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Ngauranga to Airport

Let's Get Wellington Moving

Travel Demand Management Study

Stage One: Discovery

| Final

10 March 2017

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Ngauranga to Airport

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Contents

Executive Summary

Jacobs was engaged by the 'Let's Get Wellington Moving' group, a joint initiative between the New Zealand Transport Agency, Wellington City Council and the Greater Wellington Regional Council, to undertake the discovery phase for potential Travel Demand Management (TDM) measures that could be implemented in the Wellington region.

The discovery phase has been developed in two parts. These are:

- Part one: the literature review stage, where a long list of TDM measures used locally and around the world are identified and tabulated; and

- Part two: a workshop with the relevant parties in the 'Let's Get Wellington Moving' group to determine, using criteria analysis, which TDM measures are best suited to the N2A project.

The discovery phase will inform the next phase of the N2A project, which is a more in depth scenario development to identify workable solutions for the N2A project.

Travel demand management describes a wide range of initiatives that alter travel behaviour to optimise transport system efficiency. Travel behaviour which is altered includes how, when and where people travel. Determining who is travelling and why they are travelling will lead to discovering the best TDM measures to use in a situation.

TDM measures can be split into two broad categories, hard and soft. Hard TDM measures are those which include physical improvements of infrastructure. Soft measures are everything else, from policy changes to car sharing initiatives. In the literature review the hard and soft measures were grouped into six more distinctive categories:

- Influencing travel behaviour (soft)

- Network management (hard)

- Technology and innovation (soft)

- Land use policies (soft)

- Economic pricing measures (hard)

- Parking policies (soft)

Accompanying the long list of TDM measures are international examples of where the initiatives have worked, as well as a list of TDM studies and measures implemented in Wellington to date.

The long list of hard and soft TDM measures has been evaluated against criteria agreed with the 'Let's Get Wellington Moving' group based on how the measures have worked overseas. This long list will inform the workshop.

A workshop was held on 22nd of November 2016 between Jacobs and members of the 'Let's Get Wellington Moving' group to confirm the criteria analysis and how it relates to each TDM measure. From this workshop the criteria analysis was agreed upon and finalised.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to *evaluate a range of potential TDM measures that could be implemented in the Wellington region,* in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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1. Introduction

Jacobs has been engaged by the 'Let's Get Wellington Moving' group, a joint initiative between the New Zealand Transport Agency (NZTA), Wellington City Council (WCC) and the Greater Wellington Regional Council (GWRC), to undertake the discovery phase for potential Travel Demand Management (TDM) measures that could be implemented in the Wellington region.

The discovery stage is being developed in two parts. These are:

• Part one: the literature review stage, where a long list of TDM measures used locally and around the world are identified and tabulated; and

• Part two: a workshop with the relevant parties in the 'Let's Get Wellington Moving' group to determine which TDM measures are best suited to the N2A project.

The discovery stage will inform the next stage of the N2A project, which is a more in depth scenario development to identify workable solutions for the N2A project.

This report consists of a long list of TDM interventions identified in a local and national context, local and international case studies and the outcomes of the workshop held with 'Let's Get Wellington Moving' representatives.

The rest of the report will take the following structure:

• Section 2: Details what TDM is and why it is needed.

• Section 3: Outlines previous studies and initiatives implemented in Wellington.

• Section 4: Outlines the research taken to develop the long list of TDM measures.

• Section 5: Details the evaluation framework developed to create a short list from the long list.

• Section 6: Outlines the outcomes of the workshop and the next steps needed to get to stage 2.

1.1   Let's Get Wellington Moving[1]

'Let's Get Wellington Moving' is an initiative being implemented to engage the community in designing Wellington's transport network and city based on the wants and needs of the community.

The indicative focus area of 'Let's Get Wellington Moving' is from Ngauranga Gorge to the Wellington Airport. This includes the Wellington Urban Motorway and connections to the Wellington Hospital and the eastern and southern suburbs. This is shown in **Figure 1**.

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[1] http://getwellymoving.co.nz/about/

Figure 1 : Indicative Focus Area[2]

[2] Let's Get Wellington Moving Progress Report, Feb 2017

The guiding principles for 'Let's Get Wellington Moving' will provide the reference basis for assessing potential solutions. These guiding principles are:

1)	Accessible, healthy and safe	7)	Past, present, future
2)	Better public transport	8)	Predictable travel times
3)	Clean and green	9)	Set in nature
4)	Compact city	10)	Growth
5)	Demand and supply	11)	Travel choice
6)	Future-proof and resilient	12)	Wider view

The guiding documents identified by 'Let's Get Wellington Moving' are:

- Wellington towards 2040: Smart Capital
- Wellington Urban Growth Plan
- Wellington City's 10-year Plan
- Wellington Regional Land Transport Plan

1.2   Policy framework for TDM interventions in Wellington

The N2A network consists of both local and national road assets; local roads are administered and developed by WCC and GWRC whilst NZTA is responsible for the administration and development of the State Highway network.

1.2.1   Policy Framework for Local Roads

The Wellington Regional Land Transport Plan (2015) (RLTP) provides overall guidance on the development and management of the local transport network in the Wellington Region. The preparation of a RLTP is a legal requirement under the Land Transport Management Act (2003).

The RLTP sets the following vision for the development and management of land transport in the Wellington region:

'to deliver a safe, effective and efficient land transport network that supports the region's economic prosperity in a way that is environmentally and socially sustainable.'[3]

In order to achieve this vision four key transport corridors have been identified along with strategic principles for the management of each corridor:

- Ngauranga to Airport Corridor

- Western Corridor

- Hutt Corridor

- Wairarapa Corridor

The strategic principles for the Ngauranga to Airport corridor strategy are[3]:

- a high quality and high frequency passenger transport 'spine'

- a reliable and accessible 'ring' or bypass route for vehicles

- inter-connected, safe, and convenient local street, walking, cycling and passenger transport networks

- highly accessible and attractive 'activity' or shopping streets

The introduction of TDM measures has been identified as one of the strategic responses to address the current issues faced along this corridor in the RLTP.[3]

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[3] Greater Wellington Regional Council. (2015). *Wellington Regional Land Transport Plan 2015.*

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Part One: Literature Review

2. What is Travel Demand Management

Travel demand management describes a wide range of initiatives that alter travel behaviour to optimise transport system efficiency. Travel behaviour which is altered includes how, when and where people travel. Determining who is travelling and why they are travelling will lead to discovering the best TDM measures to use in a situation.

GWRC defines travel demand management as:

'a collection of measures used to optimise use of the existing network, reduce peak transport network demand and the reliance on private motor vehicles. This includes greater use of more efficient modes such as public transport, walking or cycling as well as more efficiently managing the use of existing road space.'[4]

TDM can either be used in combination with infrastructure improvements (for example a programme encouraging people to cycle to work launched in conjunction with the development of an urban cycling network) or as an alternative to infrastructure improvements to address congestion hotspots, pinch points or to reduce travel times.

TDM measures can be split into two broad categories, hard and soft. Hard TDM measures are those which include physical improvements of infrastructure. Soft measures are everything else, from policy changes to car sharing initiatives.

TDM can also be defined as push or pull. Push factors provide the users with an incentive to change their travel behaviour through making their current modal choice appear less attractive, for example road pricing through the introduction of congestion charging. In contrast to push factors, pull factors are designed to

increase the attractiveness of other transport modes and include measures that encourage change in travel mode, for example employer discounted public transport passes.

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[4] Greater Wellington Regional Council. (2015). *Travel Demand Management in the Wellington Region.*

3. Previous Studies and Initiatives in Wellington

It is understood that numerous TDM studies have been carried out in Wellington over the recent past, with various interventions being implemented. The details that have been provided are included in the tables below. GWRC produced a report entitled *'Travel Demand Management in the Wellington Region'* in September 2015, which Jacobs has used to inform the below tables. Jacobs has consulted with GWRC to make the list as complete as possible.

The majority of these interventions are focused on either network optimisation or influencing travel behaviour patterns. A key theme that has emerged from this review is that the interventions investigated mainly consisted of 'pull' factors to attract drivers to other transport modes.

3.1   Previous Studies

The table below lists the studies undertaken in Wellington, the outcomes of the studies and the type of TDM that the study covers.

Study	Outcomes
Public Transport Behaviour Change Research Project, Opus, 2016	An investigation into opportunities to change behaviour and use social marketing to increase Wellington's public transport patronage. The report provides details of existing programmes used around the world and relates them to a Wellington context to provide recommendations for Wellington's public transport.
Active Communities Travel Planning, Modalis NZ, June 2016	Investigation of the effectiveness of Active Travel Plans and School Travel plans. There is no 'one size fits all' and the best approach for travel planning needs to be investigated on a case by case basis. The report finds that Travel Plans need to be combined with other interventions, target culture and behaviour changes that are already 'ready to change', be tailored to the community, engage with the community, be simple and be branded effectively.
Travel Demand Management in the Wellington Region, GWRC, September 2015	Study undertaken by Greater Wellington Regional Council to assess the current TDM measures in the region and identify opportunities for the future. It concludes that a package of measures are required to achieve the best results.
2013 WTSM Update – Technical Note 5: Model Input Parameters, TDG, May 2015	A technical note that sets out the process followed to provide the 2013 update to the input parameters for two Wellington transport models – Wellington Transport Strategy Model (WTSM) and Wellington Public Transport Model (WPTM). The parameters include trip distribution, mode choice and route calculation components and are used for forecasting costs of travel for all modes of transport in Wellington.
Wellington Regional Land Transport Plan: Working Paper 4 – Development of Future	This working paper takes the results of the previous working papers' Wellington Transport Strategy Model's (WTSM) scenario modelling to compare various future scenarios and the travel patterns related to them. The expected future scenario is inspected further to inform the Regional Land Transport Plan targets.

Study	Outcomes
Scenarios, GWRC, January 2015	
Wellington Transport Models - TN15 :Input Parameters, Opus, December 2012	A technical note that sets out the process followed to provide the 2011 update to the input parameters for the Wellington Transport Model (WTSM) and also defines the development of the Wellington Public Transport Model (WPTM). The parameters developed include values of time, vehicle operating costs, parking costs, public transport fares and travel demand management parameters.
Wellington Region Road Pricing Study, SKM, March 2007	Study undertaken in to how road pricing strategies could be implemented in the Wellington region. This review included investigating how road pricing could be introduced based on either a CBD congestion cordon or shorter and longer distance charging screen lines.

3.2 Implemented TDM in Wellington

The table below lists the known TDM measures that have been implemented in Wellington, a brief description – including quantification where available, and the type of TDM.

TDM Measure	Description	Type of TDM
Improved cycling and walking infrastructure – Wellington to Hutt Valley urban cycleway	Over 13km, this cycleway is likely to provide and attractive option for commuters.	This is a hard measure that pulls people towards active modes of transport.
Bus lanes in various locations throughout Wellington.	Bus lanes give buses a priority over the general traffic, particularly when there is congestion on the roads. In Wellington, some bus lanes are for buses only and some allow bikes and taxis to use them.	This is a hard measure that pulls people towards using public transport.
Traffic calming – eg. Northland	Traffic calming includes traffic cushions, raised tables, speed bumps and many more. These have been around for many years. The purpose of traffic calming is to slow the traffic down on a quiet street to improve the safety for other users.	This is a hard measure that pushes people away from driving on the streets where these are implemented.
Active A2B	Behaviour change programme focused on promoting active travel modes to and from work. CBD cordon survey identified that the active mode count increased by 42% between 2010 and 2015 with the main reason being that people are living closer to their work locations.	This is a soft measure that pulls people towards active modes of transport.
Region wide school travel plans	Provides assistance to schools to create active travel plans to encourage students to walk or cycle to and from school. There has been a 25% increase in active travel trips to school (increase from 32% to 40%), in the schools that have implemented travel plans.	This is a soft measure that pulls students towards active modes of transport.
Move 'n' March active travel week	A week of events incentivising school children to use active modes of transport to get to and from school.	This is a soft measure that pulls students

TDM Measure	Description	Type of TDM
		towards active modes of transport.
School curriculum development to include active transport studies	Project with EnviroSchools to develop components of the primary school curriculum to focus on active and sustainable modes of transport. Currently 17,000 students in the Wellington region are enrolled in schools participating in EnviroSchools.	This is a soft measure that pulls students towards active modes of transport.
Bikes in Schools	A $600,000 fund set up by the Wellington City Council to foster the development of the Bikes in Schools programme, which provides schools with a riding track and fleet of between 30-50 bicycles and helmets. To date, 2,000 students have benefited from this programme.	This is a soft measure that pulls students towards active modes of transport.
Community events which encourage walking and cycling such as Go By Bike Day, Walk to Work Day, Cyclovia and Big Bike Fix Ups	Between the 2006 and 2013 census' there has been a 49% increase in cycle commuting in Wellington.	This is a soft measure that pulls people towards active modes of transport.
Pedal Ready – cycle skills training programme	A cycle skills training programme that teaches students and adults skills to improve their ability and confidence when cycling. 4063 children and 560 adults received training through this programme last year.	This is a soft measure that pulls people towards active modes of transport.
Bus and cycle workshops	Quarterly training sessions are held with bus companies and cyclists to encourage all road users to be aware of who they share the road with. It allows bicycle user to learn about blind spots associated with large vehicles and bus drivers gain a better understanding surrounding the needs of bicycle users.	This is a soft measure that pulls people towards active modes of transport.
Way finding and navigation tools	There are various signs around Wellington that inform the community of how to get to where they are going and where the nearest bike path or shared path is.	This is a soft measure that pulls people towards active modes of transport.
Ride sharing – Let's carpool	New Zealand app and website facilitating ride sharing by matching users with others taking a similar journey. 40 new people registered during kiwi carpool week, the average number is 11 new registrations per week. Currently 3,400 people have registered on the lets carpool website from Wellington and over 800 people from the Hutt Valley.	This is a soft measure that pulls people towards sharing their rides.
Car sharing – Cityhop, YourDrive, Roam	Car sharing companies in Wellington where users can allow their car to be used by others and/or use cars provided by the company. Wellington City Council recently developed a car sharing policy, allowing car sharing companies to apply for car share specific parking bays.	This is a soft measure that pulls people towards sharing vehicles.
New Movers transport programme	Targeted travel awareness for people who are new to an area to inform them of travel options accessible to	This is a soft measure that pulls people

TDM Measure	Description	Type of TDM
	them. GWRC purchases NZ Post data to inform new movers.	towards the best mode of travel for them.
Wellington Transport Operation Centre (WTOC)	Responsibilities of WTOC include: • Monitoring the strategic road network including the displaying of real time information on highway message boards; • Traffic signal optimisation based upon traffic flows; • Managing the Smart Motorway programme; • Managing the queue protection for The Terrace Tunnel; and • Ensuring the safe and efficient operation of the network.	This is a hard measure that optimises the network to improve capacity.
Real time public transport information website and app – Transport for Wellington, Metlink	Users get real time updates of where their bus or train is on the network. This is particularly useful when there are delays on the network.	This is a soft measure that pulls people towards making use of public transport.
Ramp metering	Controls flows on to SH2 to improve flows and driver behaviour when entering the motorway. This is due to be installed in November and be operational soon after.	This is a hard measure that optimises the network to improve capacity.
Wellington Cycleways Programme Master Plan	Provides Wellington City Council with a strategic framework for the development of cycling infrastructure in the community.	This is a soft measure that pulls people towards using active transport.
Wellington City Council Parking Policy	Provides direction for how the Wellington City Council should manage the limited number of on-street car parks in order to achieve the best outcomes.	This is a soft measure that pushes people away from driving when there are not enough parking spaces available.
Wellington City Council Car Sharing Policy	Allows operators of existing and new car share schemes to apply for on-street car parks exclusively for car share vehicles when they are not in use. This is a recently released policy and so far uptake has been positive. There is potential for more car share parking spaces to be rolled out in the near future.	This is a soft measure that pushes people towards sharing their vehicles.
Travel planning – eg. Victoria University	The Victoria University travel plan summarises the range of travel initiatives that the University employs and outlines suggested actions. It promotes the use of sustainable transport to align with other objectives the University is trying to meet, such as becoming carbon neutral.	This is a soft measure that pushes people towards considering alternative travel behaviours.

4. Long List of TDM Strategies

This section outlines current and previous known TDM strategies undertaken in the Wellington region as well as strategies (that have been used internationally) found through research.

The table provided in **Appendix A** provides a summary of the types of interventions researched along with identifying the benefits and challenges with establishing a similar intervention on the N2A network. This review contains a mixture of soft (non-pricing) and hard (road pricing) interventions from North American, European, Asian and Australian contexts.

Appendix B provides an in-depth analysis of all the case studies researched identifying variations in how similar interventions are implemented in different contexts (for example how congestion charging differs between London and Singapore).

4.1   Key Categories of TDM Strategies

As identified in **Section 2**, TDM measures can be hard or soft and have push or pull factors to them that influence travel behaviour patterns and increase network efficiency. According to the GWRC *Travel Demand Management in the Wellington Region*, TDM strategies fit into one of six categories[5], these categories are described below and form the basis of how the TDM strategies researched were categorised in the long list.

- **Influencing Travel Behaviour:** interventions used to promote a change in travel behaviour

- **Network Management:** traffic management and intelligent transport systems used to manage the operation of the network efficiently

- **Technology and Innovation:** As technology evolves, lifestyle trends will change, influencing travel efficiency and the need for travel

- **Land Use Policies:** policy development to encourage better land use and transport practices

- **Economic Pricing Measures:** congestion charging and road pricing used to influence travel choice

- **Parking Policies:** management and pricing of on and off street car parking

These categories align to the Victorian Transport Policy Institute's Online TDM Encyclopaedia, which groups TDM measures into four broad categories based on how they affect travel[6]:

- Improved transport options

- Incentives to use alternative modes and reduce driving

- Parking and land use management

- Policy and institutional reforms

TDM measures are often implemented as a package of measures that work together to achieve the desired outcome. For example, physical interventions work well when combined with behaviour change measures.

4.2   TDM Internationally

The Victoria Transport Policy Institute's Online TDM Encyclopaedia is a comprehensive source of information about travel demand management. It is updated on a regular basis, the last update being May 2014.[7]

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[5] Greater Wellington Regional Council. (2015). *Travel Demand Management in the Wellington Region*.

[6] TDM Encyclopaedia, Victoria Transport Policy Institute: http://www.vtpi.org/tdm/
[7] TDM Encyclopaedia, Victoria Transport Policy Institute: http://www.vtpi.org/tdm/

Transport Canada rereleased *'Transportation Demand Management for Canadian Communities: A Guide to Understanding, Planning and Delivering TDM Programs'* in March 2011.[8] This guide provides lessons learnt from previous implementation experiences and gives advice for how to implement TDM measures successfully in similar communities.

Smart Growth America developed a guide to world leading practices in the use of TDM in 2013 called *'Transportation Demand Management: State of the Practice'*.[9]

TDM is often not done in isolation and in many cases a range of complimentary measures can be implemented at the same time. This can make quantifying the success of a specific measure difficult because the benefits are aggregated.

The table below shows the results of some previous studies carried out overseas show the potential for mode shift due to implementation of travel plans.

Location	Target	Measure	Mode Change
Adelaide, Australia	900 households	Travel plan type intervention	• 10% reduction in car trips[10]
Perth, Australia	15,000 households	Travel plan type intervention	• 14% reduction in car trips[11] • 9% increase in car sharing • 17% increase in PT • 35% increase in walking • 61% increase in cycling

Location	Target	Measure	Mode Change
Perth, Australia	383 households (only 36% interested in participating)	Travel plan type intervention	• 10% reduction in car trips[12] • 21% increase in PT trips • Walking trips 16% increase • Cycling trips 91% increase
Brisbane, Australia	1,000 households (50% participation)	Travel plan type intervention	• 10% reduction in car trips[13] • PT increase by 31% • Cycling increase by 6%
Japan	Small scale	Travel plan type intervention	• 18% reduction in car trips[14] • 50% increase in PT usage
UK		Travel plan type intervention	• 4-5% reduction in car use for national[15] level programmes • 10-15% reduction in car use for localised interventions
UK		Work place travel plans (£2-4 per employee per year)	• 10-30% reduction in car trips[16]
UK		School travel plans (implemented in a local context)	• 8-5% of school based traffic[15]
UK		Personalised travel plans	• 7-15% reduction in car trips in urban areas[15] • 2-6% reduction in car trips in rural areas

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[8] Noxon Associates, (2011), Transportation Demand Management for Canadian Communities: A Guide to Understanding, Planning and Delivering TDM Programs, Transport Canada
[9] Nelso/Nygaard Consulting Associates Inc. (2013), Transportation Demand Management: State of the Practice, Smart Growth America
[10] Ampt *and* Rooney. (1999).
[11] Brog *et al.,* (2002).

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[12] Brog *et al.,* (2002).
[13] Marinelli *and* Roth. (2002).
[14] Fujii *and* Taniguchi. (2006).
[15] Cairns *et al.,* (2008).
[16] Richter *et al.,* (2009).

Location	Target	Measure	Mode Change
UK		Public transport information and marketing	• 1-6% increase in PT usage (when combined with other interventions)[15]
Gothenburg, Sweden		Travel planning	• 14% reduction in solo car trips[15] • 7% reduction in car trips as a passenger • Cycling trips increased by 45%
The Netherlands		Work place travel plans	• 17.8% reduction in car trips[15]

Part Two: Short List and Evaluation

5. Evaluation Framework

5.1 Evaluation Framework

'Let's Get Wellington Moving' have developed an evaluation framework (shown in **Table** 5.1) to assess the scenarios they have developed. The evaluation framework has been shared with Jacobs to assess the long list of TDM measures against for consistency.

Each TDM measure has been given a rating of **-3, -2, -1, 0, 1, 2 or 3** depending on the likelihood of impact of the measure. It has been assumed that each measure is operating in isolation and has been developed to its fullest potential. Most of the measures won't have a lot of impact on the criteria when they are implemented in isolation, meaning that there will be a lot of low scores.

Table 5.1 : Let's Get Wellington Moving Evaluation Framework

A transport system that enhances the liveability of the central city
Improved walkability in the CBD with better access to the waterfront
Enhanced urban environment
Reduced impact of motorised transport in CBD
Minimised adverse effects on natural environment
Minimised impacts on built environment
No increase to number of vehicles in the CBD
A transport system that provides more efficient and reliable access to support growth
Increased reliability and improved access to and from CBD
Consistency with the Urban Growth Plan and Wellington Regional Strategy
Improved throughput of people and goods on strategic corridors
Increased reliability of access to and from the airport, hospital and port

Reduced PT travel time variability
A transport system that reduces reliance on private vehicle travel
Increased PT catchment
Improved pedestrian mode share
Improved cycling mode share
Improved PT mode share
A transport system that improves safety for all users
Reduced deaths and serious injuries for road users
Improved safety for pedestrians and cyclists
A transport system that is adaptable to disruptions and future uncertainty
Adaptability to be able to respond and recover from unplanned events
Adaptability and flexibility to cope with future uncertainty and technologies
Implementability
Consentability
Feasibility
Cost
Capital cost
Operational cost

6. Short List Workshop

On the 22nd of November 2016, Jacobs held a workshop with the 'Let's Get Wellington Moving' group to establish which TDM measures in the long list would be applicable to the N2A network. The outcomes of this workshop are listed below.

The following people attended this workshop: Andrew Bell (Jacobs), Claire Ashburn (Jacobs), Bruce Walton (Jacobs), Melanie Thornton (GWRC), Adam Nicholls (LGWM) and Amy Kearse (NZTA).

6.1   Workshop Outcomes and Next Steps

In the workshop it was agreed that the long list is a complete list of measures and each TDM measure could be applied in their own way. For this reason the long list has not been cut down to a short list. The criteria analysis can be found in **Appendix C.** The short list will be determined in the next stage when the degree of TDM to be implemented in the 'Let's Get Wellington Moving' scenarios is agreed and the TDM measures that match each scenario will be chosen from the long list. Refer to the work carried out by the 'Let's Get Wellington Moving' group to be used at next workshop to help determine which measures will be taken forward.

Appendix A. Long list of TDM interventions

Category	TDM Measure	What does it do?	Type	Benefits	Challenges	Implementation Time Frame
Economic Pricing Measures	Congestion Charging	Congestion charge for entering the central city	Push Factor	Congestion reduction in CBD	Implementation in the New Zealand context (LTMA 2003)	Medium term
Economic Pricing Measures	Distance-based charging	Road pricing is based upon the distance driven	Push Factor	Users are only charged for how far they drive	Feasibility and setup, LTMA 2003, the majority of car trips are under 6km, would this work	Medium term
Economic Pricing Measures	High occupancy toll (HOT) Travel Lanes	Allowing people to pay for using HOV travel lanes when only one person is in the car	Pull Factor	More efficient use of highway capacity	Space for HOV lanes, cost, effectiveness	Medium term
Economic Pricing Measures	Link Tolling	Tooling on specific road segments etc.	Push Factor	Reduction in peak travel times for link of road which has been tolled	Implementation in the New Zealand context (LTMA 2003)	Long term
Influencing Travel Behaviour	Bikes on buses	Allows users to make use of public transport even when they are cycling for a section of their trip	Pull Factor	Encourages people to get out on their bikes knowing that if they want to take the bus with their bike they can	Currently in trial mode in Wellington	Currently in trial mode in Wellington
Influencing Travel Behaviour	Bike sharing (e.g. Provision of bicycle hire schemes)	Allows users to have access to publicly located bicycles, encourages the use of the bicycle as a mainstream transport mode, targets opportune and short trips	Pull Factor	Can be provisioned by the government or by the community sharing their own bikes through a web based platform	Feasibility and set up costs	Medium Term
Influencing Travel Behaviour	End of Trip Facilities for Walking and Cycling	Increases the attractiveness of walking and cycling by providing facilities for the end of the trip, such as showers, lockers, bicycle parking etc.	Pull Factor	Provides facilities for pedestrians and cyclists to safely store belongings	Tied into building redevelopments	Medium Term
Influencing Travel Behaviour	Improved services (e.g. Wi-Fi on buses, less advertising on the sides of buses)	Makes public transport more attractive by increasing the services offered on buses and trains (e.g. Wi-Fi)	Pull Factor	Gives users an incentive to use public transport	Feasibility and cost	Short Term
Influencing Travel Behaviour	Linking cycling and public transport (e.g. Bike-Train)	Targets the egress trips to train stations to be undertaken by bicycle, decreasing the overall journey time and increasing the accessibility of public transport	Pull Factor	Increasing the competitive advantage of public transport through encouraging cycling to and from stations	Public transport efficiency	Short Term
Influencing Travel Behaviour	Multimodal access guide	Making it easier to get around a city by any mode by identifying the different options along with travel time and cost per trip	Pull Factor	Users are able to put a time to their travel and use the mode most suited to them.	Sometimes these are difficult to locate and many users will not know they exist.	Short Term
Influencing Travel Behaviour	Public Education	Reducing travel demand by informing the public about the different transport modes available	Pull Factor	Improves public perception of active modes of transport	Design of effective campaigns and how to carry on the momentum afterwards.	Short Term
Influencing Travel Behaviour	Public Transport Incentives – both government and organisation level	Encourages public transport usage by subsidising the cost of monthly passes, e.g. Subsidised public transport fares as part of employment package	Push Factor	Encouraging public transport use as already paid for	Requires a culture shift regarding how public transport is paid for	Long term
Influencing Travel Behaviour	Ridesharing	Increases car occupancy by encouraging people to travel together. Ride sharing and taxi services use private vehicles, eg. Uber and Lyft	Pull Factor	Each private car user who shares a ride takes one private car off the road. Uber and Lyft operate as a carpooling service except that you are guaranteed a ride and have to pay a nominal fee, essentially they are taxi services	Perceived safety surrounding UBER rides Currently unregulated in New Zealand	Existing, but currently unregulated in NZ
Influencing	Simplified public transport	Making it easier and cheaper to use public transport	Pull Factor	Easier to work out the cost of a public transport	Lost revenue from cheaper public transport	Medium Term

Travel Behaviour	fare pricing	by having a consistent pricing structure, based on number of zones you pass through rather than the number of services you take.		trip. Decreases the cost of public transport trips whilst also increasing the convenience and attractiveness of public transport.	fares	
Influencing Travel Behaviour	Tourist transport management	Reducing travel demand by encouraging tourist to use different transport modes/ travel times	Pull Factor	Tourists to the area will be able to find their way around	Investigating how much demand tourist put on the transport system during peak periods	Short Term
Influencing Travel Behaviour	Transit Free Zone	Public transport users travel free within a certain zone, usually within the CBD area	Pull Factor	Less private vehicles within the transit free zone	Can be difficult to track if users get off the bus/train/tram within the free transit zone or not. Also makes tracking of users difficult.	Short Term
Influencing Travel Behaviour	Universal access card	Making it easier and cheaper to use public transport by having a consistent pricing structure with consistent electronic payment services	Pull Factor	Users only need one smart card for all travel	Implementation and coordination between multiple operators	Medium Term
Influencing Travel Behaviour	Wayfinding	Making it easier to find your way around by walking and cycling	Pull Factor	Enables users to find where they are going easily and to see alternative routes	The provision of consistent, clear messaging, updating information when the walking and cycling networks change	Short Term
Influencing Travel Behaviour	Work place incentives	Alternative work schedules/variable work times, encourage working from home and using telecommunications will lead to congestion reduction during peak travel times by encouraging flexible working arrangements	Pull Factor	Encourages active and diverse work places	Requires business to change their work habits and systems	Short Term
Land Use Policies	Car free planning (e.g. Car free days)	Closes areas of to motorised traffic for a specific time period so people can experience what their city would be like car free	Pull Factor	Allows users to experience the area without cars	Traffic management plans. Identifying suitable areas to have car free days to have the desired impact	Short Term
Land Use Policies	Development Travel Plans	Travel planning tool for new commercial and residential developments so that provision for other transport modes is taken into consideration	Pull Factor	Encouraging use of other transport modes and/or travel times specific to new developments	Overall coordination, leadership	Short Term
Land Use Policies	Logistics Plans - Encouraging consolidation of freight distribution	Increases the efficiency of logistics in urban areas and reduces the number of trucks/vans on urban streets	Push Factor	Reduction in number of delivery vehicles in CBD	Requires a cultural shift- collaboration between business/ freight operators	Short Term
Land Use Policies	Personalised Travel Plans	Identifies alterative transport modes that meet the needs of individuals	Pull Factor	Encouraging and educating households of other transport modes specific to their area	Ensuring that there is adequate infrastructure/incentives in place to ensure people stick to their plans	Short Term
Land Use Policies	Spatial plans - Integrating transport and land use planning	Integrates land use and transport planning	Push Factor	Improvement of transport networks and increasing the economic efficiency of cities	New way of thinking, challenges the spatial structure of our urban areas.	Short Term
Network Management	Accident response units	Allows for accidents to be cleared or moved off the network faster	Network Optimisation	Less disruption by incidents that occur in peak time	Ensuring the accident response units are aware of incidents and can access them in a timely manner	Already exists to some degree in Wellington
Network Management	High occupancy vehicle (HOV) priority (e.g. T2 lanes, bus lanes, queue jump lanes)	Increasing network efficiency and the attractiveness of carpooling and public transport by providing fast lanes for vehicles with more than one people	Pull Factor	Congestion reduction	Space for HOV lanes, cost	Medium Term
Network Management	Public Transport Priority	Increasing the attractiveness of public transport through giving it priority over private vehicles	Pull Factor	Reduces travel time for public transport users	Priority at intersections	Medium Term
Network Management	Ramp Metering	Reduces congestion on state highways through optimising the flow of traffic entering the motorway based upon current conditions	Network Optimisation	More efficient use of state highways	Coordinating ramp signals based upon traffic flows/demand	Short Term
Network Management	Tidal Flow Lanes (e.g. Moveable tidal flow	Better use of existing road space by providing an additional lane in peak demand periods	Network Optimisation	Better utilisation of road space	Perceived danger issue. Location and operation	Medium Term

	barriers to switch travel lanes based upon demand)					
Network Management	Traffic calming	Increasing the attractiveness and safety of walking and cycling through reducing the amount and speed of through traffic	Pull Factor	Slows traffic in suburban areas and deters people from taking routes that they see as taking longer. Also improves safety for walking and cycling by providing lower speed environments.	If traffic calming is to be carried out, other viable routes need to be provided for through traffic	Short Term
Network Management	Walking and cycling infrastructure improvements	Increasing the attractiveness of walking and cycling	Pull Factor	Congestion reduction/ switch to other modes	More effective at targeting shorter trips, may require the reallocation of road space	Short Term
Parking Policies	Park and Ride (e.g. Provision of subsidised parking at train stations)	Congestion reduction by encouraging people to drive to bus/ train stations and catch public transport into town	Push Factor	Congestion reduction, encourages public transport use	Space constraints, effective locations	Short Term
Parking Policies	Parking Management	Reduces the availability of on street parking making driving become less attractive	Push Factor	Congestion reduction	Requires a culture shift regarding the right/availability of on street parking	Short Term
Parking Policies	Smart Parking (e.g. variable parking prices based on demand)	Discourages driving through increasing the price of parking based on demand. Smart parking can also act as a guidance system to guide drivers to available parks.	Push Factor	Reduction in peak travel due to higher parking prices	Requires a culture shift regarding the right/availability of on street parking	Short Term
Parking Policies	Unbundled Parking (where the cost of renting/owning a car park is separate from building expenses)	Encourages a decrease in the supply of parking through allowing residents to only pay for a car park if they require it	Push Factor	Allows users to only pay for parking when they require it.	Requires a culture shift regarding how parking is provided/paid for.	Medium Term
Technology and Innovation	Improved travel time information	Provides customers with up to date, real time travel time information	Pull Factor	Creates a more reliable network for users	Ensuring technology is up to date and that the travel time information is reliable	Short Term
Technology and Innovation	Mobility as a service	Uses technology to offer a customer any type of travel experience using any mode of transport to meet the transport requirements of the customer	Pull Factor	Aims to change the thinking of the user and show all of their alternative options	Technology, understanding and thinking for mobility as a service is still being developed.	Medium Term

Appendix B. List of Case Studies

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Economic Pricing Measures	*London:* congestion charge[17] Introduction of a congestion charge for vehicles entering central London		Bus, the London underground and bicycle ridership also increased significantly. Revenue from this went in to transport projects Road space was able to be reallocated to bicycle and pedestrian spaces.	Encourages the use of alternative transport modes whilst also increasing capacity of other transport modes through re allocating road space. Upon extending the congestion zone westward, it is estimated that around 30% of those that previously drove in the extended zone do not do so any more.[18]	The state highway would have to be excluded from any congestion charge as per the LTMA 2003.
Economic Pricing Measures	*Singapore*: electronic road pricing[19] Introduction of a congestion charge in Singapore based on air pollution.		Vehicles are charged based on when and where they cause congestion within cordons around the most congested areas in the city. Each access point provides information about alternate routes with no charge. Automatic tolling, the daily rate changes depending on the amount of congestion	Since its implementation in 1975 there has been a 45% traffic reduction and a 20% increase in PT usage.[20]	
Economic Pricing Measures	*Stockholm:* congestion charge[21] Introduction of a zone based congestion charging system.		Congestion charges were introduced in 2006 and were initially strongly objected. Overtime opposition to congestion charging decreased as people began to see the benefits that it produced. Around 2/3 of the city lives within the cordon zone. Cars are photographed and the owners sent a monthly invoice.	Approximately 22% reduction in traffic in the cordon zone in the peak times.	

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[17] Institute for Transportation and Development. (2013). *Practical Guidebook: Parking and Travel Demand Management Policies in Latin America.*
[18] Transport For London. (2008). *Central London Congestion Charging: Impacts monitoring.*
[19] Institute for Transportation and Development. (2013). *Practical Guidebook: Parking and Travel Demand Management Policies in Latin America.*
[20] Danish Architecture Centre. (2014). *Singapore: The World's First Digital Congestion Charging System.*
[21] Transport Styrelsen. (2016). *Transport taxes in Stockholm and Gothenburg*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Economic Pricing Measures	*Sydney Harbour Tunnel:* link tooling[22] Operation of a time-based tolling system for southbound (city) traffic only with price varying by time of day		Encourages off peak travel into the CBD and use of PT.	Although the variation between peak/off peak tolling is low $4/$3, the toll itself is high for a daily user therefore incentivising a PT mode shift rather than off peak travel. *No quantifiable evidence available.*	The Land Transport Management Act (2003) states that link tolling can only be applied in NZ if there are alternative routes of similar quality available.
Economic Pricing Measures	*Riverside County, California*: HOT travel lanes[23] Installation and running of high occupancy toll lanes on state highways.		High occupancy toll (HOT) lanes are high occupancy travel lanes which other vehicles can use by paying a toll. Prices are reviewed every 12 weeks, once a certain amount of capacity is met on the road, the price will increase accordingly.	Some users, including vehicles with 3 or more people, zero emission vehicles and motorcycles, travel free during certain times. *No quantifiable evidence available.*	Physical constraints on the corridor mean that there are limited opportunities for HOT lanes.
Influencing Travel Behaviour	*The Netherlands:* End of trip facilities for walking and cycling *Safe, secure and convenient bike parking in the Netherlands*		Facilities to increase the convenience of walking and cycling trips. End of trip facilities include secure, undercover bike parking (e.g. bike box) that is easily accessible at apartments, workplaces and public attractions. Locker and showering facilities may also be considered	*No quantifiable evidence available surrounding impact of switching to active modes.*	End of trip facilities are an important aspect determining if people choose to cycle. Safe and secure parking is a must have and showers are beneficial if you are trying to attract people to cycle long distances.
Influencing Travel Behaviour	*Trondheim, Norway*: Trampe Bicycle lift/escalator[24]		Provides bicycle users with an added push up hill through the installiation of a pully and plate system which pushes users up hill	Appears to be more of a gimmick than a practical solution to assisting bicycle users up hill. The capacity of the system would also be a limiting factor as it appears to be more suited to a recreational/ tourist user context than for commuters. *No quantifiable evidence available.*	Not applicable for this context although could be beneficial in other wellington locations

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[22] Roads and Maritime Services. (2015). *Sydney Harbour bridge and Tunnel*
[23] 91 Project. (2013). *Tolled Express Lanes*
[24] Trondheim Municipality. (2016). *Trampe Bicycle Lift*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Influencing Travel Behaviour	*Amsterdam, NL:* bicycle gutters on stairways		Gutters/ ramps on stairs to allow bicycles to be wheeled up/down stairs allowing shortcuts to be taken on cycling routes as well as easy access to basement bicycle parks.	Increasing the convenience and attractiveness of cycling by providing shortcut routes not available to cars. Small, well thought out infrastructure improvements also show bicycle users that they bare a valued mode of transport. *No quantifiable evidence available.*	
Influencing Travel Behaviour	*France:* PT passes as part of employment package		Employment law requires employers to subsidise 50% of employees monthly public transport pass.	Highly effective in incentivising people to use PT as it is heavily subsidised and paid in advance. *No quantifiable evidence available.*	Would be an attractive option to encourage a change in travel behaviour and likely to have a significant increase in PT ridership. Likely to have strong opposition from business owners
Influencing Travel Behaviour	*United Kingdom:* Cycle to work scheme Ability to purchase tax free bicycles		Cycle to work scheme, Employer buys bicycle for employee, up to the value of £1,000 which the employee then pays off over a 12 month period through payee deductions (minus tax and insurance premium).[25]	Effective in encouraging people to cycle to work although the true potential of the scheme may not be reached unless significant infrastructure upgrades are also completed. Likely to only attract those already confident cycling rather than people new to cycling unless the infrastructure is already in place.	
Influencing Travel Behaviour	*Guangzhou, China*: bike Share Programme[26]		15,000 bikes in the program, across 113 stations with a coverage area of 263km². Unlike many American and European cycle hire schemes the Guangzhou scheme is operated by the local council through the public transport company.	Averages 20,000 daily uses.	Bike share schemes have proven successful at targeting a mode shift for short opportune trips. Bike share schemes have also been identified as improving the bikeability and cycling culture of a place.
Influencing Travel Behaviour	*Paris, France*: bike share programme[27]		23,600 bicycles across 1,800 docking stations with a coverage area of 135km². The Paris cycle share scheme is operated by JC Decaux who do not charge the city to run the scheme but instead have exclusive	Averages 108,090 daily uses.	Bike share schemes have proven successful at targeting a mode shift for short opportune trips. Bike share schemes have also been identified as improving the bikeability and cycling culture of a place.

[25] Sustrans. (2015). *Cycle to Work Scheme*
[26] Award Guangzhou. (2016). *Hangzhou,China:Urban Public Bicycle Sharing Program*
[27] Velib. (2016). *Paris bike share*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
			rights to advertise on Paris's city owned advertising space.		
Influencing Travel Behaviour	*Portland, OR*: bike share programme[28]		Initially opened this year with 1,000 bikes across 100 stations. BikeTown, Portland's bicycle share scheme is innovative in that the technology is housed in the bicycle rather than on docking stations allowing more flexibility of scheme design and where the bikes can be ridden.		Bike share schemes have proven successful at targeting a mode shift for short opportune trips. Bike share schemes have also been identified as improving the bikeability and cycling culture of a place.
Influencing Travel Behaviour	*StattAuto/Greenwheels Germany and the Netherlands:* car sharing schemes[29] Car sharing company operating in numerous locations in Germany and the Netherlands		Membership is between €0-25 per month based upon frequency of use. Hiring costs start from €6 per hour plus €0.20 per km for a compact car. Discounts are also available for regular public transport users.	Attractive options for people/ companies that only need a car sometimes and don't want have to deal with the associated expenses of owning/operating personal/fleet vehicles. Would be practically beneficial when combined with prices increases or congestion charging. *No quantifiable evidence available.*	Car sharing is a new concept for New Zealand and would therefore require a shift in mindset surrounding sharing a common car.
Influencing Travel Behaviour	*Cityhop, Auckland and Wellington:* car sharing schemes[30] Cityhop is New Zealand's first car sharing company with cars in 19 locations in Auckland and 3 locations in Wellington.		Membership cost works out to be $10 per month with 6 and 12 month membership options available. Hiring cost is $15 per hour.		Already in the network
Influencing Travel Behaviour	*Milan*: public transport vouchers for leaving the car at home ('Park your car and go Public')[31]. Partnership between city council, insurance firm, and device manufacture. Cars are fitted with telematics devices which are able to detect vehicle speed, movement and location.		If cars are left in the same spot for a 12 hour period the owner is rewarded with a public transport pass.	Beneficial partnership as the insurer offers discounted insurance rates for cars fitted with telematics. In addition to achieving a congestion reduction the council is also able to collect valuable data surrounding car use.	Highly applicable to the N2A network as good public transport infrastructure is already in place. Would require further investigation as to funding mechanisms.

[28] BikeTown. (2016). *BikeTown: How it works.*
[29] Greenwheels. (2016).
[30] Cityhop. (2016).
[31] Transport and Environment. (2015). *Milan paying motorists not to drive*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Influencing Travel Behaviour	*Western Australia:* Smart Transport[32] Integrated platform combining travel plans, information on network wide transport plans and projects along with research.		Encourages people to travel off peak by providing updates about how much time people could save by delaying their travel. Keeps people up to date with network outages and planned works	*No quantifiable evidence available.*	Similar platforms are already operating including Transport for Wellington and the Metlink website.
Land Use Policies	*Transport for London (TfL) Olympic Games Travel Plans[33]* TfL undertook a significant TDM programme as part of improvement works to PT infrastructure in the lead up to the Olympic Games		Approach focused on the 4 Rs: Reduce Re-mode Re-route Re-time Travel planning was targeted towards large businesses and through PR campaigns	Monitoring identified that on an average weekday during the Olympics:: 20% Reduced 4% Re-moded 6% Re-routed 13% Re-timed This led to over 77% of London's travellers changing their travel habits during the games	The TfL 'Get ahead of the Games' campaign identifies how successful a travel planning campaign can be. Apart from physical improvements to infrastructure this campaign was primarily media based. The main driver behind the success of this campaign was fear from individuals and businesses that the infrastructure wouldn't cope during the games.
Land Use Policies	*Europe*: Sustainable mobility plans[34] Sustainable mobility plans act as an overarching approach to mobility planning, which smaller (work or school place plans fall under).		This approach ensures that all travel planning in a certain area is consistent and that the flow on effects of these plans can be managed. For example if multiple large organisations in a specific locality all advocate for the use of PT then extra capacity on specific bus or train lines may be required. If these issues are captured at the onset through the development of sustainable mobility plans then they can be managed ensuring a favourable user experience is achieved likely resulting in repeated patronage	Sustainable mobility plans ensure that a consistent approach towards travel plans is undertaken and that potential issues are captured at the onset. Sustainable mobility plans also act as a beneficial feedback loop identifying priority areas for the provision of infrastructure or additional services based upon demand. *No quantifiable evidence available.*	Although travel planning is not a new concept in NZ, sustainable mobility plans are. The intention is to provide a coordinated approach to the development of travel plans in order to identify what transport modes are desirable to encourage a mode shift to and what improvements to the network need to be made.

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[32] Department of Transport. (2016). *Smart Transport: Smart News*
[33] TfL. (2013). *Travel Demand Management: Lessons Learned from the Olympic Games.*

[34] Eltis. (2016). *European Platform on Sustainable Urban Mobility Plans.*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Land Use Policies	*The Netherlands:* Personal travel plans Personalised travel plans identifying mobility options based on individuals needs and required travel times. In the Netherlands there is a comprehensive travel planning app/website, 9292[35].		Can be undertaken either online or through service agents at public transport interchanges. In the Netherlands there are different types of travel plans; apps like 9292 are promoted to residents for everyday use whilst new arrivals are able to undergo more comprehensive travel planning sessions to learn the Dutch transport networks. This type of travel planning also allows for the identification of areas where additional skills are needed, for example learning to cycle classes.	Effective at establishing sustainable travel patterns and travel behaviour particularly if prompts are given e.g. your trip is 10 mins quicker if you travel off peak or take the train. Identifies when people need to travel and if this travel needs to be undertaken during peak travel times. Through gathering metadata surrounding personalised travel patterns it is possible to forecast transport/ mode demand in advance and undertake subsequent changes. *No quantifiable evidence available.*	Wellington already has a number of successful personal travel plan interventions in place. However these seem to be undertaken independent of each other. If all of these interventions were undertaken as a coherent package they would likely have a higher impact.
Land Use Policies	Logistic planning and freight consolidation (including use of cargo bikes for the last kms)		Integrated city logistics plans encouraging freight distribution warehouses to be located on the outskirts of cities and the last kilometres of the journey to be undertaken on cargo bikes which often have the competitive advantage in urban areas. Significant uptake in the European context	Reduces congestion and frees up capacity by moving short distance courier type trips onto other modes. In built up areas cargo bikes have a competitive advantage over traditional courier services as long as the infrastructure is in place. *No quantifiable evidence available.*	Collaborative consolidation of freight would require a change in mindset surrounding how we do business
Land Use Policies	*Rotterdam, NL:* Spatial development strategy (2030)[36] Spatial development strategy for the city of Rotterdam based around a number of strategic projects (termed VIPs) to create a strong economy and create an attractive places to live.		The focus is on urban densification to enable the strengthening of existing transport and urban infrastructure rather than urban expansion.	Spatial plans are highly effective in encouraging sustainable urban development and transport use as land use and transport planning are integrated from the start. Spatial development strategies and plans are long term planning tools with their effect measured over time rather than immediately. *No quantifiable evidence available.*	

[35] 9292. (2016). *Plan Your Journey:* www.9292.nl/en
[36] Gemeente Rotterdam. *Spatial Development Strategy 2030.*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Land Use Policies	*Amsterdam, NL*: the Bike-Train system Increases the competitive advantage of train based public transport by encouraging the egress trips to and from stations to be undertaken by bicycle		Trips to stations from home locations typically undertaken on personal bicycles whilst trips from stations typically undertaken on hire bicycles. Significantly increases station catchment size increasing the efficiency of the train service	Effective as targeting behaviour change whilst also strengthening the competitive advantage of public transport. Low set up cost although most effective if there is a surrounding network of bicycle infrastructure that people are happy to cycle on. On a daily basis 47% of all train trips (in the Netherlands) involve cycling to the train station, this is growing by 5% per year[37]	
Network Management	*Multiple locations*: Tidal flow lanes[38] Tidal flow lanes allow road lanes to be reconfigured depending on which travel direction has the greatest demand		Ability to re configure existing road space based on demand. Lane separation can either be physical (for example Auckland harbour bridge) semi physical (lanes separated by road cones or just separated by lane markings and directional signage.	Operational measure (efficient use of road space). *No quantifiable evidence available.*	In some locations tidal flow lanes have led to increase in head on collisions.
Network Management	*The Netherlands:* Dynamic Road Marking (DRM)[39] Use of LED technology in lane marking enables configuration of motorways (particularly at on and off ramps) to be modified based upon traffic flows.		Ability to re configure existing road space based on demand.	Operational measure to ensure efficient use of road space.	The BCR for the research undertaken identified that in this instance the benefits of DRM didn't outweigh the costs.
Network Management	*The Netherlands:* Grade separation at intersections for pedestrians/bicycles		Grade separation at major intersections (e.g. with state highway) provides a travel time saving for all modes as neither mode has to stop for the other along with peak hour congestion reductions due to an improvement in traffic flows. An additional benefit is an accident reduction among bicycle users and	Likely to have a significant impact on bicycle/pedestrian accidents. *No quantifiable information on travel time savings.*	The majority of roads and cycle links crossing SH1 are already grade separated with the exception of between Willis Street and the Basin Reserve where spatial constraints mean grade separation is not a viable option.

[37] Kager, R. (2016) *Cycling and Transit: Competition, synergy or both?*
[38] Fafieanie, M. & Sambell, E. (2008). *Assessment of Dynamic Tidal Flow Lane on Provincial Roads in the Netherlands.*
[39] Fafieanie, M. & Sambell, E. (2008). *Assessment of Dynamic Tidal Flow Lane on Provincial Roads in the Netherlands.*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
			pedestrians as intersection are associated with a high accident risk.		
Network Management	*London:* Improvements to the walking and cycling network[40]		Improvements to the walking and cycling network to encourage active transport instead of car use.	Cycling trips increased by 117% between 2000 -2010. The construction of the 'cycle superhighways' is predicted to generate an additional 120,000 cycle trips per day.	Walking and cycling are ideal for short cross town trips.
Network Management	*Victoria, Australia:* Monash Freeway (M1) Ramp Metering Based on real time measurements, the ramp metering on Melbourne's Monash Freeway overcomes the problem of uncertain freeway capacity by targeting the critical occupancy for maximum throughput.		Increased efficiency of motorways through the regulation of timing of vehicles entering the system.	Increase in traffic throughput and a reduction of travel times. Accident reduction. *No quantifiable evidence available.*	Ramp metering is currently operational on the Auckland motorway network demonstrating its effectiveness in the NZ context.
Network Management	*Minneapolis–Saint Paul, USA:* Ramp metering[41] 8 week study to test the effectiveness of previously installed ramp meters on 433 highway on-ramps.		Increased efficiency of motorways through the regulation of timing of vehicles entering they system.	Study identified that ramp meters increased highway capacity by 9% whilst improving travel times by 22% and 26% reduction in crashes was also noted.	
Network Management	*South Gloucestershire* High Occupancy Vehicle (HOV) Lanes.[42] Sometimes called T2+ lanes as the permit vehicles carrying two or more people to travel in the HOV lane along		Sometimes called 2+ lanes as the permit vehicles carrying two or more people to travel in the HOV lane along with motorcycles. The concept behind HOV lanes is to encourage car sharing and public transport	Incentivising carpooling and public transport usage through the provision of special lanes will likely decrease travel times for these modes encouraging their use as long as the convenience of the mode and travel time reduction can be	HOV/ T2+ lanes are already operational in Auckland with bus lanes operational in all the main urban centres in NZ.

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[40] Transport for London. *Cycling Revolution London*
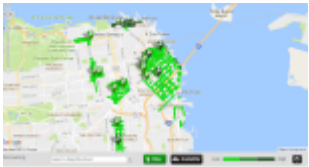[41] Levinson, D *and* Zhang, L. (2006). *Ramp meters on trial: Evidence from the Twin Cities metering holiday.*
[42] Department for Transport. (2006). *Traffic advisory leaflet: High occupancy vehicle lanes.*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
	with motorcycles.		use in locations that don't meet the criteria for bus lanes. Can either be operational on a full or part time basis.	maintained. *No quantifiable evidence available.*	
Parking Policies	Park and Ride, various locations[43]		Providing safe car parking at railway and bus stations to encourage people to drive to their nearest station and take public transport into the central city.	Upon construction of park and ride facilities it was identified that during peak travel times Park and Ride made up: 15% of the total mode share for rail based park and ride (Sydney, Melbourne and Adelaide). 12.5% for busway park and ride services (Adelaide) 1-5% for on street bus services (Adelaide, Perth and Brisbane)	As the catchments are beyond the range of the network so would park and ride locations (e.g. Hutt Valley and Porirua).
Parking Policies	*Portland, Oregon, USA[44]* Maximum and Minimum parking requirements based upon zoning requirements.		Encouraging more sustainable land development Parking requirements don't apply for developments in dense commercial areas or close to PT	Policy only somewhat effective as it doesn't advocate for a reduction in car use, policy similar to what is currently present in many NZ localities. *No quantifiable evidence available.*	Maximum and minimum parking requirements can be ineffective as there is no incentive for the individual to change their travel behaviour.
Parking Policies	*Zurich, Switzerland:* city wide parking cap, encouraging off street parking[22] When new off street parking comes online, on street parking is removed to maintain balance.		Restricts new parking developments and reduces congestion by increasing capacity of the road corridor.	Long term project to reduce parking availability, therefore not likely to have an immediate impact. *No quantifiable evidence available.*	Unlikely to have any short term impacts on either parking supply on the number of cars entering the CBD as the intention is to limit the long term supply of parking and free up road space.
Parking Policies	*Chicago, Illinois, USA[22]* Private company manages all parking for a 75 year period (paid the council ($US 1.5 billion).		Annual increase in parking costs over a four year period (US$3-6.50 p/h for CBD and US$1-4 p/h for other locations).	Increasing parking cost over time to push people towards using other transport modes. *No quantifiable evidence available.*	Slowly increasing the cost of parking would work well if other interventions are also introduced at the same time (carrot and the stick)

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[43] Vincent, M. (2007). Park and ride: Characteristics and demand forecasting. *Land Transport NZ Research Report 328*.
[44] Institute for Transportation and Development. (2013). *Practical Guidebook: Parking and Travel Demand Management Policies in Latin America.*

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Parking Policies	*Amsterdam, the Netherlands*[22] Zone specific parking prices.		Zone specific rates, with the cost of parking increasing closer to the city centre. Residents can buy a residential parking permit (substantial cost). Park and ride on the outskirts of Amsterdam, cheap parking which includes a public transport pass. Use of mobile app to pay for parking. Regulation for off street parking (requirement for parking increases further out from the city centre and public transport infrastructure.	Parking policies are effectively integrated with other policies e.g. integration with public transport and provision for cycling. It also needs to be taken into account that cycling has a 60-70% mode share in Amsterdam; therefore, the provision of parking etc can increase congestion and travel times for other modes. *No quantifiable evidence available.*	Comprehensive mixture of parking policies to have maximum impact. The issue with staggered parking zones from the corridor perspective is that for the majority of traffic (travelling from the North) the heart of the CBD (and therefore the highest parking price) comes first.
Parking Policies	*San Francisco, California, USA*[45] Dynamic pricing of parking.		Dynamic parking using smart technology, price increases with demand	Encourages people to travel outside of the peak (high demand) periods in order to get cheaper parking Incentivises people to choose different travel modes during peak periods. *No quantifiable evidence available.*	Dynamic price parking is a more logical approach to parking management in the Wellington context due to the spatial distribution of the city as it allows the parking price to be set by demand.
Parking Policies	*Frog Parking*[46] Smart technology for car parking		Sensor embedded in carpark (solar powered) is able to detect presence of a vehicle allowing for more efficient management of parking on a network level and guiding cars to vacant carparks removing the need to physically search for parks increasing network efficiency. Payment is done automatically via app and can also be used with smart parking permits. Technology removes the need for parking meters, pay and display tickets and parking wardens as enforcement is carried out automatically. Dynamic parking using smart technology, price increases with demand.	Reduces congestion and increases efficiency of the current network by guiding vehicles to vacant parks. Encourages people to travel outside of the peak (high demand) periods in order to get cheaper parking Incentivises people to choose different travel modes during peak periods. Provides information surrounding how parking is used allowing additional TDM interventions based upon user statistics. *No quantifiable evidence available.*	Dynamic price parking is a more logical approach to parking management in the Wellington context due to the spatial distribution of the city as it allows the parking price to be set by demand. Frog parking has the additional benefit of being able to identify vacant car parks, eliminating the requirement for cars to search for available car parks.

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[45] SFMTA. (2016). *SFpark.org*
[46] Frogparking.com

Category	Location and Description	Picture	Benefits	Mode Shift Potential/ Notes	Applicability to the N2A Network
Technology and Innovation	Whim App – Mobility as a Service Global, Finland[47] Whim uses your origin and destination to recommend different modes of transport that are available to take that route. It also operates as a ticketing system.		All modes of transport can be assessed for the best option on one app, meaning travel choices are easier for users.	*No quantifiable evidence available.*	Whim can be used to provide users with options they may not have realised they can use before to get around the network.

[47] https://whimapp.com/fi-en/

Appendix C. Criteria Analysis

Category	TDM Measure	Considerations	A transport system that enhances the liveability of the central city						A transport system that provides more efficient and reliable access to support growth					A transport system that reduces reliance on private vehicle travel				A transport system that improves safety for all users		A transport system that is adaptable to disruptions and future uncertainty		Implementability		Cost	
			Improved walkability in the CBD with better access to the waterfront	Enhanced urban environment	Reduced impact of motorised transport in CBD	Minimised adverse effects on natural environment	Minimised impacts on built environment	No increase to number of vehicles in the CBD	Increased reliability and improved access to and from CBD	Consistency with the Urban Growth Plan and Wellington Regional Strategy	Improved throughput of people and goods on strategic corridors	Increased reliability of access to and from the airport, hospital and port	Reduced PT travel time variability	Increased PT catchment	Improved pedestrian mode share	Improved cycling mode share	Improved PT mode share	Reduced deaths and serious injuries for road users	Improved safety for pedestrians and cyclists	Adaptability to be able to respond and recover from unplanned events	Adaptability and flexibility to cope with future uncertainty and technologies	Consentability	Feasibility	Capital cost	Operational cost
Economic Pricing Measures	Congestion Charging	Legislation change and political acceptance. Requires improvements to alternate modes of transport to make them attractive alternatives	1	1	3	0	0	3	2	1	1	2	1	1	1	1	1	0	1	0	1	0	-2	M	L
Economic Pricing Measures	Distance-based charging		0	1	3	0	0	3	1	1	1	2	1	0	0	0	0	0	0	0	1	0	-2	M	L
Economic Pricing Measures	High occupancy toll (HOT) Travel Lanes		0	0	2	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-2	M	L
Economic Pricing Measures	Link Tolling		0	0	2	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-2	M	L
Influencing Travel Behaviour	Bikes on buses		0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	L	L
Influencing Travel Behaviour	Bikesharing (e.g. Provision of bicycle hire schemes)	Requires improved infrastructure and speed limits, unlikely to be implemented without this. Do minimum includes improvements made by the UCP. Potential provision of e-bikes	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2	0	0	L	L
Influencing Travel Behaviour	End of Trip Facilities for Walking and Cycling	Both in open public space and in private buildings	1	0	1	0	-1	1	1	0	0	0	0	0	1	1	0	0	0	0	2	0	0	L	L
Influencing Travel Behaviour	Improved services (e.g. Wi-Fi on buses, less advertising on the sides of buses)	Improved PT infrastructure will complement this	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	L	L
Influencing Travel Behaviour	Linking cycling and public transport (e.g. Bike-Train)		0	0	1	0	0	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	L	L
Influencing Travel Behaviour	Multimodal access guide		0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	L	L
Influencing Travel Behaviour	Public Education		0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2	2	1	2	0	0	L	L
Influencing Travel Behaviour	Public Transport Incentives – both government and organisation level		0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2	0	0	L	L
Influencing Travel Behaviour	Ridesharing		0	0	1	0	0	1	1	1	0	0	0	0	0	0	-1	0	0	0	2	0	0	L	L
Influencing Travel Behaviour	Simplified public transport fare pricing		0	0	1	0	0	1	0	1	0	0	0	1	0	0	2	0	0	0	2	0	0	L	L
Influencing Travel Behaviour	Tourist transport management		0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0	L	L
Influencing Travel Behaviour	Transit Free Zone		0	0	1	0	0	0	0	1	1	0	0	0	0	0	2	0	0	0	2	0	0	L	L
Influencing Travel Behaviour	Universal access card		0	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	2	0	0	L	L
Influencing Travel Behaviour	Wayfinding		0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	L	L

Category	Policy	Notes																						
Influencing Travel Behaviour	Work place incentives		0	0	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	2	0	0	0	L
Land Use Policies	Car free planning (e.g. Car free days)		2	1	3	1	0	2	0	1	0	0	1	1	2	2	1	2	2	1	2	0	0	M	L
Land Use Policies	Development Travel Plans		0	0	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	2	0	0	0	0
Land Use Policies	Logistics Plans - Encouraging consolidation of freight distribution		0	1	2	1	0	1	1	1	2	0	0	0	0	0	0	0	0	0	2	0	0	L	L
Land Use Policies	Personalised Travel Plans		0	0	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	L
Land Use Policies	Spatial plans - Integrating transport and land use planning		1	0	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	2	0	0	L	L
Network Management	Accident response units		0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	2	1	0	0	L	L
Network Management	High occupancy vehicle (HOV) priority (e.g. T2 lanes)	This would not be implemented in such a way as to have adverse effects on PT	0	0	2	0	0	2	2	1	2	1	1	0	0	0	0	0	0	0	1	0	0	L	L
Network Management	Public Transport Priority (eg. bus lanes, queue jump lanes, priority intersections)		0	0	2	0	0	2	2	1	2	1	2	1	0	0	2	0	0	0	1	0	0	L	L
Network Management	Ramp Metering		0	0	1	0	0	0	2	1	2	0	1	0	0	0	0	0	0	1	1	0	0	M	L
Network Management	Tidal Flow Lanes (e.g. Moveable tidal flow barriers to switch travel lanes based upon demand)		0	-1	1	0	0	0	2	1	2	1	0	0	0	0	0	0	0	1	1	-1	0	M	L
Network Management	Traffic calming	Reduced capacity and speed on key arterialsReduced supply	1	1	2	0	0	2	-1	1	-1	-1	0	0	0	1	1	1	1	-1	0	0	-1	M	L
Network Management	Walking and cycling infrastructure improvements	Increased supply	3	0	1	0	0	1	2	1	0	0	0	0	3	3	0	1	2	0	1	0	0	M	L
Parking Policies	Park and Ride (e.g. Provision of subsidised parking at train stations)		0	0	1	0	0	2	1	1	0	1	0	1	0	0	2	0	0	-1	1	0	0	M	L
Parking Policies	Parking Management		0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	M	L
Parking Policies	Smart Parking (e.g. variable parking prices based on demand)		0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	M	L
Parking Policies	Unbundled Parking (where the cost of renting/owning a car park is separate from building expenses)		0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	-1	1	0	0	0	0
Technology and Innovation	Improved travel time information		0	0	0	0	0	0	1	1	0	0	2	0	0	0	2	0	0	1	2	0	0	L	L
Technology and Innovation	Mobility as a service		2	1	0	0	0	1	2	1	1	2	1	0	2	2	2	1	2	2	2	0	0	M	M

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