

# Arataki

Lenses

September 2023 v1.1





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The September 2023 v1.1 release of *Arataki* includes updates to reflect the severe weather events of 2023 and correct minor errors. This includes the new Climate Change Adaptation Lens added to the *Lenses* section.



# Climate change adaptation lens

This section pulls together all available evidence and information on climate change adaptation that was included in the March 2023 release of *Arataki*. Some minor updates have been made.

We need more evidence to support climate change adaptation in the context of the Equity Lens and the outcomes of environmental sustainability, inclusive access, and healthy and safe people. We will address these in future updates of *Arataki*.

This section serves as a foundation for future development of the Climate Change Adaptation Lens for *Arataki*, to be developed collaboratively with partners.

## At a glance

To support wellbeing and create great places to live in Aotearoa New Zealand, the transport sector needs to focus less on the physical movement of people and goods (mobility), and more on safe, sustainable access and connectivity for all. This shift requires integration with digital, urban development, energy, and other related systems.

To achieve this, we need to adapt to climate change and improve resilience.

In Aotearoa, we are significantly exposed to natural hazards like floods, erosion, landslides, and coastal inundation. Around 750,000 New Zealanders, and 500,000 buildings worth more than \$145 billion, are located near rivers and in coastal areas already exposed to extreme flooding.<sup>1</sup>

Climate change and more frequent extreme weather events mean there are significant challenges ahead. We need to respond in different ways to build greater resilience. There will be ongoing impacts on communities and the transport networks that connect them.

The transport sector will need to work with communities and infrastructure providers to adapt by:

- identifying at-risk areas
- making plans to manage impacts
- considering different approaches to rebuilding or moving away from high-risk locations.

Together we need to find new solutions and identify long-term options that reflect the diverse requirements for urban and rural communities.

Disruption from climate change should be managed through adaptive and timely responses. The way the land transport system is planned, operated, and managed will increasingly respect and integrate Te Tiriti o Waitangi and a Te Ao Māori perspective.

Severe weather events are already affecting the land transport system.<sup>2</sup> As we move forward, these events will occur more often. This will threaten people's safety, disrupt transport services, and affect infrastructure.

It will also impact the predictability and reliability of travel routes. This will mean looking at a different mix of transport options, like including more water-based travel, to provide network backup to minimise downtime (redundancy) and system resilience.

How the system is maintained, operated, and developed will be different. Nature-based solutions will be used to adapt to climate change.

Our ways of working will be different. As the nature of climate change is better understood, the transport sector will work with communities to plan when to defend, accommodate, and retreat.

The government's first *National Adaptation Plan* sets the direction for how Aotearoa will:

- adapt to the unavoidable impacts of climate change
- address key climate risks up to 2028.

The *National Adaptation Plan* outlines actions about:

- reforming institutions to be fit for a changing climate
- providing accessible data, information, and guidance to reduce climate risks
- embedding climate resilience across government strategies and policies.

Waka Kotahi has committed to the following actions in the *National Adaptation Plan*:

- integrating adaptation into decision making
- progressing the Rail Network Investment Programme with Te Manatū Waka Ministry of Transport
- investing in public transport and active transport with Te Manatū Waka
- developing and implementing a climate adaptation plan, known as *Tiro Rangī*.<sup>3</sup>

## Outlook

Climate change is already impacting the land transport system and will continue to do so for decades to come. The transport system will have to adapt to escalating impacts from climate change. This includes sea level rise as well as increasingly severe and frequent climate-related events, like storms, droughts, floods, and fires.

At the same time, we will need to continue focusing on reducing emissions to meet net-zero targets by 2050.<sup>4</sup>

Climate change must be part of all decision making, to ensure the infrastructure and services we provide:

- are resilient to climate change impacts
- enable emissions reductions
- continue to support the needs of New Zealanders.

To achieve our long-term goals, the *National Adaptation Plan* provided the framework to avoid, protect, accommodate, and retreat. A combination of these strategies should be adapted to each situation, depending on the location and amount of time to act. Nature-based solutions will also help us adapt to and lessen the impacts of climate change. Adaptation strategies should be built into long-term planning.

We can be proactive and choose to:

- avoid building in areas where future climate hazards have been identified
- use transport-oriented development in the right locations.

Infrastructure in urban and rural communities is highly interdependent. Extreme weather has the potential to affect many systems and cause a chain of impacts. For example, disruption to transport can prevent access to critical infrastructure, such as power, water, and telecommunications; these resources are also essential to emergency response and recovery.<sup>5</sup> This can also lead to cyclical impacts that affect transportation. For example, if an area loses power, then electric vehicles cannot be charged.

## Urban communities

Urban transport networks play an important role in moving large numbers of people and freight. Increasing levels of disruption and delay can affect access to essential services on roads, rail lines, bus routes, ferries, and cycle routes.

The impact of severe weather events on multiple modal networks can be complex, widespread, and cascade down the land transport system. The closure of main roads can lead to delays and congestion, which can spread if traffic shifts to alternative routes. Extreme weather can cause delays and cancellations of public transport, affecting reliability and user comfort. Disruption to transport can prevent access to other critical infrastructure such as power, water, or telecommunications, which may need repair.<sup>6</sup>

Urban areas have more alternative routes and modes, but network efficiency may still be impacted when there's additional pressure on areas that are still functioning. Although disruption in urban areas can sometimes be short-lived, it has the potential to affect many people at significant economic cost.<sup>7</sup>

Current approaches to urban development have generally resulted in low-density, car-dependent development without enough consideration of where people live, work, study, and play. These environments are poorly suited to adapting to future drivers of change, such as an ageing population or climate change.

For example, to enable retreat we could relocate transport infrastructure and other assets away from locations exposed to climate-related hazards, such as coastal areas. We could improve system resilience by providing multiple travel modes and alternative routes for more options.<sup>8</sup>

Decisions around how to recover from disruption and provide a more resilient network need to balance cost, access, and equity. In some cases this could mean a reduced level of service.

Future opportunities, particularly around technology, mobility as a service, and connected vehicles, should be leveraged. Integrating transport investment and resourcing decisions within the urban transport, spatial planning, and development system is essential. This will help transform urban mobility from car dependency towards more sustainable, adaptable, and safer forms of transport. Ultimately, transport can play a role in making urban environments great places to live by creating green spaces, providing natural resilience, and connecting communities.

## Rural communities

Severe weather events may mean rural and coastal communities grow more isolated as:

- infrastructure is damaged more frequently
- service outages last longer
- repair costs increase.

Some communities rely on road transport for access and economic activity, and often don't have alternative routes or mode options. This means these locations may not be accessible for residents, businesses, tourists, recreational visitors, and essential services.

Decisions around how to recover from disruption and provide a more resilient network will need to balance cost, access, and equity. In some cases this could mean reduced levels of service, use of alternate modes, or support for communities to adapt to intermittent service.

## Māori

Māori as tangata whenua are particularly sensitive to the impact of climate on the natural environment for social, economic, cultural, and spiritual reasons.<sup>9</sup>

Many Māori communities are in rural and remote locations. These areas are particularly vulnerable to the effects of climate change on homes and infrastructure.

Of the 191 marae in Aotearoa New Zealand within one kilometre of the coast, about 47 are potentially exposed to a 100-year extreme sea level now and in the future.

Changing climate also threatens sites of cultural significance like marae, urupā (burial grounds), wāhi tapu (sacred sites), and mahinga kai (food gathering sites).<sup>10</sup>

Many Māori depend on primary industries for their livelihoods. In some places, climate change may alter ways of using mahinga kai or rongoā crops (medicinal plants). Coastal impacts could disrupt access to marae or wāhi tapu.<sup>11</sup>

Impacts on Māori and the wider economy could limit whānau access to:

- food
- electricity
- housing
- health services.<sup>12</sup>

These limitations could compound existing inequalities of Māori wealth and wellbeing.<sup>13</sup>

The socio-economic disparities between Māori and non-Māori communities mean sensitivity to climate change impacts and risks are higher for Māori society.<sup>14</sup>

Currently nearly all Māori land is Māori freehold land. There are about 1.47 million hectares of Māori freehold land, which makes up roughly 5% of all land in Aotearoa.<sup>15</sup> Large proportions of Māori freehold land are located in low-lying and coastal areas, which results in higher exposure to damage from rising seas. Some land is located by rivers and lakes, while other areas contain fragile environments, such as wetlands. These areas are at risk of erosion, storm surges, and flooding.<sup>16</sup> The primary sector, which includes agriculture, forestry, and fishing, makes up \$23 billion of the total Māori asset base of an estimated \$68.7 billion.<sup>17</sup> This means a large portion of the Māori economy is vulnerable to the impacts of climate change.

There are also particular challenges to responding to climate change impacts and risks for Māori communities. Around 30% of Māori freehold land is believed to be landlocked and remote, which makes it difficult to make infrastructure improvements for resilience.<sup>18</sup> The governance and management activities of Māori freehold land are restricted by Te Ture Whenua Māori Act The Māori Land Act (1993). Multiple and absentee ownership can complicate preparing for climate change.

Many Māori communities are in coastal regions and adjacent to rivers. This means access roads to marae are often exposed to flooding, landslides, and coastal processes, like changing sea levels. Damage to the transport network could cut off marae and wider Māori communities on a more frequent basis.<sup>19</sup>

These challenges especially impact young people, Māori, Pasifika, and vulnerable segments of the rural community. If we make poor decisions about how we operate and manage the land transport system, this will only contribute to those existing challenges.

Further evidence is needed to understand the:

- scale of the issue
- availability of mahinga kai and food production on Māori land
- accessibility to marae
- locations where impacts could be greater for Māori than other groups, or if a different response is required.

The first *National Adaptation Plan* notes that establishing a platform for Māori climate action is the most important way government can build a climate-response partnership with Māori. This platform will build:

- Te Tiriti partnership
- greater recognition of Māori rights and interests, including Treaty settlement commitments.

The platform will build on three focus areas:

- embed partnership and representation
- support Māori-led strategy and alignment
- activate kaupapa Māori, tangata Māori solutions.

## Impact on the land transport system

There are many uncertainties regarding the future impacts of climate change.

Adapting to the impact of climate change will require refocused effort. This means not just building back what's there now following disruption, but increasing resilience for the future. This will require working with communities to find new ways forward and develop plans for when to defend, accommodate, and retreat.

Analysis of the potential impacts of climate change on the transport system will also need ongoing work and updates for future planning and decision making.

### Climate change events

Climate change will increase the frequency and severity of climate-related hazards such as:

- flooding
- coastal inundation and erosion
- landslides
- high winds
- heatwaves
- drought
- wildfires.

The consequences of climate impacts will extend far beyond damage to transport infrastructure. It will also impact the economy and affect the lives and livelihoods of people who rely on our land transport system.<sup>20</sup>

The land transport system will have to adapt to the escalating impacts from climate change.

Climate change must be part of all decision making, ensuring the infrastructure and services we provide:

- are resilient to climate change
- enable emissions reductions
- continue to support the needs of New Zealanders.

There were two severe weather events at the start of 2023. In January, the Auckland Anniversary Weekend floods caused flooding, landslips, and storm damage, resulting in road closures in Te Tai Tokerau Northland, Tāmaki Makaurau Auckland, and Waikato. In February, Cyclone Gabrielle caused flooding and landslips resulting in closures to roads and railway lines in Te Tai Tokerau, Tāmaki Makaurau, Waikato, Tairāwhiti Gisborne, and Te Matau-a-Māui Hawke's Bay.<sup>21</sup>

The South Island experienced the fifth driest summer on record in 2022 to 2023.<sup>22</sup> Despite this, Marlborough is still in recovery mode following the floods of August 2022, when slips and road damage cut off communities in Canvastown and Rai Valley from Te Taihū-o-te-Waka-a-Māui Marlborough and Whakatū Nelson.<sup>23</sup>

Even with aggressive strategies to reduce greenhouse gas emissions, the impacts of climate change will continue for decades.

### Changing weather patterns

Changing weather patterns will continue increasing the frequency and severity of flood events, storm surge, and landslips. These weather events will affect communities and the transport networks that connect them.

### Hotter temperatures and wildfires

Hotter temperatures and wildfires can damage transport infrastructure, causing buckled railway lines and damaged roads.

### Sea level rise

Most people in Aotearoa New Zealand live near water. Many are within a few kilometres of the coast, or next to rivers and lakes.

From 1901 to 2010, global sea levels rose an average of 19cm total.<sup>24</sup> Between 1990 and 2016, global sea levels rose an average of 3.4mm per year.<sup>25</sup>

Rising sea levels won't be felt evenly around Aotearoa. Impacts will vary depending on a range of factors like topography, coastal processes, and vertical-land movement.

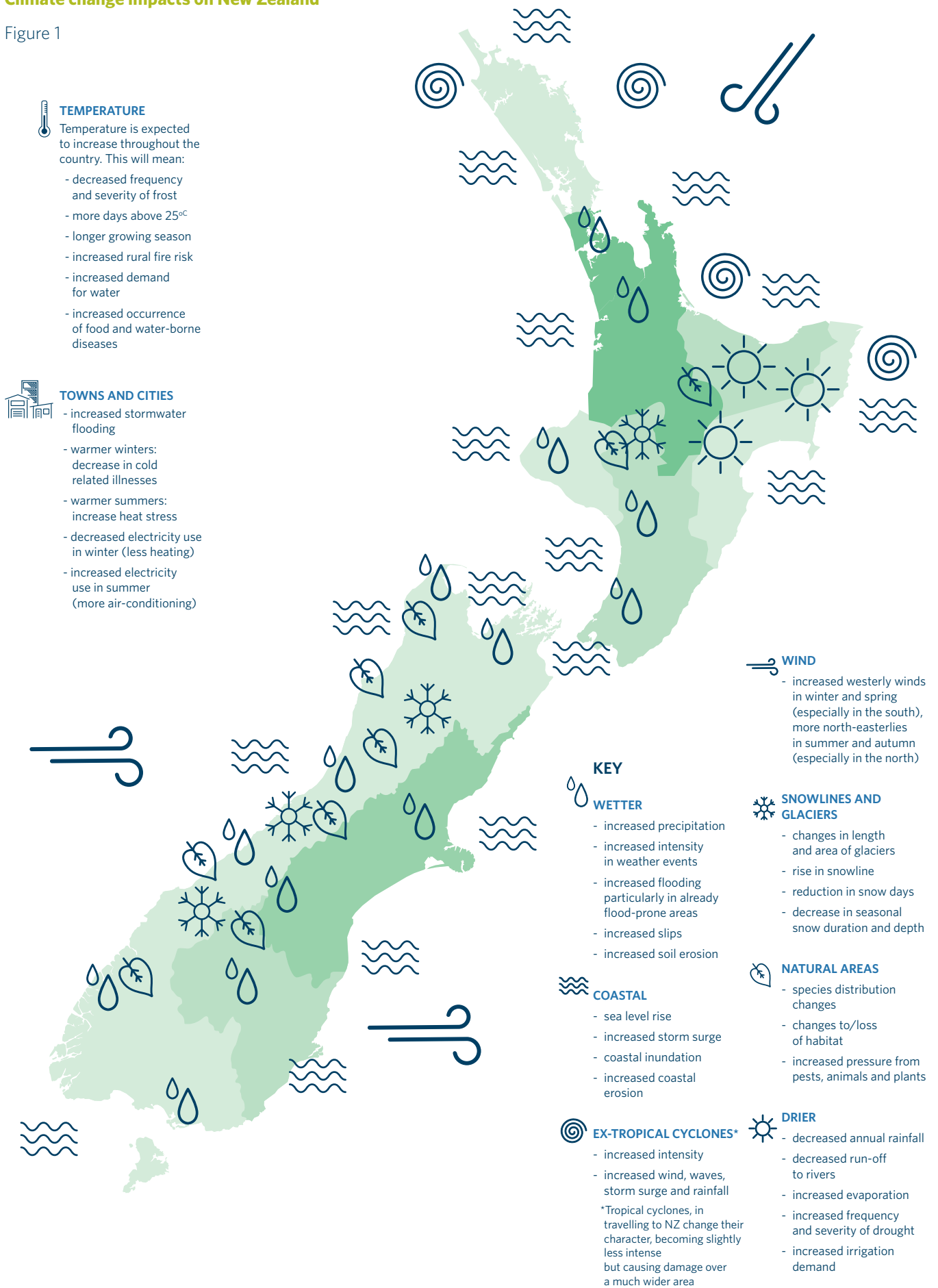
The most affected coastal areas will experience sea level rise of 30cm in 10 to 20 years, and one metre by 2060.<sup>26</sup>

Rising sea levels mean tides, waves, storm surges, and elevated groundwater will reach further inland. This will cause more frequent and extensive flooding in low-lying areas. Coastal communities and routes will be impacted by increased erosion and receding shorelines.



# Climate change impacts on New Zealand<sup>27</sup>

Figure 1



**TEMPERATURE**  
 Temperature is expected to increase throughout the country. This will mean:

- decreased frequency and severity of frost
- more days above 25°C
- longer growing season
- increased rural fire risk
- increased demand for water
- increased occurrence of food and water-borne diseases

**TOWNS AND CITIES**

- increased stormwater flooding
- warmer winters: decrease in cold related illnesses
- warmer summers: increase heat stress
- decreased electricity use in winter (less heating)
- increased electricity use in summer (more air-conditioning)

**WIND**

- increased westerly winds in winter and spring (especially in the south), more north-easterlies in summer and autumn (especially in the north)

**KEY**

**WETTER**

- increased precipitation
- increased intensity in weather events
- increased flooding particularly in already flood-prone areas
- increased slips
- increased soil erosion

**SNOWLINES AND GLACIERS**

- changes in length and area of glaciers
- rise in snowline
- reduction in snow days
- decrease in seasonal snow duration and depth

**COASTAL**

- sea level rise
- increased storm surge
- coastal inundation
- increased coastal erosion

**NATURAL AREAS**

- species distribution changes
- changes to/loss of habitat
- increased pressure from pests, animals and plants

**EX-TROPICAL CYCLONES\***

- increased intensity
- increased wind, waves, storm surge and rainfall

\*Tropical cyclones, in travelling to NZ change their character, becoming slightly less intense but causing damage over a much wider area

**DRIER**

- decreased annual rainfall
- decreased run-off to rivers
- increased evaporation
- increased frequency and severity of drought
- increased irrigation demand

## Impact on major transport corridors

The need for maintenance and renewal along major transport corridors is likely to increase. This could result in more delays and divert costs from other investments.

The risk of a major disruption will increase for interregional connections and the economic and social interactions that rely on them. Long detours and delays for freight would have significant economic impact.

Disruption to supply chains and the movement of exports and imports could result in backlogs at airports, seaports, and freight hubs. This might lead to product shortages for consumers or lost income for producers.<sup>28</sup>

## Impact on modes

There are several modes in the land transport system. These ways of moving play different roles based on their strengths, locations, networks, levels of service, and user preferences.

Maintaining and building network resilience, like planning for extreme weather events and climate change, is currently an operational challenge for road and rail transport.

In the future, climate change may require a review of the location of some roads because of flooding and landslides. With sea levels forecast to rise, coastal erosion and inundation in low-lying coastal areas will increase the need for repairs, relocation, and preventative measures.

It won't always be practical or affordable to continue providing the same levels of service across the network. Some parts are likely to have reduced levels of service, depending on their importance and access requirements. This could mean more temporary fixes, like one-lane sections or bridges, are needed to maintain access.

Where these approaches aren't possible and there are low-access requirements, tough decisions about retreating from the network, or providing access through other means like coastal shipping, will have to be made in partnership with communities.

## Impact on strategic networks

Strategic networks are the most critical parts of the country's land transport network. They form the backbone of the entire transport system, supporting the most essential movements of people and freight across all modes.

There are some key climate challenges and opportunities in achieving resilience and security on strategic networks.

Strategic networks provide lifeline connections between populated areas, ports, and other infrastructure. They need to be resilient to perform their functions effectively.

A well-functioning strategic network is vital for:

- responding to emergencies quickly
- restoring communities and business activity after an emergency.

As climate-related impacts increase, adaptation planning is critical for managing future vulnerabilities in the transport system and the communities served.

There is a lack of redundancy, or ways to minimise downtime, in parts of the strategic network. Some regions depend on one or two critical lifelines to stay connected to neighbouring regions.

Emergency and maintenance costs on strategic networks are rising. This is mostly because of climate change. Areas of the transport network are experiencing more significant climate-related impacts, especially from storms and flooding. This is expected to continue and get worse.

Challenges are likely to remain the same, but grow in:

- magnitude
- frequency
- duration.

To continue as lifeline connections, the strategic network will need to balance resilience, service levels, and maintenance costs.

As we expand or change strategic networks in the future, we'll need to make sure we don't create new resilience challenges.

Some key areas to focus efforts are:

- consider how to maintain lifeline connections and service levels during disruption
- develop a greater understanding of the changing risks of climate-related hazards
- use an adaptive-management approach to climate change when maintaining and operating the transport network.

## Our strategic networks plan

Our standard approach across most strategic networks, especially well-developed networks, is a series of programmes that maintain, renew, and make the most of existing infrastructure. Making the most of the existing network and resilience are key.

We will build our understanding and management of the:

- physical risks to assets
- risks that hinder our ability to deliver to expectations, maintain service levels, and fund priorities.<sup>29</sup>

To ensure critical parts of the strategic networks continue to function, decisions must be made about programme investment standards and timings.

Programmes should avoid rebuilding infrastructure that's not fit for purpose. Instead, the focus should be on improvements to all modes and safety. Programmes will need to adapt to change over time.

One of the key drivers where transformational change may be required on the strategic road network is when significant safety, resilience, or reliability issues with national-scale implications can't be addressed through incremental improvement programmes.

## Current and future strategic networks

During the next 30 years, improving climate change resilience along strategic networks will be one of the most significant drivers of change.

For example, transformational change is needed on sections of the strategic network from Kawakawa to Kaitaia, especially through Mangamuka Gorge. This route connects many isolated communities, but is extremely vulnerable to ongoing closures from slips, resulting in extended, repeated, and ongoing closures. Because of climate change, these closures are expected to become more frequent.

Previous work on this section of the strategic network has confirmed the:

- entire route is vulnerable to flooding, rockfalls, and slips – some parts have limited redundancy (ability to minimise downtime when disruption occurs)
- topography and geology is challenging
- alternate routes are limited and substandard.

The strategic direction and next steps are:

- fast-track planning work to respond to current closures
- investigate what's required to achieve a long-term solution to current slip vulnerabilities
- investigate potential alternative routes to existing connections.

For wider context relating to the current and future strategic networks, see the *Land Transport Modes and Strategic Networks* section of *Arataki*.



## Making progress

The land transport system will need to deliver significant change to achieve multiple outcomes over the coming years. We need to shift approaches to find effective and efficient solutions.

Climate change adaptation planning will help improve the resilience of the transport system. It will also help ensure we recover quickly when disruption occurs.

We will engage with system changes already underway, both at a national level, such as the resource management reform, and internally, like the *State Highway Strategy*. We'll then leverage these system changes to influence investment direction, like the *Government Policy Statement on Land Transport*, with the goal of enabling long-term investment in climate adaptation.<sup>30</sup>

Our transport system needs to:

- prepare for natural and human-made risks
- make plans to recover from disruptive events.

Some parts of the country depend on one or two transport links to stay connected. Maintaining these links during severe weather or natural disasters is a challenge.

Some transport corridors are in areas with extreme and high risk of disruption. Climate change is expected to increase the frequency of these risks.

Adapting to climate change must be a focus for strategic networks so these routes continue to function as important parts of the network. In some places this may mean changing the mode mix or providing lower service levels.

Highly impacted parts of the network are also expensive to maintain and operate, and often have limited funding. This is another reason why new approaches are needed.

We will maximise value from transport infrastructure and services by:

- boosting network resilience by maintaining critical parts of the network
- addressing immediate climate change and extreme weather challenges in high-risk areas.

New Zealand's *National Adaptation Plan* sets objectives to improve resilience of infrastructure by:

- reducing vulnerability of exposed assets
- ensuring all new infrastructure is fit for a changing climate
- using renewal programmes to improve our ability to adapt.

New approaches to recovering from disruption should be considered like:

- using an adaptive-management approach to decision making
- adapting to new conditions
- reducing service levels
- providing access through alternative means like coastal shipping
- using other ways of travel.

### Key actions to make progress:

- Build resilient communities by including climate adaptation in national and regional transport planning.
- Build resilience in rural and coastal communities by making adaptation a core and urgent element of transport planning, especially for high-risk areas and connections.
- Ensure climate change is allowed for in physical- and digital-security standards for construction, asset management, and operations.
- Embed Te Ao Māori views into regional and local transport planning to work with communities on adaptation responses.
- Work with Māori to understand if Māori communities are more sensitive to climate change and where impacts could be greatest.
- Collaboratively build spatial tools to assess and understand geological and hydrological risk across the network.
- Support the development of a digital hazards and risks platform across the transport network.
- Support planning and design work that identifies natural hazards in high-risk areas with vulnerable communities and infrastructure.
- Plan and invest in managing extreme resilience risks on the state highway network.
- Work proactively with communities to assess approaches to dealing with extreme events and climate change before events occur.
- Use an adaptive planning approach to support future resilience.
- Identify alternate places, routes, and modes to support alternative networks that can be used in times of disruption.
- Use local planning processes to prepare for climate issues.
- Plan proactively with communities for when to avoid, protect, accommodate, and retreat.
- Better understand the locations of marae and the exposure to sea level rise and other land factors, like plate tectonics, volcanic activity, and soil subsidence, that create hazards for the transport system.

## Regional context and directions

The regional directions provide guidance for 14 regions in Aotearoa New Zealand. Each regional section includes a high-level summary, context, and outlook to set the scene. This is followed by:

- detailed guidance to progress the five transport outcomes from Te Manatū Waka Ministry of Transport
- specific needs for urban areas
- a summary of where effort should be focused during the next 10 years.

Refer to the section on climate adaptation and regional direction for information on the five regions affected by the Auckland Anniversary Weekend floods and Cyclone Gabrielle in 2023:

- Te Tai Tokerau Northland
- Tāmaki Makaurau Auckland
- Waikato
- Tairāwhiti Gisborne
- Te Matau-a-Māui Hawke's Bay.

**Regional Directions**



# Climate change adaptation and transport outcomes

## Resilience and security

Given the uncertainty of climate change, an adaptive-management approach is necessary to provide a structured, iterative process of robust decision making.

The *National Resilience Programme Business Case* is an output of the *Waka Kotahi Resilience Framework*.<sup>31</sup> The business case provides an evidence base for future planning and investment decisions. It identifies and rates current and future natural hazard risks to the land transport system.

Further work is underway in the five regions affected by the Auckland Anniversary Weekend floods and Cyclone Gabrielle. This work will determine how to balance access and costs to improve the resilience of the network.

High-priority risks need a range of responses. We also need to take a long-term view when considering the changing hazards of climate change.

An integrated-system response doesn't assume infrastructure will be maintained or upgraded to lessen risk; other interventions will be considered.

Response options include:

- **avoid** – avoid placing infrastructure in high-risk locations where possible
- **protect** – develop solutions to lessen the risk of disruption, like flood protection or slope stabilisation
- **accommodate** – plan for periodic disruption, like providing for temporary inaccessibility, rapid reinstatement, detour routes, and/or timely information
- **retreat** – re-route journeys away from the impacted area.

Climate change, particularly sea level rise and more extreme weather events, presents increased risk to the transport system. The transport sector will work with communities to plan when to defend, accommodate, and retreat. Adapting to climate change means the land transport system is preparing for, and adjusting to, the impacts of a changing climate so the land transport system is resilient.

The *National Adaptation Plan* focuses on:

- reducing vulnerability to climate change impacts by enhancing adaptive capacity
- considering climate change in all levels of decision making
- strengthening resilience.

To make infrastructure less vulnerable, renewal programmes need to:

- improve adaptive capacity
- carry out preventative maintenance
- ensure new infrastructure is ready for climate change.

Waka Kotahi has developed *Tiro Rangi – Our Climate Adaptation Plan*. *Tiro Rangi*:

- shapes the Waka Kotahi response to the changing climate
- describes the role of Waka Kotahi in climate adaptation across the land transport system.

It also includes the four actions in the *National Adaptation Plan* that Waka Kotahi leads or co-leads.

*Tiro Rangi* identifies priorities that underpin a Waka Kotahi adaptation response including:

- better understanding climate risks
- embedding climate adaptation into planning and decision making
- applying a Te Ao Māori worldview.

Ways to measure how we're tracking and the progress being made are still to be developed.

The *National Adaptation Plan* has highlighted the scale of the climate adaptation challenge and improved understanding of climate-related impacts.

Actionable data on climate impacts and resilience risks has been improved through the *National Adaptation Plan* and the *National Resilience Programme Business Case*. This will inform future decision making.

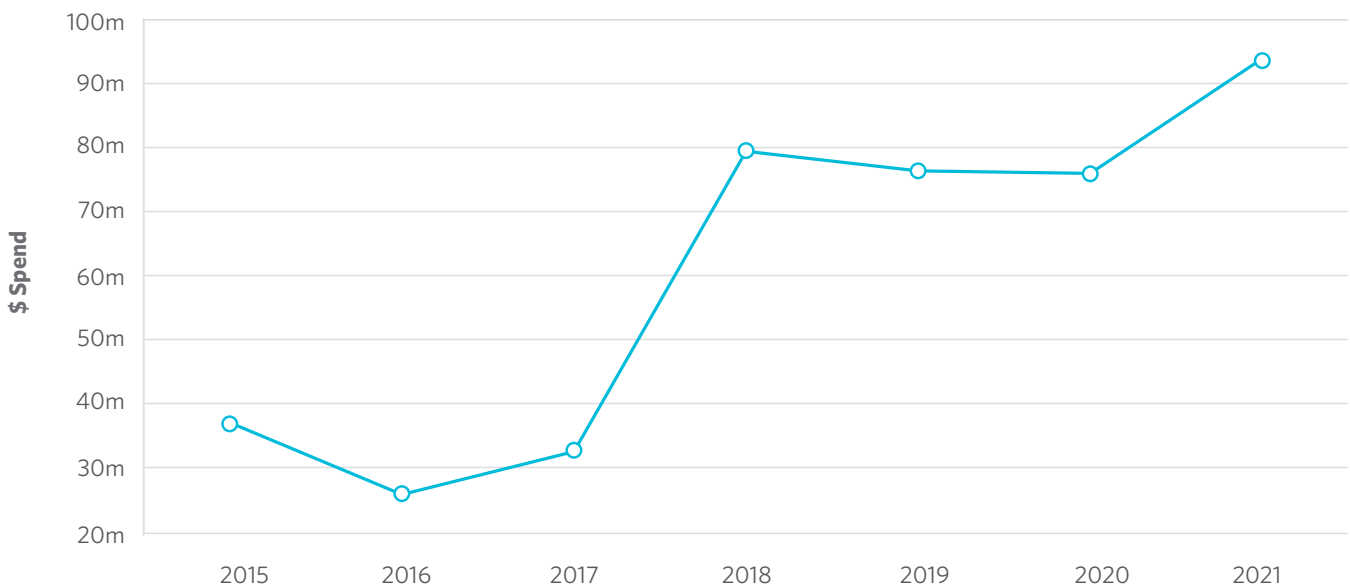
System-wide action on climate adaptation has grown. This is because national initiatives are funded through the Crown and regional adaptation plans through local government.

## Some key challenges for this outcome as we move forward:

- There is a lack of redundancy in parts of the land transport system – some regions rely on one or two critical lifelines to stay connected to neighbouring regions.
- Some existing corridors are at high risk of disruption; climate impacts are expected to increase these risks.
- Climate change is already contributing to extreme and severe weather events resulting in more frequent flooding and slips; these events will happen more often.
- The rising costs of maintaining and repairing networks amidst growing climate impacts, like storms, flooding, sea level rise, and high temperatures.
- Māori communities in rural and coastal areas will be disproportionately affected by climate change impacts.

## Emergency works spend<sup>32</sup>

Figure 2



### What do we still need to work on?

The *National Adaptation Plan* has several actions across infrastructure and the built environment that will be lead, or supported, by Waka Kotahi.

A key action in the plan is to investigate nature-based solutions for adapting to climate change.

The Climate Emergency Response Fund has funded the Māori Climate Action Platform. This platform will look into Māori-led responses to climate adaptation and mitigation.

Resource management reforms will inform future planning for resilience and climate change. Waka Kotahi will continue to work with local government on resilience and climate adaptation strategies. Future work will include collaboration on regional spatial strategies and managed retreat.

Our first *Tiro Rangi* set the foundations for the next couple of years. Initially, actions will build on existing initiatives. Those that unlock future action will be prioritised.

Waka Kotahi will also develop climate-change risk assessment tools specifically for the state highway network.

### Environmental sustainability

Reducing carbon emissions worldwide is critical to mitigating the impacts of climate change. Activities that reduce carbon emissions can also contribute to resilience actions. Using nature-based solutions to increase resilience and reduce greenhouse gas emissions supports environmental sustainability. We will address this in more detail in future updates of *Arataki*.

### Inclusive access

Climate change and extreme weather events will continue to impact many communities and groups. An inclusive and equitable approach to resilience would seek to manage these impacts for all communities.

Remote communities rely heavily on lifeline infrastructure. Severe weather events and sea level rise can impact these communities and cut them off from services for days. Some people that live in these locations are less able to respond quickly, like those that are lower-income, elderly, or mobility-restricted.

To support more equitable, long-term outcomes, we need to:

- continue targeted resilience programmes, ensuring all communities are appropriately supported
- look for new ways to keep communities connected through technology
- find ways to increase resilience of lifeline utilities like electricity, water, and communications, and better integrate this into the land transport network
- design resilience programmes that recognise some communities have limited access and need different support if lifelines are cut off.

There is currently little evidence about the impact of climate change on inclusive access and equity. We will address this in future updates of *Arataki*.

## Economic prosperity

Climate change is already impacting the economy and will continue to do so with the rising costs of network resilience.

All regions have experienced extreme weather events, such as flooding and drought. The severity and frequency of these events is expected to grow.

Over the coming decades, parts of the country will become wetter, or drier and warmer. This may lead to changes in the nature and location of primary production. It may also affect businesses and freight that support the primary sector.

Tangata whenua are especially vulnerable to the effects of climate change.<sup>33</sup> We know that during previous recessions and COVID-19 lockdowns there were greater impacts on Māori. There are risks and opportunities for the Māori economy, particularly because of asset dominance in natural, resource-based sectors.

Significant growth in Te Ōhanga Māori (the Māori economy) is set to continue. This will be seen in the proportion of Māori in the labour force, as well as a diversified asset base of Māori employers, entities, and self-employed Māori.

## Freight

Much of the strategic network used to move freight is vulnerable to extreme natural hazards. For example, in some locations that are important for the movement of goods, future sea level rise will greatly increase coastal flooding, erosion, and groundwater levels.

Climate change may also reduce production quality and quantity across primary industries like horticulture, viticulture, agriculture, and forestry.<sup>34</sup>

The amount of suitable land for primary industries will decrease as sea levels rise and low-lying coastal areas are affected by inundation and groundwater salinisation.

The volume of freight of supply-driven primary industries, like dairy and meat, is forecast to grow less than 2% by 2033 and 0.4% by 2053.<sup>35</sup>

## Healthy and safe people

As we know from the severe weather events of 2023, climate change presents risks to the health and safety of the people of Aotearoa New Zealand. More work needs to be done to better understand this outcome. We will address this in future updates of *Arataki*.

For wider context relating to the five transport outcomes from Te Manatū Waka Ministry of Transport, please see the *Strategic Context*.

Strategic Context →

# Equity lens





The land transport system enables people to access work, healthcare, essential services, and social events. However, access is not evenly spread through different places or groups in the community.

Equity refers to the distribution of fairness and justice. Some places are better served by a range of services than others. Sometimes services aren't always fairly and equitably accessible to all people regardless of their income, race, gender, disability, age, or other factors.

## Transport equity

Having an equitable system means no one is excluded from experiencing fairness and justice. An equitable system recognises people have different needs and opportunities available to them. Interventions and activities are needed to help people or communities who are excluded, or experience disadvantages.

Transport equity is when groups and individuals have access to affordable transport options that meet their needs. Every person has many ways to travel; each transport option is safe, secure, reliable, and supports a range of individual capabilities.

Transport policy supports transport equity through the fair distribution of resources, benefits, costs, programmes, and services. It aims to reach many groups in all geographic locations, such as rural and urban areas.

Transport equity changes over time; this means individuals can experience it at different stages in their lives. This can happen as the result of a change in circumstance, such as having a family, losing a job, experiencing health issues, or ageing. Transport equity can also change when a person relocates geographically, such as moving to rural or outer city suburbs.

An equitable land transport system is one that:

- focusses on the outcome, such as access to employment, and removes barriers for different groups
- considers how transport accessibility, affordability, and availability impact people's ability to fully engage in social and economic opportunities
- considers how personal preferences and choices influence engagement with the transport system.

Achieving equity in the land transport system will take time and requires a shift in how we do things. Achieving equity for some or the majority won't be enough – we must aim for equitable access for all.

The inclusive access outcome from Te Manatū Waka Ministry of Transport's *Transport Outcomes Framework* aims for all people to participate in society through access to social and economic opportunities, such as work, education, and healthcare.<sup>36</sup>

The inclusive access outcome has encouraged the transport sector to think more widely about transport equity. This includes policy work led by Te Manatū Waka, with Waka Kotahi as an implementation agency. Both agencies have a role to play to improve transport equity.

The approach to transport equity described here is based on work by Te Manatū Waka. It's ongoing and not finalised. As the work progresses, updates will be reflected in future releases of *Arataki*.

The *Strategic Context of Arataki* has more on this.

**Strategic Context** →

## Components of transport equity

An equitable transport system is when accessibility, affordability, and availability are in balance. A few examples of this might include:

- A person can afford to use a particular mode, or way of travel, that's available for their trip. However, they have a broken leg, so it's not an accessible option for them.
- A person has app-based on-demand services in their area and can physically access these. However, the services are too expensive, so it isn't an affordable option for them.
- A person lives near a bus stop, can afford to use the bus, and is physically able to do so. However, the bus doesn't run past 10pm and their work shift finishes at 11pm, so there may not be an available option for them.

## Accessible transport

Accessibility in transport is the ability to reach desired goods, services, and destinations using the transport options available to them. If access is limited, this impacts the ability to access opportunities such as work, social events, and healthcare. Several factors contribute to transport accessibility such as:

- physical or mental illness, physical disability, reduced mobility, visual and audible limitations, or speaking a foreign language
- the built environment, including footpaths, ramps, lack of street lighting at night, and partially blocked footpaths because of bins or scooters
- access to technology through smartphones and the internet for route planning, ticket purchasing, or app-based services – not everyone has the required technology
- access to a pre-paid public transport card that requires funds to be loaded through a bank account, outlet, or automated machine
- personal circumstances including illness, injury, or disease; this may change over time and some people may experience this after an event, such as surgery
- overwhelming or complicated travel, like having to transfer while using public transport
- discrimination against certain groups that can impact safety.<sup>37</sup>

## Affordable transport

Affordable transport is the ability to pay for services people want to access without experiencing financial stress or hardship. Several factors contribute to transport affordability:

- Significant existing income disparities across a range of groups. For example, Māori are more likely to be on lower incomes or be unemployed.<sup>38</sup> Older people tend to have less disposable income.<sup>39</sup> Migrants and refugees sometimes experience lower wages.<sup>40</sup>
- Those who earn lower incomes need to spend a higher proportion of their income on transport. This makes them vulnerable to rising costs and therefore unlikely to offset through other ways, like middle- and high-income earners working from home.
- Those with no alternatives to driving face rising and volatile maintenance costs that make budgeting difficult.
- New technologies or modes, like e-bikes, are expensive and require high start-up funds to access.

## Available transport

Available transport is the range of options for people to travel. This includes the number of services, quality, timeliness, and convenience. Several factors contribute to transport availability such as:

- some urban areas have a range of options, while others have fewer; this can vary even between suburbs
- rural areas and smaller towns have much lower availability overall than larger cities
- a lower number of services reduces reliability; for example, relying on a vehicle exposes people to issues if it breaks down or reliance on a single mode of public transport if there is a cancellation or maintenance is required
- infrastructure, such as cycleways, may not exist or be planned but not yet ready
- how public transport is scheduled; for example, some services may not run when shift workers need to travel, or may follow a reduced schedule in evenings, weekends, or public holidays
- when there is maintenance required or faults to be repaired, particularly on metro rail, and services are replaced by alternatives which impacts availability.

## Equity and transport outcomes

### Inclusive access

Inclusive access focuses on enabling all people to participate in society through access to social and economic opportunities, such as work, education, and healthcare.<sup>41</sup>

A range of groups experience reduced access to transport; this is influenced by income and availability. These groups include those that are:

- Māori
- people on low incomes
- women
- LGBTQI+
- people with disabilities
- older
- ethnic minority.

Since 2016, the proportion of household income spent on transport has increased from 16% to 28%.<sup>42</sup> This means transport is becoming less inclusive for lower-income earners. One of the key factors for inclusive access is income, but it's not the only factor that determines equity and access.<sup>43</sup>

The percentage of adults unable to travel because of cost, time pressure, and/or a lack of transport choice has declined from 12% in 2018–2019 to 8% in 2020–2021.<sup>44</sup> While this is trending in the right direction, it's likely influenced by the COVID-19 lockdowns.

The number people living near frequent public transport is relatively low in urban centres with:

- Tāmaki Makaurau Auckland at 26%
- Te Whanganui-a-Tara Wellington City at 18%
- Ōtautahi Christchurch at 24%.<sup>45</sup>

Of those low numbers, it's likely a smaller percentage can use services in an equitable way.

Having a bus stop or a train station nearby is often not enough to support access for low-income people; this is because while the service might be affordable, it may not be frequent enough or serve the right places.<sup>46</sup>

Most trips are multi-purpose; people leave home for an initial reason, like travelling to work, but complete other tasks while out, like dropping off kids at school or shopping.<sup>47</sup>

Lower-income areas often have less access to public transport and live further away from work, meaning long journey times that might require them to transfer as part of their trip.<sup>48</sup>

When public transport doesn't meet people's needs, they often require a vehicle. There are barriers to using private vehicles that can cause significant financial stress. These costs include:

- the amount to purchase a vehicle, which may require financing
- ongoing fuel and maintenance needs.

Sometimes multiple vehicles are required for a single household to meet their needs, like to accommodate work schedules and childcare.

There may be limited access to driver licensing testing centres, particularly in rural areas, that also impacts inclusive access.

## Economic prosperity

Transport equity supports economic prosperity by helping people access jobs and opportunities.

Currently access to jobs is not equitably spread or enabled across modes.

In Tāmaki Makaurau Auckland, growth and pressure on existing networks means access to jobs will get worse for some parts of the city, particularly in the west and south, where incomes are generally lower and travel times longer.<sup>49</sup>

Some future approaches to reducing congestion and improving freight reliability are likely to impact transport equity.

The introduction of congestion pricing will likely negatively affect low-income earners, who are already experiencing transport equity and find it hard enough as it is.<sup>50</sup> This could mean discounts or exemptions would be needed.<sup>51</sup>

However, congestion pricing could free up the network to allow faster trips that can't be shifted to other modes.

To support this outcome, Waka Kotahi will need to continue to:

- support programmes to improve access to transport, land-use planning, and getting the most from the existing network
- work with our partners on congestion pricing programmes to stay focussed on transport equity.

## Environmental sustainability

Emissions reduction is likely to have transport equity implications. There are also opportunities to improve equity outcomes.

Aotearoa New Zealand has a high level of car dependency; this is inequitable in many ways. People who depend on vehicles are often unable to switch to lower-emission modes, like public transport (where it exists), because those options don't meet their needs.

Switching to e-bikes and cycling is often difficult, given the cost of the initial purchase and lack of infrastructure. For those with mobility restrictions, walking and cycling may not be possible.

It is essential to support a just transition when reducing transport emissions. This means prioritising actions that reduce emissions in a way that also helps improve equity outcomes.

At times, interventions and activities that aren't equitable may be put in place because they are effective. In these cases, any negative impacts on equity should be well understood and appropriately mitigated.

Transitioning to lower-emission vehicles is challenging given the:

- high cost to buy
- small used market to choose from.

As new low-emissions vehicles enter the fleet, this will increase the supply of used vehicles over time.



To support this outcome, the land transport system will need to:

- accelerate the delivery of low-emissions options, such as walking and cycling, in land transport projects
- continue supporting increased access to public transport
- support the implementation of electric vehicle (EV) uptake schemes, like Clean Car Discount
- consider how the transition to EVs can support safety improvements
- provide quality, mixed-use, compact towns and cities with the most growth in locations with better travel options and shorter trip lengths; this means people won't have to travel so far and/or use a car as much
- support rideshare programmes as well as bike- and micromobility-device sharing.

## Resilience and security

Climate change and extreme weather events will continue to impact many communities and groups. An equitable approach to resilience would seek to manage these impacts for all communities.

Remote communities rely heavily on lifeline infrastructure. Severe weather events can impact these communities and severely cut them off from services for days. This is also where many people live who are less able to respond quickly, like those that are lower-income, elderly, and mobility-restricted.

To support this outcome, Waka Kotahi should:

- continue targeted resilience programmes, ensuring all communities are appropriately supported
- design resilience programmes recognising some communities have limited access and need different support if lifelines are cut off.

## Healthy and safe people

People are over twice as likely to die or be seriously injured in a crash in a one-star vehicle as compared to a five-star.<sup>52</sup>

One- and two-star safety-rated cars make up 41% of the national vehicle fleet.<sup>53</sup> Fifty-two percent of deaths and serious injuries (DSIs) occur in these cars; the figure is even higher for young drivers at 57%.<sup>54</sup>

Vehicle safety is not evenly distributed. A range of groups are more likely to have older vehicles, mostly because of the high cost of newer, safer vehicles.

Vehicles older than 13 years make up half the total fleet and are more likely to be owned by young people.<sup>55</sup> These vehicles travel only 40% of the total distance covered by the whole fleet yet account for the majority of vehicles where someone is killed or seriously injured.<sup>56</sup>

Air pollution is another concern and has been found to be responsible each year for:

- more than 3,300 premature adult deaths (60% associated with pollution from motor vehicles)
- more than 13,100 hospital admissions for respiratory and cardiac illnesses, including 845 asthma hospitalisations for children
- over 13,200 cases of childhood asthma
- about 1.7 million days when people couldn't do what they might have done if air pollution hadn't been present.<sup>57</sup>

Air pollution may impact those with existing conditions, including:

- elderly people
- children, including babies
- people with pre-existing heart or lung disease
- people with respiratory conditions
- asthmatics
- diabetics
- pregnant people.

Air quality is typically worse:

- near major roads, especially near intersections with stop/start traffic
- in more industrialised areas, including ports and airports
- in low-lying valleys where pollution can get trapped.

Low-income areas are often near major roads, in valleys, or near industrial areas.

Increased air pollution makes people less likely to engage in physical activity, which means they're missing out on a wide-range of health benefits.

Air pollution is often worse during winter months, when the air is cold and calm meaning emissions from wood burners and traffic may be more concentrated.

To support this outcome, Waka Kotahi should:

- investigate programmes to reduce the age of the vehicle fleet
- look for ways to minimise exposure to transport emissions and noise, such as reverse-sensitivity setbacks and buffers that put distance or greater separation between residential and transport areas
- continue to support research about air quality.

# Māori lens



For the 2023 release of Arataki, we have presented some of the available evidence about Māori in relation to the land transport system and the aspirations of Māori, as they have expressed them in their own documents. These include reports and strategic documents of iwi and post-Treaty settlement organisations, as well as secondary information from the transport and public sectors. Using the transport outcomes framework from Te Manatū Waka Ministry of Transport, several insights have been introduced to offer some conversation starters for future exploration with Māori.

While information and insights about Māori populations and aspirations are not limited to the Māori lens, we recognise the need to pull together, in one place, new insights about how the transport sector needs to develop and respond to Māori to ensure better outcomes for all. As we develop the Māori lens, we will continue to uplift the insights and evidence developed within it to shape the entire Arataki 30-year plan and its direction.

We look forward to using this as a base for engagement with Māori in future years to confirm these aspirations and develop a plan to respond to these in partnership with Māori.

## Who are Māori?

Māori are the tangata whenua – the people of the land of Aotearoa New Zealand. Nearly 776,000 people, or 16.5% of the country's population, identify as part of the Māori ethnic group.<sup>58</sup> The median age for Māori is 25.4 years compared to 37.4 years for Aotearoa as a whole.<sup>59</sup> Of the total Māori population:

- more than 85% of live in Te Ika-a-Māui North Island
- about 14% live in Te Waipounamu South Island.<sup>60</sup>

Māori descended from people who have always seen the value of travel and exploration.<sup>61</sup> Archaeological evidence reveals Māori people came from Eastern Polynesians who travelled to Aotearoa over 700 years ago. Aotearoa was likely part of a voyage of discovery that marked the final stage of Polynesian migration and is now regarded as among the greatest acts of travel in world history. Today, these stories of transport to Aotearoa form a key part of Māori identity.<sup>62</sup>

After arrival in Aotearoa, Māori became explorers of the land. In the first century after settlement, the main emphasis of mobility and transport was on locating resources, with

travel routes formed around mahinga kai (food sources). Settlements were often built on water- and track-based transport routes, to allow access to resources. There was also significant trade between hapū, because of the different resources available in different geographic areas.<sup>63</sup>

Māori tended to travel on the water. Because of their preference for travel by waka, connection between coastal areas was far less of a barrier than inland routes. Transport along rivers was also important as it allowed access to settlements and mahinga kai. Only where access was not possible by river, Māori ventured by foot.<sup>64</sup>

Travel patterns varied significantly between areas of the country, depending on available resources. Coastal iwi relied heavily on fishing, while inland tribes relied more on forest products.

There were also different iwi travel patterns in Te Ika-a-Māui and Te Waipounamu, largely driven by climate. For example, in Te Waipounamu, the cooler climate made it hard to plant and manage large-scale gardens, so Māori lived a nomadic lifestyle based around seasonal hunting.<sup>65</sup>

Early settlers relied heavily on Māori knowledge for access to the inland areas of Aotearoa and many early roads were based on historic Māori routes. It is suggested that inland Māori communities were further connected by the introduction of Pākehā transport networks.<sup>66</sup>

Development of the transport network has been criticised as being inflicted on Māori, with the government not always considering the broader impacts of transport decisions on society and Māori.

Historical and recent decisions about infrastructure have had intergenerational and inequitable consequences for Māori wellbeing. This legacy is seen by some Māori as disruptive and damaging, with ongoing consequences for safety, as well as physical, cultural, and emotional wellbeing.



**Iwi highlight their key areas of interest as education, housing, employment, sustainable Māori businesses, social and cultural development, and their role as kaitiaki to the environment.**

For many Māori, construction of roading infrastructure is part of a wider story of displacement, dislocation, and disenfranchisement from their land.<sup>67</sup>

From 2018 to 2022, over 100 iwi and post-Treaty settlement organisations have produced annual reports and strategic documents that highlight their key interests or issues. There are several reoccurring themes:

- education
- housing
- employment
- sustainable Māori businesses
- social and cultural development
- kaitiaki roles to the environment.

Many of these annual reports also looked at the mental and physical health of their people.

Waka Kotahi can support the realisation of several iwi aspirations through the land transport system, by:

- connecting people to housing and jobs
- supporting the Māori economy
- developing enduring partnerships for safer road-user outcomes
- exploring environmental protections.

The next section, Māori and transport outcomes, expands on these themes.

We must understand the transport sector through a Te Ao Māori framework, with a whole-of-system lens, not just focusing on parts of it.<sup>68</sup> This means developing a land transport system that:

- is caring and nurturing
- provides support, inclusive mobility, and wellbeing for the people it serves.

Developing a holistic transport system in this way supports healthy whānau by removing barriers, such as cost, transport, and lack of opportunity.<sup>69</sup>

While there is limited research about achieving Māori aspirations for hauora (wellbeing) in the land transport system, Te Whare Tapa Whā model describes health and wellbeing as a wharehui (meeting house) with four walls. These walls represent four aspects of wellbeing from a Māori world view, and when all are in balance, wellbeing thrives. Given its origins in the health sector, Te Whare Tapa Whā model was applied to the transport system to provide insight that may suggest how transport might be considered to uplift Māori wellbeing.<sup>70</sup>

Aspect of wellbeing	Interaction between transport and aspect of wellbeing
Taha tinana (physical wellbeing)	Transport enables people to move around their communities. An element of taha tinana is providing active transport. Transport also enables access to important places including jobs, education, food, healthcare, and exercise.
Taha hinengaro (mental and emotional wellbeing)	Transport provides better mental health through increased control over one's life and how it is spent.
Taha whānau (social wellbeing)	Transport connects people to places and events. This supports connection to friends and whānau, leisure pursuits, and recreation.
Taha wairua (spiritual wellbeing)	Transport can increase spiritual wellbeing by increasing access to individual places of identity and beliefs, such as improving access to places of cultural significance and religious institutions.

## Māori and transport outcomes

### Environmental sustainability

The government's *Emissions Reduction Plan* recognises Māori are:

- kaitiaki of their whenua
- leaders in their communities
- decision-makers about resources and infrastructure
- land and business owners.

Māori will help lead the transition in each of these roles. Mātauranga Māori will help us learn and better inform our decision making.

The *Emissions Reduction Plan* notes that we need to ensure an equitable transition for Māori, led by Māori, to uphold their rights and interests under Te Tiriti o Waitangi. This requires building relationships and capability between government and Māori to work together as equal partners on our climate response.<sup>71</sup>

From 2018–2021, walking made up 10% of trips for Māori as compared to the national population at 12%.<sup>72</sup> Cycling made up 1% of trips for Māori as compared to the national population at 2%.<sup>73</sup> Māori took more trips by car than the national population.<sup>74</sup> Public transport use was identical.<sup>75</sup>



Tūhoe are the kaitiaki of Te Urewera and apply the principle of sustainable co-existence between people and the land. A section of State Highway 38 is largely unsealed as it runs through Te Urewera, causing potholes, corrugations, and dust. Since 2016, Tūhoe and Waka Kotahi have been trialling a road binder known as tall oil pitch as a sustainable option for resurfacing and maintaining this section. Tall oil pitch is:

- locally sourced from pine trees
- a natural by-product of the wood pulping process
- non-hazardous and doesn't harm the environment.<sup>76</sup>

## Resilience and security

The first *National Adaptation Plan* notes that establishing a platform for Māori climate action is the key way government will build a climate-response partnership with Māori.<sup>77</sup> This platform will build:

- Te Tiriti partnership
- greater recognition of Māori rights and interests, including Treaty settlement commitments.

The platform will build on three focus areas:

- embed partnership and representation
- support Māori-led strategy and alignment
- activate kaupapa Māori, tangata Māori solutions.

Of the 191 marae in Aotearoa New Zealand within one kilometre of the coast, about 47 are potentially exposed to a 100-year extreme sea-level now and in the future.<sup>78</sup>

Further evidence is required on the locations of marae and their exposure to sea level rise; this should consider other land movements from:

- plate tectonics
- volcanic activity
- soil subsidence
- other factors.

Further evidence is also required to quantify the scale of climate change impacts on:

- the availability of mahinga kai food production on Māori land
- living conditions and access to marae
- the locations where impacts could be greater for Māori than other groups, or if a different response is required.

## Healthy and safe people

When considering Māori road safety outcomes, it's important to also include contextual factors of Māori such as:

- geographic distribution
- age distribution
- deprivation status.<sup>79</sup>

It's useful to understand these factors as part of a system, and how the various parts of the system lead to high-severity crash outcomes for Māori.

For example, the Māori population is relatively young and many live in the most populated parts of the country, such as Tāmaki Makaurau Auckland, Waikato, and Te Moana a Toi-te-Huatahi Bay of Plenty.<sup>80</sup>

Some key findings about Māori health and safety from 2013–2017:

- Māori are overrepresented in death and serious injury (DSI) caused by road crashes; this is expected to continue increasing
- DSI for Māori remains above average through to 64 years old (for non-Māori, it levels out around 30 years old)
- tamariki Māori are more likely to be killed or seriously injured in crashes than non-Māori children
- Māori DSI is 8 to 13% higher in areas of deprivation
- Tairāwhiti Gisborne, Te Tai Tokerau Northland, and Te Moana a Toi-te-Huatahi regions have the highest numbers of Māori DSI
- Tāmaki Makaurau Auckland, Waikato, and Te Tai Tokerau combined make up half of all Māori DSIs.<sup>81</sup>

When asked about Māori aspirations for land transport in Aotearoa New Zealand, many iwi have expressed concern for safe physical access to:

- marae for tamariki (children) and kaumātua/kuia (the elderly)
- papakāinga (collective residential areas), wāhi tapu (sacred sites) and wāhi taonga (precious sites).<sup>82</sup>

Many marae in rural areas are now accessed directly from state highways.<sup>83</sup>

## Inclusive access

Māori reliance on cars and roading infrastructure has grown because of transport and urban policy.<sup>84</sup>

Māori homes are located further from whānau, cultural sites, and other places of social connection because of the:

- loss of land
- concentration of people and places in urban areas (urbanisation)
- areas changing because of more affluent resident and businesses (gentrification).<sup>85</sup>



Many Māori people live and work in areas not well served by public transport.<sup>86</sup> Whānau are an important source of transport and sometimes the only option for those with:

- less social power
- greater financial constraints
- language and technology barriers.

Māori are often required to drive further than non-Māori, to pick up whānau or get to cultural sites.<sup>87</sup> Particularly in rural areas, Māori community roads are often of poor quality; this means more wear and tear on vehicles and more money spent on vehicle repair and maintenance.<sup>88</sup>

Māori have lower average incomes and tend to experience more transport inequities than other New Zealanders.<sup>89</sup> As a result, Māori are more likely to be involuntarily without a vehicle, or in 'forced car ownership', where a low-income household must have a vehicle and a high amount of their income must go towards maintenance and upkeep.<sup>90</sup>

Māori are less likely to gain their full licence and have lower rates of driver licensing as compared to non-Māori.<sup>91</sup> This is particularly true for Māori living in rural areas.<sup>92</sup>

Increased travel distance has caused Māori to be disconnected from whānau, cultural sites, and other places of social connection. This causes isolation and harm to Māori identity and has serious implications on wellbeing. Forced car ownership and usage causes social harms in low-income and Māori communities by making financial hardship and debt worse.<sup>93</sup>

Māori are potentially missing out on important trips for shopping, social, sports or exercise, education, and even personal or medical appointments. In 2020–2021, 5.5% of Māori couldn't visit a general practitioner because they didn't have transport; this is compared to 2.4% of all New Zealanders.<sup>94</sup> In addition, 1.7% of Māori couldn't access after-hours healthcare compared to 0.7% of all New Zealanders.<sup>95</sup>

Lack of transport access makes existing inequalities worse for Māori. Driver licensing is an example of the cyclical effects transport access has on opportunities. Financial barriers are the most common reason Māori don't get a driver's licence. Not having a driver's licence has implications on employment and further limits wider financial opportunities.<sup>96</sup>

Not having a driver's licence also has wider social implications. For example, young Māori are more likely to drive illegally before getting a licence.<sup>97</sup> A common reason for entering the criminal justice system, particularly for young Māori men, is driving illegally.<sup>98</sup>

## Economic prosperity

In 2018, the financial value of Te Ōhanga Māori was estimated at \$68.7 billion.<sup>99</sup> Assets include those in the transport, postal, and warehousing sector totalling \$4.1 billion.<sup>100</sup>

Of the total asset base, nearly \$21 billion is in Māori trusts, incorporations, and entities, with the majority (\$14 billion) in natural resource-based sectors.

There is a considerable amount of assets held by Māori entities in industrial, commercial, and residential property totalling \$4.8 billion.<sup>101</sup>

The assets of the businesses of more than 9,900 Māori employers makes up the bulk of this asset base at \$39.1 billion.<sup>102</sup> The assets and businesses of Māori employers are spread broadly across many sectors, including:

- primary industries
- manufacturing
- service sectors.

Assets in real estate and property services total over \$8.2 billion, with another \$7.5 billion in agriculture, forestry, and fishing.<sup>103</sup>

Many business assets of Māori employers are in transport and other sectors. These are mostly smaller businesses with self-financed ownership, such as vehicle drivers. Many businesses are much smaller, with an average of 14 employees and \$4 million in assets.<sup>104</sup>

There are nearly 18,600 self-employed Māori whose assets total \$8.6 billion.<sup>105</sup> The majority are in primary industries, and real estate and property services. There are \$397 million in assets of self-employed Māori in transport, postal, and warehousing.<sup>106</sup>

Of the 300,000 Māori employees in Aotearoa New Zealand, 74,000, or one quarter, are employed in high-skill jobs.<sup>107</sup> Of those in high-skill occupations, 40% are employed in two industries:

- health care and social assistance
- education and training.

Forty-four percent of Māori are operating their own business, either as a sole-trader or employer in a high-skill job.<sup>108</sup>

Te Ōhanga Māori contributes to gross domestic product (GDP) across all three of its dimensions:

- value added by Māori organisations (the production measure)
- income (wages and profits, also known as operating surplus) received by Māori individuals (the income measure)
- spending of Māori households (the expenditure measure).<sup>109</sup>

Each of these measures provides a different insight into the participation of Māori in the economy of Aotearoa. Across the three dimensions, Te Ōhanga Māori in 2018 ranges from 6.5% to nearly 15% of the national economy.<sup>110</sup>

We need to further understand the opportunities and challenges facing Māori entities, employers, self-employed, and employees in the transport sector.



# Freight lens

Over the next 30 years, we must move to an integrated freight system. This means road, rail, and coastal shipping will each play to their strengths. Each will support a safe, reliable, and resilient freight system. Each will move goods effectively and with low emissions.

To do this, we need to respond to factors such as:

- population growth
- changing travel patterns
- climate change
- changing economic structure
- other factors that will influence freight and the demand for it.

We will support implementation of the government’s *Emissions Reduction Plan* and the *National Freight and Supply Chain Strategy* from Te Manatū Waka Ministry of Transport. We will work closely with the freight industry, central government, and local government to identify and address new challenges and opportunities. We need more high-quality evidence and data so we can identify how the strategic modal networks might change over the next three decades.

## What is freight?

Freight is the movement of commercial and domestic goods, and the distribution of exports and imports.

Freight is a key part of economic activity and is fundamental to making places great to live (liveability).<sup>111</sup>

Freight volume depends on demand for goods and is heavily influenced by:

- the strength of the New Zealand dollar
- population growth
- disposable income.<sup>112</sup>

## Freight today

In 2017-2018, the size of the country’s freight task was

- 278.7 million tonnes
- 30.1 billion tonne-kilometres.<sup>113</sup>

Road is the dominant way of moving freight; it makes up nearly 93% of the total tonnes and 75% of the total tonne-kilometres (Figure 3).<sup>114</sup>

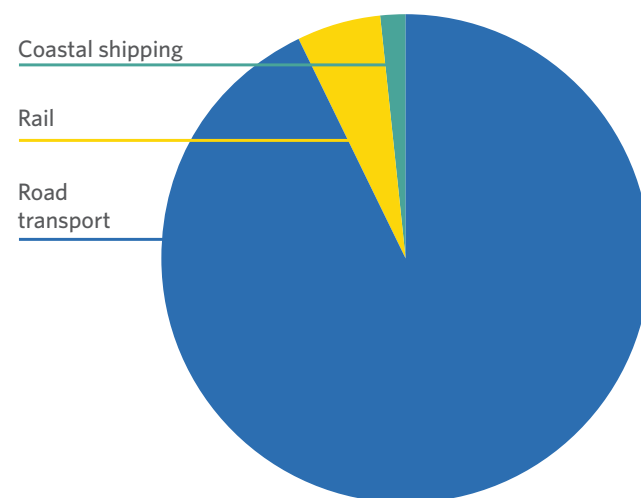
The heavy freight vehicle fleet accounts for 23% of transport carbon dioxide emissions, but only 6% of the annual vehicle kilometres travelled (VKT).<sup>115</sup>

In 2017-2018, 67% of freight movements were less than 100kms, 22% between 100 and 300km, and 10% longer than 300km (Figure 4).<sup>116</sup>

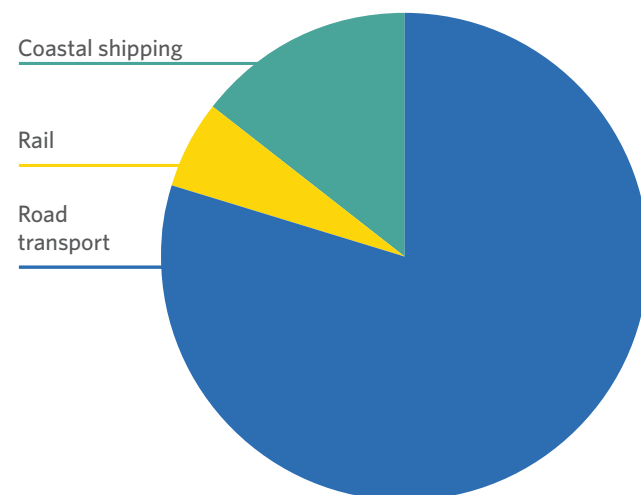
### The freight task in 2017-2018 by mode

Figure 3

#### Freight tonnes

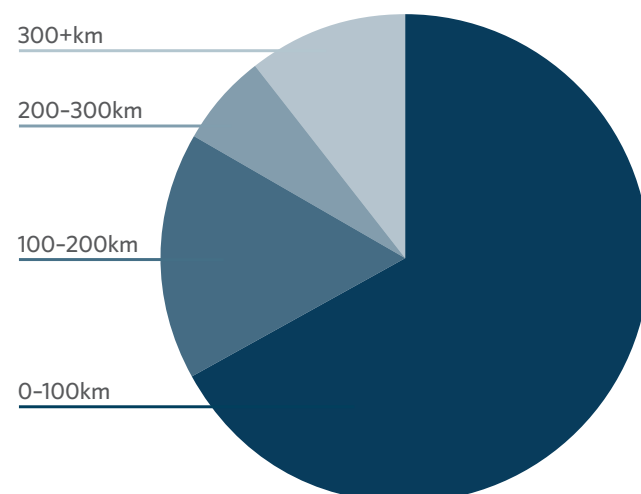


#### Freight tonnes per kilometre



### Freight tonne kilometre distribution

Figure 4



## Role of modes

For some goods, there are benefits to moving more freight by rail and coastal shipping.

In the short-to-medium term, shifting to lower-emissions modes like rail and coastal shipping can support:

- a transition to net zero
- improved road safety
- reduced road maintenance costs.

### Road freight

Road freight can:

- accommodate shifting demands
- move time-critical goods
- serve almost any location in the country.<sup>117</sup>

Road freight is mostly moved on state highways, motorways, and the arterial roading network.

However, in the industrial areas of Tāmaki Makaurau Auckland and other major urban centres, a large number of freight movements happen on local roads to access warehouses and distribution centres.<sup>118</sup>

Road freight tends to be localised, with around 77% remaining within the region it was sourced.<sup>119</sup>

### Rail freight

Rail freight is an attractive alternative for long-distance freight transport, especially for moving

- goods between major centres
- import and export goods to and from major ports.

Rail freight is best suited for moving bulk commodities such as coal, milk, logs, and steel.<sup>120</sup>

The ability of rail to play a larger role in the movement of freight is constrained by a range of factors. These include:

- the current unreliable condition of the network
- network capacity constraints in Tāmaki Makaurau Auckland and Te Upoko o te Ika a Māui Greater Wellington where metro passenger services compete for 'slots' on the network with freight services
- the comparatively small size of the rail network relative to the roading network and the limited number of intermodal freight terminals that provide efficient and effective transfers of freight between different modes.<sup>121</sup>

The mode share of rail has also been affected by the:

- rolling stock capacity constraints such as the towing capacity of locomotives and wagon availability

- Kaikōura earthquake in 2016 that reduced freight travelling between Te Ika-a-Māui North Island and the main centres of Te Waipounamu South Island
- reduction of coal exports from Te Tai o Poutini West Coast to Ōhinehou Lyttelton over the past 10 years.<sup>122</sup>

The costs of external factors, such as environmental costs, are not currently internalised for road freight, which reduces the price competitiveness of rail.

### Coastal shipping

Coastal shipping of domestic cargo supports the movement of:

- bulk commodities such as cement
- containerised goods, trucks, and trains on roll-on roll-off (RORO) ships.<sup>123</sup>

Investments made through the Coastal Shipping Activity Class in the 2021-24 National Land Transport Programme will make coastal shipping a more viable alternative to strengthen and diversify our domestic supply chain.

Future government policy statements on land transport will guide decisions on investments in the coastal shipping industry.

## Strategic freight connections

Nationally significant freight connections are critical to supporting the country's economic wellbeing. They provide primary land-based connections across Aotearoa New Zealand. They link the largest:

- population centres
- inland ports and freight hubs
- main seaports
- airports.

Regionally significant freight connections are vital to supporting a region's economic wellbeing. They link important:

- places
- industries
- main seaports.

Regional connections provide primary land-based connections between regions and sometimes serve a lifeline function.

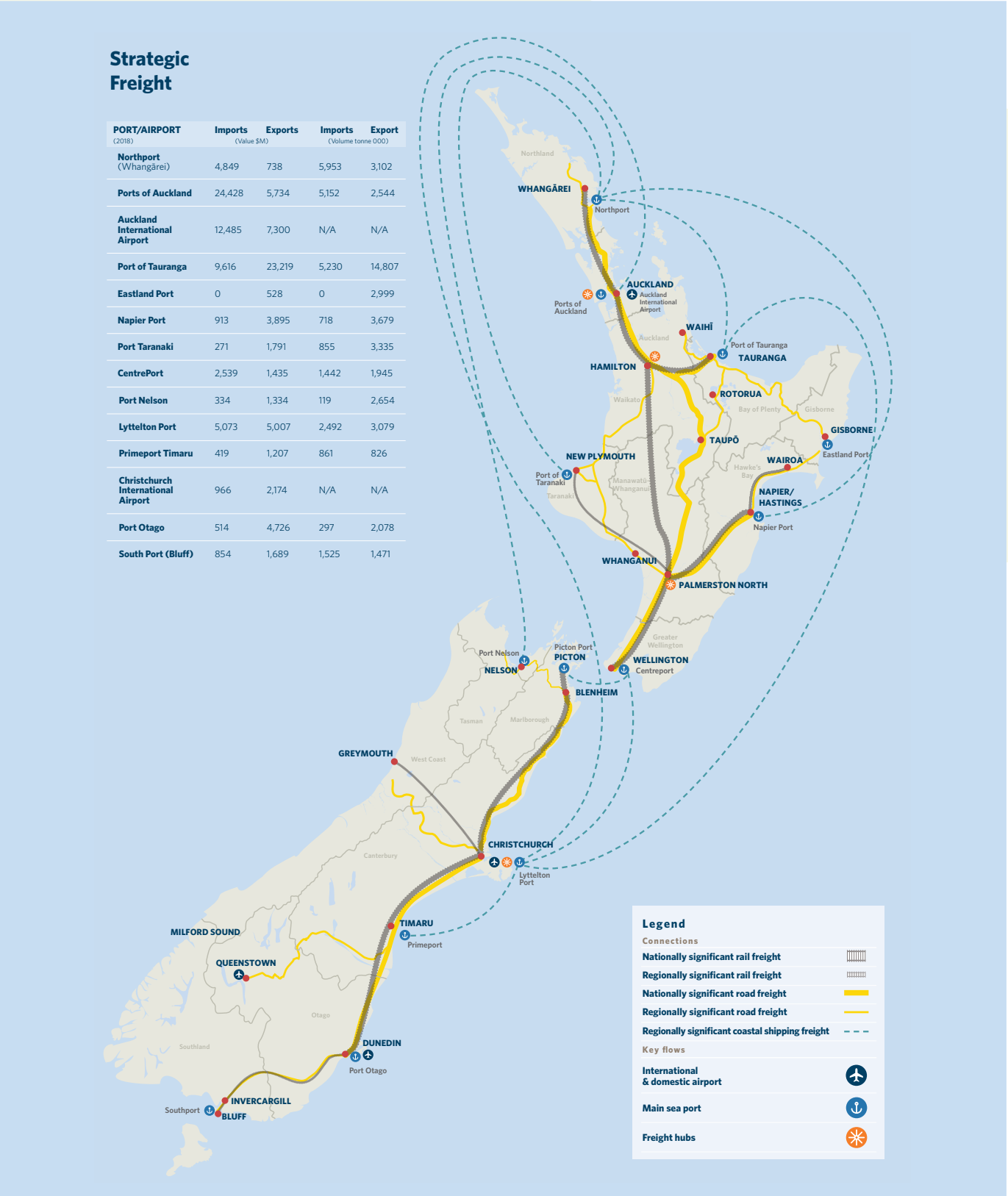
The strategic freight connections map (Figure 5) shows the significant national or regional freight connections from road or rail to seaports, airports, inland ports, and freight hubs that provide both international and domestic services.

The map includes summary information about the value and volume of imports and exports moving through seaports and airports that provide international and domestic services.

In addition to the strategic freight connections, Our Current Network Map developed as part of *Arataki* shows the suitable routes for High Productivity Motor Vehicles (HPMV), or vehicles that can carry the maximum loads available under a permit.

**Our Current Network Map** →

**Strategic freight connections**  
Figure 5



## Freight and transport outcomes

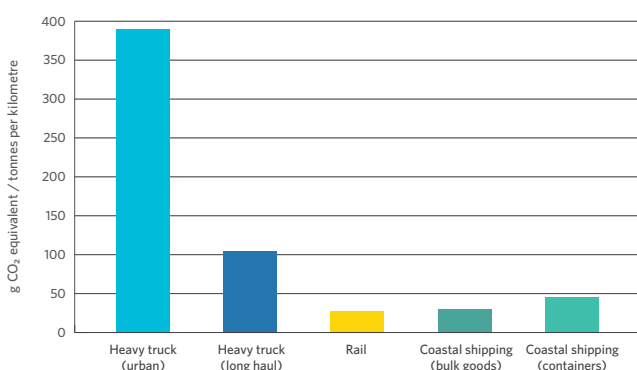
### Environmental sustainability

The heavy freight vehicle fleet produces high carbon dioxide emissions because it takes more energy to move heavier vehicles.<sup>124</sup> The heavy freight vehicle fleet share of carbon dioxide emissions has remained mostly the same from 2017 to 2019.<sup>125</sup>

Carbon dioxide emissions from rail is about 1% of total emissions; this has stayed consistent at just under 200 kiloton carbon dioxide equivalent (kt CO<sub>2</sub>-e) since 2000.<sup>126</sup>

#### Emission comparison by mode<sup>127</sup>

Figure 6



Emissions from coastal shipping range from 30 g CO<sub>2</sub>-e/tonne-km (bulk goods) to 46 g CO<sub>2</sub>-e/tonne-km (container freight).<sup>128</sup> These have remained steady since 1990.<sup>129</sup>

Under the Climate Change Response (Zero Carbon) Amendment Act 2019, Aotearoa New Zealand has committed to domestic and international targets to reduce greenhouse gas emissions to net zero by 2050 (except biogenic methane).<sup>130</sup> This will contribute to the international effort to limit global warming.

Moving to a low-emissions freight transport system will help us avoid the worst impacts of climate change. It will help:

- limit disruptions arising from climate change
- ensure the connectivity and performance of supply chains
- support the wellbeing of the people of Aotearoa.

Growing consumer preference for 'green' goods could provide opportunities for the country's producers. A low-emissions freight system could also put the country in a good position to deal with potential:

- global taxes on shipping emissions
- emission regulations imposed by trading partners.

The *Emissions Reduction Plan* sets a 2035 target to reduce:

- freight transport emissions by 35%
- transport emissions by 41%
- total vehicle kilometres travelled (VKT) by the light fleet by 20% to support improved reliability and efficiency of the freight network
- emissions intensity of transport fuel by 10% that will require an increased uptake of lower-emissions fuels, such as sustainable biofuels, by the road freight fleet; this has potential cost implications.<sup>131</sup>

Actions for reducing freight emissions in the *Emissions Reduction Plan* are:

- develop a national freight and supply chain strategy with industry that will identify how to best remove carbon (decarbonise) from the freight transport system to be net zero by 2050, while improving the efficiency and competitiveness of the supply chain
- continue implementing the *New Zealand Rail Plan* and support coastal shipping
- provide funding to support the freight sector to purchase zero- and low-emissions trucks
- establish a freight decarbonisation unit to help remove carbon from the freight sector through regulation and investment policy
- evaluate options to improve the efficiency of heavy vehicles
- regulate heavy vehicle imports to reduce emissions
- support infrastructure development for green fuels and fast charging for heavy vehicles
- reduce emissions from heavy vehicles operated or procured through government activities
- evaluate options for road user charges to support emissions reductions; this includes whether to extend the heavy electric vehicle (EV) exemption from road user charges and if road user charges rates should be set differently by fuel type/emissions
- consider the implementation timing of Euro VI standard for heavy vehicles
- work to remove carbon from aviation
- progress the removal of carbon from maritime transport.



## Resilience and security

Climate change adaptation means the land transport system is prepared for, and resilient to, the impacts of a changing climate.

Much of the strategic network is vulnerable to extreme natural hazards. For example, in some locations that are important for the movement of goods, future sea level rise will greatly increase coastal flooding, erosion, and groundwater levels.

The *New Zealand Freight and Supply Chain Issues Paper* from Te Manatū Waka Ministry of Transport encourages a strong focus on long-term resilience in our supply chains to prepare for changing climate, demographics, and technology.<sup>132</sup>

Resilient supply chains are more able to:

- avoid, absorb, and recover from disruptions
- maintain freight connections to keep goods moving.

Prompted by the end of refinery operations at Marsden Point in April 2022, the government is developing a policy on minimum onshore fuel stockholding.<sup>133</sup> An increase in onshore fuel stockholding, particularly diesel, would provide better resilience for emergency services and the broader supply chain.

Government is also developing a roadmap for hydrogen in Aotearoa New Zealand. This strategy will guide investment in hydrogen to maximise economic benefits and emissions reductions.<sup>134</sup>

A project in the Taranaki region is looking into green hydrogen production from water through electrolysis.<sup>135</sup> Domestic hydrogen production would improve the resilience of the freight industry by reducing reliance on imported fuels. Similarly, the adoption of battery-electric vehicles in the freight sector would also decrease the need for imported fuels.

The government's first *National Adaptation Plan* sets the direction for how Aotearoa will:

- adapt to the unavoidable impacts of climate change
- address key climate risks up to 2028.<sup>136</sup>

The *National Adaptation Plan* outlines actions about:

- reforming institutions to be fit for a changing climate
- providing data, information, and guidance to enable everyone to assess and reduce climate risks
- embedding climate resilience across government strategies and policies.

Waka Kotahi has committed to several actions in the plan, including:

- integrating adaptation into decision making
- developing and implementing a climate adaptation plan.

Waka Kotahi is working to support a more resilient land transport system. We are implementing and supporting activities to move more freight by rail and coastal shipping. This supports continued economic activity during and following unplanned disruptions, or a more redundant system.

We help the land transport system and communities recover from disruptive events. We respond quickly to transport network disruptions on significant freight connections. We work to restore appropriate levels of service, including emergency works. We manage and operate the state highway network to provide alternative routes and reopen disrupted routes as soon as possible. We invest in coastal erosion protection work on significant freight connections at high-priority locations when:

- it's cost-effective
- won't create negative impacts in the future.

We are developing a climate change adaptation plan to help us better understand the most effective mix of responses for the network. This will potentially include infrastructure to protect, accommodate, or retreat.

The Maps section of *Arataki* includes more information about the land transport system now and in the future.

[Arataki Maps →](#)

## Healthy and safe people

Heavy goods vehicles aren't involved in more crashes than other vehicle types.<sup>137</sup> However, given how large heavy goods vehicles are, many deaths and serious injuries (DSIs) involving them are fatal.<sup>138</sup>

From 2012 to 2021, heavy goods vehicles were involved in 9.5% of road crashes causing DSIs (Figure 8).<sup>139</sup> Of those crashes, 20% resulted in death (Figure 7).<sup>140</sup>

Mode shift from road to rail and coastal shipping can support improved safety by reducing the number of freight movements along the road network. It can also decrease air pollution.

Road freight vehicles release harmful pollutants, such as nitrogen dioxide (NO<sub>2</sub>) by diesel vehicles.<sup>141</sup> Each year, harmful pollutants contribute to

- more than 3,300 premature adult deaths
- over 13,200 cases of childhood asthma
- around 1.7 million days when people can't do the things they might otherwise do if air pollution had not been present.<sup>142</sup>

Even small improvements to air quality will significantly improve the health of many people. Quite a few actions in the *Emissions Reduction Plan* seek to reduce harmful pollutants by addressing diesel freight vehicle emissions.

Freight carried on key corridors through urban areas can cause noise or vibration impacts. As demand for urban freight increases over time, this could worsen noise pollution.

Health and safety on rail is improving, but there is still work to be done.

In 2020–2021, there were 13 deaths and four serious injuries on the rail system.<sup>143</sup> This is a reduction from 21 deaths and four serious injuries eight years earlier.<sup>144</sup>

Also in 2020–2021, there were:

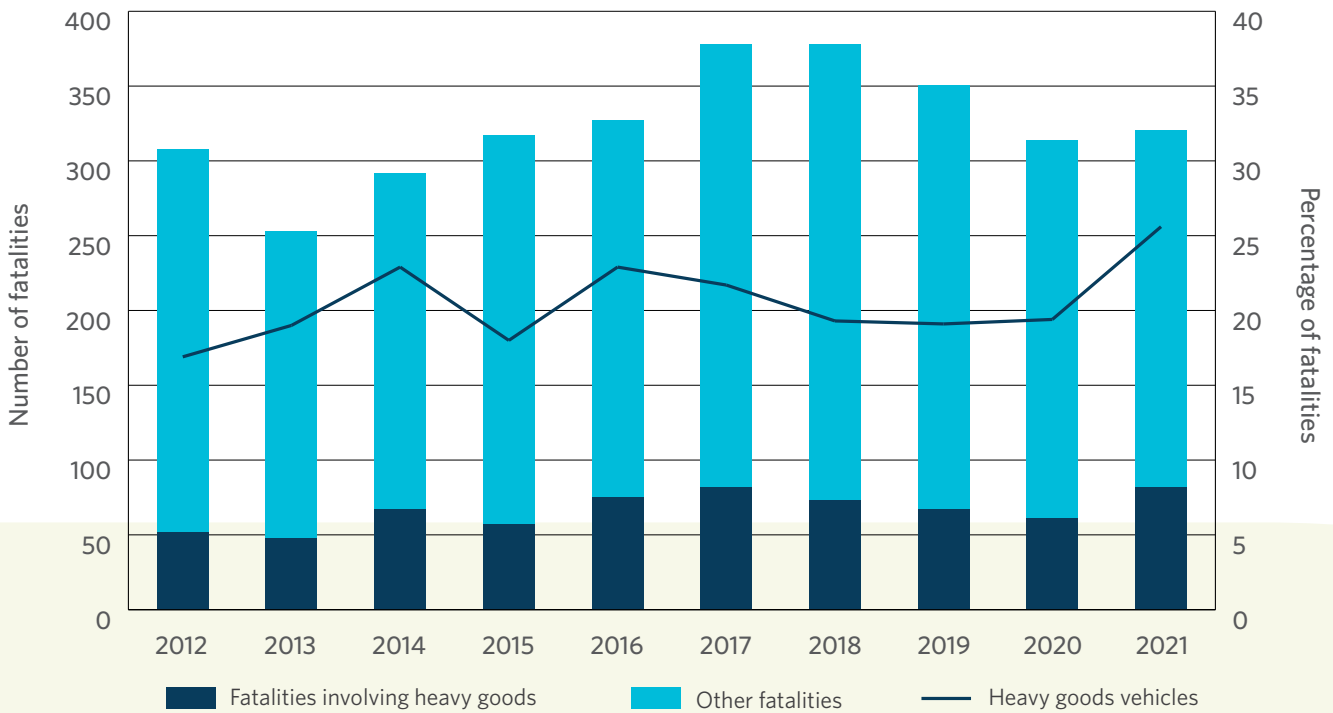
- three collisions between rail vehicles and heavy motor vehicles
- nineteen collisions between rail vehicles and light motor vehicles.<sup>145</sup>

This is a reduction from 2013–2014 when there were:

- five collisions between rail vehicles and heavy motor vehicles
- twenty-nine collisions between rail vehicles and light motor vehicles in.<sup>146</sup>

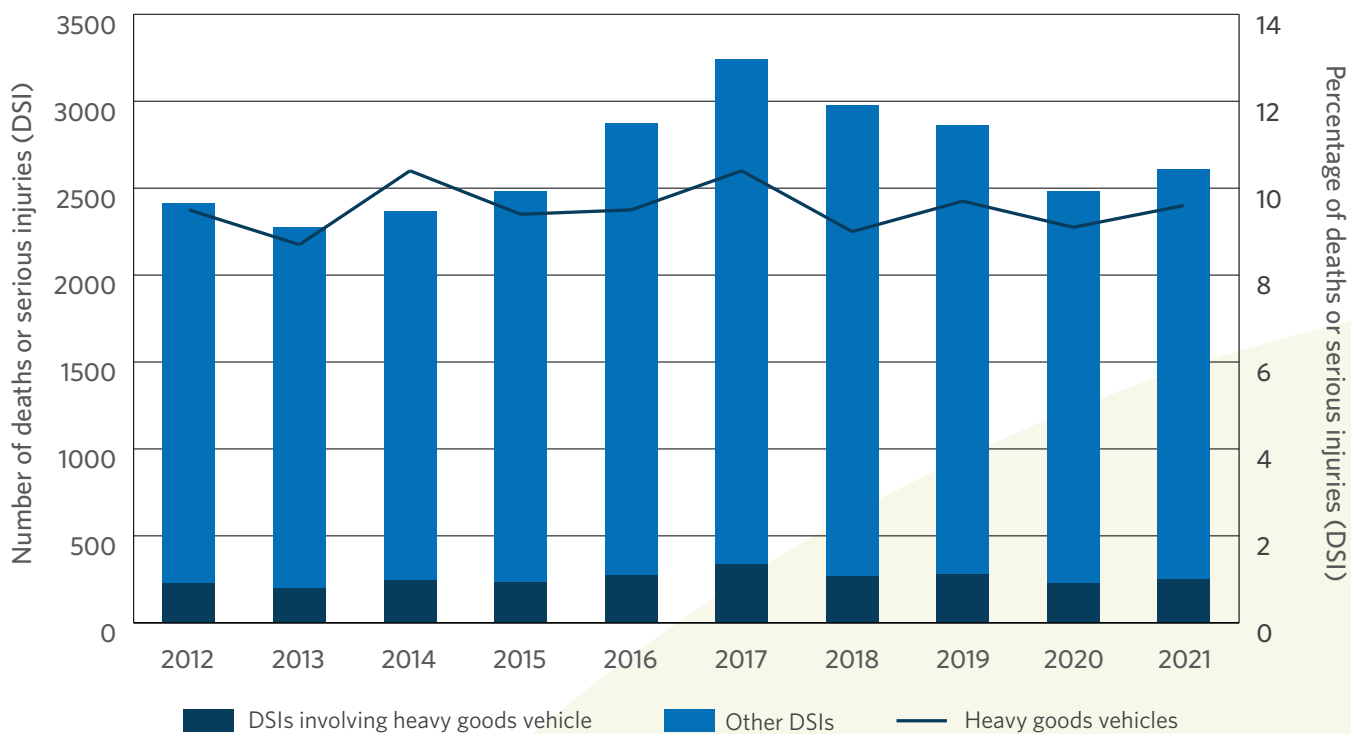
**Heavy goods vehicle fatalities 2012–2021** <sup>147</sup>

Figure 7



## Heavy goods vehicles death and serious injuries 2012-2021 <sup>148</sup>

Figure 8



### Inclusive access

There is currently little evidence about freight in relation to the inclusive access outcome. We will address this in the next release of *Arataki*.

Competition for road space between the movement of freight and people is discussed in the following section, Economic prosperity. There are place and movement conflicts on some parts of the network, as identified in the *Transport Modes and Strategic Networks* section of *Arataki*.

[Transport Modes and Strategic Networks →](#)



## Economic prosperity

How our urban centres are laid out determines the:

- distance goods need to travel between home, workplaces, distribution centres and ports
- transport options for these movements.

Most urban freight is moved by small trips in light vehicles between home, workplaces, and distribution centres. Larger freight movements by truck or train also move through our urban areas in transit for distribution.<sup>149</sup>

Most container imports arrive through seaports in Tāmaki Makaurau Auckland, Te Whanganui-a-Tara Wellington City, and Ōtautahi Christchurch.<sup>150</sup> Over half of the country's employment is in these cities. This causes competition for road space between the movement of freight and people.<sup>151</sup>

Urban freight movement also adds to congestion in city centres. Congestion can delay deliveries and this unreliability can lead to less productivity.<sup>152</sup>

Existing congestion on our roads costs us \$1.3 billion annually.<sup>153</sup>

For example, key parts of the freight network in Tāmaki Makaurau, such as State Highway 1 between the city centre and Penrose, are often congested throughout the day. This rise in interpeak congestion is increasingly affecting freight travel, which mainly happens in the middle of the day.<sup>154</sup>

Costs from congestion include:

- travel-time delays
- schedule delays
- environmental impacts.<sup>155</sup>

Proposals for land use near freight corridors can impact the ability for these corridors to manage local and national travel demand. Increasing capacity on these corridors to maintain reliability could encourage local passenger vehicle travel during peak periods, when freight uses these corridors less.

Provincial areas help shape the economies of urban centres. These make a significant contribution to the country's freight task through primary production and related industries. For example, while Tāmaki Makaurau is a primary import gateway, exports mostly come from rural regions further south.<sup>156</sup>

Nearly 75% of the country's state highways are equipped for high productivity motor vehicles (HPMVs).<sup>157</sup>

50MAX vehicles have one more axle than conventional 44-tonne vehicles. This means the overall truck load of 50MAX is spread further with no additional wear on roads.

50MAX allows operators to carry larger payloads on parts of the network that, while economically important to the country, carry lower volumes of freight.<sup>158</sup>

Road user charges (RUC) are paid by drivers of:

- light diesel vehicles
- diesel-powered heavy vehicles, such as trucks.

This is to ensure the drivers of heavier vehicles cover their share of the damage made to the road network. These charges also cover the wider costs of building and maintaining the land transport system.

Revenue is collected and paid to the National Land Transport Fund and allocated every three years through the National Land Transport Programme.

Some local roads in parts of the country experience greater damage from heavy freight vehicles. This creates funding challenges for affected local councils.

Waka Kotahi is working to identify the nature, scale, and location of this issue in central parts of Te Ika-a-Māui North Island and Te Upoko o te Ika a Māui Greater Wellington.

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