 41% in 2028 and from 26% to 47% in 2048 comparing the reference and option scenarios.

A detailed accessibility modelling report has been produced separately to this TSOF report.

Emissions

With uptake in electric vehicles and mode shift supported by the strategies and activities in the programme, vehicle tailpipe carbon emissions are expected to reduce by 50% (2028) and 90% (2048). However, as discussed in the emissions study, considering holistic carbon creation in electricity generation and infrastructure, wider and national level intervention is necessary to achieve the national net zero carbon target by 2050.

Operating Gaps

The following table shows the operating gap outputs for the do minimum and option scenario side by side for each peak period. The pie charts show the location and scale of the gap. The size of the pie reflects scale of the gap which considers volume of users effected and priority of the route. Detailed explanation of the SmartRoads analysis is provided in TSOF report 2. Blue colours represent gaps for traffic, orange shows gaps for PT and black shows gaps for freight.

The SmartRoads tool shows the potential of the PT gap based on an assumption that all buses can carry 30 passengers. The scale of the gap reflects the number of buses on the network and an assumption that all buses can carry 30 passengers. This influences the scale of the PT gap in the option scenarios shown below, as the option has significantly more buses than the do minimum and the tool assumes each bus carries 30 passengers.

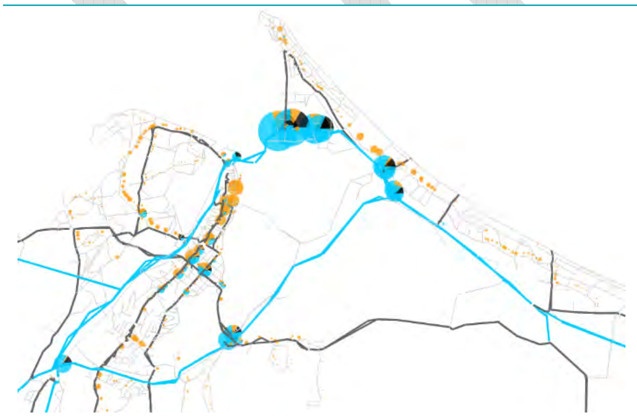
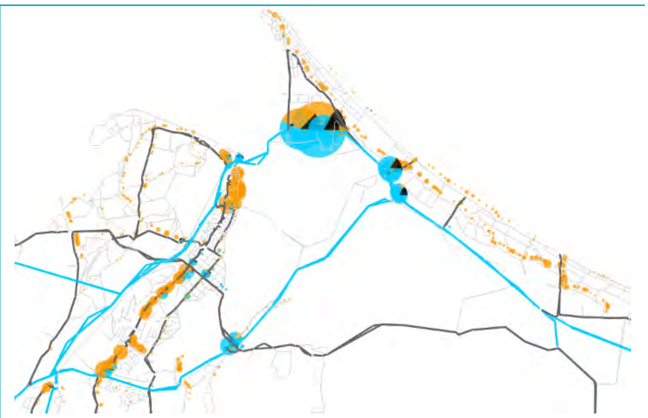
Do Minimum	Option (2028)
AM Peak	
	
Interpeak	
	
PM Peak	

Figure 34: Comparison Of Operating Gaps Between Do Minimum And Option In Smartroads Tool.

The SmartRoads outputs generally show a reduction in the scale of operating gaps between the do minimum and the option. Gaps still appear on Hewletts Road in the option assessment. This is influenced by the scale of customers impacted (Hewletts Road carries the highest volumes of any part of the network). The business case proposed for this area will define the treatment and outcomes for this part of the network.

Safety

Transport modelling indicates that by suppressing traffic growth the annual cost of crashes can be reduced compared with a do minimum scenario. Actual crash cost savings will be achieved through measures to support safety of vulnerable road users such as cycleways, intersection treatments and general safety improvements in high risk areas. The safety benefit of these would be quantified in the business case phase.

6.2 Land Use Benefits

The land use benefits of the TSOF are consistent with and aligned to those identified by UFTI. The SOF is one of the key tools used to translate UFTIs strategic direction on urban form and transport, known as the 'Connected Centres' programme, into implementation. This programme includes catering for approximately 200,000 additional people, 95,000 new homes, and two million additional transport movements per day expected within the next 30 to 70 plus years across the Western Bay of Plenty sub-region.

The TSOF has had a particular focus on the first 30-year period of the UFTI programme. It has considered the demands from the projected growth and employment and how to support this from a transport system perspective, in a way that achieves agreed benefits aligned to the UFTI programme. This has included how to deliver the function of the strategic network from a network form (e.g. mode priority) perspective. In undertaking this analysis the SOF has been able to further define the activities identified by UFTI to implement the Connected Centres programme. In achieving this, the SOF supports planned land use in existing areas of Tauranga City like Te Papa and growth areas like Te Tumu, Tauriko and Omokoroa in ways that support increased intensification, multimodal and environmental outcomes and the benefits identified by UFTI.

6.3 Indicative Economic Appraisal

Indicative economic benefits have been derived from the transport modelling. This considers primarily the benefits of reduced vehicle kilometres travelled, reduced emissions and PT benefits. This indicative economic appraisal at this stage identifies approximately $5B of economic benefit realisation over 60 years. It is possible more detailed economic analysis could increase the benefit value as this would consider other wider economic benefits not considered in this indicative appraisal such as transformational and non-transport specific benefits, e.g. the enabling urban and economic development.

Comparing total cost of the programme of approximately $3B, with the anticipated benefits results in a high-level indicative benefit cost ratio of between 1 and 3.

A technical economic summary memo is provided in **Appendix G**.

The TSOF can positively contribute to the UFTI vision and TSP objectives and deliver value for money. Achieving anticipated gains early in the programme, will set a platform for continual improvement and adaptability. As a result, longer term gains could be much more substantial.

7 Monitoring and Review

This chapter describes how the delivery and outcomes of the programme will be monitored and evaluated over time. Clear accountability is important with multiple partners responsible for delivering separate components of the system that need to be integrated in design and timing. The TSOF and the accompanying Shared Tactical Implementation Plan (STIP) promote a one system / one plan approach across the partnership.

The TSOF is a framework that sits below the UFTI Programme Business Case as a means of refining and prioritising a programme of activities to inform the RLTP and LTP. The actual adoption of activities into these plans needs to happen subsequently to the TSOF and the programme that is adopted and delivered will be confirmed through the RLTP and LTPs to be formally adopted in 2021.

7.1 Data Collection

Data collection and understanding of transport data changes and trends over time is essential to monitoring and improving the transport system. It is also essential in demonstrating benefits to external sponsors.

The collection of data can also assist in addressing perception, opinion and views. Without data and the establishment of a base line, the impact of interventions cannot be quantified. Data is becoming more readily available and data analytics is business as usual for informing and monitoring transport decisions in cities.

The TSOF programme includes an activity to gain the most out of the data available and use this to improve the system (information sharing with customers) and monitoring. This is an essential step in the monitoring and evaluation of the framework.

7.2 Monitoring and Review

The objective of ongoing monitoring and reporting is to guide optimisation through implementation, review whether the programme is delivering the intended outcomes and make sure lessons can be learnt and applied to other activities.

In addition to overall monitoring and review, a strategic check-in, review and reconfirmation is required at each NLTP period. This is to ensure the programme remains aligned to GPS results and can be optimised for emergent information. A funding approval from the NLTF can only cover the three-year period of the NLTP for a programme and is made when the NLTP is adopted by the Waka Kotahi Board.

The KPI and targets defined below provide a comprehensive list of indicators against which the delivery and outcomes of the TSOF will be monitored. Achievement against these can be monitored through the data collection activity and communicated across the partnership via a shared online dashboard of similar. Many of these indicators are already monitored by the Transport Partners. Going forward, monitoring against these will be the responsibility, ideally of a joint planning and delivery office / alliance, or alternatively by each of the Partner organisations where the activity is primarily delivered.

7.3 KPI and Targets

A series of key performance indicators and targets have been defined to assist with monitoring of UFTI and the TSOF implementation over time. Each objective has an associated set of KPI and targets as shown in the following table. The KPI and targets below are a subset and more refined version of the UFTI KPI and could be monitored as such.

Table 14: TSP KPIs and Targets

Objective	KPI	Source	Baseline	Target (2030)	Target (2050)	Rationale
Contribute to an outcome where no one is killed or seriously injured in road crashes.	Total road deaths and serious injuries within the Western BOP subregion.	Waka Kotahi CAS Database	17 deaths and 79 serious injuries from road crashes per annum (five year rolling average).	40% reduction. Less than 10 deaths and 48 serious injuries from road crashes per annum (five year rolling average)	0 deaths and serious injuries from road crashes per annum.	Align with Road to Zero strategy including interim target of 40% reduction.
	Road deaths and serious injuries for active mode users within the subregion.	Waka Kotahi CAS Database	3 active mode deaths and 14 serious injuries from road crashes per annum (five year rolling average).	40% reduction. Less than 2 active mode deaths and 8 serious injuries from road crashes per annum.	0 active mode deaths and serious injuries from road crashes per annum.	Align with Road to Zero strategy including interim target of 40% reduction.
Support quality urban growth by improving accessibility (dwellings within 15, 30, 45 minutes travel time) to key social and economic opportunities by different modes.	Percent or number of jobs accessible from all dwellings within the objective travel time thresholds by PT, walk, cycle and private vehicles in the AM peak (UFTI KPI). Assume 15min = walk & cycle. 30 and 45min = cycle, PT and private vehicle.	TTM (baseline 2018) Accessibility model	Cycle = 15min 7% PT = 30min 9%, 45min 24% Private vehicle = 30min 87%, 45min 94%.	Cycle: 15min 10%, 30min 20% PT: 45min 47%. Private vehicle: 30 min 95%.	Cycle: 15min 15% 30min 25% PT: 45min 80%. Private vehicle: 30 min 84%.	Support UFTI aspiration of 15min local and 45min sub-regional accessibility.
	Percent of population or number of people within the objective travel time thresholds of 'sub-regional destinations' (CBD, town centres, hospital, university,	TTM Accessibility model	See Waka Kotahi baseline accessibility outputs in Appendix D.	See accessibility model outputs in Appendix D. Model outputs for future years present targets to be achieved by delivering the programme of activities.	See accessibility model outputs in Appendix D. Model outputs for future years present targets to be achieved by delivering the programme of activities.	Support UFTI aspiration of 15min local and 45min sub-regional accessibility

Objective	KPI	Source	Baseline	Target (2030)	Target (2050)	Rationale
	secondary schools, major reserves) by all modes.					
	Percent of dwellings in an urban area within 500m (or 5min walk) of frequent PT services (combined 15min headway or less) (UFTI KPI).	GIS / Transport model	42.5%.	70% (based on BOPRC proposed frequencies)	87% (UFTI).	To measure the potential catchment of PT services as it influences the potential for mode shift.
	Percent of dwellings in an urban area within 1Km (or 5min cycle) of high quality (AAA) cycle facility to key destinations.	GIS/ MCR PBC	0% no current facilities.	40%	50%	To measure the potential catchment of cycle facilities as it influences the potential for mode shift.
	Increase PT priority.	GIS	4.5km of bus lanes (1.5% of the bus network).	Approximately 30km of dedicated bus or managed lanes. (assumes at least Takitimu North Link, Cameron Rd, Te Tumu).	Approximately 50km of dedicated bus or managed lanes (UFTI assumption).	To measure the level of PT priority physically delivered on the network.
	Increase supply of 'AAA' cycle facilities as identified in the preferred cycle programme.	GIS	0% no current facilities. (1.5km with Ngatai Road)	33Km (assumes 1/3rd delivery)	99Km of new and improved cycle routes (Tauranga Accessible Streets target)	To measure the level of cycle priority and safety improvements physically delivered on the network.
Increase mode share for PT and active modes	AM peak period mode share in the existing urban area (UFTI KPI).	TTM	PT = 3% Active modes = 7% Private car = 90% Work from home 13%.	PT: > 5% Active modes: > 10% Private car: < 85% Increase work from home. Subsidiary PT targets: Cameron Rd (1st Ave): 20% PT mode share SH2 Bethlehem: 15% PT mode share	PT: > 10% Active modes: >15% Private car: < 75% Increase work from home. Subsidiary PT targets: Cameron Rd (1st Ave): 30% PT mode share SH2 Bethlehem: 20% PT mode share	To measure the outcome of TSP interventions on mode shift.

Objective	KPI	Source	Baseline	Target (2030)	Target (2050)	Rationale
				15th Ave: 10% PT mode share Gravatt Rd (Pap plaza): 15% PT mode share	15th Ave: 15% PT mode share Gravatt Rd (Pap plaza): 20% PT mode share	
	• Number of passenger journeys' using western Bay of Plenty urban PT services (UFTI KPI).	BOPRC (base), TTM Transport model (future)	1.86M trips per year.	3.1M (assuming the 66% growth in peak period PT trips to meet the mode shift target translates into equivalent growth in total trips).	6.2M (assuming the 230% growth in peak period PT trips to meet the mode shift target translates into equivalent growth in total trips).	To measure the outcome of TSP interventions on PT patronage.
	• Tonnes of harmful emissions emitted per year from transport (UFTI KPI).	TTM Transport model (future)	7.1kg of CO_2 per person per day.	5.5kg of CO_2 per person per day (UFTI).	2048 2.1kg of CO_2 per person per day (UFTI).	To measure the benefit of TSP interventions on emission reductions.
Maintain or improve travel time predictability for freight movements on the primary freight network (road and rail) interpeak (between 9am and 4pm).	• Travel time variability for freight movements between Tauriko Business Estate and the Port.	Google (base) TTM (future)	Tauriko (SH29 / Redwood Lane) to Port (Totara Street gate) = 14 to 20 minutes weekday interpeak (≈1pm). Tauriko (SH29 / Redwood Lane) to Port (Sulphur Point gate) = 16 to 20 minutes weekday interpeak (≈1pm). (source Google validated against transport model travel times)	Improve on the baseline.	Improve on the baseline.	To measure the benefit of the TSP in supporting freight movements and access to Port of Tauranga specifically.
	• Travel time variability for freight movements between Rangiuru	Google (base)	Rangiuru (TEL / Maketu Road) to Port (SH2 Totara gate) = 18	Maintain or improve on the baseline.	Maintain or improve on the baseline.	To measure the benefit of the TSP in supporting freight

Objective	KPI	Source	Baseline	Target (2030)	Target (2050)	Rationale
	Business Estate and the Port.	TTM (future)	to 28 minutes weekday interpeak (≈1pm). Rangiuru (TEL / Maketu Road) to Port (Sulphur Point gate) = 28 to 45 minutes weekday interpeak (≈1pm). (source Google validated against transport model travel times)			movements and access to Port of Tauranga specifically.

Additional Monitoring Indicator

Monitoring of the following indicator will support understanding of network operation, the conditions experienced by all modes and the change in conditions over time. There are no targets associated with this indicator. Table 15: Monitoring Indicator

Indicator	Source	Baseline	Targets	Rationale
Travel speed and journey time reliability for buses, cars and trucks across the network.	Bluetooth, GPS data, TTM	Shown in TTM outputs within TSP reports and Tauranga key route performance reports.	No targets, monitoring indicator only.	To assist with monitoring of network conditions over time.

The TSOF sets a solid foundation for delivering a connected movement and place outcome. Key to realising this will be sticking to the plan, monitoring delivery over time and lead organisations being accountable for funding and delivery.

8 Conclusions

The TSOF has been developed by the Western Bay of Plenty Transport Partners as an important step in translating the UFTI vision into reality.

The project has been collaborative and has followed a structured process from defining problems, benefits and objectives, network and operating gaps and evaluating a broad list of interventions to derive a recommended programme. Multiple specialists and technical staff have been engaged from across the Partner organisations in this process. This has resulted in a balanced, multimodal programme that follows the intervention hierarchy while setting out a plan for longer term strategic network development.

Broader engagement with stakeholders, and communities on the projects and activities through the RLTP and LTP processes and onward through the business case / project development phase will help to establish buy in to process and outcomes.

The engagement platform is a repeatable and adaptable tool that can be used at any time to assess new gaps and or evaluate new projects to address gaps. This and the completed network operating plan provide a basis for a sustained approach to transport planning rather than the TSOF being an isolated project.

The solution is not just infrastructure and systems, developing and delivering the strategies and policies to support the vision is also essential. Key to this will be collecting and analysing data to broaden understanding of the transport system and the people who use it so that the system can respond to the people, rather than people having to respond to the system.

The technical process has derived a programme of recommendations for the Transport Partners to take forward in informing the respective RLTP and LTP submissions. A Shared Tactical Implementation Plan will summarise the outcomes of the TSOF for Transport Partner agreement.

The platform is set for the 2021 planning cycle to deliver tangible transport and urban form outcomes. Delivery will require ongoing collaboration, support and accountability.

UFTI and the TSOF are valuable steps toward improving and future proofing the Western Bay of Plenty. The potential benefits won't be realised until delivery follows strategy.

9 Appendices

A

Appendix A – Emissions Analysis

Tauranga Transport Emissions Analysis

Prepared for Western Bay of Plenty Transport System Plan Partners

Prepared by Beca Limited

26 August 2020

Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1	Renée Jens	Draft for client	14.08.20

Document Acceptance

Action	Name	Signed	Date
Prepared by	Renée Jens		14.08.20
Reviewed by	Rick Lomax		14.08.20
Approved by	Genevieve Smith		14.08.20
on behalf of	Beca Limited		

Executive Summary

As part of the Western Bay of Plenty Transport System Plan project (WBOP TSP), Beca has considered the scale of existing and projected regional transport emissions and opportunities for the TSP to contribute toward the New Zealand Government target of net zero carbon by 2050. The aim of this work is to inform the TSP in defining initiatives that will contribute toward the targeted national outcome.

The Tauranga Transport Strategic Model (TTSM) and the Waka Kotahi (NZTA) Vehicle Emissions Prediction Model (VEPM) were used to determine the vehicle kilometres travelled (VKT) and estimated litres of fuel used for the different vehicle types expected to be used in Tauranga in the years 2018, 2028 and 2048. Based on the litres of fuel used for combustion vehicles and kilometres travelled for electric vehicles (EVs), the emissions associated with transport in Tauranga could be estimated.

Modelling a linear trajectory from 2018 emissions to the zero emissions target in 2050 helps us understand how much mode shift from fossil fuelled vehicles would be required to achieve the national target if mode shift were the only 'lever' available. The modelling shows that the level of mode shift required to align to the net zero emissions trajectory is significant. This is displayed in **Figure A** below.

For transport emissions to be in line with the zero carbon trajectory (as depicted by the grey line in the graph below), it was determined that a 40% reduction from business-as-usual emissions is needed in 2028 (shown by the purple bar in the graph). By only reducing private petrol and diesel VKT (to determine the amount of mode shift required away from private vehicle use), the 40% emissions reduction is equivalent to a 75% reduction in private petrol and diesel vehicle VKT (i.e. internal combustion engine or ICE).

The 75% reduction in private car petrol and diesel vehicles (PC ICE) VKT is assuming an increased uptake of active modes of transport and increased use of the existing bus fleet (i.e. the bus VKT does not increase but buses will have more occupants). It also assumes that all other predicted VKT for 2028 fleet stays the same. The 75% reduction scenario is hypothetical, as it is not realistic without increasing the number of buses or other public transport options.

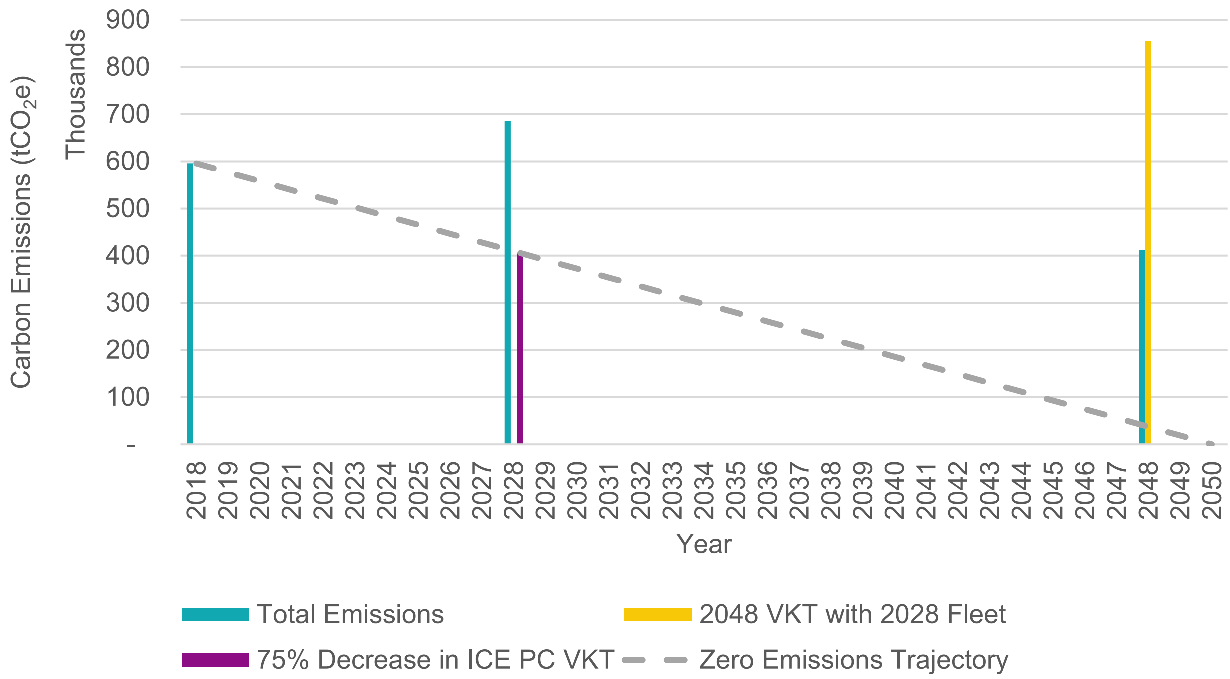


Figure A. Emissions reduction required from BAU transport scenarios to reach zero carbon emissions

This signals that, even with substantial electric vehicle uptake, due to rising demand in travel and transport, a more holistic solution is needed to reduce transport emissions.

Demand will need to be managed through macro trends such as town planning and flexible/remote working initiatives, and the carbon efficiency of travel will need to improve with the potential uptake of electric and hydrogen buses and vehicles, active transport and micro-mobility. Carbon offsets will be needed as even with a fully electric vehicle fleet, there are still likely to be emissions associated with 100% renewable generation of electricity.

It is also important to note that other aspects such as forestry offsets and carbon credits may also be part of this holistic approach, and nationally there are significant carbon offsets that may support New Zealand's transport sector get to net zero by 2050, but these cannot be modelled in this study without further detail from the Government.

This study therefore highlights that mode shift is an important contribution to reducing transport emissions and this needs to be supplemented with other carbon reducing initiatives locally, regionally and nationally in order to contribute to the national net zero carbon target by 2050.

1 Introduction

As part of the Western Bay of Plenty Transport System Plan project (WBOP TSP), Beca has considered the scale of existing and projected transport emissions and opportunities for the TSP to contribute toward the New Zealand Government target of net zero carbon by 2050. The aim of this work is to inform the TSP in defining approaches that will contribute toward the targeted national outcome.

This report summarises the findings of carbon emission calculations for the transport fleet predicted for the years 2018, 2028 and 2048 and considers the level of mode shift that would be required to be in line with New Zealand's emissions reduction target. The report also highlights some of the key challenges faced by the transport sector in supporting New Zealand's net zero carbon target and discusses some of the national and macro level changes that could contribute alongside mode shift to the national emission reduction target.

2 Methodology

The Tauranga Transport Strategic Model (TTSM) has been used as the basis for the carbon calculations. The model, for the years 2018, 2028 and 2048 provided the following:

- Vehicle Kilometres Travelled (VKT) broken down as:
  - Private Car (PC) & Light Commercial Vehicle (LCV) (New Zealand Transport Agency (NZTA) Class 2 and 3) estimated average annual daily VKT and estimated annual VKT
  - Medium Commercial Vehicle (MCV) / Heavy Commercial Vehicle (HCV) (NZTA Class 4 and above) estimated average annual daily VKT and estimated annual VKT
  - Public Transport (Buses) estimated average annual daily VKT and estimated annual VKT
- Estimated fuel consumption in litres per day for vehicles (excluding Buses)
- Estimated average speed in kilometres per hour for Buses, PC & LCV, and MCV/HCV

Using the numbers from the above model for average speed, these were then entered into the NZTA Vehicle Emissions Prediction Model (VEPM) version 6.0[1] to obtain the outputs of the vehicle fleet makeup for 2018, 2028 and 2048 given as the percentage of VKT as well as the fuel consumption in litres per 100 kilometres. The steps undertaken are displayed in **Figure 1** below. VEPM gives the fleet broken down as per the following vehicles:

- *PCs*
  - Petrol Cars
  - Diesel Cars
- *LCVs*
  - Petrol LCVs
  - Diesel LCVs
- *Buses*
  - Buses
  - Electric HCV Buses
- *Electric/Hybrid PCs & LCVs*
  - Car Hybrid
  - LCV Hybrid
  - Car Plugin Hybrid
  - LCV Plugin Hybrid
  - Car Electric
  - LCV Electric
- *HCVs*
  - HCV 3.5-7.5t
  - HCV 7.5-10t
  - HCV 10-20t
  - HCV 20-25t
  - HCV 25-30t
  - HCV >30t
  - Electric HCV <10t
  - Electric HCV >10t

[1]NZTA VEPM Model: https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/air-quality-climate/planning-and-assessment/vehicle-emissions-prediction-model/

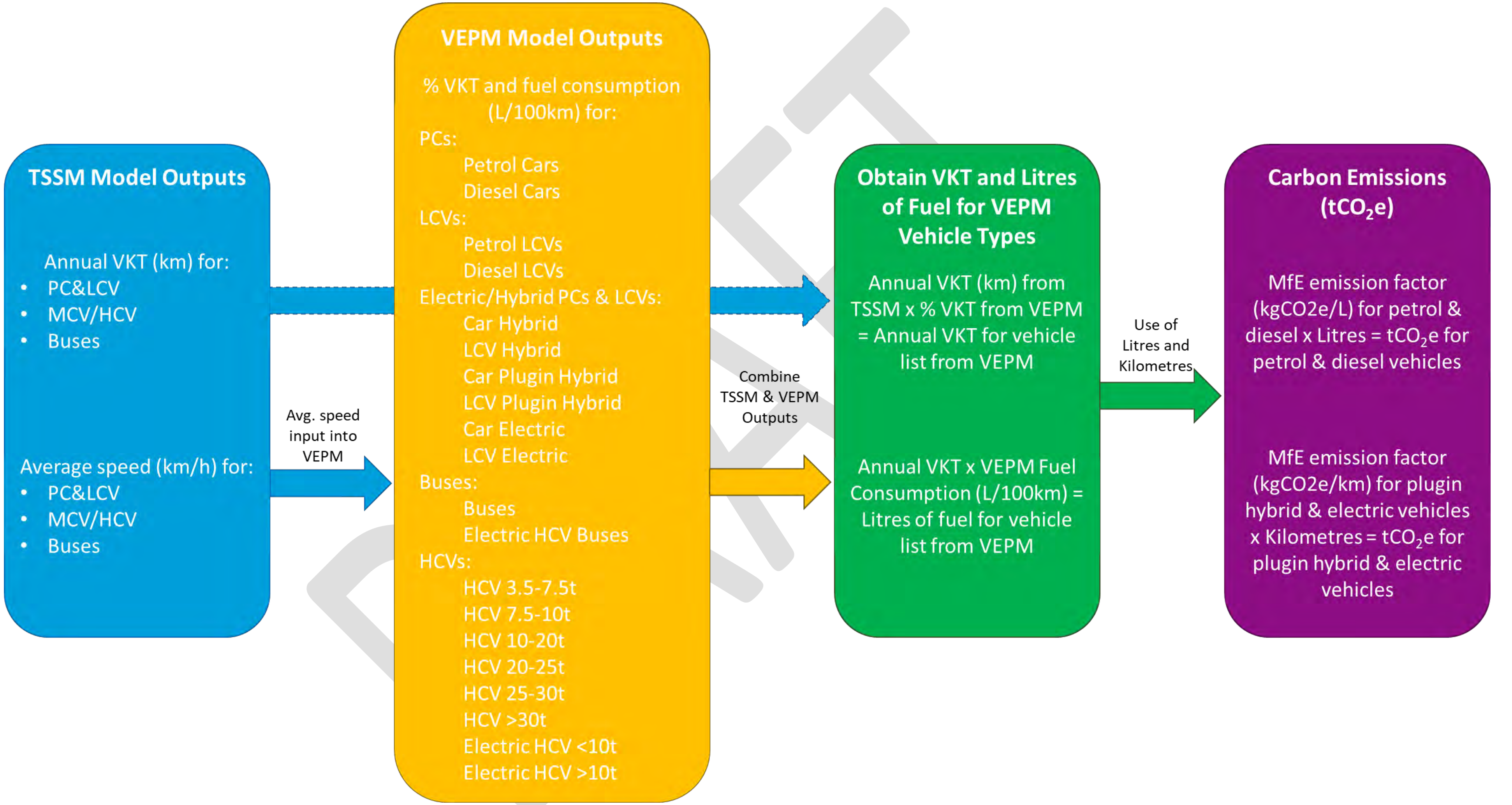


Figure 1. Overview of the calculation steps showing the use of outputs and connectivity between the models to obtain the final transport carbon emissions for the respective years

As per **Figure 1** above, the annual VKT for each of the vehicle types was calculated by proportionally applying the %VKT output from VEPM to the TTSM total annual VKT output for each of the vehicle categories.

The annual litres of fuel used for each vehicle type was calculated by multiplying the annual VKT for each vehicle type to the fuel consumption output from VEPM (in litres per 100km). The estimated annual fuel consumption from TTSM was compared with the fuel consumption determined using VEPM to check for accuracy. The total fuel consumption had a minimal variation between the models with a 0.2 – 3% variance for the different years.

Carbon emissions from the annual fuel use were calculated using MfE's emission factors for mobile fuel use[2].

- For petrol, diesel and hybrid vehicles these emission factors were based upon litres of fuel.
- For plugin hybrids and electric vehicles these were based upon kilometres travelled.

Both TTSM and VEPM have assumptions built into the model, such as the proportion of electric vehicles in the fleet in the future, which lowers fuel consumption and therefore carbon emissions. Modelling was undertaken to estimate carbon emissions in 2048 if the predicted high uptake of EVs does not occur. Using the 2048 total annual VKT from the TSSM, and using the same predicted vehicle fleet composition for 2028 (chosen as this would be more likely than a 2018 fleet composition), a 'worst case' scenario was modelled if EV uptake does not increase as expected from 2030 onwards but with VKT staying as predicted.

The methodology used to determine transport carbon emissions in this study may differ from previous carbon assessments undertaken for the Tauranga area, such as AECOM's Community Carbon Footprint[3]. For this study, carbon emissions have been based upon VKT derived from transport modelling, instead of using data for purchased fuel.

The assumptions behind the models used and for the calculations are given in **Section 3** below. The outputs from the models are given in **Appendix A**, and results of the carbon emission projections are given in **Section 4** below.

3 Assumptions and exclusions

The carbon projection analysis primarily used the TTSM[4] and VEPM transport models. Please see **Appendix B** for more detail on the specific assumptions related to these models. This section details the specific assumptions relating to the carbon analysis.

VEPM version 6.0 provides carbon dioxide emissions for each vehicle type, however, these carbon dioxide numbers have not been used due to the following limitations:

- VEPM's emissions modelling only accounts for tail pipe emission, consequently making the assumption that EVs are zero carbon as they have no tail pipe emissions. However, operationally EVs still have a carbon impact resulting from the use of grid electricity to charge the battery. This study has used the MfE carbon conversion factor for battery and plugin hybrid EVs to provide an assessment of the emissions

[2] MfE emissions workbook: https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/2019-emission-factors-workbook.xlsx

[3] AECOM, Community Carbon Footprint, Tauranga City 2015/16
https://www.tauranga.govt.nz/Portals/0/data/future/strategic_planning/strategic_focus/files/carbon_footprint_report15-16.pdf

[4] Data outcomes only for VKT from TTSM was provided and used in this carbon assessment report.

associated with electricity consumption based on the 2016[5] grid mix of renewable and fossil fuel generation.
- The VEPM model uses assumptions made by NZTA which is largely suited to the Auckland region. There may therefore be some limitations in the applicability of this model to TCC and WBoPDC in terms of fleet VKT and fuel consumption. VEPM does not account for alternative transport technologies such as green hydrogen, which may also help to further lower emissions.
- VEPM only includes carbon dioxide (CO_2) in its model. CO_2 is not the only greenhouse gas emitted by fuel and electricity use, therefore, MfE emission factors have been used to account for other greenhouse gases, which converts each greenhouse gas to carbon dioxide equivalents by using each gases' Global Warming Potential. The MfE emission factors have been applied to either fuel use or vehicle kilometres travelled.

Please note that NZTA have stated they are soon to release an updated version of VEPM assumed to be version 6.1. They have stated that one of the key improvements from version 6.0 is better projections for fuel consumption of current and future fleet[6]. This version has not been released yet and therefore hasn't been used in the analysis. This is expected to affect the total overall emissions, but the level of this impact cannot be estimated.

Other assumptions and exclusions:

- The TTSM model grouped the car types into three categories; PC&LCVs, MCVs/HCVs, and Buses (public transport). VEPM's outputs are for a larger number of car types, and therefore VKT and fuel consumption in litres have been determined by grouping VEPM's car types into the categories provided by the TTSM model. All combustion engine and electric PCs and LCVs from the VEPM model were assumed to make up the PC and LCV VKT from the TTSM model. All combustion engine HCVs and electric HCVs from the VEPM model have been assumed to make up the HCV VKT from the TTSM model. Combustion engine buses, electric buses and HCVs within bus category from the VEPM model have been assumed to make up the Bus VKT from the TTSM model.
- The carbon analysis hasn't included indirect emissions such as Well to Tank (WTT) emissions from the production and transport of petrol and diesel, as the majority of these emissions would be created outside of New Zealand. Transmission and distribution (T&D) losses from the grid electricity powering EVs has also been excluded as MfE only publish these factors based on kWh consumed, which is unknown in this study. These aspects may create a small increase in overall emissions if included.
- The carbon modelling assumes no increase in efficiency of EVs, i.e. as battery and vehicle technology improves the increased efficiency may reduce the carbon emissions per km for EVs.
- New Zealand has a target to have a 100% renewable electricity grid by 2035. The reduction in the carbon intensity of the grid hasn't been factored in over time, however this would decrease the emissions per km associated with EVs. Please note that even a 100% renewable grid in New Zealand will not be carbon neutral due to the use of Geothermal power (~20% of the supply) which still creates greenhouse gas emissions from the process of generating power even when there is no combustion of fuels.
- This report also indicates a linear trajectory from 2018 emissions to zero carbon in 2050. Please note that in 2021 the New Zealand government will announce national 4-5 year carbon budgets which may set a non-linear trajectory to 2050.
- The Climate Change Response (Zero Carbon) Amendment Act sets a net zero target for New Zealand by 2050. In 2018 the gross emissions were nearly 80,000 kilotonnes of CO_2e but net emissions were circa

[5] This is the latest set of MfE emissions factors: https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/2019-emission-factors-workbook.xlsx

[6] Paul Boulter, 16 June 2020. Road transport emission modelling in Australia and New Zealand. Air Talks 2020.

55,000 kilotonnes of CO_2e due to carbon sequestrated or absorbed by forestry assets. The modelling in this report assumes a linear trajectory to net zero without any of the sequestered carbon being applied to the transport sector nationally, which is a significant simplification.

- This report's carbon analysis has not included any assessment of the embodied or capital carbon emissions associated with the manufacture and transport of new vehicles into New Zealand. Under the international guidelines for emissions measurement (IPCC guidelines) reporting of these emissions is the responsibility of the country of origin manufactured goods, to therefore manage the emissions created from manufacturing.
- This study has determined carbon emissions from transport modelling data with VKT as the basis of carbon calculations. Other studies have used different methodologies, such as determining carbon emissions based upon purchased fuel data within the city / region. Using purchased fuel data for the region may therefore provide different carbon emission results compared to this study. Both methods have limitations, such as the ability to ascertain whether emissions from fuel purchased could be attributed to a certain region, due to the movement of vehicles between regions.

4 Results

The results from the carbon emission calculations are displayed in **Figure 2** to **5** below. **Figure 2** displays the total predicted carbon emissions for the years 2018, 2028, 2048 and also for 2048 with the predicted VKT but with the 2028 fleet composition; this is to reflect a slower conversion of the fleet to EVs than has been modelled by NZTA.

For all years, private petrol car use is the highest contributor to emissions, followed by diesel LCVs, except for 2048 where HCV 25-30t have higher emissions than diesel LCVs.

HCV 25-30t and HCV >30t are the next highest contributors to emissions. In 2048, due to a higher proportion of electric vehicle uptake within the predicted fleet, private electric cars make up almost 10% of 2048 predicted emissions.

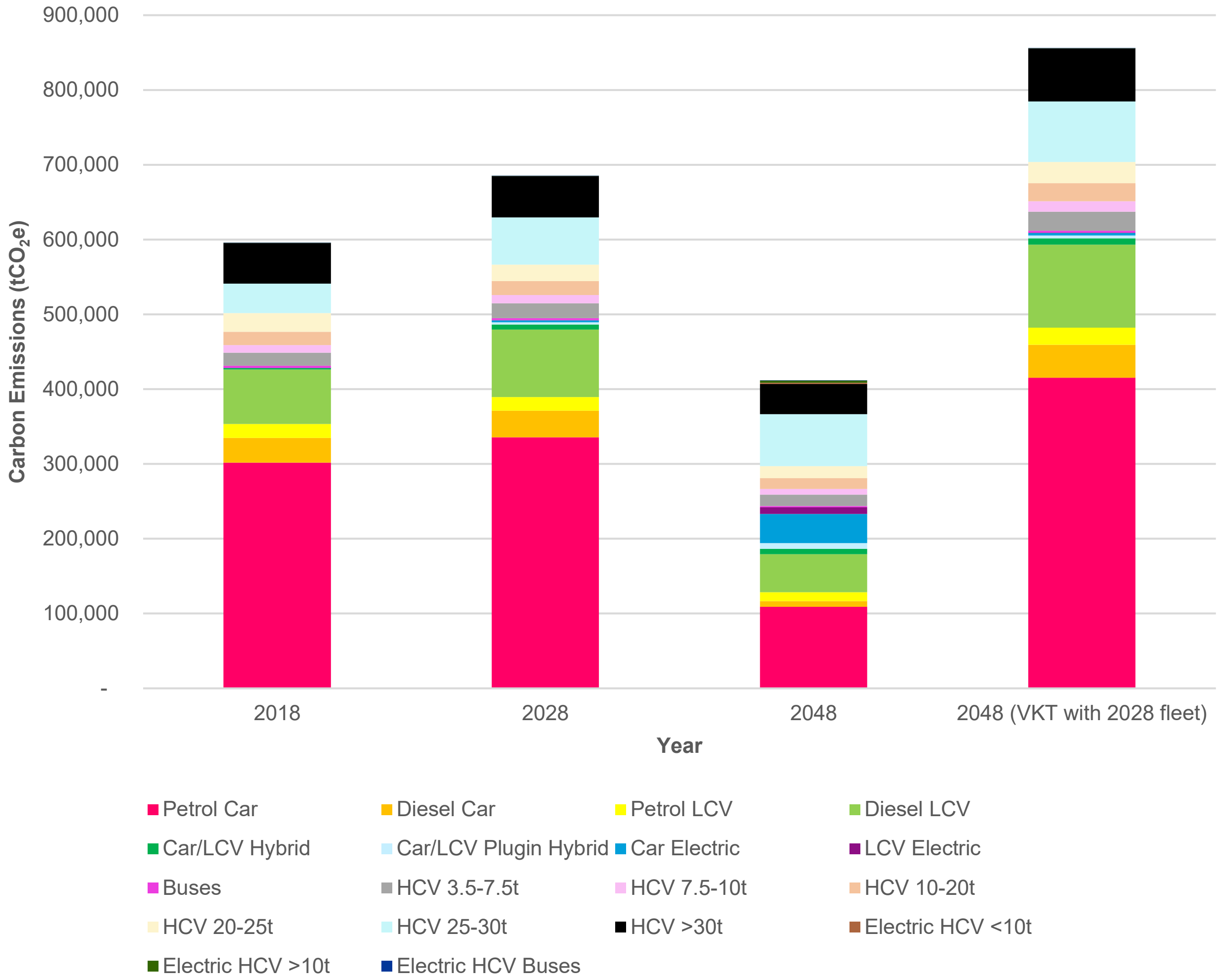


Figure 2. Total carbon emission projections with a breakdown per vehicle type for 2018, 2028, 2048, and for the year 2048 based on 2048 VKT with 2028 fleet vehicle composition.

Figure 3 below shows the predicted carbon emissions for higher level vehicle categories, and is a simplification of vehicle types shown in **Figure 2**. Combustion engine cars and LCVs are the highest contributors to emissions for all years modelled. HCVs are then next highest contributors to emissions. Emissions decrease in 2048 for combustion engines due to the predicted uptake of electric vehicles.

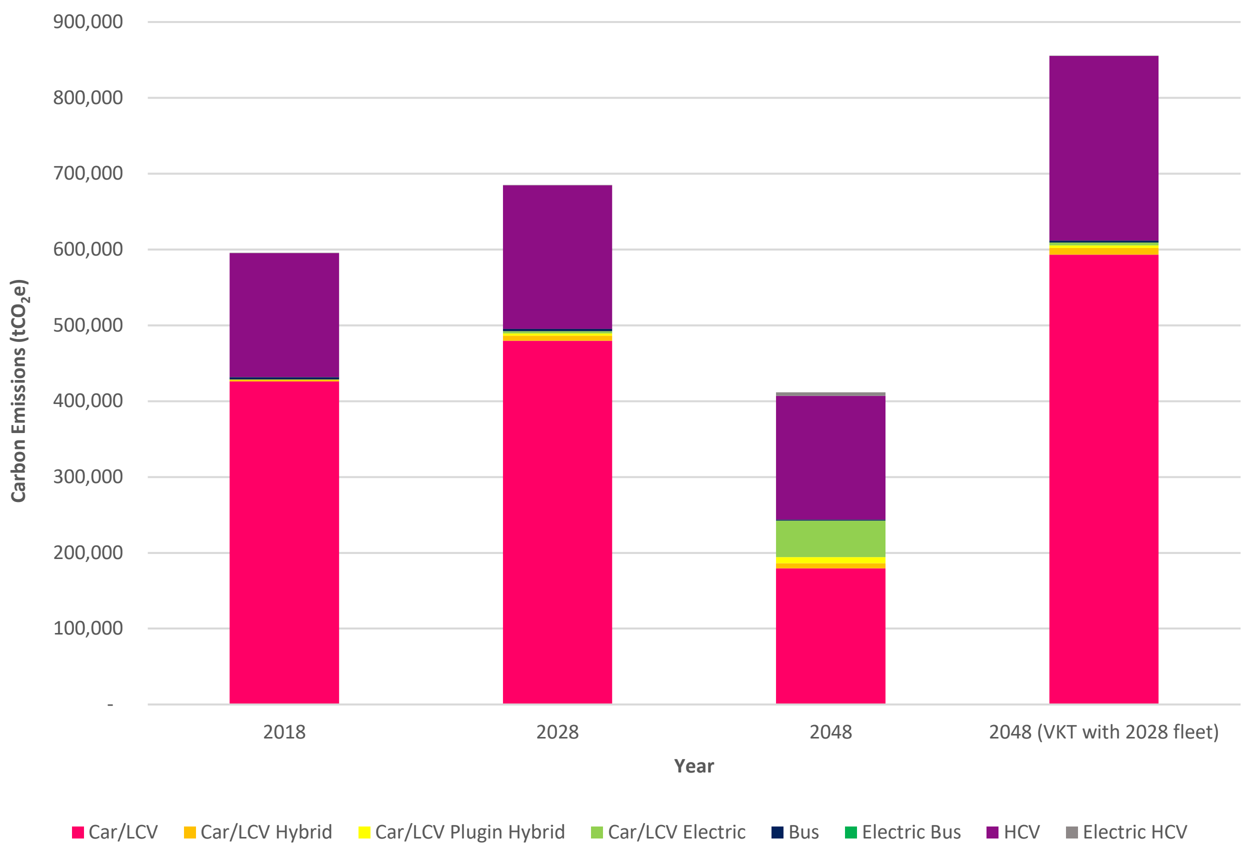


Figure 3. Total carbon emission projections with a breakdown per high level vehicle category for 2018, 2028, 2048, and for the year 2048 based on 2048 VKT with 2028 fleet vehicle composition.

The 2048 VKT with 2028 fleet bar on the far right of the graph shows that modelling a smaller proportion of EVs replacing internal combustion engine (ICE) PCs, the increase in emissions from 2028 to 2048 could be much larger than the emission increase from 2018 to 2028 due to the increase in travel demand.

VKT allocation per vehicle type and the total for the modelled years is shown in **Figure 4** below. Modelling outputs from the TTSM indicates that the total VKT is expected to increase over the years, most likely due to population increase. With the predicted high uptake of EVs from 2030 onwards, replacing combustion engine PCs, EVs in 2048 are therefore expected to have the largest contribution to the total annual VKT.

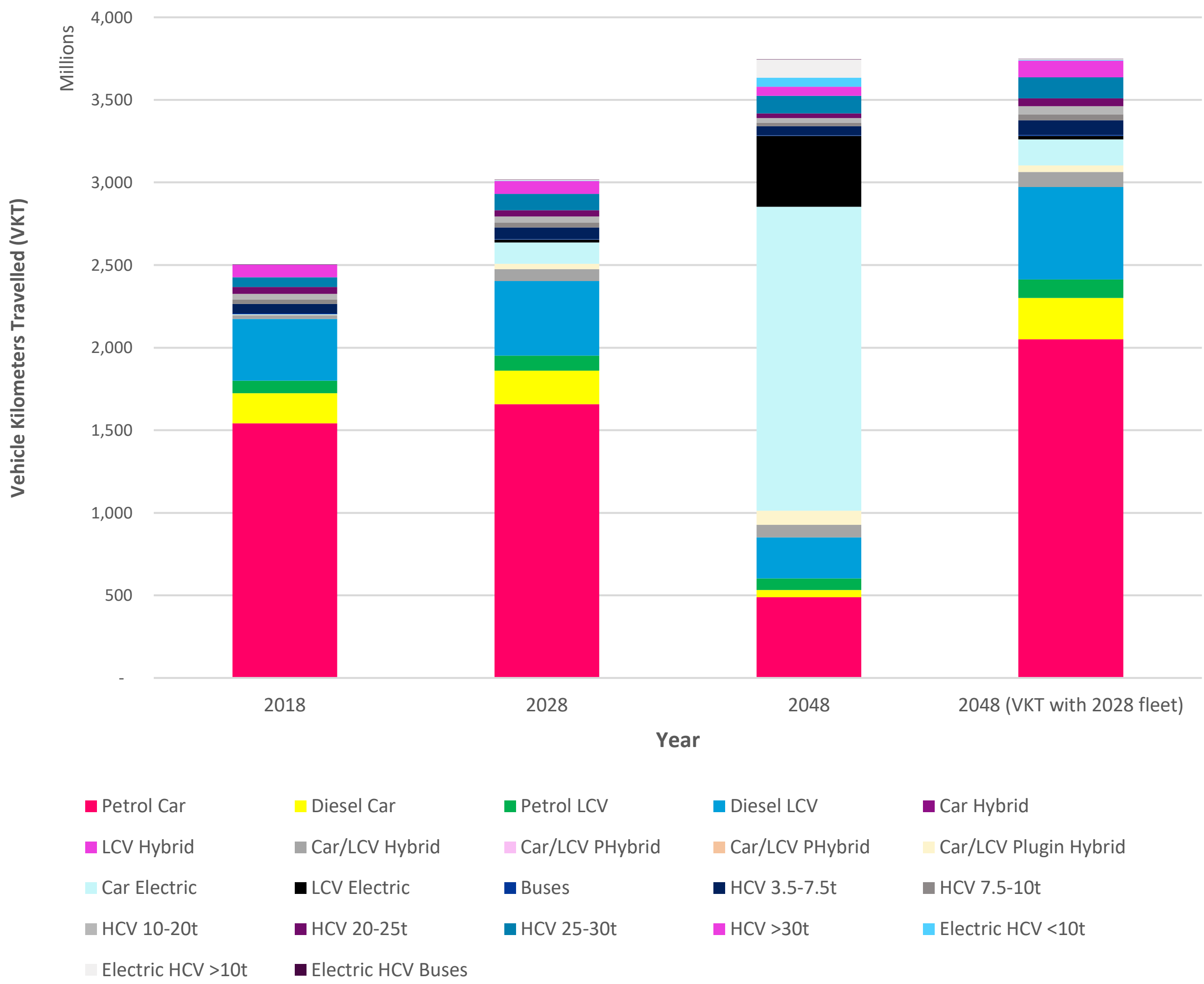


Figure 4. Total VKT projections with a breakdown per vehicle type for 2018, 2028, 2048, and for the year 2048 based on 2048 VKT with 2028 fleet vehicle composition.

Figure 5 below shows which fuel types are the greatest contributor to emissions. Petrol is the highest for most years based on private vehicle use, followed by diesel. In 2048 it is predicted that diesel emissions will be larger than petrol emissions due to petrol cars being replaced with electric vehicles. It is important to note that although electric vehicles will be powered from electricity from the national grid, which is proposed by the current government to be 100% renewable by 2035, there are still emissions associated with geothermal energy production, therefore a 100% renewable grid will still create carbon emissions.

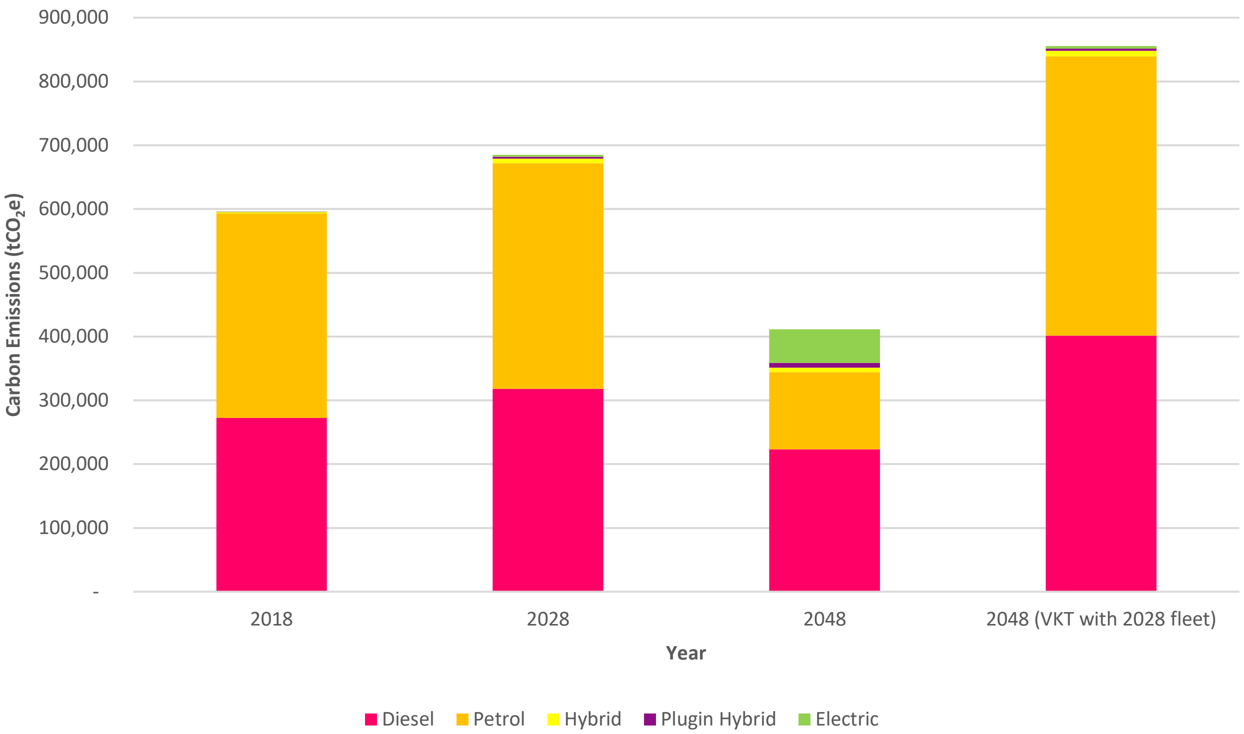


Figure 5. Total carbon emission projections with a breakdown per vehicle fuel type for 2018, 2028, 2048, and for the year 2048 based on 2048 VKT with 2028 fleet vehicle composition.

5 Mode Shift and Zero Emissions Context

Private vehicles with internal combustion engines make up the largest proportion of emissions and can be reduced through uptake of public and active transport. Modelling the net zero trajectory from 2018 to 2050 (the grey line in **Figure 6** below) shows that even with the high uptake of electric vehicles in 2048 (the turquoise bar), transport emissions are still well above the net zero 2050 target.

It was determined that to be in line with the zero carbon trajectory, a 40% reduction from business-as-usual emissions is needed in 2028 (shown by the purple bar in the graph). By only reducing private petrol and diesel VKT (to determine the amount of mode shift required away from private vehicle use), the 40% emissions reduction is equivalent to a 75% reduction in private petrol and diesel vehicle VKT.

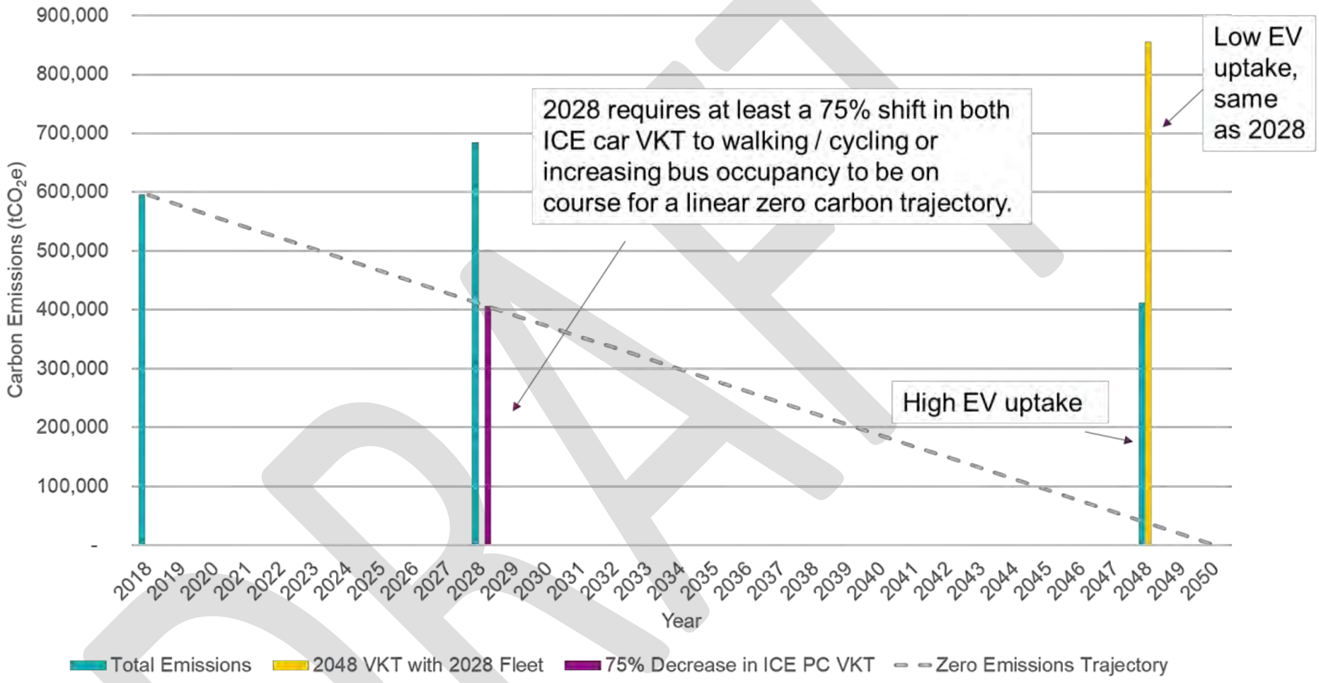


Figure 6. Emissions reduction required from BAU transport scenarios to reach zero carbon emissions

The 75% reduction in private petrol and diesel vehicle VKT is assuming an increased uptake of active modes of transport and increased use of the existing bus fleet (i.e. the bus VKT does not increase but buses will have more occupants). It also assumes that all other predicted VKT for 2028 fleet stays the same (see **Figure 7** below). The 75% reduction scenario is hypothetical however, as it is not realistic to only decrease private combustion vehicle use without understanding the impact and need of increasing the number of buses or other public transport options.

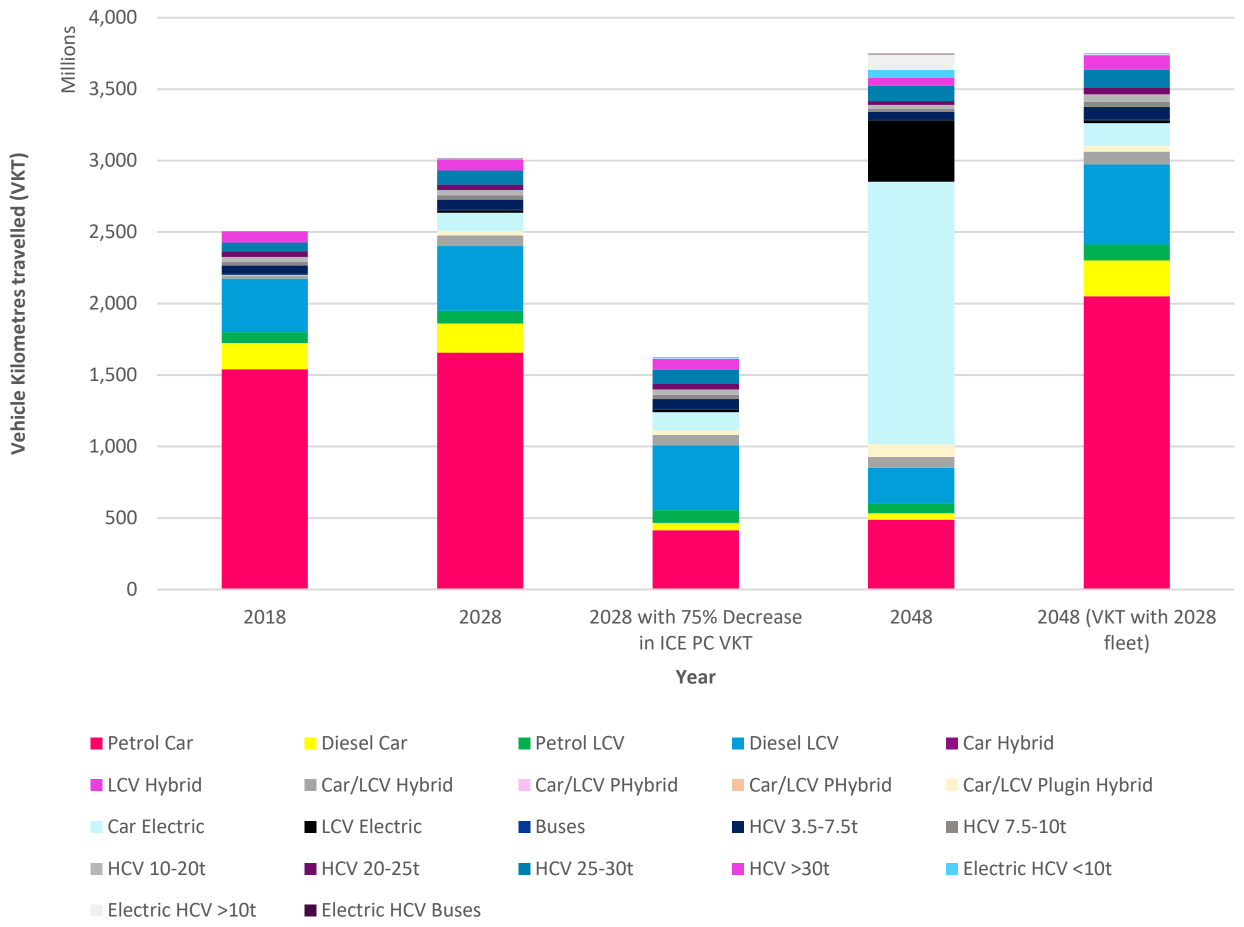


Figure 7. Projected VKT including the 2028 VKT with a 75% reduction in private petrol and diesel vehicles.

By 2050 it is not realistic to have no transport emissions, even with an electric vehicle fleet for the reasons discussed earlier. Transport is always likely to create carbon emissions, especially due to the projected growth of transport demands, and based on current technology, emissions will need to be offset by use of forestry land or purchasing of carbon credits for transport emissions to be net zero by 2050.

Modal shift and uptake of EVs is important to support transport emission reductions, but will need other supplementary reduction initiatives to help achieve the linear zero emission trajectory to 2050. The more approaches there are to greatly reduce emissions from transport means less carbon credits will need to be allocated to offset transport emissions. Other sectors will be competing to apply the credits to their emissions, such as agriculture which makes up nearly 50% of New Zealand's emissions.

There are many other factors that can help drive carbon reduction from transport, these include:

At the national and regional level:

- Other sectors contributing to New Zealand's emissions reducing their emissions further and quicker than the transport sector to give the transport sector more time to decarbonise against the backdrop of growth in transport demand.
- New Zealand increasing the amount of carbon sequestered either through improving forestry stocks or utilising carbon capture and storage or other technologies that actively absorb greenhouses gases from the atmosphere.
- Greening of the New Zealand electricity grid will further reduce the carbon impact of EVs and potentially hydrogen vehicles.

- Significant changes in town planning that support the shift away from single occupancy vehicle travel and towards uptake of low carbon public transport and active modes such as walking, cycling and micro mobility.

At the transport sector level:

- Support in reducing the need to travel; from virtual access to services and 'workplaces' to greater availability of shared paths and other active travel infrastructure.
- Increased uptake of low emissions fleet both EV and other technologies such as hydrogen for all fleet types cars to MCVs; through both a significant investment in EV infrastructure, government incentives and low emissions vehicle zones or lanes.

6 Limitations

This report has been prepared by Beca Ltd (Beca) solely for Tauranga City Council (TCC) and Western Bay of Plenty (WBoPDC) (Client). Beca has been requested by the Client to provide a carbon analysis for transport within the region for the years 2018, 2028 and 2048.

This report is prepared solely for the above stated purpose. The contents of this report may not be used by TCC and WBoPDC for any purpose other than in accordance with the stated Scope.

Beca accepts no liability to any other person for their use of or reliance on this report, and any such use or reliance will be solely at their own risk. In preparing this report Beca has relied on key information from provided by the client such as population, employment, bus route, and network information.

This report contains information obtained by use of transport models TTSM and VEPM. Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client or any third party, including the information listed above, and has not independently verified the information provided. Beca accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the information provided. Publicly available records are frequently inaccurate or incomplete.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers.

A

Appendix A – Outputs from TTSM and VEPM Models

Table 1. Annual VKT for vehicle groups from the TTSM Model

Year	PC & LCV VKT	MCV/HCV VKT	Bus VKT	Total Annual VKT
2018	2,202,229,855	294,886,926	4,811,412	2,501,928,193
2028	2,652,784,563	358,172,842	5,172,792	3,016,130,196
2048	3,282,045,654	459,774,661	5,172,792	3,746,993,107

Table 2. Outputs of %VKT and fuel consumption (l/100km) from the VEPM model for the speeds given from TTSM model

Year	Speed (km/hr)				% VKT	Fuel Consumption (L/100km)	% VKT	Fuel Consumption (L/100km)	% VKT	Fuel Consumption (L/100km)	% VKT	Fuel Consumption (L/100km)
	Car	LCV	HCV	Bus	Petrol Cars		Diesel Cars		Petrol LCVs		Diesel LCVs	
2018	56	56	64	21	65.02%	8.0045	7.75%	6.6184	3.19%	10.1816	15.78%	7.2165
2028	57	57	65	22	58.07%	8.2785	7.09%	6.5294	3.19%	8.1754	15.84%	7.3842
2048	53	53	61	21	13.92%	9.1333	1.27%	6.3823	1.99%	6.9031	7.05%	7.6024

Year	Speed (km/hr)				% VKT		Fuel Consumption (L/100km)	% VKT		Fuel Consumption (L/100km)	% VKT		Fuel Consumption (L/100km)
	Car	LCV	HCV	Bus	Car hybrid	LCV Hybrid	Hybrid (cars & LCVs)	Car Plugin hybrid	LCV Plugin Hybrid	Plug in hybrid (cars and LCVs)	Car electric	LCV electric	Electric Vehicles
2018	56	56	64	21	0.97%	0.00%	3.8474	0.06%	0.00%	1.8468	0.13%	0.02%	0
2028	57	57	65	22	2.54%	0.01%	3.8527	1.12%	0.02%	1.8493	4.46%	0.59%	0
2048	53	53	61	21	2.15%	0.02%	3.8358	2.42%	0.05%	1.8412	52.38%	12.25%	0

Year	Speed (km/hr)				% VKT	Fuel Consumption (L/100km)				% VKT	Fuel Consumption (L/100km)	% VKT	Fuel Consumption (L/100km)	% VKT	Fuel Consumption (L/100km)
	Car	LCV	HCV	Bus	Buses	Bus Average FC	Bus HCV 3.5-7.5t	Bus HCV 7.5-10t	Bus HCV 10-20t	HCV 3.5-7.5t		HCV 7.5-10t		HCV 10-20t	
2018	56	56	64	21	0.62%	22.56	13.4822	23.3287	30.8697	1.28%	10.8657	0.54%	15.4301	0.78%	18.8058
2028	57	57	65	22	0.71%	20.79	12.6544	21.1077	28.5985	1.24%	10.3356	0.49%	14.7244	0.68%	18.0773
2048	53	53	61	21	0.51%	20.87	12.7888	20.9993	28.8136	0.67%	10.0223	0.25%	14.3304	0.35%	18.0584

Year	Speed (km/hr)				% VKT	Fuel Consumption (L/100km)	% VKT	Fuel Consumption (L/100km)	% VKT	Fuel Consumption (L/100km)	% VKT Electric HCV			Fuel Consumption (L/100km)
	Car	LCV	HCV	Bus	HCV 20-25t		HCV 25-30t		HCV >30t		<10 t	>10 t	Buses	Electric Vehicles
2018	56	56	64	21	0.89%	22.9352	1.32%	24.0843	1.64%	26.8686	0.00%	0.00%	0.01%	0
2028	57	57	65	22	0.64%	22.2163	1.74%	23.5795	1.36%	26.5025	0.05%	0.09%	0.05%	0
2048	53	53	61	21	0.33%	22.3110	1.28%	23.9759	0.67%	27.0304	0.65%	1.32%	0.48%	0

B

Appendix B – Transport Model Background and Assumptions

Model Background and Assumptions

TTSM Model

The Tauranga System Plan (TSP) modelling scenarios are:

- Base Year 2018
- Year 2028 and Year 2048
  - This involves modelling the Do Minimum network for TSP Study

Modelling was undertaken for all scenarios in the regional Tauranga Transport Strategic Model (TTSM).

Modelling Inputs/Assumptions

Modelling Periods

The TTSM model is an average hour model for the following time periods:

- AM peak: 7 am – 9 am.
- Inter peak (IP): 9 am – 4 pm.
- PM peak: 4 pm – 6 pm.

Land Use

All land use inputs were provided by Tauranga City Council (TCC)/Western Bay of Plenty (WBoP), which are summarised below:

- Year 2018
  - TCC/WBoP land use update in March 2020 for population and dwellings
  - Employment projections from Market Economics Ltd in March 2020
- Year 2028 and Year 2048
  - TCC/WBoP land use update in June 2020 for population and dwellings
  - Employment projections from Market Economics Ltd in June 2020

Network

- Year 2018

Detailed network assumptions (Highway and PT services) are documented in "TTSM Enhancement – 2018, Beca, 19 June 2019" and "TTSM PT Model Update and Testing Report, Beca, 8 October 2019" submitted to TCC.

- Year 2028 and Year 2048

The Do Minimum network utilises the base year 2018 network plus the additional interventions for the TSP study. They are listed below:

- Highway Network:
  - Tauranga Northern Link (TNL)-Omokoroa scheme as per the NZ Upgrade announcements
  - Tauriko West local roads scheme
  - Updated Te Tumu internal network from Te Tumu Stage 3 study
  - Maunganui-Girven Road Interchange scheme
- PT Network:
  - The 2020 PT services lines were coded based on the information from the Tauranga bay hopper website. The data includes urban, regional and school buses services with scheduled bus route itineraries, service frequency and bus fare. Some of the 2020 bus routes are extended to cover the Te Tumu and Tauriko West growth areas.

Model Outputs

Network Statistics

Table 3 and

Table 4 shows the vehicle kilometres travelled (VKT) and vehicle hour travelled (VHT) for the TSP modelled scenarios. The percentage numbers in the brackets are changes in comparison to 2018.

Table 3. Vehicle Kilometres Travelled (VKT)

Year	PC & LCV (NZTA class 2 & 3) (Cars)				
	AM	IP	PM	Estimated Average Annual Daily	Estimated Annual (i.e. for 365 days)
2018	524,701	445,116	577,254	6,033,506	2,202,229,855
2028	638,164 (22%)	533,920 (20%)	697,158 (21%)	7,267,903 (20%)	2,652,784,563 (20%)
2048	789,806 (51%)	661,401 (49%)	859,357 (49%)	8,991,906 (49%)	3,282,045,654 (49%)
	MCV/HCV (NZTA class 4 and above)				
2018	70,542	65,993	54,649	787,961	287,605,767
2028	86,105(22%)	79,839(21%)	67,062(23%)	957,066(21%)	349,329,068(21%)
2048	109,298(55%)	103,550(57%)	83,595(53%)	1,228,554(56%)	448,422,200(56%)
Year	**Public Transport (Buses)**				
	AM/IP/PM	**Estimated Average Annual Daily**		**Estimated Annual (i.e. for 365 days)**	
2018	14,712	13,182		4,811,412	
2028	15,817 (8%)	14,172 (8%)		5,172,792 (8%)	
2048	15,817 (8%)	14,172 (8%)		5,172,792 (8%)	

Table 4. Vehicle Hour Travelled (VHT)

Year	PC & LCV (NZTA class 2 & 3) (Cars)			MCV/HCV (NZTA class 4 and above)		
	AM	**IP**	**PM**	**AM**	**IP**	**PM**
2018	9,609	7,700	10,435	1,126	987	867
2028	11,410(19%)	9,077(18%)	12,492(20%)	1,349(20%)	1,179(19%)	1,052(21%)
2048	15,264(59%)	11,825(54%)	16,757(61%)	1,855(65%)	1,612(63%)	1,425(64%)

The key findings from the above tables are:

- Change in the annual VKT (Cars and HCV) for the year 2028 is 20% and 21% when compared to 2018. For the year 2048, change in the annual VKT (Cars and HCV) is 49% and 56% when compared to 2018
- Change in the annual VKT for buses is similar for 2028 (8%) and 2048 (8%) when compared to 2018. This is because same PT service plan was used for both 2028 and 2048 Do Minimum scenarios.

Average Vehicle Speeds

The estimated average speeds for the AM/IP/PM peaks for PC & LCV and MCV/HCV are provided in **Table 5**. The estimated average speed for the buses is 20km/hr.

Table 5. Average Vehicle Speeds (km/hr)

Year	PC & LCV (NZTA class 2 & 3) (Cars)			MCV/HCV (NZTA class 4 and above)		
	AM	IP	PM	AM	IP	PM
2018	55	58	55	63	67	63
2028	56	59	56	64	68	64
2048	52	56	51	59	64	59

VEPM v6.0 Model Assumptions

NZTA's VEPM version 6 (released in July 2019) was adopted for this study. VEPM's assumed vehicle fleet distribution by VKT over time is provided in **Figure 8**. According to VEPM, while the light petrol vehicles (blue) are dominant in the year 2020, light hybrid/electric vehicles will make most of the fleet in 2050. The model does not factor in improvement in efficiency of electric vehicles over time.

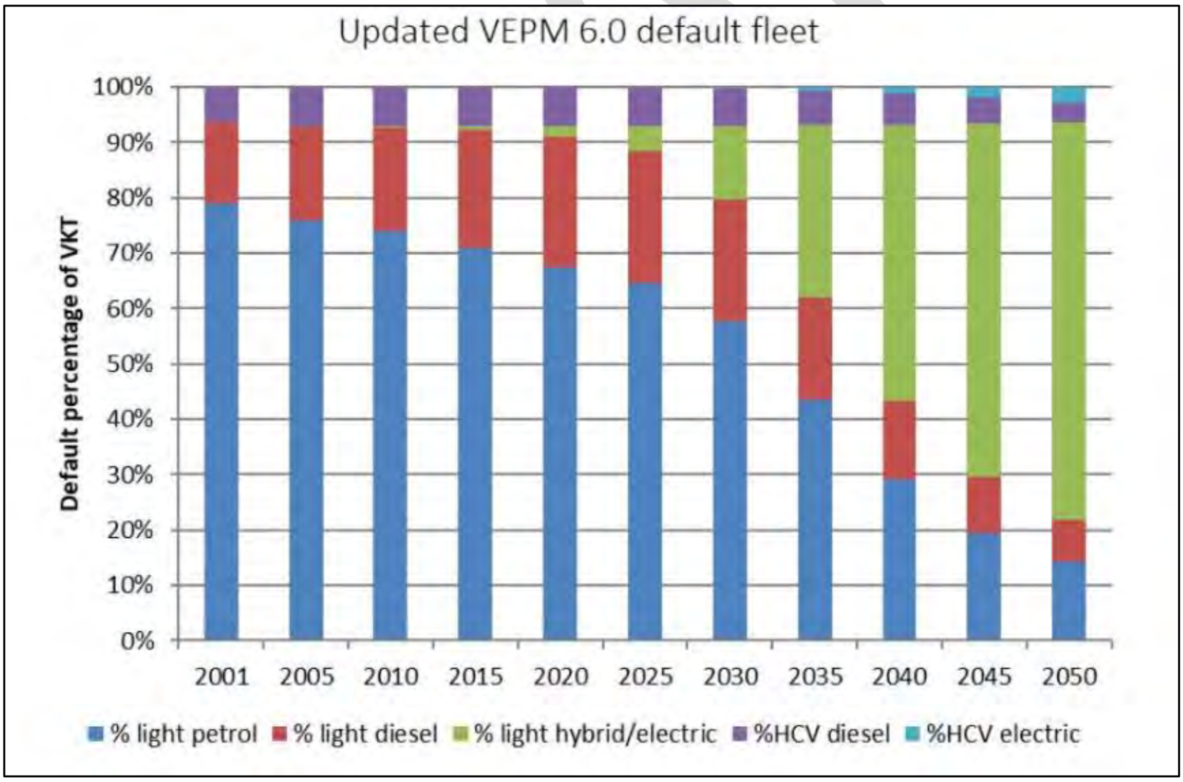


Figure 8. Summary of the Assumed Vehicle Fleet in VEPM 6.0 (Waka Kotahi)

Table 6 provides the fuel consumptions for car and heavy vehicles, excluding buses.

Table 6. Fuel Consumption from VEPM

Year	PC & LCV (NZTA class 2 & 3)				
	AM	IP	PM	Estimated Average Annual Daily (litres/day)	Estimated Annual (litres/year)
2018	41,863	35,035	45,944	477,331	174,225,837
2028	48,057	39,719	52,376	543,158	198,252,535
2048	18,446	15,239	20,062	208,334	76,041,923
	MCV/HCV (NZTA class 4 and above)				
2018	14,468	13,350	11,196	160,152	58,455,303
2028	16,718	15,299	12,997	184,201	67,233,510
2048	13,671	12,761	10,455	152,184	55,547,162

- The fuel consumption for the year 2028 is higher than 2018. This is due to higher vehicle travelled (VKT) and minimal change in the VEPM fuel consumption rates between 2028 and 2018
- Due to changes in the fleet size to light hybrid/electric vehicles in 2048, the fuel consumption for both cars and heavy vehicles are lower in the year 2048 compared to 2018

VEPM's default inputs for the model are shown in **Figure 9** below. These are the same inputs for the year 2018 and 2048 also.

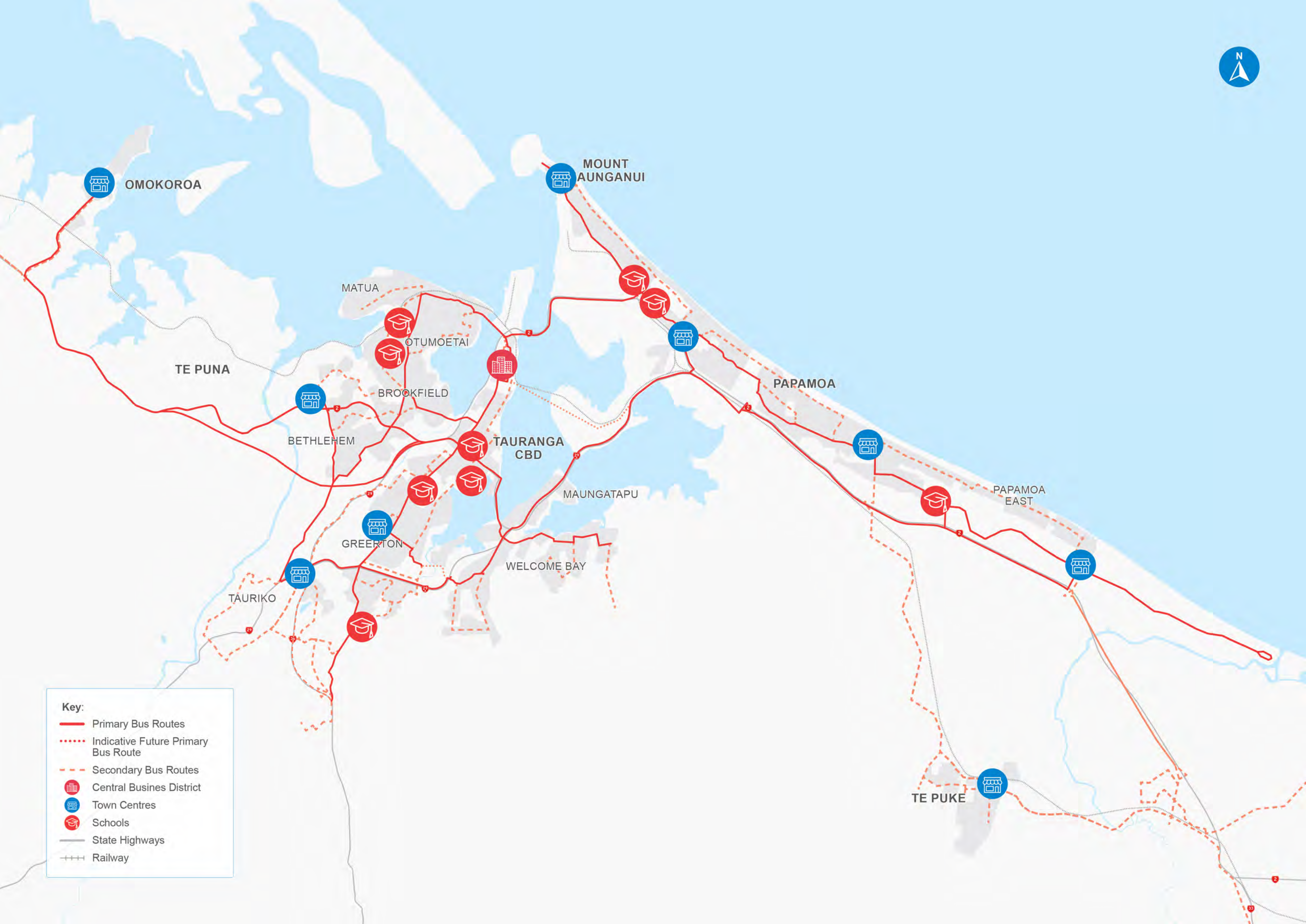
	Default values	Optional user entry	Options
Average trip length (km)	9.1		8 to 25
Ambient temperature °C	13.1		-10 to 30'
Petrol fuel type 2028	6		0 to 7
Diesel fuel type 2028	5		0 to 5
Consider cold start?	yes		no
Consider degradation?	yes		no
% of catalyst not working - old vehicles	15%		0-100%
% of catalyst not working - new vehicles	0%		0-100%
Gradient	0%		±2, 4, 6
Heavy vehicles: load	50%		0, 100%
Number of axles			
Vehicle type	**Default values**	**Optional user entry**	
Car	2		
LCV	2		
HCV 3.5-7.5 t	2		
HCV 7.5-10 t	2		
HCV 10-20 t	3		
HCV 20-25 t	4		
HCV 25-30 t	5		
HCV >30 t	6		
Brake and tyre PM output	**PM10**		

Figure 9. Default inputs for the VEPM 6 model

B

Appendix B – Primary and Secondary Route Maps


N
OMOKOROA
MOUNT
MAUNGANUI
MATUA
OTUMOETAI
TE PUNA
PAPAMOA
BROOKFIELD
BETHLEHEM
TAURANGA
CBD
MAUNGATAPU
PAPAMOA
EAST
GREERTON
WELCOME BAY
TAURIKO
TE PUKE
2
29
29A
36
33
Key:
Primary Cycling Routes
Primary Traffic Rout
Primary Bus Routes
Indicative Future Primary
Bus Route
Primary Freight Routes
Pedestrian Activity Centres
Central Busines District
Town Centres
Industrial Area
Local Shopping Areas
Tauranga Port
State Highways
Railway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BROOKFIELD
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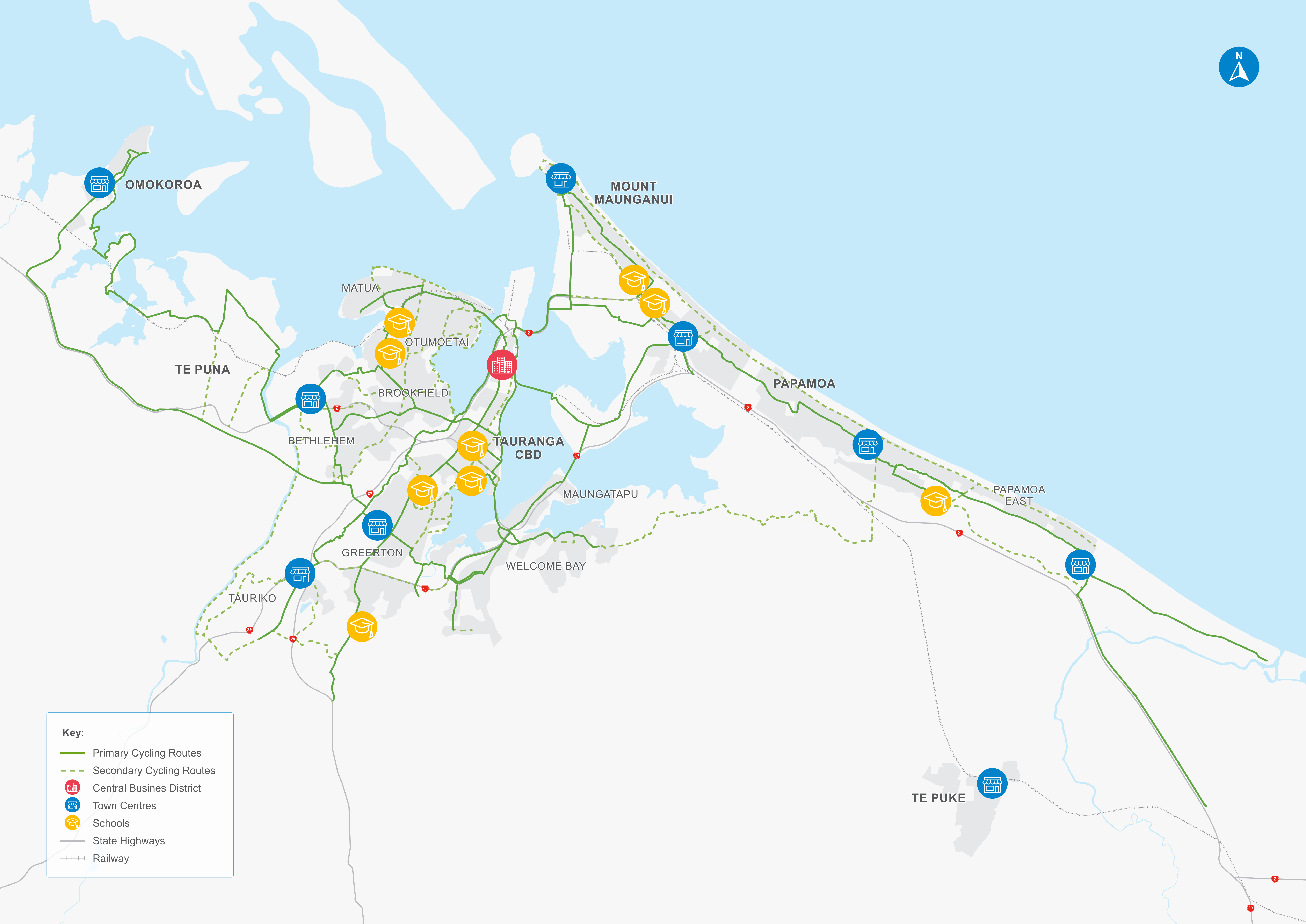
MAUNGATAPU
GREERTON
WELCOME BAY
TAURIKO
TE PUKE
Key:
Primary Bus Routes
Indicative Future Primary Bus Route
Secondary Bus Routes
Central Busines District
Town Centres
Schools
State Highways
Railway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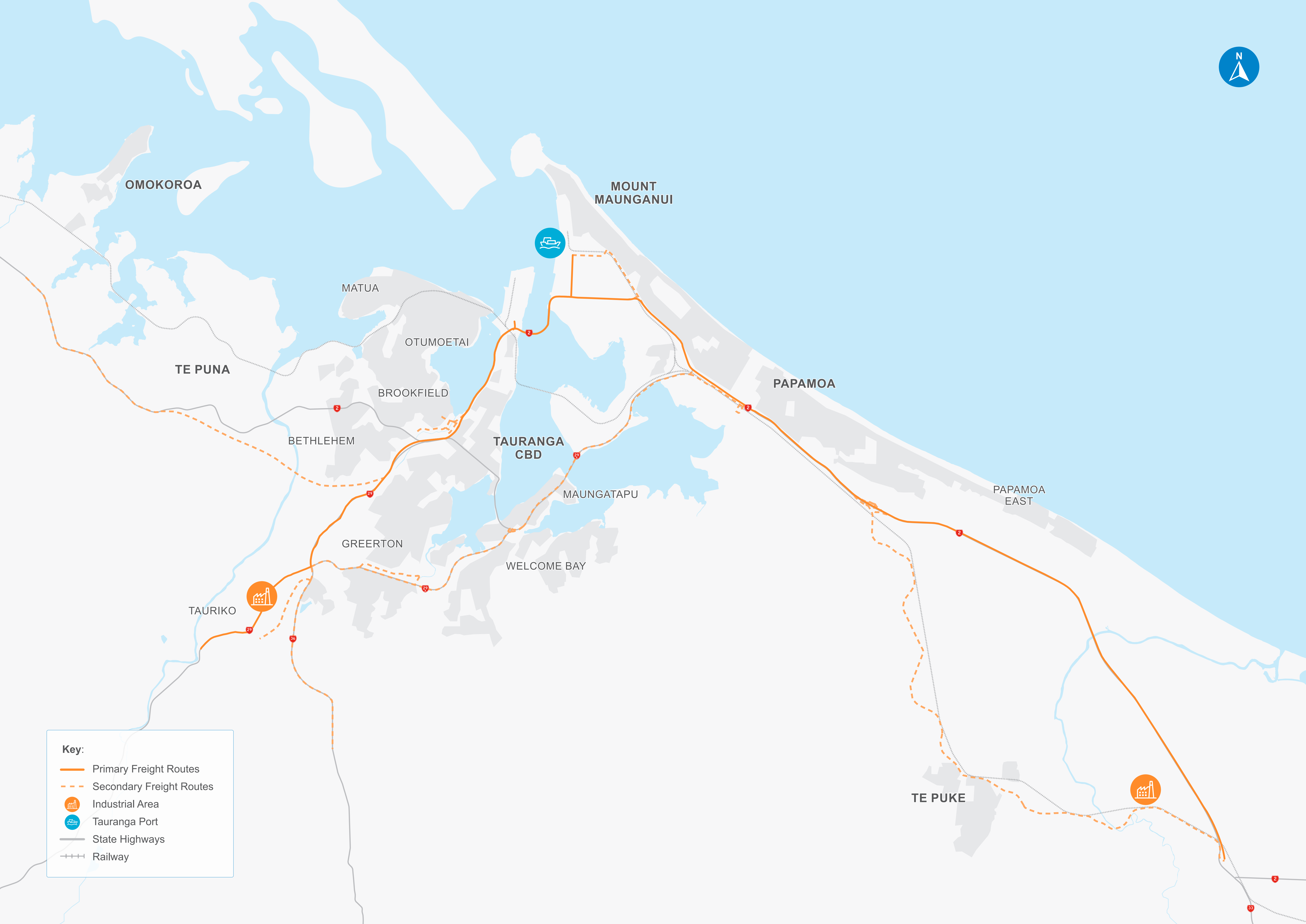
PAPAMOA EAST
GREERTON
WELCOME BAY
TAURIKO
TE PUKE
Key:
Primary Cycling Routes
Secondary Cycling Routes
Central Busines District
Town Centres
Schools
State Highways
Railway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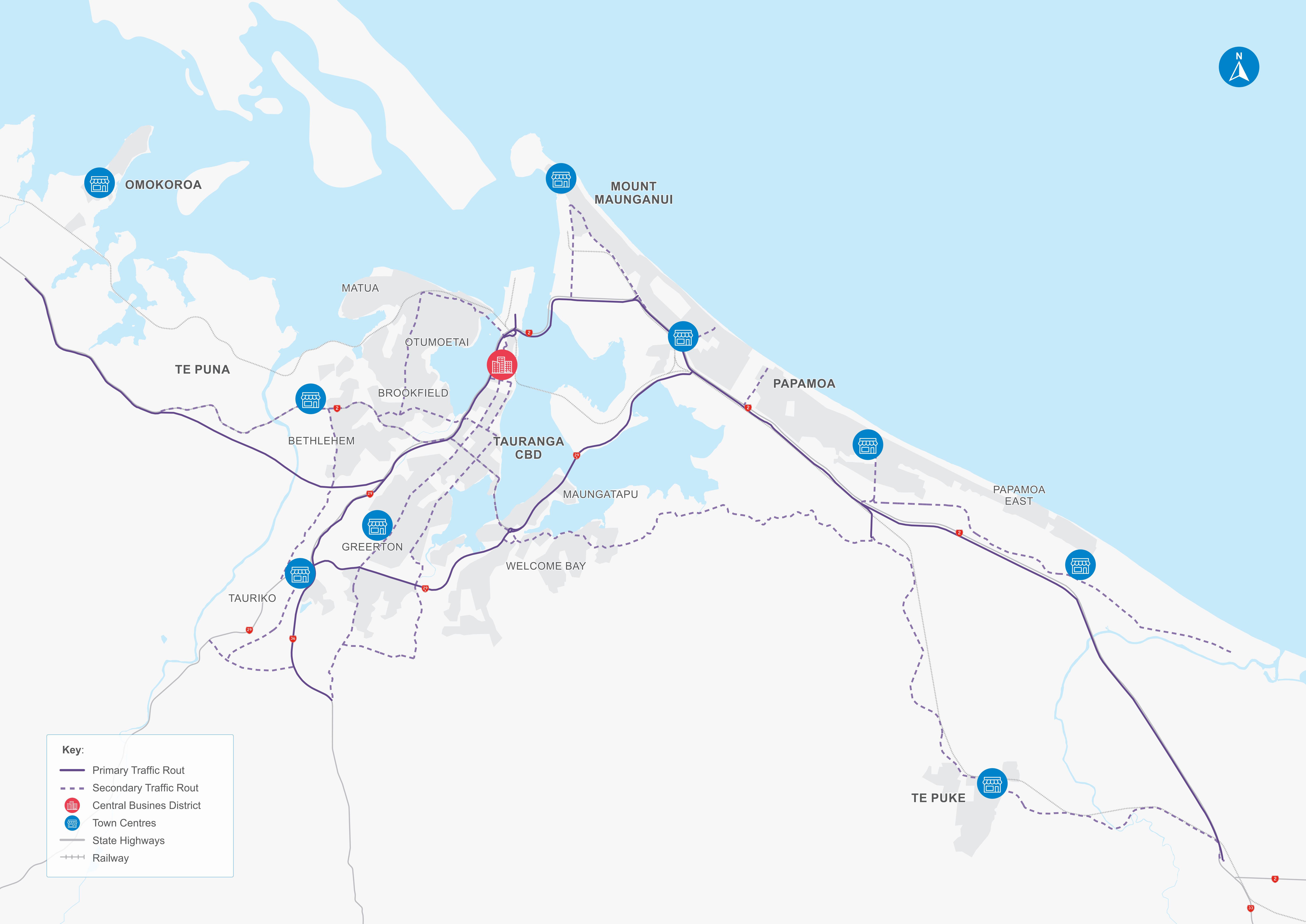
PAPAMOA
EAST
GREERTON
WELCOME BAY
TAURIKO
TE PUKE
Key:
Primary Freight Routes
Secondary Freight Routes
Industrial Area
Tauranga Port
State Highways
Railway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OTUMOETAI
TE PUNA
BROOKFIELD
PAPAMOA
BETHLEHEM
TAURANGA CBD
MAUNGATAPU
PAPAMOA EAST
GREERTON
WELCOME BAY
TAURIKO
TE PUKE
Key:
Primary Traffic Rout
Secondary Traffic Rout
Central Busines District
Town Centres
State Highways
Railway

C

Appendix C – Engagement Platform Outputs

Considerations for objective impact: Potential volume of users impacted; e.g. primary routes higher potential volumes
Scale of operating gap, e.g. actual LOS E/ F = high, LOS D medium / low
Period weighting, gaps appearing in early 0-3, 3-10 higher impact than later periods

Objectives Impacted and Severity (1 low, 3 high)

Ref		Nature of gap	Modes	Period 0to3	Period 3to10	Period 10to30	Safety 25%	Mode share 25%	Accessibility 25%	Freight 25%	Impact Rating	Priority	Sorted priority
	Northern sub area												
1	Omokoroa Rd poor LOS	LOS	car, cycle, bus				1	1	1	0	25%	44	41
2	Poor accessibility from northern areas	Accessibility	bus				0	2	3	0	42%	30	23
3	Moffatt Rd and Bethlehem Rd primary route mode conflict	Safety	cycle				1	2	0	0	25%	44	42
4	Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	Safety	cycle				2	2	0	0	33%	39	38
5	Brookfield roundabouts poor LOS AM Peak	LOS	car, bus, peds, cycle				1	2	1	1	42%	30	24
6	Waihi Rd poor LOS AM Peak	LOS	car, bus				1	1	2	1	42%	30	25
7	Primary cycle routes northern poor LOS for cycling	LOS	cycle				1	2	1	0	33%	39	39
8	Safety risk on existing SH2 north (also primary bus route)	Safety	car, bus, peds, cycle				2	2	2	0	50%	18	14
	Central sub area												
9	Hewletts Rd poor LOS and all day	LOS, Safety	car, freight, cycle, peds, bus				2	1	3	3	75%	2	1
10	Totara St poor LOS peak periods	LOS, Safety	car, freight, cycle, peds, bus				2	2	2	3	75%	2	2
11	Totara St primary route mode conflict	Safety	cycle, freight				3	2	1	1	58%	11	8
12	SH2 harbour bridge poor LOS peak periods	LOS	car, freight, bus				1	1	1	2	42%	30	26
13	SH2 / Elizabeth Street poor LOS AM peak	LOS	car, freight				1	0	3	2	50%	18	15
14	Takitimu Dr / SH2 poor LOS	LOS	car, freight, bus				2	0	2	2	50%	18	16
15	Golf Rd roundabout LOS and safety risk	LOS, Safety	car, freight, cycle, peds				2	2	2	2	67%	5	3
16	CBD area poor LOS all periods	LOS	bus, peds, cycle				1	3	2	0	50%	18	17
17	Cameron Rd primary route mode conflict	Safety	bus, cycle, peds				2	3	2	0	58%	11	9
18	Cameron Rd poor LOS peak periods	LOS, Safety	bus, car, cycle				3	1	2	1	58%	11	10
19	Primary cycle routes central poor LOS for cycling	LOS	cycle				2	2	1	0	42%	30	27
20	Fraser Chadwick poor LOS on a primary route	LOS	bus, car, cycle				1	2	2	0	42%	30	28
21	Turret Rd / 15th Ave primary route mode conflict	Safety	cycle, bus, car				1	2	2	0	42%	30	29
22	Turret Rd / 15th Ave poor LOS peak periods	LOS	bus, car, cycle				2	2	3	1	67%	5	4
23	Pyes Pa Rd primary route mode conflict	Safety	bus, cycle				1	1	1	0	25%	44	43
24	SH29 Tauriko Cambridge Rd poor LOS	LOS, Safety	car, cycle, peds, freight				2	1	2	3	67%	5	5
25	Te Papa area high safety risk	Safety	cycle, peds				3	2	0	0	42%	30	30
	East-west Sub Area												
26	SH29A primary general traffic and cycle crossing conflicts (Oropi)	Safety	car, cycle, peds				2	1	1	0	33%	39	40
27	SH29A poor LOS on a primary route peak periods	LOS	bus, cars, freight				1	2	2	2	58%	11	11
28	SH29A mode conflicts (Tauriko to Oropi Rd)	Safety & LOS	bus, car, cycle, peds				2	2	1	0	42%	30	31
29	SH29A LOS worsening by 2048	LOS	freight, bus, car				1	2	1	3	58%	11	12
30	Poike Rd poor LOS	LOS	bus, car				1	1	1	0	25%	44	44
31	Maungatapu Rd primary route mode conflict	Safety	bus, cycle				1	1	1	0	25%	44	45
32	Welcome Bay Rd primary route mode conflict	Safety	bus, cycle, car, peds				2	2	3	0	58%	11	13
33	Welcome Bay Rd poor LOS	LOS	bus, car, cycle				2	3	3	0	67%	5	6
34	Primary cycle routes east west poor LOS for cycling	LOS	cycle				2	2	2	0	50%	18	18
35	Welcome Bay area poor accessibility (all modes)	Accessibility	cycle, bus, car				1	2	3	0	50%	18	19
36	Welcome Bay Rd high road safety risk	Safety	cycle, car, peds				3	2	0	0	42%	30	32
37	Kaitemako Rd high road safety risk	Safety	cycle, car, peds				2	1	0	0	25%	44	46
	East Sub Area												
38	Mount Maunganui poor LOS within an activity centre	Safety & LOS	peds, cycle, bus				1	2	2	0	42%	30	33
39	Doncaster Dr primary route mode conflict	Safety & LOS	bus, cycle				1	1	0	0	17%	48	48
40	Grenada St primary route mode conflict	Safety & LOS	bus, cycle				2	2	1	0	42%	30	34
41	Farm St / Links Ave primary route mode conflict	Safety	bus, cycle				2	2	2	0	50%	18	20
42	Girven Rd poor LOS and safety risk within an activity centre	LOS	bus, peds, cycle				2	1	2	0	42%	30	35
43	Maunganui Rd poor LOS for buses on primary bus route	LOS	bus				1	1	1	0	25%	44	47
44	Maunganui Rd /SH2 poor LOS for freight on primary freight route	LOS	freight				1	0	1	3	42%	30	36
45	Oceanbeach Rd poor LOS and safety risks	Safety & LOS	peds, cycle				2	2	1	0	42%	30	37
46	Primary cycle routes east poor LOS for cycling	LOS	cycle				2	2	2	0	50%	18	21
47	Poor accessibility all modes from east suburbs	Accessibility	bus, cycle, car, pedestrian				1	3	3	1	67%	5	7
48	Arataki area high road safety risk	Safety	pedestrian, cycle				3	2	1	0	50%	18	22

Option Evaluation

			Option Evaluation									
			Gap		UFTI			Urgency				
			14%	14%	14%	14%	14%	14%	14%			
Significant Operaitng Gaps	Options	Intervention Hierarchy	Gap impact rating	Support planned urban growth	Support urban form outcomes	Support strategic journeys	Delivery timeframe	System enabling	Value for money	Option Rating	Progress?	Rationale
Northern Sub Area												
Omokoroa Rd poor LOS	Omokoroa Road multimodal upgrade	New infrastructure	1	2	0	2	1	1	1	37%	Defer	possible longer term project
Poor accessibility from northern areas	Park and ride sites	Demand management	2	1	1	2	3	3	2	65%	Progress	
Poor accessibility from northern areas	Ferry	Demand management	2	2	1	1	2	1	1	47%	Discount	possible longer term project low demand
Poor accessibility from northern areas	Improve bus services	Use of existing network	2	3	2	3	3	2	2	79%	Progress	
Poor accessibility from northern areas	Improved bus priority facilities on existing SH2	Demand management	2	3	2	3	2	2	3	79%	Progress	
Poor accessibility from northern areas	Local road connections to the TNL and SH2	Use of existing network	2	1	1	1	3	1	2	51%	Progress	
Poor accessibility from northern areas	Western Bay local road upgrades	Use of existing network	2	1	1	1	3	1	2	51%	Progress	
Poor accessibility from northern areas	Brookfield intersection and interchange upgrade	Demand management	2	2	1	2	1	2	2	56%	Progress	needed to support PT services
Poor accessibility from northern areas	Bethlehem PT interchange	Demand management	2	2	2	3	2	3	2	75%	Progress	
Waihi Rd poor LOS AM Peak	Waihi Rd multimodal upgrade	New infrastructure	2	2	1	2	1	1	1	47%	Progress	longer term gap and project
Moffatt Rd and Bethlehem Rd primary route mode conflict	Otumoetai cycleways	Demand management	1	2	2	2	2	2	1	56%	Progress	
Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	Otumoetai cycleways	Demand management	2	2	2	2	3	2	1	65%	Progress	
Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	Otumoetai / Bellview multimodal improvements	Demand management	2	2	2	2	2	1	2	61%	Progress	
Brookfield roundabouts poor LOS AM Peak	Brookfield intersection and interchange upgrade	Demand management	2	2	1	2	1	2	2	56%	Progress	
Primary cycle routes northern poor LOS for cycling	Otumoetai cycleways	Demand management	2	2	2	2	3	2	1	65%	Progress	
Safety risk on existing SH2 north (also primary bus route)	Existing SH2 upgrade to improve safety and accessibility	Use of existing network	2	2	2	2	2	2	1	61%	Progress	Post TNL upgrade of SH2 to support primary modes
Safety risk on existing SH2 north (also primary bus route)	Standard interventions for active modes	Use of existing network	2	0	1	0	1	0	0	19%	Defer	Part of above multimodal project
Central Sub Area												
Hewletts Rd poor LOS and all day	Hewletts Rd optimisation (te marie, aerodrome etc)	Use of existing network	3	0	0	1	2	0	1	33%	Progress	Planned LCLR may have some reletivley minor benefits
Hewletts Rd poor LOS and all day	Hewletts Rd sub area major interventions	New infrastructure	3	1	2	3	1	3	2	70%	Progress	
Hewletts Rd poor LOS and all day	Hewletts Rd sub area land use changes to reduce traffic	Integrated planning	3	0	0	1	0	0	1	23%	Defer	Something to be considered as part of business case
Hewletts Rd poor LOS and all day	TDM pricing to manage network demands	Demand management	3	1	0	2	2	0	3	51%	Progress	as part of city wide strategy for other gaps
Totara St poor LOS peak periods	Totara St multimodal upgrade	New infrastructure	3	1	2	3	2	2	2	70%	Progress	
Totara St poor LOS peak periods	Mt Maunganui ferry	Demand management	3	1	1	1	2	1	1	47%	Discount	
Totara St poor LOS peak periods	Improve bus services Central area	Use of existing network	3	1	2	2	3	2	1	65%	Progress	
Totara St poor LOS peak periods	TDM pricing to manage network demands	Demand management	3	1	0	2	2	0	3	51%	Progress	as part of city wide strategy for other gaps
Totara St primary route mode conflict	Totara St multimodal upgrade	New infrastructure	2	1	2	3	2	2	2	65%	Progress	progress on interdependency with hewletts road
Totara St primary route mode conflict	Totara St seperated cycleway	Demand management	2	1	1	2	2	2	1	51%	Existing project	Short term low cost project
SH2 harbour bridge poor LOS peak periods	TDM pricing to manage network demands	Demand management	2	1	0	2	2	3	3	61%	Progress	Need to test effectivness
SH2 harbour bridge poor LOS peak periods	Optimisation for priority modes e.g. shoulder running	Demand management	2	1	0	1	3	2	2	51%	Progress	low benefit questionable feasiblity but needs a study
SH2 harbour bridge poor LOS peak periods	Additional bridge connection for priority modes	New infrastructure	2	2	2	3	0	3	1	61%	Progress	Longer term harbour crossing aligns with UFTI
SH2 harbour bridge poor LOS peak periods	Aerial tram CBD to Arataki (park /cycle and ride site)	New infrastructure	2	1	0	1	0	0	0	19%	Discount	Possible subset of harbour crossing business case
SH2 harbour bridge poor LOS peak periods	Passenger rail strategy to protect sites for longer term	Integrated planning	2	1	1	1	3	3	2	61%	Defer	Assume UFTI / Smartgrowth progress as per UFTI
SH2 / Elizabeth Street poor LOS AM peak	Optimisation for priority modes	Use of existing network	2	1	0	2	3	1	2	51%	Progress	Study requried to assess options
SH2 / Elizabeth Street poor LOS AM peak	SH2 / Elizabeth St upgrade for priority modes	New infrastructure	2	2	1	3	1	1	1	51%	Progress	Supports commercial growth Tauriko and beyond
Takitimu Dr / SH2 poor LOS	Takitimu Dr upgrade for priority modes	New infrastructure	2	1	0	2	2	1	2	47%	Defer	Longer term gap and project possibly
Takitimu Dr / SH2 poor LOS	TDM pricing to manage network demands	Demand management	2	1	0	3	2	3	3	65%	Progress	Need to test system benefit
Takitimu Dr / SH2 poor LOS	Tauriko PT facility	Demand management	2									
Golf Rd roundabout LOS and safety risk	Golf Rd optimisation for priority modes e.g. queue jump	Use of existing network	2	1	1	1	3	2	2	56%	Progress	Short term low cost project
Golf Rd roundabout LOS and safety risk	Golf Rd / Maunganui Rd upgrade for priority modes	New infrastructure	2	1	2	3	1	3	2	65%	Progress	
CBD area poor LOS all periods	Te Papa IBC recommended programme	Use of existing network	2	3	3	2	2	3	2	79%	Progress	
CBD area poor LOS all periods	CBD bus interchange	New infrastructure	2	3	2	3	1	3	2	75%	Progress	
Cameron Rd primary route mode conflict	Cameron Rd multimodal upgrade stage 1	New infrastructure	2	3	3	3	2	2	1	75%	Existing project	Part of Do Min
Cameron Rd primary route mode conflict	Cameron Rd multimodal upgrade stage 2	New infrastructure	2	3	3	3	2	2	1	75%	Progress	
Cameron Rd poor LOS peak periods	Cameron Rd multimodal upgrade stage 1	New infrastructure	2	3	3	3	2	2	1	75%	Existing project	
Cameron Rd poor LOS peak periods	Cameron Rd multimodal upgrade stage 2	New infrastructure	2	3	3	3	2	2	1	75%	Progress	following stage 1
Cameron Rd poor LOS peak periods	Hospital PT interchange	New infrastructure	2	2	1	2	2	1	1	51%	Progress	Step change enabler for PT, timing dependant on te papa IBC
Cameron Rd poor LOS peak periods	Greerton PT interchange	New infrastructure	2	2	1	2	2	1	2	56%	Progress	Step change enabler for PT, timing dependant on te papa IBC
Cameron Rd poor LOS peak periods	Te Papa Peninsular second N-S PT route priority	Demand management	2	2	2	1	2	1	1	51%	Defer	possibly after stage 2 of cameron rd
Primary cycle routes central poor LOS for cycling	Central area cycleways	Demand management	2	3	1	2	2	2	1	61%	Progress	
Primary cycle routes central poor LOS for cycling	Te Papa Peninsular second N-S cycleway	Demand management	2	3	1	2	2	2	1	61%	Defer	Part of central area cycleways
Primary cycle routes central poor LOS for cycling	Gate Pa active mode bridge	Demand management	2	2	3	1	2	2	1	61%	Existing project	Dependant on Te Papa IBC detailed analysis
Primary cycle routes central poor LOS for cycling	10th Ave active mode bridge	Demand management	2	2	1	1	2	2	1	51%	Existing project	Dependant on Te Papa IBC detailed analysis
Fraser Chadwick poor LOS on a primary route	Fraser / chadwick area optimisation for priority modes	New infrastructure	2	2	1	1	2	2	2	56%	Progress	supports primary routes and access to an activity centre
Turret Rd / 15th Ave primary route mode conflict	Central area cycleways	Demand management	2	3	1	2	2	2	1	61%	Progress	
Turret Rd / 15th Ave poor LOS peak periods	Turret / 15th optimisation e.g. tidal flow	Use of existing network	2	1	2	3	2	2	2	65%	Progress	possible short term improvement prior to longer term option
Turret Rd / 15th Ave poor LOS peak periods	Turret / 15th Ave multimodal upgrade	New infrastructure	2	1	2	3	1	3	2	65%	Progress	
Turret Rd / 15th Ave poor LOS peak periods	Park and ride site welcome bay area	Demand management	2	0	0	1	2	1	1	33%	Discount	
Turret Rd / 15th Ave poor LOS peak periods	Improve bus services welcome bay area	Use of existing network	2	2	1	3	3	2	2	70%	Progress	
Turret Rd / 15th Ave poor LOS peak periods	TDM pricing to manage network demands	Demand management	2	1	0	1	0	1	2	33%	Discount	
Turret Rd / 15th Ave poor LOS peak periods	Ramp metering	Use of existing network	2	1	0	1	3	1	1	42%	Progress	include as option for turret rd multimodal
Pyes Pa Rd primary route mode conflict	Pyes Pa Rd multimodal upgrade	New infrastructure	1	2	1	2	1	1	2	47%	Progress	Progressed for longer term, low gap ranking
SH29 Tauriko Cambridge Rd poor LOS	SH29 Tauriko DBC early works package	New infrastructure	2	2	2	3	3	2	2	75%	Progress	Short term
SH29 Tauriko Cambridge Rd poor LOS	SH29 Tauriko DBC infrastrucutre and facilities all modes	New infrastructure	2	2	2	3	2	3	2	75%	Progress	Longer term
SH29 Tauriko Cambridge Rd poor LOS	PT facility Tauriko area	Demand management	2	3	1	2	2	2	2	65%	Progress	
SH29 Tauriko Cambridge Rd poor LOS	Smaiths Farm access to housing	Integrated planning	2	3	1	0	2	0	2	47%	Progress	requirement for access to housing area
Te Papa area high safety risk	Cameron Rd multimodal upgrade	New infrastructure	2	3	3	3	2	2	1	75%	Existing project	Covered above as well
Te Papa area high safety risk	Standard interventions for safety	New infrastructure	2	1	2	2	3	1	2	61%	Progress	Delivered under Te Papa IBC
Te Papa area high safety risk	Improve access to centres all modes	Demand management	2	3	3	1	2	1	2	65%	Progress	Will need detailled accessibility study

East-west Sub Area												
SH29A primary general traffic and cycle crossing conflicts (Oropi)	Roundabout safety treatments	Use of existing network	2	1	1	1	3	1	2	51%	Defer	feasibility / safety benefit uncertain
SH29A primary general traffic and cycle crossing conflicts (Oropi)	Grade separated crossing	New infrastructure	2	1	1	1	2	1	1	42%	Discount	maybe part of SH29A multimodal
SH29A poor LOS on a primary route peak periods	SH29A optimisation for priority modes e.g. queue jumps	Use of existing network	2	1	0	3	3	2	2	61%	Progress	
SH29A poor LOS on a primary route peak periods	SH29A multimodal upgrade for priority modes	New infrastructure	2	3	2	3	1	3	2	75%	Progress	
SH29A poor LOS on a primary route peak periods	Poike to Oropi Rd PT bridge	Demand management	2	2	2	3	2	3	1	70%	Progress	step change enabler for PT, feasibility?
SH29A poor LOS on a primary route peak periods	TDM pricing to manage network demands	Demand management	2	2	1	3	2	3	3	75%	Progress	
SH29A poor LOS on a primary route peak periods	Western corridor transport infrastrucutre (Tauriko Stage 3 ring route)	New infrastructure	2	3	2	2	2	2	1	65%	Progress	Supporitng growth area
SH29A LOS worsening by 2048	SH29A multimodal upgrade for priority modes	New infrastructure	2	3	2	3	1	3	2	75%	Progress	
Poike Rd poor LOS	Poike Rd multimodal upgrade	New infrastructure	1	1	1	1	2	1	2	42%	Defer	Possible longer term project
Maungatapu Rd primary route mode conflict	Maungatapu Rd multimodal upgrade	New infrastructure	1	1	1	2	2	1	2	47%	Defer	Possible longer term project
Welcome Bay Rd primary route mode conflict	Welcome Bay Rd multimodal upgrade	New infrastructure	2	1	2	3	1	1	1	51%	Progress	Part of 15th Ave Turret study
Welcome Bay Rd poor LOS	Welcome Bay Rd multimodal upgrade	New infrastructure	2	1	2	3	1	1	1	51%	Progress	Part of 15th Ave Turret study
Primary cycle routes east west poor LOS for cycling	East-west area cycleways	Demand management	2	1	1	1	2	2	1	47%	Progress	Lower priority than pther cycleways areas
Welcome Bay area poor accessibility (all modes)	Park and ride site welcome bay area	Demand management	2	0	0	1	2	1	1	33%	Discount	Too close to city to be viable
Welcome Bay area poor accessibility (all modes)	Improve access to centres all modes	Demand management	2	1	2	1	2	1	2	51%	Progress	Possibly part of safety study
Welcome Bay area poor accessibility (all modes)	Turret / 15th Ave multimodal upgrade	New infrastructure	2	1	2	3	1	3	2	65%	Progress	
Welcome Bay area poor accessibility (all modes)	Improve bus services Welcome Bay area	Use of existing network	2	1	1	3	3	2	2	65%	Progress	
Welcome Bay area poor accessibility (all modes)	Enhanced bus stop facilities at Hairini	Demand management	2	1	2	3	2	2	2	65%	Progress	
Welcome Bay area poor accessibility (all modes)	Aerial tram Welcome Bay - CBD	New infrastructure	2	1	0	0	1	1	1	28%	Discount	
Welcome Bay area poor accessibility (all modes)	Mobility as a service interventions	Demand management	2	1	1	2	3	2	1	56%	Progress	Addressing accessibility need for WB
Welcome Bay Rd high road safety risk	Standard interventions for safety	New infrastructure	2	1	2	1	3	1	2	56%	Progress	High risk area
Welcome Bay Rd high road safety risk	Travel behaviour change strategy Welcome Bay area	Demand management	2	1	0	0	3	1	1	37%	Defer	Standalone not successful but should be ingrained to support other interventions
Welcome Bay Rd high road safety risk	Welcome Bay Rd rural section safety improvements	New infrastructure	2	1	1	1	3	1	2	51%	Progress	wbopdc saefty improvements ongoing
Kaitemako Rd high road safety risk	Standard interventions for safety	New infrastructure	1	1	2	1	3	1	2	51%	Progress	High safety risk
Kaitemako Rd high road safety risk	Speed limit review Welcome Bay area	Demand management	1	1	1	0	3	1	2	42%	Progress	Part of TCC speed management package
East Sub Area												
Mount Maunganui poor LOS within an activity centre	Mt Maunganui accessible streets projects	Demand management	2	1	2	1	3	1	1	51%	Progress	short term improvements in an activity centre
Mount Maunganui poor LOS within an activity centre	Network wide PT realtime information	Demand management	2	0	0	0	3	3	2	47%	Progress	
Doncaster Dr primary route mode conflict	East area cycleways	Demand management	1	2	1	3	3	2	1	61%	Progress	
Doncaster Dr primary route mode conflict	Bus route review east area	Use of existing network	1	2	1	3	3	3	1	65%	Progress	
Grenada St primary route mode conflict	East area cycleways	Demand management	2	2	1	3	3	2	1	65%	Progress	
Grenada St primary route mode conflict	Bus route review east area	Use of existing network	2	2	1	3	3	3	1	70%	Progress	
Farm St / Links Ave primary route mode conflict	East area cycleways	Demand management	2	2	1	3	3	2	1	65%	Progress	
Farm St / Links Ave primary route mode conflict	Arataki area bus interchange	New infrastructure	2	2	2	3	2	2	2	70%	Progress	
Farm St / Links Ave primary route mode conflict	Golf course cycle connection	Demand management	2	2	1	3	2	2	1	61%	Defer	Possibly part of cycleways strategy longer term
Farm St / Links Ave primary route mode conflict	Keep buses on links ave (compared with diverting buses)	Use of existing network	2	2	1	3	3	3	2	75%	Progress	
Farm St / Links Ave primary route mode conflict	Alternative bus route (Pap Becah Road / Maunganui Rd)	Use of existing network	2	1	1	1	2	1	1	42%	Discount	Other routes don't have facilities for buses
Girven Rd poor LOS and safety risk within an activity centre	Arataki area accessibility and placemaking improvements	Demand management	2	1	2	2	2	1	1	51%	Progress	
Maunganui Rd poor LOS for buses on primary bus route	Maunganui Rd multimodal upgrade	New infrastructure	1	2	2	3	2	3	2	70%	Progress	
Maunganui Rd poor LOS for buses on primary bus route	Maunganui Rd freight restrictions	Demand management	1	0	2	1	2	2	1	42%	Defer	a consideration in multimodal upgrade above
Maunganui Rd /SH2 poor LOS for freight on primary freight route	Hewletts Rd sub area major interventions	New infrastructure	2	1	2	3	1	3	2	65%	Progress	
Maunganui Rd /SH2 poor LOS for freight on primary freight route	Improved bus services east area	Use of existing network	2	2	1	3	3	3	1	70%	Progress	
Maunganui Rd /SH2 poor LOS for freight on primary freight route	TDM pricing to manage network demands	Demand management	2	1	0	2	2	3	3	61%	Progress	Tolling on takitumu to reduce cross harbour demand
Maunganui Rd /SH2 poor LOS for freight on primary freight route	Increase freight transfer to rail to reduce road demands	Demand management	2	2	1	2	1	1	1	47%	Defer	recommend as part of a rail or rangiuru land use strategy
Oceanbeach Rd poor LOS and safety risks	Oceanbeach to Papamoa beach safety improvements	Demand management	2	2	1	0	2	1	2	47%	Progress	
Primary cycle routes east poor LOS for cycling	East area cycleways	Demand management	2	2	1	3	3	2	1	65%	Progress	
Poor accessibility all modes from east suburbs	Papamoa East Interchange	New infrastructure	2	3	2	2	2	3	2	75%	Progress	Supports growth and accessibility
Poor accessibility all modes from east suburbs	Wairakei Te Tumu multimodal transport network and facilities	New infrastructure	2	3	3	3	2	3	3	89%	Progress	Supports growth and accessibility
Poor accessibility all modes from east suburbs	Hewletts Rd sub area major interventions	New infrastructure	2	1	2	3	1	3	2	65%	Progress	
Poor accessibility all modes from east suburbs	Improved bus services east area	Use of existing network	2	2	1	3	3	3	1	70%	Progress	
Poor accessibility all modes from east suburbs	Improve PT access via TEL for express services	Use of existing network	2	2	1	3	1	2	1	56%	Progress	
Poor accessibility all modes from east suburbs	Improve access to centres all modes	Demand management	2	2	3	3	3	1	3	79%	Progress	Accessibility strategy? Low on enabling as applied to existing centres, higher for greenfield
Poor accessibility all modes from east suburbs	Micomodes sharing scheme	Demand management	2	1	1	1	3	1	2	51%	Defer	Sharing scheme has low benefit, should be private led. Recommend support for micromode:
Poor accessibility all modes from east suburbs	Park and ride site east area	Demand management	2	2	1	3	2	2	1	61%	Progress	
Poor accessibility all modes from east suburbs	On demand bus services (e.g. to P&R site)	Demand management	2	1	1	1	3	1	1	47%	Discount	
Arataki area high road safety risk	Standard interventions for safety	New infrastructure	2	1	2	1	3	1	2	56%	Progress	High risk area in aratraki
Arataki area high road safety risk	Speed limit review eastern subburbs	Demand management	2	1	1	0	3	1	2	47%	Progress	Part of TCC speed management package
Arataki area high road safety risk	Travel behaviour change strategy Arataki area	Demand management	2	1	0	0	3	1	1	37%	Defer	Standalone not successful but should be ingrained to support other interventions

Gap Priority	Gap Rank	Gap Ref	Operating Gap	Progressed Options Option	Option Rating	Option	Option Rating	Option	Option Rating	Option	Option Rating	Option	Option Rating	Option	Option Rating	Option	Option Rating
High	1	9	Hewletts Rd poor LOS and all day	Hewletts Rd optimisation (te marie, aerodrome etc)	33%	Hewletts Rd sub area major interventions	70%	TDM pricing to manage network demands	51%								
	2	10	Totara St poor LOS peak periods	TDM pricing to manage network demands	51%	Totara St multimodal upgrade	70%	Improve bus services Central area	65%								
	3	15	Golf Rd roundabout LOS and safety risk	Golf Rd / Maunganui Rd upgrade for priority modes	65%	Golf Rd optimisation for priority modes e.g. queue jump	56%										
	4	22	Turret Rd / 15th Ave poor LOS peak periods	Improve bus services welcome bay area	70%	Turret / 15th Ave multimodal upgrade	65%	Ramp metering	42%	Turret / 15th optimisation e.g. tidal flow	65%						
	5	24	SH29 Tauriko Cambridge Rd poor LOS	SH29 Tauriko DBC early works package	75%	Park and ride site Tauriko area		SH29 Tauriko DBC infrastrucutre and facilities all modes	65%	Smaiths Farm access to housing	47%						
	6	33	Welcome Bay Rd poor LOS	Welcome Bay Rd multimodal upgrade	51%												
	7	47	Poor accessibility all modes from east suburbs	Hewletts Rd sub area major interventions	70%	Improve access to centres all modes	65%	Improved bus services east area	70%	Improve PT access via TEL for express services	56%	Park and ride site east area	61%	Papamoa East Interchange	75%	Wairakei Te Tumu multimodal transport netwo	89%
	8	11	Totara St primary route mode conflict	Totara St multimodal upgrade	70%												
	9	17	Cameron Rd primary route mode conflict	Cameron Rd multimodal upgrade stage 2	75%												
	10	18	Cameron Rd poor LOS peak periods	Cameron Rd multimodal upgrade stage 2	75%	Hospital PT interchange	51%	Greerton PT interchange	56%								
	11	27	SH29A poor LOS on a primary route peak periods	TDM pricing to manage network demands	51%	SH29A multimodal upgrade for priority modes	75%	Poike to Oropi Rd PT bridge	70%	SH29A optimisation for priority modes e.g. queue	61%	Western corridor transport infrastrucutre (Tauriko Stage	65%				
	12	29	SH29A LOS worsening by 2048	SH29A multimodal upgrade for priority modes	75%												
	13	32	Welcome Bay Rd primary route mode conflict	Welcome Bay Rd multimodal upgrade	51%												
	14	8	Safety risk on existing SH2 north (also primary bus route)	Existing SH2 upgrade to improve safety and accessibility	61%												
	15	13	SH2 / Elizabeth Street poor LOS AM peak	SH2 / Elizabeth St upgrade for priority modes	51%	Optimisation for priority modes	51%										
	16	14	Takitimu Dr / SH2 poor LOS	TDM pricing to manage network demands	51%												
	17	16	CBD area poor LOS all periods	CBD bus interchange	75%	Te Papa IBC recommended programme	79%										
	18	34	Primary cycle routes east west poor LOS for cycling	East-west area cycleways	47%												
	19	35	Welcome Bay area poor accessibility (all modes)	Improve bus services welcome bay area	70%	Improve access to centres all modes	65%	Turret / 15th Ave multimodal upgrade	65%	Mobility as a service interventions	56%	Enhanced bus stop facilities at Hairini	65%				
	20	41	Farm St / Links Ave primary route mode conflict	East area cycleways	61%	Keep buses on links ave (compared with diverting buses)	75%	Arataki area bus interchange	70%								
	21	46	Primary cycle routes east poor LOS for cycling	East area cycleways	61%												
	22	48	Arataki area high road safety risk	Standard interventions for safety	61%	Speed limit review eastern subburbs	47%										
	23	2	Poor accessibility from northern areas	Bethlehem PT interchange	75%	Improve bus services	79%	Local road connections to the TNL and SH2	51%	Park and ride sites	65%	Brookfield intersection and interchange upgrade	56%	Improved bus priority facilities on existing SH2	79%	Western Bay local road upgrades	51%
	24	5	Brookfield roundabouts poor LOS AM Peak	Brookfield intersection and interchange upgrade	56%												
	25	6	Waihi Rd poor LOS AM Peak	Waihi Rd multimodal upgrade	47%												
	26	12	SH2 harbour bridge poor LOS peak periods	TDM pricing to manage network demands	51%	Optimisation for priority modes e.g. shoulder running	51%	Additional bridge connection for priority modes	61%								
	27	19	Primary cycle routes central poor LOS for cycling	Central area cycleways	61%												
	28	20	Fraser Chadwick poor LOS on a primary route	Fraser / chadwick area optimisation for priority modes	56%												
	29	21	Turret Rd / 15th Ave primary route mode conflict	Central area cycleways	61%												
	30	25	Te Papa area high safety risk	Standard interventions for safety	61%	Improve access to centres all modes	65%										
	31	28	SH29A mode conflicts (Tauriko to Oropi Rd)														
	32	36	Welcome Bay Rd high road safety risk	Standard interventions for safety	61%	Welcome Bay Rd rural section safety improvements	51%										
	33	38	Mount Maunganui poor LOS within an activity centre	Mt Maunganui accessible streets projects	51%	Network wide PT realtime information	47%										
	34	40	Grenada St primary route mode conflict	East area cycleways	61%	Bus route review east area	65%										
	35	42	Girven Rd poor LOS and safety risk within an activity centre	Arataki area accessibility and placemaking improvements	51%												
	36	44	Maunganui Rd /SH2 poor LOS for freight on primary freight route	Hewletts Rd sub area major interventions	70%	TDM pricing to manage network demands	51%	Improved bus services east area	70%								
	37	45	Oceanbeach Rd poor LOS and safety risks	Oceanbeach to Papamoa beach safety improvements	47%												
	38	4	Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	Otumoetai cycleways	56%	Otumoetai / Bellview multimodal improvements	61%										
	39	7	Primary cycle routes northern poor LOS for cycling	Otumoetai cycleways	56%												
	40	26	SH29A primary general traffic and cycle crossing conflicts (Oropi)														
	41	1	Omokoroa Rd poor LOS														
	42	3	Moffatt Rd and Bethlehem Rd primary route mode conflict	Otumoetai cycleways	56%												
	43	23	Pyes Pa Rd primary route mode conflict	Pyes Pa Rd multimodal upgrade	47%												
	44	30	Poike Rd poor LOS														
	45	31	Maungatapu Rd primary route mode conflict														
	46	37	Kaitemako Rd high road safety risk	Standard interventions for safety	61%	Speed limit review Welcome Bay area	42%										
	47	43	Maunganui Rd poor LOS for buses on primary bus route	Maunganui Rd multimodal upgrade	70%												
	48	39	Doncaster Dr primary route mode conflict	East area cycleways	61%	Bus route review east area	65%										
Low	49	0	0	0		0		0		0		0		0			

Sensitivity: General

Red cells highlight top 10 gaps

Gap Description	Base priority	High mode shift	High accessibility	High safety	High freight	Exclude freight	All safety	All Accessibility	All mode share	All freight	All 3's	Rank extractor
Hewletts Rd poor LOS and all day	1	4	1	1	1	7	8	2	34	1	1	1
Totara St poor LOS peak periods	2	1	2	2	2	8	9	11	11	2	2	2
Golf Rd roundabout LOS and safety risk	3	5	6	4	4	10	11	13	13	9	3	3
Turret Rd / 15th Ave poor LOS peak periods	4	7	3	6	6	3	14	4	17	15	4	4
SH29 Tauriko Cambridge Rd poor LOS	5	10	7	7	3	22	15	19	38	3	5	5
Welcome Bay Rd poor LOS	6	2	4	8	13	1	19	6	3	35	20	6
Poor accessibility all modes from east suburbs	7	3	5	11	8	5	47	8	4	16	6	7
Totara St primary route mode conflict	8	8	16	3	9	9	1	29	12	13	21	8
Cameron Rd primary route mode conflict	9	6	10	9	16	2	12	15	2	24	22	9
Cameron Rd poor LOS peak periods	10	15	11	5	12	12	2	16	36	14	23	10
SH29A poor LOS on a primary route peak periods	11	11	12	16	7	24	38	20	19	10	24	11
SH29A LOS worsening by 2048	12	12	19	17	5	38	39	35	21	4	25	12
Welcome Bay Rd primary route mode conflict	13	13	8	10	17	4	18	5	22	34	7	13
Safety risk on existing SH2 north (also primary bus route)	14	14	15	13	20	6	7	10	10	22	8	14
SH2 / Elizabeth Street poor LOS AM peak	15	36	9	22	10	35	33	3	46	7	9	15
Takitimu Dr / SH2 poor LOS	16	37	17	14	11	36	10	12	47	8	10	16
CBD area poor LOS all periods	17	9	18	23	21	11	34	14	1	23	26	17
Primary cycle routes east west poor LOS for cycling	18	16	20	18	22	13	20	21	23	36	11	18
Welcome Bay area poor accessibility (all modes)	19	17	13	26	23	14	42	7	24	37	27	19
Farm St / Links Ave primary route mode conflict	20	18	21	20	24	15	23	23	28	43	28	20
Primary cycle routes east poor LOS for cycling	21	19	22	21	25	16	26	25	30	47	29	21
Arataki area high road safety risk	22	20	28	12	26	17	5	42	31	48	30	22
Poor accessibility from northern areas	23	21	14	39	27	18	48	1	5	18	12	23
Brookfield roundabouts poor LOS AM Peak	24	22	29	31	18	32	29	27	8	11	13	24
Waihi Rd poor LOS AM Peak	25	33	23	32	19	33	30	9	33	12	31	25
SH2 harbour bridge poor LOS peak periods	26	35	30	33	15	41	32	30	35	6	32	26
Primary cycle routes central poor LOS for cycling	27	23	31	24	28	19	13	31	14	25	33	27
Fraser Chadwick poor LOS on a primary route	28	24	24	34	29	20	35	17	15	26	34	28
Turret Rd / 15th Ave primary route mode conflict	29	25	25	35	30	21	36	18	16	27	14	29
Te Papa area high safety risk	30	26	37	15	31	23	3	45	18	29	35	30
SH29A mode conflicts (Tauriko to Oropi Rd)	31	27	32	25	32	25	17	34	20	31	36	31
Welcome Bay Rd high road safety risk	32	28	39	19	33	26	4	46	25	38	37	32
Mount Maunganui poor LOS within an activity centre	33	29	26	37	34	27	43	22	26	40	38	33
Grenada St primary route mode conflict	34	30	33	27	35	28	22	38	27	42	15	34
Girven Rd poor LOS and safety risk within an activity centre	35	38	27	28	36	29	24	24	44	44	16	35
Maunganui Rd /SH2 poor LOS for freight on primary freight route	36	41	34	38	14	48	46	40	48	5	39	36
Oceanbeach Rd poor LOS and safety risks	37	31	35	29	37	30	25	41	29	46	17	37
Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	38	32	41	30	38	31	6	44	7	20	18	38
Primary cycle routes northern poor LOS for cycling	39	34	36	40	39	34	31	28	9	21	40	39
SH29A primary general traffic and cycle crossing conflicts (Oropi)	40	40	38	36	40	37	16	33	39	30	41	40
Omokoroa Rd poor LOS	41	42	40	42	41	39	27	26	32	17	42	41
Moffatt Rd and Bethlehem Rd primary route mode conflict	42	39	46	43	42	40	28	43	6	19	43	42
Pyes Pa Rd primary route mode conflict	43	43	42	44	43	42	37	32	37	28	44	43
Poike Rd poor LOS	44	44	43	45	44	43	40	36	40	32	45	44
Maungatapu Rd primary route mode conflict	45	45	44	46	45	44	41	37	41	33	46	45
Kaitemako Rd high road safety risk	46	46	47	41	46	45	21	47	42	39	47	46
Maunganui Rd poor LOS for buses on primary bus route	47	47	45	47	47	46	45	39	45	45	48	47
Doncaster Dr primary route mode conflict	48	48	48	48	48	47	44	48	43	41	49	48

Green calls highlight scores above 75%

Gap	Option	Base Impact Score	Sensitivity Tests						Min	Max
			UFTI Only	Urgency Only	Gap Only	Value for money only	Delivery timeframe	Gap, timeframe, value		
Northern Sub Area										
Omokoroa Rd poor LOS	Omokoroa Road multimodal upgrade	37%	44%	33%	33%	33%	33%	33%	33%	44%
Poor accessibility from northern areas	Park and ride sites	65%	44%	88%	33%	67%	100%	63%	33%	100%
Poor accessibility from northern areas	Ferry	47%	44%	44%	33%	33%	67%	43%	33%	67%
Poor accessibility from northern areas	Improve bus services	79%	88%	77%	33%	67%	100%	63%	33%	100%
Poor accessibility from northern areas	Improved bus priority facilities on existing SH2	79%	88%	77%	33%	100%	67%	63%	33%	100%
Poor accessibility from northern areas	Local road connections to the TNL and SH2	51%	33%	66%	33%	67%	100%	63%	33%	100%
Poor accessibility from northern areas	Western Bay local road upgrades	51%	33%	66%	33%	67%	100%	63%	33%	100%
Poor accessibility from northern areas	Brookfield intersection and interchange upgrade	56%	55%	55%	33%	67%	33%	43%	33%	67%
Poor accessibility from northern areas	Bethlehem PT interchange	75%	77%	77%	33%	67%	67%	53%	33%	77%
Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	Waihi Rd multimodal upgrade	47%	55%	33%	67%	33%	33%	47%	33%	67%
Omokoroa Rd poor LOS	Otumoetai cycleways	56%	66%	55%	33%	33%	67%	43%	33%	67%
Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	Otumoetai cycleways	56%	66%	55%	33%	33%	67%	43%	33%	67%
Otumoetai loop (Chapel – Ngati – Waihi) primary route mode conflict	Otumoetai / Bellview multimodal improvements	61%	66%	55%	33%	67%	67%	53%	33%	67%
Moffatt Rd and Bethlehem Rd primary route mode conflict	Brookfield intersection and interchange upgrade	56%	55%	55%	33%	67%	33%	43%	33%	67%
Brookfield roundabouts poor LOS AM Peak	Otumoetai cycleways	56%	66%	55%	33%	33%	67%	43%	33%	67%
Safety risk on existing SH2 north (also primary bus route)	Existing SH2 upgrade to improve safety and accessibility	61%	66%	55%	33%	33%	67%	43%	33%	67%
Safety risk on existing SH2 north (also primary bus route)	Standard interventions for active modes	19%	11%	11%	33%	0%	33%	23%	0%	33%
Central Sub Area										
Hewletts Rd poor LOS and all day	Hewletts Rd optimisation (te marie, aerodrome etc)	33%	11%	33%	100%	33%	67%	70%	11%	100%
Hewletts Rd poor LOS and all day	Hewletts Rd sub area major interventions	70%	66%	66%	100%	67%	33%	70%	33%	100%
Hewletts Rd poor LOS and all day	Hewletts Rd sub area land use changes to reduce traffic	23%	11%	11%	100%	33%	0%	50%	0%	100%
Hewletts Rd poor LOS and all day	TDM pricing to manage network demands	51%	33%	55%	100%	100%	67%	90%	33%	100%
Totara St poor LOS peak periods	Totara St multimodal upgrade	70%	66%	66%	100%	67%	67%	80%	66%	100%
Totara St poor LOS peak periods	Mt Maunganui ferry	47%	33%	44%	100%	33%	67%	70%	33%	100%
Totara St poor LOS peak periods	Improve bus services Central area	65%	55%	66%	100%	33%	100%	80%	33%	100%
Totara St poor LOS peak periods	TDM pricing to manage network demands	51%	33%	55%	100%	100%	67%	90%	33%	100%
Totara St primary route mode conflict	Totara St multimodal upgrade	70%	66%	66%	100%	67%	67%	80%	66%	100%
Totara St primary route mode conflict	Totara St seperated cycleway	51%	44%	55%	67%	33%	67%	57%	33%	67%
SH2 harbour bridge poor LOS peak periods	TDM pricing to manage network demands	51%	33%	55%	100%	100%	67%	90%	33%	100%
SH2 harbour bridge poor LOS peak periods	Optimisation for priority modes e.g. shoulder running	51%	22%	77%	67%	67%	100%	77%	22%	100%
SH2 harbour bridge poor LOS peak periods	Additional bridge connection for priority modes	61%	77%	44%	67%	33%	0%	37%	0%	77%
SH2 harbour bridge poor LOS peak periods	Aerial tram CBD to Arataki (park /cycle and ride site)	19%	22%	0%	67%	0%	0%	27%	0%	67%
SH2 harbour bridge poor LOS peak periods	Passenger rail strategy to protect sites for longer term	61%	33%	88%	67%	67%	100%	77%	33%	100%
SH2 / Elizabeth Street poor LOS AM peak	Optimisation for priority modes	51%	33%	66%	67%	67%	100%	77%	33%	100%
SH2 / Elizabeth Street poor LOS AM peak	SH2 / Elizabeth St upgrade for priority modes	51%	66%	33%	67%	33%	33%	47%	33%	67%
Takitimu Dr / SH2 poor LOS	Takitimu Dr upgrade for priority modes	47%	33%	55%	67%	67%	67%	67%	33%	67%
Takitimu Dr / SH2 poor LOS	TDM pricing to manage network demands	51%	33%	55%	100%	100%	67%	90%	33%	100%
Golf Rd roundabout LOS and safety risk	Golf Rd optimisation for priority modes e.g. queue jump	56%	33%	77%	67%	67%	100%	77%	33%	100%
Golf Rd roundabout LOS and safety risk	Golf Rd / Maunganui Rd upgrade for priority modes	65%	66%	66%	67%	67%	33%	57%	33%	67%
CBD area poor LOS all periods	Te Papa IBC recommended programme	79%	88%	77%	33%	67%	67%	53%	33%	88%
CBD area poor LOS all periods	CBD bus interchange	75%	88%	66%	33%	67%	33%	43%	33%	88%
Cameron Rd primary route mode conflict	Cameron Rd multimodal upgrade stage 1	75%	99%	55%	33%	33%	67%	43%	33%	99%
Cameron Rd primary route mode conflict	Cameron Rd multimodal upgrade stage 2	75%	99%	55%	33%	33%	67%	43%	33%	99%
Cameron Rd poor LOS peak periods	Cameron Rd multimodal upgrade stage 1	75%	99%	55%	33%	33%	67%	43%	33%	99%
Cameron Rd poor LOS peak periods	Cameron Rd multimodal upgrade stage 2	75%	99%	55%	33%	33%	67%	43%	33%	99%
Cameron Rd poor LOS peak periods	Hospital PT interchange	51%	55%	44%	67%	33%	67%	57%	33%	67%
Cameron Rd poor LOS peak periods	Greerton PT interchange	56%	55%	55%	67%	67%	67%	67%	55%	67%
Cameron Rd poor LOS peak periods	Te Papa Peninsular second N-S PT route priority	51%	55%	44%	67%	33%	67%	57%	33%	67%
Primary cycle routes central poor LOS for cycling	Central area cycleways	61%	66%	55%	33%	33%	67%	43%	33%	67%
Primary cycle routes central poor LOS for cycling	Te Papa Peninsular second N-S cycleway	61%	66%	55%	33%	33%	67%	43%	33%	67%
Primary cycle routes central poor LOS for cycling	Gate Pa active mode bridge	61%	66%	55%	33%	33%	67%	43%	33%	67%
Primary cycle routes central poor LOS for cycling	10th Ave active mode bridge	51%	44%	55%	33%	33%	67%	43%	33%	67%
Cameron Rd poor LOS peak periods	Fraser / chadwick area optimisation for priority modes	56%	44%	66%	33%	67%	67%	53%	33%	67%
Turret Rd / 15th Ave primary route mode conflict	Central area cycleways	61%	66%	55%	33%	33%	67%	43%	33%	67%
Turret Rd / 15th Ave poor LOS peak periods	Turret / 15th optimisation e.g. tidal flow	65%	66%	66%	67%	67%	67%	67%	65%	67%
Turret Rd / 15th Ave poor LOS peak periods	Turret / 15th Ave multimodal upgrade	65%	66%	66%	67%	67%	33%	57%	33%	67%
Turret Rd / 15th Ave poor LOS peak periods	Park and ride site welcome bay area	33%	11%	44%	67%	33%	67%	57%	11%	67%
Turret Rd / 15th Ave poor LOS peak periods	Improve bus services welcome bay area	70%	66%	77%	67%	67%	100%	77%	66%	100%
Turret Rd / 15th Ave poor LOS peak periods	TDM pricing to manage network demands	51%	33%	55%	100%	100%	67%	90%	33%	100%
Turret Rd / 15th Ave poor LOS peak periods	Ramp metering	42%	22%	55%	67%	33%	100%	67%	22%	100%
Pyes Pa Rd primary route mode conflict	Pyes Pa Rd multimodal upgrade	47%	55%	44%	33%	67%	33%	43%	33%	67%
SH29 Tauriko Cambridge Rd poor LOS	SH29 Tauriko DBC early works package	75%	77%	77%	100%	67%	100%	90%	67%	100%
SH29 Tauriko Cambridge Rd poor LOS	SH29 Tauriko DBC infrastrucutre and facilities all modes	75%	77%	77%	100%	67%	67%	80%	67%	100%
SH29 Tauriko Cambridge Rd poor LOS	Park and ride site Tauriko area	#N/A	66%	66%	100%	67%	67%	80%	#N/A	#N/A
SH29 Tauriko Cambridge Rd poor LOS	Smaiths Farm access to housing	47%	44%	44%	100%	67%	67%	80%	44%	100%
Te Papa area high safety risk	Cameron Rd multimodal upgrade	75%	99%	55%	33%	33%	67%	43%	33%	99%
Te Papa area high safety risk	Standard interventions for safety		55%	66%	33%	67%	100%	63%	33%	100%
Te Papa area high safety risk	Improve access to centres all modes	65%	77%	55%	33%	67%	67%	53%	33%	77%

Sensitivity: General

East-west Sub Area									0%	0%
SH29A primary general traffic and cycle crossing conflicts (Oropi)	Roundabout safety treatments	51%	33%	66%	33%	67%	100%	63%	33%	100%
SH29A primary general traffic and cycle crossing conflicts (Oropi)	Grade separated crossing	42%	33%	44%	33%	33%	67%	43%	33%	67%
SH29A poor LOS on a primary route peak periods	SH29A optimisation for priority modes e.g. queue jumps	61%	44%	77%	67%	67%	100%	77%	44%	100%
SH29A poor LOS on a primary route peak periods	SH29A multimodal upgrade for priority modes	75%	88%	66%	67%	67%	33%	57%	33%	88%
SH29A poor LOS on a primary route peak periods	Poike to Oropi Rd PT bridge	70%	77%	66%	67%	33%	67%	57%	33%	77%
SH29A poor LOS on a primary route peak periods	TDM pricing to manage network demands	51%	33%	55%	100%	100%	67%	90%	33%	100%
SH29A poor LOS on a primary route peak periods	Western corridor transport infrastrucutre (Tauriko Stage 3 ring route	65%	77%	55%	67%	33%	67%	57%	33%	77%
SH29A poor LOS on a primary route peak periods	SH29A multimodal upgrade for priority modes	75%	88%	66%	67%	67%	33%	57%	33%	88%
Poike Rd poor LOS	Poike Rd multimodal upgrade	42%	33%	55%	33%	67%	67%	53%	33%	67%
Maungatapu Rd primary route mode conflict	Maungatapu Rd multimodal upgrade	47%	44%	55%	33%	67%	67%	53%	33%	67%
Welcome Bay Rd primary route mode conflict	Welcome Bay Rd multimodal upgrade	51%	66%	33%	33%	33%	33%	33%	33%	66%
Welcome Bay Rd poor LOS	Welcome Bay Rd multimodal upgrade	51%	66%	33%	33%	33%	33%	33%	33%	66%
Primary cycle routes east west poor LOS for cycling	East-west area cycleways	47%	33%	55%	33%	33%	67%	43%	33%	67%
Welcome Bay area poor accessibility (all modes)	Park and ride site welcome bay area	33%	11%	44%	67%	33%	67%	57%	11%	67%
Welcome Bay area poor accessibility (all modes)	Improve access to centres all modes	65%	77%	55%	33%	67%	67%	53%	33%	77%
Welcome Bay area poor accessibility (all modes)	Turret / 15th Ave multimodal upgrade	65%	66%	66%	67%	67%	33%	57%	33%	67%
Welcome Bay area poor accessibility (all modes)	Improve bus services Welcome Bay area	70%	66%	77%	67%	67%	100%	77%	66%	100%
Welcome Bay area poor accessibility (all modes)	Enhanced bus stop facilities at Hairini	65%	66%	66%	33%	67%	67%	53%	33%	67%
Welcome Bay area poor accessibility (all modes)	Aerial tram Welcome Bay - CBD	28%	11%	33%	33%	33%	33%	33%	11%	33%
Welcome Bay area poor accessibility (all modes)	Mobility as a service interventions	56%	44%	66%	33%	33%	100%	53%	33%	100%
Welcome Bay Rd high road safety risk	Standard interventions for safety	61%	55%	66%	33%	67%	100%	63%	33%	100%
Welcome Bay Rd high road safety risk	Travel behaviour change strategy Welcome Bay area		11%	55%	33%	33%	100%	53%	11%	100%
Welcome Bay Rd high road safety risk	Welcome Bay Rd rural section safety improvements	51%	33%	66%	33%	67%	100%	63%	33%	100%
Kaitemako Rd high road safety risk	Standard interventions for safety	61%	55%	66%	33%	67%	100%	63%	33%	100%
Kaitemako Rd high road safety risk	Speed limit review Welcome Bay area	42%	22%	66%	33%	67%	100%	63%	22%	100%
East Sub Area										
Mount Maunganui poor LOS within an activity centre	Mt Maunganui accessible streets projects	51%	44%	55%	33%	33%	100%	53%	33%	100%
Mount Maunganui poor LOS within an activity centre	Network wide PT realtime information	47%	0%	88%	33%	67%	100%	63%	0%	100%
Doncaster Dr primary route mode conflict	East area cycleways	61%	66%	66%	33%	33%	100%	53%	33%	100%
Doncaster Dr primary route mode conflict	Bus route review east area	65%	66%	77%	33%	33%	100%	53%	33%	100%
Grenada St primary route mode conflict	East area cycleways	61%	66%	66%	33%	33%	100%	53%	33%	100%
Grenada St primary route mode conflict	Bus route review east area	65%	66%	77%	33%	33%	100%	53%	33%	100%
Farm St / Links Ave primary route mode conflict	East area cycleways	61%	66%	66%	33%	33%	100%	53%	33%	100%
Farm St / Links Ave primary route mode conflict	Arataki area bus interchange	70%	77%	66%	33%	67%	67%	53%	33%	77%
Farm St / Links Ave primary route mode conflict	Golf course cycle connection	61%	66%	55%	33%	33%	67%	43%	33%	67%
Farm St / Links Ave primary route mode conflict	Keep buses on links ave (compared with diverting buses)	75%	66%	88%	33%	67%	100%	63%	33%	100%
Farm St / Links Ave primary route mode conflict	Alternative bus route (Pap Becah Road / Maunganui Rd)	42%	33%	44%	33%	33%	67%	43%	33%	67%
Grenada St primary route mode conflict	Arataki area accessibility and placemaking improvements	51%	55%	44%	33%	33%	67%	43%	33%	67%
Maunganui Rd poor LOS for buses on primary bus route	Maunganui Rd multimodal upgrade	70%	77%	77%	33%	67%	67%	53%	33%	77%
Maunganui Rd poor LOS for buses on primary bus route	Maunganui Rd freight restrictions	42%	33%	55%	33%	33%	67%	43%	33%	67%
Maunganui Rd /SH2 poor LOS for freight on primary freight route	Hewletts Rd sub area major interventions	70%	66%	66%	100%	67%	33%	70%	33%	100%
Maunganui Rd /SH2 poor LOS for freight on primary freight route	Improved bus services east area	70%	66%	77%	100%	33%	100%	80%	33%	100%
Maunganui Rd /SH2 poor LOS for freight on primary freight route	TDM pricing to manage network demands	51%	33%	55%	100%	100%	67%	90%	33%	100%
Maunganui Rd /SH2 poor LOS for freight on primary freight route	Increase freight transfer to rail to reduce road demands	47%	55%	33%	100%	33%	33%	60%	33%	100%
Maunganui Rd poor LOS for buses on primary bus route	Oceanbeach to Papamoa beach safety improvements	47%	33%	55%	33%	67%	67%	53%	33%	67%
Primary cycle routes east poor LOS for cycling	East area cycleways	61%	66%	66%	33%	33%	100%	53%	33%	100%
Poor accessibility all modes from east suburbs	Papamoa East Interchange	75%	77%	77%	67%	67%	67%	67%	67%	77%
Poor accessibility all modes from east suburbs	Wairakei Te Tumu multimodal transport network and facilities	89%	99%	88%	67%	100%	67%	77%	67%	100%
Poor accessibility all modes from east suburbs	Hewletts Rd sub area major interventions	70%	66%	66%	100%	67%	33%	70%	33%	100%
Poor accessibility all modes from east suburbs	Improved bus services east area	70%	66%	77%	100%	33%	100%	80%	33%	100%
Poor accessibility all modes from east suburbs	Improve PT access via TEL for express services	56%	66%	44%	67%	33%	33%	47%	33%	67%
Poor accessibility all modes from east suburbs	Improve access to centres all modes	65%	77%	55%	33%	67%	67%	53%	33%	77%
Poor accessibility all modes from east suburbs	Micomodes sharing scheme	51%	33%	66%	67%	67%	100%	77%	33%	100%
Poor accessibility all modes from east suburbs	Park and ride site east area	61%	66%	55%	67%	33%	67%	57%	33%	67%
Poor accessibility all modes from east suburbs	On demand bus services (e.g. to P&R site)	47%	33%	55%	67%	33%	100%	67%	33%	100%
Arataki area high road safety risk	Standard interventions for safety	61%	55%	66%	33%	67%	100%	63%	33%	100%
Arataki area high road safety risk	Speed limit review eastern subburbs	47%	22%	66%	33%	67%	100%	63%	22%	100%
Arataki area high road safety risk	Travel behaviour change strategy Arataki area	37%	11%	55%	33%	33%	100%	53%	11%	100%

D

Appendix D – Recommended Programme

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Business case and design	
Implementation	

TSP Action Plan Summary (0-3 years)

Activity	Objective	UFTI Alignment	Indicative Cost	Way Forward	Lead Organisations	2020 to 2023
Strategy, policy and programme development as recommended below.	Support the TSP objectives.	The sub-regional PT, mode shift, and emission reduction initiatives package	<$2M development cost, implementation to be defined in strategies	Develop and implement	All	
Optimise bus services and frequencies city wide, short term improvements.	Continual improvement of the bus system to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package	$24M-29M p/a (existing approx. $19M)	PT Blueprint	BOPRC	
Improve bus infrastructure city wide, short term improvements including stops and associated facilities.	Continual improvement of the bus system to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package	$8M over 3 years	LCLR	TCC	
City wide PT real-time information at stops and via personal devices.	Support PT use by improving access to accurate travel information.	The sub-regional PT, mode shift, and emission reduction initiatives package	<$2M per year	LCLR	TCC	
Deliver minor / low cost optimisation, safety and placemaking activities in the 2020 to 2023 period as described in full list of activities (refs 5-7 & 16-26 in full list of activities).	Improve access to centres, support travel time reliability, improve safety.	Various including; CBD mount, freight, mode shift, eastern corridor packages and movement, environment, prosperity KPI.	$56M	LCLR and SSBC Light as below	Waka Kotahi, TCC, WBOPDC	
Papamoa East Interchange and Wairakei/Te Tumu transport infrastructure.	Support quality urban growth and accessibility in eastern suburbs.	Eastern corridor package	$80.5M (PEI), $140M (transport infrastructure across 10 years+)	Design and construct	TCC, Waka Kotahi	and implement
Combined preferred scenario bus services and supporting infrastructure (access facilities, dedicated connections, park and ride, bus priority etc) business case.	Encourage mode shift to public transport.	The sub-regional PT, mode shift, and emission reduction initiatives package	$700K (business case cost only)	Planning and SSBC	BOPRC	and implement
Priority area cycle route facilities (Accessible Streets programme - Area A Mount/Papamoa/CBD and Area B Otumoetai/Bellevue/Brookfield)	Address safety and mode conflict gaps to support mode shift.	The sub-regional PT, mode shift, and emission reduction initiatives package	$45M (of $90M total cost over 10 years)	Area based SSBCs	TCC	and implement
Hewletts sub area single stage business case including Totara St, Golf Rd, Maunganui Rd.	Improve accessibility, safety and access to Port of Tauranga, support UFTI Strategic Journey.	Freight access to the Port and the upper north island package	$1-2M (business case cost only)	SSBC	Waka Kotahi, Port of Tauranga, TCC, BOPRC	
Turret / 15th Ave multimodal improvements business case including Welcome Bay Road.	Improve accessibility and travel time reliability for all modes, support UFTI Strategic Journey.	The central corridor urban form and transport corridor package	$1-2M (business case cost only)	SSBC	TCC, BOPRC, Waka Kotahi	
SH29 Tauriko complete long-term business case and implement Enabling works business case	Support quality urban growth, improve safety and improve travel time reliability.	The western corridor package	Long term business case $1.05-1.5B. Early works $42M	Complete long term DBC, implement early works	Waka Kotahi, TCC, BOPRC	and implement
Tauriko West and Tauriko Business Estate internal transport networks	Support quality urban growth and accessibility within planned urban growth areas	Supports planned urban growth within UFTI	Developer costs to be agreed	Design and implement with urban growth	TCC	and implement
Western Corridor ring route (SH29 – SH36 section) staged to align with planned urban growth	Support planned urban growth in the western corridor	The western corridor package	Developer costs to be agreed	Implement in stages to align with urban growth	TCC	
Te Papa IBC recommended programme	Support quality urban growth and accessibility in an activity centre.	The central corridor urban form and transport corridor package	$40M	As recommended in IBC	TCC	and implement
Otumoetai, Brookfield, Bellevue area multimodal improvements to support spatial planning	Improve accessibility, safety and support mode shift.	The central corridor urban form and transport corridor package	<$5M	SSBC Light	TCC	and implement

Committed Significant Projects Assumed to be Proceeding

Project	Status	Way forward	Lead Organisations	Period		
				2020 to 2023	2024 to 2030	2031 to 2050
Baylink	In construction	Complete construction	Waka Kotahi			
Cameron Road Multimodal Stage 1	Committed, CIP Funded	Design and construct	TCC			
Omokoroa Road upgrade	Committed, CIP Funded	Construction	WBOPDC			
Takitimu North Link	Committed, NZUP programme	Design and construct	Waka Kotahi			
Rangiuru Interchange and Rangiuru Industrial area transport infrastructure	Committed, CIP Funded	Design and construct	Quayside, WBOPDC			

Strategy and Policy Interventions to Support the TSP Subregion-wide

Strategy, Policy or Programmes	Objective	Way forward	Lead Organisations	Period		
				2020 to 2023	2024 to 2030	2031 to 2050
Regional Mode Shift Plan.	To support mode shift to sustainable modes.	Finalise and implement	Waka Kotahi, BOPRC			
EV and hydrogen uptake strategy, e.g. parking incentives and policy to support EV's, charging infrastructure to support EV's, fleet vehicle policies etc.	To reduce transport emissions.	Develop strategy	All TSP Partners			
Bus fare and parking management policies.	To support mode shift to public transport.	Policy reviews	BOPRC, TCC			
Freight mode shift strategy to support road to rail and costal shipping transfer.	To reduce road network volumes, improve system operation and support freight objective.	Develop strategy	BOPRC, KiwiRail, Port of Tauranga			
Emerging transport technologies strategy, e.g. data analytics and application to optimise transport systems, real time information to customers, adaptive network messaging and signal controls.	Adopt new technologies to manage network demands and improve planning.	Develop strategy	Waka Kotahi, TCC			
Travel demand management strategy as directed by the Mode Shift Plan, e.g. reduce the need to travel, reduce peak travel demand and encourage mode shift to sustainable modes.	To reduce network demands and prolong network functionality.	Develop strategy	TCC, BOPRC, WBOPDC, Waka Kotahi			
Travel behaviour change programme as directed by the Mode Shift Plan and linked to the above broader TDM strategy, e.g. customer and community insight, travel planning programme	Change perception and culture toward mode shift, PT phycology, understand user preferences	Develop programme	BOPRC, TCC			

Proposed List of Activities (sorted by Anticipated Time Period, short term to longer term) to Deliver UFTI and the Transport System Operating Framework

Ref	Project	Objective	Gap Priority in Evaluation Platform	UFTI Alignment	Indicative cost estimate	Way forward	Lead Organisations	Period		
								2020 to 2023	2024 to 2030	2031 to 2050
1	Optimise bus services and frequencies short term improvements (0 to 3 years)	Continual improvement of the bus system to support mode shift	2	Sub-regional PT, mode shift	$24M to $28.8M opex p/a	Implementation	BOPRC			

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Ref	Project	Objective	Gap Priority in Evaluation Platform	UFTI Alignment	Indicative cost estimate	Way forward	Lead Organisations	Period		
								2020 to 2023	2024 to 2030	2031 to 2050
					(existing approx. $19M)					
2	Improve bus stops and access facilities short term improvements (0 to 3 years)	Continual improvement of the bus system to support mode shift	2	Sub-regional PT, mode shift	$8M over 3 years	Implementation	TCC			
3	Preferred scenario bus services and frequencies	Frequent and reliable PT services to support mode shift	2	Sub-regional PT, mode shift	$28.8M to $34M p/a[1]	SSBC (with below)	BOPRC			
4	Supporting stops and access facilities for preferred scenario bus services and frequencies	Improve access to PT and quality of PT facilities to support mode shift. SSBC to confirm location, timing, concept etc for basic access facilities and larger facilities like park and ride, larger stops, priority and connections etc included below.	2	Sub-regional PT, mode shift	$1M p/a (excludes P&R and hubs etc included below)	SSBC (with above)	TCC			
5	Hewletts Rd optimisation, e.g. Te Marie link, Aerodrome Rd signals etc.	Improve travel time reliability for freight interpeak	1	Freight Access (optimisation prior to business case)	$2M	LCLR	Waka Kotahi			
6	Golf to Hewletts Rd stage 1 optimisation for bus and cycle, e.g. queue jump, bus priority, safety facilities	Support travel time reliability for PT on a primary route	3	Freight Access (optimisation prior to business case)	$1M	LCLR	Waka Kotahi			
7	Welcome Bay Rd to Turret Rd optimisation, e.g. ramp metering.	To improve accessibility, travel time reliability and make best use of existing infrastructure.	4	Central Corridor (optimisation prior to business case)	$1M	LCLR	TCC			
8	SH29 Tauriko West Enabling works package (DBC)	Support planned urban growth	5	Western Corridor	$42M	Complete DBC	Waka Kotahi, TCC, BOPRC			
9	City-wide PT real-time information at stops and via personal devices	Support PT use by improving access to accurate travel information.	7	Sub-regional PT, mode shift	<$2M per year	Implementation	BOPRC, TCC			
10	Papamoa East Interchange	Support quality urban growth and accessibility in eastern suburbs	7	Eastern Corridor	$80.5M	Design and construct	TCC, Waka Kotahi			
11	Wairakei Te Tumu urban growth area internal multimodal transport network and facilities	Support quality urban growth and accessibility in eastern suburbs	7	Eastern Corridor	$140M	Design and construct	TCC, Waka Kotahi			
12	Park and ride sites eastern corridor, e.g. Domain Rd and Wairakei	Improve access to PT and support mode shift objective	7	Sub-regional PT, mode shift	$7M per site	SSBC Light	TCC, BOPRC			
13	Primary cycle route facilities (Accessible Streets programme - Area A Mount/Papamoa/CBD and Area B Otumoetai/Bellevue/Brookfield)	Address safety and mode conflict gaps to support mode shift	18	Sub-regional PT, mode shift	$45M 0-3yrs ($46M 4-10yrs, $100M 11-30yrs)	Area focussed SSBCs (Mount and Otumoetai)	TCC, Waka Kotahi	Imp Area B	Imp Area A	
14	Mobility as a Service interventions / trial (e.g. on demand bus services) for Welcome Bay area	Improve accessibility and support mode shift objective	19	Sub-regional PT, mode shift	<$2M	Trial	BOPRC			
15	Arataki area PT facility	Improve access to PT, support planned intensification and improve amenity in an activity centre	20	Sub-regional PT, mode shift	$5-15M	SSBC	TCC			

[1] Indicative annual operating cost (Medium Scenario 2028). Existing OPEX approx. $19M

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Ref	Project	Objective	Gap Priority in Evaluation Platform	UFTI Alignment	Indicative cost estimate	Way forward	Lead Organisations	Period 2020 to 2023	Period 2024 to 2030	Period 2031 to 2050
16	Arataki area standard interventions for safety, e.g. traffic calming, intersection improvements, pedestrian and cycle treatments	Address high personal road safety risk, improve access to centres, support planned intensification, and mode shift	22	Safety KPI (DSI reduction)	$5M	SSBC Light	TCC			
17	Speed management network wide	Reduce speeds in high risk areas complementing physical changes	22	Safety KPI (DSI reduction)	$1M (TCC programme)	LCLR	TCC			
18	Harbour Bridge to Hewletts Rd optimisation for buses, e.g. shoulder running, signal pre-emption	Reduce travel time for PT and support mode shift	26	Sub-regional PT, mode shift (optimisation prior to business case)	<$2M	LCLR	Waka Kotahi			
19	Fraser / Chadwick area optimisation multi-modal improvement	Improve accessibility to Te Papa Peninsular	28	Sub-regional PT, mode shift	<$2M	LCLR	TCC			
20	Te Papa area standard interventions for safety, e.g. traffic calming, intersection treatments, ped and cycle facilities[2]	Address high personal road safety risk, improve access to centres and support mode shift	30	Central Corridor	$3.5M	DBC	TCC			
21	Welcome Bay Rd rural section safety improvements	Improve safety for all users on a route with high personal risk	32	Safety KPI (DSI reduction)	$5M	LCLR	WBOPDC			
22	Welcome Bay area standard interventions for safety, e.g. traffic calming, intersection treatments, ped and cycle facilities	Address high personal road safety risk, improve access to centres and support mode shift	32	Safety KPI (DSI reduction)	<$5M	LCLR	TCC			
23	Mt Maunganui Activity Centre accessible streets projects	Improve facilities for movement and placemaking within an activity centre to enhance safety, accessibility and amenity	33	Improves access to a defined centre. Access and safety KPI	$12.55M	SSBC Light	TCC			
24	Arataki area (Concord to Monowai) accessibility and placemaking improvements, e.g. reduce conflict, improve quality of movement and place facilities	Improve access to an Activity Centre for walking, cycling and public transport journeys	35	Improves access to a defined centre. Access and safety KPI	$5M	Review existing SSBC, or part of above project	TCC			
25	Oceanbeach Road, Maranui Street safety improvements	Improve safety, placemaking and accessibility to reserves	37	Safety KPI (DSI reduction)	$3.64M	SSBC Light	TCC			
26	Smiths Farm access to housing	Support planned residential growth	5	Supports planned urban growth	$7M	SSBC Light	TCC			
27	Western Corridor Ring Route (SH36 – Oropi Road/SH29a)	To support planned urban growth in western corridor, resilience and wider network accessibility.	11	Western Corridor	$238m	Business case, design and implementation	TCC			
28	Hewletts Rd sub area access single stage business case (includes Totara, Golf, Maunganui).	Improve access to Port of Tauranga, improve safety and journey time reliability on an UFTI Strategic Journey	1	Freight Access	$170M	SSBC	Waka Kotahi, PoT, TCC, BOPRC		SSBC to confirm timing beyond optimisation	

[2] Also defined in detail within the Te Papa IBC.

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Ref	Project	Objective	Gap Priority in Evaluation Platform	UFTI Alignment	Indicative cost estimate	Way forward	Lead Organisations	Period		
								2020 to 2023	2024 to 2030	2031 to 2050
29	Turret and 15th Ave improvements to support improved multimodal access business case	Improve multimodal access on an UFTI Strategic Journey. Improve accessibility to Welcome Bay.	4	Central Corridor	$53M	SSBC	TCC		SSBC to confirm timing beyond optimisation	
30	SH29 Tauriko longer term infrastructure and facilities all modes	Support growth and freight movement on a primary route	5	Western Corridor	DBC $2M $1.05-1.5B	Complete DBC	Waka Kotahi, TCC, BOPRC			
31	Welcome Bay Rd multimodal upgrade within the urban area	Improve accessibility, safety and travel time reliability on an UFTI Strategic Journey	6	Movement KPI and Strategic Journey	$24M	SSBC, or part of Turret/15th Ave SSBC above	TCC			
32	Improve PT access via TEL for express services, e.g. Parton Road or Domain Road access to / from TEL for buses	Reduce travel time and improve reliability for bus travel	7	Sub-regional PT, mode shift	$10M	SSBC Light	TCC, BOPRC			
33	Cameron Rd multimodal upgrade stage 2	Improve PT reliability, urban form and safety for all modes	9	Central Corridor	$54M	SSBC	TCC			
34	Hospital area transport facility[1]	Improve access to PT and support mode shift	10	Central Corridor	$10M	SSBC Light	TCC, BOPRC			
35	Greerton area transport facility[1]	Improve access to PT and support mode shift	10	Central Corridor	$10M	SSBC Light	TCC, BOPRC			
36	SH29A optimisation package, e.g. intersection optimisation, lane usage, PT priority lanes etc.	Improve travel time reliability and support mode shift on an UFTI Strategic Journey	11	Freight Access (optimisation prior to business case)	$4M	SSBC Light	Waka Kotahi			
37	Windermere to Oropi Rd green bridge	Enabling primary route, improve accessibility and support mode shift	11	Sub-regional PT, mode shift	$35M	SSBC	TCC, BOPRC			
38	Western Corridor Ring Route (SH29 to SH36 - Tauriko Stage 3 Ring Route)	Supporting growth, resilience, network accessibility and reducing the need to use the state highway network for short trips	11	Western Corridor	$95M*	SSBC	TCC, Waka Kotahi			
39	Tauriko West internal network connections	Support planned urban growth with a multimodal transport network for Tauriko West	11	Western Corridor	Developer cost to be agreed	DBC	TCC, Waka Kotahi			
40	Tauranga Crossing PT facility (on street)	Improve access to PT to encourage mode shift	11	Sub-regional PT, mode shift	$1.7M	SSBC	TCC			
41	Keenan Road access to planned urban growth (assumes roundabout on SH36)	Provide access for planned urban growth area	11	Supports planned urban growth	$8M	SSBC	TCC			
42	Existing SH2 (Omokoroa to Cameron Road) multimodal upgrade post Takitimu North Link completion	Improve access to PT, improve safety and support mode shift	14	Sub-regional PT, mode shift	$47.5M	SSBC	WOBDC			
43	SH2 optimisation at Elizabeth Street to support reliable journey times for freight from Port of Tauranga on SH2	Improve travel time reliability on a strategic freight journey from Port of Tauranga	15	Prosperity KPI (optimisation prior to business case)	<$2M	LCLR	Waka Kotahi			
44	CBD area transport facility[2]	Improve access to PT and support mode shift objective	17	Central Corridor	$30M	SSBC	TCC			
45	Bethlehem area transport facility	Improve access to PT and support mode shift objective	23	Sub-regional PT / Central Corridor	$2M	SSBC Light	TCC, BOPRC			
46	Park and ride site northern corridor, e.g. Omokoroa and Te Puna	Improve access to PT and support mode shift objective	23	Northern Corridor	$9.5M per site	SSBC Light	WBOPDC, BOPRC			

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Ref	Project	Objective	Gap Priority in Evaluation Platform	UFTI Alignment	Indicative cost estimate	Way forward	Lead Organisations	Period		
								2020 to 2023	2024 to 2030	2031 to 2050
47	Local road connections to the TNL and SH2	Improve safety and quality of local road connections	23	Northern Corridor	<$5M	SSBC Light	WBOPDC			
48	Brookfield enhanced bus facility	Improve accessibility to an activity centre and support mode shift objective	24	Sub-regional PT, mode shift	<$250k	LCLR	TCC, BOPRC			
49	Tauriko Business Estate transport network	Provide access for a planned urban growth area	31	Supports planned urban growth	Developer cost to be agreed	SSBC	TCC			
50	Otumoetai / Brookfield / Bellevue multimodal improvements to support spatial framework / urban growth area	Improve accessibility, urban growth, safety and mode shift	38	Central Corridor	<$5M	SSBC Light	TCC			
51	Maunganui Rd multimodal upgrade (beyond current SSBC)	Improve bus priority and improve safety for all users	47	CBD and Mt Maunganui	$12.7M	SSBC Light	TCC			
52	SH29A multimodal upgrade to support the strategic function and mode / movement priorities.	Support sub-regional movement for all modes and manage network demands	11	Central Corridor / Freight Access	$450M	SSBC (consider as part of Hewletts)	Waka Kotahi			
53	SH36 multimodal improvements to support planned urban growth	Support multimodal accessibility on an UFTI Strategic Journey	11	Supports planned urban growth	TBC in SSBC	SSBC	Waka Kotahi, TCC			
54	SH2 travel time reliability improvement at Elizabeth Street to support strategic freight journey from Port of Tauranga	Support travel time reliability for freight from Port of Tauranga on a primary freight route and UFTI Strategic Journey	15	Prosperity KPI	$24M	SSBC	Waka Kotahi			
55	Additional bus and cycle capacity (harbour crossing) and Matapihi Rail Bridge replacement	As described in UFTI, longer term dedicated additional capacity for PT and cycling harbour crossing	26	CBD and Mt Maunganui	$175M	IBC (consider as part of Hewletts)	Waka Kotahi, KiwiRail			
56	Network wide TDM pricing to manage network demands	Manage demand on the network and prolong functionality of assets	11	Other policy and pricing	<$1M	SSBC	Waka Kotahi			
57	Pyes Pa Rd multimodal upgrade	Improve accessibility, safety for all modes	43	Supports planned urban growth area	$117M	IBC	TCC			

Indicative cost profile – unconstrained at this stage, deliverability and affordability to refine the programme for the RLTP inputs subsequently.

Indicative cost estimate 0 to 3 years = $230M Programme CAPEX, $79M PT OPEX

Indicative cost estimate 4 to 10 years = $466M Programme CAPEX, $220M PT OPEX

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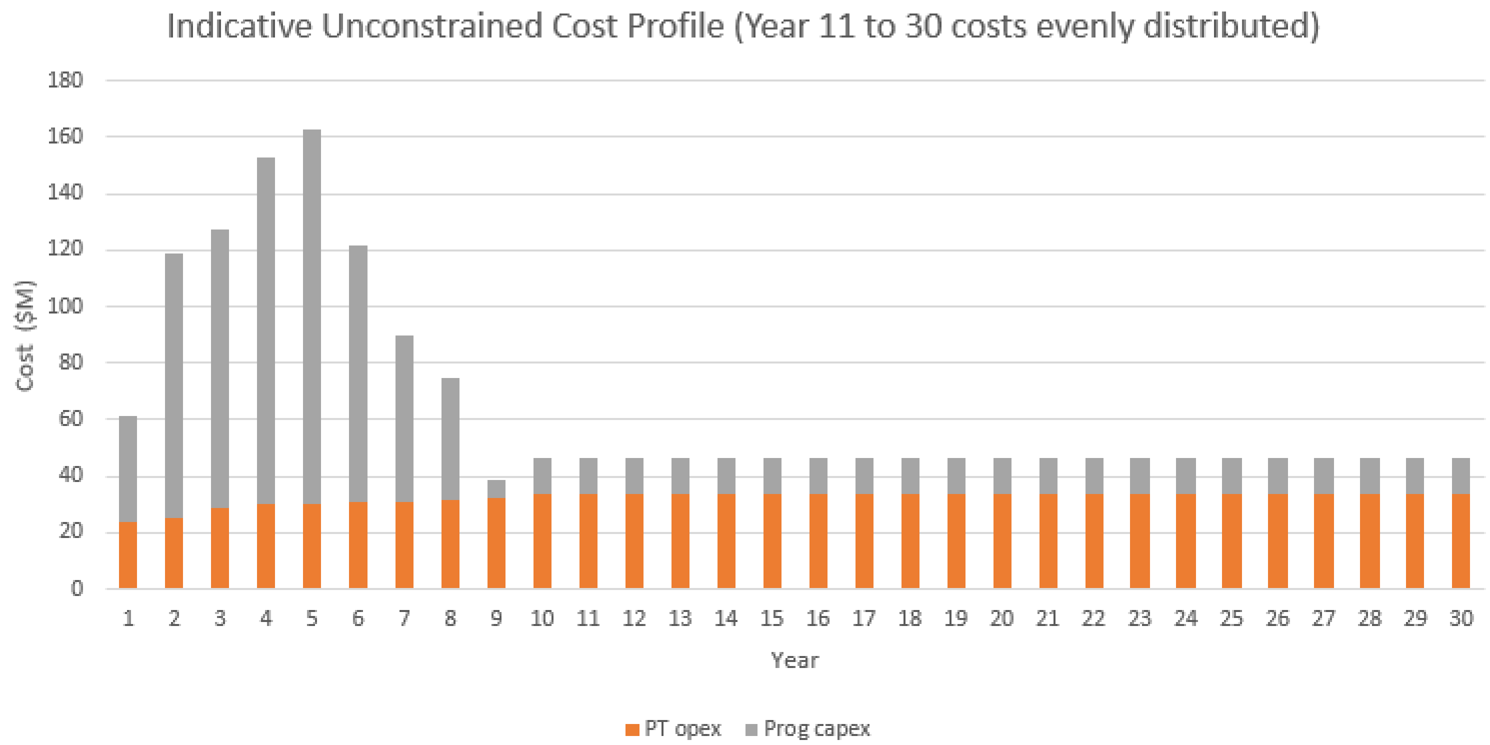
Indicative cost estimate 11 to 30 years = $1.9 – 2.4B Programme CAPEX, $680M PT OPEX.



Glossary	
POE	Point of Entry
EV	Electric vehicles
IBC	Indicative business case
DBC	Detailed business case
SSBC	Single stage business case
SSBC Light	Single stage business case for projects below $15M
LCLR	Low cost low risk, for projects below $2M
CIP	Crown Infrastructure Partners
PT	Public transport

E

Appendix E – Transport Modelling Technical Note

WBOP Transport System Plan Memorandum

To:	TSP Study Team	**Date:**	10 August 2020
From:	Nyan Aung Lin		
Subject:	Tauranga Northern Link		

1 Purpose and Scope

This note outlines high-level analysis of how potential operational decisions on the Tauranga Northern Link (TNL) project could impact the wider transport system. This analysis has been carried out as part of the TSP project option testing as a key issue / opportunity, the findings will also be summarised in the TSP option evaluation report.

The following operational matters are covered in this memo, as agreed with Waka Kotahi prior to the analysis:

- The influence of tolling the TNL/Takitimu Drive corridors on the wider network
- The potential influence on bus patronage and travel times for alternative bus routes along old SH2 or the TNL
- Potential usage of managed lanes along the TNL
- Demand and effect of 15th-Takitimu links (including impact on 15th Avenue).

This analysis uses existing models and simplifying assumptions to identify the potential impact of the above issues. The toll analysis utilizes the existing strategic model without any adjustment, so has not used any new local traffic surveys or market research to inform the motorists response to tolls. As such, this analysis is for strategic planning purposes, rather than a detailed business case or financial modelling. This study has also not considered any legislative requirements or restraints associated with tolling.

Therefore, this analysis should not be considered to be detailed analysis of the TNL project. The intent is to identify the above potential network-wide impacts to inform subsequent analysis for both the TNL and TSP studies.

2 Methodology and Structure

To address the type and scope of these questions this analysis utilised previous modelling, simplified flow analysis and both the Tauranga Transport Strategic Model (TTSM) and Tauranga Transport Hybrid Model (TTHM) models. The general methodology for each question was as follows:

Toll effects and location of toll gantry for the TNL: the documentation for a previous TNL toll study was reviewed first to understand the toll scenarios and their outcome. A couple of toll scenarios using the latest version of TTSM was also undertaken to understand the effects of the toll effects and gantry locations using updated land and network inputs.

Bus Route on old SH2 or the TNL: Scenarios were tested in TTSM to understand the benefits of buses running along either SH2 or the TNL.

Potential usage of managed lanes along the TNL: TTHM model flows were used to estimate the potential usage and corridor performance of different managed lane scenarios, particularly providing priority to trucks and 2+ or 3+ occupant vehicles.

Effect of 15th-Takitimu links and impact on 15th Avenue: A new scenario was set up in TTHM model to understand the effects of 15th-Takitimu links on the 15th Avenue corridor.

A summary of the overall findings are presented in the next Chapter, followed by details on the specific analysis.

3 Summary of Findings

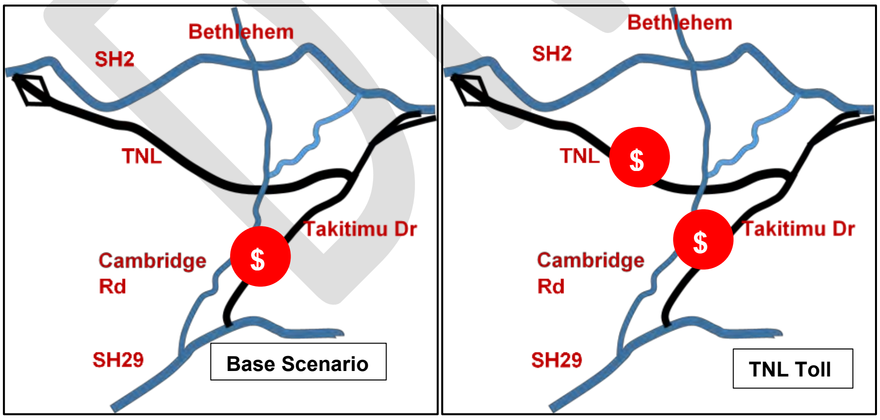
3.1 Toll effects and location of toll gantry for the TNL (refer to Section 5 for more details)

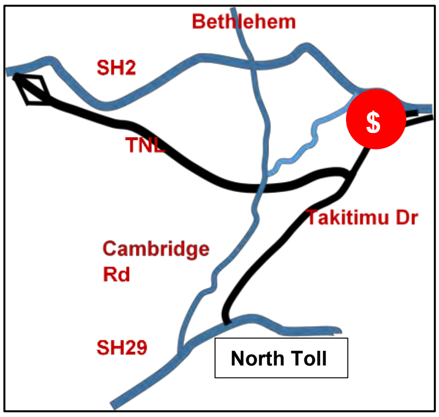
A previous TNL toll study for Waka Kotahi (October 2016) recommended that if tolling was to be considered, the preferred strategy involved a new toll gantry on the TNL itself whilst retaining the existing toll gantry on Takitimu Drive (with consideration of discounting for those users who pass through both the TNL and existing Takitimu Drive gantries). This was primarily based on the findings of reduced vehicle travel, reduced congestion on Takitimu Drive and revenue potential. The TSP study has identified wider network conflicts and performance issues on Hewletts Road, Elizabeth Street and 15th Avenue.

From this current study, three toll scenarios were considered using the 2028 TSP Do Minimum scenario in TTSM:

- Base Scenario – Retain the toll on Takitimu Drive south with no toll gantry on the TNL
- TNL Toll – Additional toll gantry on the TNL, and toll tariffs consistent with Takitimu Drive
  - A consequence of this scenario is that users of the southern end of Takitimu Drive and TNL pay both tolls at full price (discounted tolls could be considered as a refinement of such as strategy)
- North Toll – Shifting the existing gantry on Takitimu Drive to north of the TNL connection point. Toll values remain the same.

Figure 3-1: Tolling Scenarios





From this study, the following can be summarised:

- The TNL toll scenario diverts more traffic to the alternative SH2 corridor than North Toll scenario. Under the TNL toll scenario, the TNL carries 45% of the total northern corridor traffic. It should however be noted that no changes were assumed on the old SH2 route to prioritise movement for local traffic, PT, and/or mitigate the effects of diverted traffic.
- The TNL toll scenario has the highest trip suppression effect as this toll strategy impacts trips heading to the CBD as well as trips heading to Tauriko.
- Because of the trip suppression effects, the TNL toll scenario has the lowest vehicle kilometre travelled (VKT), vehicle hour travelled (VHT) and vehicle emissions.
- The Base Scenario predicts very high traffic flows on Takitimu Drive north of the TNL connection, which is expected to create operational issues and queueing through weaving and merging issues. **Appendix A** provides traffic diversion patterns. **Table 5-1** and **Table 5-2** summarises traffic flows along key corridors.
- Both toll scenarios reduce the traffic on this section of Takitimu Drive, although with a much larger reduction for the North Toll.
- The North Toll scenario does however increase traffic on the southern part of Takitimu Drive, which could increase congestion and/or drive the need for additional capacity in that section.
- The North Toll scenario is predicted to provide the most significant reduction in traffic on Hewletts Road and 15th Avenue.

The overall network statistics indicate the TNL toll scenario performs best, with the exception of low utilisation of traffic on the TNL. This is consistent with the previous study. However, having an additional toll gantry on the TNL would penalise traffic from the west to the south and vice-versa. This would discourage “round-harbour” traffic and potentially conflict with a long-term strategy of discouraging traffic from using the Hewletts Road and 15th Avenue corridors.

The North Toll strategy would favour “round-harbour” traffic (via SH29A) as there is no toll imposed to traffic using the TNL and then heading south and vice-versa. The flow difference plot (North Toll vs Base) indicates increase in traffic on the Takitimu Drive south section, but the wider flow difference plot shows limited increase in traffic along SH29A. Hence, having a toll gantry on the northern part of Takitimu Drive (before joining 15th Avenue) may not be enough to divert long distance cross harbour traffic. This could be due to the congestion along SH29A as a Do Minimum network scenario was used in this test (this can be retested once the future reference model scenario is agreed).

A combination of a higher toll tariff, treatment to the existing SH2 corridor (e.g. reducing speed limit), providing capacity along SH29A and route signage may promote the usage of “round-harbour" traffic. Hence from a demand management perspective, having a toll gantry on the northern part of Takitimu Drive is a viable option and should be considered.

Overall, it is considered that tolling of the TNL provides positive contribution to a range of network objectives, including reduced VKT, reduced traffic on 15th Avenue and Hewletts Road and reduced congestion on Takitimu Drive through the merge/weave section. The North Toll scenario provides less overall VKT reduction than the TNL toll scenario, but arguably better wider network effects.

If either toll scenario is to be progressed, careful design of the existing SH2 corridor would be required to prioritise capacity for local movement and mitigate potential toll diversion.

3.2 Bus Route on old SH2 or the TNL (refer to Section 6 for more details)

Two scenarios were studied in TTSM using the 2028 Do Minimum assumptions to understand the effects of running the bus services along the TNL or the old SH2.

In summary,

- Running Omokoroa and Katikati bus services along the existing SH2 corridor provides better PT access for the areas between Omokoroa and Te Puna. There are other bus services available from the Bethlehem area and hence running these two services through the Bethlehem town centre may have limited effects on patronage.
- Running the Omokoroa and Katikati bus services along the TNL reduces perceived travel time to the city by up to 10 minutes, especially for the longer-distance movements. As buses are running on the TNL, a park and ride facility was provided near the Minden interchange in this scenario to serve the areas along the old SH2 (between Omokoroa and Te Puna). Due to improved travel time and the assumed provision of a park and ride facility, patronage numbers in this scenario was increased slightly. Overall, however, the differences in patronage numbers were small
- A potential hybrid option can be considered in which these two bus services run along SH2 between Omokoroa and Te Puna for local access, then use the TNL via the Minden interchange to get travel time improvement.

In summary, providing services along the existing SH2 corridor will be important to service local areas in Te Puna and Bethlehem, however services on the TNL provide an attractive 'express'-type service for longer distance movements. The provision of managed lanes on the TNL will allow for such express services to operate in the TNL corridor, however provision of reliable and attractive services along the existing SH2 corridor will be important for those communities. The role of Park and Ride in the northern corridor should be considered, especially to optimize use of express-type service on the TNL.

3.3 Potential scale of usage of managed lanes along the TNL (refer to Section 7 for more details)

Currently, a managed lane is modelled in TTHM as a high occupancy lane (HOV) with access permitted to 2+ occupancy vehicles, trucks and buses. Findings of this work included:

- Traffic information was extracted from the 2048 TSP Do Minimum scenario (TTHM), in relation to overall traffic flows and likely composition
- A simple spreadsheet tool was used to understand the feasibility and potential effectiveness of different managed lane options. The spreadsheet estimates speeds in each lane and potential mode shift to higher-occupancy vehicles

- Analysis is focused on the eastbound section of TNL between the Minden Interchange and Takitimu Drive
- Four scenarios were investigated
  - General traffic lane for both lanes
  - One T2+ lane (allow for trucks and buses as well) and one general traffic lane
  - One T3+ lane (allow for trucks and buses as well) and one general traffic lane
  - One truck only lane and one traffic lane
- Three key measures were prepared in the analysis
  - **Productivity**: This is a simple measure of person-throughput and efficiency based on multiplying speed and person volumes on the corridor. For the three managed lane scenarios investigated, the T2 scenario provides highest productivity (although this remains lower than the scenario without managed lanes)
  - **Speed**: A high speed differential between adjacent lanes on a corridor could contribute to serious crashes and this could be an important factor when considering managed lane options. From the analysis, speeds on the general traffic lanes are reduced with more restriction on usage of the managed lane. T3 and HCV only scenarios have low speeds on general traffic lanes (less than 50 km/hr). Hence speed differential between the general and priority traffic lanes will be high under these two scenarios.
  - **Person-Hour**: This measure is the product of travel time and person volumes on the corridor (in this case, a ~5km section of TNL from the Minden Interchange to Takitimu Drive). Again, the T2 scenario provides the lowest person-hours of the managed lane scenarios. All managed lane scenarios had higher overall person-delay than the scenario without managed lanes

Based on the simple assessments undertaken, a T2 managed lane scenario, with access to 2+ occupant cars, trucks and buses would perform the best of the managed lane scenarios in terms of productivity, speed and person-hours. Any such scheme would however require careful design to mitigate potential safety risks associated with high speed differentials between traffic lanes. Although not explicitly tested, a scenario where priority was provided only at key capacity constraints (such as intersections/merge areas etc) rather than continuously over the full corridor length.

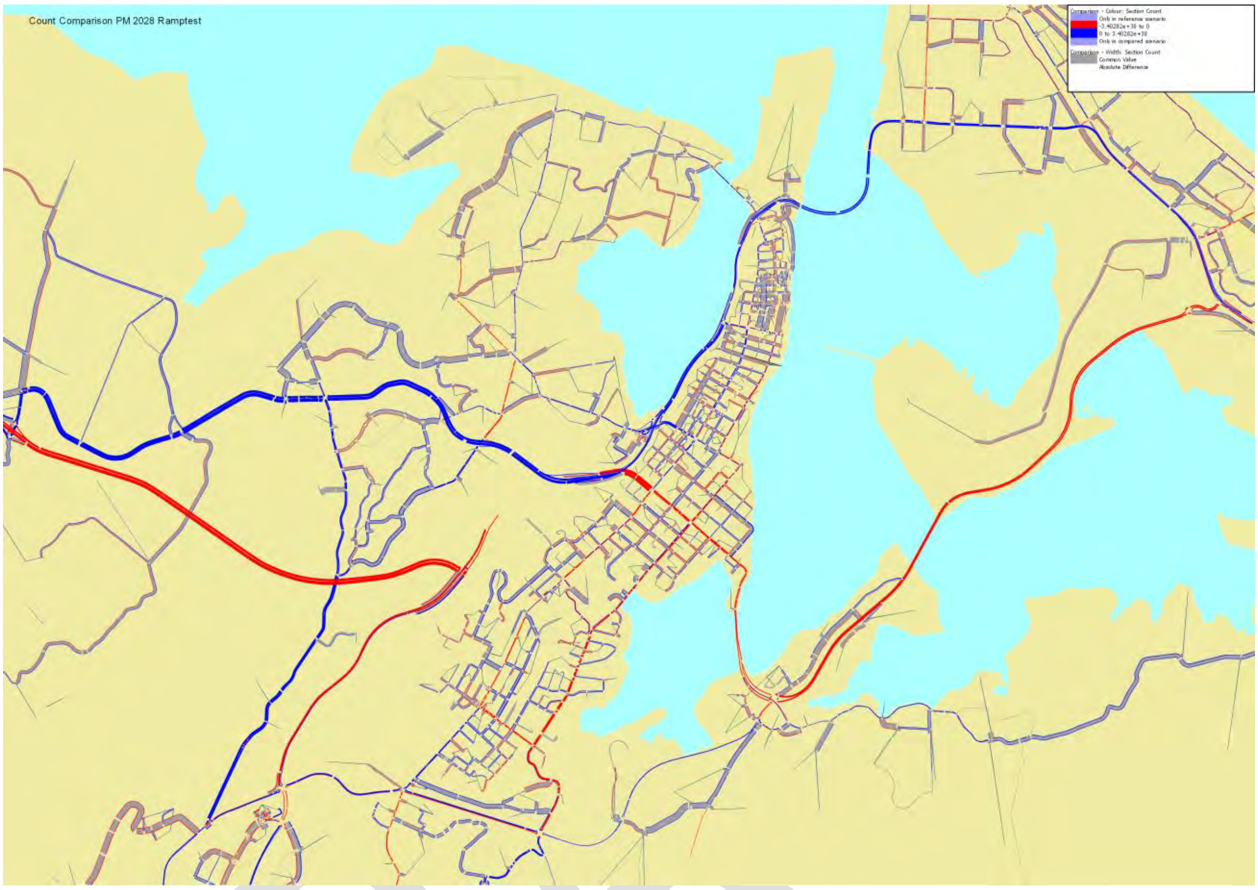
3.4 Effect of 15th-Takitimu links and impact on 15th Avenue

TSP Do Minimum (DM) scenario includes the TNL project as a committed project, which includes a new link from 15th Avenue to Takitimu Drive. This is to balance the flow as the reverse direction link from Takitimu Drive to 15th Avenue already exists. However, inclusion of a new westbound link could potentially attract more traffic along 15th Avenue which is already congested.

To understand the effects of these links on 15th Avenue, a scenario was set up in TTHM by converting these links (both directions) to a T2 (2+ occupant and truck only) lanes. This test was undertaken for 2028 PM peak. This is a scenario test only and it does not consider feasibility, design and potential safety issues of the high occupancy priority lanes.

Figure 3-2 shows the diversion effects in TTHM, red colour indicates decrease in traffic volume and blue colour shows increase in traffic volume.

Figure 3-2: Flow Difference Plot, 2028 PM Peak



Travel pattern changes due to conversion of general traffic lanes to HOV/Truck are provided below:

- A reduction in traffic on the route along the Maungatapu Bridge, 15th Avenue and the TNL
- An increase in traffic on the route along Hewletts Road, the Harbour Bridge, Takitimu Drive and SH2

From this test, a reduction in traffic was achieved on 15th Avenue as expected, but this increases the traffic flow on the Hewletts Road corridor which is already congested.

Note that the DM network scenario was used in this test, in which the SH29A corridor was congested as no capacity improvement was made along this corridor. If this test were repeated under different network assumption, the diversion patterns could be different.

Conversion of the links between 15th Avenue and Takitimu Drive could reduce traffic flows on 15th Avenue and provide priority to higher-occupancy vehicles, albeit with a potential increase on Waihi Road and Hewletts Road. Such links would however require careful design to address potential safety risks in a high-speed environment.

3.5 Critical Assumptions

This analysis was based on the Do Minimum models. However, the decision on one element will affect the outcomes of another element. For example, a decision on toll locations or no toll on the TNL will affect the study outcomes of the managed lane type on the TNL.

Table 3-1 summaries critical assumptions and the potential effects on other elements.

Table 3-1: Critical Assumptions and Potential Effects

Element	Critical Assumptions	Potential Effects on other Elements
Toll effects and locations on TNL	▪ Network assumptions along SH29A (DM network in this test) ▪ Treatment along alternative corridor, SH2 (DM network in this test) ▪ Toll level and response parameters in TTSM	▪ High - Managed lane type on TNL ▪ High -Form and effect of TNL-15th links
Managed lane type on TNL	▪ Assumption of Toll and locations on TNL (No toll in this test) ▪ Treatment along alternative corridor, SH2 (DM network in this test) ▪ Assumption of % HOV for T2+ and T3+ options ▪ Design of managed lane facilities	▪ Medium - Toll effects and locations on TNL ▪ Low - Form and effect of TNL-15th links
Effect of TNL-15th Avenue Links	▪ Network assumptions on "cross-harbour" and "round-harbour" routes (DM network in this test) ▪ Assumption of Toll and locations on TNL (No toll in this test) ▪ Assumption of Toll and locations on Takitimu Drive (Toll on existing location in this test)	▪ Low - Toll effects and locations on TNL ▪ Low – Managed lane type on TNL ▪

This analysis was undertaken to inform understanding of wider-network effects. However, the analysis itself is dependent on assumptions made elsewhere in the network. These assumptions and limitations should be considered in subsequent planning.

4 Model Inputs/Assumptions

4.1 TTSM

4.1.1 Model Periods

The TTSM model is an average hour model for the following time periods:

- AM peak: 7 am – 9 am.
- Inter peak (IP): 9 am – 4 pm.
- PM peak: 4 pm – 6 pm.

4.1.2 Land Use

Tauranga City Council (TCC)/Western Bay of Plenty (WBOP) provided the following land use inputs for 2028 and 2048:

- TCC/WBOP land use update in June 2020 for population and dwellings
- Employment projections from Market Economics Ltd in June 2020

4.1.3 Network

The 2028 / 2048 Do Minimum network utilises the base year 2018 network plus the additional key interventions for the TSP study. They are listed below:

- Tauranga Northern Link (TNL) to Omokoroa scheme as per the NZ Upgrade announcements

- Tauriko West local roads scheme
- Updated Te Tumu internal network from Te Tumu Stage 3 study
- Papamoa East Interchange
- Maunganui-Girven Road Interchange scheme

For the 2048 year, no toll has been applied to Takitimu Drive and Tauranga Eastern Link (TEL)

4.1.4 PT Network

The 2020 PT service lines were coded based on the information from the Tauranga bay hopper website. The data includes urban, regional and school buses services with scheduled bus route itineraries, service frequency and bus fare. Some of the 2020 bus routes are extended to cover the Te Tumu and Tauriko West growth areas.

4.2 TTHM

The TTHM is a "Dynamic Traffic Assignment" (DTA) simulation model in the Aimsun software. This is a time-varying model where traffic flows and traffic conditions vary across the peak period. The key purpose of the TTHM is therefore to represent the road network in greater detail than the TTSM, with enhanced capabilities around operational issues such as queues, merges and traffic signal operation.

4.2.1 Model Periods

The TTHM covers three periods:

- AM peak: 6:30 am – 9:30 am.
- Inter peak (IP): 11:30 am – 1:30 pm.
- PM peak: 3:30 pm – 6:30 pm.

4.2.2 Demand

The TTHM demand is sourced from the TTSM. The demand is disaggregated into a more refined zone system within the Te Papa peninsular. The demand is also expanded from the TTSM to cover the peak periods listed above. Following the expansion, the demand is split into seven user-classes; low, medium and high value of time by two occupancy levels, low and high, as well as a truck user-class. This gives the model the ability to respond to both tolls (value of time) and high occupancy reserved lanes (occupancy split). Finally, the demand is given release profiles to represent the time-varying travel patterns in the region.

4.2.1 Network and PT Services

The network and PT services are consistent with that in the TTSM.

5 Toll effects and location of toll gantry for the TNL

The analysis utilizes the existing TTSM without any adjustment. No detailed traffic surveys to validate the model, nor market research to inform the motorists response to tolls has been undertaken. As such, this analysis is for strategic planning purposes, rather than a detailed business case or financial modelling

5.1 Previous Study Findings

The previous toll study documentation, "*Tauranga Northern Link - Additional Toll Analysis, Beca, October 2016*", was reviewed. The key conclusions are provided below:

"*This analysis has identified a preferred strategy for tolling the TNL and Takitimu Drive, involving a toll gantry on the TNL itself whilst retaining the existing toll gantry on Takitimu Drive. Providing a discount for motorists using both toll gantries would provide improved transport benefits and greater equity for the various users of the toll roads, however the feasibility of adding this functionality to the National Toll System would need to be confirmed before this scenario could be progressed.*

This analysis identified that tolling has the ability to create positive outcomes for the users and the network, including:

- *Providing an element of Travel Demand Management in the northern corridor*
- *Providing a better balance of traffic flows between the TNL and the existing route through Bethlehem*
- *Providing additional revenue*
- *Providing an improved perception of equity, with all users of these two toll roads accruing a toll (in the Base Case some movements would be untolled)*
- *Providing potential positive network efficiencies and benefits*
- *Providing some potential to influence the timing or need of other network upgrades, such as on Takitimu Drive itself*."

5.2 Scenario Tests in TSP Do Minimum

New toll scenarios were developed in the latest version of TTSM using the 2028 TSP Do minimum scenario as a base case. The previous analysis was undertaken in 2016. Land use and TTSM model versions have been updated several times since 2016. Also, the TNL scheme itself has been changed as the latest scheme starts from Omokoroa while the 2016 scheme started from Te Puna. The latest TNL scheme also includes managed lanes along its length. The other change includes widening of Takitimu Drive between TNL and 15th Avenue.

5.3 ASC Assumptions

The TTSM responds to tolls in two ways, firstly through trip diversion (where vehicles between an origin and destination change the route they take), and through trip suppression (where the origin-destination pattern itself changes). Trip suppression is effectively the opposite of induced traffic.

The models comprise the following two parameters to represent the toll through Willingness to Pay (WTP):

- Value of Time (VOT), which converts the monetary toll to equivalent minutes so that the motorist can weigh the toll cost against the time savings.
- An Alternative Specific Constant (ASC): The ASC is a more intangible variable, that represents motorists' perceptions of the toll road, such as the relative safety, reliability, convenience and general attractiveness, relative to the alternative.

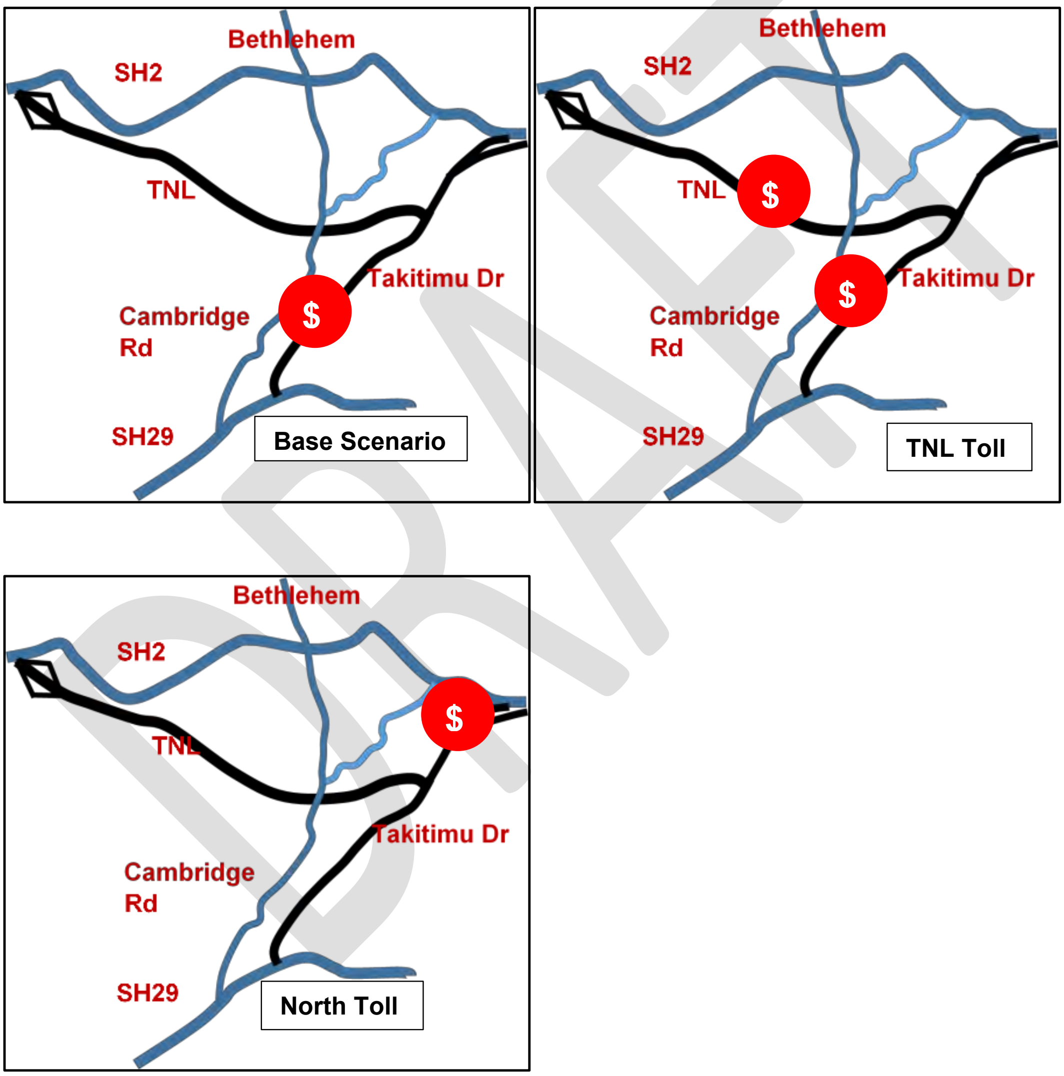
For the present study, an ASC equivalent to 2.5 minutes was assumed for the TNL, which implies that motorists would perceive a benefit of using the TNL of 2.5 minutes in addition to the time savings.

5.4 Tolling Scenarios

The various toll scenarios modelled for the TNL are outlined below and shown in **Figure 5-1**.

- Base Scenario – Retain the toll on Takitimu Drive south with no toll on the TNL.
- TNL Toll – This option add a toll gantry on the TNL, which would operate independently of the existing toll on Takitimu Drive south. The tolls on TNL were assumed to be consistent with the existing Takitimu Drive toll tariff.
- North Toll – This option shifts the gantry on Takitimu Drive to the north of the TNL to capture vehicles from the TNL heading towards the CBD. The toll values are the same as the existing toll.

Figure 5-1: Tolling Scenarios



5.5 Daily Traffic Flows on the Northern Corridor

The predicted daily traffic flows (AADT) on the TNL and the alternative route SH2 (at the Wairoa Bridge) for each tolling scenario are tabulated in **Table 5-1**. The trip suppression effect can be seen in the changes in the total screenline flows.

Table 5-1: 2028 AADT

Scenario	TNL	SH2 (Wairoa Bridge)	Total	% Change to Base Scenario
Base Scenario	29,640	8,700	38,340	
TNL Toll	15,720	18,900	34,620	-10%
North Toll	21,550	15,660	37,210	-3%

The trip suppression effect is noticeable and varies for each tolling strategy. Relative to the Base Scenario (only the existing toll on Takitimu Drive), the toll on TNL has reduced the total corridor flow up to 10% and north toll scenario has resulted in 3% reduction in total corridor flows.

5.6 Traffic Diversion

Average daily vehicles flow difference plots are provided for all toll scenarios (against Base Case) to understand traffic diversion patterns due to the tolling are shown in **Figure 5-2** and **Figure 5-3**. The below figures show decreases in traffic volumes in red colour and the increase in traffic volumes in blue colour.

Higher-resolution flow difference plots are provided in **Appendix A**.

Figure 5-2: Average Daily Vehicles Flow Difference Plot – TNL Toll vs Base Scenario

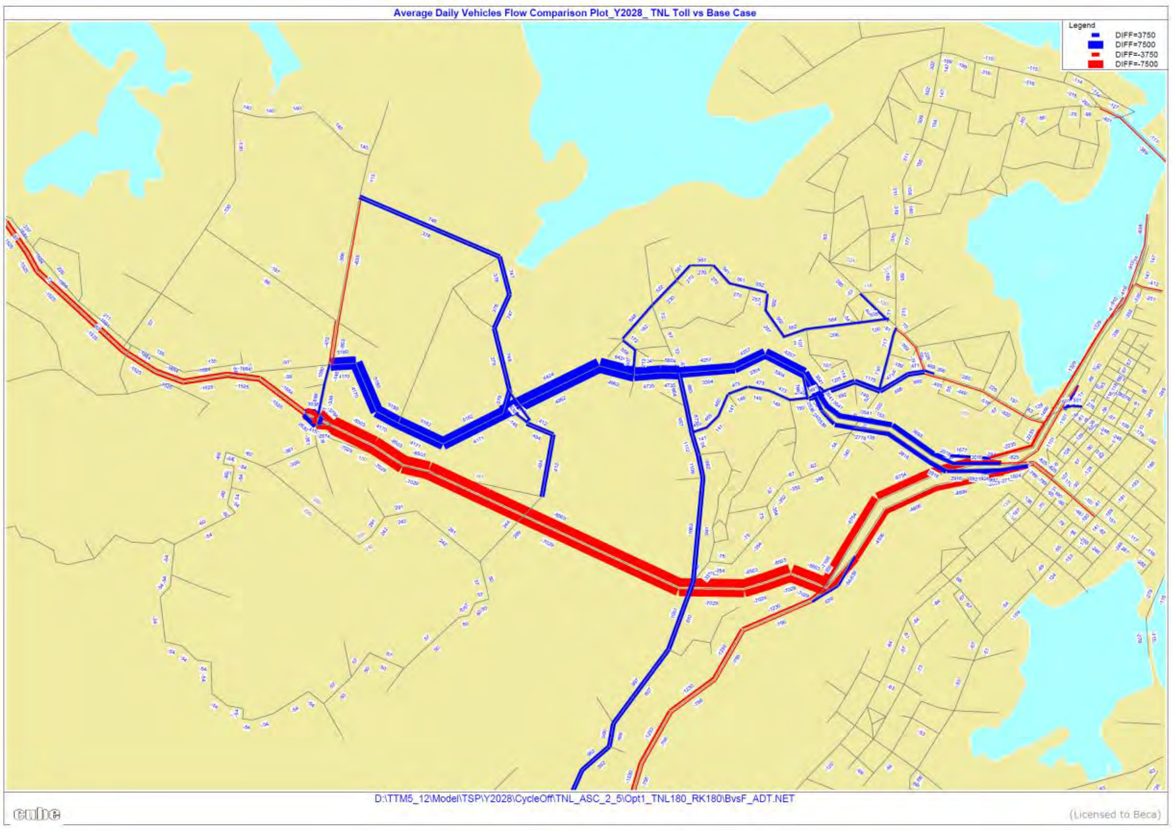
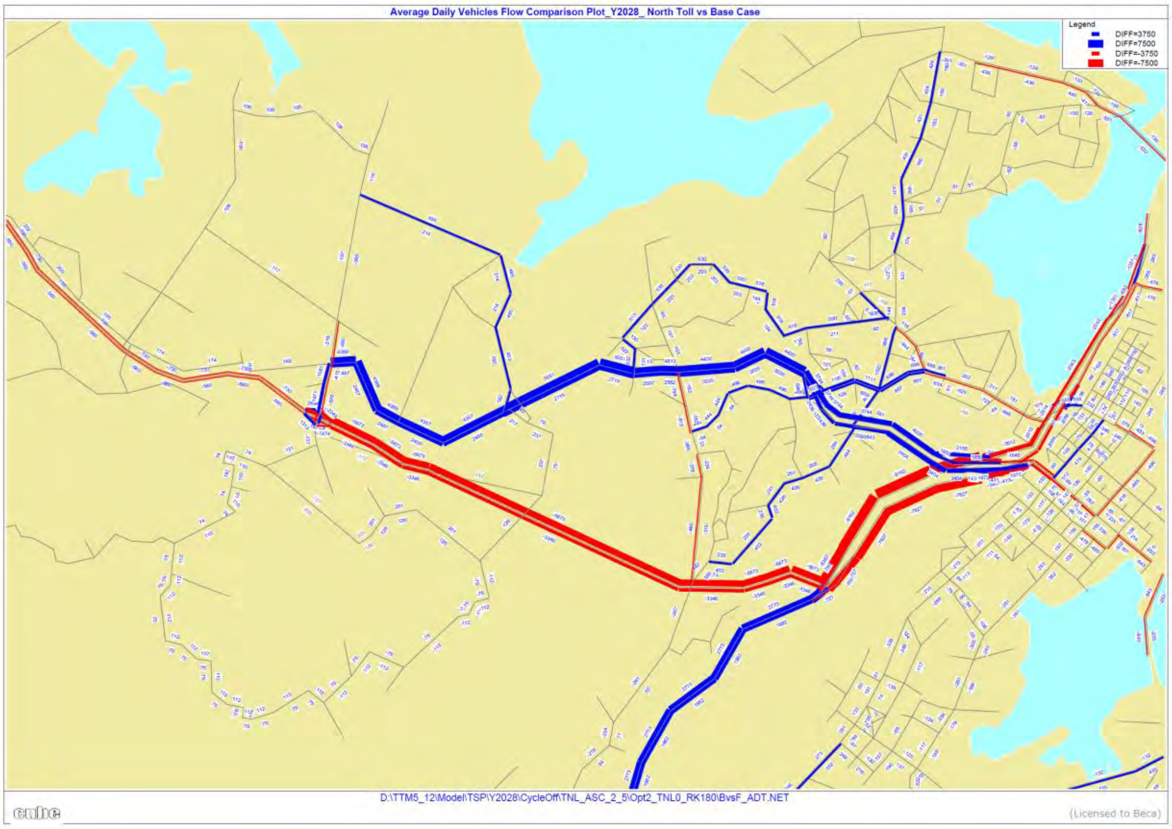


Figure 5-3: Average Daily Vehicles Flow Difference Plot – North Toll vs Base Scenario



The flow difference plots show a trip diversion of approximately 15,500 daily vehicles for TNL toll scenario and 9,000 vehicles for North Toll scenario compared to the Base Scenario.

Table 5-2 summarises traffic information in the wider area.

Table 5-2: 2028 Daily Traffic Flows

Location	Base Scenario	TNL Toll	North Toll	TNL Toll - Base	North Toll - Base
15th Avenue	19,650	19,060	18,090	-590	-1,560
Elizabeth Street	21,360	20,810	20,770	-550	-590
Harbour Bridge	59,410	59,220	58,930	-190	-480
Takitimu Drive, south TNL	23,720	21,940	27,980	-1,780	4,260
Takitimu Drive, north TNL	41,170	30,810	26,130	-10,360	-15,040
Cambridge Road	12,780	14,210	12,590	1,430	-190

From the table, the North Toll scenario diverts more traffic on the key corridors such as 15th Avenue, Elizabeth Street and the Harbour bridge.

5.7 Total Network Statistics

The combined effect of trip suppression and traffic diversion are reflected in the vehicle kilometres travelled (VKT) and vehicle hours travelled (VHT) statistics for each tolling scenario, as shown in **Table 5-3** and **Table 5-4**. It should be noted that these are regional totals of the whole modelled network, which will tend to make the localised effect appear small.

Table 5-3: Vehicle Kilometers Travelled (VKT)

Scenario	AM	IP	PM	Average Annual Daily VKT	Average Annual Daily Change to Base Scenario
Base Scenario	719,850	609,290	759,360	8,192,650	
TNL Toll	714,340 (-0.77%)*	603,130 (-1.01%)	753,230 (-0.81%)	8,117,320 (-0.92%)	-75,330
North Toll	717,110 (-0.38%)	606,250 (-0.50%)	755,630 (-0.49%)	8,153,880 (-0.47%)	-38,770

**% change in VKT relative to Base Scenario*

Table 5-4: Vehicle Hours Travelled (VHT)

Scenario	AM	IP	PM	Daily VHT	Daily Change to Base Scenario
Base Scenario	12,680	10,190	13,480	140,230	
TNL Toll	12,610 (-0.55%)*	10,130 (-0.59%)	13,400 (-0.59%)	139,450 (-0.56%)	-780
North Toll	12,690 (0.08%)	10,190 (0.00%)	13,460 (-0.15%)	140,190 (-0.03%)	-40

**% change in VHT relative to Base Scenario*

Key points from the above tables are:

- Relative to Base Scenario, reduction in the daily VKT statistics for the TNL Toll scenario is 75,330 vehicle kilometres which is almost double the reduction of the North Toll scenario (38,770 vehicle kilometres).
- The model predicts that tolling on TNL or North sections have suppressed travel demand in the corridor (refer Section **5.6**), as it increases the perceived cost of travel. This has reduced the overall amount of travel. This is evident from the change in VHT statistics in the TNL Toll scenario (780 less vehicle hours) and North Toll scenario (40 less vehicle hours).

5.8 Vehicle Emission

NZ Transport Agency's VEPM version 6 (released in July 2019) was adopted for this study. Features of the VEPM 6 model are outlined below:

- VEPM estimates vehicle tail-pipe emissions only, i.e. does not include vehicle manufacture or energy generation
- VEPM provides rates in terms of grams per km of travel, depending on average vehicle speeds
- VEPM rates are based on assumed vehicle fleet composition in future years

Vehicle emissions are estimated for each link in the strategic model (TTSM) by applying the VEPM rates to congested network speed. The emissions are then summed across all links in the model

Table 5-5 summarises the outcomes from the VEPM model for each tolling scenario and percentage change in emission results relative to the base scenario.

Table 5-5: Summary of Vehicle Emission Results

Measures	Units	Base Scenario	TNL Toll	North Toll	Changes relative to Base Scenario	
					TNL Toll	North Toll
Carbon monoxide (CO)	Kg/day	6,504	6,430	6,461	-1.14%	-0.67%
Carbon dioxide (CO2)	Kg/day	1,792,253	1,774,837	1,782,310	-0.97%	-0.55%
Volatile organic compounds (VOC)	Kg/day	496	492	494	-0.69%	-0.28%
Nitrogen oxides (NOx)	Kg/day	4,040	3,995	4,014	-1.11%	-0.64%
Nitrogen dioxide (NO2)	Kg/day	839	830	834	-1.12%	-0.64%
PM2.5 E	Kg/day	112	111	111	-1.30%	-0.85%
PM10.0 BT	Kg/day	133	132	133	-0.45%	-0.02%
Fuel Consumption	l/day	727,573	720,567	723,619	-0.96%	-0.54%

Key points from the above table are:

- Reduction in emission for the TNL Toll scenario is higher than the North Toll scenario. This is because of higher vehicle kilometers travelled in North Toll scenario.
- CO_2 reduction is 0.97% and 0.55% for the TNL Toll and North Toll scenario, respectively.

5.9 Summary and Discussion of Toll Effects

The previous toll study (October 2016) recommended a strategy of; tolling the TNL and Takitimu Drive, involving a new toll gantry on the TNL itself whilst retaining the existing toll gantry on Takitimu Drive. This was primarily based on the benefit cost ratio outcomes.

From this current study, the following can be summarised:

- Three toll scenarios were studied using the 2028 TSP Do Minimum scenario in TTSM:
  - Base Scenario – Retain the toll on Takitimu Drive south with no toll on the TNL.
  - TNL Toll – Additional toll gantry on the TNL, and toll tariffs consistent with Takitimu Drive
    - A consequence of this scenario is that users of the southern end of Takitimu Drive and TNL pay both tolls at full price
  - North Toll – Shifting the gantry on Takitimu Drive to north of the TNL connection point. Toll values remain the same.
- The TNL toll scenario diverts more traffic to the alternative SH2 corridor than North Toll scenario. Under the TNL toll scenario, the TNL only carries 45% of the total northern corridor traffic.
- The TNL toll scenario has the highest trip suppression effect as this toll strategy impacts trips heading to the CBD as well as trips heading to Tauriko.
- Because of the trip suppression effects, the TNL toll scenario has the lowest vehicle kilometre travelled (VKT), vehicle hour travelled (VHT) and vehicle emissions.

The key statistics indicate the TNL toll scenario performs better, with the exception of low utilisation of traffic on the TNL. This is consistent with the previous study. However, having an additional toll gantry on the TNL would penalise traffic from the west to the south and vice-versa. This would discourage "round-harbour" traffic and potentially conflict with a long-term strategy of discouraging traffic from using the Hewletts Road and 15th Avenue corridors.

The North Toll strategy would favour "round-harbour" traffic (via SH29A) as there is no toll imposed to traffic using the TNL and then heading south and vice-versa. The flow difference plot (North Toll vs Base) indicates increase in traffic on the Takitimu Drive south section, but the wider flow difference plot shows limited increase in traffic along SH29A. Hence, having a toll gantry on the northern part of Takitimu Drive (before joining 15th Avenue) may not be enough to divert long distance cross harbour traffic. This could be due to the congestion along SH29A as a Do Minimum network scenario was used in this test.

A combination of a higher toll tariff, treatment to the existing SH2 corridor (e.g. reducing speed limit), providing capacity along SH29A and route signage may promote the usage of “round-harbour” traffic. Hence from a demand management perspective, having a toll gantry on the northern part of Takitimu Drive is a viable option and should be considered.

6 Bus Route on old SH2 or the TNL

In the TSP Do Minimum scenario (Base), the Katikati and Omokoroa bus routes are located along the existing SH2 which are running parallel to the TNL mainline. These services serve local patronage from the area between Omokoroa and Te Puna.

A scenario test was developed in TTSM by rerouting the Katikati and Omokoroa bus routes via the TNL mainline. As the bus routes are now located on the TNL, a park and ride station was introduced at the Minden Interchange to serve the Te Puna/Minden areas.

The bus travel times for the two scenarios are provided in **Table 6-1** .

Table 6-1: Bus Perceived Travel Time - Katikati and Omokoroa Bus Services

Services	Direction	Base Scenario			Bus Service along TNL		
		AM	IP	PM	AM	IP	PM
Katikati	Towards CBD	46.9	45.4	--	36.3 (-10.6)*	34.7 (-10.7)	--
Omokoroa		31.4	30.7	--	21.3 (-10.1)	20.4 (-10.3)	--
Katikati	From CBD	--	--	49.5	--	--	39.7 (-9.9)
Omokoroa		--	--	34.5	--	--	25.1 (-9.4)

** % change in PT Travel Time relative to Base Scenario*

The table shows that running the Katikati and Omokoroa bus services along the TNL improves bus perceived travel time by approximately 10 minutes. TTSM’s bus travel time (perceived) includes actual travel time and perception effects to represent reliability and quality of service. In this case, the TNL is assumed to have high occupancy vehicle lanes which allow buses to use the facility. Hence running the buses along the TNL improve actual travel time as well as perceived benefit of using a high-quality facility.

Regarding the bus patronage, having the bus services along the TNL attracts more patronage due to reduced travel time and the provision of park and ride facility at the Minden interchange. The combined (Katikati and Omokoroa) patronage for the citybound direction during the AM peak is 40 patronage/hr in the TNL scenario while the base scenario (bus services along old SH2) is 29 patronage/hr.

In summary,

- Running Omokoroa and Katikati bus services along the existing SH2 corridor provides a better access for the areas between Omokoroa and Te Puna. There are other bus services available from the Bethlehem area and hence running these two services through the Bethlehem town centre may have limited effects on patronage.
- Running the Omokoroa and Katikati bus services along the TNL reduced perceived travel time by approximately 10 minutes. As buses are running on the TNL, a park and ride facility was provided near the Minden interchange in this scenario test to serve the areas along the old SH2

(between Omokoroa and Te Puna). Due to improved travel time and provision of a park and ride facility, patronage numbers in this scenario was increased slightly.

- A potential hybrid option can be considered in which these two bus services run along SH2 between Omokoroa and Te Puna for local access, then use the TNL via the Minden interchange to get travel time improvement.

7 Potential scale of usage of managed lanes along the TNL

Currently, a managed lane is modelled in TTHM as a high occupancy lane (HOV). Generally, HOV lanes in TTHM allow 2+ occupancy vehicles, trucks and buses.

No additional specific modelling was undertaken for this analysis. The traffic information along the northern corridor from the existing TTHM DM model was extracted to understand the feasibility and potential effectiveness of different managed lane options.

The Aimsun model predicts traffic usage between the old SH2 and the TNL based on the travel time between their origins and destinations. **Table 7-1** summarises traffic information extracted from the 2048 TSP Do Minimum scenario for the AM peak.

Table 7-1: Traffic Information from TTHM (2048, TSP DM) for Eastbound AM Peak – 7:00-8:00am

Location	Single Occupant	2+ Occupant	Trucks	Buses	Total
SH2 (Wairoa Bridge)	582	106	30	2	720
TNL	1,463	284	246	0	1,990
Total Northern Corridor	**2,045**	**390**	**276**	**2**	**2,710**

From the table, TTHM predicts 27% (720 veh/hr) of traffic on SH2 and the remaining 73% (1,990 veh/hr) on the TNL. TTSM's split information was also extracted and a 21%/79% split (old SH2 vs TNL) is noted.

The following inputs and assumptions were made in the analysis:

- A 20% / 80% traffic split between SH2/TNL which gives 2,200 veh/hr flow on the TNL
- 10% truck on the TNL based on the Aimsun model
- Initial 15% of 2+ HOV vehicles (based on 2018 occupancy survey on SH2 west of Bethlehem)
- Initial 2% of 3+ HOV vehicles (based on 2018 occupancy survey on SH2 west of Bethlehem)
- Fixed number of vehicles between scenarios
- Analysis is for a ~5km length of the TNL eastbound section from the Minden interchange to Takitimu Drive as this section is expected to have the highest traffic flow.
- Akcelik speed flow curve is used to predict the speed on the TNL with the assumption of a 1,900 veh/hr/lane capacity, a free flow speed of 90km/hr and an Akcelik parameter of 0.9
- The analysis is for the road mid-block capacity and no consideration of potential downstream bottleneck effects (e.g. queues from interchange or merge)

This analysis investigates possible 4 scenarios:

- General traffic lane for both lanes (although this is not a managed lane scenario, we included this for a comparison purpose)
- One T2 lane (allow for trucks and buses as well) and one general traffic lane
- One T3 lane (allow for trucks and buses as well) and one general traffic lane

- One truck only lane and one traffic lane

Figure 7-1 shows vehicles per lane type on the TNL under different managed lane scenarios.

Figure 7-1: Vehicles per Lane Type on TNL (eastbound) in 2048

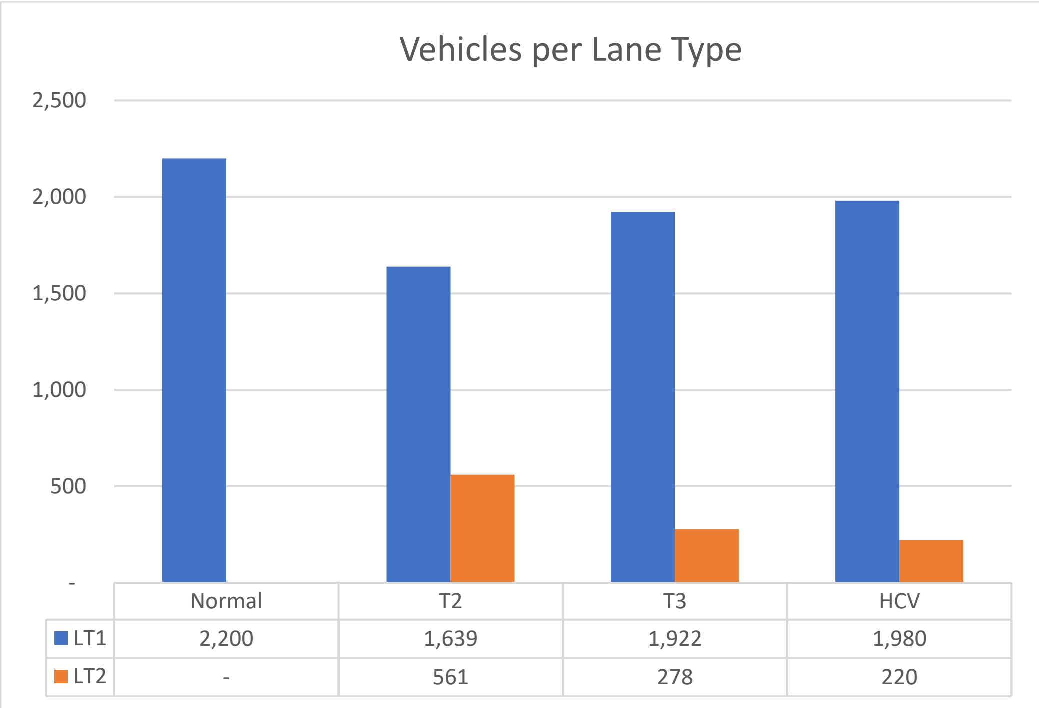
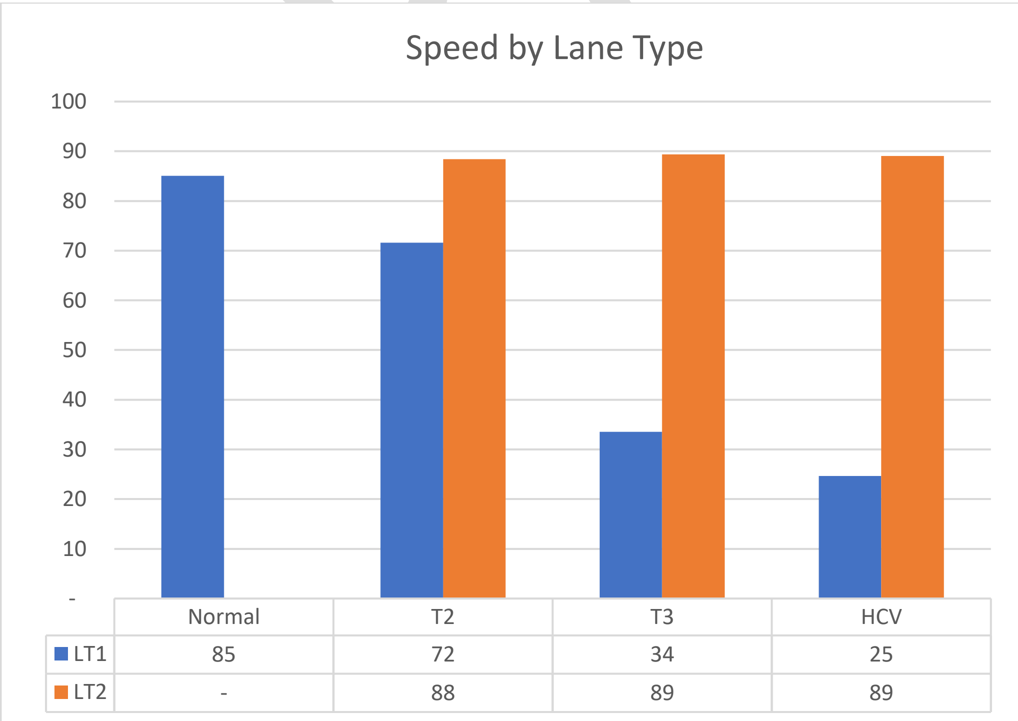


Figure 7-2 shows expected travel speeds on the TNL under different managed lane scenarios.

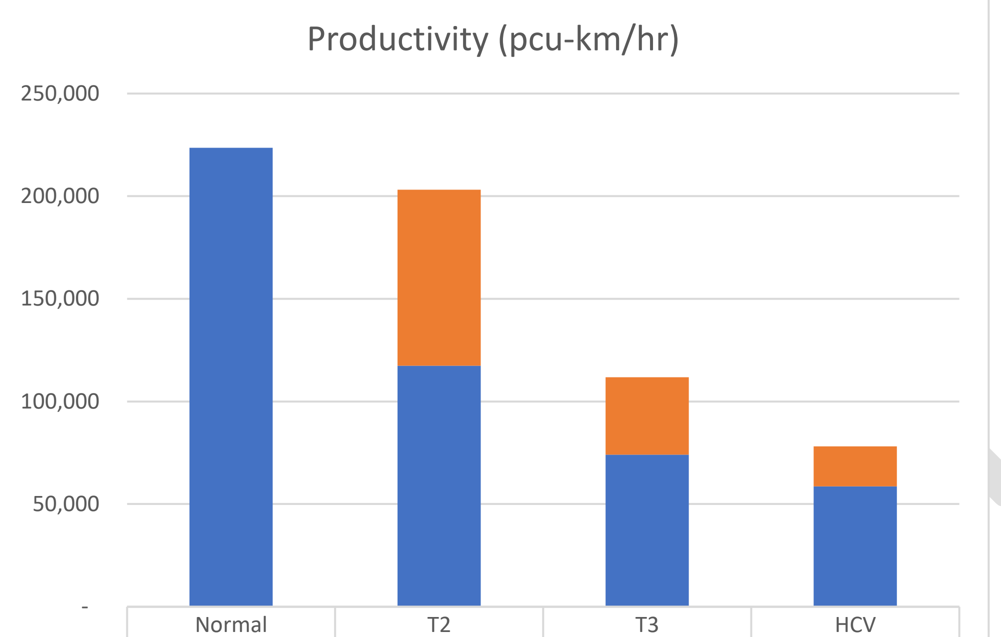
Figure 7-2: Expected Speeds on TNL (eastbound) in 2048



In the analysis, lane type 1 (LT1) is for general traffic lane and lane type 2 (LT2) is for priority traffic lane. Under different scenarios, speeds on the general traffic lanes are reduced with more restriction on usage of the managed lane.

Figure 7-3 shows corridor productivity for the TNL under different managed lane scenarios.

Figure 7-3: Productivity on TNL (eastbound) in 2048

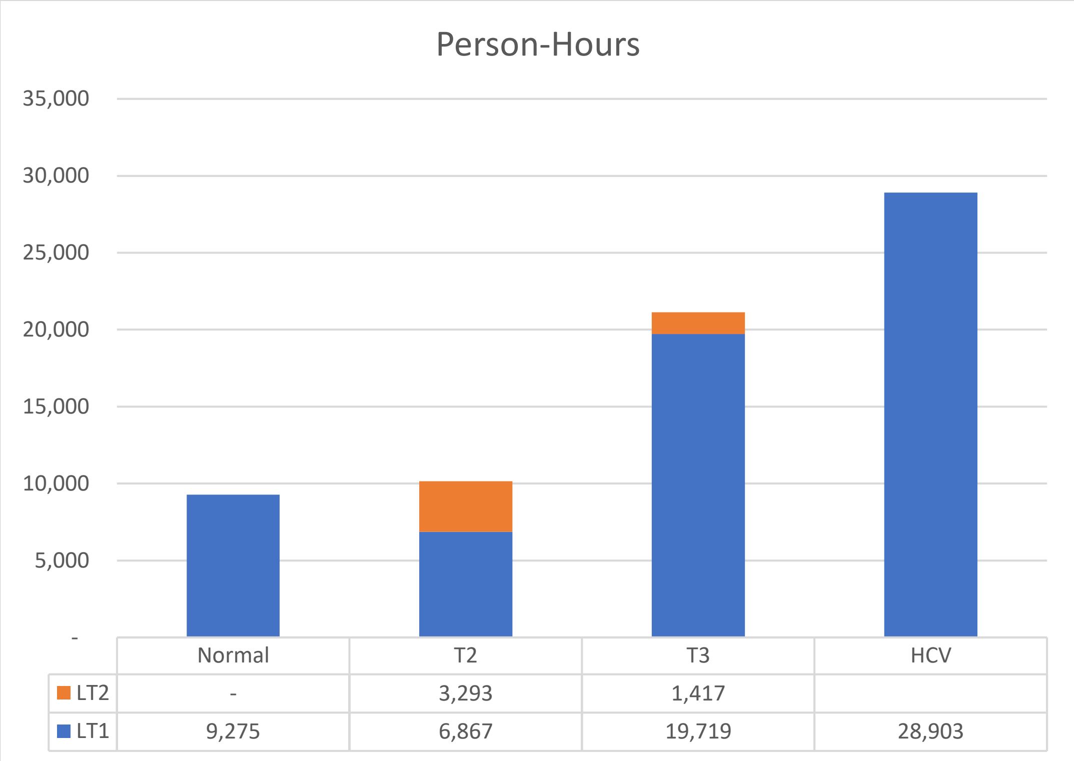


	Normal	T2	T3	HCV
LT2	-	85,806	37,715	19,598
LT1	223,546	117,351	74,052	58,597

As per the NZ Transport Agency's research report 557, a corridor productivity is measured in terms of the product of speed and person volume. In this analysis, a T2 priority lane option provides higher productivity than that of T3 or HCV only lane option.

Figure 7-4 shows person-hours on the TNL under different managed lane scenarios.

Figure 7-4: Person-hours on TNL (eastbound) in 2048



The figure shows person hours on the eastbound TNL section in TNL. Note that this measure is only for a ~5km section of the TNL between the Minden Interchange and Takitimu Drive. The person-hours in the T2 scenario is significantly lower than that of T3 or HCV scenario.

In summary,

- A managed lane a spreadsheet tool was used to understand the feasibility and potential effectiveness of different managed lane options.
- Traffic information was extracted from the 2048 TSP Do Minimum scenario (TTHM)
- Analysis is focused on the eastbound section of TNL between the Minden Interchange and Takitimu Drive
- Four scenarios were investigated
  - General traffic lane for both lanes
  - One T2+ lane (allow for trucks and buses as well) and one general traffic lane
  - One T3+ lane (allow for trucks and buses as well) and one general traffic lane
  - One truck only lane and one traffic lane
- Three key measures were prepared in the analysis
  - **Speed**: A high speed differential between adjacent lanes on a corridor could contribute to serious crashes and this could be an important factor when considering managed lane options. From the analysis, speeds on the general traffic lanes are reduced with more restriction on usage of the managed lane. T3 and HCV only scenarios have low speeds on general traffic lanes (less than 50 km/hr). Hence speed differential between the general and priority traffic lanes will be high under these two scenarios.
  - **Productivity**: This is a simple measure to understand a productivity of corridor by multiplying speed and person volumes on the corridor. For the three managed lane scenarios investigated, the T2 scenario provides highest productivity.

- **Person-Hour**: This measure is the product of travel time and person volumes on the corridor (in this case, a ~5km section of TNL from the Minden Interchange to Takitimu Drive). Again, the T2 scenario provides the lowest person-hours.

Based on the simple assessments undertaken, a T2 managed lane scenario, with access to 2+ occupant cars, trucks and buses would perform the best of the managed lane scenarios in terms of productivity, speed and person-hours. Any such scheme would however require careful design to mitigate potential safety risks associated with high speed differentials between traffic lanes. Although not explicitly tested, a scenario where priority was provided only at key capacity constraints (such as intersections/merge areas etc) rather than continuously over the full corridor length.

F

Appendix F – TSOF Alignment with UFTI Key Moves

TSOF Alignment with UFTI Key Moves

The Central Corridor urban form and transport corridor package

UFTI benefits Housing, movement, environment, prosperity	Broader outcomes Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	**Expected timing**	**TSOF Alignment**
Complete Te Papa business cases, District Plan changes to support City intensification, and carparking strategy changes to support increased parking turn-over	0–5 years	Te Papa complete, TCC working on district plan changes. TSOF includes parking strategy already underway at TCC.
Complete Te Papa placemaking initiatives to support increased residential density and provide amenity such as Memorial Park Upgrade	0–30 years	Te Papa IBC outcomes in TSOF programme.
Complete multimodal Cameron Rd improvements to support PT uptake, active modes, and intensification (TCC). Project in two stages to deliver PT infrastructure necessary to support PT journeys. Stages 1 and 2 completed early to encourage PT uptake.	0–10 years for early stage; 0–20 years for full completion	Included in TSOF – Stage 1 underway as per CIP funding Stage 2 SSBC starting in 2021.
Complete multimodal corridor and intersection	0–10 years	Included in TSOF SH29 Tauriko DBC 0-10 years

improvements at Barkes Corner and Takitimu Drive roundabout to support strategic PT journey from Tauriko to the City Centre		
SH29A capacity improvements between SH29 and Oropi Roundabout to support PT and freight journeys (could be delivered together with key move 4 above)	10–15 years	In TSOF 10 to 30 year programme SH29a – optimization and then upgrade timing to be confirmed in business case.

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	**Expected** **timing**	**TSOF Alignment**
Confirm locations for PT hubs and interchanges in the central corridor (in consideration of TNL connections decisions)	1–4 years	Included in TSOF business case to define PT priority to support medium scenario bus routes.
Turret Rd and 15th Ave improvements to support improved multimodal access, safety, better travel choices, and Te Papa placemaking	1–10 years	Included in TSOF 4-10 years
- Gate Pā and Merivale residential areas in partnership with Accessible Properties, central and local government to provide additional social housing dwellings	1–3 years	Housing specific. TSOF supports accessibility to these areas with projects along Te Papa.
Establish active Partnership with Bay of Plenty District	1 year	TSOF has examined accessibility to both the hospital and university as key destinations. TSOF

Health Board and Waikato University as key destinations in the corridor to promote use of public transport and active modes		bus and cycle routes support access to these locations and these facilities will support the Health Board and University in promoting the use of PT and active modes.
Determine future use of Crown-owned land in the Central Corridor	4–10 years	Not something TSOF can actively influence but the transport system will support higher density use of land in the central corridor.
Otūmoetai Spatial Framework and DBC	1–3 years	TSOF includes a SSBC project in Otumoetai to support spatial planning exercise 0-3 years.
Incorporate Otūmoetai, Mt Maunganui to Bayfair/Arakaki intensification provisions into revised District Plan	4–10 years	Not specific for TSOF but TSOF includes activities in these areas to support the spatial planning exercise.

�� The timing and sequencing of this activity with the Northern Corridor will need to be reviewed once the review of timing and sequencing of greenfield sites in the action above is completed. This is likely to occur in ten years time.

The Western Corridor Package

UFTI benefits	**Broader outcomes**	
Movement, prosperity	Thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, inter-regional freight efficiency	

Key moves	Expected timing	TSOF Alignment
Complete structure planning and rezoning for the Tauriko Business Estate extension and Keenan Rd	0–5 years	Not transport specific but TSOF programme includes activities to support this rezoning e.g. SH29a and Keenan Road access. 4-10 years
Complete local authority boundary adjustments	1 year	Not something for TSOF
Complete Tauriko West structure plan and rezoning	1–3 years	TSOF programme includes activities to support this e.g. SH29a DBC
Complete and deliver Tauriko early works business case and associated improvements	1–3 years	Included in TSOF 0-3 years
Complete Tauriko West Network Connections Detailed Business Case and other related DBCs to create a multimodal transport network	1–3 years	Included in TSOF 0-3 years
Implement Tauriko West Network Connections (including multimodal) improvements stage 1	4–10 years	Included in TSOF 0-3 years and 4-10 years
Implement Tauriko West Network Connections (including multimodal) improvements stage 2	10 plus years	Included in TSOF 10-30 years
Review timing and sequencing of new greenfield sites on the western and northern corridors in light of further technical work and adjust spatial plan as appropriate	10 years	Not transport specific but TSOF includes projects that support planned urban growth

Complete master plan for the Western Corridor urbanisation (including Upper Belk, Merrick, and Joyce Roads��	10–20 years	Included in TSOF 10-30 years
Deliver social and community infrastructure to support planned growth in the Western Corridor	1–10 years	Not transport specific but TSOF includes projects that support planned urban growth
Construct new infrastructure to support further Western Corridor urbanisation	30 plus years	TSOF includes western corridor ring route investigation to determine timing linked with growth in this area
Construct new infrastructure to support further Western Corridor urbanisation	30 plus years	TSOF includes western corridor ring route investigation to determine timing linked with growth in this area

Freight access to the Port and the upper North Island package

UFTI benefits Movement, prosperity	**Broader outcomes** Thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, inter-regional freight efficiency	
Key moves	**Expected timing**	**TSOF Alignment**
intersection optimisation improvements, lane usage, PT priority lanes etc. to support the strategic function and mode/movement priorities	0–1year	Included in TSOF high priority, 0-3 years
Implement Hewletts Road optimisation package, including intersection optimisation improvements, lane usage, PT priority lanes etc. to support the strategic function and mode/movement priorities	1–3 years	Included in TSOF high priority, 0-3 years
Complete Hewletts Road sub-area access single stage	1–3 years	Included in TSOF high priority, 0-3 years

business case		
Implement Hewletts Road sub-area access single stage business case	4–10 years	Included in TSOF high priority, 4-10 years
Investigate SH29A single stage business case and optimisation package (including intersection optimisation improvements, lane usage, PT priority lanes etc.) to support the strategic function and mode/movement priorities	1–3 years	Included in TSOF 0-3 years
Implement SH29A single stage business case and optimisation package	10–30 years	Included in TSOF 4-10 years
Continue to invest in optimisation of the rail network to continue to increase mode share of freight movement by rail	Ongoing	Freight mode share strategy included in TSOF

CBD and Mt Maunganui package

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	Expected timing	**TSOF Alignment**
Complete investigations into Mount Maunganui to CBD Ferry Connection and convert into business case	0–1 year	TSOF investigations indicate ferry will not compete with buses on time, price or catchment and this has been deferred in the TSOF framework. This means it might be worth doing for tourism or other purposes but it does not provide sufficient benefit against the TSOF objectives to be taken further as a transport solution at this time.
Deliver Mount Maunganui to CBD Ferry Connection	1–3 years	As above

Implement multimodal Maunganui Rd business case	1–3 years	Implementation is in progress. Stage 2 longer term SSBC included in TSOF
Complete Mt Maunganui/Bayfair/Arataki Spatial Planning Framework and DBCs	1–3 years	Not transport specific but TSOF includes SSBC for this area to support spatial planning exercise.
Complete IBC(s) and DBCs examining potential alignment of additional bus lane capacity (Harbour Crossing) and alternatives for the Matapihi Rail Bridge replacement��	4–10 years	Included in TSOF, we consider the Hewletts Sub Area business case will need to consider this.
Implement additional bus lane Capacity (Harbour Crossing) and Matapihi Rail Bridge replacement IBC/DBC	10–30 years	The replacement bridge is included in TSOF 10-30 years and subject to business case development
Complete CBD revitalisation strategy to attract business and residential growth	1–3 years	Not transport specific but TSOF includes a CBD area transport facility business case to support access to CBD
Implement CBD revitalisation strategy	3–10 years	As above

�� The potential for an additional harbour crossing is sensitive and will involve the same communities in potentially parallel conversations. We have proposed combining the two topics into a single process to avoid duplication and enable an integrated conversation with tangata whenua. If necessary, they can be separated.

The Northern Corridor package

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	Expected timing	**TSOF Alignment**

Complete investigations into Omokoroa to CBD Ferry Connection (Ferry Connections SSBC)	0–1 year	TSOF investigations indicate ferry will not compete with buses on time or price or catchment and this has been deferred in the TSOF framework. This means it might be worth doing for tourism or other purposes but it does not provide sufficient benefit against the TSOF objectives to be taken further as a transport solution at this time.
Complete Omokoroa Stage 3 Structure Plan	1–3 years	Not transport specific but TSOF includes Omokoroa Road upgrade – now committed, and improved access to the Omokoroa growth area through improved bus routes and frequencies
Deliver social and community infrastructure to support planned growth in the Northern Corridor	1–10 years	Not transport specific
Complete Northern revocation planning for old SH2 through Te Puna and Bethlehem	1–3 years	Revocation will occur as part of Takitimu North Link. TSOF includes a project to investigate further improvement to SH2 beyond revocation to support primary bus route
Complete the TNL Tauranga Connections Network Plan via the Transport system operating framework.	0–1 year	TSOF has considered matters agreed with Waka Kotahi to support Takitimu North Link network planning, specific modelling note provided. Section in report on managed lane onward connections.
Construct Tauranga Northern Link and Omokoroa Extension with Tauranga network connections	1–7 years	Underway
Complete Northern revocation planning for old SH2 Te Puna to Omokoroa	3–7	Underway
Complete Te Puna Master Plan	20–30 years	Not transport specific but TSOF supports access to Te Puna with increased bus services
Design park & ride facilities at Apata, Omokoroa, and Te Puna for high frequency PT services (future proofed for rail)	1–5 years	Park and ride included in TSOF. PT access business case to determine timing, concept and cost of these network wide.
Deliver park & ride facilities at Apata, Omokoroa, and Te Puna for high frequency PT services (future-proofed for rail)	5–10 years	Park and ride included in TSOF. PT access business case to determine timing, concept and cost of these network wide.

Eastern Corridor package

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	**Expected timing**	**TSOF Alignment**
Resolve access to Te Tumu	1–3 years	Not transport specific but TSOF includes PEI to be delivered when appropriate
Te Tumu Structure Plan and rezoning	1–3 years	TSOF includes the transport network as per the structure plan to support this rezoning 0-30 years aligned with growth
Te Tumu transport multimodal network design and delivery	4–10 years	TSOF includes the transport network as per the structure plan 0-30 years aligned with growth
Te Tumu and Wairakei community facilities to support town centre and amenity	4–10 years	Not transport specific
Complete Rangiuru Business Park including the interchange to support road/rail integration, and freight movements to the Port	1–3 years	Interchange now committed CIP funding
Complete Pāpāmoa East Interchange	1–10 years	Included in TSOF 0-3 years
Prepare new eastern settlement concept plan that defines location of new settlement, and associated District Plan change to protect the area from inappropriate subdivision and development	4–10 years	Not transport specific but TSOF includes bus services to the east that could be adapted as part of this concept plan consideration to support access.
Complete New Eastern Settlement Masterplan including decisions on multimodal connectivity between new	10–20 years	Not transport specific but TSOF includes bus services to the east that could be adapted as part

settlement, Wairakei, Rangiuru and Te Puke		of this master plan consideration to support access.
Construct infrastructure to support new eastern settlement	20 years onwards	As above

Enhancing the role of tangata whenua as a Treaty partner

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Tangata whenua participation, Māori social and economic outcomes	
Key moves	Expected timing	**TSOF Alignment**
Improve level of advice, support, and resourcing for tangata whenua participation in SmartGrowth. Set up a new expert advisory panel of relevant experts from within tangata whenua to assist tangata whenua in their role as partners of SmartGrowth. The expert group will provide advice and assist with indirect engagement with hapū and iwi, Māori Land Trusts and Incorporations and Post-Settlement Governance Entities	0–1 year	Not something for TSOF specifically but TSOF reports notes the same UFTI priority for increased partnership with Iwi in project delivery. To be progressed via SmartGrowth
SmartGrowth Leadership Group to develop agreed iwi and hapū engagement protocols and work with tangata whenua to establish cultural outcomes as key performance indicators	0–1 year	As above
Develop Iwi Spatial Plan for incorporation in SmartGrowth Joint Spatial Plan	0–1 year	As above
Develop and implement plan of actions arising from Joint	1–3 years	As above

Spatial Plan		

Sub-regional housing supply and affordability initiatives package

UFTI benefits Housing	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, improved housing affordability	
Key moves	**Expected timing**	**TSOF Alignment**
Portfolio management approach: take a portfolio management approach to foster greater collaboration and strategic decisions potentially through a new Housing Portfolio Partnership Entity (HPPE) to co-ordinate response to housing supply and affordability issues.	0–1years	All of this key mov~~s~~ are not transport specific but the TSOF programme will deliver improved accessibility compared with a do minimum, this will support housing delivery aligned to UFTI.
Project delivery of affordable housing (firstly in the Te Papa peninsula): capitalise opportunities for social and affordable housing (identified through the portfolio management approach) through the most effective project structure. Short-term focus (in Te Papa and Te Puke, Omokoroa and Katikati first)	1–10 years	As above
Project delivery for affordable housing elsewhere, with an emphasis on catalyst projects in urban centres and around PT nodes/corridors	3–30 years	TSOF defines detailed PT routes and facilities that will support the planning and delivery of this activity
Develop sub-regional social and affordable housing plan using a collaborative approach to set out actions and responsibilities between partners	1–3 years	Not transport specific. TSOF will support by defining the detail transport system and priorities that the housing plan can align to.

Investigate on a council by council basis the ability for financial incentives or concessions to deliver social housing.	1–3 years	
Actively encourage philanthropic investment into social housing	Ongoing	Not something TSOF can influence.

UFTI benefits Housing	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, improved housing affordability	
Key moves	Expected timing	**TSOF Alignment**
Continue to optimise through district plan reviews and plan changes how district plans: • provide for regulatory incentives and addressing disincentives to affordable housing • enable a greater mix of residential section size and building typologies • define an appropriate balance between quality of developments and cost effectiveness	1–10 years	Not transport specific but TSOF provides a transport framework that this planning can align to e.g. transport accessibility can support greater housing densities

• streamline administrative and plan change processes		
Reinvigorate Te Keteparaha Mo Nga Papakāinga – Māori Housing Toolkit	0–1 year	Not something TSOF can actively contribute to
Seek voluntary agreements with developers regarding land covenants they impose in private developments to ensure such covenants do not preclude delivery of affordable housing	Ongoing	Not something TSOF can actively contribute to
Support removal of barriers in legislation such as RMA and Building Act to provision of affordable and social housing	Ongoing	Not something TSOF can actively contribute to

Sub-regional public transport, mode shift, and emission reduction initiatives package

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	Expected timing	**TSOF Alignment**
Plan and facilitate introduction of low carbon transport fuel infrastructure (e.g., EV or Hydrogen) network for the sub-region	0–10 years	TSOF includes a EV / low carbon strategy 0-3 years
Implement Western Bay of Plenty Strategic Walking and	0–30 years	

Cycling network (first 60% delivered within 10 years)		TSOF includes the cycle plan 'accessible streets' network, 0-3 and 4-10 years.
Complete mode shift plan for the sub-region	0–1 years	Included in TSOF 0-3 years
Enhancements to existing PT network and infrastructure to support mode shift and intensification initiatives including those identified via the Transport System Operating Framework	Ongoing	TSOF includes optimization of the bus service 0-3 years prior to the medium scenario 4-10 years
Deliver a mode shift behavioural change programme to support and enable mode shift	1–3 years	TBC programme included in TSOF 0-3 years

Other transport, policy, and pricing interventions package

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	Expected timing	**TSOF Alignment**
Complete Transport System Operating Framework and refine list of UFTI implementation actions accordingly	0–1 year	This is TSOF.
Develop a monitoring framework for the Key Performance Indicators and Measures to form part of SmartGrowth	0–1 year	TSOF has defined more detailed KPI and targets to support this monitoring programme aligned to UFTI.

Leadership Group's portfolio monitoring and reporting		
Complete SmartGrowth Joint Spatial Plan including new iwi spatial layer, utility service provision plan and consideration of other core services such as fire, police, health, and education	0–1 year	TSOF supports the spatial plan development as the transport framework
Revise Regional Policy Statement to support Settlement Pattern and implement new NPS requirements (including addressing natural hazard and resilience issues)	0–2 years	Not something TSOF can actively contribute to
Review District Plans giving effect to RPS changes	2–5 years	Not something TSOF can actively contribute to
Investigate and introduce economic instruments to influence travel choice (parking policies, tolling, congestion charging, freight mode choices). Parking policy changes to commence 2021 as per the Te Papa business case.	0–10 years	TSOF includes TDM strategy 0-3 years and parking strategy 0-3 years
Update sub-regional economic development strategy and implement	1–10 years	Not something TSOF can actively contribute to
Complete and implement a seasonal workers accommodation and transport action plan	1–3 years	TSOF bus network connections provide for a range of users and can complement this plan. TSOF includes a trial of on demand buses that may also support this.
Investigate, and if appropriate, establish sub-regional urban development entity to co-ordinate delivery of regeneration activities, including facilitating private investment	1–5 years	Not something TSOF can actively contribute to

UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	Expected timing	**TSOF Alignment**
Consider the use of different planning tools to speed up land use planning change processes	0–1 years	Not something TSOF can actively contribute to

Portfolio management, funding, and financing package

Funding and financing package		
UFTI benefits Housing, movement, environment, prosperity	**Broader outcomes** Improved liveability/placemaking/amenities, attractive and thriving sub-region, supporting growth, increased safety (transport and personal), better travel choices, improved modal shift, improved housing affordability	
Key moves	Expected timing	**TSOF Alignment**
Update and revise UFTI economic case based on business cases and more detailed evaluation of wider economic benefits etc. in accordance with the Waka Kotahi Economic	1–3 years	Not something TSOF can actively contribute to

Evaluation Model.		
Develop an outcomes based portfolio management approach including reporting system for the SmartGrowth Leadership Group	1–3 years	Not something TSOF can actively contribute to
Investigate the suitability of new funding instruments such as PPPs or Regulatory Asset Base for specific UFTI projects and the governance and business systems required to procure and participate in managing complex alternative procurement methodologies�� (TCC change). procurement methodologies�� (TCC change).	1–3 years	Not something TSOF can actively contribute to

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Appendix G – Economics Memo

File Note

By:	Nyan Aung Lin	**Date:**	2 October 2020
Subject:	TSP Benefit Cost Ratio Assessment	**Our Ref:**	0

1 Introduction and Summary

This file note documents the high-level benefit cost ratio analysis for the Western Bay Tauranga System Plan (TSP) Project. The analysis only considers interventions that would have a noticeable impact on benefits / costs within the transport model and minor safety, placemaking type projects are not included in the costs or benefits at this stage.

The TSP project has identified a programme of upgrades to be prioritized. The study has identified high priority areas and corridors, however the specific interventions are indicative only. The scope of this assessment is therefore targeted at that same level, using aggregated modelling scenarios and simplified assessment methods.

Three main benefits were estimated using the Tauranga Transport Models:

- Traffic benefits from Tauranga Transport Strategic Model (TTSM)
- Public Transport (PT) benefits from TTSM
- Cycle benefits from Tauranga Cycle Model (TCM)

A high-level, indicative cost estimate was provided by the TSP study for the benefit cost assessment. The evaluation is summarised as follows:

Table 1 : Evaluation Summary

Item	Value
Capital Cost (years 0-3), $m	$514 m
Capital Cost (years 4-30), $m	$815 m
Annual PT operating cost in 2028, $m	$25 m
Annual PT operating cost in 2048, $m	$34 m
Discounted Capital $ Operating Costs, $m PV	$1264 m PV
Discounted Benefits, $m PV	$3,402 m PV
Benefit/Cost Ratio	**2.7**

2 Benefit Calculation Methodology

This section discusses the methodology for the following benefit calculation processes:

- Traffic benefit calculation
- PT benefit calculation
- Cycle benefit calculation
- Crash cost saving calculation

2.1 Traffic Benefit Calculation

The two benefit streams calculated internally in the TTSM are:

- Travel Time Costs (hours); and
- Vehicle Operating Costs ($).

2.1.1 Travel Times Costs

For this assessment, the three considered components of travel time were:

- Base travel time;
- Congested travel time (denoted as 'CRV' in the EEM)
- Reliability

Base travel time indicates whether the initiative would improve traffic flows in terms of total travel time between the option and the reference scenario. It is applied to the entire network.

Congested travel time is applied only on road sections that are deemed congested. CRV benefits/dis-benefits are calculated in accordance with the EEM as follows:

- Urban roads in the model use the methodology for urban roads, whereby CRV only applies to links with a Volumes/Capacity (V/C) ratio greater than 70%; and
- Rural roads used the Percent Time Delayed (PTD) method. The PTD was estimated from the V/C ratios by adopting values from Table A4.4 of the EEM, assuming generally rolling terrain, and typically 50% of overtaking sight distance less than 400m.

Traffic reliability benefits were assessed as 5% of the combined base and congested travel time benefits.

2.1.2 Vehicle Operating Costs (VOC)

The three components of VOC that were evaluated as part of this assessment were:

1. Base running costs

Base running costs were calculated for each link based on the average travel speed and vehicle type by adopting the regression formulas in the EEM and assuming an average gradient of 0%. This regression formula is defined as:

$$VOC_B = a + c.\ln(S) + e.[\ln(S)]^2 + h.[\ln(S)]^3$$

Where VOC_B = Base running cost in cents/km

S = speed in km/hr

a,c,e,h = coefficients as per **Table 2** below.

Coefficients for light vehicles were estimated as a weighted average between those provided for passenger cars and those for light commercial vehicles. Similarly, coefficients for medium (MCV)/heavy commercial vehicles (HCV) were estimated as a weighted average of MCV, HCV-I and HCV-II coefficients.

Table 2 : Coefficients for Base VOC Models (2015)

Coefficient	Light Vehicles	MCV / HCV
a	21.2535	-28.5846
c	27.7933	155.5623

e	-13.4476	-55.6943
h	1.6345	6.141633

2. Fuel costs at intersections

Fuel costs at idle were applied to all intersection that were experiencing delays at a rate of 1.89 c/min for light vehicles and 3.96 c/min for medium and heavy class vehicles.

3. Additional running costs due to road congestion

Additional VOC running costs were calculated using the following formula and adopting coefficient values in the table below (adopted from EEM, Table A5.21). This can be expressed as:

VOC_{cong} = min {a, exp(b + c*VC) – exp(b)}

Where VOC_{cong} = additional VOC due to congestion in cents/km

VC = Volume to Capacity Ratio, and

a -c = coefficients as indicated in **Table 3** below.

Table 3 : Coefficients for Congested VOC Models (2015)

Coefficient	Urban	Rural 2-Lane Highway		Motorway
		Strategic	Other	
a	9.211	7.704	6.979	7.084
b	-1.904	-1.235	-1.563	-5.931
c	4.327	3.210	3.408	7.866

2.1.3 Benefit Calculation Process

For this study, a Variable Trip Matrix (VTM) benefit calculation procedure was used. The calculation is based on the formula provided in Section A11-12 of the Waka Kotahi NZ Transport Agency's Economic Evaluation Manual (EEM). This formula is provided below:

$$Bij = (R_{ij}^{DM}\, T_{ij}^{DM} - R_{ij}^{OPT}\, T_{ij}^{OPT}) + \tfrac{1}{2}\,(U_{ij}^{DM} + U_{ij}^{OPT}) \times (T_{ij}^{OPT} - T_{ij}^{DM})$$

Where T_{DM} = Number of trips in the Do Minimum

T_{OPT} = Number of trips in the Option

U_{DM} = User cost of travel in the Do Minimum

U_{OPT} = User cost of travel in the Option

R_{DM} = Resource cost of travel in the Do Minimum

R_{OPT} = Resource cost of travel in the Option

2.1.4 Annualisation from Modelled Periods for Traffic Benefits

Annual benefits have been estimated through weighted factoring of the three modelled weekday periods (AM, inter-peak and PM). The AM and PM peak models were used to represent the 2-hour weekday periods of 7:00-9:00am and 4:00-6:00pm respectively, while the inter-peak model was used to represent all other periods.

Average weekday and weekend hourly flow profiles were created from across several traffic count locations in Tauranga. The resulting annualisation factors are summarised in **Table 4**.

Table 4 Annualisation Factors for Traffic

Period	Model Used	Equivalent Hours per day	Days per year	Factor
Weekday AM	AM	2	245	490
Weekday PM	PM	2	245	490
Weekday Interpeak	IP	7	245	1715
Weekday evening/night	IP	3.04	245	744.8
Weekend/holiday	IP	9.62	120	1154.4

The above factors were applied to the respective model outputs to represent annual vehicle operating costs. For the travel time costs, given that the base time values are different between off-peak and weekends than they are during the weekday inter-peak periods, these differences were considered and a different set of annualisation factors were applied.

2.2 PT User Benefit Calculation

In TTSM, PT user benefits were assessed directly from the demand and generalised cost matrices in the model, using the benefit formula in Section A11-12 of the EEM:

B_{ij} = [½ (T_{DM} + T_{OPT}) (U_{DM} – U_{OPT})] (perceived user benefits)

+ [(T_{DM} PTR_{DM} – T_{OPT} PTR_{OPT}) (change in public transport supply resource cost)

+ [T_{OPT} (OU_{OPT} – OR_{OPT}) – T_{DM} (OU_{DM} – OR_{DM})] (change in other resource costs)

+ [T_{OPT} F_{OPT} – T_{DM} F_{DM}] (fare resource correction)

Where, for each ij pair:

T = number of trips.

U = perceived cost/trip.

F = fare/trip (as included in the perceived cost of travel).

OU = other perceived user cost/trip (e.g. generalised cost of travel time).

PTR = resource cost of providing public transport/trip.

OR = other resource travel costs (eg travel time and environment)/trip.

Subscripts:

DM = do-minimum, OPT = option, U = F + OU and R = PTR + OR.

In the above benefit formula, the second term (change in operating costs) is omitted as they are directly treated as operating costs (which should be added as a negative cost in the evaluation).

Based on experience from other PT improvement projects, the PT reliability benefits were assessed as 50% of the PT user benefits.

2.2.1 Annualisation from Modelled Periods for PT Benefits

PT annualisation factors were estimated from the 2018 PT observed data. The resulting annualisation factors are summarised in **Table 5.**

Table 5 Annualisation Factors for PT

Period	Model Used	Equivalent Hours per day	Days per year	Factor
Weekday AM	AM	2	245	490
Weekday PM	PM	2.75	245	673.8
Weekday Interpeak/night	IP	7.139	245	1739.0
Weekend/holiday	IP	1.25	120	150

2.3 Cyclist User Benefit Calculation

The cyclist benefits were calculated using the Waka Kotahi NZ Transport Agency's Monetised Benefits and Costs Manual. Section 3.2 of the manual states that a composite conventional cycle benefit of $6.60/trip can be claimed for a new cyclist, but not exceeding $2,500 annual benefit per new conventional cyclist.

New cyclist numbers were extracted from the Tauranga Cycle Model (TCM). The new cycle trips from the TCM were converted to daily, then to annual numbers by an annual factor of 245. This gives annual benefits of $1,617 per new cyclist.

In the Tauranga Transport Model structure, the reduction of car and PT trips due to mode shift to cycle trips were captured in TTSM. Hence the traffic decongestion benefit was included in traffic travel time saving benefits.

2.4 Crash Cost Saving Calculation

Crash reduction benefits were estimated in the TTSM using average crash costs per VKT for different road categories. This captures changes in total VKT (e.g. from mode shift) and from shifting traffic between different road categories.

The crash rates used were calculated based on the total recorded crashes in the model area over the last 5 years and the VKT by road type and speed from the 2018 TTSM. The rates are outlined in **Table 6**.

Table 6 Crash Cost Results

Road Type	Speed Band (km/hr)	Crash Cost (Cents/Veh km)
Local Road	<=60	8.77
Arterial	<=60	5.95
	>60 & <80	7.32
Rural	<=60	2.30
	>60 & <80	36.04
	>=80	48.45

Major Rural	<=60	13.60
	>60 & <80	2.37
	>=80	10.24
Motorway	<=60	4.99
	>60 & <80	1.51
	>=80	2.58
All Categories		**7.92**

3 Economic Analysis

3.1 Evaluation Approach and Methodology

The overall economic evaluation is based on the following assumptions:

- A Variable Trip Matrix (VTM) modelling methodology applied for benefit calculation. Consumer surplus evaluation calculations, as defined in Appendix 11 of the EEM, to account for the different trip matrices assigned to the Do Minimum and Option scenarios;
- Assessment of base and congested (CRV) travel time benefits;
- Assessment of base running, fuel at idle and congestion-related vehicle operating costs (VOC);
- Base Date of 1 July 2019;
- Time Zero of 1 July 2025;
- Urban Arterial values of travel time saving (VTTS) for traffic benefit calculation;
- Discount rate 4% applied to all annual benefits and costs;
- Analysis period 60 years;
- CO2 benefits as 4% of VOC benefits;
- Maintenance cost as 1% of capital costs plus $2M per annum;

The benefit update factors used in the evaluation are shown in **Table 7**.

Table 7 - Update factors (2019) for benefits

Variable	Base Date	Update factor
Travel time cost savings	July 2002	1.54
Vehicle operation cost savings	July 2015	1.10
Crash cost savings	July 2015	1.09
Cycling benefits	July 2018	1.00

3.2 Capital Costs

The cost estimate for the options are shown in **Table 8**.

Table 8 Capital Costs, $million

Cost	10 Year Programme	30 Year Programme
Capital	514	815

Capital costs were applied at the following years (construction years):

- 10-year programme cost was uniformly distributed between 2025 and 2027

- 30-year programme cost was uniformly distributed between 2028 and 2048

Maintenance and operation costs were applied yearly from 2028.

3.3 Economic Evaluation Results

The evaluation results are summarised in **Table 9**.

Table 9 Detailed BCR Analysis

Items	TSP
Benefits (NPV):	
Travel Time Benefits	1165.4
Congestion Benefits	364.7
Trip Reliability	93.6
Vehicle Operating Costs Benefits	-89.6
Carbon Dioxide	-3.6
Public Transport	640.6
Crash Saving Benefit	24.5
Cycle Benefit	526.3
PV Total Net Benefits	**2722.0**
Agglomeration Benefit (assumed 25%)	680.5
PV Total Net Benefits with Agglomeration	**3402.5**
Costs (NPV):	
30 Year Programme	492.3
10 Year Programme	475.5
Annual and Periodic Maintenance	60.4
Net PT Operating Cost	235.5
PV Total Net Cost	1263.7
BCR	**2.7**

File Note

Nyan Aung Lin

Document Acceptance

Action	Name	Signed	Date
Prepared by	Craig Richards		9 October 2020
Reviewed by	Andrew Murray		9 October 2020
Approved by	Tania Hyde		9 October 2020
on behalf of	Beca Limited		

tsp transport system plan