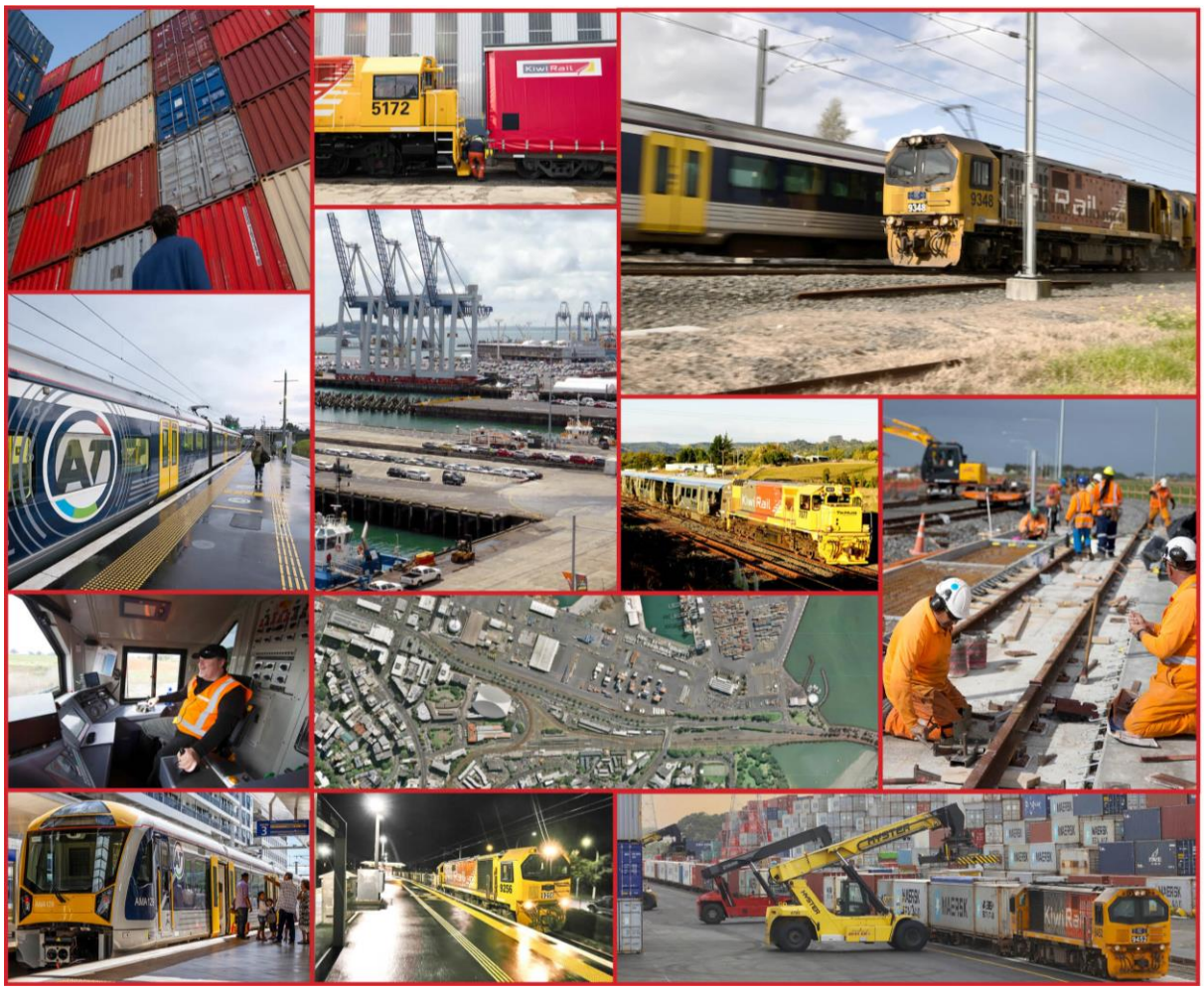
AUCKLAND'S RAIL STORY

11 JANUARY 2024



wsp

commute
TRANSPORTATION CONSULTANTS

RICS
RAIL INFRASTRUCTURE CONSULTANTS (NZ)

pwc

INTRODUCTION

Across 2022/23, KiwiRail and Auckland Transport jointly undertook a Programme Business Case for the development of the rail system over a 30-year horizon, known as the Auckland Rail PBC. In the course of that work, it became apparent that the complexity of the rail system (incorporating all the physical elements of the network, its multiple markets and needs of those diverse users, as well as maintenance and operation thereof) was difficult for readers to fully comprehend. This document – Auckland's Rail Story – was originally conceived as a 'pre-read' to aid understanding of those diverse needs individually ahead of attempting to understand the collective.

It achieved this purpose and subsequently was in large part subsumed into the overall PBC document. However, the Auckland Rail Story still has a place in aiding understanding. We have since added to that purpose in Part 2 with a description of the Strategic Rail Investment Programme that emerged from the Rail PBC, and how this addresses the needs set out by the Rail Story.

PART 1: THE AUCKLAND RAIL NETWORK

The Auckland rail network is a mixed-use railway where passenger (metro and inter-regional) and freight services operate on the same tracks. These services need to be timetabled to allow balanced and safe access for all users, while also providing sufficient time for the network to be adequately maintained. A schematic of the Auckland network following the completion of the under-construction City Rail Link (CRL), is shown in Figure 1.

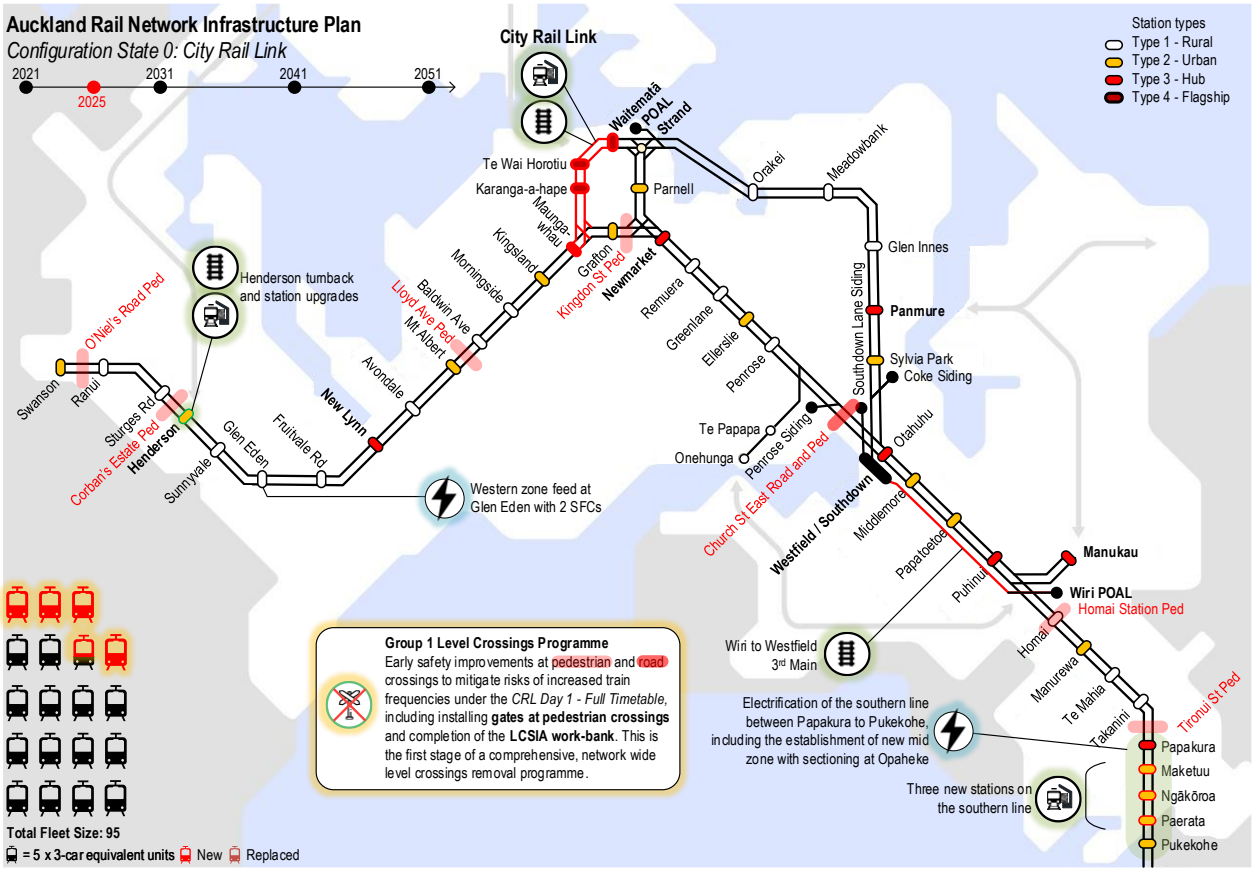
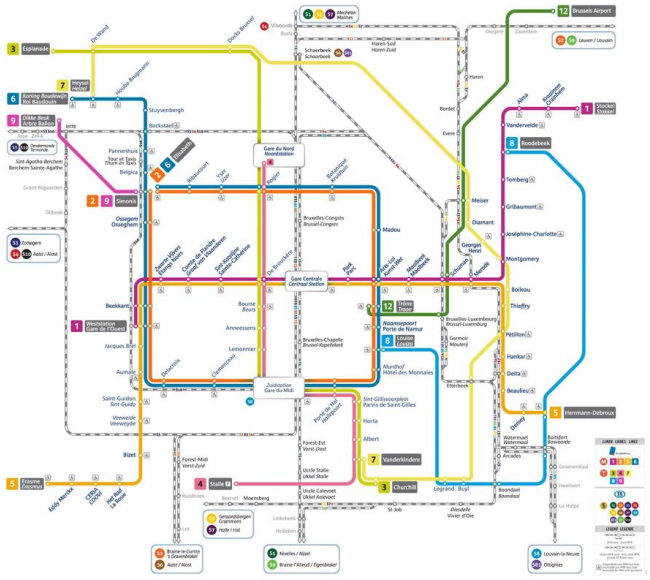


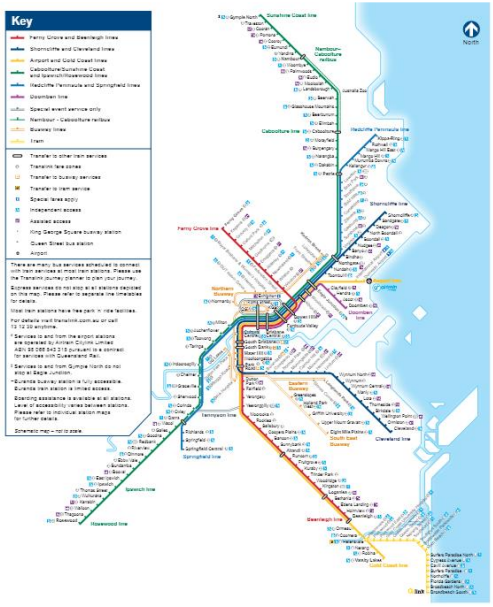
Figure 1: Auckland's rail network

For comparative purposes, the schematic network maps of selected European and Australian cities of similar size to Auckland (c. 1.6 mn now and projected 2.0 mn by 2051) are shown below. Despite similarity of population size, the networks of these cities demonstrate vastly greater development and connectivity options. More developed networks contain multiple inter-connecting spines and/or loops enabling ease of travel around the city, not just to/from its centre.

Network map, Brussels (Belgium) – 1.2m population



Network map, Brisbane (Australia) – 2.5m population



Network map, Vienna (Austria) – 1.9m population

Network map, Perth (Australia) – 2.1m population

Figure 2: Comparative rail networks

WHAT AUCKLAND NEEDS FROM THE RAIL NETWORK

The rail network in Auckland is a shared network and it needs to work for **all** of its users. These are metro and inter-regional passengers, and inter-regional/national rail freight.

For intra-Auckland metro passengers, rapid transit should play a fundamental role in Auckland's transport network and its importance should continue to increase over time as Auckland grows and single occupancy private vehicle travel becomes increasingly unviable. It is intended to

provide a quick, frequent, reliable and high-capacity public transport service that operates on a permanent route, largely separated from other traffic[1]. Other than the Northern and (partially completed) Eastern Busways, passenger rail is Auckland's only rapid transit network and is the only one with substantial mass transit capability.

Access to the Auckland network is also important for inter-regional passengers, for whom the aspiration is access to the range of economic and cultural opportunities available in Auckland. For this to be possible via public transport, inter-regional rail services need to be able to offer a combination of journey time, service timing and frequency to make this practicable.

In addition to its passenger carrying function, Auckland's rail network plays a critical role in New Zealand's freight and supply chain. Auckland is a key international import/export destination and approximately 29% of New Zealand's freight has an origin or destination in Auckland. With one third of New Zealand's population, Auckland is also an important producer, consumer, and distributor of freighted goods. This nationally important freight role means that national connections – including to Northland, the Port of Tauranga, and the Cook Strait connection to the South Island - are critical to maintaining an effective and efficient national freight supply chain. Constraints in the Auckland rail network have national implications for freight supply and the economy more broadly.

AUCKLAND'S MIXED-MODE RAIL NETWORK HAS INSUFFICIENT CAPACITY TO MEET DEMANDS

The mixed-use nature of Auckland's rail network means that passenger (metro and inter-regional) and freight services must share track space, and a balanced approach is required to accommodate all markets.

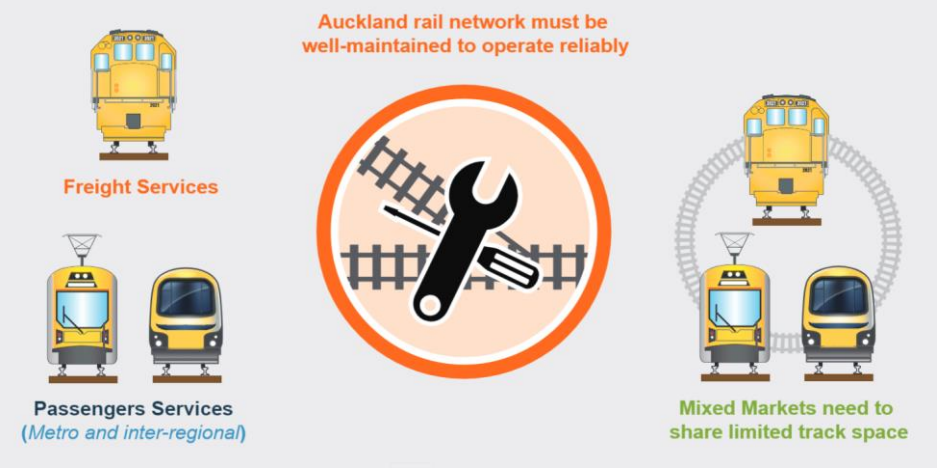


Figure 3: Access needs on the Auckland Rail Network

A mixed-mode network is less 'capacity-efficient' than a dedicated network for a single mode would be. This is because the operational characteristics of all-stops metro and non-stops services such as freight are fundamentally different. Metro trains are comparatively lightweight, nimble vehicles that accelerate and decelerate quickly between stops. They also stop often, to pick up and discharge passengers. Conversely, freight trains are very long and heavy vehicles that take a long time to speed up and slow down, and which aim to traverse long distances without stopping. When freight trains are forced to speed up and slow down behind all-stops metro trains, they

[1] National Policy Statement on Urban Development (NPS:UD 2021)

become very slow, and more space is needed between services to avoid complete stops with subsequent slow restarts. Long distance passenger trains (and express metro) tend to share much of the nimbleness of metro services but are operationally more akin to freight (i.e., no or few stops).

Mixed use networks are inherently more complicated than dedicated use networks, leading to less reliability and ultimately lower utilisation of capacity. Mixed use reduces the overall capacity of the network by approximately 10%, as shown in Table 1, compared to networks where freight and passenger services run on separate tracks.

Table 1: Network utilisation planning maximum operational ability[2]

Type of line	Peak hour	Daily period
Dedicated suburban passenger traffic	85 %	70 %
Dedicated high-speed line	75 %	60 %
Mixed traffic lines	75 %	60 %

Accordingly, most large cities opt to separate freight and passenger networks. In Auckland, the initial foundations for this segregation are laid by the City Rail Link (CRL) project, which will create a high-capacity, passenger-only link within the inner network. However, this still leaves the majority of the remaining network in mixed mode operation and it is these areas of the network which will fill up quickly after CRL opens, becoming new bottlenecks in the system. In the long term, and as the network in Auckland gets busier for longer periods of time, **further segregation of traffic types will need to be a strategic aim in Auckland.**

ALL MARKETS WANT - AND NEED - TO GROW

In addition to mixed-use operations limiting the overall capacity of the network, as demand for metro passenger services has increased over time, metro service access has historically been prioritised over freight service access, especially during peak periods. This has limited the ability of freight to grow and to operate sufficiently reliably to provide an attractive and productive service to customers. This is even though rail freight represents commercially viable network use, and to lower New Zealand's transport emissions well beyond the capability of metro passenger services.

The prioritisation of metro passenger services means that there is insufficient capacity for freight services during peak demand periods and there are clashes in the morning and evening peaks, especially on the NIMT. This means freight services have been restricted to off peak times and are unable to easily respond to customer needs. Just like passengers, freight customers send their freight when it needs to go – they have integrated supply chain elements, of which rail freight is one key element (others include their pickup and delivery fleet, processing sites, etc) and if trains cannot accommodate demand at the right times, then customers choose road transport instead.

As metro passenger services aspire to extend the duration of peak periods in the future to accommodate growing patronage, the exclusion problem for freight services would worsen substantially (before even considering the need for freight to also be able to grow). Furthermore, there is a limit to usable operating hours. Overnight operation has practical limits due to community acceptance of effects such as noise – and there is limited freight customer demand during night hours (for example, the Port of Auckland is not permitted to be a 24-hour operation).

[2] International Union of Railways, Capacity Guide, 2013

In addition, maintenance is prioritised during the overnight window, further reducing available freight operating windows.

For freight customers, right-timed, reliable, punctual, and cost-effective services are the critical factors that determine the level of service and influence freight's rail mode share.

The impacts of wrong-timed freight services extend well beyond rail operations and can require entire freight and logistics chains to extend or alter their hours of operation. Optimising productivity at freight and logistic hubs is critical for freight customers. Wrong-timed deliveries can compromise businesses' ability to deliver for their subsequent customers, including meeting ships in port and meeting the inter-island ferry sailing times. The ability to be competitive depends on highly productive capital and labour, therefore wrong-timed freight services that lead to staffing challenges, such as odd-timed shifts, can be impactful in a competitive market, adding significantly to the overall cost of rail freight, affecting its ability to be competitive versus road.

These capacity restrictions and their wider impacts (combined with reliability issues) mean that moving freight by rail is not as attractive as it otherwise could be. If rail services are unreliable, wrong-timed, unable to flex to meet customer needs and unable to deliver sufficient productivity, then freight customers more often choose trucks travelling on the road network to complete the freight task.

Port of Auckland is one of the largest and busiest ports in New Zealand and serves as a key gateway for goods arriving at and departing from New Zealand. This makes it a critical component of the country's import and export industries. Yet the central city location of Ports of Auckland means that it has limited space for expansion and is constrained by transport infrastructure, which can result in congestion and delays in moving freight in and out of the port. Therefore, substantial volumes of freight traffic are required to travel through the city centre, competing for space with passengers and other users on already congested rail and road corridors.

At the time of writing, only 12% (approximately. 100,000 TEU[3] per annum) of Port of Auckland volumes moves by rail. KiwiRail have been asked to increase up to 30%, or around 300,000 TEU. However, doing so would require right timed, and reliable access for freight trains on the Auckland rail network. In context, carrying 100,000 TEU by road requires 50,000 truck trips capable of carrying two 20' containers (or a higher number of trucks, if only one container can be carried). If the increase to 30% could be achieved, an additional 100,000 truck trips (200,000 TEU) could be removed from the Auckland road network each year.

THE NEED TO GROW - MORE SUSTAINABLY

The global climate is getting warmer because of rising greenhouse gas emissions. Extreme weather events are becoming more severe and more common and sea levels are rising. To reduce these global and local risks, the New Zealand Government has committed to the Paris Agreement, a legally binding United Nations treaty[4]. In 2021, New Zealand confirmed its Nationally Determined Contribution (NDC) to reduce net greenhouse gas emissions to 50% below gross 2005 levels by 2030.[5]

[3] TEU is a twenty-foot equivalent unit, meaning one 20' container of freight.
[4] https://unfccc.int/process-and-meetings/the-paris-agreement
[5] https://unfccc.int/sites/default/files/NDC/2022-06/New%20Zealand%20NDC%20November%202021.pdf

In its Emissions Reduction Plan (ERP) the Government has set out its plans to meet this obligation. For transport, this means:

- Reduce total vehicle kilometres travelled (VKT) by the light fleet by 20% by 2035 below projected growth levels.
- Reduce emissions from freight transport by 35% by 2035.

DECARBONISING NEW ZEALAND'S FREIGHT SUPPLY CHAIN

To meet New Zealand's Paris Agreement NDC, emissions from freight transport need to reduce by 35% by 2035. Rail freight is significantly more emission efficient than freight carried by road, with every tonne of long-haul freight moved by rail today producing 70% less carbon emissions than the equivalent carried by road[6].

A single 750m freight rail service carries a freight load equivalent to approximately 54 heavy trucks[7]. This is illustrated in Figure 4. KiwiRail currently operates seven such services per day in each direction between Auckland and Tauranga, a distance of approximately 209km. This equates to approximately 12% of the freight market between these locations. Were the equivalent freight task carried by road instead, this would require an additional 749 truck trips covering more than 155,000km on Auckland, Waikato, and Bay of Plenty roads every single day, along with the corresponding emission load on the environment.

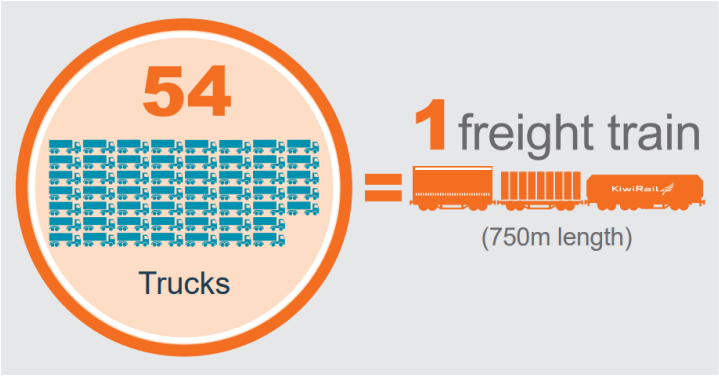


Figure 4: Rail freight efficiency

There is an industry shift to decarbonise both road and rail freight through fleet changes. For road freight, electric trucks are becoming more prevalent, particularly for first mile, last mile deliveries and KiwiRail plans to introduce battery electric locomotives progressively from 2027 to 2041[8]. Even with the move towards electric road freight vehicles, noting the large number of trucks required to move the equivalent of one freight train load, a substantial increase in mode share for freight moved by rail will be needed to achieve the 35% target reduction in New Zealand's freight emissions.

[6] https://www.knowledgehub.transport.govt.nz/assets/TKH-Uploads/TKC-2019/Real-world-fuel-economy-of-heavy-trucks.pdf

[7] Assumes 2 TEU (2x20' or 1x40' containers) per heavy truck. KiwiRail Metroport trains carry, per contract, 107 TEU. In the future, longer trains will carry even greater loads per journey.

[8] KiwiRail Decarbonisation IBC, 2022

THE FREIGHT TASK IS GROWING AND THE POTENTIAL FOR MODE SHIFT IS HIGH

The transport sector's contribution to greenhouse gas emissions is documented in the Ministry of Transport's Green Freight Strategic Working Paper (2020), which projects that trucks will overtake cars and account for the largest share of greenhouse emissions in coming decades as shown in Figure 5.

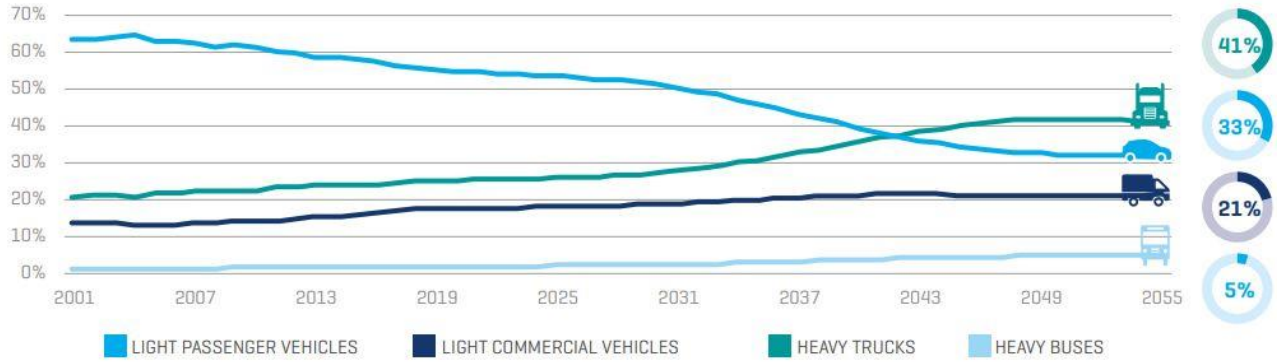


Figure 5: Projected percentage of emissions from road transport

Increasing rail's share of the freight task above 12%[9] (refer Figure 6) presents an opportunity to remove the equivalent number of heavy vehicles from the national road network. Rail freight trips are typically over long distances, meaning that their existing and potential future contribution to emissions reduction is significant. Modelling for KiwiRail's concurrent Decarbonisation Indicative Business Case (IBC) indicates that the potential for mode shift from road to rail is high and that some 481,000 tonnes of carbon would be avoided if 21% of the national freight task in 2035 was carried by rail rather than road.

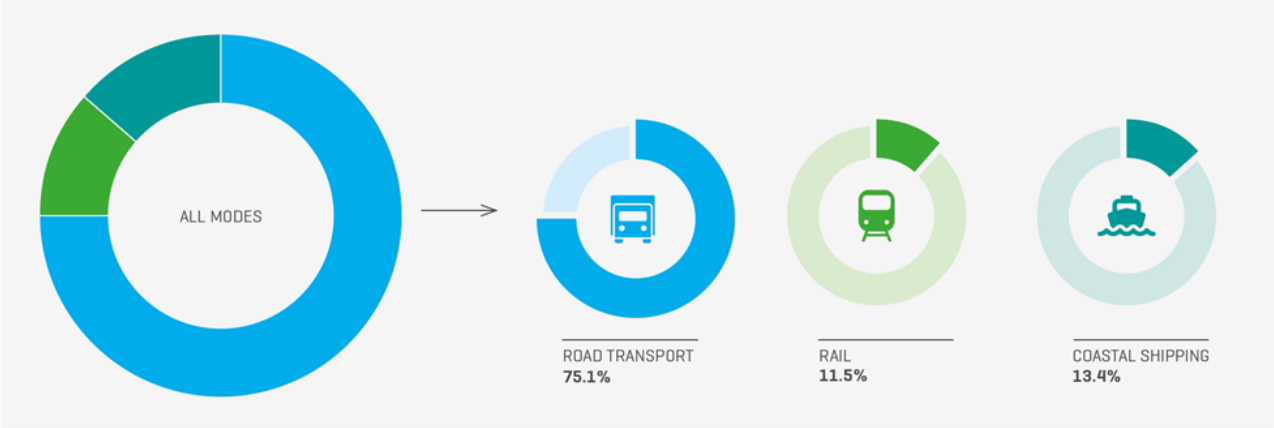


Figure 6: New Zealand's Domestic Freight Net Tonne-Km by Mode (2017/2018)

Not all freight markets across New Zealand are accessible to rail. For example, rail is not suited to compete with couriers to carry packages across town and it cannot provide services where there are no rail tracks. Rail is best suited to carrying freight over longer distances, between regions where it has natural price and productivity advantages[10], or to carrying larger volumes over shorter distances, such as between seaports and inland freight distribution centres. These kinds of movements make up the addressable market for freight in New Zealand.

[9] KiwiRail estimate (see also MoT estimate of 11.5% in 2017/18)

[10] So long as road transport is not subsidised

In the Auckland context, the Decarbonisation IBC estimates mode shift to 26% of the addressable Auckland freight market (i.e., freight that already exists but travels by road and is suitable to be carried by rail) is achievable[11]. In 2051, the equivalent of 3,780 heavy truck trips *daily* could instead travel by 35 rail journeys between the ports of Auckland and Tauranga[12]. The opportunity to reduce net tonne kilometres by road increases even further when longer distances are involved – for example between Auckland and South Island destinations. This will consequently make a significant contribution to the national 35% freight emissions reduction target.

This level of mode shift will require a significant increase in freight train volumes and can only be achieved with adequate and right-timed access to the rail network. To be efficient, longer freight trains up to 1500m are forecast to be required by the early-mid 2030s.

Nationally since 2019, Government has invested more than $8.5bn in KiwiRail and the national rail network, including investments in freight locomotives and wagons as well as infrastructure improvements aimed at restoring and enabling the growth of rail freight, as well as metro services. However, further investment is required to accommodate the level of demand required to meet these emission reduction targets.

RAIL FREIGHT IS A NATIONAL STORY, WITH NATIONAL IMPACTS & OPPORTUNITIES

Figure 7 shows the density of freight movement on New Zealand's rail network. It highlights that the freight corridors connecting to and from Auckland carry by far the greatest density of freight in the country, meaning that Auckland plays a very significant role in New Zealand's freight supply chain – both for international imports and exports and domestically.

Auckland rail freight is therefore a national and inter-regional story rather than a local one, and the ability for freight to access rail in Auckland affects its ability to serve a much wider national catchment.

Restricting access for freight services in Auckland to accommodate metro passengers means that freight carried by road in Auckland typically continues on-road all the way to its destination in Northland, Tauranga, Palmerston North, Wellington, or Christchurch (or vice versa) even if there is capacity on the rail network outside of Auckland. This leads not only to extra trucks on Auckland roads, but also on the national road network. It also affects the commercial viability of rail freight – which is a productive and efficient mode of transport for its customers only if it can operate reliably and when needed[13].

[11] This mode shift is predicated on a scenario that assumes funding for KiwiRail initiatives, but no significant changes to government policies.

[12] In reality, there would be fewer rail journeys using longer trains, but for comparative purposes train length has been held at 750m

[13] Mainfreight customer interview, August 2022

Therefore, insufficient access to right-timed freight services in Auckland affects the entire national rail freight chain, underutilises the national rail network and increases:

- greenhouse gas and other air polluting emissions
- wear and tear on the roads that adds to ongoing maintenance costs
- congestion, particularly during peak periods, with the associated negative economic impacts
- exposure to road-based harm for road users.

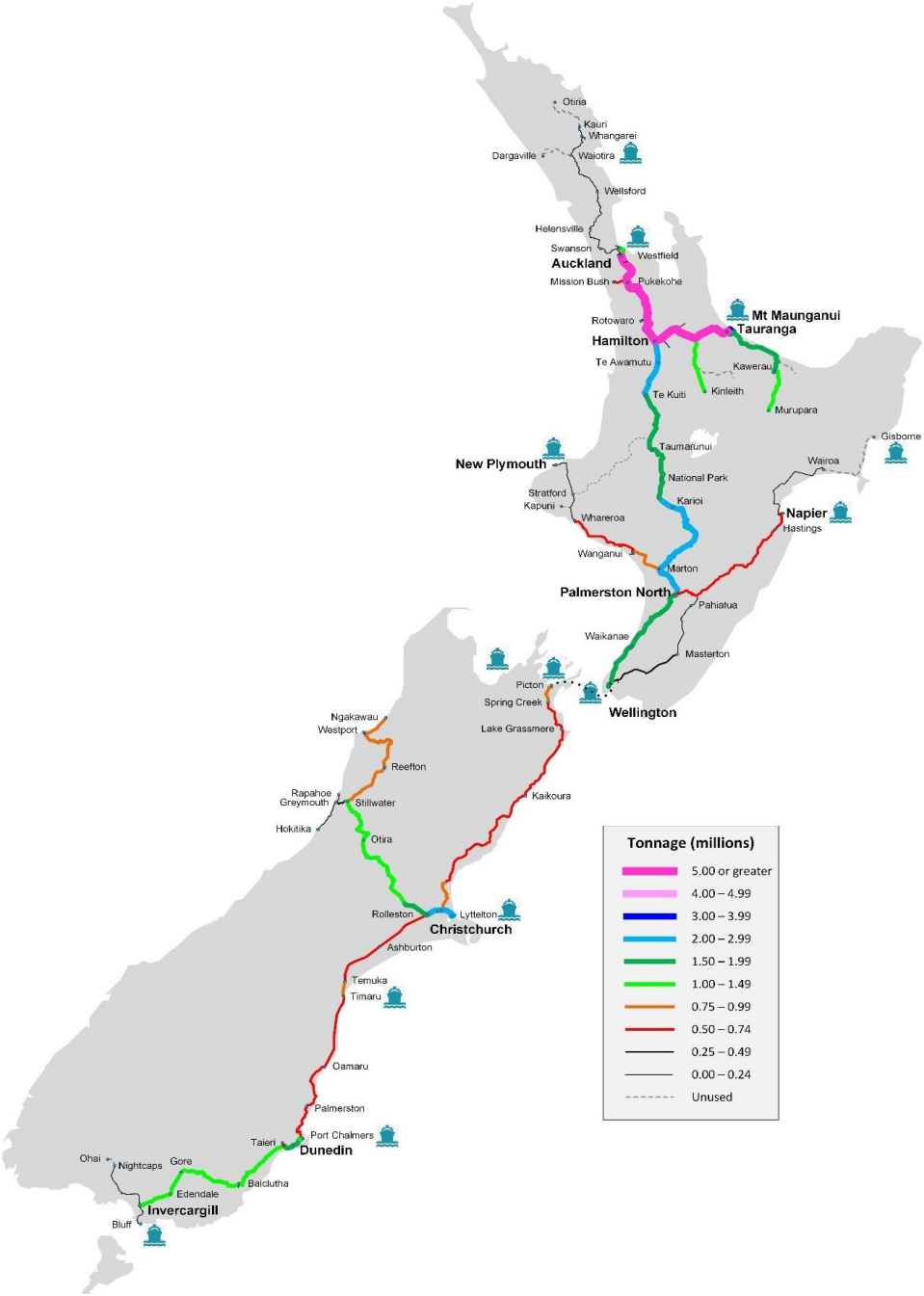


Figure 7: Density of freight movement on New Zealand Rail Network[14]

[14] KiwiRail Decarbonisation Indicative Business Case, 2021

INTER-RELATIONSHIP OF RAIL FREIGHT WITH PORTS

Demand for rail freight is intrinsically linked with ports. Rail is the most efficient way to carry much of New Zealand's import and exports to and from our international gateways. Port policy and market competition have profound effects on the location of demand for, and timing of, rail freight services both within Auckland and nationally. These are the demands that the rail network needs to be able to respond to and that affect the efficiency of the entire supply chain. Growth in one Port location would require different rail capacity to growth in another location, or at least change the timing of requirements.

For example:

- Ports of Auckland is reaching the limits of growth and could potentially face some level of reduction,
- Metroport will continue to grow and play a significant role, but will also reach limits over 30 years, and
- Northport's role will grow from its small base.

In this context, it is critical that planning for rail in Auckland also contemplates how the long- term port capacity in the North Island will be serviced, and what that means for the future distribution of freight flows. The rail network needs to have sufficient resilience and capacity to be able to enable this competitive market to operate efficiently – rather than being dictated to by availability of rail network capacity.

MANAGING AUCKLAND'S PASSENGER GROWTH SUSTAINABLY

Auckland Council has adopted Te Tāruke-ā-Tāwhiri (Auckland's Climate Plan)[15], which sets out Auckland's long-term approach to climate change in response to the more frequent and extreme weather events the city is facing. It commits to reduce Auckland's transport emissions by 64% by 2030. The Transport Emissions Reduction Pathway (TERP)[16] provides formal direction that Auckland Council and Auckland Transport must follow in all their activities to achieve this target. Figure 8 summarises the TERP targets and benefits.

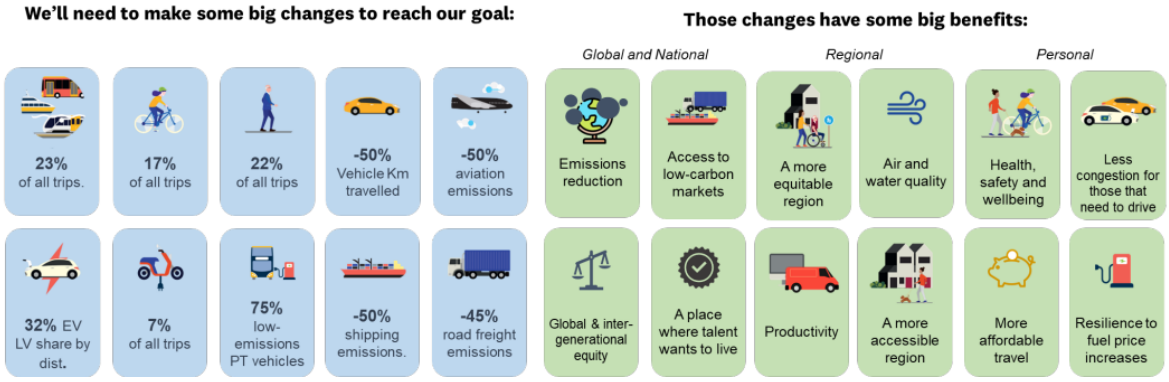


Figure 8: Auckland TERP – targets and benefits

[15] Te Tāruke-ā-Tāwhiri, Auckland Council, 2020

[16] Transport Emissions Reduction Pathway, Auckland Council 2020

Figure 9 shows the breakdown of Auckland's greenhouse gas emissions. The transport system accounts for just over 40% of Auckland's total emissions[17]. Within transport emissions, 95% come from road transport (almost 38% of Auckland's total emissions),[18] with rail's contribution being negligible (0.1% of total emissions).

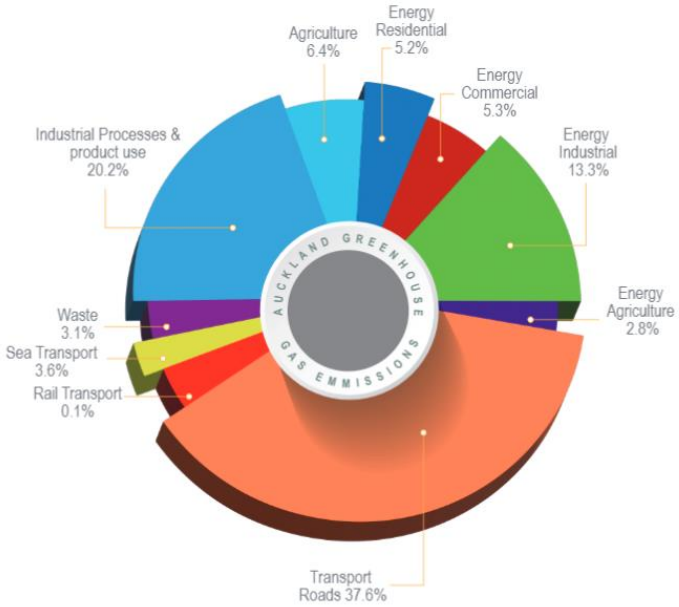


Figure 9 Auckland's greenhouse gas emissions by market

The average occupancy of private vehicles in Auckland is 1.05[19], therefore, a single passenger rail service (3-car EMU) can carry the equivalent of ~357 private vehicles and avoid the emission of around 1029kg of CO_2, making a significant contribution to Auckland's emission reduction targets.

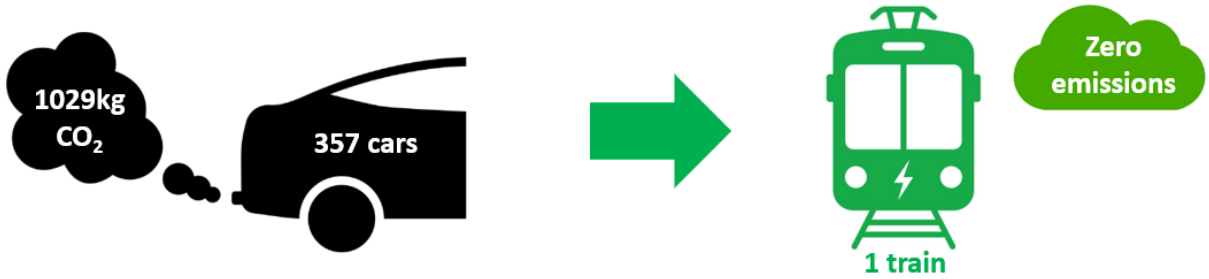


Figure 10: Public transport efficiency

Auckland has a current estimated population of 1.59 million people[20]. This population is projected to grow by 27% to 2.02 million by 2051. Employment is forecast to grow by 24% from 680,000 to 842,000 by 2035[21].

---

[17] Auckland's Greenhouse gas emissions profile

[18] Transport Emissions Reduction Pathway, Auckland Council 2020

[19] A full 3 car EMU can carry 375 passengers (all seats and standing room occupied). This is divided by average vehicle occupancy of 1.05 to get to the equivalent number of private vehicles. The average rail journey is 16km, and vehicle emission rate is 0.18kg/km (2018 fleet statistics). 357 x 16 x 0.18 = 1029kg CO_2.

[20] 2018 Census

[21] Household, employment, and population data for 2018, 2031, 2041, and 2051 is drawn from Auckland Council's land use scenario I11.6, the current agreed land use scenario for future planning purposes. New

To meet emission reduction targets and allow Auckland to grow in a more sustainable way, the transport system must respond to this increase in travel demand by providing capacity and attractive services to enable customers to choose low-emission rail travel over higher-emission road-based travel. However, despite more recent and planned investment into active modes and public transport that are forecast to deliver more than a 120% increase in public transport boardings, a 27% increase in population is expected to drive a 25% increase in vehicle kilometres travelled (VKT) across the region by 2035.

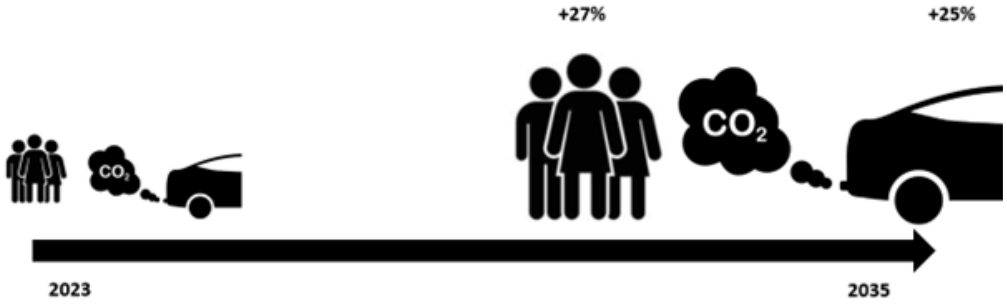


Figure 11: Population growth will drive a significant increase in VKT without further investment

To meet Auckland's emissions reduction targets, VKT must reduce some 10% from current levels, despite growing population. Achieving this target will require a substantial shift in passenger and freight customer behaviour.

URBAN FORM CONTRIBUTES TO HIGH ROAD TRANSPORT DEPENDENCY

The location of growth is important in determining the efficiency with which the transport system can cater for people's travel needs in the future.

A combination of Auckland's geography and historic transport and land-use decisions has greatly influenced current travel behaviour. Major decision-making in the 1950s centred Auckland's transport system around a network of motorways, rather than prioritising mass rapid public transport networks, fundamentally shaped the nature of urban development across the city.

This legacy of outward expansion into greenfield areas and the development of many satellite suburbs, combined with relatively little past investment in multi-modal networks has resulted in some of the highest rates of car ownership in the world (0.76 vehicles per capita[22], with 93.6% of households having 1 or more vehicles[23]) and a corresponding high dependence on private vehicle travel (94% of trips (by distance) were made by car, 4% by public transport and 2% by active modes.

Physical pinch points, including where the isthmus is narrowest, add significant constraints and complexity to land-use development and expansion of the transport network. In addition, the flow of people, goods and services becomes more complex due to the limited alternative access points caused by these geographic restrictions. This means Auckland's road-centric transport system is significantly constrained.

Transport network policy now prioritises a more balanced, less road-centric investment approach, acknowledging the growth in demand required from the public and active transport networks.

---

growth forecasts are currently being developed and are likely to show slower growth than previously forecast.

[22] https://www.ehinz.ac.nz/indicators/transport/motor-vehicles-2/

[23] https://figure.nz/chart/ip6SOAB4VnTQVOuQ

Rail contributed to around 20% of public transport boardings in 2018 (Pre-Covid)) and this needs to increase substantially to avoid Auckland being strangled by congestion as it seeks to continue to grow.

In a future where rail will be required to undertake a greater proportion of Auckland's transport task, intensification around the RTN, and particularly near rail stations, is a positive step towards enabling that outcome.

BETTER LEVELS OF SERVICE IS NEEDED FOR MORE PEOPLE TO CHOOSE RAIL TRAVEL

To meet the Government's committed emission reduction targets, rail needs to be sufficiently attractive to retain existing customers and to encourage more customers to choose rail in the future.

Rail customer level of service is based on a range of factors summarised in Figure 12.

Figure 12: Customer Level of Service considerations

For metro passengers, the perception of level of service is often relative to alternative modes (e.g. bus or car), meaning changes in those modes (for example increased levels of congestion reduce the level of service experienced when travelling by car) will increase the attractiveness of rail relative to that mode. As customers' travel decisions are dependent on the relative perceived costs of the whole journey, they may accept the trade-off of a longer journey time if the service is punctual, affordable, reliable, and safe.

To achieve the mode shift required by the ERP all aspects of level of service need to improve (by varying degrees) to bring down the perceived cost of rail journeys such that they become a viable option for most customers within the addressable market.

AUCKLAND'S RAIL NETWORK HAS INSUFFICIENT CAPACITY TO SUPPORT FORECAST DEMAND, NOR REACH EMISSION REDUCTION TARGETS

Physical infrastructure constraints restrict the number or size of services that can be operated. Customers experience the effects of these constraints on their services (e.g. an overcrowded train), but the underlying cause is network infrastructure capacity.

Operating rail services with infrastructure constraints means:

- Service frequencies, operating times and/or train lengths cannot increase to accommodate growing patronage or freight demand, resulting in constrained growth and productivity.
- Limited inter-regional service frequencies undermine the ability to provide a viable alternative to car (or air) travel for longer distance trips and are therefore less attractive for customers.
- Reduced service frequencies or operating times mean customers cannot travel when they need to.
- Lower frequencies and/or restricted train lengths cause crowding on existing services
- Limited stop services (metro and inter-regional passenger) either cannot be operated or are constrained and therefore unable to achieve the journey time benefits that would attract customers for medium to long journeys (typically longer than 45 minutes for metro journeys)

Metro service capacity is a combination of service frequency and seat availability, and both these factors influence the attractiveness of rail from a customer perspective and therefore the patronage of these services., i.e., people will choose a rail journey if it is right-timed, and it is not too crowded.

Approximately 62 million metro passenger trips per annum are forecast on the Auckland rail network by 2051[24]. This is more than triple 2018 demand levels. Metro service capacity constraints must be addressed to accommodate this considerable growth in demand. Some service capacity upgrades are already underway on the Auckland rail network, including delivery of the CRL, expanding the EMU fleet from 72 to 95 units, extending electrification south to Pukekohe and a new western power feed to increase the power to the system (to allow more units to be in service at the same time). These items all form part of the base case on which the investment programme will build.

The complex nature of the rail system means that overall network capacity is governed by the relationships between the components that make it up. The component that dictates overall system capacity can be thought of as the 'weakest link in a chain'. Once the capacity constraint associated with the critical component is addressed, a different component then governs overall system capacity, and so on. Post-CRL, other areas that will constrain capacity include level crossings, Southern Line track and signalling constraints, flat junctions at Westfield, and Wiri and Newmarket, fleet and stabling.

Figure 13 and Figure 14 show where metro service capacity will be constrained by 2031 and 2051 without further investment in the rail network[25].

[24] MSM output mode share using 2051 Base Case network and services

[25] Freight scenario B1 and RTN metro scenario applied. MSM crowding module on, increasing generalised cost when seated capacity is over 80%. No explicit capacity constraints modelled.

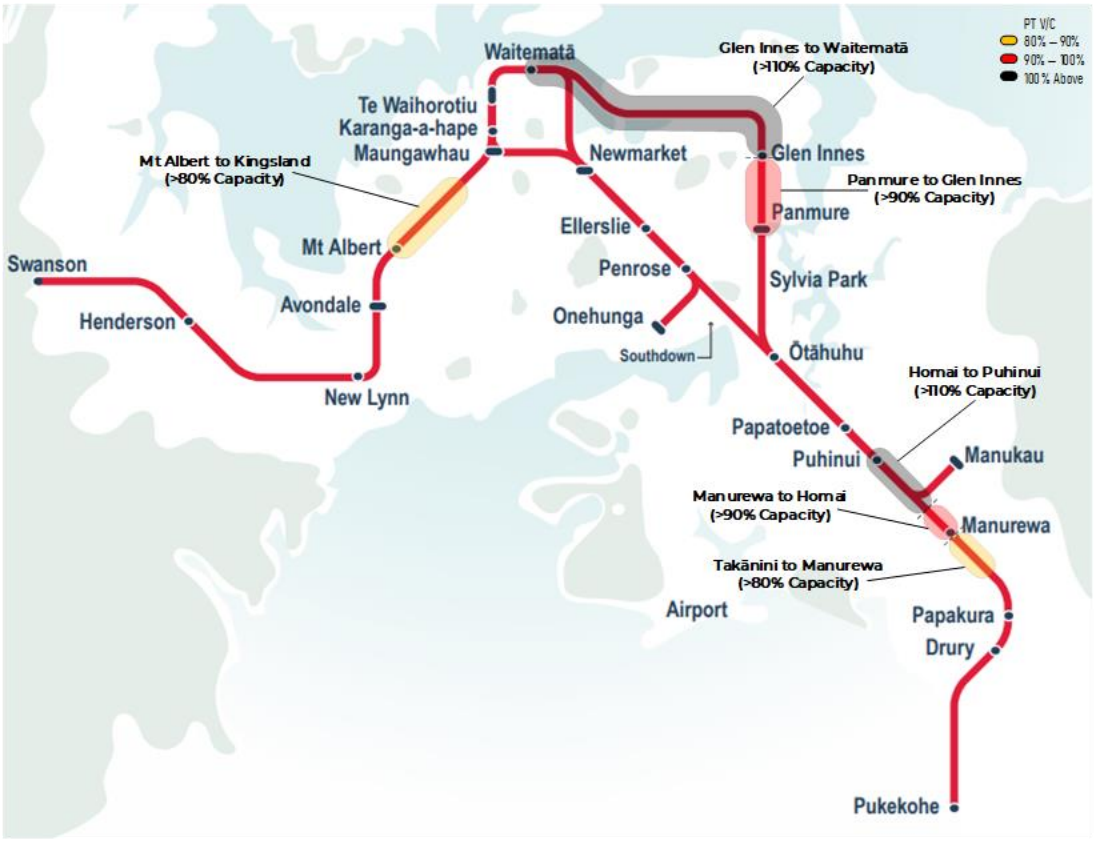


Figure 13: 2031 Service Capacity Constraints

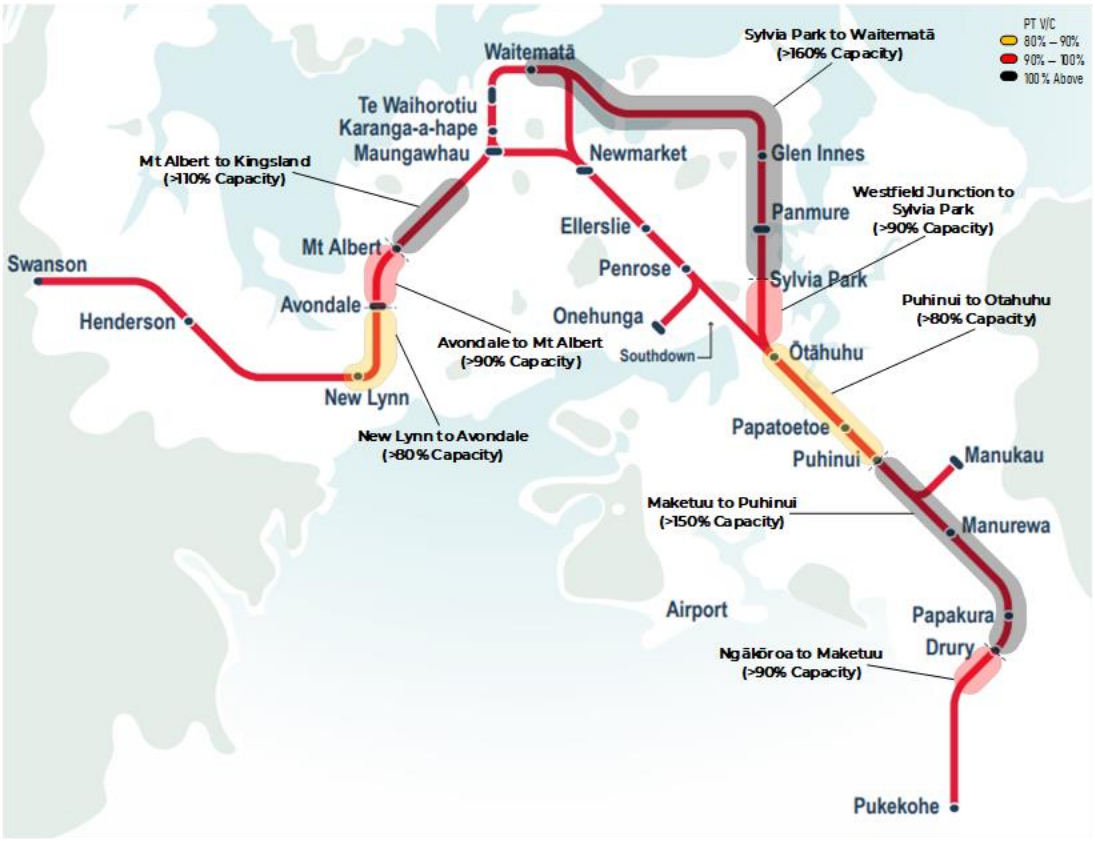


Figure 14: 2051 Service Capacity Constraints

In addition to constraints on metro services shown above, there are also physical infrastructure constraints that constrain freight capacity. Forecasts indicate that longer (up to 1,500m trains) will be required to accommodate future demand on the NIMT.

Network and key hub upgrades are required to support train lengths up to 1500m. Constraints that currently prevent longer trains from operating from Southdown include:

- Arrival and departure 'roads' (for rail services) at the Southdown depot are too short to receive/depart a 1500m train without blocking the mainline.
- Time slot availability on the NIMT is insufficient for a 1500m train without reducing the overall network capacity for freight, metro, and inter-regional services.

In addition to these issues, the availability of adjacent land at Wiri and to the south, and the prevalence of level crossings on the network also constrain freight capacity. Growth of freight services to Northport will also require greater access for freight services to the NAL.

WE MUST LOOK AFTER WHAT WE HAVE BUILT, AND WILL BUILD

The significant capital investment and network operating constraints of the recent Rail Network Rebuild project has demonstrated the fundamental importance of maintenance to operate a reliable and resilient rail network and has prompted a consequent shift in investment priorities.

Inadequate funding, a symptom of the long-standing lower prioritisation status of maintenance historically in comparison with capital works, has led to maintenance deferrals, increasing the need for catch-up renewals.

Historic insufficient maintenance activity has meant that the Auckland rail network has often operated at a degraded level, resulting in inefficient operation, and declining levels of service (such as service cancellations and poor travel time reliability) for rail passenger and freight customers. This has highlighted the importance of a robust maintenance regime in the future to underpin the whole rail system to deliver and sustain high levels of reliability.

Typically, network maintenance is completed overnight, but some activities, particularly renewals, require longer access that need to be completed during a longer line closure. Existing timetables restrict many maintenance activities, with access and setting up/packing down requirements reducing the time available to undertake productive maintenance work to as little as 2 hours in many cases.

Maintaining and renewing a significantly busier rail network in the future will require completion of catch-up renewals and the implementation and funding of a highly productive and proactive maintenance and renewals regime.

This will avoid repeating the problems of the past where the de-prioritisation of network maintenance has led to network deterioration and materially degraded service reliability, including long term outages that disrupt supply chains and increase economic costs.

This concludes Part 1 of Auckland's Rail Story. The following Part 2 outlines the 30-year Strategic Rail Investment Programme developed by the Programme Business Case and how it will address the needs described here.

PART 2: STRATEGIC RAIL INVESTMENT PROGRAMME

The outcome of the Auckland rail programme business case is a comprehensive programme to be delivered in its entirety over a 30-Year period. It includes the following components:

- Southern line (Westfield – Pukekohe) 4-track capacity expansion,
- Wiri – Westfield additional capacity expansion,
- New Avondale-Southdown cross town line,
- Stations upgraded to meet Auckland Transport TDM requirements and platforms extended to accommodate 9-car EMUs,
- All level crossings removed,
- Additional EMU fleet and depot improvements,
- Signalling and power feed improvements
- Higher capacity maintenance plant and equipment, heavy maintenance facility, additional sidings for maintenance.

Figure 15 summarises the recommended investment programme for the Auckland rail network.

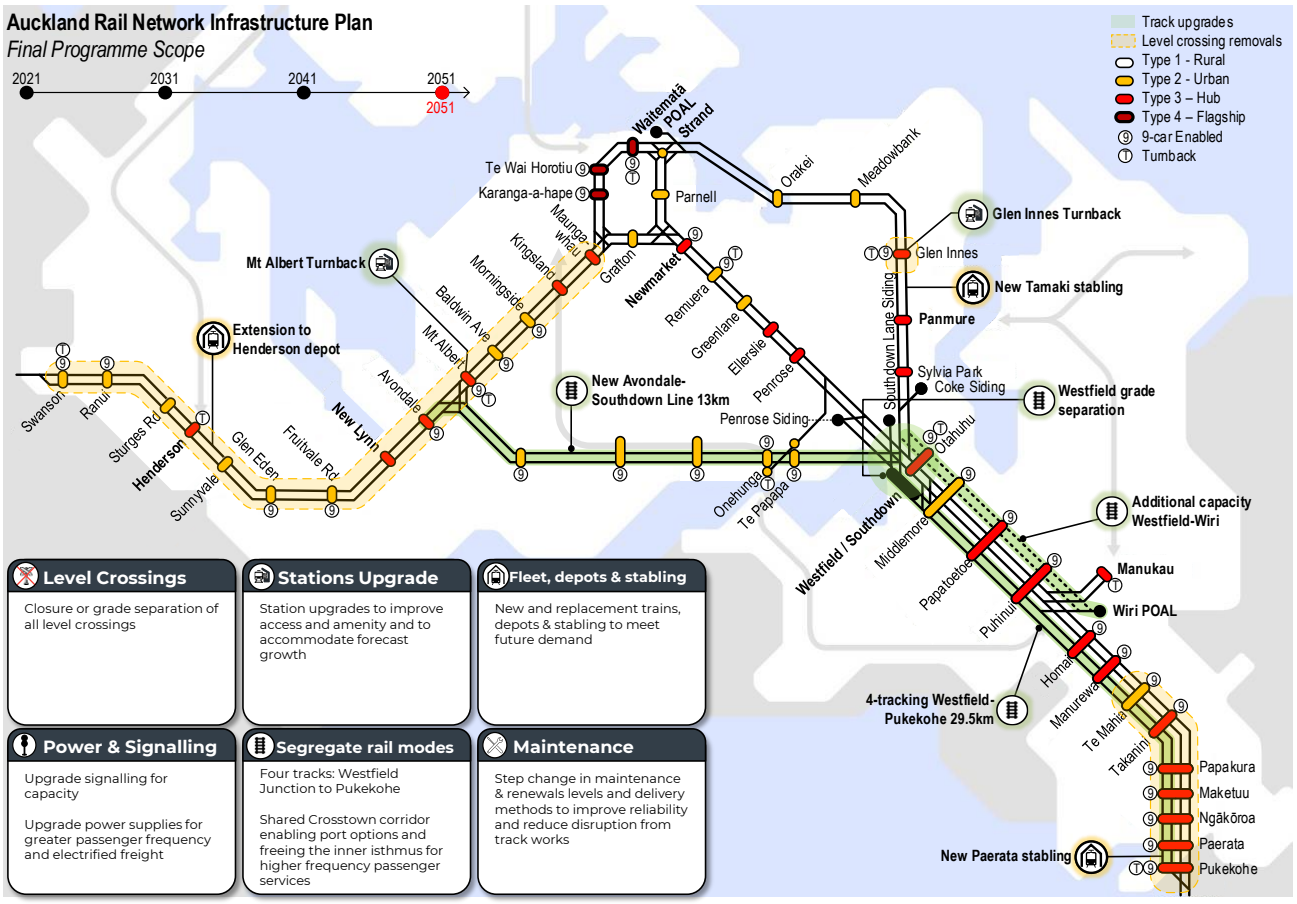


Figure 15: Recommended investment programme

The investment produces a comprehensive set of benefits (including economic benefits) at local, regional, and national levels that will result from the successful delivery of the strategic rail investment programme. These benefits arise from the interactions of the whole programme, and collectively address the needs of the network's users.

The programme not only provides the additional capacity to provide for future demand for all markets. Of strategic importance are the two new track elements, which are the critical enablers of a strategic vision for the rail network in the upper North Island. A network that provides rich benefits for all its users, including:

- greater reliability and resilience throughout the network
- capacity and far greater efficiency for the national supply network
- access, capacity and journey time improvements for inter-regional services
- substantial capacity, frequency, reliability and connectivity benefits for metro services

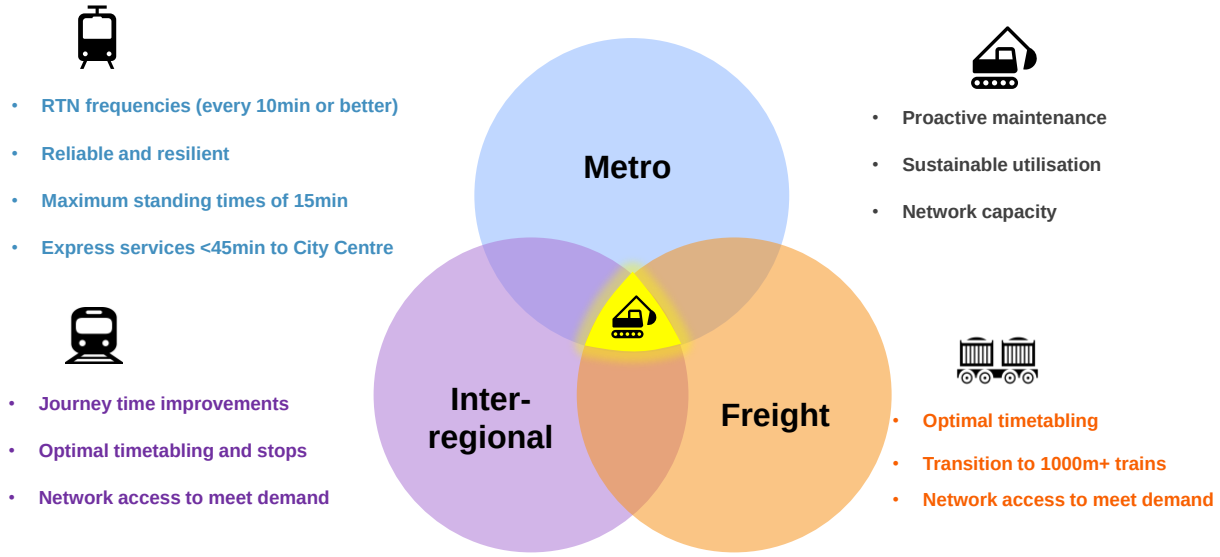


Figure 16: A comprehensive benefits package

The benefits are reliant on the delivery of the whole programme as they work together across the entire rail system to address current deficiencies and meet the future needs of network users. For example:

- The recommended maintenance and resilience programme elements are pre-requisites for the success of the overall programme. Without a reliable and maintainable network, including investment in plant and equipment to achieve these outcomes, it is not possible to run reliable, frequent, and fast services. The forecast step-change in usage intensity means the network must become more resilient to climate, with more optionality, and by segregating all-stops and non-stop traffic in order to achieve the desired level of system reliability.
- 4-tracking the Southern corridor to Pukekohe is needed to enable material mode shift, reduce vehicle kilometres travelled (VKT) and meaningfully deliver on climate treaty objectives.
    - 4-tracking will provide attractive frequencies and express services for passengers with the longest journey times. Passengers between Papakura and Pukekohe have the longest journeys and therefore have the greatest impact on Auckland's emissions and congestion reduction. 4-tracking also enables growth from beyond Auckland's southern border. Mode shift for these passengers delivers the greatest economic benefit.

- Freight demand cannot grow beyond the early-mid 2030s until 4-tracking delivers the capacity to enable longer freight trains to operate[26]. Freight services provide the greatest economic benefits on a per-train basis, and therefore are fundamental to deliver the outcomes sought by the programme. Unless 4-tracking is extended to Pukekohe, freight benefits can only be achieved at the expense of the equally valuable passenger services.

- The crosstown Avondale-Southdown corridor delivers significant strategic benefits as part of the overall programme. This corridor removes most freight services from the inner network, enables express services from the Outer Southern network to the city centre to operate across a much greater span of the day, and significantly improves network resilience. It also creates optionality for future passenger services - the PBC includes an option for a crosstown route using this corridor, connecting Henderson and Glen Innes.
    - The 'outer link' across the isthmus created by this corridor offers multiple future metro passenger service options that can enhance Auckland's connectivity, similar to the inner link created by the CRL tunnel. Freight and metro services can be compatible at low utilisation levels, but in a high-utilisation environment, the right investment is required to enhance service reliability and safety.
    - For the national freight and logistics industry, the Avondale-Southdown corridor significantly enhances operational efficiency as the North Island Main Trunk (NIMT) Line effectively extends between Wellington and Whangarei, reducing freight reliance on the inner Auckland network and allowing it to be utilised for more intensive passenger operations.
    - These outcomes will noticeably enhance the attractiveness of both freight and passenger services, enabling the mode shift required to deliver the scale of benefits identified for the PBC programme.
    - This corridor is also the key enabler of the strategic aim of maximising segregation of modes on the network, thereby minimising the complexity of operation, enhancing reliability and resilience and allowing maximum use of the existing capacity.
- Level crossing removals are also an essential programme element. If level crossing removals are not implemented, the increased train frequencies required to accommodate forecast growth in passenger and freight demand would require extremely high barrier-down times of 50% during peak hours. The PBC does not include road user benefits of avoiding these delays because Waka Kotahi as safety regulator would not allow train services to run with this level of disruption. Concretely, the increased services and passenger mode shift expected from this PBC requires that level crossings are removed.
- Station upgrades are an important element in enabling access for more people to the network, as well as service quality enhancement contributing to mode shift.

---

[26] There are practical limitations on the frequency of freight services, which means enabling longer trains is the most viable strategy to achieving growth beyond the mid-2030s.. Even if two freight paths are provided during every hour of the day in the network timetable, it is not feasible to achieve a throughput of 48 trains per day given limitations of terminal size, hours of operation, unload and reload time windows, the need for resiliency paths, and so on. Running longer trains enables more freight to be carried with a smaller number of train movements, provides efficiencies in terminal operation (including turn-around times that can be as fast, or nearly as fast, as shorter trains), and several other operational and economic benefits.

- **Fleet, depots & stabling**, additional services and capacity require a sufficient train fleet and places to stable and maintain them.
- System investment in **power, network and signalling** are critical to network operation and the programme. This is particularly critical in early years of the programme while the more substantial infrastructure works are still being planned and implemented – to make best use of existing assets through technology enhancements.

It is important to note that while this programme of investments occurs over a long time period – many of its critical elements have long lead times given their great scale and complexity. The four-tracking programme for example is expected to take close to two decades to implement (including property acquisition), while it is needed to meet the growing demands and aspirations of freight and passenger markets by the mid 2030s. There is therefore an urgent need to kick off planning and implementation as early as possible, to ensure the benefits of these investments are delivered at the time when they are needed (or as close to this as possible) – and to secure required land as affordably as possible, in the context of continually increasing competition for development.

Not only is it important that this programme be progressed quickly, but equally that it be maintained as a cohesive whole. While most of the investment programme is required to support metro growth, metro alone cannot justify the scale of investment required and it is the benefits to all users; freight, inter-regional and metro, that ultimately justify the programme. These benefits arise from the programme as a whole (and, as will be discussed below, the strategic national vision that it enables) – and would be degraded if specific elements are cherry picked over others.

STRATEGIC VISION

Beyond providing for future demand with the investment programme, there is also a strategic vision emerging. As described in Part 1 of the Rail Story, we do not have a metro railway in Auckland. It is a mixed-use railway network, where all types of passenger and freight services need access to a fair share of the network and available capacity. This includes all-stops metro services alongside non-stop services - express metro and inter-regional passenger and inter-port/inter-regional freight services.

As set out earlier, mixed use networks are complicated to operate, impacting capacity realisation and reliability and hence as demand increases, most large cities opt to separate freight and passenger networks. In the long term, and as the network in Auckland gets busier for longer, **segregation of traffic types will need to be a strategic aim in Auckland.**

The initial groundwork for segregation has been created by the CRL, due to open around the end of 2025. This will create a high-capacity, passenger-only link within the rail network, allowing trains to travel through the city centre rather than having to stop in Britomart to turn around and come back the way they came in. This 'through-running' capability will prompt a step change in the capacity of the overall network and a different pattern of use whereby metro trains will run east-west, and north-south via the CRL.

4-tracking of the southern corridor builds upon this segregation journey, allowing all-stops metro to be separated from the range of non-stopping services. Completing the picture is the Avondale – Southdown crosstown corridor, which creates an outer circle and is the key to enabling a very significant semi-segregation of the network to occur and a strategic vision for each of the future metro network and future freight and logistics network to emerge.

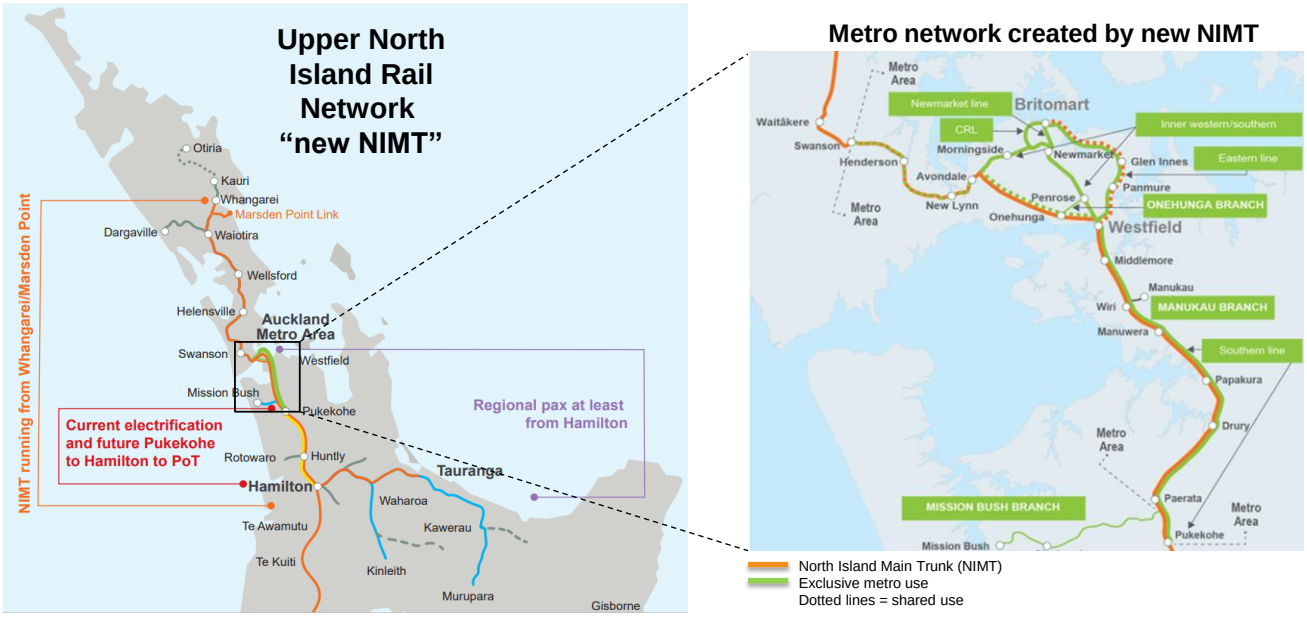


Figure 17: Future Auckland rail network local, regional and national strategic context

The key features are:

- Full segregation to the south between stopping and through trains via 3rd and 4th main lines,
- Intense metro-only passenger services;
  I. around the waterfront through the City Rail Link
  II. through the middle of the isthmus
- A shared freight and metro service to the south of the isthmus using the Avondale - Southdown Line,
- A vision for the North Island Main Trunk (NIMT) which currently runs from Wellington to Britomart instead running from Wellington to Whangarei/Marsden Point with the Avondale – Southdown line becoming part of the NIMT.

Both infrastructure elements (4 tracks on NIMT-S and 2 tracks from Southdown to Avondale) are required to turn this vision into reality.

It is worth noting that the fact that KiwiRail has owned the Southdown-Avondale corridor since the 1940s/50s is due to the vision of our forebears who recognised its strategic importance to the long-term development of the rail network. Without that foresight and in particular the setting aside of land for the rail network's future development, it is extremely unlikely that such a corridor could be envisaged today – and, as the Rail PBC explored, significantly more expensive solutions with lesser benefits would be required. As also demonstrated by the PBC, the expected future demands on the rail network and long lead times for development require that it is time to be visionary again.

The strategic investment programme achieves its aims of providing for the sustainable future growth of all users of the rail network in Auckland. It also achieves the strategic aim of segregating traffic types to enable a more resilient network and better utilisation of capacity.

And it goes beyond this, creating a strategic vision for the upper North Island that brings benefits well beyond Auckland. Succinctly, it is about Auckland – but not *only* about Auckland. In solving the challenges of future growth needs within the Auckland network, the strategic rail investment

programme creates benefits that are more widely shared and provides a basis for next stage development well beyond the 30-year horizon of the investment programme.