Transport impacts on wellbeing and liveability: literature summary

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Abbreviations and acronyms

CO_2	carbon dioxide
GDP	gross domestic product
OECD	Organisation for Economic Co-operation and Development
Waka Kotahi	Waka Kotahi NZ Transport Agency

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Executive summary

In May 2019, the New Zealand Government produced its first wellbeing budget. Central to this budget was the intent to move beyond a narrow focus on GDP and develop a broader understanding of what it meant for a country to be successful. They summarise this broader perspective in the term wellbeing. The report draws on the literature to explore the links between transport and wellbeing with the purpose of supporting policy initiatives that would improve the wellbeing of urban residents. This report, written in 2019 and 2020, does not explore, in any detail, the impact on those living in rural Aotearoa New Zealand. The key questions addressed in the report are:

1. How does transport affect individual or family wellbeing, and the liveability of different communities?
2. Are initiatives to encourage mode shift, reduce car dependence and reduce environmental impacts of transport likely to increase wellbeing (and for whom) or reduce wellbeing (and for whom)?
3. If changes in transport arrangements reduce health and other costs from accidents or from the use of cars for transport, how should those savings be attributed to the transport sector (apart from specific projects)?
4. What are the most important transport variables to include in measures of liveability for New Zealand?
5. What transport changes provide the greatest improvement in wellbeing and liveability?
6. How should new policies or programmes address the link between transport interventions and wellbeing or liveability outcomes in their intervention logic?

Question 1 is the overarching question that the report focuses on, while using the other five questions to add further details and 'fill in the gaps'. The key message in this report is that transport has a significant effect on wellbeing, but those effects are most clear not in large roading projects connecting our larger towns and cities, but in the local transport initiatives that affect how people move around in their local community. Thus, if Waka Kotahi NZ Transport Agency wishes to have a positive impact on wellbeing and do so in a way that addresses issues of equity, its focus has to be local, and that means working alongside people in their local communities.

A challenge in writing a report of this nature is that the concept of wellbeing is multifaceted and takes on different meanings depending on the context within which it is being used. It is also a concept that includes subjective components, so if you are designing initiatives to improve wellbeing, it is important to work closely with those whose wellbeing you are trying to improve. This has significant implications for how Waka Kotahi goes about its work.

While there is no universally accepted definition of wellbeing, we have adopted for this report the definition used by the New Zealand Treasury in *The Wellbeing Budget*:

> *Wellbeing is when people are able to lead fulfilling lives with purpose, balance and meaning to them. Giving more New Zealanders capabilities to enjoy good wellbeing requires tackling the long-term challenges we face as a country, like the mental health crisis, child poverty and domestic violence. It means improving the state of our environment, the strength of our communities and the performance of our economy.*

Liveability is a concept more familiar to transit planners. This report draws on the definition used by the Ministry of Transport:

> *Liveability refers to the environmental and social quality of an area as perceived by residents, employees, customers and visitors. This includes safety and health (traffic safety, personal*

> *security and public health), local environmental conditions (cleanliness, noise and air quality), the quality of social interactions (neighbourliness, fairness, respect, community identity and pride), opportunities for recreation and entertainment, aesthetics and existence of unique cultural and environmental resources (eg historic structures, mature trees and traditional architectural styles).*

Historically, liveability has referred much more to the physical landscape within which we live. It is a significant contributor to wellbeing and a major focus for transport initiatives.

Besides the overarching definitions of wellbeing and liveability, we have also used the four dimensions of hauora to structure our thinking:

- taha tinana (physical wellbeing)
- taha hinengaro (mental and emotional wellbeing)
- taha whānau (social wellbeing)
- taha wairua (spiritual wellbeing).

Section 4 in the report focuses on what the literature says about the links between transport and wellbeing. The conclusions are clear: transport plays a significant role in providing people with access to work, services, recreation, and community facilities, as well as family and friends. The built environment that facilitates different patterns of transport use has a major impact on wellbeing, as does the specific transport mode used. But the links are not always straightforward. Car use, for example, especially amongst older people, is a key facilitator of their mobility and independence. Yet cars, and the enormous amount of infrastructure that supports car use, can literally divide communities, with transport corridors making connecting with each other and the community at large more difficult. Cars, while facilitating movement, can inhibit people connecting. Cars also have major negative effects in terms of safety and pollution.

The benefits of walking and active transport are well documented, and designing communities to facilitate movement using active transport modes has major benefits for wellbeing. This is not just in terms of physical health, but also in terms of the increased connectedness between people in communities facilitated by active transport modes. Where active transport modes are more available, there are more interactions between those living in that community. But, as with cars, the story is not so simple. For some people – for example, poor single mothers – walking is not something they do out of choice. They do it because there is no alternative or it is something they cannot afford. For them, walking to the shops, doctors, or local playground, often with one or more children, is stressful and not conducive to improved hauora across the four dimensions noted above.

The concept of liveability highlights that the design of the community spaces has a significant impact on transport modes and the transport corridors that the transport options utilise. Understanding these links is important if the benefits that can come from shifts in transport utilisation are to be achieved.

Transport mode is a well-researched topic, confirming that increasing the use of public and active transport modes has a significant positive impact upon wellbeing. However, while this is true at a population level, the nature of the local context may mean that the benefits are shared unequally and may exacerbate inequities that already exist. Do people have choices, or are they, for example, forced to take public transport, even if it is less than adequate, because they cannot afford a car? Public and active transport has major benefits, but only if they enable people to get where they need to go in an affordable, safe and comfortable manner. Traditionally, transport routes have focused on getting people to and from work. If wellbeing is to become a major focus, this historical pattern will need to be reviewed. We describe the effects of different transport modes in section 4.2.

Research question 3 asks how any savings that are derived from transport initiatives can be attributed to the transport sector. We argue that that is the wrong question, as the challenges involved make any cost estimates that result from such an analysis highly unreliable. Furthermore, approaches that focus on realised cost-savings can exclude other values that may have been achieved. For example, aspects of inclusive access are unlikely to be accounted for when focusing only on financial outcomes. Such an approach also ignores changes in equity, which are an important outcome that needs to be considered when attributing value to transport activities. Instead of a narrow focus on cost-savings, we argue for an approach called 'contribution analysis', which we describe in section 4.3. A key feature of this approach is that it makes explicit the theory of change behind the initiative, and it can be a powerful way of bringing diverse stakeholders together to discuss not only the outcomes of value to them but also the key drivers that will influence whether those outcomes are likely to be achieved.

Research questions 4–6 take these key themes and explore what variables need to be included (question 4), what will deliver the greatest improvement (question 5), and how can these themes be addressed in new policies and programmes (question 6).

Section 5.1 develops a causal map that visually describes the historical drivers of transport investment in New Zealand. Section 5.2 describes three key pathways of influence through which transport initiatives impact wellbeing: mobility, built environment, and transport mode. Together they provide the pathways through which the transport sector can structure its initiatives to have the most beneficial impact.

These pathways of influence are then used in section 5.4 to develop the causal map further to explore potential initiatives that have emerged from the literature review as contributing to improved wellbeing.

In conclusion, we highlight that while there are well documented areas in which transport initiatives can positively affect wellbeing, the contextual nature of wellbeing means that the transport sector needs to design and implement these initiatives in close collaboration with the communities in which they will be placed.

Abstract

The purpose of the study was to support Waka Kotahi NZ Transport Agency's goal of developing a transport system that improves wellbeing and liveability by bringing together, into one report, research on the links between transport, wellbeing and liveability.

The research was conducted during the latter part of 2019 and early 2020. We conducted an initial review to gather key themes, which were then discussed with the Steering Group. Following feedback from the Steering Group, the research team explored key themes in greater depth.

While many of the issues highlighted in the literature review are already known to the transport sector and many of the changes required to address them are being implemented, this report brings together the key findings and outlines the key causal pathway through which transport affects wellbeing and liveability and along which transport policy will need to continue developing. The insights also highlight the influence and ongoing contribution of the transport sector to supporting wellbeing and liveability in Aotearoa New Zealand.

1 Introduction

In 2019, the New Zealand Coalition Government introduced its first Wellbeing Budget. This budget recognises the importance of improving living standards, and, more specifically, who is experiencing improvements and who is left out or behind. This is important for addressing the inequities in wellbeing outcomes that are typically evident for Māori, Pasifika and those on low incomes. The Government notes that while New Zealand has experienced good economic growth for a number of years, we have also experienced some of the highest rates of suicide, homelessness, family violence and child poverty. Focusing on wellbeing and living standards encourages the system to think differently about how it understands success and how it can contribute to improvements to wellbeing in Aotearoa New Zealand.

This report draws on a literature review to explore the links between transport, wellbeing and liveability. The report was commissioned by Waka Kotahi NZ Transport Agency (Waka Kotahi) in collaboration with the Ministry of Transport and local councils, in September 2019. The report is designed to support the transport sector in identifying policy changes and initiatives that would contribute to improving the wellbeing of urban residents and the overall liveability of different areas. The report integrates insights from key research papers and relevant grey literature to highlight the positive and negative effects that transport can have on wellbeing, with a view to supporting the sector in designing policies and initiatives that enhance wellbeing.

This report focuses on private, public and active road transport in urban areas, as specified in the brief, and therefore has little focus on train, sea or air travel, and rural settings. The report is guided by six key questions from Waka Kotahi and the Ministry of Transport:

1. How does transport affect individual or family wellbeing, and the liveability of different communities?
2. Are initiatives to encourage mode shift, reduce car dependence, and reduce environmental impacts of transport likely to increase wellbeing (and for whom) or reduce wellbeing (and for whom)?
3. If changes in transport arrangements reduce health and other costs from accidents or from the use of cars for transport, how should those savings be attributed to the transport sector (apart from specific projects)?
4. What are the most important transport variables to include in measures of liveability for New Zealand?
5. What transport changes provide the greatest improvement in wellbeing and liveability?
6. How should new policies or programmes address the link between transport interventions and wellbeing or liveability outcomes in their intervention logic?

During the scoping of this work, we recognised that fully addressing each of these questions would require additional resource and research. This report, therefore, uses a review of the existing literature to consider these questions to support the transport sector in understanding the key themes emerging from existing evidence. This report is designed to support the transport sector in further understanding how it can support and understand its contribution to wellbeing and liveability in Aotearoa New Zealand.

1.1 Structure of this report

Following this introduction, section 2 presents the definitions of wellbeing and liveability that are used in this report. Section 3 describes the approach used for the literature review and the development of systems maps. Section 4 focuses on each of the six research questions. Section 5 reflects on the historical drivers of transport policy and describes how this will need to change if transport investment is to have a more positive impact on wellbeing.

2 Understanding wellbeing and liveability

2.1 Defining wellbeing

Wellbeing is a multifaceted construct that is complex and difficult to define because it encompasses many different areas (Dodge et al 2012; Tyler 2014; Waikato Regional Council 2018). In discussions about the elderly, for example, it is often strongly linked to concepts of mobility and independence (Dodge et al 2012). In economics, it revolves around the OECD's work on 'capitals', incorporating environmental, financial, social and human wellbeing. In the work of Nobel prize winning economist Amartya Sen, it focuses on capabilities. As wellbeing includes subjective components, it can also be challenging to measure, especially when comparing across different population groups (Dodge et al 2012). While there is no universally accepted definition, wellbeing is seen as something to do with a 'good life'. Wellbeing is about people being in a positive state – being healthy, happy and comfortable (Dodge et al 2012; Tyler 2014).

Although the research around wellbeing and how to define wellbeing has been growing over recent decades, there is still no universally accepted definition (Dodge et al 2012). Many thoughts around wellbeing are often descriptions rather than definitions and do not make the exact meaning and how to interpret and measure clear (Dodge et al 2012; Waikato Regional Council 2018). Given this context, this report will draw on the New Zealand Treasury's definition of wellbeing:

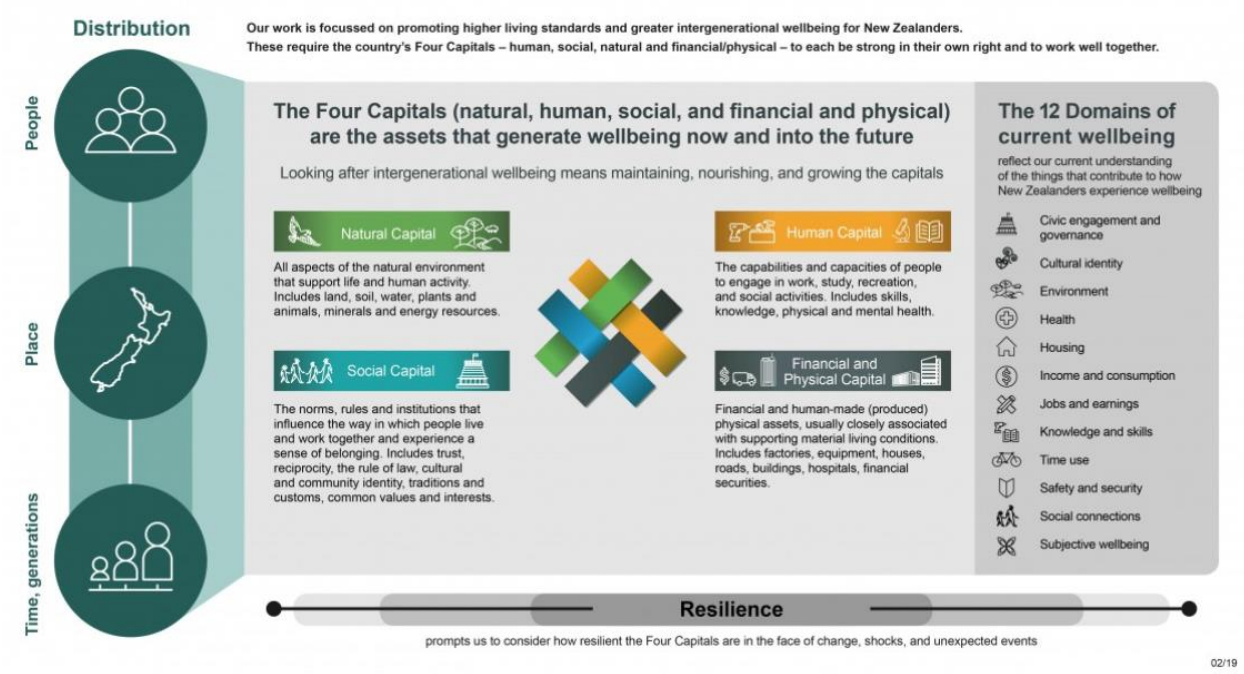
> *Wellbeing is when people are able to lead fulfilling lives with purpose, balance and meaning to them. Giving more New Zealanders capabilities to enjoy good wellbeing requires tackling the long-term challenges we face as a country, like the mental health crisis, child poverty and domestic violence. It means improving the state of our environment, the strength of our communities and the performance of our economy.* (Treasury, 2019c, p 5)

The Treasury's Living Standards Framework (figure 2.1) identifies Four Capitals as assets that generate wellbeing now and into the future: natural, human, social, and financial and physical (Treasury 2019a). These Four Capitals recognise the importance of:

- the natural environment
- the capabilities and capacities of people to engage in pro-social activities
- social norms
- financial and physical assets that support quality living conditions.

To contribute to wellbeing in Aotearoa New Zealand, each of these capitals must be strong in their own right and work well together.

Figure 2.1 The Treasury's Living Standards Framework



2.2 Defining liveability

Liveability has a narrower definition than wellbeing and typically refers to the liveability of places. Definitions have historically focused on safety, the built environment and how it feels for communities living there. This report draws on the following definition.

> *Liveability refers to the environmental and social quality of an area as perceived by residents, employees, customers and visitors. This includes safety and health (traffic safety, personal security and public health), local environmental conditions (cleanliness, noise and air quality), the quality of social interactions (neighbourliness, fairness, respect, community identity and pride), opportunities for recreation and entertainment, aesthetics and existence of unique cultural and environmental resources (eg historic structures, mature trees and traditional architectural styles).* (Victoria Transport Policy Institute, as cited in Ministry of Transport 2008, p 3)

2.3 Wellbeing, liveability and the transport sector

In 2018, the Ministry of Transport developed an outcomes framework focused on achieving 'a transport system that improves wellbeing and liveability' (Ministry of Transport 2018a). The Transport Outcomes Framework (figure 2.2) identifies five key outcomes that contribute to wellbeing and liveability: inclusive access; healthy and safe people; economic prosperity; environmental sustainability; and resilience and security. These reflect the Ministry of Transport's assessment of the ways that transport can contribute to wellbeing in Aotearoa New Zealand. As explained in the academic literature explored in this literature review, transport influences wellbeing directly and indirectly. For example, engaging in active transport can directly improve someone's health by increasing their level of physical activity. Transport can also have indirect influences on wellbeing through facilitating access to work, health services or activities that support social connection (Currie and Stanley 2008; Waikato Regional Council 2018).

Liveability reflects the quality of life enjoyed by local residents and is often measured and reported at a city level, using a mix of indicators. These include transport-related measures such as access to public transport, connectivity of streets, walking or cycling paths, average commute times and transport affordability (Badland et al 2017; Waikato Regional Council 2018).

Figure 2.2 The Ministry of Transport's Transport Outcomes Framework

The key link between these two frameworks is that the Transport Outcomes Framework does what its name suggests – it provides a set of outcomes that the transport sector can aim for in the quest to improve wellbeing and liveability. In contrast, the Living Standards Framework, now adopted by the Government, identifies key capitals that are important for wellbeing across all sectors. They are complementary and will no doubt evolve as the various groups and organisations in Aotearoa New Zealand apply them in their own specific context.

2.4 The issue of equity

As noted above, a key aspect of the Government's wellbeing framework is to increase understanding of 'who is experiencing improvements and who is left out or behind', and thereby increase the country's ability to respond effectively. These questions also have to sit at the centre of transport policies aimed at improving wellbeing. Transport planners need to consider not just whether or not a specific policy has an impact at a population level but also what impact it has within sub-populations. That is, who is going to benefit, and who is going to miss out? Who is being advantaged, and who is being disadvantaged? This is a question of equity. Policies designed to improve wellbeing need to be equitable; that is, they need to be fair and impartial, not favouring one group over another. Equity is multifaceted and is a form of distributive justice (Litman 2002). In the context of transport, equity can be defined as the fair distribution of transport impacts (costs and benefits) throughout society. It is important to recognise that equity differs from equality. Equality is focused on making sure that there is equal distribution to population groups. This overlooks the needs and lived contexts of different populations in society, which is why we should focus on achieving equity (Jeekel

and Martens 2017). Equity analysis in transport is important because transport planning decisions often have significant impacts on different population groups (Jeekel and Martens 2017; Litman 2002). In the context of New Zealand, this means that planners need to pay more attention to their impact on Māori and Pasifika.

3 Method

This report is a narrative literature review as opposed to a systematic review. We reviewed key publications and documents that enabled us to consider each of the six research questions. This approach was designed to ensure that we were able to consider each of the questions within the scope and time available for this work, as each question could be explored through its own in-depth or systematic literature review.

We have also developed the insights from the literature review into systems maps. The purpose is to go beyond the lists of key themes that emerge from the literature review to better illustrate the relationships and connections between transport policy, liveability and wellbeing. This approach has enabled the review to identify key areas to consider when seeking to enhance wellbeing and liveability through the transport sector in Aotearoa New Zealand.

3.1 Literature review

The literature review has adopted a general inductive approach (Thomas 2006). A general inductive approach is often used in evaluation, whereby the evaluation questions are used to guide the data collection and analysis. In this sense the overarching questions provide a frame by which to identify and review relevant literature. The research questions we considered were:

1. How does transport affect individual or family wellbeing, and the liveability of different communities?
2. Are initiatives to encourage mode shift, reduce car dependence and reduce environmental impacts of transport likely to increase wellbeing (and for whom) or reduce wellbeing (and for whom)?
3. If changes in transport arrangements reduce health and other costs from accidents or from the use of cars for transport, how should those savings be attributed to the transport sector (apart from specific projects)?
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The literature review used the following key search terms: liveability, wellbeing, health, public transport, active transport, community, built environment, and theories of change. This identified 213 articles and government reports, of which 135 were considered to be relevant.

All publications and documents are fully referenced to recognise the contribution of the original authors.

3.2 Causal mapping

In parallel with the review of the literature, we have also developed a number of causal maps to help describe the multiple interacting factors that are involved in transport, wellbeing and liveability. Causal maps are visual representations of the causal links between key variables. Their aim is to help move thinking beyond a list of independent factors to a deeper understanding of how these factors influence each other.

We developed some initial causal mapping to highlight the potential value of causal maps as a tool for developing and articulating a robust causal theory, an essential prerequisite for effective and efficient policymaking (Givoni et al 2013). Done well, causal maps describe the key variables that are involved in a specific context, and the direction and strength of their causal relationships. This facilitates debate and understanding about how the objectives of any policy initiatives are to be achieved. While there are a number of techniques that can be used, causal mapping has the benefit of being able to describe and communicate underlying assumptions held by those involved in the policy development process, and act as a ‘visual aid’ to support a greater shared understanding.

The causal maps in this report are designed to engage the transport sector in thinking through the issues raised in the literature review. We do not claim that the causal maps are definitive causal theories, nor do we claim that they are sufficient in their current state to become the basis for policy development. However, they do provide plausible examples of the interaction between key variables explored in the literature review and should be seen as examples that can stimulate debate and be used as inputs into a more robust and detailed policy development process.

The role of the causal maps in this report is to help tease out some of the pathways of influence by which transport policy can have a positive impact on wellbeing and liveability, as well as exploring the contextual factors that affect those pathways.

4 Research questions: what the literature tells us

4.1 Research question 1

How does transport affect individual or family wellbeing, and the liveability of different communities?

As will be discussed further in section 5, transport investment has historically focused on reducing congestion and travel time, especially in regard to reducing commute times (Lucas and Jones 2012; Ministry of Transport 2014), as key drivers of economic growth. The addition of wellbeing has broadened this focus to include, for example, access to a broader range of amenities such as community and health services. Transport provides access to goods, services and employment, and enhances social connectedness (Currie and Stanley 2008). Transport also interacts with the built environment and is therefore an important part of the liveability of a community (Giles-Corti et al 2014).

4.1.1 Individual and whānau wellbeing

Wellbeing is linked with accessibility, which can be accomplished through transport (Tyler 2014). Transport connects people with goods and services, friends, families, events, hobbies and paid and unpaid work. It improves the wellbeing of individuals and communities by giving people access to different modes of mobility and autonomy, as well as traditional wellbeing contributions such as safety and reducing pollution (Schwanen and Ziegler 2011). This increases one's freedom of choice, social inclusion, life satisfaction, equity and health (Chng et al 2016).

Individual wellbeing can also be explored through hauora, the Māori view of wellbeing (Raerino et al 2013). Transport can impact on all four dimensions of hauora, as seen in figure 4.1 on the next page.

Figure 4.1 Transport and hauora

Taha tinana (physical wellbeing) is about the physical body and its development, ability to move and the different ways to care for it.

Transport allows people to move around their communities and this can be done in different modes. Active transport provides the most physical exercise and is a good way to care for one's body.

This will be explored further in the physical and mental wellbeing section.

Taha hinengaro (mental and emotional wellbeing) focuses on thinking processes and responding to feelings and thoughts constructively.

Transport provides better mental health through opportunities for increased exercise, increased downtime when using public transport and increased control over one's life.

This will be explored further in the physical and mental wellbeing section.

Taha whānau (social wellbeing) focuses on relationships with family and friends, feelings of belonging and social support.

Transport helps connect people to places and events, increasing access to social events, friends and families.

This will be explored further in the community wellbeing section.

Taha wairua (spiritual wellbeing) is about personal identity and self-awareness. This includes the values and beliefs that underpin the way people live.

Transport can increase spiritual wellbeing by increasing access to individuals' places of identity and beliefs. For example, improving access to places of cultural significance and religious institutions.

This will be explored further in the community wellbeing section.

4.1.2 Physical and mental wellbeing

Physical wellbeing is about being safe and in good health, and it is closely connected to mental wellbeing. Transport can improve the physical and mental wellbeing of individuals by moving people around and getting them out of their homes, improving their access to parks and hobbies (Lee and Sener 2016; Mollenkopf et al 2004). On the other hand, personal car use is one of the biggest sources of air pollution in New Zealand cities, it is a leading cause of death and serious injury from crashes, it results in a poorly documented but substantial burden of chronic disease due to physical inactivity, and it is one of the most troublesome sources of noise in urban areas (Shaw et al 2018). Transport is also the fastest growing source of greenhouse gas emissions nationally, due principally to increasing numbers of motor vehicles, unfavourable changes in the vehicle fleet (increasing vehicle size and static fuel efficiency) and greater distances travelled (Ministry for the Environment 2019). Transport emissions contribute to accelerated global heating, which

threatens liveability and wellbeing on a global scale. This relates to the Transport Outcomes Framework goals of healthy and safe people and environmental sustainability.

Some types of transport can bring benefits to physical and mental health. For example, active transport, particularly cycling, is associated with reduced mortality (due most likely to the health-promoting effects of physical activity) (Shaw et al 2018) and improved mood and travel satisfaction (Humphreys et al 2013; Warburton et al 2006). Public transport is also seen to improve physical health because people generally have to walk to and from train stations and bus stops (Sugiyama et al 2017). Active transport avoids pollution if it substitutes for car trips, and thus it improves the air quality, which also contributes to better health (Rabl and de Nazelle 2012). Public transport may also reduce congestion and pollution if it reduces the number of vehicles on the road. In New Zealand, the average occupancy of cars is 1.56 people per car, and it has been steadily declining over the past two decades (New Zealand House of Representatives 2017). Increased physical activity protects against illnesses such as type 2 diabetes, cardiovascular disease, colon and breast cancer, and raised blood pressure (Laverty et al 2013; Reynolds et al 2010). People using active transport are more likely to meet the target of 30 minutes exercise a day recommended by the Ministry of Health (2017) than those who travel by other modes.

Research has also shown a correlation between physical activity and mental health. The recommended 30 minutes of moderate intensity activity on most days of the week not only improves physical health but also reduces anxiety and improves mood (Ministry of Transport 2008; NZ Transport Agency 2019; Tin Tin et al 2009). There is increasing research showing how physical activity plays a preventative role in the development of serious mental health problems such as depression (NZ Transport Agency 2019; Tin Tin et al 2009). Exercising causes the body to release chemicals that relieve stress and pain and contribute to a strong sense of wellbeing – a feeling of euphoria that makes individuals feel good after exercising (Warburton et al 2006).

Different modes of travel have different impacts on mental wellbeing. Active transport users have the highest mode satisfaction, and public transport users have the lowest, with car use falling in between (Reardon and Abdallah 2013). Train users generally have higher mode satisfaction than bus users (de Vos et al 2013; Smith 2017). Car use, especially single-occupancy car use, in congested conditions has been shown to generate the highest levels of commuter stress (Chatterjee et al 2020). In contrast, cyclists are the most likely to find their commute ‘exciting’, pedestrians to find their commute ‘relaxing’, and public transport users to find their commute ‘boring’ (Chatterjee et al 2020). Cycling studies have shown that people value being outside, having greater certainty about the time of arrival, and having opportunities for flexible social interactions (Wild and Woodward 2019). Taking public transport has also been linked to better mental wellbeing than driving a vehicle. Users value the downtime activities they can do in public transport, such as listening to music, reading books, answering texts or personal emails, and talking to friends (Ettema et al 2012; Nordbakke and Schwanen 2015). These activities are similar to mindfulness or de-stressing activities that are used to reduce anxiety and depression (Nordbakke and Schwanen 2015; Russell 2012).

However, trip satisfaction varies depending on the kind of public transport: bus travel is consistently shown to be the least satisfying transport mode, due to psychological distress caused by unpredictability and inadequate personal space (Chatterjee et al 2020; Thomas 2010). Train travel generally has higher satisfaction than bus travel, due to greater predictability and more spacious compartments, although both modes are negatively affected by the lack of attention to passenger comfort (Thomas 2010). Research has shown that the lack of personal space afforded public transport commuters is an ongoing deterrent to use, creating levels of crowding considered unacceptable from a health and safety perspective in other environments such as the workplace or even prison environments (Thomas 2010). Improvements to the comfort, frequency and predictability of public transport have been identified as key ways to realise the wider

social and environmental wellbeing benefits of public transport. These wider social impacts of active and public transport will be discussed in more detail in the next section.

Transport may increase access to valuable goods and services such as healthy food and recreational activities. This increases the opportunities for physical activity and healthy living. Transport allows families to go to parks and recreational areas. This is particularly the case for urban residents who do not have as much backyard space for children or pets (Rundle et al 2013; Smith, Hosking et al 2017). Being outside has been linked to better mental and physical wellbeing (Fisher et al 2007; Oliver et al 2015; NZ Transport Agency 2019; Wild and Woodward 2019). Furthermore, transport allows for increased access to fresh produce and health services, which improves the overall health of an individual. Good access to primary care services can protect individuals from serious illnesses, reducing the demand on tertiary health services and improving quality of life (Lee and Sener 2016). Transport also reduces the need for clinics and hospitals in every neighbourhood, allowing for better quality, concentrated clinics (Giles-Corti et al 2014; Nordbakke and Schwanen 2015).

Much of the research that points to improved mental health is in the context of travelling to and from employment. Mental wellbeing has been shown to worsen when there is a lack of choice around the mode of transport (Bostock and Hons 1998; Smith 2017). For example, although active transport makes a positive contribution to wellbeing by facilitating exercise outdoors, it can also contribute to increased stress for those who have no choice but to walk everywhere to meet their basic everyday needs (Bostock and Hons 1998). Walking and other forms of active transport are weather dependent. In bad weather, such as heavy winds and rain, those without choice still have to walk to the stores, to pick up their children, and to run errands. Walking with young children during busy days in an underprivileged lifestyle is experienced as stressful and tiring, adding to the anxieties and pressures of caring in poverty. Often being too stressed and tired, many mothers in the study commented on the fact that they were not able to appreciate the nature outside. For this population group, walking, which is generally seen as a leisurely activity that is often enjoyed either alone or with others, is now a necessity that causes more stress.

‘Forced car ownership’ or a lack of alternatives to car use created by insecure and dispersed employment and the lack of alternative transport infrastructure has also been identified as a key source of stress and disadvantage for lower-income New Zealanders. New Zealand research estimates that 30% of New Zealanders do not have access to a car, in part due to the lack of ability to afford the costs of ownership, licensing and fuel (Canterbury District Health Board 2019; Rose et al 2009). Some research also suggests that ‘forced car ownership’ or owning a car despite being unable to afford it is also a significant cause of financial hardship in low-income communities in New Zealand (Haerewa et al 2018; Rose et al 2009). In a transport system designed for driving, these two situations – being involuntarily car-free, or in a situation of ‘forced car ownership’ – are identified as the cause of a number of social harms in low-income and Māori communities, including dependency on others (especially for low-income women), financial hardship, debt, illegal driving, and entry into the criminal justice system (particularly for young Māori men) (Raerino et al 2013). One recent Australian study (Awaworyi Churchill and Smyth 2019) showed that low income ‘forced’ car commuters to face the double burden of the financial stress associated with unaffordable car ownership combined with the stress of car commuting. This study showed that as a result of this ‘double stress’, low-income car commuters had poorer mental health than people in the community who were not employed. These examples highlight how inequities require transport policy to take account of the differing lives people have, the freedom they have to prioritise different choices, and the capabilities they have to make those choices (Sen 1999).

4.1.3 Community wellbeing

The biggest links between wellbeing and transport occur at the community and neighbourhood level. People's wellbeing is strongly influenced by where they live (Bostock and Hons 1998). Safety, social inclusion, noise and pollution are all important features that impact on community wellbeing (Badland et al 2014; Waikato Regional Council 2018). People's social and cultural needs and mental health are also impacted by the community they live in. The more people feel connected to others in their community, the stronger their sense of identity, and this improves their mental health. Transport allows people to connect with their places of identity, such as family and community spaces and cultural and religious sites (Raerino et al 2013).

Transport also allows people to travel beyond their communities. This provides people with a sense of independence and mobility. This is particularly needed with the growing sprawl of cities (Kennedy and Buys 2009). Not all communities have the goods and services that people need available in their community, so people need to go to other communities to access certain things. For example, if there are no health clinics in a neighbourhood, people living in the neighbourhood will have to find transport to get to the nearest clinic. Transport also diversifies the skills and resources in a community, as people can gain increased access to resources that can improve the development and growth of their community.

Transport can reduce social exclusion, or it can make it worse by making it more difficult and unpleasant to move around neighbourhoods. Active transport provides opportunities for people to 'bump' into neighbours and community members (NZ Transport Agency 2019; Wild and Woodward 2019). For example, when walking, it is easy to stop and chat to a friend who is walking down the same road, or to meet new neighbours and increase social capital (Tin Tin et al 2009). Public transport can also act as a public space for people to socialise and bump into friends (Currie and Stanley 2008; Stanley and Lucas 2008). However, crowding, lack of control over arrival time, and difficulty in exiting difficult situations commonly makes social contact on public transport stressful and unpleasant (Thomas 2010).

With increased social capital, people are able to access various resources and services that may help improve their life. For example, if people who are strongly connected to their community are sick, community members may check on them, providing extra support to nurse them back to health. Recent research on a study of 15 interventions across a number of counties in the United States showed two interventions standing out as consistently improving health and wellbeing, regardless of context (Milstein and Homer 2020). The first intervention is increasing social connections within communities and reducing poverty. The second intervention is direct impact by transport interventions – for example, transit-oriented community development and reducing toxic emissions.

The physical layout of a community also affects the mobility and social inclusion of community members (Kleinert and Horton 2016; Mollenkopf et al 2004). For example, for children, older people, and people with disabilities, the ability to use a private car is often dependent on others. By designing an environment with access to good, clean public transport and community transport initiatives to help people get to places and meet people, the wellbeing of communities will improve (Appleyard 2017; Miller et al 2013). With more people being able to socialise with each other, the stronger the community will be, improving their sense of belonging and wellbeing. Shared space is another planning factor when designing communities and the transport system. The sharing of space for transport modes such as cars and cyclists or pedestrians and scooters is important, as too many people sharing space can cause collisions, accidents and annoyance. For example, the introduction of electric scooters after a community was designed has negatively affected the shared space. Electric scooters are often sharing footpaths with pedestrians. The Blind and Low Vision Foundation (Blind Low Vision NZ 2019) has mentioned that people with visual disabilities who walk on the shared footpath have found them frightening and dangerous because they are quiet and can travel quite fast.

Additionally, extended family or friends often live in different areas and neighbourhoods. Being able to get to family members or friends decreases social isolation and improves wellbeing. For example, children have a high dependence on parents to transport them to events. Public transport allows children to go to events such as friends' birthday parties without having to rely on their parents (Smith, Amann et al 2019). This has major wellbeing benefits as it improves children's social connection, autonomy and happiness. A few studies have explored how children feared missing out, and the autonomy provided through public and active transport allowed children to go to events (Roth et al 2012; Smith, Amann et al 2019). This was shown to improve family wellbeing as children did not feel like they were bothering family members who could drive, or feeling resentment against caregivers for isolating them from friends. In some cities such as Auckland, children under 16 now have free public transport on the weekends. This improves equity as children who would otherwise face a financial barrier or have parents unable to drive them around are able to visit friends and play in parks (Lucas and Jones 2012; Oliver et al 2015; Smith, Amann et al 2019).

4.1.4 Liveability of different communities

Liveability is a narrower concept than wellbeing and one that has been addressed in the transport literature for a longer period (Goldman and Gorham 2006; Miller et al 2013). Research on transport and liveability is strongly embedded in the urban design literature and highlights how good urban design affects peoples' safety and allows them to access community resources (eg, community centres) and essential services (eg, hospitals) (Kennedy and Buys 2009; Kleinert and Horton 2016). There is an interplay between transport and the built environment, as transport plays a big part in building a liveable environment (Miller et al 2013). For example, transport allows people to get to places. The more liveable a community is, the more options there will be for modes of transport. This then impacts and improves people's wellbeing. However, communities differ vastly, and what works in one community may not always work in another.

Literature around the built environment has shown for many years that the urban form impacts on wellbeing (Badland et al 2014; Smith, Hosking et al 2017). Some studies have looked at various liveability indicators and assessed its quality using a wellbeing lens. Badland et al's (2017) study identified 11 indicators of liveability as contributing to wellbeing through the social determinants of health. These include safety, education, employment, housing, leisure and culture, social cohesion, public open space, local democracy, health and social services, natural environment, local food, and other goods and transport. Lower residential densities with reduced street connectivity and poor access to public spaces, shops, services and public transport infrastructure have been shown to be associated with poorer health (Badland et al 2014; Giles-Corti et al 2014; MacDonald et al 2010; Smith, Obolonkin et al 2019).

Perceived safety is a big part of wellbeing and liveability. For example, the liveability and design of the neighbourhood impacts people's perceived safety. This then influences whether or not parents allow their children to play or go outside, which affects the autonomy and health of the child. Research indicates that residents of a community are more likely to choose to use environmentally sustainable modes of transport, such as walking and cycling, when the environment is safe and easy to use (Appleyard 2017; NZ Transport Agency 2015; Smith 2017; Smith, Amann et al 2019). Infrastructure that makes walking and cycling safer is likely to be the most effective intervention for encouraging active transport (Smith, Amann et al 2019; Smith, Hosking et al 2017; Smith, Obolonkin et al 2019).

Raerino et al (2013) suggest that because much of the literature has historically focused on access to work and essential services, important issues such as access to family, religious and cultural sites such as marae have been largely ignored. These aspects of liveability will be discussed further in the fourth research question. Urban density is also an increasing theme in the transport and wellbeing literature (Owen et al 2007). Urban density makes active and public transport more feasible and, as a consequence, can have a

positive impact on carbon emissions, which are much higher in highly dispersed cities, such as Auckland (Owen et al 2007).

Given the overlaps between research questions 1 and 2, the key points will be summarised together at the end of question 2.

4.1.5 The impact of transport corridors

It has been noted by a number of researchers (Appleyard 2017; Appleyard 1980; Wiki et al 2018) that motorised transport, public and private, has significant negative impacts upon neighbourhoods. As people in our large cities move further and further away to places serviced by large transport corridors, the living environment becomes dominated by roads and private cars.

The result is that neighbourhoods become less places of 'social connection and value' (Wiki et al 2018) and more like transport corridors that people use to get from home to work. This has negative impacts upon neighbourhood liveability through the effect of noise (Kingston Reynolds Thom and Allardice Limited 1982) and by limiting the opportunities for social interaction (Tranter and Pawson 2010).

As will be pointed out in section 5, transport corridors enable these suburban communities to be developed, and because of the greater distances involved in connecting people to work and to health, social and cultural services, they make the development of public and active transport alternatives less viable.

4.2 Research question 2

Are initiatives to encourage mode shift, reduce car dependence and reduce environmental impacts of transport likely to increase wellbeing (and for whom) or reduce wellbeing (and for whom)?

4.2.1 Transport modes

Transport helps people gain access to goods, services and employment, and enhances social connectedness. However, different modes of transport have different positive and negative impacts.

Land transport is known to contribute to noise and air pollution, as well as using up a significant amount of energy in the infrastructure required to support it (Giles et al 2011; Rabl and de Nazelle 2012; Reynolds et al 2010). Land transport is also a major contributor towards climate change, which is having, and will increasingly have, a significant impact on peoples' wellbeing through forcing a change in land-use patterns, coastal erosion, and increasing health problems associated with warmer temperatures. Reducing the number of cars on the road will reduce the amount of pollution, which in some New Zealand cities is now at a level well above what is considered safe (Lee and Sener 2016; Ministry of Transport 2018a; Mugion et al 2018; New Zealand Government 2014; NZ Transport Agency 2018). The increasing number of electric vehicles is one trend that may help to alleviate the worst effects of current transport fuels.

The future is changing fast, and transport modes are shifting quickly. Smart phones are driving new initiatives such as app-based ride share, and globally there is a change taking place in which mobility is being seen as a service that a person can buy, as opposed to the historical link between being mobile and owning a vehicle (Schlossberg et al 2012). Today there is an increasing focus on 'being mobile', purchasing mobility as a service rather than as a product (Wong et al 2019). Therefore, it is important to explore and understand the changing space of transport and its impact on people's wellbeing. The potential is for it to greatly increase the options available because a person could have access to both a car and public transport

without having to make the large capital investment in purchasing a car. Smart phones are, for example, supporting the rise of car share schemes, making it feasible for people to use a car only when suitable public transport options are not available.

4.2.2 Reducing car dependence for wellbeing

Many people think that the lack of access to a car is the same as transport disadvantage. However, poor proximity to good public transport services or the lack of availability of active transport facilities are more likely the causes of transport disadvantage (Chng et al 2016; Lucas and Jones 2012; Smith, Obolonkin et al 2019).

Strategic decisions prioritising highways over railways have led to the convenience and prioritisation of private car use (McLintock 1966; Ministry of Transport 2017). In 2018, the Ministry of Transport's strategic direction changed to include safety, access, environment and value for money, compared to the previous strategic direction in 2015 of economic growth, road safety and value for money (New Zealand Government 2014, 2018). The inclusion of prioritising access and environment are heavily supported in the literature as necessary for the growing and changing needs of transport for improved social, cultural and environmental wellbeing that results in reduced private car dependence (Appleyard 2017; Currie et al 2010; Goldman and Gorham 2006; Lucas 2012; Ministry of Transport 2008; Rabl and de Nazelle 2012; Raerino et al 2013).

There is strong evidence in the literature that driving cars impacts negatively on physical and mental wellbeing (Laverty et al 2013; Rabl and de Nazelle 2012; Sugiyama et al 2016; Sugiyama et al 2017). People are less likely to exercise or walk in their transport journey when using a private car (Jacobson et al 2011). It is estimated that one in eight deaths is caused by physical inactivity (Owen et al 2007). Physical inactivity is the fourth largest cause of mortality worldwide, and it is estimated to be the main factor for 30% of cardiovascular disease, 27% of diabetes and 21–25% of colon and breast cancer globally (Frank et al 2016; World Health Organization 2016). The World Health Organization (2010) believes that this rising trend is partly caused by transport systems that promote private car use. People who drive to work report lower life satisfaction and feel more stressed (Chng et al 2016). Driving a car is a non-passive travel mode that requires constant concentration. This is seen to increase stress levels and anger, particularly in traffic (Ettema et al 2012; Lyons et al 2013; Martin et al 2014). Overall, research appears to suggest that avoiding car driving may be beneficial to wellbeing.

Cars are a major contributor to climate change and pollution. In New Zealand, harmful emissions are the primary cause of 256 premature deaths a year (Fisher et al 2007). As mentioned earlier, the average car occupancy is 1.56 people per car in New Zealand. This statistic shows that many people are driving on their own, thereby increasing congestion and pollution and decreasing individual physical and mental health. The average vehicle occupancy of Auckland's morning peak periods is 1.32. If this increased to an occupancy rate of 1.9 (as seen in some European nations), this would remove 31% of vehicles from the road (New Zealand House of Representatives 2017). New Zealand has committed to net zero emissions by 2050 and has enacted the Climate Change Response (Zero Carbon) Amendment Act 2019. Shifting to more sustainable transportation modes is required if this goal is to be achieved. The extensive use of cars is not only environmentally harmful but also bad for most people's wellbeing. Initiatives that encourage mode shift, reduce car dependence, and reduce environmental impacts of transport include active and public transport.

Although the literature points to the negative impacts of car dependency, it is also important to recognise that for some population groups, car use is liberating because it allows these groups to be mobile and not dependent on others (Marottoli et al 1997; Mollenkopf et al 2004; Park and Chowdhury 2018). For example, for older people, cars give them a sense of independence and mobility. Some people with disabilities do not have the ability to walk far, and people who use a wheelchair find it difficult to get on public transport,

particularly buses. Therefore, the ability to have and operate a car provides them with mobility they otherwise would not have.

It is equally important to acknowledge that these groups are often forced to use a car by the lack of alternatives (Park and Chowdhury 2018). Lack of ability to use public transport when you use a wheelchair is an equity issue caused by inaccessible design – a disabling environment (Park and Chowdhury 2018). Equally, car dependency amongst the elderly is also often forced by poor design and lack of public transport (Mollenkopf et al 2004; Wiles et al 2009). In other societies with higher quality active transport and public transport infrastructure, older people walk, cycle and use public transport to a much higher degree than they do in New Zealand, and their health and social contact is better as a result (Mollenkopf et al 2004; Park and Chowdhury 2018; Wiles et al 2009). Forced car use due to inaccessible design and lack of alternatives is particularly difficult and inequitable for low-income elderly and disabled people. New Zealand research (Park and Chowdhury 2018; Wiles et al 2009) has shown ways that the current transport system is disabling and inaccessible for people with impairments.

Nonetheless, it is important to acknowledge that if we rely on car use to liberate older people and people with disabilities from inaccessible street design and poor quality, this 'liberation' will be one that is only available to wealthy older and disabled people for as long as they have the ability to drive (Marottoli et al 1997; Mollenkopf et al 2004; Shope et al 2019). New Zealand research (Shope et al 2019; Wiles et al 2009) shows that car dominance and the current lack of alternative transport choice means that when older New Zealanders have to give up their driver licence, they experience high rates of social exclusion and depression. However, research (Shope et al 2019; Wiles et al 2009) also shows that this is not the case for older people in countries with high quality public transport and active transport infrastructure. This highlights the importance of considering the design of public transport options to provide a feasible and accessible option for a broad range of people.

4.2.3 Positive impacts of active transport on wellbeing

There is extensive research showing that those who choose to walk and cycle have better health outcomes than people who use other modes or use them less frequently (Laverty et al 2013; Martin et al 2014; Ministry of Transport 2008; NZ Transport Agency 2019; Rabl and de Nazelle 2012; Reynolds et al 2010; Smith, Hosking et al 2017; Tin Tin et al 2009; Wild and Woodward 2019). People who walk to work report higher life satisfaction compared to people who drive to work (Chng et al 2016; Owen et al 2007; Reynolds et al 2010).

Regarding physical health, active transport acts as a protective factor against obesity and related illnesses such as cardiovascular disease and diabetes (Giles et al 2011; Laverty et al 2013; Reynolds et al 2010; Sugiyama et al 2016). As mentioned in the previous section, those who choose active transport are most likely to reach the recommended level of regular, moderate intensity physical activity that improves the physical and mental health of individuals.

There is a positive relationship identified between wellbeing and time spent walking. It has been suggested that intrinsic enjoyment is gained from the exercise and relaxation associated with active transport (Rabl and de Nazelle 2012; Waikato Regional Council 2018). In comparison to car drivers, choosing active transport acts as a protective factor for depression (Rabl and de Nazelle 2012; Waikato Regional Council 2018). This is particularly a result of being surrounded by nature and not being stuck in traffic. In many surveys, pedestrians and cyclists are significantly more satisfied than drivers and bus users.

Active transport users are shown to be the happiest commuters (Wild and Woodward 2019). Cycling and walking allow people to have more control over their commute journey because they are able to predict their time of arrival, stop wherever they want, and not have to worry about parking. This control is in contrast to the anxiety that car drivers feel around congestion or finding a car park. Active transport users also have

sensory stimulation that comes from exercising combined with the increased awareness of surroundings (Wild and Woodward 2019). As exercise creates a feel-good effect, this sort of moderate exercise is motivating and enjoyable and is associated with improved mood and mental alertness (Humphreys et al 2013; Wild and Woodward 2019). In addition, active transport users have greater opportunities for social interaction, which is different from a car driver, who is most likely driving alone, or busy concentrating on driving. Those who choose active transport are more likely to have opportunities to observe what is going on around them, interact with others, and bump into friends (Reynolds et al 2010; Wild and Woodward 2019). For example, one of the e-bikers in a New Zealand qualitative study said, 'Me and my friend, we had a lovely ride last week. We just meandered along and talked, and all these different people were out there, someone was walking a dog and someone was jogging, and you just say "hello"' (Wild and Woodward 2019). Active transport gives commuters the opportunity to stop and chat, and this can improve community wellbeing and connectedness.

Cyclists are more likely to be healthier than car or public transport users; however, it is unclear whether or not healthier people choose to cycle, or cycling makes them healthier. It has also been shown that people who start using active transport young are more likely to be physically active (Roth et al 2012). Active commuting has also proved to be easier to adopt and sustain when compared with exercise programmes.

4.2.3.1 Environmental and other impacts

Changing from predominantly motorised transportation to active transportation has the potential for societal benefits and reducing injuries. Active transport does not produce any emissions, and this shift can reduce the emission of greenhouse gases and air pollutants, reduce traffic noise, and provide more liveable neighbourhoods with less motor-vehicle traffic (Giles et al 2011; Reynolds et al 2010). Active transport can further contribute to emissions reductions by improving traffic flow and reducing vehicle congestion.

Active transport depends on the environment being well built and appropriate for active commuters. Uncontrollable environmental barriers such as bad weather can override behavioural influences to choose active transport (Appleyard 2017; Miller et al 2013; Smith 2013). In a New Zealand study (Tin Tin et al 2012) there were consistent associations between temperature, hours of sunshine and rainfall and cycling volumes, although hourly rainfall appeared to influence primarily the timing of travel rather than overall amount (Tin Tin et al 2012).

Active transport is cost effective, as cycling and walking lanes are cheaper to make and maintain than roads (Martin et al 2012; Sugiyama et al 2017; Waikato Regional Council 2018). Additionally, it reduces congestion and can improve people's moods. The positive emotions from active transport have been shown to influence emotions during the day and improve work performance. It is suggested that the improved mood from active transportation modes results in increased productivity, which improves the overall economy of the country (Martin et al 2012; Tyler 2014). Research has also shown that people who drive to work are more likely to take sick days than those who use active transport to get to work (Rabl and de Nazelle 2012; Smith 2013; Smith 2017; Sugiyama et al 2016).

Investing in footpaths is associated with boosts to the local economy and increases in the overall quality and value of businesses and homes, and it provides financial savings from transportation-related costs (National Pedestrian Project, nd; NZ Transport Agency 2019). However, to benefit fully from these outcomes, investing in footpaths or cycle lanes should be combined with other initiatives to promote it. There are also future savings expected in healthcare costs as there are savings gained from choosing footpaths over roads as seen from the benefits of active transport. This can equate to more money for individuals to invest in local services, goods and entertainment (Ministry of Transport 2008; Waikato Regional Council 2018).

With the introduction of electric modes of active transport such as e-bikes and e-scooters, it is necessary to keep in mind the impact and enjoyment of these modes (NZ Transport Agency 2015). Electric bicycles may further enhance the high mode satisfaction of cyclists (Wild and Woodward 2019).

4.2.3.2 Contextual factors and concerns

Currently, people who choose to use active transport face an increased risk of injury due to collisions with others sharing the road (Rabl and de Nazelle 2012; Reynolds et al 2010). With fewer motor vehicles on the road, people using active transport may have less dangerous collisions. New Zealand's road toll is rising, while most OECD countries have a declining trend. In 2018, the death toll for road accidents was 377. Lower fuel prices generate more miles travelled and have been linked to the increase in road accidents, which increases the road toll and pushes against the long-term goal for improved road safety (Best and Burke 2018). However, although it is unknown why, the number of serious injuries to cyclists has been seen to increase when fuel prices are high. The literature on active transport suggests that road safety should be prioritised and speed should be significantly reduced in high-pedestrian areas (Badland et al 2014; Best and Burke 2018; Kleinert and Horton 2016; Reynolds et al 2010).

Different population group studies have shown different contextual factors. For example, children are seen to benefit from active transport and are more likely to sustain this throughout their lives (Roth et al 2012). However, the liveability of the neighbourhood affects children's ability for independent mobility (Smith, Amann et al 2019). If a neighbourhood has a low level of liveability, it impacts on children's wellbeing because they are then dependent on parental guardians in order to go places. If neighbourhoods have high traffic and crime, children are less likely to have the opportunity to be let out to ride a bike or go on walks with their friends (Smith, Amann et al 2019). Research has shown that street connectivity is positively associated with active transport and mobility (Moran et al 2016; Oliver et al 2015). However, research also shows that cul-de-sacs increase independent mobility (Villanueva et al 2014). Where independent active transport is required, street connectivity plays a significant role for influencing people to use active transport. Nonetheless, cul-de-sacs are seen to be just as significant for influencing people, particularly children, to use active transport if independent play is of interest (Villanueva et al 2014). Therefore, in the context of children, linking a high prevalence of neighbourhood cul-de-sacs with street connectivity (particularly accessibility to schools, parks and other local destinations) has a positive association with increased uptake of active transport use and independent mobility (Smith, Amann et al 2019). It is also necessary to recognise that those who cycle are more likely to choose to cycle compared to pedestrians who may have no other option but walking.

The enjoyment from active transport receives less attention in research when compared to safety concerns (Wild and Woodward 2019). Understanding satisfaction from cyclists and active commuters can help agencies promote cycling more effectively.

4.2.4 Positive impacts of public transport on wellbeing

It has been demonstrated that globally and in New Zealand, walking is usually a substantial part of a public transport journey (Sugiyama et al 2017; Wellington Regional Council 2012). This means that people who use public transport also benefit from taking part in some exercise during their day. As mentioned previously, there is a positive relationship identified between wellbeing and time spent walking. Access to public transport has been correlated with good health outcomes because bus stops and stations encourage people to walk more than drive.

Public transport allows for opportunities and downtime for catching up with work, friends and emails (Martin et al 2014). Train users are significantly more satisfied than bus users and car drivers due to an increased ability for quiet downtime. Activities people engage in on public transport show that they are using public

transport as a time to catch up on their lives and relax (Ettema et al 2012; Martin et al 2014). Some of the activities include listening to music, reading books, catching up on emails, and talking to people (Russell 2012). People seem to be able to do more activities to 'wind down' on train rides, and this was seen to improve mental health and give people a break from their busy schedules (Martin et al 2014; Nordbakke and Schwanen 2015; Russell 2012). It has been suggested that the downtime experienced during travel and also the activities passengers undertake while travelling and waiting in public transport have a positive impact on wellbeing (Ettema et al 2012; Russell 2012). The view of travel time has changed over the past two decades. Fewer passengers consider their travel time as wasted, and more passengers are considering it as worthwhile time (Laverty et al 2013). Russell (2012) and Nordbakke and Schwanen (2015) recommend that policymakers take into account travel time use and its impact on people.

While it is suggested that public transport may be better for mental health than driving cars, more research needs to be been done in this area (Humphreys et al 2013; Waikato Regional Council 2018). A few studies have shown that both active transport and train users show better psychological wellbeing (Humphreys et al 2013; Mugion et al 2018; Schwanen and Ziegler 2011). Additionally, those who switch between public transport and active transport show better psychological wellbeing than those who switch between car travel to active transport (Humphreys et al 2013; Mugion et al 2018; Schwanen and Ziegler 2011).

Literature shows that mental distress is lower for all public transport users in areas with better public transport connectivity (Chng et al 2016). This information is useful for individuals to know when considering trade-offs between jobs and for planners who want to address socio-economic disparities in wellbeing. Mental distress in low socio-economic neighbourhoods can be reduced through better public transport infrastructure, particularly connectivity to work, schools and services. It has been suggested that while life satisfaction has a correlation with the type of public transport used, mental distress is more closely linked to the connectivity of public transport (Chng et al 2016).

Public transportation modes are often seen by the community as public spaces where people can bump into community members or socialise with their friends, increasing their connectivity within the community (Currie and Stanley 2008; Currie et al 2010). This improves community wellbeing. Public transport also improves the mobility of people who are otherwise unable to drive or reach further destinations (Schwanen and Ziegler 2011). For example, good public transport means children do not have to depend on their parents/guardians to attend social events or visit their friends.

4.2.4.1 Environmental and other impacts

In New Zealand, 20% of total greenhouse gas emissions are from the transport sector (Ministry of Transport 2019). However, public transport emissions per passenger kilometre are significantly lower than passenger kilometres from single-occupant car use (Wright and Fulton 2005). With an average bus capacity of 60 people on metropolitan routes, this means that buses can move as many people as 40 cars at peak times while taking up the equivalent road space of roughly three cars. This makes public transport an efficient and more environmentally friendly way of moving people during peak times (New Zealand House of Representatives 2017). Although public transport is better than private car travel regarding the reduction of emissions, it is not as good as active transport (Reynolds et al 2010; Wright and Fulton 2005). However, unlike active transport, people can use public transport in most weather because it provides shelter.

Public transport enables increased employment in central city locations by reducing commuting costs in congested transport networks by freeing up space that would otherwise be needed for parking facilities (NZ Transport Agency 2018; Stanley 2014). Transport improvements can reduce costs of commuting, which can lead to a growth in the city and improve the economy (NZ Transport Agency 2018; Stanley 2014).

4.2.4.2 Contextual factors and concerns

Research shows that service quality has a direct impact on the intention to use public transport (Mugion et al 2018). This affects individuals' intentions to use a car less as well as their intentions to use more sustainable transport modes more. Improving service quality adds value to public transport for commuters. Some examples of service quality improvements include investing in machines for convenient tapping of transport cards and investing in customer service. It is suggested that to best attract potential users, public transport services must be designed according to customer needs and expectations (Badland et al 2014; Mugion et al 2018). Mental distress can also be caused by low connectivity to public transport (Chng et al 2016). Having less control over the end point of one's journey and having to change multiple transport modes leads to increased distress, particularly from time delays.

Historically, transport has been created to help move people to and from employment. This has led to public transport routes being created around the needs of workers who work '9-to-5' jobs. With cities growing with businesses, other uses for public transport such as going to cultural or religious sites have been overlooked (Raerino et al 2013). As a result, people have to drive or use active transport modes to get to places significant to their identity. For some population groups, such as Māori, gentrification has caused their homes to be further pushed away from marae and their whānau (Raerino et al 2013). This has caused a disconnectedness from family, cultural sites and other social requirements, resulting in isolation and harm to their identity. Restricting access to travel by car without providing alternative methods for transport will negatively impact on wellbeing. For example, wellbeing is negatively impacted by reducing Māori participation in fulfilling cultural and community obligations by reducing access to cultural sites or family homes (Raerino et al 2013). Additionally, it can reduce the safety of community members who have the responsibility to drive younger members to school or have to drive longer distances to pick up whānau or get to cultural sites.

The importance of equity and variation of experiences for different populations when designing public transport has often been overlooked. It is suggested that providing more voices in decision-making will improve equity and prioritise the wellbeing of groups that do not benefit from the transport sector (Raerino et al 2013; Waikato Regional Council 2018). More voices are needed – particularly from Māori, Pasifika, people with disabilities, people on low income and people from minority groups – to ensure that public transport provides opportunities to enhance their wellbeing.

Although public transport provides opportunities to relax when compared to driving a car in traffic, when trains and buses are crowded, the wellbeing and mental health of individuals reduces (Ettema et al 2012; Lyons et al 2013; Martin et al 2014). This is particularly due to the small amount of space allocated to each passenger, especially on buses (Thomas 2010). The poor seating design in public transport in New Zealand (Thomas 2010) has been shown to discourage interaction and create a socially sterile environment, particularly for strangers. The lack of allocated space per passenger forces people into intimate proximity with strangers in a way that reduces the potential for enjoyable social connection (Lyons et al 2013; Thomas 2010). Improving seating and carriage design can increase comfort in ways that stimulate social connection and improve the wellbeing of public transport users in New Zealand.

Additionally, people with poor mental health react differently to public transport than those with good mental health. For example, people with depression find public transport to be a lonely experience, whereas much of the literature suggests that public transport acts as a public space for social interaction (Martin et al 2014). People with anxiety have also reported higher rates of mental distress when using public transport modes. People with poor mental health may find using a private car or a taxi more comfortable than using public transport (Martin et al 2014).

It is also important to recognise that the difficulties of using public transport amongst people with mental health challenges are also related to poor quality and discriminatory services. Often, public transport staff have not received training in identifying and accommodating the needs of people with mental health problems. The Human Rights Commission (2005) conducted research on the experiences of people with mental illness and found that they regularly experienced discrimination from bus drivers.

People with disabilities, including people with mental health challenges, are particularly likely to live in poverty and to have difficulties affording taxis or a car if they are feeling overwhelmed using public transport. As a result, mental health services often work on improving access to lower-cost transport options. One option seen in a local initiative in Christchurch (Canterbury District Health Board 2018) shows how using bikes instead of public transport can help reduce the transport disadvantage and social exclusion faced by people with poor mental health.

4.2.5 Key points for research questions 1 and 2

1. Transport mode has a significant impact on wellbeing and liveability. Active and public transport have significant benefits over private car travel. Those who use public and active transport have higher levels of life satisfaction and wellbeing when compared with those who travel by car, especially during the commute time. Table 4.1 provides a summary of the different impacts of mode shift on wellbeing and liveability.
2. The broad conclusions in key point 1 do not necessarily follow for some sub-populations, such as those with mental health issues. As a consequence, it is important to understand the experiences of different populations when implementing policies to encourage mode shift. For example, while public transport generally has a positive effect on wellbeing, people with mental health issues have increased anxiety and stress levels when the buses and/or trains are crowded. Furthermore, for many economically disadvantaged people, walking is a necessity, not a choice, and this can have a significant negative impact on wellbeing.
3. Following on from key point 3, it is clear that socio-economic differences impact the mode choice that people can make, thereby limiting the potential benefits for those on lower incomes.
4. The built environment, especially urban density, has a significant impact on the viability of active and public transport systems. Furthermore, as people move further and further away from urban settings, their suburban communities become dominated by private vehicles, which use large transport corridors to travel between home and places of work and health and social services. The lower density and larger distances typical of these suburban communities also make it much more difficult to provide public transport alternatives.

Table 4.1 Summary of the impact of mode shift on wellbeing and liveability

Private car	Public transport	Cycling	Walking	e-scooters
• Increased congestion • Increased noise and air pollution • Increased CO_2 emissions • Negative impacts on physical and mental health • Lower life satisfaction and increased stress • Increased mobility and access for those unable to use other travel modes, or when other travel modes are unavailable • Increased time off work due to sickness	• Reduced congestion • Reduced noise and air pollution • Reduced CO_2 emissions • Increased physical and mental health • Potentially higher rates of social exclusion and depression amongst the elderly if high quality public transport is not available • May contribute to increased levels of anxiety for those with poor mental health • Contributes to the local economy • Reduced cost of commuting • Can increase mental distress if system is not well connected and/or is overcrowded	• Reduced congestion • Reduced noise and air pollution • Reduced CO_2 emissions • Increased physical and mental health • Increased opportunities for social interaction • If supported with investment in walking infrastructure, it contributes to the local economy • If people start cycling when they are young, they are more likely to continue cycling throughout their lives	• Reduced congestion • Reduced noise and air pollution • Reduced CO_2 emissions • Increased physical and mental health • Higher levels of life satisfaction • Greater opportunities for social interaction • Decreased social isolation • Greater connectivity in communities • Potential increase in social isolation for some groups for whom walking is a necessity rather than a choice • If supported with investment in walking infrastructure, it contributes to the local economy • If people start walking when they are young, they are more likely to continue walking throughout their lives	• Overall effects are largely unknown at this stage; however, they are contributing to increased competition for use of the footpath, potentially disadvantaging elderly and disabled people

4.3 Research question 3

If changes in transport arrangements reduce health and other costs from accidents or from the use of cars for transport, how should those savings be attributed to the transport sector (apart from specific projects)?

There is evidence in the literature that changes in transport arrangements can improve physical and mental health and therefore reduce associated health and other costs. However, the attribution of cost-savings to a specific organisation (ie, Waka Kotahi) when the effects are felt across the sector is a complex issue with a number of challenges and considerations.

The issue being addressed here is not the impact that transport has on wellbeing and liveability, or the savings that could be attributed to, for example, a reduction in injury rates from a specific transport project. The focus of this question is on the overall transport sector and how the savings – for example, through improved physical health arising from an increase in the numbers adopting active transport modes – could be attributed to the transport sector. That is a much bigger challenge.

Anciaes et al (2016) looked at the impact of large roads on health and wellbeing. They noted that

> *there is growing evidence on the benefits of policies to promote walking, but seldom in the context of policies to reduce the impacts of road traffic. Methods to value other aspects, such as the impacts on health, wellbeing and social cohesion remain scarce.*

Despite extensive data collection utilising video surveys of traffic flows, specific health measures, street audits of the pedestrian environment, and household surveys, the authors concluded that although valuable, the complexity 'leads to unreliable results for cost estimates'.

There is also some work being undertaken in behavioural economics that could be of potential value, but it is also fraught with challenges. Metcalfe and Dolan (2012) concluded 'there are a number of contextual factors on individual behaviour', and that further research is needed to 'demonstrate causality in the evaluation of interventions'.

The challenge of attributing benefits and cost-savings is not unique to the transport sector; it is an issue experienced across many government departments when savings that are generated by their initiatives are received by organisations in other sectors. For example, improved social housing initiatives are known to result in savings to the health system.

When considering how the cost-savings from transport arrangements should be attributed to the transport sector, there are a few key issues/questions to consider (Macmillan et al 2014):

- What health and other costs should be included in an analysis? (identification)
- How can these health and other cost-savings be measured? (measurement)
- To what extent can these cost-savings plausibly be linked to changed transport arrangements? (contribution)

Given the challenges noted above, a more appropriate task is to assess the contribution that such an initiative makes. Mayne (2001) acknowledges this challenge and considers that extensive social science research methods have been designed with this challenge in mind and that an evaluation study is the best way to explore the contributions of initiatives to cross-sector outcomes if there is adequate time, resource and expertise.

An evaluation study that is able to assess the contribution that an initiative makes to improvements in wellbeing should utilise frameworks for evaluating systems initiatives (Funnell 1997) and contribution analysis (Mayne 2001). Frameworks are used in evaluation to make transparent the understanding of the world that is being applied to the design, analysis and interpretation. Specifically:

- It is important to have a clear map of the relationships within the project, the context within which it is being implemented, and the factors that can affect its impacts. This moves the evaluation beyond the boundaries of specific projects or departments. This puts the focus of an evaluation on wider changes in transport arrangements and the cross-sector outcomes these changes contribute towards. The Ministry of Transport's Transport Outcomes Framework can be used to support the understanding of the cross-sector outcomes that should be included within this focus and to provide the boundaries for a systems-based theory of change.
- Contribution analysis is an approach to exploring the contribution an intervention makes to a specific outcome when the causal links are complex and multifaceted. It provides a multi-step method for increasing the understanding of the association between changes in transport arrangements and the cross-sector outcomes or cost-savings that have been observed (Mayne 2001).

This approach to evaluating systems initiatives and drawing on a contribution analysis to attribute health and other cost-savings to the transport sector involves the following steps.

1. Develop a systems-based theory of change that provides a plausible hypothesis for how changes in the transport, health and other sectors contribute to the transport sector's wellbeing and liveability outcomes. All theories of change require boundaries, and these should be informed by the Transport Outcomes Framework. This process should also articulate outcomes that can be directly attributed to the transport sector's initiatives or policies and those that it is contributing to.
2. Measure the outcomes that have been achieved within the boundaries of this systems-based theory of change. Gathering empirical evidence about what has been achieved will be an important step in being able to attribute anything to the initiative.
3. Develop plausible explanations for the observed outcomes using the systems-based theory of change and evidence collected. Explore alternative explanations for these outcomes that are in addition to, or in conflict with, the explanations embedded in the theory of change. Patterns in the data should be consistent with your theory.
4. Revise your understanding and evidence as you develop explanations and gather evidence. The theory of change may be challenged by new information and may need to be revised to represent a more accurate hypothesis of which activities and departments are contributing to the overall outcomes. In addition, gaps may emerge for which additional research methods are required to collect evidence on key points in presenting evidence for the plausible explanation/s.

It should be noted that, because of the complex and contextual nature of the relationship between transport and wellbeing, there is no method that we have been able to uncover that can precisely and reliably determine a dollar value that can be attributed to changes in measured wellbeing. Rather, the measurement and analysis will seek to reduce uncertainty and increase what we know about the expected contribution of transport changes to those outcomes and the subsequent reduction in health and other related costs.

Any approach that focuses purely on realised cost-savings will exclude other value that is achieved from transport changes. For example, aspects of inclusive access are unlikely to be accounted for when focusing only on financial outcomes. This includes changes in equity, which are important outcomes to include when attributing value to department activities, including transport changes (Hosking et al 2019).

In addition, the Treasury's Living Standards Framework encourages us to understand the impact of department activity in natural units. Natural units are those that can be measured but may not necessarily have a financial cost-saving associated with them. For example, the Treasury's Living Standards Framework Dashboard (Treasury 2019b) includes indicators for access to the natural environment, feeling safe, and Māori connection to marae. Fully recognising the value of changes in transport arrangements will require an analysis of the impacts of transport arrangements to go beyond those outcomes that demonstrate cost-savings or can be quantified in monetary terms.

4.3.1 Key points

1. While there are some studies that show the links between transport changes and injury rates, the complex and contextual nature of the links between transport and wellbeing make direct attribution of cost-savings very difficult because they:
    a. are embedded in social settings and therefore subject to numerous exogenous factors that influence the targeted outcomes
    b. involve feedback loops that generate unintended activities and strategies
    c. may involve emergent outcomes
    d. do not allow for experimenting, either with the implementation of the interventions as a whole, or with other influencing factors
    e. are often made up of a number of multiple project-level interventions that will be implemented over time
    f. often involve multiple levels of national, regional and local organisations.
2. Because of this, the challenge becomes one of providing a logical argument, supported by sufficient evidence, that the intervention made an important contribution to the observed results. This requires that:
    a. the intervention has a clear, explicit theory of change
    b. the intervention is implemented as set out in the theory of change, or any changes are captured in an updated theory of change
    c. the theory of change is supported by, and confirmed by, evidence of observed results and underlying assumptions
    d. other influencing factors have been assessed and either shown not to have made a significant contribution, or their relative role in contributing to the desired result has been recognised.

4.4 Research question 4

As mentioned in the first two research questions, there is an interplay between transport and the built environment. Transport is necessary for a community to function because it enables people to access education, employment, health and social services, food, and meeting with family and friends (Giles-Corti et al 2014; Lee and Sener 2016; Lucas 2012). In order for transport to be effective, transport planning should

be integrated with land-use, environmental, housing, education and health planning. Providing pedestrian-friendly environments that support and encourage active and public transport modes to destinations meaningful to members of the community can help reduce inequalities by providing proximate and inexpensive access (Lee and Sener 2016; Moran et al 2016; Wellington Regional Council 2012). Pedestrian-friendly environments also provide people with more opportunities to engage in physical activity that can improve their physical and mental health. On the other hand, environments designed primarily for the use of private cars are based on the assumption that people can afford and maintain a vehicle. Poor access to public transport or a motor vehicle can result in social isolation and reduced opportunities for skill development and valuable employment (Kenyon 2011; Lucas 2012; Markovich and Lucas 2011). For poorer members of society, this can reinforce a cycle of poverty.

The contribution of car transport and road freight to liveability is often debated. The literature has argued that reducing car dependence and incentives for private car use will increase levels of active transport, which influences liveability positively (Martin et al 2012; Ministry of Transport 2008; Smith 2017). However, literature has also shown that improving vehicle traffic movement and reducing congestion can enhance air quality and provides economic and time benefits for the community (Badland et al 2014; Badralexe and Freeman 1987; Rabl and de Nazelle 2012). Additionally, high levels of congestion from motor vehicles are associated with higher mental distress from noise and air pollution, reduced sense of community, and increased harmful environmental impacts on the wider community (Fisher et al 2007; Giles et al 2011). However, as will be discussed in more detail in section 5.1, reducing congestion by simply increasing road capacity can generate its own demand, thus increasing road congestion further.

As noted in section 4.1, the transport variables that are strongly associated with wellbeing and liveability are:

- safety
- urban design
- access
- social inclusion
- travel time and traffic congestion
- pollution
- physical and mental health.

Safety, and the idea of perceived safety, is an important measure of liveability. As mentioned previously, people are more likely to use public transport or active transport modes if the neighbourhood and transport facilities are safe (Badland et al 2014; Kleinert and Horton 2016; Villanueva et al 2014). With high crime rates or unsafe roads, certain population groups such as children may not find it comfortable or may not be allowed to go outside. This then reduces their access, social inclusion and physical and mental health. It is also important to note that people living in lower socio-economic neighbourhoods are more likely to have lower rates of liveability, with reduced rates of perceived safety and higher rates of transport disadvantage (Barnett et al 2001; Currie et al 2010; Witten et al 2012), and are therefore less likely to want to use public or active transport modes (Barnett et al 2001; Currie et al 2010).

Urban design plays an important role in the wellbeing of communities. Regarding transport, communities that are well built for public transport and have good transport facilities for moving people, goods and services have higher levels of liveability (Appleyard et al 2014; Kennedy and Buys 2009; Kleinert and Horton 2016). Designing communities with people and transport in mind increases people’s access to goods and services and allows them to move around more efficiently.

Access, particularly to employment, family, community and cultural resources, is an important factor for liveability (Raerino et al 2013). As mentioned previously, transport allows people to move around and go beyond their neighbourhood to access resources and family and friends who may live outside of their neighbourhood. Transport can improve social inclusion, which is important in building a community. Liveability goes beyond the physical environment and includes the social interactions in a community (Badland et al 2014).

Increased travel time and traffic congestion negativity affect people's physical and mental health. Traffic congestion causes noise and air pollution (Rabl and de Nazelle 2012; Reynolds et al 2010), whereas a long travel time can cause people mental distress (Chng et al 2016). People living in low socio-economic neighbourhoods are more likely to be most affected by congestion and have increased travel time due to reduced access to services (Barnett et al 2001; Currie et al 2010). Forced car ownership and financial hardship due to the high costs of car ownership, licensing and fuel have been identified as playing a key role in creating debt, economic hardship and entry into the criminal justice system within low-income New Zealand communities (Haerewa et al 2018; Raerino et al 2013; Rose et al 2009).

Liveability is often assessed and recorded at a city and community level, using a combination of indicators that collectively reflect the quality of life citizens enjoy. Indicators for active and public transport include travel time and distances, the layout of street networks and access points, and rates of engagement in active and public transport modes (Badland et al 2014; Giles-Corti et al 2014; Miller et al 2013). Other transport variables that affect liveability include travel mode to work or education, transport affordability, transport network connectivity, transport safety, and transport noise (Badland et al 2014; Giles-Corti et al 2014; Miller et al 2013).

It is difficult to generalise what the most important transport variables are for New Zealand overall because there are variations within communities, such as age and abilities, that will affect people's transport needs. Therefore, these variations and needs ought to be considered within transport planning at the neighbourhood level. For example, the needs of a community with mostly older people may require more car parking and having more transport options, whereas a community with lots of children may find it more important to have transport services that provide direct access to schools and parks. To find what is most important to a community, it is necessary to include community voices and their expectations in decision-making (Lucas 2012; Miller et al 2013; Raerino et al 2013). Essentially, prioritising is a process of value judgements. Any investment that prioritises one aspect of transport over another reflects a set of values, and the key point is to ensure that these values are made explicit so that they are open to discussion.

4.4.1 Key points

1. Measures of liveability should include:
    a. measures of mobility, including accessibility, connectivity, cost and safety of transport options – that is, can people access transport, does it go to where they want to go, is it affordable, and is it safe
    b. a measure of transport mode – that is, are options for public and active transport available, and are they being utilised
    c. a measure related to the built environment – that is, can the environment create and support public and active transport modes?
2. Each of the above measures needs to address socio-economic disparities. That is, they need to assess whether those on low incomes are able to access the different model choices available. Are transport options available, and are those on low incomes able to access them? If not, what needs to be done to ensure that they are available more broadly across society?

3. Many of the impacts to wellbeing and liveability noted in this review are a result of changes at the level of the local community. Therefore, local input into the planning processes is an important variable to consider.

4.5 Research question 5

What transport changes provide the greatest improvement in wellbeing and liveability?

While the research makes strong arguments for changes that improve wellbeing and liveability, as mentioned previously, any discussions about what will provide the *greatest* improvement has to answer the questions about the greatest improvement in what and to whom. As noted above, this is a process of using evidence and making value judgements that prioritise some outcomes over others. For example, should we prioritise the need to improve people's ability to commute to work within a reasonable timeframe, thus maximising the mental health of commuters, or prioritise the needs of those already disadvantaged by current transport policies, such as older people, the disabled and those on low incomes?

The literature, as mentioned previously, has shown plenty of evidence that increased walking and cycling infrastructure has significant benefits at low cost and is often quoted as being one area that provides the greatest improvement. Also, as mentioned in previous sections, it is clear that it is local transport options that have the biggest impact on wellbeing, not large motorways connecting population centres.

While active transport and reductions in motorised traffic in local communities has been shown to have significant benefits in terms of wellbeing, it is important to consider the equity issues noted above. This raises questions about where these infrastructure investments are being made. Who is able to make best use of them? Are they serving people who are already resource rich? Are they improving infrastructure in low decile areas? The evidence for the benefits of walking and cycling infrastructure and the reduction of motorised traffic in local communities is strong, so it is important to ensure that those investments are benefitting those most in need (Badland et al 2014).

4.5.1 Key points

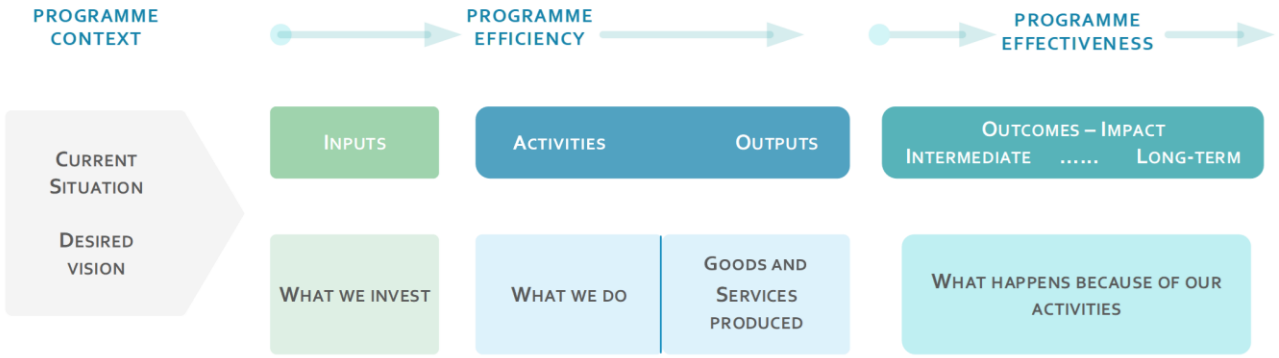
1. As discussed in earlier sections, it is clear that big gains in wellbeing and liveability come from increasing use of public and active transport.
2. A second point is that it is local roads that have the biggest impact on wellbeing in communities, and efforts to reduce the use of motorised traffic in local communities will provide substantial gains.
3. In both cases, however, the gains will not be equitably distributed, so it will be important to take into account peoples' socio-economic and cultural conditions, age, and ability, as they will have a significant impact on who benefits from the changes.
4. Transport changes do not occur in isolation, and that is why we advocate for much closer cooperation between transport and land-use planners, as transport planning can both facilitate and inhibit certain types of land use. For example, facilitating the opening up of suburban and rural land to meet short-term housing needs creates car-dependent communities that impact negatively on wellbeing.

4.6 Research question 6

How should new policies or programmes address the link between transport interventions and wellbeing or liveability outcomes in their intervention logic?

Intervention logics represent programme-level theories of change. In this sense they explain how the activities of a programme, project or policy are expected to achieve or contribute to specific short-, medium- and longer-term outcomes. An intervention logic presents the causal links across key components – resources, activities, short-term and long-term outcomes – and like any other theory, it should be testable (Funnell 1997). Figure 4.2 summarises the key components of a typical intervention logic. The theory might also be supported by the identification of key barriers and enablers that might be faced during implementation.

Figure 4.2 Key components of an intervention logic



The literature review has identified some of the causal connections between transport interventions, wellbeing and liveability. This evidence should support new transport policies and programmes in articulating the connections to wellbeing and liveability. For example, the literature has highlighted the contribution of active transport to wellbeing in terms of increasing people's physical activity, while accessibility to public transport can support social cohesion, mobility and wellbeing. This is often achieved through enabling people to access work, services or social activities. In the latter example, the transport sector can be considered to contribute to wellbeing rather than having a direct causal relationship.

When developing intervention logic models, the transport sector might want to consider direct and contributory outcomes. For example, public transport has a direct causal relationship with people's accessibility while also *contributing* to wellbeing through providing access to something that can enhance a person's wellbeing, such as a marae, church or other spaces that support social connectivity. This contribution to wellbeing could also be understood further at a community level, for the wellbeing of specific groups. The sector can review local transport options and the things that these are connecting people to and the potential benefits that this could bring to people's wellbeing and liveability, as well as identifying gaps and areas for improvement. In this sense, transport policies and programmes can use intervention logic models to demonstrate their contribution to wellbeing and liveability, as well as their direct causal impacts. For example, the perceived safety of transport options can directly impact on an individual's wellbeing by reducing or increasing their accessibility and mobility.

Future intervention logic models could consider the contribution of transport policies or programmes to wellbeing and liveability, as well as their direct impact. This notion is reflected in the ideas underpinning contribution analysis discussed earlier. For example, Mayne (2008) identifies three circles of influence when discussing the development of intervention logics for programmes:

1. direct control – where the programme has fairly direct control of the results
2. direct influence – where the programme has a direct influence on the expected results, such as the reactions and behaviours of its clients through direct contact
3. indirect influence – where the programme can exert significantly less influence on the expected results due to its lack of direct contact with those involved and/or the significant influence of other factors.

This type of framing might be useful for reflecting the direct influence and broader contribution of transport policies and programmes to liveability and wellbeing. In adopting this type of approach, the intervention logic could also identify key influencing factors that could affect wellbeing and liveability outcomes. This could include the culture of a workplace or the quality of interactions at a social activity or an event that a person has reached through public transport. Understanding the transport sector's potential to contribute to wellbeing and liveability outcomes in this way should also support the transport sector in focusing its efforts at a national and local level. When taking this approach, however, it is important not to undervalue aspects of policies or programmes that are making contributions to wellbeing and liveability over direct influence. As reflected in a systems approach, contributions within and across sectors can collectively shift us towards improving wellbeing and liveability.

4.6.1 Key points

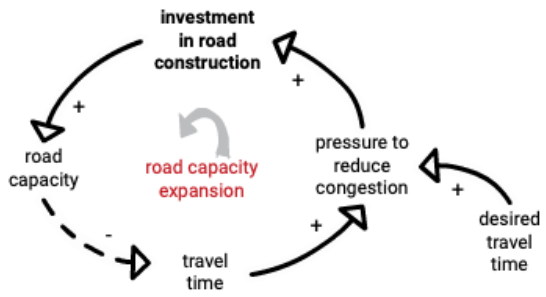
1. Developing robust theories of change will highlight the links between transport interventions and wellbeing and liveability outcomes.
2. When developing theories of change, identify the level of contribution that transport interventions are likely to have on wellbeing and liveability. For example, which outcomes will they impact on, and which outcomes will they have a more influential role or contribution to?
3. Consider the role and influence of context when developing theories of change. What other factors are likely to influence wellbeing and liveability? This is important for recognising the broader system or context within which transport interventions are seeking to contribute to wellbeing and liveability.
4. A systems mapping approach would support the transport sector to look across its efforts with a view to understanding its overall contribution to wellbeing and liveability.

5 Transport investment in the context of wellbeing

5.1 Historical drivers of transport investment

Transport investment in New Zealand has, for many years, been dominated by decisions to improve car travel, especially long-distance travel and commuting to work (Buchanan et al 2006; Ministry of Transport 2014). The focus has been to decrease congestion and travel time, as it is assumed that it will contribute to increased economic growth (Ministry of Transport 2014). While it is claimed that safety has been an important consideration, it has not strongly influenced investments in transport infrastructure (Wilke et al 2017). Where changes have been made to reduce the incidence and severity of injuries, they have been moderated by concerns about travel time, and they have been related to the design of roads and, on occasions, speed restrictions, rather than decisions to build roads or not. Figure 5.1 shows the key dynamics underpinning this investment pattern (based on the work of Sterman 2000).

Figure 5.1 Road capacity expansion



This diagram visually describes the key drivers of transport investment, which historically has been used to reduce the gap between the *desired travel time* and the *actual travel time.* This gap creates a *pressure to reduce congestion*, which results in *investment in road construction*, which increases *road capacity*, thereby, in theory, reducing *travel time*. The Roads of National Significance, a key project of the last Government, was simply the latest manifestation of this approach. In fact, road building does not reduce travel time if it is accompanied by an increase in traffic, which has been the experience throughout the motorised world.

READING CAUSAL MAPS

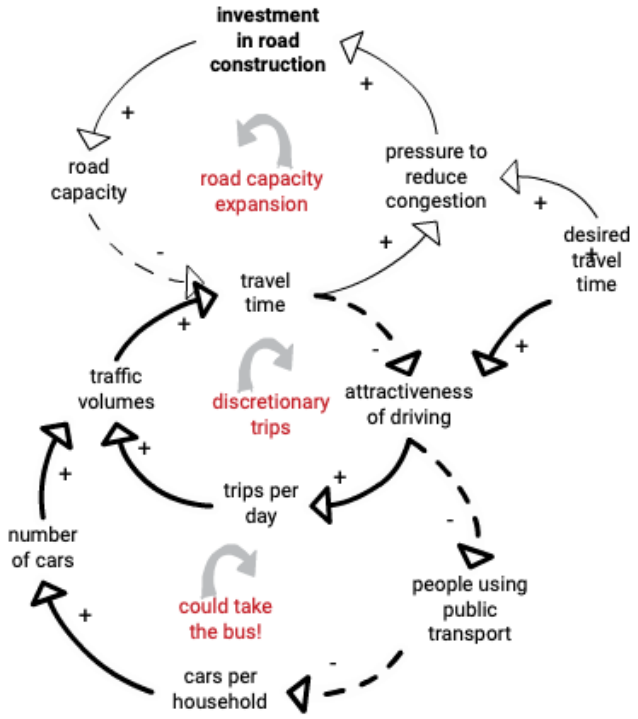
Causal maps are maps of causal influence. In figure 5.1, *travel time* has an influence on *pressure to reduce congestion*, shown by the arrow from *travel time* to *pressure to reduce congestion*. What this link is saying is that as the *travel time* increases (or decreases) the *pressure to reduce congestion* also increases (or decreases). This is a positive link, denoted by the '+' sign at the arrowhead. With positive causal links, more of one leads to more of the other and, conversely, less of one leads to less of the other. Following the loop around clockwise, the greater the *pressure to reduce congestion*, the greater the *investment in road construction* and, in turn, the greater the *road capacity*. This then feeds back to reduce *travel time*. The causal link here is negative, denoted by the dashed line and the '-' sign at the arrowhead. With negative causal links, more of one leads to less of the other and, conversely, less of one leads to more of the other. Following the story around the loop (*road capacity expansion*) shows that *investment in road construction* increases *road capacity*, which reduces *travel time*, thereby reducing *pressure to reduce congestion*. However, as figure 5.2 shows, the story is not that simple when additional variables are included into the map.

As described by the Ministry of Transport (2017):

> *The seven Roads of National Significance projects address urgent priorities for the State highway system within, or close to, our five largest population centres. All support large traffic volumes, and all need work to reduce congestion, improve safety and support economic growth. The programme commenced in 2009.*

However, this strategy becomes self-perpetuating, in that investment in improving roads creates its own demand, increasing the number of vehicles on the road and thereby further increasing congestion and further investment in roads. This is shown in figure 5.2.

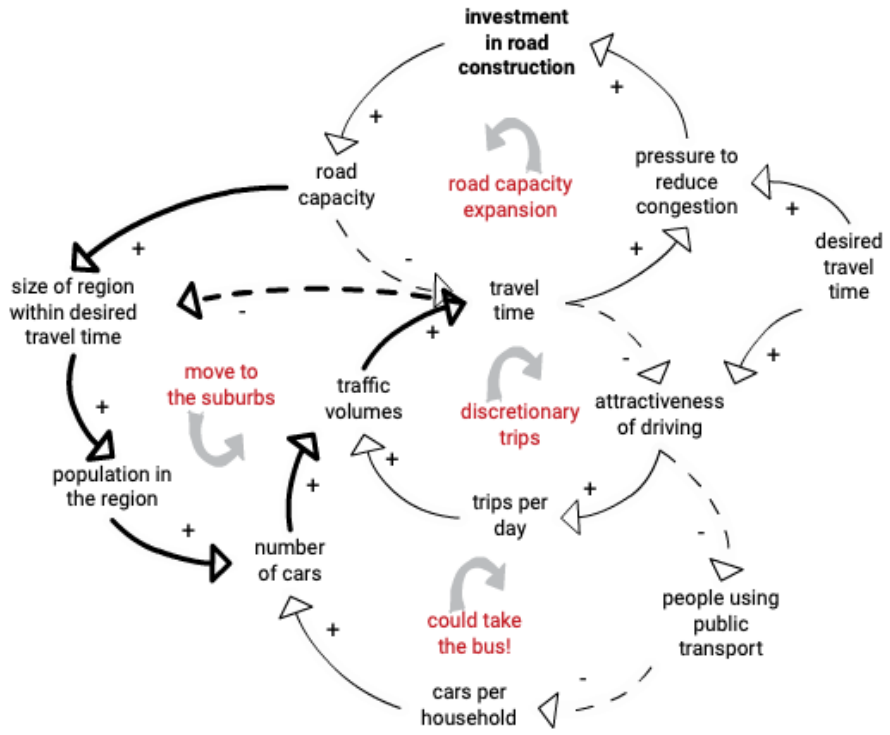
Figure 5.2 Attractiveness of driving



The feedback loop *discretionary trips* highlights the first mechanism that drives this investment. The investment reduces *travel time*, which in turn increases the *attractiveness of driving* (shown by the negative causal link) in relation to any other options that may be available. As a consequence, people drive *more trips per day* (shown by the positive causal link), thus increasing *traffic volumes* and thereby increasing *travel time*, resulting in further *pressure to reduce congestion*. In addition, as daily transport decisions are always made in the light of the options available, the *attractiveness of driving* reduces the number of *people using public transport.* This drives up the number of *cars per household*, which in New Zealand has increased from around 650 per 1,000 in 2000 to just under 800 per 1,000 in 2018 (Ministry of Transport 2018b). This increases the *number of cars* on the road and thereby increases *traffic volumes*, which over time increases the *pressure to reduce congestion* once again, driving the investment direction designed to expand road capacity.

This strategy also plays a part in supporting urban sprawl (figure 5.3), which is a key feature of our larger cities and has substantial, mostly harmful impacts on liveability and wellbeing (Frumkin 2004).

Figure 5.3 Urban sprawl



By increasing *road capacity* and thereby reducing *travel time*, this approach increases the *size of region within desired travel time*. Auckland is a prime example of this, with development taking place all around Auckland and commuting distances increasing so that dense urban housing now exists from south of the Bombay Hills to north of Warkworth, a distance of over 100 kilometres. One development alone – Millwater, in Silverdale, 30 kilometre north of Auckland – has 3,000 properties and around 10,000 residents, many of whom commute into Auckland to work (Reddell 2009). Milldale, across the motorway from Millwater, is projected to be even bigger, with 3,500 homes planned (Boreham 2017). These developments sit adjacent to the Northern Motorway, which is increasingly struggling to cope with the addition of over 20,000 residents, many of whom use that motorway to commute to work, causing congestion at peak times (figure 5.4). It is also important to note that investment in Auckland in motorways began at a time when motor vehicle ownership was uncommon and there was an extensive public transport network in place. De-funding public transport and investing in motorways was not a response to public demand. It was based on the view held by planners and some politicians that high speed travel (by car) to and from the city centre was essential for Auckland to progress as a metropolis.

Figure 5.4 Developments on the urban fringe (Boreham 2017)

This style of development, supported by a transport policy that favours cars and emphasises travel time, drives the spiral of increasing the number of cars commuting large distances to places of work, thereby further increasing *traffic volumes* and *travel time* and once again increasing *pressure to reduce congestion*.

As a strategy, this approach drives up the number of cars on the road, creating ongoing pressure to provide good infrastructure for cars. However, what it also does is contribute to a decrease in the use of public transport. It does this in at least three ways. Firstly, daily transport choices are made based on the attributes of each option. Travelling by car is usually the most convenient, with the shortest travel time and not restricted to travel timetables. Secondly, by contributing to urban sprawl, it also supports people moving to places where public transport is not available and/or very limited. Public transport is very limited in both of the developments described above, and those who wish to use public transport currently have to drive to Silverdale, which is where the nearest main public transport hub is. This bus station, by design and location, is not accessible by foot.

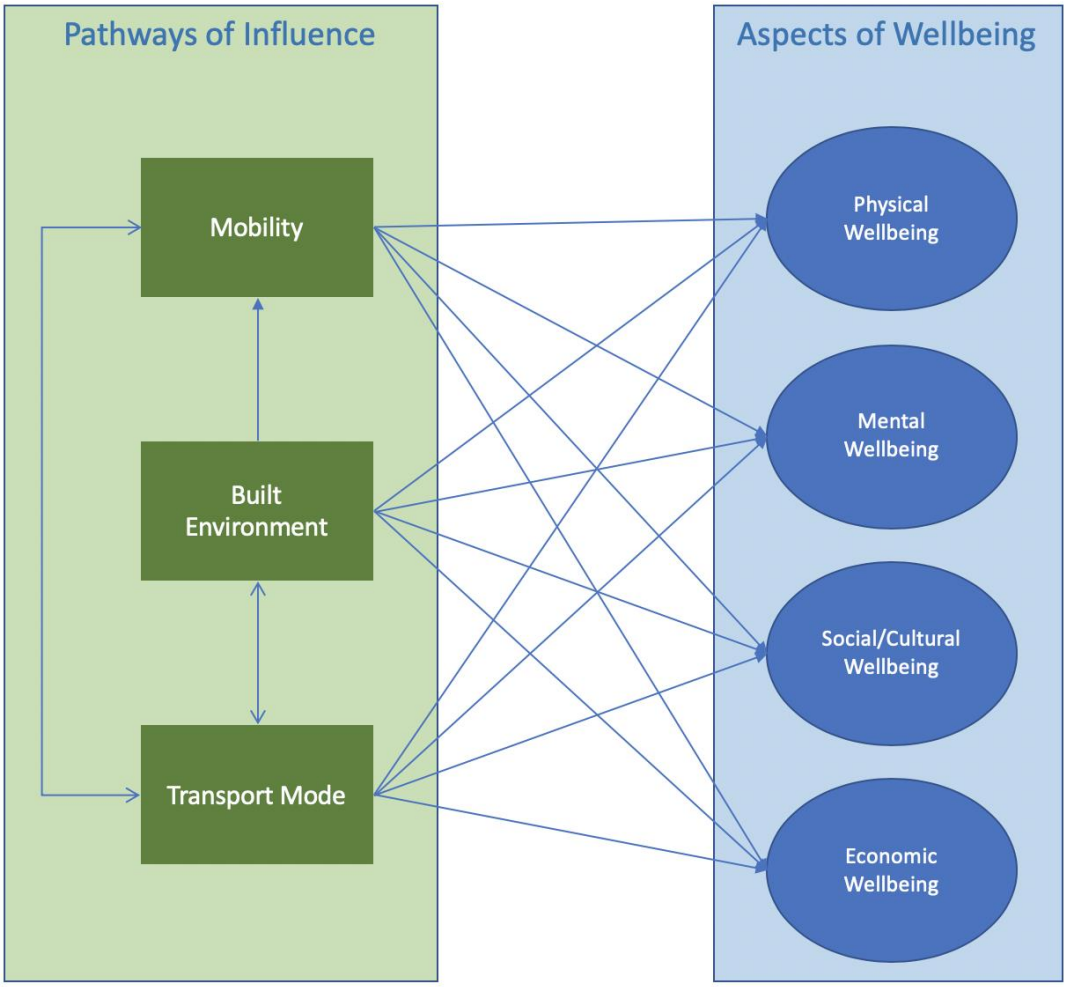
Many of the consequences of this strategy are now well understood, and investment patterns are changing. The next section describes a framework to support a pattern of investment informed by the literature on wellbeing.

5.2 Understanding the pathways of influence

This section reflects upon the literature review and proposes frameworks and ideas that could usefully inform attempts to improve the contribution transport makes to wellbeing and liveability.

As noted above, wellbeing is a concept that is complex and hard to define out of any specific context. Wellbeing is a concept that changes over time and varies between different cultures and life stages. Nonetheless, the literature we have reviewed shows that there are clear pathways of influence: mobility, built environment and transport mode. Figure 5.5 shows the link between the pathways and key aspects of wellbeing.

Figure 5.5 Pathways of influence



5.2.1 Pathways of influence: mobility

Historically, transport planners have focused on the concept of travel, focusing on what people do. Where do they travel to, how long do they travel for, and what mode of travel do they use? The focus has been on making this as convenient as possible, especially in regard to reducing the amount of time it takes to travel. Fast, easy travel between destinations has been a prime focus of transport investment over many decades. The concept of mobility has broadened this focus.

Mobility, as explored in the first two research questions, is more than simply the ability to move from one place to another. The concept of mobility goes beyond what people do (for example, commute to work, take their children to school, go to pick up groceries, visit family and friends) and highlights the benefits that people experience by being able to move around. The concept of mobility places more emphasis on the subjective experience of being mobile and what being mobile provides (Lucas 2012; Schwanen and Ziegler 2011; Stanley et al 2010). As mobility enables connection with people, places and resources, it is a key factor in social inclusion, the ability of people to play an active role in their community (Nordbakke and Schwanen 2015; Stanley et al 2011). The ability to participate in a full range of activities is a key factor in supporting wellbeing.

Mobility also emphasises *local* transport – the ability of people to move around their communities, interact with others, and access the resources the community has to offer. Underpinning this focus is the need for the

transport sector to put greater emphasis on local and community transport services. How people are able to move around in their community is a key feature of wellbeing, and transport plays a key role in facilitating community connectedness (Stanley et al 2010). Mobility, therefore, also highlights the importance of the built environment as a pathway influencing wellbeing.

5.2.2 Pathways of influence: built environment

While the literature focuses on strategies to improve wellbeing such as improving infrastructure to increase active transport, improving public transport, and decreasing the emission of greenhouse gases, there has been much less focus on the effect of land-use patterns on transport. As described in section 5.1, there is a mutually reinforcing relationship at play that contributes to urban sprawl, increased private car use, and longer commute distances. For transport to contribute to improved wellbeing, transport planners need to:

- explore the links between transport and land use
- support the move to higher-density urban living
- explore policies and strategies that reduce the appeal of living great distances away from urban centres.

Table 5.1 shows there is a clear link between urban form and the use of public and active transport modes.

Table 5.1 Modal split and population density in major cities of seven world regions (adapted from de Vos and Witlox 2013)

	Australia; New Zealand	Canada	China	Eastern Europe	High income Asia	Western Europe	USA
Active travel (%)	16	10	65	26	28	31	8
Public transportation (%)	5	9	19	47	30	19	3
Motorised private modes (%)	79	81	16	27	42	50	89
Population density (inhabitants per km^2)	1,500	2,600	14,600	5,300	15,000	5,500	1,450
Number of cities	5	5	4	6	8	35	10

There are three drivers of this pattern (de Vos and Witlox 2013). The first is density, with high-density neighbourhoods characterised by short distances between community amenities and resources, increasing the share of cycling and walking. The second is diversity, which also supports an increased use of cycling and walking. The third, design of streets, can favour certain travel modes. Historically, many suburban streets, including the streets around urban shopping facilities, support the use of private cars. This largely neglects the needs of pedestrians and cyclists.

Research has shown that the built environment has a significant effect on physical wellbeing. People walk more if they live in neighbourhoods with higher-density housing and easier access to a range of destinations, including public transport and well-connected street networks (Witten et al 2012). There is a growing understanding of the links between transport planning, urban planning and features of the built environment that impact both physical and mental wellbeing (Frank et al 2016). So much so that the World Health Organization (2016) has made a call for countries to create and implement strategies to reduce the adverse health impacts of car-dependent environments and to increase the supply of health-promoting environments.

As well as the effect the built environment has on walking and cycling, it also affects safety (Dumbaugh and Rae 2009) and the length and volume of car travel (Buchanan et al 2006), with the resulting impact on the

environment. To have an ongoing impact on wellbeing, the transport sector has to work closely with other agencies involved in the design of the urban environment and support initiatives that promote higher-density housing.

5.2.3 Pathways of influence: transport mode

The major links between transport modes and wellbeing are well known and described in detail throughout this report. As discussed in the second research question, active and public transport enhances mental and physical health, while car travel can undermine wellbeing through injury, social isolation, commute times, and pollution.

However, as wellbeing is always a feature of individuals and communities, those effects are not universally felt. Single mothers living in poverty with their young children often walk to get to places. This is not because they choose to but because they cannot afford or are not able to access a private car or public transport. In this example, walking is not a positive contributor to physical and mental health and adds to the daily pressures they experience (Bostock and Hons 1998). Furthermore, older people and people with mobility problems are less able to walk and/or utilise public transport, sometimes because the bus stop is not near where they live, sometimes because it is perceived as not being safe, and often because public transport does not go close enough to the destinations they want to go to. Moves to restrict car use without investment in alternatives may have negative equity impacts. However, research shows that transport poverty due to the high costs of owning and running a car is a significant cause of financial hardship, offending, and social exclusion in New Zealand, and reducing car dependence by increasing access to low-cost, reliable transport alternatives such as high quality public transport and active transport is likely to provide important equity and environmental co-wellbeing benefits (Awaworyi Churchill and Smyth 2019; Bostock and Hons 1998; Currie et al 2010).

Literature has shown that there are well known links between different transport modes and their effects on wellbeing. However, it is difficult to find research on how these effects play out in specific contexts, especially around issues of equity and disadvantage.

5.3 Transport equity

While still small, the research on transport, wellbeing and equity is increasing. There is some research in New Zealand that has looked at Māori perspectives on transport and wellbeing (Raerino et al 2013), and some international research has looked at the perspectives of low-income mothers (Bostock and Hons 1998) and older people (Schwanen and Ziegler 2011). The recent work by David Banister (2019) also has explored issues of inequality and transport.

In the New Zealand context, wellbeing cannot be considered in isolation from equity. In the health sector, equity has been a major issue for many years, and efforts by the transport sector to increase transport's impact on wellbeing will need to address equity.

In terms of transport, the key impacts are upon Māori and Pasifika, those on low incomes, the disabled and older people. The needs of these groups have largely been absent from transport planning. To address wellbeing in a way that does not contribute to further disadvantage for these groups, transport planners need to consider whether what they propose reinforces the inequities that exist or help redress the balance. This means they need to have a deep understanding of how people live, the freedoms they have to make choices, and the capabilities they have to enact those choices (Sen 1999).

Having a concern for increasing equity influences how one thinks about wellbeing and the goals involved in transport's contribution to wellbeing. The following questions should be asked as part of decision-making on inequality in transport (Banister 2018).

- Does the policy explicitly address inequality, and who are the beneficiaries?
- Does the policy reduce or increase inequality? Are costs and benefits distributed equally?
- Does the policy address the indirect effects of transport on users and non-users, and who are the losers and how can they be compensated?

5.4 Rethinking the drivers of transport investment

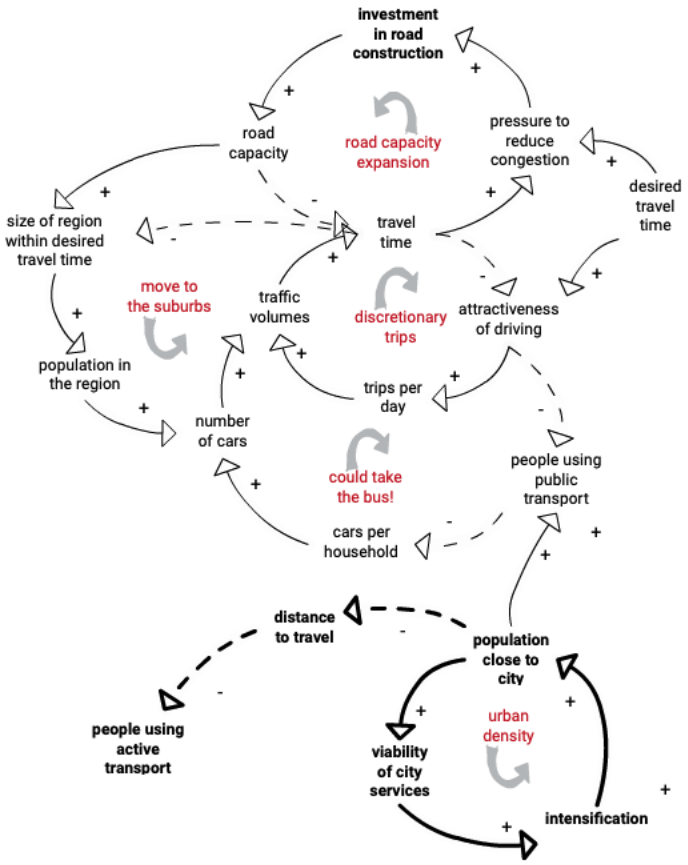
Section 5.1 developed a systems map of the historical drivers of transport investment. This section builds on the literature review and the pathways of influence noted in section 5.2 to develop the map further to explore potential investment strategies that could improve the impact transport has on wellbeing and liveability.

Note: This map is meant to stimulate thinking, not to be a definitive statement on transport investment. It reflects the literature and explores some key connections that could be exploited to maximise the positive impact on wellbeing. It is by no means exhaustive of the range of possibilities.

5.4.1 Built environment

Figure 5.6 describes how urban density impacts the number of people using public transport. (The variables added to the map described in section 5.1 are bold.)

Figure 5.6 Urban density

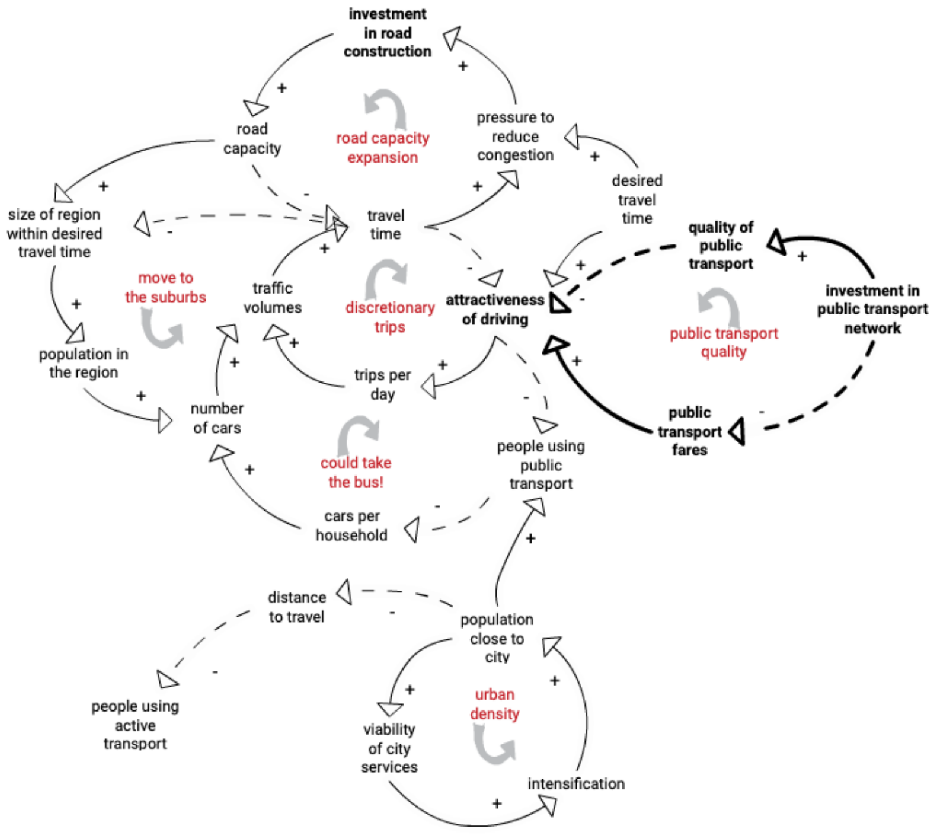


The important point here is that one of the key pathways by which the built environment affects transport is through increased density to reduce the *distance to travel*. This has an immediate effect on increasing the *people using active transport*. Also, as the *population close to the city* increases, not only does it increase the *viability of city services* and thereby further increase the trend towards *intensification*, it also increases the number of *people using public transport*. In addition, although not noted on the map for reasons of clarity, the use of congestion or pollution charges, or their equivalent, not only supports the shifts in transport mode, it also serves to decrease the attractiveness of driving over time, and thereby helps shift the underlying dynamics that drive car dependency.

5.4.2 Transport mode: public transport quality

Figure 5.7 shows the potential causal pathway of investing in public transport, specifically through increasing quality and reducing fares.

Figure 5.7 Quality of public transport



The key impact of this is that *investment in the public transport network* reduces the relative *attractiveness of driving*. Public transport becomes more appealing as *public transport fares* reduce and the overall *quality of public transport* increases. This in turn increases the number of *people using public transport*. While this is helpful in supporting a shift in transport mode, other considerations are needed to contribute to wellbeing.

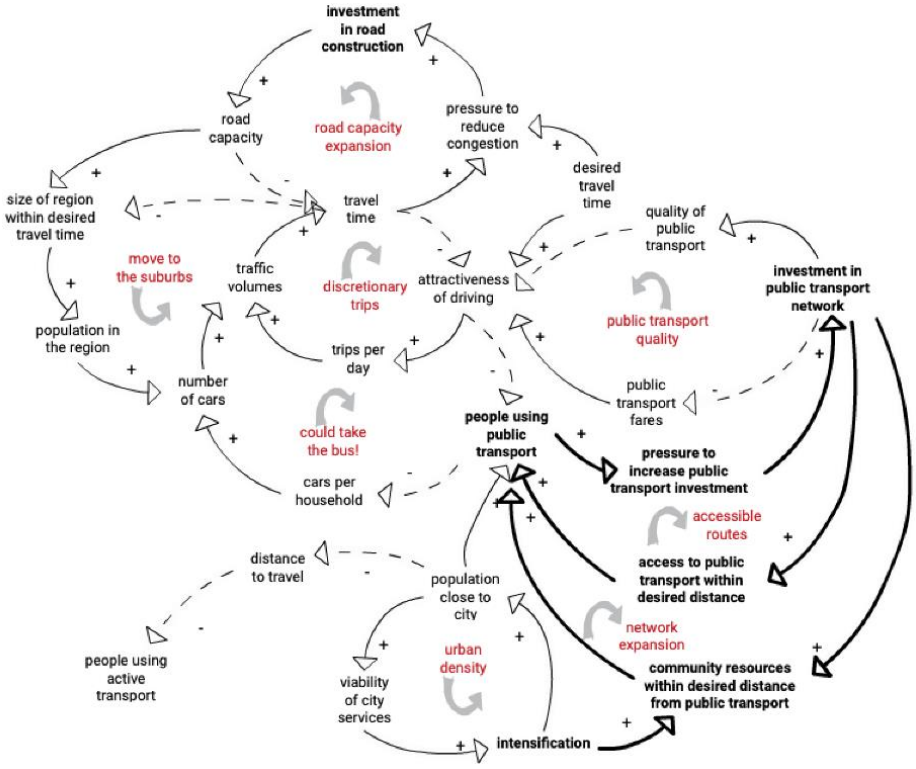
5.4.3 Transport mode: public transport and access

As noted above, mobility refers not just to where and how people travel, but also to their experience of it, and the experiences it allows them to access. This means that the distance needed to travel to access public

transport has to be short, and that the routes that public transport serves need to provide access to a wide range of community facilities.

The map in figure 5.8 highlights the need for *investment in the public transport network* to not only increase the *quality of public transport* but also to include *accessible routes* so that people are able to get to transport hubs easily. Those routes should be increased through *network expansion* so that people are able to get to the community resources they need to access. As the map notes, this is also facilitated by two aspects of the built environment: *urban density* and *intensification*.

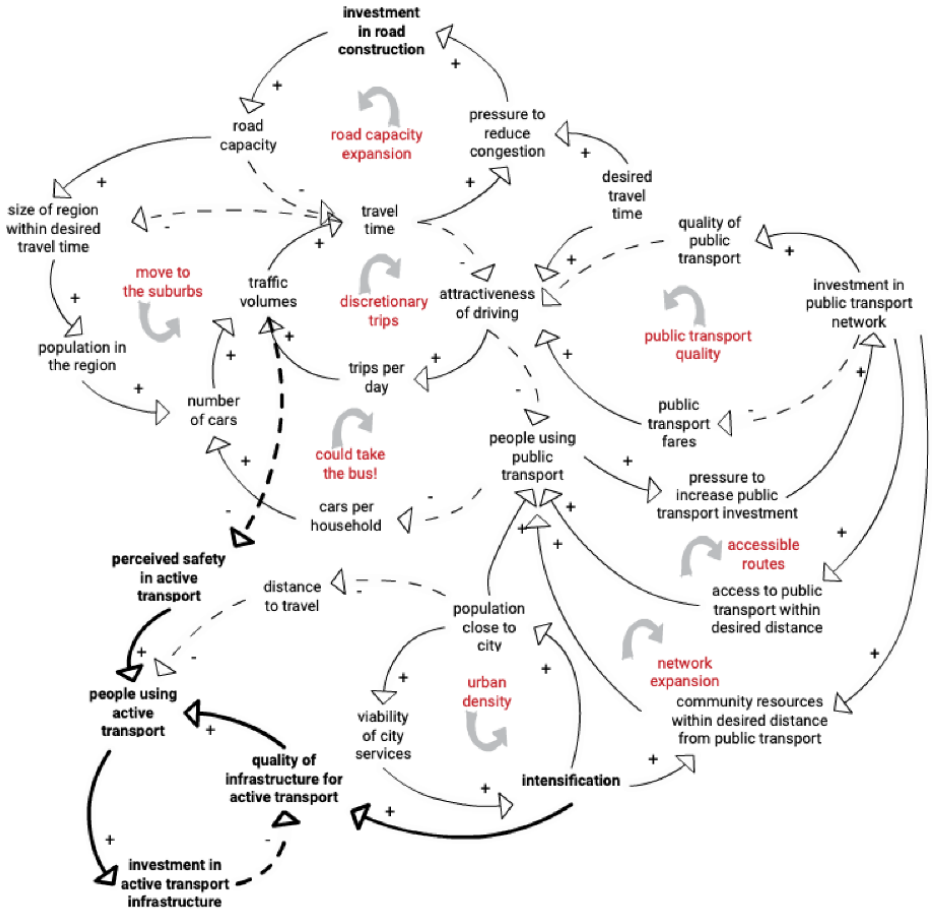
Figure 5.8 Improving access



5.4.4 Transport mode: active transport

The final map (figure 5.9) includes active transport in the mix.

Figure 5.9 Active transport



This map highlights two of the drivers increasing the number of *people using public transport*. The first is the direct *investment in active transport infrastructure*. The second is the *perceived safety in active transport* due to the reduction in cars on the road, driven by the shifts in transport mode that these maps are describing.

5.5 Using causal maps to design transport policies that enhance wellbeing

Given that consideration of wellbeing and liveability requires that transport planning is undertaken as part of a suite of connected policies, it is important that, prior to implementation, the process includes the development and articulation of a robust causal theory. Such a theory helps to describe how the policy is going to affect each aspect of wellbeing – physical, mental, social/cultural, and economic – and do so in a way that reflects the people and the place where it is going to be implemented. This is crucial if issues of inequity are to be addressed.

A good, well-articulated causal theory should:

- clearly describe the major variables involved in the policy
- explain the likely direction and strength of their causal relationships
- stimulate people to think about the means by which the policy objectives are going to be reached.

The use of causal mapping to describe these theories is increasing, as they allow codification and communication of tacitly held assumptions (Givoni et al 2013). By providing a diagrammatic representation of what people know, causal maps provide a visual aid to enhance understanding of the thoughts of individuals, groups and organisations. They also illustrate the means by which those involved believe the policy will achieve the objective.

In parallel with the development of causal theories, it is also important to accumulate a set of measures that can be used to assess effectiveness and efficiency. Amongst these measures it is important to include measures that act as 'trigger mechanisms' that initiate feedback loops, which are needed if it is to become sustainable and effective beyond the short term.

Wellbeing and liveability are complex concepts, and for transport policies to contribute to improving them, attention needs to be given to the process by which they are developed. Causal mapping not only provides a robust process to develop a strong theory of change, it is a powerful tool to engage individuals and communities in the planning process. Used in conjunction with intervention logic models that describe how an initiative is actually going to work, system maps describe how they will actually bring about the change they are designed to bring about in the context in which they are implemented.

6 Conclusion

The literature review and causal maps discussed in this report highlight the contribution that the transport sector can and is making to wellbeing and liveability in Aotearoa New Zealand. An important insight from this work is the importance of understanding the needs and lived contexts of different populations in society and how they can benefit from the transport options available. For example, walking can bring great health benefits, but it is less beneficial if people are walking because they cannot afford to access other transport options. Maximum wellbeing benefits will be achieved by making sure that everyone has access to high-quality, low-carbon transport systems that promote health and social connection, and receive high levels of travel satisfaction. The built environment, especially urban density, has a significant impact on the viability of active and public transport systems. Recognising the role of context and the needs of specific groups is therefore important when developing transport interventions or policies that are designed to improve wellbeing and liveability.

The links between transport and wellbeing need to be taken into account within transport planning at the neighbourhood level. However, these are difficult to generalise due to the variations within communities that affect their transport needs. This challenge is not unique to the transport sector. Interventions are implemented in settings with other initiatives and varying social and environmental contexts. This affects the intended implementation and outcomes of any initiative, and while some contexts can be reinforcing, others can pose challenges. To make the desired changes in wellbeing and liveability, we should focus more on using evidence to support logical arguments about the contribution that an intervention or policy is making, and having more context-specific and equity-based interventions.

The literature highlighted the importance of robust theories of change and associated measures or ways of understanding success to support the transport sector and the system in understanding its contribution to wellbeing. Traditional intervention logic models are useful for specific policies and programmes; however, a systems mapping approach would support the transport sector to look across its efforts with a view to understanding its overall contribution to wellbeing and liveability. Understanding contributions to wellbeing and liveability also requires a different measurement approach.

Historically, the key transport variables have been related to travel time and congestion, with the goal of reducing both, on the basis that it would improve economic growth. This review has highlighted the importance of using other measures or pathways to understand the influence of transport interventions on wellbeing and liveability. The literature suggests that priority should be given to measures that assess how people are able to access key community resources, their experience using and accessing different transport modes, the ability of the built environment to enhance connections within and between communities, and the impact of any intervention on mode choice. Recent research has emphasised that reducing poverty and increasing social connections within communities, as well as the direct impact of transport interventions, stand out as consistently improving health and wellbeing, regardless of context.

The literature also highlights the importance of working with other sectors. Working collaboratively would support the transport sector to understand how its value is enhanced when implemented alongside the efforts of other sectors working collaboratively towards shared goals. Working across sectors takes time and investment; however, collaborative approaches can be achieved locally as well as nationally. Adopting a localised approach could support the transport sector in establishing effective relationships with local communities. This should include those who are experiencing current inequities to ensure that their views and experiences inform the development of local programmes and initiatives. This could also support the development of cross-sector approaches that could be tested, further refined and then shared with others for broader roll out.

While many of the issues highlighted in the literature review are already known to the transport sector and many of the changes required to address them are being implemented, this report brings together the key findings and outlines the key causal pathway through which transport affects wellbeing and liveability and along which transport policy will need to continue developing. The insights also highlight the influence and ongoing contribution of the transport sector to supporting wellbeing and liveability in Aotearoa New Zealand.

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