Arataki
Supporting Paper

Integrated urban transport

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NZ TRANSPORT AGENCY
WAKA KOTAHI

Te Kāwanatanga o Aotearoa
New Zealand Government

Contents

The purpose of this paper is to help guide NZTA and our partners in how to plan improvements to the transport system in urban areas to deliver better outcomes, more efficiently and effectively. It is focused on supporting integrated urban transport in our largest (Tier 1), fastest growing urban areas.

While NZTA has a range of implementation plans and guidance documents for different modes and urban issues, this paper provides an over-arching summary that describes the case for change, the potential benefits of increased integration, the system shifts required and how we can work with partners in urban areas to plan and deliver integrated urban transport that delivers across multiple outcomes.

This paper builds on earlier work, including the New Zealand Infrastructure Commission Te Waihanga New Zealand Infrastructure Strategy[1], research into the impact of urban form on transport and economic outcomes[2], NZTAs Keeping Cities Moving[3] (mode shift plan), Urban Development Position[4], Cycle Action Plan[5], Toitu te taiao[6] (Sustainability Action Plan), and Environmental and Social Responsibility Policy[7], and the Government's Emissions Reduction Plan[8] and the Decarbonising Transport Action Plan 2022-25[9].

Overview

Cities are important. Nearly 9 out of 10 New Zealanders live in urban areas (86 percent in 2018) and they are where most future population growth is expected to occur. Urban centres are hubs of economic activity, production and distribution, and deliver a wide range of services and amenities to residents, surrounding communities and visitors.

Transport is critical to supporting well-functioning urban environments and the well-being of urban communities. Transport enables economic activity and contributes to the prosperity of our cities, towns and local neighbourhoods. Cities thrive when people and goods can move around easily, and when people have genuine options for getting to work and education, connecting with family and friends, and accessing services.

Cities are complex, dynamic systems. This means delivering transport infrastructure and services can be challenging due to multiple system users, high trip volumes across multiple modes, space constraints, the need to balance competing priorities, and the importance of delivering multiple outcomes at once. At the same time, cities provide opportunities to deliver benefits at scale and improve outcomes for large numbers of people, businesses and organisations.

Our cities face an increasingly uncertain future, due to climate change, emerging technologies, unpredictable population growth (or decline), and the impacts of unexpected events (such as the COVID-19 pandemic). This uncertainty means that we can't assume that the future will play out in line with past trends.

Improving urban transport outcomes in this complex, dynamic and increasingly uncertain environment will require new ways of operating. We increasingly need to take a system view that:

- Integrates transport with other urban systems, particularly land use.
- Integrates across different modes and networks.
- Prioritises integrated programmes of activities that deliver multiple benefits (outcomes).

Integrated urban transport can help support well-functioning urban environments and economies by enabling the efficient and effective movement of people and goods, extracting maximum value from existing infrastructure and assets, as well as improving liveability.

It's particularly critical for the transport system to operate as a cohesive whole in urban environments. More than in other locations. This requires different transport modes and networks to come together effectively, playing to the strength of each mode. For example, as more individuals opt for 'space efficient' modes like public transport, walking and cycling, it 'frees up' road space for other journeys – such as freight movements, deliveries, and facilitating connections between trades people and service providers with their customers.

This paper outlines what it will take to deliver integrated urban transport to support well-functioning urban environments. It identifies a practical pathway to deliver the transformative change likely to be required to address existing transport system deficiencies, provide for future growth and support successful urban areas into the future.

Delivering integrated urban transport requires new ways of doing things and this paper sets out four big shifts:

1. Shaping urban form to reduce pressure on the transport system.
2. Maximising the value and efficiency of existing infrastructure and services.
3. Improving travel options and motivating people to travel differently.
4. Managing the transport system to reduce its harms.

It also provides an intervention framework to help assess what should be done to progress these shifts.

The paper is structured as follows:

- **Section one** defines integrated urban transport, outlines why it is important and describes the current legislative context.
- **Section two** makes the case for change.
- **Section three** outlines the key considerations that will guide the NZ Transport Agency Waka Kotahi (NZTA) efforts in supporting integrated urban transport.
- **Section four** explains what it will take to deliver integrated urban transport including four big shifts and an intervention framework outlining key system changes.
- **Appendix A** provides a stocktake of resources, research, analysis and evidence to support progress in delivering integrated urban transport.

Section one: what is integrated urban transport?

The phrase 'integrated urban transport' is used in this context to describe the potential benefits of increased integration of transport in our urban centres. Integrated urban transport means:

Planning and delivering transport in our urban areas in a way that integrates with other systems (including land use and telecommunications), across modes and across outcomes, to support an effective, efficient and safe land transport system and well-functioning urban environments.

Integrated urban transport recognises that transport and land use are deeply intertwined – especially in urban areas – meaning that it is critical to connect planning and decision-making on both.

Increased integration of policy, investment and delivery across land use and transport matters will help guide decision-making to achieve both the purposes of the Land Transport Management Act, as well as direction set by the National Policy Statement for Urban Development.

While this guidance focuses primarily on the integration of transport and land use, integrated urban transport will increasingly need to consider the contribution that digital connectivity can make to urban accessibility.

Advances in digital technology that increase connectivity between system users, vehicles and smart infrastructure, can improve system efficiency, enhance user experiences and even provide alternatives to physical travel.

In recent years the concept of Triple Access Planning has emerged, which recognises that improving urban accessibility needs greater integration of the transport, land use and telecommunications[10]. The origins of Triple Access Planning are from New Zealand Ministry of Transport's (MoT) policy work in the early 2010's to inform early integrated transport and demand management thinking. The principles have since been developed and tested in the UK and northern Europe and are being implemented by UK local authorities[11].

Figure 1: Triple Access Planning Graphic
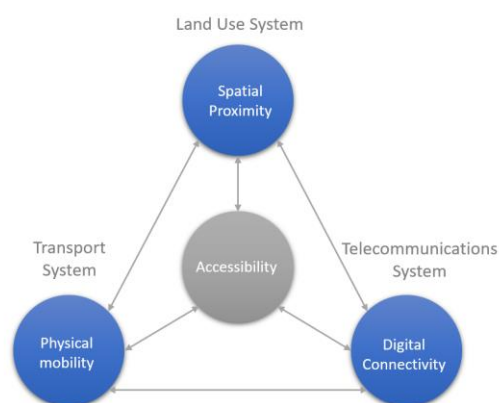
Why is it important?

New Zealand has one of the most urbanised populations in the world. In 2018, 86% of people lived in urban centres, and this is projected to increase to over 90% by 2040. Over half the country's population live in the five largest urban centres of Auckland, Hamilton, Tauranga, Wellington and Christchurch[12].

Transport is critical to supporting well-functioning urban environments and economies. Cities thrive when people, goods and services can move around easily and people have a range of travel options for getting to work and education, connecting with family and friends, and accessing services.

Transport connects businesses and contributes to the economic prosperity of our cities, towns and local neighbourhoods. Transport supports the supply of goods and services, and connects our country with the rest of the world. In many areas transport corridors also serve as key public spaces, providing amenity and enabling social interaction that is vital to building strong, resilient and prosperous communities.

Successful, growing cities create challenges and opportunities for transport. As populations increase the number of trips grows, potentially leading to congestion which impacts on the travel times and reliability of journeys. With space being constrained within our cities, adding vehicle capacity to existing networks is difficult and costly. At the same time escalating costs of maintaining and operating transport networks are also increasing placing pressure on central and local government budgets.

> **The transport challenges and opportunities in urban areas are quite different to those in rural and provincial areas.**

Larger urban populations living in relatively close proximity expose more people to the potentially harmful impacts of transport (including noise and air pollution) and place pressure on constrained networks. The safety challenges in urban centres are also different with pedestrians, people on bikes and other vulnerable users overly represented in urban crash statistics.

In addition to the above, customer expectations on what the land transport system should deliver are expanding.

Despite these challenges, people are increasingly choosing to live within cities (globally and in NZ) due to the economic, societal and other benefits of living in relatively dense areas that provide access to a wide range of services and opportunities.

Space constraints and the large number of different and potentially conflicting demands on urban transport networks mean that:

- It is difficult, disruptive and very expensive to expand the transport infrastructure network.

- Any changes to transport infrastructure networks are likely to involve complex trade-offs between different outcomes, priorities and users.

> **While delivering transport and related (societal) outcomes in urban areas is difficult and complex, there is a corresponding opportunity to deliver outcomes at scale and provide benefits for many people and businesses.**

Realising the potentially significant benefits from successful growing urban areas requires a different, more integrated, approach to planning and delivering transport in urban areas. This will mean less of a focus on individual modes and delivering to single outcomes, and a greater focus on integrated programmes and packages of complimentary interventions that deliver across multiple modes and outcomes. This approach will deliver greater impact than the sum of its parts, while also increasing the attractiveness of living and working in urban areas.

We need to make sure that what is delivered is efficient and effective, and in cities this is likely to mean focusing on delivering integrated packages of incremental improvements. This might include relatively small-scale, low-cost programmes that when combined deliver wide benefits at scale.

Integrated urban transport supports well-functioning urban environments by:

- Ensuring that land use and transport are planned and delivered together to support urban growth that results in vibrant, connected communities that enable all people to access the things that are important to them.

- Supporting increased productivity and enabling economic activity.

- Minimising costs by reducing reliance on new infrastructure (including non-transport infrastructure), optimising network efficiency and maximising the value of existing and planned infrastructure, assets and services.

- Better aligning transport improvements with the staging and sequencing of urban growth so new communities have good travel options from the outset.

- Using the best mode for the job to efficiently move people and goods.

- Supporting improved safety and public health outcomes.

- Supporting delivery of climate commitments and helping to manage the impacts of climate change.

Legislative Context

The Land Transport Management Act (2003) (LTMA)[13], National Policy Statement on Urban Development (NPS UD)[14] and Government Policy Statement on Housing and Urban Development (GPS-HUD)[15] provide the key legislative and policy directions guiding the planning and decision making for land use and transport in our main urban areas.

 The Climate Change Response (Zero Carbon) Amendment Act (2019)[16] is also relevant as it commits New Zealand to a target of net zero greenhouse gas emissions by 2050 (excluding biogenic methane). The Resource Management Act (1991)[17] provides the legislative framework for land use planning in New Zealand and is critical in setting and managing environmental limits in

relation to delivery of integrated land use and transport.

The purpose of the LTMA is to contribute to an

> **Land Transport Management Act 2003**
>
> NZ Transport Agency's statutory functions under section 95 the Land Transport Management Act, include:
>
> 1(a) contribute to an effective, efficient and safe land transport system in the public interest
>
> 1(h) manage the State highway system (including its planning, funding, design, supervision, construction, maintenance and operation)
>
> 1(i) oversee of the planning, operation, implementation and delivery of public transport
>
> 1(k) assist, advise and co-operate with approved organisations
>
> 1(p) issue reports and guidance and comment about any matter relating to the land transport system and its participants.

effective, efficient and safe land transport system in the public interest, and NZTA is required to give effect to the purpose of the Act. In more complex urban environments, integrated urban transport is increasingly required to ensure transport networks are effective and efficient (and safe).

The LTMA also requires that NZTA, when undertaking its functions, must exhibit a sense of social and environmental responsibility, and use its revenue in a way that seeks value for money (section 96).

The NPS UD recognises the fundamental link between urban development and provision of development infrastructure, including transport, and seeks greater integration of their planning and delivery.

The NPS UD supports integrated urban transport through objectives to:

- Deliver well-functioning urban environments that enable all people and communities to provide for their social, economic, and cultural wellbeing, and for their health and safety, now and into the future. (Objective 1)

- Enable more people, businesses and community services to be in (or near) a centre zone, area with many employment

opportunities or area well served by existing or planned public transport. (Objective 3)

- Ensure local government decisions on urban development are integrated with infrastructure planning and funding decisions. (Objective 6)

Policy 1 of the NPS UD requires that planning decisions contribute to *well-functioning urban environments*, which (among other matters):

- Have good accessibility for all people between housing, jobs, community services, natural spaces and open spaces, including by way of public or active transport.

- Improve housing affordability (by enabling a range of homes and supporting competitive land and development markets).

Support reductions in greenhouse gas emissions, and are resilient to the impacts of climate change Policy 10 requires Tier 1, 2 and 3 local authorities engage with providers of development infrastructure and additional infrastructure to achieve integrated land use and infrastructure planning.

Aligned with the NPS UD, the GPS-HUD provides a multi-decade system strategy for housing and urban development. The long-term vision of the GPS-HUD is that 'everyone in Aotearoa New Zealand lives in a home, and within a community, that meets their needs and aspirations'.

The GPS-HUD seeks to deliver thriving and resilient communities and notes the importance of working collaboratively to support coordinated planning, investment and decision making to deliver outcomes.

The Climate Change Response (Zero Carbon) Amendment Act will also influence the future form of our cities and the transport system that serves them. It provides the legal framework to enable New Zealand to meet its international emission reduction commitments, and to prepare for and adapt to the effects of climate change.

The legislation sets a 2050 target and establishes a system of emissions budgets and emissions reduction plans, plus national climate change risk assessments and national adaptation plans.

Section two: urban context and the case for change

This section provides an overview of how people currently get around urban areas in Aotearoa New Zealand. It explains why we need to prioritise integrated urban transport to create well-functioning urban environments, support the efficient movement of people and goods, provide value for money, meet our climate commitments, and make travel safer.

## How people move around urban areas

People travel for a wide variety of purposes, including for social visits, shopping, work, and recreation, as highlighted in Figure 2.

Figure 2:Purpose of household travel in Aotearoa New Zealand (time spent travelling for each purpose, excluding travel back home)
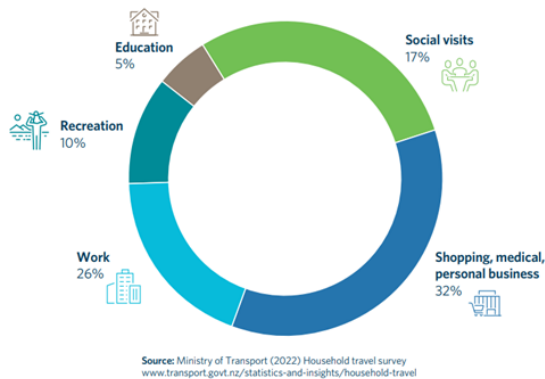
Most people use cars frequently to access their daily needs and to reach the people and places that are important to them. 92 percent of households in Aotearoa New Zealand own at least one car, with 38 percent owning two cars and 16 percent owning 3e or more cars.[18] Figure 3 summarises the share of travel by different modes in our 5 largest cities.

Figure 3:Transport mode share of all trips in our 5 largest cities
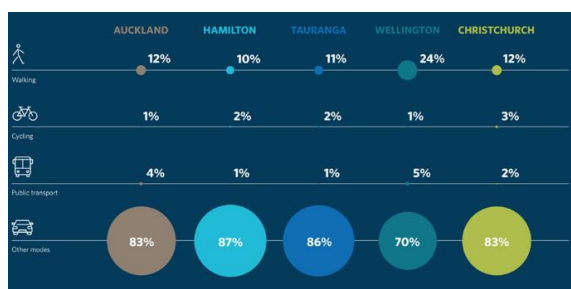
Source: New Zealand Household Travel Survey[19]

Most of the trips that people make in urban areas are relatively short (less than 5km). A third of transport trips are less than 2km. However, long trips (over 25km) account for almost half the total distance travelled by cars.

The total annual amount of car travel has grown over time. Over the last 20 years, the total distance travelled by cars has increased by 25 percent.[20]

Our urban areas are forecast to receive the vast majority of Aotearoa New Zealand's population growth over the coming decades. The on-going growth of our urban centres brings both challenges and opportunities for land transport, and these are explored in the following section.

Why we need better integrated urban transport

Improving transport options and making smarter use of what we have is essential for managing congestion

If vehicle traffic in our cities continues to grow at the same pace as recent decades, congestion will get worse, impacting more places more of the time. This will make our cities less accessible and attractive for people. It will also slow freight movements, increasing cost to businesses and reducing productivity.

> **Building additional lanes or new roads in congested areas is expensive and doesn't work. In fact, it often increases congestion by encouraging more people to drive, which creates more congestion. Rather than building more lanes or new roads to reduce peak time congestion, we're better off using the roading infrastructure we already have in smarter ways.**
>
> *Te Waihanga New Zealand Infrastructure Commission*

Reducing congestion and providing other transport options supports economic activity and increased productivity by enabling people and goods to move around our cities faster and more reliably.

Over time we have often aimed to reduce congestion by expanding roads. In larger urban areas this approach can be very expensive, difficult and disruptive. It is also often counterproductive as road expansion induces more car travel and increases traffic until the system once again gets congested.[21]

Congestion is a consequence of high traffic volumes, a high proportion of single-occupancy car trips, and inefficient road use. All these factors need to be addressed to effectively manage congestion.

Making better use of infrastructure will help to avoid social and economic costs

As noted above, adding capacity to existing urban networks is difficult, disruptive and very expensive. Increasing costs of maintaining existing infrastructure and services, and developing the transport system to support urban growth, have

amplified the affordability and funding challenges for central and local government.

Supporting the efficient movement of people and goods in the current constrained financial environment will require a focus on extracting increased value from existing infrastructure and services.

At a system level, land use decisions are the largest determinant of transport demand and have the greatest impact on the capital and operating costs, and the outcomes delivered by transport investments in the long run.

Optimising the use of existing transport infrastructure assets and investing wisely in new assets is critical during economically constrained periods. Integrating investment within the urban transport, spatial planning and development system is essential to maximise the benefit of investment in all public assets. NZTA has a fundamental interest in ensuring that good spatial planning delivers value for money for New Zealand within the land transport system.

Maximising the benefits from existing networks and assets can be supported by:

- concentrating urban development in mixed use neighbourhoods, hubs and corridors that let people live closer to the things they need,
- optimising existing networks (including through use of new technology to monitor and adjust system settings in real time to minimise delays and disruption), and
- re-balancing road space to prioritise the most efficient modes.

These approaches are also often cheaper and quicker to implement, and can avoid or delay the need to invest in expensive new infrastructure.

At a more operational level, providing space to park and store cars also takes up large amounts of urban land, which comes at a high opportunity cost. This is space and money that could be used for other purposes, including for housing, community spaces, and business activities. The total economic cost of providing and operating car parking spaces in Aotearoa New Zealand is $3,700 per car, each year[22].

A dedicated bus lane with frequent buses can move **more than 5-10 times as many people** per hour than a lane with single-occupancy cars. Put another way, **one dedicated bus lane can move the same number of people as up to ten lanes of car traffic**.

An on-street rapid transit line (e.g. light rail) can **move up to 40 times as many people** per hour than a lane with single-occupancy cars.

People need a range of good transport options for cities to function well

Recent changes to the planning system have emphasised the importance of creating well-functioning urban environments that enable people to access housing, jobs, community services, and open spaces – including by public and active transport modes.[23] These changes are also enabling much more residential development and intensification in major urban areas compared to the past.[24]

To support these changes, the transport system needs to ensure that people have a range of safe, reliable, and convenient transport options to choose from. While most travel in our cities is currently done by car, space constraints mean it will not be feasible for the same proportion of urban trips to be made by car in the future while maintaining reliable journey times and improving access between places. This is because cars take up a large amount of road space both when they are moving and when they are parked or stored. In comparison, public transport, walking, and cycling are space-efficient travel modes. As Figure 4 highlights, these modes enable many more people to travel through urban areas than cars do.

Figure 4:How many people can move through a road corridor per hour by different travel modes?
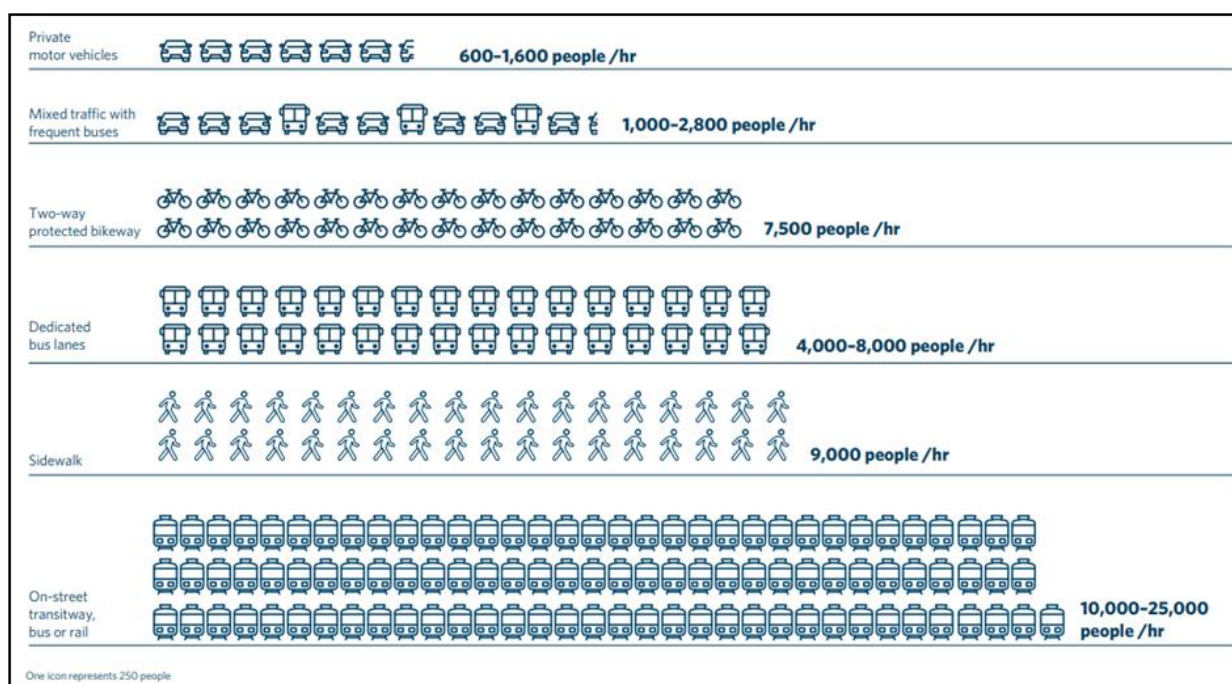
Roading infrastructure and travel by private car will remain important in our largest cities. However, investing in other modes like dedicated bus lanes and rapid transit is key to enabling more people and goods to move around in the limited space that we have, and ensure that the capacity of our transport system doesn't become a constraint on economic activity or access to opportunity.

Reducing the need to travel by car is vital for tackling climate change

The climate emergency has added extra weight and urgency to the need to transform transport in our cities. Aotearoa New Zealand is already experiencing the damaging impacts of climate change on the transport system and more broadly on the built environment, and impacts will get worse unless greenhouse gas emissions are rapidly reduced.

The Climate Change Response (Zero Carbon) Amendment Act commits New Zealand to deliver net zero emissions of all greenhouse gas emissions (other than biogenic methane) by 2050. Transport, particularly land transport, is the second largest source of greenhouse gas emission in New Zealand and the fastest growing source of domestic emissions.
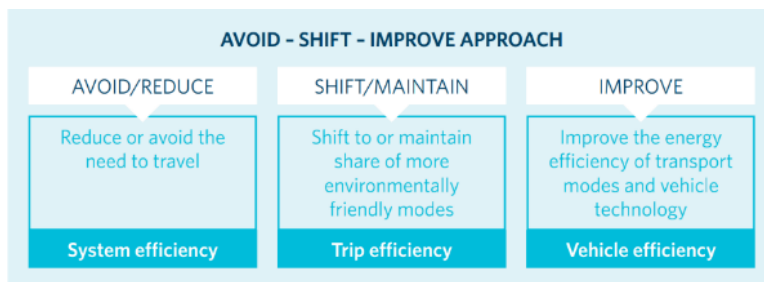
The current Emissions Reduction Plan[25] seeks to reduce emissions from transport by 41 percent by 2035, including through improved urban form and providing lower emission travel options, particularly in our largest cities[26].

Reducing emissions

Aotearoa New Zealand needs to reduce transport emissions by **41 percent by 2035** to meet our climate commitments. 65 percent of transport greenhouse gas emissions come from cars.

The Avoid – Shift – Improve framework outlines the key opportunities to reduce transport emissions.

AVOID - SHIFT - IMPROVE APPROACH

AVOID/REDUCE	SHIFT/MAINTAIN	IMPROVE
Reduce or avoid the need to travel	Shift to or maintain share of more environmentally friendly modes	Improve the energy efficiency of transport modes and vehicle technology
System efficiency	**Trip efficiency**	**Vehicle efficiency**

AVOID/REDUCE interventions aim to avoid or reduce the need to travel, or the time or distance travelled by car while improving accessibility, for example through integrated land use and transport planning for urban form that enables

more things to be accessed locally, and supports well-connected multi-modal access to wider services and employment. This is critical for long term emission reductions at a system level; and brings many other transport, public health and environmental benefits.

SHIFT/MAINTAIN focuses on shifting people who need to travel from cars to more energy efficient modes such as public transport and active or shared modes. One way to achieve this is through better provision of low carbon travel options and incentives to choose them.

IMPROVE focuses on improving the energy efficiency of motorized vehicles (through fuel standards or EV uptake) and optimisation of transport networks for more efficient vehicle movement.

Over time, successive governments are likely to place different levels of emphasis on different parts of the A -S- I framework.

The Emissions Trading Scheme (ETS) is a key tool for reducing New Zealand's net emissions. The ETS will provide a critical price mechanism across the economy, delivering sustained increases in the price of carbon over time to deliver emissions reductions. For transport, the ETS will mean that fossil fuels (petrol and diesel) will become a lot more expensive over time.

Integrated urban transport needs to contribute to the reduction of emissions through improving lower emission travel options and reducing the length of trips. This will be especially important in supporting affordable, equitable access to the transport system.

Making it easier for people to get around without a car will reduce the financial burden of transport

While cars provide people with many benefits, owning and maintaining a vehicle is expensive. These costs include purchase, servicing, repairs, insurance, registration, and fuel. Often people go into debt to purchase a vehicle and may face high financing costs.

On average, about 14 percent of household costs are transport costs, but for low-income households, the figure is 28 percent.[i][27] Low-income households also often live in areas that are not well connected by public transport, and that are further away from amenities, places of work, and essential services.

Improving options for people to access places by public transport and active modes will give households more opportunities to travel by lower cost modes. This will reduce the need for households to own so many cars. In 2015, it was estimated that households using one fewer car could save on average $9,000 every year.[28] Inland Revenue estimates the cost of operating a vehicle to be $14,560 annually (based on driving 14,000km per year).[29] Providing travel choice and reducing trip length will be critical in supporting low-income households as costs increase.

Providing households with lower cost transport options means more people will have more discretionary income to spend, contributing to vibrant communities and a more productive economy.

Improving transport options will contribute to a fairer society

Our cities should be places where everyone can safely and conveniently reach the people and places that are important to them. Making places more walkable and bikeable, and improving public transport services, will benefit many groups that are currently disadvantaged in our transport system.

The high levels of motor vehicle dependence in our urban centres means access to opportunities can also be limited for those that are unable, or choose not to drive due to physical impairment, age or cost barriers. Surveys undertaken since 2021 indicate that approximately one in ten New Zealanders are unable to undertake a beneficial journey in any given week because of cost, time pressure, and/or a lack of transport choice, with younger people, low-income households and Pacific peoples more likely to miss journeys[30].

About a quarter of our population identify as disabled, and many have physical or vision impairments that prevent them from driving.[31]

Making footpaths, cycling networks, and public transport services more accessible for disabled people – as well as providing access to mobility services and parking – will support their wellbeing. Many people experience disabilities as they get older, so these improvements will also help to deliver on the government's strategy for an ageing population.[32]

Enabling young people to get around without needing someone to drive them will give young people more autonomy. It will also reduce the amount of driving that their caregivers do. Young New Zealanders strongly support better options for travelling by foot, bike, and public transport, including travel to and from school.[33]

There are also inequities in access to transport for Māori, for women, for the LGBTTQI+ community, and for ethnic minority groups.[34] These inequities can be reduced by ensuring transport options are inclusive for people in these groups.

How integrated urban transport can help benefit Māori

Compared to other groups, Māori do not have equal access to transport and are more likely to experience transport-related social exclusion.[35] Lack of transport access can make other inequities worse.

Many Māori live and work in areas that are not well served by public transport and are potentially missing out on important trips for shopping, social contact, sports, exercise, education, and medical appointments. In 2020–2021:

- 5.5% of Māori could not visit a general practitioner because they did not have transport, compared to 2.4% of all New Zealanders.

- 1.7% of Māori could not access after-hours healthcare, compared to 0.7% of all New Zealanders.[36]

Similarly, cultural events, marae and other sites of importance to Māori often require long trips, with little choice but to take a car.

Māori have lower incomes on average and are more likely to have a disability at younger ages than other ethnicities.[37] Both of these factors affect access to the transport system. Māori are

more likely to be unable to afford or drive a vehicle, or experience 'forced car ownership', where a low-income household must have a vehicle and a high proportion of their income must go towards maintenance and upkeep.[38]

Supporting Māori participation in the planning of our cities and transport systems is critical to ensure actions do not worsen existing inequities, and support changes that can improve health and well-being for Māori.

Improving options for people to get around by foot, bike and public transport will reduce transport related harms

Aotearoa New Zealand has far higher rates of death and injury on our roads than most other developed countries.[39] We need to move to a safe system which recognises that crashes are inevitable but deaths and serious injuries are not. This requires roads that are more forgiving of the mistakes that people make. Everyone, whether they are walking, cycling, driving, motorcycling, or taking public transport, should be able to get to where they are going safely.

People who walk and cycle are currently over-represented in death and serious injury statistics compared to people travelling by car. 248 people died from collisions with vehicles while walking or cycling between 2016 and 2022, with at least another 2,550 seriously injured. Safe cycling and micro-mobility networks are needed in all our cities, along with safety improvements to footpaths and intersections.

Public transport is the safest mode of transport in Aotearoa New Zealand, so road safety can also be increased by shifting more trips from cars to buses, trains, and ferries.[40]

The health and air pollution in New Zealand 2016 (HAPINZ 3.0) study[41] estimated that anthropogenic (human-made) air pollution in New Zealand was responsible for approximately 3,300 premature deaths per year, with an associated social cost of $15.6 billion per year. Motor vehicles, particularly diesel vehicles, are a major, and growing, source of air pollution, contributing 100% of the costs of nitrogen dioxide (NO2) exposure ($9.5 billion) and 17% of the costs of particulate matter (PM2.5)

pollution. The impacts of air pollution tend to be greater in urban areas due to the increased concentration of vehicles and greater numbers of people living near pollution sources.

Providing people with better opportunities to get around by foot and bike will boost health outcomes

The quality of the urban environment has major impacts on people's health.[42] Improving opportunities for people to walk and cycle around urban areas will enable more people to incorporate physical activity into their daily lives.

This is important because fewer than half of New Zealand's population currently meets physical activity guidelines.[43] On average, New Zealanders walk for less than one hour per week. 41 percent of children and young people do not get enough physical activity.[44]

Lack of physical activity is a major risk factor for heart disease, type 2 diabetes, some cancers, and osteoarthritis.[45] Partly due to low rates of physical activity, Aotearoa New Zealand has the third-highest adult obesity rate in the Organisation for Economic Co-operation and Development (OECD).[46]

Regular physical activity on most days of the week can improve mood and decrease anxiety and stress. People who regularly walk or cycle to work enjoy their commutes more, and are less likely to take sick leave, than those who travel by car.[47] The risk of cancer is 25 percent less for people who cycle to work instead of drive.[48]

Section three: key considerations in delivering integrated urban transport

Successfully delivering integrated urban transport will require shifts in how we currently plan land use and transport in Aotearoa New Zealand. In working with others to help plan and deliver well-functioning urban environments, NZTA will be guided by the following key considerations when delivering actions it is responsible for:

Te Tiriti o Waitangi underpins our approach

Government has an obligation to uphold Te Tiriti o Waitangi. Our current transport system does not meet the needs of many Māori and is inequitable.[49]

Working alongside local government and within existing relationships, NZTA aims to understand Māori needs and aspirations for transport within their communities and identify opportunities to partner to deliver outcomes.

We will collaborate across sectors and agencies

Many agencies in the transport and planning systems, across central and local government, have a role to play in creating better cities for people. Approaches to delivering integrated urban transport also need to support broader aspirations for urban development, such as increasing housing supply and improving affordability.

NZTA will work to align actions across central and local government, Māori, communities and the private sector to deliver positive outcomes when undertaking its mahi.

We need to plan for transport infrastructure differently

Historically, transport planning has taken a 'predict and provide' approach. This involves predicting future transport demand based on past trends and assumes that these trends will continue into the future. However, events such as the COVID pandemic and the emergence of new, potentially disruptive technology, highlights the increasing uncertainty regarding what the future has in store. In an increasingly uncertain world, future demand cannot be predicted with much confidence. As a result we need to shift to a new way of planning.

A new approach, sometimes known as 'vision and validate', or 'decide and provide' involves clearly outlining the preferred future we are seeking to achieve, then consistently making decisions that take us towards this this future.[50] The approach is also designed to accommodate uncertainty by using 'scenario planning' to test a range of plausible potential futures. Scenario testing is critical so that we can confidently invest in solutions that deliver value in a variety of possible futures, rather than solutions that are strongly dependent on one particular future.

Overcoming Strategic Transport System Challenges

A new way of planning

Key attributes of the new approach are:

1. Determine a preferred future.

2. Develop a series of plausible scenarios that help expose future uncertainties.

3. Identify and prioritise options for helping move towards the preferred future.

4. Test how those options perform in each of the plausible scenarios – are they effective in all scenarios (resilience) or are they ineffective (or less effective) in some scenarios (risk)?

5. Compose a strategy to move towards the preferred future that accounts for the uncertainty that has been explored.

The land transport system has at least 3 key transport challenges at a system level, that impact on how effectively it is able to contribute to delivery of an integrated land use and transport system. In summary these are:

- **A complex investment system** – with multiple decision makers across central and local government, short-term and politically driven focus and many funding sources that

are not always aligned to integrated urban outcomes.

- **Declining system performance** – with many metrics showing worsening performance despite significant investment, and a growing set of public and government expectations.
- **Growing affordability gap** – with increasingly complex and high-cost solutions alongside insufficient cost-recovery and funding / finance tools to support growth infrastructure in the medium and long-term.

These issues have arisen over many decades and across multiple political and funding cycles, with a range of tools (from partnerships to targeted investment funds) established to resolve them. Although a silver bullet solution does not exist, evidence indicates that work to improve integration between spatial planning and transport planning is one of the elements that can be most effective. This might include:

- Coordinating with partners at both local and central government levels in the development, aggregation and prioritisation of growth priorities that meet economic and social objectives across transport and other sectors, in turn providing a sharper focus on whole-of-life costs both capital and operational expenditure,) and understanding how proposed transport investment can 17optimize benefits and build certainty that those benefits will arise.
- Developing and maintaining a trusted spatial evidence base to support investment options and decisions that provides transparent information about the investment required to improve performance of the transport system related to growth.

Historically, inconsistent approaches to the integration of urban planning and transport investment have meant opportunities are missed to better align services and infrastructure with growth patterns, risking under-utilisation of new infrastructure or over-burdening of the existing transport system.

## Plan to ensure we are efficient and effective

We need to support the shift to a 'decide and provide' approach by planning and delivering transport in a way that is efficient and effective. This means using a strong evidence base to understand where the greatest need is and applying the intervention hierarchy when

generating and considering alternatives and options. The intervention hierarchy is used to help drive value for money by promoting lower-cost, high-impact solutions ahead of more costly physical infrastructure. While the intervention hierarchy promotes integrated planning, demand management and optimisation of the existing system, there will be times when new infrastructure, including lead infrastructure, is required to advance progress on long term outcomes. Lead infrastructure refers to infrastructure that needs to be developed in advance, in order to shape future urban form patterns, support urban intensification, or enable the development of future urban areas.

Where an agreed urban growth strategy identifies the need for significant new infrastructure, confirming the preferred alignment and securing route protection early can deliver a range of benefits including:

- lower land purchase costs
- signalling support for delivery of the growth strategy
- providing certainty for development in areas adjacent to the route.

Figure 5:Intervention hierarchy
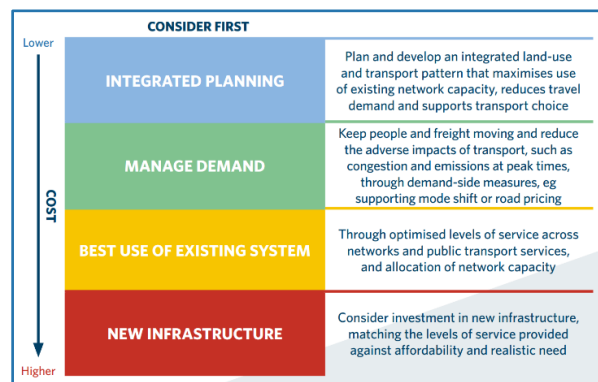
We will tailor approaches to different places

There is tremendous diversity in Aotearoa New Zealand, across different regions, cities, and neighbourhoods. Every place has its own qualities, communities, and environment. Travel by different modes already differs significantly between, and within, cities. This means that there will never be a one-size-fits-all approach.

Despite these differences, many places share characteristics such as dispersed urban development patterns and a lack of real transport options. Similar approaches can be used in many places to improve transport integration.

We will reduce inequities, not reinforce them

Integrated urban transport provides the opportunity to improve accessibility for those that currently experience transport disadvantage [ii] or transport poverty [iii]. We need to ensure that changes to our urban transport systems make

people better off, rather than reinforcing existing inequities. Not every single change must directly improve equity, but the full package of decisions and initiatives must result in a more equitable transport system overall.

This is particularly important given the actions that will be required to meet our climate commitments. The ERP emphasises the need for an equitable transition to a low-emissions society and economy.[iv] As the impact of the ETS grows over time, prices of fossil fuels will rise significantly. This will place an increasing burden on households that are highly reliant on travel by private vehicle, particularly lower income households, and this will need to be managed.

It is also important to recognise that some people are highly reliant on private vehicles and cannot use other modes, including people with a physical disability. In some cases, it will be important to improve access by car for these groups while reducing car use overall.

Section four: delivering integrated urban transport

This section explains what it will take to deliver integrated urban transport to support well-functioning urban environments and economic prosperity. It outlines a practical pathway to transformative change, sets out four big shifts that are needed to deliver integrated urban transport and provides an intervention framework outlining where effort needs to be focused to achieve the shifts.

A practical pathway towards integrated urban transport

Delivering more integrated urban transport will take time and require coordinated delivery of multiple, inter-linked initiatives. NZTA has designed a practical pathway to guide us central government, local authorities, and others on the actions they can take to support integrated urban transport.

Each of our largest cities is at a different stage in terms of urban form, growth plans, network performance, the quality and reach of active and shared transport networks, and current mode shares. Each urban area has its own challenges and opportunities that determine how quickly some things can be delivered. Sector capability and capacity, funding and social licence for change will also influence the nature and timing of interventions. There is no single pathway to success. Future planning will reflect the unique attributes of each place, including existing urban form, transport networks and services, trip patterns, forecast levels of growth, topography, demographics, and local economic drivers.

Central and local government will need to work in partnership with iwi, communities, and businesses, to confirm the preferred future for each of our largest cities, and design, develop and implement a pathway to

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[ii] *Transport disadvantage refers to disadvantage caused by a lack of transport options, for example not owning a car or not living near reliable public transport.*
[iii] *Transport poverty refers to poverty induced by people paying more than they can afford for their mobility, for example taking out a high*

interest loan to repair a car or spending a high proportion of their income on petrol, bus fares or other travel costs.
[iv] *This is outlined in Chapter 3 of the ERP, including international agreements and declarations that New Zealand has committed to for an equitable transition.*

get there. Action will be needed by all parties to achieve the transformational changes likely to be required to address existing transport challenges, provide for future growth and move towards the preferred future. The potential scale of change makes it important to know where to focus efforts first while also setting up for long-term success. The practical pathway towards transformation has three broad stages, summarised below.

One: Quick wins & laying the groundwork	Two: Accelerating progress	Three: Transformational change

One: Quick wins and laying the groundwork

This focuses on getting the basics right, demonstrating change is possible, and getting some early low-cost initiatives in place such as re-prioritising road space for dedicated bus lanes, cycle networks and pedestrian improvements, to support economic prosperity and the efficient movement of people and goods. This stage needs to include a significant early focus on confirming the preferred future for each urban area and ensuring land use plans, development strategies, policies and other system settings are in place to set ourselves up for long-term success.

Two: Accelerating progress

This builds on the solid foundations of the previous stage, with a strong focus on maximising the value of existing infrastructure and services, increasing system efficiency and providing people with better quality travel options. More people are enabled to change the way they travel, resulting in the network effect, where the use of public transport and active modes increases in response to more places being easy and safe to access by those modes.

Three: Transformational change

At this point a much wider range of initiatives come together to help achieve integrated urban transport and support economic prosperity. The network effect grows as various networks become more joined up, enabling seamless, multi-modal

journeys. With far better travel options now available, it's feasible to take steps to manage vehicle travel to a greater extent.

While the graphic above implies that the stages in the pathway are sequential, the reality is more complex. There will be some overlap between the stages, both spatially and temporally, within and between different urban areas. Similarly, in any given urban area, different intervention categories may be applied at different points on the pathway.

Progression through the stages does not always need to be linear. For example, in new developments or urban expansion into greenfield areas it may be possible to jump straight to stage three.

While the practical pathway emphasises the need to build towards transformational change, some interventions will be required that continue through all stages of the process. These include:

- building and maintaining social license for the proposed changes
- sustainable funding to provide certainty for long-term planning
- measuring, monitoring and reporting on progress
- travel behaviour change approach embedded into business as usual for all activities
- continue to identify opportunities to apply technology and innovation to increase efficiency and effectiveness.

Four big shifts

Four big shifts are needed to make it easier for people to choose from a wider range of transport options, reduce congestion, and support well-functioning and economically prosperous urban areas. While the shifts are focused on the movement of people, any improvements in the efficiency and effectiveness of urban networks will also benefit the movement of freight and other trips that support economic activity. Elements of the shifts are already underway in our main urban areas, but they will need to be expanded and accelerated to address existing system deficiencies, provide for future growth and support successful urban areas into the future. The four shifts are summarised in the table below, followed by a focus on each shift and key considerations.

Shift Required	Why this is important
1. Shape urban form to reduce pressure on the transport system	Many urban areas have been planned and built in ways that require people to travel relatively long distances to access their everyday needs, mostly by car. Far-apart destinations are slow or difficult for people to easily reach by foot, bike, and other active travel modes. Frequent public transport services are often unviable when they serve large areas with low population density. Forecast growth will place increasing pressure on road capacity if travel by private vehicle remains the only viable option for many, resulting in growing congestion and longer, less reliable travel times.
2. Maximise the value and efficiency of existing infrastructure and services	As our cities grow, the number of trips increases, placing pressure on networks, ultimately resulting in congestion. Space in our cities is scarce and valuable. Widening existing corridors and building new ones is difficult, disruptive and expensive, and often only delivers temporary relief as induced demand results in increased trips over time. In most situations a more efficient, sustainable and cost-effective option is to find ways to move more people and more goods along the corridors we already have.
3. Improve travel options and motivate people to travel differently	Providing travel options is critical to enabling the efficient, effective and equitable movement of people and goods around our cities. Previous transport planning and investments have prioritised the movement of cars through urban areas, instead of ensuring that people and goods can get around easily by multiple modes. As a result, travel by public transport, walking or cycling has become less attractive and convenient than travelling by car for many people. It is important to improve the quality and performance of shared and active modes to improve safety, accessibility, equity, and public health. People are highly accustomed to travelling by car, often on their own, and many of the full costs of travelling by car are not reflected in the prices that people pay. Effective community and employer engagement, and initiatives such as pricing tools, can encourage people to make different travel choices.
4. Manage the transport system to reduce its harms	Our transport system should enable people and goods to move around our cities safely. Unfortunately, around 1200-1300 people are killed or seriously injured each year while traveling in our main urban areas. Over time our urban networks need to align with the Safe System approach that would enable a more forgiving transport system that protects people from death and serious injury when crashes occur. A Safe System is created when system designers design and manage a transport system with safe speeds and infrastructure, and there are safe vehicles and users. The transport system also generates a range of harms that impact beyond the system itself. Harmful emissions from vehicles are a major contributor to premature deaths and hospitalisations for respiratory and cardiac illnesses. Land transport can also generate other harms in urban centres, including excessive noise and vibration. Transport is also New Zealand's second largest source of GHG emissions. Reducing emissions from land transport will be critical to meeting New Zealand climate change commitments.

Shift one: Shape urban form to reduce pressure on the transport system

Shift one is about creating places where people can access most of their daily needs, such as shops, schools, cultural and community facilities, green spaces and health services by a short, 20-minute walk or bike ride. These are places where people also have good options to access urban areas further afield, including by public transport. This approach has been labelled 'living well locally' or the '20-minute city'.[51]

Land use planning in Aotearoa New Zealand has, from the 1950s until very recently, encouraged low-density urban expansion that results in longer trip distances and people relying on their car to access their everyday needs. As a result, travelling by car is often the only viable option to access places spread across large areas.

To improve access, reduce congestion and support the efficient movement of people and goods, land use planning needs to prioritise medium to high density, mixed-use urban developments that are well-connected by public transport and active modes. Land use planning in Aotearoa New Zealand has recently shifted in this direction. However, more needs to be done to strengthen this shift.

Key considerations for making this shift

Urban form takes a long time to change but has a major impact on how far people need to travel, the transport options they have, and traffic volumes. We are living with the legacy of past land use decisions, which will continue to have an impact.

This shift is crucial to maximise the value from existing infrastructure and services, support well-functioning urban environments and economic prosperity, and get us on the path to net-zero emissions by 2050.

Land use planners, transport planners, housing and urban development agencies, education and health agencies, road controlling authorities, and economic development entities will need to work closely together to achieve this shift. For example, plans for new housing and social infrastructure such as schools and hospitals, need to be integrated with plans and funding to improve transport options. Similarly transport initiatives need to be aligned with government's broader objectives for urban development, including significantly increasing housing supply, improving economic productivity and delivering better health, education and infrastructure.

Transport has a key role to play in supporting urban growth and development. Important considerations include how transport can support a greater mix of land uses, how growth can be encouraged in areas with good travel options, and how development planning can ensure that future growth areas are provided with a mix of land uses and good travel options from the outset.

Spatial planning plays an important role in shaping urban form by setting out, at a whole of city or regional scale, how land, infrastructure and other resources will be used and integrated to promote wellbeing, and shape funding decisions.

The ongoing development of joint spatial plans and urban programmes, including through the Urban Growth Partnerships, provides the opportunity to align the spatial plans and joint work programmes to deliver priority transport outcomes, while continuing to meet other housing and urban development objectives. This involves:

- considering the sequencing of growth initiatives
- focusing investment to maximise outcomes (such as putting greater focus on mixed-use development in locations with good options for travelling by public transport and active modes)
- accelerating the delivery of agreed transport projects
- adding further activities that substantially improve transport options and motivate people to travel differently
- and ensuring critical supporting actions such as enabling congestion pricing are carried out.

Shift two: Maximise the value and efficiency of existing infrastructure and services

With the space constraints in our urban centres and the high cost of expanding existing corridors, we will increasingly need to use existing corridors more efficiently in order to accommodate future growth. Interventions to optimise networks are often more cost effective than infrastructure upgrades, and can deliver additional cost savings by delaying or removing the need to invest in additional infrastructure capacity.

There are two key opportunities to increase the value and efficiency of existing infrastructure and services:

- Actively managing networks to enable the most efficient movement of people and goods. This can include:
  - intersection priority, kerb-space and parking management by place and time of day
  - the use of traffic operating centres to monitor and respond to events on the network
  - emerging technologies combining vehicle connectivity, mobile networks, smart infrastructure and machine learning provide scope for significant improvements in this area.
- Repurpose road space to support more efficient modes:
  - high occupancy vehicle lanes
  - dedicated bus lanes
  - cycle lanes.

Key considerations for making this shift

Making the most of existing street space

One of the quickest and cheapest ways to increase network productivity is by changing the current configuration of streets and roads. For example, some street space that is currently used for parking cars can be repurposed to create dedicated bus lanes or high-occupancy vehicle lanes. If existing road lanes are managed to give priority to buses, high-occupancy vehicles, cyclists or freight vehicles, as appropriate, this enables more people and goods to move more quickly.

In town centres and residential areas objects such as bollards and planter boxes can also be used to quickly create and trial low-traffic areas that are often highly valued by residents and can support business activity.[52]

Widespread reallocation of street space will be needed to optimise existing networks and rapidly improve transport options. While councils have been growing their toolkit and capability in making street changes, experience to date has shown that building public support and political commitment is critical for making these changes at pace and scale. Ongoing work will be needed to build support for adapting and repurposing streets as part of the delivery of integrated urban transport systems.

Tools such as the One Network Framework[53] can help identify the role and function of different corridors within urban networks, including the balance of movement (the role of streets in enabling the movement of people and goods) and place (the role of streets as places for people to live, work and enjoy) in different areas. This can support network optimisation by efficiently allocating road space between modes and enabling high value trips to be prioritised along certain corridors or at certain times of day. The Future Network Planning Process[54] also enables consideration of how the existing form and function of a corridor may need to change over time to support a city's 'preferred future'.

New technologies provide scope to further optimise network efficiency and improve trip reliability

Urban transport systems are complex and challenging to manage to maintain efficient travel. The impact of events such as crashes or severe weather, can quickly spread across the network, creating gridlock and reducing trip reliability. Emerging technologies provide scope to help manage urban network more effectively, enabling real time responses to disruptive events and keeping more trips flowing smoothly, more of the time. These include:

- An increasingly connected transport system using wireless networks to connect vehicles, software systems and road infrastructure to better operate intersections, optimise travel speeds, provide safer journeys and minimise delays.

- Improvements in computing power and machine learning will enable the collection, analysis and sharing of data in real time to detect congestion, reroute traffic, calculate distances to destinations and up-date dynamic road signs. These connected networks can optimise network efficiency, minimise congestion, enhance road safety and help ensure smooth traffic flows.

- Provision of real time information to enable system users to make efficient travel choices.

- Managing networks and kerb space in activity centres to support more efficient trips and reduce time spent circulating looking for a place to park.

- Automated pricing mechanisms to enable seamless collection of payments and adjust prices (such as time of use charging) to reflect network demand.

Shift three: Improve travel options and motivate people to travel differently

In combination with reshaping our cities and optimising the value of existing infrastructure and services, we need to improve the travel options people have available to them. Providing safe and attractive travel options will enable people to travel in the way that best meets their needs and circumstances, increasing access to opportunities and supporting a more efficient transport system. Moving trips to other modes frees up road space providing faster, more reliable trips for freight and for those that choose or need to drive.

We need to rapidly improve walking, cycling, and micro-mobility networks and significantly improve the quality, reliability, reach and performance of public transport services. We also need to improve other options for ridesharing (like car-pooling, shared shuttles) and micro-mobility devices such as e-scooters.

This will involve making more efficient use of existing infrastructure (for example, through repurposing road space), investing in new infrastructure and services, and providing better connections between modes.

Providing people with better options to travel by shared and active modes will not automatically mean that people will use these modes. People also need to be aware of their options and feel motivated to try something new.

Techniques to motivate people can include community engagement, education, and promotions. They can also include economic instruments, such as pricing tools, that incentivise or disincentivise different travel choices. Motivational techniques are often most effective when implemented alongside infrastructure or service improvements, for example, cycle skills training in partnership with new cycle networks near schools.

Key considerations for making this shift

Focus on all types of trips, not just commuting to and from work

Previous efforts to encourage transport mode shift have primarily focused on peak travel periods and commuting for work. However, as Figure 2 in Section 2 highlighted, people travel around urban areas for a wide variety of purposes. The three most common trip types are for 'shopping, medical, and personal business' (32 percent of trips), work (26 percent of trips), and for social visits (17 percent of trips).[55] These activities are often dispersed across urban areas.

Integrated walking, cycling, and public transport networks are needed to maximise the value of investment

Integrated planning and operation of networks are required to ensure we maximise the value of investment. Without integration there is a risk that networks will duplicate functions (such as bus and rail networks delivering similar services), or gaps within networks will put people off using them (for example people avoiding cycling due to gaps in the safe cycling networks)

Integrated networks are also required to maximise the reach of each mode. While most urban areas are relatively easy to access by car, this is not the case for getting around by foot, bike, micro-mobility devices, and public transport. People need to be able to travel easily between these modes in convenient ways. For example, every public transport journey starts and ends with walking or another form of active travel, so pedestrian facilities around public transport stops and stations need to be safe and attractive for

walking at all times of day. Cycling paths and routes need to be connected in dense networks so that people can complete safe journeys by bike. People also need to be able to transfer easily between public transport services and different modes, including other forms of shared mobility.

Delivering and integrating networks will generate the 'network effect', where the use of public transport and active modes increases in response to more places being easy and safe to access by those modes.

> **Accelerating cycling**
>
> Less than **20% of cycling networks** in our main urban areas have been completed. At current rates of delivery, it will be over **150 years** before networks are sufficiently connected to get people where they need to go.
>
> To complete connected networks in the next decade will require nationwide acceleration of quick build programmes that can be constructed up to **90% faster** than permanent built networks.
>
> *Stats taken from National Cycling Action Plan*

Public transport services need to become much more reliable, convenient, and frequent

To provide a viable alternative to travel by private vehicle, public transport networks need to offer people reliable, timely and convenient trips. International best practice indicates that for public transport networks to support significant mode share (up to 30 percent of trips in areas served by public transport), they need to deliver three key components:

- service frequencies of at least every 15 minutes

- travel times no more than 1.5 times the time taken to travel by private vehicle.

- transfers that are quick, safe and convenient.

At present, the percentage of people in our Tier 1 urban areas that live within a 500m walk of a frequent public transport network (with service frequency of at least every 15 minutes) ranges from 5 to 43 percent, while average public transport travel times range from 2.1 to 3.4 times

the time taken by private vehicle[56]. Combined approaches are needed to make trips by public transport faster and more reliable, including dedicated bus lanes, prioritising buses at intersections, more frequent services, and integrated ticketing.

Rapid transit networks are key for delivering step-change improvements in public transport services in our largest cities but will take decades to fully develop

Rapid transit will form an integral part of public transport systems in our largest cities, delivering fast, frequent, reliable, and high-capacity public transport services to key centres and destinations on dedicated corridors. They will also provide a backbone for large-scale urban developments.

Rapid transit projects are large and complex initiatives that take years to plan, design, and build. They also need to be well-integrated within denser, mixed-use centres and with supportive land use changes to deliver transit-oriented development. In most instances rapid transit networks will be developed in stages, spread over decades.

Over the next decade, several major rapid transit projects currently underway will be completed (City Rail Link and Eastern Busway in Auckland, and rail upgrades in Wellington).

Additional improvements need to be carefully sequenced over time, not only in terms of which transit corridors are developed first, but also in the ways rapid transit can be delivered progressively through successive smaller-scale improvements. We expect that in most areas the first stage will be relatively low-cost solutions like bus priority on strategic corridors to enable improved public transport travel times and reliability, accompanied by improvements in service frequency. This can be followed by the development of dedicated public transport corridors that incrementally evolve over time.

Need to bring communities on the journey

Effective community engagement needs to be an early priority and integrated with other interventions, to build and maintain the social mandate for change. Communities need to be well informed about why the existing system is problematic, how the issues can be resolved and

why the proposed interventions will create positive results. Measuring and communicating positive changes, and the impacts of interventions is key to maintaining public buy-in to system changes.

Communications techniques such as *Narratives for change* [57] and engagement tools such as *deliberative democracy* [58] forums can be used to support effective community engagement.

Economic tools need to be integrated with other interventions

Previous modelling and research by the Ministry of Transport and NZTA has highlighted the importance of including pricing tools such as road pricing or congestion charging in packages to reduce congestion, shape behaviours and make more efficient use of existing infrastructure and services.[59]

Use of pricing tools needs to be managed in a way that considers equitable outcomes. Charges based on geographic scope and time-of-day can be useful in this regard. Revenue from pricing scheme can also be spent on improving the quality and affordability of alternate transport options.

The role of pricing tools and financial incentives

Pricing tools, when combined with other initiatives to improve transport options, are an important part of the mix to manage network use and reduce congestion. Local authorities already use some transport pricing tools (such as parking pricing), within a framework set by central government. Central government also uses tools such as distance-based pricing (for example Road User Charges), fuel levies, and road tolls in some locations.

Pricing tools can be used for different objectives. Sometimes they are primarily used for managing traffic (for example congestion pricing). In other cases, they are primarily used to generate revenue to maintain and improve the transport system (for instance fuel levies). In many cases, pricing tools have multiple objectives. For example, revenue gained from congestion pricing can help to fund transport improvements. International experience shows that pricing tools are most likely to be effective and well supported by the public when revenue

is invested in improvements that communities can experience directly, such as better public transport services and street improvements.

Further pricing tools, and smarter use of existing ones, will be needed to effectively reduce congestion. The Government made commitments to enable congestion charging and to investigate other pricing and demand management tools (ERP Action 10.1.3). This is being done alongside a review on the future of the transport revenue system. Some local authorities have also been considering the use of workplace parking levies (a charge on off-street car parks provided by employers).

Broader financial incentives can also influence changes. For example, in 2023 the Government removed fringe benefit tax for employer-subsidised public transport, electric bikes, and scooters to support more travel by these modes.

Shift four: Manage the transport system to reduce its harms

While transport provides many valuable benefits to communities, it can also cause harms to people and the environment, including through death and serious injuries resulting from crashes, and negative health impacts from restricted physical activity, harmful emissions and noise pollution.

People should be able to feel safe and travel safely around our cities. Yet, on average, one person is killed every day on New Zealand roads (including roads, streets, footpaths, cycleways, bus lanes and state highways) and another is injured every hour. Between 2019-2023, road crashes in our largest cities[60] resulted in approximately 1,245 deaths and serious injuries (annual average) at a social cost of nearly $4.0 billion per year[61]. In our Tier 1 urban centres, vulnerable users (pedestrians and people on bicycles, scooters etc) are over-represented in these crashes. The ripple effect of these tragedies on families, survivors, and local communities, as well as the economy and health system is massive and unacceptable.

Surveys indicate that perceived safety risk is also a barrier to greater uptake of walking and cycling, so

improving system safety is critical to support improved travel options in our urban centres.

To make New Zealand's roads and streets safe for everyone, we are guided by the Safe System approach. This recognises that people make mistakes and are vulnerable in a crash, and seeks to create a more forgiving road transport system that protects people from death and serious injuries when they crash.

The safety of our roads and streets is a critical part of ensuring urban transport systems deliver on their various roles. A safe urban land transport system not only prevents needless deaths and serious injuries, but also supports economic activity through reduced disruption to transport networks and can help improve lives and lifestyles too.

Recent studies have highlighted links between a car-dominated transport system and negative health effects associated with restricted physical activity (including high and growing level of obesity, heart disease and diabetes)[62], and the connection between transport environments, social connectedness and mental health[63].

Transport is responsible for two thirds of the harm estimated to be caused by human-made air pollution in New Zealand[64]. Despite improvements to vehicle efficiency over recent decades, health and social costs have increased due to growth in vehicle numbers (particularly diesel vehicles) and total kilometres travelled, combined with an increase in the number of people exposed to air pollution.

The health and air pollution in New Zealand 2016 (HAPINZ 3.0)[65] report estimates that annual transport-related air pollution harms from NO_2 and $PM_{2.5}$ in 2016 included 2,250 premature deaths and over 9,300 hospitalisations from cardiovascular and respiratory illnesses.[66] The social costs of these harms are estimated to be over $10 billion annually. Approximately two thirds of these harms occur in our five largest urban centres.

Reducing vehicle emissions is also critical to supporting New Zealand's commitment to reach net zero emissions by 2050. Transport, primarily land transport, is the second largest source of greenhouse gas emissions in New Zealand and the fastest growing source of domestic emissions. System wide changes, drawing from across the Avoid – Shift – Improve framework are needed to put our urban transport systems on the trajectory to a low emissions future, and it will take time to see the results of interventions. Reshaping our cities to reduce the need to travel long distances, improving travel options to support lower emission modes, and improving the efficiency of the vehicle fleet are all critical if New Zealand is to meet its climate commitments.

Reducing emissions from the land transport system will lead to a healthier and fairer transport system, improved freight efficiency and better road safety outcomes.

Key considerations for making this shift

Reducing road related trauma

Delivering safe urban journeys requires the design and management of our urban networks to be aligned with the Safe System approach, particularly designing for human vulnerability (one of the four Safe System principles). In providing for our most vulnerable road users, including children and people with limited mobility, we can deliver an urban transport system that is safer and more accessible for everyone.

Delivering safe trips on urban networks requires a focus on managing those potential conflicts that are most likely to result in death and serious injuries and reducing crash forces to survivable levels. Pedestrians, people on bikes, and other vulnerable road users (defined as people travelling without the protection of a vehicle) are at increased risk of dying or being seriously injured in crashes where vehicle speeds exceed 30 km/h. Similarly, people in vehicles are particularly at risk in side impact crashes (which are most likely to

Integration with energy systems

As the vehicle fleet transitions to lower emissions fuel sources, there will be an increasing need to consider how land use, transport and digital systems integrate with energy networks. Areas of focus include supporting delivery of charging networks (including potential for new technology such as in ground induction charging), standardisation of charging interfaces, and enabling smart charging systems to reduce peak electricity demand and support wider electricity system resilience.

occur at intersections) where vehicle speeds exceed 50km/h.

Safety responses in urban areas will often involve the use of infrastructure to transform the physical environment in tandem with the implementation and enforcement of safe and appropriate speed limits. The appropriate mix of each will depend on the context. For example, the optimal mix of safety interventions in a town centre with many local trips and high numbers of pedestrians, will differ to the mix of interventions on a high volume urban arterial road. Ensuring the safety of all people on urban networks requires an integrated planning approach that considers the role and function of different corridors, current and future road users, and land use mix.

Integrated urban transport also requires that opportunities to increase safety are considered as part of the planning, design and delivery of non-safety focused improvements, and that new improvements do not inadvertently create safety risks, such as ensuring new public transport services are supported by safe 'first and last mile' walking and cycling trips.

Reducing harmful emissions

The emergence of new, low emission transport technology, including EVs and micro-mobility provides the opportunity to reduce harmful emissions from land transport, supporting improved public health outcomes and contributing to delivery of climate change commitments. In the context of EVs, as a relatively small market globally, New Zealand will be a taker of new vehicle technology developed primarily for larger overseas markets. International trends supporting the on-going shift to low-emission vehicles include governments setting stricter fuel efficiency standards and providing incentives to consumers to purchase EVs, and vehicle manufacturers offering more electric and hybrid models. Given these global trends, and New Zealand's commitments to GHG emission targets it is anticipated that the proportion of EVs in the New Zealand fleet will continue to increase[67].

The uptake of micro-mobility will also be driven by the on-going development of this technology and price reductions as it becomes more popular.

While wider global factors are expected to drive the long-term trend to EVs and micro-mobility,

there are steps that can be taken within urban areas to enable and accelerate this uptake and reduce harmful emissions. These include:

- ensuring the efficient electrification of urban bus fleets (already under way but emerging technology may create further opportunities)
- supporting electrification of the existing petrol and diesel fleet
- supporting the uptake of existing (and emerging) micro-mobility options.

Opportunities to support reduced emissions include providing incentives to adopt low-emission transport options, setting emissions standards for vehicles imported into New Zealand, enabling the uptake of new technology where it can be safely integrated into the existing transport system, supporting the provision of charging infrastructure (including provision of private charging in new buildings and developments) supported by smart charging systems, and enabling provision of charging information to drivers (such as EVRoam).

Shifts 1 and 3 will also support the reduction in harmful emissions from transport through shaping urban form to reducing trip length, and providing people with lower emissions transport options that are safe, convenient and reliable.

Many agencies have a role to play in making these shifts

The ideas supporting integrated urban transport are not new, and there are examples in many of our towns and cities of integration between land use and transport, between modes and between networks. But there is scope to do more, to increase integration at a system level to maximise the benefits for users of the system.

Delivering these shifts at local, regional, and national levels will require strong collaboration and partnership across central and local government, and agencies working with iwi, community groups, and the private sector. No single agency or organisation can apply all the levers needed to deliver the changes required to support our urban areas to thrive.

Intervention framework for achieving the four big shifts

NZTA has developed a framework (see Table 1) that sets out the interventions and system changes needed to make the four big shifts. The framework aligns ten intervention categories with the four shifts.

Key points about this framework:

- The four shifts are inter-related, so they need to be progressed together as part of a whole of system approach. To avoid unnecessary duplication in the framework, the intervention categories have been attributed to the shifts that provide the best fit, but it should be noted that many of the interventions can deliver to multiple shifts. For example, applying pricing tools sits under Shift 3 – Improve travel options and motivate people to travel differently, but these tools can also be designed and implemented to maximise the value and efficiency of existing infrastructure and services (Shift 2) and manage the transport system to reduce its harms. (Shift 4)

- Delivering integrated urban transport in our largest cities will require, to a greater or lesser extent, activities in all the intervention categories to deliver change at the scale and pace required.

- Integrated packages of complimentary interventions that deliver across multiple outcomes can deliver more than individual interventions. their combined impact is greater than the sum of their parts.)

- Urban transport systems are complex and challenging to manage with multiple user groups, competing priorities and pressure for space. This complexity requires a different approach to transport planning, with less of a focus on projects that deliver to a single mode or outcome, and a greater focus on developing programmes that integrate across modes, balance competing priorities and deliver to multiple outcomes.

- Some of the system changes identified in the intervention framework are not able to be realised given current system settings. Legislation to enable road pricing tools to be applied more widely is an example of a critical dependency that needs to be addressed to enable integrated urban planning.

Table 1:Intervention framework for creating better cities and reducing traffic

Shift 1	Shape urban form to reduce pressure on the transport system	
Intervention Category	**Description**	**How does the system need to change?**
Integrate planning to create thriving and resilient communities	Quality, medium to high density, mixed-use urban development, integrated with active travel and public transport networks, shortens trip lengths, increases transport options and reduces the need to travel by car. This requires transport and land use planners to undertake integrated land use and transport planning and deliver integrated programmes to achieve shared goals.	- New urban development supports, enables and encourages as much growth and development as possible in areas that have good levels of accessibility, and access to existing or planned mass rapid transit services - Transport investment is prioritised to support compact, mixed-use communities and vibrant public spaces that enable more residents to live well locally - Future transit corridors are identified and protected to enable delivery of agreed urban growth plans

Shift 2 | Maximise the value and efficiency of existing infrastructure and services

Intervention Category	Description	How does the system need to change?
Increase network efficiency through targeted prioritisation and use of technology and data to optimise system productivity and reliability	Adding capacity to urban networks is difficult, expensive and disruptive. As our cities grow it is critical that we optimise the potential of the existing transport system to enable the efficient, reliable and sustainable movement of people and goods. Current initiatives include signal optimisation, use of traffic operations centres to manage networks and respond to disruption, and provision of real time information to inform travel choices. On-going advances in mobile communications, vehicle connectivity, smart infrastructure, computing power and machine learning will increasingly combine to enable systems that can collect, collate, analyse and distribute network data in real-time, enabling greater scope to adjust system settings and advise system users of the most efficient travel options.	• Increased integration of planning and operational activities across networks and between modes, to optimise journeys for different modes, avoid system duplication and close gaps in networks • Actively work to understand and, where appropriate, enable opportunities for technology to improve the safety and efficiency of urban networks • Development of a national access point to manage and coordinate the collection, collation, analysis and distribution of data on system performance • Grow opportunities to share travel information with system users to enable efficient travel choices
Rebalance the road network and its use to support more efficient travel options	Many urban road networks prioritise travel by car and car parking over other modes. This intervention category involves considering the form and function of our roads, and repurposing space to support safer and more efficient travel. This can quickly help to improve the attractiveness and reliability of active and shared modes, while also improving the efficiency of urban corridors and overall network productivity and accessibility. Road space reallocation can also support wider outcomes including economic prosperity, place-making, more attractive urban spaces, and improving the health and safety of communities. Tools such as the One Network Framework and Future Network Planning Process can be used to confirm the role and function of different corridors within urban networks, and how these may need to change over time to support delivery of a city's 'preferred future'.	• A focus on moving people and goods, not vehicles, results in a transport system that is more efficient, more productive and gives more choice about how to travel • Safe, separated and highly integrated networks provide efficient, reliable and seamless journeys across multiple modes • Regulatory settings enable quick build, low-cost trialling of street changes

Shift 3 | Improve travel options and motivate people to travel differently

Intervention Category	Description	How does the system need to change?
Improve the reach, frequency, and quality of public transport	Efficient, frequent, and reliable public transport networks and services need to form the backbone of urban growth and transport systems, including rapid transit in our largest cities. Improving the quality, coverage and performance of public transport will put it within reach of more people.	• Improve the reliability and convenience of existing PT services to grow customer confidence • Increase the speed, frequency and coverage of PT networks over time, and roll-out rapid transit, aligned to agreed urban growth plans • Increase access to PT services through improved integration with active and shared modes (to support first and last mile trips)
Deliver a step change in walking and cycling	Improving the safety, quality and coverage of infrastructure for walking, cycling, and other forms of micro-mobility will make our transport system safer and more inclusive, make active trips more convenient, and support more travel by these modes. Changes to urban form and reshaping how existing road networks are used have roles to play in making active modes safer and more attractive. Providing direct connections, and ensuring that public spaces are safe, comfortable and interesting is also critical to supporting more trips by active modes. Improved integration with public transport networks and completing and improving existing active mode networks have a role to play here.	• Completed urban arterial cycle networks provide safe and convenient connections to activity centres and key destinations • Walkable neighbourhoods, including safe speeds, provide safe and convenient access to schools, PT hubs and neighbourhood centres • Support public bike / micro-mobility share schemes • Transport investment is prioritised to support active trips in areas identified for urban intensification
Facilitate car sharing and shared trips	A high proportion of travel on urban roads is by single-occupancy vehicles. This intervention category includes support for car sharing and ride sharing (such as through dedicated parking for car-share vehicles and high-occupancy vehicle lanes to support ride sharing), and integrating these with public and active transport systems where appropriate.	• System settings support car and vanpooling, and car-share initiatives • Identify opportunities to introduce high-occupancy vehicle (HOV) lanes to enable more people to move more quickly. HOV lanes tend to be most effective for large employment centres, heavily congested roads, and on arterial roads with capacity to reprioritise existing road space. Where HOV lanes are introduced, ensure they are enforced
Manage car parking and vehicle use, and incentivise more efficient travel options	Managing the use of vehicles through parking management, zoning, and various pricing tools can play an effective part in reducing traffic, motivating people to use different travel options, and increasing network efficiency. This category involves identifying a range of interventions to improve the attractiveness of public transport, walking and cycling relative to travel by car for many daily travel	• Parking is actively managed in areas well served by active / shared modes • Remove minimum parking requirements for new development in activity centres and along frequent and rapid transit corridors • Pricing tools such as congestion charging and road pricing are increasingly utilised to manage demand, reduce congestion and increase network efficiency. These tools are implemented alongside targeted incentives

Shift 3 | Improve travel options and motivate people to travel differently

Intervention Category	Description	How does the system need to change?
	needs. Pricing levers sit with a variety of sectors – some are available for use now, such as parking pricing and public transport fare settings, while others such as congestion pricing are expected to be available in the future.	and exemptions to avoid inequitable outcomes
Education, communication and travel planning programmes	This intervention category includes national, regional, area-wide, and site-specific programmes (such as at an event, or school or business travel planning). These aim to grow public awareness and support for proposed system improvements, change people's perceptions of different travel modes, and increase their willingness to change.	• Engage with Māori, stakeholders and communities to agree the future urban form and transport system that will best meet community aspirations • Monitor, measure and communicate the positive changes, impacts of interventions, and progress towards delivering the preferred future • Support travel planning for large trip generators

Shift 4 | Manage the transport system to reduce its harms.

Intervention Category	Description	How does the system need to change?
Design and manage urban networks to improve safety for all users	Significantly reducing the number of deaths and serious injuries, especially for vulnerable road users, by creating safer and more forgiving roads and streets, applying safe and appropriate speed limits, and reducing dangerous travel behaviour.	• Urban corridors are increasingly designed to deliver safe journeys for all users, with infrastructure design reflecting traffic volumes, speed, users and corridor function • Enable new technology that can improve safety outcomes • Automated enforcement is increasingly used to manage high risk behaviours, such as intersection safety and site speed cameras
Significantly reduce harmful emissions from the transport system	Vehicle emissions from land transport are a major contributor to poor public health outcomes, and a significant source of GHG emissions. This intervention category is focused on reducing harmful emissions and mitigating the effects of land transport on the environment and public health, through reducing emissions from motorised vehicles, optimising transport networks for more efficient vehicle movements and supporting the uptake of micro-mobility alternatives. It works in combination with interventions to reshape urban form and improve lower emission travel options to deliver on the A-S-I framework.	• Uptake of low emission vehicles – both EVs and micro-mobility, continues to accelerate, supported by the widespread delivery of public charging infrastructure • Widespread installation of private charging is supported by building and development standards • The roll-out of smart charging means that EV charging improves rather than worsens the resilience and reliability of electricity networks • Opportunities to work and learn from home and the provision of on-line services continues to reduce the need to travel

Appendices

Appendix A: Resources, research and evidence base to support Integrated Urban Transport

Plans
Resource

Ireland – Redesigning Ireland's Transport for Net Zero (2022)

Author: OECD

https://www.oecd-ilibrary.org/environment/redesigning-ireland-s-transport-for-net-zero_b798a4c1-en

Ireland plans to achieve an economy-wide 51% greenhouse gas emissions reduction by 2030 (relative to 2018 levels), with the transport sector required to reduce its emissions by 50% by 2030. This plan recognises the need to prioritise policies with the transformative potential to shift the country's transport system away from car dependency. The plan supports the shift to a 'decide and provide' approach to transport planning, and includes a three-step process that supports a systematic approach to identify policies of high transformative potential:

1. **envision** the goal(s) and patterns of behaviours a properly functioning system fosters
2. **understand** why the current system is not achieving the envisioned goals and patterns of behaviour
3. prioritise policies that can **redesign** the system to foster desirable pattens of behaviour.

The plan applies a **behaviour change lens** and provides a very useful summary of how investment in the transport system in recent decades has shaped individual behaviour and led to increasing levels of car dependency.

The context for the plan has many parallels with Aotearoa New Zealand in that Ireland has a similar population, a recent history of investment to provide capacity for private vehicles, urban growth largely through expansions, resulting in similar levels of car dependency (approximately 75% of trips).

Transforming the North – Strategic Transport Plan (2024)

Author: Transport for the North

https://transportforthenorth.com/our-north/strategic-transport-plan/

The Strategic Transport Plan sets the vision, strategic ambitions and long-term strategic transport priorities (up to 2050) for the north of England, creating a consistent framework for on-going work with government, local transport bodies and delivery bodies. The Plan outlines how better connecting the key economic centres across the North can transform economic performance, open opportunities for people, business and communities, and facilitate the rapid decarbonisation of the transport network. The approach taken to develop the plan provides a positive template for integrated transport planning, including:

1. applying a 'decide and provide approach' that clearly outlines the **vision and strategic ambitions** that the North wants to achieve
2. taking a system approach that recognises the need to deliver across multiple outcomes and **integrate transport solutions** with **energy, spatial planning and digital connectivity**.

Recognising that many aspects of the future are uncertain and the application of plausible **future travel scenarios** to help manage that uncertainty. The scenarios were used to test the effectiveness and resilience of proposed policies and interventions

Guidance

Resource

Understanding Smart Growth Savings – evaluating the savings and benefits of compact development (2024)

Author: Victoria Transport Policy Institute

https://vtpi.org/sg_save.pdf

This paper explores the potential benefits of pursuing Smart Growth policies to create compact, mixed-use multi-modal communities where residents consume less land, drive less and make greater use of non-car-based travel. While the costs of development vary in different locations, the paper draws from many international studies to describe and quantify potential benefits of Smart Growth around land utilisations, reduced public infrastructure and service costs, transport costs and safety, improved accessibility, public health, household affordability and economic resilience, energy consumption and harmful emissions, and other social and economic metrics. The paper notes that compact, mixed-use multi modal communities are particularly beneficial for people who cannot, should not or choose not to drive.

Reversing car dependency (2021)

Author: International Transport Forum

https://www.itf-oecd.org/sites/default/files/docs/reversing-car-dependency.pdf

International examples of policies and intervention used to reduce car dependency. It is a useful resource for tracking what has been used in other places, the rationale/history behind those decisions and case studies with examples of impact. The case studies are not at the same scales, so reading them with that context in mind is important.

Main interventions suggested and outlined:

- Review the street space and urban land share allocated to cars.
- Use road space allocation to proactively manage traffic.
- Consider road pricing to drive more efficient use of scarce road space and urban land.
- Use parking rates to discourage excessive driving.
- End employer-paid parking subsidies.
- Ensure that quality alternatives to private cars are convenient and efficient.
- Work towards integrated planning of transport and land use.
- Review land use regulations that hinder compact development patterns.

Relevant case studies (with included VKT or relevant effects):

- Paris (Page 13)
- Waltham Forest (Page 14)
- Los Angeles (Page 16)

The document also reviews a land use change analysis of Auckland, conducted by the OECD (Page 32).

A narrative literature review of the effectiveness of interventions to reduce light vehicle travel (2023)

Author: NZTA Research Report 707

https://www.nzta.govt.nz/assets/resources/research/reports/707/707-a-narrative-literature-review-of-the-effectiveness-of-interventions-to-reduce-light-vehicle-travel.pdf

This research report contains useful assessments of the potential impact and applicability of different interventions in a New Zealand context, broken down by the following intervention type:

- Incentives (extrinsic and intrinsic)
- Information and advice (including travel planning)
- Congestion charging
- Infrastructure development and improvements
- Car parking
- Other interventions

The report draws insights for achieving LVT reduction in New Zealand and identifies examples where combinations of interventions have increased the scale of impact (see Discussion pages 60-63). The report notes that interventions should not be considered on their own, either because they are likely to be context dependent or because there is a strong indication that interacting interventions are more effective.

Handbook for Analysing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity (2021)

Author: California Air Pollution Control Officers Associationhttps://www.caleemod.com/documents/handbook/full_handbook.pdf

This handbook provides a range of measures to reduce and measure Greenhouse Gas Emissions across various sectors as part of California-wide legislation requiring local governments to reduce GHG emissions, including through reducing vehicle miles travelled (VMT).

Its stated intent is "to provide local government with accurate, reliable, and standardised emission reduction quantification methods for land use, climate action, and long-term planning." The handbook has been used to design VMT reduction calculators for counties and other jurisdictions within California, and provides outlines of what type of VMT/VKT reductions can be expected from different measures.

Specifically relevant are the "Measure Factsheets" which outline the "measure" which can be taken to reduce emissions, its potential to reduce emissions/VKT/VMT, implementation requirements to achieve these reductions, and other considerations including co-benefits and costs.

The section for Transportation (which includes land use interventions also), begins on page 62 of the handbook and runs to page 223. Supporting measures are listed on page 47.

Travel demand management: strategies and outcomes (2020)

Author: NZTA Research Report 661

https://www.nzta.govt.nz/assets/resources/research/reports/661/661-travel-demand-management-strategies-and-outcomes.pdf

This is a comprehensive review of travel demand management strategies, their effectiveness and how they have been implemented elsewhere. There is a detailed literature review (if searching for references for specific interventions), but the case studies are likely to be the most relevant for Tier 1 cities.

Case studies (pp38-107) show what cities have done to reduce driving. The actions of each city are broken into the following categories:

- Improve transport options
- Land use planning and development
- Financial incentives (including parking)
- Outreach and implementation programmes

There are also "focus area" studies that may also be helpful, specifically:

- Beter Benutten (p108)
- Urban Logistics (p121)

San Francisco's TDM Ordinance (p156)

Evaluating the greenhouse gas emission reduction benefits from land transport mode shift programmes and projects – a research note (2021)

Author: NZTA Research Note 004

https://www.nzta.govt.nz/assets/resources/research/research-notes/004/004-evaluating-ghg-emission-reduction-benefits.pdf

This research included 16 case studies of cities with tangible measured outcomes relating to their effect on either emissions or amount of vehicle travel from land transport programmes. This work is especially useful for showing the benefits of specific approaches with real-world examples.

The report is easy to navigate with case studies chosen to show a broad range of programme types, including:

- Integrated transport programmes
- Land use (transit-oriented development)
- Parking management
- Traffic restriction (pricing, low-emissions zones, traffic circulation plans)
- Walking & cycling
- Bus rapid transit
- Travel behaviour change
- Urban logistics

Each case study is split into the following sections:

- Programme detail
- Measurement methodology
- Emissions outcomes
- Other contributing factors

Relevance to New Zealand

Travel Behaviour Change – Travel demand management literature review (2022)

Author: NZTA

https://www.nzta.govt.nz/assets/resources/travel-behaviour-change/Travel-behaviour-change-report.pdf

This document provides a literature review about the effectiveness of travel behaviour change (TBC) programmes. This research supports the findings of the two studies above (Thorwaldson, Thomas & Carran-Fletcher, 2021) and (Carran-Fletcher, et. al., 2020), by showing limited evidence for the effectiveness for many of the "soft" TBC programmes many authorities prefer to rely on, such as Mobility as a Service (MaaS).

This literature review shows that bespoke TBC programmes can be effective when there is a convergence of supporting factors: "A travel plan with a coordinated strategy that is tailored to the context, strong relationship building and engagement between those assisting with creating the travel plan and the school/workplace, and at least one person within the school/workplace that champions the work." Soft TBC programmes can be an effective solution in specific circumstances, once stronger, supporting approaches are in place, workplace travel plans and MaaS alone will not give the VKT reductions we need.

The previous two research papers go into more detail about the range of supporting approaches available, their effectiveness and some case study examples.

Integrated land use and transport planning (2022)

Author: NZTA

https://www.nzta.govt.nz/resources/research/reports/702/

Research undertaken to improve understanding of the benefits of integrated transport and land use planning, and provide a foundation for additional work to improve integrated planning processes, delivery and outputs in New Zealand. The research used a literature review, policy stocktake and stakeholder interviews to build a picture of the potential benefits of integrated planning, current policy settings, barriers to integration and recommendations to address the barriers.

Social and distributional impacts of time and space-based road pricing (2019)

Author: NZTA/ MRCagney

https://www.nzta.govt.nz/resources/research/reports/654/

This research report outlines a framework for assessing the wider effects of road pricing. It includes two case studies of potential road pricing schemes in New Zealand and their associated effects (Auckland and Wellington). The Auckland case study provides a quantitative analysis, while the Wellington case study is qualitative. The report provides insights into which households/locations would be most affected by such schemes and how those effects can be mitigated (if needed). This is a useful resource for considering equity impacts of road pricing.

Equity in Auckland's Transport System - Summary Report (2020)

Author: Te Manatū Waka, Ministry of Transport / MRCagney

https://www.transport.govt.nz/assets/Uploads/Report/NZ3060_Equity_in_Auckland_Transport_System.pdf

The report provides a useful overview of equity within the transport system, with a focus on transport disadvantage (a lack of transport options) and transport poverty (paying more than can be afforded for mobility). The report notes the strong connection between income inequality and transport inequity, but also notes that fears for personal security, perceptions of transport options and physical barriers can also exclude people from accessing the transport system.

While focused on Auckland, the report contains general evidence and insights regarding barriers facing Māori, those on low incomes, women, LGBTQI+ people, disabled people, older people and ethnic minorities, that are relevant to other New Zealand cities. It also identifies data sets that can be used to begin to build a picture off groups and areas likely to experience inequity in transport.

Mode shift to micro-mobility (2021)

Author: NZTA/ Beca

https://www.nzta.govt.nz/resources/research/reports/674/

This report contains useful information outlining which forms of micro-mobility are available in New Zealand, data about current use of micro-mobility in New Zealand, and modelling of the potential effect of micro-mobility on mode share in New Zealand.

The report notes that there is a lack of quantitative information available on the likely future usage of micro-mobility across different scenarios and land use contexts, including the effect on mode share. Despite this, the report attempts to model the potential uptake of micro-mobility and effect on other mode share because of greater and lesser availability of micro-mobility and other factors such as trip length,

Most relevant for councils are sections 5 (Transport modelling of micro-mobility), 6 (Impact evaluation), and 7 (Results).

Safety interventions and their contribution to mode shift (2022)

Author: NZTA/WSP

https://www.nzta.govt.nz/assets/resources/research/reports/701/701-safety-interventions-and-their-contribution-to-mode-shift.pdf

This report outlines which safety interventions are expected to generate the greatest mode shift. The results are determined by literature review, interviews, and case studies.

Vehicle Kilometres Travelled Reduction: Public Transport Base and Target Forecast Study (2023)

Author: NZTA (Transport Futures Ltd)

https://www.nzta.govt.nz/resources/vkt-pt-base-and-target-forecast-study

The government's first Emissions Reduction Plan includes a target to reduce national light vehicle kilometres travelled by 20% (relative to projected growth) by 2035. Public transport would need to play a major part in supporting mode shift, and this analysis was undertaken to estimate the scale of growth in public transport (PT) that would be required to support delivery of the VKT reduction target.

The analysis includes a national level assessment of the overall PT task for five different scenarios, as well as sub-national assessments for Tier 1 and 2 urban areas. The analysis indicates that to sufficiently contribute to light VKT reductions, passenger kilometres travelled by public transport would need to return to pre-COVID levels by 2024, and then increase by approximately 10 percent per year between 2025 and 2035. By way of comparison the annual increase in passenger kilometres travelled achieved between 2010 and 2020 was 4 to 5 per cent.

In real terms, an annual increase of 10 percent means that by 2035 passenger kilometres travelled would need to:

- almost triple in Tier 1 urban areas
- at least double in Tier 2 urban areas
- increase by at least half in smaller centres

This analysis was commissioned to help build an understanding of the scale of the challenge to deliver on VKT reduction targets. It is not intended that the findings of the analysis should be treated as targets for each Tier 1 urban centre.

Household travel in our major urban areas (2023)

Author: NZTA (WSP)

https://nzta.govt.nz/resources/household-travel-in-our-major-urban-areas

Analysis of the NZ Household Travel Survey data was undertaken to determine light vehicle use in our Tier1 and Tier 2 urban areas and assess the possibility of mode shift and the suitability of mode substitution based on journey purpose and distance.

The research provides valuable insights regarding:

- the purpose of trips taken
- trip distances broken down by mode
- VKT generated by trips of different lengths

the potential for mode-shift alone to deliver the scale of change required to meet the VKT target in the Emissions Reduction Plan.

Auckland VKT Reduction Programme and supporting documentation (2024)

Author: Auckland Transport (MRCagney, Mott MacDonald, AECOM)

https://infocouncil.aucklandcouncil.govt.nz/Open/2024/04/20240404_TICCC_ATT_11408_EXCLUDED.PDF

The draft Auckland VKT Reduction Programme was developed in response to an action in the Government's first Emissions Reduction Plan that required NZ's largest cities to develop programmes to support delivering of the National VKT Reduction target. The analysis to support the Auckland programme concluded that meeting the VKT target would require a system level transformation, involving reshaping urban growth away from greenfield areas and towards existing urban areas with high levels of PT accessibility, recalibration and rebalancing of the transport system to lessen Aucklanders' dependence on cars, enhancing the ease and convenience of public transport and active modes, encouraging diverse travel behaviours, and enabling people to live in areas with greater travel options and closer to everything they need. Delivering on the programme would require significant, sustained investment in integrated programmes to the value of approximately $20 billion over the next 10 years. The modelling and analysis also indicated that in addition to meeting the objectives of the ERP, delivering the programme would also reduce traffic congestion, improve freight reliability, increase accessibility and foster a healthier, safer, and more sustainable, equitable and liveable city.

While the programme is bespoke to Auckland, the evidence, analysis, modelling undertaken to support its development provides insight that could guide similar integrated planning initiatives elsewhere in New Zealand, in particular:

- Modelling to forecast future VKT and test options against a range of KPI's including PT patronage, network performance, accessibility, trip length and mode share (see Appendix A – Modelling Report)
- Methodology for testing various scenarios and identifying a preferred programmes (see Appendix B – Developing the Plan from Longlist to Preferred)
- Evidence base summary of potential contribution of different interventions to VKT reduction (see Appendix C – Intervention Research Evidence Report)
- Summary of engagement approach, including Māori and youth engagement, and the results of Deliberative Forum process (see Appendix D – Engagement)
- Analysis and modelling of the potential impact of different urban growth patterns on VKT reduction and guidance on how to deliver more compact, mixed use urban areas (see Appendix E – Land use)

Indicative costings, sequencing of programme interventions, and delivery dependencies (see Appendices H – J).

Understanding attitudes and perceptions of cycling and walking (2023)

Author: NZTA

https://www.nzta.govt.nz/assets/resources/understanding-attitudes-and-perceptions-of-cycling-and-walking/Waka-Kotahi-Attitudes-to-cycling-and-walking-final-report-2023.pdf

The survey provides a way of monitoring attitudes and behaviours around walking and cycling, in response to ongoing efforts to improve our cities for people getting around on foot or by bike. This summary report covers walking and cycling behaviour, factors impacting and limiting uptake, and levels of support for infrastructure.

Results are broken down into cities including Auckland, Hamilton, Tauranga, Wellington, Christchurch and Dunedin.

VKT evidence pack (2022)

Author: NZTA

https://www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/viewupdate/290

In 2022 NZTA compiled an evidence pack on light vehicle VKT to support the planning and work to reduce light vehicle VKT and transport emissions by 2035.

This evidence base comprises of:

- Current VKT data, tends and patterns,
- Insights into customer behaviour and trip types,
- Existing trends in mode share, accessibility, GHG emissions and VKT by urban areas,
- Emissions from freight transport
- Extensive Geospatial, graphical and textual mapping.

The evidence base covers urban, provincial, and rural aspects of VKT and provides initial insights into the potential impact, indicative cost and critical dependencies for different interventions to contribute to the required levels of VKT reduction.

NZTA geospatial layers

Author: NZTA

https://experience.arcgis.com/experience/4fe182b964824f26970bbdc49b3882e2/page/Page-1/?views=Layers

2022 Accessibility Mapping

Spatial accessibility maps used to assess the current state to accessibility in NZTA's Annual Report. The maps provide nationally consistent data regarding how 'access rich' each neighbourhood is (disaggregated to SA1 level). The layers indicate the relative reach of each of the four main modes (driving, PT, walking and cycling), and levels of access to a range of destinations including employment, health care, education and supermarkets. The data can be aggregated to TA and regional levels, and can be combined with other data available at the SA1 level (such as spatial deprivation).

The underlying data is available to download and access to the maps can be requested from the Geospatial Team at NZTA (GeospatialSystems@nzta.govt.nz).

NZTA geospatial layers

Author: NZTA

https://nzta.maps.arcgis.com/apps/dashboards/b0bcf80edc2644e7b669ef3440579bc1

Origin and Destinations Mapping for Jobs Access

Map layers that show the localised (to Statistical Area 2 level) origins and destinations that generated the most VKT from commuting trips in 2021. The maps also indicate the origins and destinations that experienced the greatest rate of change

in commuter VKT between 2018-2021. The maps provide valuable insights into which parts of our Tier 1 cities generate the highest levels of commuter VKT. It draws on a range of anonymised datasets within the Integrated Data Infrastructure (IDI) and Longitudinal Business Database (LBD).

The underlying data is available to download and access to the maps can be requested from the Geospatial Team at NZTA (GeospatialSystems@nzta.govt.nz).

Health and air pollution in New Zealand 2016 (HAPINZ 3.0) (2022)

Author: Ministry for the Environment

https://environment.govt.nz/publications/health-and-air-pollution-in-new-zealand-2016-findings-and-implications/

This report summarises the updated health and air pollution in New Zealand 2016 (HAPINZ 3.0) study which evaluates the effects of air pollution (including air pollution from the land transport system) on human health across New Zealand, and the resulting social cost.

Climate Assessment of Transport Investment (CATi)

Author: NZTA

https://nzta.govt.nz/resources/cati

NZTA has developed the Climate Assessment of Transport Investment (CATI) model to assess the potential impact of land transport investment programmes on carbon emissions. The CATI model rates activities and work categories based on their potential to reduce or increase emissions.

CATI can be applied to all components of a given land transport investment programme to assess their potential to reduce emissions or likely increase emissions. It is applicable to Regional Land Transport Plans (RLTPs), the National Land Transport Programme (NLTP), as well as other large plans and programmes.

Assessing induced road traffic demand in New Zealand

Author: NZTA

https://www.nzta.govt.nz/resources/research/reports/717/

Induced demand describes the paradox whereby the more we add capacity to road networks and widen congested roads to ease traffic, the more they continue to fill up with additional traffic. Induced demand can be explained by the act of increasing capacity in road networks makes it quicker and easier to travel, which encourages people to travel more, thereby generating increased traffic which in time takes up the additional capacity provided, eventually resulting in congestion. But the scale of induced demand created by improvements to increase road capacity depends on several factors:

- The volume of traffic on the current road (very busy major roads tend to generate more induced traffic)
- The degree to which the improvements reduce the cost of travel (the greater the reduction in cost (measured in travel time and vehicle operating costs) the more likely there will be induced traffic)
- The potential for people to divert to the new or improved road (areas with extensive networks of interconnected roads tend to experience greater induced traffic)

A tool has been developed to help predict induced traffic created by projects to increase capacity on New Zealand roads. By combining elasticities around lane kilometres and cost of travel, the tool provides a likely range of VKT that researchers think will be created each day by adding new lanes to an existing road, or by creating a new road. The purpose of the tool is to help planners to quickly assess a range of transport proposals early in the design process and test potential mitigations for addressing induced traffic.

References

[1] New Zealand Infrastructure Commission Te Waihanga (2022) New Zealand Infrastructure Strategy 2022-2052 – Rautaki Hanganga o Aotearoa. https://tewaihanga.govt.nz/the-strategy/foreword

[2] Donovan, S and Munro, I (2013) Impact of urban form on transport and economic outcomes. NZ Transport Agency Waka Kotahi research report 513. https://www.nzta.govt.nz/assets/resources/research/reports/513/docs/513.pdf

[3] NZTA Waka Kotahi (2019) Keeping Cities Moving. https://www.nzta.govt.nz/assets/resources/keeping-cities-moving/Keeping-cities-moving.pdf

[4] NZTA Waka Kotahi (2023) Urban Development Position. https://www.nzta.govt.nz/assets/resources/auckland-strategic-spatial-view/urban-development-position-summary-and-key-components-march-2023.pdf

[5] NZTA Waka Kotahi (2023) Cycling Action Plan https://www.nzta.govt.nz/resources/waka-kotahi-cycling-action-plan/

[6] NZTA Waka Kotahi (2020) Toitū te Taiao Our Sustainability Action Plan https://nzta.govt.nz/assets/resources/toitu-te-taiao-our-sustainability-action-plan/sustainability-action-plan-april-2020.pdf

[7] NZTA Waka Kotahi (2022) Environment and social responsibility policy. https://www.nzta.govt.nz/assets/resources/environmental-and-social-responsibility-manual/docs/environmental-and-social-responsibility-policy.pdf

[8] Ministry for the Environment (2022) Te hau māhori ki anamata. Towards a productive, sustainable and inclusive economy. https://environment.govt.nz/assets/publications/Aotearoa-New-Zealands-first-emissions-reduction-plan.pdf

[9] Ministry of Transport (2022) *Mahere Hohenga kia Whakakorea te Waro ā-Kawenga 2022-25* | Decarbonising Transport Action Plan 2022-25. https://www.transport.govt.nz/assets/Uploads/MOT4716_Emissions-Reduction-Plan-Action-Plan-P04-V02.pdf

[10] European Commission (2024) *Triple Access Planning for Uncertain Futures.* Exploring triple access in sustainable urban mobility planning. https://www.tapforuncertainty.eu/

[11] Oxfordshire County Council (2022) Implementing 'decide & provide': *Requirements for Transport Assessment.* https://www.oxfordshire.gov.uk/sites/default/files/file/roads-and-transport/ImplementingDecideandProvideTARequirements.pdf

[12] Statistics NZ (2019) 2018 Census population and dwelling counts; Subnational population projections: 2018(base)–*2048 update. https://www.stats.govt.nz/information-releases/2018-census-population-and-dwelling-counts & https://www.stats.govt.nz/information-releases/subnational-population-projections-2018base2048-update/*

[13] New Zealand Government (2024) Land Transport Management Act 2003 https://www.legislation.govt.nz/act/public/2003/0118/latest/DLM226230.html

[14] Ministry for the Environment (2022) National Policy Statement on Urban Development 2020 – update May 2022 https://environment.govt.nz/publications/national-policy-statement-on-urban-development-2020-updated-may-2022/

[15] Ministry of Housing and Urban Development (2022) Government Policy Statement on Housing and Urban Development https://www.hud.govt.nz/assets/Uploads/Documents/HUD-Implementation-plan-5_3-2.pdf

[16] Ministry for the Environment (2021) Climate Change Response (Zero Carbon) Amendment Act 2019 https://environment.govt.nz/acts-and-regulations/acts/climate-change-response-amendment-act-2019/

[17] Ministry for the Environment (2023) Resource Management Act 1991 https://environment.govt.nz/acts-and-regulations/acts/resource-management-act-1991/

[18] Statistics NZ (2019) 2018 Census Families and Households; Number of motor vehicles by tenure of household, for households in occupied private dwellings. https://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE8430

[19] Waka Kotahi (2022) Sustainable urban mobility benchmarking report - https://www.nzta.govt.nz/assets/resources/sustainable-urban-mobility-benchmarking/sustainable-urban-mobility-benchmarking-report.pdf

[20] This is the growth in the distance travelled by light vehicles (light VKT). This data is sourced from the vehicle fleet emissions model available at https://www.transport.govt.nz/statistics-and-insights/transport-outlook/sheet/updated-future-state-model-results

[21] NZ Infrastructure Commission (2021) New Zealand's infrastructure challenge – Quantifying the gap and path to close it https://tewaihanga.govt.nz/media/lhhm5gou/new-zealands-infrastructure-challenge-quantifying-the-gap.pdf

[22] Ministry of Transport (2022) Domestic Transport Costs and Charges. https://www.knowledgehub.transport.govt.nz/assets/5-DTCC-draft-results-Alternative-modes-August-2022.pdf

[23] Ministry for the Environment (2020) National policy statement on urban development. https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-urban-development/ *This is outlined in Objective 1 and Policy 1 of the NPS.*

[24] The Resource Management (Enabling Housing Supply and Other Matters) Amendment Act (2021) https://www.legislation.govt.nz/act/public/2021/0059/latest/LMS566049.html *This Act requires territorial authorities in Tier 1 urban areas to incorporate medium-density residential standards into their district plans. Rotorua Lakes Council was also granted its request to implement the medium-density residential standards in its District Plan.*

[25] Ministry for the Environment (2022) Towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's first emissions reduction plan. https://environment.govt.nz/publications/aotearoa-new-zealands-first-emissions-reduction-plan/

[26] Ministry for the Environment (2022) Towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's first emissions reduction plan. https://environment.govt.nz/publications/aotearoa-new-zealands-first-emissions-reduction-plan/

[27] Ministry of Transport Te Manatū Waka (2022) Transport Indicators Inclusive Access – Household Spending on transport (source data drawn from the Household Travel Survey). https://www.transport.govt.nz/statistics-and-insights/transport-indicators/inclusive-access/

[28] Australasian Railway Association (2015) The costs of commuting: an analysis of potential commuter savings. https://at.govt.nz/media/913854/Commuter-costs-potential-savings-report.pdf

[29] Inland Revenue (2023) Vehicle expenses – kilometre rates 2023-2024 https://www.ird.govt.nz/income-tax/income-tax-for-businesses-and-organisations/types-of-business-expenses/claiming-vehicle-expenses/kilometre-rates-2023-2024

[30] Ministry of Transport Te Manatū Waka (2022) Transport Indicators Inclusive Access – Barriers to access: People unable to make a beneficial transport journey (source data drawn from the Journey Monitor Survey). https://www.transport.govt.nz/statistics-and-insights/transport-indicators/inclusive-access/

[31] Statistics New Zealand (2014) One in four New Zealanders identified as disabled (online resource) https://www.stats.govt.nz/news/one-in-four-new-zealanders-identified-as-disabled/

[32] Office for Seniors Te Tari Kaumatua (2019) Better Later Life – He Oranga Kaumatua 2019 to 2034 https://officeforseniors.govt.nz/better-later-life-strategy/

[33] Rive, G *et al* (2015) Public transport and the next generation (NZ Transport Agency research report 569) https://nzta.govt.nz/assets/resources/research/reports/569/docs/569.pdf

[34] MRCagney (2020) Equity in Auckland's Transport System – Summary Report https://www.transport.govt.nz//assets/Uploads/Report/NZ3060_Equity_in_Auckland_Transport_System.pdf

[35] Sweeney, M. et al (2022) A pathway towards understanding Māori aspirations for land transport in Aotearoa New Zealand (NZ Transport Agency research report 688) https://www.nzta.govt.nz/resources/research/reports/688/

36 Massey University, Environmental Health Intelligence New Zealand (2022) Unmet need for GP services due to a lack of transport https://www.ehinz.ac.nz/assets/Factsheets/Released_2022/Unmet-need-for-GP-services-due-to-a-lack-of-transport_New-Zealand_2022.pdf

37 MRCagney (2020) Equity in Auckland's Transport System – Summary Report https://www.transport.govt.nz//assets/Uploads/Report/NZ3060_Equity_in_Auckland_Transport_System.pdf

38 Sweeney, M. et al (2022) A pathway towards understanding Māori aspirations for land transport in Aotearoa New Zealand (NZ Transport Agency research report 688) https://www.nzta.govt.nz/resources/research/reports/688/

39 New Zealand Government (2019) Road to Zero, New Zealand's Road Safety Strategy v2020-2030 https://www.transport.govt.nz/assets/Uploads/Report/Road-to-Zero-strategy_final.pdf

40 See Ministry of Transport (2017) Overview of road safety in New Zealand. https://www.transport.govt.nz/assets/Uploads/Presentation/Overview-of-Road-Safety-in-NZ-Data-packs-for-reference-groups.pdf

41 Ministry for the Environment (2022) Health and air pollution in New Zealand 2016: *Findings and implications*. https://environment.govt.nz/publications/health-and-air-pollution-in-new-zealand-2016-findings-and-implications/

42 Wild, K. *et al* (2021) The relationship between transport and mental health in Aotearoa New Zealand (NZ Transport Agency research report 675) https://www.nzta.govt.nz/assets/resources/research/reports/675/675-the-relationship-between-transport-and-mental-health-in-aotearoa.pdf

43 Ministry of Health (2023) Annual update of key results 2022/23: New Zealand Health Survey https://www.health.govt.nz/publication/annual-update-key-results-2022-23-new-zealand-health-survey

44 Sport New Zealand (2022) Active NZ Changes in Participation; The New Zealand Participation Survey 2021 https://sportnz.org.nz/media/5150/active-nz-changes-in-participation-2021-1.pdf

45 Ministry of Health (2023) Annual update of key results 2022/23: New Zealand Health Survey https://www.health.govt.nz/publication/annual-update-key-results-2022-23-new-zealand-health-survey

46 Ministry of Health (2024) Obesity statistics (online resource) https://www.health.govt.nz/our-work/diseases-and-conditions/obesity

47 Smith *et al* (2017) and Rabl, A., & de Nazelle, A. (2012). Benefits of Shift from Car to Active Transport. Transport Policy, 19, 121-131. https://doi.org/10.1016/j.tranpol.2011.09.008

48 Dinu, M., Pagliai, G., Macchi, C. et al. Active Commuting and Multiple Health Outcomes: A Systematic Review and Meta-Analysis. Sports Med 49, 437–452 (2019). https://doi.org/10.1007/s40279-018-1023-0

49 See https://www.nzta.govt.nz/assets/resources/research/reports/688/688-a-pathway-towards-understanding-Māori-aspirations-for-land-transport-in-new-zealand.pdf

50 International Transport Forum (2021) Travel transitions; how transport planners and policy makers can respond to shifting mobility trends. https://www.itf-oecd.org/sites/default/files/docs/travel-transitions-shifting-mobility-trends.pdf

51 Urban Design Group (2024) Understanding the20-minute Neighbourhood – Making opportunities for people to live well locally https://www.udg.org.uk/publications/udgpub-otherpub/20-minute-neighbourhoods-living-well-locally

52 Kingham, S et al (2020) Streets for transport and health: The opportunity of a temporary road closure for neighbourhood connection, activity and wellbeing. https://www.sciencedirect.com/science/article/abs/pii/S2214140520300761

53 NZ Transport Agency Waka Kotahi (2023) One Network Framework (online resource). https://www.nzta.govt.nz/planning-and-investment/planning/one-network-framework/

54 NZ Transport Agency Waka Kotahi (2022) Future Network Planning Process (online resource) https://www.nzta.govt.nz/planning-and-investment/planning/one-network-framework/future-network-planning/

[55] Ministry of Transport Te Manatu Waka (2023) Household Travel Survey – Travel purpose share by time: overall excluding 'went home' 2020-2023. https://www.transport.govt.nz/statistics-and-insights/household-travel/

[56] NZ Transport Agency Waka Kotahi (2022) Benchmarking Sustainable Urban Mobility – how do our urban centres compare on their journeys toward delivering a low carbon, safe and healthy urban mobility environment. https://www.nzta.govt.nz/assets/resources/sustainable-urban-mobility-benchmarking/sustainable-urban-mobility-benchmarking-report.pdf

[57] The Workshop (2020) How to Talk About Urban Mobility and Transport Shift: A Short Guide https://www.theworkshop.org.nz/publications/how-to-talk-about-urban-mobility-and-transport-shift-a-short-guide

[58] Watercare (2022) Citizen's assembly project (online resource). https://www.watercare.co.nz/About-us/Information-Hub/Community-engagement-hub/citizens-assembly-project

[59] NZ Transport Agency Waka Kotahi (2022) VKT evidence package https://www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/viewupdate/290. Pricing tools also played a significant role in modelling by the Ministry of Transport for a pathway to meet the VKT reduction target in the ERP.

[60] Auckland, Hamilton, Tauranga, Wellington and Christchurch Tier 1 urban areas as defined in the National Policy Statement on Urban Development 2020 https://environment.govt.nz/publications/national-policy-statement-on-urban-development-2020-updated-may-2022/

[61] NZ Transport Agency Waka Kotahi (2024) Crash Analysis System https://cas.nzta.govt.nz/

[62] Frank W. Booth, Christian K. Roberts, and Matthew J. Laye, (2012) Lack of Exercise Is a Major Cause of Chronic Diseases, Comprehensive Physiology 2, no. 2 (April 2012): 1143–1211.

[63] Wild, K. *et al* (2021) The relationship between transport and mental health in Aotearoa New Zealand (NZ Transport Agency research report 675) https://www.nzta.govt.nz/assets/resources/research/reports/675/675-the-relationship-between-transport-and-mental-health-in-aotearoa.pdf

[64] Ministry of Transport Te Manatū Waka (2023) Reducing noxious vehicle emissions from road transport https://www.transport.govt.nz/area-of-interest/environment-and-climate-change/reducing-noxious-vehicle-emissions-from-road-transport/

[65] Ministry for the Environment (2022) Health and air pollution in New Zealand 2016 (HAPINZ 3.0) https://environment.govt.nz/assets/publications/HAPINZ/HAPINZ-3.0-Findings-and-implications.pdf

[66] Ministry for the Environment (2022) Health and air pollution in New Zealand 2016 (HAPINZ 3.0) https://environment.govt.nz/assets/publications/HAPINZ/HAPINZ-3.0-Findings-and-implications.pdf

[67] Energy Efficiency and Conservation Authority (2021) Electric vehicles and Aotearoa https://www.eeca.govt.nz/insights/eeca-insights/electric-vehicles-and-aotearoa/?gad_source=1&gclid=Cj0KCQjwq86wBhDiARIsAJhuphmOkcrx1pp27X88nv-MWmvypwfaPI8nyY1-FwLejzjW8Xx3LSwMVs0aAgSWEALw_wcB