WELLINGTON RAIL PROGRAMME BUSINESS CASE

WELLINGTON'S STRATEGIC RAIL PLAN

July 2022

Greater Wellington
Te Pane Matua Taiao

metlink

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Executive Summary

This Wellington Rail Programme Business Case (PBC) has been prepared by Stantec New Zealand and Greater Wellington Regional Council (GWRC) in collaboration with KiwiRail, Transdev New Zealand (GWRC's current rail service operator), and Waka Kotahi New Zealand Transport Agency (Waka Kotahi). It replaces the Wellington Regional Rail Plan and sets out a new customer-driven strategic plan for the region's rail system for the next 30 years, outlining what is required beyond current investment to help drive the region's economic development and social wellbeing in an environmentally and socially sustainable and resilient manner. It covers the passenger services and infrastructure needed to deliver a modern transit system, and the network infrastructure required to support this system while also enabling a growing freight operation, both within the region and linking into the neighbouring Horizons Region. The PBC thus provides the investment pathway needed to achieve the long-term vision of the New Zealand Rail Plan in the region.

Background

Rail is a critical component of Wellington's transport system. It forms the backbone of GWRC's extensive Metlink network of public transport services north of the Wellington CBD, where three quarters of region's population lives, and it provides a crucial link to the region and between the North and South islands, which is strategically important to the national transport system.

Metlink rail services radiate out over four key lines – the Johnsonville, Kāpiti, Wairarapa and Hutt lines – as well as the short Melling branch, which are collectively known as the Wellington metro rail network. The network has been electrified and emission-free since 1955 (aside from Wairarapa services), contributing strongly to the region's position as the least carbon-emitting. The 400,000 residents of the rail service area have access to 2,250 Metlink rail services in a typical week, and customers made 14.32 million trips in the year prior to the COVID-19 pandemic, when peak services were close to capacity. This patronage was more than 20 per cent higher than a decade earlier, a growth rate double that of population, with the extra growth reflecting a strong customer response to improvements to infrastructure, rolling stock, and services. The 42,000 daily peak trips accounted for over 40 per cent of peak trips from the north and around 20 per cent of all peak trips into the Wellington CBD.

KiwiRail's freight and passenger services also use the network – more than one hundred freight trains and sixteen inter-regional passenger trains in a typical week. The Kāpiti Line has a prominent role as the southern end of the North Island Main Trunk (NIMT) railway from Auckland, with freight services connecting most parts of the North Island to local industry, international shipping, and the South Island via the interisland ferry connection. The tourist-focused Northern Explorer from Auckland and the weekday peak Capital Connection (Manawatū Line) commuter service from Palmerston North also use that line. The Hutt and Wairarapa lines connect forestry-related freight traffic from Wairarapa to the port and provide access to KiwiRail's primary engineering facility at Gracefield.

Rail sits outside of the Let's Get Wellington Moving (LGWM) programme, as do all other transport system elements north of Ngauranga Gorge, which lies just to the north of the Wellington CBD. LGWM will provide mass transit to the south and east of Wellington City, which will complement the rail system that makes up the rapid transit system to the north, and interface with it at Wellington Station to enhance cross-region travel options and support mode shift. The success of the two programmes is consequently interlinked.

Growth Context

The region's rail system will need to respond to significant population growth over the coming decades. The 2021 Wellington Regional Growth Framework (RGF), a spatial plan developed by central government, local government, and iwi stakeholders, anticipates that the Wellington-Horowhenua region will need to accommodate an additional 200,000 people, a 35 per cent increase, and 100,000 jobs in the next 30 years. Three quarters of this growth is expected to occur to the north, along the eastern and western growth corridors that follow the primary rail corridors as shown in Figure 1. A substantial proportion of this growth is expected to occur in areas of the region with longer rail journey times, reflecting land cost and availability and recent improvements to the road link between Wellington and the Kāpiti and Horowhenua districts.

The RGF identifies the Metlink rail service as a key enabler of the growth to the north. It envisages intensification around railway stations and improved connections to stations to enable much of the additional transport demand associated with the expected growth to be borne by rail. Intensification around railway stations (as rapid transit stops) is required by the National Policy Statement on Urban Development (NPS-UD). The RGF recognises that rail capacity upgrades will be necessary to enable and meet this demand.

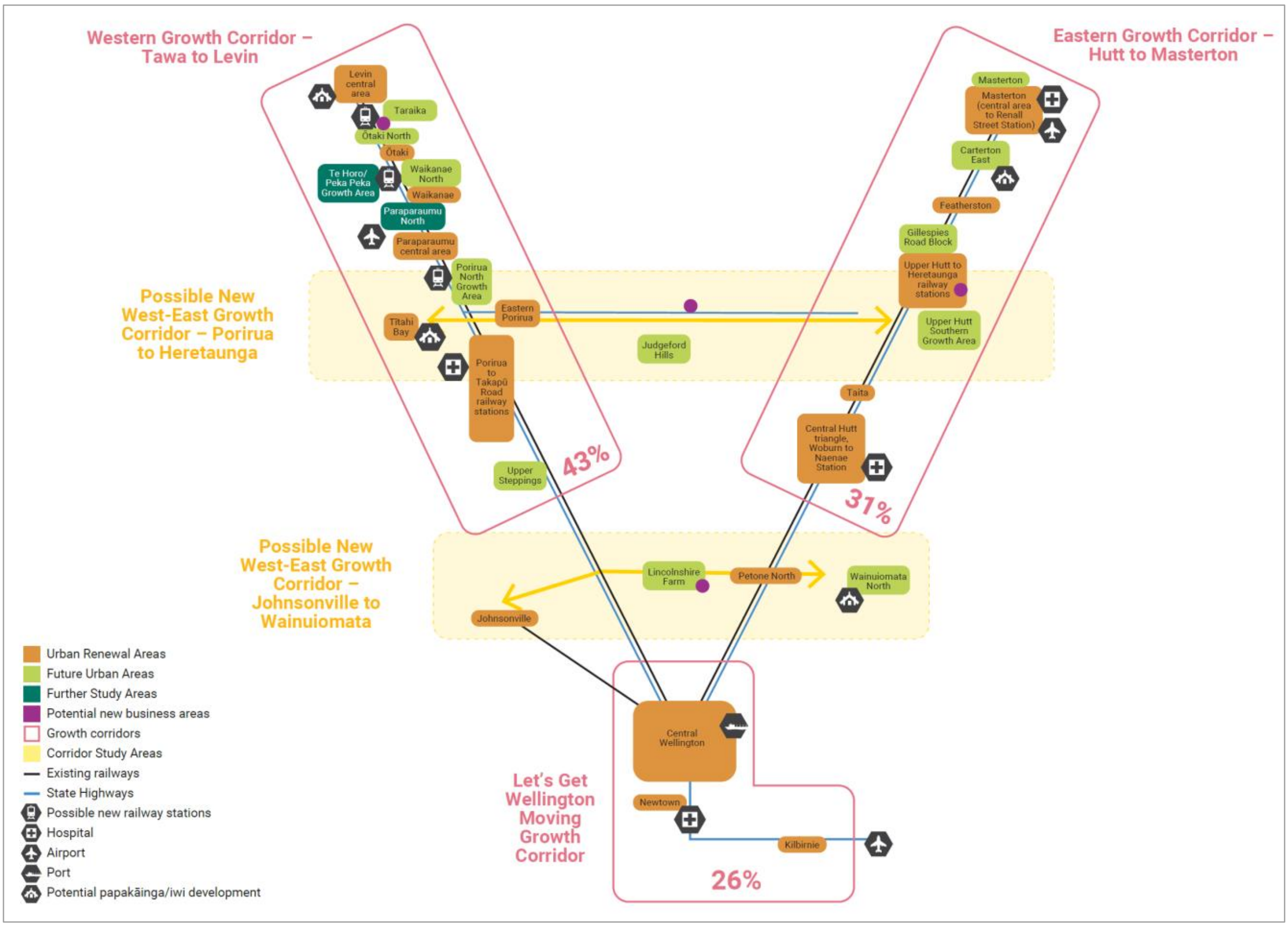

Figure 1: RGF growth corridors

Environmental Context

The region's rail system will need to respond to significant mode shift requirements over the coming decades, reflecting regional and national targets. At the regional level, the 2021 Wellington Regional Land Transport Plan (RLTP) seeks to increase active and public transport mode share by 40 per cent and reduce carbon emissions by 35 per cent by 2030. At the national level, the Climate Change Commission's 2021 Ināia Tonu Nei demonstration path requires an even greater level of uptake, assuming a 60 per cent increase in the distance travelled by public transport in Wellington by 2030. The 2022 Emission Reductions Plan, Te Hau Mārohi Ki Anamata, includes a key action to reduce reliance on cars by improving the reach, frequency, and quality of public transport, including service and infrastructure improvements in Wellington. An associated target aims to reduce total kilometres travelled by the light vehicle fleet by 20 per cent by 2035 through improved urban form and providing better travel options in the largest cities. These targets reflect the national net zero emissions by 2050 target set by the 2019 Climate Change Response (Zero Carbon) Amendment Act.

Rail is the rapid transit option for most of the region's residents. The above mode shift targets require substantial increases in rail patronage on top of population-related patronage growth. The rail system will consequently need to be attractive and convenient to use and have sufficient capacity to both encourage residents to forego private vehicle for most of their trips and comfortably accommodate them when they switch modes. The 2020 Wellington Regional Mode Shift Plan, developed by Waka Kotahi and endorsed by the Regional Transport Committee, therefore supports increased development density near railway stations and improved rail safety, capacity, infrastructure, and service levels to meet the regional targets. The RLTP also includes an investment priority to build rail capacity and reliability, and it prioritises five significant rail projects within the current investment programme, which are included in most programme options within this PBC.

Need for Investment

Stakeholders have identified three fundamental problems that need to be addressed through investment in the region's rail system. These are:

1. Inconsistent customer journey experience and limited rail system capacity result in the network being unable to meet mode share targets, which prevent achievement of growth and environmental obligations
2. Current infrastructure is not capable of safely accommodating additional trains, restricting the options available to accommodate future demand
3. The condition and configuration of the rail network makes it vulnerable to service disruptions, which has a flow on impact onto the wider transport system.

The supporting evidence for Problem 1 confirms that declining levels of service linked to constrained capacity and strong patronage growth, along with variable and often poor station connectivity and amenity, will deter many potential customers and in turn limit the mode share that can be achieved. Capacity in this situation relates to both on-train capacity and rail network infrastructure capacity. It includes major physical bottlenecks at several key locations, and network-wide limitations such as traction power supply, which restrict the number and size of trains that can operate through the network to just above the current level.

Problem 2 evidence confirms that the antiquated signalling system that governs train movement, and the risk of collisions at multiple pedestrian and vehicle level crossings, limits the effective frequency that can be safely provided to customers to relatively low levels. It also recognises the potentially major safety impact of the failure of infrastructure such as track and slopes. Any of these elements could result in a crash or derailment, which could cause significant casualties and lead to a reduction or complete suspension of passenger services by the rail regulator.

Problem 3 evidence confirms that service reliability is (and increasingly will be) inhibited by the failure of aging network infrastructure and its proximity to natural hazards that are susceptible to weather-related failure and climate impacts. It also demonstrates that the network lacks operational resilience and is consequently vulnerable to operational events that hinder operations, such as freight train derailments. Service delay and suspension deter customers, and major rail disruptions have compounded to cause significant and wide-ranging delay across the region's road network over the last decade.

The problems are weighted equally since they are interdependent. Fixing only one or two problems would have limited impact and prevent the rail system from achieving the benefits sought and the expanded role required by regional and national policies. The short timeframes associated with the mode share targets and the long lead times associated with rail infrastructure place considerable urgency on any response to the problems.

Investment Benefits and Objectives

Stakeholders have identified the following benefits of addressing the problems:

- Improved environmental outcomes (15 per cent of the overall benefit), supported by carbon emission and mode share measures
- Enable regional growth through improved access to economic and social opportunities (30 per cent of the overall benefit), supported by passenger capacity and freight path measures
- Improved customer experience (15 per cent of the overall benefit), supported by frequency, customer satisfaction, and punctuality measures
- Improved transport system resilience (20 per cent of the overall benefit), supported by system impact-related measures
- A safer rail system (20 per cent of the overall benefit), supported by safety incident and perception measures.

The investment objectives for this PBC were derived from the problems and benefits. They seek to deliver a rail system that:

- Provides capacity that supports access and growth (20 per cent of the overall objective)
- Is attractive and easy to use (25 per cent overall objective)
- Improves safety for all (20 per cent overall objective)
- Is adaptable to disruptions (20 per cent overall objective)
- Supports a sustainable future (15 per cent overall objective).

The investment objectives align strongly with all five of the enduring outcomes within the Ministry of Transport's (MOT) Transport Outcomes Framework: inclusive access, economic prosperity, healthy and safe people, resilience and security, and environmental sustainability. Each objective is supported by specific and timebound benefit KPIs. Overall success will be measured using an overarching success factor of increased rail passenger and freight use.

Option Development

A long list of nearly two hundred potential interventions expected to respond to the problems and help to achieve the investment objectives was developed with stakeholders in an 'all ideas welcome' environment through a series of meetings and workshops early in the option development phase of the PBC. Duplicates, specific minor works, business-as-usual, interventions considered not to contribute to an investment objective or enable an objective, and those that were out of scope were excluded at the early assessment stage. Interventions that remained following the early assessment were organised into the eight rail system investment programmes outlined in Table 1. All, other than the Do-Nothing and Do-Minimum programmes, sought to address all key problem areas, although each had a different focus and addressed each problem area to a greater or lesser extent or over a shorter or longer timeframe.

Table 1: Programme long list

Programme	Summary
Do-Nothing	Manage rail system decline while prioritising other modes. Lowest direct cost, but highest transport system and environmental cost.
Do-Minimum	Maintain a basic rail system while focusing investment on other modes. Low direct cost but high transport system and environmental cost.
Minor Improvements	Demand management with a focus on low-cost improvements to reliability, safety, and resilience. Lower direct cost but high transport system and environmental cost.
Moderate Improvements	Demand management with a focus on improvements to reliability, safety, and resilience, moderate capacity uplift, and station improvements. Moderate direct cost but still sizeable transport system and environmental cost.
Train Size Focus	Focus on maximising train size while holding frequency in the medium term to boost capacity while delaying the need to invest in below rail infrastructure. Supported by a wide range of reliability, safety, resilience, and customer-focused improvements. Higher direct cost but lower transport system and environmental cost.
Frequency Focus	Focus on maximising frequency, particularly during peak periods, before later increasing train size as needed. Supported by a wide range of reliability, safety, resilience, and customer-focused improvements. Higher direct cost but lower transport system and environmental cost.
Mixed Focus	Balance train size and frequency, by pragmatically increasing train size first where frequency is difficult to enable, and frequency first where it is easier to implement. Supported by a wide range of reliability, safety, resilience, and customer-focused improvements. Higher direct cost but lower transport system and environmental cost.
Drive Mode Shift	Remove all barriers to a high frequency, reliable, and comfortable passenger rail experience, and accelerate network capacity improvements, to drive mode shift within the required horizon. Supported by a wide range of safety, resilience, and customer-focused improvements. Highest direct cost but lowest transport system and environmental cost.

Long List Assessment

The programmes were evaluated using a two-stage process. Long list programmes were firstly outlined at a high-level, then assessed by stakeholders against the five investment objectives and five other criteria using multi-criteria analysis (MCA), with the Do-Minimum option as the baseline for comparison. The results were sensitivity tested using eleven weighting systems.

The long list assessment showed that the Drive Mode Shift programme consistently ranked as the best programme, with the best or equal-best score across most criteria (including all investment objectives) and most sensitivity tests, although it was the poorest scoring option against the deliverability and affordability criteria and sensitivity tests. The Mixed Focus programme scored similarly and generally in second place behind the Drive Mode Shift programme but was much better performing against the deliverability and affordability criteria and sensitivity tests. These programmes were taken forward to the short list as the best scoring programmes.

The Moderate Improvements programme was selected to take forward to the short list as a more deliverable and affordable alternative. It provided the best balance between deliverability and affordability criteria, and the investment objective, outcome, and policy-focused criteria. It can be regarded as a 'middling' option with neither significant advantages nor disadvantages, although it would only partially realise the investment objectives.

The Train Size Focus and Frequency Focus programmes scored well, but did not offer the same investment objective, outcome, and policy-focused advantages as the Drive Mode Shift and Mixed Focus programmes, or the deliverability and affordability advantages of the Moderate Improvements programme. These were consequently discounted, along with the Do-Nothing, Do-Minimum, and Minor Improvements programmes, which scored poorly against the investment objective, outcome, and policy-focused criteria. The Do-Minimum programme was carried forward for comparison purposes only.

Short List Assessment

The three shortlisted programmes were further developed to define critical aspects, identify next steps and bundling, better define cost estimates, better understand timeframes, better understand operational issues, undertake more detailed patronage forecasting, and undertake initial economic analyses based on early-estimate benefits and costs. Table 2 provides the results of the initial economic analyses, showing that all three programmes would provide a positive return on investment, with the Drive Mode Shift programme offering the best potential value in terms of its positive mid and upper range incremental benefit cost ratio (BCR) and net present value (NPV), despite having the highest cost.

Table 2: Shortlisted programme value (60-year evaluation period)

	Benefit ($m)	Cost ($m)	Inc Benefit ($m)	Inc Cost ($m)	BCR	Inc BCR	NPV ($m)
Moderate Improvements	$1,780 - $2,200	$1,000	-	-	1.8 - 2.2	-	$780 - $1,200
Mixed Focus	$2,450 - $3,360	$2,080	$670 - $1,160	$1,080	1.2 - 1.6	0.6 - 1.1	$370 - $1,280
Drive Mode Shift	$4,080 - $5,890	$3,820	$1,630 - $2,530	$1,740	1.1 - 1.5	0.9 – 1.5	$260 - $2,070

The developed short list programmes were then reassessed by stakeholders through a second MCA process using an expanded scoring framework and the following wider set of criteria:

- The five investment objectives and overarching success factor (increased rail usage)
- Two policy alignment criteria: national policies, and regional policies and investment
- Six deliverability and wider outcomes criteria: funding availability, construction/engineering difficulty, consenting degree of difficulty, programme impacts from delays, economic impacts, and impacts to services during construction.

The status quo situation was used as the baseline for comparison. Results were sensitivity tested using three workshop and eleven other weightings, which emphasised specific criteria or criteria groupings, with the highest workshop priorities being given to the overarching success factor, economic outcomes, and improved safety.

The short list assessment reconfirmed the findings of previous assessment, finding the Drive Mode Shift programme to be the best programme, having the best or equal-best score across most criteria, including all investment objectives, the critical success factor, and the policy alignment criteria. Other than the Do-Minimum, it was the poorest scoring option against the deliverability and wider outcomes criteria, except for economic outcomes, reflecting the challenge of delivering a large programme of works quickly to meet mode shift requirements. It ranked as the first-choice option in most sensitivity tests, including all workshop tests.

The Mixed Focus programme generally ranked second to the Drive Mode Shift programme, again with a similar pattern to the previous assessment. Critically, it was well behind against the capacity and attractiveness investment objectives since it would deliver on these much later than the Drive Mode Shift programme. In contrast, it performed much better against the deliverability and wider outcomes criteria, mostly due to this delayed delivery. It ranked as the second-choice option in most sensitivity tests.

The Moderate Improvements programme again provided the best balance between the objective and policy focused criteria and the deliverability-focused criteria. It again offered neither significant advantages nor disadvantages, although it would only partially realise the investment objectives and would not support significant growth or mode shift in the short or medium term. It ranked as the third-choice option in most sensitivity tests, only coming first in the consenting focus test, reflecting its minimal infrastructure investment in the short and medium terms.

The Drive Mode Shift programme was selected as the best programme to take forward as the preferred programme based on the above assessments and conclusions.

Preferred Programme

The preferred programme delivers a 'fit for purpose', resilient, and safe rail system, enhances customer experience to encourage mode shift, and supports this with the capacity needed to meet and drive high patronage growth, providing:

- Highly connected stations in communities where people work, live, play and learn
- Accommodating stations that make any wait both pleasant and productive
- Frequent services that are faster and more convenient than by car
- Reliable services that recover quickly from disruption
- Links that facilitate convenient connections for national freight customers
- Infrastructure and safety systems that enable transport without undue conflict.

The programme includes a wide range of improvements, key elements of which are summarised in Figure 2, including:

- **Station access improvements** to make active and public transport more attractive as access modes, which will support first and last mile accessibility, reduce the reliance on private vehicle and park and ride in line with zero carbon objectives, and support intensification near stations as envisaged by the RGF and NPS-UD.
- **Improvements to all aspects of station amenity** across the network, including to accessibility, shelter, and information, which will ensure that accessibility obligations to disabled customers are met, that the waiting and overall customer journey experience is first-class, and that it is attractive to new customers for mode shift. These improvements will support increased at-station transit-oriented development where feasible.
- Progressive **service frequency improvements**, from the current 20-minute peak frequency to a 15-minute, then 10-minute, and finally 6-minute peak (turn up and go) frequency at most stations on the Hutt and Kāpiti lines, along with an improved 15-minute off-peak frequency within the electrified area and significantly improved service levels on long-distance services, which will provide better travel options for customers, support the region's growth, and deliver the capacity needed to drive and accommodate the required mode shift.
- Supporting **electric multiple unit (EMU) fleet expansion** to enable the higher frequencies, and replacement and expansion of the mixed and obsolete long-distance Wairarapa and Manawatū train fleets with new low emission trains to reduce rail emissions and provide system bridging capacity in first decade.
- **Network resilience and operational flexibility upgrades**, including improvements to slopes, bridges, culverts, track infrastructure, areas subject to sea level rise and storm surge, and operational patterns and maintenance, which will make the Wellington rail system safer and more resilient, particularly in the face of climate change, and ensure that it can recover quickly when events occur to minimise customer impact.
- **Wellington throat capacity improvements**, including a fourth main to enable the operational separation of Hutt and Kāpiti services, northern access to EMU stabling, and separated access to the Wellington freight terminal, which will significantly reduce conflict between passenger and freight services and improve network and service resilience and reliability.
- **Full duplication between Pukerua Bay and Paekakariki** (North-South Junction), a key single-track constraint with several tunnels, and addition of a third main in the Porirua-Tawa area, which will enable higher passenger frequencies and improve service resilience and reliability on the Kāpiti Line. This will make rail a more attractive travel option on that line, where population growth is expected to be highest, and ensure continued freight access to the network as passenger frequencies increase.
- **Duplicated approach to the Waikanae Station**, including a bridge and second platform, which will reduce conflict between passenger and freight services, improve service resilience and reliability, and enable higher passenger frequencies on the Kāpiti and Manawatū lines.
- **Network resignalling**, which will remove restrictions on the number of peak hour services, safely enable future frequency improvements, and improve operational flexibility, resilience, and reliability.
- **Traction power upgrades**, including additional substations and wider enabling power network upgrades, which will overcome current limitations and enable higher future train frequencies.
- **Rail network segregation** at all places where reasonably practicable, including improved fencing and grade separation of pedestrian and vehicle level crossings, which will significantly improve safety and the experience of surrounding communities as frequencies increase.
- **Continuous improvement of systems, processes, and capability**, including improved asset management.

Figure 2: Key improvements

Table 3 shows the strong alignment of the preferred programme with the five investment objectives.

Table 3: Alignment with the investment objectives

Objective	Preferred Programme	Alignment
Support a sustainable future	• 34 per cent increase in peak hour passenger arrivals by 2032, and 82 per cent by 2052 (excluding long-distance), relative to 2019 • Expected mode shift to rail of between 14.2 per cent and 20.5 per cent by 2031, with a similar reduction in vehicle kilometres travelled (11.8 million km per annum in the latter case) • Mode shift related emission reductions of approximately 3 per cent (3,435 tonnes) per annum by 2031.	High
Provide capacity that supports access and growth	• EMU fleet expansion from 166 to 366 cars by 2048 • Long distance rolling stock fleet replacement and expansion from 32 to 88 carriage equivalents by 2028 • Continued access and increased reliability for freight services.	High
Attractive and easy to use	• Progressive increases in frequency from 3 trains per hour (tph) to 10 tph at most stations in peak periods by 2042 • Increase from 3 to 4 tph at most stations in off-peak periods • Station accessibility and customer experience improvements, including improved shelter at all stations, improved cycle facilities at 38 stations, improved disabled access at 21 stations, community hubs/facilities at 13 stations, improved bus connection facilities at 10 stations, active modes change facilities at 10 stations, and maintenance to prevent flooding and improve attractiveness.	High
Adaptable to disruptions	• Improved network infrastructure and operations to minimise the likelihood and effect of disruption and mitigate climate change impacts • Removal of bottlenecks, track changes, and a new signalling system to reduce conflict between trains, improve flexibility and reliability, and aid recovery from events • Annual resilience benefits of $9.1m by 2032 and $17.9m by 2052.	High
Improve safety for all	• New signalling system to provide modern engineering control and significantly reduce the likelihood of train collisions • Grade separation of 15 road level crossings to remove the risk of collision between trains and vehicles • Grade separation of 6 pedestrian level crossings to remove the risk of collision between trains and pedestrians • Improved fencing to reduce risk of accidental track access.	High

The final programme has a BCR range of 1.1 to 1.5 (with a sensitivity range of 0.9 to 1.8), based on discounted economic benefits of between $4,430m (lower patronage) and $5,760m (higher patronage), and discounted economic costs of $3,880m, over the 60-year evaluation period. Benefits are split across wider economic (24 per cent), road user (20 per cent), public transport user (19 per cent), land use (18 per cent), rail freight (14 per cent), and other benefits (6 per cent). The programme has a recommended National Land Transport Programme priority order rating of 2, based on the BCR range, a very high Government Policy Statement on Land Transport Alignment rating, and a high Scheduling rating.

Financial Case

The expected (P50) preferred programme cost and revenue estimates are shown in Table 4, for the initial four three-year planning cycles of the programme, the remaining period, and the overall programme. Around 69 per cent of capital costs relate to below rail infrastructure (rail network infrastructure and network segregation), and 25 per cent to rolling stock (train fleet expansion and replacement). The balance relates to above rail infrastructure (station, station precinct, and station access improvements). The 95th percentile (P95) cost is 57 per cent higher at $15,629.7m reflecting a similar increase in the capital cost P95 estimate.

Table 4: Expected programme cost and revenue estimates (2022 $m)

Category	2021-24	2024-27	2027-30	2030-33	2033-52	Total
Capital	$27.6	$504.1	$1,269.7	$1,380.5	$4,164.2	**$7,346.1**
Network Maintenance	$89.6	$147.5	$137.3	$153.3	$1,031.6	**$1,559.3**
Service Operating	$174.0	$261.7	$279.7	$308.2	$2,383.8	**$3,407.4**
Fare Revenue	($113.1)	($179.3)	($192.9)	($210.6)	($1,686.8)	**($2,382.7)**
Total Net Cost	**$178.1**	**$734.0**	**$1,493.8**	**$1,631.4**	**$5,892.8**	**$9,930.1**

Figure 3 outlines the annual and accumulating P50 capital costs of the programme, showing the large amount of up-front investment in enabling infrastructure that is required in the first half of the programme, particularly between 2027-28 and 2035-36. The timing and scale of service level improvements and associated train fleet requirements will be able to be accelerated or decelerated depending on government priorities and the level of demand once this infrastructure is in place, taking account of relevant lead times, providing some flexibility.

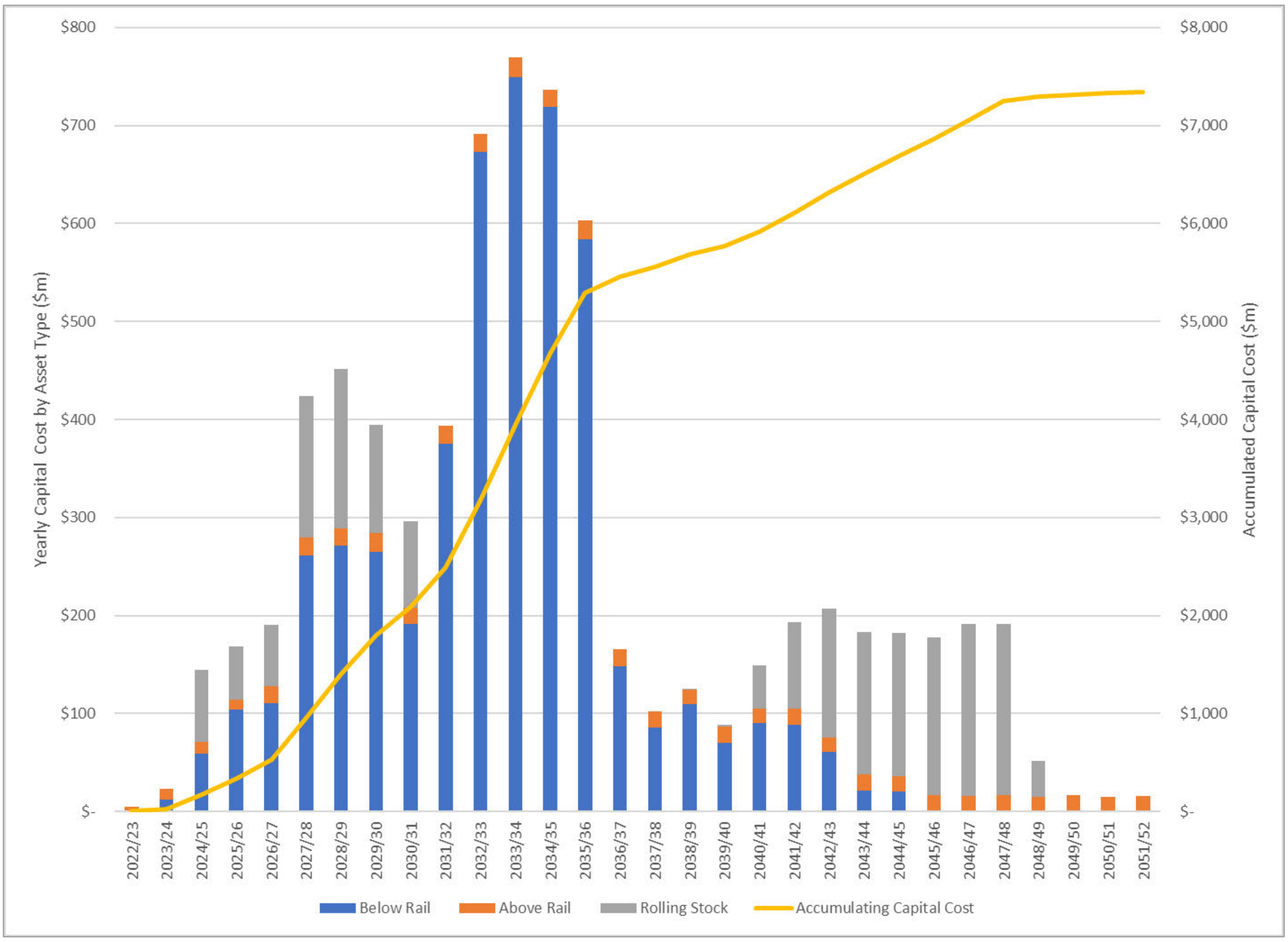

Figure 3: Annual and accumulating capital costs by asset type (2022 $m)[1]

Funding arrangements have not been confirmed, but it is expected that contributions will come from passenger fares, regional council and territorial council rates and debt funding, the National Land Transport Fund through Waka Kotahi, Crown funding, the Climate Emergency Response Fund, new policy and regulatory approaches such as congestion

[1] Below rail capital costs relate to KiwiRail network infrastructure. Above rail capital costs relate passenger-focused fixed infrastructure. Rolling stock capital costs relate to the trains that operate on the network.

charging, and potentially public private partnerships. Below rail capital improvement costs are substantial, and it is recommended that these are fully funded by Waka Kotahi and/or the Crown, as those assets are owned by KiwiRail (and therefore ultimately by the Crown), and the North Island Main Trunk railway, where most network infrastructure improvements are required, is a strategic freight corridor of national significance. GWRC will need to bear a significant share of the remaining costs (for train fleet and station improvements, and service operations), which are unaffordable for that council through current standard funding arrangements. The contribution of each funding source will be determined by subsequent business cases and depend on the type of activity and funding body.

Commercial Case

Projects within the preferred programme range significantly in scale. Large investments will likely progress to indicative followed by detailed business cases, allowing a range of alternatives to be explored before determining the most appropriate investment. Relatively simple programme elements will be assessed through single stage business cases. Single specific investments, such as the train replacement will be progressed through detailed business cases. Each future business case will detail the procurement approach for the programme element that it is delivering, and, as appropriate, the approach to consenting (which will primarily apply to below rail capital projects) and risk sharing.

Management Case

It is proposed that a new Wellington Rail Programme Governance Group will oversee delivery of the overall programme on an ongoing basis. This group will be responsible for delivering the programme in accordance with the timelines outlined in Figure 4, ensuring coordination between programme components (e.g. network infrastructure, rolling stock, stations), managing programme risks, and achieving the benefits and outcomes outlined in this PBC. It will consist of GWRC (Chair and member), KiwiRail (member), Waka Kotahi (member), Metlink rail service operator (observer), and Ministry of Transport (observer). Regular reporting to the Wellington Regional Leadership Committee and Regional Transport Committee will ensure that iwi, territorial councils, and road controlling authorities are kept informed, and provide the means for determining the degree of their involvement at the programme and individual project levels.

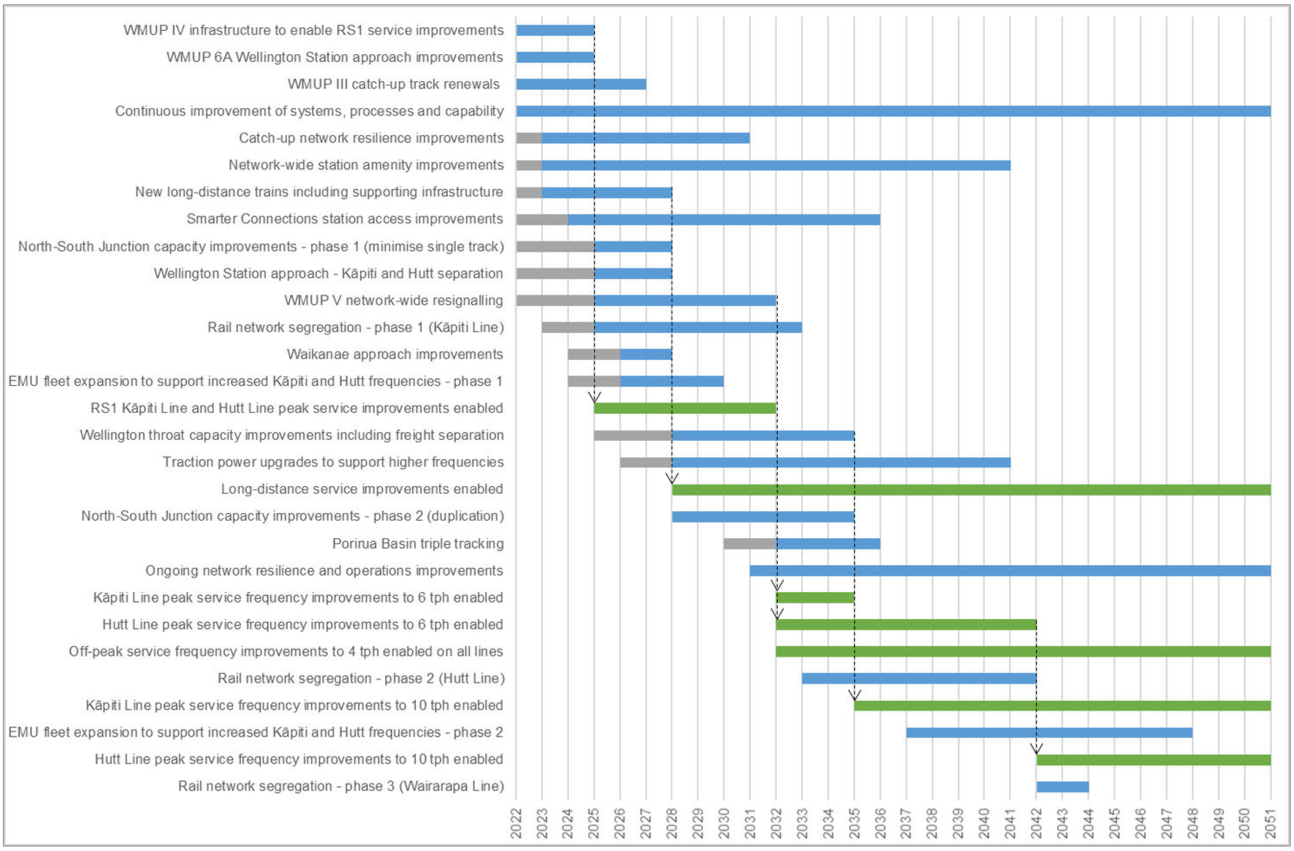

Figure 4: Outline programme plan[2]

Particular programme risks that will need to be managed relate to demand (and the location and scale of growth), financial elements (funding availability and cost variability), planning requirements for improvements to physical

[2] Grey relates to planning and business case timelines, blue to implementation timelines, and green to service improvements. Key dependencies are denoted by arrows.

infrastructure, delivery (lead times and programme interdependencies), and other risks such as policy priority (particularly in relation to the degree of emphasis given to road investment).

Next Steps

This PBC provides a clear investment pathway for the region's rail system over the next 30 years, which will enable achievement of important regional and national growth and environmental policy objectives and provide significant value for investors. It is therefore recommended that decision-makers:

- Approve the overall investment programme as outlined in this business case, and commit to the associated investment requirements and timeframes, subject to the outcome of further business cases and other investigations
- Approve funding of the first three-year stage of the programme, which includes a series of further business cases and other investigations that will determine the optimal solution for and timing of key elements of the programme, particularly the below rail capital components on which the remainder of the programme is dependent
- Approve funding for implementation of the investment proposal outlined in the Lower North Island Rail Integrated Mobility Detailed Business Case, which is a key first decade element of this programme that reduces rail emissions and provides essential system bridging capacity to support growth and mode shift in the short term
- Confirm governance arrangements for delivery of the programme through a new Wellington Rail Programme Governance Group.

Contents

List of Tables

List of Figures

List of Appendices

Abbreviations

Abbreviation	Full Name
ATP	Automatic Train Protection
BCR	Benefit Cost Ratio
DBC	Detailed Business Case
EMU	Electric Multiple Unit
ETCS	European Train Control System
FAR	Funding Assistance Rate
FY	Financial Year
GPS	Government Policy Statement on Land Transport
GWRC	Greater Wellington Regional Council
GWRL	Greater Wellington Rail Limited
HRC	Horizons Regional Council
IBC	Indicative Business Case
ILM	Investment Logic Map
IPM	Investment Prioritisation Method
iReX	Interisland Resilience Connection
IVT	In-Vehicle Time
NSJ	North-South Junction
KPI	Key Performance Indicator
LGWM	Let's Get Wellington Moving
LNIRIM	Lower North Island Rail Integrated Mobility
m	Million
MCA	Multi-Criteria Analysis
MOT	Ministry of Transport
NIMT	North Island Main Trunk
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NPS-UD	National Policy Statement on Urban Development
NPV	Net Present Value
NZRP	New Zealand Rail Plan
NZUP	New Zealand Upgrade Programme
P50	Expected Estimate
P95	95^{th} Percentile Estimate
PBC	Programme Business Case
RGF	Regional Growth Framework
RLTP	Regional Land Transport Plan
RMA	Resource Management Act
RMSP	Regional Mode Shift Plan
RPTP	Regional Public Transport Plan

RNIP	Rail Network Investment Programme
RRP	Regional Rail Plan
RS1	Rail Scenario 1
SH	State Highway
SPAD	Signals Passed at Danger
SSBC	Single Stage Business Case
TOD	Transit Orient Development
tph	Trains per hour
Waka Kotahi	Waka Kotahi NZ Transport Agency
WMRN	Wellington Metro Rail Network
WMUP	Wellington Metro Upgrade Programme
WTAU	Wellington Transport Analytics Unit
WTSM	Wellington Transport Strategic Model
%	Per Cent

Glossary

Term	Definition
Above Rail	Passenger focused infrastructure and activities, which is the responsibility of GWRC, such as shelter, seating, lighting, signage, and CCTV
Below Rail	Network infrastructure and activities, which is the responsibility of KiwiRail, such as track, overhead power supply, signals, and platforms
Rail Network	The physical infrastructure that enables the use of rail, such as track, overhead power supply, signals, and platforms
Rail System	All aspects relating to the user interaction with rail, such as the network, rolling stock, and stations
Rolling Stock	The trains that operate on the network, including EMUs, dual and tri-mode multiple units, and locomotive-hauled carriages and wagons
Transport Network	The physical infrastructure enabling transport including all modes (road, rail, active)
Transport System	All aspects of how users interact with the transport network

1 Introduction

This Wellington Rail Programme Business Case (PBC) has been prepared by Stantec New Zealand and Greater Wellington Regional Council (GWRC). It sets out a new customer-driven strategic plan for the region's rail system for the next 30 years, outlining what is required beyond current investment to achieve a vision of a rail system that provides:

> **Safe, customer focused and efficient rail passenger and freight services, and supporting infrastructure, to drive the region's economic development and social wellbeing in an environmentally and socially sustainable and resilient manner**.

The PBC has been developed collaboratively by the following project partners and key stakeholders, who are represented on the project steering group:

- GWRC, which is responsible for regional economic development, strategic transport planning and provision of public transport in the Wellington region, and owner of passenger train and 'above rail' infrastructure assets
- KiwiRail, the rail network owner ('below rail' infrastructure assets) and access provider, operator of rail freight and long-distance rail passenger services, and owner of associated train and infrastructure assets
- Transdev Wellington Ltd (Transdev), the incumbent Metlink rail service operator for GWRC
- Waka Kotahi NZ Transport Agency (Waka Kotahi), the Government's transport investor and state highway network provider.

Further input has been provided by the following stakeholders:

- Horizons Regional Council (HRC), which is responsible for regional economic development, strategic transport planning and provision of public transport in the neighbouring Horizons (Manawatū-Whanganui) Region, reflecting the importance of inter-regional connections to both regions
- Ministry of Transport (MOT), which leads transport sector policy development, including the recent 'future of rail' policy development process
- Local councils within the Wellington region, which are responsible for local planning, and provision of local roads and pathways.

Figure 1-1 (following page) outlines the relationships between these stakeholders and the wider public in relation to the planning, funding and delivery of rail passenger services and infrastructure in the Wellington region (as at mid-2022).

The PBC has been developed following the Waka Kotahi Business Case Approach. It outlines the passenger services and infrastructure needed to respond to new challenges and deliver a modern transit system for the next three decades, and the network infrastructure required to support this system while also enabling a growing freight operation, both within the region and linking into the neighbouring Horizons Region. It therefore provides the investment pathway needed to achieve the long-term vision of the 2021 New Zealand Rail Plan in the region.

The PBC replaces the Wellington Regional Rail Plan (RRP)[1], which has delivered significant upgrades since 2009 to address previous underinvestment and provide some public transport service level and quality improvements. This investment programme has delivered substantial patronage growth and provided benefits to KiwiRail's freight operation but is now drawing to a close.

The document has the following structure:

- Chapter 2 describes the context in which the PBC has been developed
- Chapter 3 presents the strategic assessment of problems, benefits of investment and resulting investment objectives, to complete the strategic case for investment
- Chapter 4 outlines the key constraints, dependencies, and assumptions that have shaped the project and development of the options
- Chapter 5 outlines option development, including intervention development, packaging into programmes, and initial assessment of the long list to determine a short list of programme options
- Chapter 6 outlines the short list of programme options and the assessment process to determine the preferred programme
- Chapter 7 outlines the preferred programme in further detail and provides economic assessment of it, to complete the economic case for investment
- Chapter 8 outlines the financial case, including programme cost, funding sources, and funding risks

[1] Note that this PBC was initially intended to underpin a new iteration of the Regional Rail Plan. Some appendices to it therefore use the RRP title but relate to this business case not the previous RRP.

- Chapter 9 outlines the commercial case, including the procurement approach, capability of the market to deliver, potential for risk sharing, and consenting and property approaches
- Chapter 10 outlines the management case, including key roles and responsibilities, outline programme plan, and benefits management, and risk management.

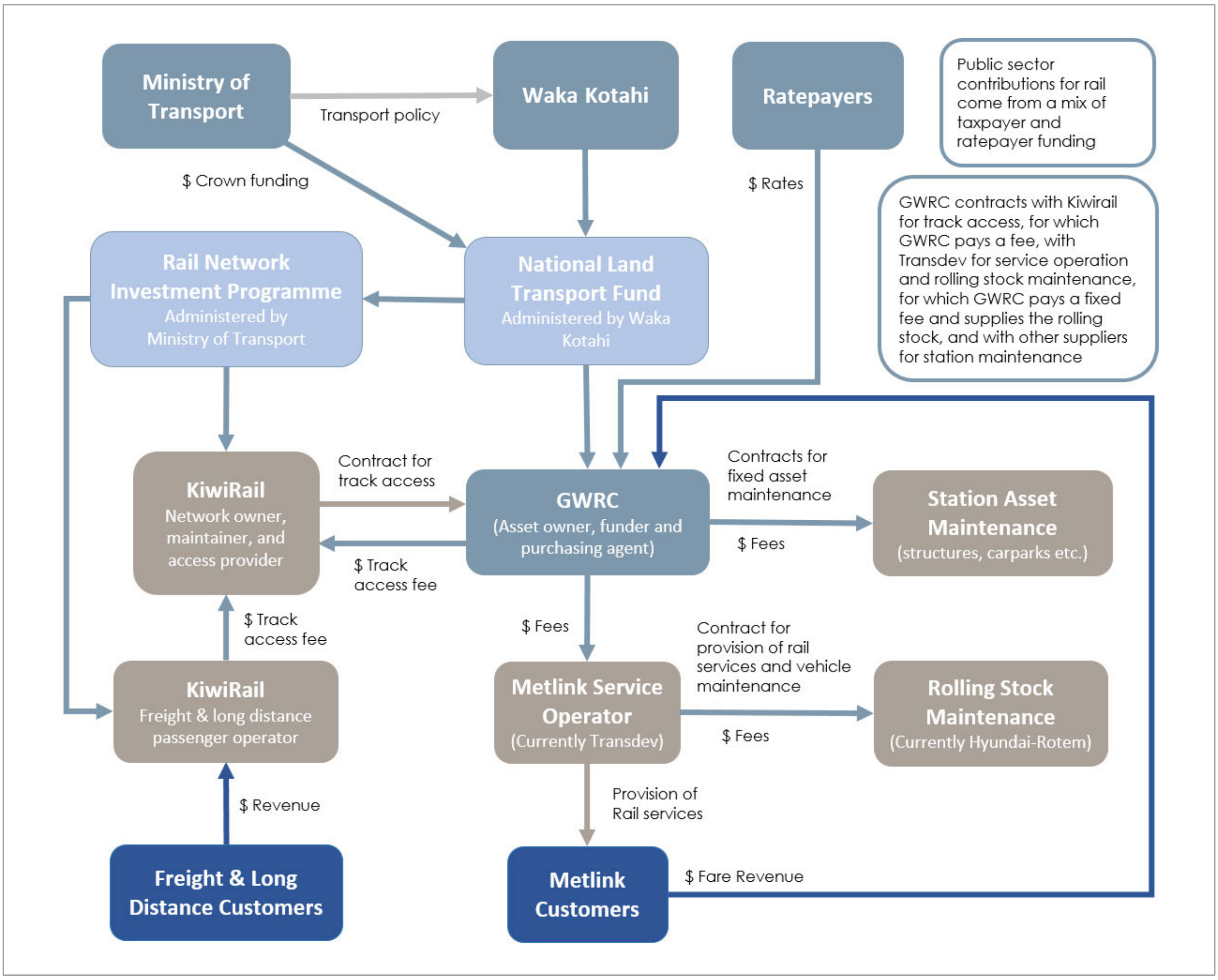

Figure 1-1: Wellington rail passenger planning, funding, and delivery relationships[2]

[2] With the release of the 2021-24 GPS, there are now several funding sources available through Waka Kotahi, indicated by the $ NLTF funding line in the table. Funding is further discussed in the Financial Case.

2 Programme Context

2.1 The Region's Rail System

Rail is a critical component of Wellington's transport system. It forms the backbone of GWRC's extensive Metlink network of bus, rail, and ferry public transport services north of the Wellington CBD, where three quarters of region's population lives, and provides a crucial link to the region and between the North and South islands, which is strategically important to the national transport system.

Metlink services radiate out over four key lines – the Johnsonville, Kāpiti, Wairarapa and Hutt lines, as well as the short Melling branch, which operates as a component of the Hutt Line and joins it just north of Petone. These lines collectively form the Wellington metro rail network (WMRN), which is shown schematically in Figure 2-1 along with the other lines that form part of the wider lower North Island rail system. The Kāpiti Line forms the southern portion of the North Island Main Trunk (NIMT) railway from Auckland, as does the section of line between Waikanae and Palmerston North (denoted on the map as the Manawatū Line). The Hutt and Wairarapa lines form the lower part of the Wellington to Woodville railway. Both lines converge just north of Wellington Station at Kaiwharawhara, creating a bottleneck and key constraint to rail operations, since all passenger services except those from the Johnsonville Line travel over it and all freight services use it to reach KiwiRail's freight terminal and the interisland connection. The Johnsonville Line joins the system at Wellington Station. Table 2-1 outlines the key characteristics of each line.

The Johnsonville, Kāpiti, Hutt and Melling lines were electrified using 1600V DC in stages between 1938 and 1955, with further extensions of the Kāpiti Line to Paraparaumu in 1983 and Waikanae in 2011, which has contributed strongly to the region's position as the least carbon-emitting[3]. Much of the associated infrastructure has required renewal over the last decade. Potential expansion of the electrified network beyond Upper Hutt and Waikanae as previously been investigated, but found to be unviable, although an increased focus on climate change and emission reduction has caused these decisions to be reconsidered in recent years. Electrified services utilise the two-car 'Matangi' FT/FP class electric multiple unit (EMU) fleet[4], 83 of which replaced the previous life-expired EMU fleet between 2010 and 2016, which will themselves require replacement from the mid-2040s.

The Wairarapa Line is not electrified beyond Upper Hutt, and services utilise a mixed fleet of 24 locomotive-hauled carriages (plus one luggage/generator van), which will require replacement in the next decade. These and the EMU fleet are owned by Greater Wellington Rail Limited (GWRL), a GWRC council-controlled organisation. GWRL also owns 'above rail assets' such as stations across the network. Metlink rail services are currently operated under contract by Transdev. Wairarapa Line locomotive haulage is provided by KiwiRail under a hook and tow arrangement.

Metlink rail services are heavily used, and patronage is growing strongly. Services carried 14.32m passengers in the 2019 financial year (FY)[5], a 20.6 per cent (%) increase over the 11.88m carried a decade earlier in the 2009 FY. This growth is nearly twice the population growth rate of 11.0 per cent over the period, reflecting growth on the corridors that the lines serve and investment over the decade, which has improved service capacity, quality, frequency, and reliability, and unlocked supressed demand. Year on year rail patronage growth was 5.7 per cent across all periods and 7.3 per cent at peak periods between the 2018 FY and 2019 FY. Strong growth continued into the 2020 FY prior to the impact of COVID-19.

Approximately 20,000 people typically use peak services each day. Most access the Wellington CBD, where 40 per cent of the region's 235,000 jobs are located[6]. Rail accounts for 22 per cent of all peak person trips to the CBD[7]. The share is much higher from the north, with, for example, 2013 census data showing that over 40 per cent of those who lived in Kāpiti and worked in Wellington CBD used rail. Census data also indicates that almost all of the net growth in commuter trips to the Wellington CBD between 2013 and 2018 was accommodated on rail, although growth was beginning to be constrained by capacity. No major changes are expected to employment distribution over the next 30 years.

KiwiRail's rail and passenger services also use the network – more than one hundred freight trains and sixteen inter-regional passenger trains in a typical week. The Kāpiti Line has a prominent role as a crucial link in the national freight network, connecting most parts of the North Island to local industry, international shipping, and the interisland ferry connection with the South Island. The tourist-focused thrice-weekly Northern Explorer from Auckland and the weekday peak Capital Connection commuter service from Palmerston North also use that line. The Wairarapa and Hutt lines[8] carry significant and growing forestry traffic between Waingawa near Masterton and CentrePort, with the latter line also providing access to KiwiRail's primary engineering facility at Gracefield.

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[3] Statistics New Zealand greenhouse gas emissions by region (industry and household) for the year ended 2018.

[4] Electric multiple units are self-propelled carriages that use electrical current drawn from overhead lines as motive power.

[5] Financial years in this document denote the 12-month period ending on 30 June of the year stated, so the 2019 financial year refers to the period between 1 July 2018 and 30 June 2019.

[6] Let's Get Wellington Moving, Programme Business Case Report, June 2019.

[7] GWRC, Wellington City CBD Cordon Survey: An Overview of the findings (2000-2018), November 2018.

[8] KiwiRail refers to the whole line as the Wairarapa Line. Metlink operates Wairarapa and Hutt services separately, although they combine to provide higher services levels at some stations. They are thus referred to separately here.

Figure 2-1: Wellington rail system

Table 2-1: Summary of characteristics by line

	Johnsonville Line	Kāpiti Line	Wairarapa Line	Hutt Line (incl. Melling Line)
Length	10.5 km	55.4 km to Waikanae (NIMT continues to Palmerston North and Auckland)	58.6 km north of Upper Hutt (line continues to Woodville but the Masterton-Pahiatua section is not currently used by scheduled services)	Hutt 32.4 km Melling 3.0 km from Petone
Service area population (30 June 2019)[9]	50,000	125,000 (plus 130,000 north to Palmerston North)	48,000	155,000
Stations (excluding Wellington Station)	8	13	8 (also stop at 3 Hutt stations)	18 (16 Hutt and 2 Melling)
Stations with park and ride facilities	5	11	5	12 (11 Hutt and 1 Melling)
Peak service level at Wellington (each way)	4 per hour	7 per hour	3 per day	6 Hutt and 3 Melling per hour
Interpeak service level (each way)	2 per hour	3 per hour	2 per day	3 Hutt and 1 Melling per hour
Annual patronage (2019 FY)	1.46m	6.01m	0.78m	6.08m
Patronage change over decade (2019 vs 2009 FY)	15%	33%	15%	12%
Avg. daily morning peak patronage (June 2019)	1,743	7,826	1,252	8,468
Morning peak patronage change (2019 vs 2009)	11%	29%	24%	16%
KiwiRail passenger services per weekday[10]	-	3	-	-
Freight services per 24-hour mid-week period[11]	-	14	4	4 (from Wairarapa)
Track arrangement	Single track with passing loops	Double track other than 3.5 km single track section between Paekākāriki and Pukerua Bay, and 1.0 km single track at Waikanae	Single track with passing loops north of Upper Hutt (services use double track the Hutt Line south of Upper Hutt)	Hutt Line double track Melling branch single track
Electrification Status	Electrified	Electrified to Waikanae – not electrified north of there	Not electrified	Electrified

[9] Statistics NZ subnational population estimates by territorial authority on 30 June 2019, combined with 2018 Census statistical area data for the rail-served areas of Wellington City.

[10] Includes the weekday peak Capital Connection from Palmerston North and alternating-day Northern Explorer from Auckland.

[11] Excludes shunting services.

2.2 Population Growth

The Wellington region was home to 547,000 people in mid-2021[12]. Around 39% reside in Wellington City, with the remaining 61% being dispersed in the surrounding Lower Hutt, Upper Hutt Porirua, Kāpiti and Wairarapa territorial council areas. Rail provides the primary public transport link between these areas, and particularly to the Wellington CBD, the economic engine of the region, where it has a significant transport system role as noted in Section 2.1.

Population is expected to grow significantly over the next 30 years. The 2021 Wellington Regional Growth Framework (RGF), a spatial plan developed by central government, local government, and iwi stakeholders, anticipates that the Wellington-Horowhenua region will need to accommodate an additional 200,000 people, a 35 per cent increase, and 100,000 jobs in the next 30 years. Three quarters of this growth is expected to occur to the north, along the eastern and western growth corridors north of the Wellington CBD, which extend to Masterton and Levin respectively along the primary rail corridors, as shown in Figure 2-2.

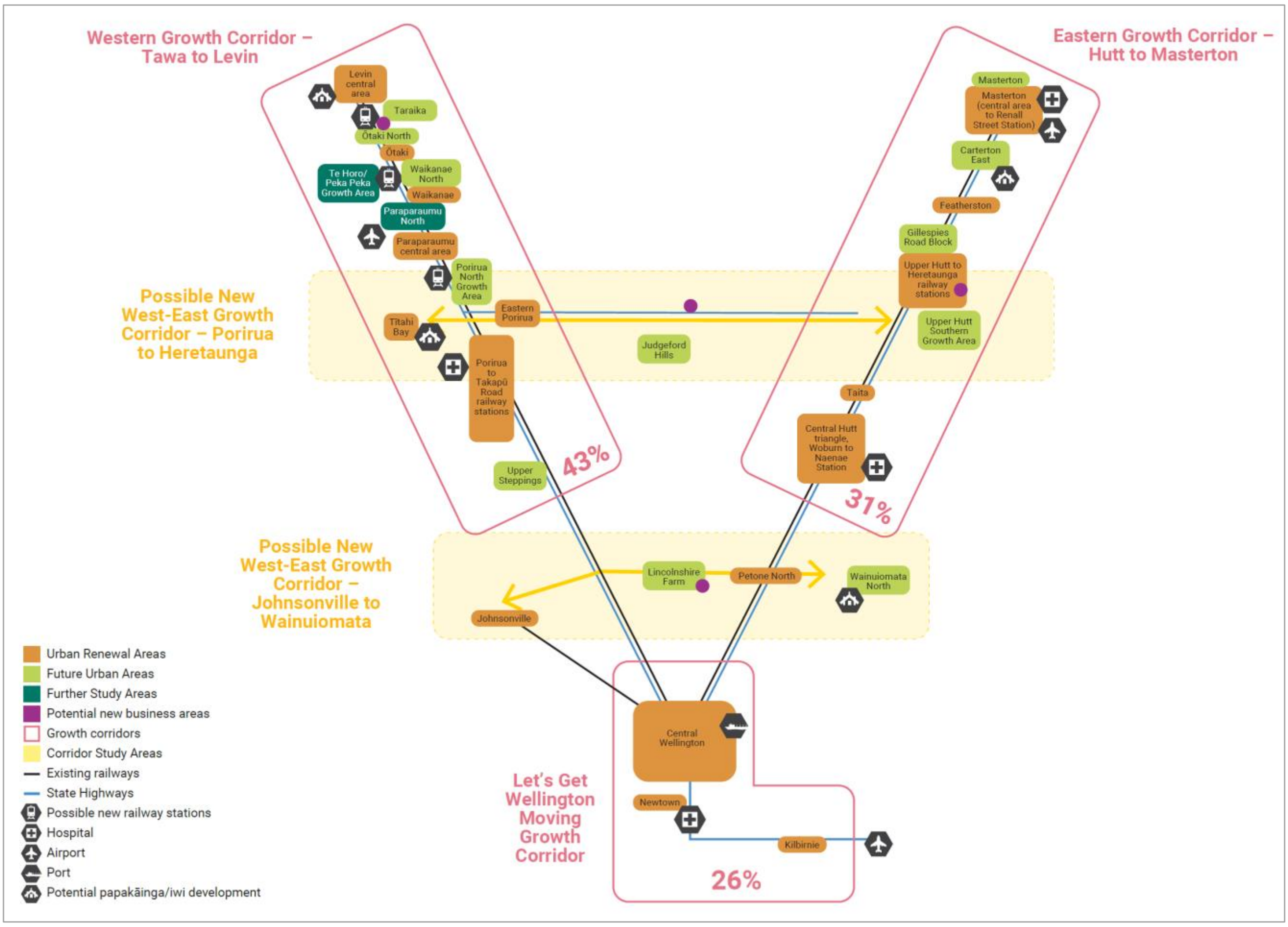


Figure 2-2: RGF growth corridors

Key RGF objectives that are relevant to this PBC include:

- Improving access to and between housing, employment, education, and services utilising all multi-modal transport choices
- Encouraging sustainable, resilient, and affordable settlement patterns/urban form that make efficient use of existing infrastructure and resources.

The RGF identifies rail, as a rapid transit service, as a key enabler of regional growth that enables a high degree of transport and land use integration through intensification around railway stations and improved connections to stations. Such intensification is required under the National Policy Statement on Urban Development (NPS-UD, see Section 2.4.6. This growth will include a mix of greenfield and brownfield developments, many of the latter being high-density developments in the seven major regional centres and medium-density developments at nodes such as railway stations.

The RGF recognises that rail capacity upgrades will be necessary to enable and meet the resulting demand, and its development informed and was informed by the development of this PBC. It identified access improvements at

[12] Statistics NZ subnational population estimate at 30 June 2021.

Wellington Station, elimination of the single-track section between Pukerua Bay and Paekākāriki and service improvements north of Waikanae as being key supporting elements.

In the medium term, population is forecast to grow by 72,400 or 14 per cent between 2018 and 2036, the majority outside of Wellington City as shown in Table 2-2. This business case takes particular note of the RGF and Let's Get Wellington Moving (LGWM) forecasts[13], due to the integrated planning nature of the RGF (see below) and the likely impact of LGWM on mode shift.

Table 2-2: Medium term regional population growth forecasts

	2013 (Census)	2018 (Census)	2036 RGF		2036 LGWM Do-Minimum	
			Abs	% Diff	Abs	% Diff
Wellington City	200,300	211,500	230,700	9%	240,800	14%
Northern Suburbs only[14]	64,100	67,600	76,300	13%	78,100	16%
Lower Hutt	101,100	107,600	119,600	11%	116,600	8%
Upper Hutt	41,400	45,300	63,100	39%	47,300	4%
Porirua	53,700	58,700	64,400	10%	79,400	35%
Kāpiti	50,700	55,400	70,000	26%	62,600	13%
Wairarapa	42,400	46,700	49,800	7%	50,900	9%
Region	**489,600**	**525,200**	**597,600**	**14%**	**597,600**	**14%**

These forecasts show how population change is likely to impact rail customer demand. Table 2-3 provides further detail, outlining expected population growth by line and travel time to 2036 and 2051. It shows that a large proportion of anticipated growth is expected to occur in areas of the region with longer rail journey times. This has implications for the level of demand, the capacity required in response, and consequently the number of trains required to provide an adequate level of service for all customers. The table was prepared before the Resource Management (Enabling Housing Supply and Other Matters) Amendment Bill was announced and passed. This will enable intensification in all developed areas. However, its impact may be more significant in areas along the rail corridor, due to the ease of access that rail provides from these areas to the Wellington CBD.

Figure 2-3 shows the location of future growth areas along the rail corridors as proposed in the RGF. It also notes the journey time to the Wellington Station where this growth occurs in relation to the 30 minutes travel barrier. This distinguishes between shorter trips where standing is more acceptable to longer ones where there is a greater desire for all passengers to be seated.

[13] For later analysis, the RGF forecasts were given priority over the LGWM D-Minimum forecasts, as the LGWM forecasts were predicated on minimal investment.

[14] Wellington northern suburbs – a subset of the overall Wellington City population figure.

Table 2-3: Population growth by rail line and travel time

Area or Line and Travel Time Increment	Population – Actual		Population – Forecast		Actual Population Growth 2013-2018	Forecast Population Growth 2018-2051	Actual Average Annual Population Growth 2013-2018	Forecast Average Annual Population Growth 2018-2051
	2013	2018	2036	2051				
Johnsonville Line	36,154	38,841	42,542	45,150	2,687	6,309	1.49%	0.49%
Palmerston North-Ōtaki	96,472	103,985	124,835	138,336	7,513	34,351	1.56%	1.00%
Kāpiti	46,631	50,175	67,512	83,907	3,544	33,732	1.52%	2.04%
Manawatū-Kāpiti (over 30 min)	***143,103***	***154,160***	***192,347***	***222,243***	***11,057***	***68,083***	***1.55%***	***1.34%***
Plimmerton-Porirua-Tawa	63,391	67,593	80,022	84,987	4,202	17,394	1.33%	0.78%
Manawatū-Kāpiti (under 30 min)	***63,391***	***67,593***	***80,022***	***84,987***	***4,202***	***17,394***	***1.33%***	***0.78%***
Wairarapa	42,601	48,700	51,881	58,580	6,099	9,880	2.86%	0.61%
Upper Hutt-Taita	57,074	60,377	64,836	71,952	3,303	11,575	1.16%	0.58%
Wairarapa/Hutt (over 30 min)	***99,675***	***109,077***	***116,717***	***130,532***	***9,402***	***21,455***	***1.89%***	***0.60%***
Taita-Petone	72,832	75,539	82,128	88,462	2,707	12,923	0.74%	0.52%
Melling	9,351	9,416	10,436	11,096	65	1,680	0.14%	0.54%
Wairarapa/Hutt (under 30 min)	***82,183***	***84,955***	***92,564***	***99,558***	***2,772***	***14,603***	***0.67%***	***0.52%***
All lines (over 30 min)	*242,778*	*263,237*	*309,064*	*352,775*	*20,459*	*89,538*	*1.69%*	*1.03%*
All lines (under 30 min)	*181,728*	*191,389*	*215,128*	*229,695*	*9,661*	*38,306*	*1.06%*	*0.61%*
Wellington	151,397	163,152	184,902	207,173	11,755	44,021	1.55%	0.82%

Figure 2-3: Congested roads and growth areas

2.3 Regional Planning Context

The PBC is informed by a mixture of regional transport, development, and growth plans and strategies. Many of these set mode shift targets or direct transport investment to support growth. Their relevance to the PBC and implications for it are discussed in the following sections.

2.3.1 Regional Land Transport Plan (2021)

The Wellington Regional Land Transport Plan (RLTP) is a statutory document developed for the Regional Transport Committee, which provides higher-level strategic direction for the region's land transport. The current RLTP was issued in June 2021.

The RLTP includes a thirty-year vision for the regional land transport system, which the PBC's vision is closely linked to. This is:

> **A connected region, with safe, accessible, and liveable places – where people can easily, safely, and sustainably access the things that matter to them – and where goods are moved efficiently, sustainably, and reliably**.

The RLTP strongly supports further investment in the region's rail system. It notes the importance of rail for both passenger and freight movement in the region, being an efficient way to move large numbers of people and bulk freight over longer distances. Its role in reducing greenhouse gas emissions and improving transport system resilience (by providing both a modal alternative and system capacity) is highlighted.

The RLTP set three ambitious targets to achieve by 2030, which the region's rail system will be key to enabling given its key role within the region's transport system:

- Carbon emission – 35 per cent reduction in transport-generated emissions
- Safety – 40 per cent reduction in deaths and serious injuries on the region's roads
- Mode share – 40 per cent increase in active travel and public transport mode share.

These targets do not include allowance for land use changes through the RGF.

The RLTP outlines five thirty-year strategic objectives, which are all relevant to the PBC, and the benefits of investment and investment objectives described in Chapter 3:

- People in the Wellington Region have access to good, affordable travel choices
- Transport and land use are integrated to support compact urban form, liveable places, and a strong regional economy
- People can move around the Wellington Region safely
- The impact of transport and travel on the environment is minimised
- Journeys to, from and within the Wellington Region are connected, resilient and reliable.

The RLTP outlines five ten-year transport investment priorities, which are also relevant to the PBC:

- Build capacity and reliability into the Wellington Region's rail network and the Wellington City public transport network to accommodate future demand
- Make walking, cycling and public transport a safe and attractive option for more trips through the region
- Improve access to key regional destinations, such as ports, airports and hospitals for people and freight
- Improve safety, particularly at high-risk intersections and on high-risk rural and urban roads
- Build resilience into the region's transport network by strengthening priority transport lifelines and improving the redundancy in the system.

The RLTP indicates a commitment to continue to build on the region's established rail system and prioritises five significant rail projects within the current investment programme, which have been included in most programme options in later parts of this business case. Long distance rail services (end-of-life rail signal system replacement, Manawatū and Wairarapa line fleet renewal and service increase, additional network capacity improvements), national ticketing system, additional metro (electrified) rolling stock to meet future capacity requirements, rail capacity step change (10-minute timetable), resilient port and multi-user ferry terminal access are top 10 priority projects. An additional five significant activities (top 39) are related to rail.

2.3.2 Regional Public Transport Plan (2021)

The Wellington Regional Public Transport Plan (RPTP) is a statutory document developed by GWRC, which identifies the public transport services that are integral to the region's public transport network, and the policies, procedures, information, and infrastructure that support them. The current RPTP was issued in July 2021 and outlines the ten-year strategic focus, with particular attention on the current three-yearly operational cycle.

The RPTP identifies the purpose of the core rail routes as being to provide high-capacity, long-distance, time-competitive commuter services connecting key urban areas across the region. The RPTP strongly supports further investment in the region's rail system, setting out initiatives to:

- Implement the Wellington Regional Rail Strategic Direction[15] investment pathway of rail service, rolling stock and infrastructure improvements for the region
- Increase peak rail timetable frequency up to ten-minutes where practicable by 2030
- Explore ways to further decarbonise the Metlink rail fleet by procuring and delivering new Lower North Island regional rail trains
- Monitor and manage Greater Wellington assets in accordance with the Greater Wellington Public Transport Asset Management Plan
- Require operators to provide for the safe carriage of micro-mobility devices on appropriate rail services
- Work with local councils to develop station access plans to improve accessibility of train stations, subways, and underpasses.

The RPTP notes that KiwiRail's Capital Connection is an exempt service under the Land Transport Management Act. However, it has received public subsidy since 2015, and a 2019 business case recommended that the service be integrated into the Metlink network, to both reflect the subsidy and enable economies of scale and scope. No formal decision has been made on this.

2.3.3 Regional Mode Shift Plan (2020)

The Wellington Regional Mode Shift Plan (RMSP) was developed by Waka Kotahi, councils across the Wellington region, and KiwiRail, and completed in September 2020. It seeks to improve active mode and public transport uptake by 40 per cent by 2030, which equates to a 45 per cent mode share, reflecting the RLTP target.

The RMSP action plan highlights that:

- Strong recent rail patronage growth has reflected rail catchment population growth and investment in improvements in infrastructure, rolling stock, and services that have improved service quality, frequency, and reliability
- Continued rail patronage growth has created capacity issues, with seated capacity and park and ride capacity generally being reached between 7:00 and 7:30 am, from Waterloo on the Hutt Line and from Porirua on the Kāpiti Line. Some current potential passengers are already being deterred from using rail because of these capacity constraints.

The RMSP presents three key levers for improving mode shift within the region:

- Shaping urban form
- Making shared and active modes more attractive
- Influencing demand and transport choices.

Investment in the rail system is a 'making shared and active modes more attractive' lever.

The RMSP notes that, historically, the growth resulting from major public transport investment has tended to be underestimated. It uses the investment in the Matangi trains as a case study, noting that:

- The original business case for new Matangi trains in Wellington used a base growth rate of 1.7 per cent with sensitivity testing at 2.7 per cent and 0.7 per cent. This equals a 17 per cent increase between 2009 and 2019 with sensitivity testing at 27 per cent and 7 per cent growth
- Patronage growth on the electrified sections of the Hutt, Johnsonville and Kāpiti Lines increased by 21 per cent to 13.5m boardings in the 2019 financial year, reaching seated capacity on these lines
- Electrified area patronage growth has been most significant at the peak, with Hutt Line, Johnsonville Line, and Kāpiti Line average daily morning peak patronage increasing by 16 per cent, 11 per cent and 29 per cent respectively between mid-2009 and mid-2019.

The RMSP target requires substantial increases in rail patronage. Mode shift will require the rail system to be attractive and convenient to use and have sufficient capacity to encourage residents to forego private vehicle for most of their trips. The RMSP will consequently necessitate reconsideration of some medium to longer-term projects that may need to be brought forward and implemented earlier than previously expected.

[15] The Wellington Regional Rail Strategic Direction provided early signals from this PBC to inform transport and local government planning processes. The RPTP therefore commits to implementing this PBC.

2.3.4 Regional Rail Plan (2013)

GWRC's Regional Rail Plan has provided for the long-term development of the Wellington rail system over the last thirteen years, supplementing the statutory RLTP and RPTP. It has been through two iterations, having been first developed in 2009 and subsequently revised in 2013.

The 2009 RRP identified a preferred investment pathway based around what is known as Rail Scenario 1 (RS1). This provided for increased passenger capacity, reliability and frequency, and freight capacity and speed, with subsequent potential steps to further improve frequency, capacity, journey time and reach based on demand. The current 2013 RRP refreshed RS1 to improve rolling stock utilisation and enable peak spreading. It also revised the implementation timeline.

The 2009 RRP and its 2013 revision have delivered significant improvements over the last ten years, including new Matangi EMUs, double tracking and electrification to Waikanae, track and signal upgrades, station upgrades, and increased park and ride capacity. Further improvements through the Wellington Metro Upgrade Programme (WMUP) have been recently completed or are due for completion within the next five years, as outlined in Section 4.2.1. These include:

- Renewal of traction overhead on Hutt Valley, Johnsonville and Kāpiti lines.
- Catch-up track renewals, formation and drainage upgrades, and slope stabilisation, a significant proportion of which is required to enable continued operation of the Wairarapa Line
- Capacity and resilience upgrades, including double tracking between Trentham and Upper Hutt, and Plimmerton turn back and Kāpiti Line traction power supply upgrade, which will enable implementation of the RS1 service improvements that maximise operational efficiency within the electrified area
- Wellington Station signalling and track layout changes for improved safety and capacity.

In combination, the improvements resulting from the 2009 and 2013 RRPs are making the Wellington rail system safer and more resilient than it was previously, and providing the capacity needed to keep pace with growth in the short term. However, many outstanding issues remain for the PBC to address as outlined in Section 3.1, so these improvements should be regarded as a starting point only.

This PBC provides a new strategic rail plan for the region that replaces and supersedes the RRP.

2.3.5 Let's Get Wellington Moving

The LGWM programme is a joint Wellington City Council, GWRC and Waka Kotahi initiative to deliver a transformational city-shaping transport programme for Wellington City. It focuses on the south and east of Wellington City, in the area from Ngauranga Gorge to Miramar, including access to the port, and connections to the central city, Wellington Hospital, and the airport.

The June 2019 draft LGWM PBC includes a range of active mode, public transport and road-based initiatives that are expected to substantially increase demand on the rail system, although their exact form is subject to further detailed business case assessment. The public transport initiatives include some form of rapid transit south of Wellington Station and assume implementation of proposed RS1 rail timetable improvements and related capacity enhancements. This will enhance cross-region public transport travel options and support mode shift but require development of the Wellington Station precinct to better enable connections between rail and bus/mass transit in a customer-friendly manner. LGWM is also looking at travel demand management initiatives, which will significantly impact rail demand if implemented.

Rail makes up the rapid transit system to the north of Wellington Station. It sits outside of the LGWM investment programme, as do all transport system elements north of Ngauranga Gorge, which is located just north of the Wellington CBD. The LGWM PBC assumed that there would be complementary and significant investment in rail capacity and service levels beyond RS1, which this PBC relates to, as this was seen as being necessary to enable and accommodate the expected demand generated by LGWM investment in the medium to long term. More recent LGWM work has not assumed the same uplift in rail capacity, however it is noted that the modelled rail patronage volumes cannot be carried by the existing rail system.

2.3.6 Road and Sea Investment

The main rail corridors are parallel to State Highways 1 and 2, which are planned and managed by Waka Kotahi. State Highway 1 has been the subject of significant investment over the last decade, as the Wellington Northern Corridor component of the previous Government's Roads of National Significance investment programme, which will provide a continuous motorway/expressway between Ōtaki and Wellington when complete in the early 2020s. This is expected to improve road capacity, travel times, safety, and resilience in the short to medium term, but increase urban development and population growth in the Kāpiti and Horowhenua districts, and road congestion at the Wellington end of the corridor.

State Highway 2 has been the subject of several investigations over recent years. The section north of Upper Hutt is the subject of ongoing safety-related improvements, but these are unlikely to significantly improve resilience (which is a significant issue on that road corridor) or meaningfully improve road capacity. A 2016 business case recommended a $1.4-$2.1 billion investment programme of road and rail capacity, travel demand management, safety, and resilience improvements on the Hutt Valley section, but the roading improvements are unlikely to be funded within the next ten years. These are focused on removal of at-grade intersections and are therefore unlikely to have a significant effect on congestion at the Wellington end of the corridor.

The Government's New Zealand Upgrade Programme (NZUP) announcement in early 2020 included $1.35 billion for road and rail improvements in the Wellington region, with roading investment including the new Ōtaki to North of Levin highway, State Highway 58 (SH58) Safety improvements and the construction of a grade separated interchange at Melling. The NZUP funding included $270 million for safety and capacity improvements north of Wellington Station, plus improvements to the Wairarapa line track and signalling, new train stabling sidings at Masterton, Levin and Wellington and short-term upgrading of the existing Capital Connection trains.

The interisland connection is also being improved by means of the Interisland Resilience Connection project (iReX). This involves the replacement of the current mixed three-strong Interislander fleet with two larger rail enabled ferries, and associated reconfiguration of both the Picton and Wellington ferry terminals. This project will improve the resilience and reliability of the interisland freight connection and could increase future rail freight demand.

2.3.7 Regional Sustainability

GWRC declared a climate emergency in August 2019, and formally established a target for the organisation to become carbon neutral by 2030, supporting this with a Corporate Carbon Neutrality Action Plan and Regional Climate Emergency Action Plan. Neither action plan makes specific reference to rail or public transport, but the latter includes actions to review GWRC's 2015 Climate Change Strategy, develop a regional carbon neutrality plan in conjunction with key stakeholders across the region, and embed emissions reductions targets in key programmes and projects to ensure the region contributes to the target of Net Zero New Zealand 2050. The PBC consequently has a sustainability objective with supporting key performance indicators (KPIs), as outlined in Section 3.3. This is also in line with indications from the RLTP, which seeks to reduce carbon emissions by 30 per cent, consistent with national targets.

The regional greenhouse gas emissions profile shows that land transport accounted for nearly 30% of the region's greenhouse gas profile in 2014-15. Rail is a key method to reduce transport related emissions for the region. This role of mode shift in is explored in Section 2.3.3. The emissions benefits are tied to both the problems and benefits of investment in the PBC.

2.3.8 Regional Resilience

The region's rail network and the services that run on it are lifelines from a Civil Defence perspective. The Wellington Lifelines Group, which represents 16 lifelines utilities, completed a PBC for accelerated infrastructure investment to address resilience vulnerabilities in October 2019.

The resilience PBC recommended that a (notional) $100m be invested in seismic upgrading of slopes and bridges along the Kāpiti Line, and Wairarapa Lines. This investment was additional to that currently committed through the WMUP but has not yet been funded. Further investment in the region's rail system through this Wellington Rail PBC will enable these resilience issues to be addressed.

2.4 National Planning Context

The PBC is informed by a mixture of policy direction, legislation, and plans developed under legislative direction. Many of these set mode shift targets or direct transport investment to support growth. Their relevance to the PBC and implications for it are discussed in the following sections.

2.4.1 Emissions Reduction Plan (2022)

The 2022 Emission Reductions Plan (ERP), Te Hau Mārohi Ki Anamata, sets the Government's direction for climate action for the next 15 years, providing strategies, policies, and actions for achieving the first emissions budget, as required by the 2002 Climate Change Response Act.

The ERP notes that transport is one of the country's largest sources of greenhouse gas emissions, being responsible for 17 per cent of gross emissions and 39 per cent of total domestic CO_2 emissions. It consequently includes several transport actions, including one to reduce reliance on cars and support people to walk, cycle and use public transport including by improving its reach, frequency, and quality, and making it more affordable for low-income people. This action includes a specific sub-action to improve the reach, frequency, and quality of public transport by delivering major service and infrastructure improvements in Auckland, Wellington, and Christchurch. Investment in the region's rail network is very complementary with this action.

The above action is supported by a target to reduce total kilometres travelled by the light vehicle fleet by 20 per cent by 2035 through improved urban form and providing better travel options, particularly in the largest cities. Rail journeys tend to be longer than on other public transport modes, and they are consequently more likely to substitute for car journeys, so investment in rail improvements can be expected to provide a significant contribution to this target.

2.4.2 New Zealand Rail Plan (2021)

The April 2021 New Zealand Rail Plan (NZRP) outlines the Government's vision and priorities for the national rail network. It is the first iteration of the NZRP. The NZRP is a non-statutory planning document, and an output of the recommendations of the Future of Rail review by the MOT, KiwiRail, Waka Kotahi, and Treasury, which sought to identify the role of rail in the transport system and a sustainable long-term funding approach. GWRC was engaged during this process.

The NZRP sets out a long-term vision for:

> **New Zealand's rail network to provide modern transit systems in our largest cities, and to enable increasing volumes of freight to be moved by rail**.

The PBC provides the investment pathway that enables this vision to be achieved for both public transport and freight within the Wellington region.

The NZRP is the first component in a new planning and funding framework. It sets out the Government's intentions for the first decade of investment needed to achieve a reliable, resilient, and safe rail network, and identifies two strategic investment priorities, both of which are relevant to this PBC:

- Investing in the national rail network to restore freight rail and provide a platform for future investments for growth
- Investing in the metropolitan rail networks to support growth and productivity in our largest cities.

The investment priorities informed the development of the 2021 GPS (see Section 2.4.4). However, with the vision, they point towards investment in rail capacity, reliability, resilience, and safety, which shows close alignment with four of the five PBC investment objectives outlined in Section 3.3 (sustainability is not identified as an investment priority, but it is identified as a rail benefit in the NZRP).

The NZRP identifies the following future opportunities for the WMRN and services to accommodate current growth and safety expectations in the medium term:

- New trains for the Wairarapa and Capital Connection and increased service frequency (including a new depot and Wairarapa Line capacity and safety upgrades)
- Signalling improvements and automated train protection
- Re-modelling rail approaches to Wellington Station to improve safety and add capacity
- Improvements to platforms and station facilities coupled with greater integration with other modes of transport.

Beyond that, the NZRP notes that, with growth and increased pressure on capacity, additional investment may need to be considered to:

- Reduce the length of the North and South Junction single track section on the Kāpiti Line between Pukerua Bay and Paekākāriki
- Provide an additional platform at Waikanae
- Replace and/or expand the EMU fleet
- Provide further grade separation
- Upgrade the Wellington Station passenger terminal and building.

The NZRP notes that electrification can be justified on high volume routes, and it indicates that the NIMT and the East Coast Main Trunk lines would benefit from electrification. This rationale would enable future conversations into electrification of the rail network north of Waikanae to take place under a different strategic context than previously. Electrification would potentially support several key strategic objectives such as decarbonisation, close one of the two non-electrified gaps in the NIMT, and provide improved operational efficiency and reduced operational costs for both passenger and freight. However, it would not resolve the issue of two separate electrification systems, with the WMRN utilising a 1600V DC system and the remainder using a 25kV AC system. KiwiRail is currently investigating further electrification.

2.4.3 Rail Network Investment Programme (2021)

The first Rail Network Investment Programme (RNIP) was approved by the Minister of Transport in June 2021, reflecting a new rail funding process outlined in the Land Transport (Rail) Legislation Act 2020. It outlines a 10-year investment programme for the rail network (below rail infrastructure) and was prepared by KiwiRail with input from GWRC and Auckland Transport in the metro areas.

The RNIP sets out planned rail network infrastructure maintenance, management, renewal, and improvement work for the national rail network over the three-year period from 2021-2024, along with forecast potential investment over the 10-year period from 2021-2031. Its focus, in line with the priorities set out in the NZRP, is:

- Investing in the national rail network to restore rail freight and provide a platform for future investments for growth, meaning:
    - a primary focus (and majority of spend) on the continuous programmes of maintenance, management, and renewal
    - a modest allowance for improvement projects to support resilience and reliability.

- Investing in metropolitan rail to support productivity and growth in New Zealand's largest cities, meaning:
  - a focus on completing the programmes that align with ATAP and the RLTPs
  - enhanced regional services (embedding the Hamilton to Auckland and Palmerston North to Wellington services).

The RNIP outlines the Wellington rail network infrastructure projects that are delivered through the WMUP (see Section 4.2.1), including track, structures, civils, signals, telecommunications, traction, and electrical, and active level crossings, as well as unplanned works and renewals. The current RNIP notes the funding application for network infrastructure improvements to enable a 10-minute timetable, noting the need for improvement of the Kapiti Line North-South Junction (NSJ) single track section, an additional platform at Waikanae, and level crossing and resilience upgrades. Investigations into resignalling and wider capacity improvements are included in the RNIP.

This PBC reflects the Wellington projects and programmes contained in the current RNIP. Future rail network infrastructure works that result from the PBC will be included in future RNIPs. It is noted that some aspects of the RNIP are included in the RLTP development process, highlighting their importance to the transport network.

2.4.4 GPS (2021)

The GPS outlines the Government's priorities and objectives for land transport investment. It is released every three years and informs the subsequent development of the National Land Transport Programme (NLTP).

The GPS has four strategic priorities:

- Safety: Developing a transport system where no-one is killed or seriously injured
- Better Travel Options: Providing people with better transport options to access social and economic opportunities
- Improving Freight Connections: Improving freight connections for economic development
- Climate Change: Developing a low carbon transport system that supports emissions reductions, while improving safety and inclusive access.

Transitional Rail has been removed as an activity class in the current GPS and replaced by a Rail Network activity class, which aims to improve freight network reliability. This change enables the GPS to deliver on the findings of the Future of Rail Review, which provides funding to KiwiRail to maintain and renew the national rail network. Additional Crown funding has been provided to support a reliable and resilient national rail network.

It is expected that much of the PBC programme will be funded from the Public Transport Infrastructure and Public Transport Services activity classes. However, some of the improvements will benefit other transport system users or have wider strategic justification and could be funded in whole or in part from other activity classes, particularly the Rail Network activity class. Funding is explored in the Financial Case in Chapter 8.

This investment proposal aligns to all objectives under the GPS 2021-31.

2.4.5 The National Land Transport Plan (2021)

The National Land Transport Plan is a six-year plan with a 10-year forecast, which is reviewed every three years. It informs the investment direction and responds directly to the GPS, including determining projects in accordance with the funding ranges for each activity class.

The National Land Transport Plan has four areas of focus for the Wellington Region, three of which are directly related to the PBC. These are:

- Providing better travel options: Improvements to public transport to sustainably support the region's growth
- Improving freight connections: Improvements to ensure the safety and reliability of rail corridors north of Wellington and the safety, access, and resilience to future Cook Strait freight and passenger growth
- Responding to climate change: Investments in public transport infrastructure and services to support mode shift to low carbon travel.

The National Land Transport Plan outlines six strategic responses to the GPS priorities in the Wellington Region, three of which include rail-related initiatives. These initiatives include improvements to the freight interchange at CentrePort, active and shared mode access to railway stations, and public transport.

2.4.6 National Policy Statement on Urban Development (2020)

The NPS-UD aims to ensure that New Zealand's towns and cities are well-functioning urban environments that meet the changing needs of communities. It removes overly restrictive barriers to development to allow growth 'up' and 'out' in locations that have good access to existing services, public transport, and infrastructure.

Key relevant requirements are:

- For local authorities to enable greater intensification in areas of high demand including city centres, metropolitan centres, town centres, and near rapid transit stops

- For the removal of minimum car parking rates from district plans.

A significant implication is that the NPS-UD enables public transport supportive intensification (to at least six storeys) around railway stations in the Wellington region where, in many cases, there is underutilised land available. In tandem with the elimination of minimum parking requirements, this should enable more people to live with fewer cars around railway stations in Transit Oriented Developments (TODs), which is expected to lead to reduced car use and increased public and active travel use.

2.4.7 Climate Change Response (Zero Carbon) Amendment Act (2019)

The Climate Change Response (Zero Carbon) Amendment Act was passed in 2019 and provides a framework by which New Zealand can develop and implement clear and stable climate change policies. The effect of these policies will contribute to the global effort under the Paris Agreement and allow New Zealand to prepare for and adapt to the effects of climate change.

The Act involves four key changes, being:

- Set a new domestic greenhouse gas emissions reduction target for New Zealand to:
  - Reduce net emissions of all greenhouse gases (except biogenic methane) to zero by 2050
  - Reduce emissions of biogenic methane to 24–47 per cent below 2017 levels by 2050, including to 10 per cent below 2017 levels by 2030
- Establish a system of emissions budgets to act as stepping-stones towards the long-term target
- Require the Government to develop and implement policies for climate change adaptation and mitigation
- Establish a new, independent Climate Change Commission to provide expert advice and monitoring to help keep successive governments on track to meeting long-term goals.

The obligation to reduce net emissions of all greenhouse gases to zero by 2050 is very relevant to investment in the region's rail system, as the Wellington passenger rail system predominantly utilises electric propulsion and it therefore provides significantly reduced emission form of transport for most users.

Ināia tonu nei: a low emissions future for Aotearoa, prepared by the new Climate Change Commission and tabled in Parliament in June 2021, provided advice to the Government on its first three emissions budgets and direction for its ERP. The demonstration path assumes a 60 per cent increase in the distance travelled by public transport in Wellington by 2030 (a passenger kilometre measure). The rail system will bear a significant share of this burden.

2.5 COVID-19

The enduring effects of the COVID-19 pandemic could be wide ranging, influencing land use, employment, trip rates and mode choice, but are yet to be fully understood.

COVID-19 has significantly affected public transport in the short term, due to travel and capacity restrictions, masking requirements and some associated fear of the virus in relation to public transport, and alternative working arrangements. However, Wellington rail patronage is recovering, and it is significantly better than in other Australasian cities, although it remains lower than similar periods in 2019 prior to the pandemic[16]. Waka Kotahi's assessment of the impact of COVID-19 on the land transport system did not expect significant change in the nature, scale, and location of transport demand over the medium to long-term in the Wellington region. The response to the Government's half price fares scheme and reduced pandemic restrictions gives confidence that patronage will recover as expected.

Given the above, and since this PBC sets the long-term strategic plan for Wellington rail investment, it has been assumed that the strategic direction will remain constant, although the timing of specific investments could be altered if patronage growth is lower than expected. The impact of COVID-19 on long term travel behaviour is identified as a risk and sensitivity tested in relation to the preferred programme.

[16] At time of writing, Wellington's rail patronage is around 75% of pre-COVID levels (higher for bus). In comparison, recent figures indicate patronage on Brisbane's core public transport corridors (train, busway, and light rail) is down by around 50%, as is Adelaide's rail patronage (discounting the effect of the full closure of one line for electrification). Auckland's rail patronage was lower at around 45% but has been significantly affected by urgent network repairs early in 2021 and the effects of the later lockdown.

3 Strategic Assessment

3.1 Problem Definition

The problems and benefits were identified at a facilitated Investment Logic Mapping (ILM) workshop with key stakeholders – GWRC, KiwiRail, Transdev, the Waka Kotahi, HRC, and the MOT – in April 2019, and subsequently refined and agreed with the Steering Group. The revised problem statements focus on barriers to achieving the mode share targets, safety, and resilience, as follows:

- **Inconsistent customer journey experience and limited rail system capacity result in the network being unable to meet mode share targets, which prevent achievement of growth and environmental obligations**
- **The current infrastructure is not capable of safely accommodating additional trains on the network preventing additional services, which are required to accommodate future demand**
- **The condition and configuration of the rail network makes it vulnerable to service disruptions, which has a flow on impact onto the wider transport system**.

The problems are weighted equally since they are interdependent. Fixing only one or two problems would have limited impact and prevent the rail system from achieving the benefits sought and the expanded role required by regional and national policies. The short timeframes associated with the mode share targets and the long lead times associated with rail infrastructure place considerable urgency on any response to the problems. Addressing them will allow GWRC and KiwiRail to deliver a modern, reliable, and accessible rail system.

The problem statements and weightings reflect the problem interdependency:

- The first problem highlights that the rail system will increasingly provide a poor customer experience, particularly as patronage demand and constrained capacity lead to declining levels of service, resulting in lower uptake than needed
- The second problem highlights that infrastructure constraints limit the capacity of the network to safely accommodate extra trains, which prohibits a full response to the first problem
- The third problem highlights that even if the infrastructure constraints were fixed, the network would be vulnerable to disruption, making it unreliable and unattractive to use, with major events causing wide transport system delay.

The problems and their consequences are described further in the following sections and summarised along with their relationship to the benefits in the ILM map in Appendix A.

3.1.1 Inconsistent Journey Experience

Problem 1 highlights that there is an inconsistent customer experience across the network. This problem focuses on all aspects that cause a potential rail network user to choose another mode of transport. Table 3-1 provides the problem statement and outlines components of the cause, effect, and consequence of the problem.

Table 3-1: Inconsistent journey experience causes, effects, and consequences

Problem 1: Inconsistent customer journey experience and limited rail system capacity result in the network being unable to meet the mode share targets, which prevent achievement of growth and environmental obligations	
Cause	• Customer journey experience is impacted by substandard station amenity, ease of access, comfort, seat availability, insufficient shelter from weather, reliability, lack of information, safety perceptions and payment methods • Sustained high passenger growth rates are surpassing previous forecasts, with growth trends expected to continue alongside population growth in the region • Increasing future freight demands (e.g. logs) • Current infrastructure constrains capacity at multiple points along the network (e.g. track, signalling, power supply)
Effect	• The number and size of passenger and freight trains needed to cater for this growing demand is expected to exceed the capacity of the Wellington network in the mid to late 2020s, despite the currently planned infrastructure and service improvements • Potential customers will use alternative modes
Consequence	• More crowded trains, declining service quality and reliability reducing levels of both passenger and freight customer satisfaction • Wider transport system impacts due to people choosing other, more attractive, modes (road congestion, accident rates, and environmental effects)

	• Potential negative impacts on the Wellington region economy and performance of the national road and rail freight network • Some users are discouraged from using rail due to poor first and last mile connectivity • Some users are discouraged due to physical barriers and the level on inconvenience caused by the facilities (i.e. mobility impaired users, lack of park and ride capacity, method of ticket payment, etc) • Full potential of mode shift to public transport not realised requiring additional investment in other modes

3.1.1.1 Causes

The key causes reflect an increase in passenger demand and expectations, increasing freight demand and the infrastructure constraints on the network.

Poor customer journey experience

GWRC regularly conducts customer experience surveys across a range of public transport users (see Section 3.1.1.3). While the surveys are not specific to rail, many respondents are rail users, and the trends and identified areas for improvement apply across each mode.

The customer experience surveys highlight that the attractiveness and ease of use of Wellington rail services, by current and potential users, is affected by many factors. These include station amenities, ease of access (including accessibility), and availability of car parking. The surveys also highlight negative perceptions of overcrowded trains, journey times and delays, anti-social behaviour, insufficient shelter from the weather, unreliable real time journey information and inflexible payment options.

Other key areas for improvement are:

- Delay information is not always 'real time', which causes issues with interconnecting services
- Lack of an integrated, multi-modal ticketing system
- Lack of frequent off-peak services
- Access and use are difficult for passengers with small children and the mobility impaired, especially in peak times
- Frequent bus replacement services and the lack of a sufficiently large replacement bus fleet result in demand exceeding supply when network disruption occurs (at peak period).

The surveys noted that some park and ride facilities reach capacity very early in the day on weekdays. This is relevant because the end-to-end journey experience includes access to the origin railway station and from the destination station to the final destination (i.e. the first and last leg of the journey), as well as time at the station and on the train.

For a seamless customer journey, it is essential to have convenient, safe access to and from the railway station. Focussing on the first and last leg connections to the station will maximise the return on investment through increasing the potential customer catchment. There is a need to design access to provide greater transport choices for all.

Failure to provide infrastructure for passenger amenity, such as shelters at stations creates a less pleasant user experience at the station. Surveys showed passenger aversion to using public transport during poor weather. A lack of shelters also encourages the congregation of groups of passengers near the same carriages. This creates a mismatch between the demand within a train and the seats and space provided, as well as contributing to platform congestion.

GWRC has previously conducted an accessibility audit of railway stations using the RTS14 (guidelines for facilities for blind and vision impaired pedestrians). GWRC adopted an Accessibility Charter for all Metlink services and facilities in 2021[17]. While all stations have some issues, some key stations such as Paraparaumu, Paremata, Petone, Porirua, Waikanae and Waterloo have been identified as a priority due to the volumes of users at these stations.

The impact of service disruption and service cancelations (reliability) contribute to the user experience and are explored in more detail in the third problem statement.

High passenger growth

Passenger growth on the network has considerably exceeded the forecast 2 per cent per annum growth since the 2013 RRP. The effect of this is even more pronounced when examining the peak periods as outlined in Figure 3-1.

[17] The Metlink Public Transport Accessibility Charter 2021, available at https://www.metlink.org.nz/assets/Accessibility-content/Metlink-Accessibility-Charter/Metlink_Accessibility_charter_1.5_English_web1.pdf, sets out Metlink's vision to make the public transport network accessible for all with ease and dignity by embedding the concept of the accessible journey, and outlines the actions that will be taken to achieve this. The plan has been prepared in accordance with documents including the Human Rights Act 1993, and the UNCRPD 2006. Central to the plan is full engagement with disability advisory groups and service providers, and disabled individuals, when planning any changes to services or infrastructure.

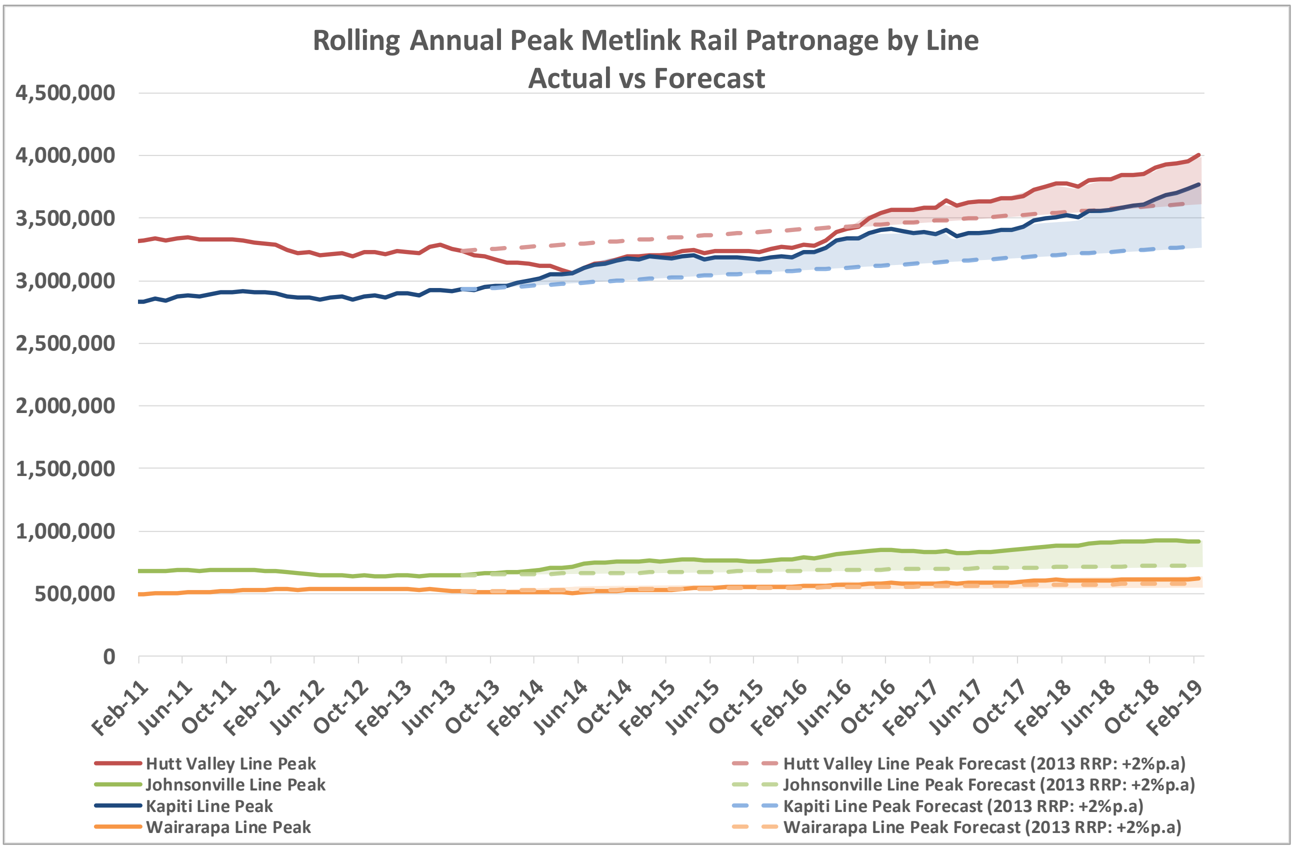


Figure 3-1: Patronage by line Actual v Forecast

The gap between the forecast and actual continues to increase. Further stresses are likely to be felt with delivery of the Let's Get Wellington Moving (LGWM) programme, which seeks to reduce the number of vehicles entering the Wellington CBD, resulting in additional mode shift to rail.

Figure 3-2 shows the clear effect of investment on patronage, indicating that peak period growth in rail was relatively steady from 2000 until around 2008, when a combination of the global financial crisis and network disruption caused patronage to decline. This decline ended in around 2010, after which there was little growth until around 2014. Growth was significant from 2014 onwards, reflecting the replacement of the old Ganz-Mavag EMU fleet by Matangi EMUs and ongoing rail network infrastructure renewals, which resulted in significant service reliability improvements. The growth trends from 2014-2020 and 2016-2020 are far greater than even the highest forecast WTSM projections. The future year scenarios are outlined in Section 5.3.5.

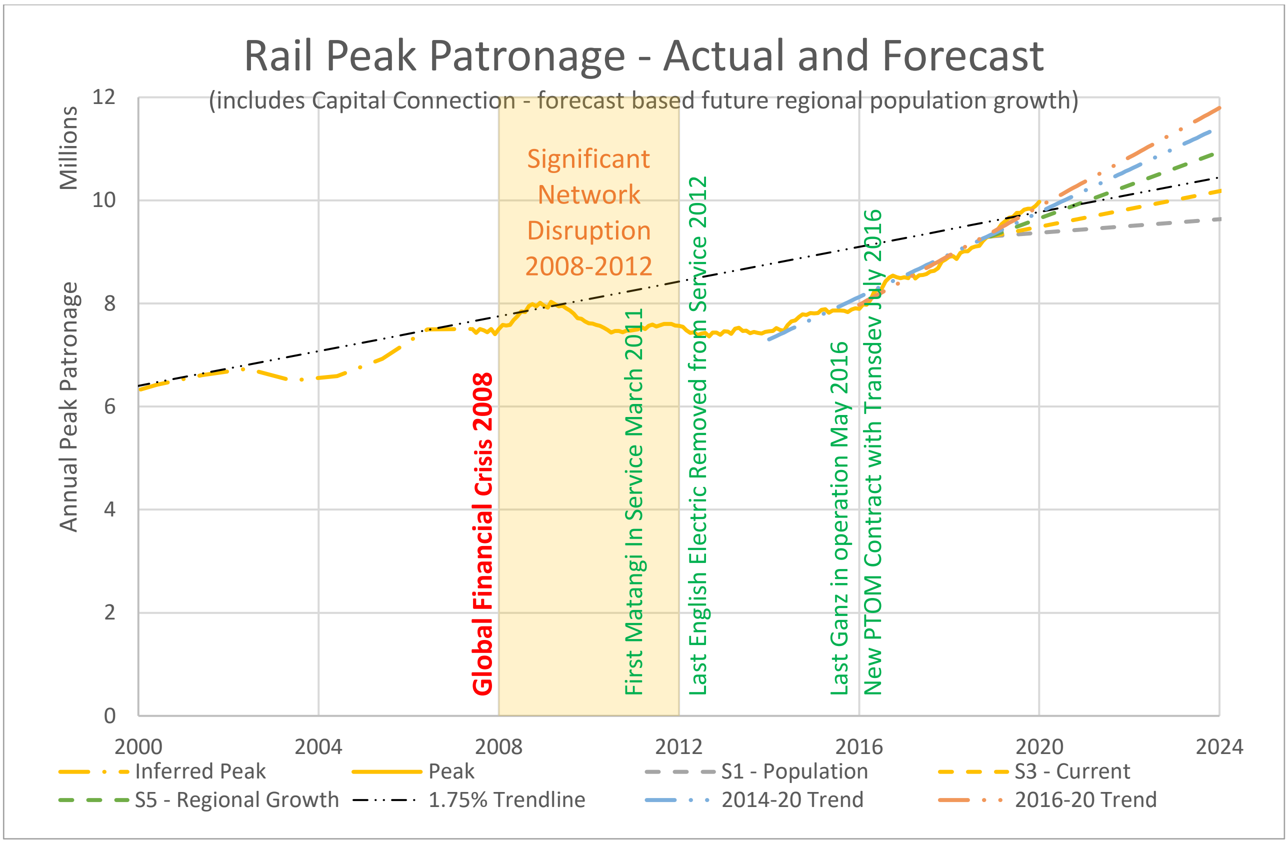


Figure 3-2: Historic growth and forecasts and trendlines based on different analysis periods

Increasing freight demand

The Wellington rail network is a key element of the national rail system. Wellington's CentrePort handles approximately 10.5 million tonnes of a cargo on an annual basis, which is served by a combination of road and rail. A connection to the South Island is provided by the Interislander ferries. The 2019 National Freight Demand Study showed a large increase in logs moving through the Wellington Region, primarily from CentrePort's inland rail hub at Waingawa near Masterton as shown in Figure 3-3.

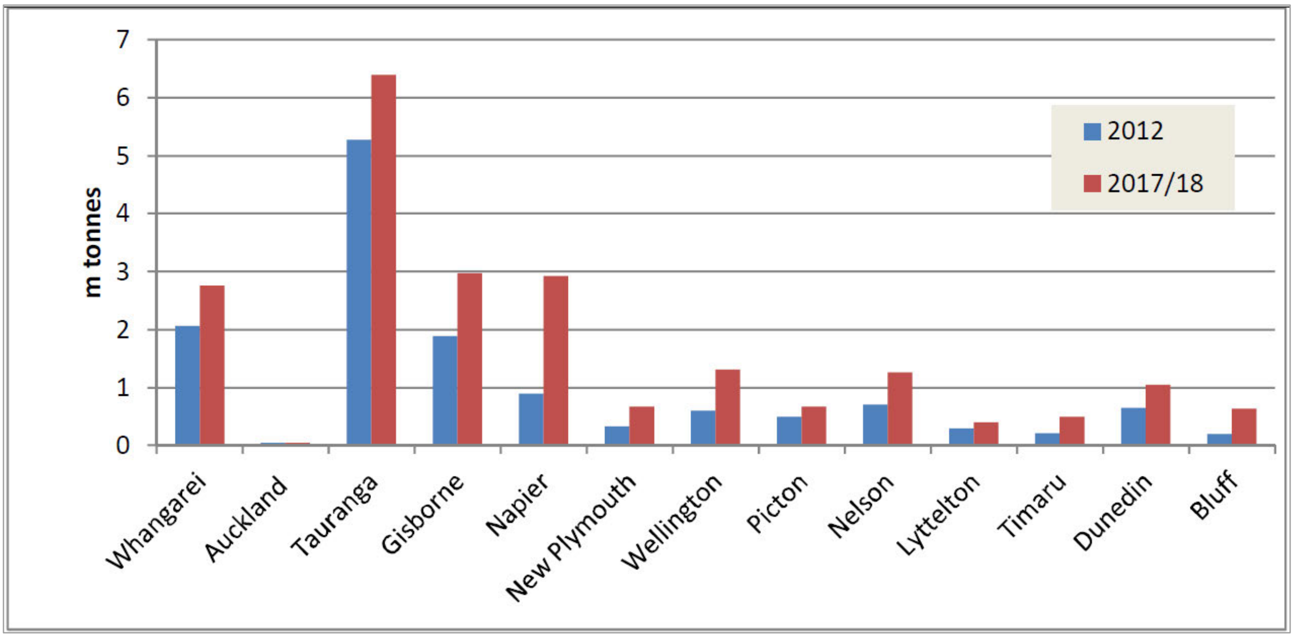


Figure 3-3: Growth in log export traffic through New Zealand ports 2012 and 2017/18

While domestic rail freight was significantly impacted by the Kaikōura earthquake in 2016, traffic volumes are recovering following the reopening of the South Island's Main North Line. KiwiRail is currently progressing plans to replace its current fleet of three Interislander ferries with two new, large rail-enabled ferries from 2024, which will significantly improve rail freight capacity across the Cook Strait. This will increase the competitiveness of rail on the key Auckland –

Christchurch corridor and help shift freight from road to rail. This is expected to result in the use of an increasing number of currently unused freight train timetable paths through the Wellington rail network.

Infrastructure constraints

This is primarily a factor relating to the ability to schedule larger or additional trains on the network. Although there is significant current investment in the Wellington rail network, this is primarily aimed at replacing life expired assets-particularly track and traction power supply overhead line masts and wiring. Within the Wellington network there are several key infrastructure constraints preventing additional train service frequency and capacity improvements from being implemented. These include:

- Traction power supply capacity restrictions along key parts of the network that limit the number of additional peak period passenger trains that can be run as well restricting the number of longer eight car trains that can be operated.
- Aging signalling systems that do not provide modern levels of safety risk mitigations and are not easily modified to enable higher train frequencies.
- Track configuration between Kaiwharawhara and Wellington Station, which limits the number of trains that can be safely operated in and out of the Wellington Station terminus. In addition, this has the effect of spreading delays from late running trains across the network.
- The configuration of the tracks leading to KiwiRail's freight terminal at Kaiwharawhara means that long slow-moving freight trains entering or leaving the freight yard block all main lines into and out of Wellington Station. This can result in delays to passenger services. In 2019 a freight train departing from the freight yard derailed and blocked all tracks into Wellington Station, causing the cancellation of all passenger services into Wellington for a day, impacting up to 20,000 passengers.
- The 3.3 km long single-track section, including six tunnels and grade, between North Junction and South Junction on the Paekākāriki Escarpment, together with a short single-track section south of Waikanae station, on an otherwise double tracked line constrains the ability to add more trains on the Kāpiti Line. In addition, the steep grade between Paekākāriki and Pukerua Bay constrain the weight of southbound freight trains.
- The short 3km single track Melling branch line and associated junction with the Hutt Line at Petone, limits the capacity of the Hutt Line, by taking up train paths between Petone and Wellington by shorter Melling Line services, which might otherwise be used for busier Hutt services.
- Single track north of Waikanae and Upper Hutt on the NIMT and Wairarapa Line respectively, which limits line capacity and the frequency of both freight and passenger trains.
- Freight train weight and axle limitations on the NIMT and the Wairarapa lines, which may become a limiting factor following the arrival of the new Interislander ferries, which will expand rail capability and capacity between the islands.

The implications of safety restrictions on the network are explored in Problem 2.

3.1.1.2 Effects

Insufficient capacity

The number and size of passenger and freight trains, needed to cater for the growing demand, is expected to exceed the current capacity of the Wellington network in the mid to late 2020s. This is despite the current and planned infrastructure and service improvements.

An example of this is shown graphically for the Taita and Kāpiti peak services[18] in Figure 3-4 and Figure 3-5. The upper and lower growth scenarios are outlined in Section 5.3.5, and capacity definitions are outlined in Section 6.2 and further detailed in Appendix D. The graphs show the effect of the reallocation of rail capacity through the RS1 service improvements, optimising use of the existing EMU fleet and maximising operational efficiency within the electrified area. The result is a reduction of effective capacity and crowding on Taita services and an increase in capacity on Kapiti services in the short term, but a lack of any long-term capacity.

[18] At peak times, Kapiti Line services operate from/to from Waikanae, Plimmerton, and Porirua, and Hutt Line services operate from/to Upper Hutt and Taita following a layered service approach, where outer services (those departing Waikanae and Upper Hutt) serve the outer tier of stations then run express to/from Wellington Station, and inner services (those departing from Plimmerton, Porirua, and Taita) serve the inner tier of stations. This allows peak capacity to be allocated where needed, with more seats being provided to reduce standing on longer-distance outer tier services, and reduces the travel time to outer stations slightly, making journeys more competitive with road. Wairarapa and Manawatu services run a similar limited stop service, providing, effectively as a further outer layer. Off-peak Kapiti and Hutt services and all Johnsonville and Melling services stop at all stations.

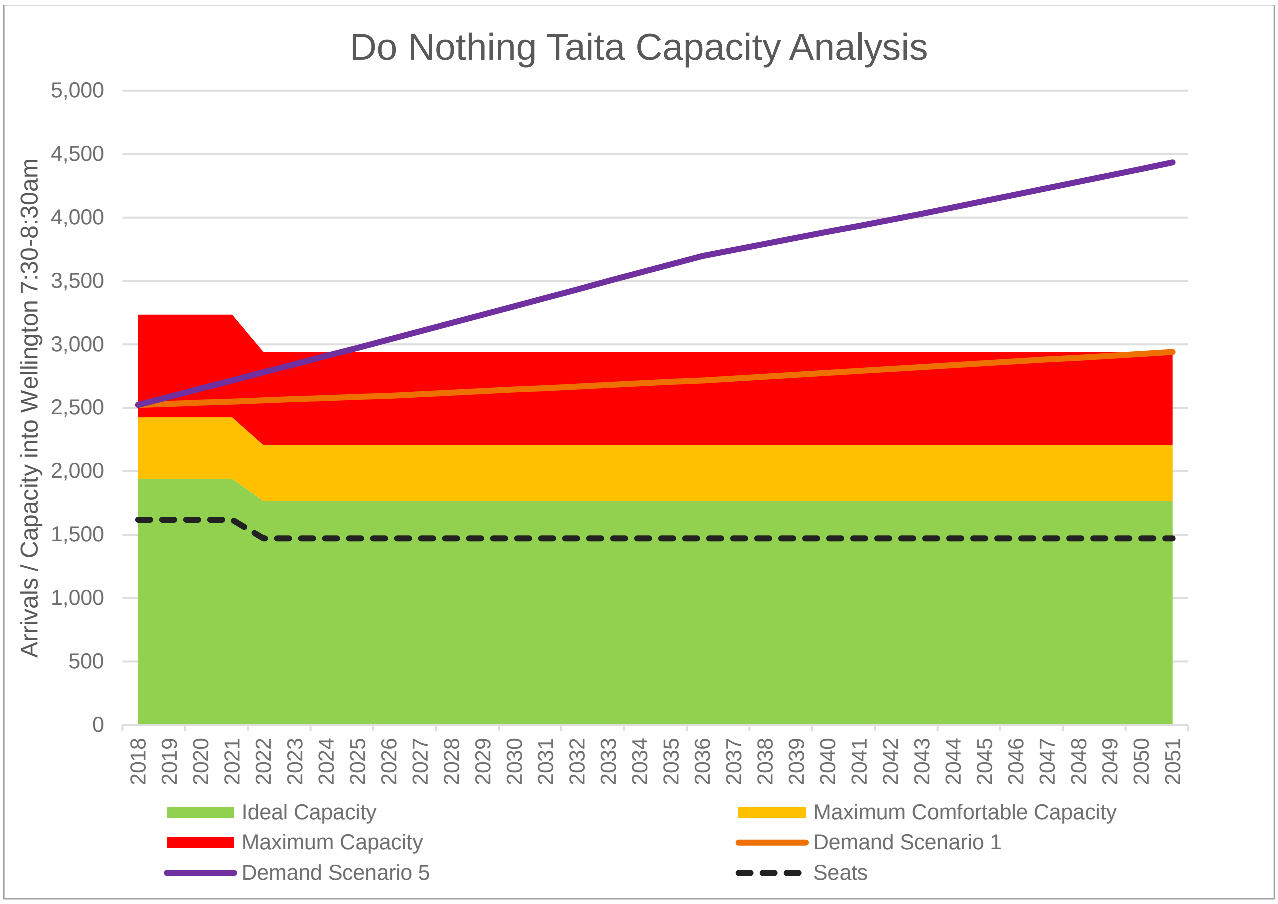


Figure 3-4: Taita Line capacity graph including upper and lower growth scenarios

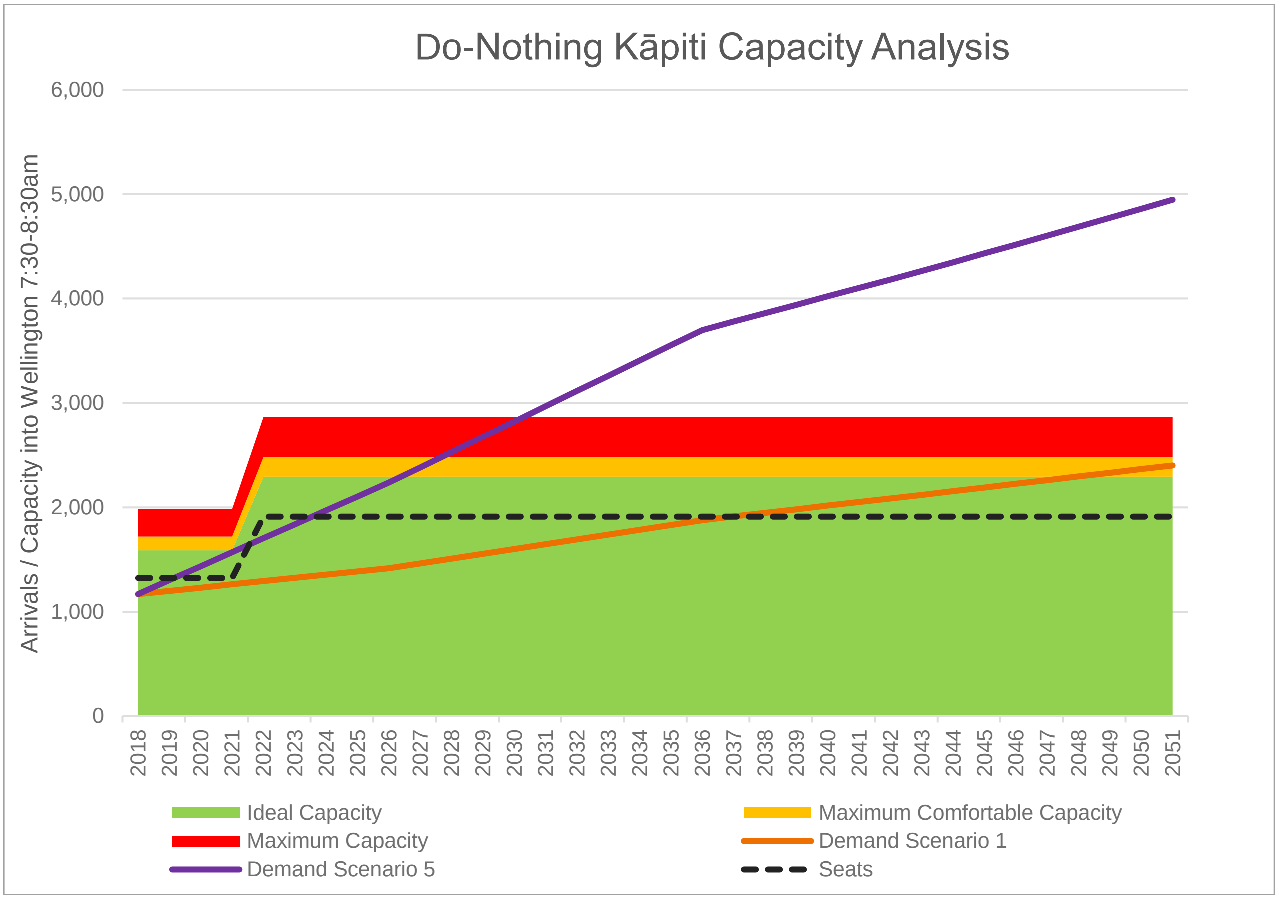


Figure 3-5: Kāpiti Line capacity graph including upper and lower growth scenarios

Improvements to capacity are currently limited by a combination of factors, the most significant being the number of trains that can safely operate into Wellington Station. This is expected to be addressed in the next five years through NZUP funding for track and signalling improvements there. However, signalling system and other infrastructure constraints limit capacity increases to train size, not train frequency, and electric traction limitations (i.e. the number and capacity of substations) limit the number of EMUs on a section, which in turn limits train length.

Train size is currently limited to eight cars on the electrified network. A small number of peak period services operate as eight car trains (consisting of 4 two-car Matangi EMUs), but EMU fleet size and the above-mentioned power supply limitations limit the extent to which this can be increased.

Use of other modes

When the customers' expectations for public transport are not met, there is a shift away from these modes, typically to private motor vehicle. This has negative implications for carbon emissions, as well as journey times and reliability on the road network for those who are not served by the public transport network.

3.1.1.3 Consequences

Declining levels of service

Increasing numbers of passengers using rail services, coupled with a constrained ability to provide more or larger trains, results in trains becoming overcrowded. GWRC does not expect to provide seats for all passengers at peak periods, particularly for journeys of 20 minutes or less. However, overcrowded trains, declining level of service quality and degraded reliability reduce customer satisfaction.

Very high passenger numbers can also degrade service reliability. This is due to increased boarding and alighting times and a greater chance of incidents resulting in delay. The July 2021 Metlink Public Transport Customer Satisfaction Survey[19] provides an insight into this impact. Figure 3-6 shows customer satisfaction with the punctuality of rail services at 84 per cent to 87 per cent (or lower) between 2016 and 2021[20]. This is lower than desirable from a service attractiveness perspective.

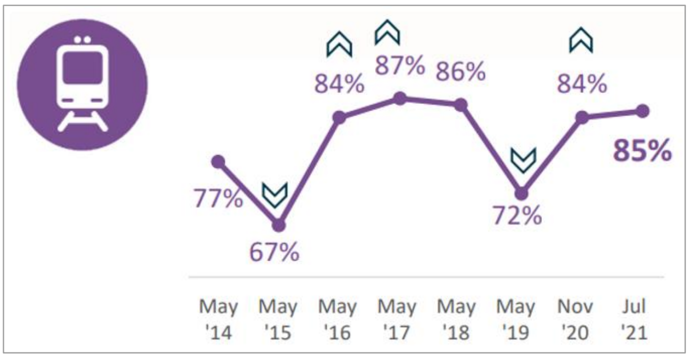


Figure 3-6: Rail customer satisfaction with the punctuality of services

Figure 3-7 provides an indication of the overall impact, showing the compounding effect that declining service quality has on rail customers' overall satisfaction with public transport as an option. This downward trend can ultimately lead to mode shift away from public transport, with an associated impact on road congestion and emissions.

Figure 3-7: Rail customer overall satisfaction with the public transport system

Figure 3-8 shows customer satisfaction with the overall rail trip. It appears to counter the trend shown in Figure 3-7. However, a clear decline is evident over the 2016 to 2019 period, which only reversed with COVID-19, when patronage and crowding reduced. Total public transport patronage decreased by 28 per cent from May 2019 to November 2020.

[19] https://beta.metlink.org.nz/assets/Customer-Satisfaction-Surveys/Public-Transport-Customer-Satisfaction-Report-July-2021.pdf

[20] The May 2019 survey results were impacted by a lack of train drivers and trains, which resulted in significant disruption, and can be considered an outlier when compared to the other recent years.

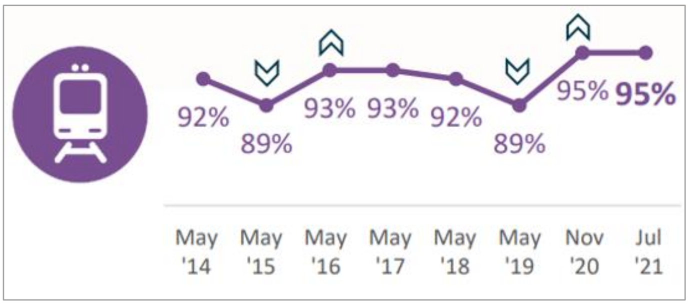


Figure 3-8: Rail customer satisfaction with the trip overall

The July 2021 survey also asked customers why it was not easy to use public transport services. Rail customers responded that service unreliability (29 per cent), poor communications (26 per cent), and the lack of service frequency (19 per cent) are the most significant reasons why services are not easy to use. Lack of seating was identified as a significant issue prior to the pandemic, but it did not feature in the 2020 and 2021 surveys – this is likely due to the lower demand (and increased space per passenger) resulting from COVID-19. These ease-of-use priorities provide a clear indication of where improvements might be prioritised to improve service attractiveness.

Mobility impaired users discouraged

Waka Kotahi 's RTS14 document provides guidelines for facilities for blind and vision impaired pedestrians. When infrastructure does not meet the standards set in RTS14, this acts as a deterrent to mobility impaired users. Factors such as inappropriate pathway widths and ramp gradients can act as barriers, and mismatches between platform and train height compound this further. These effects are wider than just for mobility impaired users. Access barriers also discourages the use of rail for trips to destinations such as Wellington Airport, when for example moving large suitcases can be troublesome for users. GWRC focus-group-based customer experience segmentation highlighted issues with the accessibility of public transport for those with young children requiring prams are a barrier to use.

Wider transport system impacts

When the rail network is unable to accommodate additional users, the customer is forced to choose between delaying (or cancelling) the journey or using an alternative mode. For longer journeys this is likely to be a motor vehicle.

Figure 3-9 shows the growth in the peak and off-peak patronage on the Hutt Valley services between 2010 and 2019, compared to the increase in the peak period (7-9 am) and pre peak period (5-7 am) southbound traffic volumes on State Highway 2 (SH2). The patronage or vehicle counts have been compared to the average for the 2010 calendar year.

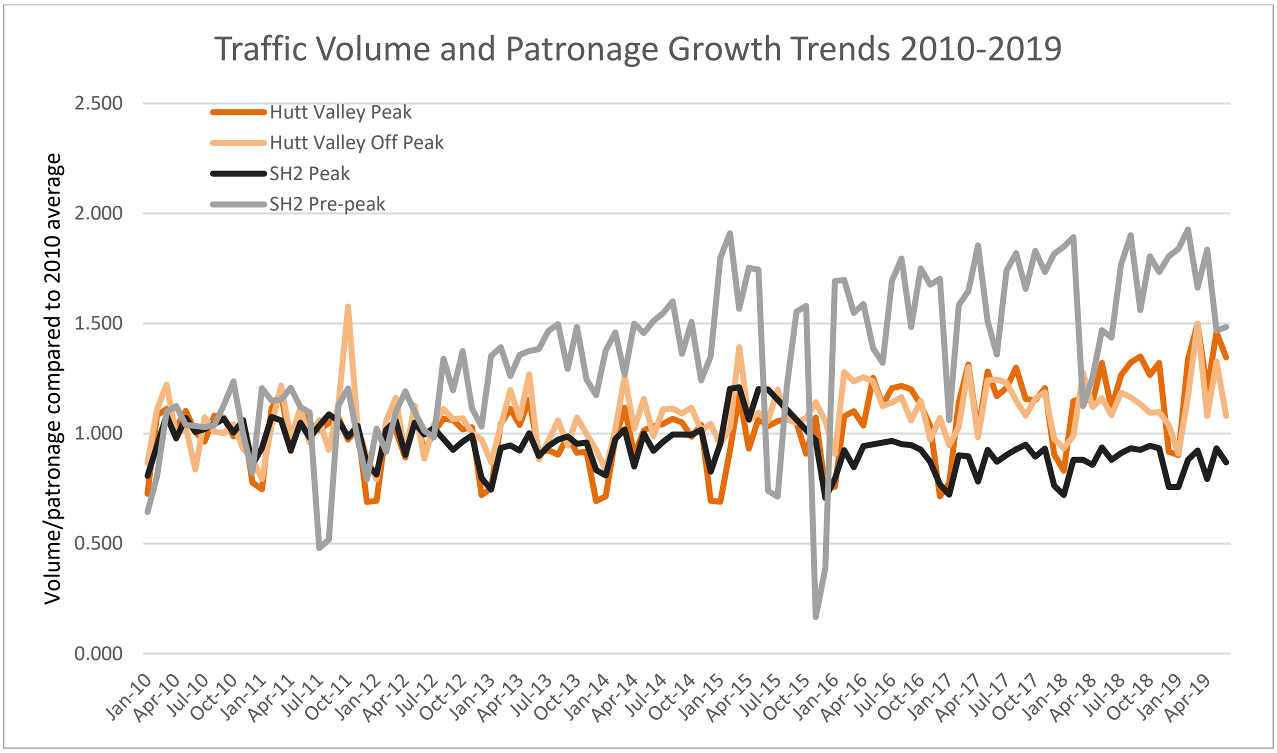


Figure 3-9: SH2 southbound and Hutt Valley peak and off-peak patronage growth

The relatively flat line for peak period traffic volumes, along with the growth in pre-peak traffic volumes suggests that SH2 is at capacity during peak periods (excluding some suspected erroneous counting in Jan-April 2015). Capacity issues on SH2 between Petone and Ngauranga were noted in the 2003 Hutt Corridor Plan. Both the peak and off-peak rail patronage is, however, growing at relatively similar rates. This is in stark contrast to the 'pre-peak' on the highway, which is growing at a much faster rate than all other metrics shown. This clearly demonstrates that if a potential passenger wants to shift the time of their travel (in this case earlier), they will use other modes if rail services are not as convenient at the new travel times.

The wider impact to the transport network when services are cancelled is explored in problem 3.

Restricting regional growth

An inefficient transport network can act as a barrier to both population and economic growth. Waka Kotahi's research report 350[21] notes that, in general, the development of transport infrastructure is a necessary, but not sufficient, condition for national and regional economic development and growth.

While the Wellington Region has a developed transport network, there are significant periods where it is at capacity and does not effectively move goods or people. This means that further investment in forms of transport that do not move large numbers of people efficiently are unlikely to result in a return on investment.

Failure to meet zero carbon act obligations

The Climate Change Response (Zero Carbon) Amendment Act 2019 provides a framework for moving the country to zero net emissions by 2050. Currently transport represents around 21 per cent of our greenhouse gas emissions, with road transport representing approximately 90 per cent of those emissions. This means all other forms of transport collectively represent around ten per cent of transport related emissions. The New Zealand greenhouse gas profile is shown below in Figure 3-10.

Within the Wellington context, a significant proportion (between 40 and 45 per cent) of peak period journeys to work along the Kāpiti and Hutt corridors into Wellington are already made on low emission (electrically powered) rail services. Increasing the use of rail for non-peak journeys further will assist with meeting the net zero emissions targets.

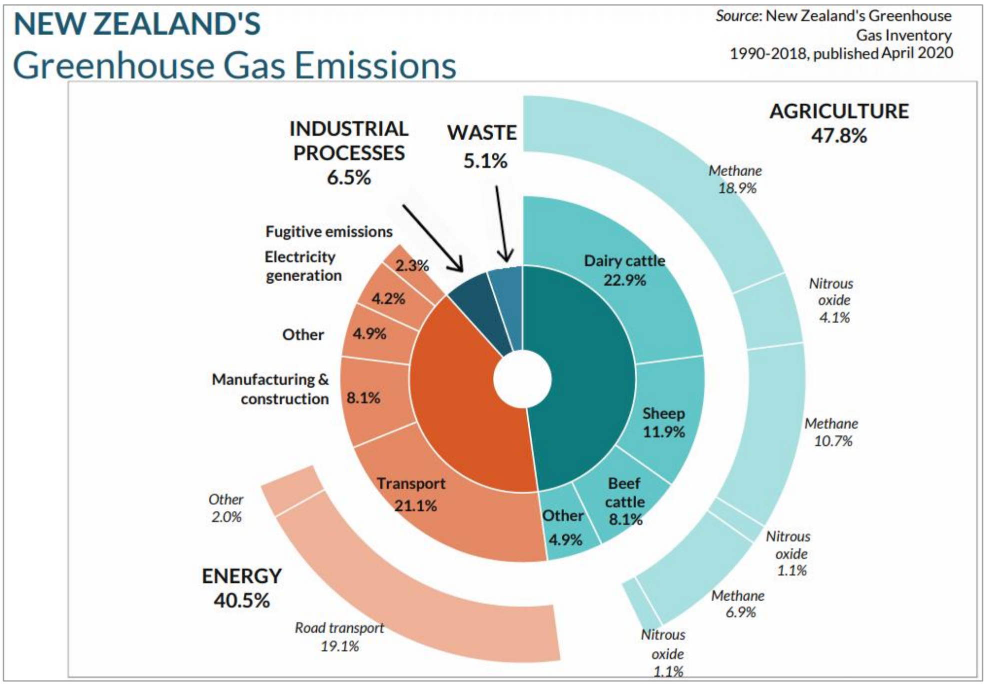


Figure 3-10: Greenhouse gas emissions profile

Customers discouraged by first and last mile and station accessibility

First and last mile access causes issues with uptake of some users. Customer feedback indicates that barriers to first and last mile access include:

- Frequency of connecting bus services
- Reliability of bus and rail connections
- Lack of integrated fares and ticketing (bus and rail utilise different ticketing systems)
- Lack of provision for alternative modes, particularly on access routes
- Park and ride capacity, which is limited and fills up early in the morning at many stations.

[21] Waka Kotahi Research Report 350 Economic development benefits of transport investment

The above factors all influence the perceived cost of taking rail services compared to the perceived cost of the private motor vehicle alternative. Further work is needed to address these factors[22].

On days with poor weather there is lower rail uptake. Customer experience surveys note that, while rail performs better than bus services, weather is a significant factor for morning commuters. People using rail for shopping have the greatest issues with the level of shelter provided.

As previously discussed, the fact that some stations are not RTS14 compliant causes issues for not just mobility impaired users, but also elderly and those with large luggage hoping to use the rail network for some of their journey to the airport.

Failure to meet growth and mode share targets

The RGF foundation document predicts an increase of between 90,000-150,000 people living in the region. Accommodating these people will require between 52,000 and 66,000 new homes. The RGF is considering what mix of locations for new urban development can best deliver on the framework objectives.

The RMSP has been developed in conjunction with the RLTP and the RGF and seeks to help shape urban form. Areas of focus for the RMSP are:

- Increasing density near rail stations and major bus hubs and significantly improving multi-modal connections to stations/hubs
- Optimising greenfields for improved urban form/increased density and to deliver on RGF outcomes, including multi-modal access
- Working with Kainga Ora to implement current projects (e.g. Eastern Porirua) and identify new urban development opportunities (including establishment of a region-wide UDA).

These focus areas rely on an effective transport network to ensure people can get to where they want to go without reliance on private motor vehicles.

Required investment for other modes

Investment is likely to be required if mode share targets are not met and the use of private motor vehicle increases. Much of the road network already operates at capacity during peak periods. Significant investment would be required to cater for the additional growth in private motor vehicle use. This would likely be far more significant than that required to accommodate the same number of customers on rail.

3.1.1.4 Summary

The evidence shows that there are opportunities for improvement for the Metlink Services. Customer experience surveys highlight many issues with the rail network, but importantly, show commonality between the regular users and the agnostic users. Despite these issues, rail growth has been higher than predicted by the business cases for both the Matangi trains and the KiwiRail WMUP capacity and resilience improvements.

This growth has led to insufficient capacity to meet demand on the rail network, which has led to people taking alternative modes for their journeys into town. This is particularly notable when looking at the ‘pre-peak’ traffic volumes along SH2, which are growing considerably faster than rail patronage.

If residents are using private transport because of a perceived lack of sustainable alternatives, then this will prevent the region reaching its mode share target and this would also cause significant difficulties in achieving the region’s (and nation’s) goals of being carbon neutral.

The additional use of private transport would also create additional pressures on the transport network as seen in Figure 3-9 highlighting the growth in traffic in the pre-peak periods. This would also lead to requiring sizable investment in modes other than rail to accommodate this demand as well as fail on the government’s objectives for transport funding.

3.1.2 Safety Concerns Preventing Additional Services

Problem 2 highlights that there are currently safety issues with the existing rail network. Table 3-2 provides the problem statement and outlines components of the causes, effects, and consequences of the problem.

[22] GWRC is working to improve the customer offering in some of these areas, through initiatives like the introduction of integrated ticketing as part of the new national ticketing system, an upgraded real time information system, and the introduction of on demand bus services to some railway stations. These initiatives are being developed at a wider public transport system level (i.e. they are not specific to rail investment), and they are expected to improve rail customer experience, but do not address all issues.

Table 3-2: Safety concerns preventing additional services causes, effects, and consequences

Problem 2: Current infrastructure is not capable of safely accommodating additional trains, restricting the options available to accommodate future demand	
Cause	• Current infrastructure constrains capacity at multiple points along the network (e.g. track, signalling, power supply) • The existing Wellington network was designed to be safe under the applicable standards at the time of construction (hazards mitigated by procedure rather than eliminated through engineering) • A legacy of underinvestment that has resulted in an ageing infrastructure with little redundancy and has limited the ability for step changes in safety performance to be achieved through investment • Legal and societal expectations for safety and security have changed since much of the network was constructed and previous levels of risk and mitigations may no longer be acceptable • Significant numbers of level crossings (both vehicle and pedestrian)
Effect	• Ability for pro-active changes in safety performance to be made is limited by constrained funding • A high incidence of Signals Passed at Danger (SPAD) by trains, which indicates a potential risk compounded by the lack of automatic train protection • Pedestrians and vehicles at risk of collisions with trains • Compliance with stricter safety standards could degrade existing service levels and mean that plans to increase capacity, frequency and reduce journey times may not be realised • Available funding is funnelled into mitigating urgent problems rather than investing in solving the important ones, driving short term 'band-aid' approaches rather than long term engineering ones • The absence of automatic train protection means the potential consequence of a safety failure is catastrophic
Consequence	• Perception of high-risk of deaths and serious injuries and other notifiable events may lead to a loss of confidence by users, regulators, and stakeholders • Train spacing and administrative control will remain a critical safety feature for network operations, which will limit the flexibility and capacity of the network • Inability to increase service frequency at peak periods • Poor asset condition leading to increasing risk of safety incidents • Service levels may need to be reduced if investment is not provided to enable safety risk reduction improvements

3.1.2.1 Cause

Infrastructure constraints

Signalling systems control the safe operation and movement of trains and prevent train collision by ensuring safe stopping distances are maintained between trains and prohibiting conflicting train movements. Legacy signalling systems provide capacity that reflect the rail operating needs and practices, as well as the safety environment of the era in which they were developed. Signal systems restrict the speed and volume of trains that may be safely accommodated on a network. Modern signal and train protection systems enable shorter gaps between trains and higher operating speeds than legacy systems, therefore providing a greater number of trains per hour (tph) without compromising safety.

The control of trains on the approach to the Wellington Station (the A Box) Wellington Metro Rail Network still uses the signalling system installed in the 1930s in the Wellington A Signal box, to control the safe operation of trains. The control mechanism for the busiest area of the WMRN is shown in Figure 3-11. Other constraints limiting capacity from a physical perspective have been discussed previously.

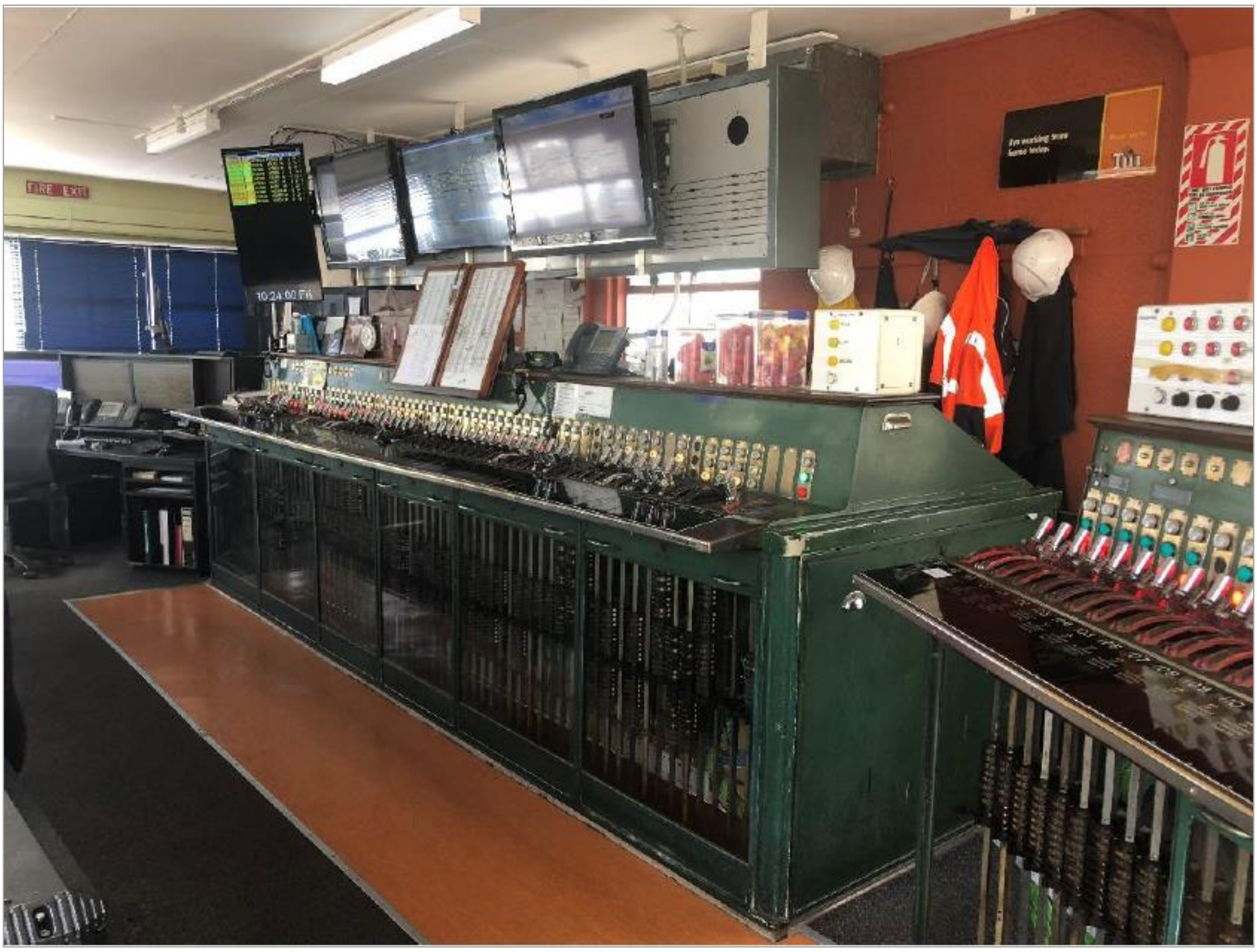


Figure 3-11: 'A' Box lever frame

While a range of upgrades have been made to the signalling and control systems, it has been noted that more significant upgrades would require a significant investment on the rail network. While the signalling system is an engineering control, it still relies on the train drivers obeying the signals, which means it still fundamentally relies on administrative controls to govern system safety. This is one of the lower levels of train collision control within the collision risk control hierarchy, as shown in Figure 3-12.

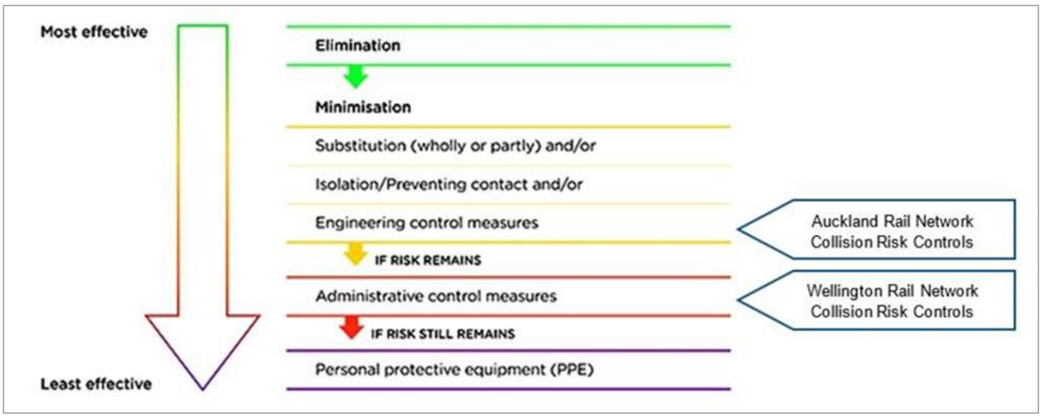


Figure 3-12: Collision risk control hierarchy

The Wellington network provides a lower level of risk protection than the Auckland network, which has a modern signalling system that was introduced in the early 2010s. This provides automatic train protection, which is an engineering control measure that significantly mitigates collision risk.

Signalling systems are also safety critical systems are designed to be failsafe, with any anomaly or fault expected to direct trains to stop. While more modern signalling systems typically use parallel computing processors to provide redundancy for both safety and availability purposes, single equipment failures in older signalling technologies as used in parts of the Wellington network typically cause delays to multiple trains, until they can be rectified.

Legal constraints

Under the Health and Safety at Work Act (HSWA) 2015, a Person Conducting a Business or Undertaking (PCBUs) have a primary duty of care to ensure, so far as is reasonably practicable (SFAIRP), the health and safety of workers, and that other persons are not put at risk by work carried out as part of the conduct of the PCBU. PCBUs are required to eliminate or minimise risks from hazards unless the cost of doing so is grossly disproportionate to the risk.

In addition to obligations under HSWA, rail operators such as Transdev and KiwiRail and access providers (KiwiRail) are required, under the Railways Act 2005, to hold rail licences issued by Waka Kotahi, with associated safety cases documenting how their rail activities are managed safely. Changes to operations, such as new service patterns, infrastructure or rolling stock, depending on their significance, require rail licence holders to prepare safety case variations for Waka Kotahi approval.

Level crossings

Level crossings are considered one of the highest risks on the WMRN. The WMRN has 42 pedestrian level crossings, 50 public vehicle crossings and 12 private level crossings. Of these crossings, 15 have passive warnings only. The KiwiRail Wellington network management plan notes that elimination of level crossings where possible is preferred and new crossings will be allowed where two others are removed as part of the installation (resulting in a net reduction).

Level crossings present a high-risk scenario because it is where other transport network users can interact directly with trains. This is compounded by the network being an unfenced network. This leads to train-versus-person incidents being relatively common. In addition to concerns with level crossings, there are areas such as the Ngauranga Foreshore, where people frequently cross the rail network to reach recreational fishing sites.

Complex investment framework

Figure 1-1 highlighted the WMRN organisational structure for planning and funding of maintenance on the network. It highlights the complicated relationships and processes to be navigated, which can delay funding for works.

3.1.2.2 Effect

Reactive approach to safety improvements

A coherent proactive and well-funded programme to eliminate or reduce safety and security risks, as part of other network investments, is more likely to deliver both higher capacity and service levels. It is also more likely to reduce safety and security risk, than a more reactive approach of addressing issues and risks as they occur, and in isolation from other projects. In addition, in the absence of a coordinated response to emerging safety issues, the interaction between safety interventions may result in further constraints to network capacity.

Risk and expectations increase with overall network growth to the point where current assets, processes and tolerable levels of risk may no longer be deemed adequate. Inadequate consideration of safety risks and associated funding for mitigations could mean that plans to increase capacity and frequency, and/or reduce journey times, may not be able to be realised.

However, existing service levels could also be degraded if additional safety mitigations are mandated because of an incident or accident, or because of external factors such as heightened security threat levels.

Signals Passed at Danger

Signals Passed at Danger (SPAD) is an incident where a train passes a red signal. It is indicative of a potential risk of train collision. Figure 3-13 shows a comparison of SPAD frequency rates on the Wellington and Auckland metro passenger systems (excluding freight trains) for the 2009-2019 period. It shows that the rate of SPAD events per million train-kms dropped on both networks and is now broadly similar, even though around 30 per cent more annual train-kms are operated annually in Auckland.

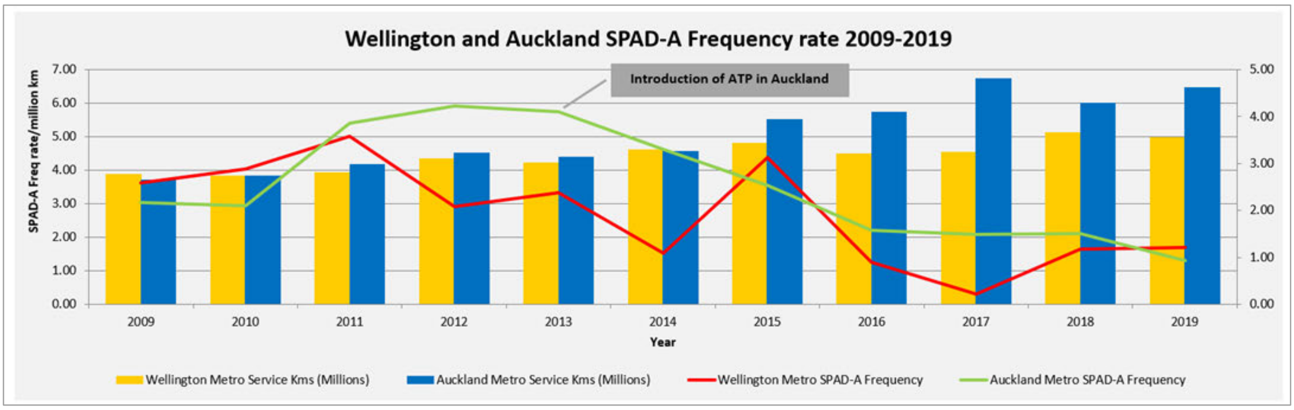


Figure 3-13: Wellington and Auckland SPAD frequency 2009-2019

The reduction in SPADs in Auckland primarily resulted from the introduction of Automatic Train Protection (ATP) from 2013. SPADs can still occur under European Train Control System (ETCS) based ATP, but the resulting consequences are eliminated as a train will be stopped before any collision point. The general trend downwards in Wellington since 2011 reflects specific management and driver training SPAD avoidance initiatives by the operators, which shows that the network is currently operating within the limits of non-ATP operation.

The potential consequence of a SPAD in Wellington is much higher than Auckland due to the reliance on administrative collision risk control measures. Apart from the thirty signals that have train-stops, there is nothing to prevent a train that passes a red signal from continuing until the next signal or worse, colliding with another train. In Auckland, the ATP system will apply the train brakes if the train driver does not slow in time to stop at a red signal or is exceeding the permitted speed limit for the line. In Wellington, a full speed collision may occur in the absence of the application of brakes by the driver, with potentially catastrophic effects.

Risk of collisions at level crossings

The large number of level crossings on the network leads to a high risk of collisions and near collision. Data provided from 2010 to February 2019 shows that there have been 15 collisions recorded and over 250 near-collisions. This is shown by line in Figure 3-14.

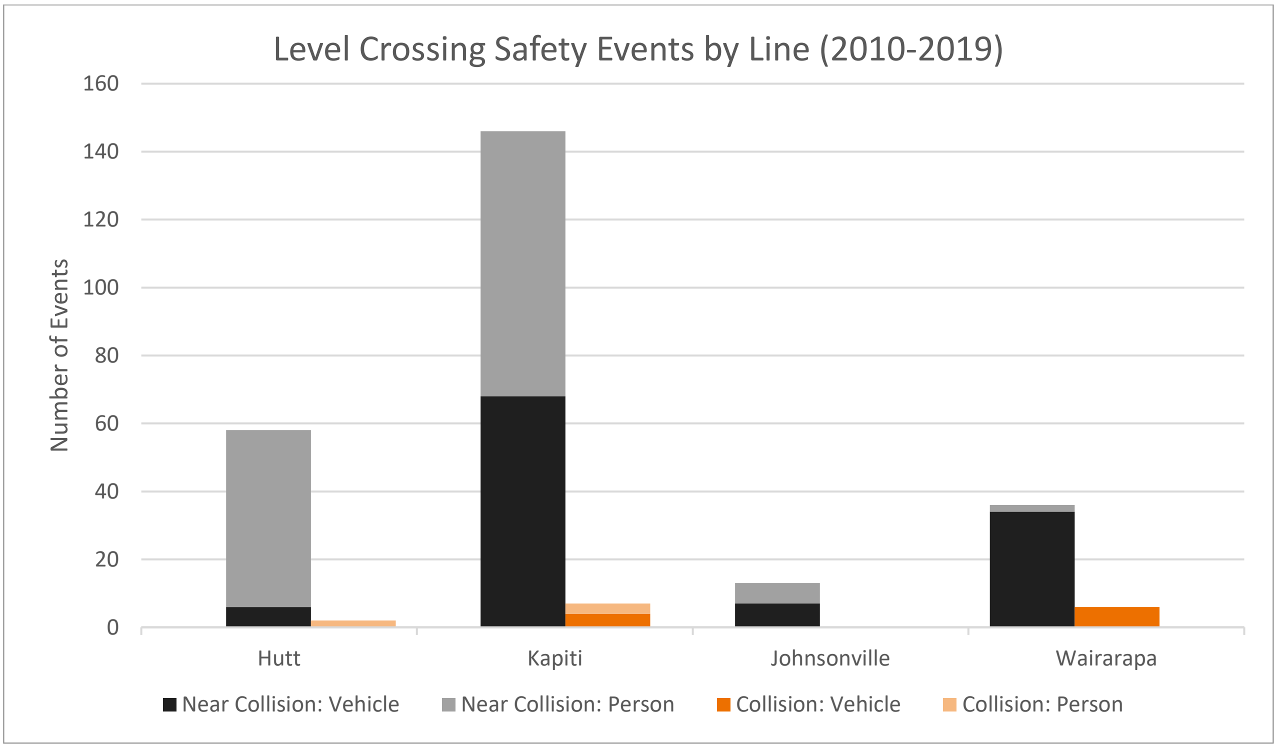


Figure 3-14: Level crossing collisions and near collisions by line 2010 (Source: ALCAM)

Service frequencies improvements increase the time trains and other transport system users are close to each other, therefore increasing the risk to safety and associated service disruptions.

There are wider effects to the impact of increased services on level crossings. As trains are given priority at roads which cross the rail network, the barrier arms spend more time down with increased train frequencies. This can reduce the capacity of the road network, and lead to increased likelihood of motorists and pedestrians taking risks at crossings.

Available funding restricts interventions to urgent issues

Funding streams for rail issues is usually limited. When funding is available to address problems, it is typically used to address only those that are most urgent. While this reduces short-term costs, there is an opportunity lost to progressively improve the network. This may result in higher long-term costs from continuous 'band-aiding' instead of a properly designed, long-term engineered solution, as well as an increased track access requirement leading to more disruption for rail users.

3.1.2.3 Consequence

Continued high-risk operations

Following several SPADs in the Wellington Station throat area, independent reviews of the rail operations controlled from the A box found that it operates in a high-risk environment. This is due to the high density of train operations together with a complex and geographically constrained track layout. While the probability of a collision between trains is considered 'unlikely' due to the 25 km/h speed limit through the station throat, the consequence, according to the KiwiRail risk rating matrix, is 'major'.

The layout of the throat is shown in Figure 3-15. The complexity of signalling and track arrangements is clear, compounded by the reliance on administrative controls to mitigate risk.

Figure 3-15: Signal and track arrangement at Wellington Station

The high-risk operations extend to the wider network, with interactions between the rail system and the wider transport network also posing a high-risk. This would be exacerbated by increases to rail service frequency without associated investment to upgrade or remove level crossings.

Unable to increase service frequency

The Waka Kotahi Rail Safety Regulator placed a condition on the KiwiRail and Transdev operating licences in January 2019. Its purpose was to prevent an increase in the number of peak period train services operating into Wellington Station until safety case variations demonstrating improved collision risk mitigations were submitted by both organisations and approved by Waka Kotahi. Work is currently underway to address this condition through NZUP Safety and Capacity funded improvements, so that the planned RS1 timetable change can be implemented. These will address the immediate safety issue in this area but will not provide sufficient improvement to enable a significant increase in the frequency of passenger services.

Poor asset condition leading to safety issues

The number of safety incidents can be expected to increase if rail asset condition drops. Unlike issues resulting from increased frequencies, poor asset condition arises from a lower standard of maintenance. This can have significant impact on the provision of rail services, exemplified in the Auckland example, where trains have reduced speed and frequency while urgent repairs are being carried out.

Services may be suspended

Should an event occur on the network, particularly in the throat of the Wellington Station, it would shake confidence in the network operation. This could result in either Transdev or KiwiRail losing their license due to being unable to operate the rail network safely.

3.1.2.4 Summary

This problem highlights a range of infrastructure and safety issues, which prevent additional services being run on the WMRN. The signalling system used on the network is a key limitation.

The impacts of the current infrastructure constraints also limit the ability to increase services, as desired by GWRC, to meet demand explored earlier in problem statement one. The two problem statements having linked outcomes.

It also highlights that the consequences of an event could easily result in the suspension of services in Wellington. This would have dramatic outcomes on the wider network (also discussed in problem one). The suspension of services would result in many of the government’s objectives being unable to be met, from policy objectives for transport to wider emissions reduction aspirations.

3.1.3 Inadequate Network Condition and Configuration

Problem 3 highlights that the network condition and configuration contribute to its vulnerability to service disruptions. Table 3-3 provides the problem statement and outlines components of the cause, effect, and consequence of the problem.

Table 3-3: Poor network condition causes, effects, and consequence

Problem 3: The condition and configuration of the rail network makes it vulnerable to service disruptions, which has a flow on impact onto the wider transport system	
Cause	• Historic underinvestment in the Wellington rail network and a focus on minimising operating cost over many decades has resulted in ageing infrastructure (including stations, track, signalling and traction overhead) • Investment has been focused on the core assets required for everyday operation, and not on infrastructure to provide increased operational flexibility and/or resilience in the event of a disruption • Proximity of the rail network to geographic features that are susceptible to weather and other failure, such as unstable slopes and seawalls
Effect	• Increased risk of delays and cancellations of services, particularly as the network gets busier over the next decade, due to ageing infrastructure or extreme events • The region's rail network and services are unable to recover quickly when such disruption occurs • Reductions in the achievable capacity of the system and service reliability leads to declining levels of customer satisfaction • The ability of the network to easily accommodate changes to operational patterns is constrained
Consequence	• More reliance on the roading network with potential negative impacts on the regional and national transport system (congestion, increased disruption impacts, accident rates and emission levels) and economy • Long term vulnerability to weather events, which will increase as the climate changes • Potential reputational damage to GWRC, KiwiRail and the Metlink rail service operator • Creates a bow wave effect where large amounts of investment are suddenly required instead of a planned and affordable cashflow

3.1.3.1 Cause

Historic underinvestment

In 2017, KiwiRail, in consultation with GWRC, completed the Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals Single Stage Business Case (SSBC). This document highlighted historic funding restrictions for the rail network. It states that it is expected that the condition of the network will deteriorate over the next five years (from 2017), with significant adverse impacts on service levels if key track assets are not renewed.

Figure 3-16 shows the strong correlation between previous network investment, on time performance, and overall patronage growth. It also illustrates the forecast patronage growth and the future investments proposed. Track infrastructure was not addressed in any of these previous deferred maintenance and catch-up renewal investments.

Large quantities of track, civil and structure infrastructure assets are at or near the end of their lives. This is due to both the timing of when they were installed (i.e. large sections of track commissioned at the same time), as well as historic (pre-2000) low levels of investment in the rail network related to previous railway funding models. This has resulted in a large 'bow wave' of renewals for some long-life assets that need to be delivered in a short timeframe. The 2017 SSBC enabled $95.8m of funding from the National Land Transport Fund (NLTF) Transitional Rail activity class for catch-up renewals over the FY19-26 period. This is being implemented as WMUP III (see Section 4.2.1). However, further investment is required on ageing signalling equipment, and to address areas of low resilience to operational incidents or natural events.

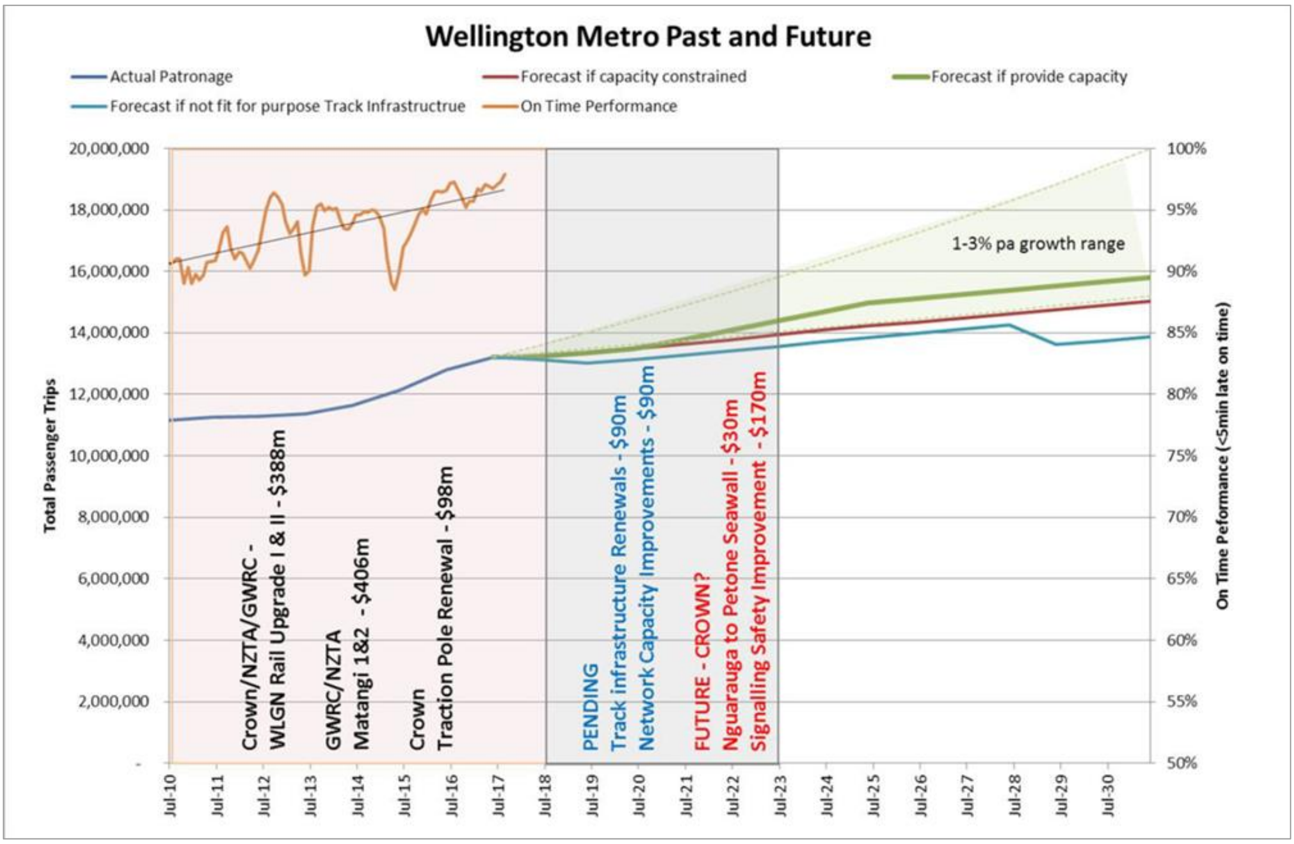


Figure 3-16: Wellington rail investments and results achieved[23]

Investment focused on core operations only

Recent significant investment in the network and rolling stock fleet has only focused on rectifying some of the historical underinvestment in rail based on the at-the-time risk profile. This was not updated to allow investment to enable improved operational resilience or flexibility as required by the network today. This means that when disruption occurs to the network or parts of it, it has a much larger and wider impact than if the same event were to occur on a fully modern rail network.

Proximity to natural hazards

Wellington's topography has constrained land use and associated infrastructure and transport links into narrow corridors. This makes the region's infrastructure and transport spines susceptible to disruption from natural hazards events and unplanned events (i.e. crashes or rail events). Impacts of events are compounded by both the lack of alternative routes and the proximity of road and rail infrastructure (e.g. Hutt Valley corridor and the Kāpiti Line north of Wellington City).

For example, slips frequently impact the operation of passenger services between Paekakariki and Pukerua Bay, as they did in August and December 2021, which caused damage, and in one case a derailment along with the closure of SH1 (now SH59). The impacts of climate change will exacerbate the risks, with likely increases in both the frequency and severity of future flooding, storm, and other weather-related events. Repeats of issues such as the June 2013 storm, when a major washout closed the Hutt Line for several days (see Section 3.1.3.3), are top of mind for low lying coastal sections of rail. It is noted that a June 2015 storm caused more widespread damage to the entire network, which resulted in all lines sustaining damage compared to the localised extreme damage in 2013[24].

Earthquakes are an expected event in Wellington and the WMRN has been identified within the Wellington Lifelines PBC to be a key transport route in the event of a large magnitude rupture within the Wellington Region. The earthquake resilience of all rail structures, tunnels, embankments, and slopes is therefore critical to the region's overall earthquake resilience.

3.1.3.2 Effect

Unable to recover quickly when disruption occurs

Figure 3-17 provides the delay event duration for the top delay-inducing events between May 2018 and May 2019. This shows a wide variation in both the average and maximum delay per event type. Signalling events are both the second

[23] From the 2017 Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals SSBC

[24] https://www.stuff.co.nz/dominion-post/news/68569411/wellington-region-begins-clean-up-after-flood-chaos

most common event and cause the most significant delay for infrastructure (i.e. non third party) events, since signalling faults will typically delay several trains before they are fixed. Such delays average nearly an hour on a monthly basis.

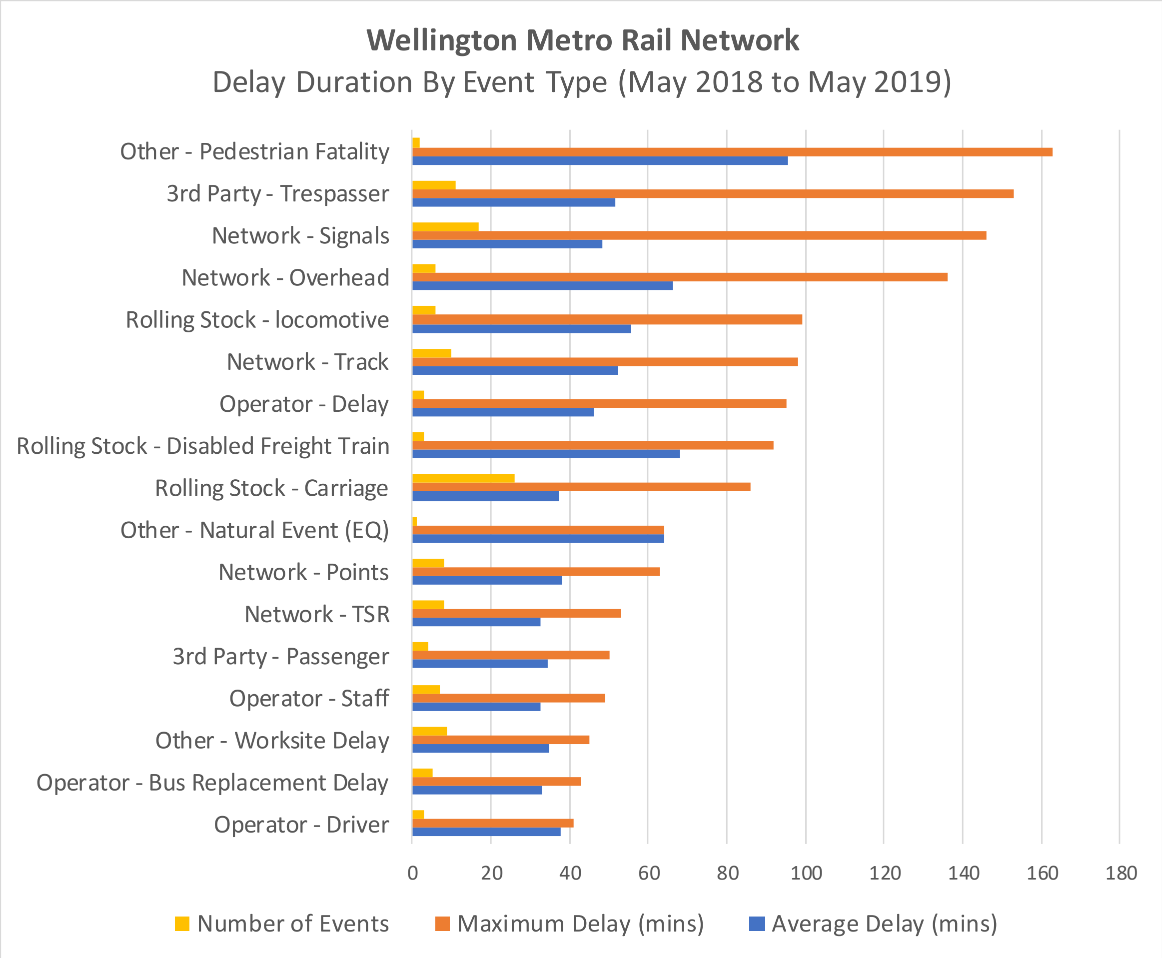


Figure 3-17: Top monthly delays by event type (Source: Transdev Monthly Reports)

The current configuration of track and signalling infrastructure in Wellington does not allow signalled bi-directional train operation on each track of a double track line (also known as 'wrong line running'), unlike Auckland. This restricts the ability for trains to bypass failed trains or infrastructure fault locations and requires the use of low capacity manual safe-working procedures during operational events and in the rare situations where operations continue during planned maintenance. In addition, there are few locations where trains can cross over to the other track or be terminated at stations to enable passengers to transfer to other transport. This increases the delays caused by individual events, as well as the passenger impact and cost of planned infrastructure maintenance activities.

Reductions in the achievable capacity

Current signalling infrastructure limits the ability to safely add new trains. On most of the network, the available headways (the time between a train passing a signal and when a following train receives a green signal) exceed current peak timetable requirements. In principle, service frequencies could be increased (with exception to rail safety regulator notice). However, because most of the current signalling, other than at critical junctions, is not fitted with train stops, the risk profile of running the existing signalling harder increases. In some parts of the network, such as the automatic signalling through the Tawa basin, there are not even signalling overlaps, a standard signal safety feature. Unused track capacity is effectively providing some measure of collision risk mitigation, which might be eroded if trains were running more closely.

The ability of the network to accommodate changes to operational patterns is constrained

The prevalence of legacy infrastructure and the absence of a consistent network wide signalling system, reduces the agility of the network to accommodate changes to network operations or adapt to new requirements for services.

The current mix of signalling, interlocking and track infrastructure are labour intensive to administer. Coupled with preventative maintenance regimes requiring administrative control for the protection of track workers, the result is conservative restrictions to train movements. This limits the ability to programme new services onto the network, and to accommodate changes to operational patterns due to operational events and planned maintenance.

Modern, integrated systems allow for efficient train control, which can be quickly adapted to allow additional services or variations to established service patterns to be introduced.

3.1.3.3 Consequence

More reliance on the roading network

When trains fail to operate there is significant impact on the remainder of the transport system. This is evidenced by two key events – the 20 June 2013 storm, when a major washout closed the Hutt Line for several days, and the derailment of a freight train on the evening of 2 July 2019. In both cases, the loss of rail led to major congestion across much of the road network.

Surveys conducted in the wake of the June 2013 storm event highlighted the drastic change in commuting patterns for those from the Hutt Valley (Figure 3-18). The associated report noted that there were large changes to the time of commute, with 57 per cent of respondents leaving for work earlier than usual. Only 9 per cent delayed their travel with the remainder leaving at the normal time. Those who left earlier than normal, nearly two-thirds of respondents, experienced delays of half an hour of more. Some workers chose not to attempt to travel to work resulting in lost productivity.

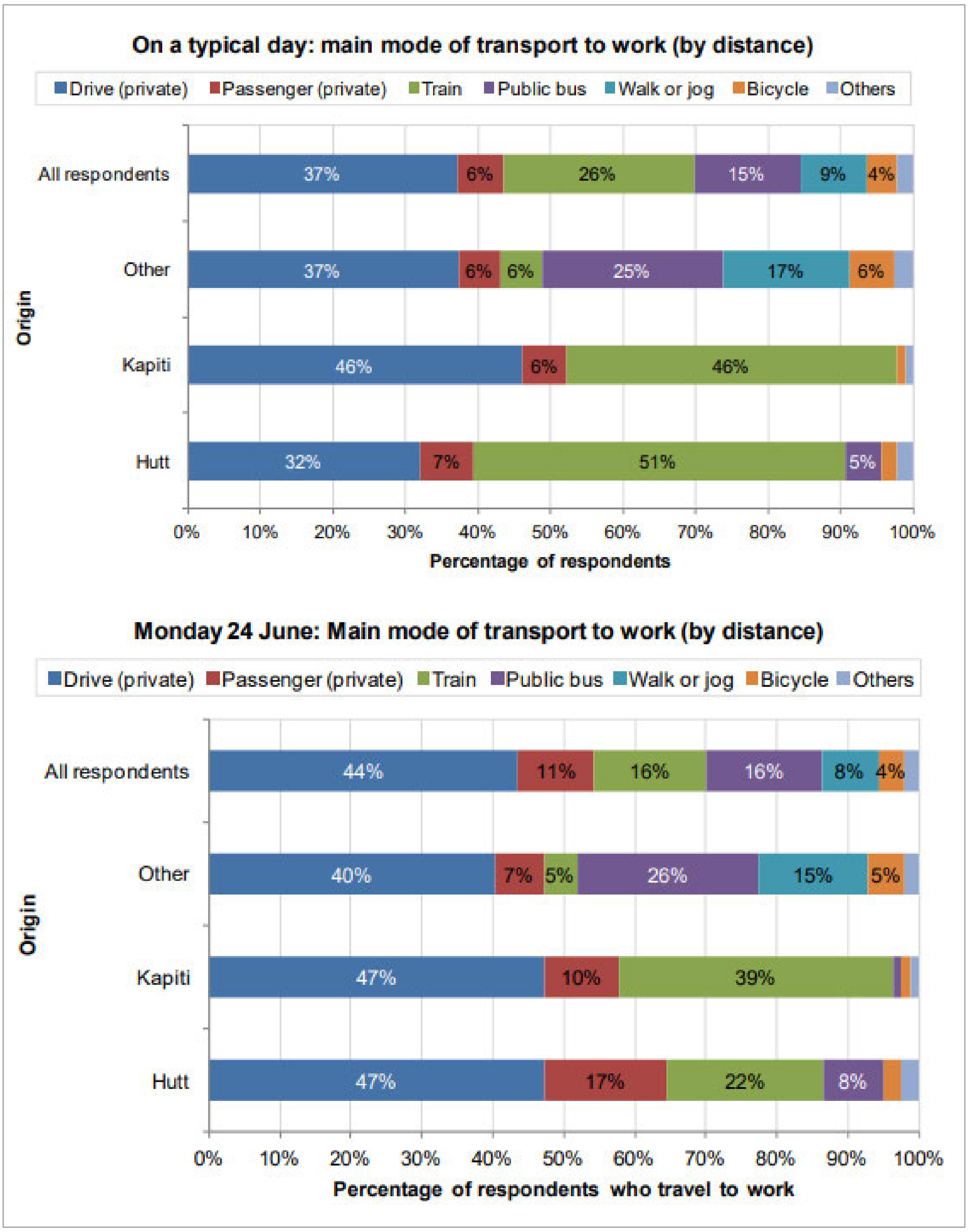


Figure 3-18: Main mode of transport to work (by distance) - typical day and Monday 24 June

The closure of the Hutt Line put significant pressure on all parts of the roading network. The large volume of Hutt Valley vehicles clogged not only SH2, but the Wellington CBD and consequently State Highway 1 (SH1) and all major arterial roads. The MOT subsequently estimated that it significantly increased average travel times during the morning peak, by

20 minutes on Friday 21 June, 18.5 minutes on Monday 24 June, and 14 minutes on Wednesday 26 June. It then used these estimates to determine that the added cost of congestion of the four-day outage was in the order of $2.66m in lost time in the morning peak alone, suggesting that the daily cost of the outage was around $1.33m per day[25].

The impact of the July 2019 freight train derailment is clear when evaluating the traffic volumes on SH2 southbound at Ngauranga, which is presented in Table 3-4. The effect of the cancelations of the trains is shown with traffic volumes starting to climb above normal at 5am and remaining higher than normal until 11am. The road remained at capacity for a significantly longer period than normal.

Table 3-4: SH2 traffic volumes on SH2 before, during and after train cancelations

Hour of:	05:00 - 06:00	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00
Week before average	678	2396	2496	2322	1750	1368	1350
July 3 2019	797	2420	2581	2234	2311	1584	1380
Average Week after	662	2352	2493	2159	1693	1474	1436

This story of the road network being unable to cope with the additional traffic after the freight train derailment is also replicated in the expected travel times. TomTom travel times between the Mungavin Interchange and the intersection of Vivian and Willis Streets via SH1 showed that the median expected travel time was equal to or higher than the normal 95th percentile expected travel time. The 95th percentile expected travel time was significantly higher, nearly reaching two hours at one point compared to the 50 minutes, which is the typical 95th percentile travel time. A comparison of the expected travel times is shown in Figure 3-19.

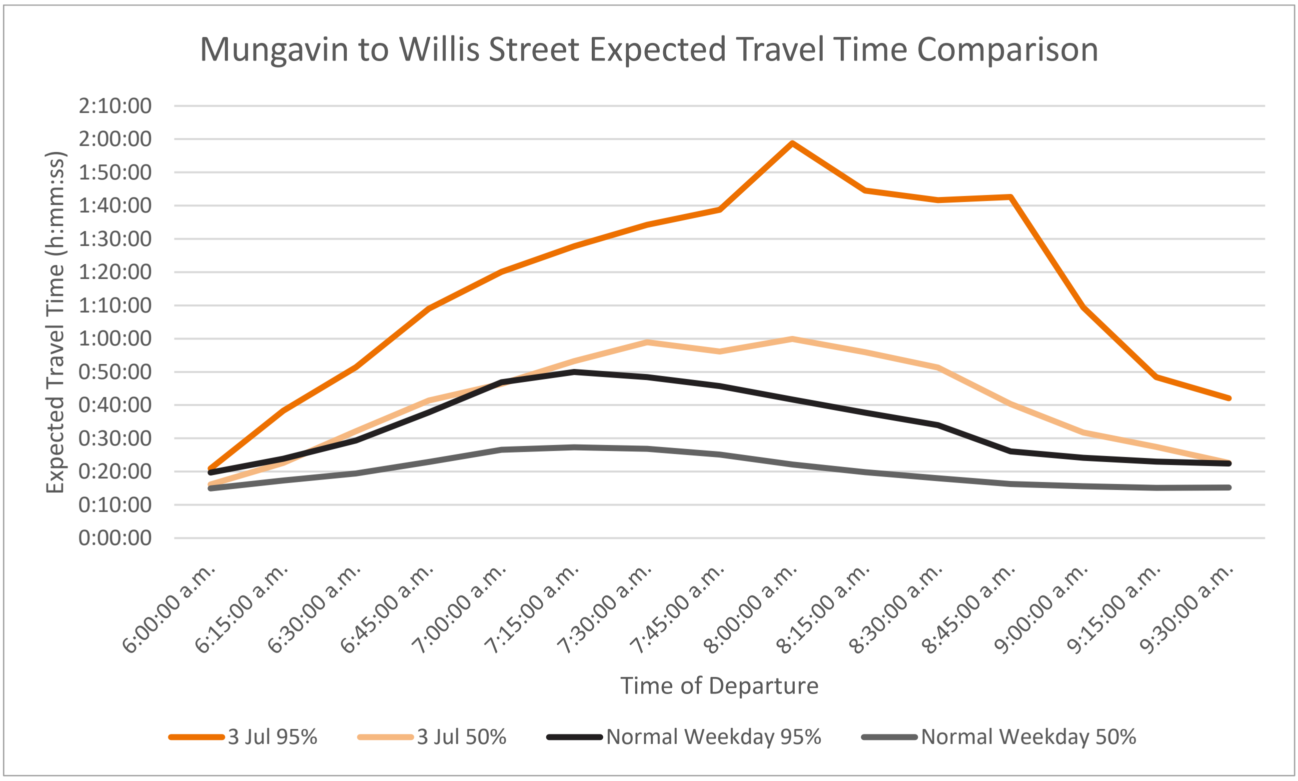


Figure 3-19: Expected travel times from Porirua to Wellington with and without rail services

Both events show the importance of the rail contribution to the effective operation of the transport system for both Hutt Valley and Porirua/Kāpiti commuters. The impact may now be less pronounced than previously due to an increased ability for people to work from home, but it remains substantial as recent rail disruption events show.

Long term vulnerability

The rail network has a long-term vulnerability to weather events and sea level rise, due to its proximity to steep slopes and coastal areas. Weather events such as the June 2013 storm had a week-long impact on the network, with services unable to run, and widespread disruption across the transport system. Unless mitigation work is conducted, this type of

[25] In contrast, the Wellington rail system cost an average of $222,000 per day to operate in 2013, suggesting that the value of the Wellington rail system to the region and country is high.

disruption is likely to become a more regular occurrence, based on current understandings of the expected changes from climate change.

Impacts on the Wellington regional economy

The loss of the Hutt Line for that week in 2013 reduced the gross output of the region by between $21.4m and $42.9m, inclusive of the excess of $5m to fix the transport infrastructure damaged in the storm. While there have been changes in many people's ability to work remotely in similar scenarios since the COVID-19 pandemic, such events are still likely to have a negative impact on the GDP and economic output.

No study has been conducted into the impacts of the freight train derailment on the region's productivity.

Reputational damage

With each event, customers are disrupted and are required to make alternative plans. This undermines their faith in public transport as an option, and in turn affects the reputation of Metlink (and consequently GWRC), KiwiRail, and the Metlink rail service operator.

Sudden funding required

When the network is not maintained and is vulnerable to events, a single event can cause large amounts of damage that must be addressed immediately. This creates an immediate funding requirement, which can present affordability challenges as well as cost more than a planned replacement of assets.

3.1.3.4 Summary

The network condition has had an unsatisfactory level of investment in it in the past, which has led to a high amount of reactive maintenance on the network, as well as the network being unavailable following significant events.

The current signalling system is out of date and does not facilitate bi-directional operation of trains during planned or unplanned events that impact one track. This means events that only impact a small section of the network have system-wide impacts and result in significant disruptions to passenger journeys and incur high bus replacement costs.

As the rail network is a mature network and its place in the transport system has always been assumed when doing other transport planning activities, the transport network does not have sufficient capacity to cope with the additional demand placed on it caused by the absence of the rail system. The functionality of a high-capacity public transport system is required for government to meet its objectives for land transport.

3.2 Benefits of Investment

The April 2019 ILM workshop identified five key benefits that investing to address the problems would provide:

- Improved environmental outcomes (15 per cent of the overall benefit)
- Enable regional growth through improved access to economic and social opportunities (30 per cent of the overall benefit)
- Improved customer experience (15 per cent of the overall benefit)
- Improved transport system resilience (20 per cent of the overall benefit)
- A safer rail system (20 per cent of the overall benefit).

The benefits of investment are described further in the following sections and summarised along with their relationship to the problems in the ILM map in Appendix A.

Each benefit has been evaluated. The benefits and overview of their associated measures is outlined below. The full benefits map can be found in Appendix B.

3.2.1 Improved Environmental Outcomes

The key investment benefit will support a sustainable future.

The implementation of this plan will enable improved environmental outcomes to be reached by the provision of near emission free transport to a large proportion of the population. This shift will be driven by the improvements to the passenger rail services and infrastructure, which will in turn encourage more mode shift to rail. This shift promotes the use of a mostly emissions free mode of transport.

The environmental outcomes are proposed to have two measures – carbon emissions and mode share.

3.2.1.1 Carbon Emissions

Carbon emissions are to be calculated by the fuel usage of trains running WMRN services and calculated on a per passenger km and per tonne km freight basis. To ensure this measure can be consistently quantified, it has been assumed that the carbon cost of the electricity generation is to be calculated from the kg CO_2-e/kWh reported by the Ministry for the Environment on an annual basis.

3.2.1.2 Mode Share

Mode share is to be calculated with two methods:

- Census journey to work data for trips to Wellington from the North of the Wellington CBD
- Rail freight volume.

Census journey to work data can be evaluated every census. There is potential in the future, if work patterns shift, to evaluate trips to other employment centres served by rail as well.

For the purposes of this PBC, only the rail freight volume will be measured. While this is not specifically a mode share representation, it allows for simpler assessment.

3.2.2 Improved Access to Economic and Social Opportunities

The key investment benefit will provide capacity that supports access and growth.

The implementation of the PBC will enable improved access by means of increasing capacity to allow people to access economic and social opportunities by rail, particularly at peak times. This enables the transport network to function more effectively.

This outcome is measured by two main ways – passenger capacity and freight paths. It has three indirect measures that also support it – mode share (discussed above), frequency and accessibility (discussed below).

3.2.2.1 Passenger Capacity

Passenger capacity is proposed to be assessed by the number of peak seat-kilometres. This can be assessed by the timetables and number of units run on each service.

3.2.2.2 Freight Paths

The maintaining of freight paths allows for additional freight services to be run throughout the day, enabling services to be put on to match demand. It is to be reported for both the NIMT and Wairarapa lines separately.

3.2.3 Improved Customer Experience

The key investment benefit will make the rail system attractive and easy to use.

This is achieved by improvements to a range of factors, which have been highlighted by customer surveys as barriers to uptake. This will make rail a more attractive and easier to use mode of transport, which will help increase demand.

Improved customer experience is measured by three criteria – frequency, customer satisfaction, and punctuality – but also has two indirect measures – the transport system impact and perception of safety (discussed below).

3.2.3.1 Frequency

Frequency is proposed to be measured in two ways:

- Off -peak period frequency
- Peak period frequency.

Increase in frequency also serves as a measure for improved access to economic and social opportunities.

3.2.3.2 Customer Satisfaction

Improving customer satisfaction will be measured by the GWRC rail customer survey.

3.2.3.3 Punctuality

Punctuality formed a core part of the customer surveys with delays causing anxiousness for users, particularly those who are using a connecting service. It shall be taken from the monthly operator reporting. The punctuality measure also has a link to the number of peak passengers impacted by cancellations as discussed below.

3.2.4 Improved Transport System Resilience

The key measurable benefit is to make the transport network more adaptable to disruptions. This benefit has a single measure, evaluated in three ways. Methods to measure the improved transport system resilience are:

- Peak period passengers impacted by cancellations, measured by the number of peak services cancelled multiplied by their average patronage
- Number of services cancelled due to asset health related faults or planned maintenance, calculated from operator and KiwiRail monthly reporting

- Network adaptability measurements, measured by the customer hours lost, which is the number of passengers impacted multiplied by the additional travel time they have over their preferred mode.

Investment would also enable GWRC to make a trade-off between network reliability and resilience, since a more adaptable rail network would allow responses to incidents faster and consequently a return to normal operation faster. As new assets, such as crossovers and signalling that enable operational flexibility, are added to the network, they increase the complexity and number of assets in the network. This leads to a higher probability of asset failure. However, as these things are added to the network, the consequence of a single asset failing has a lower impact to the network, therefore increasing resilience.

3.2.5 A Safer Rail System

The key benefit from a safer rail system is that safety is improved for all. This has two measures.

3.2.5.1 Rate of Safety Incidents

This is measured by the rate of safety incidents reported by the operator.

3.2.5.2 Safety Perception

This is measured by the public and user perception of safety and security as per the passenger surveys. Improvements to customer perception of safety and security also has benefits to how attractive and easy the rail system is to use, which will help improve patronage.

3.3 Investment Objectives

Five high level investment objectives were agreed with the Steering Group following the ILM workshop, based on the identified problems and benefits. These are to deliver a rail system that:

- Provides capacity that supports access and growth (20 per cent)
- Is attractive and easy to use (25 per cent)
- Improve safety for all (20 per cent)
- Is adaptable to disruptions (20 per cent)
- Supports a sustainable future (15 per cent).

The investment objectives align strongly with all five of the enduring outcomes within the MOT’s Transport Outcomes Framework – inclusive access, economic prosperity, healthy and safe people, resilience and security, and environmental sustainability.

Each investment objective is supported by the specific and timebound KPIs outlined in the benefits map (see the Benefits Map in Appendix B), which allow for the specific measurement of key elements of the headline investment objectives. These essentially break the high-level investment objectives into eleven SMART investment sub-objectives with fifteen sub-measures. This distinction allowed the high-level objectives to be used in long list assessments and the detailed KPIs to be considered more carefully during the more detailed short list assessments.

Overall success will be measured through increased passenger and freight rail use.

4 Key Constraints, Dependencies, and Assumptions

4.1 Constraints

4.1.1 Long Lead Times

Rail investment requires long lead times. Rolling stock typically needs up to six years to plan, design, procure, construct, certify and put into operation. Heavy infrastructure such as tunnelling, bridging, signalling, and major track alteration needs up to a decade to plan, design, procure and construct, particularly in constrained urban and geographical environments and when services must be maintained.

This urgency is exemplified by the Matangi EMU procurement process between 2006 and 2011:

- Release of Expression of Interest document – September 2006
- Release of Request for Tender – January 2007 (4 months later)
- Selection of Preferred Tenderer – July 2007 (6 months later)
- Commencement of first Matangi units into revenue service – March 2011 (44 months later).

The above Matangi procurement timeframe excludes the lead time needed to make the investment case and confirm funding and requirements scoping prior to the release of the EOI document.

The previous sections point to the need for investment in system capacity and infrastructure to address the problems and enable regional growth and mode shift. Responses to the problems will include interventions that have long lead times. Demand modelling suggests that planning needs to commence urgently to ensure that the capacity is available when it is required from around 2030. Business case investigations into signalling system replacement and improvements to long distance services have already been accelerated for this reason (see Section 4.2.2). COVID-19 is not expected to materially reduce this urgency, due to the lead times and the natural trigger points associated with the additional work required before any commitment to investment.

4.1.2 Network Constraints

4.1.2.1 Electrification

The WMRN uses 1600V DC electrification (see Section 2.1). This differs from the 25kV AC electrification used in Auckland and on the Hamilton-Palmerston North section of the NIMT (as described in Section 2.4.2). There are no plans to remove the existing 1600V DC electrification or to convert it to 25kV AC. Both changes are outside the scope of the PBC.

Conversion to 25kV AC would be a substantial, complex, and costly exercise with little direct benefit at a regional level. 25kV AC requires increased electrical clearance, which is difficult to provide within existing infrastructure. Conversion would require new electrical infrastructure such as substations and the entire EMU fleet to be upgraded or replaced.

KiwiRail is investigating wider rail network options for further electrification separately from this project, which may lead to an expansion of the 25kV AC system.

4.1.2.2 Dual Use Railway

The WMRN and wider railway network is a dual use railway, being used by both passenger and freight traffic. Metlink passenger services are the dominant users of the network, but KiwiRail’s passenger and freight services also require access. The Kapiti Line and wider NIMT is a nationally significant freight corridor, linking all parts of the North Island to Wellington and the interisland ferry link to the South Island. The Wairarapa Line is a regionally significant freight corridor that carries substantial forestry traffic (see Section 2.1). The requirement for passenger and freight trains to interact adds extra complication and necessitates extra track capacity than single use would require.

4.1.3 Physical Constraints

The Wellington region grew around rail and has continued to develop around the rail lines along the main corridors. The resulting urban areas constrain all rail lines. In many other areas, there are significant geographical constraints, with sections of the rail network close to the sea, rivers, and mountains, resulting in numerous bridges and tunnels, including the Remutaka Tunnel, the second longest tunnel in the country and the longest used by passenger trains. The network is consequently severely space-constrained with limited low-cost opportunities for widening in many areas.

Some key physical constraints are outlined in Table 4-1, which highlights some of the challenges with rail expansion.

Table 4-1: Key physical constraints

Line	Area	Constraints/Issues
All	Wellington Station Approach	Existing assets (maintenance facility, stabling and maintenance yards) KiwiRail freight yard
	Kaiwharawhara	Interislander terminal SH1 and Hutt Road
Johnsonville	Ngaio Gorge	Single track (capacity) Slope stability Five tunnels Wadestown escarpment Kaiwharawhara Stream General steep gradients and sharp curves
	Crofton Downs to Raroa	Single track (capacity) Residential houses Khandallah Rd/Cockayne Road/Burma Road Two tunnels Slope stability General steep gradients and sharp curves
	Johnsonville	Single track (capacity) Slope stability Moorefield Road Johnsonville Mall
Kāpiti	Kaiwharawhara to Glenside	Tawa Tunnels and SH1 overbridge
	Glenside to Tawa	SH1 Porirua Stream Slope stability
	Tawa Basin	Residential houses Porirua Stream Level crossings at Tawa Street, McLellan Street, and Collins Avenue
	Porirua – Plimmerton	Porirua Stream SH59 Porirua Harbour Level crossings at Pascoe Ave and Steyne Avenue
	Plimmerton to Pukerua Bay	Taupo Swamp Slope stability
	Pukerua Bay to Paekakariki	SH59 Paekakariki Escarpment (Slope stability) NSJ single track (capacity) Beach Rd level crossing
	Mackays to Raumati	SH1 Raumati Escarpment (Slope stability)
	Paraparaumu	Old SH1 Level crossings at Kapiti Road and Otaihanga Road Residential and commercial properties

	Waikanae	Single track including Waikanae River crossing (capacity) Elizabeth St level crossing Residential houses Main Road (old SH1)
NIMT (beyond Waikanae)	Peka Peka to Te Horo	SH1 Peka Peka to Otaki Expressway construction Single track with passing loops (capacity)
	Otaki	Otaki River SH1 Peka Peka to Otaki Expressway construction Single track with passing loops (capacity)
Hutt	Ngauranga to Petone	SH2 Wellington Harbour Wellington Harbour escarpment
	Melling Branch	Single track in constrained corridor SH2 Commercial and residential properties Slope stability
	Petone to Upper Hutt	State highways and local roads Melling Branch Junction Commercial and residential properties Hutt River bridges Level crossings at Manor Park Road, Sutherland Avenue, Ward Street and Blenheim Street
Wairarapa (beyond Upper Hutt)	Maymorn	Single track (capacity) Maoribank and Remutaka Tunnels Slope stability Lifestyle properties
	Featherston to Carterton	Single track with passing loops (capacity) Remutaka Range Slope stability Farmland Numerous level crossings, rural and suburban Residential houses Tauherenikau River Waiohine River
	Masterton	Single track (capacity) Waingawa industrial area Level crossings Waingawa River Lifestyle properties Ngaumutawa Road Residential houses West Masterton industrial area

4.1.4 Train Capacity

Opportunities to increase train capacity are limited to:

- Increasing train carrying capacity (more people per two-car unit). This leads to a decline in customer experience due to a more crowded interior layout.

- Increasing train size (longer trains). This option maintains current level of customer experience by enabling existing services to carry more people, but it requires additional power supply and platform lengthening if trains extend beyond the current 8-car limit.
- Introducing 3-car units (reduced proportion of train space required for driver cabs). This option is neutral to customer experience, but it requires additional power supply and may require platform lengthening to enable trains of longer than six cars to operate.
- Increasing train frequency (more services per hour). This course of action gives a pronounced customer benefit as it increases capacity and provides more travel options, but it requires additional power supply and removal of bottlenecks.

Different frequency and capacity improvement combinations create different pathways, with different capacity outcomes over the short and medium term.

4.2 Dependencies

4.2.1 WMUP

The WMUP is a coordinated delivery programme of rail network infrastructure upgrade projects, led by KiwiRail as network owner. The WMUP projects have been critical to improving safety, resilience, and capacity in the short-term, as noted in Section 2.2, and reflect the priorities identified in the 2009 and 2013 RRPs.

Table 4-2 describes each of the WMUP projects to date and identifies their status. Funded and committed WMUP projects have been included in the PBC Do-Minimum (see Section 5.3.3). Projects that are currently in the planning phase and future network projects identified in the preferred programme will be added to the WMUP delivery programme.

Table 4-2: Summary of WMUP Projects

Stage	Status	Description
WMUP I	Complete	Renewal of end-of-life infrastructure conducted between 2011 and 2018.
WMUP II	Near Complete	Renewal of the traction power overhead system for the WMRN electrified area between 2018 and 2022.
WMUP III	In Progress	A programme of track renewals to improve track condition and performance on the WMRN between 2019 and 2026 as discussed in 3.1.3.1.
WMUP IV	In Progress	Infrastructure improvement to enable the RS1 'clockface' passenger timetable on the Hutt Valley and Kapiti Routes between 2020 and 2024.
WMUP 5	Detailed Business Case (DBC) stage	Upgrade WMRN signalling system and introduce of automatic train protection between 2021 and 2031.
WMUP 6A	In progress	Safety and capacity improvements and upgrades of Wellington Station northern approaches between 2021 and 2024.
WMUP 6B	In progress	Infrastructure programme to support higher frequency longer distance passenger services on the Wairarapa Line.
WMUP 7	Planning	Study to confirm the key network constraints that need to be addressed to support future frequencies, building on earlier WMUP projects, the LNIRIM DBC (see below), and the outcomes of this PBC. Its recommendations will inform all future business cases within the preferred programme.

4.2.2 Recent Rail Business Cases

Recent Wellington rail business cases include the WMUP 5 WMRN Resignalling and Automatic Train Protection Indicative Business Case (IBC), and the Lower North Island Rail Integrated Mobility (LNIRIM) DBC. Both business cases are component projects of this PBC, but were accelerated due to their urgency, complexity, and long lead times. The outcomes of these business cases have been reflected in the development of the PBC programmes. The PBC provides the overarching framework within which they will be funded and delivered and ensures that they reflect and meet wider passenger and freight rail system requirements.

4.2.2.1 WMUP 5

The Resignalling and Automatic Train Protection IBC was led by KiwiRail as network owner. It was completed in June 2021 and recommended that a group of in-cab signalling system options (ETCS Level 2 or 3) be investigated further in a DBC that is set to start in 2022. This solution provides capacity, safety, and resilience outcomes required by the PBC. The current signalling system would not meet such requirements in any situation other than the PBC Do-Minimum.

4.2.2.2 LNIRIM

The LNIRIM DBC was led by GWRC as the region's public transport authority. It was completed in October 2021 and assessed improvements to longer distance services from Masterton and Palmerston North, recommending new tri-mode rolling stock, a new maintenance depot to service them at Masterton, new stabling facilities, driver training, station upgrades and new track infrastructure. It followed on from a prior business case, which recommended service improvements, rolling stock replacement, and new infrastructure including track improvements, sidings and passing loops in the Wairarapa that have since been funded through the NZUP.

4.2.3 Regional Planning

4.2.3.1 Regional Growth Framework

The RGF and PBC have been developed with an awareness of one another, recognising that rail will play a crucial role in enabling population growth in most parts of the Wellington Region (and Horowhenua District), and that the projected population growth will drive much of the need for capacity enhancements on the rail network. The RGF identified access improvements at Wellington Station, elimination of the single-track section between Pukerua Bay and Paekākāriki and service improvements north of Waikanae as being key supporting elements.

4.2.3.2 Regional Mode Shift Plan

The RMSP was developed alongside the RLTP. It recognises the importance of LGWM investment to the south, and PBC investment to the north, to enable and encourage the major mode shift to public transport and active modes required by the RLTP. Both the RMSP and PBC have been developed with significant input from GWRC and KiwiRail.

4.2.3.3 Let's Get Wellington Moving

LGWM focuses on travel to the south of the Wellington Station but is likely to include significant investment in public transport, including mass transit to improve intermodal public transport connectivity at the railway station and increase the attractiveness of rail for trips to the south and east of the city. The LGWM programme has identified a need to reduce road traffic from the north and assumes that there will be complementary and significant investment in rail capacity and service levels beyond RS1 as noted in Section 2.3.5.

4.3 Assumptions

Several key assumptions have been made when developing this PBC, as outlined in Table 4-3.

Table 4-3: Key assumptions informing PBC development

Assumption	Explanation	Impact of Assumption Being Incorrect
COVID-19	COVID-19 will not have a significant effect on the nature, scale, or location of public transport demand over the medium to long-term. It will have a short-term impact, which will provide time to plan and start to execute improvements that will be in place when needed in the medium to long-term.	While initial investment could be earlier than required, there are opportunities within each business case to defer future investment. Rolling stock and service expansion can be delayed in particular. All interventions are expected to deliver benefits to rail users, but they may not deliver full benefits until demand picks up.
Population growth	Population growth will occur along the rail corridors and broadly at the rates expected by RGF projections.	If population growth varies significantly from anticipated levels, it will require either acceleration or deceleration of investment to ensure that demand is appropriately met. Particular programme elements can be varied in this way as noted above.
Funding	Funding will be available when required. This funding may come from the NLTF or Crown sources, with a regional contribution that is appropriate to the intervention.	Funding delays will delay the programme and associated regional and national targets will not be met.
Freight services	Freight services will continue to use the network in the future, including during the weekday morning and afternoon commuter peaks. Rail	Freight services have access rights, but additional peak period freight services cannot be easily accommodated without network capacity

	freight volumes may increase in the medium term due to other KiwiRail investment, such as the higher capacity ferries being delivered through the iReX project and the new Palmerston North Freight Hub. This increase may be managed by increasing train length or operating more services outside commuter peaks, or by accepting reduced reliability in peak periods.	improvements unless Metlink services levels are reduced. Such a change would be counter to regional and national objectives and increase the maintenance requirements for the network.
Metlink service patterns	The RS1 service improvements will be implemented and included in the Do-Minimum. Current operational patterns will continue to be used on all lines, including the peak layered service approach on the Kapiti and Hutt lines, consisting of full-line express services serving outer tier stations and all stops short workings serving inner tier stations. These patterns will be maintained as frequencies increase, but further considered through later investigations.	RS1 service improvements are necessary to provide better short to medium term capacity on the longer lines (Upper Hutt and Kāpiti), and most infrastructure to enable them has been completed. They will be included in all programmes if not included in the Do-Minimum, providing greater economic benefits for these options. Should the service patterns change, there will be an increase in effective capacity, but a lower level of service to customers (less frequency to inner areas and longer travel times to outer areas). This can be expected to reduce the attractiveness of rail as a travel option, providing lower mode shift than required.
Heavy rail	All lines will continue to operate as heavy rail for the life of this plan.	If rail operations were to be discontinued on a line and services replaced by buses, it would require substantial uplift in bus volumes and capacity to provide a similar level of capacity. It is likely many users would also move to private motor vehicle due to the lower service level of a bus compared to rail. Safety concerns relating to crash impact prevent tram trains or light rail vehicles from operating on the heavy rail network but could interchange with it similarly to bus if using a dedicated line.
Road investment	Current road improvement projects will be completed as planned, including the expressway to Otaki and a new road from there to north of Levin on SH1, as well as the upgrade of the Melling interchange on SH2. Further upgrades will not be made due to complexity of adding further capacity to the strategic road network and challenges of accommodating additional motor vehicles in the Wellington CBD (see Section 7.2.1 for a discussion of this in relation to the preferred option). Investment in the rail network, and the associated mode shift away from private motor vehicles, will reduce or eliminate the need for further road investment.	Any additional road capacity will make rail less attractive, particularly if capacity is added closer to Wellington where there is currently the most restriction. Any reduction of promised capacity will increase demand on rail and further improve the case for future rail investment.

5 Option Development

5.1 Development and Refinement Process

The process for identifying a preferred programme took the following steps:

- Assess strategic alternatives
- Identify and filter a long list of interventions
- Allocate interventions into a long list of programmes
- Assess the long list of programmes using high-level multi-criteria analysis (MCA) to identify a short list of programmes
- Further develop and cost the shortlisted programmes
- Assess the short list of programmes using detailed multi-criteria analysis (MCA) to identify a preferred investment programme.

5.2 Strategic Alternatives

Potential alternatives were assessed as a first step in the option development process using Waka Kotahi’s intervention hierarchy for NLTF investments. The results of this assessment are outlined in Table 5-1.

Table 5-1: Assessment against the Waka Kotahi intervention hierarchy

Priority	Intervention Category	Assessment
1	**Integrated planning**	Integrated planning is inherent in all potential options, as the development of the PBC has informed and been informed by development of the RGF regional spatial plan. The RGF envisages significant growth and intensification along the rail (rapid transit) corridors as required by the NPS-UD and recognises that rail capacity upgrades are required to enable it. The RMSP and LGWM also assume that there will be rail capacity upgrades beyond RS1 to reduce road traffic from the north. Some programme options that would not fully support the RGF, RMSP and LGWM were included in the programme development process to provide lower-cost options for investors - the Do-Nothing, Do-Minimum, and Minor Improvements, and Moderate Improvements programme options. However, these would likely lead to development away from the rail corridors, since rail would not be an attractive public transport option, would result in poor urban form and increased road demand, and would consequently not meet the requirements of this level of the hierarchy.
2	**Demand management**	Public transport is a supply-side measure as defined for this level of the hierarchy, which relates to road demand management. The PBC responds to this and the mode shift requirements that are central to the RLTP and RMSP. Rail capacity is limited however, so increased public transport demand will either require more investment in rail or supplementing rail with bus services. Rail has significant advantages over bus, being both faster and more reliable, particularly over longer distances and where parallel roads are congested, which is the case with the roads that parallel the rail corridors - SH1 and SH2. One programme option with rail demand management features was included in the programme development process to provide an option for investors – the Moderate Improvements option. However, this and the other programmes noted above would lead to higher road demand and would consequently not meet the requirements of this level of the hierarchy.
3	**Best use of existing**	Recent rail network investment and the upcoming RS1 service changes that this investment enabled are intended optimise use of the existing EMU fleet and maximise operational efficiency within the electrified area and is included in the Do-Minimum option. There is little more if anything that can be done to optimise service levels as required by this level of the hierarchy.

4	**New infrastructure**	A range of infrastructure and non-infrastructure responses are required to address the problems and provide capacity, improve the attractiveness of the service offering to customers, improve safety, improve the resilience of infrastructure and operations (particularly in the face of climate change), and support sustainability goals in line with the investment objectives. The capacity-related elements largely relate to infrastructure improvements that eliminate bottlenecks and improve train throughput. These have the largest cost but are required to enable the rail system to function at its full potential and meet the planning and demand management requirements above.

5.3 Programme Development

5.3.1 Intervention Long List and Filtering

A long list of interventions was developed with stakeholders in an 'all ideas welcome' environment through a series of meetings and workshops in late-2019. Nearly 200 interventions and outcomes were identified as options through this process.

Each intervention was assessed to confirm whether it offered a primary benefit or was required to enable an intervention that would contribute to the benefits sought by the PBC, and then grouped and put through a modified version of the Waka Kotahi Early Assessment Sifting Tool (EAST). The output of this process is documented in Appendix C.

Interventions that were considered fundamentally the same were grouped and any duplicates were excluded. Specific minor works (such as installation of a single crossover) were excluded and resubmitted as part a wider network intervention, on the basis that future business cases would determine specific locations. Interventions that were considered business-as-usual, those did not contribute to an investment objective or did not enable an objective, and those that were out of scope were also excluded.

5.3.2 Organisation Into Programmes

Interventions that remained following the EAST assessment were organised into programmes for assessment. Eight programme options were identified:

- Do-Nothing
- Do-Minimum
- Minor Improvements
- Moderate Improvements
- Train Size Focus
- Frequency Focus
- Mixed Focus
- Drive Mode Shift[26].

All programmes other than the Do-Nothing and Do-Minimum option sought to address all key problem areas. Each had a different focus and addressed each problem area to a greater or lesser extent or over a shorter or longer timeframe.

The Minor Improvements and Moderate Improvements programmes provided two lower cost programme options, which were only expected to have a modest impact. The remaining programmes provided a stronger response but were expected to require significantly more investment. The Train Size Focus, Frequency Focus, and Mixed Focus programmes provided alternative approaches for higher investment. The Drive Mode Shift programme provided a do-maximum programme option.

There is a large amount of crossover between the long list programmes, since there are only a limited number of feasible improvement options. The programmes build upon each other, and primarily differ in terms of the number, timing and scale interventions included, with higher growth (and benefit) programmes requiring more to be done sooner. For this PBC, the current maximum 8-car train was retained due to the large amounts of physical works that would be required to enable longer trains to use the stations in a customer friendly way.

All programmes had a 30-year focus in line with the PBC timeframe. Some longer-term interventions were included where it was considered possible that they might be required earlier due to growth, particularly in the higher growth programmes.

[26] This programme was named Facilitate Mode Shift during the programme development stage and shortlisting process but was later renamed Drive Mode Shift to better emphasise its focus compared to the other programmes, several of which facilitate mode shift.

The exclusion of an intervention did not mean it will not eventually be needed. A number of 'programme additions' could be added or brought forward within programmes to emphasise certain outcomes, such as options to address further decarbonisation or station accessibility.

5.3.3 Do-Minimum Programme

The Do-Minimum programme was developed in conjunction with Waka Kotahi and GWRC using the current Waka Kotahi definition[27]. It consists of:

- Completion of currently committed projects
- Implementation of the RS1 timetable
- Increasing train capacity during heavy maintenance
- Matangi end of life replacements with minor fleet increase in the mid-2040s
- Timetabling changes to Waikanae services following the fleet replacement
- Power supply upgrades to enable the above capacity improvements
- Commencing investigation work on reducing the NSJ bottleneck in circa 2050
- Maintenance works to ensure the network can deliver the above services
- Increased maintenance and improved whole-of-life asset management practices to avoid future repetition of the Wellington Metro Upgrade Programme – Catch Up Renewals programme and associated disruption
- Rollout of electronic ticketing.

The Do-Minimum programme seeks to maintain the current level of rail patronage growth, but accepts growth in line with the population growth, which is considerably below the desired rail uptake. It includes capacity improvements only when absolutely needed and, consequently, does not provide a customer-friendly solution.

Appendix D provides additional details on the Do-Minimum and its development.

5.3.4 Long List Programmes

Table 5-2 summarises all programmes included in the long list. Appendix E provides further detail on each programme, including the key interventions included, anticipated timeframes, indicative capacity provided, and indicative patronage response.

Initial capacity and patronage assessments were revisited and refined at the short list stage. Section 5.3.5 discusses the growth scenarios used to support this assessment.

[27] See https://www.nzta.govt.nz/planning-and-investment/learning-and-resources/business-case-approach-guidance/supporting-material/glossary/#D

Table 5-2: Summary of Long List Programmes

Programme	Programme Philosophy and Summary	Key Benefits	Key Limitations
Do-Nothing	Manage rail system decline while prioritising other modes. Includes only those projects that are sufficiently advanced that costs to abandon them outweigh costs to complete.	• Lowest cost (in the short term).	• Does not address investment objectives • Likelihood that the rail network will be shut down in future for not meeting required safety standards • Would lead to major mode shift to private vehicle.
Do-Minimum	Maintains a basic rail system while focusing investment on other modes. Includes projects that are already committed and those essential to maintain a minimum level of service as described in Section 5.3.3.	• Low cost.	• Does not address investment objectives • Potential for the rail network to be shut down for not meeting required safety standards • Would lead to mode shift to private vehicle.
Minor Improvements	Focuses on low-cost improvements to reliability, safety, and resilience. Makes minor capacity improvements but uses demand management and peak spreading to carry additional passengers, accepting that the service offering will not support mode shift. Includes all aspects of the Do-Minimum programme plus shortening NSJ single track and several low-cost improvements. Elements are included in all subsequent programmes.	• Lower cost • Improved reliability relative to the Do-Minimum • Includes station accessibility improvements.	• Minimal realisation of the investment objectives • Few peak period reliability improvements.
Moderate Improvements	Focuses on improvements to reliability, safety, and resilience, with slight acceleration compared to the Minor Improvements programme. Undertakes sufficient capital works to provide a moderate capacity uplift, but primarily uses demand management and peak spreading to carry additional passengers, accepting that the service offering is not ideal. Also includes station improvements. Elements are included in subsequent programmes.	• Moderate cost • Improved reliability relative to Do-Minimum • Enables managed growth.	• Partial realisation of the investment objectives • Provides only minor capacity uplift • Few peak period reliability improvements.
Train Size Focus	Focuses on maximising train size while holding frequency in the medium term, to boost capacity while reducing the need to invest in track and associated infrastructure. Provides reliability improvements and improves capacity by removing barriers to using 8-car trains during the peak periods as soon as practicable. Includes major power supply, and station and access improvements.	• Addresses the investment objectives • Improves capacity to support mode shift • Maximises throughput using existing infrastructure • Lower cost than frequency options.	• Higher cost option • Reduced peak period resilience • Lower customer attractiveness than frequency options and therefore lower mode shift.
Frequency Focus	Focuses on maximising frequency, particularly during peak periods, before later increasing train size as needed. Provides reliability improvements and removes barriers to enabling a turn up and go peak frequency. Includes substantial network capacity improvements, including to track, power supply, and	• Addresses the investment objectives • Increases frequency at all time periods to maximise customer benefits • Drives more mode shift than train size focus • Can be staged on a line-by-line basis	• Higher cost option that requires significant capital investment to enable early term gains • Impacts to network maintenance and freight paths • Increased operational costs.

	grade separation. Includes station and access improvements.		
Mixed Focus	Balances train size and frequency, by pragmatically increasing train size first on the Kapiti Line, where frequency is difficult to enable, and frequency first on the Hutt Line where it is easier to implement. Provides reliability improvements and appropriate supporting capacity infrastructure. Further improvements are then made to facilitate growth on both lines over time, by providing more frequency on the Kapiti Line and train size on the Hutt Line. Includes station and improvements.	• Addresses the investment objectives • Provides flexibility to respond to demand changes • Delays large capital investment where feasible • Maintains freight paths.	• Higher cost option that requires some capital investment to enable early term gains • Reduced operational resilience in short term • Delayed implementation on the Kapiti Line where growth is highest.
Drive Mode Shift	Removes all barriers to a high frequency, reliable, and comfortable passenger rail experience. Accelerates network capacity improvements to enable accelerated implementation of higher frequencies. Also provides additional capacity to enable better freight access at peak. Supported by a wide range of customer-focused improvements.	• Addresses the investment objectives to the greatest extent • Provides a wide range of improvements for customers • Reduces travel times for most users • Maintains freight paths.	• Highest rolling stock requirements • Highest operational and capital costs • Does not meet Climate Change Commission goals despite being the do-maximum programme.

5.3.5 Programme Demand

Five growth scenarios were developed to support the development and assessment of programmes. These scenarios were used to understand the scale and timing implications of investments in the programme development phase, providing a range of demand outcomes that the programmes could be assessed against, and enabled capacity requirements and thus train size and volume to be matched to demand. The scenarios were based on peak hour (7:30-8:30am) arrivals at Wellington Station, which determines system capacity requirements, using regional population forecasts provided by Wellington Transport Analytics Unit (WTAU).

The five growth scenarios are:

- Scenario 1 – Population Growth: Future peak rail patronage growth was based on forecast population growth only, providing a likely minimum demand scenario.
- Scenario 2 – Constrained Growth: Future peak rail patronage growth was based on the ratio between rail patronage growth and population growth between 2000 and 2018 for each rail catchment area. Growth was constrained to only 60 per cent of the growth observed between 2000 and 2018.
- Scenario 3 – Long Term Growth: Future peak rail patronage growth was based on the ratio between rail patronage growth and population growth between 2000 and 2018 for each rail catchment area. A 70 per cent scaling factor was applied to growth beyond 2026 to reflect uncertainty around the longer-term sustainability of growth rates.
- Scenario 4 – Public Transport Mode Shift Target: Future peak rail patronage growth was based on the ratio between rail patronage growth and population growth between 2013 and 2018. Scaling factors were applied to these growth rates to achieve mode shift from road to rail on the SH1 and SH2 corridors in line with LGWM road congestion targets from the north. These factors were 200 per cent for period to 2026, 120 per cent between 2026 and 2036, and 75 per cent beyond 2036.
- Scenario 5 – High Public Transport Mode Shift: Future peak rail patronage growth was based on the ratio between rail patronage growth and population growth between 2013 and 2018. Scaling factors were applied to these growth rates to achieve mode shift from road to rail on the SH1 and SH2 corridors, similarly to but at a higher level than Scenario 4. These factors were 250 per cent for period to 2026, 130 per cent between 2026 and 2036, and 80 per cent beyond 2036.

The demand growth scenarios are projections from 2018 levels and, consequently, do not account for the impact of the COVID-19 pandemic. However, the nature, scale, and location of transport demand in the region is not expected to change over the medium to long-term as noted in Section 2.5, and the PBC is focused on those longer-term needs.

The scenarios were derived from population growth and did not factor in the positive demand impacts of improvements to service levels or service quality by means of customer willingness to pay or standard service elasticities of demand. All programmes improve frequency and quality, so the demand assessment is considered to be inherently conservative.

The relationship between the scenarios, the demand achieved by each programme, and programme capacity, is shown graphically for the shortlisted programmes at the system level in Section 6.2, and for all programmes and line segments in Appendix D, Appendix E, and Appendix H.

The scenarios were used for programme planning purposes. Detailed analysis and economic assessment of the shortlisted programmes used outputs from the Wellington Transport Strategic Model (WTSM) and the associated Wellington Public Transport Model, as outlined in Section 7.2.1.

5.4 Long List Programme Assessment

The programmes were qualitatively assessed in a high-level Long List to Short List MCA workshop, on 15 April 2021. The MCA process provided a means for equitably assessing the long list of programmes and identifying the programmes that were worth taking forward for more detailed assessment

Participants represented a range of organisations, including the project team, GWRC/Metlink, KiwiRail, Transdev and Waka Kotahi. Participants were invited for their knowledge and understanding of:

- The rail network
- Rail operations
- The wider public transport network
- Investment requirements.

This section provides a brief overview of the process. Full details of the process and briefing to the assessors is provided as Appendix E. Workshop outcomes are summarised in Appendix F.

5.4.1 Assessment Criteria

Table 5-3 outlines the criteria used to assess the long list of programmes and the workshop weighting placed on each criterion. Assessment criteria were based around the investment objectives and other criteria recommended by Waka

Kotahi guidance material. Workshop participants judged the capacity, attractiveness, safety, and increased use criteria as being the most important.

Table 5-3: Programme shortlisting assessment criteria

Assessment Criteria		Weight	Considerations
Investment Objectives	Support a sustainable future	11%	• Increase rail passenger and freight mode share • Reduce rail carbon emission per passenger
	Provide capacity that supports access and growth	14%	• Improve access by increasing peak passenger capacity. • Maintain freight access by retaining existing freight paths throughout the day and ensuring capacity for growth.
	Attractive and easy to use	14%	• Increase frequency throughout the day. • Improve peak punctuality. • Improve overall satisfaction of rail passengers. • Maintain ease of access and improve accessibility for impaired users.
	Adaptable to disruptions	8%	• Reduce passenger impact of high impact low probability events. • Reduce passenger impact of unplanned events.
	Improve safety for all	14%	• Reduce the rate of safety incidents. • Increase public and user perception of safety of rail.
Other Criteria	Overarching success factor	14%	• Increase rail usage (passenger and freight).
	Alignment with regional, national policies and investments	8%	• Assesses programme alignment with policies such as the Zero Carbon Act, GPS, RLTP, RPTP, NZRP, and other investments, such as the LGWM programme.
	Implementability	5%	• Assesses how practical each of the projects are, considering aspects such as consenting of any capital works, funding availability and ability to run services during the construction. Can be considered similar to engineering degree of difficulty.
	Risks to programme delivery	5%	• Identifies if a programme is at risk of not being implemented as expected for any reason. This is inclusive of legal or political risk.
	Affordability	7%	• Scores the cost of the programme, on the assumption that more expensive programmes may be more difficult to fund and therefore will be less affordable.

5.4.2 Scoring Framework

Table 5-4 outlines the scoring framework that was used to score the programmes against the criteria.

Table 5-4: Programme shortlisting scoring framework

Benefit Level/ Duration	High Benefit	Medium Benefit	Low Benefit	Neutral	Low Disbenefit	Medium Disbenefit	High Disbenefit
Long term	3	3	2	0	-2	-3	-3
Medium term	3	2	2	0	-2	-2	-3
Short term	2	1	1	0	-1	-1	-2

5.4.3 Assessment Result

5.4.3.1 Workshop Scores

The original intent was to score all programmes against the Do-Minimum programme, scored as zero against all criteria. However, during the workshop, participants felt that a three-point benefit scale did not sufficiently differentiate between the programmes and noted that the Do-Minimum did not achieve the investment objectives. The Do-Minimum programme was consequently given a revised score below zero in the cases where the additional differentiation was wanted, and the programme did not achieve the investment objectives.

The project team subsequently rebalanced the workshop scores so that the Do-Minimum was scored at zero to maintain compliance with the Waka Kotahi MCA guidance. Table 5-5 shows the resulting moderated score for each programme and criterion.

Table 5-5: Long list moderated scores by criterion

Programme	Sustainable Future	Provide Capacity	Attractive and Easy to Use	Adaptable	Improve Safety	Increased Use	Alignment with Policies	Implementability	Risks	Affordability
Do-Nothing	-2	-1	-3	-2	-2	-1	-1	1	-2	2
Do minimum	0	0	0	0	0	0	0	0	0	0
Minor Improvements	0	1	1	1	1	1	1	0	-1	0
Moderate Improvements	1	2	1	2	1	2	1	0	-1	0
Train Size Focus	2	2	2	2	2	2	2	-1	-1	-2
Frequency Focus	2	2	3	2	2	2	2	-3	-2	-3
Mixed Focus	2	2	3	2	2	2	2	-2	-1	-2
Drive Mode Shift	3	3	3	3	3	3	3	-3	-2	-3

5.4.3.2 Sensitivity Tests

Both the workshop and moderated scores were put through a range of sensitivity tests. These used additional weighting systems developed by the workshop attendees and project team, which emphasised one or many criteria and gave un-emphasised criteria an equal weighting. The weighting systems included the following (further described in Appendix F):

- Workshop weighting (moderated).
- Equal weighting
- Investment objectives as a singular criterion
- Safety emphasis
- Capacity emphasis
- Success factor emphasis
- Customer focus emphasis

- Delivery emphasis
- Delivery and customer focus
- Implementable and affordable focus
- Affordable focus.

5.4.3.3 Assessment Outcomes

Table 5-6 outlines the assessment outcome, providing overall weighted scores for the workshop (moderated score) and the ten sensitivity tests, for each programme.

Table 5-6: Long list weighted sensitivity test scores

Rank	Workshop (Moderated)	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable	Affordable Focus
Do-Nothing	-2.3	-2.0	-1.5	-2.3	-2.3	-2.0	-2.2	-1.2	-1.3	-0.9	-1.4
Do minimum	-0.9	-0.8	-0.8	-0.9	-1.1	-0.9	-0.7	-0.6	-0.6	-0.7	-0.9
Minor Improvements	-0.1	-0.2	-0.5	-0.1	-0.1	-0.1	0.1	-0.4	-0.4	-0.3	-0.4
Moderate Improvements	0.5	0.3	0.0	0.2	0.5	0.5	0.6	-0.2	0.0	-0.1	-0.1
Train Size Focus	1.0	0.7	0.0	0.8	1.1	0.8	1.1	-0.3	-0.2	-0.3	-0.1
Frequency Focus	1.3	0.7	-0.3	1.1	1.1	1.1	1.5	-1.0	-0.6	-0.9	-0.3
Mixed Focus	1.5	1.0	0.2	1.3	1.3	1.3	1.7	-0.3	0.0	-0.3	0.2
Drive Mode Shift	2.0	1.3	0.2	1.8	1.8	1.8	2.0	-0.7	-0.2	-0.6	0.1

5.4.4 Conclusion

The long list assessment showed that the Drive Mode Shift programme consistently ranked as the best programme, with the best or equal-best score across most criteria (including all investment objectives) and most sensitivity tests, although it was the poorest scoring option against the deliverability and affordability criteria and sensitivity tests. The Mixed Focus programme scored similarly and generally in second place, although it was much better performing against the deliverability and affordability criteria and sensitivity tests than the Drive Mode Shift programme. These programmes were taken forward to the short list as the best scoring programmes.

The Moderate Improvements programme provided the best balance between deliverability and affordability criteria, and the investment objective, outcome, and policy-focused criteria. It can be regarded as a ‘middling’ option with neither significant advantages nor disadvantages, although it would only partially realise the investment objectives. It was selected to take forward to the short list as a more deliverable and affordable alternative.

The Train Size Focus and Frequency Focus programmes scored well, but did not offer the same investment objective, outcome, and policy-focused advantages as the Drive Mode Shift and Mixed Focus programmes, or the deliverability and affordability advantages of the Moderate Improvements programme. These were consequently discounted, along with the Do-Nothing, Do-Minimum, and Minor Improvements programmes, which scored poorly against the investment objective, outcome, and policy-focused criteria. The Do-Minimum programme was carried forward to enable comparison between the three shortlisted programmes and a situation where no significant investment was to occur.

6 Option Refinement

6.1 Short List Programme Development

The three shortlisted programmes – Moderate Improvements, Mixed Focus, and Drive Mode Shift were further developed at this stage of the process to:

- Define critical aspects of the programmes
- Identify next steps and bundling of investigations for further investigation or implementation
- Better define programme cost estimates, both capital and operational costs
- Better understand the required timeframes for investment
- Better understand operational issues such as staffing requirements and integration with other aspects of the public transport network
- Undertake more detailed patronage forecasting
- Undertake initial economic analyses based on early-estimate benefits and costs.

No additional work was undertaken on the Do-Minimum, which was also brought forward for comparison as a baseline.

6.1.1 Capacity Study Inputs

Independent of the PBC, KiwiRail commissioned KSP Consultants to evaluate the required changes to the network to enable a:

- 4+4 timetable (15-minute frequency on both tiers under the layered service approach described in Footnote 18)
- 6+6 (10-minute frequency on each tier)
- 10+10 timetable (6-minute frequency on each tier).

The RS1 service improvements will implement the 4-4 timetable. The 6+6 and 10+10 timetables represent peak frequency improvements that are core elements of the shortlisted programmes, particularly the Mixed Focus and Drive Mode Shift programmes. The KSP assessment focused on the Kapiti Line, which is most constrained.

A summary of KSP Consultants evaluation is outlined in the following sections.

6.1.1.1 4+4 Timetable

KSP noted that, while a 4+4 service can run on the Kāpiti line, there are minor changes that would need to be made to ensure the network could run reliably. These included:

- SPAD mitigation track and signalling changes Wellington Station throat, including A Box renewal, ROW indicators, signalled moves EMU Depot to Station
- Porirua Area Capacity Enhancements as proposed (noting that the additional crossover to allow two trains off-network simultaneously can be deferred)
- NSJ “tweaks”:
  - NSJ – Up Main signal block split (currently ~ 3 km long - SJN8R-> S3444)
  - Plimmerton to Pukerua bay – Up Main signal block split (currently ~ 4 km long - M258-> S2950)
  - Pukerua Bay to Plimmerton – Down Main signal block split (currently ~ 3 km long - S2885-> M259)
  - NSJ – track circuit timers (latency reduced from 30+30 seconds to 5+5 seconds)
- More stabling Waikanae (From 12 to min 20 cars)/ or Paekakariki and operational adjustments.

While not specific to the capacity, it was also noted that the following may cause operational issues when operating a 4+4 timetable:

- The Waikanae turnback is tight
- The Wellington Station east-side link (used to allow simultaneous diesel shunts P8/P9 short-term; and in the future for east-side relay movements of EMUs) is required.

6.1.1.2 6+6 Timetable

KSP noted that significant additional investment would be required to enable additional services beyond the 4+4 timetable, including:

- A fourth main to enable separation of the Kapiti and Hutt lines on approach to Wellington Station, significantly reducing conflict potential and to allow each line to operate to separate timetables
- Reduction of the NSJ single track capacity constraint, assuming an extension of double track to Tunnel 3, and daylighting of Tunnel 7; and extending the double track to Tunnel 6, which would effectively halve the single-track section
- Double tracking at Waikanae - Waikanae and NSJ are directly related due to the journey time profiles and current stopping patterns (it was noted that the Waikanae bridge may be able to remain as single track)
- Waikanae second platform due to the short layover (alternatively need to shorten journey time by at least 3 minutes)
- 40 kph freight access Wellington freight terminal, which is critical for any further growth
- East-side EMU stabling is required at Wellington Station, plus northern access to east and west stabling
- Wellington stabling for increased EMU fleet and regional fleet during interpeak
- Increased out-stabling (Waikanae, Paekakariki, Upper Hutt, Taita) to enable Wellington bound services to be run prior to arrivals of the first outbound services
- Additional tracks at Wellington Station to allow access to outer platforms during relay movements

Even with these investments it was noted that:

- The Johnsonville Line is still highly susceptible to delays resulting from relay moves – grade separation is unlikely to be cost-effective so puts pressure on Wellington Station platforms for “pre-loading”
- Increased number of Wellington platforms – no flexibility to adjust/optimise timetable for layover until NSJ daylighted, peak shoulders and service transitions critical periods
- An additional Wellington platform is required when Kapiti and Hutt services (+ regionals) each require 4 platforms, which is likely for 10+10 timetable
- An upgraded signalling system (ETCS – Transition to Level 2 “optimised”) is required since reduced headway will impact timetable margins, on-time performance and/or stopping patterns with both an inner and outer tiers
- Plimmerton station requires second crossover for “turnback-and-pull forward to platform”.

The modelled 6+6 timetable did not provide full Metlink service in the counter-peak direction (i.e. northbound service in the morning peak and the reverse in the afternoon peak), to allow long distance and freight paths to be used. The resulting low frequency would deter existing and new users from travelling to Kāpiti, as that part of the region grows, and becomes more of a destination for work and other activities, but likely promote private vehicle use.

6.1.1.3 10+10 Timetable

KSP noted that it would not be possible to maintain a 10+10 timetable on the Kāpiti line without the addition of significant sections of third main and full double tracking of the entire NSJ section. KSP also noted that the removal of the express pattern might enable other options.

6.1.2 Shortlisted Programme Descriptions

The three shortlisted programmes include a mix of fleet, infrastructure, and service improvements beyond the Do-Minimum. The timing and extent of the improvements differ between programmes, i.e.:

- Moderate Improvements programme manages growth
- Mixed Focus programme enables growth in pragmatic way
- Drive Mode Shift programme accelerates growth.

The following sections outline the shortlisted programmes at a high level. The appraisal summary tables in Appendix G, and workshop briefing note in Appendix H, provide greater detail on each programme.

6.1.2.1 All Programmes

All three shortlisted programmes include the following:

- Investigations into optimisation of stations, station zoning, service frequency span, future rail lines and use of existing lines, and network constraints
- Resilience and operations improvements, including slope stabilisation, resilience to sea level rise, drain and culvert capacity to a higher degree than existing maintenance practices
- Capacity improvements at NSJ and Waikanae
- Network segregation improvements, including the gating of all pedestrian level crossings, closure and segregation of road crossings, and other safety-related segregation (e.g. fencing)

- Network wide resignalling
- Train related improvements, including Wi-Fi or phone coverage in tunnels, improved platform interface, train capacity indicators, long distance fleet replacement and expansion, EMU fleet expansion and replacement at end of life
- Wellington Station improvements, including northern access to the Wellington EMU stabling yard improved access to the Wellington freight terminal, and Wellington-Kaiwharawhara quadruplication
- Station access improvements, including to subways, suburban interchanges, access links, cycle facilities, and bus connections
- Station improvements, including to accessibility for mobility impaired and other users, shelter, CPTED, sustainability, wayfinding and signage, platform markers, and transit-oriented development
- Maintenance improvements, including the use of new technologies and overnight maintenance
- Other improvements, including to analytics, operations control, train crew allocation, recovery practices following events, and the roll out of electronic ticketing
- Incremental service improvements, linked to the degree and timing of infrastructure and fleet improvements provided
- All activities included in the Do-Minimum programme, other than the capacity improvements through mid-life heavy maintenance
- Comparative changes to service levels as discussed in 6.1.3.

6.1.2.2 Moderate Improvements Programme

The Moderate Improvements programme would take a managed approach to growth. It seeks to make more use of demand management tools, such as charging for park-and-ride to delay the need to make capacity improvements and places an increased emphasis on the use of passenger data to prioritise and target investment.

In addition to the list in Section 6.1.2.1, this programme includes the following specific interventions:

- Network Constraints and Capacity Study to commence and be completed by end of 2024
- Implementation of short-term NSJ capacity improvements in 2027 to enable 12-minute intervals and 10-minute intervals by 2043
- Targeted pricing to spread peak demand
- Park and ride charging
- Kapiti Line power supply upgrades
- Station renewals at key sites
- Grade separation of busiest level crossings
- Review of park and ride to evaluate impacts of user charges
- Fleet expansion to 129 EMUs by 2050.

The Moderate Improvements programme would have a reduced capital cost compared to the other programmes. It would focus on delivering reliability improvements, while accepting a lower level of service to the passengers than the other shortlisted programmes.

Within the 30-year timeframe, the programme would enable a 6+6 operational pattern on the Kāpiti Line, and at least a 5+5 pattern on the Hutt Line. It would not seek to reach a 10+10 timetable on either major line in the 30-year timeframe but some of the larger enabling works would commence towards the end of that timeframe.

6.1.2.3 Mixed Focus Improvements Programme

The Mixed Focus programme would take a pragmatic approach to provision of the capacity needed to enable mode shift and growth, by providing frequency where it is easier to do in the short term and delaying frequency where significant investment is required to enable it. Frequency improvements would be made first on the Hutt Line, while train size expansion would be used to accommodate short term growth on the Kapiti Line. The Kapiti Line frequency would be brought into line with the Hutt Line when constraints were removed in the early 2030s. Further improvements would then be made to facilitate further growth over time.

Building on the Moderate Improvements programme (including items listed in Section 6.1.1.1), this programme includes the following interventions:

- Network Constraints and Capacity Study to be complete by early 2023 evaluating:
  - NSJ capacity improvements, with potentially staged implementation

    - Wellington throat capacity improvements
    - Removal of network constraints Waikanae to Palmerston North
- Further resilience and operations improvements, including bridge seismic resilience, EMU depot location, Porirua freight passing enhancements, increased outer stabling, additional crossovers, track improvements to reduce speed restrictions, improved Woburn siding access
- Power supply upgrades on all lines – focusing on the Kapiti Line initially
- Grade separation of road crossings on all lines, but with initial focus on the Hutt Line
- Gating all pedestrian crossings, but with initial focus on the Hutt Line
- Hutt Line 12-minute peak intervals then progressively higher intervals at peak times, with train size improvements as required by demand
- Kapiti Line peak services to 8-car trains as fast as reasonably practicable, then moving to 12-minute intervals by 2034 and 10-minute intervals by 2040
- Off-peak service improvements
- Fleet expansion to 146 EMUs by 2050.

The Mixed Focus programme would deliver many of the same large infrastructure improvements as the Drive Mode Shift programme. But it would implement them later and consequently provide a lower customer level of service, and less patronage growth and mode shift than that programme.

The initial action would be to commence a Future Network Form study to confirm the long-term network requirements (see Section 6.1.4.1).

6.1.2.4 Drive Mode Shift Programme

The Drive Mode Shift programme is a ‘do maximum’ programme, where all efforts to drive more shift and patronage growth would be followed. Interventions that enable frequency would be accelerated, so that capacity could be increased quickly through both frequency and train size improvements.

Building on the Mixed Focus programme, this programme includes the following interventions:

- Network Constraints and Capacity Study to be complete by early 2023 evaluating:
    - NSJ capacity improvements, with potentially staged implementation
    - Wellington throat capacity improvements
    - Removal of network constraints Waikanae to Palmerston North
    - Third track in Tawa Basin
    - Separated access into the Wellington freight terminal
    - Melling junction improvements
- Multiple rounds of additional train procurement, with new trains arriving every decade
- Major train frequency improvements, aiming to roll out a 6-minute peak interval once level crossings are removed
- Initiating work on a second Remutaka tunnel around 2050 to enable higher future frequency on the Wairarapa Line if identified by the Network Constraints and Capacity Study
- Review of the role of the Johnsonville Line as heavy rail to enable better efficiency at Wellington Station
- Fleet expansion to 183 EMUs by 2050.

The Drive Mode Shift programme takes many aspects from the earlier programmes and accelerates them. It would focus on the removal of constraints, the separation of freight and metro services as far as reasonably practicable, and improvement of day-to-day network and operational resilience. It would seek to boost peak period public transport service levels to 6-minute intervals on both main corridors within the 30-year timeframe. It would also seek to improve the off-peak service offering to 15-minute intervals.

As with the Mixed Focus programme, the initial action would be to commence a Future Network Form study to confirm the long-term network requirements.

6.1.3 Programme Comparison

Table 6-1 highlights some of the key differences between programmes, showing the incremental improvements from each programme to the next across a range of factors. The service frequency enabled date this refers to the date that infrastructure would be safely capable of accommodating service improvements. This was later revised with respect to the preferred option, reflecting additional investigation. It is noted that, in some cases, there are multiple outcomes of improving the infrastructure. For example, shortening the single-track section of NSJ is required for a reliable 12-minute and 10-minute interval and so the key improvements have enabled the 10-minute interval even if only a 12-minute peak interval is initially delivered.

Table 6-1: Key differences between shortlisted programmes

Factor	Do-Minimum	Moderate Improvements	Mixed Focus	Drive Mode Shift
Morning Peak Hour Passenger Arrivals at Wellington Station in 2032/2052 (excluding long distance services)	11,900/13,900	13,100/16,600	13,400/17,600	13,800/18,700
Morning Peak Hour Seat Arrivals at Wellington Station 2032/52 (excluding long distance services)	8,900/10,100	9,800/12,900	11,000/14,500	12,800/17,300
6 Trains Per Hour Enabled	Not enabled – investigations commenced in the life of the PBC	Kāpiti – 2030 (but rolled out around 2040-2045) Hutt – 2052	Kāpiti – 2030 (but rolled out around 2035-40) Hutt – 2040	Kāpiti – 2027 (but rolled out around 2030-35) Hutt – 2034
Turn Up and Go Peak Hour Frequencies (10 Trains Per Hour) Enabled	Not enabled	Not enabled on Kāpiti line Hutt – Not in the life of the PBC, but most required works delivered by 6 tph	Kāpiti – 2040 (but not required) Hutt – 2040 (but rolled out in 2046)	Kāpiti – 2034 Hutt – 2040 (and expected to be in service 2041)
Environmental Resilience improvements (e.g. slopes, seawalls, culverts, and bridge strengthening) over 30 years	$63m additional spend in environmental resilience works over the existing planned spend to address historic underinvestment	$145m additional spend in environmental resilience works over the existing planned spend to address historic underinvestment and improve service levels	$199m additional spend in environmental resilience works over the existing planned spend to address historic underinvestment and improve service levels	$242m additional spend in environmental resilience works over the existing planned spend to address historic underinvestment and improve service levels
Operational Resilience Improvements	Nil	Resignalling programme, but no additional crossovers outside of the resignalling programme	Resignalling with an additional crossover delivered in tandem with the resignalling programme	Resignalling with 10 additional crossovers delivered prior to the resignalling programme to deliver a highly flexible network
Level Crossings Grade Separated	Nil	3 level crossings grade separated by 2030 5 further level crossings grade separated by 2050	3 level crossings grade separated by 2030 8 further level crossings grade separated by 2050	6 level crossings grade separated by 2030 9 further level crossings grade separated by 2050
Pedestrian Crossings Grade Separated	Nil	2 pedestrian crossings grade separated	5 Pedestrian crossings grade separated	6 Pedestrian crossings grade separated

This table clearly highlights that the mixed and drive-mode shift programmes have significant uplift compared to the moderate programme, which is still a significant step change above the Do-Minimum. While there are similarities between the two higher investment programmes outcomes in 2032, the additional investment in the drive-mode shift programme delivers significantly better outcomes by 2052 as they key constraints have been addressed enabling the higher growth.

6.1.4 Programme Packaging

Programme interventions were grouped during the shortlisting process to understand how they would be delivered in practice. This involved packaging up a range of future studies and business cases to understand the full delivery process. While the packages were the same between programmes, the content, scale, and timing of the interventions within each package varied between programmes.

6.1.4.1 Studies Outside of the Programme

Investigative studies were included in the Mixed Focus and Drive Mode Shift programmes to improve understanding of the impacts of different measures, and the role of the rail for future programme and RPTP updates. Table 6-2 outlines the proposed studies and their objectives.

Table 6-2: Studies recommended to inform future planning

Study	Key Objectives
Customer Habit and Optimisation	This seeks to understand: • Patronage impacts from the use of peak pricing to spread demand • Patronage impacts from paid park and ride • Trigger points for introducing new or removing existing stations • Impacts of ticket zoning boundary changes • Impacts of seasonable timetables from both a passenger perspective and operational reliability perspective • Understanding trigger points for expanding peak time services • Understanding trigger points for expanding the service span.
Future Network Form	This seeks to understand any future form benefits that may arise from integration with the LGWM programme, and: • Constraints and capacity restrictions on the network • Understanding Tawa Basin third main, Melling Line extension and second Remutaka Tunnel requirements • Any required additional track to enable higher frequencies of long-distance services and the metro services • Any new lines required, i.e. a future east-west link • Changes required due to increased rail freight demand, and interactions with the new interisland ferry terminal • Implications of converting the Johnsonville Line to light rail and using the displaced EMUs on the remainder of the network.

6.1.4.2 Committed Business Cases

The WMUP 5 IBC (signalling) and LNIRIM DBC (long distance service improvements) are integral to the PBC, and these projects were included in all shortlisted programmes. Both have been accelerated due to their urgency, complexity, and long lead times (see Section 4.2.2).

The delivery of their outcomes is required for the PBC to be successful. WMUP 5 is an essential enabler of higher network frequencies (and therefore capacity), which cannot be implemented without it. LNIRIM has identified future service levels for long-distance services on the Wairarapa and Manawatū lines, and the associated rolling stock and infrastructure needed to both maintain and expand services. It also provides the crucial additional bridging capacity needed to supplement the EMU fleet in the short to medium term until that fleet is expanded.

6.1.4.3 Common Investigations and Business Cases

Several other investigations and business cases were included in all programmes, as the first step towards the implementation of new infrastructure and improved infrastructure. These are outlined below. Several could be combined[30], but they are shown separately, as each has a different focus, and some are likely to be quite substantial.

Network Constraints and Capacity Study

This is an essential study for the mixed and drive mode shift programmes. It seeks to find the required network form to enable a reliable 10+10 service on the electrified network, including counter peak services. This would enable the more specific business cases to determine the appropriate staging plans to work efficiently towards achieving the outcome

[30] The 2021 RNIP includes $1m for a WMUP 7 business case that is intended to investigate capacity improvements to address capacity constraints identified by the LNIRIM DBC and earlier WMUP projects (as noted Section 4.2.1). This could be expanded to include some of the investigations noted in this section.

identified by this study. The 10+10 form has been assumed as the final state, since it is likely that enabling works would be required within even the Moderate Improvements programme. This study would also identify the ideal network If being done as a standalone study as part of the Moderate Improvements programme. This study can be merged with the Future Network Form study if it is undertaken in the first three years.

Wellington Station Approach IBC

This IBC encompasses the area south of Grenada to Wellington Station. It would be informed by the Network Constraints and Capacity Study, which would identify the track requirements and provide a staged programme of works that improve station approach capacity and enable the required frequencies at the right time. It would consider track configuration, stabling, access to maintenance areas, access to freight areas, and access to the potential new interisland ferry terminal, including segregation to improve the reliability for all services. This includes any additional structures or tunnelling required for the separation of freight and passenger services. The geographic scope has been selected to determine any additional tunnelling for triple tracking for efficient freight and passenger services for the final approach from the north on the NIMT.

North-South Junction Capacity Improvements IBC

This IBC would seek to identify the preferred means of removing the single-track capacity constraint between Pukerua Bay and Paekakariki. It would evaluate the best way to double track the line, noting any required shortening and long-term requirements. It is expected that it would evaluate (at a minimum) daylighting, a long tunnel, or a viaduct to provide one track in each direction. A subsequent DBC would determine the optimum manner to deliver the preferred option once it is defined. This work would remove capacity constraints on the NIMT, enabling higher frequencies and improved reliability for both passenger and freight services.

Waikanae Approach IBC

This IBC would seek to determine the required track, station, and stabling layout for the Waikanae Station Approach. This is inclusive of all stabling, station access, double tracking, and platform changes to enable sufficient frequencies, operational reliability, and long distance (inclusive of freight) services. This work would prevent delays at Waikanae, which have the impact of cascading through the WMRN. It would also provide separation of the long-distance passenger and freight services and allow additional freight and passenger services to use the line.

Resilience and Operational Improvements Business Case

This business case would identify a range of specific improvements to the operational resilience of the rail network. This could include asset improvements/replacement projects to reduce the probability of failure, as well as other methods of improving operational resilience, such as increasing the number and location of track crossovers. The intent would be to minimise the number events that affect operations (e.g. points failure, storm impact) and enable the network to recover to normal operations quickly when they eventuate. This business case has been identified as one of the ‘quick wins’, as it is probable that it could quickly identify a range of minor projects (less than $1m each) with little required consenting work, which could be rapidly implemented if required. This work would enable a more reliable service, while also providing additional capacity when combined with resignalling, as well as other improvements such as off-peak maintenance without bus replacements.

Network Segregation Business Cases

These business cases (one for each line requiring segregation) would prioritise the grade separation of level crossings (pedestrian and vehicle) by line. They would also review the fencing along the length of the rail corridor and prioritise improvements to ensure the network operates as safely as reasonably practicable. This work is required to enable higher frequencies to occur safely. With the existing limitations, the Kāpiti services will not have sufficient capacity in the early 2030s.

Traction Power Upgrade Business Case

This business case would identify the long-term traction power supply upgrades needed to support future frequency and train size requirements, as well as investigate the opportunities to improve energy efficiency. It would build upon previous studies to reduce cost, although these studies are likely to have assumed lower future EMU demand. This work is required to enable additional EMUs on the network and to enable more large train sets to operate. There are currently limits to the number of 8-car sets that can operate in a 24-hour period, which will need to be removed to cater for growth in the late 2020s until other improvements enable higher frequencies.

6.1.4.4 Rolling Stock, Station, and Accessibility Business Cases

These business cases would focus specifically on the key areas where the customer experiences the rail system, and they have a primary focus on improving that experience. They are common to all programmes.

Matangi Replacement DBC

In a similar manner to the LNIRIM business case, this business case would determine the key requirements for Matangi EMU fleet expansion and replacement. It would identify the fleet size and technical requirements, including customer amenities and service levels, and the preferred procurement approach and likely costs. This work would ensure that the new trains are ready for service when required. It would improve the reliability of the network as the Matangi units start to age and provide a capacity uplift.

Smarter Connections SSBCs

These SSBCs (one for each line) would look at improvements to first and last mile access (i.e. connections to railway stations) and be delivered in conjunction with the relevant territorial councils. It would seek to better integrate the rail system into the wider public transport system and micromobility/active modes networks, and include any improvements required to improve access to the station platform access, including for mobility impaired users. This would make accessing rail services easier to help prevent barriers to climate friendly first and last mile access.

Station Improvements SSBC

This SSBC would seek to improve the railway station environment and user experience, including such things as improved accessibility, shelter, platform train interface (in conjunction with the Matangi Replacement), and environmental design to prevent crime, and the potential for transit-oriented development. This project would have a large amount of crossover with the Smarter Connections Business Case and any resulting physical works might be delivered in the same package of works, but this project would be GWRC-led and focus on improvements to existing stations to bring them up to a modern customer-friendly standard. This work seeks to improve the passenger experience once at the station, contributing to a positive passenger experience.

6.1.4.5 Other Improvements

A range of identified interventions would help improve service delivery but are unlikely to require business cases for justification. These include:

- New infrastructure maintenance technologies to enable safe and efficient maintenance
- Catch up on asset renewals and maintenance
- Move to conducting fleet maintenance overnight (enabling works to allow)
- Improved collection and analysis of passenger data
- Automated analytics from CCTV data for improved customer security
- Wellington metro rail operations centre train control, rail operations and station security
- Integrated/electronic ticketing (being separately delivery by GWRC as part of the wider NTS project)
- Train crews dedicated to specific routes during peak periods
- Off peak service offering improvements, both frequency and hours of service
- Deployment of additional infrastructure maintenance staff outside of Wellington
- Increased number of rail replacement buses/availability of drivers to cover rail service failures
- Bi-directional running enabled to reduce disruption during maintenance or during abnormal events.

Is it noted that some of these improvements may overlap with current RLTP plans, however those plans reflect specific responses to specific issues, whereas this PBC takes a wider view reflecting the business case problems and investment objectives.

6.2 Short List Programme Capacity

The three shortlisted programmes offer a wide range of benefits. However, the provision of capacity is key to supporting wider growth and mode shift goals.

Figure 6-1, Figure 6-2, Figure 6-3, and Figure 6-4 provide an indication of the degree of capacity provided by the Do-Minimum and the three shortlisted programme options, in the key 7:30-8:30 morning peak hour when passenger arrivals and congestion on the parallel road network are highest, along with an indication of expected patronage during this period and a comparison against the lower and upper bound demand scenarios described in Section 5.3.5. The figures present average capacity across the network, so some services and line segments would have less capacity, and others more. Appendix H provides additional breakdowns by line segment.

There is a circular cause and effect relationship between demand and capacity. The four capacity and demand charts, which use the same scale to facilitate comparison, show that each successive programme would enable an increase in patronage as capacity increases, since rail would become more competitive and increasingly customer-friendly for more journeys.

Three levels of capacity are shown in the figures: ideal capacity, maximum comfortable capacity, and maximum capacity. Ideal capacity is GWRC's term for the train capacity level that provides sufficient seating to customers making longer trips (approximately more than 20 minutes), but not to customers making shorter trips where standing is less of an issue due to the shorter travel time. It is the capacity level that passengers will accept as being reasonable and is consequently the level of capacity that GWRC plans services around. Appendix D provides a discussion on train capacity and provides specific definitions for the three capacity levels.

The Do-Minimum programme would provide ideal capacity for around 12,900 morning peak hour arrivals by 2051. This is 23 per cent above the 2018 level, but most of the uplift would only be achieved in the mid-2040s, which would deter passengers and supress growth. In contrast, the Moderate Improvements option would provide ideal capacity for 15,500 arrivals (a 48 per cent ideal capacity increase by 2051), Mixed Focus would provide for 17,500 arrivals (a 67 per cent increase), and Drive Mode Shift would provide for 20,800 arrivals (a 98 per cent increase). Drive Mode Shift would also provide additional capacity for growth beyond the 30-year planning horizon.

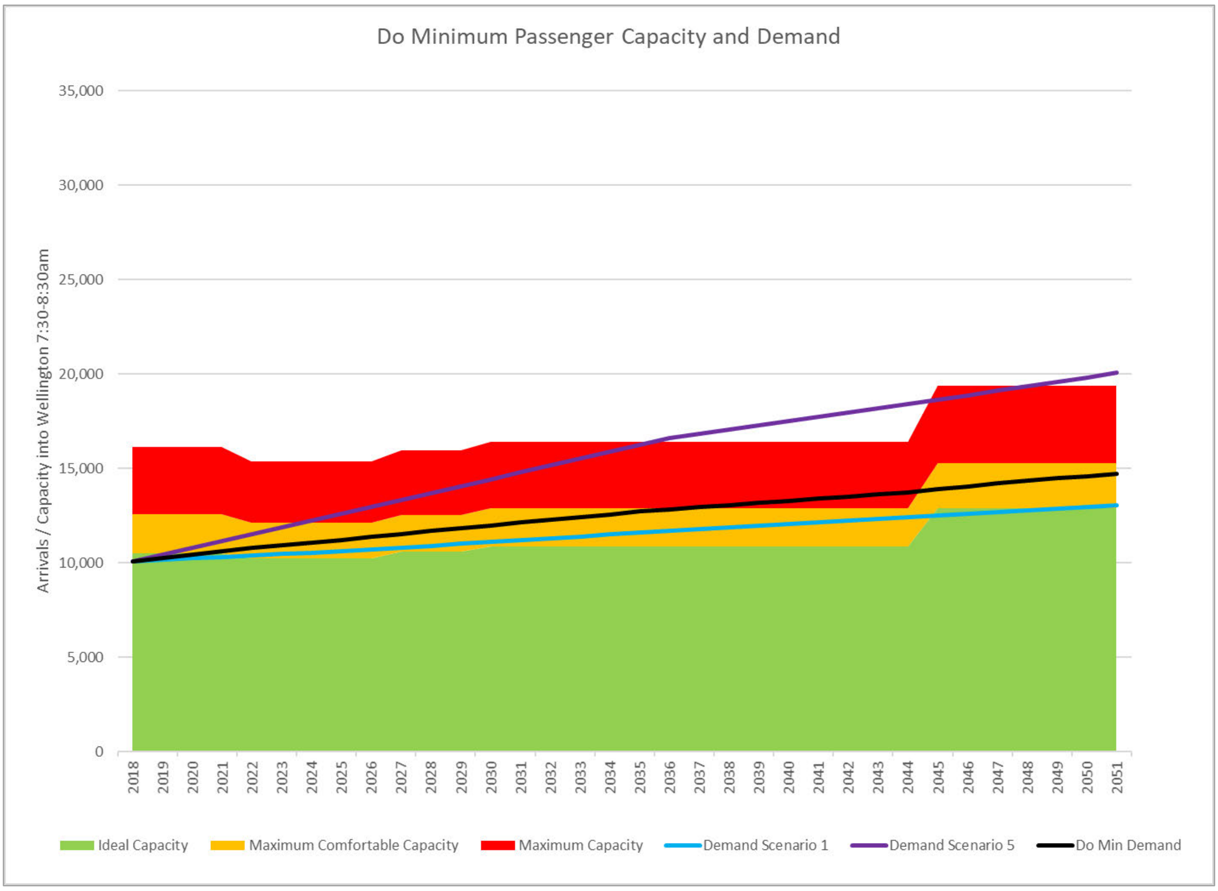


Figure 6-1: Do-Minimum peak hour passenger capacity and demand

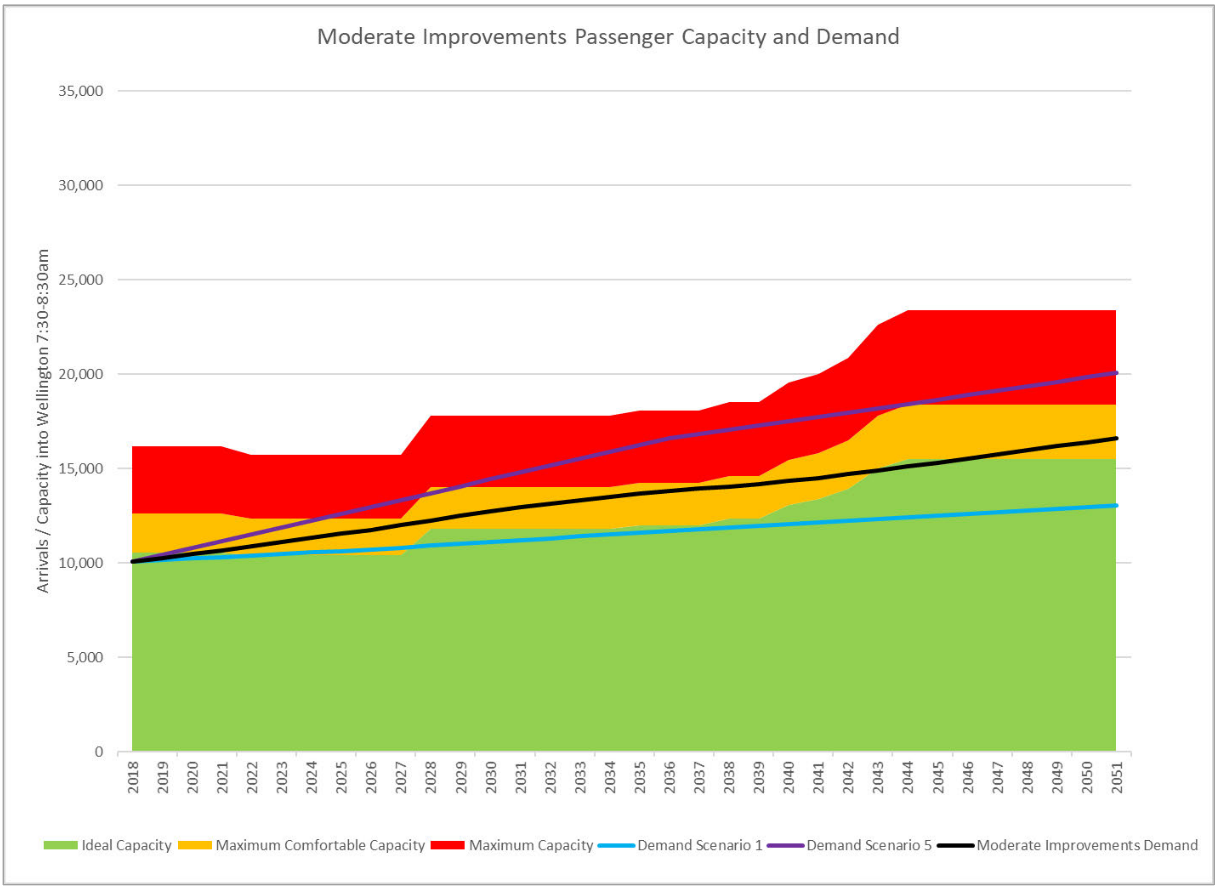


Figure 6-2: Moderate Improvements peak hour passenger capacity and demand

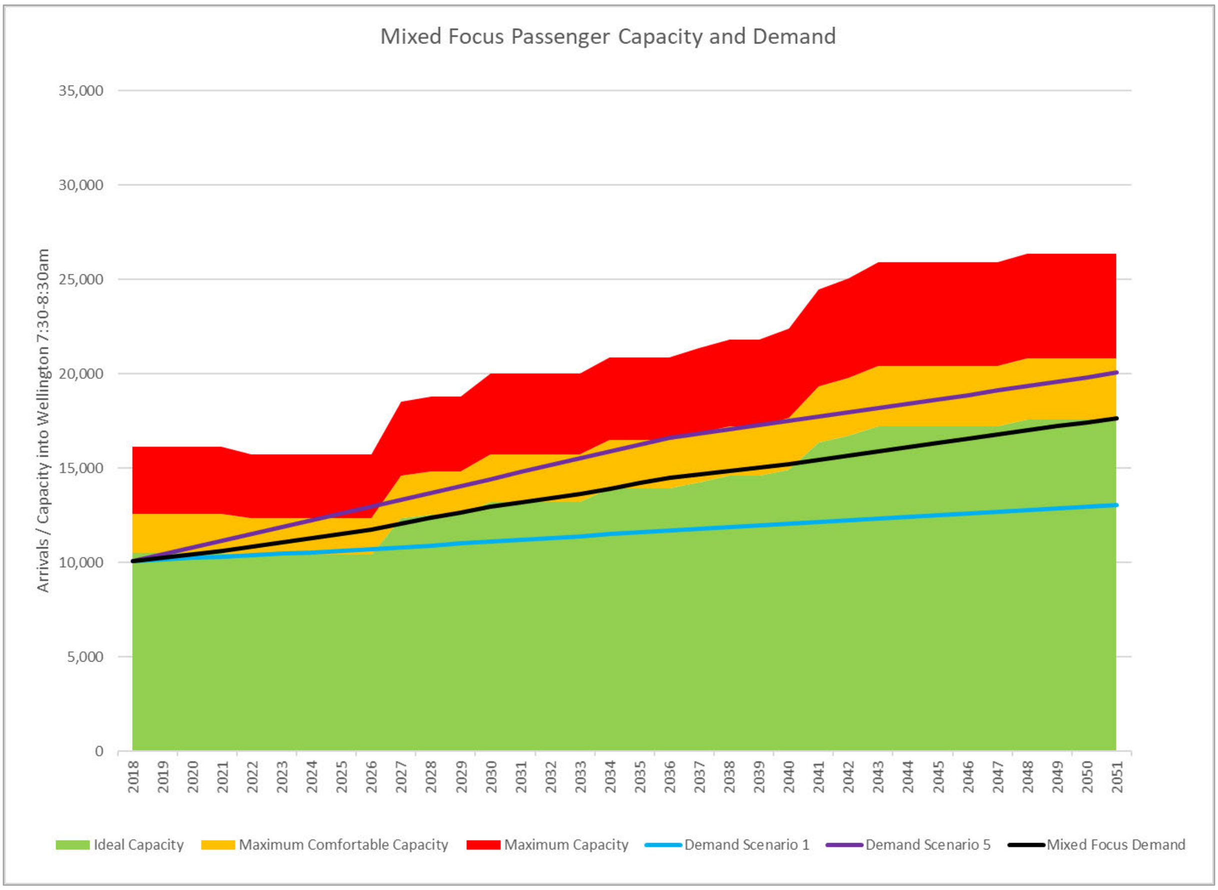


Figure 6-3: Mixed Focus peak hour passenger capacity and demand

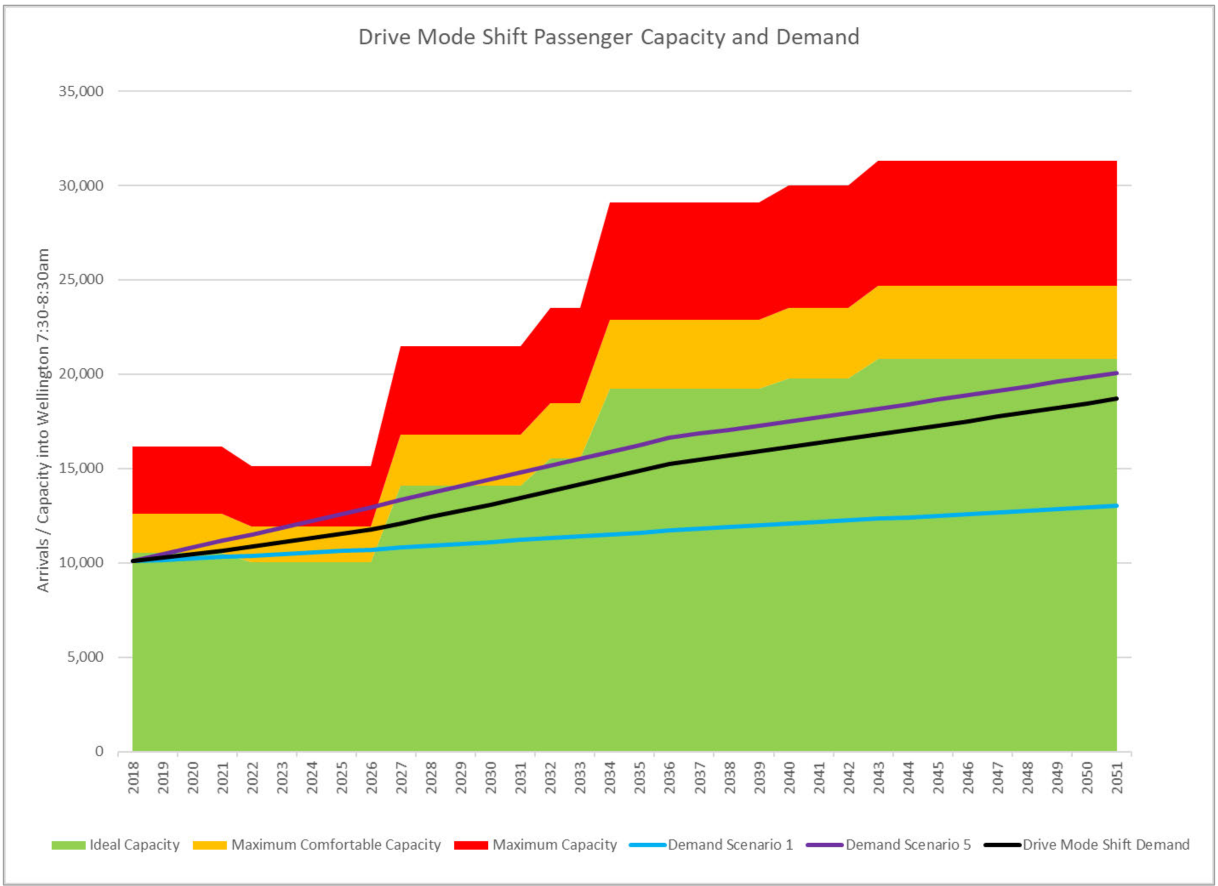


Figure 6-4: Drive Mode Shift peak hour passenger capacity and demand

6.3 Short List Programme Value

Table 6-3 outlines the value and relative value delivered by each of the shortlisted programmes over a 60-year period as determined by the initial economic analyses, providing lower and upper range benefit, cost, incremental benefit, incremental cost, benefit cost ratio (BCR), incremental BCR, and net present value (NPV) estimates respectively for each programme, based on early-estimate benefits and costs. The assumptions that underpin this assessment are outlined in Appendix K and have been rounded to the nearest $10m. Appendix L outlines the cost estimation inputs, assumptions, and outputs for the Do-Minimum programme and three shortlisted programmes.

Table 6-3: Shortlisted programme value (60-year evaluation period)

	Benefit ($m)	Cost ($m)	Inc Benefit ($m)	Inc Cost ($m)	BCR	Inc BCR	NPV ($m)
Moderate Improvements	$1,780 - $2,200	$1,000	-	-	1.8 - 2.2	-	$780 - $1,200
Mixed Focus	$2,450 - $3,360	$2,080	$670 - $1,160	$1,080	1.2 - 1.6	0.6 - 1.1	$370 - $1,280
Drive Mode Shift	$4,080 - $5,890	$3,820	$1,630 - $2,530	$1,740	1.1 - 1.5	0.9 – 1.5	$260 - $2,070

The tables show that all three programmes would deliver value to investors and the country, providing a positive return on investment as measured through the headline BCRs. The Mixed Focus and Drive Mode Shift programmes offer incremental BCRs of 1.1 and 1.5 respectively at the upper end of the benefit range, indicating that Mixed Focus would deliver more value than the Moderate Improvements programme, and that Drive Mode Shift would deliver more value than Mixed Focus. This outcome is supported by the NPV assessment, which also indicates that the Drive Mode Shift programme delivers the most additional value.

6.4 Short List Programme Assessment

The three shortlisted programmes were qualitatively assessed in the Short List to Preferred Programme MCA workshop, on 23 November 2021. Participants represented the same range of organisations as were involved in the April MCA workshop, including the project team, and representatives of GWRC/Metlink, KiwiRail, Transdev and Waka Kotahi. Most participants had attended the previous workshop, but several new people from the Waka Kotahi multi-modal team provided fresh perspectives, particularly around the importance of retaining good freight access. The MCA process provided a means for assessing the remaining programmes at a more refined level and using better information than the earlier workshop. This section provides a brief overview of the process. Further details of the process and briefing notes to the assessors is provided as Appendix H. The workshop outcomes are summarised in Appendix I.

It was agreed with the client that the MCA would identify the technically preferred programme, which would be recommended for consideration by investors. It is acknowledged that funding constraints may lead to changes in what is taken forward from the technically preferred programme. Future updates to the programme will reflect any changes to the preferred programme if this occurs.

6.4.1 Assessment Criteria

The evaluation criteria were developed from the Waka Kotahi's MCA guidance. The shortlisted programmes were scored against fourteen criteria – five investment objectives, one critical success factor, and eight that were developed by the project team to reflect key effects and outcomes. Table 6-4 summarises the criteria.

Table 6-4: Preferred programme workshop assessment criteria

Assessment Criteria		Description
Investment Objectives and Critical Success Factor (CSF)	Support a sustainable future	• Increase rail passenger and freight mode share • Reduce rail carbon emission per passenger.
	Provide capacity that supports access and growth	• Improve access by increasing peak passenger capacity • Maintain freight access by retaining existing freight paths throughout the day and ensuring capacity for growth.
	Attractive and easy to use	• Increase frequency throughout the day • Improve peak punctuality • Improve overall satisfaction of rail passengers • Maintain ease of access and improve accessibility for impaired users.
	Adaptable to disruptions	• Reduce passenger impact of high impact low probability events • Reduce passenger impact of unplanned events.
	Improve safety for all	• Reduce the rate of safety incidents • Increase public and user perception of safety of rail.
	Overarching critical success factor	• Increase rail usage (passenger and freight).
Policy Alignment	National policies	• Programme alignment with national policies, as outlined in the Zero Carbon Act, GPS, NZRP, and other documents.
	Regional policies and investment	• Programme alignment with regional policies such as the RLTP, RPTP, MSP, and RGF, as well as significant regional investments, such as the LGWM programme.
Deliverability and Wider Outcomes	Funding availability	• Whether or not the programmes will have significant sustained funding requirements or whether it can be managed to improve affordability.
	Construction/engineering difficulty	• The difficulty of delivering the required infrastructure from an engineering perspective, particular attention given to: ○ Geotechnical considerations ○ Waterway considerations ○ Services ○ Traffic management ○ Market capability and capacity.
	Consenting degree of difficulty	• Alignment to district plans and regional standards • Relevant national policy statements • Impacts of and difficulty of designation.
	Programme impacts from delays	• Impact to the programme outcomes of delay to individual projects.

	Economic impacts	• Disruption costs from delivering the programme • Long term economic benefits from the programmes.
	Impacts to services during construction[31]	• Considers both passenger and freight impacts while delivering the key projects within the programme.

6.4.2 Scoring Framework

For this MCA assessment, each programme was scored using the 11-point scoring framework (-5 to +5) outlined in Table 6-5. This approach was chosen to align with the approach used the LGWM IBC MCA process and ensure consistency of assessment between the two major Wellington transport investment programmes.

Table 6-5: Eleven-point scoring framework

Magnitude	Definition	Score
Large positive	Substantial benefits and a high degree of confidence of benefits being realised and/or long term/permanent benefits	5
Moderate to large positive	High extent of benefits and confidence of benefit being realised and/or medium - long term benefits	4
Moderate positive	Good benefits and/or medium term	3
Small to moderate positive	Low or localised benefits and/or short term	2
Slight positive	Very low benefits and/or very short term	1
Neutral	No change in benefits, impacts, or difficulties from current situation	0
Slight negative	Few difficulties, very low cost, or low impact on some resources/values and/or very short term	-1
Slight to moderate negative	Minor difficulties, low cost, or minor impacts on resources/values and/or short term	-2
Moderate negative	Some difficulties, moderate cost, or some impact on resources/values and/or medium term	-3
Moderate to large negative	Clear difficulties, high cost or high impact on resources/values and/or medium - long term	-4
Large negative	Substantial difficulties, very high cost, or substantial impact on resources/values and/or long term/permanent	-5

6.4.3 Assessment Result

6.4.3.1 Workshop Scores

Table 6-6 outlines the raw scores agreed by participants at the workshop, compared to the baseline (status quo), which was scored at zero in alignment with the approach used for LGWM IBC MCA process.

Table 6-6: Short list scores by criterion compared to the baseline

Criterion	Do-Minimum	Moderate Improvement	Mixed Focus	Drive Mode Shift
Investment Objectives and CSF				
Support a sustainable future	0	2	3	4
Capacity that supports access and growth	0	1	3	5
Attractive and easy to use	-3	1	3	5
Adaptable to disruptions	-1	2	4	5
Improve safety for all	-3	3	4	4
Critical Success Factor	1	3	4	5
Policy Alignment				

[31] This criterion was added just before the workshop and was not described in the workshop briefing document.

National Policies	-4	1	3	4
Regional Policies and Investment	-4	1	5	5
Deliverability and Wider Outcomes				
Funding availability	-1	-2	-3	-5
Construction/engineering difficulty	0	-2	-3	-5
Consenting degree of difficulty	0	-1	-4	-5
Programme impacts from delays	0	-1	-2	-5
Economic outcomes	-3	2	4	5
Impacts to services during construction	0	-1	-3	-4

The Drive Mode Shift and Mixed Focus programmes recorded the highest against nine of the criteria. These were sustainable future, capacity, attractive and easy to use, adaptable, improve safety, increased use (critical success factor), alignment with national and regional policies, and economic outcomes. In contrast, those programmes scored the lowest against implementability, risks and affordability.

The Moderate Improvements programme had a more balanced profile as it had in the April MCA process. The Do-Minimum programme was given the almost entirely negative scores.

6.4.3.2 Workshop Weightings

To determine the workshop weighting, participants gave each criterion a score between 0 and 10, with zero being considered least important and 10 being considered most important. A second weighting was also applied to the criteria groupings: Investment Objectives and CSF, Policy, and Deliverability and Wider Outcomes. This created a double-weighted workshop priority weighting, where the weighting of individual criteria contributed a grouping's weighting. The three workshop weighting systems are outlined in Table 6-7.

Table 6-7: Workshop weightings

Criterion	Base Weighting	Workshop Priority	Workshop Secondary 1	Workshop Secondary 2
Support a sustainable future	8	10.8%	8.9%	8.3%
Capacity that supports access and growth	5	6.8%	5.6%	8.3%
Attractive and easy to use	8	10.8%	8.9%	8.3%
Adaptable to disruption	5	6.8%	5.6%	8.3%
Improve Safety for all	9	12.2%	10.0%	8.3%
Critical success factor	10	13.6%	11.1%	8.3%
National policies	4	1.4%	4.4%	6.3%
Regional policies and investment	6	2.0%	6.7%	6.3%
Funding availability	2	2.0%	2.2%	6.3%
Construction/engineering difficulty	5	5.1%	5.6%	6.3%
Consenting degree of difficulty	8	8.1%	8.9%	6.3%
Programme impacts from delays	6	6.1%	6.7%	6.3%
Economic outcomes	10	10.2%	11.1%	6.3%
Impacts to services during construction	4	4.1%	4.4%	6.3%

6.4.3.3 Sensitivity Test Weightings

The project team developed additional weightings to sensitivity test the programmes. These were designed to understand the impact of emphasising different aspects of the programmes. The additional weighting systems included the following (further described in Appendix I):

- Equal Weighting
- Investment Objective as Single
- Safety Emphasis
- Capacity Emphasis

- Success Factor Emphasis
- Customer Focus Emphases
- Delivery Emphasis
- Customer and Delivery Focus
- Consenting Focus
- Policy Alignment
- Equal Weighting Area.

All except the equal weighting scenario followed the same procedure of emphasising criteria. The proportion each criterion contributed to the final weighted score is outlined in Table 6-8.

Table 6-8: Sensitivity test percentage weightings

	Equal Weighting	Investment Objective as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Consenting Focus	Policy Alignment	Equal Weighting Area
Support a sustainable future	7.1	2.0	5.1	5.1	5.1	6.1	6.1	6.7	5.1	5.6	5.6
Capacity that supports access and growth	7.1	2.0	5.1	33.3	5.1	11.1	6.1	6.7	5.1	5.6	5.6
Attractive and easy to use	7.1	2.0	5.1	5.1	5.1	11.1	6.1	8.3	5.1	5.6	5.6
Adaptable to disruption	7.1	2.0	5.1	5.1	5.1	6.1	6.1	6.7	5.1	5.6	5.6
Improve Safety for all	7.1	2.0	33.3	5.1	5.1	6.1	6.1	6.7	5.1	5.6	5.6
Critical success factor	7.1	10.0	5.1	5.1	33.3	11.1	6.1	8.3	5.1	5.6	5.6
National policies	7.1	10.0	5.1	5.1	5.1	6.1	6.1	6.7	5.1	16.7	16.7
Regional policies and investment	7.1	10.0	5.1	5.1	5.1	6.1	6.1	6.7	5.1	16.7	16.7
Funding availability	7.1	10.0	5.1	5.1	5.1	6.1	11.1	6.7	5.1	5.6	5.6
Construction/engineering difficulty	7.1	10.0	5.1	5.1	5.1	6.1	11.1	8.3	5.1	5.6	5.6
Consenting degree of difficulty	7.1	10.0	5.1	5.1	5.1	6.1	11.1	8.3	33.3	5.6	5.6
Programme impacts from delays	7.1	10.0	5.1	5.1	5.1	6.1	6.1	6.7	5.1	5.6	5.6
Economic outcomes	7.1	10.0	5.1	5.1	5.1	6.1	6.1	6.7	5.1	5.6	5.6
Impacts to services during construction	7.1	10.0	5.1	5.1	5.1	6.1	6.1	6.7	5.1	5.6	5.6

6.4.3.4 Assessment Outcomes

Table 6-9 outlines the assessment outcome, providing the post-weighted scores for each programme under each scenario. Table 6-10 provides the associated ranking for each programme.

Table 6-9: Final weighted scores for all weighting scenarios

	Workshop Weighting Primary	Workshop Weighting Secondary 1	Workshop Weighting Secondary 2	Equal	Investment Objective as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Consenting Focus	Policy Alignment	Equal By Assessment Area
Baseline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Do-Minimum	-1.08	-1.31	-1.25	-1.29	-1.24	-1.77	-0.92	-0.64	-1.19	-1.14	-1.23	-0.92	-1.89	-1.89
Moderate Improvements	1.21	1.04	0.81	0.64	0.18	1.31	0.74	1.31	0.80	0.29	0.62	0.18	0.72	0.72
Mixed Focus	1.92	1.82	1.56	1.29	0.44	2.05	1.77	2.05	1.60	0.59	1.20	-0.21	1.89	1.89
Drive Mode Shift	2.25	2.03	1.71	1.29	-0.04	2.05	2.33	2.33	1.85	0.33	1.20	-0.49	2.00	2.00

Table 6-10: Final weighted rankings for all weighting scenarios

	Workshop Weighting Primary	Workshop Weighting Secondary 1	Workshop Weighting Secondary 2	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Consenting Focus	Policy Alignment	Equal By Assessment Area
Baseline	4	4	4	4	3	4	4	4	4	4	4	2	4	4
Do-Minimum	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Moderate Improvements	3	3	3	3	2	3	3	3	3	3	3	1	3	3
Mixed Focus	2	2	2	1	1	1	2	2	2	1	2	3	2	2
Drive Mode Shift	1	1	1	2	4	1	1	1	1	2	1	4	1	1

6.4.4 Conclusion

The short list assessment reconfirmed the findings of previous assessment, finding the Drive Mode Shift programme to be the best programme, having the best or equal-best score across most criteria, including all investment objectives, the critical success factor, and the policy alignment criteria. Other than the Do-Minimum, it was the poorest scoring option against the deliverability and wider outcomes criteria, except for economic outcomes, reflecting the challenge of delivering a large programme of works quickly to meet mode shift requirements. It ranked as the first-choice option in most sensitivity tests, including all workshop tests, coming second to the Mixed Focus programme in the Equal and Customer and Delivery Focus tests, and second to last on the IO as Single and Consenting Focus tests. The Customer and Delivery Focus and Consenting Focus test scores reflect the challenges associated with a major upgrade to a working railway.

The Mixed Focus programme generally ranked second to the Drive Mode Shift programme, again with a similar pattern to the previous assessment. Critically, it was well behind against the capacity and attractiveness investment objectives since it would deliver on these much later than the Drive Mode Shift programme. In contrast, it performed much better on the deliverability and wider outcomes criteria, mostly due to this delayed delivery. It ranked as the second-choice option in most sensitivity tests, only markedly performing better than the Drive Mode Shift programme in the IO as Single test.

The Moderate Improvements programme again provided the best balance between the objective and policy focused criteria and the deliverability-focused criteria. It was again a 'middling' option that offered neither significant advantages nor disadvantages, although it would only partially realise the investment objectives and would not support significant growth or mode shift in the short or medium term. It ranked as the third-choice option in most sensitivity tests, only coming first in the consenting focus test, reflecting its minimal infrastructure improvements in the short and medium terms, and second in the IO as Single test.

All three programmes would deliver value to investors and the country, providing a positive return on investment. However, the Drive Mode Shift programme would perform much better than the Mixed Focus programme, which would in turn perform much better than the Moderate Improvements programme.

The project partners determined that the Drive Mode Shift programme was the best programme to take forward as the preferred programme based on the above assessments and conclusions, despite it having the highest cost, subject to some further refining of programme elements and costs.

7 Preferred Programme

7.1 Overview

7.1.1 Key Improvements and Outcomes

The preferred programme delivers a 'fit for purpose', resilient, and safe rail system, enhances customer experience to encourage mode shift, and supports this with the capacity needed to meet and drive high patronage growth, providing:

- Highly connected stations in communities where people work, live, play and learn
- Accommodating stations that make any wait both pleasant and productive
- Frequent services that are faster and more convenient than by car
- Reliable services that recover quickly from disruption
- Links that facilitate convenient connections for national freight customers
- Infrastructure and safety systems that enable transport without undue conflict.

The programme includes a wide range of improvements, key elements of which are summarised in Figure 7-1 including:

- **Station access improvements** to make active and public transport more attractive as access modes, which will support first and last mile accessibility, reduce the reliance on private vehicle and park and ride in line with zero carbon objectives, and support intensification near stations as envisaged by the RGF and NPS-UD.
- **Improvements to all aspects of station** amenity across the network, including to accessibility, shelter, and information, which will ensure that accessibility obligations to disabled customers are met, that the waiting and overall customer journey experience is first-class, and that it is attractive to new customers for mode shift. These improvements will support increased at-station transit-oriented development where feasible.
- Progressive **service frequency improvements**, from the current 20-minute peak frequency to a 15-minute, then 10-minute, and finally 6-minute peak (turn up and go) frequency at most stations on the Hutt and Kāpiti lines, along with an improved 15-minute off-peak frequency within the electrified area and significantly improved service levels on long-distance services, which will provide better travel options for customers, support the region's growth, and deliver the capacity needed to drive and accommodate the required mode shift.
- Supporting **electric multiple unit (EMU) fleet expansion** to enable the higher frequencies, and replacement and expansion of the mixed and obsolete long-distance Wairarapa and Manawatū train fleets with new low emission trains to reduce rail emissions and provide system bridging capacity in first decade.
- **Network resilience and operational flexibility upgrades**, including improvements to slopes, bridges, culverts, track infrastructure, areas subject to sea level rise and storm surge, and operational patterns and maintenance, which will make the Wellington rail system safer and more resilient, particularly in the face of climate change, and ensure that it can recover quickly when events occur to minimise customer impact.
- **Wellington throat capacity improvements**, including a fourth main to enable the operational separation of Hutt and Kāpiti services, northern access to EMU stabling, and separated access to the Wellington freight terminal, which will significantly reduce conflict between passenger and freight services and improve network and service resilience and reliability.
- **Full duplication between Pukerua Bay and Paekakariki** (North-South Junction), a key single-track constraint with several tunnels, and addition of a third main in the Porirua-Tawa area, which will enable higher passenger frequencies and improve service resilience and reliability on the Kāpiti Line. This will make rail a more attractive travel option on that line, where population growth is expected to be highest, and ensure continued freight access to the network as passenger frequencies increase.
- **Duplicated approach to the Waikanae Station**, including a bridge and second platform, which will reduce conflict between passenger and freight services, improve service resilience and reliability, and enable higher passenger frequencies on the Kāpiti and Manawatū lines.
- **Network resignalling**, which will remove restrictions on the number of peak hour services, safely enable future frequency improvements, and improve operational flexibility, resilience, and reliability.
- **Traction power upgrades**, including additional substations and wider enabling power network upgrades, which will overcome current limitations and enable higher future train frequencies.
- **Rail network segregation** at all places where reasonably practicable, including improved fencing and grade separation of pedestrian and vehicle level crossings, which will significantly improve safety and the experience of surrounding communities as frequencies increase.
- **Continuous improvement of systems, processes, and capability**, including improved asset management.

Figure 7-1: Key improvements

Appendix J provides an overview of programme packaging, components, delivery, and cost.

7.1.2 Timing

Table 10-2 provides indicative programme timelines. Significant investment in enabling infrastructure is required in the first half of the programme, particularly the first ten years. However, the timing and scale of service level improvements and associated train fleet requirements will be able to be accelerated or decelerated depending on government priorities and the level of demand once this infrastructure is in place, taking account of relevant lead times. The programme will therefore be able to flexibly react to changes over the longer term, such as to policy or passenger and freight growth patterns, without being restricted by infrastructure lead time-related delay.

Further work will be required to determine specific trigger points for improvements once Network Constraints and Capacity and Future Network Form studies and the first tranche of business cases have been completed. Assuming that the key network infrastructure constraints are addressed in the first decade as proposed, it is expected that these will relate to patronage thresholds, from which specific frequencies and consequential rolling stock and electricity requirements can be determined.

7.1.3 Alignment with Investment Objectives

Table 7-1 shows that the preferred programme aligns strongly with the five investment objectives, providing concrete upgrades that address the problems and drive a corresponding uplift in passenger mode share while maintaining and enhancing freight access.

Table 7-1: Alignment with the investment objectives

Objective	Preferred Programme	Alignment
Support a sustainable future	• 34% increase in peak hour passenger arrivals by 2032, and 82% by 2052 (excluding long-distance), relative to 2019 • Expected mode shift to rail of between 14.2% and 20.5% by 2031, with a similar reduction in vehicle kilometres travelled (11.8 million km per annum in the latter case) • Mode shift related emission reductions of approximately 3% (3,435 tonnes) per annum by 2031.	High
Provide capacity that supports access and growth	• EMU fleet expansion from 166 to 366 cars by 2048 • Long distance rolling stock fleet replacement and expansion from 32 to 88 carriage equivalents by 2028 • Continued access and increased reliability for freight services.	High
Attractive and easy to use	• Progressive increases in frequency from 3 tph to 10 tph at most stations in peak periods by 2042 • Increase from 3 to 4 tph at most stations in off-peak periods • Station accessibility and customer experience improvements, including improved shelter at all stations, improved cycle facilities at 38 stations, improved disabled access at 21 stations, community hubs/facilities at 13 stations, improved bus connection facilities at 10 stations, active modes change facilities at 10 stations, and maintenance to prevent flooding and improve attractiveness.	High
Adaptable to disruptions	• Improved network infrastructure and operations to minimise the likelihood and effect of disruption and mitigate climate change impacts • Removal of bottlenecks, track changes, and a new signalling system to reduce conflict between trains, improve flexibility and reliability, and aid recovery from events • Annual resilience benefits of $9.1m by 2032 and $17.9m by 2052.	High
Improve safety for all	• New signalling system to provide modern engineering control and significantly reduce the likelihood of train collisions • Grade separation of 15 road level crossings to remove the risk of collision between trains and vehicles • Grade separation of 6 pedestrian level crossings to remove the risk of collision between trains and pedestrians • Improved fencing to reduce risk of accidental track access.	High

7.2 Economic Analysis

7.2.1 Demand

The existing version of the WTSM model does not include a rail patronage constraint, an issue that is being addressed by the current model update. The existing model consequently provides indicative rail demand outputs for multi-modal testing purposes, but it was of only limited use for testing changes to rail service scale or frequency between programme options. However, it was used to inform the peak rail requirement for the three shortlisted options and subsequent sensitivity testing of the preferred option, based on a two-hour morning peak scenario.

Peak rail demand is heavily focused on the Wellington CBD, so peak demand was assessed using a screenline at SH1, Hutt Road and all rail lines. This allowed for the impact of future growth on options to be understood. Three scenarios were initially modelled, which included the base 2013 validated model and four runs in 2046. The four runs reflected the expected Do-Minimum, the expected preferred programme, and variations on the 'in vehicle time' factor (IVT) for both. The model then output the expected rail patronage and vehicles crossing the screen lines, which are shown for the Do-Minimum and preferred option in Table 7-2.

Table 7-2: WTSM screenline outputs (two-hour peak)

Transport User	2013	Do-Minimum (IVT 0.9)	Do-Minimum (IVT 1)	Drive Mode Shift (IVT 0.85)	Drive Mode Shift (IVT 0.75)
Rail Passengers	15,500	23,600	23,400	24,100	24,400
Vehicles	14,400	15,600	15,700	15,400	15,200
Total	29,900	29,200	39,100	39,500	39,600

The tabulated outputs highlight the limited patronage uptake that WTSM predicted based on an increase in IVT and reduced headway between services. WTSM did predict an overall rail patronage increase in the order of 8,500-9000 passengers and a screenline increase of only 1,200 vehicles across 5 lanes of traffic in the two hours. As shown in Figure 6-1, predicted rail demand growth cannot be accommodated with the existing infrastructure and service levels.

WTSM sensitivity testing included changes to land use to incorporate some of the elements of the RGF in a transit-oriented demand scenario, which included intensification near key nodes on the rail corridor, strong CBD employment, and mass transit south of Wellington Station (with some associated intensification). This comprised:

- An increase in employment in Wellington CBD of 10,000, focused on the station end of CBD
- A corresponding reduction in employment in Lower Hutt, Porirua, Upper Hutt, and Kapiti CBD
- A reduction in population in CBD of 4,000, drop of 5,000 in North suburbs of Wellington, 4,000 along MRT corridor to south, 1000 in western suburbs
- An additional 15,000 residents in the rest of region:
    - 7,000 in LH around Waterloo and Naenae stations
    - 3,000 in Porirua CBD
    - 3,000 in Paraparaumu around CBD
    - 2,000 in Upper Hutt CBD.

This scenario is not considered a realistic scenario without investment in the preferred programme, but it becomes easily sustainable with this investment. The current base, Do-Minimum programme, and preferred programme demand are shown below in Table 7-3. Note that some totals may not tally due to rounding.

Table 7-3: Impacts of Transit Orientated Demand from WTSM (two-hour peak)

Transport User	2013	2046 Do-Minimum	2046 Drive Mode Shift	2046 TOD Do-Minimum	2046 TOD Drive Mode Shift
Rail Passengers	15,500	23,600	24,100	28,400	29,100
Vehicles	14,400	15,600	15,400	16,000	16,300
Total	29,900	29,200	39,500	44,300	45,400

The WTSM outputs highlight several things:

- They do not show the frequency elasticity effect that would usually be expected from a major frequency improvement like the preferred programme, nor the mode shift that what usually be expected as a result

- They do show a significant level of rail demand that cannot be incorporated without capacity improvements
- They highlight the road capacity constraint, which cannot be easily addressed.

Waka Kotahi's Monetised Benefits and Costs Manual indicates that a short run elasticity of 0.2-0.7 can be expected for service level improvements. This would indicate that, all things being equal, for a shift from four trains per hour in the Do-Minimum programme to the ten trains per hour in the Drive Mode Shift programme, an uplift of 30 per cent to 105 per cent is a reasonable expectation. This would result in an extra 7,000-21,000 peak period passengers in the short run compared to the observed 500 shown in the model.

The WTSM outputs support the need to invest in rail, where the capacity increases can physically be accommodated with appropriate investment. They also indicate that the intended land use and job distribution being concentrated within the Wellington CBD is reliant on rail investment.

The WTSM outputs were adapted for the economic analysis. Appendix K provides further detail.

7.2.2 Benefits

The preferred programme provides significant benefits over the Do-Minimum for its investment. These are primarily rail user, road user and wider economic benefits (WEBs), and are estimated as being between $4.1b and $5.9b (discounted) over the 60-year appraisal period.

Benefits include the following:

- Benefits to public transport users:
    - Reduced delays to trains, because of the improved signalling system and network capacity enhancements. This is expected to deliver over one minute delay reduction per train on average
    - Reduced wait time at stations due to increased frequencies
    - Improved train reliability
    - Speed increases due to work planned to alleviate sections of track which require speed restrictions
    - Improvements to railway stations
    - A more resilient network, with reduced impact from and frequency of disruptions.
- Benefits to road users:
    - Significantly reduced road congestion (50 per cent of new train users are assumed to be former car drivers)
    - Consequential time and vehicle operating cost savings
    - Improvements to local road networks because of grade separation of level crossings.
- Other benefits:
    - CO2 and particulate emissions reduction, stemming both from reduced vehicle traffic and improved efficiency for remaining vehicles
    - Health, due to more people using active modes for first and last mile journeys in connection with the train
    - Road safety, due to a reduction in vehicle traffic reducing both the quantity and probability of crashes
    - Rail freight, due to improved capacity for and efficiency of freight operations, assumed as 8.3 per cent of total benefits
    - Rail safety, primarily from the renewed signalling system and grade separation of road crossings, but also from slip prevention and other infrastructure improvements, which is assumed as 2.4 per cent of total benefits (this accounts for a relatively small proportion of the benefits as the network is not in an unsafe condition at present and safety-related investment is primarily to ensure that the network remains fit to meet future safety standards)
    - Land use benefits reflecting increased intensification around railway stations
    - WEBs such as social good and improved productivity, which account for 28 per cent of the benefits within this programme.

This WEBs and land use benefits reflect the significant economic and population growth that the programme enables, and their level reflect within Waka Kotahi guidelines and parameters.

Beyond the quantified benefits included in the economic analysis, the preferred programme has several non-quantified and non-monetised benefits:

- Increased connectivity within the public transport network
- Avoidance of road investment, since the preferred programme has the capability for over twenty mainline trains per hour per direction exclusive of long distance and freight services, a step change in capacity that could eliminate or delay the need for road investment

- Air Quality – while emissions have been modelled, the impacts on air quality specifically have not (these benefits are gaining more importance as their contribution to the impacts to both health and water quality are being more widely understood)
- The SATURN model takes a conservative approach towards decongestion benefits within central Wellington, so these may in fact be higher than modelled
- Potential for TOD opportunities around key railway stations, which will be a more attractive development opportunity with higher frequency train services.

Figure 7-2 provides a breakdown of quantified benefits. Appendix K provides further detail on the expected benefits.

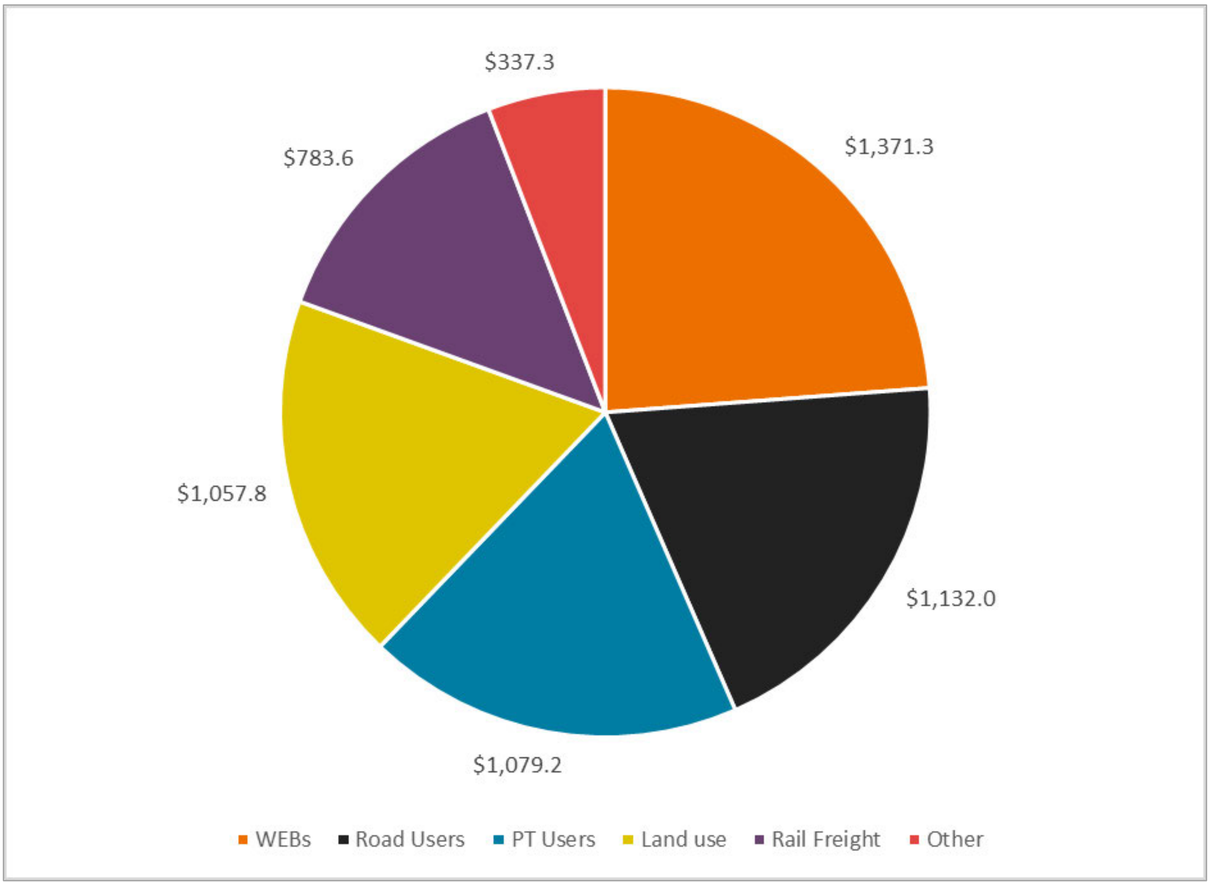


Figure 7-2: Preferred programme benefits (60 years)

7.2.3 Costs

The preferred programme cost estimates are based on a range of assumptions relating to the nature of each intervention and have been baselined against recent cost examples. Cost estimates are based on high-level inputs and understanding of the requirements, along with unit rates provided/accepted by KiwiRail and GWRC where available. The quantum of works was estimated, accounting for uncertainties and any difficulties required by the area. For example, adding an additional rail line was considered more difficult in the Tawa Basin due to the constraints of the Porirua Stream, existing housing, and lack of space, than it is between Waikanae and Ōtaki. Appendix L outlines the preferred programme cost estimation inputs, assumptions, and outputs.

Two costing workshops were held with a range of GWRC and KiwiRail experts on 17 September and 27 September 2021. General unit rates for the key base units in a rail environment were agreed at these workshops. The workshops also clarified some of the rail-specific costings for things such as signalling changes.

Operational costs for Metlink services were provided by GWRC and adjusted based on the expected uplift in weekly services on a year-by-year basis. Network maintenance costs were also uplifted in a similar manner. However, as the EMUs create little wear on the network relative to freight trains, only a proportional increase was made. In addition to the increase for track and service maintenance, additional costs were agreed with the KiwiRail network maintenance team to address slope stability concerns, structure maintenance, structure strengthening and improved network flexibility.

The preferred programme has a 30-year cost of $12.2b, an increase of $7.2b over the Do-Minimum programme. This equates to $3.8b (discounted) over the 60-year appraisal period. This cost relates to the following intervention types:

- Rail infrastructure capital works includes track, traction power, and other KiwiRail assets that are new capital works

- Service operational costs includes all costs borne by GWRC to maintain and operate the EMU fleet
- Rolling stock capital works includes all capital costs of replacing and expanding the long distance and EMU fleets
- Rail network maintenance includes all costs to ensure the rail network is in a fit for purpose for commuter services
- Rail network segregation includes all capital costs related to the separation of rail from other modes
- Station access and amenity improvements includes all publicly worn costs related to improvements to station access, transit orientated development and amenity improvements at stations.

7.2.4 Cost Benefit Analysis

Table 7-4 summarises the discounted benefit and cost inputs and the outputs of the economic analysis for the preferred option, assuming a 60-year appraisal period, based on the information provided in the above sections and the additional detail provided in Appendix K. These values are discounted values above the Do-Minimum.

Table 7-4: Preferred option benefits, costs, and BCR

($million)	Low	High
Benefits	$4,090	$5,890
Costs	$3,820	$3,820
BCR	1.1	1.5

The BCRs are low, but do demonstrate a positive return on investment, with a range of 1.1 to 1.5 and an assumed mid-range BCR of 1.3. These BCRs are consistent with those of most infrastructure projects of this magnitude, since BCRs tend to decrease as the scale of costs increase. There is also a diminishing marginal return on investment once easy wins have been achieved.

7.2.5 Sensitivity Analysis

Sensitivity analysis has been undertaken to understand the effect of plausible economic risks that fall outside of the influence of the programme. The impact of changes to the discount rate, patronage, capital costs and fare revenue have been tested. The scenarios represent the key economic risks and opportunities to the programme, and are variations of differing timing, cost, and benefits compared to the base case. Table 7-5 shows the sensitivity tests carried out and their resulting BCR ranges.

Table 7-5: Sensitivity Analysis

Sensitivity Scenario	Sensitivity Test	Low BCR	High BCR
Base Case	-	**1.1**	**1.5**
Discount Rate	The discount rate is decreased to 3%	**1.0**	**1.5**
	The discount rate is increased to 6%	**1.3**	**1.8**
Patronage	The long-term impact of COVID-19 results in 10% lower patronage	**1.1**	**1.5**
	Service level improvements result in 10% higher patronage	**1.1**	**1.6**
	Intensification along rail corridors (TOD and CBD employment) results in 28% higher patronage	**1.1**	**1.6**
Capital Costs	Capital costs are 10% lower	**1.2**	**1.7**
	Capital costs are 20% higher	**0.9**	**1.3**
Patronage and Capital Costs	10% lower patronage due to COVID-19 and 20% higher capital costs	**0.9**	**1.3**
	28% higher patronage due to intensification along rail corridors and 10% lower capital costs	**1.2**	**1.8**
Government BCR	Net costs to investors (capital and operational costs less fare revenue)	**1.1**	**1.6**

The sensitivity analysis found that the preferred programme BCR remains relatively stable across the range of scenarios tested. This indicates that investment is likely to be worthwhile even accounting for areas of uncertainty. Key findings were:

- The lowest performing scenarios were found to be a capital cost increase of 20 per cent, or if capital costs increase by 20 per cent and patronage is lower by 10 per cent, which both had a BCR range of 0.9-1.3. However, these only reduce the BCR by 0.2 compared to the base case.
- The highest performing scenarios were found to be a discount rate increase to 6 per cent (BCR=1.3-1.8), or if capital costs are 10 per cent lower and patronage is 28 per cent higher due to intensification along rail corridors (BCR=1.2-1.8). However, these only increase the BCR by 0.1-0.3 compared to the base case.
- All other sensitivity test scenarios result in a very similar BCR range (within 0.2) of the base case.

7.3 Investment Profile

The preferred programme has been assessed against Investment Prioritisation Method (IPM) for the 2021-24 NLTP. This assessment, which is outlined in Table 7-6, recommends a VH/H/L rating, with a consequential NLTP priority order rating of 2.

Table 7-6: IPM assessment for the preferred programme

Factor	Comment	Rating
GPS Alignment	The preferred programme reduces private vehicle trips on the northern corridor into Wellington by: • 14.2% for the lower range demand forecast • 20.5% for the higher range demand forecast. This assessment is based on forecast inbound 2031 morning peak (2 hour) rail passenger trips into Wellington Station and vehicle passenger trips (car and bus) using the parallel SH1 urban motorway and Hutt Road. Similar mode change is expected for other time periods/years. The reduction in trips is well above the 6% threshold for a Very High rating for the change in share of private passenger vehicle-based trips to other modes under the Better Travel Options and Climate Change GPS Strategic Priority.	Very High
Scheduling	Several ‘critical path’ projects within the preferred programme (such as the signalling, LNIRIM, NSJ and Waikanae improvements) require immediate start and meet the High requirement: *Need to undertake this activity in order to deliver/ prepare for remainder of programme/package where its implementation is to begin in 2021 or early 2024 NLTP.* The scheduling criteria appear to be focused on specific projects rather than wider programmes. However, the critical path projects cannot be delivered without the justification of the wider programme, so the overall programme has been assigned a rating of High.	High
Efficiency	The preferred programme has a BCR of 1.1-1.5, which sits within the Low band.	Low

8 Financial Case

8.1 Programme Cost

Estimated total preferred programme costs are shown in Table 8-1 (the expected or P50 estimate), and Table 8-2 (the 95th percentile or P95 estimate). These include capital cost, network maintenance cost, rail services operating cost, fare revenue, and the resulting total net cost to investors. Table 8-1 also provides indicative farebox recovery, showing the degree to which maintenance and operational costs are expected to be recovered through fares. The first four columns of each table show the breakdown for the initial four three-year planning cycles of the programme, and the subsequent columns provide indicative costs over the remainder of the programme and for the overall programme. All costs are in 2022 dollars and have not been escalated or discounted. Appendix L provides further detail on costs.

Table 8-1: Preferred programme expected cost estimate

($million)	2021-24	2024-27	2027-30	2030-33	2033-52	Total
Capital	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Network Maintenance	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Service Operating	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Fare Revenue	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Net Cost	**$178.1**	**$734.0**	**$1,493.8**	**$1,631.4**	**$5,892.8**	**$9,930.1**
Farebox Recovery (M&O)	42.9%	43.8%	46.3%	45.6%	49.4%	**48.0%**

Table 8-2: Preferred programme 95th percentile cost estimate

($million)	2021-24	2024-27	2027-30	2030-33	2033-52	Total
Capital	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Network Maintenance	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Service Operating	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Fare Revenue	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Net Cost	**$268.0**	**$1,108.2**	**$2,320.7**	**$2,553.8**	**$9,379.0**	**$15,629.7**

Figure 8-1 provides a 30-year cashflow breakdown using the expenditure categories outlined in Section 7.2.3.

The capital cost is broken down in further detail by category in Table 8-3 (P50 costs) and Table 8-4 (P95 costs). Note that some totals within these tables do not tally due to rounding. The types of interventions included in each category include:

- Above rail infrastructure: station, station precinct, and station access improvements
- Below rail infrastructure: Wellington throat capacity improvements, separated access into the Wellington freight terminal, third track in the Tawa Basin, NSJ capacity improvements, removal of network constraints Waikanae to Palmerston North, Melling junction improvements, electrification improvement and potential extension, network segregation at road and pedestrian level crossings, and network resignalling
- Rolling stock: rolling stock fleet expansion and replacement, including new long-distance trains.

Figure 8-2 outlines the annual and accumulating P50 capital costs of the programme, showing the large amount of up-front investment in enabling infrastructure that is required in the first half of the programme, particularly between 2027-28 and 2035-36.

s7(2)(b)(ii)

[redacted]

Table 8-3: Capital cost expected estimate by category

($million)	2021-24	2024-27	2027-30	2030-33	2033-52	Total
Below Rail Infrastructure	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Above Rail Infrastructure	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Rolling Stock	s7(2)(b)(ii [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Capital Cost	$27.5	$504.1	$1,269.7	$1,380.5	$4,164.2	$7,346.0

Table 8-4: Capital cost 95th percentile estimate by category

($million)	2021-24	2024-27	2027-30	2030-33	2033-52	Total
Below Rail Infrastructure	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Above Rail Infrastructure	s7(2)(b)(ii) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Rolling Stock	s7(2)(b)(ii [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Capital Cost	$41.9	$761.2	$1,972.6	$2,159.6	$6,590.3	$11,525.6

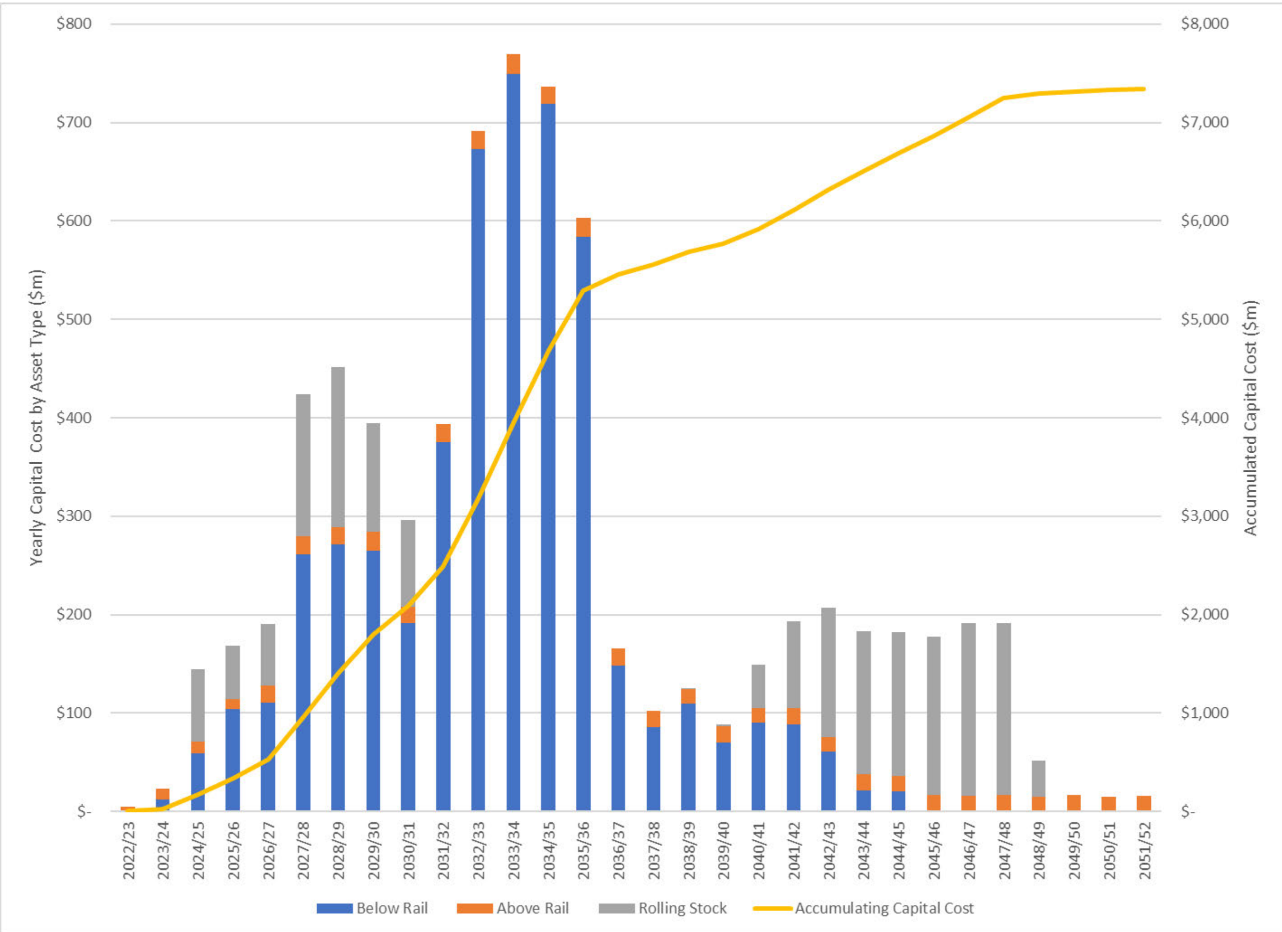


Figure 8-2: Annual and accumulating capital cost by asset type

8.2 Funding Sources

Public transport services and infrastructure are typically funded by passenger fares, regional council and territorial council rates and debt funding, and the NLTF through Waka Kotahi. These and other potential funding sources for the programme are outlined in Table 8-5.

Table 8-5: Potential funding sources

Potential Funding Source	Description
Passenger Fares	The preferred programme will increase service quality, capacity, frequency, and reliability, which is in turn expected to lead to higher patronage and consequently to higher fare revenue. This revenue will offset the cost of the preferred programme.
Council Funding	GWRC and territorial councils fund public transport services and infrastructure, and supporting infrastructure such as active mode links, through rates and sometimes debt, supported by NLTF contributions. Councils may be able to leverage value capture through development contributions or targeted rates.
National Land Transport Fund	NLTF revenue comes from a range of sources, particularly fuel excise duty and road user charges, and is used to fund land transport investment through the NLTP. The current 2021-2024 NLTP allocates $16.5 billion in NLTF funding across several funding buckets known as activity classes. The preferred programme interventions fall into the following NLTF activity class categories: • Public Transport Infrastructure: most infrastructure-related costs • Public Transport Services: public transport operational costs • Rail Network: may be justifiable where interventions enhance the strategic rail freight network and where there are significant freight-related benefits • Walking and Cycling: station connectivity improvements • Road to Zero: removal or grade separation of road and pedestrian level crossings. State highway and rail network activities are fully funded by the NLTF. Other activities receive funding at a Funding Assistance Rate (FAR), with the balance being funded by the relevant council. The actual NLTF contribution depends on the council's FAR and the timing of the intervention in relation to the NLTP cycle. Waka Kotahi can consider varying the FAR for specific projects, as has been done for special purpose roads, Total Mobility, the Safe Network Programme, and previously for rail improvements including GWRC's Matangi EMU purchase. This is likely to be necessary under the preferred programme, as significant major investments such as NSJ capacity improvements and major fleet expansion are unaffordable for GWRC at the council's standard 51% FAR rate.
Crown Funding	Crown funding may be available for significant projects that are unaffordable for councils. The Crown has previously funded other rail projects through the NZUP and Provincial Growth Fund channels, including investment in track, railway stations, rail electrification, rail connections and rail network capacity and resilience improvements in Auckland, Wellington, and regional areas. Crown funding has been used for several Wellington rail projects, including WMUP 6A, and WMUP 6B. The Government is currently considering a funding contribution to support the LNIRIM business case outcome.
Climate Emergency Response Fund	The Climate Emergency Response Fund (CERF) was established in 2021. It allocates Emissions Trading Scheme proceeds towards initiatives that help meet climate change objectives. The Government allocated $2.9 billion in CERF funding across a four-year forecast period in its 2022 budget, in addition to pre-commitments of $840 million and $25 million for the Decarbonising Industry Fund. $1.3 billion was allocated to the transport sector, $375m of which was allocated specifically to activities, infrastructure and services that reduce reliance on cars and support the uptake of active and shared modes. It is reasonable to expect that the preferred programme will receive funding from this source, given the role of rail within the region's transport system and climate response.
New Policy and Regulation	New policy and regulatory approaches may be used to both influence transport system use and create new funding streams for this programme. Examples could include a regional fuel tax, as implemented in Auckland since 2018, or congestion charging, as used in London, Singapore, and many other cities abroad.

	These taxes are typically hypothecated to provide a continuous funding stream for public transport or rail-related projects. For example, the Auckland Regional Fuel Tax is hypothecated to a list of transport initiatives focused on, but not limited to, sustainable transport and network improvements.
Private Partnerships	GWRC plans to partner with private developers to deliver TOD around stations, which would otherwise be unaffordable for the Council to deliver alone.

The contribution of the potential funding sources to the various interventions will be determined by subsequent business cases and depend on the type of activity and the funding council. Table 8-6 shows the potential funding implication for councils and the NLTF if the whole capital cost is funded through traditional means, assuming that below rail capital costs are fully funded by the NLTF through Waka Kotahi or another source. The values in the table have been calculated at the standard FAR (51 per cent Waka Kotahi/49 per cent council) and assume that Crown, CERF, policy/regulatory-related funding streams, or private investment are either unavailable or cannot be secured, and that fare revenue primarily contributes to the cost of maintenance and operations.

Table 8-6: Funding share without Crown or private funding (P50)

($million)	2022-24	2024-27	2027-30	2030-40	2040-50	Total
Councils (49%)	[redacted] s7(2)(b)(ii)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Waka Kotahi (51%)	[redacted] s7(2)(b)(ii)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Waka Kotahi (100%) – Below Rail Capital Cost	[redacted] s7(2)(b)(ii)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Capital Cost	$27.50	$504.10	$1,269.70	$1,380.50	$4,164.20	$7,346.00

The table indicates that, even excluding below rail capital costs, the cost to councils is substantial at [redacted] s7(2)(b)(ii) over the life of the programme at the standard FAR. Most of the council cost will be borne by GWRC, since GWRC costs include rolling stock fleet, station infrastructure, and service operations, although territorial councils will likely need to fund station access improvements and contribute to the cost of level crossing removal within their jurisdiction. GWRC's share would require rates to increase by approximately an average of 10 per cent year on year over the first ten years of the programme if funding is only available at a standard FAR. The programme is therefore unaffordable for that council at the current standard FAR without Crown funding or another source, such as a new hypothecated tax like a regional fuel tax or congestion pricing scheme.

A 100 per cent FAR is recommended for below rail capital improvements, including ongoing catch-up renewals, as those assets are 100 per cent owned by KiwiRail (and therefore ultimately by the Crown), and the NIMT, where most below rail improvements are required, is a strategic freight corridor of national significance. In both cases, KiwiRail could be the applicant. This arrangement was used to fund passing loops north of Waikanae as part of KiwiRail's iReX project. Rail capital costs could alternatively be funded directly by the Crown.

NLTP investment has been sought for this programme through the current 2021-2024 NLTP and was included the 2021 RLTP. It is currently classified as probable but not approved, with approval being dependent on the outcome and approval of this PBC.

Committed RNIP and NZUP investment is shown in Table 8-7. This covers WMUP 5 (signalling), WMUP 6A (entrance to Wellington Station), WMUP 6B (Wairarapa capacity upgrades) and WMUP 7 (capacity improvements business case) from the PBC programme.

Table 8-7: Investment committed by RNIP and NZUP

($million)	2021-24	2024-27	2027-30	2030-40	2040-50	Total
Committed Investment (RNIP, NZUP)	**$183.8**	**$151.7**	**$194.7**	**$0**	**$0**	**$530.2**

8.3 Funding Risks

Investment sources, investment cashflow and cost increases are the main funding risks for the programme. The key funding risk elements are:

- Investing organisations (GWRC, territorial councils, Waka Kotahi, central government, private developers) have multiple commitments, and the programme will be competing against other priorities for investment, both within the region and nationally
- Public transport fare revenue, a key investment source, may be lower than projected in the short to medium term due to the impacts of the COVID-19 pandemic, and could be disrupted by the impacts of construction
- Cost increases are probable due to range of factors over the course of the 30-year programme, including increased market rates, supply chain disruption, new regulation, changes in risk profile, increased knowledge of asset condition or ineffective collaboration between delivery organisations.

The above risks and others are discussed further in Section 10.4.

The Wellington Rail Programme Governance Group (see Section 10.1) will be responsible for managing the programme in relation to these risks and ensuring that the longer-term objectives remain in focus as the programme adapts to risk changes over time. It is expected that Waka Kotahi will advocate for and interact with central government in relation to funding allocation. Intervention and programme costs will be refined in subsequent business cases to provide more cost certainty and ensure the programme remains affordable.

9 Commercial Case

9.1 Procurement Approach

It is expected that the PBC will be approved by the GWRC Council and Waka Kotahi Board during 2022. The programme calls for a range of business cases to then be procured in the 2022-23 financial year to enable physical works to commence in the later stages of the 2021-24 NLTP period and particularly in the 2024-27 NLTP period. Each subsequent business case will identify project-specific management and commercial cases.

GWRC will be the main delivery agent for the programme, reflecting its planning, investing, and asset owning roles, and lead role in several delivery streams. However, a range of projects will be led by other entities. KiwiRail will lead the delivery of network infrastructure, while local councils will lead delivery of projects that improve active mode links to stations. The roles of the respective organisations are outlined in the Management Case.

The projects within the programme range significantly in scale. As a result, the procurement approach will be varied:

- Large investments, such as the Kāpiti business case are likely to progress to an indicative followed by a detailed business case. This allows a range of alternatives to be explored before determining the most appropriate version of that investment to be made.
- Relatively simple programmes, such as the rail network segregation programme will be dealt with by means of an SSBC. These may be split by line to manage size. In cases where a SSBC identifies a specific and/or difficult intervention that requires additional work, it may refer specific parts of the programme to a DBC. SSBCs will be used where there are economies of scale due to the problems and issues being similar for individual projects.
- Single specific investments, such as the Matangi EMU replacement, will be progressed through a DBC. This will be used for specific, non-repeating interventions.

It is expected that these business cases will be procured through a mix of direct appointment, invited tender, and open tender, depending on the scale of the project. The business cases will determine how each project will be specifically funded and its delivery managed.

GWRC adopted its Transport Procurement Strategy in 2014. All procurement relating to later stages of the programme will be required to comply with this strategy or future versions of it, to ensure that procurement is compliant with Waka Kotahi, Land Transport Management Act, Local Government Act, and the auditor general's procurement guidance for public entities. This strategy has a specific Public Transport Operating Model Rail Procurement section, which was not available when the RRPs were developed.

9.2 Market and Supply Assessment

9.2.1 Infrastructure

Compared to other infrastructure assets, there is limited capacity for significant rail construction within New Zealand, particularly in specialist fields such as signalling and track design and construction where capacity is constrained and will need to be augmented.

Auckland's City Rail Link and associated projects, which represent the largest segment of the rail construction capacity in the country, are currently projected for completion in 2024. This date aligns well with the timing of some of the more significant investigations required by the preferred programme, particularly the investigations into the NSJ improvements. Within the Wellington region, the Trentham to Upper Hutt double tracking project is now complete, marking the completion of the only new rail construction in the region since the extension of electrification to Waikanae was completed in 2011. Some of the other WMUP projects also include some new construction, and some local contractor capability remains.

Several large roading projects that are currently under construction in the region will finish in the next few years, with limited replacement projects, which is expected to free up some construction capacity. The programme may be able to take advantage of this capacity, as many projects within the programme relate to elements like grade separation, which draw on similar capabilities. The Peka Peka to Ōtaki Expressway project has also directly involved rail realignment and road bridges over rail.

Station, station access, and other similar improvements will draw on an existing pool of local suppliers with general construction capability. There is currently limited capacity in this market, but demand is slowing, and it is expected that there will be more market competition by the time that most projects within the programme are tendered.

9.2.2 Rolling Stock

New Zealand does not currently have domestic rolling stock construction capability and it is unlikely that this will change. All train fleet expansion and replacement will therefore be tendered on the international market, reflecting all recent rolling stock procurement. For example, the Matangi EMU fleet was constructed by Hyundai Rotem in Korea, and the Auckland EMU fleet was constructed by CAF in Spain. There is significant capacity within the international market, reflecting strong investment in rail improvements around the world, and it is expected that there will be market interest in train fleet expansion and replacement despite New Zealand's non-standard track gauge, particularly for larger fleet purchases.

9.2.3 Services

Metlink services are currently operated by Transdev under a 15-year performance-based contract that commenced in 2016 following a competitive tendering process involving several tenderers. Auckland Transport services are currently operated by Auckland One Rail under an initial 8-year term that commenced in 2022 following a competitive tendering process. Both new operators replaced incumbents – KiwiRail's Tranz Metro in Wellington and Transdev in Auckland. It is expected that there will be market competition from experienced operators when the current Metlink contract comes up for renewal.

9.3 Risk Sharing

Commercial risk allocation will be dependent on the procurement approach and delivery model chosen for each element of the programme. A key principle will be that risks will be allocated to the organisation that is best placed to manage them.

The programme is complex, as are rail funding and delivery responsibilities. The Wellington Rail Programme Governance Group will therefore be responsible for managing the overall programme in relation to cost and delivery risk, and for the integration of the different elements of the programme. Individual project owners will be responsible for managing the cost and delivery risk of the programme elements within their control, to both the Governance Group and their own organisation, through contracts that appropriately allocate risk between the contractual parties:

- GWRC for the procurement of Metlink rolling stock and supporting facilities, stations and passenger facilities, and services
- KiwiRail for the procurement of below rail network infrastructure
- Territorial councils for the procurement of improvements to active mode links to stations.

Subsequent business cases will determine the best means for managing commercial risk in relation to individual projects, including the most appropriate design, construction, and operation forms of tender and contract. The delivery of the more minor or continuous elements of the programme will use current approaches.

It is possible that the preferred procurement and delivery approach does not provide value for money, or that insufficient information is provided to tenderers on the scope and requirements of the intervention. These risks will be the responsibility of the procuring organisation and mitigated through peer review of the delivery strategy and procurement process. Additional risks include ineffective procurement processes that benefit some tendering parties over others, tenderers having existing relationships and perceived unfair advantages in the procurement process, and a lack of market interest and capability, leading to a lack of competitive tension and lower value for money.

Procurement evaluation processes will be well developed so they align with the project objectives. Project governance and approval structures will be clear to minimise potential delays in decision making.

9.4 Consenting

This section provides a high-level assessment of the planning inputs that are likely to be required for the large infrastructure projects within the programme.

Statutory Context

A consenting strategy will be developed for each business case. It is anticipated that most interventions will be undertaken within the rail designation, however it will be necessary to alter the designation where they fall outside of the designation, necessitating a Notice of Requirement under the Resource Management Act 1991 (RMA) to the relevant territorial authority.

The relevant planning documents have a multitude of objectives and policies that include protectionist or avoidance requirements, which RMA case law gives considerable prominence. This has significant implications for the consenting of infrastructure projects that are likely to require non-complying activity resource consents.

There is a high likelihood that one or more of the activities associated with interventions will be in an area deemed by the HRC's One Plan[32] as an at-risk or threatened habitat or will not meet the standards in GWRC's proposed Natural Resources Plan, meaning non-complying activity regional resource consents would be required.

The activities that are high risk are:

- The removal of vegetation
- Earthworks and discharges that may impact on wetlands

[32] One Plan is the resource management planning document for the Horizons Region.

- Stormwater discharges
- Discharges of sediment during construction
- Disturbance of the riverbed
- The construction and placement of structures in rivers on fish passage.

It is also anticipated that following completion of a detailed site investigation, resource consent will be required pursuant to the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health for works within and potentially outside the rail corridor, and resource consents will likely be required under the National Environmental Standard for Freshwater Management 2020 for works in streams.

Alternatives Assessment

Under the RMA, a consideration of alternative routes, sites and methods is relevant. Alternatives assessment will be needed at each stage of project development. An initial assessment has been undertaken through the shortlist to preferred programme MCA process of this PBC.

At each subsequent stage, a process of identifying and evaluating alternatives will be undertaken, commensurate with the level of detail at that stage. The site selection, site layout and concept designation steps will involve consideration of impacts on the existing natural and built environment, as well as social and cultural values.

Consultation and Engagement

It is expected that projects will be delivered in partnership or with the active engagement of mana whenua. Collaboration with mana whenua at the early stages of a project is important to ensure a partnership approach is taken to honour Te Tiriti o Waitangi - The Treaty of Waitangi. An assessment of effects on heritage and archaeology will also be prepared.

Engagement with other affected parties and the wider public will be undertaken as appropriate to each individual project.

Planning Complexity

The key planning requirements and complexities are highlighted in Table 9-1. A high difficulty rating refers to the expected difficulty based on the tasks and the timeframes. Detailed assessments will be undertaken to determine complexity as each project within the programme develops.

The programme covers a range of sensitive environments (coastal and water courses), steep terrains and constrained urban areas with potential property ownership implications (land requirements), meaning non-complying activity regional resource consents will be required.

Table 9-1: Assessment of planning complexity[33]

Location	Relevant Councils	Constraints and Planning matters	Difficulty
Wairarapa	GWRC MDC CDC SWDC	Water courses Urban considerations	High
North of Waikanae	GWRC/HRC KCDC	Water courses	High
Waikanae Station Approach	GWRC KCDC	Property Water courses Urban considerations	High
North-South Junction	GWRC PCC	Water courses; coastal; steep terrain	High
Upper Hutt Basin	GWRC UHCC HCC	Water courses Urban considerations	High
Tawa Basin	GWRC PCC WCC	Water courses; Porirua Harbour Urban considerations	High
Wellington Station Approach	GWRC WCC	Wellington Harbour; property	High

[33] MDC=Masterton District Council, CDC=Carterton District Council, SWDC=South Wairarapa District Council; KCDC=Kapiti Coast District Council; PCC=Porirua City Council; UHCC=Upper Hut City Council; HCC=Hutt City Council; WCC=Wellington City Council.

9.5 Property

Property strategies will be developed by each of the subsequent business cases once the extent of any required property requirement is determined. At this stage in the process, there is only the expectation for limited property acquisition. This will be driven by the Waikanae Station Access requirements, grade separation and potential NSJ capacity improvements recommended by the next steps in the project development process.

There may be areas where Heritage NZ will become a key partner for isolated projects within the programme.

10 Management Case

10.1 Key Roles and Responsibilities

It is proposed that a new Wellington Rail Programme Governance Group will oversee delivery of the overall programme on an ongoing basis. This group will be responsible for delivering the programme in accordance with the timelines outlined in Section 10.2, for ensuring coordination between programme components (e.g. delivery of network infrastructure when required to enable service improvements), for managing programme risks, and for achieving the benefits and outcomes outlined in this PBC. The Governance Group will consist of:

- GWRC (Chair and member), as regional strategic transport and public transport planner, an investor, Metlink rail service owner, passenger asset owner, and lead of three main delivery streams
- KiwiRail (member), as the network owner, freight operator, track access and rail license holder, and lead of the key network infrastructure delivery stream
- Waka Kotahi (member), as an investor and strategic planner
- Metlink rail service operator (observer) as the passenger service contractor, and track access and rail license holder
- Ministry of Transport (observer) who will provide guidance on government strategic ambitions and preferred direction.

Figure 10-1 outlines the proposed governance and management structure for the delivery of the programme.

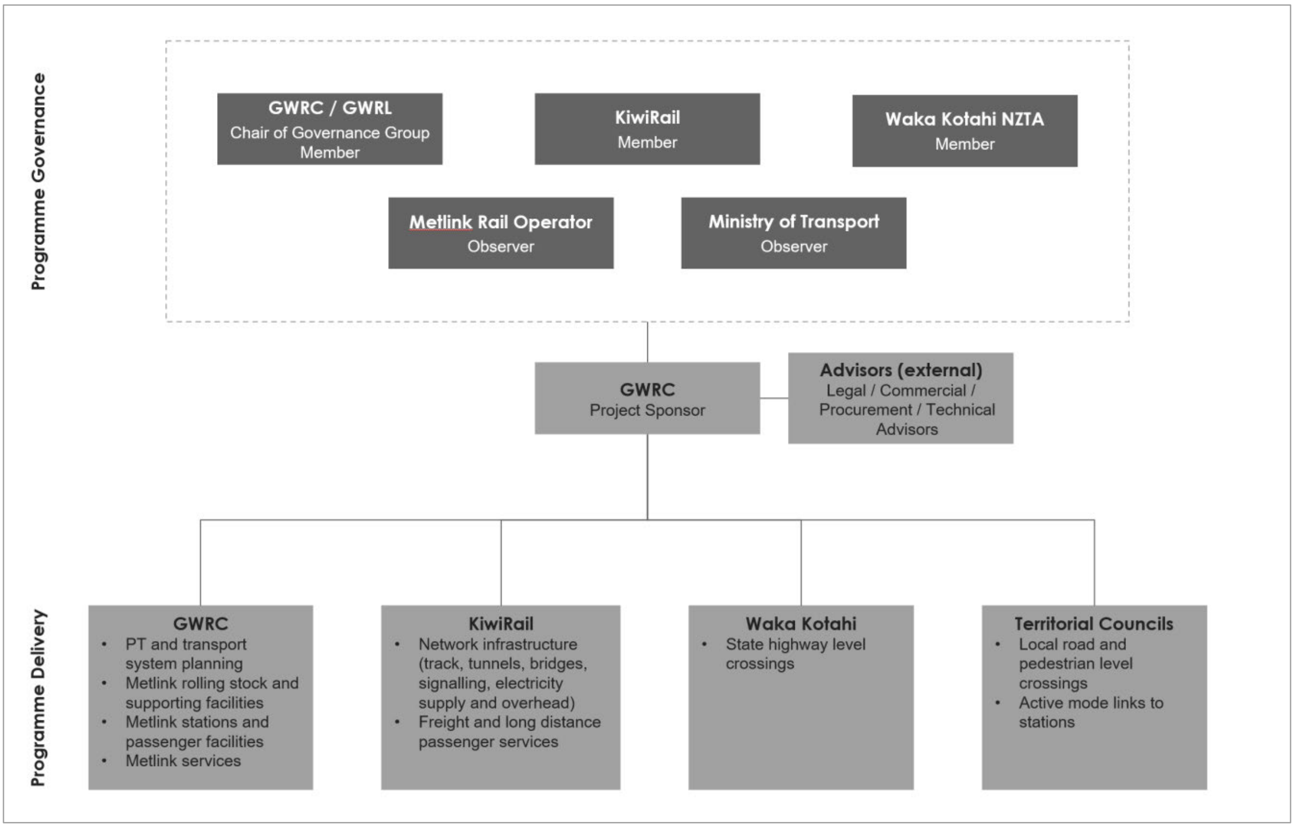


Figure 10-1: Proposed governance and delivery structure

The programme will result in physical, technological, and operational changes that will impact the assets and processes of GWRC, KiwiRail, the Metlink rail operator and territorial councils. Delivery streams will therefore be led by the organisation best placed to manage the associated risks. It is expected that it will primarily be delivered by the following organisations:

- GWRC, which will lead delivery of improvements to Metlink rolling stock and supporting facilities, stations and passenger facilities, and rail and connecting public transport services
- KiwiRail, which will lead delivery of improvements to below rail network infrastructure (e.g. track, tunnels, bridges, signalling, electricity supply and overhead)
- The region's eight territorial councils, which will lead delivery of improvements to active mode links to stations.

Waka Kotahi and the territorial councils will also be directly involved in the segregation of road and pedestrian crossings.

It is proposed that project reporting from the delivery leads to the Governance Group will be primarily through GWRC as the project sponsor. Major projects may report directly to the Governance Group.

Each individual organisation will retain and follow their own decision-making processes. The Governance Group will therefore be critical ensuring that these are built into the programme and adhered to minimise delay, and for ensuring that decision-makers are fully aware of the wider strategic context of decisions.

The success of the programme will require partnering and engagement with iwi, territorial councils, and road controlling authorities. The Governance Group will therefore report regularly to the Wellington Regional Leadership Committee and Regional Transport Committee to ensure that these organisations are kept informed and provide the means for determining the degree of their involvement at the programme level and in individual projects. This involvement could include governance-level involvement of representatives of these organisations, even if just in an advisory or observational capacity. Decisions around programme-level involvement will be made at the earliest opportunity.

10.2 Outline Programme Plan

Figure 10-2 provides indicative programme planning and implementation timelines. Grey relates to planning and business case timelines, blue to implementation timelines, and green to service improvements. Key dependencies are denoted by arrows.

The proposed implementation timing has been developed based on the following principles:

- Remove capacity constraints as a priority
- Enable 6 trains per hour frequency/10min headway on the Hutt Line and Kapiti Line by 2032
- Enable 10 trains per hour frequency/6min headway on the Hutt Line and Kapiti Line by 2042
- Provide capacity to meet the highest rail patronage growth scenario provided by WTAU
- Enhance the customer experience to encourage mode shift.

Rail network segregation, NSJ capacity improvements, upgraded signalling and additional rolling stock are required to enable the desired frequency. The timing of additional rolling stock has been driven by projected rail patronage, noting that the projected patronage does not exceed seated capacity by more than 20 per cent[34]. Station upgrades and other interventions that enhance the customer experience have also been prioritised to encourage mode shift.

The outline programme plan includes projects that are currently underway, including WMUP III, IV, 5, 6A, and long-distance trains and infrastructure resulting from the LNIRIM business case, as well as continuous improvement of systems process and capacity throughout the programme. All are key short-term elements of the programme.

The early delivery of improved signalling and associated increased number of crossovers will enable services to continue running during maintenance and capital works, reducing and some cases eliminating the need for bus replacements. This will help rail remain as a viable option for customers even when the significant physical works are taking place.

The outline programme plan is based on a current understanding of GWRC's priorities. Assumptions have been made on cashflows as well as the market's ability to deliver. These assumptions should be tested and refined in subsequent business cases. Consultation with the community through the RLTP process, changes to funding processes, funding availability and project affordability, as well as further investigations (particularly for large-scale projects) will influence timing and investment priorities.

The timing of implementation of service enhancements is dependent completion of capacity improvements earlier in the programme, as well as demand and the procurement of sufficient rolling stock.

[34] This was deemed an appropriated threshold as few passengers will be on the train from the very first to the very last stop.

Figure 10-2: Indicative programme timelines

10.3 Benefits Realisation Management

Table 10-1 contains the proposed Benefits Management Plan. It identifies who is responsible for monitoring each benefit and what information sources to use. This table should be used together with the appraisal summary table contained in Appendix G, which outlines the anticipated benefits and their expected timing.

It is proposed that GWRC monitor all benefits, with input from the Metlink Rail Operator and KiwiRail, where required. Monitoring should begin at the commencement of the preferred programme. Confidentiality agreements may be used if the data used for monitoring is considered commercially sensitive. In theory, the monitoring of benefits realised will demonstrate the value of investment in rail and may help to secure additional rail funding in the future, to the benefit of all three organisations.

Table 10-1: Benefits management plan

Benefit	Non-monetised Benefit Measure	Responsibilities	Source
Improved environmental outcome	1. Carbon emissions per passenger km and per freight tonne-km. 2. Commuter mode share north of Wellington CBD. 3. Rail freight tonne-kms.	1. GWRC to monitor with input from the Metlink Rail Operator, KiwiRail and the Ministry for the Environment. 2. GWRC. 3. GWRC to monitor with input from KiwiRail.	1. Carbon emissions calculated from the fuel usage of trains running WMRN services, carbon cost of electricity generation (reported annually by the Ministry for the Environment), passenger-kms and freight tonne-kms. 2. Journey to work and education census data. 3. KiwiRail rail freight tonne-km data.
Enable regional growth through improved access to economic and social opportunities	1. Peak rail passenger capacity, measured by peak period seat-kms. 2. Number of rail freight paths on the NIMT Line. 3. Number of rail freight paths on the Wairarapa Line.	1. GWRC. 2. GWRC with input from KiwiRail. 3. GWRC with input from KiwiRail.	1. Passenger service timetables, number of units and their seated capacity. 2. Number of rail freight paths on the NIMT Line. 3. Number of rail freight paths on the Wairarapa Line.
Improved customer experience	1. Peak period passenger service frequency, by line. 2. Off-peak period passenger service frequency, by line. 3. Customer satisfaction. 4. Passenger service punctuality.	1. GWRC. 2. GWRC. 3. GWRC. 4. GWRC to monitor with input from the Metlink Rail Operator.	1. Passenger service timetables. 2. Passenger service timetables. 3. Public Transport Customer Satisfaction Survey (reported annually by GWRC). 4. Service punctuality from monthly operator reporting.
Improved transport system resilience	1. Peak period passengers impacted by cancellations. 2. Number of services cancelled due to asset health-related faults or planned maintenance. 3. Customer hours lost.	1. GWRC to monitor with input from the Metlink Rail Operator. 2. GWRC to monitor with input from the Metlink Rail Operator and KiwiRail. 3. GWRC to monitor with input from the Metlink Rail Operator.	1. Service punctuality from monthly operator reporting, corresponding average patronage. 2. Service cancellations from monthly operator reporting and monthly KiwiRail reporting. 3. Service punctuality and cancellations from monthly operator reporting, corresponding average patronage.

			Some assumptions will need to be made to calculate the additional travel time incurred.
A safer rail system	1. Rate of safety incidents. 2. Public perception of safety.	1. GWRC to monitor with input from the Metlink Rail Operator and KiwiRail. 2. GWRC.	1. Monthly reporting from operator and KiwiRail. 2. Public Transport Customer Satisfaction Survey (reported annually by GWRC).

Following approval by GWRC's Council and Waka Kotahi's Board, GWRC will develop and implement a detailed benefits management plan, including confirming organisational responsibilities. GWRC already conduct annual transport monitoring, and it is possible that the PBC benefits realisation monitoring could be incorporated into that exercise.

10.4 Risk Management

Table 10-2 summarises the programme risks. The owning organisation, mitigation measures and the residual threat/opportunity rating are included. Appendix M provides a detailed risk table that includes threat and opportunity likelihood and consequence ratings.

Threat and opportunity ratings were determined with reference to Waka Kotahi's Risk Management Practice Guide (Minimum Standard Z/44). The risk has been assigned to the organisation with the greatest influence to manage the likelihood or consequence of the risk occurring.

The only critical threat identified relates to funding being unavailable when required. The Governance Group will need to manage this risk carefully to ensure that the interventions and their associated benefits are delivered as planned.

Ten risks have been identified as having a high residual risk rating. These relate to demand (growth, travel patterns), financing (funding, cost increases), planning (consenting, iwi concerns), delivery (lead times, interdependencies) and general (road investment, natural hazard events) risks. These risks will be further investigated and managed as the programme elements are developed. Individual projects will maintain their own risk registers.

Policy-lever changes enhanced public transport south of Wellington Station, and a change in Government direction have been identified as the highest potential opportunities. The PBC has very little influence over these, but the Governance Group should stay aware of these potential opportunities and be ready to take advantage of them if they eventuate.

Table 10-2: Summary of programme risks

Risk/Opportunity	Risk Owner	Mitigation	Residual Threat Rating	Residual Opportunity Rating
Demand:				
COVID-19 impacts travel patterns	GWRC	Monitor public transport patronage and travel patterns; adjust timing of intervention implementation as needed.	HIGH	LOW
Population growth is away from / along rail corridors	GWRC	Support development that aligns with the Regional Growth Framework.	MEDIUM	MEDIUM
Population growth is below/above current expectations	GWRC	Monitor population growth against projections and adjust timing and outcomes, as necessary.	MEDIUM	HIGH
Financial:				
Investment cashflow is not available when required	GWRC / KiwiRail / Waka Kotahi	Governance group to communicate with investing organisations and central government frequently so they understand cashflow requirements; prioritise the most impactful interventions; adjust intervention delivery timing, as necessary.	CRITICAL	N/A
Investment required or investment sources are not available	GWRC / Waka Kotahi	Governance group to communicate with investing organisations and central government frequently so they understand the investment requirements.	HIGH	N/A
Cost increases	GWRC	Refine cost estimates of interventions as they are further developed through subsequent business cases; communicate changes to investors.	HIGH	N/A
Planning:				
Consenting delays or prevents outcomes	GWRC	Involve planners and environmental specialists in projects early to identify and minimise potential consenting issues.	HIGH	N/A
Iwi concerns with required projects	GWRC	Engage with tangata whenua early and work collaboratively to develop solutions.	HIGH	N/A
Heritage concerns delay or prevent outcomes	GWRC	Engage with relevant organisations and the local community early and work collaboratively to develop solutions.	MEDIUM	MEDIUM
Subsequent business cases indicate some elements of the programme are not affordable	GWRC	Implement alternative interventions that achieve similar outcomes but are economically justified where possible.	MEDIUM	N/A
Policy levers change (e.g. congestion charging, Zero Emissions)	GWRC / TLA / Waka Kotahi	Implement policy levers that encourage and support sustainable transport and a low-carbon future.	LOW	HIGH
LGWM enhances public transport south of Wellington Station	LGWM	Work with LGWM to ensure the two programmes are coordinated and integrated.	N/A	CRITICAL
Delivery:				

Long lead times delay the delivery of outcomes	GWRC	Educate investors about the long lead times associated with rail projects; commence planning and procurement early.	HIGH	N/A
Delays due to interdependencies of programme elements	GWRC	Communicate with lead organisations to minimise potential knock-on effects; carefully select governance group members to establish a champion of PBC projects within partner organisations.	HIGH	N/A
Market capability and capacity delay delivery	GWRC	Consider the timing of other major projects when timing the delivery of interventions; understand supplier availability by requesting expressions of interest.	MEDIUM	N/A
Partner organisations do not prioritise delivery of programme elements	GWRC	Communicate with delivery lead organisations periodically to ensure they understand the importance of delivery to the Wellington region; carefully select governance group members to establish a champion of PBC projects within partner organisations.	MEDIUM	N/A
General:				
Road investment reduces rail patronage	Waka Kotahi	Prioritise investment and delivery of sustainable transport modes.	HIGH	N/A
Large scale natural hazard events occur	GWRC	Incorporate climate change mitigation and adaption into interventions where appropriate; design elements that enable recovery from major events.	HIGH	N/A
Policy change: overall government direction	GWRC / Waka Kotahi	Scale interventions up/down and adjust delivery timing if required after changes of government but ensure programme continuity.	MEDIUM	HIGH
Public perception and reputational risk	GWRC	Engage with the public and local communities and work collaboratively to develop solutions; communicate with the public and be realistic so they understand the expected timing, disruptions, and benefits of projects.	MEDIUM	MEDIUM
Regulation changes affect timeframes, cost, or outcome	GWRC	Be aware of potential regulatory changes and adjust programme timing and costs as needed.	MEDIUM	N/A
Climate change happens more quickly / severely than predicted	GWRC	Be aware of the potential need to accelerate the programme if climate change adaption measures are required earlier than expected, or if additional investment for sustainable transport is made available earlier than expected.	MEDIUM	N/A
Freight volumes increase sooner than anticipated	KiwiRail	Monitor freight volumes with reference to projections; bring forward delivery of interventions if required.	LOW	MEDIUM

10.5 Next Steps

This PBC provides a clear investment pathway for the region's rail system over the next 30 years, which will enable achievement of important regional and national growth and environmental policy objectives and provide significant value for investors. It is therefore recommended that decision-makers:

- Approve the investment programme as outlined in this business case, and commit to the associated investment requirements and timeframes, subject to the outcome of further business cases and other investigations.
- Approve funding of the first three-year stage of the programme, which includes a series of further business cases and other investigations that will determine the optimal solution for and timing of key elements of the programme, particularly the below rail capital components on which the remainder of the programme is dependent – these include:
    - Network Constraints and Capacity Study (can be merged into the Future Network Form Study)
    - Customer Habit and Optimisation Study
    - Future Network Form Study
    - Wellington Station Approach IBC
    - North-South Junction Capacity Improvements IBC
    - Waikanae Approach IBC
    - Resilience and Operational Improvements Business Case
    - Network Segregation Business Case(s)
    - Traction Power Upgrade Business Case
    - Matangi Replacement DBC
    - Smarter Connections SSBC (covering station access in partnership with territorial councils)
    - Station Improvements SSBC
- Approve funding for implementation of the investment proposal outlined in the Lower North Island Rail Integrated Mobility Detailed Business Case, which is a key first decade element of this programme that reduces rail emissions and provides essential system bridging capacity to support growth and mode shift in the short term
- Confirm governance arrangements for delivery of the programme through a new Wellington Rail Programme Governance Group.

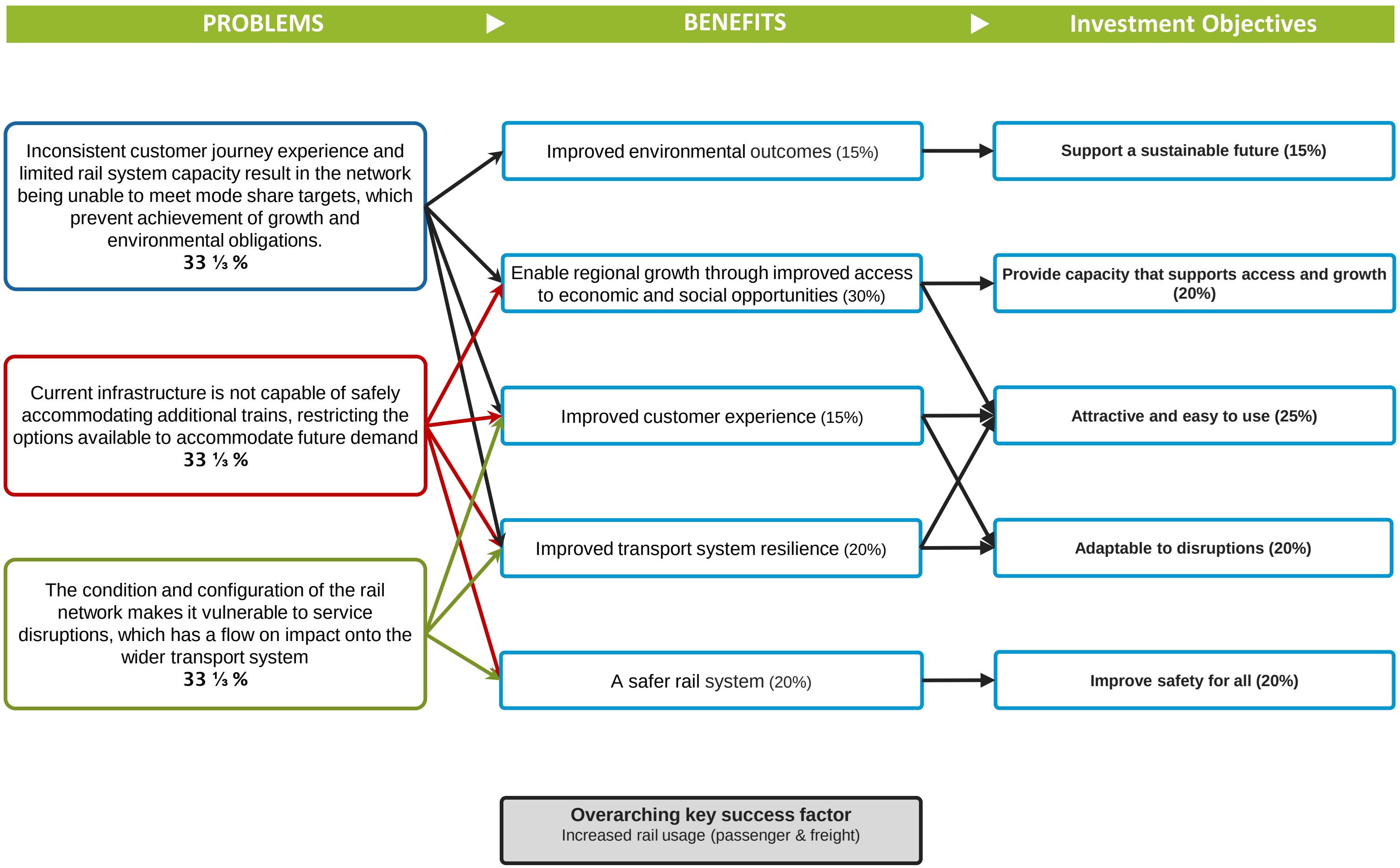
Appendices

Appendix A Investment Logic Map

Investment Logic Map

Wellington Rail PBC

greater WELLINGTON REGIONAL COUNCIL



Appendix B Benefits Map

greater WELLINGTON
REGIONAL COUNCIL

Wellington Regional PBC

BENEFIT MAP

BENEFIT	INVESTMENT BENEFIT
Improved environmental outcomes 15%	Support a sustainable future
Enable regional growth through improved access to economic and social opportunities 30%	Provide capacity that supports access and growth
Improved customer experience 20%	Attractive and easy to use rail system
Improved transport system resilience 20%	Adaptable to disruptions
A safer rail system 20%	Improve safety for all

MEASURE	DESCRIPTION	BASELINE	TARGET
Carbon Emissions 5%	Tonnes of CO2 equivalent emitted calculated by fuel usage to run WMRN services per person/tonne of freight	407g CO2e/passenger 2018/19 FY	30% reduction by 2050
Mode Share 10%	Census Journey to Work data for trips to Wellington from the north	35.8% 03/2018	50.0% By 2046
	Increased rail freight volume	TBC Mm/yyyy	25% Increase Mm/yyyy
Passenger capacity 22%	Improve access by increasing peak passenger capacity	8800 peak hour seats 2021	11,000 peak hour seats 2031 14,000 peak hour seats 2046
Maintain Freight Paths 8%	Retain existing freight paths throughout the day and ensuring capacity for growth	4 Wairarapa 14 NIMT 2021	6 Wairarapa 20 NIMT 2046
Frequency 8%	Number of trains per hour in peak periods	22 trains in AM peak hour 2021	41 trains in AM peak hour 2046
	Increase average trains per hour in non peak periods	3 trains per hour on Hutt and Kāpiti lines 2021	4 trains per hour on Hutt and Kāpiti lines 2040
Accessibility 2%	Maintaining ease of access and improve accessibility for impaired users	14 stations with challenging access 2021	100% of stations fully accessible by 2035
Customer satisfaction 2%	Improve the overall satisfaction of rail passengers as per the rail customer survey	95% 07/2021	97.5% 07/2030
Punctuality 8%	Improve peak punctuality as per operator reporting	95.7% Year to October 2021	99.0% by 2030
	Reduction in the number peak period passengers impacted by cancellations	TBC In Customer Habit and Optimisation Study	TBC In Customer Habit and Optimisation Study
Transport system impact 20%	Services impacted by asset health related faults	446 cancellations or delays cause by network Nov-20 to Jan 21	45 cancellations or delays caused by network per 3 month period
	Adaptability Measure (i.e. customer hours lost)	TBC In Customer Habit and Optimisation Study / Network Resilience Planning	TBC In Customer Habit and Optimisation Study / Network Resilience Planning
Rate of safety incidents 15%	Reduce the rate of safety incidents reported by operator	253 near collisions at level crossings 15 collisions 126 SPADA/Derailments 2009-19	Reduction of 80% By 2040
Perception 5%	Increase public and user perception of safety and security as per passenger surveys	93% 07/2021	97.5% 07/2035

RESPONSIBILITY FOR DELIVERING THE BENEFITS

Name: GWRC Position GWRC Rail Asset Manager 22/12/2021

Appendix C Early Assessment Sifting Tool

Early Assessment Sifting Tool

Early Assessment Sifting Tool: Excel template

Project Overview

Date:	29/06/2020
Project	Wellington Regional Rail Plan
Business case p	Programme Business Case
Problem/oppor	Increased rail used (passenger
Do minimum:	As Per do-minimum document, no uncommitted capital works, only maintenance and fleet replacement

Investment	Improve Safety for All
Investment	Provide capacity that supports access and growth
Investment	Attractive and easy to use
Investment	Support a sustainable future
Investment	Adaptable to disruptions

Note: Please copy the row above to add an additional investment objective.

Alternative or option details				Investment objective					Practical Feasibility				Scheduling/ programming	Cost	Special notes on cost estimates
Unique identifier	Name of alternative/option	Alternative/Option Type	Description of alternative/option	Improve safety for all	Provide capacity that supports access and growth	Attractive and easy to use	Support a sustainable future	Adaptable to disruptions	Technical	Safety and Design	Political and Public Acceptance	Consentability			
1	Improved freight loop at Porirua to ensure freight trains can continue to operate between more frequent services	Infrastructure - Track	Installation of a freight loop at Porirua to ensure freight trains can continue to operate between more frequent services without causing delays	2	4	3	4	3	1. Green	1. Green	1. Green	2.Amber/green	0-5 years	$1m - $10m	
2	Infrastructure investment to support significant increase in freight services operating on network	Unknown	WMUP Programme	2	5	2	3	2	Don't know	Don't know	Don't know	Don't know		Unknown	
3	Install automatic gates on all pedestrian level crossings	Infrastructure - Crossing	Installation of automatic gates on all pedestrian level crossings on the WMRN to enable higher frequencies to be implemented safely	4	3	3	2	2	1. Green	1. Green	1. Green	1. Green	0-5 years	$10m - $100m	Includes Wairarapa
4	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	Infrastructure - Other	Install fences along track and fences and gates at platforms to physically separate the network from its surroundings	4	3	3	2	2	3.Amber	1. Green	3.Amber	2.Amber/green	20-30 years	$10m - $100m	Property not included in cost estimate as scale not known
5	New infrastructure maintenance technologies to enable safe and efficient maintenance	Maintenance	Allowance for capital investment to enable new maintenance tehcnologies to be rolled out in line with best practice into the future.	4	3	2	2	2	Don't know	1. Green	1. Green	Don't know		Opex only	Required capex for new equipment still funded as opex
6	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	Infrastructure - Signalling	Short term improvements to enable RS1 timetable	4	4	3	3	4	3.Amber	1. Green	1. Green	1. Green	0-5 years	$1m - $10m	
7	Close or grade separate level crossings- road and pedestrian	Infrastructure - Crossing	Generic closures or grade separate level crossings across the network	5	3	3	2	4	3.Amber	1. Green	3.Amber	2.Amber/green	20-30 years	$10m - $100m	
8	Close or grade separate level crossings - Hutt Valley	Infrastructure - Crossing	Close or grade separate level crossings within the Hutt Valley	5	3	3	2	4	3.Amber	1. Green	3.Amber	4.Red/amber	5-10 years	$10m - $100m	
9	Close or grade separate level crossings - Wairarapa	Infrastructure - Crossing	Close or grade separate level crossings within the Wairarapa	5	3	3	2	4	3.Amber	1. Green	5. Red (difficult/complex)	3.Amber	0-5 years	$10m - $100m	
10	Close or grade separate level crossings - Kapiti	Infrastructure - Crossing	Close or grade separate level crossings along the Kapiti line	5	3	3	2	4	3.Amber	1. Green	3.Amber	4.Red/amber	10-20 years	$10m - $100m	
11	Close or grade separate level crossings - Johnsonville	Infrastructure - Crossing	Close or grade separate level crossings along the Johnsonville line	5	3	3	2	4	3.Amber	1. Green	5. Red (difficult/complex)	3.Amber	10-20 years	$10m - $100m	
12	Enhance operations - contigency planning for one -off events Storm etc.	Operational - Planning	Prepare standard procedures to revert to in the event of various unplanned scenarios	2	3	4	2	4	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only	
13	Contigency plans to respond to terrorist attacks	Operational - Planning	Prepare standard procedures to revert to in the event of a terrorist attack	5	2	4	2	4	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only	
14	Infrastructure improvements to cope with weather conditions, winter or summer	Operational - Planning	Reschedule timetables to run more smoothly with seasonal conditions	2	4	4	2	4	1. Green	1. Green	3.Amber	1. Green	0-5 years	Opex only	
15	Contigency planning to respond to Cyber attacks (future signalling system concerns?)	Operational - Planning	Prepare standard procedures to revert to in the event of a cyber attack	2	2	4	2	5	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only	
16	Changes to operations management to manage more complex staffing arrangements from longer Reach Services	Operational - Planning	Changes to how long distance services are staffed	2	2	2	2	2	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only	
17	Electrification North of Upper Hutt - Featherston	Infrastructure - Power	Electrification from Upper Hutt - Featherston to enable EMU services to Featherston	2	3	3	5	2	3.Amber	3.Amber	1. Green	3.Amber	5-10 years	$10m - $100m	
18	Electrification North of Waikanae (To Otaki)	Infrastructure - Power	Electrification North of Waikanae to Otaki to enable EMU service to Otaki	2	3	3	5	2	3.Amber	2.Amber/green	1. Green	3.Amber	5-10 years	$10m - $100m	Assumed to Otaki (can also do to Levin at this cost)
19	Alternative Traction energy sources (passenger) (battery or hydrogen)	Infrastructure - Power	Introduction of alternative power sources (battery/hydrogen etc) on rail services	2	2	2	5	2	3.Amber	3.Amber	1. Green	3.Amber	10-20 years	Unknown	
20	Reduction in business carbon footprint - Less paper etc	Operational - Other	Reduction in business carbon footprint - Less paper etc	2	2	2	5	2	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only	
21	Planning for changes to operations and maintenance from zero carbon tax impacts	Operational - Other	Planning for changes to operations and maintenance from zero carbon tax impacts	2	2	2	5	2	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only	
22	Responses to achieving compliance with low emission policies e.g. by 2050	Operational - Planning	Changes to operational procedures to ensure policy targets are met	2	2	2	5	2	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only	
23	Increase use of electric traction propulsion for freight	Rolling Stock	Increase use of electric traction propulsion for freight	2	2	2	5	2	3.Amber	2.Amber/green	1. Green	1. Green	30+ years	Opex only	
24	Slope Stabilisation- address seismic/storm risk	Infrastructure - Civil	Slope Stabilisation across high risk sites on the - address seismic risk	4	2	3	4	5	3.Amber	2.Amber/green	1. Green	3.Amber	5-10 years	$10m - $100m	
25	Seawall improvements Petone- Ngauranga as part of NZTA cycleway	Infrastructure - Civil	Seawall improvements Petone-Ngauranga as part of NZTA cycleway	4	2	3	4	5	3.Amber	2.Amber/green	1. Green	3.Amber	0-5 years	$0	Assumed covered by the cycleway
26	Improve resilience of rail bridges across network to seismic events	Infrastructure - Civil	Improve resilience of rail bridges across network to seismic events	4	2	3	2	5	3.Amber	2.Amber/green	1. Green	3.Amber	0-5 years	$10m - $100m	
27	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	Infrastructure - Civil	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	2	2	2	4	5	3.Amber	2.Amber/green	1. Green	3.Amber	10-20 years	$100m - $500m	Little information to inform cost estimate at this stage
28	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation	Infrastructure - Depot	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation	2	3	2	2	3	3.Amber	2.Amber/green	1. Green	3.Amber	5-10 years	$10m - $100m	
29	Second Remutaka tunnel	Infrastructure - Civil	Widening of the existing rail corridor and a second Rimutaka Tunnel. Potential for a single wider tunnel to replace the existing tunnel.	2	5	3	2	3	4.Red/amber	2.Amber/green	1. Green	4.Red/amber	30+ years	$500m +	Based on the 2008 estimate of $800m for a 3km road tunnel + 3km new road
30	Improve condition and capacity of drains and culverts	Infrastructure - Civil	Improve condition and capacity of drains and culverts	2	2	2	3	5	1. Green	1. Green	1. Green	1. Green	5-10 years	$10m - $100m	Could make as large or small as budgets required

Unique identifier	Key risks and uncertainties	Climate change		Impacts on Te Ao Māori	Environmental and Social Responsibility			Fatal flaws	Summary of decision made		
		Mitigation	Adaptation required		Identify	Mitigation Can these be avoided, remedied or mitigated?			Summary of decision made	Progress or discontinue this alternative/option?	Option merged to
1	Track access and ability to disrupt normal services	Reduce	No	N/A	N/A - Within rail corridor	N/A		No	Retain for future consideration	Progress	
2	Financial constraints	Reduce	No	Positive - increased freight on the rail network means less heavy vehicles on the road network, reducing environmental impacts and improving safety.	N/A - Maintenance	N/A		No	Remove as vague and specific interventions are covered elsewhere	Discontinue	
3	N/A	Neutral	No	Positive - improved safety at level crossings.	N/A - Minor works	N/A		No	Retain for future consideration	Progress	
4	Property access, maintenance of any new structures	Neutral	No	Positive - improved safety at all parts of the rail network.	N/A - Minor works	N/A		No	Retain for future consideration	Progress	
5	Unknown outcomes	Neutral	No	Positive - improved safety for maintenance staff.	N/A - Maintenance	N/A		No	While keeping up to date with new maintenance processes is consider BaU, the RRP recognises that this may occasionally require capital investment in new equipment and an allowance is therefore made for inclusion in the RRP.	Progress	
6	Safety of track workers during upgrades, disruption to services during implementation	Reduce	No	Minor positive - improved safety for users.	N/A - Within rail corridor	N/A		No	Retain for future consideration	Progress	
7	Public acceptance	Neutral	No	**Potential impacts: positive - improves safety at level crossings; negative - reduces pedestrian and car connectivity**	Negative impacts to community cohesiveness	Yes	Connectivity impacts to be studied in the later business case phases	No	Option has been split into line by line projects	Discontinue	
8	Public acceptance	Neutral	No	**Potential impacts: positive - improves safety at level crossings; negative - reduces pedestrian and car connectivity**	Negative impacts to community cohesiveness	Yes	Connectivity impacts to be studied in the later business case phases	No	Retain for future consideration	Progress	
9	Public acceptance especially for low volume roads	Neutral	No	**Potential impacts: positive - improves safety at level crossings; negative - reduces pedestrian and car connectivity**	Negative impacts to community cohesiveness	Yes	Connectivity impacts to be studied in the later business case phases	No	Retain for future consideration	Progress	
10	Public acceptance	Neutral	No	**Potential impacts: positive - improves safety at level crossings; negative - reduces pedestrian and car connectivity**	Negative impacts to community cohesiveness	Yes	Connectivity impacts to be studied in the later business case phases	No	Retain for future consideration	Progress	
11	Public acceptance	Neutral	No	**Potential impacts: positive - improves safety at level crossings; negative - reduces pedestrian and car connectivity**	Negative impacts to community cohesiveness	Yes	Connectivity impacts to be studied in the later business case phases	No	Retain for future consideration	Progress	
12	Integration between rail and bus operations, council support	Reduce	Is the mitigation	Positive, improves safety for rail workers and passengers	N/A - Operational			No	Considered a BaU activity and not required in the RRP. If not a BaU activity currently it should become one.	Discontinue	
13	Road/Rail availability post event	Neutral	No	Positive, improves safety for rail workers and passengers	N/A - Operational			No	Considered a BaU activity and not required in the RRP. If not a BaU activity currently it should become one.	Discontinue	
14	Public acceptance	Neutral	Is the mitigation	Positive, improves safety for rail workers and passengers	N/A - Operational			No	Merge into other options	Merged	TBC
15	Systems operationability	Neutral	No	Positive, improves safety for rail workers and passengers	N/A - Operational			No	Considered a BaU activity and not required in the RRP. If not a BaU activity currently it should become one.	Discontinue	
16	Staff union acceptance	Neutral	No	N/A	N/A - Operational			No	Retain for future consideration	Progress	
17	Working in tunnel is a big safety risk	Reduce	No	Positive - low carbon transport has lower impact on the environment	Visual impacts, potential land take required		Design to consider environment rail corridor goes through and any land requirements	No	Retain for future consideration	Progress	
18	Working on rail corridor	Reduce	No	Positive - low carbon transport has lower impact on the environment	Visual impacts, potential land take required		Design to consider environment rail corridor goes through and any land requirements	No	Retain for future consideration	Progress	
19	Unknown outcomes	Reduce	No	Positive - low carbon transport has lower impact on the environment	Unknown	N/A		No	Retain for future consideration	Progress	
20	Wider government regulations	Reduce	No	Positive - reduced emissions improving planet health	N/A - Operational	N/A		No	Considered a BaU activity and not required in the RRP. If not a BaU activity currently it should become one.	Discontinue	
21	Unknown outcomes	Reduce	No	Positive - reduced emissions improving planet health	N/A - Operational	N/A		No	Considered a BaU activity and not required in the RRP. If not a BaU activity currently it should become one.	Discontinue	
22	Funding	Reduce	No	Positive - low carbon transport has lower impact on the environment	N/A - Operational	N/A		No	Considered a BaU activity and not required in the RRP. If not a BaU activity currently it should become one.	Discontinue	
23	Unknown requirements from KiwiRail decarbonisation project	Reduce	No	Positive - low carbon transport has lower impact on the environment	N/A - Operational	N/A		No	Retain for future consideration	Progress	
24	Funding and extent of works	Neutral	Yes	Positive - improves safety at high risk locations	Visual impacts, potential land take required	Yes	Design can be low impact, land take minimised through design if possible and required	No	Retain for future consideration	Progress	
25	Waka Kotahi altering the design to result in lower protection to the rail corridor	Neutral	Is the mitigation	Positive - protects natural environment, iwi consultation required	Wildlife, coastal policy statement	Yes	Mitigation required for impacts to wildlife, and coastal policy statement contradictions along with bypassing the RMA.	No	Removed as made redundant by the construction of N2P cycleway.	Discontinue	
26	Future work may show it uneconomical to strengthen the structures and to replace instead	Neutral	Yes	Positive - improves safety for rail workers and passengers	Minor impacts at works sites in line with general construction	Yes	Impacts likely to be minor and dealt with as design	No	Retain for future consideration	Progress	
27	Ability to build in or adjacent to the harbour	Neutral	Is the mitigation	Positive - protects natural environment, iwi consultation required	Cultural impacts based on impacting the harbour	Yes	Engagement with Iwi to ensure culturally acceptable	No	Retain for future consideration	Progress	
28	Land acquisition costs, impact to operational procedures	Neutral	No	Potential impacts depending on the location of the new depot. Iwi consultation required.	N/A - unlikely to have significant impacts if on existing rail land	N/A		No	Retain for future consideration	Progress	
29	Consents, public acceptance	Reduce	No	Potential negative impacts on the land and groundwater, depending on mitigation. Iwi consultation required.	Land take, permanent character change	No	While the design can mitigate impact, there may need to be offsetting conducted elsewhere	No	Retain for future consideration	Progress	
30	Quantity of work required	Neutral	Is the mitigation	Positive - improved environmental outcome	N/A - Operational	N/A		No	Retain for future consideration	Progress	

	C-D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
15	Alternative or option details				Investment objective					Practical Feasibility				Scheduling/ programming	Cost	Special notes on cost estimates	Key risks and uncertainties	Climate change		Impacts on Te Ao Māori	Environmental and Social Responsibility			Fatal flaws		Summary of decision made		
16	Unique identifier	Name of alternative/option	Alternative/Option Type	Description of alternative/option	Improve safety for all	Provide capacity that supports access and growth	Attractive and easy to use	Support a sustainable future	Adaptable to disruptions	Technical	Safety and Design	Political and Public Acceptance	Consentability					Mitigation	Adaptation required		Identify	Mitigation Can these be avoided, remedied or mitigated?				Summary of decision made	Progress or discontinue this alternative/option?	Option merged to
47	31	Inspection and remote condition monitoring technologies	Maintenance	Inspection and remote condition monitoring technologies	4	3	2	2	4	1. Green	1. Green	1. Green	1. Green		Unknown		Unknown outcomes	Neutral	No	Positive - safer working environment	N/A - Operational	N/A		No		Considered a BaU activity and not required in the RRP. If not a BaU activity currently it should become one.Considered the same as Option 5.	Merged	5
48	32	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	Maintenance	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	4	3	5	2	3	1. Green	1. Green	1. Green	1. Green	0-5 years	$10m - $100m	WMUP	N/A	Neutral	No	Positive - safer outcomes for passengers and workers	N/A - Operational	N/A		No		Opex plans for each programme consider appropriate maintenance and KR consider the network is up to scratch after WMUP programmes.	Discontinue	
49	33	Change of roles of onboard staff once electronic ticketing introduced + Onboard transport security personel (in DM)	Operational - Staffing	Change of roles of onboard staff once electronic ticketing introduced + Onboard transport security personel	3	3	4	2	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	Opex only	Assume that no new technology required once NEXT replaces snapper on trains	Union acceptance	Neutral	No	Potential positive - improved safety for rail workers and passengers	N/A - Operational	N/A		No		Wider conversation outside of rail specific areas	Discontinue	
50	34	Develop stations as community hubs / TOD	Other	Develop Stations as community hubs	4	2	4	2	2	1. Green	1. Green	1. Green	2.Amber/green	5-10 years	$10m - $100m		Government planning requirements	Neutral	No	Positive - improved connection between the stations and the local communities they serve. Opportunity to highlight cultural heritage.	N/A	Yes	To be dealt with during development of stations	No		Retain for future consideration	Progress	
51	35	Improved collection and analysis of passenger data	Operational - Data and Analytics	Improved collection and analysis of Passenger data, likely through an electronic ticketing system	2	3	2	2	3	1. Green	1. Green	3.Amber	1. Green	0-5 years	<$1m		Privacy act requirements, public backlash	Neutral	No	N/A	N/A - Operational	N/A		No		Retain for future consideration	Progress	
52	36	Automated analytics from CCTV data for improved customer security	Operational - Data and Analytics	Automated analytics from CCTV data for improved customer security	4	2	2	2	2	1. Green	1. Green	1. Green	1. Green	0-5 years	$1m - $10m		Privacy act requirements, public backlash	Neutral	No	Positive - improved safety for passengers and workers	N/A - Operational	N/A		No		Retain for future consideration	Progress	
53	37	Prioritise between passenger and freight services if not able to develop infrastructure	Operational - Planning	Operational changes to ensure that once capacity is met that both freight and passenger demands can be met over the course of a day	2	3	2	2	2	1. Green	1. Green	3.Amber	1. Green	0-5 years	Opex only		Network user backlash	Neutral	No	N/A	N/A - Operational	N/A		Yes	Violates network access agreement	Removing freight paths throughout the day would violate the network access agreement	Discontinue	
54	38	Automatic Train Operation (ATO) on congested parts of network	Operational - Other	Automatic Train Operation (ATO) on congested parts of network	5	3	5	3	3	5. Red (difficult/complex)	1. Green	3.Amber	5. Red (difficult/complex)	0-5 years	$10m - $100m		Union acceptance	Neutral	No	Positive - improved safety	N/A - Operational	N/A		No		To be considered as part of the resignalling DBC	Merged	95
55	39	Increased train stabling capacity at outer stations for operational efficiencies	Infrastructure - Track	Increased train stabling capacity at outer stations for operational efficiencies	2	4	3	3	3	2.Amber/green	1. Green	1. Green	3.Amber	0-5 years	$10m -100m		Land requirements and availability	Neutral	No	N/A	Change to land use in some areas may create opposition	Yes	Mitigated through public engagement about the benefirs	No		Retain for future consideration	Progress	
56	40	Train crews dedicated to specific routes during peak periods	Operational - Planning	Work with operator to alter staff rostered to working multiple lines consecutively without standby staff during peak periods to reduce impact of delays on one service impacting other services	2	2	2	2	3	4.Red/amber	4.Red/amber	1. Green	1. Green	0-5 years	Opex only		Would contravene train drivers union requirements	Neutral	No	N/A	N/A - Operational	N/A		No		Retain for future consideration	Progress	
57	41	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	Operational - Other	Relocation of existing metro trail operatiosn centre before lease expires	2	2	4	2	4	3.Amber	1. Green	1. Green	1. Green	0-5 years	$10m - $100m	Depends on scale of intervention and if it is required to also accommodate national train movements etc	N/A	Neutral	No	Positive - improved safety	N/A - Well developed	N/A		No		Retain for future consideration	Progress	
58	42	Build CBD fringe station for terminating trains north of Wellington Station to facilitate for maintenance or service disruptions	Infrastructure - Stations	Build CBD fringe station for terminating trains north of Wellington Station to facilitate for maintenance or service disruptions	2	3	2	2	4	5. Red (difficult/complex)	1. Green	3.Amber	3.Amber	10-20 years	$10m - $100m		Land requirements and availability. Impacts to operational patterns	Neutral	No	N/A	Depeding on location, aspects may need to be considered	Yes	To be dealt with during development of fringe station	No		Considered part of the wider station optimisation/rationalisation study in ID70	Merged	170
59	43	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	Infrastructure - Stations	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	2	3	3	2	4	3.Amber	1. Green	1. Green	3.Amber	5-10 years	$10m - $100m		Land requirements and availability. Impacts to operational patterns	Neutral	No	Unknown	N/A - unlikely to have significant impacts if on existing rail land	Yes	To be dealt with during development of stations	No		Retain for future consideration	Progress	
60	44	Provide a northern access to the Wellington EMU stabling yard	Infrastructure - Track	Provide a northern access to the Wellington EMU stabling yard	3	3	3	2	4	3.Amber	1. Green	1. Green	3.Amber	0-5 years	$1m - $10m		Land requirements and availability. Impacts to operational patterns	Neutral	No	N/A	N/A - unlikely to have significant impacts if on existing rail land	N/A	N/A	No		Retain for future consideration	Progress	
61	45	Staff amenities at outer stations	Infrastructure - Stations	Provision of staff amenities such as kitchens/toilets/relaxation areas	2	2	2	2	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	$1m - $10m		N/A	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
62	46	Purchase of assets to be adaptable to new technology	Other	Ensuring that new purchases are flexible and adaptable to future anticipated standards	2	2	2	2	2	1. Green	1. Green	1. Green	1. Green	0-5 years	N/A		Unknown requirements	Neutral	No	Positive - new technology likely to be more efficient, reducing environmental impacts	N/A - Operational	N/A	N/A	No		Considered BaU, discontinued as a standalone option, but carried forward as part of BaU	Discontinue	
63	47	Deploy additional infrastructure maintenance staff outside of Wellington	Operational - Staffing	Have emergency staff located outside of Wellington to reduce wait times until issues can be understood and addressed	2	3	2	2	3	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only		Operational requirements	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
64	48	Bi directional running	Outcome	Track, signalling and operational changes to allow trains to run in both directions on the same section of track. This creates redundancy in the system, which is useful in the event that a portion of the line is unusable, e.g. a train breakdown.	1	2	4	2	5	3.Amber	3.Amber	1. Green	1. Green	5-10 years	Opex only		Bi-directional running creates a risk that trains will meet head on	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Operational outcome of crossovers and resignalling	Merged	49
65	49	More crossovers	Infrastructure - Track	Track infrastructure changes to allow bidirectional running (trains running on both directions on the same section of track).	1	2	4	2	5	2.Amber/green	3.Amber	1. Green	1. Green	0-5 years	$1m - $10m		Work needed to ensure they help improve the rail networks operability	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
66	50	increase no. of rail replacement buses/ availability of drivers to cover rail service failures.	Operational - Planning	increase no. of Rail replacement Buses/ availability of drivers to cover rail service failures	2	2	4	2	4	5. Red (difficult/complex)	1. Green	1. Green	1. Green	0-5 years	N/A		Cost and availability of appropriate number of buses and drivers	Neutral	No	Positive - improves connectivity which improves economic, health and social outcomes	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
67	51	Invest in higher quality track to reduce risk of speed restrictions in hot weather	Infrastructure - Track	Invest in higher quality track to reduce risk of Heat 40 kmh speed restrictions in hot weather	4	2	4	2	4	1. Green	1. Green	1. Green	1. Green	0-5 years	Unknown		Cost	Neutral	Is the mitigation	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
68	52	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Infrastructure - Track	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services	3	4	3	2	5	4.Red/amber	4.Red/amber	1. Green	3.Amber	0-5 years	Unknown		Cost	Neutral	No	Positive - improves connectivity which improves economic, health and social outcomes	Minor, within rail reserve	N/A	N/A	No		Merge to Option 139	Merged	139
69	53	New interlocking for Woburn siding access to reduce track occupancy time for shunts	Infrastructure - Track	Track infrastructure changes to allow more efficient access to the maintenance depot, which will reduce the impact on trains using the network at the Woburn station.	3	4	3	2	4	1. Green	1. Green	1. Green	1. Green	0-5 years	$1m - $10m		N/A	Neutral	No	N/A	Minor, within rail reserve	N/A	N/A	No		Retain for future consideration	Progress	
70	54	Plimmerton Turnback	Infrastructure - Track	Track infrastructure changes to allow trains to change directions at Plimmerton, including letting other trains pass.	2	5	4	2	3	2.Amber/green	2.Amber/green	1. Green	2.Amber/green	0-5 years	$1m - $10m		N/A	Neutral	No	N/A	Minor, within rail reserve	N/A	N/A	No		Has been completed during RRP Development	Discontinue	
71	55	Wifi on trains or provide 4G cell phone coverage through tunnels	Infrastructure - Other	WIFI on trains or provide 4G cell phone coverage through tunnels	2	3	5	2	3	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	$1m - $10m		Cost, tunnel repeaters	Neutral	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
72	56	Off peak service offering improvements (frequency and operational hours)	Operational - Planning	Adding earlier services in the morning and later services in the evening to increase the window that people are able to get around by rail.	2	3	5	3	2	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only		Cost	Reduce	No	Positive - improves connectivity which improves economic, health and social outcomes	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
73	57	Study into the network constraints which prevent additional services. Looks at signalling, single & double track sections and express services	Operational - Planning	Taking express trains out of service to enable higher frequency all stops services to optimise efficiency and catchment	2	5	2	2	3	1. Green	1. Green	5. Red (difficult/complex)	1. Green	0-5 years	Opex only		N/A	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
74	58	Increase train speeds to reduce journey times	Outcome	Increase train speeds to reduce journey times	2	3	4	3	2	4.Red/amber	2.Amber/green	1. Green	3.Amber	10-20 years	Opex only		Cost, network maintenance standards	Neutral	No	N/A	Noise	Yes	Follow existing noise management plan procedures	yes	Requires closures of stations which needs to follow the network study	Discontinue, station rationalisation required or significant track works which needs a wider network study to occur first before being considered	Discontinue	
75	59	Run express trains with fewer stops from outer stations such as Waikanae/ Paraparumu/Upper Hutt etc.	Operational - Planning	Run express trains with fewer stops from outer stations such as Waikanae/ Paraparumu/Upper Hutt etc.	2	1	2	2	1	1. Green	1. Green	3.Amber	1. Green	0-5 years	Opex only		Public and political backlash	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	

	C/D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
15	Alternative or option details				Investment objective					Practical Feasibility				Scheduling/ programming	Cost	Special notes on cost estimates	Key risks and uncertainties	Climate change		Impacts on Te Ao Māori	Environmental and Social Responsibility			Fatal flaws		Summary of decision made		
16	Unique identifier	Name of alternative/option	Alternative/Option Type	Description of alternative/option	Improve safety for all	Provide capacity that supports access and growth	Attractive and easy to use	Support a sustainable future	Adaptable to disruptions	Technical	Safety and Design	Political and Public Acceptance	Consentability					Mitigation	Adaptation required		Identify	Mitigation Can these be avoided, remedied or mitigated?				Summary of decision made	Progress or discontinue this alternative/option?	Option merged to
76	60	Review role,extent and form of Melling Line services to optimise efficiency and catchment	Operational - Planning	Review role,extent and form of Melling Line services to optimise efficiency and catchment	2	2	2	2	2	1. Green	1. Green	3.Amber	1. Green	0-5 years	<$1m		Public and political backlash	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Considered part of the wider rail line study in ID140	Merged	140
77	61	Double tracking Trentham-Upper Hutt (Do Minimum)	Infrastructure - Track	Double tracking Trentham-Upper Hutt	2	2	2	2	2	1. Green	1. Green	1. Green	1. Green	0-5 years	$10m - $100m		Complete	Neutral	No	N/A	N/A - Completed	N/A	N/A	No		Committed project and therefore removed	Discontinue	
78	62	Third track between Petone and Wellington	Infrastructure - Track	Third track between Petone and Wellington	2	5	5	1	5	5. Red (difficult/complex)	1. Green	3.Amber	5. Red (difficult/complex)	5-10 years	$100m - $500m		Cost, N2P cycleway	Neutral	Yes	Neutral - reclamation will damage coastline, but will improve social connectivity	Wildlife, coastal policy statement	No	Mitigation required for impacts to wildlife, and coastal policy statement contradictions along with bypassing the RMA.	Yes	N2P Cycleway would make this impossible	Remove due to cost and required removal of part of the new cycleway. Requirements for it will come out of future network form study	Discontinue	
79	63	Extend Melling Line to Riverside -bypass for Hutt Valley Line	Infrastructure - Track	Extend Melling Line to Riverside -bypass for Hutt Valley Line	2	5	5	5	5	1. Green	1. Green	3.Amber	3.Amber	10-20 years	$100m - $500m		Rail line would run through flood prone area	Neutral	Yes	Potential impacts to waterway and scarring of the Hutt Valley Landscape	Visual impacts, potential land take required	Yes	Design can be low impact, land take minimised through design if possible and required	No		Considered part of the wider rail line study in ID140	Merged	140
80	64	Power supply upgrade on Kapiti Line (short term)	Infrastructure - Power	Power supply upgrade on Kapiti Line (short term)	2	5	5	5	4	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$1m - $10m		Cost	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
81	65	Implement outcome of North South Junction Capacity Improvements Study	Infrastructure - Track	Double track North - South Junction between Paekakariki and Pukerua Bay	4	5	5	5	5	5. Red (difficult/complex)	5. Red (difficult/complex)	1. Green	5. Red (difficult/complex)	10-20 years	$500m +		Cost, iwi engagement, pushback for construction impacts	Reduce	Yes	Potential land, water and wildlife impacts depending on mitigation, view of piercing the earth father	Visual impacts, potential land take required, water quality concerns, dust	Yes	Early engagement with Iwi. Mitigation required for impacts to wildlife and water, and coastal policy statement contradictions along with difficulting consenting pathway	No		Merged into wider study and outcomes	Merged	176
82	66	Shorten North - South Junction single track section from approx 3.3 km to around 1 to 1.5 km by daylighting Tunnels 3 and 7	Infrastructure - Track	Shorten North - South Junction single track section from approx 3.3 km to around 1 to 1.5 km by daylighting Tunnels 3 and 7	3	4	4	3	4	4.Red/amber	4.Red/amber	1. Green	4.Red/amber	10-20 years	$100m - $500m		Cost	Neutral	No	Potential land, water and wildlife impacts depending on mitigation	Visual impacts, potential land take required, water quality concerns	Yes	Mitigation required for impacts to wildlife and water, and coastal policy statement contradictions along with bypassing the RMA.	No		Merged into wider study and outcomes	Merged	176
83	67	Third track between Porirua and Glenside	Infrastructure - Track	Third track between Porirua and Glenside	2	5	5	3	5	4.Red/amber	2.Amber/green	1. Green	4.Red/amber	10-20 years	$10m - $100m		Cost, waterway consent conditions	Neutral	No	Potential land, water and wildlife impacts depending on mitigation	Visual impacts, potential land take required, water quality concerns	Yes	Mitigation required for impacts to wildlife and water, and coastal policy statement contradictions along with bypassing the RMA.	No		Merged into wider study on network requirements	Merged	140
84	68	Second platform at Waikanae station	Infrastructure - Stations	Second platform at Waikanae station	2	3	4	2	5	3.Amber	3.Amber	1. Green	3.Amber	5-10 years	$1m - $10m		Cost, separation of Elizabeth Road	Neutral	No	N/A	Land take, noise concerns, visual impacts	Yes	Design can be low impact, land take minimised through design if possible and required	No		Retain for future consideration	Progress	
85	69	Duplicate NIMT overbridge south of Waikanae and approach	Infrastructure - Civil	Duplicate NIMT overbridge south of Waikanae, includes Waikanae River	2	4	2	2	5	4.Red/amber	2.Amber/green	1. Green	4.Red/amber	5-10 years	$10m - $100m		Seismic design and consenting issues	Neutral	No	N/A	Visual impacts, potential land take required, water quality concerns	Yes	Mitigation required for impacts to wildlife and water, land take minimised through design if possible and required	No		Retain for future consideration	Progress	
86	70	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	2	2	2	2	2	1. Green	1. Green	3.Amber	1. Green	0-5 years	<$1m		N/A	Reduce	No	Potential impact, depending on the findings of the study. Likely positive as improves access	N/A	N/A	N/A	No		Merged into wider study	Merged	140
87	71	extend frequent service to Otaki	Operational - Planning	Extend metlink services from Waikanae to Otaki	2	5	5	2	2	3.Amber	1. Green	1. Green	1. Green	0-5 years	Opex only		Requires electrification to Otaki unless covered by non EMUs	Reduce	No	Positive - improves connectivity which improves economic, health and social outcomes	N/A	N/A	N/A	No		Merged into wider study	Merged	137
88	72	Inner East West Link - High frequency and connecting the two rail corridors future Petone to Grenada	Infrastructure - Track	t's	2	4	3	3	4	5. Red (difficult/complex)	3.Amber	3.Amber	5. Red (difficult/complex)	10-20 years	$500m +		Cost, network needs, property take, consenting issues	Reduce	Yes	Potential land, water and wildlife impacts depending on mitigation	Visual impacts, potential land take required, water quality concerns	Yes	Mitigation required for impacts to wildlife and water, land take and dust management	No		Considered part of the wider rail line study in ID140	Discontinue	
89	73	All day regular services between Wellington and North of Otaki	Operational - Planning	Improve service levels	2	5	5	2	2	3.Amber	1. Green	1. Green	1. Green	0-5 years	Opex only		Cost, lack of appropriate rolling stock	Reduce	No	Positive - improves connectivity which improves economic, health and social outcomes	N/A	N/A	N/A	No		Merged into wider study	Merged	137
90	74	Outer East West Link - High frequency and connecting the two rail corridors SH 58	Infrastructure - Track	Outer East West Link - High frequency and connecting the two rail corridors SH 58	2	4	3	3	4	5. Red (difficult/complex)	3.Amber	3.Amber	5. Red (difficult/complex)	10-20 years	$100m - $500m		Cost, network needs, property take, consenting issues	Reduce	No	Potential land, water and wildlife impacts depending on mitigation	Visual impacts, potential land take required, water quality concerns	Yes	Mitigation required for impacts to wildlife and water, land take and dust management	No		Considered part of the wider rail line study in ID140	Merged	140
91	75	New stations - e.g. Whenua Tapu (north of Plimmerton) ,Aotea, Churton Park, Johnsonville	Infrastructure - Stations	New stations - e.g. Whenua Tapu (north of Plimmerton) ,Aotea, Churton Park, Johnsonville	2	2	2	2	2	3.Amber	1. Green	1. Green	4.Red/amber	5-10 years	$10m - $100m		Impacts to operational patterns	Reduce	No	Potential impacts: positive - improves connectivity which supports economic, health and social outcomes; negative - potential land, water and wildlife impacts depending on mitigation.	Potential land, water and wildlife impacts	Yes	Early engagement and detailed plannign required	No		Considered part of the wider station optimisation/rationalisation study in ID70	Merged	70
92	76	Extend Melling Line to form loop through Lower Hutt	Infrastructure - Track	Extend Melling Line to form loop through Lower Hutt	2	5	4	4	3	4.Red/amber	3.Amber	1. Green	5. Red (difficult/complex)	5-10 years	$10m - $100m		Consenting, land impacts to traffic	Neutral	Yes	Potential impacts: positive - improves connectivity which supports economic, health and social outcomes; negative - potential land, water and wildlife impacts depending on mitigation.	Potential land, water and wildlife impacts	Yes	Early engagement and detailed plannign required	No		Considered part of the wider rail line study in ID140	Merged	140
93	77	Heavy rail extension south of Wellington station	Infrastructure - Track	Heavy rail extension south of Wellington station	2	5	4	4	1	5. Red (difficult/complex)	5. Red (difficult/complex)	3.Amber	5. Red (difficult/complex)	10-20 years	$500m +		LGWM programme, consenting, land impacts to traffic	Reduce	No	Potential impacts depending on the location and delivery of the rail extension. Iwi consultation required.	Change to land use in some areas may create opposition, noise concerns, construction difficulties, dust	Yes	Mitigated through public engagement about the benefits	No		Out of geographic scope, also considered part of the wider rail line study in ID140, within LGWM scope	Merged	140
94	78	New lines - Wainuiomata Branch, Waitangirua Branch, Kapiti Coast Loop, Johnsonville to Tawa	Infrastructure - Track	New lines - Wainuiomata Branch, Waitangirua Branch, Kapiti Coast Loop, Johnsonville to Tawa	2	2	2	2	2	4.Red/amber	3.Amber	3.Amber	5. Red (difficult/complex)	10-20 years	$10m - $100m		Consenting, land impacts to traffic, operational costs, construction costs	Reduce	Yes	Potential impacts depending on the location and delivery of the new lines. Iwi consultation required.	Change to land use in some areas may create opposition, noise concerns, construction difficulties, dust	Yes	Mitigated through public engagement about the benefirs	No		Considered part of the wider rail line study in ID140	Merged	140
95	79	Extend the suburban service frequency span in response to developments and patronage	Operational - Planning	Extend the suburban service frequency in response to developments	2	4	4	3	2	3.Amber	2.Amber/green	1. Green	1. Green	0-5 years	Opex only		Costs	Reduce	No	Positive - improves connectivity which improves economic, health and social outcomes	N/A	N/A	N/A	No		Retain for future consideration	Progress	
96	80	Tram-Trains able to run over both heavy rail network and future light rail south of Station	Rolling Stock	Tram-Trains able to run over both heavy rail network and future light rail south of Station	2	5	5	4	2	4.Red/amber	3.Amber	1. Green	1. Green	5-10 years	$10m - $100m		LGWM programme, consenting, land impacts to traffic	Reduce	No	N/A	Changes in operational patterns, noise issues and any construction difficulties	Yes	Mitigated through public engagement about the benefirs	No		Retain for future consideration	Progress	
97	81	Convert Johnsonville branch to Light rail deploy displaced EMUs on rest of network	Infrastructure - Track	Convert Johnsonville branch to Light rail deploy displaced EMUs on rest of network	2	5	5	4	4	3.Amber	2.Amber/green	3.Amber	2.Amber/green	5-10 years	$10m - $100m		LGWM Programme dependent	Reduce	No	N/A	Changes in operational patterns, noise issues and any construction difficulties	Yes	Mitigated through public engagement about the benefirs	No		Retain for future consideration	Progress	
98	82	RS1 Timetable Improvements	Outcome	RS1 Timetable Improvements	2	5	5	3	2	2.Amber/green	2.Amber/green	1. Green	1. Green	0-5 years	Opex only		N/A	Reduce	No	N/A	N/A	N/A	N/A	No		Considered committed and part of the Do minimum	Progress	
99	83	Increasing no of carriages and train frequency to maintain capacity - Other regional Lines - select services only	Operational - Planning	Increasing no of carriages and train frequency to maintain capacity- Other regional Lines	1	5	5	3	1	2.Amber/green	2.Amber/green	1. Green	1. Green	0-5 years	Opex only		Availability of EMUs, costs of new EMUs	Reduce	No	N/A	N/A	N/A	N/A	No		Split into capacity and frequency increases in later options	Discontinue	
100	84	Increasing no of carriages and train frequency to maintain capacity- Kapiti Line - select services only	Operational - Planning	Increasing no of carriages and train frequency to maintain capacity- Kapiti Line	1	5	5	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	0-5 years	Opex only		Operational requirements	Reduce	No	N/A	N/A	N/A	N/A	No		Split into capacity and frequency increases in later options	Discontinue	
101	85	Increasing no of carriages and train frequency to maintain capacity - Hutt line - select services only	Operational - Planning	Increasing no of carriages and train frequency to maintain capacity - Hutt line	1	5	5	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	0-5 years	Opex only		Operational requirements	Reduce	No	N/A	N/A	N/A	N/A	No		Split into capacity and frequency increases in later options	Discontinue	
102	86	Increasing no of carriages and train frequency to increase capacity - Johnsonville Line - select services only	Operational - Planning	Increasing no of carriages and train frequency to increase capacity - Johnsonville Line	1	5	5	2	1	2.Amber/green	2.Amber/green	1. Green	1. Green	0-5 years	Opex only		Operational requirements	Reduce	No	N/A	N/A	N/A	N/A	No		Split into capacity and frequency increases in later options	Discontinue	
103	87	Further power supply upgrade to enable frequency and capacity (long-term)	Infrastructure - Power	Further power supply upgrade to enable frequency and capacity (long-term)	2	5	3	5	4	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$10m - $100m		N/A	Reduce	No	N/A	N/A	N/A	N/A	No		Dealt with more specifically by other options	Discontinue	
104	88	Long term power supply upgrade - Kapiti Line	Infrastructure - Power	Long term power supply upgrade - Kapiti Line	2	5	3	5	4	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$10m - $100m		Cost	Reduce	No	N/A	N/A if within rail reserve	N/A	N/A	No		Retain for future consideration	Progress	
105	89	Long term power supply upgrade - Hutt Valley Line	Infrastructure - Power	Long term power supply upgrade - Hutt Valley Line	2	5	3	5	4	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$10m - $100m		Cost	Reduce	No	N/A	N/A if within rail reserve	N/A	N/A	No		Retain for future consideration	Progress	
106	90	Long term power supply upgrade - Melling Line	Infrastructure - Power	Long term power supply upgrade - Melling Line	2	5	3	5	4	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$10m - $100m		Cost	Reduce	No	N/A	N/A if within rail reserve	N/A	N/A	No		Retain for future consideration	Progress	
107	91	Long term power supply upgrade - Johnsonville Line	Infrastructure - Power	Long term power supply upgrade - Johnsonville Line	2	5	3	5	4	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$10m - $100m		Cost	Reduce	No	N/A	N/A if within rail reserve	N/A	N/A	No		Retain for future consideration	Progress	
108	92	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	Infrastructure - Track	proposed track modifications to be done through NZ Upgrade $70M Wellington station safety and capacity enhancements project along with resignalling A Box before 2025. Assume does not achieve full separation	5	5	3	3	5	3.Amber	2.Amber/green	1. Green	2.Amber/green	5-10 years	$10m - $100m		Safety of track workers during upgrades, disruption to services during implementation, land availability	Reduce	No	Positive - improved safety for passengers and workers	Visual impacts, potential land take required, water quality concerns	Yes	Mitigation required for impacts to wildlife and water, and coastal policy statement contradictions along with difficult consenting pathway	No		Retain for future consideration	Progress	
109	93	Longer trains and platforms to address capacity on existing services	Infrastructure - Stations	Longer trains and platforms to address capacity on existing services - applied to select services above 8 cars?	2	5	5	4	3	3.Amber	1. Green	3.Amber	3.Amber	0-5 years	$10m - $100m		Ability to operate on existing platforms	Reduce	No	N/A	N/A	N/A	N/A	No		To be included in the Future Network Form Study, Also likely outside 30 year timeframe for implementation	Discontinue	

	C/D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
15	Alternative or option details				Investment objective					Practical Feasibility				Scheduling/ programming	Cost	Special notes on cost estimates	Key risks and uncertainties	Climate change		Impacts on Te Ao Māori	Environmental and Social Responsibility			Fatal flaws		Summary of decision made		
16	Unique identifier	Name of alternative/option	Alternative/Option Type	Description of alternative/option	Improve safety for all	Provide capacity that supports access and growth	Attractive and easy to use	Support a sustainable future	Adaptable to disruptions	Technical	Safety and Design	Political and Public Acceptance	Consentability					Mitigation	Adaptation required		Identify	Mitigation Can these be avoided, remedied or mitigated?				Summary of decision made	Progress or discontinue this alternative/option?	Option merged to
110	94	Dedicated Higher speed Regional passenger rail network (new rail network)	Infrastructure - Track	Dedicated Higher speed Regional passenger rail network	4	4	5	4	2	5. Red (difficult/complex)	2.Amber/green	3.Amber	5. Red (difficult/complex)	10-20 years	$500m +		Cost	Reduce	No	Potential impacts: positive - improves connectivity which supports economic, health and social outcomes; negative - potential land, water and wildlife impacts depending on mitigation.	Affordability, construciton, land use changes, impacts to waterways and wildlife, safety concerns	No	Project would be more significant than any other infrastructure project in NZ and would have to be conducted in an urban area to be done safely	Yes	Does not achieve Ios in timeframe, significantly above potential future budget	Would require national level investment and a national level strategy to ensure compatability with other high speed rail investment. Would not be able to contribute to achieving IOs in timeframes required. Could be progressed outside the rail plan	Discontinue	
111	95	Network wide resignalling	Infrastructure - Signalling	Network wide resignalling	3	3	3	3	2	2.Amber/green	2.Amber/green	1. Green	1. Green	0-5 years	$100m - $500m		Cost	Reduce	No	Positive - improved safety for passengers and workers	N/A - if within rail reserve	N/A	N/A	No		Retain for future consideration	Progress	
112	96	Automatic Train Protection (ATP)	Infrastructure - Signalling	Installing ATP (a physical safety measure) that will prevent SPADs	5	3	3	3	4	3.Amber	2.Amber/green	1. Green	1. Green	0-5 years	$100m - $500m		Included in option 95	Neutral	No	Positive - improved safety for passengers and workers	N/A	N/A	N/A	No		To be considered as part of the resignalling DBC	Merged	95
113	97	Fleet maintenance overnight - enabler	Maintenance	Enabling increased frequencies without increasing rolling stock requirements	2	4	3	3	4	2.Amber/green	1. Green	1. Green	2.Amber/green	0-5 years	Opex only		Cost, workforce acceptance	Neutral	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
114	98	Additonal trains to respond to demand and service requirements	Rolling Stock	Additonal trains to respond to demand and service requirements done with LDRS order	2	3	3	3	4	2.Amber/green	1. Green	1. Green	1. Green	10-20 years	$100m - $500m		Cost, timeframes for procurement	Reduce	No	N/A	N/A	N/A	N/A	No		Merged to wider fleet expansion item	Merged	136
115	99	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	Rolling Stock	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	4	3	3	3	4	2.Amber/green	1. Green	1. Green	1. Green	20-30 years	$100m - $500m		Cost, timeframes for procurement	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
116	100	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	Infrastructure - Track	Protect Easement of land on west side of KiwiRail corridor through Thorndon area could be used to connect future light rail to Johnsonville line, also valuable to EMU depot	2	3	3	3	2	2.Amber/green	1. Green	1. Green	2.Amber/green	0-5 years	Opex only		N/A	Neutral	No	N/A	N/A - existing KiwiRail land	N/A	N/A	No		Retain for future consideration	Progress	
117	101	Improve Johnsonville Line track configuration to improve capacity	Study	Improve Johnsonville Line track configuration to improve capacity	2	3	3	2	4	3.Amber	2.Amber/green	1. Green	4.Red/amber	5-10 years	$10m - $100m		Cost	Reduce	No	N/A	Significant structural works near waterways and on slopes, would introduce noise issues to an already sensitive area	Yes	Dust and noise management plans critical along with early engagement, likely major compensation for nearby residents	No		Retain for future consideration	Progress	
118	102	increase Wairarapa line services via shuttle services to Upper Hutt	Operational - Planning	increase Wairarapa line services via shuttle services to Upper Hutt	2	4	2	4	4	1. Green	1. Green	3.Amber	1. Green	0-5 years	Opex only		Cost	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		To be considered as part of LNIRIM	Merged	137
119	103	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	Operational - Planning	Optimise bus connnections to stations to maximise efficiency and access to communities/ catchments	2	4	4	4	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	Opex only		Cost	Reduce	No	Positive - improved connection to communities supports economic, health and social outcomes	N/A - Operational	N/A	N/A	No		To be included as part of the station access planning	Merged	107
120	104	Increase station Park and Ride capacity to meeting demand through utilisation	Infrastructure - Stations	Additional park n ride carparks	2	3	5	2	2	1. Green	1. Green	3.Amber	3.Amber	5-10 years	$10m - $100m		Scale of project	Reduce	No	N/A	Visual impacts, potential land take required	Yes	Design can be low impact, land take minimised through design if possible and required	No		To be included as part of the station access planning	Merged	107
121	105	Charging for parking to manage demand	Operational - Other	Charging for parking to manage demand	2	2	2	2	2	2.Amber/green	1. Green	3.Amber	1. Green	0-5 years	$1m - $10m		Public backlash	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		To be included as part of the station access planning	Merged	107
122	106	Larger multi storey Park & Ride facilities at key locations	Infrastructure - Stations	Larger multi storey Park & Ride facilities at key locations	2	3	5	2	2	3.Amber	1. Green	3.Amber	3.Amber	10-20 years	$10m - $100m		Cost, consenting	Neutral	No	N/A	Visual impacts, potential land take required	Yes	Design can be low impact, land take minimised through design if possible and required	No		To be included as part of the station access planning	Merged	107
123	107	Station access planning+D15 to maximise connections to communities and catchments	Infrastructure - Stations	Wider study with local councils to improve the connections to train stations	3	3	3	3	3	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	<$1m		N/A	Reduce	No	Positive - improved connection to communities supports economic, health and social outcomes	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
124	108	Covered secure cycle\multi modal facilities at all stations	Infrastructure - Stations	Covered secure cycle\multi modal facilities at all stations	4	3	4	4	2	1. Green	1. Green	1. Green	1. Green	0-5 years	<$1m		N/A	Reduce	No	Positive - improved connection to communities supports economic, health and social outcomes	N/A - Operational	N/A	N/A	No		To be included as part of the station access planning	Merged	107
125	109	Change facility for cyclist at stations	Infrastructure - Stations	Change facility for cyclist at stations (WGN)	2	3	4	4	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	<$1m		Cost and ability to add to stations	Reduce	No	N/A	Visual impacts, potential land take required if large or no space available	Yes	Design can be low impact, land take minimised through design if possible and required	No		To be included as part of the station access planning	Merged	107
126	110	Electric Car charging in station carparks	Infrastructure - Stations	Electric Car charging in station carparks	2	2	4	5	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	<$1m		Cost, location of available power supplies	Reduce	No	N/A	N/A - Operational	N/A	Design can be low impact, land take minimised through design if possible and required	No		To be included as part of the station access planning	Merged	107
127	111	All stations to be accessible for mobility impaired and other users e.g. prams etc	Infrastructure - Stations	All stations to be accessible for mobility impaired and other users e.g. prams etc	5	3	5	5	2	2.Amber/green	1. Green	1. Green	2.Amber/green	0-5 years	$10m - $100m		Cost	Reduce	No	Positive - improved accessibility supports economic, health and social outcomes	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
128	112	Increased shelter at stations that match passenger flows	Infrastructure - Stations	Shelters at stations that match pedestrian flows Station capacity - pedestrian	2	4	5	4	2	2.Amber/green	1. Green	1. Green	2.Amber/green	0-5 years	$1m - $10m		Consenting of structures could be an issue, Objections from residents nearby	Reduce	No	N/A	N/A - Minor Works	N/A	N/A	No		Retain for future consideration	Progress	
129	113	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	Infrastructure - Track	Improved maintenance practices	4	3	5	4	2	1. Green	1. Green	1. Green	1. Green	0-5 years	$10m - $100m		N/A	Reduce	No	N/A	N/A - Minor Works	N/A	N/A	No		Retain for future consideration	Progress	
130	114	Station serving Multi use ferry terminal with passenger access (assumptions on how it operates to be made)	Infrastructure - Stations	Station serving Interislander terminal with passenger access	2	4	4	4	2	3.Amber	2.Amber/green	3.Amber	3.Amber	10-20 years	$10m - $100m		Cost, unknown multi use ferry terminal layout and location	Reduce	No	N/A	Wildlife, coastal policy statement	Yes	Mitigation required for impacts to wildlife, and coastal policy statement contradictions along with dififculting consenting pathway. Best delivered in conjunciton with MUFT.	No		Considered part of the wider station optimisation/rationalisation study in ID70	Discontinue	
131	115	Platform train interface without ramps	Infrastructure - Stations	Platform train interface without ramps - level access - requires new trains	4	3	5	3	2	3.Amber	2.Amber/green	1. Green	1. Green	0-5 years	$100m - $500m		Cost	Neutral	No	N/A	N/A - Minor works	N/A	N/A	No		Retain for future consideration	Progress	
132	116	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	Infrastructure - Stations	design of stations and facilities to prevent crime by increasing visibility, lighting etc	5	3	5	4	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	<$1m		N/A	Neutral	No	Positive - improved safety for users	N/A - Minor works	N/A	N/A	No		Retain for future consideration	Progress	
133	117	Platform screen Doors/ gates	Infrastructure - Stations	Introducing platform screens and doors to stations	5	2	2	2	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	<$1m		Needs trains to stop consistently	Neutral	No	Positive - improved safety for passengers	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
134	118	Station sustainability (More extensive) - solar panels for lighting power - LED lighting -Recycling	Infrastructure - Stations	Station sustainability (More extensive) - solar panels for lighting power - LED lighting -Recycling	2	2	2	4	2	1. Green	1. Green	1. Green	1. Green	0-5 years	<$1m		N/A	Reduce	No	Positive - reduces impact on the environment	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
135	119	Improvements to station subway drainage to reduce flooding risk	Infrastructure - Civil	Improvements to station subway drainage to reduce flooding risk	2	3	5	5	4	2.Amber/green	1. Green	1. Green	2.Amber/green	0-5 years	$10m - $100m		N/A	Neutral	Is the mitigation	Positive - reduces negative impacts on the environment	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
136	120	Train capacity indicators for passengers	Rolling Stock	Sensors screens on trains to tell you how full a carriage is Indication of how full the train is at each station	2	3	4	2	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	<$1m		backend system capability	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
137	121	Improved real time information across the network to communicate to customers during disruptions (audio, visual and app)	Infrastructure - Stations	More accurate, real time information to communicate to customers during disruptions	2	2	5	2	3	3.Amber	1. Green	1. Green	1. Green	0-5 years	Opex only		Systems behind the info	Reduce	No	Positive - easier user experience will improve connectivity and support economic, health and social outcomes.	N/A - Operational	N/A	N/A	No		Being progressed as part of a Metlink programme across modes, any specific individualinvestment would be included in station refurbishment	Discontinue	
138	122	Improved Public Address and visual information at all stations - Better real time and customer information, Wayfinding signage & digital signage solutions to increase information at Stations	Infrastructure - Stations	Improved Public Address and visual information at all stations - Better real time and customer information	3	2	4	2	2	1. Green	1. Green	1. Green	1. Green	0-5 years	Opex only		Systems behind the info	Neutral	No	Positive - easier user experience will improve connectivity and support economic, health and social outcomes.	N/A - Operational	N/A	N/A	No		Considered as part of 121	Merged	121
139	123	interactive signage - information TBC	Infrastructure - Stations	interactive signage - information TBC	2	2	4	2	2	1. Green	1. Green	1. Green	1. Green	0-5 years	Unknown		Systems behind the info	Neutral	No	Positive - improved accessibility of rail system will improve connectivity and support economic, health and social outcomes.	N/A - Operational	N/A	N/A	No		Not enough information to understand how it differs to other nominated projects considered part of 121	Merged	121
140	124	Wayfinding signage & digital signage solutions to increase information at stations	Infrastructure - Stations	Wayfinding signage & digital signage solutions to increase information at stations	2	3	4	4	3	1. Green	1. Green	1. Green	1. Green	0-5 years	$1m - $10m		N/A	Neutral	No	Positive - easier user experience will improve connectivity and support economic, health and social outcomes.	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
141	125	Platform markers for Wheelchair bikes 8/6/4/2	Infrastructure - Stations	Platform markers for Wheelchair bikes 8/6/4/2	2	3	4	3	2	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	<$1m		Needs trains to stop consistently	Reduce	No	Positive - improved accessibility of rail system will improve connectivity and support economic, health and social outcomes.	N/A - Operational	N/A	N/A	No		Advance as minor works	Progress	
142	126	Integrated/electronic ticketing -One pass - all modes - tickets	Operational - Other	Integrated ticketing -One pass - all modes - tickets	2	4	5	4	2	3.Amber	1. Green	1. Green	1. Green	0-5 years	$1m - $10m	Being delivered outside of Rail Plan	Timeframe for delivery	Neutral	No	Positive - easier user experience will improve connectivity and support economic, health and social outcomes.	N/A - Operational	N/A	N/A	No		Already committed project to not be costed	Progress	
143	127	Mobility as a Service Apps , on demand, helping you purchase	Operational - Data and Analytics	Introduction of specialty apps to provide mobility	2	4	5	2	3	3.Amber	1. Green	1. Green	1. Green	0-5 years	<$1m		user update	Neutral	No	Positive - easier user experience will improve connectivity and support economic, health and social outcomes.	N/A - Operational	N/A	N/A	No		Discontinue, metlink issue not specific to rail	Discontinue	
144	128	Travelwise Working with organisations on worKapiti Lineace travel plans	Operational - Other	Travelwise Working with organisations on worKapiti Lineace travel plans	2	4	5	4	3	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	Opex only		Potential for uptake and ability to influence travel patterns	Reduce	No	N/A	N/A - Operational	N/A	N/A	No		Discontinue, metlink issue not specific to rail	Discontinue	
145	129	Targeted Peak pricing to help spread peak demand	Operational - Data and Analytics	Targeted Peak pricing to help spread peak demand	2	3	2	2	2	2.Amber/green	1. Green	5. Red (difficult/complex)	1. Green	0-5 years	<$1m		Has potential to drive customers to non rail modes	Neutral	No	N/A	Public perception	No	Public backlash	No		Retain for future consideration	Progress	
146	130	Review station ticket zoning boundaries and implications	Study	Review station ticket zoning boundaries and implications e.g. P&R capacity	2	3	2	3	2	1. Green	1. Green	3.Amber	1. Green	0-5 years	<$1m		N/A	Neutral	No	Unknown	N/A - Operational	N/A	N/A	No		Included in 131	Discontinue	

	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
15	Alternative or option details					Investment objective					Practical Feasibility				Scheduling/ programming	Cost	Special notes on cost estimates	Key risks and uncertainties	Climate change		Impacts on Te Ao Māori	Environmental and Social Responsibility			Fatal flaws		Summary of decision made		
16		Unique identifier	Name of alternative/option	Alternative/Option Type	Description of alternative/option	Improve safety for all	Provide capacity that supports access and growth	Attractive and easy to use	Support a sustainable future	Adaptable to disruptions	Technical	Safety and Design	Political and Public Acceptance	Consentability					Mitigation	Adaptation required		Identify		Mitigation Can these be avoided, remedied or mitigated?			Summary of decision made	Progress or discontinue this alternative/option?	Option merged to
147		131	Look at how station zoning changes habits in accessing station. E.g. people driving further to get a cheaper zone	Study	Look at how station zoning changes habits in accessing station. E.g. people driving further to get a cheaper zone + 117.	2	3	3	3	2	3.Amber	1. Green	1. Green	1. Green	0-5 years	<$1m		N/A	Neutral	No	N/A	N/A - Operational	N/A	N/A	No		Merged as part of the station access planning study	Merged	107
148		132	Planning for future interchange for Wellington Station	Study	Planning for future interchange for Wellington Station Precinct and LGWM interactions	2	4	5	3	2	2.Amber/green	2.Amber/green	1. Green	3.Amber	0-5 years	<$1m		N/A	Reduce	No	Unknown	Unlikely to have significant impacts on rail corridor. Wider impacts can be dealt with as part of LGWM	Yes	Do be dealt with as part of LGWM	No		LGWM to consider	Discontinue	
149		133	Pedestrian and micromobility connections from station to communities	Infrastructure - Other	Improving pedestrian and micromobility infrastructure to ensure safe and comfortable first and last mile journeys	4	5	5	5	2	2.Amber/green	2.Amber/green	1. Green	2.Amber/green	0-5 years	$1m - $10m		N/A	Reduce	No	Positive - improves connection to communities which will support economic, health and social outcomes	Minor Works	Yes	Early public engagement	No		Considered part of Statio D15 study	Discontinue	
150		134	Double decker trains	Rolling Stock	Using double decker trains on the network to increase customer capacity.	2	5	2	4	2	5. Red (difficult/complex)	4.Red/amber	3.Amber	4.Red/amber	5-10 years	$100m - $500m		Fitting through tunnels	Reduce	No	N/A	N/A - Operational	N/A	N/A	Yes	Not feasible with existing rail guage and non rail infrastructure (road bridges etc)	Loading Guage to constrained to be practical on the network	Discontinue	
151		135	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN	Rolling Stock	Additonal rolling stock to respond to demand and service requirements on the electrified network	2	5	5	5	4	2.Amber/green	2.Amber/green	1. Green	1. Green	5-10 years	$100m - $500m		Timeframes for procurement	Reduce	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
152		136	Additional EMUs for increased service frequency (may be part of the Matangi replacement)	Rolling Stock	Additional EMUs procured independently or as part of the Matangi replacement to enable additional frequencies on the WMRN	2	5	5	5	4	2.Amber/green	2.Amber/green	1. Green	1. Green	5-10 years	$100m - $500m		Timeframes for procurement	Reduce	No	N/A	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
153		137	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	Rolling Stock	Long Distance Rolling Stock procurement for the Wairarapa and Manawatu services	2	5	5	4	4	2.Amber/green	2.Amber/green	1. Green	1. Green	5-10 years	$100m - $500m		N/A (dealt with under LNIRIM)	Reduce	No	N/A	N/A - Operational	N/A	N/A	No		Progress as DBC about to commence	Progress	
154		138	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	Infrastructure - Signalling	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	5	3	3	3	4	2.Amber/green	1. Green	1. Green	1. Green	5-10 years	$100m - $500m		N/A (dealt with under LNIRIM)	Reduce	No	Unknown	N/A - Operational	N/A	N/A	No		Retain for future consideration	Progress	
155		139	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	Infrastructure - Track	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	5	5	5	2	5	5. Red (difficult/complex)	3.Amber	3.Amber	4.Red/amber	5-10 years	$10m - $100m	For Wairarapa signals only	Cost, land availability, operational impacts during construction	Reduce	No	Unknown	Visual impacts, potential land take required	No	Design can be low impact, land take minimised through design if possible and required. Ideal freight line location may be on harbour side of SH1 depending on where the Multi User Ferry Terminal ends up and how it will operate	No		Progress	Progress	
156		140	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	Study	Study on future rail lines and use of existing lines. This includes things such as the evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links. This also includes aspects of third tracking areas such as Porirua to Glenside and Petone to Ngauranga. Reliant on decisions being made on express services or accounts for retaining or elimination of express services.	3	3	3	3	3	2.Amber/green	1. Green	3.Amber	1. Green	0-5 years	$1m - $10m		N/A	Neutral	No	N/A	N/A	N/A	N/A	No		Catch all railway line study to replace individual line studies as scope to big for RRP	Progress	
157		141	Increase Matangi seated capacity during heavy maintenance (DO Min)	Rolling Stock	Joining of two Matangi units and removing driver cabs to give additional passenger space	2	4	4	2	1	3.Amber	1. Green	1. Green	1. Green	10-20 years	Unknown		Costs	Reduce	No	N/A	N/A	N/A	N/A	No		Progress as included in the do-minimum	Progress	
158		142	Electrification North of Featherston - Masterton	Infrastructure - Power	Electrification North of Featherston - Masterton	2	3	3	5	1	3.Amber	1. Green	1. Green	3.Amber	5-10 years	$10m - $100m		KiwiRail Requirements for future decarbonisation	Reduce	No	N/A	Visual impacts	No	Unlikely to be significant	No		Retain for future consideration	Progress	
159		143	Double Track remainder of Waikanae approach (see 34, 35)	Infrastructure - Track	Double Track remainder of Waikanae approach (see 34, 35)	2	3	3	3	4	3.Amber	1. Green	1. Green	3.Amber	5-10 years	$10m - $100m		Costs, space, structures	Reduce	No	N/A	Landowners may object	Yes	Early consultation	No		Covered in other options	Discontinue	
160		144	12 minute peak interval - Hutt Line	Outcome	12 minute peak frequency - Hutt Line	1	5	5	5	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Level Crossings, Wellington Station Approach capacity, EMU requirements, interaction with long distance service	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
161		145	10 minute peak interval - Hutt Line	Outcome	10 minute peak frequency - Hutt Line	1	5	5	5	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Level Crossings, Wellington Station Approach capacity, EMU requirements, interaction with long distance service	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
162		146	6 minute peak interval - Hutt Line	Outcome	6 minute peak frequency - Hutt Line	1	5	5	5	1	3.Amber	3.Amber	1. Green	1. Green	20-30 years	Opex only		Level Crossings, Wellington Station Approach capacity, EMU requirements, interaction with long distance service	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
163		147	15 minute off peak frequencies - Hutt Line	Outcome	15 minute off peak frequencies - Hutt Line	2	5	4	4	1	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	Opex only		Level Crossings, Wellington Station Approach capacity, EMU requirements, interaction with long distance service	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
164		148	12 minute off peak interval - Hutt Line	Outcome	12 minute off peak frequency - Hutt Line	1	5	4	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Level Crossings, Wellington Station Approach capacity, EMU requirements, interaction with long distance service	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
165		149	10 minute off peak interval - Hutt Line	Outcome	10 minute off peak frequency - Hutt Line	1	5	5	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Level Crossings, Wellington Station Approach capacity, EMU requirements, interaction with long distance service	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
166		150	8 car trains all peak services - Hutt Line	Outcome	8 car trains all peak services - Hutt Line	2	5	4	4	1	1. Green	1. Green	1. Green	1. Green	10-20 years	Opex only		Power supply and EMU availability	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
167		151	6 car trains all peak services - Hutt Line	Outcome	6 car trains all peak services - Hutt Line	2	5	4	4	2	1. Green	1. Green	1. Green	1. Green	5-10 years	Opex only		Power supply and EMU availability	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
168		152	12 minute peak interval - Kapiti Line	Outcome	12 minute peak frequency - Kapiti Line	1	5	5	5	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		NSJ capacity, level crossings, EMU availability, power supply availiability, interaction with long distance services	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
169		153	10 minute peak interval - Kapiti Line	Outcome	10 minute peak frequency - Kapiti Line	1	5	5	5	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		NSJ capacity, level crossings, EMU availability, power supply availiability, interaction with long distance services	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
170		154	6 minute peak interval - Kapiti Line	Outcome	6 minute peak frequency - Kapiti Line	1	5	5	5	1	3.Amber	3.Amber	1. Green	1. Green	20-30 years	Opex only		NSJ capacity, level crossings, EMU availability, power supply availiability, interaction with long distance services	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
171		155	15 minute off peak frequencies - Kapiti Line	Outcome	15 minute off peak frequencies - Kapiti Line	2	5	4	4	1	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	Opex only		NSJ capacity, level crossings, EMU availability, power supply availiability, interaction with long distance services	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
172		156	12 minute off peak interval - Kapiti Line	Outcome	12 minute off peak frequency - Kapiti Line	1	5	4	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		NSJ capacity, level crossings, EMU availability, power supply availiability, interaction with long distance services	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
173		157	10 minute off peak interval - Kapiti Line	Outcome	10 minute off peak frequency - Kapiti Line	1	5	5	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		NSJ capacity, level crossings, EMU availability, power supply availiability, interaction with long distance services	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
174		158	8 car trains all peak services - Kapiti Line	Outcome	8 car trains all peak services - Kapiti Line	2	5	4	4	1	1. Green	1. Green	1. Green	1. Green	10-20 years	Opex only		Power supply and EMU availability	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
175		159	6 car trains all peak services - Kapiti Line	Outcome	6 car trains all peak services - Kapiti Line	2	5	4	4	2	1. Green	1. Green	1. Green	1. Green	5-10 years	Opex only		Power supply and EMU availability	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
176		160	12 minute peak interval - Johnsonville Line	Outcome	12 minute peak frequency - Johnsonville Line Line	1	5	5	5	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Tunnels and passing opportunities and ability to deliver	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
177		161	10 minute peak interval - Johnsonville Line	Outcome	10 minute peak frequency - Johnsonville Line Line	1	5	5	5	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Tunnels and passing opportunities and ability to deliver	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
178		162	6 minute peak interval - Johnsonville Line	Outcome	6 minute peak frequency - Johnsonville Line Line	1	5	5	5	1	3.Amber	3.Amber	1. Green	1. Green	20-30 years	Opex only		Tunnels and passing opportunities and ability to deliver	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
179		163	15 minute off peak frequencies - Johnsonville Line	Outcome	15 minute off peak frequencies - Johnsonville Line Line	2	5	4	4	1	2.Amber/green	1. Green	1. Green	1. Green	0-5 years	Opex only		Tunnels and passing opportunities and ability to deliver	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
180		164	12 minute off peak interval - Johnsonville Line	Outcome	12 minute off peak frequency - Johnsonville Line Line	1	5	4	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Tunnels and passing opportunities and ability to deliver	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
181		165	10 minute off peak interval - Johnsonville Line	Outcome	10 minute off peak frequency - Johnsonville Line Line	1	5	5	4	1	2.Amber/green	2.Amber/green	1. Green	1. Green	10-20 years	Opex only		Tunnels and passing opportunities and ability to deliver	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
182		166	8 car trains all peak services - Johnsonville Line	Outcome	8 car trains all peak services - Johnsonville Line Line	2	5	4	4	1	1. Green	1. Green	1. Green	1. Green	10-20 years	Opex only		Station and power supply limitations	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
183		167	6 car trains all peak services - Johnsonville Line	Outcome	6 car trains all peak services - Johnsonville Line Line	2	5	4	4	2	1. Green	1. Green	1. Green	1. Green	5-10 years	Opex only		Station and power supply limitations	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
184		168	Peak periods increased train sizes (above 8)	Outcome	Peak periods increased train sizes (generic)	2	5	4	4	1	1. Green	1. Green	1. Green	1. Green	5-10 years	Opex only		Power supply limitations, EMU avilability	Reduce	No	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
185		169	Double Track Waikanae to Otaki	Infrastructure - Track	Double Track Waikanae to Otaki	2	3	3	3	3	3.Amber	1. Green	1. Green	3.Amber	5-10 years	Opex only		Working on rail corridor, land requirements	Reduce	No	Possible impacts to waterways to be managed	Visual impacts, potential land take required, water quality concerns	Yes	Mitigation required for impacts to wildlife and waterways during design	No		Retain for future consideration	Progress	
186		170	Electrification Otaki to Levin	Infrastructure - Power	Electrification from Otaki to Levin	2	3	3	5	1	3.Amber	2.Amber/green	1. Green	3.Amber	0-5 years	$10m - $100m		Working on rail corridor	Reduce	No	N/A	Visual impacts	No	Unlikely to be significant	No		Retain for future consideration	Progress	

	C D	E	F	G	H	I	J	K	L
15	Alternative or option details				Investment objective				
16	Unique identifier	Name of alternative/option	Alternative/Option Type	Description of alternative/option	Improve safety for all	Provide capacity that supports access and growth	Attractive and easy to use	Support a sustainable future	Adaptable to disruptions
187	171	Electrification Levin to Palmerston North	Infrastructure - Power	Electrification of Levin to Palmerston North	2	3	3	5	1
188	172	North-South Junction Tunnel Bypass	Infrastructure - Civil	A dual direction rail tunnel bypassing N-S Junction	3	3	3	3	3
189	173	Short and medium term power supply upgrade - Kapiti Line	Infrastructure - Power		2	5	5	5	4
190	174	Short and medium term power supply upgrade - Hutt Line	Infrastructure - Power		2	5	5	5	4
191	175	Short and medium term power supply upgrade - Johnsonville Line	Infrastructure - Power		2	5	5	5	4
192	176	North-South Junction Capacity Improvements (Generic Study)	Study	Next business case to determine the required capacity improvements for the N-S Junction	3	3	3	3	3
193	177	All day regular services between Wellington and North of Upper Hutt	Operational - Planning	Improve service levels	2	5	5	2	2
194	178	Remove Seating to increase capacity	Rolling Stock	Removing seats from Matangi EMU's to create more standing space and therefore capacity	2	5	1	2	2
195	179	Discrete Electrification of unpowered network (battery)	Infrastructure - Power	Discrete electrification of parts of the Rail Network	2	5	5	5	4
196	180	Network plant and equipment to improve safety and efficiency during renewals, maintenance and ops	Maintenance	With increased frequency of service, track access windows decrease, so this enables the same work to be delivered in a the increasingly shorter available time	4	3	2	2	2
197	181	Additional sections of double tracking / passing loops north of Waiakanae	Infrastructure - Track	Additional sections of double tracking / passing loops north of Waiakanae to enable higher frequencies on long distance rolling stock without impacting counter peak services or freight	2	5	3	2	4

	C D	M	N	O	P	Q	R	S	T	U	V
15		Practical Feasibility				Scheduling/ programming	Cost	Special notes on cost estimates	Key risks and uncertainties	Climate change	
16	Unique identifier	Technical	Safety and Design	Political and Public Acceptance	Consentability					Mitigation	Adaptation required
187	171	3.Amber	2.Amber/green	1. Green	3.Amber	0-5 years	$10m - $100m		Working on rail corridor	Reduce	No
188	172	5. Red (difficult/complex)	3.Amber	3.Amber	4.Red/amber	20-30 years	$500m +	Based on LGWM Tunnel Estimates	Consents, financial, opposition groups	Reduce	No
189	173	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$1m - $10m		N/A	Reduce	No
190	174	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$1m - $10m		N/A	Reduce	No
191	175	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$1m - $10m		N/A	Reduce	No
192	176	5. Red (difficult/complex)	3.Amber	3.Amber	4.Red/amber	0-5 years	$1m - $10m	Based on LGWM Tunnel Estimates	Consents, financial, opposition groups	Reduce	No
193	177	3.Amber	1. Green	1. Green	1. Green	0-5 years	Opex only		Cost, availability of rolling stock	Reduce	No
194	178	1. Green	1. Green	5. Red (difficult/complex)	1. Green	0-5 years	$1m - $10m	Assume not applied to all EMUs	Public backlash, increased complexity with scheduling as required to keep on shorter routes		
195	179	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$1m - $10m		Operational requirements	Reduce	No
196	180	Don't know	1. Green	1. Green	Don't know	0-5 years	Opex only	Required capex for new equipment still funded as opex	Unknown outcomes	Neutral	No
197	181	2.Amber/green	1. Green	1. Green	2.Amber/green	5-10 years	$1m - $10m	Assumed small scale localised works	Requirement for land acquisition	Reduce	No

	C D	W	X	Y	Z	AA	AB	AC	AD	AE
15		Impacts on Te Ao Māori	Environmental and Social Responsibility			Fatal flaws		Summary of decision made		
16	Unique identifier		Identify	Mitigation Can these be avoided, remedied or mitigated?				Summary of decision made	Progress or discontinue this alternative/option?	Option merged to
187	171	N/A	Visual impacts	No	Unlikely to be significant	No		Retain for future consideration	Progress	
188	172	Potential negative impacts on the land, water and wildlife, depending on mitigation. Iwi consultation required.	Land take, permanent character change	No	Requires early engagement	No		Merge to wider study into North-South Junction	Merged	176
189	173	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
190	174	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
191	175	N/A	N/A	N/A	N/A	No		Retain for future consideration	Progress	
192	176	N/A As a study (implementation evaluated separately)	Land take, permanent character change	No	Requires early engagement, future analysis will	No		Retain for future consideration	Progress	
193	177	Positive - improves connectivity which supports economic, health and social outcomes	N/A	N/A	N/A	No		Progress under merged option evaluating long distance services	Merged	137
194	178	N/A	N/A	N/A	N/A	Yes	Public Reception	Remove due to likely poor reception	Discontinue	
195	179	N/A	May require land take or wider network upgrade	Yes	To be dealt with through design process	No		LNIRIM is in a position where additional electrification is not required as part of the improvement of services. There is further work being conducted into decarbonisation being conducted at a National Level for freight services which may benefit the WMN. This does not preclude future investment in further electrification	Discontinue	
196	180	Positive - improved safety for maintenance staff	N/A	N/A	N/A	No		While keeping up to date with new maintenance processes is consider BaU, the RRP recognises that this may occasionally require capital investment in new equipment and an allowance is therefore made for inclusion in the RRP.	Progress	
197	181	N/A	Landowners may object	Yes	Early consultation	No		Progress as part of the wider network constraints project	Merged	57

Appendix D Do-Minimum Programme Definition

Stantec

REGIONAL RAIL PLAN – Do-Min Definition

This report has been prepared for the benefit of Greater Wellington Regional Council. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
0.1	29/7/20	Internal team draft	SR	DW	DW	DW
0.2	11/9/20	Draft for comment	SR	DW	DW	DW
1.0	17/09/20	Update based on client comment	SR	DW	DW	DW
2.0	29/09/20	Updated draft for wider circulation	SR	DW	DW	DW
2.1	14/01/21	Inclusion of electronic ticketing	SR	DW	DW	DW
2.2	22/11/21	Final with maintenance programme changes	SR	DW	DW	DW

1 Introduction

1.1 Purpose

Greater Wellington Regional Council (GWRC) is updating the Wellington Regional Rail Plan (RRP) using the Programme Business Case (PBC) methdology. This is to set out the direction for investment in the rail network over the next 30 years to 2050.

The PBC is following the Waka Kotahi NZ Transport Agency (Waka Kotahi) process and is being developed in conjunction with key partners and stakeholders. As part of the Waka Kotahi PBC process, the do-minimum is the base option to which other projects are compared against.

1.2 Definitions

Following the Investment Decision Making Framework (IDMF) review, Waka Kotahi's glossary for business case terms lists has the following as the definition of the do-minimum[1]:

> *In developing business cases, the do-minimum option should represent the minimum level of expenditure required to maintain a minimum level of service, not the minimum level of investment required to achieve the investment objectives. For example, the most likely transport situation over the course of the appraisal period if no further intervention were to occur.*
>
> *In theory, every option should be compared with the option of doing nothing at all, that is, the do-nothing option; however, for many transport activities it is not practical to do nothing at all.*
>
> *It is important not to overstate the scope of the do-minimum option, that is, it should only include activities that are absolutely essential to preserve a minimum level of service. Where network interdependencies exist, the do-minimum option should take into account other activities elsewhere on the network where these other activities have a commitment to funding, and where they affect the demands and level of service at the location of interest.*
>
> *The minimum level of investment to achieve the investment objectives is explored through the use of further options, in addition to the do-minimum. The do-minimum option is used as a baseline for comparing marginal costs and benefits of alternative activities. It provides the benchmark for determining the relative marginal value for money added by the other options under consideration.*

There is no definition for 'minimum level of service'. The do-minimum must be the cheapest option when excluding the do-nothing.

A meeting with Waka Kotahi was held on 5 August 2020 to understand what should be targeted in the do-minimum. Waka Kotahi confirmed that the do-minimum may include capital expenditure and that the do-minimum must be a credible and practicable alternative to the options. It was confirmed that the do-minimum does not need to be able to achieve the investment objectives.

The new guidance in closer in scope to the NZ Treasury guidance than the previous Waka Kotahi definitions. The current Treasury definition, as sourced from the PBC template/guidance document[2], is as follows:

> *The long-list must also include a realistic 'do minimum' option based on the core functionality and essential requirements for the programme.*
>
> *The 'do minimum' scope must be a realistic option that meets the 'core' scope and essential business needs of the programme.*

This definition and the new Waka Kotahi definition are in close agreement and is used as the basis for determining the do minimum.

1.3 The do-nothing

The do-nothing for this case would constitute the completion of committed projects and the implementation of crown funded business cases as well as continuing 'business as usual' maintenance. This would deliver no service or other improvements to either freight or passenger rail.

[1] https://www.Waka Kotahi.govt.nz/planning-and-investment/learning-and-resources/business-case-approach-guidance/supporting-material/glossary/
[2] https://treasury.govt.nz/sites/default/files/2019-11/BBC-Programme-business-case-template-and-guidance-October-2019.doc

The do-nothing was agreed to be the finishing of committed capital works projects and the continuation of operations in accordance with the appropriate network management plan.

1.4 Outcome sought

The outcome sought is agreement on the minimum acceptable level of service required to be provided by the do-minimum option for the development of the RRP.

2 The Minimum Level of Service

2.1 General principals of the do-minimum

Following the meeting with Waka Kotahi on 5 August 2020, the following general principals have been agreed:

- growth in rail patronage is to be expected and planned for in the do-minimum
- capital expenditure is expected but must be minimised
- the do-minimum will have negative impacts on the roading network
- the do-minimum must be a credible and realistic alternative.

Any capital expenditure in the do-minimum will be closely scrutinised during assessment and must be appropriately justified.

This signals that investment in new rolling stock etc to cater for growing demand at a reasonable level is allowable under the do-minimum. Replacement of existing rail stock due to end of life concerns is valid under the do-minimum.

2.2 The rail network

2.2.1 Overview

The Wellington Metro Rail Network (WMRN) serves both passenger and freight demands within the Wellington Region. While the great majority of trains on the network are Metlink public transport services, the WMRN also carries long-distance passenger services, and freight services from both the Wairarapa line and the North Island Main Trunk (NIMT) line to Centreport and the associated ferry/shipping services.

2.2.2 Core functionality and essential services

The Treasury definition notes the do-minimum must meet the core functionality and essential services of programme. The implications of this are explored below to inform the features of a minimum level of service.

Core functionality

The core functionality is explained in the vision statement of the rail plan, for the 2020 update this is a rail network that:

> *provides safe, customer focused and efficient rail passenger and freight services, and supporting infrastructure, to drive the region's economic development and social wellbeing in an environmentally and socially sustainable and resilient manner.*

This is similar to the 2010 (revised 2013) vision statement which is:

> *To deliver a modern, reliable and accessible rail system that competitively moves people and freight in an economic, environmental, integrated and socially sustainable way.*

While there are subtle differences between the statements it is clear that a core functionality of the rail network is to deliver a rail network that delivers both passenger and rail services. That is the rail network must cater for freight and provide an alternative to road during peak periods.

Essential services

Services that would prevent the core functionality of being achieved if they were not delivered are deemed essential services. This includes but is not limited to end-of-life replacements and maintenance to that ensure core functionality is delivered but exclude improvements outside of those required to deliver core functionality.

Public Commitments

In September 2020 GWRC announced an investigation into rolling out Snapper onto trains. In January 2021 it was confirmed that trials were being planned in early 2021 to roll out electronic ticketing on the rail network. Due to this public announcement, it has been assumed that electronic ticketing will be a feature of the do-minimum. This assumption only extends to replacing the payment method and does not constitute a multi modal integrated ticketing solution.

2.3 Features of a minimum level of service

For the purpose of defining the minimum acceptable level of service, the following things have been considered:

1. Provision of rail services

2. Passenger level of service
3. Freight level of service
4. Safety provision of rail services
5. Reliability of rail services
6. Asset condition.

With these in mind, this document focuses on three points, the passenger level of service, the freight level of service and safety level of service.

The provision of rail services is a given, since the wider transport network has been developed on the basis that the rail network provides a passenger (primarily commuter) and freight task. Passenger and freight services will therefore be maintained to avoid significant negative impacts on the transport network. Furthermore, allowing the rail network to degrade to the point where rail services cannot be offered would be contrary to the objectives of the:

- Government Policy Statement on Land Transport (2018-28)
- Draft Government Policy Statement on Land Transport (2021-31)
- National Land Transport Plan (2018-21) (currently being updated)
- Wellington Regional Land Transport Plan – mid-term review 2018 (currently being updated)
- Wellington Regional Public Transport Plan 2014 (currently being updated)
- Draft New Zealand Rail Plan
- Wellington Regional Rail Plan (2013 revision).

Reliability of rail services has been excluded from having metrics with respect to the minimum level of service. While this may seem counter-productive, the metrics chosen for the do-minimum passenger level of service and the asset condition level of service will ensure that a base level of reliability will be met.

2.4 Passenger level of service

The minimum passenger level of service for public transport services has been defined be evaluating the following:

1. Frequency
2. Capacity
3. Journey time
4. Ability to meet growth.

Of these metrics, while there shall be a minimum standard set for the frequency and journey time, the driver to meet the minimum level of service will likely be governed by the capacity and ability to meet growth.

2.4.1 Frequency

For the purposes of defining the minimum acceptable frequency, it has been assumed that the planned ‘RS1’ timetable improvements enabled by the currently underway works will be implemented and maintained for the duration of the plan. No further improvements are proposed as part of the minimum acceptable level of service.

The planned timetable improvements are outlined in the 2014 Regional Public Transport Plan (RPTP) and have been endorsed by Waka Kotahi. The proposed frequencies (inclusive of all stoppers and express services) are shown in Table 2-1.

Table 2-1: Future Rail Scenarios (Source: Unit 16: Future Rail Services, RPTP 2014)

Line	Number of trains per hours between these stations and Wellington	Weekday				Weekend		(approximate)
		Morning Peak Hour	Daytime	Afternoon peak hour	Evening	Daytime	Evening	
HVL	Upper Hutt	4	2	4	2/1	2	1	Mon-Thurs 18 hours Fri-Sat 21 hours Sun 17 hours
HVL	Taita	9	2	9	2/1	2	1	
JVL	Johnsonville	4	2	4	2/1	2	1	Mon-Thurs 17 hours Fri-Sat 19 hours Sun 17 hours
KPL	Waikanae	3	2	3	2/1	2	1	Mon-Thurs 18 hours Fri-Sat 21 hours Sun 17 hours
KPL	Plimmerton	7	2	7	2/1	2	1	
KPL	Porirua	8	2	8	2/1	2	1	
MEL	Melling	3	1	3	n/a	n/a	n/a	Mon-Fri 12hours
WRL	Masterton	3 peak trips	2 off peak trips	3 peak trips	1 Friday only	2 trips	n/a	Mon-Thurs 10 hours Fri 14 hours Sat-Sun 9 hours

The RPTP frequencies differ slightly from the 2013 RRP, which are shown in Figure 2-1.

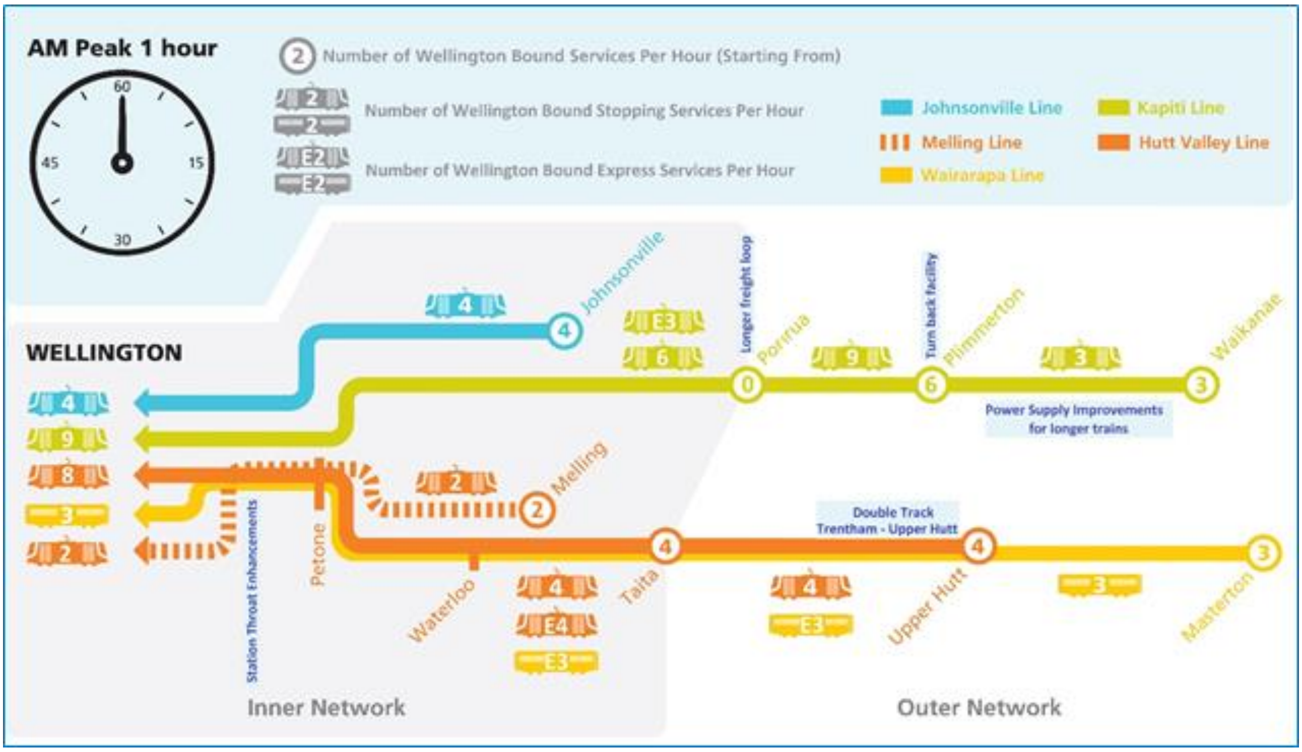


Figure 2-1: RRP RS1 peak hour (source: Figure 12, RRP 2013 revision)

There are no further guaranteed changes to the frequency of passenger services under the minimum level of service. This does not prevent additional services being run to meet other do-minimum requirements.

2.4.2 Capacity

It is expected that under the minimum acceptable level of service capacity would be the most noticeable change for users. Guidance from international examples on standing capacity on metro rail services has been sought.

Transport for London (TfL) and Transport for New South Wales (TfNSW) have published documents on expected people per square metre (ppm^2). Comparisons between the GWRC, TfL, and TfNSW standing capacity is outlined below.

TfNSW triggers investigations into providing additional capacity when there are on average 4 ppm^2. Despite this, services are not considered at capacity until there are 6 ppm^2. This also notes that passengers should not be required to stand for more than 20 minutes.

TfL considers a line at capacity when there are 4 ppm^2 but allows for 6 ppm2 to be used over multiple stations. TfL also notes that 'crush capacity' is the absolute maximum and considers this 7 ppm^2. No documents have been found for areas where capacity improvements should be investigated.

If the TfNSW guidance that people shouldn't stand for more than 20 minutes is adopted the capacity calculations become more difficult, however if this is extended to 30 minutes, then it identifies that at a high level, services from Upper Hutt, Kapiti and the Wairarapa should have no standing passengers, with standing passengers allowed on all other services (Johnsonville, Melling, Plimmerton and Taita onwards).

Auckland Transport has a policy aspiration that no one stands for greater than 15 minutes. This is not a requirement on the operator.

The FP/FT Matangi units have a maximum capacity of 377 people per 2-car set. This consists of 147 seated passengers and 230 standing passengers at 6 ppm^2. If the TfL capacity metric of 4 ppm^2 is adopted this reduces the total capacity to 300 people per 2-car unit. The 2013 RRP noted that a realistic capacity is 2.55 ppm^2 and that 2.55 ppm^2 does not cover the entire train (as passengers boarding do not distribute themselves through the entire train). This makes achieving an average density of 4 ppm^2 impractical in many cases. For this reason, an average density of 4 ppm^2 has only been applied to trains with shorter travel times.

Given the range of standing passenger capacities based on total travel time, the following ratio to seated passengers are proposed for the do-minimum and are shown in Table 2-2.

Table 2-2: Ratios of passengers to seats on services which is acceptable in the do-minimum

Capacity	Johnsonville, Melling, Plimmerton and Taita Services	Kapiti and Upper Hutt Services	Wairarapa and Capital Connection
Seated	1:1	1:1	1:1
Ideal	1.2:1	1.2:1	1.025:1
Maximum Comfortable	1.5:1	1.3:1	1.05:1
Maximum Loading	2:1	1.5:1	1.075:1

These ratios allow for different levels of crowding for each scenario based on travel times. Even services with greater than 30 minutes travel time allow for some standing passengers since some will travel to/from intermediate stations.

2.4.3 Journey time

Table 2-3 outlines the current timetabled travel times on key services for the morning peak.

Table 2-3: Timetabled travel times in the morning on various routes

Line	Stops	Current time (h:mm)
Hutt Valley	All	0:45
Hutt Valley	Upper Hutt Express	0:38
Hutt Valley	Taita	0:27
Johnsonville	All	0:26
Kapiti	All	1:00
Kapiti	Waikanae Express	0:57
Kapiti	Plimmerton	0:34
Kapiti	Porirua	0:24
Melling	All	0:20
Wairarapa	All	1:44

Under the minimum level of service, the scheduled travel times shall not be more than 10% longer than their current scheduled times. This does not enforce running a slower service, but simply provides a floor for the do-minimum scenario.

It is expected that journey time will be governed by providing a service of acceptable quality to customers.

2.4.4 Future growth

Following the meeting with Waka Kotahi on 5 August 2020 the do-minimum is to cater for the following growth scenario:

- maintain the long-term growth trend (Growth Scenario 3) until the ideal capacity is met
- maintain Growth Scenario 2 (mid-way between Growth Scenario 1 and 3) until the maximum comfortable capacity is met
- cater for population growth (Growth Scenario 1) until maximum loading is met
- add additional capacity at this point at lowest cost.

Under the proposed minimum level of service, growth shall be catered for at the current rail mode share measured by southbound travellers between 5:30 am and 9:00am between Ngauranga and Aotea Quay.

Two methods of improving capacity without significant expenditure have been assumed: the roll out of the RS1 timetable improvements, and the permanent conversion of some 2-car sets to 4-car sets (eliminating two driver cabs and replacing with seating) during heavy maintenance that is scheduled for 2030. The RS1 timetable improvements provide a small network-wide capacity improvement, but this is significant for some sections of network. The fleet conversion intervention is expected to increase capacity by 2.9%. However, it increases operational risk, since a failure would require the removal of a 4-car set instead of a 2-car set.

The do-minimum scenario has been developed for the Kapiti and Hutt Valley lines (excluding Melling) and its effect is displayed through to 2050 in the charts below. For all four charts, the shift in capacity in 2022 represents the RS1 timetable roll out and the increase in capacity in 2030 represents the additional 2.9% seated capacity. No additional rolling stock is required at this point.

The Hutt Valley services are shown in Figure 2-2 and Figure 2-3. It can be seen that both Hutt Valley line service layers do not exceed the maximum comfortable capacity by 2050.

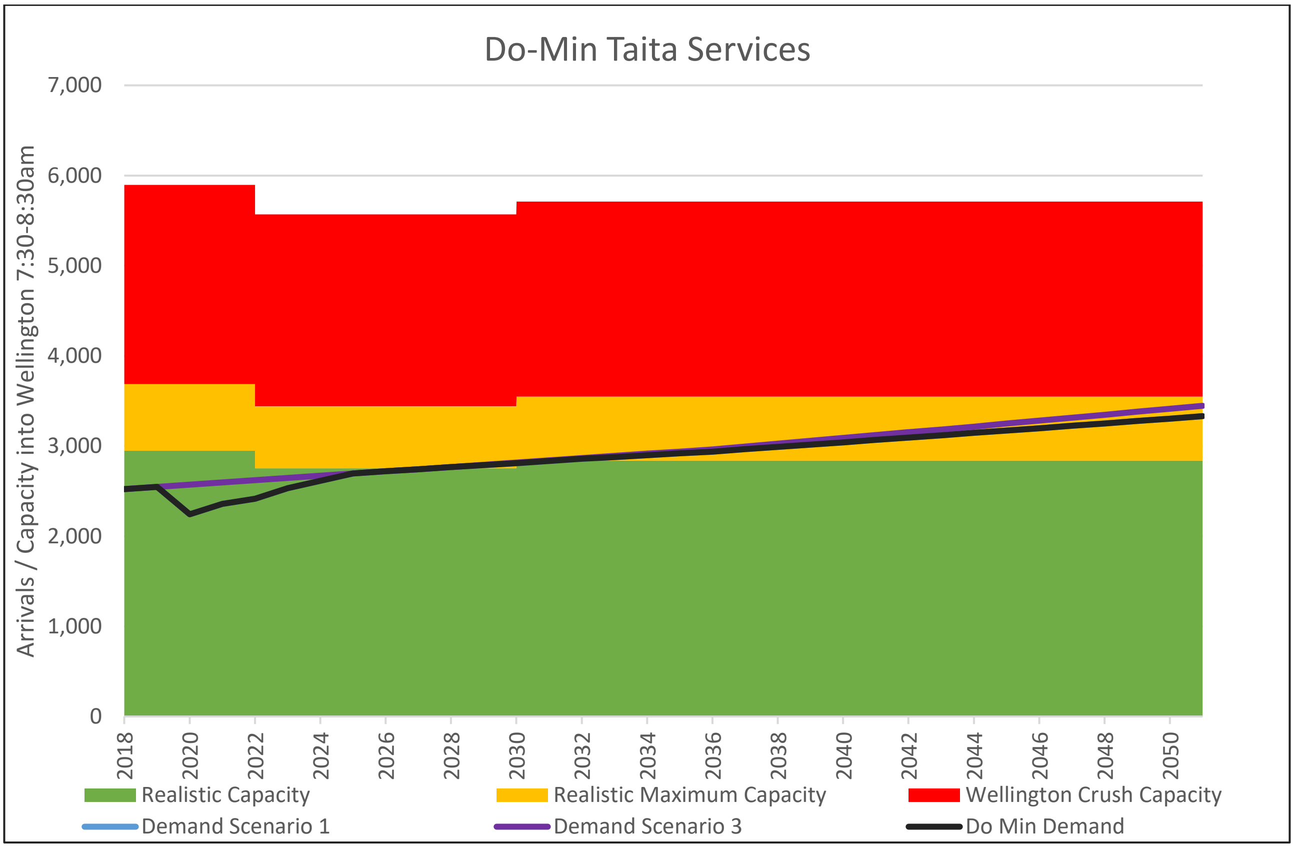


Figure 2-2: Do-min Taita services forecast

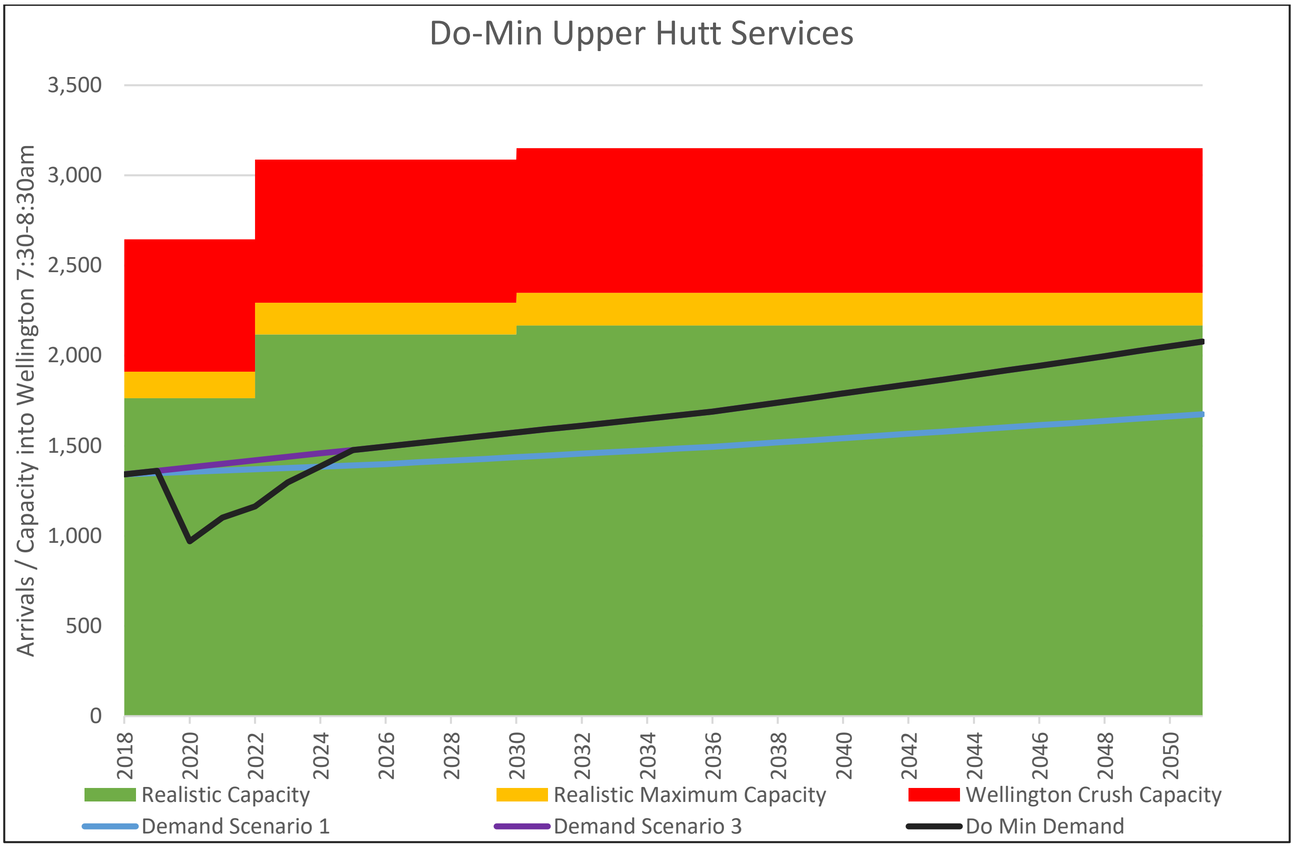


Figure 2-3: Do-min Upper Hutt services forecast

The Kapiti Line services are shown in Figure 2-4 and Figure 2-5.

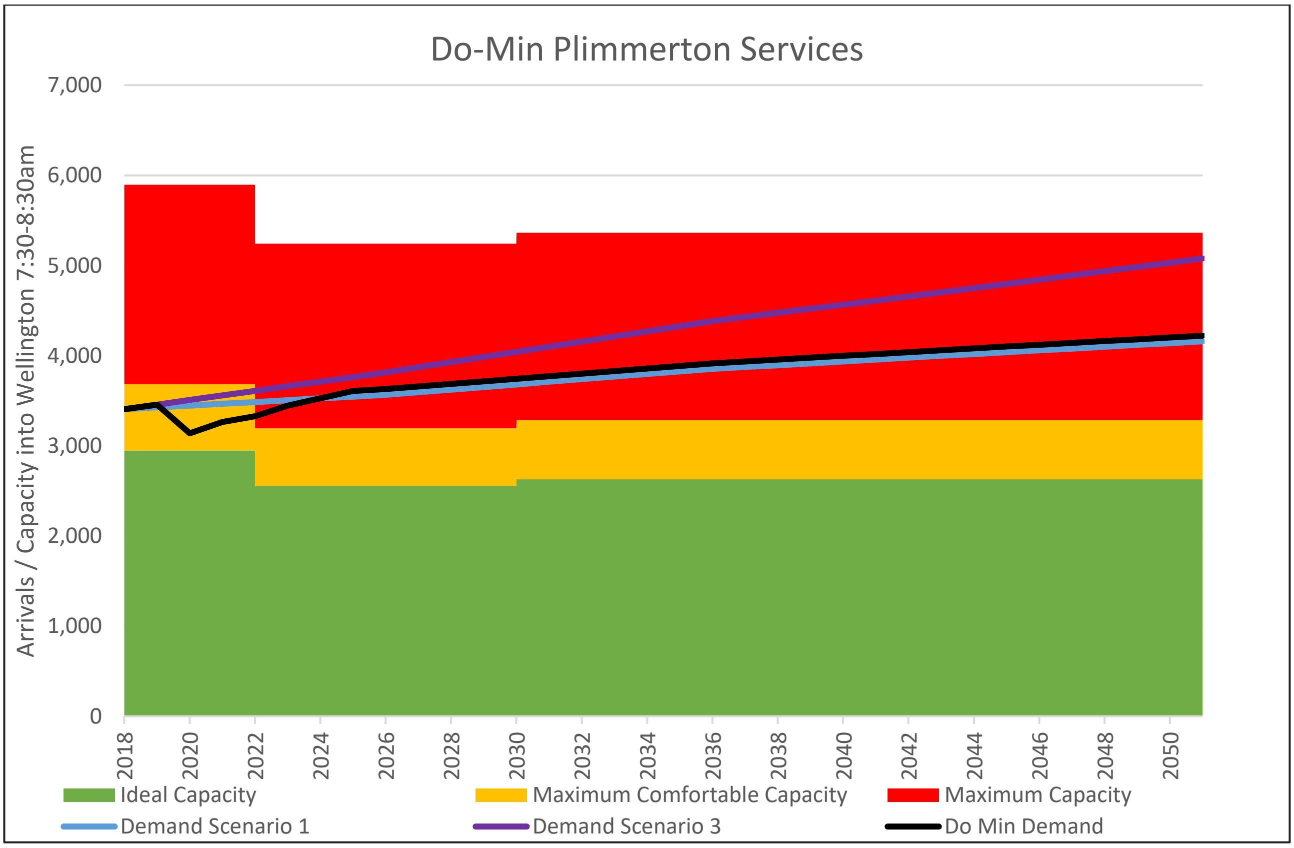


Figure 2-4: Do-min Plimmerton services forecast

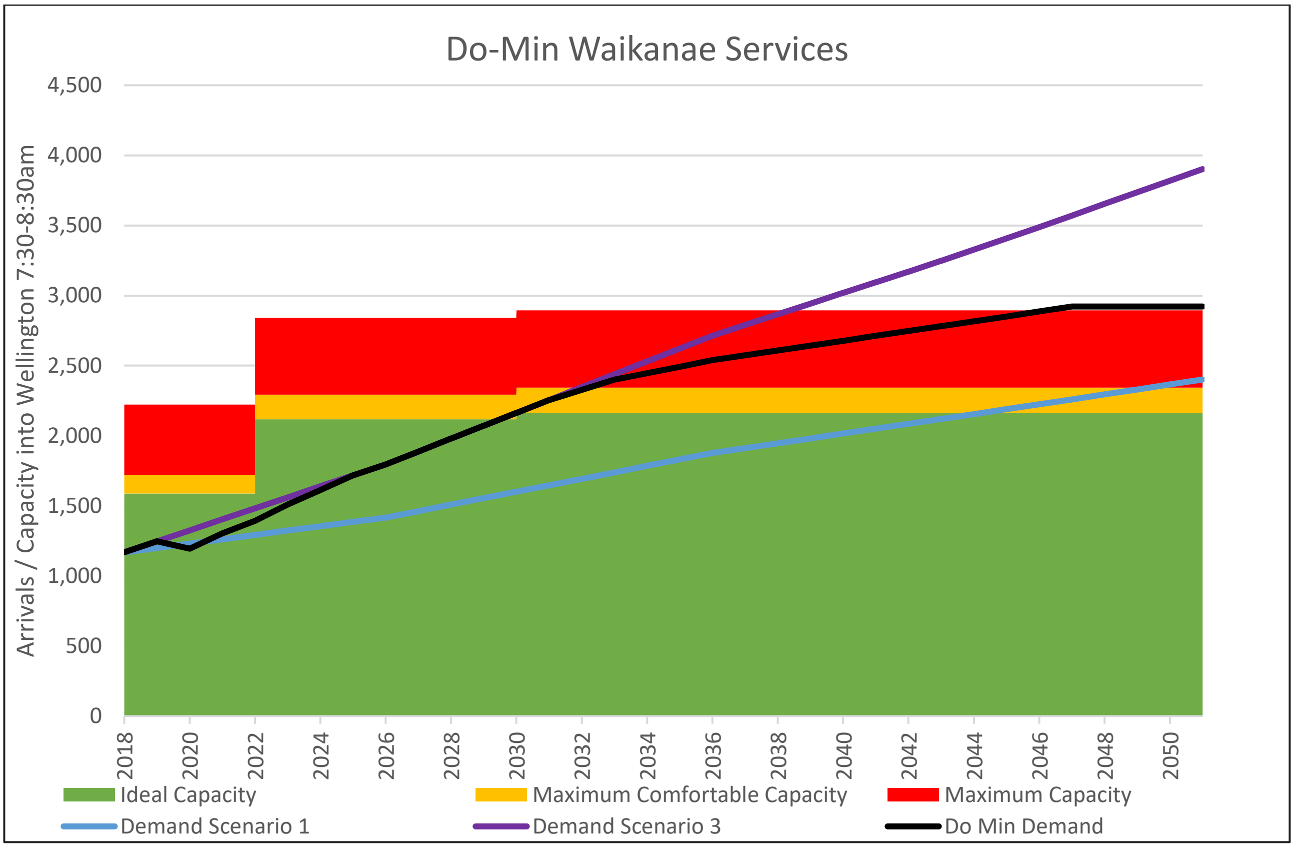


Figure 2-5: Do-min Kapiti services forecast (no expanded fleet)

Unlike the Hutt Valley line, the Kapiti Line shows significant mismatch from capacity to demand. Both the Waikanae and Plimmerton service layers operate above the maximum comfortable capacity limit for the type of journey. Services to Waikanae even reach the maximum capacity of 4ppm[2], preventing further uptake. No service offerings to improve the uptake of rail services are included in the minimum level of service. Long distance rolling stock has been assumed to be procured only when replacement is required, and at a level only to match the long-distance needs. It would not provide additional capacity within the electrified network.

The above charts indicate that, even with the fleet conversion capacity increase, the Kapiti Line is likely to run with significantly less capacity than demand. This can be mitigated by the improving the power supply to enable a fourth 4-car train to run in the peak direction in the peak hour. Counter-peak direction service would need to be reduced to enable this. The additional trains would be added by making minor fleet size increases when the existing Matangi fleet is replaced in the mid-2040s. Additional stabling may also be required in Kapiti. This would provide enough capacity only until the mid-2060s if Growth Scenario 1 is assumed.

Further practical improvements to frequency are not practicable without significant investment, particularly in the double tracking of the constrained single-track section between Pukerua Bay and Paekakariki. If it is accepted that passenger usage of rail should not decrease, then the do-min passenger growth would require this investment in late-2060 (inclusive of the 15-minute timetable for Waikanae services). With a 10-year lead time, this would result in work being required to start in 2050.

The impacts of running the additional service to Waikanae are shown in Figure 2-6.

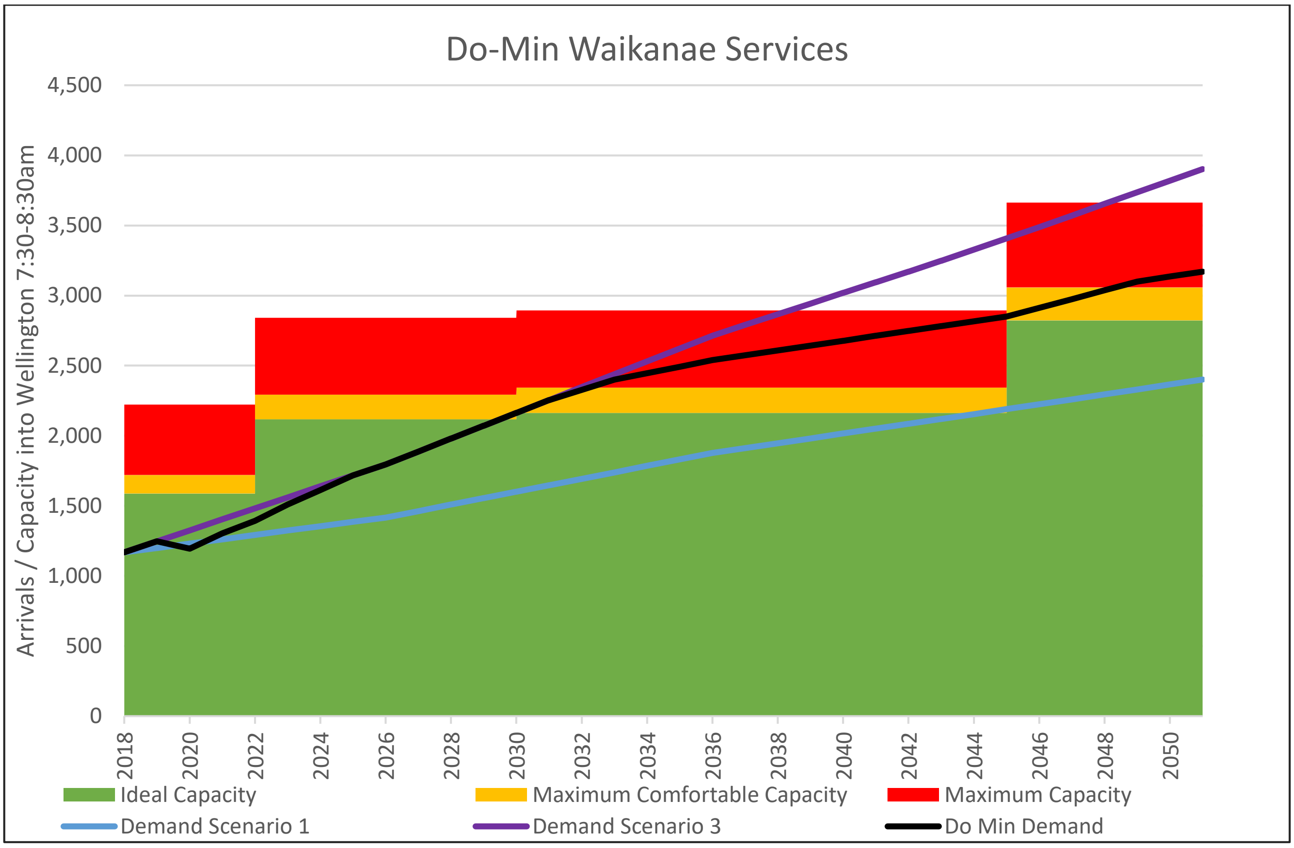


Figure 2-6: Do-min Waikanae services forecast with fleet increase

2.4.5 Asset replacements and maintenance

Under the do-minimum asset maintenance and end of life renewals will continue in line with the asset management plan.

The Matangi units require heavy maintenance around the year 2030, and end of life replacement in the mid-2040s. A small increase in fleet has been assumed at this point to maintain acceptable levels of service as noted above.

Rail network maintenance is increased from the existing 'baseline levels', as the Wellington Metro Upgrade Programme catch up renewals process has shown that this is not a sustainable if the network is to remain fully operational in the longer term. The funding levels include a slight increase to track maintenance and a lift to funding of protectional works such as slope stabilisation on high-risk sites.

2.4.6 Summary

Under the minimum level of service, demand for passenger services is expected to continue to increase at least in response to population growth. While there is only a commitment to roll out the already publicised RS1 timetable when demand exceeds the capacity of the current services, the do-minimum will expand capacity to maintain the specified minimum level of service standards by the lowest cost means.

2.5 Freight level of service

The minimum freight level of service has been defined be evaluating the following:

1. Frequency
2. Capacity
3. Ability to meet growth

Freight levels of service under the do-minimum will possibly contradict the agreed service levels in the Wellington Network Access Agreement between GWRC and KiwiRail. This could cause additional cost the alter the contract.

2.5.1 Frequency of freight services

There are currently approximately 14 freight services on the NIMT and 4 on the Wairarapa Line on a typical weekday. Freight services also operate on both lines on weekend days.

For the minimum acceptable level of service there will be no reduction in services from the current offering and planned increases.

For the purposes of the minimum acceptable level of service, long-distance passenger services (of which there are 3 on a typical weekday) are considered in the same manner as freight services.

2.5.2 Capacity of freight services

Freight services currently have the following capacity constraints as outlined in the Wellington Network Management Plan:

- speed limits at 80 km/hr
- 18 tonne axle limits
- total length 750 m (NIMT) or 500 m (Wairarapa line)
- maximum weight 1,700 tonnes.

Under the do minimum, it is expected that these levels of service would be maintained.

2.5.3 Future Growth

While the minimum level of service for rail services does not guarantee that existing unused freight paths would be maintained, it does not propose to reduce them, and does guarantee connecting freight services to any future rail enabled ferry sailings.

Investment in the network to maintain the mode share for the freight task within the region would continue under a minimum level of service.

2.6 Safety of rail services

Safety of rail services have two key areas of focus, being safety of rail operation and level crossings.

2.6.1 Safety of rail services and infrastructure

Under the minimum acceptable level of service, safety of the rail operation will be governed by the requirements of both the Railway Act 2005 and the Health and Safety at Work Act 2015.

The Railways Act 2005 requires:

> *"A rail participant must ensure, so far as is reasonably practicable (SFAIRP), that none of the rail activities for which it is responsible causes, or is likely to cause, the death of, or serious injury to, individuals."*

Under the Act, GWRC, KiwiRail and the GWRC's operator (currently Transdev) are defined as rail participants.

The Health and Safety at Work Act 2015 requires risks to health and safety to be eliminated so far as is reasonably practicable, and if it is not reasonably practicable to eliminate risks to health and safety, to reduce those risks so far as reasonably practicable.

The do-minimum case will include necessary expenditure to enable safety risks associated with operating the minimum acceptable level of service to be eliminated or reduced SFAIRP. This means that when assets are either renewed for condition reasons or upgraded to provide increased capability, that an enhanced level of risk mitigation than current may be required to reduce risks to a SFAIRP level, if the costs of doing so are not grossly disproportionate to the safety benefits achieved. This does mean that individual assets may be replaced, rather than taking a system wide approach, which could have significant cost implications. This includes funding for high-risk sites where failure would result in a casualty event.

For the purposes of defining the minimum level of service, it has been assumed that the 'RS1' timetable frequencies will be safe to operate once associated planned investment has been completed. Should additional services be required to maintain an acceptable level of service for capacity reasons, the legal test of 'so far as reasonably practicable' will be the governing requirement for the minimum level of service.

2.6.2 Level crossings

Under the minimum acceptable level of service, there will be no specific programme of upgrades to existing level crossings and no level crossing removal programme. However, the policy of no new level crossings unless two others are removed will be retained.

2.7 Operational Expenditure

Operational expenditure will be at the lowest level that enables both the freight and passenger services to operate at the required frequencies and capacity.

3 Recommendation

This memo outlines a proposed minimum level of service for rail services to be used for discussion with GWRC, Waka Kotahi and other stakeholders for the development of the RRP and subsequent investigations.

It seeks to ensure that there is sufficient capacity for seating nearly all commuters on the rail network who have expected travel times in excess of 30 minutes, and a density of no more than 4 ppm^2 for shorter journeys.

The do-minimum would improve frequency of services to the planned RS1 timetable as outlined in the current RPTP, but then only improve frequency to meet a major gap between demand and capacity on the Kapiti line. It would also improve capacity by the reallocating space when heavy maintenance is undertaken on the Matangi units.

When the Matangi fleet is replaced, a small increase in fleet would enable increased frequency on the Kapiti line services. This would require power supply improvements, timetabling alterations to the counter peak services, and may require stabling in Kapiti.

Freight services would be limited to the existing used freight paths, but allowance has been made for future growth to meet future rail enabled ferry sailings.

Reliability, punctuality, and asset faults would be allowed to degrade, provided that they did not impact the network's ability to meet the levels of service for either freight or passenger services documented in this paper.

The do-minimum for the Rail Plan therefore consists of:

- Completing currently committed projects
- Electronic ticketing
- Rolling out the RS1 timetable
- Increasing train capacity during heavy maintenance
- Matangi end of life replacements with minor fleet increase in the mid-2040s
- Timetabling changes to Waikanae services following the fleet replacement
- Power supply upgrades to enable the above capacity improvements
- Commencing investigation work on North-South Junction in circa 2050
- Maintenance works to ensure the network can deliver the above services.

Appendix E Long to Short List Workshop Briefing Note

Stantec

Wellington Regional Rail Plan: Programme Long to Short List Workshop Briefing

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
.01	12/04/21	First Draft	SR	DW	DW	DW
1.0	13/04/21	Issued	SR	DW	DW	DW

1 Purpose and Introduction

This note is provided as background to the evaluators for the Wellington Regional Rail Plan Programme Business Case long list to short list workshop. It provides a brief description of the process the evaluators will be using to assess the different programmes for the PBC and sets out how the workshop will run.

The Wellington Regional Rail Plan (RRP) Programme Business Case (PBC) is a Greater Wellington Regional Council (GWRC) initiative to set out the long-term direction of investment in the rail network. This investment is a cornerstone of the draft Regional Land Transport Plan (RLTP), draft Regional Public Transport Plan (RPTP), and draft Regional Mode Shift Plan (MSP), and it will help enable the outcomes sought by the preferred direction of the Wellington Regional Growth Framework (RGF). The RRP has a 30-year timeframe for investment and is expected to be updated throughout this period.

While the RRP does not consider maintenance or 'business as usual' (BaU) as a capital intervention, there are opportunities to improve some of these aspects which may fall out of work conducted as part of the plan.

The RRP Strategic Case was recently endorsed by Waka Kotahi, allowing the programme development process to recommence. Individual interventions, which were previously developed by a range of stakeholders, have now been assessed using the Waka Kotahi Early Assessment Sifting Tool (EAST) and allocated into a set of long list programmes.

2 Multi Criteria Analysis

Multi Criteria Analysis (MCA) is a method which enables a wide range of different aspects to be taken into consideration in evaluating options and provides a systematic framework for working through the merits and disadvantages of each option.

Done well, it can provide an open, traceable and repeatable process. It enables consideration of a range of criteria which are both qualitative and quantitative. These criteria can reflect social, economic, cultural, and environmental characteristics of the project outcomes and effects.

It can also enable sensitivity testing to a range of different perspectives to add additional robustness to the option selection process.

MCA does not supplant decision makers. It is a tool that will help decision making, but it does not make the decision. MCA should always be one of a range of inputs that decision makers use to decide on the preferred option. These other inputs will include, as a minimum:

- Investment assurance, including cost benefit analysis
- Risk assessment
- Cultural impact.

Guidance on the MCA process can be found on the Waka Kotahi Investhub Portal.

As this is a long to short listing process, the assessors will be those familiar with the programmes, have relevant rail experience, and include the project team as well as relevant experts from GWRC, Transdev, KiwiRail and Waka Kotahi.

3 Options

The project team in conjunction with GWRC have developed eight different programmes including do-nothing and do-minimum programmes. These are:

- Do-nothing
- Do-minimum
- Minor Improvements Programme
- Moderate Improvements Programme
- Train Size Focus Programme
- Frequency Focus Programme
- Mixed Focus Programme
- Drive Mode Shift Programme

Rough order capacity and patronage analyses for each programme (Hutt line services, Kapiti line services and total network capacity) are presented in Appendix A.

Each programme other than the do-nothing assume some investment in longer distance fleet and services. This could be further enhanced with a decarbonisation focus that would include electrification of the Wairarapa Line services to Masterton, Manawatu Line services to Palmerston North, and increased service frequency on these lines.

Outside of the do-nothing and do-minimum programmes, all remaining programmes rely to some extent on utilising new long distance rolling stock to improve capacity on the electrified network.

There are some key generic studies included in the list of projects within each programme. While the focus of each will vary based on the direction of investment, these studies can be summarised as:

1. North-South Junction Capacity Improvements Study. This would seek to identify the best method for removing the capacity constraints of the single-track section of the North Island Main Trunk Line between Pukerua Bay and Paekakariki. While this study is common to all programmes, the 'minor improvements' programme would focus on the most appropriate manner of obtaining an additional peak hour service, while frequency focused programmes will have the objective of eliminating the single-track section entirely.

2. Network Use and Behaviour Study. This would seek to identify how services can best service their communities, particularly with respect to expanding regular services, particularly during off-peak, evening and weekend periods. It would also seek to understand the implications of fare zone changes, and identify the parameters required to trigger a new station, new services or even the removal of a station.

3. Future Network Form Study: This would look at key changes to the network such as the removal of lines, conversion of lines from heavy to light rail, or identifying if new lines would benefit the rail network. It would also include investigation of such aspects as the Wellington Station approach, including separating passenger and freight services, and future freight capacity and needs.

Overviews of each programme are provided in the following sections.

3.1 Do-nothing

This programme consists of projects where the implementation phase is likely to be committed and not proceeding would result in a greater cost to the implementing agencies than continuing at the time of publishing the rail plan. Interventions which have been publicly announced but are not sufficiently progressed to incur a cost to not proceed have been excluded.

It consists entirely of the following:

- Wellington Metro Rail operations centre Train Control
- Plimmerton Turnback

Trentham to Upper Hutt double tracking has been excluded as it is expected to be completed prior to completion of the RRP.

3.2 Do-minimum

The do-minimum, including the work behind it to determine the suitability of the programme is outlined in Appendix B.

The do-minimum includes publically committed projects as well as projects deemed to be essential to maintain an acceptable level of service for the rail network. It can be sumarised as including the following new projects:

- Implementation of the new ('RS1') timetable
- Train capacity increases during heavy maintenance (removal of cabs)
- Matangi end of life replacements with minor fleet increase in the mid 2040s
- Timetabling changes to Waikanae services following the fleet replacement
- Power supply upgrades to enable the above capacity improvements
- Commencing investigation work on North-South Junction in circa 2050
- Maintenance works to ensure the network can deliver the above services
- Fleet storage in Kapiti to enable 12 minute peak intervals into Wellington
- Fleet expansion to 108 EMUs by 2050.

The do-minimum also includes projects announced as part of the Wellington railway upgrade as part of the New Zealand Upgrade Programme.

All interventions in the do-minimum, except for the increase to train capacity during heavy maintenance, are included in all subsequent programmes. This intervention is not needed in other options as capacity is provided by additional rolling stock.

3.3 Minor improvements

This programme consists of the do-minimum project as well as several key low-cost type projects that seek to improve reliability, safety, and resilience. This also includes the shortening of the North-South Junction section prior to full double tracking outside of the project timeline. The Hutt line moves to a 10-minute timetable with improvements to the Kapiti line enabling larger train sets when the Matangi units are replaced at end of life.

Above the do minimum this programme includes:

- Railway station accessibility improvements (including mobility impaired and public transport connections)
- Slope stabilisation works on key areas of the network
- Improved digital information including improved real time information for customers
- Alterations to services to better reflect demand
- North-South Junction capacity study and implementation of minor improvements to enable 12-minute intervals
- Moving the Hutt Valley Line and Kapiti line to 12-minute intervals circa 2044
- Fleet expansion to 116 EMUs by 2050.

The minor improvements programme is included in all subsequent programmes, however some elements such as the station accessibility improvements can be scaled up from what is included in the minor improvements programme.

3.4 Moderate improvements

This programme seeks to maximise and use of tools such as charging for park and ride, while shifting for active mode and public transport priority for the station access. It places and increased emphasis on using the passenger data to target investment.

The programme has a similar range of projects to the minor improvements programme with slight acceleration. It also includes the following interventions:

- Implementation of short-term North-South Junction capacity improvements in 2027 to enable 12-minute intervals and 10-minute intervals by 2043
- Expansion of secure facilities for cycles including changing stations/showers
- Electric car charging at park and ride sites
- Review of park and ride to evaluate impacts of user charges
- Fleet expansion to 129 EMUs by 2050.

3.5 Train sized focus

This programme seeks to maximise train size, particularly at peak periods. This requires substantial power supply upgrades and additional rolling stock to be procured up front. It has a secondary focus of improving frequency later in the programme. For the purposes of the RRP, it has been assumed that 8-car trains are the largest that can be run on the network, but an investigation would be undertaken to understand the feasibility and financial implications of moving to larger trains.

This programme includes the following interventions:

- Interventions from the minor improvements package
- Introduction of additional trains late 2020s, mid 2030s and early 2040s
- Immediate commencement on the North-South Junction study with 12-minute intervals enabled by 2034
- Wellington throat capacity improvements
- Commencement of grade separation of crossings on all lines, with increased focus on the Porirua Line south of Plimmerton
- Power supply upgrades
- Increasing peak services to 8-car trains as fast as reasonably practicable
- Increased frequencies on the peak services to 12-minute intervals in the mid-2030s
- Improved maintenance shed access
- Fleet expansion to 146 EMUs by 2050.

3.6 Frequency focus

This programme seeks to maximise the number services run per hour, particularly at peak periods. This requires power supply upgrades and additional rolling stock to be procured up front. It has a secondary focus of increasing train size later on in the programme. This programme has an upfront focus on removing safety hazards and constraints on capacity.

This programme includes the following interventions:

- Interventions from the minor improvements package
- Immediate commencement on North-South Junction capacity improvements
- Wellington throat capacity improvements
- Commencement of grade separation of road crossings on all lines
- Installation of automatic gates on all pedestrian crossings
- Power supply upgrades
- Rapid procurement of additional trains
- Move to 12, then 10 then 6-minute peak intervals as per below

Line	Hutt Valley Line	Kapiti Line
12-minute interval	Mid-late 2020s	N/A
10-minute interval	Early 2040's	Early 2030s
6-minute interval	Mid-Late 2040s	Mid-Late 2040s

- Initial decrease in train size then increasing size as required
- Improved maintenance shed access
- Fleet expansion to 155 EMUs by 2050.

3.7 Mixed Focus

This programme seeks to provide a balance between train size and the frequency. It aims to delay the need for significant investments on both major corridors, by increasing frequency on the Hutt Valley Line and train size on the Kapiti Line, to delay the required implementation date for the North-South Junction double tracking.

This programme includes the following interventions:

- Interventions from the minor improvements package
- Immediate commencement on North-South Junction study, with potentially staged implementation
- Wellington throat capacity improvements
- Commencement of grade separation of crossings on all lines, but with increased focus on the Hutt Line
- Installation of automatic gates on all pedestrian crossings, but focusing on Hutt Line
- Power supply upgrades – focusing on the Kapiti Line initially
- Additional long-distance trains used as a holdover until the Matangi Replacement
- Hutt Valley Line moving to 12-minute intervals then progressively higher intervals at peak times
- Increasing peak services on Kapiti Line to 8-car trains as fast as reasonably practicable, then moving to 12-minute intervals by 2034 and 10-minute intervals by 2040
- Increase train size on the Hutt Line as required by demand
- Improved maintenance shed access
- Fleet expansion to 143 EMUs by 2050.

3.8 Facilitate mode shift

This programme is considered to be a 'do maximum' programme, where all efforts to increase rail patronage are followed, including significant improvements to longer distance services.

This programme includes the following interventions:

- Immediate commencement on North-South junction capacity improvements
- Wellington throat capacity improvements
- Multiple rounds of additional train procurement, with new trains arriving every decade
- Major train frequency improvements, similar to the frequency focus programme
- Initiating work on a second Remutaka tunnel around year 30 to enable higher frequency on the Wairarapa Line
- Reviewing the role of the Johnsonville Line as heavy rail to enable better efficiency at Wellington Station
- Fleet expansion to 180 EMUs by 2050.

3.9 Capacity Comparison

At this stage of programme development, five growth scenarios have been provided by the Wellington Analytics Unit. These growth scenarios have been used to estimate passenger demand and associated train frequency and capacity requirements for each of the programmes. Table 3-1 outlines the base growth has been allocated to programmes based on capacity and expected reliability.

Table 3-1: Base growth scenarios used for each programme

Capacity Range / Service Reliability	High	Moderate	Low
Ideal	5	4	3
Comfortable	4	3	2
Maximum	3	2	1
Above Maximum	0	0	0

The growth scenarios have been adjusted based on the project team's experience, typically under the following circumstances:

1. After a sustained number of years above ideal capacity, the growth scenario would drop
2. After a sustained number of years in the maximum capacity range, returning to ideal capacity would not immediately return to the highest growth
3. After a sustained number of years with potential reliability issues, patronage growth can decline.

The indicative peak hour patronage into Wellington for each of the programmes is presented in Table 3-2.

Table 3-2: Comparisons between predicted patronage for each programme

	Patronage			Difference from Do-minimum		
Year	2030	2040	2050	2030	2040	2050
Do Min	13310	14680	15811	-	-	-
Minor Improvements	13634	15177	16909	+2%	+3%	+7%
Block Projects	13853	15644	17855	+4%	+7%	+13%
Train Size	13846	16314	18708	+4%	+11%	+18%
Frequency	13999	17007	19421	+5%	+16%	+23%
Mixed Focus	14076	16544	18903	+6%	+13%	+20%

Facilitate Mode Shift	14076	16544	18903	+10%	+22%	+29%

The relative similarity of the programmes in 2030 is driven by limited differences in provided capacity between programmes in the first decade, due to the long lead times associated with rail improvements.

4 Assessment Criteria

4.1 Scoring System

For this MCA assessment, a seven-point scale from -3 to +3 is proposed for each of the criteria, when each programme is considered against the do-minimum. Scores include a time-based element and a quantity-based element, as detailed in Table 4-1.

Table 4-1: Scoring system for short listening process

Benefit Level/Duration	High	Medium	Low	Neutral	Low Disbenefit	Medium Disbenefit	High Disbenefit
Long term	3	3	2	0	-1	-1	-2
Medium term	3	2	2	0	-2	-2	-3
Short term	2	1	1	0	-2	-3	-3

4.2 Investment objectives

The investment objectives are a key component of the proposed assessment criteria. The investment objectives and summary of the proposed measures are outlined below:

- Support a sustainable future:
  - Increase rail passenger and freight mode share
  - Reduce rail carbon emission per passenger

- Provide capacity that supports access and growth:
  - Improve access by increasing peak passenger capacity
  - Maintain freight access by retaining existing freight paths throughout the day and ensuring capacity for growth

- Attractive and easy to use:
  - Increase frequency throughout the day
  - Improve peak punctuality
  - Improve overall satisfaction of rail passengers
  - Maintain ease of access and improve accessibility for impaired users

- Adaptable to disruptions:
  - Reduce passenger impact of high impact low probability events
  - Reduce passenger impact of unplanned events

- Improve safety for all:
  - Reduce the rate of safety incidents
  - Increase public and user perception of safety of rail.

4.3 Other assessment criteria

4.3.1 Overarching success factor

The overarching success factor for the rail programme is to increase rail usage (passenger & freight). While achieving all investment objectives implicitly achieve this proposed criterion, this allows for programmes that have made trade-offs for some of the investment objectives.

4.3.2 Alignment with regional, national policies and investments

This proposed criterion assesses programme alignment with policies such as the Zero Carbon Act, GPS, RLTP, RPTP, NZ Rail Plan, and the programme fit with other investment such as the Lets Get Wellington Moving programme.

4.3.3 Implementability

This proposed criterion assesses how practical each of the projects are. It considers aspects such as:

- Consenting of any capital works
- Funding availability.

For this criterion, it is unlikely negative scores will be given.

4.3.4 Risks to programme delivery

This proposed criterion scores the risk to the programme delivery, and seeks identify if a programme is at risk of not being implemented as expected for any reason. For this criterion, it is unlikely negative scores will be given.

4.3.5 Affordability

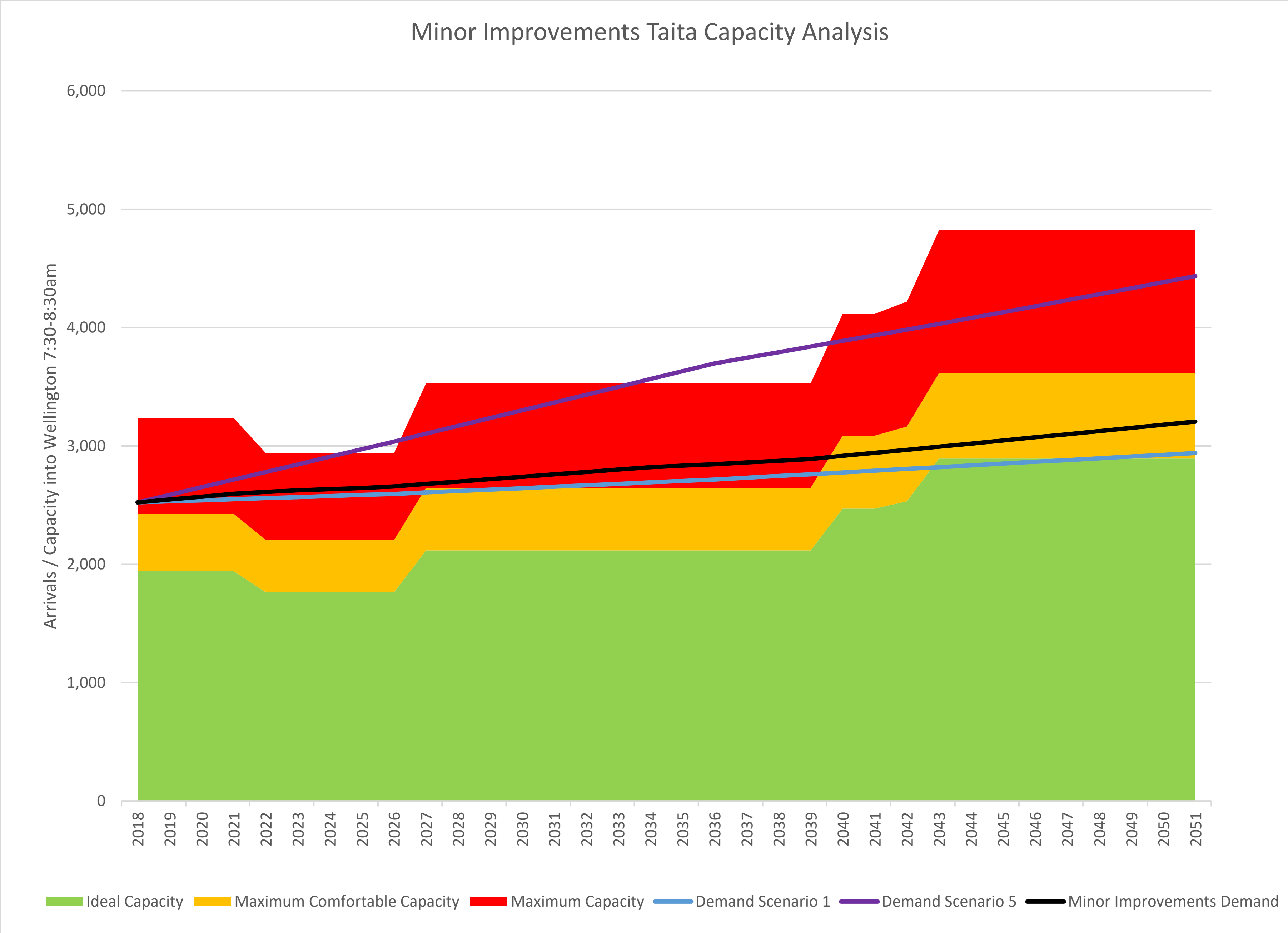
This proposed criterion scores the cost of the programme, on the assumption that more expensive programmes may more difficult to fund and therefore less affordable.

5 Reporting

Following the workshop the project team will produce a write up of the MCA process and workshop outcomes which will include the following:

- The options assessed
- The criteria used
- The scoring assigned to each option for each criterion
- The workshop process, including key items of discussion
- The weighting systems adopted
- A recommendation for the options to take forward for further detailed analysis

Appendix A Programme Summary Graphs



Minor Improvements Taita Capacity Analysis
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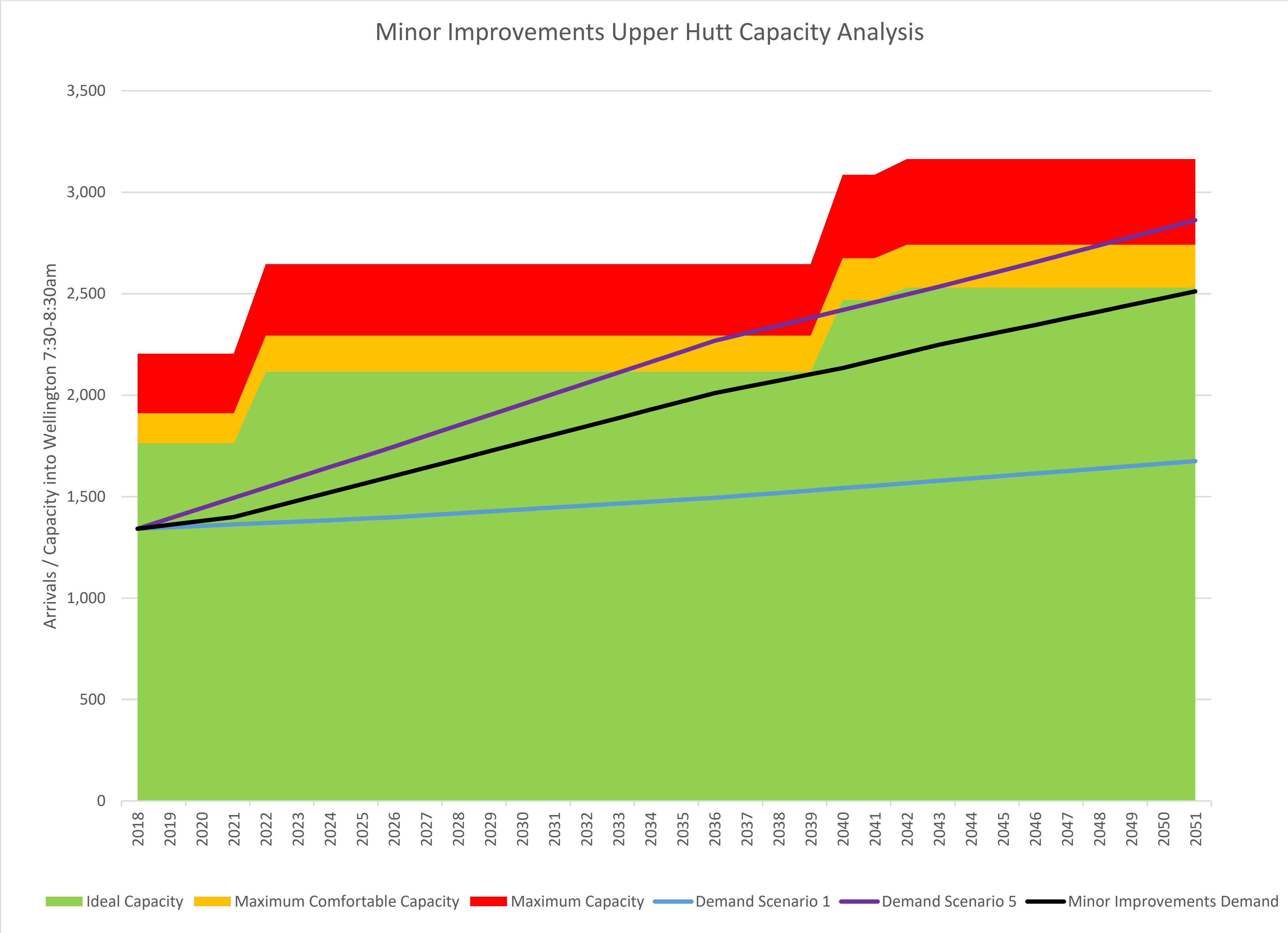

Minor Improvements Upper Hutt Capacity Analysis
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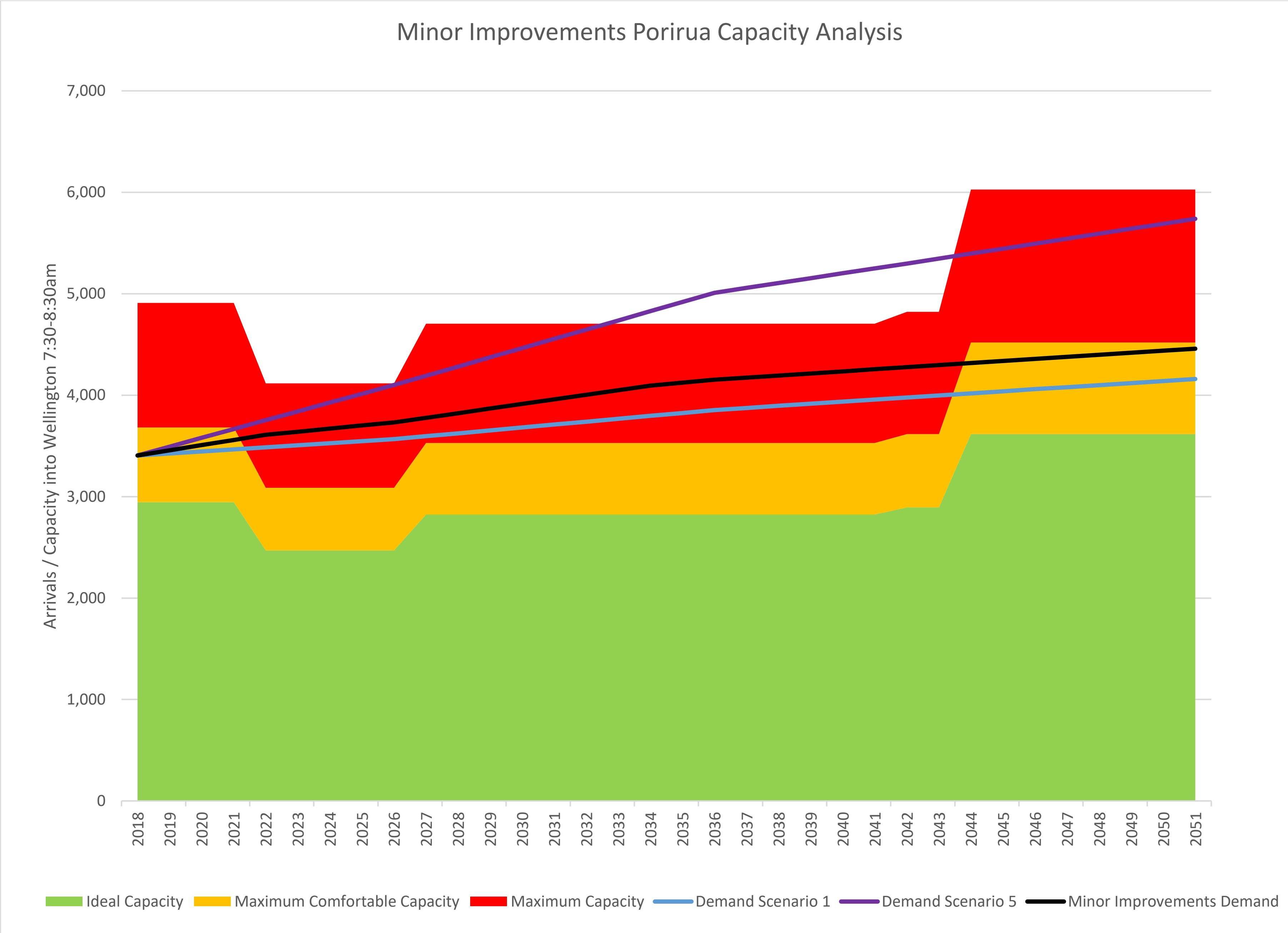
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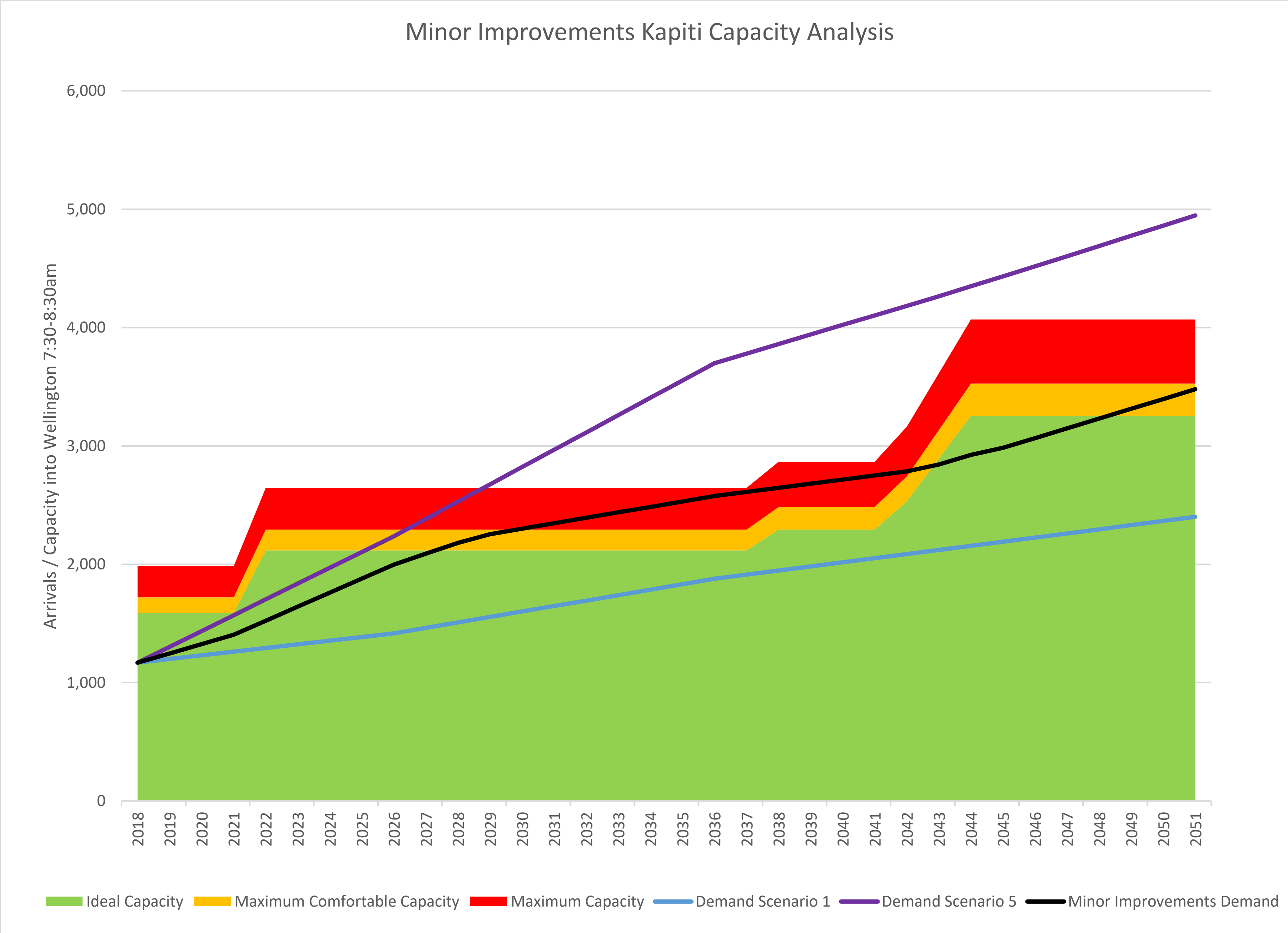

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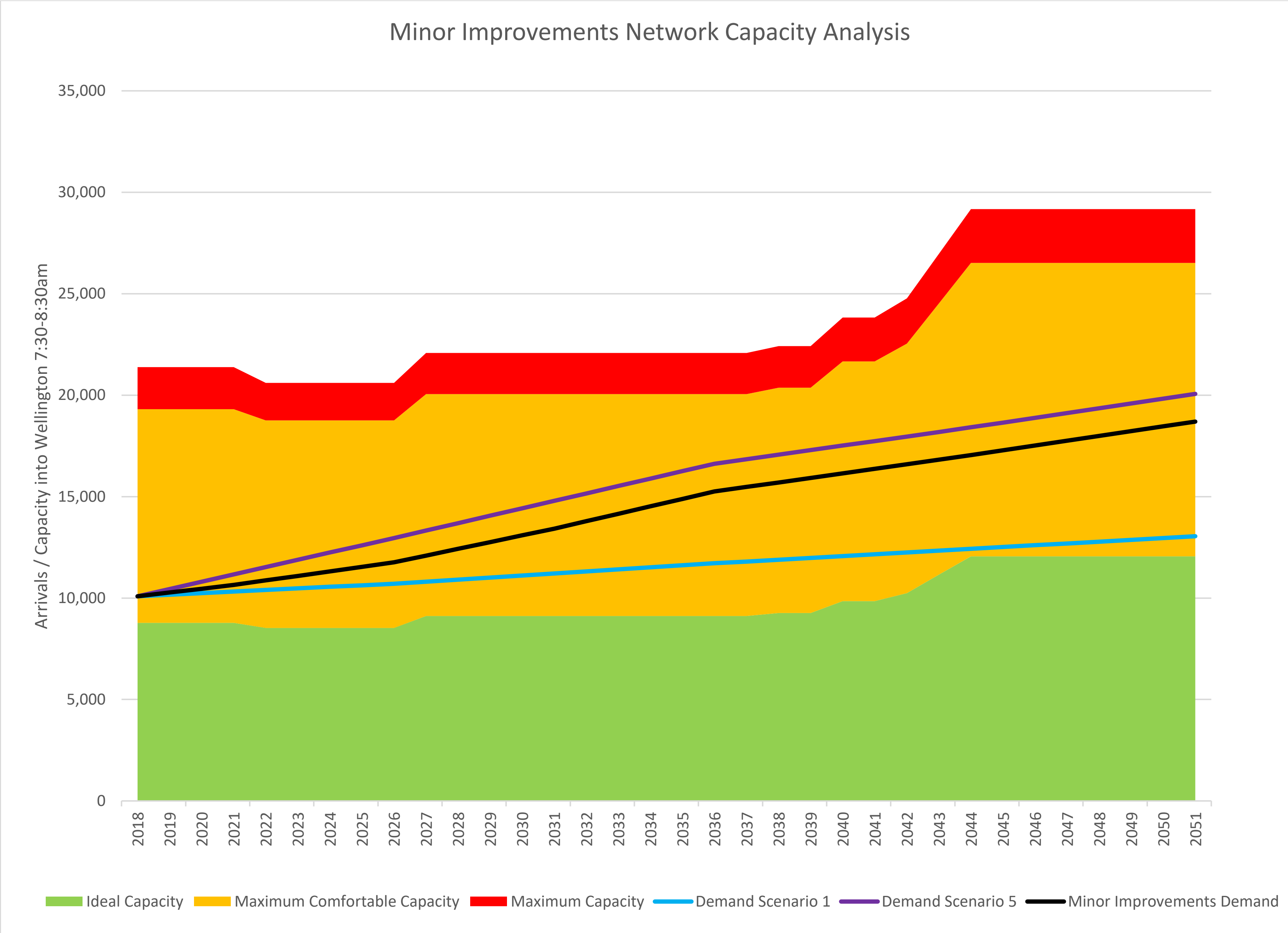

Minor Improvements Network Capacity Analysis
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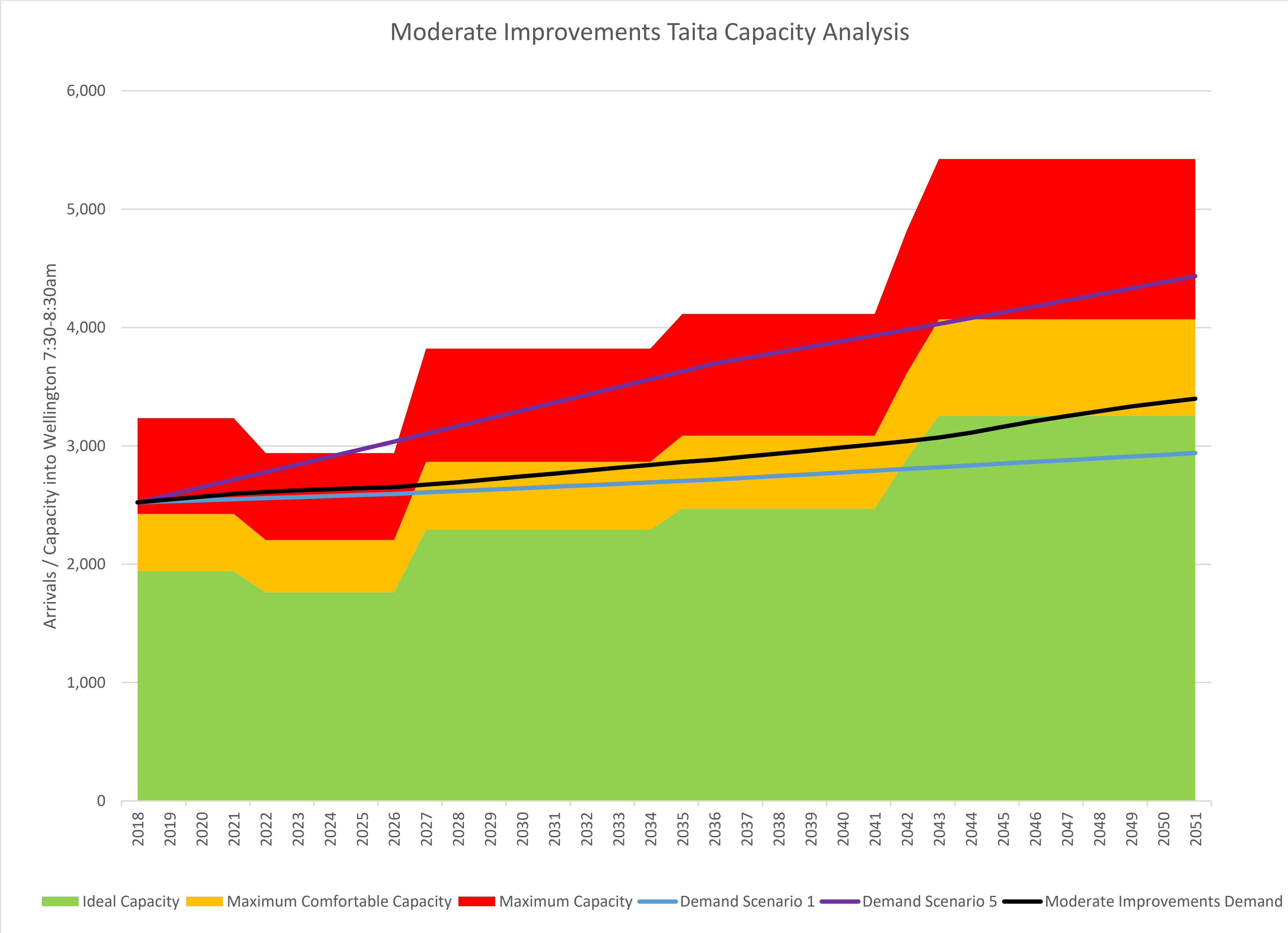

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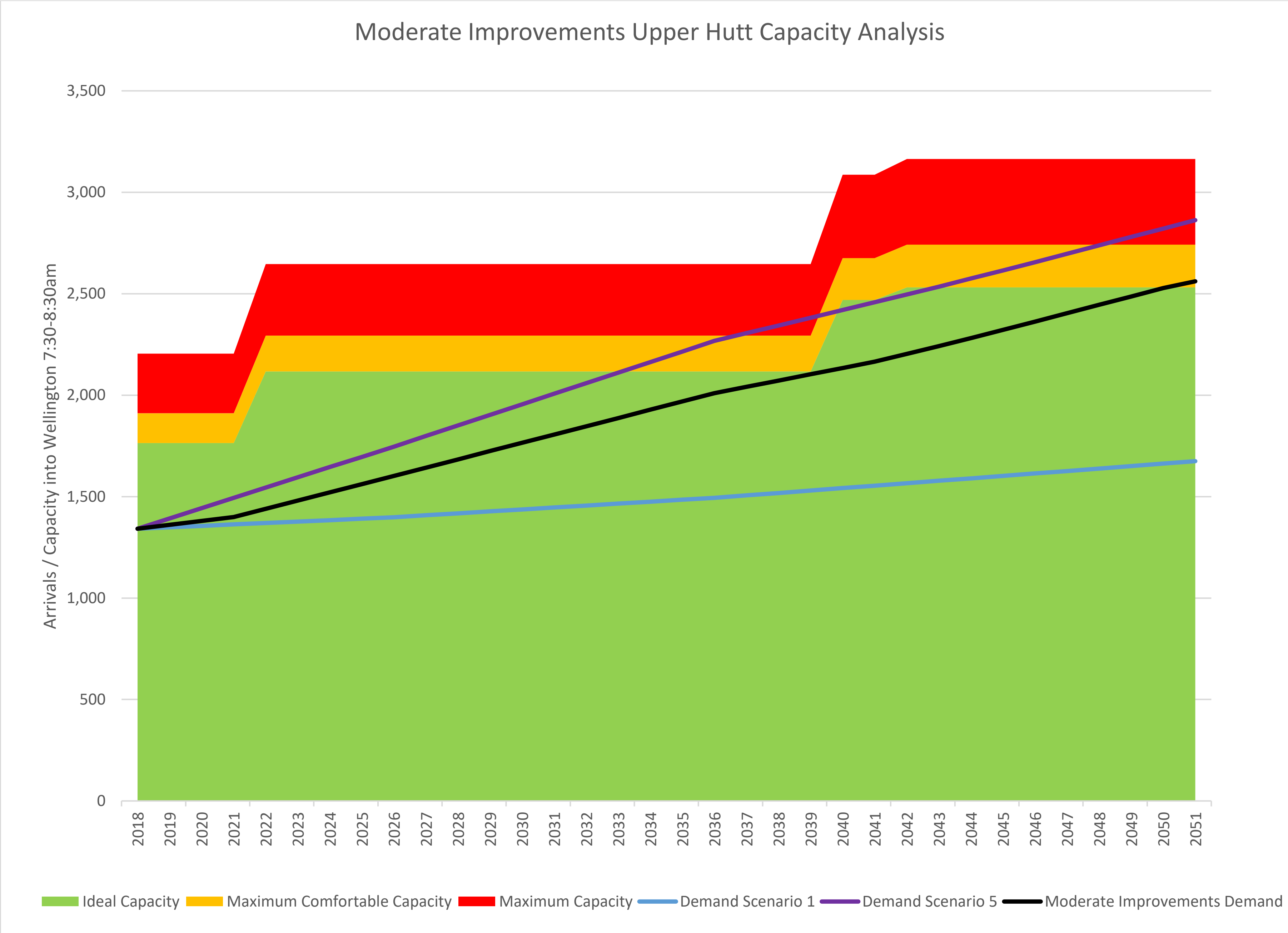
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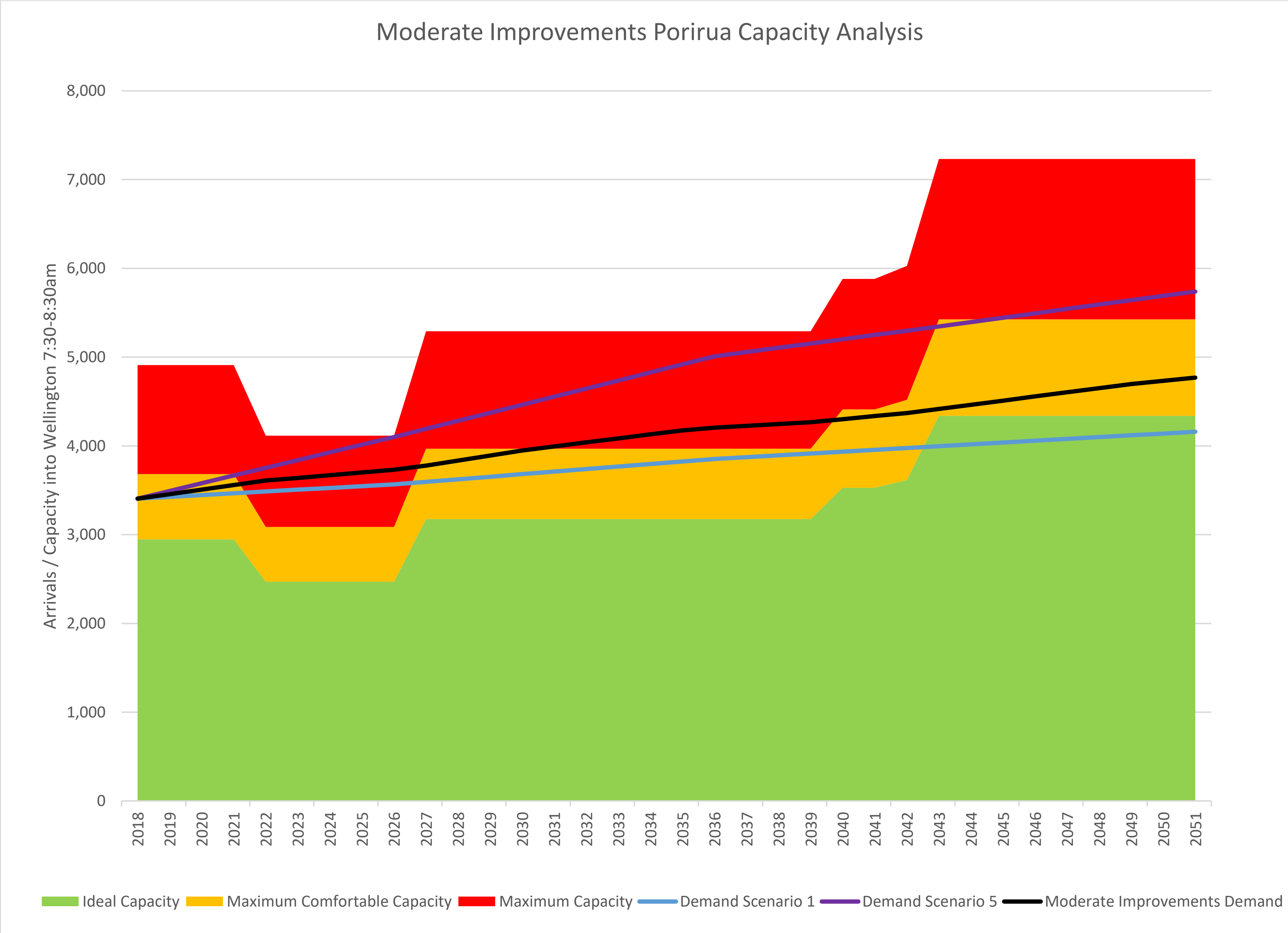
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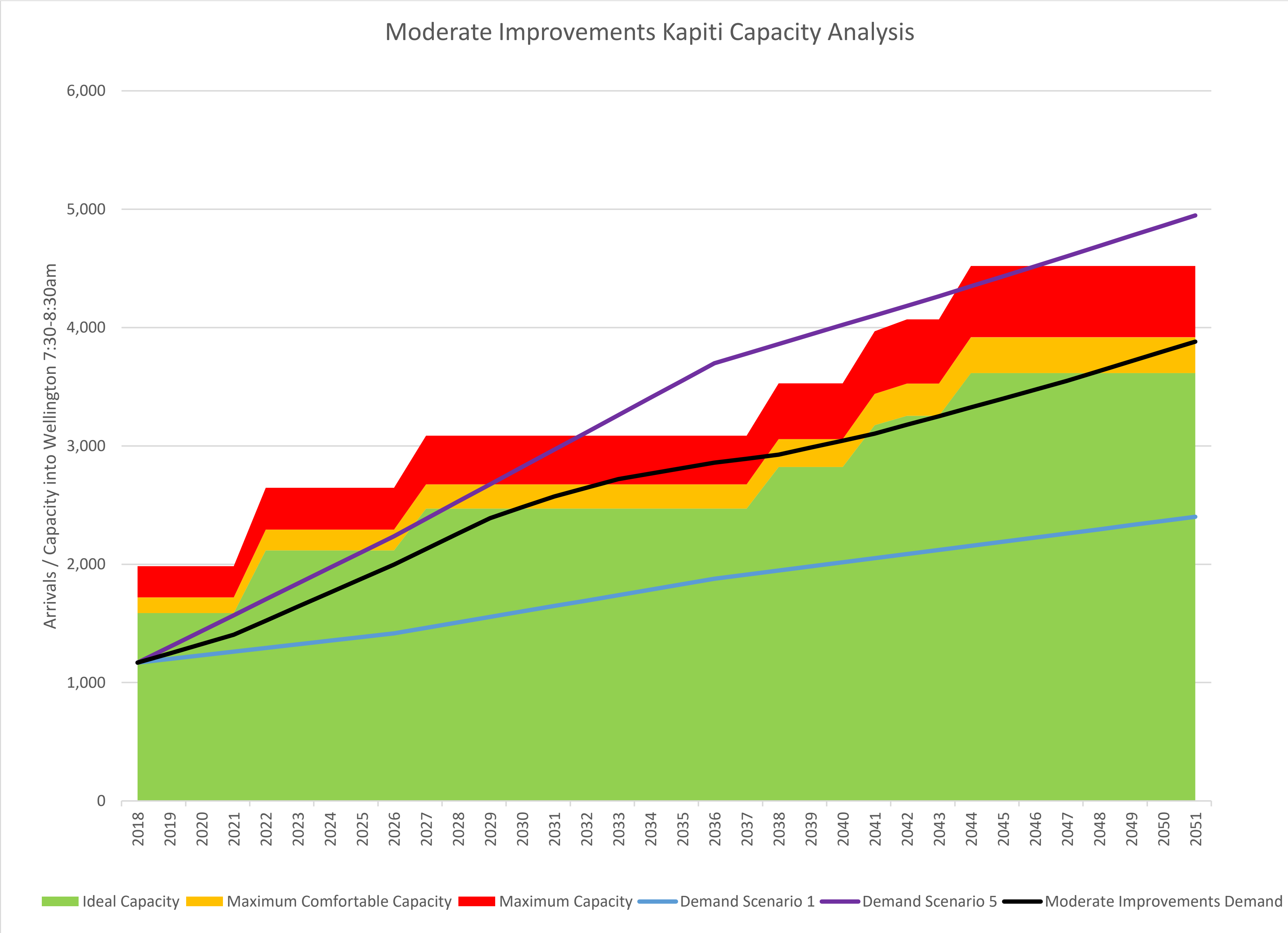

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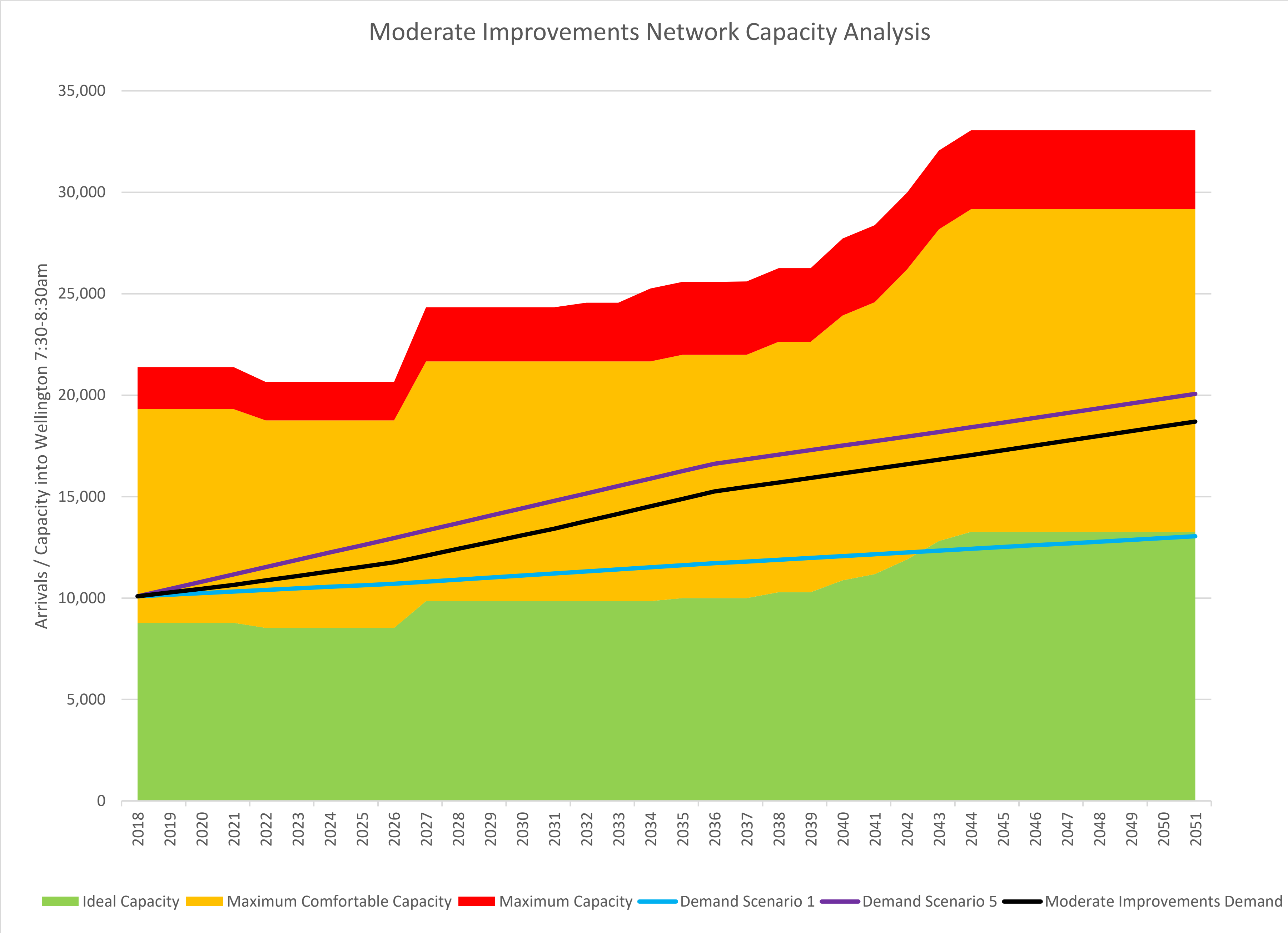

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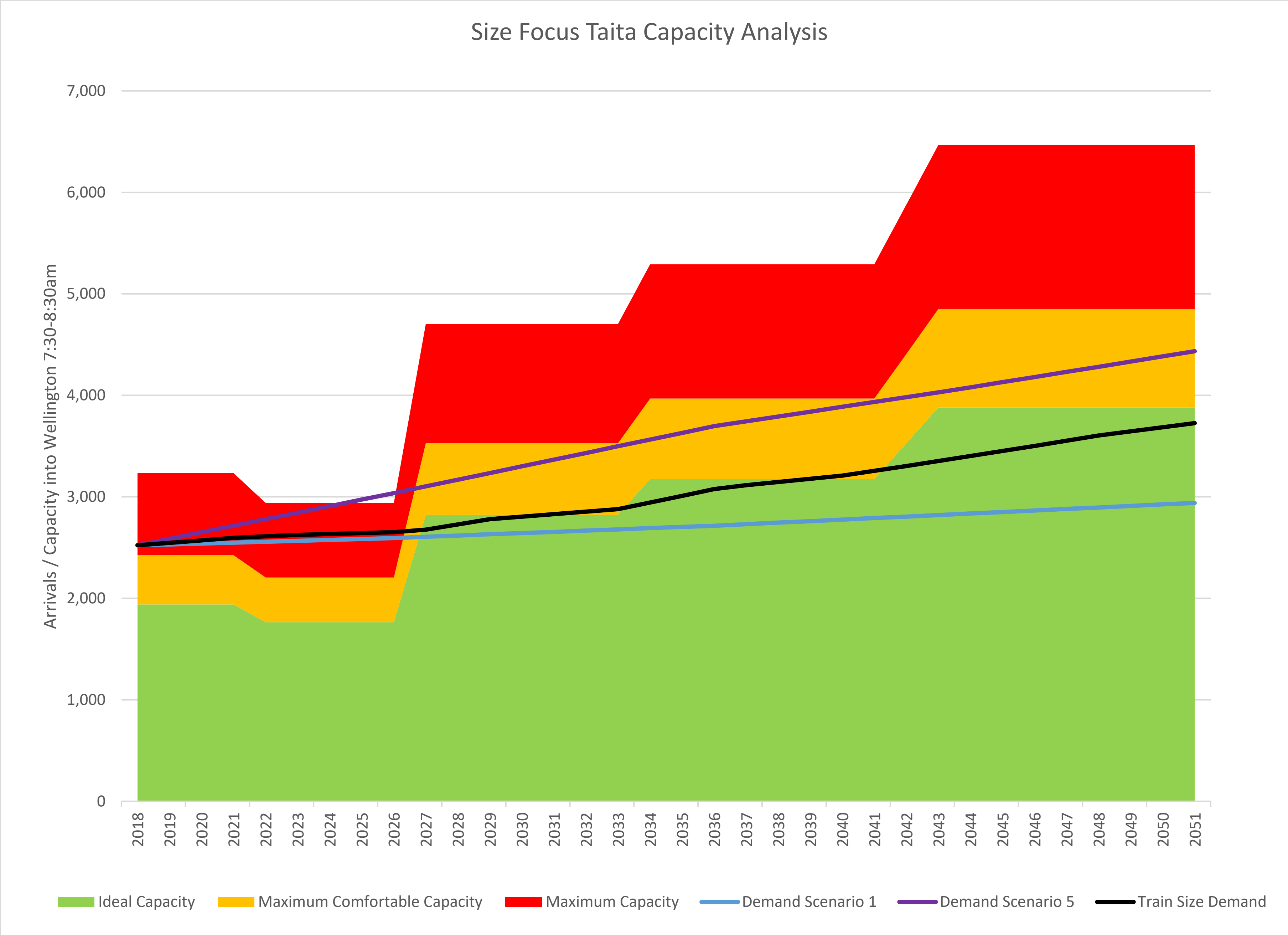
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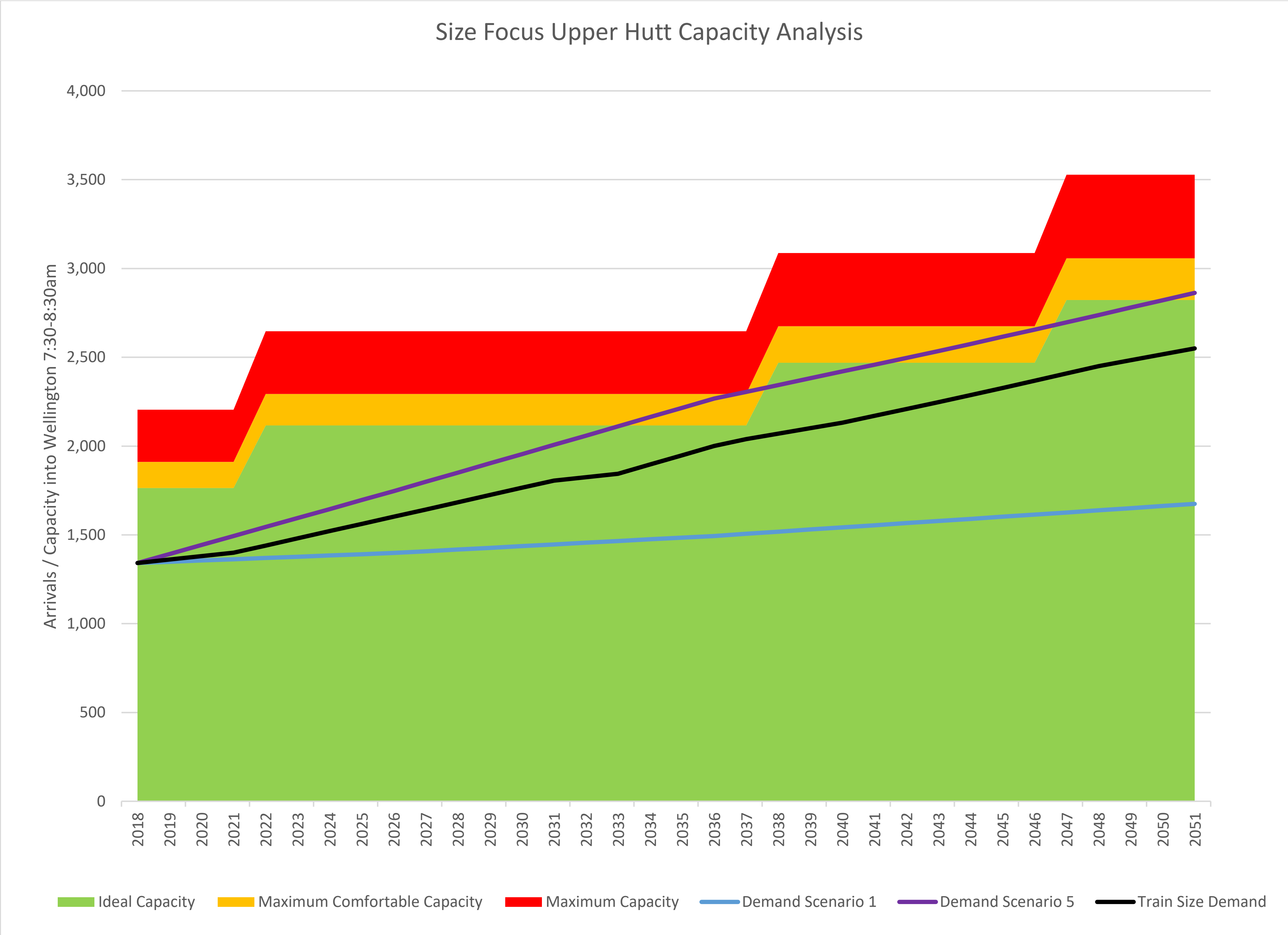

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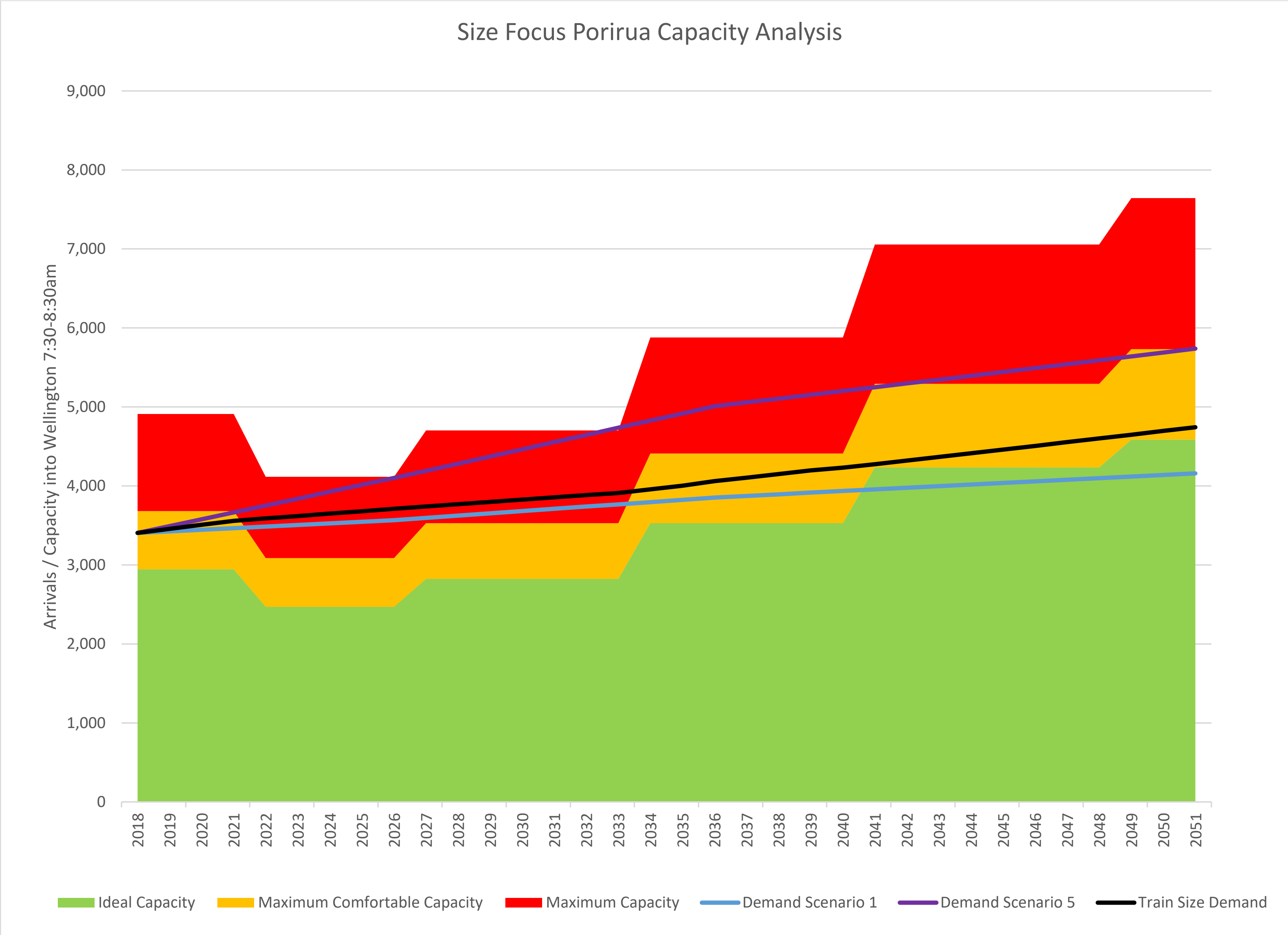

Size Focus Porirua Capacity Analysis
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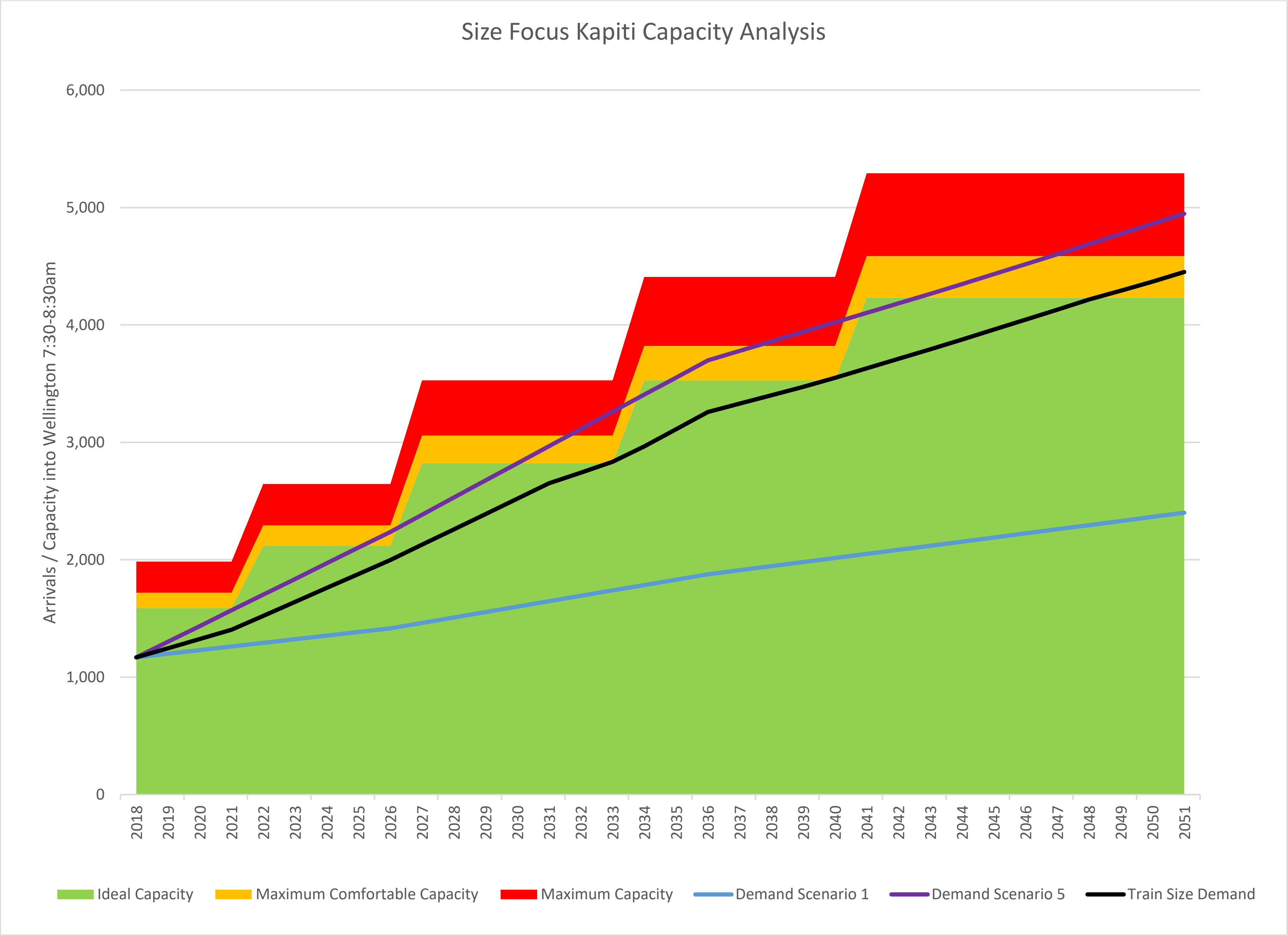
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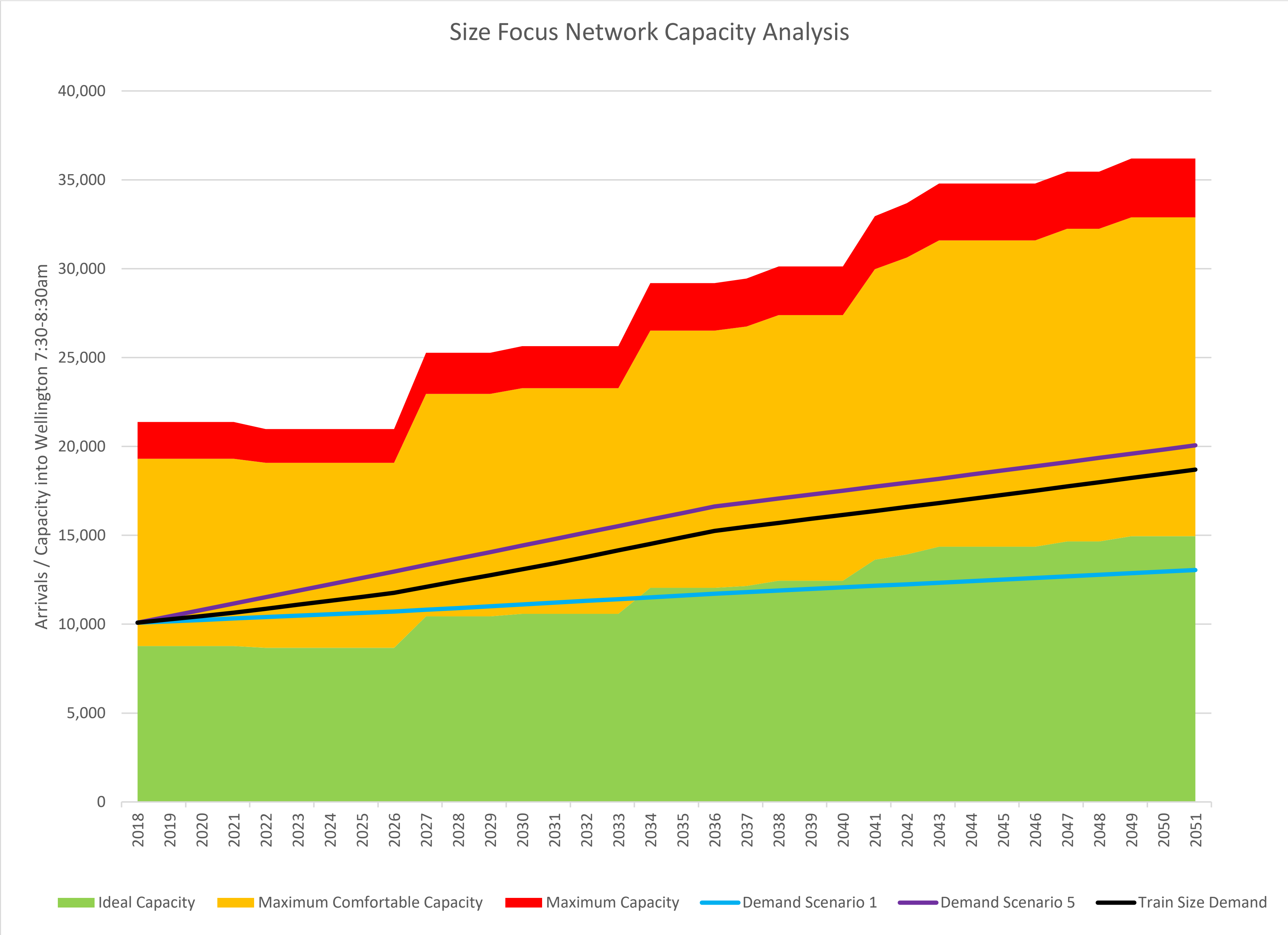

Size Focus Network Capacity Analysis
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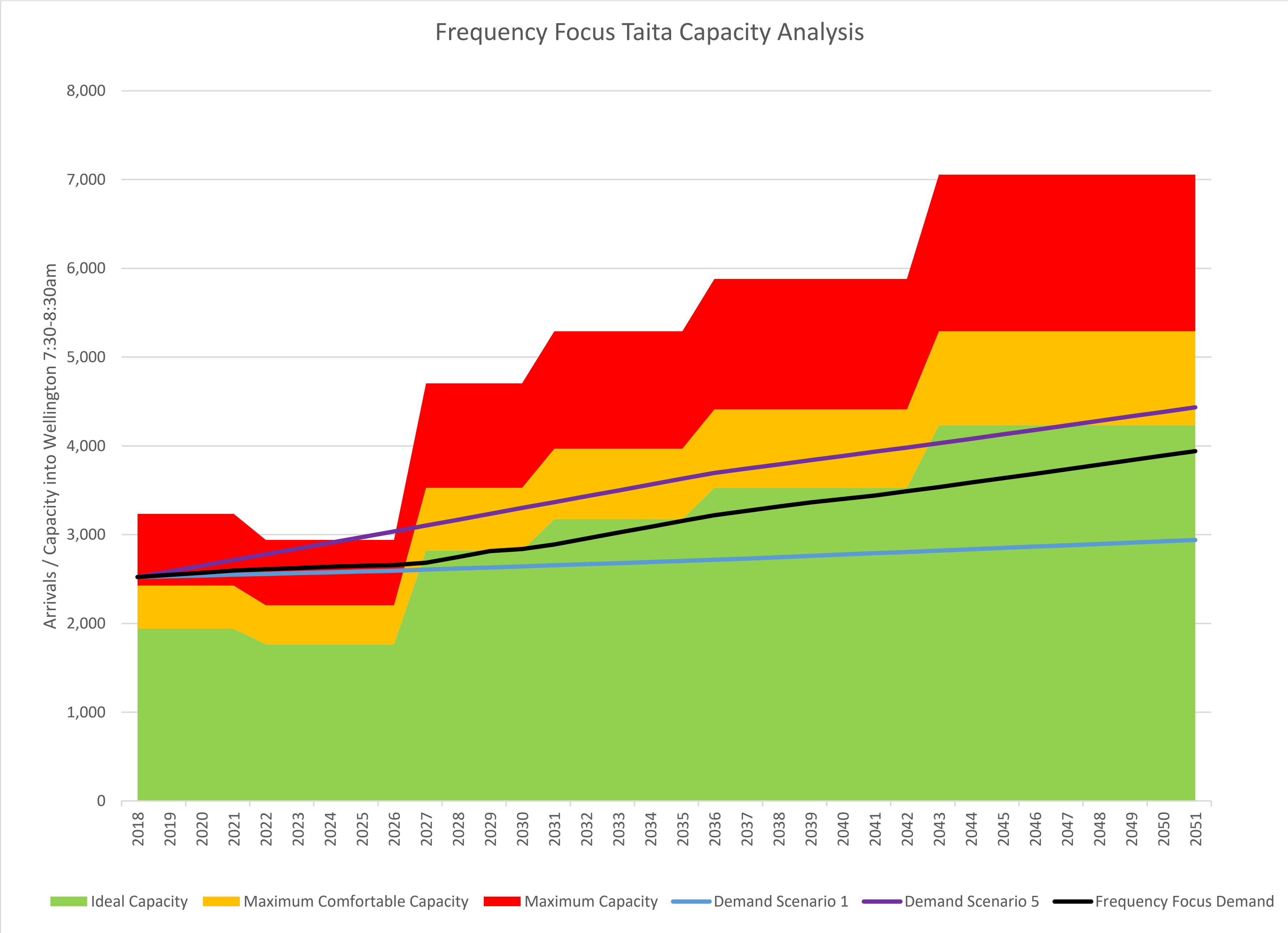
Train Size Demand


Frequency Focus Taita Capacity Analysis
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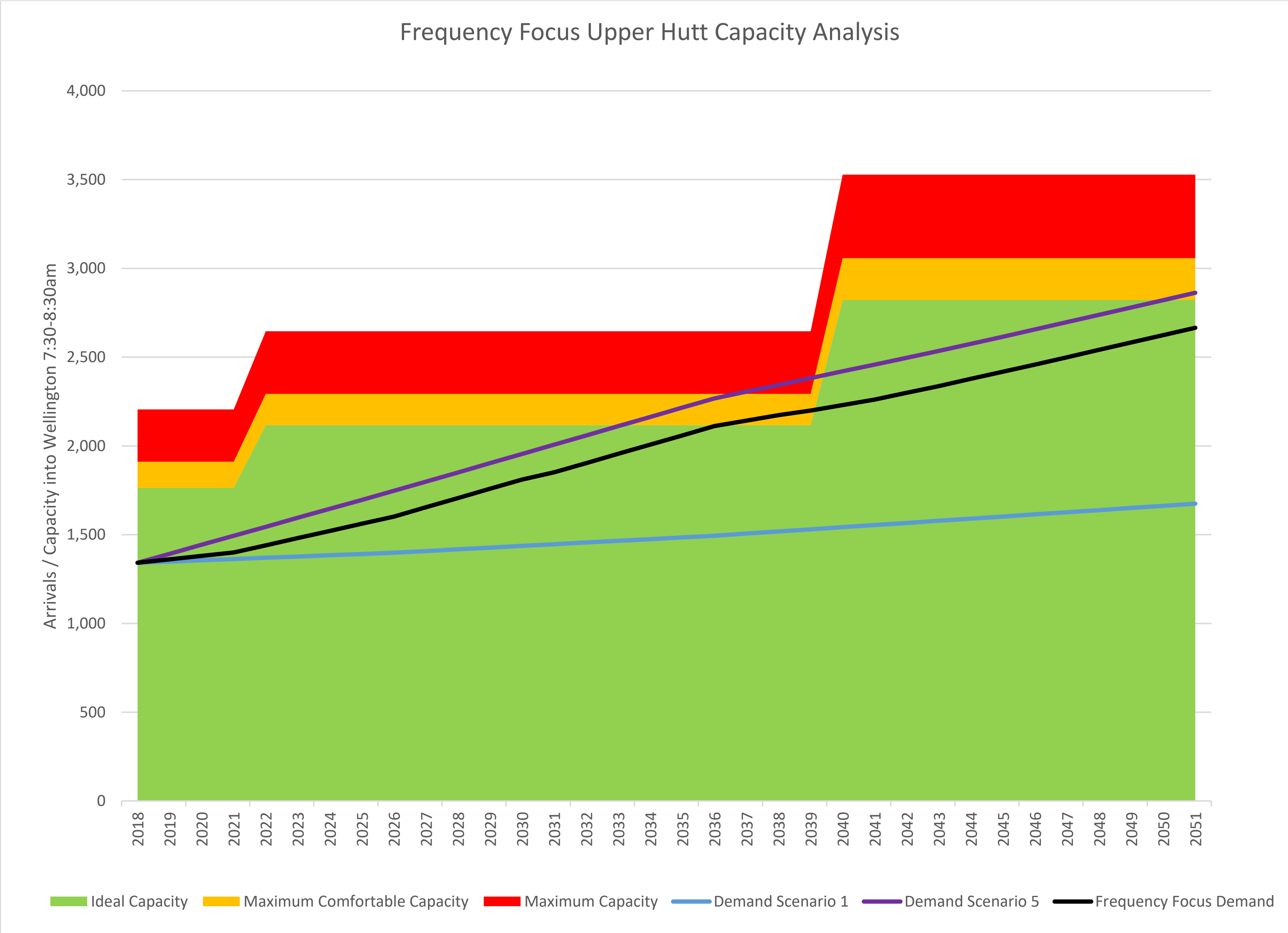

Frequency Focus Upper Hutt Capacity Analysis
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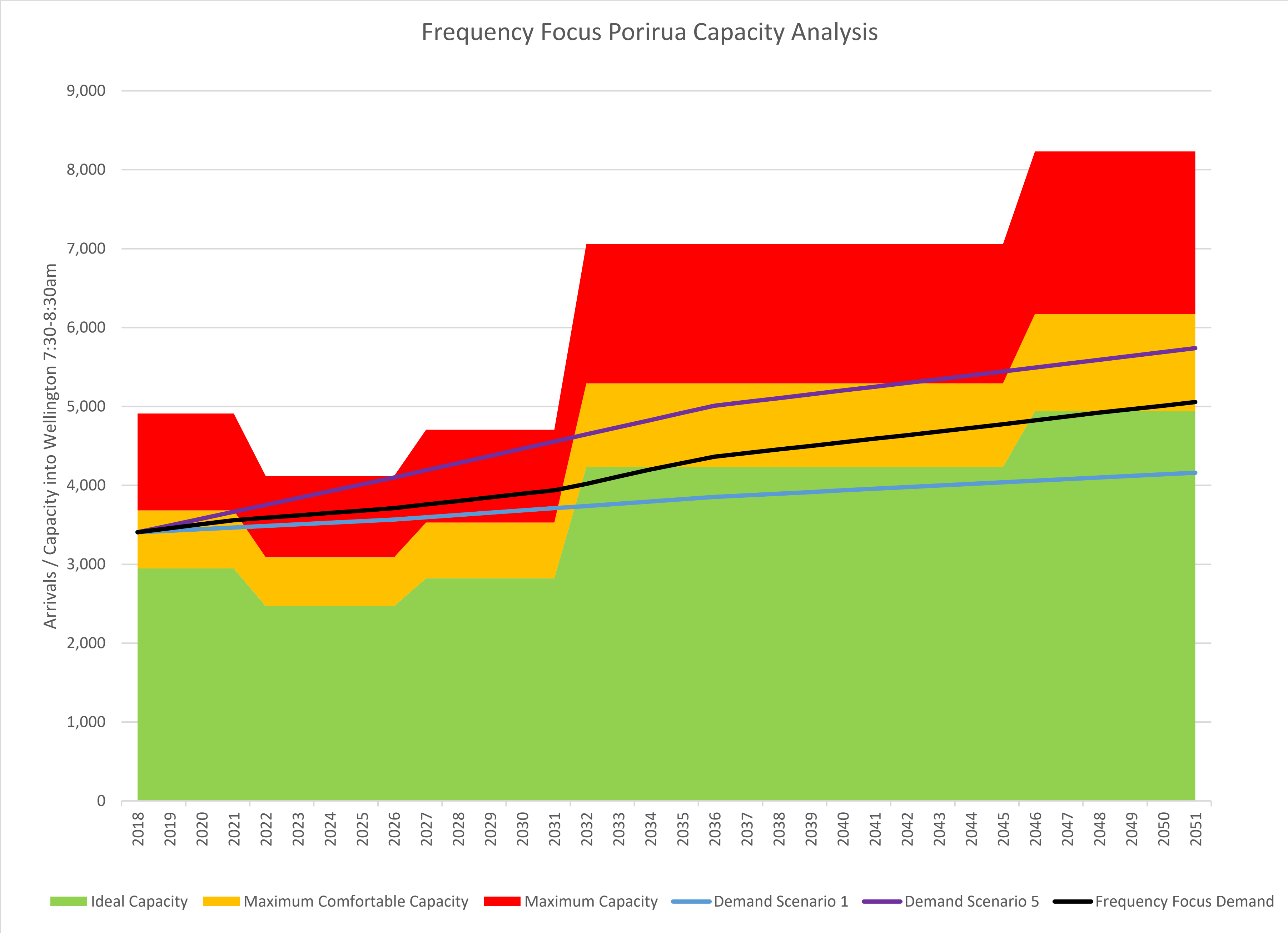

Frequency Focus Porirua Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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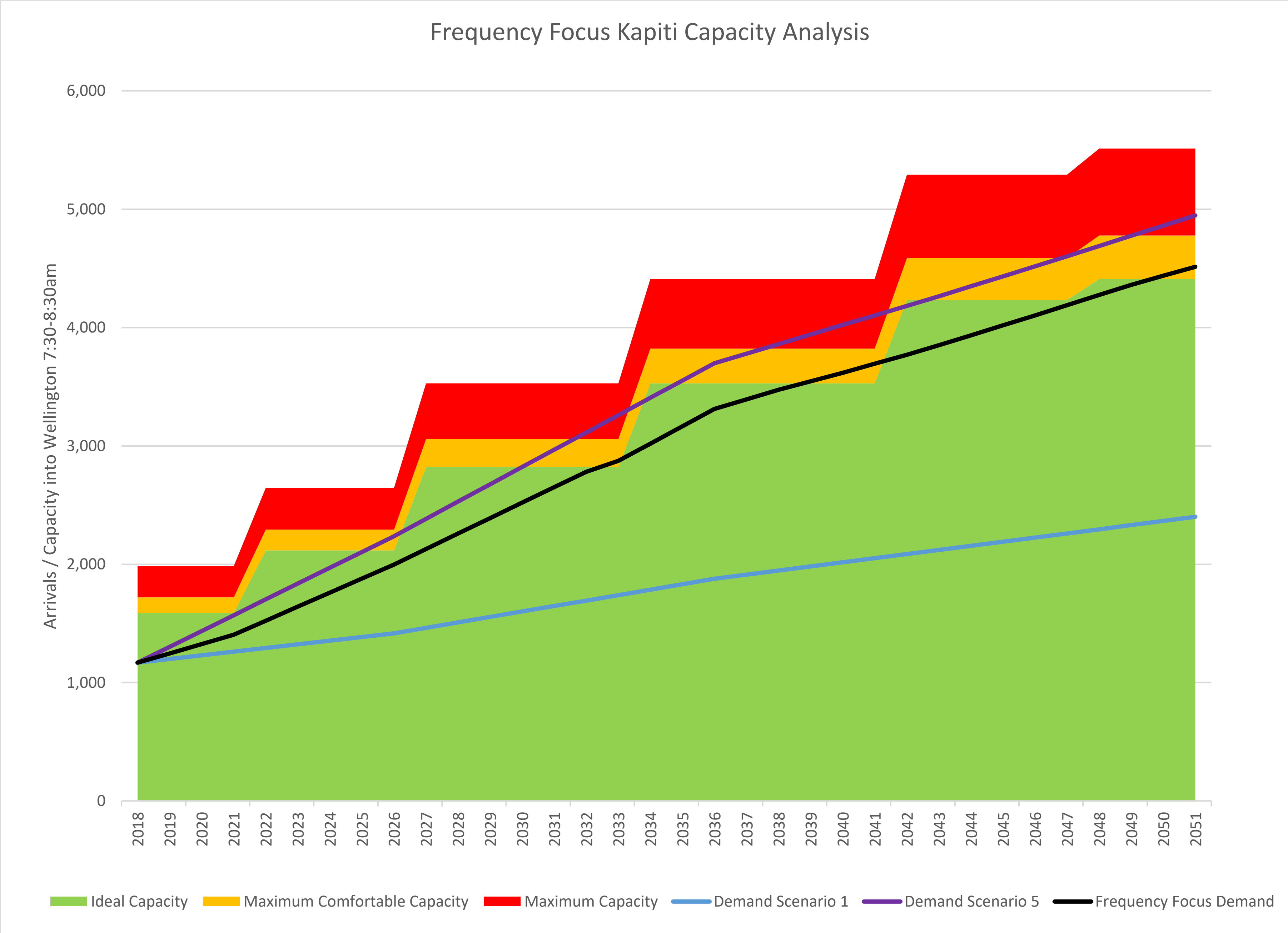

Frequency Focus Kapiti Capacity Analysis
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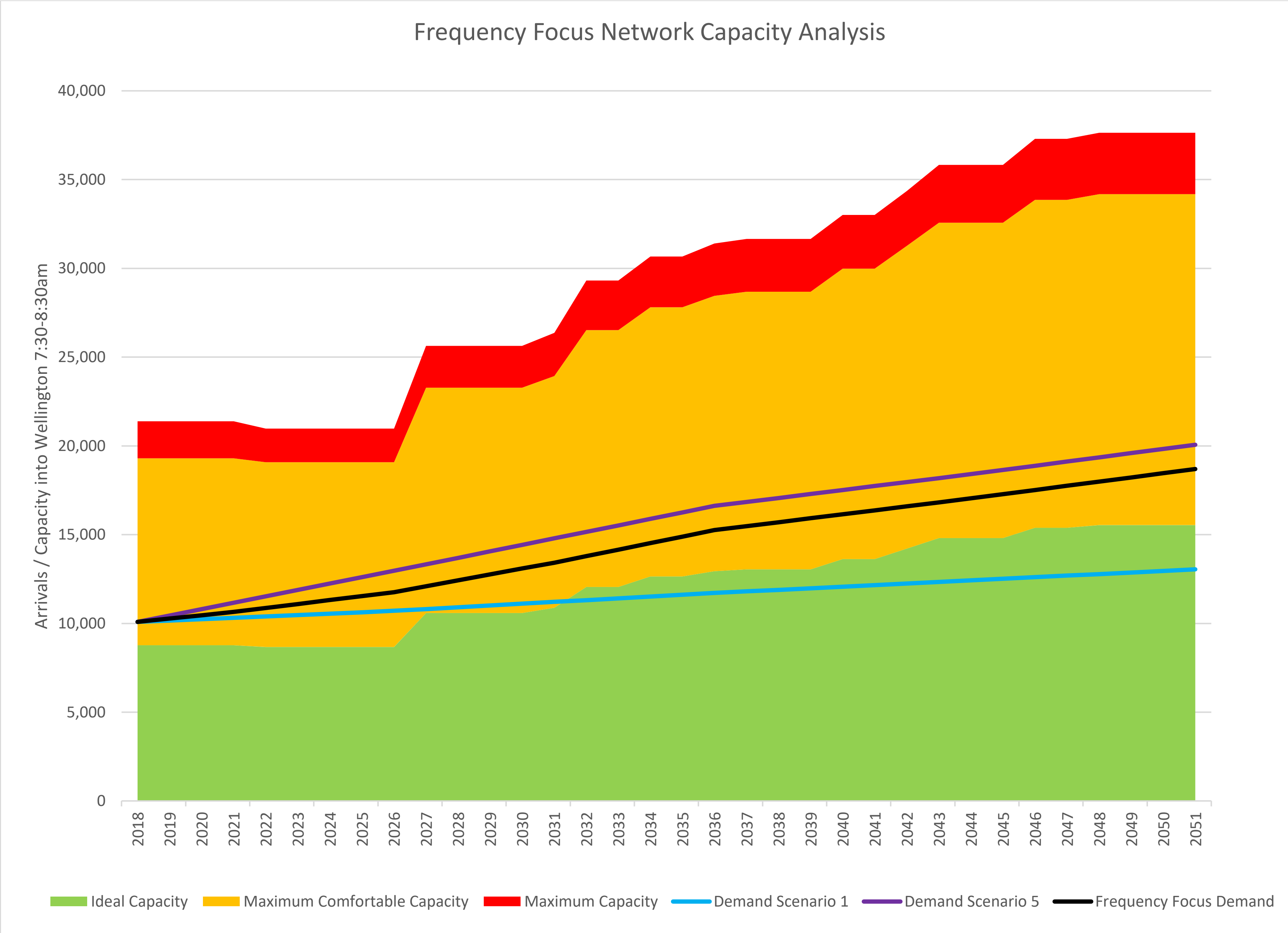
Frequency Focus Demand


Frequency Focus Network Capacity Analysis
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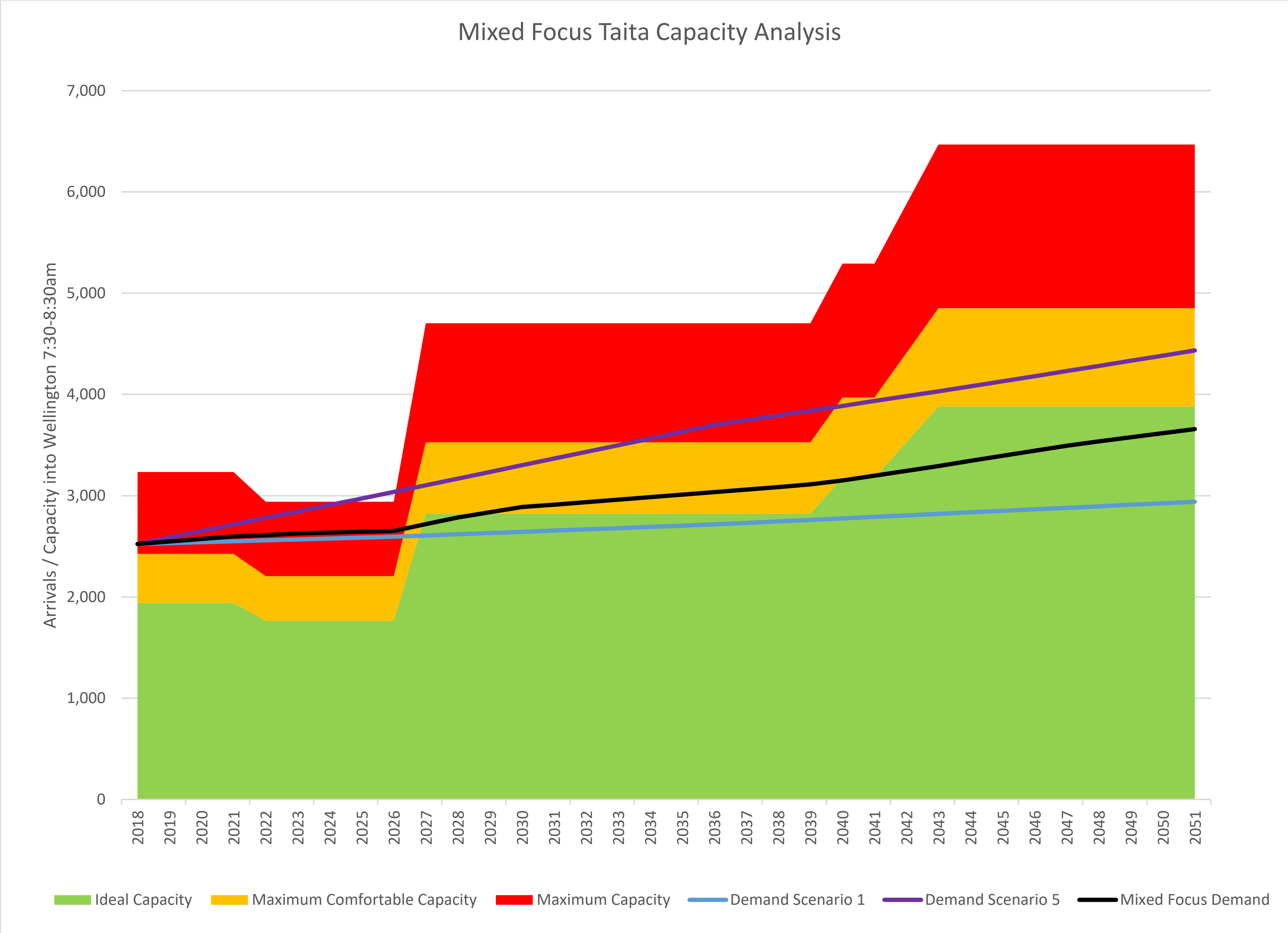
Frequency Focus Demand


Mixed Focus Taita Capacity Analysis
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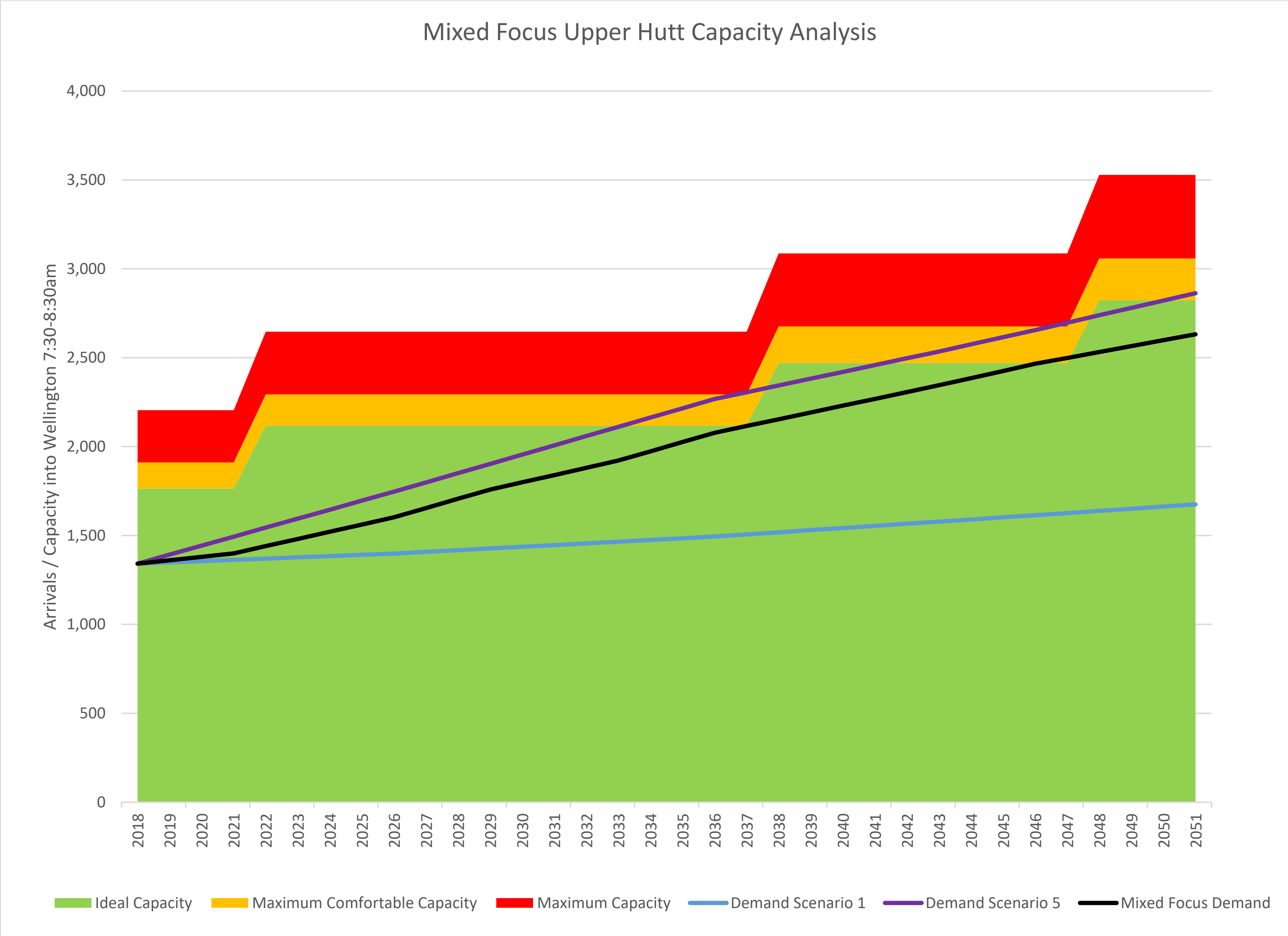
Mixed Focus Demand



Mixed Focus Upper Hutt Capacity Analysis
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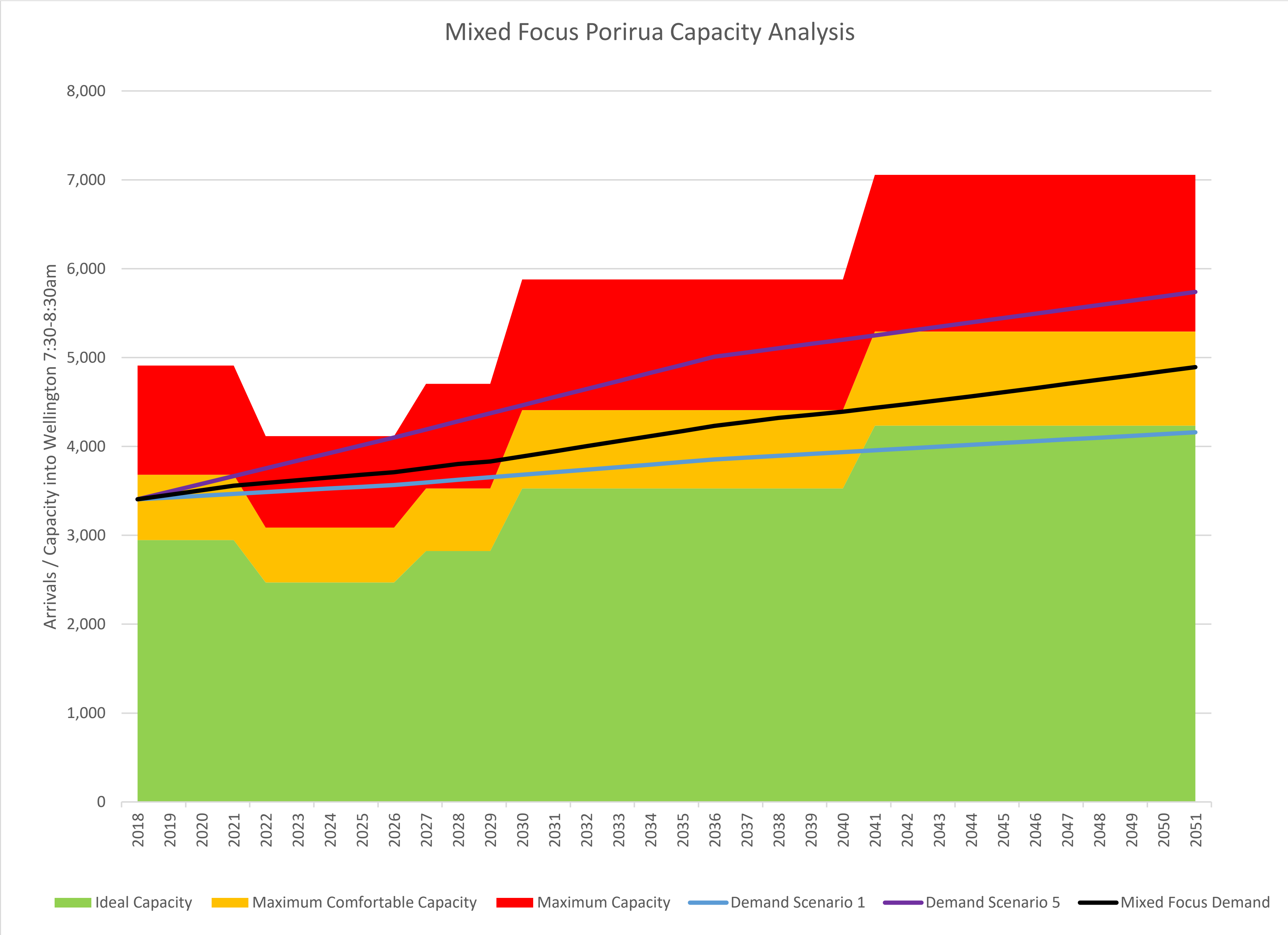
Mixed Focus Demand



Mixed Focus Porirua Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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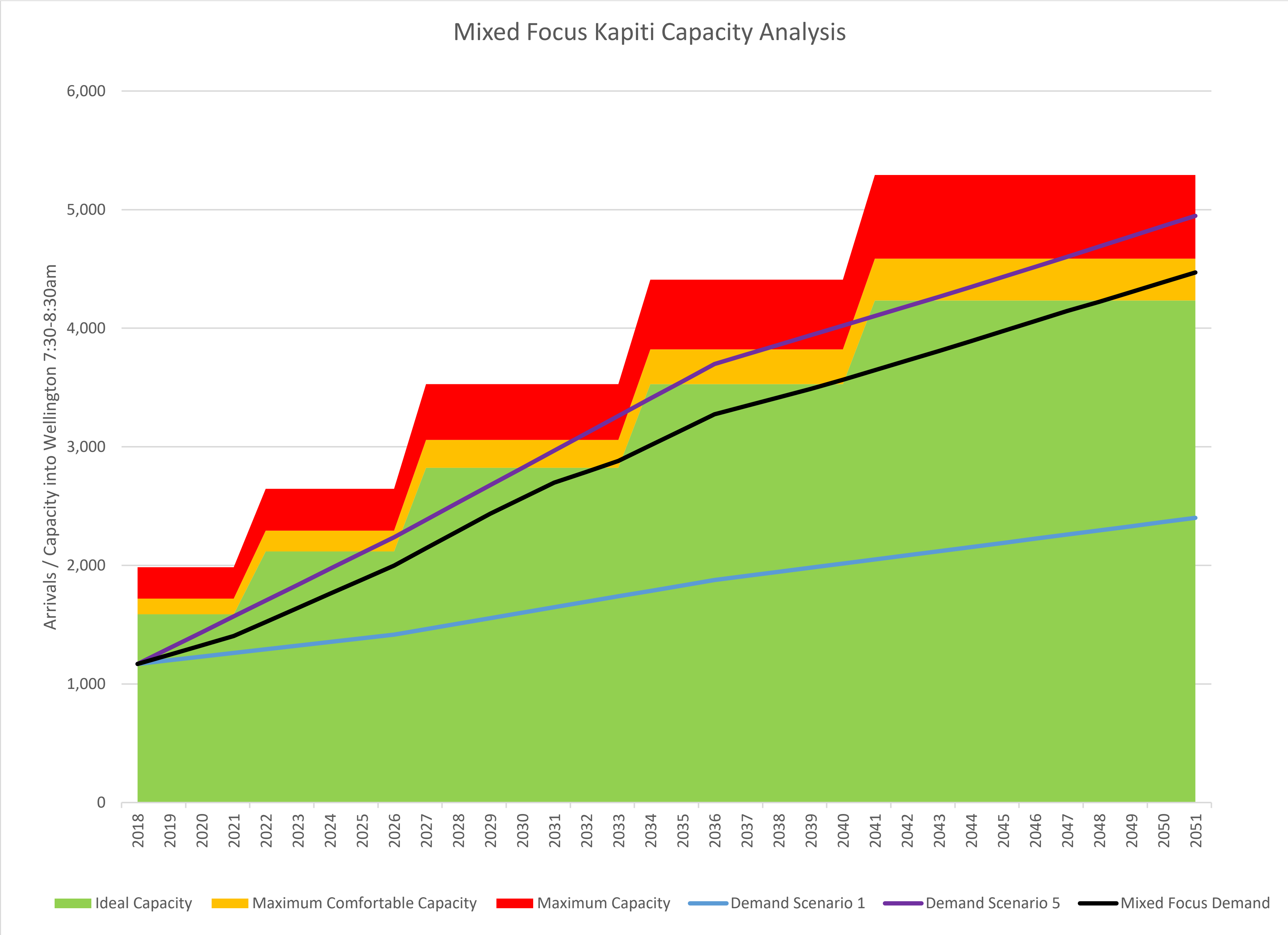
Mixed Focus Demand



Mixed Focus Kapiti Capacity Analysis
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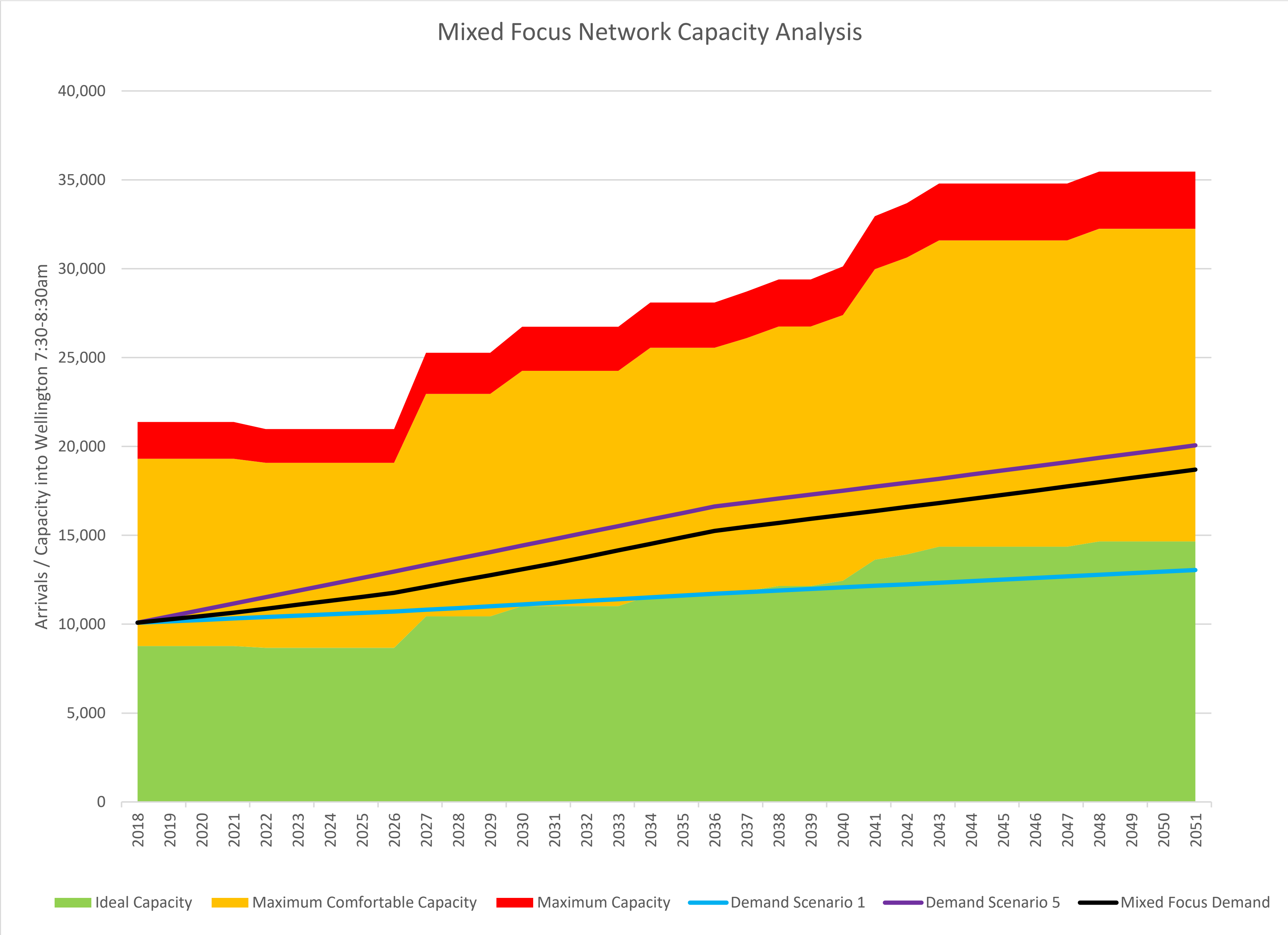
Demand Scenario 1
Demand Scenario 5
Mixed Focus Demand



Mixed Focus Network Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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Demand Scenario 1
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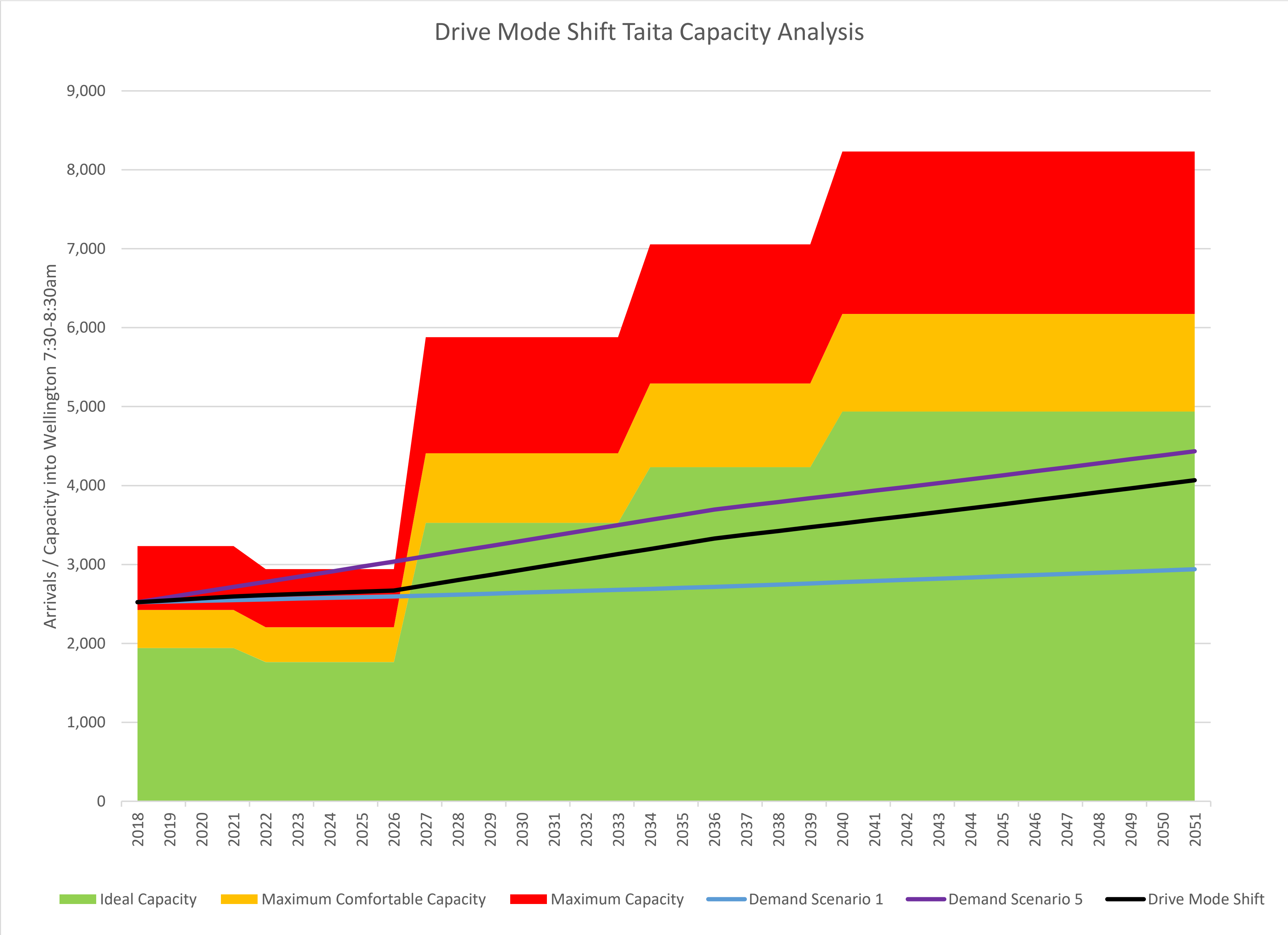
Mixed Focus Demand



Drive Mode Shift Taita Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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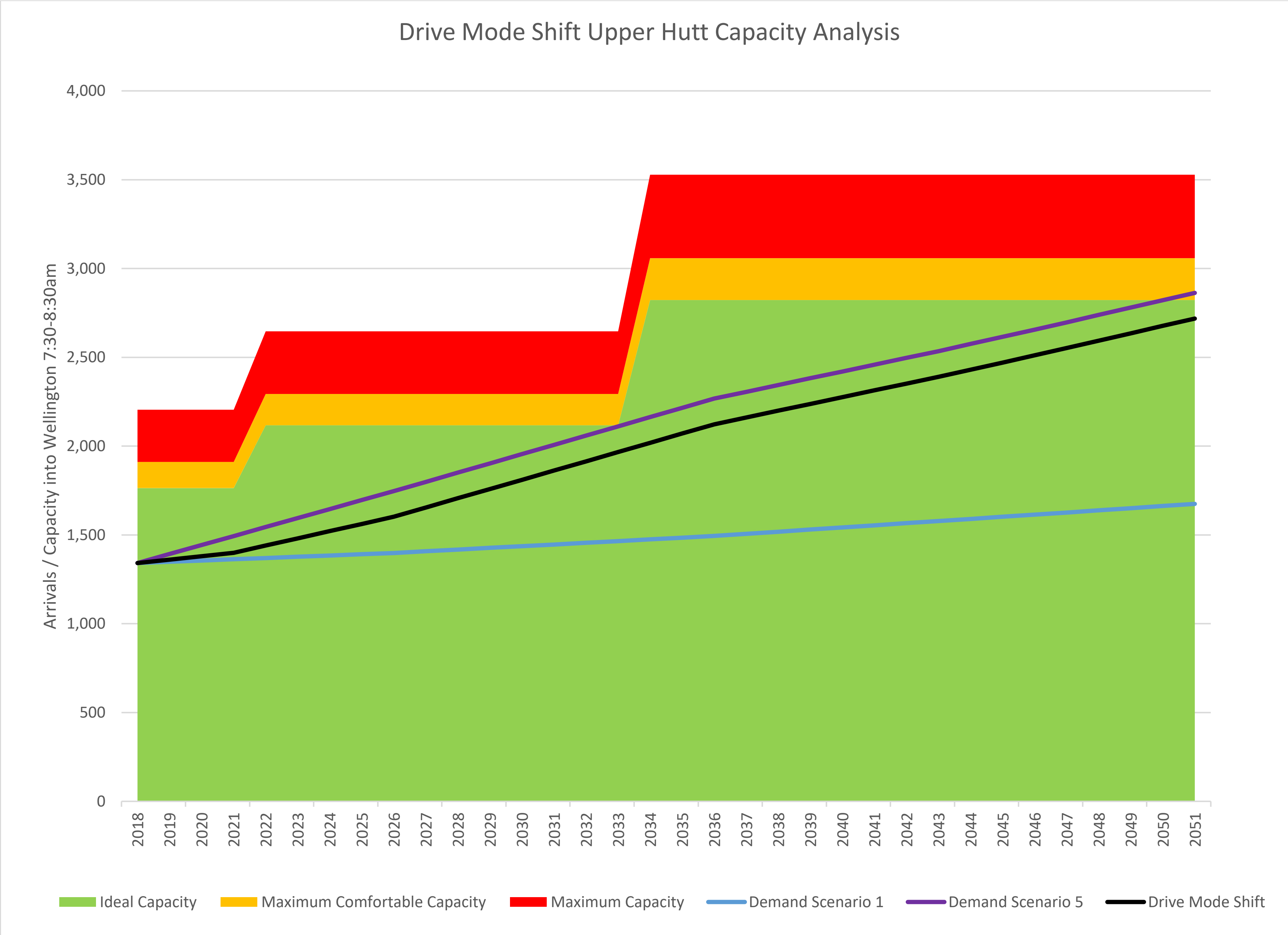
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Drive Mode Shift


Drive Mode Shift Upper Hutt Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Maximum Capacity
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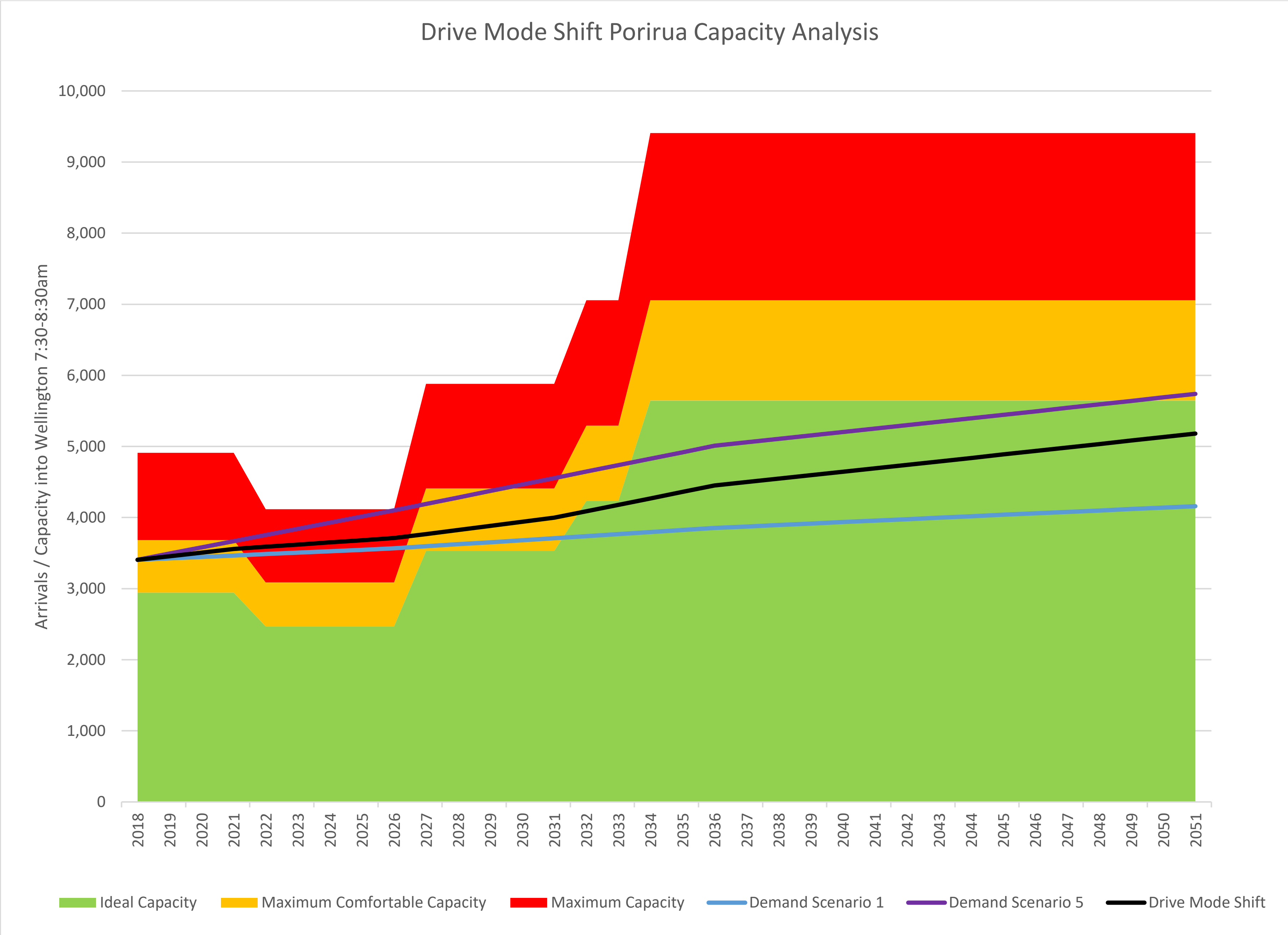
Demand Scenario 5
Drive Mode Shift


Drive Mode Shift Porirua Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Demand Scenario 1
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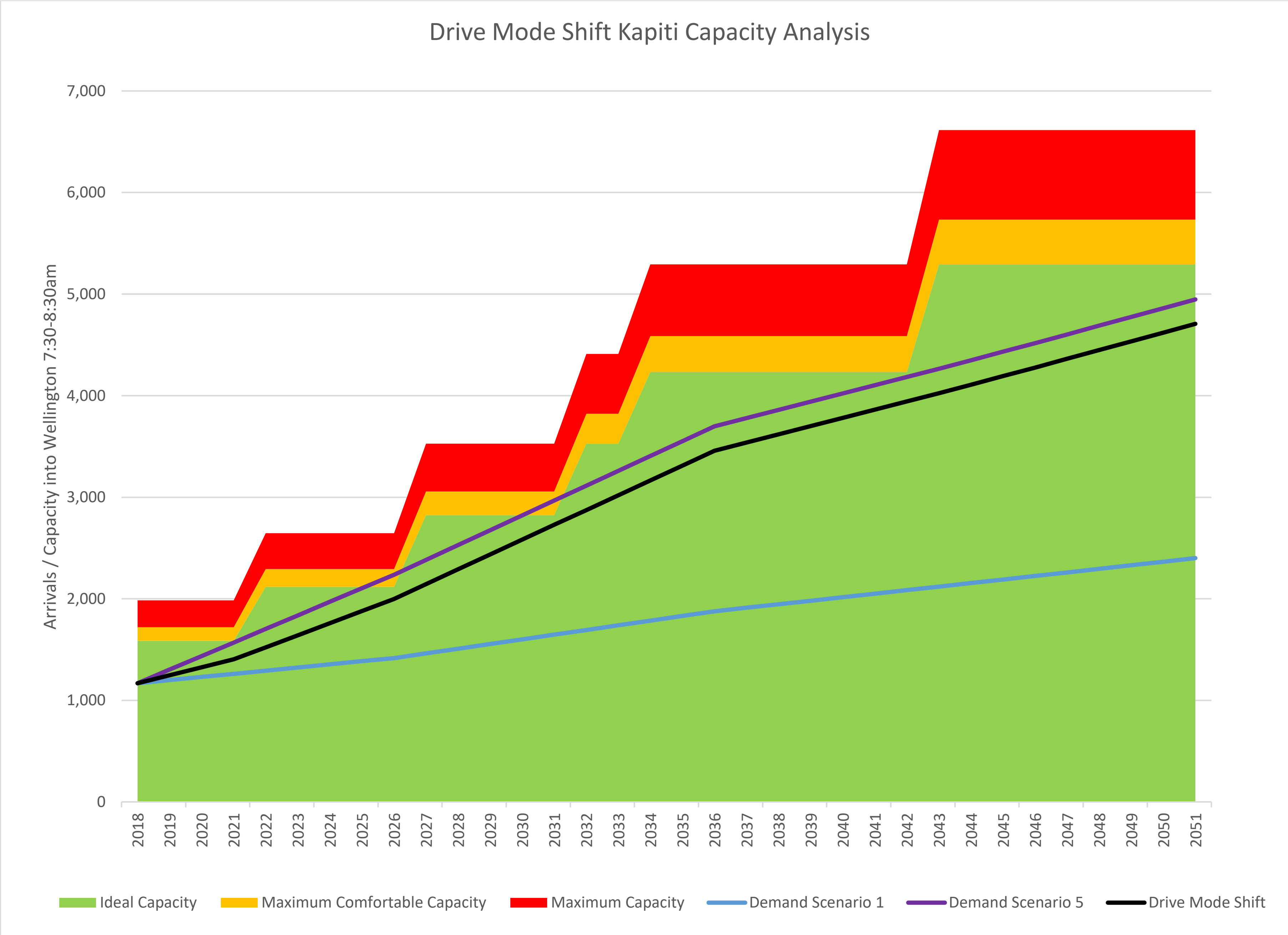
Drive Mode Shift



Drive Mode Shift Kapiti Capacity Analysis
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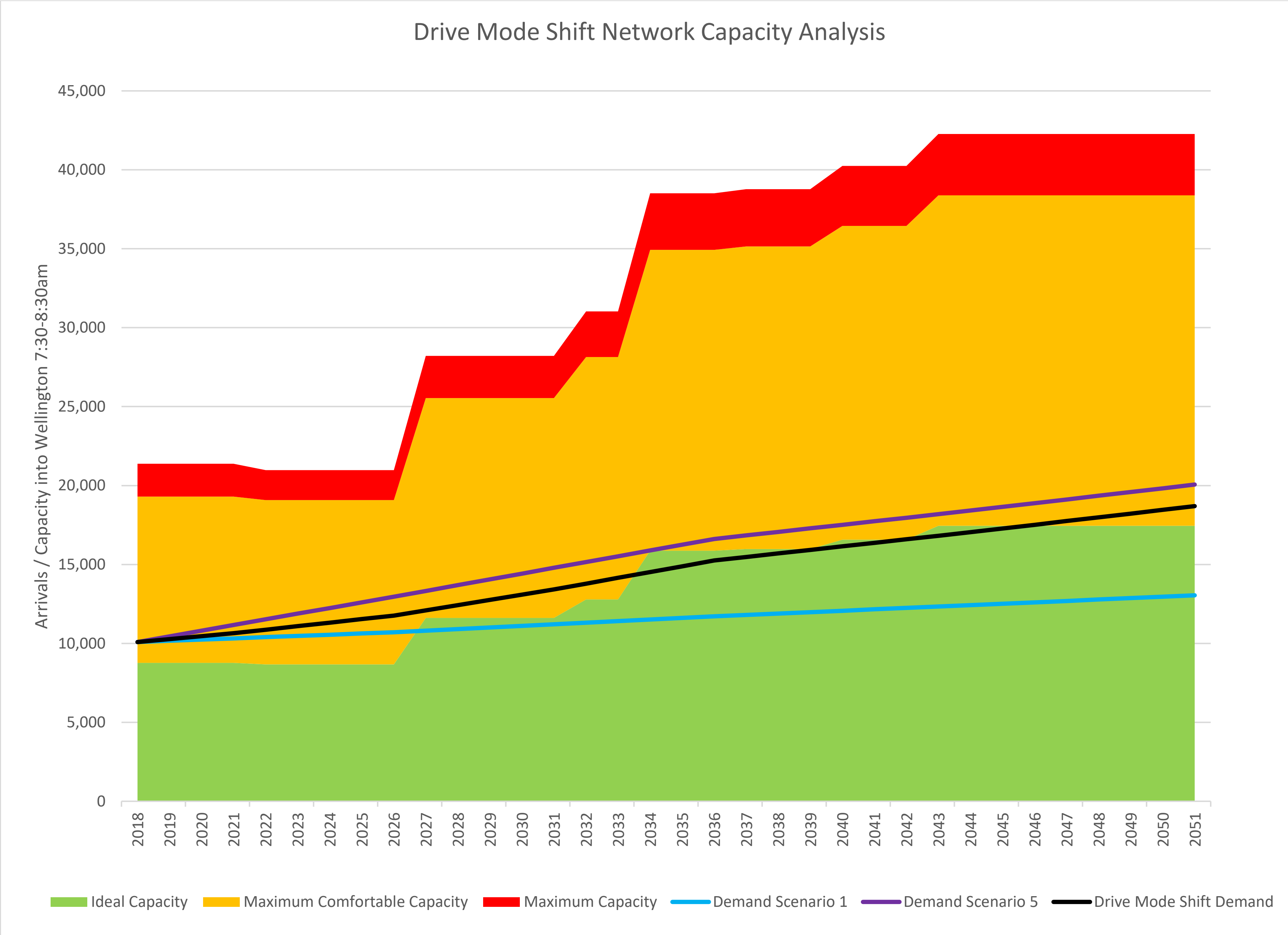
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Drive Mode Shift


Drive Mode Shift Network Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Drive Mode Shift Demand

Appendix B Do-Minimum Overview Memo

REGIONAL RAIL PLAN – Do-Min Definition

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
0.1	29/7/20	Internal team draft	SR	DW	DW	DW
0.2	11/9/20	Draft for comment	SR	DW	DW	DW
1.0	17/09/20	Update based on client comment	SR	DW	DW	DW
2.0	29/09/20	Updated draft for wider circulation	SR	DW	DW	DW

1 Introduction

1.1 Purpose

Greater Wellington Regional Council (GWRC) is updating the Wellington Regional Rail Plan (RRP) using the Programme Business Case (PBC) methdology. This is to set out the direction for investment in the rail network over the next 30 years to 2050.

The PBC is following the Waka Kotahi NZ Transport Agency (Waka Kotahi) process and is being developed in conjunction with key partners and stakeholders. As part of the Waka Kotahi PBC process, the do-minimum is the base option to which other projects are compared against.

1.2 Definitions

Following the Investment Decision Making Framework (IDMF) review, Waka Kotahi's glossary for business case terms lists has the following as the definition of the do-minimum[1]:

> *In developing business cases, the do-minimum option should represent the minimum level of expenditure required to maintain a minimum level of service, not the minimum level of investment required to achieve the investment objectives. For example, the most likely transport situation over the course of the appraisal period if no further intervention were to occur.*
>
> *In theory, every option should be compared with the option of doing nothing at all, that is, the do-nothing option; however, for many transport activities it is not practical to do nothing at all.*
>
> *It is important not to overstate the scope of the do-minimum option, that is, it should only include activities that are absolutely essential to preserve a minimum level of service. Where network interdependencies exist, the do-minimum option should take into account other activities elsewhere on the network where these other activities have a commitment to funding, and where they affect the demands and level of service at the location of interest.*
>
> *The minimum level of investment to achieve the investment objectives is explored through the use of further options, in addition to the do-minimum. The do-minimum option is used as a baseline for comparing marginal costs and benefits of alternative activities. It provides the benchmark for determining the relative marginal value for money added by the other options under consideration.*

There is no definition for 'minimum level of service'. The do-minimum must be the cheapest option when excluding the do-nothing.

A meeting with Waka Kotahi was held on 5 August 2020 to understand what should be targeted in the do-minimum. Waka Kotahi confirmed that the do-minimum may include capital expenditure and that the do-minimum must be a credible and practicable alternative to the options. It was confirmed that the do-minimum does not need to be able to achieve the investment objectives.

The new guidance in closer in scope to the NZ Treasury guidance than the previous Waka Kotahi definitions. The current Treasury definition, as sourced from the PBC template/guidance document[2], is as follows:

> *The long-list must also include a realistic 'do minimum' option based on the core functionality and essential requirements for the programme.*
>
> *The 'do minimum' scope must be a realistic option that meets the 'core' scope and essential business needs of the programme.*

This definition and the new Waka Kotahi definition are in close agreement and is used as the basis for determining the do minimum.

1.3 The do-nothing

The do-nothing for this case would constitute the completion of committed projects and the implementation of crown funded business cases as well as continuing 'business as usual' maintenance. This would deliver no service or other improvements to either freight or passenger rail.

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[1] https://www.Waka Kotahi.govt.nz/planning-and-investment/learning-and-resources/business-case-approach-guidance/supporting-material/glossary/

[2] https://treasury.govt.nz/sites/default/files/2019-11/BBC-Programme-business-case-template-and-guidance-October-2019.doc

The do-nothing was agreed to be the finishing of committed capital works projects and the continuation of operations in accordance with the appropriate network management plan.

1.4 Outcome sought

The outcome sought is agreement on the minimum acceptable level of service required to be provided by the do-minimum option for the development of the RRP.

2 The Minimum Level of Service

2.1 General principals of the do-minimum

Following the meeting with Waka Kotahi on 5 August 2020, the following general principals have been agreed:

- growth in rail patronage is to be expected and planned for in the do-minimum;
- capital expenditure is expected but must be minimised;
- the do-minimum will have negative impacts on the roading network; and
- the do-minimum must be a credible and realistic alternative.

Any capital expenditure in the do-minimum will be closely scrutinised during assessment and must be appropriately justified.

This signals that investment in new rolling stock etc to cater for growing demand at a reasonable level is allowable under the do-minimum. Replacement of existing rail stock due to end of life concerns is valid under the do-minimum.

2.2 The rail network

2.2.1 Overview

The Wellington Metro Rail Network (WMRN) serves both passenger and freight demands within the Wellington Region. While the great majority of trains on the network are Metlink public transport services, the WMRN also carries long-distance passenger services, and freight services from both the Wairarapa line and the North Island Main Trunk (NIMT) line to Centreport and the associated ferry/shipping services.

2.2.2 Core functionality and essential services

The Treasury definition notes the do-minimum must meet the core functionality and essential services of programme. The implications of this are explored below to inform the features of a minimum level of service.

Core functionality

The core functionality is explained in the vision statement of the rail plan, for the 2020 update this is a rail network that:

> *provides safe, customer focused and efficient rail passenger and freight services, and supporting infrastructure, to drive the region's economic development and social wellbeing in an environmentally and socially sustainable and resilient manner.*

This is similar to the 2010 (revised 2013) vision statement which is:

> *To deliver a modern, reliable and accessible rail system that competitively moves people and freight in an economic, environmental, integrated and socially sustainable way.*

While there are subtle differences between the statements it is clear that a core functionality of the rail network is to deliver a rail network that delivers both passenger and rail services. That is the rail network must cater for freight and provide an alternative to road during peak periods.

Essential services

Services that would prevent the core functionality of being achieved if they were not delivered are deemed essential services. This includes but is not limited to end of life replacements and maintenance to that ensure core functionality is delivered, but exclude improvements outside of those required to deliver core functionality.

2.3 Features of a minimum level of service

For the purpose of defining the minimum acceptable level of service, the following things have been considered:

1. Provision of rail services
2. Passenger level of service
3. Freight level of service
4. Safety provision of rail services
5. Reliability of rail services
6. Asset condition.

With these in mind, this document focuses on three points, the passenger level of service, the freight level of service and safety level of service.

The provision of rail services is a given, since the wider transport network has been developed on the basis that the rail network provides a passenger (primarily commuter) and freight task. Passenger and freight services will therefore be maintained to avoid significant negative impacts on the transport network. Furthermore, allowing the rail network to degrade to the point where rail services cannot be offered would be contrary to the objectives of the:

- Government Policy Statement on Land Transport (2018-28);
- Draft Government Policy Statement on Land Transport (2021-31);
- National Land Transport Plan (2018-21) (currently being updated);
- Wellington Regional Land Transport Plan – mid term review 2018 (currently being updated);
- Wellington Regional Public Transport Plan 2014 (currently being updated);
- Draft New Zealand Rail Plan; and
- Wellington Regional Rail Plan (2013 revision).

Reliability of rail services has been excluded from having metrics with respect to the minimum level of service. While this may seem counter-productive, the metrics chosen for the do-minimum passenger level of service and the asset condition level of service will ensure that a base level of reliability will be met.

2.4 Passenger level of service

The minimum passenger level of service for public transport services has been defined be evaluating the following:

1. Frequency
2. Capacity
3. Journey time
4. Ability to meet growth.

Of these metrics, while there shall be a minimum standard set for the frequency and journey time, the driver to meet the minimum level of service will likely be governed by the capacity and ability to meet growth.

2.4.1 Frequency

For the purposes of defining the minimum acceptable frequency, it has been assumed that the planned ‘RS1’ timetable improvements enabled by the currently underway works will be implemented and maintained for the duration of the plan. No further improvements are proposed as part of the minimum acceptable level of service.

The planned timetable improvements are outlined in the 2014 Regional Public Transport Plan (RPTP) and have been endorsed by Waka Kotahi. The proposed frequencies (inclusive of all stoppers and express services) are shown in Table 2-1.

Table 2-1: Future Rail Scenarios (Source: Unit 16: Future Rail Services, RPTP 2014)

Line	Number of trains per hours between these stations and Wellington	Weekday				Weekend		(approximate)
		Morning Peak Hour	Daytime	Afternoon peak hour	Evening	Daytime	Evening	
HVL	Upper Hutt	4	2	4	2/1	2	1	Mon-Thurs 18 hours Fri-Sat 21 hours Sun 17 hours
HVL	Taita	9	2	9	2/1	2	1	
JVL	Johnsonville	4	2	4	2/1	2	1	Mon-Thurs 17 hours Fri-Sat 19 hours Sun 17 hours
KPL	Waikanae	3	2	3	2/1	2	1	Mon-Thurs 18 hours Fri-Sat 21 hours Sun 17 hours
KPL	Plimmerton	7	2	7	2/1	2	1	
KPL	Porirua	8	2	8	2/1	2	1	
MEL	Melling	3	1	3	n/a	n/a	n/a	Mon-Fri 12hours
WRL	Masterton	3 peak trips	2 off peak trips	3 peak trips	1 Friday only	2 trips	n/a	Mon-Thurs 10 hours Fri 14 hours Sat-Sun 9 hours

The RPTP frequencies differ slightly from the 2013 RRP, which are shown in Figure 2-1.

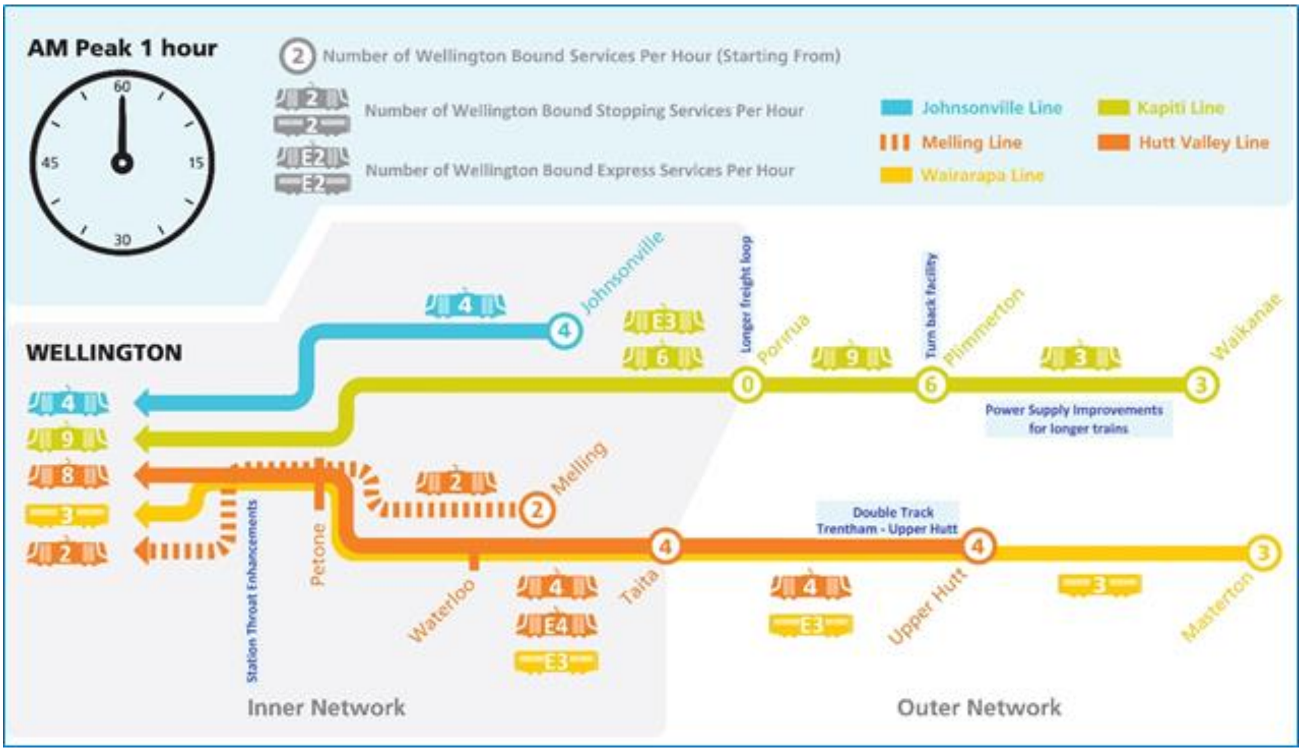

Figure 2-1: RRP RS1 peak hour (source: Figure 12, RRP 2013 revision)

There are no further guaranteed changes to the frequency of passenger services under the minimum level of service. This does not prevent additional services being run to meet other do-minimum requirements.

2.4.2 Capacity

It is expected that under the minimum acceptable level of service capacity would be the most noticeable change for users. Guidance from international examples on standing capacity on metro rail services has been sought.

Transport for London (TfL) and Transport for New South Wales (TfNSW) have published documents on expected people per square metre (ppm^2). Comparisons between the GWRC, TfL, and TfNSW standing capacity is outlined below.

TfNSW triggers investigations into providing additional capacity when there are on average 4 ppm^2. Despite this, services are not considered at capacity until there are 6 ppm^2. This also notes that passengers should not be required to stand for more than 20 minutes.

TfL considers a line at capacity when there are 4 ppm^2 but allows for 6 ppm2 to be used over multiple stations. TfL also notes that 'crush capacity' is the absolute maximum and considers this 7 ppm^2. No documents have been found for areas where capacity improvements should be investigated.

If the TfNSW guidance that people shouldn't stand for more than 20 minutes is adopted the capacity calculations become more difficult, however if this is extended to 30 minutes, then it identifies that at a high level, services from Upper Hutt, Kapiti and the Wairarapa should have no standing passengers, with standing passengers allowed on all other services (Johnsonville, Melling, Plimmerton and Taita onwards).

Auckland Transport has a policy aspiration that no one stands for greater than 15 minutes. This is not a requirement on the operator.

The FP/FT Matangi units have a maximum capacity of 377 people per 2-car set. This consists of 147 seated passengers and 230 standing passengers at 6 ppm^2. If the TfL capacity metric of 4 ppm^2 is adopted this reduces the total capacity to 300 people per 2-car unit. The 2013 RRP noted that a realistic capacity is 2.55 ppm^2 and that 2.55 ppm^2 does not cover the entire train (as passengers boarding do not distribute themselves through the entire train). This makes achieving an average density of 4 ppm^2 impractical in many cases. For this reason, an average density of 4 ppm^2 has only been applied to trains with shorter travel times.

Given the range of standing passenger capacities based on total travel time, the following ratio to seated passengers are proposed for the do-minimum and are shown in Table 2-2.

Table 2-2: Ratios of passengers to seats on services which is acceptable in the do-minimum

Capacity	Johnsonville, Melling, Plimmerton and Taita Services	Kapiti and Upper Hutt Services	Wairarapa and Capital Connection
Seated	1:1	1:1	1:1
Ideal	1.2:1	1.2:1	1.025:1
Maximum Comfortable	1.5:1	1.3:1	1.05:1
Maximum Loading	2:1	1.5:1	1.075:1

These ratios allow for different levels of crowding for each scenario based on travel times. Even services with greater than 30 minutes travel time allow for some standing passengers since some will travel to/from intermediate stations.

2.4.3 Journey time

Table 2-3 outlines the current timetabled travel times on key services for the morning peak.

Table 2-3: Timetabled travel times in the morning on various routes

Line	Stops	Current time (h:mm)
Hutt Valley	All	0:45
Hutt Valley	Upper Hutt Express	0:38
Hutt Valley	Taita	0:27
Johnsonville	All	0:26
Kapiti	All	1:00
Kapiti	Waikanae Express	0:57
Kapiti	Plimmerton	0:34
Kapiti	Porirua	0:24
Melling	All	0:20
Wairarapa	All	1:44

Under the minimum level of service, the scheduled travel times shall not be more than 10% longer than their current scheduled times. This does not enforce running a slower service, but simply provides a floor for the do-minimum scenario.

It is expected that journey time will be governed by providing a service of acceptable quality to customers.

2.4.4 Future growth

Following the meeting with Waka Kotahi on 5 August 2020 the do-minimum is to cater for the following growth scenario:

- maintain the long-term growth trend (Growth Scenario 3) until the ideal capacity is met;
- maintain Growth Scenario 2 (mid-way between Growth Scenario 1 and 3) until the maximum comfortable capacity is met;
- cater for population growth (Growth Scenario 1) until maximum loading is met; and
- add additional capacity at this point at lowest cost.

Under the proposed minimum level of service, growth shall be catered for at the current rail mode share measured by southbound travellers between 5:30 am and 9:00am between Ngauranga and Aotea Quay.

Two methods of improving capacity without significant expenditure have been assumed: the roll out of the RS1 timetable improvements, and the permanent conversion of some 2-car sets to 4-car sets (eliminating two driver cabs and replacing with seating) during heavy maintenance that is scheduled for 2030. The RS1 timetable improvements provide a small network-wide capacity improvement, but this is significant for some sections of network. The fleet conversion intervention is expected to increase capacity by 2.9%. However, it increases operational risk, since a failure would require the removal of a 4-car set instead of a 2-car set.

The do-minimum scenario has been developed for the Kapiti and Hutt Valley lines (excluding Melling) and its effect is displayed through to 2050 in the charts below. For all four charts, the shift in capacity in 2022 represents the RS1 timetable roll out and the increase in capacity in 2030 represents the additional 2.9% seated capacity. No additional rolling stock is required at this point.

The Hutt Valley services are shown in Figure 2-2 and Figure 2-3. It can be seen that both Hutt Valley line service layers do not exceed the maximum comfortable capacity by 2050.

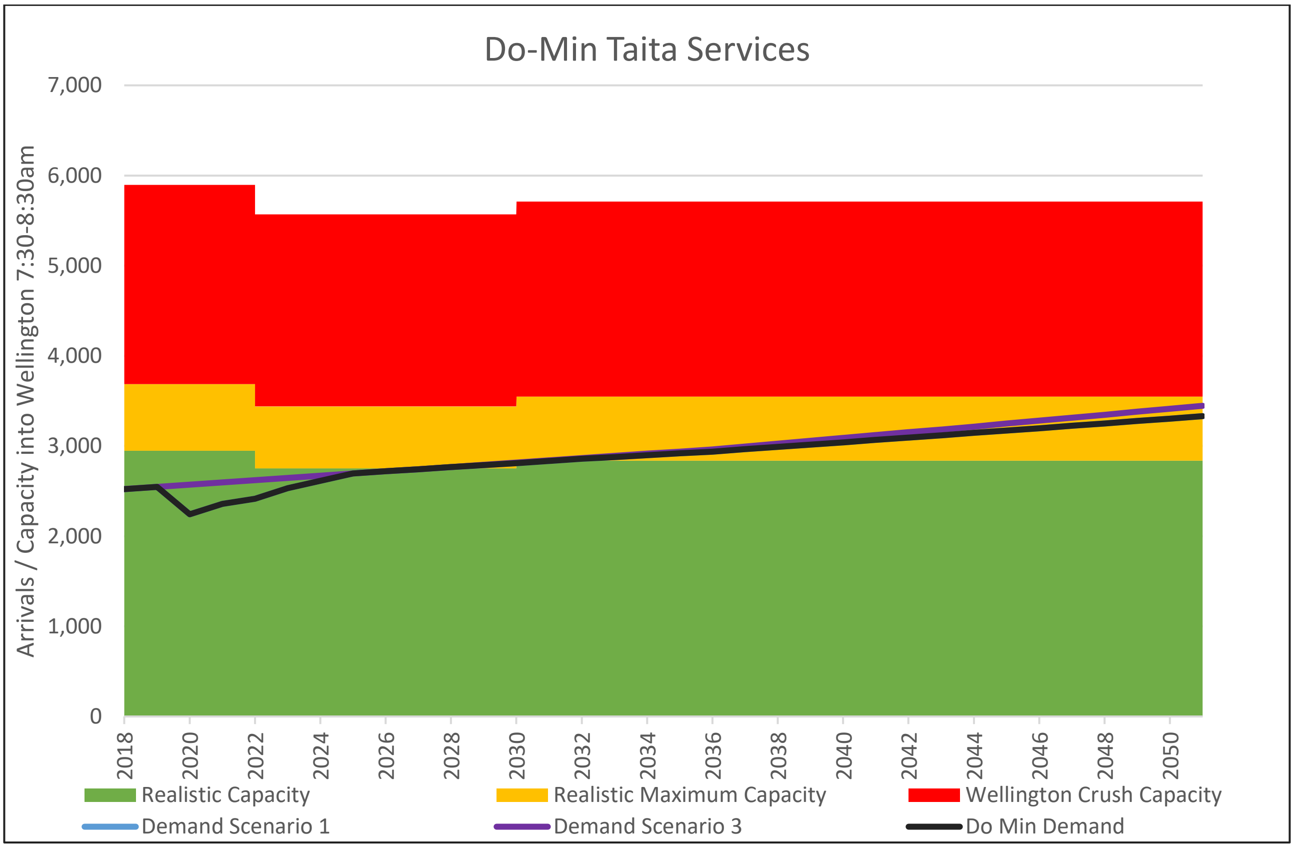

Figure 2-2: Do-min Taita services forecast

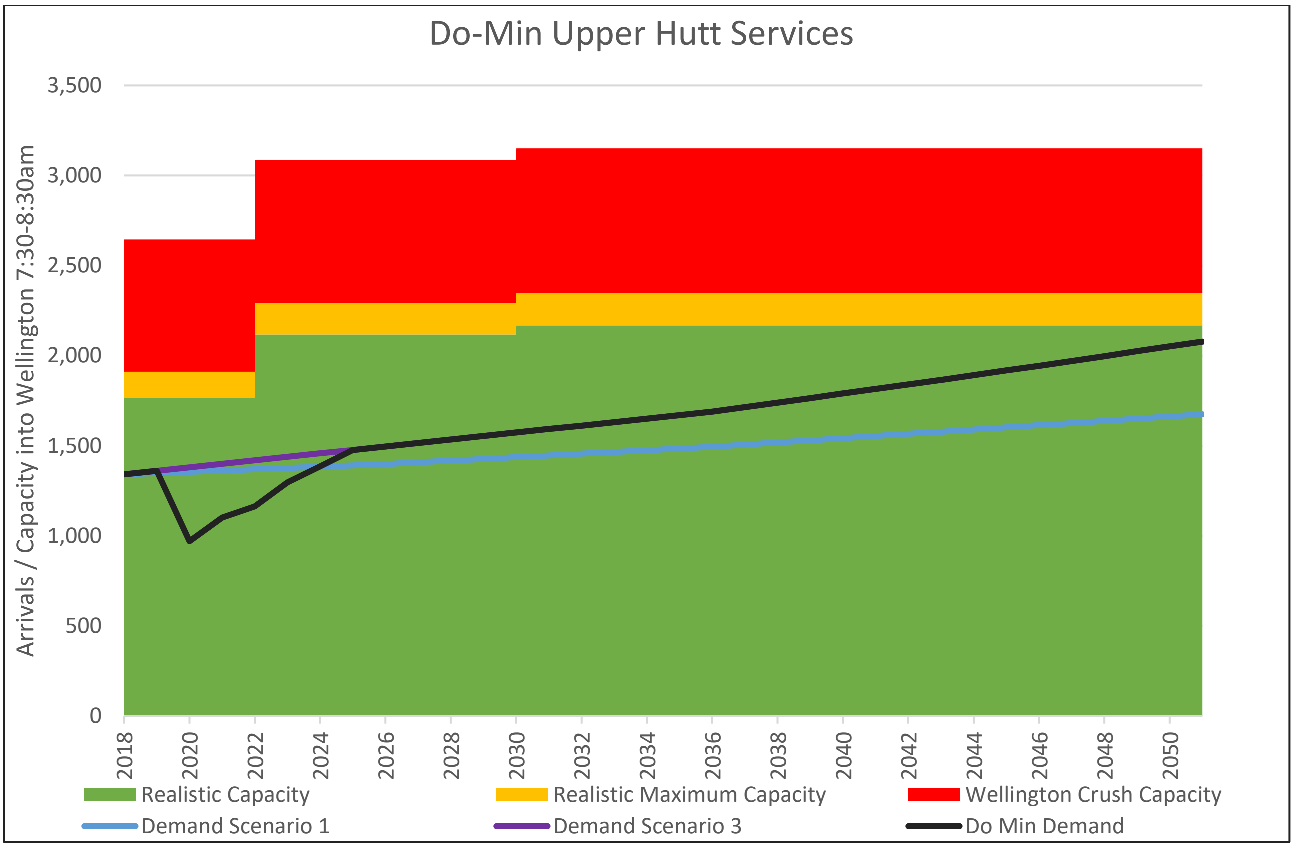

Figure 2-3: Do-min Upper Hutt services forecast

The Kapiti Line services are shown in Figure 2-4 and Figure 2-5.

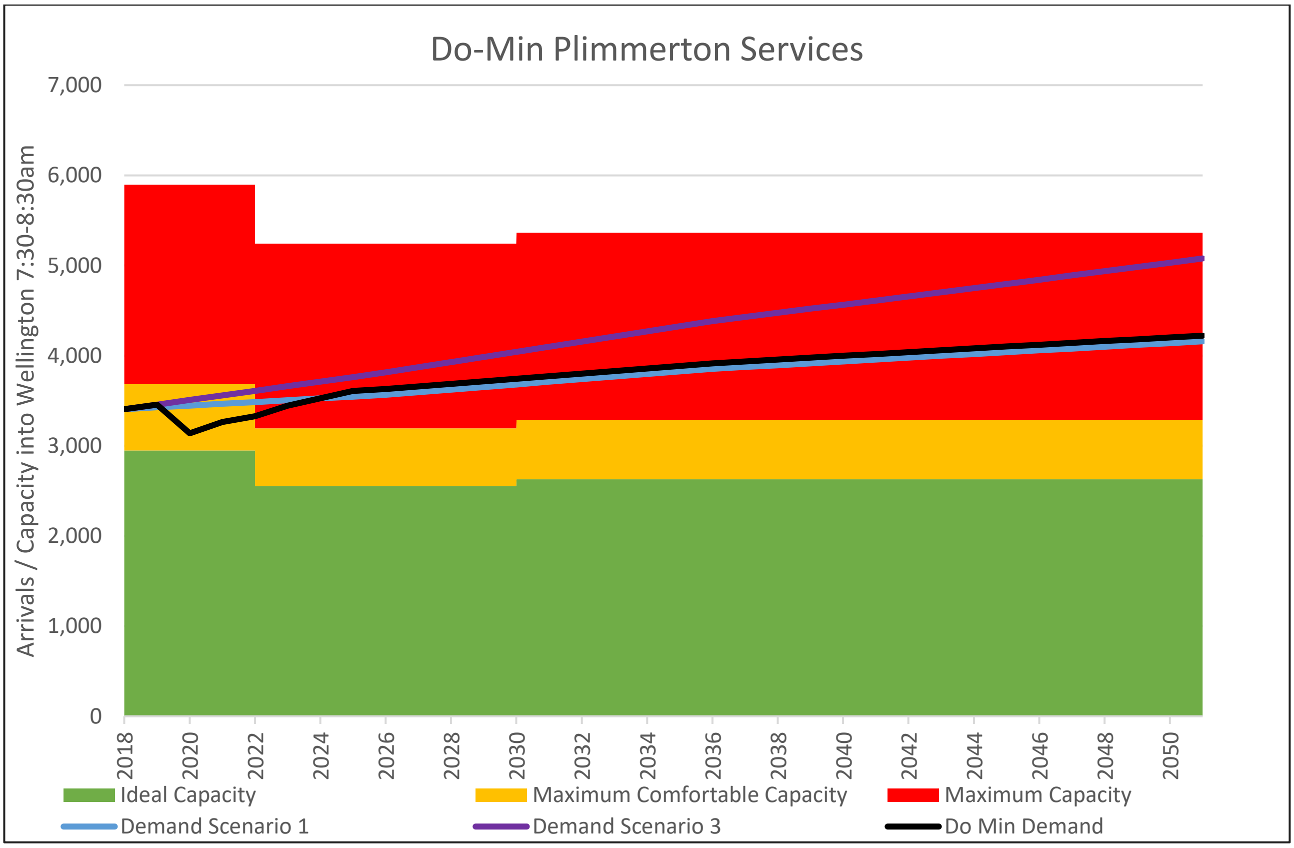

Figure 2-4: Do-min Plimmerton services forecast

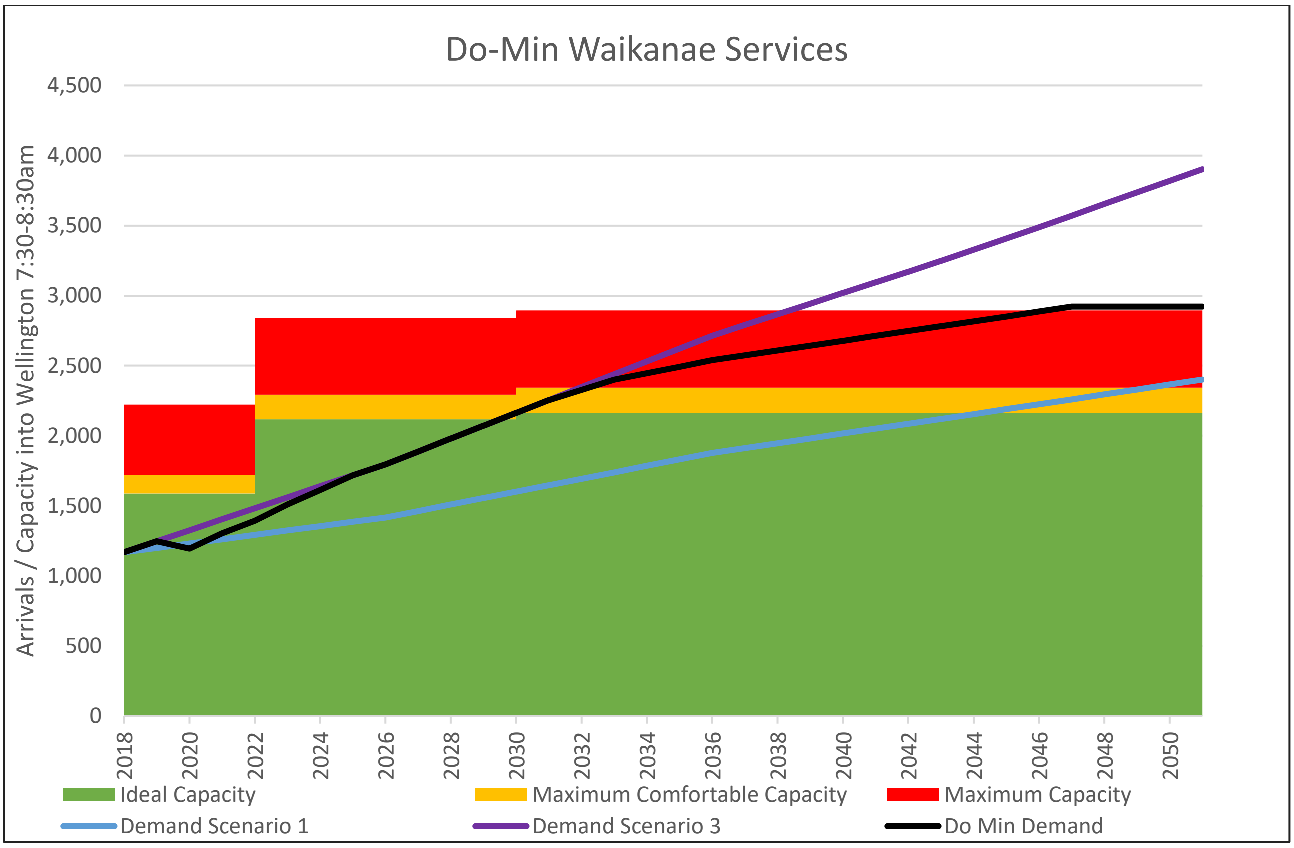

Figure 2-5: Do-min Kapiti services forecast (no expanded fleet)

Unlike the Hutt Valley line, the Kapiti Line shows significant mismatch from capacity to demand. Both the Waikanae and Plimmerton service layers operate above the maximum comfortable capacity limit for the type of journey. Services to Waikanae even reach the maximum capacity of 4ppm[2], preventing further uptake. No service offerings to improve the uptake of rail services are included in the minimum level of service. Long distance rolling stock has been assumed to be procured only when replacement is required, and at a level only to match the long distance needs. It would not provide additional capacity within the electrified network.

The above charts indicate that, even with the fleet conversion capacity increase, the Kapiti Line is likely to run with significantly less capacity than demand. This can be mitigated by the improving the power supply to enable a fourth 4-car train to run in the peak direction in the peak hour. Counter-peak direction service would need to be reduced to enable this. The additional trains would be added by making minor fleet size increases when the existing Matangi fleet is replaced in the mid-2040s. Additional stabling may also be required in Kapiti. This would provide enough capacity only until the mid-2060s if Growth Scenario 1 is assumed.

Further practical improvements to frequency are not practicable without significant investment, particularly in the double tracking of the constrained single-track section between Pukerua Bay and Paekakariki. If it is accepted that passenger usage of rail should not decrease, then the do-min passenger growth would require this investment in late-2060 (inclusive of the 15-minute timetable for Waikanae services). With a 10-year lead time, this would result in work being required to start in 2050.

The impacts of running the additional service to Waikanae are shown in Figure 2-6.

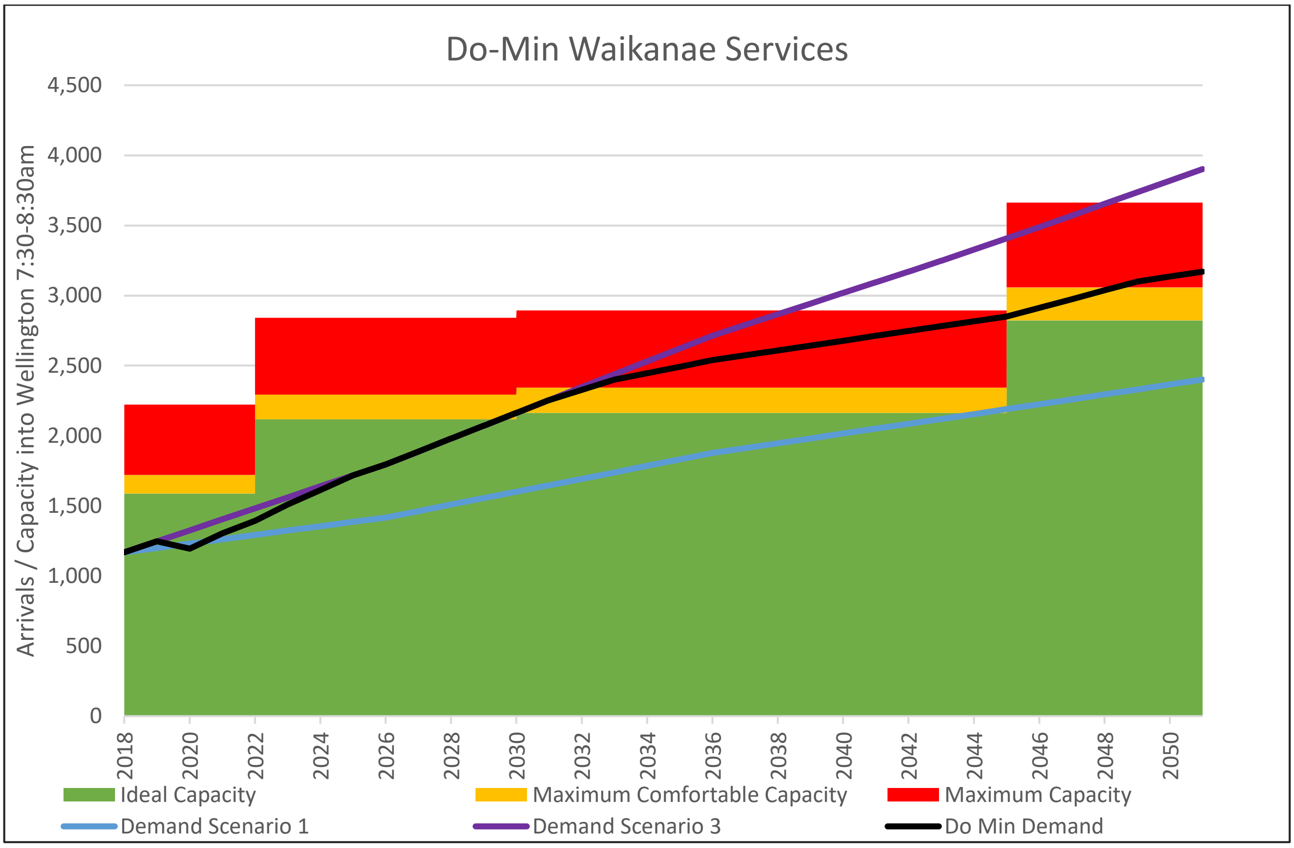

Figure 2-6: Do-min Waikanae services forecast with fleet increase

2.4.5 Asset replacements and maintenance

Under the do-minimum asset maintenance and end of life renewals will continue in line with the asset management plan.

The Matangi units require heavy maintenance around the year 2030, and end of life replacement in the mid-2040s. A small increase in fleet has been assumed at this point to maintain acceptable levels of service as noted above.

2.4.6 Summary

Under the minimum level of service, demand for passenger services is expected to continue to increase at least in response to population growth. While there is only a commitment to roll out the already publicised RS1 timetable when demand exceeds the capacity of the current services, the do-minimum will expand capacity to maintain the specified minimum level of service standards by the lowest cost means.

2.5 Freight level of service

The minimum freight level of service has been defined be evaluating the following:

1. Frequency
2. Capacity
3. Ability to meet growth

Freight levels of service under the do-minimum will possibly contradict the agreed service levels in the Wellington Network Access Agreement between GWRC and KiwiRail. This could cause additional cost the alter the contract.

2.5.1 Frequency of freight services

There are currently approximately 14 freight services on the NIMT and 4 on the Wairarapa Line on a typical weekday. Freight services also operate on both lines on weekend days.

For the minimum acceptable level of service there will be no reduction in services from the current offering and planned increases.

For the purposes of the minimum acceptable level of service, long-distance passenger services (of which there are 3 on a typical weekday) are considered in the same manner as freight services.

2.5.2 Capacity of freight services

Freight services currently have the following capacity constraints as outlined in the Wellington Network Management Plan:

- speed limits at 80 km/h;
- 18 tonne axle limits;
- total length 750 m (NIMT) or 500 m (Wairarapa line); and
- maximum weight 1,700 tonnes.

Under the do minimum, it is expected that these levels of service would be maintained.

2.5.3 Future Growth

While the minimum level of service for rail services does not guarantee that existing unused freight paths would be maintained, it does not propose to reduce them, and does guarantee connecting freight services to any future rail enabled ferry sailings.

Investment in the network to maintain the mode share for the freight task within the region would continue under a minimum level of service.

2.6 Safety of rail services

Safety of rail services have two key areas of focus, being safety of rail operation and level crossings.

2.6.1 Safety of rail services and infrastructure

Under the minimum acceptable level of service, safety of the rail operation will be governed by the requirements of both the Railway Act 2005 and the Health and Safety at Work Act 2015.

The Railways Act 2005 requires:

> *"A rail participant must ensure, so far as is reasonably practicable (SFAIRP), that none of the rail activities for which it is responsible causes, or is likely to cause, the death of, or serious injury to, individuals."*

Under the Act, GWRC, KiwiRail and the GWRC's operator (currently Transdev) are defined as rail participants.

The Health and Safety at Work Act 2015 requires risks to health and safety to be eliminated so far as is reasonably practicable, and if it is not reasonably practicable to eliminate risks to health and safety, to reduce those risks so far as reasonably practicable.

The do-minimum case will include necessary expenditure to enable safety risks associated with operating the minimum acceptable level of service to be eliminated or reduced SFAIRP. This means that when assets are either renewed for condition reasons or upgraded to provide increased capability, that an enhanced level of risk mitigation than current may be required to reduce risks to a SFAIRP level, if the costs of doing so are not grossly disproportionate to the safety benefits achieved. This does mean that individual assets may be replaced, rather than taking a system wide approach, which could have significant cost implications.

For the purposes of defining the minimum level of service, it has been assumed that the 'RS1' timetable frequencies will be safe to operate once associated planned investment has been completed. Should additional services be required to maintain an acceptable level of service for capacity reasons, the legal test of 'so far as reasonably practicable' will be the governing requirement for the minimum level of service.

2.6.2 Level crossings

Under the minimum acceptable level of service, there will be no specific programme of upgrades to existing level crossings and no level crossing removal programme. However, the policy of no new level crossings unless two others are removed will be retained.

2.7 Operational Expenditure

Operational expenditure will be at the lowest level that enables both the freight and passenger services to operate at the required frequencies and capacity.

3 Recommendation

This memo outlines a proposed minimum level of service for rail services to be used for discussion with GWRC, Waka Kotahi and other stakeholders for the development of the RRP and subsequent investigations.

It seeks to ensure that there is sufficient capacity for seating nearly all commuters on the rail network who have expected travel times in excess of 30 minutes, and a density of no more than 4 ppm^2 for shorter journeys.

The do-minimum would improve frequency of services to the planned RS1 timetable as outlined in the current RPTP, but then only improve frequency to meet a major gap between demand and capacity on the Kapiti line. It would also improve capacity by the reallocating space when heavy maintenance is undertaken on the Matangi units.

When the Matangi fleet is replaced, a small increase in fleet would enable increased frequency on the Kapiti line services. This would require power supply improvements, timetabling alterations to the counter peak services, and may require stabling in Kapiti.

Freight services would be limited to the existing used freight paths, but allowance has been made for future growth to meet future rail enabled ferry sailings.

Reliability, punctuality and asset faults would be allowed to degrade, provided that they did not impact the network's ability to meet the levels of service for either freight or passenger services documented in this paper.

The do-minimum for the Rail Plan therefore consists of:

- Completing currently committed projects
- Rolling out the RS1 timetable
- Increasing train capacity during heavy maintenance
- Matangi end of life replacements with minor fleet increase in the mid 2040s
- Timetabling changes to Waikanae services following the fleet replacement
- Power supply upgrades to enable the above capacity improvements
- Commencing investigation work on North-South Junction in circa 2050
- Maintenance works to ensure the network can deliver the above services.

Appendix C Programme Interventions

Do-Min Programme Summary

Timeframe	Intervention Type	Intervention Name	Indicative Cost
0-5	Infrastructure - Signalling	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	$1m - $10m
0-5	Infrastructure - Signalling	Network wide resignalling	$100m - $500m
0-5	Infrastructure - Signalling	Automatic Train Protection (ATP)	$100m - $500m
0-5	Infrastructure - Signalling	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	$100m - $500m
0-5	Infrastructure - Track	Provide a northern access to the Wellington EMU stabling yard	$1m - $10m
0-5	Infrastructure - Track	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Unknown
0-5	Infrastructure - Track	Plimmerton Turnback	$1m - $10m
0-5	Infrastructure - Track	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	$10m - $100m
0-5	Operational - Other	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	$10m - $100m
0-5	Operational - Other	Integrated/electronic ticketing -One pass - all modes - tickets	$1m - $10m
0-5	Operational - Staffing	Change of roles of onboard staff once integrated ticketing introduced +Onboard transport security personel (in DM)	Opex only
0-5	Rolling Stock	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	$100m - $500m
5-10	Infrastructure - Track	More crossovers	$1m - $10m
5-10	Rolling Stock	Increase Matangi seated capacity during heavy maintenance (DO Min)	Unknown
10-20	Rolling Stock	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	$100m - $500m

Minor Improvements Programme Summary

Timeframe	Intervention Type	Intervention Name	Indicative Cost
0-5	Infrastructure - Civil	Slope Stabilisation- address seismic/storm risk	$10m - $100m
0-5	Infrastructure - Civil	Improvements to station subway drainage to reduce flooding risk	$10m - $100m
0-5	Infrastructure - Signalling	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	$1m - $10m
0-5	Infrastructure - Signalling	Network wide resignalling	$100m - $500m
0-5	Infrastructure - Signalling	Automatic Train Protection (ATP)	$100m - $500m
0-5	Infrastructure - Signalling	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	$100m - $500m
0-5	Infrastructure - Stations	Station access planning+D15 to maximise connections to communities and catchments	<$1m
0-5	Infrastructure - Stations	All stations to be accessible for mobility impaired and other users e.g. prams etc	$10m - $100m
0-5	Infrastructure - Track	Provide a northern access to the Wellington EMU stabling yard	$1m - $10m
0-5	Infrastructure - Track	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Unknown
0-5	Infrastructure - Track	Plimmerton Turnback	$1m - $10m
0-5	Infrastructure - Track	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	$10m - $100m
0-5	Infrastructure - Track	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	Opex only
0-5	Maintenance	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	$10m - $100m
0-5	Operational - Other	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	$10m - $100m
0-5	Operational - Other	Integrated/electronic ticketing -One pass - all modes - tickets	$1m - $10m
0-5	Operational - Staffing	Change of roles of onboard staff once integrated ticketing introduced +Onboard transport security personel (in DM)	Opex only
0-5	Rolling Stock	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN	$100m - $500m
0-5	Rolling Stock	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	$100m - $500m
0-5	Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	<$1m
0-5	Study	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	$1m - $10m
5-10	Infrastructure - Crossing	Install automatic gates on all pedestrian level crossings	$10m - $100m
5-10	Infrastructure - Stations	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	$10m - $100m
5-10	Infrastructure - Stations	Improved real time information across the network to communicate to customers during disruptions (audio, visual and app)	Opex only
5-10	Infrastructure - Stations	Wayfinding signage & digital signagesolutions to increase information at stations	$1m - $10m
5-10	Maintenance	New maintenance technologies to enable efficient maintenance to reduce staff exposure to risk from trains movements	Opex only
5-10	Operational - Planning	Train crews dedicated to specific routes during peak periods	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Otaki	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Upper Hutt	Opex only
10-20	Infrastructure - Civil	Improve condition and capacity of drains and culverts	$10m - $100m
10-20	Infrastructure - Stations	Second platform at Waikanae station	$1m - $10m
10-20	Operational - Planning	Seasonal timetables to cope with weather conditions, winter or summer	Opex only
10-20	Operational - Planning	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	Opex only
10-20	Rolling Stock	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	$100m - $500m
10-20	Rolling Stock	Train capacity indicators for passengers	<$1m
20-30	Infrastructure - Track	Shorten North - South Junction single track section from approx 3.3 km to around 1 to 1.5 km by daylighting Tunnels 3 and 7	$100m - $500m

Moderate Improvements Programme Summary			
Timeframe	Intervention Type	Intervention Name	Indicative Cost
0-5	Infrastructure - Civil	Slope Stabilisation- address seismic/storm risk	$10m - $100m
0-5	Infrastructure - Civil	Improvements to station subway drainage to reduce flooding risk	$10m - $100m
0-5	Infrastructure - Signalling	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	$1m - $10m
0-5	Infrastructure - Signalling	Network wide resignalling	$100m - $500m
0-5	Infrastructure - Signalling	Automatic Train Protection (ATP)	$100m - $500m
0-5	Infrastructure - Signalling	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	$100m - $500m
0-5	Infrastructure - Stations	Station access planning+D15 to maximise connections to communities and catchments	<$1m
0-5	Infrastructure - Stations	Covered secure cycle\multi modal facilities at all stations	<$1m
0-5	Infrastructure - Stations	Change facility for cyclist at stations	<$1m
0-5	Infrastructure - Stations	Electric Car charging in station carparks	<$1m
0-5	Infrastructure - Stations	All stations to be accessible for mobility impaired and other users e.g. prams etc	$10m - $100m
0-5	Infrastructure - Stations	Increased shelter at stations that match passenger flows	$1m - $10m
0-5	Infrastructure - Stations	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	$10m - $100m
0-5	Infrastructure - Stations	Improved real time information across the network to communicate to customers during disruptions (audio, visual and app)	Opex only
0-5	Infrastructure - Stations	Wayfinding signage & digital signagesolutions to increase information at stations	$1m - $10m
0-5	Infrastructure - Track	Provide a northern access to the Wellington EMU stabling yard	$1m - $10m
0-5	Infrastructure - Track	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Unknown
0-5	Infrastructure - Track	Plimmerton Turnback	$1m - $10m
0-5	Infrastructure - Track	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	$10m - $100m
0-5	Infrastructure - Track	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	Opex only
0-5	Maintenance	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	$10m - $100m
0-5	Operational - Data and Analytics	Improved collection and analysis of passenger data	<$1m
0-5	Operational - Other	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	$10m - $100m
0-5	Operational - Other	Integrated/electronic ticketing -One pass - all modes - tickets	$1m - $10m
0-5	Operational - Planning	Seasonal timetables to cope with weather conditions, winter or summer	Opex only
0-5	Operational - Planning	increase no. of rail replacement buses/ availability of drivers to cover rail service failures	N/A
0-5	Operational - Planning	Remove express pattern to enable higher frequency all stops services to optimise efficiency and catchment	Opex only
0-5	Operational - Staffing	Change of roles of onboard staff once integrated ticketing introduced +Onboard transport security personel (in DM)	Opex only
0-5	Rolling Stock	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	$100m - $500m
0-5	Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	<$1m
0-5	Study	Look at how station zoning changes habits in accessing station. E.g. people driving further to get a cheaper zone	<$1m
0-5	Study	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	$1m - $10m
0-5	Study	North-South Junction Capacity Improvements (Generic Study)	$1m - $10m
5-10	Infrastructure - Crossing	Install automatic gates on all pedestrian level crossings	$10m - $100m
5-10	Infrastructure - Stations	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	$10m - $100m
5-10	Infrastructure - Stations	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	<$1m
5-10	Infrastructure - Stations	Platform markers for Wheelchair bikes 8/6/4/2	<$1m
5-10	Infrastructure - Track	More crossovers	$1m - $10m
5-10	Maintenance	New maintenance technologies to enable efficient maintenance to reduce staff exposure to risk from trains movements	Opex only
5-10	Operational - Data and Analytics	Automated analytics from CCTV data for improved customer security	$1m - $10m
5-10	Operational - Data and Analytics	Targeted Peak pricing to help spread peak demand	<$1m
5-10	Operational - Other	Charging for parking to manage demand	$1m - $10m
5-10	Operational - Planning	Train crews dedicated to specific routes during peak periods	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Otaki	Opex only
5-10	Operational - Planning	Extend the suburban service frequency span in response to developments and patronage	Opex only
5-10	Operational - Planning	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Upper Hutt	Opex only
10-20	Infrastructure - Civil	Improve resilience of rail bridges across network to seismic events	$10m - $100m
10-20	Infrastructure - Civil	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	$100m - $500m
10-20	Infrastructure - Civil	Improve condition and capacity of drains and culverts	$10m - $100m
10-20	Infrastructure - Crossing	Close or grade separate level crossings - Hutt Valley	$10m - $100m
10-20	Infrastructure - Other	Wifi on trains or provide 4G cell phone coverage through tunnels	$1m - $10m
10-20	Infrastructure - Stations	Second platform at Waikanae station	$1m - $10m
10-20	Infrastructure - Stations	Platform train interface without ramps	$100m - $500m
10-20	Infrastructure - Stations	Station sustainability (More extensive)- solar panels for lighting power- LED lighting -Recycling	<$1m
10-20	Infrastructure - Track	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	$10m - $100m
10-20	Maintenance	Fleet maintenance overnight - enabler	Opex only
10-20	Operational - Planning	increase Wairarapa line services via shuttle services to Upper Hutt	Opex only
10-20	Other	Develop stations as community hubs	$10m - $100m
10-20	Rolling Stock	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	$100m - $500m
10-20	Rolling Stock	Train capacity indicators for passengers	<$1m
20-30	Infrastructure - Civil	Duplicate NIMT overbridge south of Waikanae	$10m - $100m
20-30	Infrastructure - Track	Implement outcome of North South Junction Capacity Improvements Study	$500m +
30+	Infrastructure - Crossing	Close or grade separate level crossings - Wairarapa	$10m - $100m
30+	Infrastructure - Crossing	Close or grade separate level crossings - Kapiti	$10m - $100m
30+	Infrastructure - Crossing	Close or grade separate level crossings - Johnsonville	$10m - $100m
30+	Infrastructure - Other	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	$10m - $100m

Train Sized Focus Programme Summary			
Timeframe	Intervention Type	Intervention Name	Indicative Cost
0-5	Infrastructure - Civil	Slope Stabilisation- address seismic/storm risk	$10m - $100m
0-5	Infrastructure - Civil	Improvements to station subway drainage to reduce flooding risk	$10m - $100m
0-5	Infrastructure - Power	Power supply upgrade on Kapiti Line (short term)	$1m - $10m
0-5	Infrastructure - Signalling	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	$1m - $10m
0-5	Infrastructure - Signalling	Network wide resignalling	$100m - $500m
0-5	Infrastructure - Signalling	Automatic Train Protection (ATP)	$100m - $500m
0-5	Infrastructure - Signalling	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	$100m - $500m
0-5	Infrastructure - Stations	Station access planning+D15 to maximise connections to communities and catchments	<$1m
0-5	Infrastructure - Stations	All stations to be accessible for mobility impaired and other users e.g. prams etc	$10m - $100m
0-5	Infrastructure - Track	Provide a northern access to the Wellington EMU stabling yard	$1m - $10m
0-5	Infrastructure - Track	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Unknown
0-5	Infrastructure - Track	Plimmerton Turnback	$1m - $10m
0-5	Infrastructure - Track	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	$10m - $100m
0-5	Infrastructure - Track	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	Opex only
0-5	Maintenance	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	$10m - $100m
0-5	Operational - Other	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	$10m - $100m
0-5	Operational - Other	Integrated/electronic ticketing -One pass - all modes - tickets	$1m - $10m
0-5	Operational - Planning	Run express trains with fewer stops from outer stations such as Waikanae/ Paraparumu/Upper Hutt etc.	Opex only
0-5	Operational - Staffing	Change of roles of onboard staff once integrated ticketing introduced +Onboard transport security personel (in DM)	Opex only
0-5	Rolling Stock	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	$100m - $500m
0-5	Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	<$1m
0-5	Study	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	$1m - $10m
0-5	Study	North-South Junction Capacity Improvements (Generic Study)	$1m - $10m
5-10	Infrastructure - Civil	Improve condition and capacity of drains and culverts	$10m - $100m
5-10	Infrastructure - Crossing	Install automatic gates on all pedestrian level crossings	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Hutt Valley Line	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Melling Line	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Johnsonville Line	$10m - $100m
5-10	Infrastructure - Stations	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	$10m - $100m
5-10	Infrastructure - Stations	Covered secure cycle\multi modal facilities at all stations	<$1m
5-10	Infrastructure - Stations	Change facility for cyclist at stations	<$1m
5-10	Infrastructure - Stations	Electric Car charging in station carparks	<$1m
5-10	Infrastructure - Stations	Increased shelter at stations that match passenger flows	$1m - $10m
5-10	Infrastructure - Stations	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	$10m - $100m
5-10	Infrastructure - Stations	Improved real time information across the network to communicate to customers during disruptions (audio, visual and app)	Opex only
5-10	Infrastructure - Stations	Wayfinding signage & digital signagesolutions to increase information at stations	$1m - $10m
5-10	Infrastructure - Stations	Platform markers for Wheelchair bikes 8/6/4/2	<$1m
5-10	Infrastructure - Track	Increased train stabling capacity at outer stations for operational efficiencies	$10m -100m
5-10	Infrastructure - Track	More crossovers	$1m - $10m
5-10	Maintenance	New maintenance technologies to enable efficient maintenance to reduce staff exposure to risk from trains movements	Opex only
5-10	Maintenance	Fleet maintenance overnight - enabler	Opex only
5-10	Operational - Data and Ana	Improved collection and analysis of passenger data	<$1m
5-10	Operational - Data and Ana	Automated analytics from CCTV data for improved customer security	$1m - $10m
5-10	Operational - Planning	All day regular services between Wellington and North of Otaki	Opex only
5-10	Operational - Planning	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Upper Hutt	Opex only
5-10	Rolling Stock	Additonal trains to respond to demand and service requirements	$100m - $500m
5-10	Rolling Stock	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN	$100m - $500m
10-20	Infrastructure - Civil	Improve resilience of rail bridges across network to seismic events	$10m - $100m
10-20	Infrastructure - Civil	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	$100m - $500m
10-20	Infrastructure - Crossing	Close or grade separate level crossings - Hutt Valley	$10m - $100m
10-20	Infrastructure - Other	Wifi on trains or provide 4G cell phone coverage through tunnels	$1m - $10m
10-20	Infrastructure - Power	Further power supply upgrade to enable frequency and capacity (long-term)	$10m - $100m
10-20	Infrastructure - Stations	Second platform at Waikanae station	$1m - $10m
10-20	Infrastructure - Stations	Platform train interface without ramps	$100m - $500m
10-20	Infrastructure - Stations	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	<$1m
10-20	Infrastructure - Stations	Station sustainability (More extensive)- solar panels for lighting power- LED lighting -Recycling	<$1m
10-20	Infrastructure - Track	Invest in higher quality track to reduce risk of speed restrictions in hot weather	Unknown
10-20	Infrastructure - Track	Shorten North - South Junction single track section from approx 3.3 km to around 1 to 1.5 km by daylighting Tunnels 3 and 7	$100m - $500m
10-20	Infrastructure - Track	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	$10m - $100m
10-20	Operational - Planning	Seasonal timetables to cope with weather conditions, winter or summer	Opex only
10-20	Operational - Planning	Train crews dedicated to specific routes during peak periods	Opex only
10-20	Operational - Staffing	Deploy additional infrastructure maintenance staff outside of Wellington	Opex only
10-20	Other	Develop stations as community hubs	$10m - $100m
10-20	Rolling Stock	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	$100m - $500m
10-20	Rolling Stock	Train capacity indicators for passengers	<$1m
10-20	Rolling Stock	Additional EMUs for increased service frequency (may be part of the Matangi replacement)	$100m - $500m
20-30	Infrastructure - Civil	Duplicate NIMT overbridge south of Waikanae	$10m - $100m
20-30	Infrastructure - Crossing	Close or grade separate level crossings - Kapiti	$10m - $100m
20-30	Infrastructure - Depot	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation	$10m - $100m
20-30	Infrastructure - Other	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	$10m - $100m
20-30	Infrastructure - Stations	Staff amenities at outer stations	$1m - $10m
20-30	Infrastructure - Track	Improve Johnsonville Line track configuration to improve capacity	$10m - $100m
30+	Infrastructure - Crossing	Close or grade separate level crossings - Johnsonville	$10m - $100m
30+	Infrastructure - Power	Long term power supply upgrade - Kapiti Line	$10m - $100m
30+	Infrastructure - Stations	Longer trains and platforms to address capacity on existing services	$10m - $100m
30+	Infrastructure - Track	Implement outcome of North South Junction Capacity Improvements Study	$500m +
30+	Infrastructure - Track	Double Track Waikanae to Otaki	Opex only

Frequency Focused Programme Summary			
Timeframe	Intervention Type	Intervention Name	Indicative Cost
0-5	Infrastructure - Civil	Improvements to station subway drainage to reduce flooding risk	$10m - $100m
0-5	Infrastructure - Signall	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	$1m - $10m
0-5	Infrastructure - Signall	Network wide resignalling	$100m - $500m
0-5	Infrastructure - Signall	Automatic Train Protection (ATP)	$100m - $500m
0-5	Infrastructure - Signall	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	$100m - $500m
0-5	Infrastructure - Statior	Station access planning+D15 to maximise connections to communities and catchments	<$1m
0-5	Infrastructure - Statior	Covered secure cycle\multi modal facilities at all stations	<$1m
0-5	Infrastructure - Statior	Change facility for cyclist at stations	<$1m
0-5	Infrastructure - Statior	Electric Car charging in station carparks	<$1m
0-5	Infrastructure - Statior	All stations to be accessible for mobility impaired and other users e.g. prams etc	$10m - $100m
0-5	Infrastructure - Statior	Increased shelter at stations that match passenger flows	$1m - $10m
0-5	Infrastructure - Statior	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	$10m - $100m
0-5	Infrastructure - Statior	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	<$1m
0-5	Infrastructure - Track	Improved freight loop at Porirua to ensure freight trains can continue to operate between more frequent services	$1m - $10m
0-5	Infrastructure - Track	Provide a northern access to the Wellington EMU stabling yard	$1m - $10m
0-5	Infrastructure - Track	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Unknown
0-5	Infrastructure - Track	New interlocking for Woburn siding access to reduce track occupancy time for shunts	$1m - $10m
0-5	Infrastructure - Track	Plimmerton Turnback	$1m - $10m
0-5	Infrastructure - Track	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	$10m - $100m
0-5	Infrastructure - Track	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	Opex only
0-5	Maintenance	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	$10m - $100m
0-5	Operational - Other	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	$10m - $100m
0-5	Operational - Other	Integrated/electronic ticketing -One pass - all modes - tickets	$1m - $10m
0-5	Operational - Planning	Larger span of service hours early or late	Opex only
0-5	Operational - Planning	Remove express pattern to enable higher frequency all stops services to optimise efficiency and catchment	Opex only
0-5	Operational - Staffing	Change of roles of onboard staff once integrated ticketing introduced +Onboard transport security personel (in DM)	Opex only
0-5	Rolling Stock	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	$100m - $500m
0-5	Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	<$1m
0-5	Study	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	$1m - $10m
0-5	Study	North-South Junction Capacity Improvements (Generic Study)	$1m - $10m
5-10	Infrastructure - Civil	Slope Stabilisation- address seismic/storm risk	$10m - $100m
5-10	Infrastructure - Civil	Improve condition and capacity of drains and culverts	$10m - $100m
5-10	Infrastructure - Civil	Duplicate NIMT overbridge south of Waikanae	$10m - $100m
5-10	Infrastructure - Crossir	Install automatic gates on all pedestrian level crossings	$10m - $100m
5-10	Infrastructure - Crossir	Close or grade separate level crossings - Hutt Valley	$10m - $100m
5-10	Infrastructure - Crossir	Close or grade separate level crossings - Kapiti	$10m - $100m
5-10	Infrastructure - Other	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Kapiti Line	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Hutt Valley Line	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Melling Line	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Johnsonville Line	$10m - $100m
5-10	Infrastructure - Statior	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	$10m - $100m
5-10	Infrastructure - Statior	Second platform at Waikanae station	$1m - $10m
5-10	Infrastructure - Statior	Improved real time information across the network to communicate to customers during disruptions (audio, visual and app)	Opex only
5-10	Infrastructure - Statior	Wayfinding signage & digital signagesolutions to increase information at stations	$1m - $10m
5-10	Infrastructure - Track	More crossovers	$1m - $10m
5-10	Infrastructure - Track	Invest in higher quality track to reduce risk of speed restrictions in hot weather	Unknown
5-10	Infrastructure - Track	Implement outcome of North South Junction Capacity Improvements Study	$500m +
5-10	Infrastructure - Track	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	$10m - $100m
5-10	Maintenance	New maintenance technologies to enable efficient maintenance to reduce staff exposure to risk from trains movements	Opex only
5-10	Maintenance	Fleet maintenance overnight - enabler	Opex only
5-10	Operational - Data anc	Improved collection and analysis of passenger data	<$1m
5-10	Operational - Data anc	Automated analytics from CCTV data for improved customer security	$1m - $10m
5-10	Operational - Other	Automatic Train Operation (ATO) on congested parts of network	$10m - $100m
5-10	Operational - Planning	Seasonal timetables to cope with weather conditions, winter or summer	Opex only
5-10	Operational - Planning	Train crews dedicated to specific routes during peak periods	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Otaki	Opex only
5-10	Operational - Planning	Extend the suburban service frequency span in response to developments and patronage	Opex only
5-10	Operational - Planning	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Upper Hutt	Opex only
5-10	Operational - Staffing	Deploy additional infrastructure maintenance staff outside of Wellington	Opex only
5-10	Rolling Stock	Additonal trains to respond to demand and service requirements	$100m - $500m
5-10	Rolling Stock	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN	$100m - $500m
10-20	Infrastructure - Civil	Improve resilience of rail bridges across network to seismic events	$10m - $100m
10-20	Infrastructure - Civil	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	$100m - $500m
10-20	Infrastructure - Crossir	Close or grade separate level crossings - Wairarapa	$10m - $100m
10-20	Infrastructure - Crossir	Close or grade separate level crossings - Johnsonville	$10m - $100m
10-20	Infrastructure - Depot	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation	$10m - $100m
10-20	Infrastructure - Other	Wifi on trains or provide 4G cell phone coverage through tunnels	$1m - $10m
10-20	Infrastructure - Power	Further power supply upgrade to enable frequency and capacity (long-term)	$10m - $100m
10-20	Infrastructure - Statior	Staff amenities at outer stations	$1m - $10m
10-20	Infrastructure - Statior	Platform train interface without ramps	$100m - $500m
10-20	Infrastructure - Statior	Station sustainability (More extensive)- solar panels for lighting power- LED lighting -Recycling	<$1m
10-20	Infrastructure - Track	Increased train stabling capacity at outer stations for operational efficiencies	$10m -100m
10-20	Infrastructure - Track	Third track between Porirua and Glenside	$10m - $100m
10-20	Infrastructure - Track	Double Track remainder of Waikanae approach (see 34, 35)	$10m - $100m
10-20	Other	Develop stations as community hubs	$10m - $100m
10-20	Rolling Stock	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	$100m - $500m
10-20	Rolling Stock	Train capacity indicators for passengers	<$1m
10-20	Rolling Stock	Additional EMUs for increased service frequency (may be part of the Matangi replacement)	$100m - $500m
30+	Infrastructure - Civil	Second Remutaka tunnel	$500m +
30+	Infrastructure - Track	Double Track Waikanae to Otaki	Opex only

Mixed Focus Programme Summary			
Timeframe	Intervention Type	Intervention Name	Indicative Cost
0-5	Infrastructure - Civil	Slope Stabilisation- address seismic/storm risk	$10m - $100m
0-5	Infrastructure - Civil	Improvements to station subway drainage to reduce flooding risk	$10m - $100m
0-5	Infrastructure - Signalling	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	$1m - $10m
0-5	Infrastructure - Signalling	Network wide resignalling	$100m - $500m
0-5	Infrastructure - Signalling	Automatic Train Protection (ATP)	$100m - $500m
0-5	Infrastructure - Signalling	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	$100m - $500m
0-5	Infrastructure - Stations	Station access planning+D15 to maximise connections to communities and catchments	<$1m
0-5	Infrastructure - Stations	All stations to be accessible for mobility impaired and other users e.g. prams etc	$10m - $100m
0-5	Infrastructure - Track	Provide a northern access to the Wellington EMU stabling yard	$1m - $10m
0-5	Infrastructure - Track	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Unknown
0-5	Infrastructure - Track	Plimmerton Turnback	$1m - $10m
0-5	Infrastructure - Track	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	$10m - $100m
0-5	Infrastructure - Track	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	Opex only
0-5	Maintenance	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	$10m - $100m
0-5	Operational - Other	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	$10m - $100m
0-5	Operational - Other	Integrated/electronic ticketing -One pass - all modes - tickets	$1m - $10m
0-5	Operational - Staffing	Change of roles of onboard staff once integrated ticketing introduced +Onboard transport security personel (in DM)	Opex only
0-5	Rolling Stock	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	$100m - $500m
0-5	Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	<$1m
0-5	Study	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	$1m - $10m
0-5	Study	North-South Junction Capacity Improvements (Generic Study)	$1m - $10m
5-10	Infrastructure - Civil	Improve condition and capacity of drains and culverts	$10m - $100m
5-10	Infrastructure - Crossing	Install automatic gates on all pedestrian level crossings	$10m - $100m
5-10	Infrastructure - Crossing	Close or grade separate level crossings - Hutt Valley	$10m - $100m
5-10	Infrastructure - Crossing	Close or grade separate level crossings - Kapiti	$10m - $100m
5-10	Infrastructure - Power	Power supply upgrade on Kapiti Line (short term)	$1m - $10m
5-10	Infrastructure - Power	Long term power supply upgrade - Hutt Valley Line	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Melling Line	$10m - $100m
5-10	Infrastructure - Power	Long term power supply upgrade - Johnsonville Line	$10m - $100m
5-10	Infrastructure - Stations	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	$10m - $100m
5-10	Infrastructure - Stations	Second platform at Waikanae station	$1m - $10m
5-10	Infrastructure - Stations	Covered secure cycle\multi modal facilities at all stations	<$1m
5-10	Infrastructure - Stations	Change facility for cyclist at stations	<$1m
5-10	Infrastructure - Stations	Electric Car charging in station carparks	<$1m
5-10	Infrastructure - Stations	Increased shelter at stations that match passenger flows	$1m - $10m
5-10	Infrastructure - Stations	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	$10m - $100m
5-10	Infrastructure - Stations	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	<$1m
5-10	Infrastructure - Stations	Improved real time information across the network to communicate to customers during disruptions (audio, visual and app)	Opex only
5-10	Infrastructure - Stations	Wayfinding signage & digital signagesolutions to increase information at stations	$1m - $10m
5-10	Infrastructure - Track	More crossovers	$1m - $10m
5-10	Infrastructure - Track	Invest in higher quality track to reduce risk of speed restrictions in hot weather	Unknown
5-10	Infrastructure - Track	New interlocking for Woburn siding access to reduce track occupancy time for shunts	$1m - $10m
5-10	Infrastructure - Track	Shorten North - South Junction single track section from approx 3.3 km to around 1 to 1.5 km by daylighting Tunnels 3 and 7	$100m - $500m
5-10	Infrastructure - Track	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	$10m - $100m
5-10	Maintenance	New maintenance technologies to enable efficient maintenance to reduce staff exposure to risk from trains movements	Opex only
5-10	Operational - Data and Analytics	Improved collection and analysis of passenger data	<$1m
5-10	Operational - Data and Analytics	Automated analytics from CCTV data for improved customer security	$1m - $10m
5-10	Operational - Planning	All day regular services between Wellington and North of Otaki	Opex only
5-10	Operational - Planning	Extend the suburban service frequency span in response to developments and patronage	Opex only
5-10	Operational - Planning	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	Opex only
5-10	Operational - Planning	All day regular services between Wellington and North of Upper Hutt	Opex only
5-10	Rolling Stock	Additonal trains to respond to demand and service requirements	$100m - $500m
5-10	Rolling Stock	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN	$100m - $500m
10-20	Infrastructure - Civil	Improve resilience of rail bridges across network to seismic events	$10m - $100m
10-20	Infrastructure - Civil	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	$100m - $500m
10-20	Infrastructure - Civil	Duplicate NIMT overbridge south of Waikanae	$10m - $100m
10-20	Infrastructure - Other	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	$10m - $100m
10-20	Infrastructure - Other	Wifi on trains or provide 4G cell phone coverage through tunnels	$1m - $10m
10-20	Infrastructure - Power	Further power supply upgrade to enable frequency and capacity (long-term)	$10m - $100m
10-20	Infrastructure - Stations	Platform train interface without ramps	$100m - $500m
10-20	Infrastructure - Stations	Station sustainability (More extensive)- solar panels for lighting power- LED lighting -Recycling	<$1m
10-20	Infrastructure - Track	Improved freight loop at Porirua to ensure freight trains can continue to operate between more frequent services	$1m - $10m
10-20	Infrastructure - Track	Increased train stabling capacity at outer stations for operational efficiencies	$10m -100m
10-20	Infrastructure - Track	Implement outcome of North South Junction Capacity Improvements Study	$500m +
10-20	Maintenance	Fleet maintenance overnight - enabler	Opex only
10-20	Operational - Other	Automatic Train Operation (ATO) on congested parts of network	$10m - $100m
10-20	Operational - Planning	Seasonal timetables to cope with weather conditions, winter or summer	Opex only
10-20	Operational - Planning	Train crews dedicated to specific routes during peak periods	Opex only
10-20	Operational - Planning	Larger span of service hours early or late	Opex only
10-20	Operational - Staffing	Deploy additional infrastructure maintenance staff outside of Wellington	Opex only
10-20	Other	Develop stations as community hubs	$10m - $100m
10-20	Rolling Stock	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	$100m - $500m
10-20	Rolling Stock	Train capacity indicators for passengers	<$1m
20-30	Infrastructure - Crossing	Close or grade separate level crossings - Johnsonville	$10m - $100m
20-30	Infrastructure - Power	Long term power supply upgrade - Kapiti Line	$10m - $100m
20-30	Infrastructure - Stations	Staff amenities at outer stations	$1m - $10m
30+	Infrastructure - Crossing	Close or grade separate level crossings - Wairarapa	$10m - $100m
30+	Infrastructure - Depot	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation	$10m - $100m
30+	Infrastructure - Track	Improve Johnsonville Line track configuration to improve capacity	$10m - $100m
30+	Infrastructure - Track	Double Track Waikanae to Otaki	Opex only
30+	Rolling Stock	Additional EMUs for increased service frequency (may be part of the Matangi replacement)	$100m - $500m

Drive Mode Shift Pogramme Summary

Timeframe	Intervention Type	Intervention Name	Indicative Cost
0-5	Infrastruct	Slope Stabilisation- address seismic/storm risk	$10m - $100m
0-5	Infrastruct	Improvements to station subway drainage to reduce flooding risk	$10m - $100m
0-5	Infrastruct	Wifi on trains or provide 4G cell phone coverage through tunnels	$1m - $10m
0-5	Infrastruct	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	$1m - $10m
0-5	Infrastruct	Network wide resignalling	$100m - $500m
0-5	Infrastruct	Automatic Train Protection (ATP)	$100m - $500m
0-5	Infrastruct	Wairarapa Line Signalling and Infrastructure and other infrastructure upgrades for LD rolling stock	$100m - $500m
0-5	Infrastruct	Station access planning+D15 to maximise connections to communities and catchments	<$1m
0-5	Infrastruct	Covered secure cycle\multi modal facilities at all stations	<$1m
0-5	Infrastruct	Change facility for cyclist at stations	<$1m
0-5	Infrastruct	Electric Car charging in station carparks	<$1m
0-5	Infrastruct	All stations to be accessible for mobility impaired and other users e.g. prams etc	$10m - $100m
0-5	Infrastruct	Increased shelter at stations that match passenger flows	$1m - $10m
0-5	Infrastruct	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	$10m - $100m
0-5	Infrastruct	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	<$1m
0-5	Infrastruct	Improved freight loop at Porirua to ensure freight trains can continue to operate between more frequent services	$1m - $10m
0-5	Infrastruct	Provide a northern access to the Wellington EMU stabling yard	$1m - $10m
0-5	Infrastruct	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	Unknown
0-5	Infrastruct	New interlocking for Woburn siding access to reduce track occupancy time for shunts	$1m - $10m
0-5	Infrastruct	Plimmerton Turnback	$1m - $10m
0-5	Infrastruct	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	$10m - $100m
0-5	Infrastruct	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	Opex only
0-5	Maintenan	Catching up on asset renewals and maintenance, before it fails i.e. No deferred maintenance	$10m - $100m
0-5	Operationa	Improved collection and analysis of passenger data	<$1m
0-5	Operationa	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	$10m - $100m
0-5	Operationa	Integrated/electronic ticketing -One pass - all modes - tickets	$1m - $10m
0-5	Operationa	increase no. of rail replacement buses/ availability of drivers to cover rail service failures	N/A
0-5	Operationa	Larger span of service hours early or late	Opex only
0-5	Operationa	Remove express pattern to enable higher frequency all stops services to optimise efficiency and catchment	Opex only
0-5	Operationa	Change of roles of onboard staff once integrated ticketing introduced +Onboard transport security personel (in DM)	Opex only
0-5	Rolling Sto	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	$100m - $500m
0-5	Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	<$1m
0-5	Study	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	$1m - $10m
0-5	Study	North-South Junction Capacity Improvements (Generic Study)	$1m - $10m
0-5	Outcome	RS1 Timetable Improvements	Opex only
0-5	Outcome	12 minute peak interval - Hutt Line	Opex only
0-5	Outcome	15 minute off peak frequencies - Hutt Line	Opex only
0-5	Outcome	12 minute peak interval - Kapiti Line	Opex only
0-5	Outcome	15 minute off peak frequencies - Kapiti Line	Opex only
0-5	Outcome	12 minute peak interval - Johnsonville Line	Opex only
0-5	Outcome	15 minute off peak frequencies - Johnsonville Line	Opex only
5-10	Infrastruct	Improve condition and capacity of drains and culverts	$10m - $100m
5-10	Infrastruct	Duplicate NIMT overbridge south of Waikanae	$10m - $100m
5-10	Infrastruct	Install automatic gates on all pedestrian level crossings	$10m - $100m
5-10	Infrastruct	Close or grade separate level crossings - Hutt Valley	$10m - $100m
5-10	Infrastruct	Close or grade separate level crossings - Kapiti	$10m - $100m
5-10	Infrastruct	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	$10m - $100m
5-10	Infrastruct	Electrification North of Upper Hutt - Featherston	$10m - $100m
5-10	Infrastruct	Electrification North of Waikanae (To Otaki)	$10m - $100m
5-10	Infrastruct	Long term power supply upgrade - Kapiti Line	$10m - $100m
5-10	Infrastruct	Long term power supply upgrade - Hutt Valley Line	$10m - $100m
5-10	Infrastruct	Long term power supply upgrade - Melling Line	$10m - $100m
5-10	Infrastruct	Long term power supply upgrade - Johnsonville Line	$10m - $100m
5-10	Infrastruct	Electrification Otaki to Levin	$10m - $100m
5-10	Infrastruct	Electrification Levin to Palmerston North	$10m - $100m
5-10	Infrastruct	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	$10m - $100m
5-10	Infrastruct	Second platform at Waikanae station	$1m - $10m
5-10	Infrastruct	Improved real time information across the network to communicate to customers during disruptions (audio, visual and app)	Opex only
5-10	Infrastruct	Wayfinding signage & digital signagesolutions to increase information at stations	$1m - $10m
5-10	Infrastruct	Increased train stabling capacity at outer stations for operational efficiencies	$10m -100m
5-10	Infrastruct	More crossovers	$1m - $10m
5-10	Infrastruct	Invest in higher quality track to reduce risk of speed restrictions in hot weather	Unknown
5-10	Infrastruct	Implement outcome of North South Junction Capacity Improvements Study	$500m +
5-10	Infrastruct	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	$10m - $100m
5-10	Infrastruct	Double Track Waikanae to Otaki	Opex only
5-10	Maintenan	New maintenance technologies to enable efficient maintenance to reduce staff exposure to risk from trains movements	Opex only
5-10	Maintenan	Fleet maintenance overnight - enabler	Opex only
5-10	Operationa	Automated analytics from CCTV data for improved customer security	$1m - $10m
5-10	Operationa	Automatic Train Operation (ATO) on congested parts of network	$10m - $100m
5-10	Operationa	Seasonal timetables to cope with weather conditions, winter or summer	Opex only
5-10	Operationa	Train crews dedicated to specific routes during peak periods	Opex only
5-10	Operationa	extend frequent service to Otaki	Opex only
5-10	Operationa	All day regular services between Wellington and North of Otaki	Opex only
5-10	Operationa	Extend the suburban service frequency span in response to developments and patronage	Opex only
5-10	Operationa	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	Opex only
5-10	Operationa	All day regular services between Wellington and North of Upper Hutt	Opex only
5-10	Operationa	Deploy additional infrastructure maintenance staff outside of Wellington	Opex only
5-10	Other	Develop stations as community hubs	$10m - $100m
5-10	Rolling Sto	Increase use of electric traction propulsion for freight	Opex only
5-10	Rolling Sto	Additonal trains to respond to demand and service requirements	$100m - $500m
5-10	Rolling Sto	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN	$100m - $500m
5-10	Outcome	Bi directional running	Opex only
5-10	Outcome	10 minute peak interval - Hutt Line	Opex only
5-10	Outcome	12 minute off peak interval - Hutt Line	Opex only
5-10	Outcome	10 minute peak interval - Kapiti Line	Opex only
5-10	Outcome	12 minute off peak interval - Kapiti Line	Opex only
5-10	Outcome	10 minute peak interval - Johnsonville Line	Opex only
5-10	Outcome	12 minute off peak interval - Johnsonville Line	Opex only
10-20	Infrastruct	Improve resilience of rail bridges across network to seismic events	$10m - $100m

10-20	Infrastruct	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	$100m - $500m
10-20	Infrastruct	Close or grade separate level crossings - Wairarapa	$10m - $100m
10-20	Infrastruct	Close or grade separate level crossings - Johnsonville	$10m - $100m
10-20	Infrastruct	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation	$10m - $100m
10-20	Infrastruct	Further power supply upgrade to enable frequency and capacity (long-term)	$10m - $100m
10-20	Infrastruct	Electrification North of Featherston - Masterton	$10m - $100m
10-20	Infrastruct	Staff amenities at outer stations	$1m - $10m
10-20	Infrastruct	Platform train interface without ramps	$100m - $500m
10-20	Infrastruct	Station sustainability (More extensive)- solar panels for lighting power- LED lighting -Recycling	<$1m
10-20	Infrastruct	Third track between Porirua and Glenside	$10m - $100m
10-20	Infrastruct	Improve Johnsonville Line track configuration to improve capacity	$10m - $100m
10-20	Infrastruct	Double Track remainder of Waikanae approach (see 34, 35)	$10m - $100m
10-20	Operationa	increase Wairarapa line services via shuttle services to Upper Hutt	Opex only
10-20	Rolling Sto	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	$100m - $500m
10-20	Rolling Sto	Train capacity indicators for passengers	<$1m
10-20	Rolling Sto	Additional EMUs for increased service frequency (may be part of the Matangi replacement)	$100m - $500m
10-20	Outcome	6 minute peak interval - Hutt Line	Opex only
10-20	Outcome	10 minute off peak interval - Hutt Line	Opex only
10-20	Outcome	6 minute peak interval - Kapiti Line	Opex only
10-20	Outcome	10 minute off peak interval - Kapiti Line	Opex only
10-20	Outcome	6 minute peak interval - Johnsonville Line	Opex only
10-20	Outcome	10 minute off peak interval - Johnsonville Line	Opex only
20-30	Infrastruct	Platform screen Doors/ gates	<$1m
30+	Infrastruct	Second Remutaka tunnel	$500m +
30+	Infrastruct	Longer trains and platforms to address capacity on existing services	$10m - $100m
30+	Infrastruct	Convert Johnsonville branch to Light rail deploy displaced EMUs on rest of network	$10m - $100m
30+	Rolling Sto	Tram-Trains able to run over both heavy rail network and future light rail south of Station	$10m - $100m

Appendix D Waka Kotahi MCA Guidance

MULTI-CRITERIA ANALYSIS: USER GUIDANCE

AUGUST 2020

Multi-criteria analysis (MCA) can be used to evaluate multiple criteria, both quantitative and qualitative, and to assess different alternatives and options to inform decision making.

The MCA guidance and template is recommended for use in most business case optioneering processes to evaluate alternatives and options at the longlist and shortlist phases.

Contents

INTRODUCTION

Multi-criteria analysis (MCA) can be used to assess multiple criteria, both quantitative and qualitative. MCA can be used to compare different alternatives and options and assist with conversations between investors and stakeholders to help inform decision making.

An MCA template (Excel spreadsheet) and accompanying instructions for users are available to download from InvestHub.

https://invest.nzta.govt.nz/course/view.php?id=26

The MCA guidance in this document, and the template:

- provide a best practice process and approach to ensure robust and holistic assessment when moving from the longlist to shortlist of alternatives and options
- support investment decisions being made consistently and transparently across business cases
- embed the intervention hierarchy which ensures that a broad range of alternatives and options have been considered
- seek to create a replicable approach to scoring, such that a different group could apply the same assessment methodology and produce comparable results
- help identify environmental impacts and opportunities and aligns investment and Resource Management Act 1991 (RMA) and Public Works Act (PWA) obligations. In particular, this relates to the need for a robust, transparent and well-documented optioneering process throughout the entire business case development process, from the strategic case through to the implementation of the preferred option.

The integrity and robustness of MCA processes largely rely on the way they are done. To provide consistency and transparency across the process and methodology used, it is recommended you use this guidance and the template. It is acknowledged that all business cases have their own unique characteristics and the approach taken needs to align with the size and complexity of the problem/opportunity.

This guidance provides for flexibility in approach to accommodate a project's specific circumstances. If variations to this guidance are considered appropriate, or another MCA-type approach is preferred, the project team should clearly document the variations or different approach as part of the business case.

It is anticipated that MCA will be used as part of most business case optioneering processes to help investors and project teams evaluate alternatives and options at the longlist and at the shortlist phase to help identify a preferred solution. It is not intended to be applied when making detailed design decisions post the identification of the preferred solution.

MCA outputs support making trade-off decisions between different alternatives or options. MCA does not provide definitive answers about which is the best alternative or option. Critical thinking is important, especially when considering the right-sizing of possible solutions.

Key considerations when undertaking MCA include:

- Alternatives and options need to address the root causes of the problems identified in the strategic case.
- Only alternatives and options with true fatal flaws should be discounted at this stage.
- Synergies and conflicts between alternatives and options should be considered if packaged together.

BEFORE CONDUCTING AN MCA

To enable an MCA to be applied as part of the optioneering process, there are several things to do first.

The strategic case

The strategic case is the cornerstone for successive business case phases, and it will become the first section of the programme business case (PBC) or single-stage business case (SSBC) document. The strategic case should clearly articulate the problem or opportunity and identify the benefits sought.

Generate alternatives and options

After the strategic case has been created, a broad range of alternatives and options are generated using the intervention hierarchy and systems thinking.

Do-minimum

Assessment involves examining different options or courses of action. The 'do-minimum' must be defined before MCA is commenced. Comparing option criteria scores to the do-minimum could be accomplished by assigning a neutral score to a do-minimum and comparing all other option criteria scores against it.

Early Assessment Sifting Tool (EAST)

Prior to conducting the MCA, it may be useful to run the alternatives/options through the EAST. The EAST supports an initial 'coarse screening' of alternatives and options. The EAST is designed to quickly and robustly rule out alternatives and options, allowing for a more manageable MCA exercise. The EAST also assists in documenting why decisions have been made.

It is important that the rationale for discarding an alternative or option is well documented. This includes where an alternative or option does not align with investment objectives or there are fatal flaws.

ROLES AND RESPONSIBILITIES IN THE MCA PROCESS

It is important to have the right stakeholders involved when developing and assessing alternatives and options. A typical MCA assessment will include a range of different groups whose involvement will evolve over time.

Involvement of investment decision makers will ensure alignment to desired investment objectives. The involvement of investment partners, iwi and relevant stakeholders is strongly encouraged at appropriate times in MCA processes since it creates a stronger business case and ensures that issues to be addressed reflect different perspectives, which will in turn drive more robust outcomes.

In all cases the MCA process will be led by the project team, who may be advised by a relevant specialist or specialists. There may be instances where other parties complete specific assessments. The Waka Kotahi Environmental and Social Responsibility Standard[1] provides guidance on the scope of additional assessments.

Subject matter experts (SMEs) may be used to provide specialist input on their topic to the assessment of options.

Depending on the scale and complexity of the activity, legal advice may be sought at different points in the process. **Appendix 1** provides further guidance on the roles and responsibilities when undertaking MCA.

[1] The Environmental Standard is currently state highway focused; however, it is currently being updated to provide guidance on the scope of additional activities. The link to the current version is https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-social-responsibility/national-standards-guidelines-and-specifications/esr-standard/

Te Ao Māori

Iwi have a special relationship with the Crown as Treaty of Waitangi partners and therefore have a partnership role with Waka Kotahi across the business case phases and project life cycle.

The project team should consider the timing, nature and extent of iwi involvement in the optioneering process. Relevant iwi should be consulted regarding their participation in the optioneering processes. This may include identification or preparation of Cultural Impact Assessment(s) and/or taking a more holistic perspective on activity impacts through their participation at optioneering workshops. The timing, nature and extent of iwi input will depend on the specific circumstances but as a rule the earlier the better to ensure both positive and negative Te Ao Māori impacts can be scoped.

It should be noted that multiple iwi and hapū groups may be affected by a project and may wish to contribute their own assessments separately from one another.

Different iwi groups may have different perspectives on optioneering processes. Practitioners should be aware that iwi may not wish to be involved in optioneering processes that could be perceived to not adequately represent iwi interests. Early engagement with iwi prior to starting an optioneering process, and a flexible approach, are encouraged to determine how iwi may wish to be involved.

REPLICABILITY AND TRANSPARENCY

The MCA assessment process used should be both transparent and replicable so that a different specialist would be able to follow the logic and methodology set out in the supporting documentation and replicate the result. Well-documented MCA processes mean that decision makers will be readily able to determine whether legal requirements (eg under the Resource Management Act (RMA) and Public Works Act (PWA)) have been met.

Where specialists have been involved, their background notes or reports presented at a decision conference should be included.

Where, in the course of developing the business case, an element changes – for example, new options or specialists are introduced, or material changes in the background environment occur – the change must be adequately referenced and assessed, including going back to consider all or relevant options afresh if necessary.

NEW OPTIONS/CHANGE CIRCUMSTANCES

If a viable and substantive new option arises after an MCA has been completed, specialists should be asked to complete a review of the new option using the same methodology used for the prior MCA, and fully document the outcomes. To the extent practicable, the same specialists who completed the original MCA should be involved.

Changed circumstances after an MCA has been completed should be addressed through a review of the prior MCA processes and a documented assessment of any changes necessary. For example, if, after an MCA process has been completed, a significant earthquake altered a coastline on which an MCA process was premised, a review of the MCA assessment would be required.

All specialists involved in assessment processes would also need to review and revise their assessments if necessary.

MCA GROUP ASSESSMENT TECHNIQUES

MCA is often a group-based assessment activity, since it typically requires input from a range of different specialists. Although a single, informed participant could complete low complexity and low risk MCA assessments, for the majority of activities it is anticipated that multiple participants will be involved in the MCA process.

There are two main methods of group decision-making techniques used for MCA scoring and selecting shortlists/preferred options. These can be broadly defined as decision conferencing, a structured format among individuals in a meeting; and the Delphi method, where participants are physically remote and identify and evaluate ideas/scores independently.

Where practicable, it is recommended that a decision conferencing workshop method is used when undertaking MCA.

DECISION CONFERENCING

Decision conferencing provides for a structured format among individuals in a facilitated workshop, or across several workshops. A fundamental requirement is a comprehensive understanding of the activity or project involved. The exercise should be undertaken on the basis of agreed criteria and scoring approach.

SMEs may first independently establish provisional scores based on known evidence. This step may be completed prior to the meeting. At the workshop, each SME presents their own ideas and scores. These scores are then discussed, challenged and moderated to reach a consensus during the workshop.

The key features required for a decision conference are:

'Attendance by key players, impartial facilitation,…. and an interactive and iterative group process.[2]'

MCA CRITERIA

The project team should select the appropriate criteria for their activity on a case-by-case basis. Investment objectives and critical success factors need to be included as part of all assessments. The reasoning for selection should be discussed and documented in the MCA report. If necessary, to understand the potential social and environmental impacts of the activity, the Waka Kotahi Environmental and Social Responsibility Standard can be used to guide environmental and social criteria in the longlisting and shortlisting process[3].

Care should be taken to avoid double counting in selecting and evaluating criteria. Specialists involved in an MCA should discuss and agree the scope of the criteria and the boundaries of their assessment to remove double counting.

The aim of criteria selection is to define:

- whether an alternative or option has strategic alignment with transport system objectives (including regional land transport plans (RLTPs) and Government Policy Statement on land transport (GPS)), strategies, plans and policies
- whether an alternative or option will deliver net benefits, ie benefits greater than costs
- the relative effects of the alternatives and options under consideration, and
- whether the alternative or option is achievable in relation to applicable legislation and regulations.

As the business case develops, a project may require more refined criteria, and criteria that may have been important at the commencement of the investigation may become less applicable. For example, an investigation of sub-aspects of a new route, such as connections to the local roading system at the indicative business case (IBC) stage, may require a substantially different set of MCA criteria from those that are applied during identification of the preferred route at the PBC stage. The criteria applied should always be reviewed for successive MCAs.

The identification and description of the criteria must be discussed and agreed upfront by the project team and, where necessary, key stakeholders. Further definition of a criterion may require the input of SMEs, as specific circumstances may need to be reflected.

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[2] Phillips, 2006) http://eprints.lse.ac.uk/22712/1/06085.pdf

[3] The Environmental Standard is currently state highway focused, however it is currently being updated to provide guidance on the scope of additional activities. The link to the current version is https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-social-responsibility/national-standards-guidelines-and-specifications/esr-standard/

For activities likely to require approvals under the RMA, Part 2 of the RMA is relevant. Part 2 outlines the RMA's purpose and principles. In identifying appropriate criteria for consideration, practitioners should ensure that relevant Part 2 matters are addressed through the specialist criteria selected. Advice should be sought from RMA planning specialists and/or legal counsel to ensure Part 2 matters are adequately provided for.

The table below provides a list of possible MCA criteria. Not all the criteria will be relevant to every activity or at every stage of business case development. Stakeholders/customer perspectives should not be a criterion in and of itself. The root causes of objections or support should be captured within the relevant criterion. It may be relevant to include specific issues of interest to stakeholders (ie road safety or visual impacts).

If appropriate, a project team may wish to add intermediate and maximum ranges in addition to the do-minimum to enable greater granularity.

The upfront cost of an activity should be included in an MCA process but should not be scored. The cost and fundability require a robust assessment separate to the MCA process.

Table 1: MCA criteria to select from

Programme business case	Indicative business case	Considerations
Investment (critical success factors)		
Investment objectives How well does the alternative or option achieve investment objectives?		Alternatives and options need to be assessed for their ability to deliver against investment objectives. Investment objectives are derived from problem statements and benefit maps as part of investment logic map (ILM) sessions and are determined by a project team, based on stakeholder workshops.
Potential achievability (critical success factor) What is the potential achievability of the alternative or option? *Care needs to be taken not to double count. If consenting has environmental considerations, best practice is to exclude and ensure those key considerations are covered by environmental effects criteria. Note that consentability does not include assessment of environmental effects, which should be covered in the 'environment' criteria below.*	**Technical**	What are the technical or practical considerations that may prevent an option from achieving investment objectives, for example local site geography or existing contracts? What are the technical risks involved in developing or implementing this option?
	Safety and design	Are there significant health and/or safety risks associated with the option in its design, implementation, operation or maintenance? Does this option comply with the safe system approach? Can the risks be addressed in the design process to control it?
	Consentability	What is the level of consenting complexity/difficulty? Are there risks of this adversely impacting on required project timeframes or other aspects of delivery?
Potential affordability (critical success factor) What is the potential affordability of the alternative or options?	**Capital/operational/maintenance**	Does the cost of this option fit within the likely funding available? What factors might affect the ability of the project owner to afford the cost to operate and maintain the option over its projected life?
Potential value for money (critical success factor) What is the potential value for money of the alternative or options?		Consideration of the balance between costs and benefits, usually through cost–benefit analysis. When a proposed project does not yet have a calculated benefit–cost ratio (BCR), the

	Indicative Efficiency Rating (IER) tool can be used to calculate an IER for the project. The IER tool provides a rough estimate of monetised costs and benefits.
Supplier capacity and capability (critical success factor) What is the potential level of supplier capacity and capability of the alternative or options?	Any external resourcing challenges, for example dependency on local construction firms or IT skills, including interdependencies across projects.
Scheduling/programming (critical success factor) What is the potential scheduling/programming of the alternative or options?	When the alternative/option could be delivered and other timing requirements.
Opportunities and impacts	
Environment effects There are a variety of environmental criteria that may be relevant, depending on the project. Where an effect is likely to be significant, it should have its own line within the MCA. In some cases, there may be opportunities to improve environmental outcomes as a result of a project. **Note: impact (climate change mitigation and adaptation) is a separate criterion identified below**	What environmental effects are associated with this option? Environmental effects could include those related to ecology, water quality, stormwater, noise and vibration, visual impact, urban design, natural hazards, contaminated land, landscape, heritage (including archaeology), biodiversity, resource efficiency and air quality.
Social and cultural impacts There are a variety of criteria that may be relevant, depending on the project. Where an effect is likely to be significant, it should have its own line within the MCA.	What social or cultural impacts are associated with this option? Social or cultural impacts may include, for example, human health, impacts on community in relation to jobs, recreation, services and severance, impacts on farming and business operations.
Climate change mitigation	What is the long-term carbon emissions impact of the alternative or option? That is, consistent with carbon budgets once available.
Mandatory	
Climate change adaptation	Is the alternative or option exposed to climate change risk or other natural hazards over time?
Cumulative impacts	What cumulative impacts are there, if any, are associated with the option? Cumulative effects may be insignificant on their own, but may accumulate over time or space with other effects to become significant. Consider implementation, operation and maintenance phases. For example, air quality accumulating from increasing use of diesel engines in built up urban environments.
Impacts on Te Ao Māori	What, if any, impacts are there on Te Ao Māori? This includes areas of significance for Māori, Māori land and Kaitiakitanga (recognition that the environment is a taonga).
Property impacts	How does the option impact on property? Can the necessary property rights be obtained?

*Cost included as part of value for money; however, project teams may wish to record the cost of each option.

Number of criteria

The number of criteria should generally reflect the risk, opportunity, complexity and variety of the options assessed. As a rule, practitioners should aim for about 8 to 12 criteria in an MCA – and no more than 15. Including too many criteria can result in criteria scoring ‘balancing out’, or key criteria being outweighed by multiple other criteria. Also, double counting is more likely to occur if too many criteria are included. Some MCA will require fewer criteria than others; for example, a simple MCA process may use only four or five criteria, while a complex MCA could have significantly more.

Assessing criteria

SMEs advising on each criterion can provide indicative assessments for each option independently prior to the workshop. They should ensure that their assessment relates only to the specifics of the criterion as they have been applied to the particular activity, and that they do not comment on a matter or take into consideration a matter that is being considered in a different criterion.

SCORING: PURPOSE AND METHOD

Scoring allows for differentiation between options. The scoring system used needs to have sufficient range to sufficiently discern the benefits, disbenefits and/or effects of the various options.

There are a variety of scoring systems available. A 7-point scoring system, as detailed in table 2 below, will be appropriate for most activities. It can be used to rate quantitative and qualitative measures within the MCA template. The rating scale comprises a 7-point scale from -3 to +3. A summary of option performance can be obtained by adding these scores together. If desired, the total score or relative ranking of each option can be reported as part of the MCA table.

While Waka Kotahi recommends a 7-point scale as the standard approach, a 9- or 5- point scale can be applied where more or less granularity in scoring would better represent the evidence available.

If a project team deems the use of another scoring system more appropriate, this should be discussed and agreed with MCA technical specialists and the reasons for adopting that system well documented.

Scoring systems should be used consistently through the MCA and the activity lifecycle to enable fair comparison between options. Hence, if a new option is introduced or a reassessment is required, the same scoring system should be used.

Figure 2: 7-point scoring system

Magnitude	Definition	Score
Large positive (+ve)	Major positive impacts resulting in substantial and long-term improvements or enhancements of the existing environment.	3
Moderate positive (+ve)	Moderate positive impact, possibly of short-, medium- or long-term duration. Positive outcome may be in terms of new opportunities and outcomes of enhancement or improvement.	2
Slight positive (+ve)	Minimal positive impact, possibly only lasting over the short term. May be confined to a limited area.	1
Neutral	Neutral – no discernible or predicted positive or negative impact.	0
Slight negative (-ve)	Minimal negative impact, possibly only lasting over the short term, and definitely able to be managed or mitigated. May be confined to a small area.	-1
Moderate negative (-ve)	Moderate negative impact. Impacts may be short, medium or long term and are highly likely to respond to management actions.	-2
Large negative (-ve)	Impacts with serious, long-term and possibly irreversible effect leading to serious damage, degradation or deterioration of the physical, economic, cultural or social environment. Required major rescope of concept, design, location and justification, or	-3

	requires major commitment to extensive management strategies to mitigate the effect.	

The colours used above may allow a useful visual assessment to be undertaken as part of the MCA. This system is clear in its relationship with the do minimum, in that the neutral score is equivalent to the do-minimum.

SENSITIVITY ANALYSIS

Weights represent beliefs about how important a particular criterion is compared to other criteria. If all criteria are considered to be equally important then all weights are the same. However, some criteria are often considered more significant/material to an activity than others.

To both ensure transparency and recognise the significance/materiality of different criterion, the following steps should be followed:

- **Step one:** Undertake scoring with all criteria having equal weighting.
- **Step two:** Undertake sensitivity analysis. This enables the robust examination of the results by exploring their sensitivity to weighted changes to different criteria. All changes to weighting/data should be done systematically to assess their effect on results.
- **Step three**: Document the results and the reasoning applied.

While weighting can be used as part of sensitivity analysis, it should not be applied unilaterally to criteria to identify a 'preferred option' based on the scoring.

FATAL FLAWS

It may be beneficial to include a fatal flaw score in an MCA. A fatal flaw is a condition or circumstance that means the option will not be achieved or that a risk is so great that the option is not worth pursuing. Options that are highly difficult but not fatally flawed should remain in the mix and be scored accordingly.

If the EAST tool has been used, some fatal flaws should have already been identified and filtered.

Many fatal flaws relate to aspects which are not consentable under the RMA, or where property cannot be acquired, or where unresolvable legal challenges may arise. Engineering complexity is rarely a fatal flaw, although natural hazard exposure may be. Financially expensive options in and of themselves should not be considered fatally flawed.

CONSIDERING MITIGATION IN AN MCA

As part of option development and refinement, alternatives for avoiding significant adverse effects should be considered. If avoidance is not practicable then the reasons for this should be documented.

Individual specialists should first undertake an MCA assessment including standard 'best practice' mitigations (eg in a stormwater context, using erosion and sediment control measures to mitigate sediment runoff effects). Once completed, specialists must consider whether additional mitigation is required.

If additional practicable mitigation is identified, specialists should revisit their assessment and indicative scores to reflect this. This information should be recorded in the reporting materials, along with a description of the process by which agreement on mitigation was reached.

Mitigation for one criterion may result in changes to another. For example, adding a bridge to avoid an ecologically sensitive area may change whole-of-life costs and visual impacts.

If there is doubt about whether the additional mitigation or its flow-on impacts on other criterion is practicable and/or fundable, this should be discussed with the project team.

While the identification and assessment of effects and measures to avoid, remedy or mitigate them may be relevant at various stages of the optioneering process, it is more likely to be relevant later in the process (eg shortlist assessment) when more detailed information on the options is available.

Social and distributional effects

If an alternative or option has negative effects on particular vulnerable social groups (elderly, low income, disabled, etc.), the project team should consider whether additional measures can be introduced to avoid, remedy or mitigate this.

CRITICAL STATUTORY REQUIREMENTS FOR THE OPTIONEERING PROCESS

There are a number of legislative requirements to consider during all business case optioneering and decision-making processes. In particular, robust, transparent and well documented optioneering and decision-making processes are critical to meet the statutory requirements under the Land Transport Management Act (LTMA), Resource Management Act 1991 (RMA) and Public Works Act 1981 (PWA). Rather than adding unnecessary layers of complexity, these legislative obligations generally reflect best practice and are likely to enhance business case processes and outcomes.

Land Transport Management Act 2003

The LTMA sets out the legislative requirements that govern Waka Kotahi investment from the National Land Transport Fund (NLTF). When Waka Kotahi is approving proposed activities or a combination of activities, it must be satisfied that key legislative requirements under section 20 have been met, including that an activity or combination of activities:

- is consistent with the GPS
- is efficient and effective
- contributes to Waka Kotahi objectives
- has, to the extent practicable, been assessed against other land transport options and alternatives.

In addition, the LTMA places a number of obligations on the way Waka Kotahi undertakes its functions. In particular it requires Waka Kotahi to:

- exhibit a sense of environmental and social responsibility
- facilitate participation by Māori in land transport decision making
- ensure transparency in decision making, use of revenue and expenditure.

Resource Management Act 1991 and Public Works Act 1981 considerations

Investment proposals requiring approvals under the RMA, and/or requiring compulsory acquisition of land under the PWA, may be required to meet certain tests associated with optioneering and decision-making processes. This influences business case development processes and decisions across the entire business case development process – a thread that runs from the strategic case through to the implementation of a preferred solution.

These RMA and/or PWA requirements mean Waka Kotahi and its investment partners must clearly demonstrate:

- adequate consideration of alternatives throughout the entire optioneering process, from longlisting onwards. It is not necessary to consider all possible alternatives and options or evidentially eliminate alternatives that are clearly speculative or suppositious. In terms of the requirements under the RMA, an organisation is also not required to select the 'best' option. What is necessary is to demonstrate that an appropriate broad range of alternatives has been adequately considered.
- systematic and transparent optioneering and decision-making processes

- a sound argument for why any proposed physical works are ‘reasonably necessary’ (under the RMA) including the ability to demonstrate ‘reasonable need’ for any land required (PWA)
- appropriate recognition and provision for the principles of Te Tiriti o Waitangi in relation to managing the use, development, and protection of natural and physical resources and the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga
- consideration of a proposal’s social, cultural, environmental and economic effects and appropriate action considered to avoid, remedy or mitigate any adverse effects.

While the specific RMA and/or PWA requirements associated with a particular project are not known until at least the indicative business case (IBC) stage, it is necessary to ensure that all optioneering and decision-making processes meet these requirements from the outset, to ensure they are sufficiently robust to support any subsequent RMA approval or PWA requirements.

Seeking early input from Waka Kotahi property, RMA planning, technical and legal specialists into the business case process (particularly from longlisting onwards) will help support integrated decision making and ensure these processes meet the necessary legislative requirements.

The process of refining alternatives and options from a longlist to a shortlist, then to a preferred solution involves an increasingly refined sifting process with progressively more detailed and focused investigations and information filtering. The inclusion of ‘environmental’ criteria in optioneering processes will almost always be appropriate from the longlist stage onwards with increased granularity required at the shortlist stage.

It is likely that specific environmental criteria will be required to assess different physical options (eg different greenfield transport corridors). Identification of appropriate environmental criteria should be based on an assessment of constraints, opportunities and risks applicable to the area in question.

MCA OUTPUTS

The output from an MCA process will be a report detailing the methodology followed, the assessment of the options by criteria, the scoring of options by criteria and the basis for the scores, any further analysis, such as application of weighting through the sensitivity analysis, next steps and recommendations. For large or complex activities with complex MCA processes, undertaking a peer review on an MCA process is recommended.

The documentation of the MCA process may contain the following elements:

Summary of prior business case development (updated if EAST used)

- overview of project
- how previous spatial planning and strategic assessment outputs have been considered
- past optioneering work, including EAST outputs
- discussion on do-minimum
- discussion of objectives.

Methodology and approach

- description of agreed process for undertaking MCA, including stakeholder input
- description of methodology, including scoring (identifying departures from previous methodology, if relevant)
- description of assumptions
- identification and description of criteria.

MCA outputs

- assessment of criteria for each alternative or option (using MCA template)
- mitigation discussion

- sensitivity analysis
- appended reports, and
- decisions/discussions, including synergies and conflicts between alternatives and/or options if packaged together.

DEFINITIONS

Alternatives

An alternative is a strategic way of responding to a problem or opportunity applying a whole-of-system approach (can include corridor or network planning), such as exploring the potential for different land use arrangements or encouraging greater use of other modes to address projected growth in network demand. Alternatives may have been identified as part of development strategies and spatial plans but may also be developed as part of the Business Case Approach (BCA). In addition, the assessment of alternatives needs to meet RMA and PWA requirements as described above. In developing alternatives, it is important to consider the intervention hierarchy, which addresses:

- **demand** – for example, ways in which the need for travel can be reduced
- **productivity** – for example, by making sure the current system is optimised as far as reasonably practicable
- **supply** – for example, provision of new services or infrastructure.

Options

Options represent different ways to achieve an outcome or objective. For example, if it had been decided that the best way to address a particular problem was to improve an intersection for safety or efficiency reasons, options could include building a roundabout, installing traffic signals, or grade separation. The assessment of options needs to meet RMA and PWA requirements as described above.

Fatal flaws

A fatal flaw is a condition or circumstance that means the option will not be able to be achieved or that the risk is so great that the option is not worth pursuing. Fatal flaw analysis involves a high bar. Options that are highly difficult but not fatally flawed should remain in the mix and be scored appropriately.

Many fatal flaws relate to aspects which are not consentable under the RMA, where property cannot be acquired, or where unresolvable legal challenges may arise. Engineering complexity is rarely a fatal flaw, although natural hazard exposure may be. Financially expensive options in and of themselves should not be considered fatally flawed.

Investment objectives

The investment objectives specify the strategic outcomes for the proposed investment. Investment objectives are easily derived from information gathered during conversations in the development of the strategic assessment, around the identified problem/opportunity and the benefits associated with solving the problem. This information is entered into a ‘formula’ as follows:

[the effect of the problem] + [the selected benefit] + [the baseline and forecast impact on the benefit measure] = SMART investment objective.

Project objectives

Project objectives are those objectives specific to the preferred solution. These are important from an RMA perspective as they will be required to support the designation and consenting phase and are the objectives against which a consent application or notice of requirement is evaluated. The project objectives will be strongly informed by the investment objectives and while the purpose, framing and focus of investment and project objectives are different they should not significantly diverge. Planning and legal input on project objectives should be sought to ensure they are pitched correctly and reflect relevant case law.

APPENDIX 1: ROLES AND RESPONSIBILITIES IN THE MCA PROCESS

Role	Investment objectives	Project objectives	MCA options	
Investor/Project team	Develop investment objectives	Develop project objectives	Input into MCA process	Investor may provide background and investor context to support expert evidence on alternatives. Project team ongoing role in MCA processes as activity is developed and refined prior to lodging of a notice of requirement (NOR) and/or consent applications. Activity planner or MCA expert adviser may give evidence on alternatives assessment process.
Stakeholder	May provide input to development of investment objectives	May provide input to development of project objectives	May provide input to MCA process	May have ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
Iwi/Māori	May provide input to development of investment objectives	May provide input to development of project objectives	May provide input to MCA process Input to assessment of cultural impacts Complete Cultural Impact Assessment if required	May have ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
SME		May provide input to project objectives	Undertake provisional scores Input into MCA process	Ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications. Specialists may be used to provide specialist input on their topic to the assessment of options. If the process involves decision conferencing, they must be properly briefed, given time to undertake relevant investigations and to present and discuss their findings in the decision conference.

Role	Investment objectives	Project objectives	MCA options	
Legal advisor		May provide input into project objectives and should review consenting objectives	May advise on MCA process	Depending on the scale and complexity of the activity, legal advice may be sought at different points in the process. It may be desirable to seek high-level legal advice or review when the methodology for the MCA process is being developed for an activity, and also when the consenting strategy is being prepared. For large or complex activities, it may be helpful to engage more specific legal advice early in the process, for example, to assist in defining activity objectives against which an MCA process can be completed. The Waka Kotahi planning team should be contacted (consents@nzta.govt.nz) to work through the activity-specific requirements in this regard. May have ongoing role in review of MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
SMEs within Waka Kotahi	May provide input to development of investment objectives	May provide input to project objectives	May advise on and provide specific input to MCA process. Input into MCA process	Ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
Consenting specialists within Waka Kotahi		May provide input to project objectives and/or help project team to develop/review NOR objectives	Advise on and provide specific input to MCA process	Ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
Alternatives or MCA specialist		Input to development of project objectives	Advise on MCA process	Depending on the scale and complexity of the activity, it may be advisable to appoint an alternatives specialist. This role runs the alternatives assessment process, including coordinating the specialist inputs, facilitating workshops, undertaking subsequent analysis and ultimately preparing an overarching report on the process. They may also be required to give evidence at a hearing on the process followed. A vital role of this specialist, if appointed, will be to ensure consistency of approach both between specialists and throughout MCA processes at different stages of the activity.

Appendix F Long to Short List Workshop Outcomes

Wellington Regional Rail Plan:
Programme Long to Short List Workshop Outcomes

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
0.1	28/05/21	Draft	CL, SR	SR	DW	DW
0.2	24/06/21	Final	CL, SR	SR	DW	DW

1 Introduction and Purpose

This report summarises the outcomes from the Wellington Regional Rail Plan Programme Business Case long list to short list workshop, which was held on 15 April 2021. It provides a brief description of the process the evaluators used to assess the different programmes for the PBC and highlights where the group felt deviations from the expected process occurred.

The Wellington Regional Rail Plan (RRP) Programme Business Case (PBC) is a Greater Wellington Regional Council (GWRC) initiative to set out the long-term direction of investment in the rail network. This investment is a cornerstone of the Regional Land Transport Plan (RLTP), Regional Public Transport Plan (RPTP), and Regional Mode Shift Plan (MSP), and it will help enable the outcomes sought by the preferred direction of the Wellington Regional Growth Framework (RGF). The RRP has a 30-year timeframe for investment and is expected to be updated throughout this period.

While the RRP does not consider maintenance or 'business as usual' (BaU) as a capital intervention, there are opportunities to improve some of these aspects which may fall out of work conducted as part of the plan.

The RRP Strategic Case was recently endorsed by Waka Kotahi, allowing the programme development process to recommence. Individual interventions, which were previously developed by a range of stakeholders, have now been assessed using the Waka Kotahi Early Assessment Sifting Tool (EAST) and allocated into a set of long list programmes.

2 MCA Process

Due to the nature of the RRP and size of investment for all programmes (except doing nothing), an MCA process was undertaken to identify the short list of the options. This involved the scoring of the long list of programmes against the investment objectives and other key criteria at a high level to determine programmes worthy of further development.

2.1 Options Assessed

The long list consisted of eight different programme options:

- Do-Nothing
- Do-Minimum
- Minor Improvements
- Moderate Improvements
- Train Size Focus
- Frequency Focus
- Mixed Focus
- Facilitate Mode Shift.

The long list options are summarised in Table 2-1 below. For full details and projects included in each of the programmes, refer to the Wellington Regional Rail Plan: Programme Long to Short List Workshop Briefing document, dated 13 April 2021.

Table 2-1: Summary of Long List Programmes

Programme	Summary
Do-Nothing	• Consists of projects where the implementation phase is likely to be committed.
Do-Minimum	• Includes publically committed projects as well as projects deemed to be essential to maintain an acceptable level of service for the rail network. • Includes projects announced as part of the Wellington railway upgrade as part of the New Zealand Upgrade Programme.
Minor Improvements	• Consists of the Do-Minimum programme[1] as well as several key low-cost type projects that seek to improve reliability, safety, and resilience. • Includes the shortening of the North-South Junction section prior to full double tracking, 10-minute frequency on the Hutt line and improvements to the Kapiti line enabling larger train sets when the Matangi units are replaced at end of life.
Moderate Improvements	• Similar range of projects to the Minor Improvements programme, with slight acceleration. • Maximises use of tools such as charging for park and ride places and increased emphasis on using the passenger data to target investment.
Train Size Focus[2]	• Seeks to maximise train size, particularly at peak periods. • Includes substantial power supply upgrades and procurement of additional rolling stock up front. • Has a secondary focus of improving frequency later in the programme.
Frequency Focus[2]	• Seeks to maximise the number services run per hour, particularly at peak periods. • Includes power supply upgrades and procurement of additional rolling stock up front. • Has an upfront focus on removing safety hazards and constraints on capacity. • Has a secondary focus of increasing train size later in the programme.
Mixed Focus[2]	• Provides a balance between train size and frequency. • Delays the need for significant investments on both major corridors, by increasing frequency on the Hutt Valley Line and train size on the Kapiti Line, to delay the required implementation date for the North-South Junction double tracking.
Facilitate Mode Shift[2]	• The 'do maximum' programme, where all efforts to increase rail patronage are followed, including significant improvements to longer distance services.

[1] Except for the increase to train capacity during heavy maintenance.
[2] Includes interventions from the Minor Improvements Programme. Improvements may be scaled up.

2.2 Criteria

The long list programmes were scored against ten assessment criteria, five of which are investment objectives and five of which were developed by the project team. These criteria are described in Table 2-2 below.

Table 2-2: Assessment Criteria

Assessment Criteria		Description
Investment Objectives	Support a sustainable future	• Increase rail passenger and freight mode share. • Reduce rail carbon emission per passenger.
	Provide capacity that supports access and growth	• Improve access by increasing peak passenger capacity. • Maintain freight access by retaining existing freight paths throughout the day and ensuring capacity for growth.
	Attractive and easy to use	• Increase frequency throughout the day. • Improve peak punctuality. • Improve overall satisfaction of rail passengers. • Maintain ease of access and improve accessibility for impaired users.
	Adaptable to disruptions	• Reduce passenger impact of high impact low probability events. • Reduce passenger impact of unplanned events.
	Improve safety for all	• Reduce the rate of safety incidents. • Increase public and user perception of safety of rail.
Other Criteria	Overarching success factor[3]	• Increase rail usage (passenger & freight).
	Alignment with regional, national policies and investments	• Assesses programme alignment with policies such as the Zero Carbon Act, GPS, RLTP, RPTP, NZ Rail Plan, and other investments, such as the Let's Get Wellington Moving programme.
	Implementability	• Assesses how practical each of the projects are, considering aspects such as consenting of any capital works, funding availability. Can be considered similar to engineering degree of difficulty.
	Risks to programme delivery	• Identifies if a programme is at risk of not being implemented as expected for any reason. This is inclusive of legal or political risk.
	Affordability	• Scores the cost of the programme, on the assumption that more expensive programmes may be more difficult to fund and therefore will be less affordable.

2.3 MCA Assessors

In addition to the Stantec project team, who led the discussion, the MCA assessors were:

Greater Wellington Regional Council:

- Barry Fryer, Rail Asset Lead, Metlink/GWRC – to provide input from a Metlink Rail Asset expectation perspective as Future Asset Owner
- Daniel Pou, Rail Services Lead, Metlink/GWRC – to provide input from a Metlink Rail Operations expectation perspective as Future Service Delivery Owner
- Alex Campbell, Principal Advisor Network Design, Metlink/GWRC – to understand future direction of the rail network, and provide impact on wider public transport network (particularly bus services)
- Jarred Foster, Senior Investment Analyst, Metlink/GWRC – to understand investment requirements.

KiwiRail:

- Manjot Singh, - Infrastructure Manager Wellington, KiwiRail – Manager of the Wellington Metro Network Infrastructure – to understand future plans as Future Network Owner
- Eswar Nouthalapati, Business Manager Welly Metro Infrastructure, KiwiRail – as Future Network Owner
- Muriel Seeley, WMUP Programme Manager, KiwiRail – to provide input into current investment and as the likely delivery agent for future funding
- John Skilton, Programme Director: Future Rail Systems, KiwiRail – to provide input into current investment and as the likely delivery agent for future funding.

[3] While achieving all investment objectives will implicitly achievement this criterion, this allows for programmes that have made trade-offs for some of the investment objectives.

Transdev:

- Ian Ladd, Managing Director, Transdev – to provide operational input and as the ultimate service delivery provider
- Jonathan Tulitt, GM Wellington Operations, Transdev – to provide operational input and as the ultimate service delivery provider.

Waka Kotahi:

- Andrew Washington, Principal Investment Advisor, Waka Kotahi – observer of the process and as the ultimate receiver of the Programme Business Case.

3 MCA Scores

3.1 Workshop Scores

3.1.1 Workshop scoring system

The seven-point scoring system used for the assessment is outlines in Table 3-1.

Table 3-1: Workshop Scoring System

Benefit Level/ Duration	High Benefit	Medium Benefit	Low Benefit	Neutral	Low Disbenefit	Medium Disbenefit	High Disbenefit
Long term	3	3	2	0	-2	-3	-3
Medium term	3	2	2	0	-2	-2	-3
Short term	2	1	1	0	-1	-1	-2

It was originally intended to score all programmes against the Do-Minimum programme, which, by definition, was scored as zero against all criteria following standard practice. However, during the workshop, participants felt that a three-point benefit scale did not sufficiently differentiate between the programmes and noted that the Do-Minimum did not achieve the investment objectives. The Do-Minimum programme was consequently given a revised score below zero in the cases where the additional differentiation was wanted, and the programme did not achieve the investment objectives.

3.1.2 Workshop Scores

The programme scoring from the workshop is shown in Table 3-2.

Table 3-2: Long List Workshop Scores

Programme	Sustainable Future	Provide Capacity	Attractive and Easy to Use	Adaptable	Improve Safety	Increased Use	Alignment with Policies	Implementability	Risks	Affordability
Do-Nothing	-2	-3	-3	-3	-3	-2	-3	1	-2	0
Do-Minimum	0	-2	0	-1	-1	-1	-2	0	0	-1
Minor Improvements	0	0	1	0	0	0	-1	0	-1	-1
Moderate Improvements	1	1	1	1	0	1	0	0	-1	-1
Train Size Focus	2	2	2	2	1	1	1	-1	-1	-2
Frequency Focus	2	2	3	2	2	2	2	-3	-2	-3
Mixed Focus	2	2	3	2	2	2	2	-2	-1	-2
Facilitate Mode Shift	3	3	3	3	3	3	3	-3	-2	-3

The Facilitate Mode Shift, Frequency Focus and Mixed Focus programmes scored highest against seven of the criteria (sustainable future, provide capacity, attractive and easy to use, adaptable, improve safety, increased use, alignment with policies), but scored the poorest against implementability, risks and affordability. The Train Size Focus, Moderate Improvements and Minor Improvement programmes had a more balanced profile. The Do-Nothing option and Do-Minimum programme were given the lowest scores.

3.1.3 Commentary on Scores

Commentary on each of the assessed criteria is outlined below.

Sustainable Future

Under this criterion, the Do-Minimum programme was scored at zero. The Minor Improvements programme was considered to have some benefits above this, but these were judged to be insufficient to warrant a change in score beyond that of the Do-Minimum. The Mode Shift programme was deemed to deliver a high level of long-term benefits and scored at +3, while the remaining programme scores fell between +1 for the Moderate Improvements programme and +2 for the Train Size Focus, Frequency Focus and Mixed Focus programmes, which would enable significant mode shift (and hence reduced transport emissions), but not to the same extent as the Facilitate Mode Shift programme. The Do-Nothing option was judged to have significant disbenefits with a score of -2, reflecting the negative impact of the rail system gradually ceasing to function effectively as a modal option, which would lead to major mode shift to road and have a correspondingly negative impact on sustainability.

Provide Capacity

Under this criterion, the Do-Minimum programme was judged to score below zero, since it would only add capacity when a segment of a line was near what was considered the maximum capacity expected for that service. The Minor Improvements programme was scored at zero as it was considered to meet a base level of growth, while the Moderate Improvements programme would add additional capacity above that considered a minor improvement, giving it a score of +1. The Train Size Focus, Frequency Focus and Mixed Focus programmes again scored well at +2, with moderate benefits relating to their ability to provide lead capacity. The Facilitate Mode Shift programme was scored as +3 since it would provide significant additional capacity and do so relatively quickly. The Do-Nothing option was scored at -3 since it would not add any additional capacity.

Attractive and Easy to Use

Under this criterion, the Do-Minimum programme was scored at zero. The Minor and Moderate Improvements programmes, which would focus on improvements to reliability, although they would also include some customer-focused station improvements, were scored at +1. The Frequency Focus and Facilitate Mode Shift programmes, which target 10 trains per hour as soon as practicable and include many passenger-focused improvements such as to stations, scored at +3. The Mixed Focus programme was also scored at +3, as it is a pragmatic balance between train size on the Kapiti Line and frequency on the Hutt Line and it was felt to be a significant improvement over the Do-Minimum. The Train Size Focus programme was not felt to be as attractive or easy to use, but it was still judged to be better than the Minor and Moderate Improvements programmes and scored at +2. The Do-Nothing option scored -3 due to its lower reliability, lack of any increase in service levels, and lack of improvements to stations and other customer infrastructure.

Adaptable to Disruptions

Under this criterion, the Do-Minimum programme was judged to be both worse than existing and unable to achieve the investment objectives and was scored at -1. This was driven by the removal of EMU cabs to increase capacity, which would reduce fleet flexibility, making the system more susceptible to disruption due to events such as breakdowns. The Minor Improvements programme was judged to maintain a similar level of service to existing levels and consequently was scored at zero. The Moderate Improvements programme would have more interventions that would help restore service after disruption and was scored at +1. The Mixed Focus, Train Size Focus and Frequency Focus programmes were scored at +2, since they would make infrastructure improvements sooner and significantly expand the rolling stock fleet compared to the Do-Minimum, although they would not reach the levels provided by the Facilitate Mode Shift programme and therefore have less buffer to enable a quick response to events. The Facilitate Mode Shift programme was deemed to provide good response to unplanned events and was scored at +3. The do-nothing option was scored at -3, as it would be very vulnerable to disruption with increased demand on the network.

Improve Safety

Under this criterion, it was judged that the Do-Minimum programme would not maintain the existing level of service, as it would not provide extensive range of safety improvements. It was scored at -1 for three key reasons: (1) higher frequencies without improved protection for rail crossings would result in increasing risk; (2) safety standards would increase over time and could potentially lead to rail operations being shut down if not matched with improvements; and (3) if the Do-Minimum programme was to score zero, with the required frequency improvements, it was judged that an operation that simply maintained safety to the level where operations were legally allowed would have a default score +3. The Minor Improvements programme was scored as zero, as new trains would need to meet higher standards and reliability improvements would reduce further chances of accidents. The Moderate Improvements programme would provide more safety improvements than this, but not enough to justify a more significant score. The Frequency Focus and Facilitate Mode Shift programmes would eliminate level crossings and undertake additional safety improvements to enable the higher frequencies and were therefore scored as +3. This was in part because those higher frequencies would not be possible if safety improvements didn't occur. The Train Size Focus programme would have a less requirement for safety enhancements, due to the reduced need to enable higher frequencies. The Do-Nothing option was scored at -3, as without further investment as safety standards were increased, it is likely that Metlink operations would be shut down.

Increased Use

Under this criterion, the Do-Minimum programme was again judged to be scored below zero at -1, since it would not maintain even the long-term rail patronage growth trend and would fall substantially short of the short-term high patronage growth rate seen over the past 5 years. Each of the remaining options (other than the Do-Nothing option) scored in a range between zero to +3 in relation to their projected peak patronage in 2050, with the Minor Improvements programme scoring at zero and the Facilitate Mode Shift programme scoring +3. The Do-Nothing option was scored at -2 as some patronage would still be expected due to road congestion for as long as services were able to remain in operation, and not it would not be significantly worse than the Do-Minimum programme.

Alignment with Policies

Under this criterion, the Do-Minimum programme was judged to score below zero at -2 due to its poor alignment with policies. It was again determined that if the Do-Minimum programme was to be scored at zero, the three-point scale would only result in +3 being given to programmes that align with policies, and the programme was considered to perform poorly, since delays to several planned interventions would not align with the New Zealand Rail Plan and the programme would not enable the mode shift that is required to support legislated carbon neutrality goals. The Minor Improvements programme was given a -1 score, as its increased patronage would still fall short of mode shift and carbon aspirations. The Moderate Improvements programme was scored at zero since patronage would be insufficient to achieve RLTP targets. The Frequency Focus and Mixed Focus programmes were scored at +2, since they make good progress against the objectives. The Facilitate Mode Shift programme was again considered to best aligned with policies, since it would achieve significant mode shift and carbon emission reduction. The Do-Nothing option was scored at -3, as it would not advance government policy or objectives, nor would it align with other regional projects.

Implementability

Under this criterion, the Do-Minimum programme was scored at zero along with Minor and Moderate Improvements programmes, as all three programmes were considered to continue existing work and consequently known to be implementable. The Train Size Focus programme received a score of -1 due to the longer timeframes for large projects, while the Mixed Focus programme received a -2 score, as while there is a significant focus on implementation of large projects, but they are not as critical to the programme as the Frequency Focus and Facilitate Mode Shift programmes, which scored -3. The Do-Nothing option was scored at +1 as it would be easy, but there are no significant reductions in complexity in comparison to the Do-Minimum.

Risks

This criterion had a distinction noted by the workshop participants, where the levels of risks changed based on the programme. The Do-Minimum, Minor and Moderate Improvements programmes had operational and reputational risks, while the larger programmes had risks to programme delivery, consenting and budget. There was also the consideration of political risks of not achieving objectives. The Do-Minimum programme was scored zero, while the Minor and Moderate Improvements programmes scored at -1, due to lower financial and consenting risks but higher political risks. The Train Size Focus and Mixed Focus programmes also received -1, as they are considered to have lower public and political risks but higher property, consenting and budgeting risks. The Frequency Focus and Facilitate Mode Shift programmes scored at -2, with a higher level of property, budgeting, and consenting risk than the more moderate programmes. The Do-Nothing option was scored at -2 due to its operational and reputational risks. It did not score -3, since this option would likely result in the rail network being shut down. That risk is already of concern in the Do-Minimum programme.

Affordability

Under this criterion, the Do-Minimum programme was scored below zero, at -1, driven by the upper high-level estimates for the programme reaching $2.7b, with a concentrated spend over the initial 10 years. This exceeds the total amount of funding for rail in the 2021 GPS. It was judged that there was only a small difference from the Do-Minimum and the Minor and Moderate Improvements programmes, so they also scored -1, while the Train Size Focus and Mixed Focus programmes were both scored at -2, reflecting their higher cost. The Frequency Focus and Facilitate Mode Shift programmes scored -3. While the total cost of these programmes was relatively similar, the sustained high spending was judged to be more unaffordable than the more conservative spending load for the Mixed Focus and Train Size Focus programmes. The Do-Nothing was given a zero value due to its lower cost compared to the Do-Minimum.

3.2 Moderated Scores

A rebalancing of exercise was subsequently undertaken by the project team to test the workshop scores, reflecting Waka Kotahi's preference for the Do-Minimum option to be scored at zero. The Do-Minimum was tested with a score of both -1 and -2. During this moderation process, the project team retained the -3 to +3 scoring system. The team also tried to maintain the proportion of scores and then rounded them to zero decimal places. The focus was on preserving the ratio of positive scores. The workshop scores were retained where the Do-Minimum programme had been scored at zero during the workshop.

Table 3-3 outlines how the scores were mapped.

Table 3-3: Moderation of scores process

Initial Score	-1 Initial Score	-2 Initial Score
-3	-2	-2
-2	-1	0
-1	0	0
0	1	1
1	2	2
2	2	2
3	3	3

Table 3-4 below shows the moderated scores.

Table 3-4: Scores following adjustment to Do-Minimum to Zero

Programme	Sustainable Future	Provide Capacity	Attractive and Easy to Use	Adaptable	Improve Safety	Increased Use	Alignment with Policies	Implementability	Risks	Affordability
Do-Nothing	-2	-1	-3	-2	-2	-1	-1	1	-2	2
Do minimum	0	0	0	0	0	0	0	0	0	0
Minor Improvements	0	1	1	1	1	1	1	0	-1	0
Moderate Improvements	1	2	1	2	1	2	1	0	-1	0
Train Size Focus	2	2	2	2	2	2	2	-1	-1	-2
Frequency Focus	2	2	3	2	2	2	2	-3	-2	-3
Mixed Focus	2	2	3	2	2	2	2	-2	-1	-2
Facilitate Mode Shift	3	3	3	3	3	3	3	-3	-2	-3

Both the workshop scores and moderated scores will be used to determine the preferred options.

4 Weighting Systems

A range of weighting systems was used to understand the preferred programme at this stage and how this would change with the emphasis of different priorities.

4.1 Workshop Weighting

At the workshop, the participants gave each criterion a score between 0 and 10, with 10 being considered more important. The participants judged capacity, attractiveness, safety, and increased use as the most important, giving each a score of 10, while sustainability was given an 8. The adaptability and alignment to policies criteria were given a score of 6, affordability a score of 5, and the implementability and risk criterion a score of 4.

4.2 Other Weighting Systems

Other weighting systems were developed by the project team, and are outlined below. These weighting systems were designed to understand the impact of emphasis different aspects of the programme. These weighting systems all followed the same procedure of emphasising several criteria as outlined in Table 4-1.

Table 4-1: Weighting system emphasis

# of Emphasised Criterion	# of Unemphasised Criterion	Total Emphasised Percentage	Remaining Percentage	Difference Between Individual Emphasised and Unemphasised Criteria
1	9	35%	65%	28%
2	8	55%	45%	22%
3	7	65%	35%	17%
4	6	75%	25%	15%

Equal Weighting

In this system, all criterion were given an equal weighting to remove any potential bias towards individual criteria. All criteria consequently received a weighting of 10%.

Investment Objectives as a Singular Criterion (IO as Single)

This weighting system did not emphasise a criterion but averaged the five investment objectives scores to enable them to be treated as a single criterion. This resulted in more emphasis on the deliverability compared to the outcomes.

Safety Emphasis

This weighting system sought to understand which programmes were preferred when safety was given the most consideration. This gave the safety investment objective a 35% weighting and then equally distributed the remaining 65% of the weighting.

Capacity Emphasis

This weighting system sought to understand which programmes were preferred when capacity was given the most consideration. This gave the capacity investment objective a 35% weighting and then equally distributed the remaining 65% of the weighting.

Success Factor Emphasis

This weighting system sought to understand which programmes were preferred when the critical success factor was given the most consideration. This gave the critical success factor a 35% weighting and then equally distributed the remaining 65% of the weighting.

Customer Focus Emphasis

This weighting system sought to understand what programmes were preferred when the customer experience and use were given the highest priority. This gave both the attractive and easy to use and increased use criteria a 27.5% weighting, with the 45% remaining divided equally to the remaining criteria.

Delivery Emphasis

This weighting system sought to understand if there was a change to the preferred programme when the ease of delivery was the key consideration, noting that if programme cannot be delivered for any reason, then there are no benefits from investment. This gave a 21.7% weighting to the implementability, risk, and affordability criteria, and equally distributed the remaining 35% to the remaining criteria.

Delivery and Customer Focus

This weighting combined the two above systems, seeking to understand under the MCA process which programmes are deliverable yet still achieve the desired customer outcomes. This gave 18.8% to each of the implementability, risk, affordability, and increased use criteria, while distributing the remaining 25% equally to the remaining criteria.

Implementable and Affordable Focus

This system sought to understand the delivery emphasis if it was felt the risks could be appropriately managed. This system was tested as some attendees in the workshop thought that the implementability could be considered to include the risk component. This system eliminates the possible double counting of the risk. This gave 27.5% to each of the implementability and affordability criteria and equally distributed the remaining 65% of the weighting.

Affordable Focus

This weighting system sought to understand which programmes were preferred when affordability was given the most consideration. This gave the affordability criterion a 35% weighting and equally distributed the remaining 65% of the weighting.

4.3 Summary

Table 4-2 outlines all the weighting systems used to test the programme options.

Table 4-2: Weighting systems used to assess the programmes

Weightings	Sustainable Future	Provide Capacity	Attractive and Easy to Use	Adaptable	Improve Safety	Increased Use	Alignment with Policies	Implementability	Risks	Affordability
Workshop	11.0%	13.7%	13.7%	8.2%	13.7%	13.7%	8.2%	5.5%	5.5%	6.8%
Equal	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
IO as Single	3.3%	3.3%	3.3%	3.3%	3.3%	16.7%	16.7%	16.7%	16.7%	16.7%
Safety Emphasis	7.2%	7.2%	7.2%	7.2%	35.0%	7.2%	7.2%	7.2%	7.2%	7.2%
Capacity Emphasis	7.2%	35.0%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%
Success Factor Emphasis	7.2%	7.2%	7.2%	7.2%	7.2%	35.0%	7.2%	7.2%	7.2%	7.2%
Customer Focused Emphases	5.6%	5.6%	27.5%	5.6%	5.6%	27.5%	5.6%	5.6%	5.6%	5.6%
Delivery Emphasis	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	21.7%	21.7%	21.7%
Customer and Use Focus	4.2%	4.2%	4.2%	4.2%	4.2%	18.8%	4.2%	18.8%	18.8%	18.8%
Implementable and affordable	5.6%	5.6%	5.6%	5.6%	5.6%	5.6%	5.6%	27.5%	5.6%	27.5%
Affordable Focus	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	35.0%

The weighting systems were identified to be split between outcomes focus and deliverability focus. When assessing the programmes with the weighting systems, two sets of analysis were conducted, one including and one excluding the affordability criterion. When excluding affordability, the affordable focus was excluded as it then mirrored the equal importance weighting system.

5 Results

5.1 Workshop Scores Analysis

5.1.1 Full Analysis Including Affordability

Table 5-1 outlines the final weighted scores for all weighting systems using the workshop scores, when including affordability.

Table 5-1: Weighted programme scores using the workshop scores including affordability

Workshop Score	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable	Affordable Focus
Do-Nothing	-2.27	-2.00	-1.47	-2.28	-2.28	-2.00	-2.22	-1.17	-1.27	-0.91	-1.44
Do minimum	-0.86	-0.80	-0.80	-0.86	-1.13	-0.86	-0.67	-0.57	-0.63	-0.67	-0.86
Minor Improvements	-0.07	-0.20	-0.47	-0.14	-0.14	-0.14	0.11	-0.43	-0.38	-0.33	-0.42
Moderate Improvements	0.48	0.30	-0.03	0.22	0.49	0.49	0.61	-0.18	-0.02	-0.05	-0.06
Train Size Focus	1.04	0.70	-0.03	0.78	1.06	0.78	1.05	-0.32	-0.15	-0.26	-0.05
Frequency Focus	1.30	0.70	-0.30	1.06	1.06	1.06	1.49	-0.98	-0.58	-0.92	-0.33
Mixed Focus	1.48	1.00	0.20	1.28	1.28	1.28	1.66	-0.33	-0.02	-0.31	0.17
Facilitate Mode Shift	1.99	1.30	0.17	1.77	1.77	1.77	2.04	-0.68	-0.19	-0.58	0.11

Table 5-2 outlines the resulting ranks for each weighting system.

Table 5-2: Ranking of programmes for each weighting system

Rank	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable	Affordable Focus
Do-Nothing	8	8	8	8	8	8	8	8	8	7	8
Do minimum	7	7	7	7	7	7	7	5	7	6	7
Minor Improvements	6	6	6	6	6	6	6	4	5	4	6
Moderate Improvements	5	5	4	5	5	5	5	1	1	1	4
Train Size Focus	4	3	3	4	3	4	4	2	3	2	3
Frequency Focus	3	3	5	3	4	3	3	7	6	8	5
Mixed Focus	2	2	1	2	2	2	2	3	1	3	1
Facilitate Mode Shift	1	1	2	1	1	1	1	6	4	5	2

The Mixed Focus programme constantly ranks highly under all weighting systems when affordability is included. The Facilitate Mode Shift programme is ranked highly where the impacts of its high cost and risks have a lower weighting, but it suffers where they are given a higher weighting. The Moderate Improvements programme is the preferred programme where the delivery focus weightings are prioritised, reflecting how it balances investment against the outcomes sought. The Do-Nothing programme ranks poorly, as does the Minor Improvements programme, which only reaches the middle of the rankings in the delivery focus weighting systems.

5.1.2 Workshop Scores Full Analysis Excluding Affordability

Table 5-1 outlines the final weighted scores for all weighting systems using the workshop scores, when excluding affordability.

Table 5-3: Weighted programme scores using the workshop scores excluding affordability

Workshop Score	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable
Do-Nothing	-2.44	-2.22	-1.76	-2.43	-2.43	-2.16	-2.34	-1.28	-1.46	-1.93
Do minimum	-0.85	-0.78	-0.76	-0.84	-1.11	-0.84	-0.66	-0.35	-0.50	-0.53
Minor Improvements	0.00	-0.11	-0.36	-0.08	-0.08	-0.08	0.15	-0.33	-0.25	-0.08
Moderate Improvements	0.59	0.44	0.16	0.33	0.59	0.59	0.68	-0.08	0.17	0.30
Train Size Focus	1.26	1.00	0.36	1.00	1.27	1.00	1.21	-0.10	0.17	0.68
Frequency Focus	1.62	1.11	0.24	1.35	1.35	1.35	1.70	-0.88	-0.21	0.53
Mixed Focus	1.74	1.33	0.64	1.51	1.51	1.51	1.83	-0.23	0.29	0.90
Facilitate Mode Shift	2.35	1.78	0.80	2.11	2.11	2.11	2.29	-0.58	0.25	0.98

Table 5-2 outlines the resulting ranks for each weighting system.

Table 5-4: Ranking of programmes for each weighting system

Rank	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable
Do-Nothing	8	8	8	8	8	8	8	8	8	8
Do minimum	7	7	7	7	7	7	7	5	7	7
Minor Improvements	6	6	6	6	6	6	6	4	6	6
Moderate Improvements	5	5	5	5	5	5	5	1	3	5
Train Size Focus	4	4	3	4	4	4	4	2	3	3
Frequency Focus	3	3	4	3	3	3	3	7	5	4
Mixed Focus	2	2	2	2	2	2	2	3	1	2
Facilitate Mode Shift	1	1	1	1	1	1	1	6	2	1

The Mixed Focus programme is still constantly ranked highly under all weighting systems when affordability is excluded. The Facilitate Mode Shift programme is ranked highly where the impacts of its high cost and risks have a lower weighting, but it suffers where they are given a higher weighting. The impact to the Moderate Improvements programme is significant in this situation, with the Train Size Focus programme achieving better overall scores. The Do-Nothing option and Do-Minimum and Minor Improvements programmes score poorly under all weighting systems when affordability is excluded.

5.2 Moderated Scores Analysis

5.2.1 Moderated Scores Full Analysis Including Affordability

Table 5-5 outlines the final weighted scores for all weighting systems using the moderated scores, when including affordability.

Table 5-5: Weighted programme scores using the moderated scores including affordability

Workshop Score	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable	Affordable Focus
Do-Nothing	-2.27	-2.00	-1.47	-2.28	-2.28	-2.00	-2.22	-1.17	-1.27	-0.91	-1.44
Do minimum	-0.86	-0.80	-0.80	-0.86	-1.13	-0.86	-0.67	-0.57	-0.63	-0.67	-0.86
Minor Improvements	-0.07	-0.20	-0.47	-0.14	-0.14	-0.14	0.11	-0.43	-0.38	-0.33	-0.42
Moderate Improvements	0.48	0.30	-0.03	0.22	0.49	0.49	0.61	-0.18	-0.02	-0.05	-0.06
Train Size Focus	1.04	0.70	-0.03	0.78	1.06	0.78	1.05	-0.32	-0.15	-0.26	-0.05
Frequency Focus	1.30	0.70	-0.30	1.06	1.06	1.06	1.49	-0.98	-0.58	-0.92	-0.33
Mixed Focus	1.48	1.00	0.20	1.28	1.28	1.28	1.66	-0.33	-0.02	-0.31	0.17
Facilitate Mode Shift	1.99	1.30	0.17	1.77	1.77	1.77	2.04	-0.68	-0.19	-0.58	0.11

Table 5-6 outlines the resulting ranks for each weighting system.

Table 5-6: Ranking of programmes for each weighting system for the moderated scores

Rank	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable	Affordable Focus
Do-Nothing	8	8	8	8	8	8	8	6	7	3	7
Do minimum	7	7	6	7	7	7	7	3	4	4	6
Minor Improvements	6	6	3	6	6	6	6	2	2	2	2
Moderate Improvements	5	4	1	5	4	4	5	1	1	1	1
Train Size Focus	3	3	2	3	2	2	4	4	3	5	3
Frequency Focus	4	5	7	4	5	5	3	8	8	8	8
Mixed Focus	2	2	4	2	2	2	2	5	5	6	4
Facilitate Mode Shift	1	1	5	1	1	1	1	7	6	7	5

The impact of the moderated scores is apparent under this scenario, where the Moderate Improvements and Minor Improvements programmes score well under the IO as Single and Delivery Focus weighting systems. However, overall trends are quite similar to the workshop scores.

5.2.2 Moderated Scores Full Analysis Excluding Affordability

Table 5-7 outlines the final weighted scores for all weighting systems using the moderated scores, when excluding affordability. It shows that some of the differences reduce.

Table 5-7: Weighted programme scores using the moderated scores excluding affordability

Moderated Scores	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Attractive and Deliverable
Do-Nothing	-1.59	-1.44	-1.00	-1.59	-1.33	-1.33	-1.68	-0.93	-0.96	-1.41
Do minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Minor Improvements	0.71	0.56	0.36	0.68	0.68	0.68	0.74	-0.03	0.21	0.38
Moderate Improvements	1.21	1.00	0.68	1.00	1.27	1.27	1.21	0.18	0.58	0.68
Train Size Focus	1.65	1.33	0.80	1.51	1.51	1.51	1.61	0.05	0.50	0.90
Frequency Focus	1.62	1.11	0.24	1.35	1.35	1.35	1.70	-0.88	-0.21	0.53
Mixed Focus	1.74	1.33	0.64	1.51	1.51	1.51	1.83	-0.23	0.29	0.90
Facilitate Mode Shift	2.35	1.78	0.80	2.11	2.11	2.11	2.29	-0.58	0.25	0.98

Table 5-6 outlines the resulting ranks for each weighting system.

Table 5-8: Ranking of programmes for each weighting system for the moderated scores when excluding affordability

Rank	Workshop	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Customer and Delivery Focus
Do-Nothing	8	8	8	8	8	8	8	8	8	8
Do minimum	7	7	7	7	7	7	7	3	6	7
Minor Improvements	6	6	5	6	6	6	6	4	5	6
Moderate Improvements	5	5	3	5	5	5	5	1	1	4
Train Size Focus	3	2	1	2	2	2	4	2	2	2
Frequency Focus	4	4	6	4	4	4	3	7	7	5
Mixed Focus	2	3	4	3	2	2	2	5	3	3
Facilitate Mode Shift	1	1	2	1	1	1	1	6	4	1

Removal of the affordability criterion makes the improvement seen to the Moderate Improvements programme more moderate. It also improves the Frequency Focus programme.

5.3 Summary

The analysis shows that the Facilitate Mode Shift programme is consistently ranked as the best programme, with the Mixed Focus programme close behind. The Moderate Improvements programme also scores well when considering the delivery focus weighting system. Based on these findings, it is recommended that the Facilitate Mode Shift, Mixed Focus and Moderate improvements programmes are investigated further in the business case process before determining a preferred programme.

6 Next Steps

The next step is for GWRC to further consider the draft MCA report and confirm that the Moderate Improvements, Mixed Focus and Facilitate Mode Shift programmes should be considered further as part of the business case. Following completion of this analysis, a detailed MCA assessment of these three options will be conducted to identify a technically preferred programme for the Regional Rail Plan.

It is important to note that the MCA outcomes are not the only factor that GWRC will consider in making decisions on the preferred programme. GWRC may also consider a range of other matters including cost and funding availability, risk and opportunities, and the desired outcomes of Iwi and key stakeholders.

Appendix G Appraisal Summary Tables

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Appendix H Short List to Preferred Programme Workshop Briefing

Stantec

Wellington Regional Rail Plan: Preferred Programme Workshop Briefing

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
0.1	22/11/21	First Draft	SR	SC	DW	DW

1 Purpose and Introduction

This note is provided as background to the evaluators for the Wellington Regional Rail Plan Programme Business Case preferred programme selection workshop. It provides a brief description of the process the evaluators will be using to assess the different programmes for the PBC and sets out how the workshop will run.

The Wellington Regional Rail Plan (RRP) Programme Business Case (PBC) is a Greater Wellington Regional Council (GWRC) initiative to set out the long-term direction of investment in the rail network. This investment is a cornerstone of the Regional Land Transport Plan (RLTP), Regional Public Transport Plan (RPTP), and Regional Mode Shift Plan (MSP), and it will help enable the outcomes sought by the preferred direction of the Wellington Regional Growth Framework (RGF). The RRP has a 30-year timeframe for investment and is expected to be updated throughout this period.

While the RRP does not consider maintenance or 'business as usual' (BaU) as a capital intervention, there are opportunities to improve some of these aspects which may fall out of work conducted as part of the plan.

The RRP Strategic Case was previously endorsed by Waka Kotahi, allowing the programme development process to recommence. Individual interventions were then developed by a range of stakeholders and assessed using the Waka Kotahi Early Assessment Sifting Tool (EAST) before being allocated into a set of long list programmes. These were then assessed by a group of stakeholders from GWRC, Waka Kotahi, KiwiRail and Transdev, to identify the short list of programmes for further assessment. The shortlisted programmes have since been refined and further analysed to understand timing, exact requirements of interventions, as well as their operational, reliability, and financial implications. Representatives from the organisations involved in the shortlisting process are now coming to review the shortlisted programmes to determine the preferred programme. Identification of the preferred programme does not bind GWRC decision makers to recommend this programme, as they may consider aspects such as affordability when determining the actual programme to be taken forward.

2 Multi Criteria Analysis

Multi Criteria Analysis (MCA) is a method which enables a wide range of different aspects to be taken into consideration in evaluating options and provides a systematic framework for working through the merits and disadvantages of each option.

Done well, MCA can provide an open, traceable, and repeatable process. It enables consideration of a range of criteria which are both qualitative and quantitative. These criteria can reflect social, economic, cultural, and environmental characteristics of the project outcomes and effects. It can also enable sensitivity testing a range of different perspectives to add additional robustness to the option selection process.

MCA does not supplant decision makers. It is a tool that will help decision making, but it does not make the decision. MCA should always be one of a range of inputs that decision makers use to decide on their preferred option. These other inputs will include, as a minimum:

- Investment assurance, including cost benefit analysis
- Risk assessment
- Cultural impact.

Guidance on the MCA process can be found on the Waka Kotahi Investhub Portal.

As this MCA process will identify the preferred programme, the assessors will be those familiar with the programmes, having been involved previously in RRP process. This includes members of the project team, as well as relevant experts from GWRC, Transdev, KiwiRail and Waka Kotahi.

3 Options

Previously the project team had developed eight different programmes in conjunction with GWRC, including do-nothing and do-minimum programmes. These were:

- Do-nothing
- Do-minimum
- Minor Improvements
- Moderate Improvements
- Train Size Focus
- Frequency Focus
- Mixed Focus
- Drive Mode Shift.

The short list workshop identified a short list consisting of the:

- Moderate Improvements programme
- Mixed Focus programme
- Drive Mode Shift programme.

The shortlisted programmes along with the do-minimum have been further analysed to understand the implications and difficulty of their rollout.

3.1 Do-minimum

The do-minimum programme, including the work behind it to determine its suitability is outlined in Appendix A. It includes publicly committed projects as well as projects deemed to be essential to maintain an acceptable level of service for the rail network. It can be summarised as including the following new projects:

- Implementation of the new ('RS1') timetable
- Train capacity increases during heavy maintenance (removal of cabs)
- Matangi end of life replacements with minor fleet increase in the mid 2040s
- Timetabling changes to Waikanae services following the fleet replacement
- Power supply upgrades to enable the above capacity improvements
- Maintenance works to ensure that the network is 'fit for purpose' and can deliver the above services more reliably
- Fleet storage in Kapiti to enable 12 minute peak intervals into Wellington
- Fleet expansion to 94 EMUs by 2050 plus refurbish long distance rolling stock during fleet replacement
- Commencing investigation work on North-South Junction in circa 2050.

The do-minimum also includes projects announced as part of the Wellington railway upgrade as part of the New Zealand Upgrade Programme, such as reconfiguration of the station 'throat' layout and Wairarapa capacity and signalling improvements.

All interventions, except for the increase to train capacity during heavy maintenance, are included in all subsequent programmes. This intervention is not needed in other options as capacity is provided by additional rolling stock.

3.2 Shortlisted Programmes

The three shortlisted programmes include a mix of fleet, infrastructure, and service improvements beyond the do minimum. The timing and extent of the improvements differ between programmes, with the Moderate Improvements programme managing growth, the Mixed Focus programme enabling growth in pragmatic way, and the Drive Mode Shift programme accelerating growth.

All three programmes include the following:

- Investigations into optimisation of stations, station zoning, service frequency span, future rail lines and use of existing lines, and network constraints
- Resilience and operations improvements, including slope stabilisation, resilience to sea level rise, drain and culvert capacity
- Capacity improvements at North-South Junction and Waikanae
- Network segregation improvements, including the gating of all pedestrian level crossings, closure and segregation of road crossings, and other safety-related segregation (e.g. fencing)
- Network wide resignalling
- Train related improvements, including wifi or phone coverage in tunnels, improved platform interface, train capacity indicators, long distance fleet replacement and expansion, EMU fleet expansion and replacement at end of life

- Wellington Station improvements, including northern access to the Wellington EMU stabling yard improved access to the Wellington freight terminal, and Wellington-Kaiwharawhara quadruplication
- Station access improvements, including to subways, suburban interchanges, access links, cycle facilities, and bus connections
- Station improvements, including to accessibility for mobility impaired and other users, shelter, CPTED, sustainability, wayfinding and signage, platform markers, and transit oriented development
- Maintenance improvements, including the use of new technologies and overnight maintenance
- Other improvements, including to analytics, operations control, train crew allocation, recovery practices following events, and the roll out of electronic ticketing
- Incremental service improvements, linked to the degree and timing of infrastructure and fleet improvements provided.

Overviews of each programme are provided in the following sections. Individual interventions are listed in Appendix B. Rough order capacity and patronage analyses (Hutt services, Kapiti services and total network capacity) are provided in Appendix C.

3.3 Moderate Improvements

The Moderate Improvements programme takes a managed approach to growth. It seeks to make more use of demand management tools such as charging for park and ride to delay the need to make capacity improvements and places an increased emphasis on the use of passenger data to prioritise and target investment.

Building on the list in Section 3.2, this programme includes the following specific interventions:

- Optimise Network Capacity Study to commence and be completed by end of 2024
- Implementation of short-term North-South Junction capacity improvements in 2027 to enable 12-minute intervals and 10-minute intervals by 2043.
- Targeted pricing to spread peak demand
- Park and ride charging
- Kapiti Line power supply upgrades
- Station renewals at key sites
- Grade separation of busiest level crossings
- Review of park and ride to evaluate impacts of user charges
- Fleet expansion to 129 EMUs by 2050.

3.4 Mixed Focus Programme

The Mixed Focus programme takes a pragmatic approach to provision of the capacity needed to enable mode shift and growth, by providing frequency where it is easier to do in the short term and delaying frequency where significant investment is required to enable it. Frequency improvements are therefore made first on the Hutt Line, while train size expansion is used to accommodate short term growth on the Kapiti Line. The Kapiti Line frequency is brought into line with the Hutt Line once the constraints are removed by the early 2030s. Further improvements are then made to facilitate further growth over time.

Building on the Moderate Improvements programme, this programme includes the following interventions:

- Maximise Network Capacity Study to be complete by early 2023 evaluating:
  - North-South Junction capacity improvements, with potentially staged implementation
  - Wellington throat capacity improvements
  - Removal of network constraints Waikanae to Palmerston North
- Further resilience and operations improvements, including bridge seismic resilience, EMU depot location, Porirua freight passing enhancements, increased outer stabling, additional crossovers, track improvements to reduce speed restrictions, improved Woburn siding access
- Power supply upgrades on all lines – focusing on the Kapiti Line initially
- Grade separation of road crossings on all lines, but with initial focus on the Hutt Line
- Gating all pedestrian crossings, but with initial focus on the Hutt Line
- Hutt Valley Line 12-minute peak intervals then progressively higher intervals at peak times, with train size improvements as required by demand
- Kapiti Line peak services to 8-car trains as fast as reasonably practicable, then moving to 12-minute intervals by 2034 and 10-minute intervals by 2040
- Off-peak service improvements
- Fleet expansion to 146 EMUs by 2050.

3.5 Drive Mode Shift

The Drive Mode Shift programme is a 'do maximum' programme, where all efforts to drive more shift and patronage growth are followed. Interventions that enable frequency are accelerated, so that capacity can be increased quickly through both frequency train size improvements.

Building on the Balanced programme, this programme includes the following interventions:

- Maximise Network Capacity Study to be complete by early 2023 evaluating:
  - North-South Junction capacity improvements, with potentially staged implementation
  - Wellington throat capacity improvements
  - Removal of network constraints Waikanae to Palmerston North
  - Third track in Tawa Basin
  - Separated access into the Wellington freight terminal
  - Melling junction improvements
- Multiple rounds of additional train procurement, with new trains arriving every decade
- Major train frequency improvements, aiming to roll out a 6-minute peak interval once at-grade level crossings are removed
- Initiating work on a second Remutaka tunnel around 2050 to enable higher future frequency on the Wairarapa Line
- Review of the role of the Johnsonville Line as heavy rail to enable better efficiency at Wellington Station
- Extension of electrification beyond the current electrified area (details dependent on further investigations)
- Fleet expansion to 183 EMUs by 2050.

3.6 Capacity Comparison

At this stage of programme development, five growth scenarios have been provided by the Wellington Transport Analytics Unit. These growth scenarios have been used to estimate passenger demand and associated train frequency and capacity requirements for each of the programmes. Specific growth scenarios have been applied based on the expected reliability and quality of service. As assets age and are utilised to a greater extent the expected growth drops from the Table 3-1 outlines the base growth has been allocated to programmes based on capacity and expected reliability.

Table 3-1: Base growth scenarios used for each programme

Capacity Range / Service Reliability	High	Moderate	Low
Ideal	5	4	3
Comfortable	4	3	2
Maximum	3	2	1
Above Maximum	0	0	0

The growth scenarios have been adjusted based on the project team's experience, typically under the following circumstances:

1. As capacity becomes constricted the rate of growth reduces
2. There is an increase in uptake as frequency is improved
3. After a sustained number of years in the maximum capacity range, returning to ideal capacity would not immediately return to the highest growth
4. After a sustained number of years with potential reliability issues, patronage growth can decline or cease.

The growth scenarios were compared to typical elasticities for the changes in frequencies which indicate that they are reasonable.

The indicative peak hour patronage into Wellington for each of the programmes is presented in Table 3-2.

Table 3-2: Comparisons between predicted patronage for each programme

	Peak Hour Patronage			Difference from Do-minimum		
Year	2030	2040	2050	2030	2040	2050

Do-Minimum	11613	12780	13782	-	-	-
Moderate Improvements	12741	14351	16399	10%	12%	19%
Mixed Focus	12950	15238	17436	12%	19%	27%
Facilitate Mode Shift	13091	16147	18461	13%	26%	34%

The relative similarity of the programmes in 2030 is driven by limited differences in provided capacity between programmes in the first decade, due to the long lead times associated with rail improvements. The key drivers for the increased patronage in the programmes at this stage is the improved reliability from improved maintenance and new signalling system which are delivered in the first decade.

4 Assessment Criteria

The criteria used for the long list workshop have been refined to better account for the greater level of detail known from the work conducted in the programme development phase. The scoring system has also changed as outlined below.

4.1 Scoring System

For this MCA assessment, an eleven-point scale from -5 to +5 is proposed for each of the criteria, when each programme is considered against the existing scenario today (i.e., the evaluation of each option today scores a 0). Programmes are to be scored for their expected performance in 2040 (i.e., after 20 of the planned 30 years of investment). Since scores are relative to the current existing scenario, they can be negative if that aspect is considered worse than the existing scenario. Scores include a time-based element and a quantity-based element; however, the significance of each component is left to the discretion of the scorer. The scoring system is detailed in Table 4-1.

Table 4-1: Scoring system for preferred programme selection process

Score	Scoring Description
5	Substantial benefits and a high degree of confidence of benefits being realised and/or long term / permanent benefits
4	High extent of benefits and confidence of benefit being realised and/or medium - long term benefits
3	Good benefits and/or medium term
2	Low or localised benefits and/or short term
1	Very low benefits and/or very short term
0	No change in benefits, impacts or difficulties from current situation
-1	Few difficulties, very low cost, or low impact on some resources/values and/or very short term
-2	Minor difficulties, low cost, or minor impacts on resources/values and/or short term
-3	Some difficulties, moderate cost, or some impact on resources/values and/or medium term
-4	Clear difficulties, high cost or high impact on resources/values and/or medium - long term
-5	Substantial difficulties, very high cost, or substantial impact on resources/values and/or long term / permanent

This MCA scoring process has been developed to be consistent with the 'Let's Get Wellington Moving' Programme assessment.

The MCA processes are undertaken in a collaborative environment to gain a greater understanding of the aspects of each criterion and understand different perspectives on an issue or outcome that may arise. Draft scores have been developed to facilitate this process, and enable questions, facilitated discussion, and agreement on the approach and scores.

4.2 Investment objectives

The investment objectives are a key component of the proposed assessment criteria. The investment objectives and summary of the proposed measures are outlined below:

- Support a sustainable future:
  - Increase both rail passenger and freight mode share
  - Reduce rail carbon emission per passenger

- Provide capacity that supports access and growth:
  - Improve access by increasing peak passenger capacity
  - Maintain freight access by retaining existing freight paths throughout the day and ensuring capacity for growth

- Attractive and easy to use:
  - Increase access throughout the day
  - Improve peak punctuality
  - Improve overall satisfaction of rail passengers
  - Maintain ease of access and improve accessibility for impaired users

- Adaptable to disruptions:
  - Reduce passenger impact of high impact low probability events
  - Reduce passenger impact of unplanned events

- Improve safety for all:
  - Reduce the rate of safety incidents
  - Increase public and user perception of safety of rail.

It is important to note the KPIs do not have an equal weighting. The priority of each of the sub criteria towards the investment objective is left to the discretion of the project team. This allows greater emphasis to be placed on the areas of differentiation.

4.3 Other assessment criteria

Other criteria have been revised to reflect the better understanding of extent and timing of the interventions, the associated issues that me need to be overcome. These are outlined in the following sections.

4.3.1 Overarching success factor

The overarching success factor for the rail programme is to increase rail usage (passenger & freight). While achieving all investment objectives implicitly achieve this proposed criterion, this allows for programmes that have made trade-offs for some of the investment objectives.

4.3.2 Alignment with national policies and investment

This criterion assesses programme alignment with national policies such as the Zero Carbon Act, Governement Policy Statement on land transport, the National Land Transport Plan, NZ Rail Plan and National Mode Shift Plan. It also considers other government aspirations signalled such as the intensification of residential areas.

This criterion also assesses the degree to which each programme recongises and enhances the North Island Main Trunk railway as a nationally significant freight corridor.

4.3.3 Alignment with regional policies and investment

This criterion assesses programme alignment with regional policies such as the Regional Land Transport Plan, Regional Public Transport Plan, Regional Mode Shift Plan, and Regional Growth Framework. It also acknowledges any planned or communicated changes to district plans as a result of the reviews or intended growth areas signalled.

This criterion also assesses the degree to which each programme would enable the full outcomes of other regional investments to be realised (for example, the Let's Get Wellington Moving programme has publicly stated that it requires a range of mode shift to rail for users from the north for it to properly achieve its objectives).

4.3.4 Funding availability

This criterion assesses the ability for GWRC and the partner organisations to fund the programme. While it considers cost to an extent, it considers wider considerations such as potential rate increases, any 'spikes' in the funding requirement, and the impact on programme outcomes in the event of a significant drop in funding availability partway through the delivery.

4.3.5 Construction difficulty

This criterion looks at the difficulty associated with physical works, which could affect delivery of the programme. Not all construction difficulties have been considered, but emphasis to the following has been considered:

- Geotechnical considerations
- Waterway considerations
- Services
- Traffic management considerations
- Market capability and capacity

4.3.6 Consenting

The consenting criteria considers the consenting degree of difficulty. It compares the alignment of the programme's outcomes with the relevant district plans to enable the programme's outcomes. It also notes the difficulties for consenting individual projects within the programme for critical projects, such as the North-South Junction capacity improvements or the grade separation of busy level crossings prior to the 10+10 timetable implementation.

4.3.7 Risks to programme delivery

This criterion evaluates the probability of and impact of delays to any project within the programme to the delivery of the programme and achievement of its desired outcomes.

4.3.8 Economic impacts

This criterion evaluates both the anticipated disruption of construction to the local economy and the long-term benefits of the investment. This considers both the impact to the commuter and freight network on the regional economy, informed by the economic analysis prepared as part of the development of the RRP.

5 Reporting

Following the workshop the project team will produce a write up of the MCA process and workshop outcomes which will include the following:

- The options assessed
- The criteria used
- The scoring assigned to each option for each criterion and the justification of each score
- The workshop process, including key items of discussion
- The weighting systems adopted
- A recommendation for the preferred programme to be considered by decision makers

Appendix A Do-Minimum Overview Memo

Stantec

REGIONAL RAIL PLAN – Do-Min Definition

This report has been prepared for the benefit of Greater Wellington Regional Council. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
0.1	29/7/20	Internal team draft	SR	DW	DW	DW
0.2	11/9/20	Draft for comment	SR	DW	DW	DW
1.0	17/09/20	Update based on client comment	SR	DW	DW	DW
2.0	29/09/20	Updated draft for wider circulation	SR	DW	DW	DW
2.1	14/01/21	Inclusion of electronic ticketing	SR	DW	DW	DW
2.2	22/11/21	Final with maintenance programme changes	SR	DW	DW	DW

1 Introduction

1.1 Purpose

Greater Wellington Regional Council (GWRC) is updating the Wellington Regional Rail Plan (RRP) using the Programme Business Case (PBC) methdology. This is to set out the direction for investment in the rail network over the next 30 years to 2050.

The PBC is following the Waka Kotahi NZ Transport Agency (Waka Kotahi) process and is being developed in conjunction with key partners and stakeholders. As part of the Waka Kotahi PBC process, the do-minimum is the base option to which other projects are compared against.

1.2 Definitions

Following the Investment Decision Making Framework (IDMF) review, Waka Kotahi's glossary for business case terms lists has the following as the definition of the do-minimum[1]:

> *In developing business cases, the do-minimum option should represent the minimum level of expenditure required to maintain a minimum level of service, not the minimum level of investment required to achieve the investment objectives. For example, the most likely transport situation over the course of the appraisal period if no further intervention were to occur.*
>
> *In theory, every option should be compared with the option of doing nothing at all, that is, the do-nothing option; however, for many transport activities it is not practical to do nothing at all.*
>
> *It is important not to overstate the scope of the do-minimum option, that is, it should only include activities that are absolutely essential to preserve a minimum level of service. Where network interdependencies exist, the do-minimum option should take into account other activities elsewhere on the network where these other activities have a commitment to funding, and where they affect the demands and level of service at the location of interest.*
>
> *The minimum level of investment to achieve the investment objectives is explored through the use of further options, in addition to the do-minimum. The do-minimum option is used as a baseline for comparing marginal costs and benefits of alternative activities. It provides the benchmark for determining the relative marginal value for money added by the other options under consideration.*

There is no definition for 'minimum level of service'. The do-minimum must be the cheapest option when excluding the do-nothing.

A meeting with Waka Kotahi was held on 5 August 2020 to understand what should be targeted in the do-minimum. Waka Kotahi confirmed that the do-minimum may include capital expenditure and that the do-minimum must be a credible and practicable alternative to the options. It was confirmed that the do-minimum does not need to be able to achieve the investment objectives.

The new guidance in closer in scope to the NZ Treasury guidance than the previous Waka Kotahi definitions. The current Treasury definition, as sourced from the PBC template/guidance document[2], is as follows:

> *The long-list must also include a realistic 'do minimum' option based on the core functionality and essential requirements for the programme.*
>
> *The 'do minimum' scope must be a realistic option that meets the 'core' scope and essential business needs of the programme.*

This definition and the new Waka Kotahi definition are in close agreement and is used as the basis for determining the do minimum.

1.3 The do-nothing

The do-nothing for this case would constitute the completion of committed projects and the implementation of crown funded business cases as well as continuing 'business as usual' maintenance. This would deliver no service or other improvements to either freight or passenger rail.

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[1] https://www.Waka Kotahi.govt.nz/planning-and-investment/learning-and-resources/business-case-approach-guidance/supporting-material/glossary/

[2] https://treasury.govt.nz/sites/default/files/2019-11/BBC-Programme-business-case-template-and-guidance-October-2019.doc

The do-nothing was agreed to be the finishing of committed capital works projects and the continuation of operations in accordance with the appropriate network management plan.

1.4 Outcome sought

The outcome sought is agreement on the minimum acceptable level of service required to be provided by the do-minimum option for the development of the RRP.

2 The Minimum Level of Service

2.1 General principals of the do-minimum

Following the meeting with Waka Kotahi on 5 August 2020, the following general principals have been agreed:

- growth in rail patronage is to be expected and planned for in the do-minimum
- capital expenditure is expected but must be minimised
- the do-minimum will have negative impacts on the roading network
- the do-minimum must be a credible and realistic alternative.

Any capital expenditure in the do-minimum will be closely scrutinised during assessment and must be appropriately justified.

This signals that investment in new rolling stock etc to cater for growing demand at a reasonable level is allowable under the do-minimum. Replacement of existing rail stock due to end of life concerns is valid under the do-minimum.

2.2 The rail network

2.2.1 Overview

The Wellington Metro Rail Network (WMRN) serves both passenger and freight demands within the Wellington Region. While the great majority of trains on the network are Metlink public transport services, the WMRN also carries long-distance passenger services, and freight services from both the Wairarapa line and the North Island Main Trunk (NIMT) line to Centreport and the associated ferry/shipping services.

2.2.2 Core functionality and essential services

The Treasury definition notes the do-minimum must meet the core functionality and essential services of programme. The implications of this are explored below to inform the features of a minimum level of service.

Core functionality

The core functionality is explained in the vision statement of the rail plan, for the 2020 update this is a rail network that:

> *provides safe, customer focused and efficient rail passenger and freight services, and supporting infrastructure, to drive the region's economic development and social wellbeing in an environmentally and socially sustainable and resilient manner.*

This is similar to the 2010 (revised 2013) vision statement which is:

> *To deliver a modern, reliable and accessible rail system that competitively moves people and freight in an economic, environmental, integrated and socially sustainable way.*

While there are subtle differences between the statements it is clear that a core functionality of the rail network is to deliver a rail network that delivers both passenger and rail services. That is the rail network must cater for freight and provide an alternative to road during peak periods.

Essential services

Services that would prevent the core functionality of being achieved if they were not delivered are deemed essential services. This includes but is not limited to end-of-life replacements and maintenance to that ensure core functionality is delivered but exclude improvements outside of those required to deliver core functionality.

Public Commitments

In September 2020 GWRC announced an investigation into rolling out Snapper onto trains. In January 2021 it was confirmed that trials were being planned in early 2021 to roll out electronic ticketing on the rail network. Due to this public announcement, it has been assumed that electronic ticketing will be a feature of the do-minimum. This assumption only extends to replacing the payment method and does not constitute a multi modal integrated ticketing solution.

2.3 Features of a minimum level of service

For the purpose of defining the minimum acceptable level of service, the following things have been considered:

1. Provision of rail services

2. Passenger level of service
3. Freight level of service
4. Safety provision of rail services
5. Reliability of rail services
6. Asset condition.

With these in mind, this document focuses on three points, the passenger level of service, the freight level of service and safety level of service.

The provision of rail services is a given, since the wider transport network has been developed on the basis that the rail network provides a passenger (primarily commuter) and freight task. Passenger and freight services will therefore be maintained to avoid significant negative impacts on the transport network. Furthermore, allowing the rail network to degrade to the point where rail services cannot be offered would be contrary to the objectives of the:

- Government Policy Statement on Land Transport (2018-28)
- Draft Government Policy Statement on Land Transport (2021-31)
- National Land Transport Plan (2018-21) (currently being updated)
- Wellington Regional Land Transport Plan – mid-term review 2018 (currently being updated)
- Wellington Regional Public Transport Plan 2014 (currently being updated)
- Draft New Zealand Rail Plan
- Wellington Regional Rail Plan (2013 revision).

Reliability of rail services has been excluded from having metrics with respect to the minimum level of service. While this may seem counter-productive, the metrics chosen for the do-minimum passenger level of service and the asset condition level of service will ensure that a base level of reliability will be met.

2.4 Passenger level of service

The minimum passenger level of service for public transport services has been defined be evaluating the following:

1. Frequency
2. Capacity
3. Journey time
4. Ability to meet growth.

Of these metrics, while there shall be a minimum standard set for the frequency and journey time, the driver to meet the minimum level of service will likely be governed by the capacity and ability to meet growth.

2.4.1 Frequency

For the purposes of defining the minimum acceptable frequency, it has been assumed that the planned 'RS1' timetable improvements enabled by the currently underway works will be implemented and maintained for the duration of the plan. No further improvements are proposed as part of the minimum acceptable level of service.

The planned timetable improvements are outlined in the 2014 Regional Public Transport Plan (RPTP) and have been endorsed by Waka Kotahi. The proposed frequencies (inclusive of all stoppers and express services) are shown in Table 2-1.

Table 2-1: Future Rail Scenarios (Source: Unit 16: Future Rail Services, RPTP 2014)

Line	Number of trains per hours between these stations and Wellington	Weekday				Weekend		(approximate)
		Morning Peak Hour	Daytime	Afternoon peak hour	Evening	Daytime	Evening	
HVL	Upper Hutt	4	2	4	2/1	2	1	Mon-Thurs 18 hours Fri-Sat 21 hours Sun 17 hours
HVL	Taita	9	2	9	2/1	2	1	
JVL	Johnsonville	4	2	4	2/1	2	1	Mon-Thurs 17 hours Fri-Sat 19 hours Sun 17 hours
KPL	Waikanae	3	2	3	2/1	2	1	Mon-Thurs 18 hours Fri-Sat 21 hours Sun 17 hours
KPL	Plimmerton	7	2	7	2/1	2	1	
KPL	Porirua	8	2	8	2/1	2	1	
MEL	Melling	3	1	3	n/a	n/a	n/a	Mon-Fri 12hours
WRL	Masterton	3 peak trips	2 off peak trips	3 peak trips	1 Friday only	2 trips	n/a	Mon-Thurs 10 hours Fri 14 hours Sat-Sun 9 hours

The RPTP frequencies differ slightly from the 2013 RRP, which are shown in Figure 2-1.

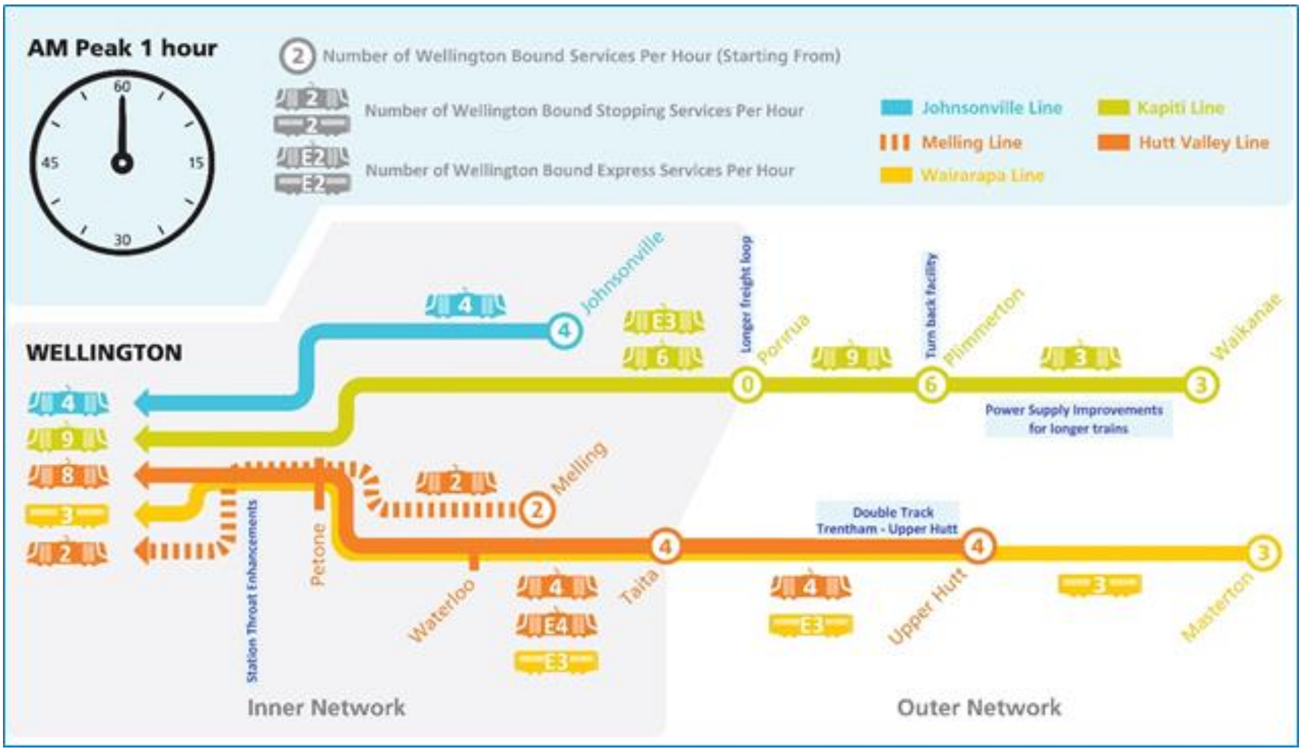


Figure 2-1: RRP RS1 peak hour (source: Figure 12, RRP 2013 revision)

There are no further guaranteed changes to the frequency of passenger services under the minimum level of service. This does not prevent additional services being run to meet other do-minimum requirements.

2.4.2 Capacity

It is expected that under the minimum acceptable level of service capacity would be the most noticeable change for users. Guidance from international examples on standing capacity on metro rail services has been sought.

Transport for London (TfL) and Transport for New South Wales (TfNSW) have published documents on expected people per square metre (ppm^2). Comparisons between the GWRC, TfL, and TfNSW standing capacity is outlined below.

TfNSW triggers investigations into providing additional capacity when there are on average 4 ppm^2. Despite this, services are not considered at capacity until there are 6 ppm^2. This also notes that passengers should not be required to stand for more than 20 minutes.

TfL considers a line at capacity when there are 4 ppm^2 but allows for 6 ppm2 to be used over multiple stations. TfL also notes that 'crush capacity' is the absolute maximum and considers this 7 ppm^2. No documents have been found for areas where capacity improvements should be investigated.

If the TfNSW guidance that people shouldn't stand for more than 20 minutes is adopted the capacity calculations become more difficult, however if this is extended to 30 minutes, then it identifies that at a high level, services from Upper Hutt, Kapiti and the Wairarapa should have no standing passengers, with standing passengers allowed on all other services (Johnsonville, Melling, Plimmerton and Taita onwards).

Auckland Transport has a policy aspiration that no one stands for greater than 15 minutes. This is not a requirement on the operator.

The FP/FT Matangi units have a maximum capacity of 377 people per 2-car set. This consists of 147 seated passengers and 230 standing passengers at 6 ppm^2. If the TfL capacity metric of 4 ppm^2 is adopted this reduces the total capacity to 300 people per 2-car unit. The 2013 RRP noted that a realistic capacity is 2.55 ppm^2 and that 2.55 ppm^2 does not cover the entire train (as passengers boarding do not distribute themselves through the entire train). This makes achieving an average density of 4 ppm^2 impractical in many cases. For this reason, an average density of 4 ppm^2 has only been applied to trains with shorter travel times.

Given the range of standing passenger capacities based on total travel time, the following ratio to seated passengers are proposed for the do-minimum and are shown in Table 2-2.

Table 2-2: Ratios of passengers to seats on services which is acceptable in the do-minimum

Capacity	Johnsonville, Melling, Plimmerton and Taita Services	Kapiti and Upper Hutt Services	Wairarapa and Capital Connection
Seated	1:1	1:1	1:1
Ideal	1.2:1	1.2:1	1.025:1
Maximum Comfortable	1.5:1	1.3:1	1.05:1
Maximum Loading	2:1	1.5:1	1.075:1

These ratios allow for different levels of crowding for each scenario based on travel times. Even services with greater than 30 minutes travel time allow for some standing passengers since some will travel to/from intermediate stations.

2.4.3 Journey time

Table 2-3 outlines the current timetabled travel times on key services for the morning peak.

Table 2-3: Timetabled travel times in the morning on various routes

Line	Stops	Current time (h:mm)
Hutt Valley	All	0:45
Hutt Valley	Upper Hutt Express	0:38
Hutt Valley	Taita	0:27
Johnsonville	All	0:26
Kapiti	All	1:00
Kapiti	Waikanae Express	0:57
Kapiti	Plimmerton	0:34
Kapiti	Porirua	0:24
Melling	All	0:20
Wairarapa	All	1:44

Under the minimum level of service, the scheduled travel times shall not be more than 10% longer than their current scheduled times. This does not enforce running a slower service, but simply provides a floor for the do-minimum scenario.

It is expected that journey time will be governed by providing a service of acceptable quality to customers.

2.4.4 Future growth

Following the meeting with Waka Kotahi on 5 August 2020 the do-minimum is to cater for the following growth scenario:

- maintain the long-term growth trend (Growth Scenario 3) until the ideal capacity is met
- maintain Growth Scenario 2 (mid-way between Growth Scenario 1 and 3) until the maximum comfortable capacity is met
- cater for population growth (Growth Scenario 1) until maximum loading is met
- add additional capacity at this point at lowest cost.

Under the proposed minimum level of service, growth shall be catered for at the current rail mode share measured by southbound travellers between 5:30 am and 9:00am between Ngauranga and Aotea Quay.

Two methods of improving capacity without significant expenditure have been assumed: the roll out of the RS1 timetable improvements, and the permanent conversion of some 2-car sets to 4-car sets (eliminating two driver cabs and replacing with seating) during heavy maintenance that is scheduled for 2030. The RS1 timetable improvements provide a small network-wide capacity improvement, but this is significant for some sections of network. The fleet conversion intervention is expected to increase capacity by 2.9%. However, it increases operational risk, since a failure would require the removal of a 4-car set instead of a 2-car set.

The do-minimum scenario has been developed for the Kapiti and Hutt Valley lines (excluding Melling) and its effect is displayed through to 2050 in the charts below. For all four charts, the shift in capacity in 2022 represents the RS1 timetable roll out and the increase in capacity in 2030 represents the additional 2.9% seated capacity. No additional rolling stock is required at this point.

The Hutt Valley services are shown in Figure 2-2 and Figure 2-3. It can be seen that both Hutt Valley line service layers do not exceed the maximum comfortable capacity by 2050.

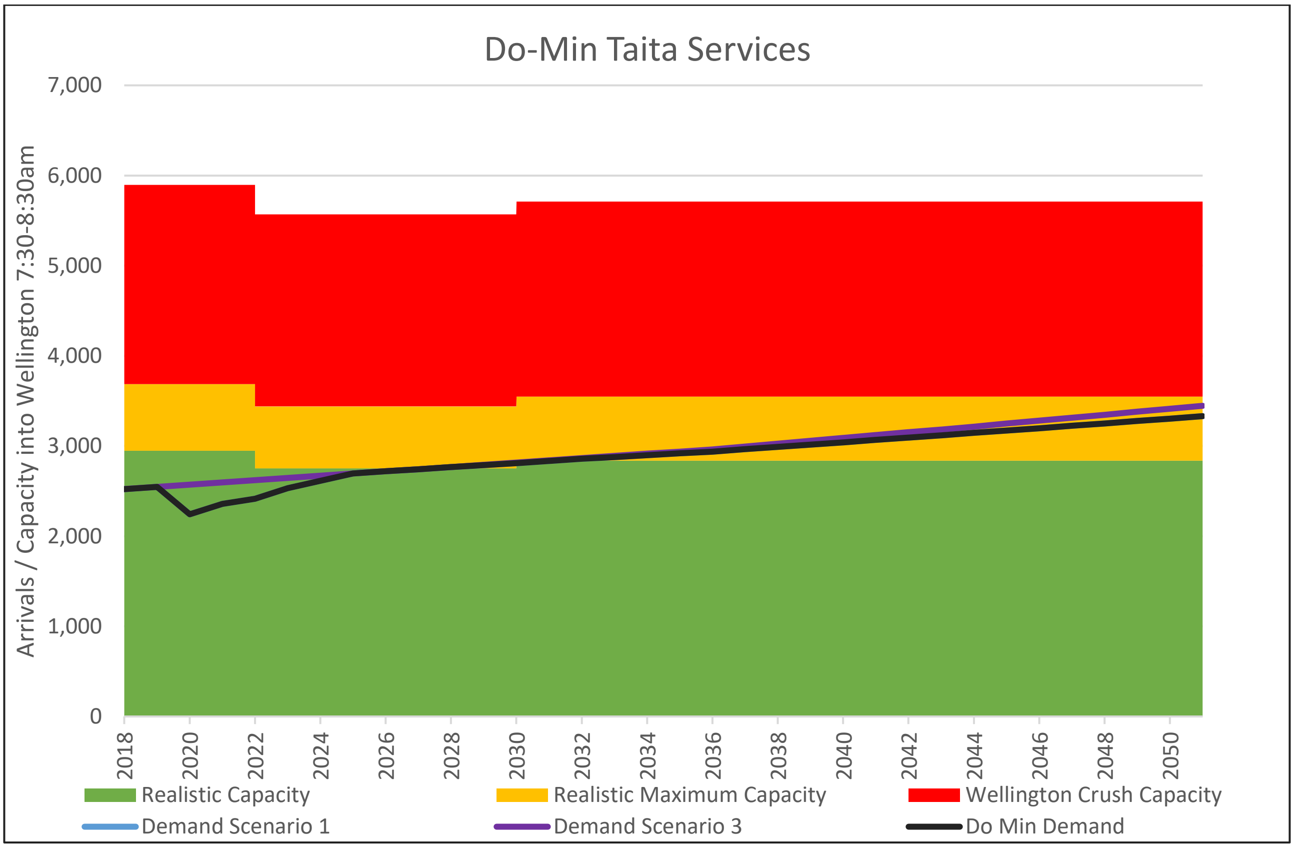


Figure 2-2: Do-min Taita services forecast

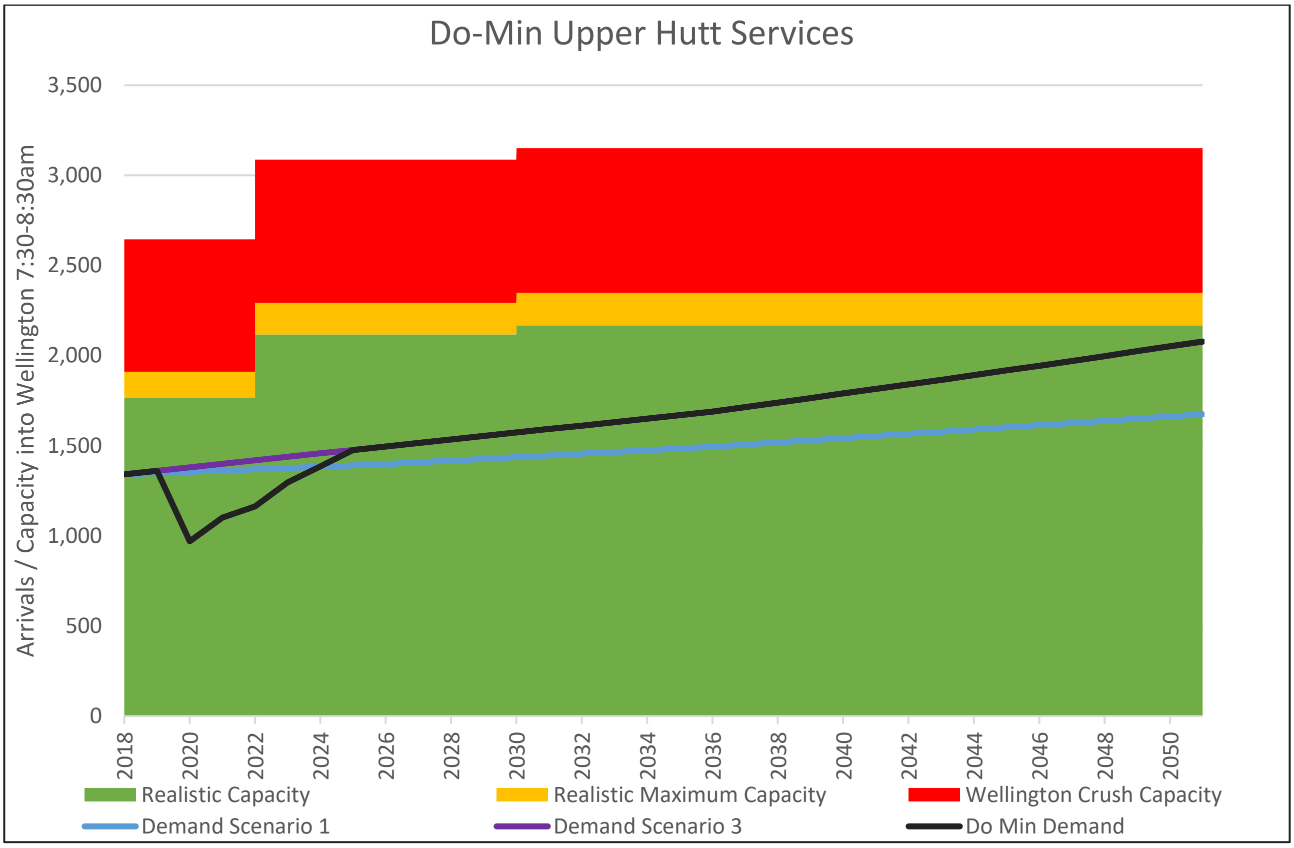


Figure 2-3: Do-min Upper Hutt services forecast

The Kapiti Line services are shown in Figure 2-4 and Figure 2-5.

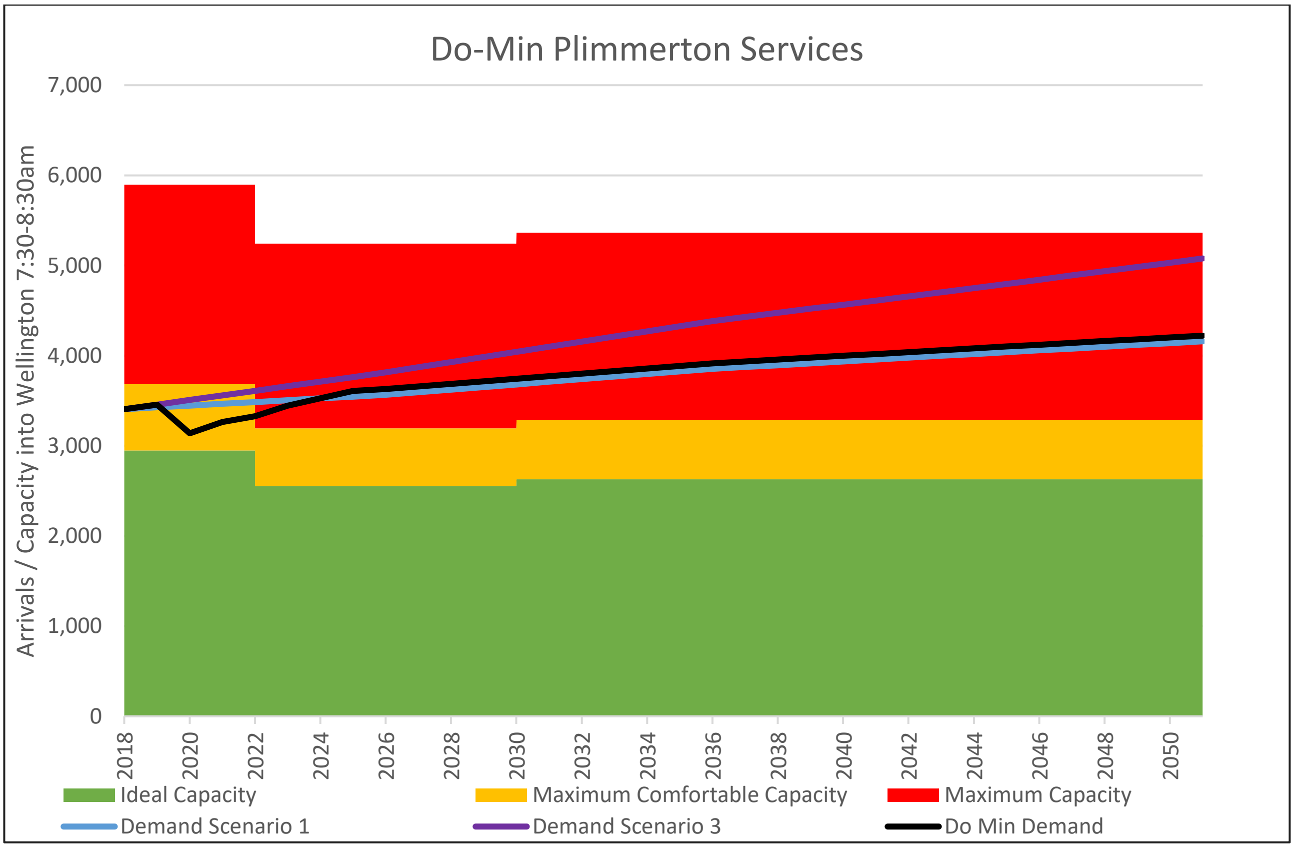


Figure 2-4: Do-min Plimmerton services forecast

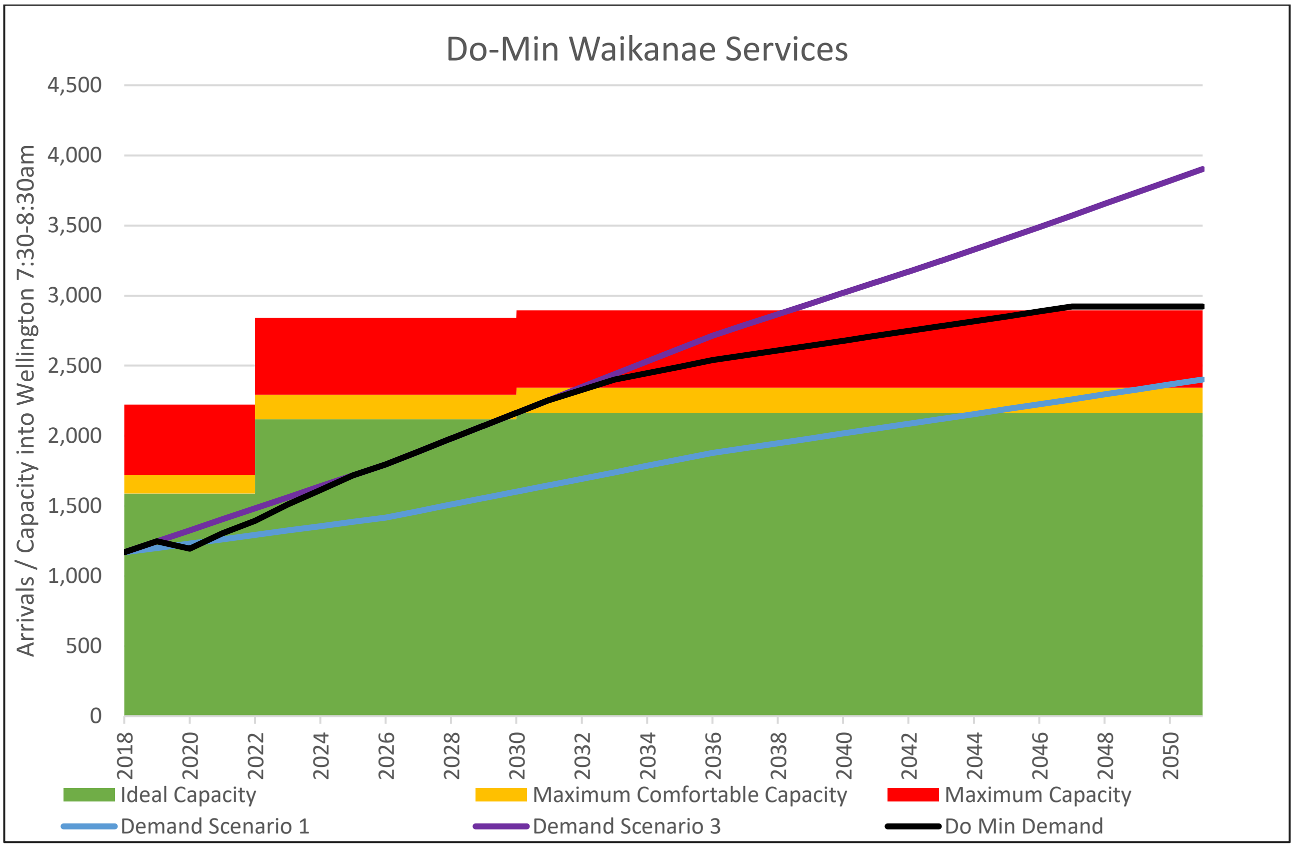


Figure 2-5: Do-min Kapiti services forecast (no expanded fleet)

Unlike the Hutt Valley line, the Kapiti Line shows significant mismatch from capacity to demand. Both the Waikanae and Plimmerton service layers operate above the maximum comfortable capacity limit for the type of journey. Services to Waikanae even reach the maximum capacity of 4ppm[2], preventing further uptake. No service offerings to improve the uptake of rail services are included in the minimum level of service. Long distance rolling stock has been assumed to be procured only when replacement is required, and at a level only to match the long-distance needs. It would not provide additional capacity within the electrified network.

The above charts indicate that, even with the fleet conversion capacity increase, the Kapiti Line is likely to run with significantly less capacity than demand. This can be mitigated by the improving the power supply to enable a fourth 4-car train to run in the peak direction in the peak hour. Counter-peak direction service would need to be reduced to enable this. The additional trains would be added by making minor fleet size increases when the existing Matangi fleet is replaced in the mid-2040s. Additional stabling may also be required in Kapiti. This would provide enough capacity only until the mid-2060s if Growth Scenario 1 is assumed.

Further practical improvements to frequency are not practicable without significant investment, particularly in the double tracking of the constrained single-track section between Pukerua Bay and Paekakariki. If it is accepted that passenger usage of rail should not decrease, then the do-min passenger growth would require this investment in late-2060 (inclusive of the 15-minute timetable for Waikanae services). With a 10-year lead time, this would result in work being required to start in 2050.

The impacts of running the additional service to Waikanae are shown in Figure 2-6.

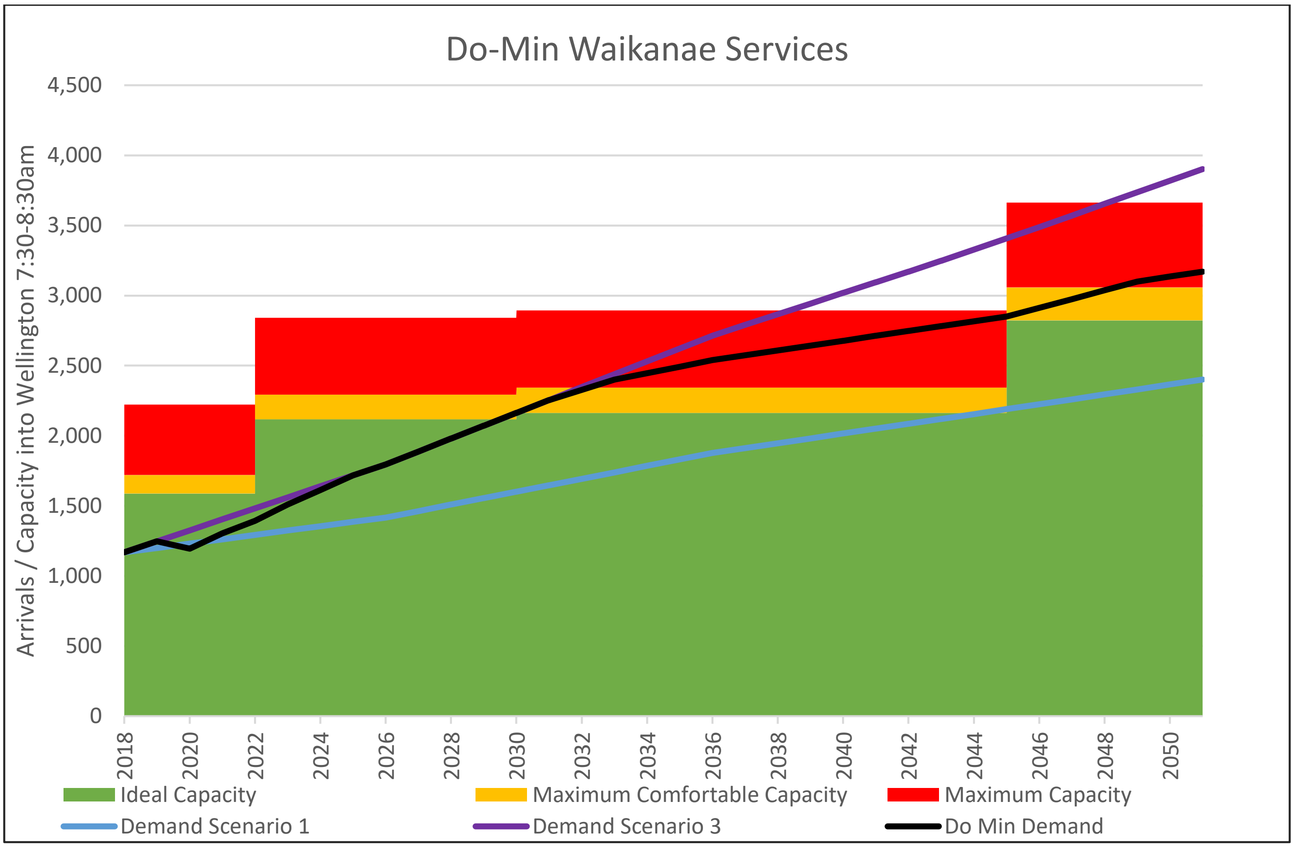


Figure 2-6: Do-min Waikanae services forecast with fleet increase

2.4.5 Asset replacements and maintenance

Under the do-minimum asset maintenance and end of life renewals will continue in line with the asset management plan.

The Matangi units require heavy maintenance around the year 2030, and end of life replacement in the mid-2040s. A small increase in fleet has been assumed at this point to maintain acceptable levels of service as noted above.

Rail network maintenance is increased from the existing 'baseline levels', as the Wellington Metro Upgrade Programme catch up renewals process has shown that this is not a sustainable if the network is to remain fully operational in the longer term. The funding levels include a slight increase to track maintenance and a lift to funding of protectional works such as slope stabilisation on high-risk sites.

2.4.6 Summary

Under the minimum level of service, demand for passenger services is expected to continue to increase at least in response to population growth. While there is only a commitment to roll out the already publicised RS1 timetable when demand exceeds the capacity of the current services, the do-minimum will expand capacity to maintain the specified minimum level of service standards by the lowest cost means.

2.5 Freight level of service

The minimum freight level of service has been defined be evaluating the following:

1. Frequency
2. Capacity
3. Ability to meet growth

Freight levels of service under the do-minimum will possibly contradict the agreed service levels in the Wellington Network Access Agreement between GWRC and KiwiRail. This could cause additional cost the alter the contract.

2.5.1 Frequency of freight services

There are currently approximately 14 freight services on the NIMT and 4 on the Wairarapa Line on a typical weekday. Freight services also operate on both lines on weekend days.

For the minimum acceptable level of service there will be no reduction in services from the current offering and planned increases.

For the purposes of the minimum acceptable level of service, long-distance passenger services (of which there are 3 on a typical weekday) are considered in the same manner as freight services.

2.5.2 Capacity of freight services

Freight services currently have the following capacity constraints as outlined in the Wellington Network Management Plan:

- speed limits at 80 km/hr
- 18 tonne axle limits
- total length 750 m (NIMT) or 500 m (Wairarapa line)
- maximum weight 1,700 tonnes.

Under the do minimum, it is expected that these levels of service would be maintained.

2.5.3 Future Growth

While the minimum level of service for rail services does not guarantee that existing unused freight paths would be maintained, it does not propose to reduce them, and does guarantee connecting freight services to any future rail enabled ferry sailings.

Investment in the network to maintain the mode share for the freight task within the region would continue under a minimum level of service.

2.6 Safety of rail services

Safety of rail services have two key areas of focus, being safety of rail operation and level crossings.

2.6.1 Safety of rail services and infrastructure

Under the minimum acceptable level of service, safety of the rail operation will be governed by the requirements of both the Railway Act 2005 and the Health and Safety at Work Act 2015.

The Railways Act 2005 requires:

> *"A rail participant must ensure, so far as is reasonably practicable (SFAIRP), that none of the rail activities for which it is responsible causes, or is likely to cause, the death of, or serious injury to, individuals."*

Under the Act, GWRC, KiwiRail and the GWRC's operator (currently Transdev) are defined as rail participants.

The Health and Safety at Work Act 2015 requires risks to health and safety to be eliminated so far as is reasonably practicable, and if it is not reasonably practicable to eliminate risks to health and safety, to reduce those risks so far as reasonably practicable.

The do-minimum case will include necessary expenditure to enable safety risks associated with operating the minimum acceptable level of service to be eliminated or reduced SFAIRP. This means that when assets are either renewed for condition reasons or upgraded to provide increased capability, that an enhanced level of risk mitigation than current may be required to reduce risks to a SFAIRP level, if the costs of doing so are not grossly disproportionate to the safety benefits achieved. This does mean that individual assets may be replaced, rather than taking a system wide approach, which could have significant cost implications. This includes funding for high-risk sites where failure would result in a casualty event.

For the purposes of defining the minimum level of service, it has been assumed that the 'RS1' timetable frequencies will be safe to operate once associated planned investment has been completed. Should additional services be required to maintain an acceptable level of service for capacity reasons, the legal test of 'so far as reasonably practicable' will be the governing requirement for the minimum level of service.

2.6.2 Level crossings

Under the minimum acceptable level of service, there will be no specific programme of upgrades to existing level crossings and no level crossing removal programme. However, the policy of no new level crossings unless two others are removed will be retained.

2.7 Operational Expenditure

Operational expenditure will be at the lowest level that enables both the freight and passenger services to operate at the required frequencies and capacity.

3 Recommendation

This memo outlines a proposed minimum level of service for rail services to be used for discussion with GWRC, Waka Kotahi and other stakeholders for the development of the RRP and subsequent investigations.

It seeks to ensure that there is sufficient capacity for seating nearly all commuters on the rail network who have expected travel times in excess of 30 minutes, and a density of no more than 4 ppm^2 for shorter journeys.

The do-minimum would improve frequency of services to the planned RS1 timetable as outlined in the current RPTP, but then only improve frequency to meet a major gap between demand and capacity on the Kapiti line. It would also improve capacity by the reallocating space when heavy maintenance is undertaken on the Matangi units.

When the Matangi fleet is replaced, a small increase in fleet would enable increased frequency on the Kapiti line services. This would require power supply improvements, timetabling alterations to the counter peak services, and may require stabling in Kapiti.

Freight services would be limited to the existing used freight paths, but allowance has been made for future growth to meet future rail enabled ferry sailings.

Reliability, punctuality, and asset faults would be allowed to degrade, provided that they did not impact the network's ability to meet the levels of service for either freight or passenger services documented in this paper.

The do-minimum for the Rail Plan therefore consists of:

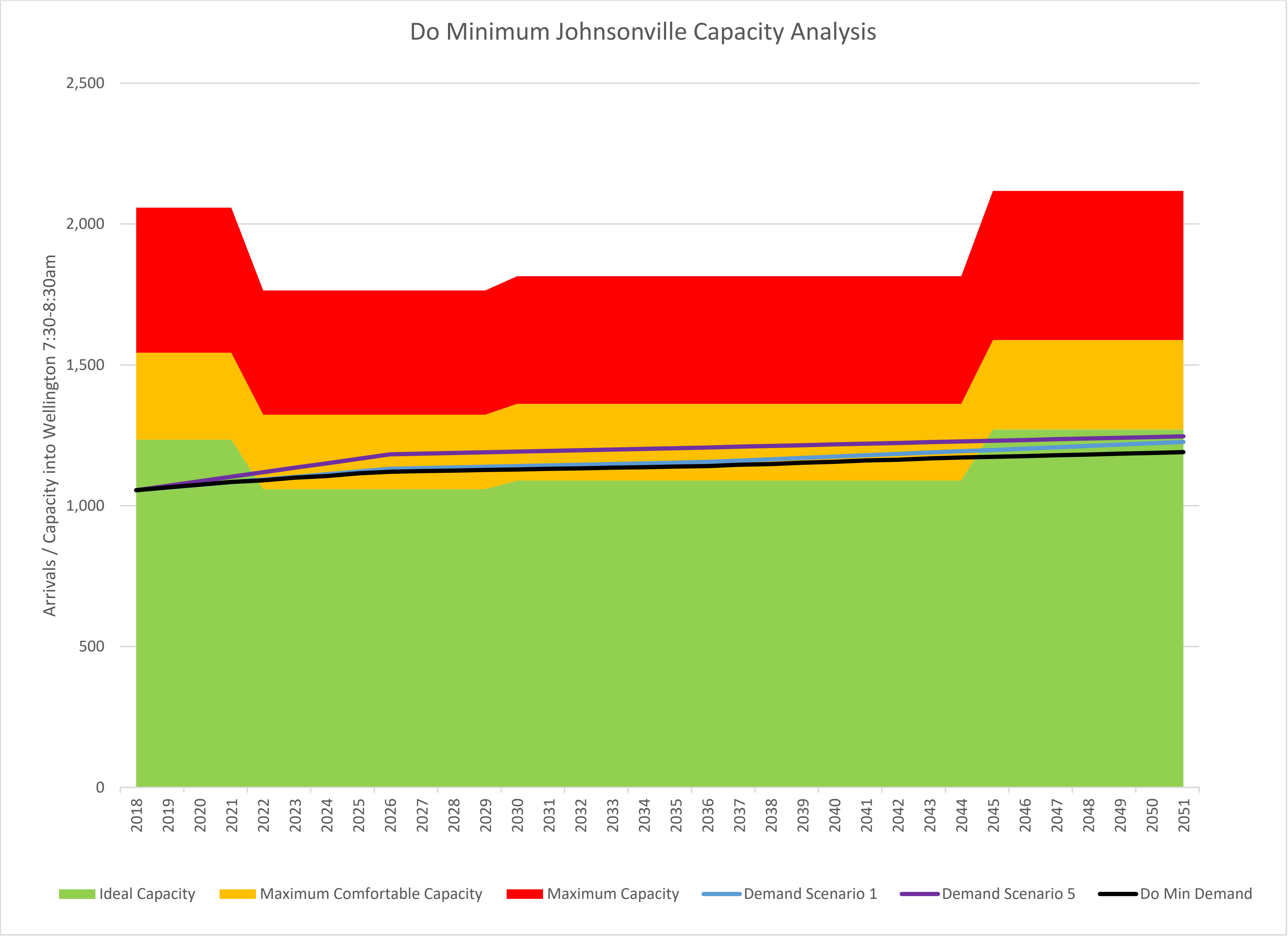
- Completing currently committed projects
- Electronic ticketing
- Rolling out the RS1 timetable
- Increasing train capacity during heavy maintenance
- Matangi end of life replacements with minor fleet increase in the mid-2040s
- Timetabling changes to Waikanae services following the fleet replacement
- Power supply upgrades to enable the above capacity improvements
- Commencing investigation work on North-South Junction in circa 2050
- Maintenance works to ensure the network can deliver the above services.

Appendix B Programme Interventions

Study Name	Items Included	Implementation Start Time		
		Moderate Improvements	Mixed Focus	Drive-Mode Shift Programme
Customer Habit and Optimisation Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	20-30	0-5	0-5
	Look at how station zoning changes habits in accessing station. E.g. people driving further to get a cheaper zone	20-30	0-5	0-5
	Targeted Peak pricing to help spread peak demand	20-30		
	Charging for parking to manage demand	20-30		
	Extend the suburban service frequency span in response to developments and patronage	20-30	5-10	5-10
Future Network Form Study	Improve Johnsonville Line track configuration to improve capacity		30+	20-30
	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	20-30	0-5	0-5
	Second Remutaka tunnel			30+
	Convert Johnsonville branch to Light rail deploy displaced EMUs on rest of network			30+
	Study into the network constraints which prevent additional services. Looks at signalling, single & double track sections and express services	0-5	0-5	0-5
	Tram-Trains able to run over both heavy rail network and future light rail south of Station			30+
North-South Junction Capacity Improvements	North-South Junction Capacity Improvements (Generic Study)	0-5	0-5	0-5
Rail Network Resilience & Operations IBC	Slope Stabilisation- address seismic/storm risk	0-5	0-5	0-5
	Improve resilience of rail bridges across network to seismic events		5-10	5-10
	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	10-20	10-20	10-20
	Improve condition and capacity of drains and culverts	0-5	0-5	0-5
	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation		30+	30+
	Improved freight loop at Porirua to ensure freight trains can continue to operate between more frequent services		10-20	0-5
	Increased train stabling capacity at outer stations for operational efficiencies		10-20	5-10
	More crossovers		5-10	0-5
	Invest in higher quality track to reduce risk of speed restrictions in hot weather		5-10	5-10
	New interlocking for Woburn siding access to reduce track occupancy time for shunts		5-10	0-5
Kāpiti Rail IBC	Duplicate NIMT overbridge south of Waikanae and approach	5-10	5-10	5-10
	Second platform at Waikanae station	10-20	5-10	5-10
	Double Track Waikanae to Otaki		30+	5-10
Rail Network Segregation IBC	Install automatic gates on all pedestrian level crossings	5-10	5-10	5-10
	Close or grade separate level crossings - Hutt Valley	10-20	5-10	5-10
	Close or grade separate level crossings - Wairarapa	30+	30+	10-20
	Close or grade separate level crossings - Kapiti	30+	5-10	5-10
	Close or grade separate level crossings - Johnsonville	30+	30+	30+
	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	30+	10-20	5-10
Matangi Replacement SSBC	Wifi on trains or provide 4G cell phone coverage through tunnels	10-20	10-20	0-5
	Platform train interface without ramps	10-20	10-20	10-20
	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	10-20	10-20	10-20
	Train capacity indicators for passengers	10-20	10-20	5-10
	Additional EMUs for increased service frequency (may be part of the Matangi replacement)	20-30	10-20	10-20
Rail Network Electrification SSBC	Electrification North of Upper Hutt - Featherston			30+
	Electrification North of Waikanae (To Otaki)			5-10
	Power supply upgrade on Kapiti Line (short term)	20-30		
	Long term power supply upgrade - Kapiti Line		20-30	5-10
	Long term power supply upgrade - Hutt Valley Line		5-10	5-10

	Long term power supply upgrade - Melling Line		5-10	5-10
	Long term power supply upgrade - Johnsonville Line		5-10	5-10
	Electrification North of Featherston - Masterton			30+
	Electrification Otaki to Levin			5-10
	Electrification Levin to Palmerston North			5-10
Wellington Station IBC	Provide a northern access to the Wellington EMU stabling yard	0-5	0-5	0-5
	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	0-5	0-5	0-5
	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	0-5	0-5	0-5
	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	0-5	0-5	0-5
	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access (further investment beyond iD 32)	10-20	5-10	5-10
Signalling IBC	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	0-5	0-5	0-5
	Network wide resignalling	0-5	0-5	0-5
Smarter Connections	Improvements to station subway drainage to reduce flooding risk	0-5	0-5	0-5
	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	5-10	5-10	5-10
	Station access planning+D15 to maximise connections to communities and catchments	0-5	0-5	0-5
	Covered secure cycle\multi modal facilities at all stations	0-5	5-10	0-5
	Change facility for cyclist at stations	0-5	5-10	0-5
	Electric Car charging in station carparks	0-5	5-10	0-5
	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	5-10	5-10	5-10
Station Improvements SSBC (by line)	Staff amenities at outer stations		20-30	10-20
	All stations to be accessible for mobility impaired and other users e.g. prams etc	0-5	0-5	0-5
	Increased shelter at stations that match passenger flows	0-5	0-5	0-5
	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	0-5	0-5	0-5
	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	5-10	5-10	0-5
	Platform screen Doors/ gates			30+
	Station sustainability (More extensive) - solar panels for lighting power - LED lighting -Recycling	10-20	10-20	10-20
	Wayfinding signage & digital signage solutions to increase information at stations	0-5	0-5	0-5
	Platform markers for Wheelchair bikes 8/6/4/2	0-5	0-5	0-5
	Develop stations as community hubs / TOD	10-20	5-10	5-10
Improved Maintenance Practices	New infrastructure maintenance technologies to enable safe and efficient maintenance	0-5	0-5	0-5
	Fleet maintenance overnight - enabler	10-20	5-10	5-10
Analytics Package	Improved collection and analysis of passenger data	0-5	0-5	0-5
	Automated analytics from CCTV data for improved customer security	5-10	0-5	0-5
Operational	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	5-10	5-10	5-10
	Integrated/electronic ticketing -One pass - all modes - tickets	0-5	0-5	0-5
	Train crews dedicated to specific routes during peak periods	5-10	10-20	5-10
	Off peak service offering improvements (frequency and operational hours)		10-20	0-5
	Deploy additional infrastructure maintenance staff outside of Wellington		10-20	5-10
Wellington Transport Network Operational Resilien	increase no. of rail replacement buses/ availability of drivers to cover rail service failures	0-5	0-5	0-5
	Bi directional running	5-10	5-10	5-10
Outside of GWRC Control, input to Rail Network Ele	Increase use of electric traction propulsion for freight			5-10
LNIRIM	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN		5-10	5-10
	Long distance rolling stock for Wairarapa and Palmerston North services- (DMMU) (DO Minimum)	0-5	0-5	0-5

Appendix C Programme Summary Graphs


Do Minimum Johnsonville Capacity Analysis
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Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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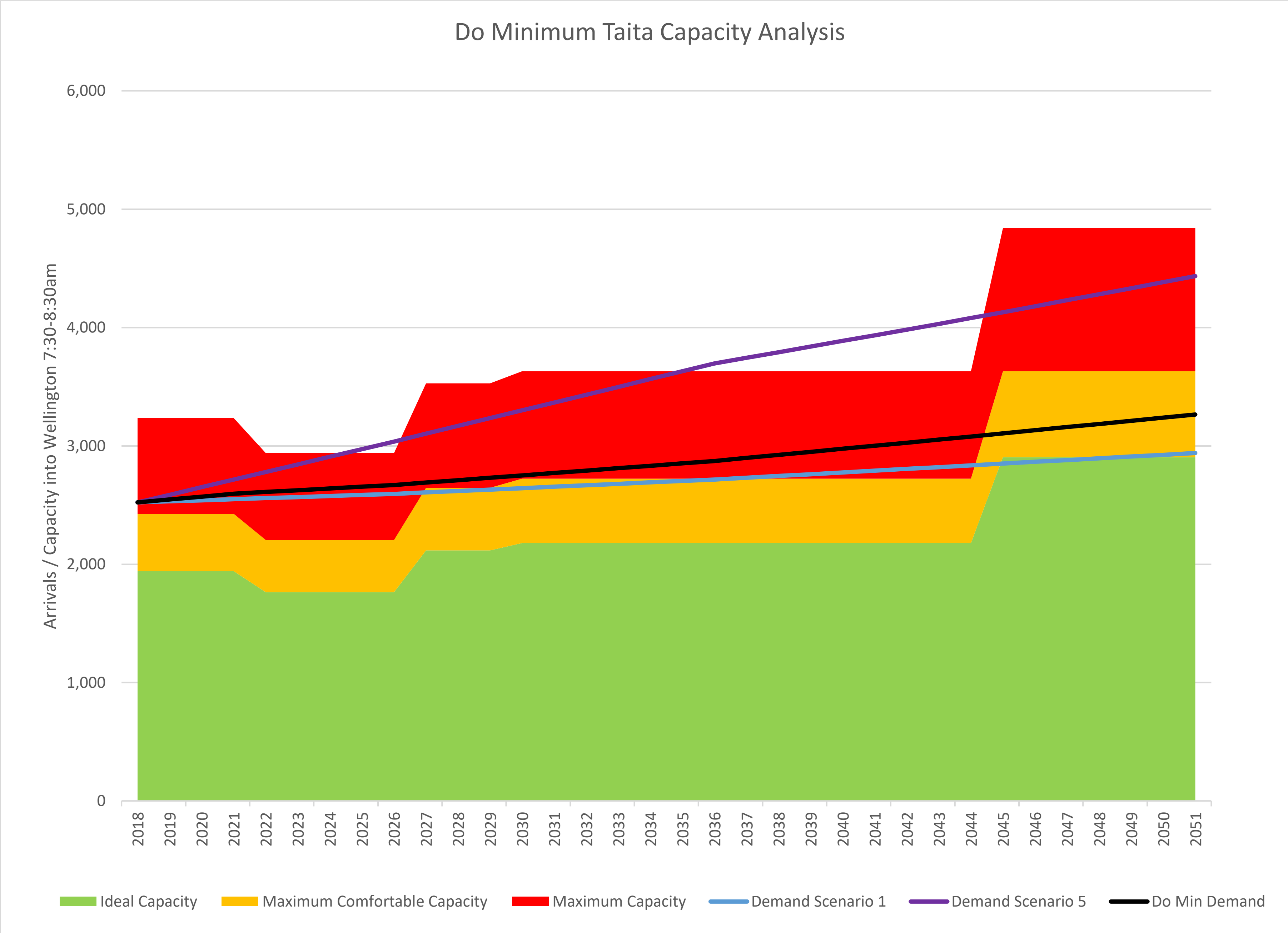
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Do Min Demand



Do Minimum Taita Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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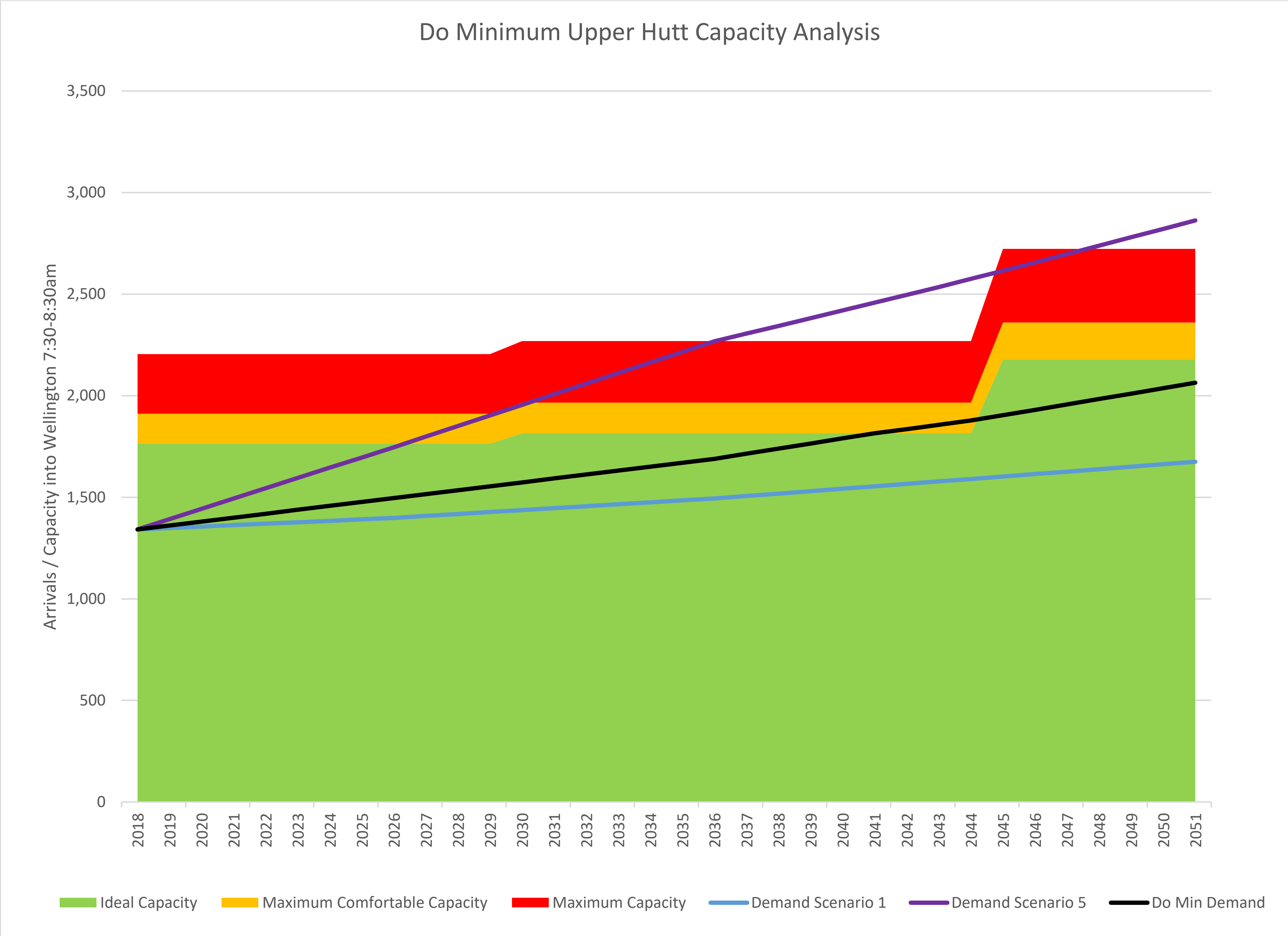
2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051
Ideal Capacity
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Do Min Demand



Do Minimum Upper Hutt Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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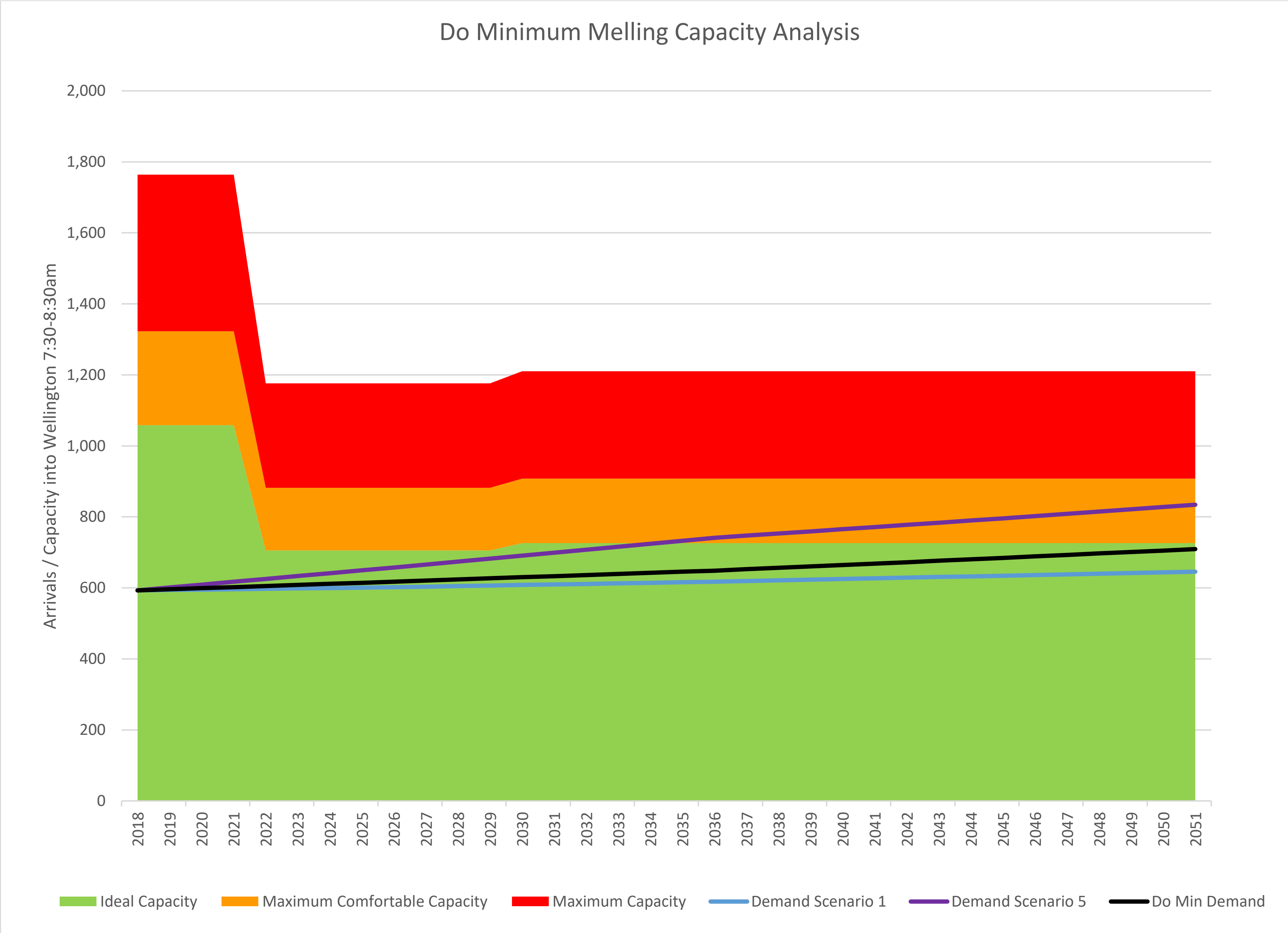
Ideal Capacity
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Do Min Demand



Do Minimum Melling Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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1,000
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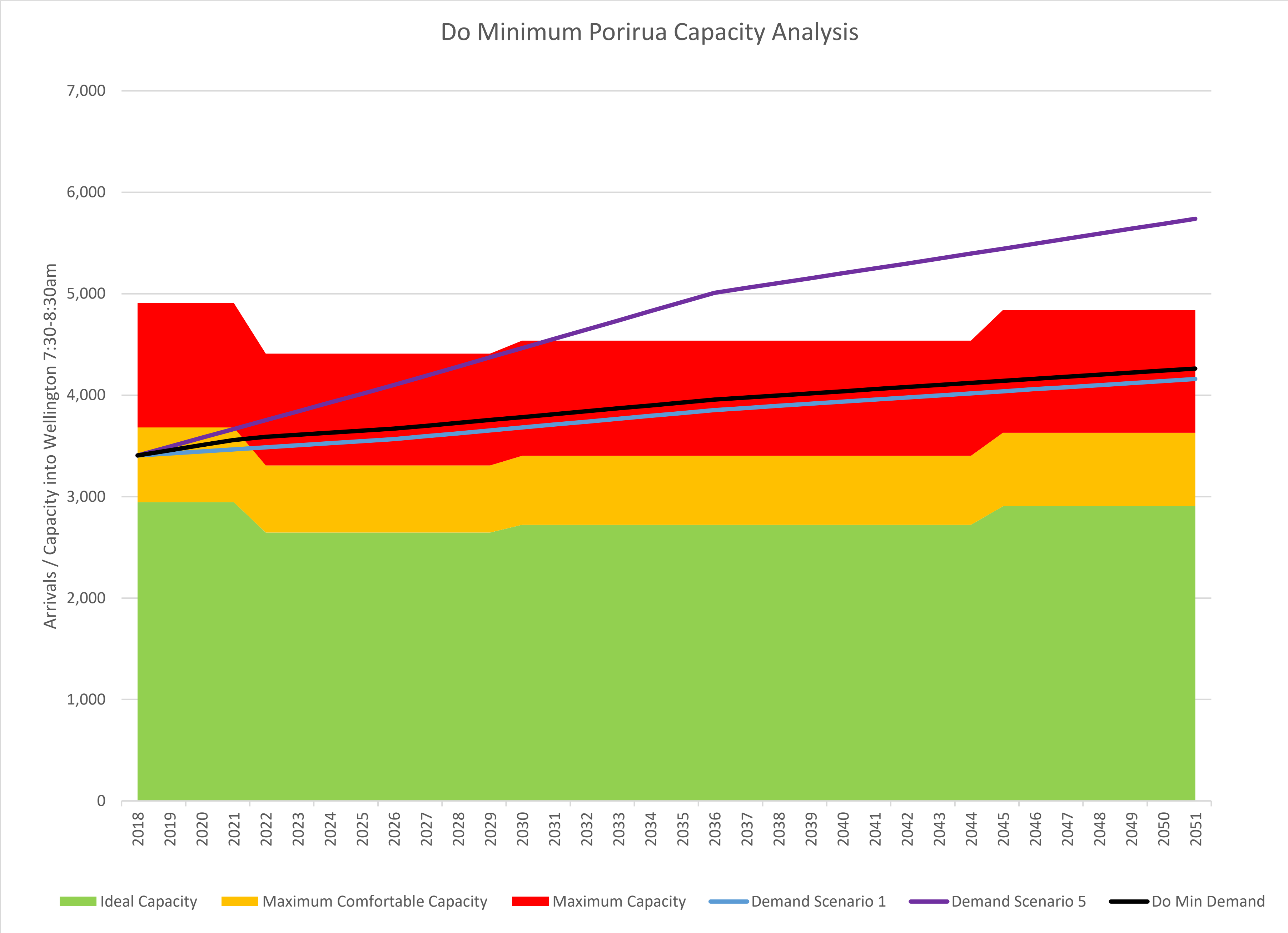
Ideal Capacity
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Do Min Demand



Do Minimum Porirua Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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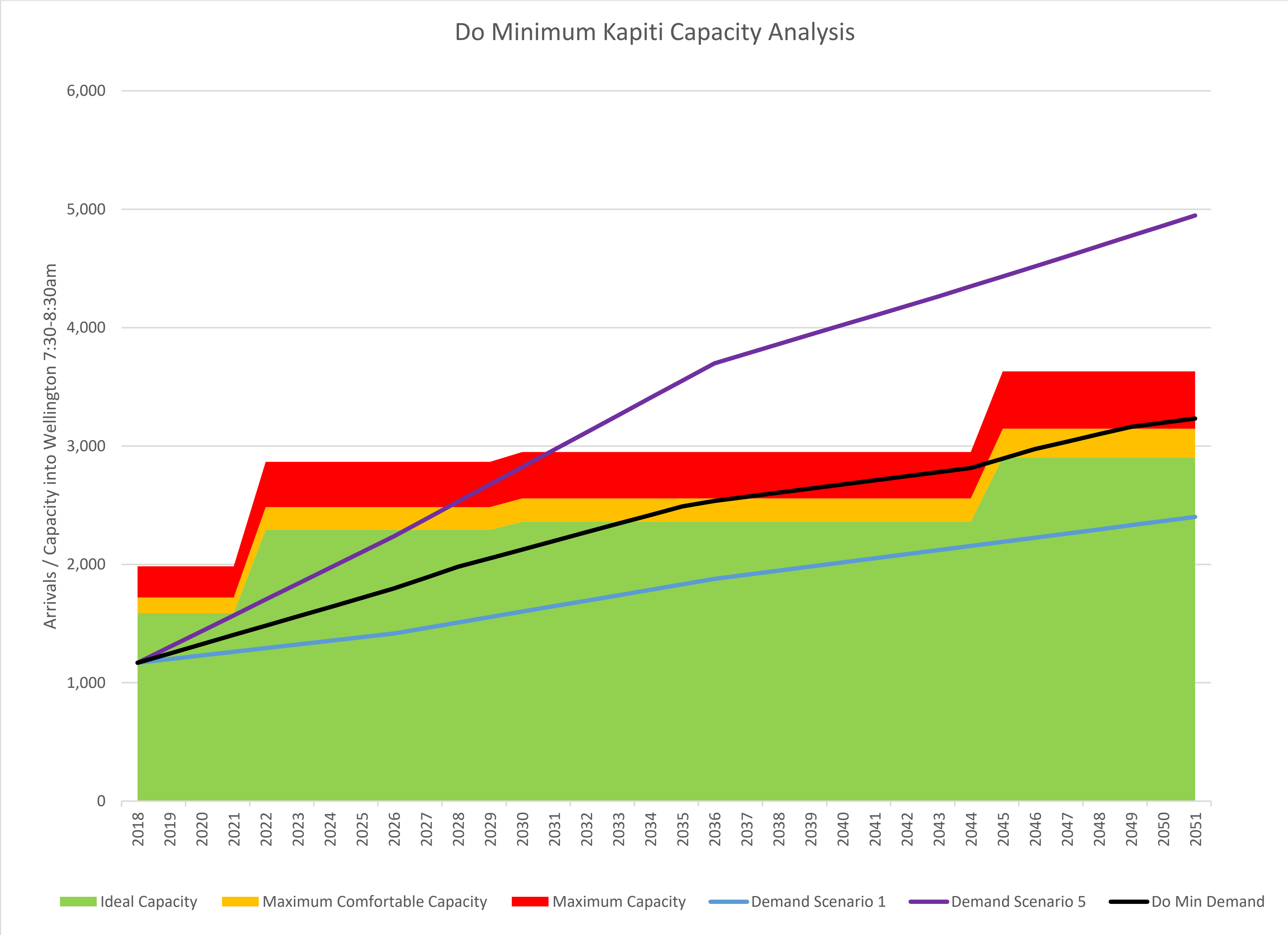
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Do Min Demand


Do Minimum Kapiti Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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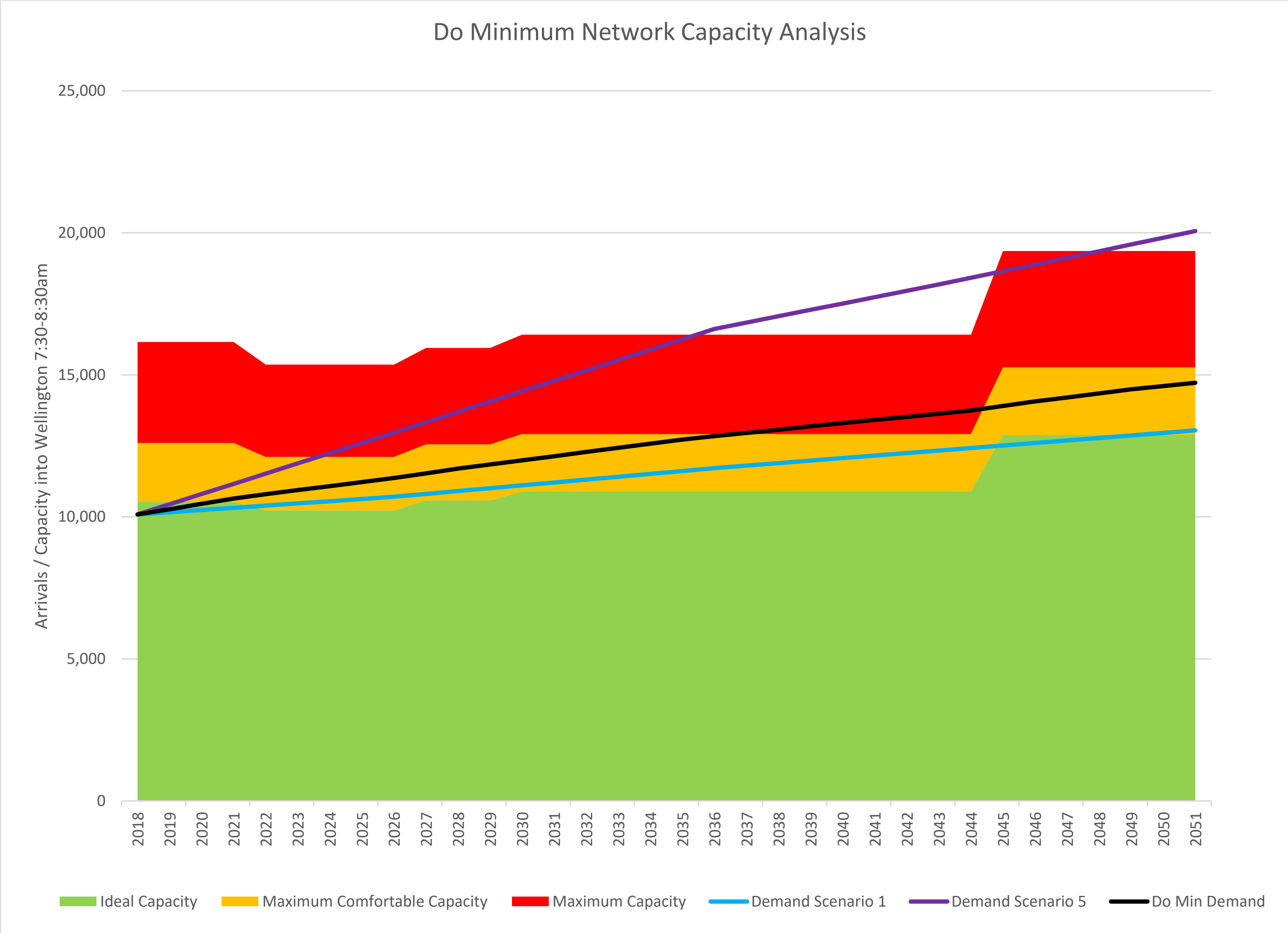
Ideal Capacity
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Do Min Demand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Arrivals / Capacity into Wellington 7:30-8:30am
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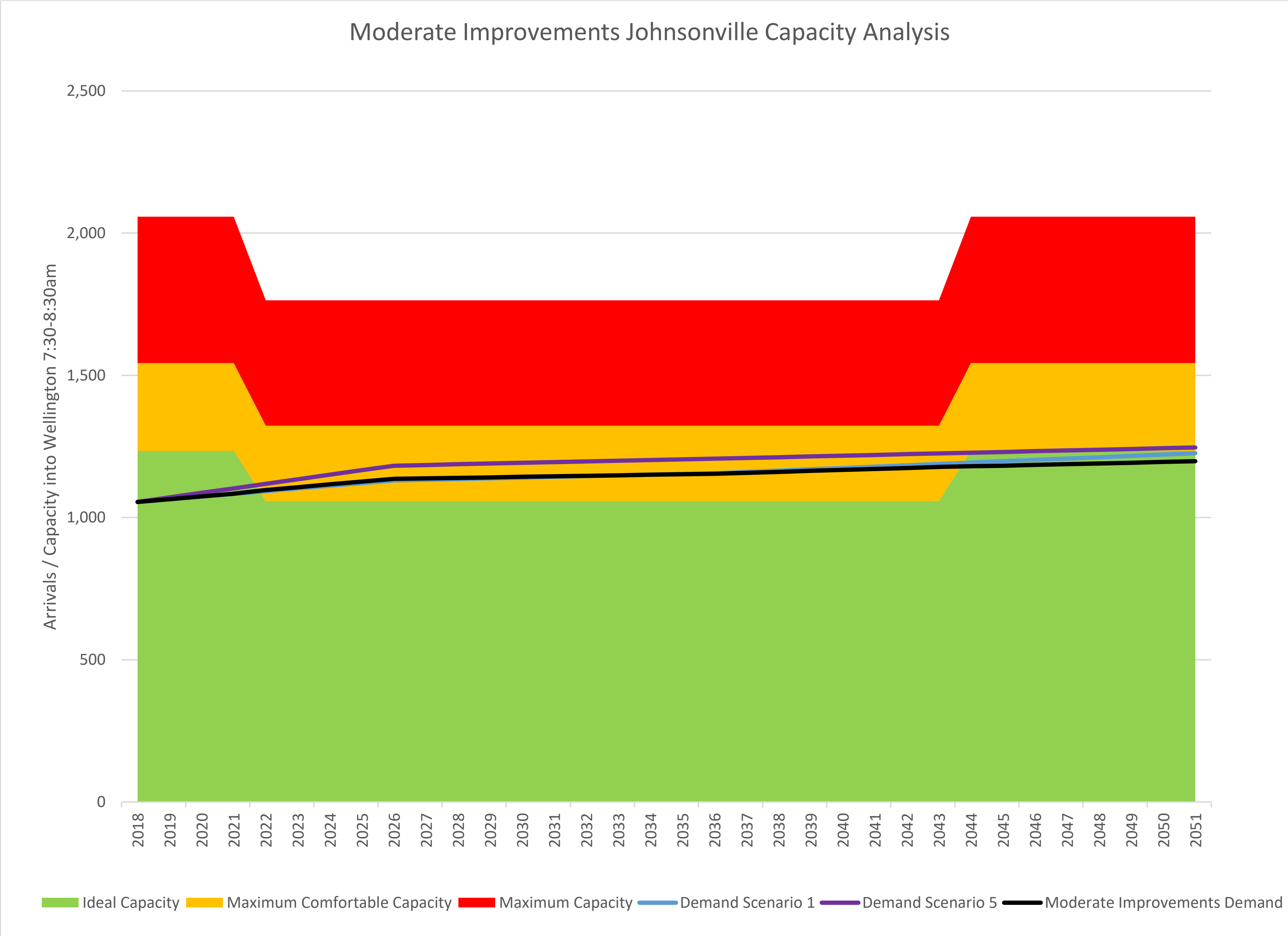
Ideal Capacity
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Do Min Demand



Moderate Improvements Johnsonville Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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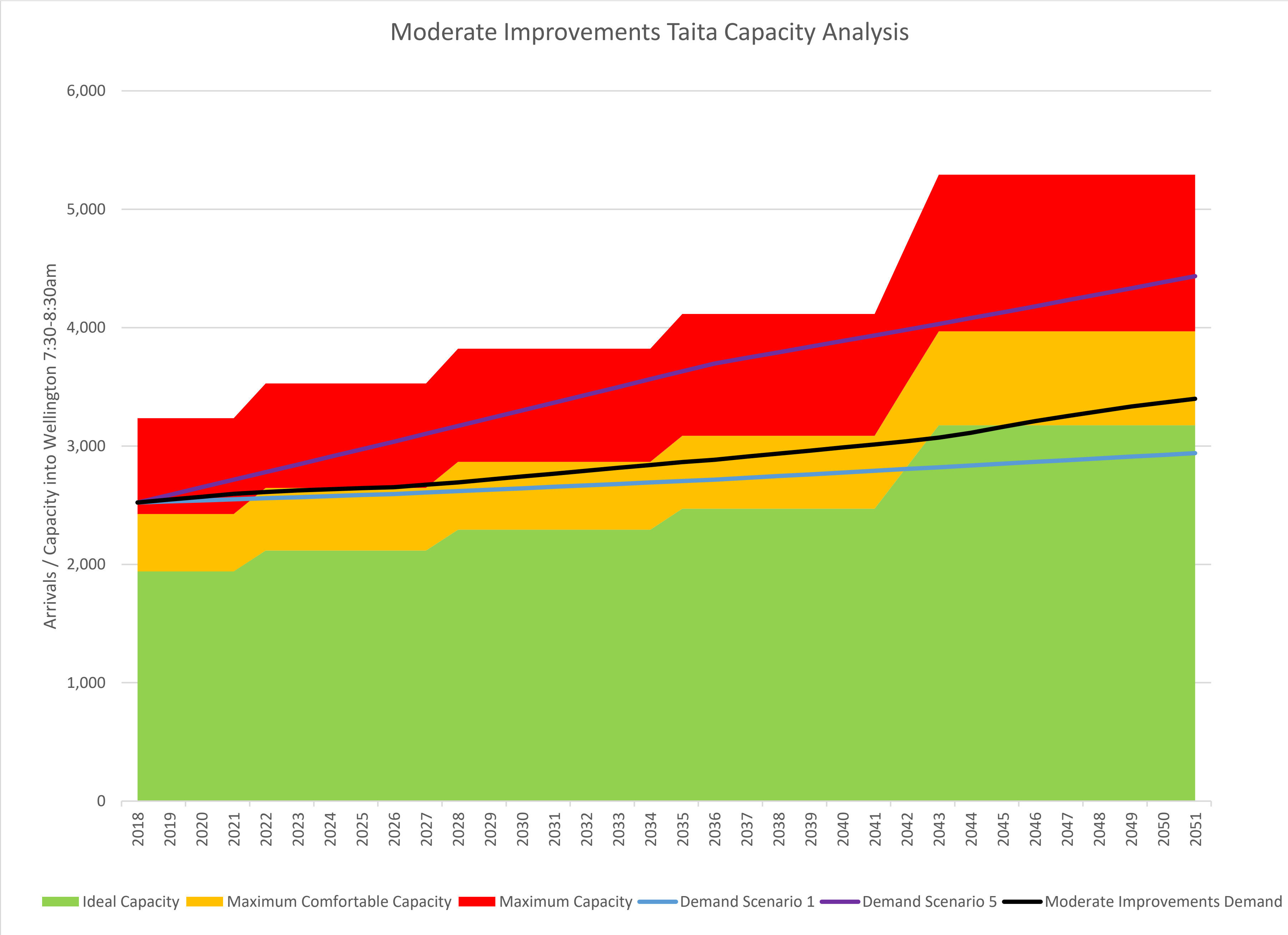
Ideal Capacity
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Moderate Improvements Demand



Moderate Improvements Taita Capacity Analysis
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Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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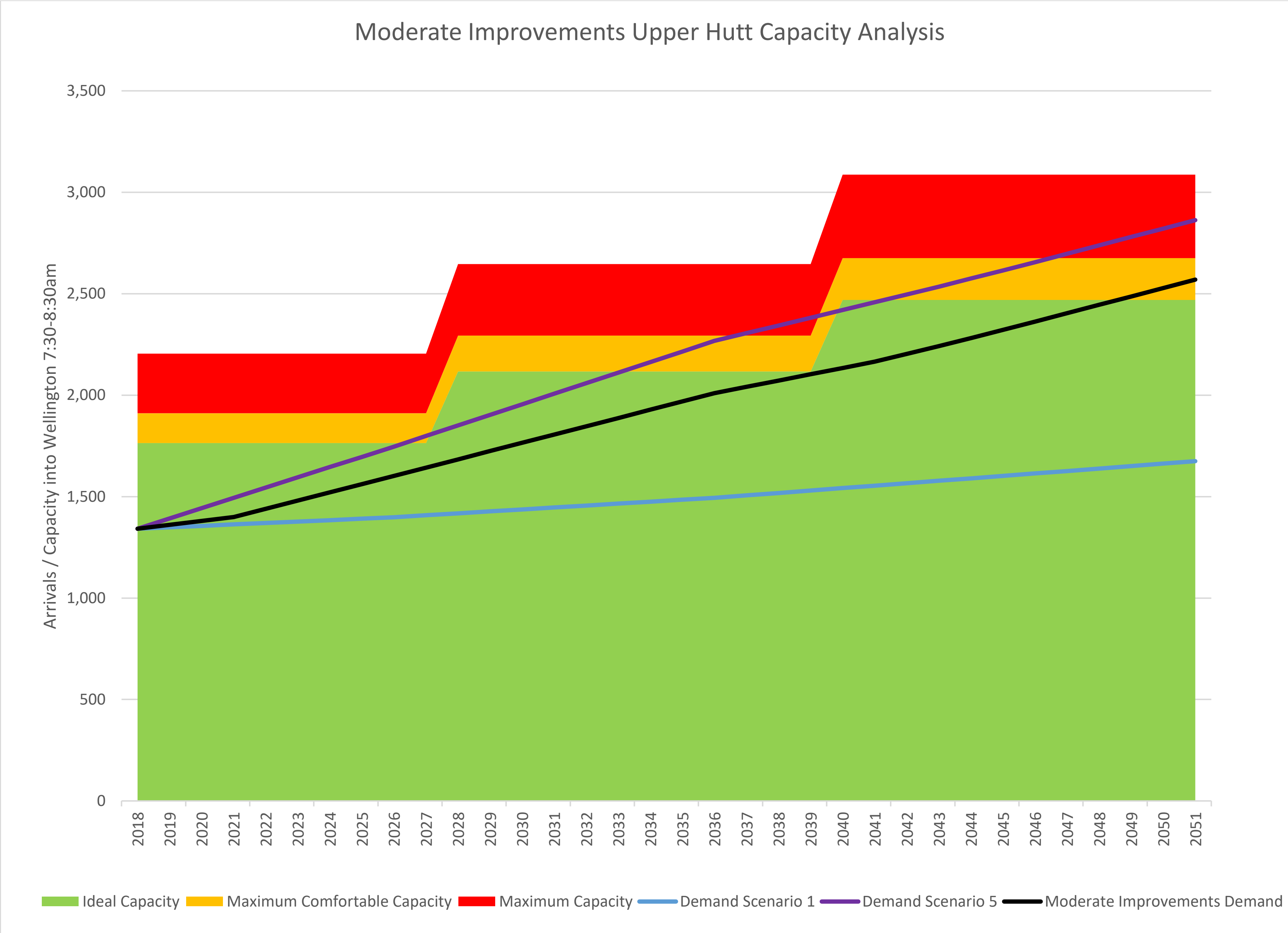
Demand Scenario 1
Demand Scenario 5
Moderate Improvements Demand


Moderate Improvements Upper Hutt Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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Demand Scenario 1
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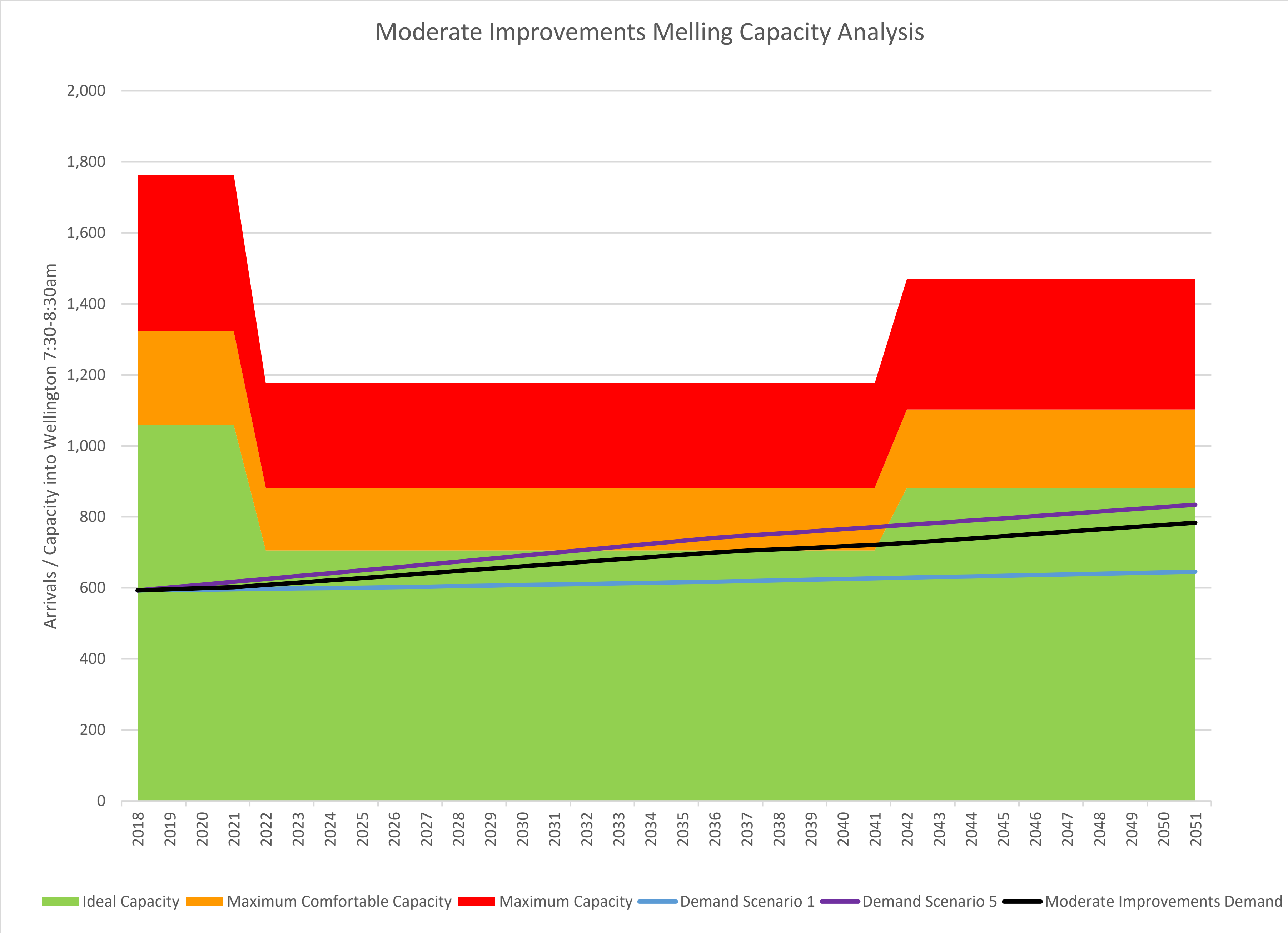
Moderate Improvements Demand



Moderate Improvements Melling Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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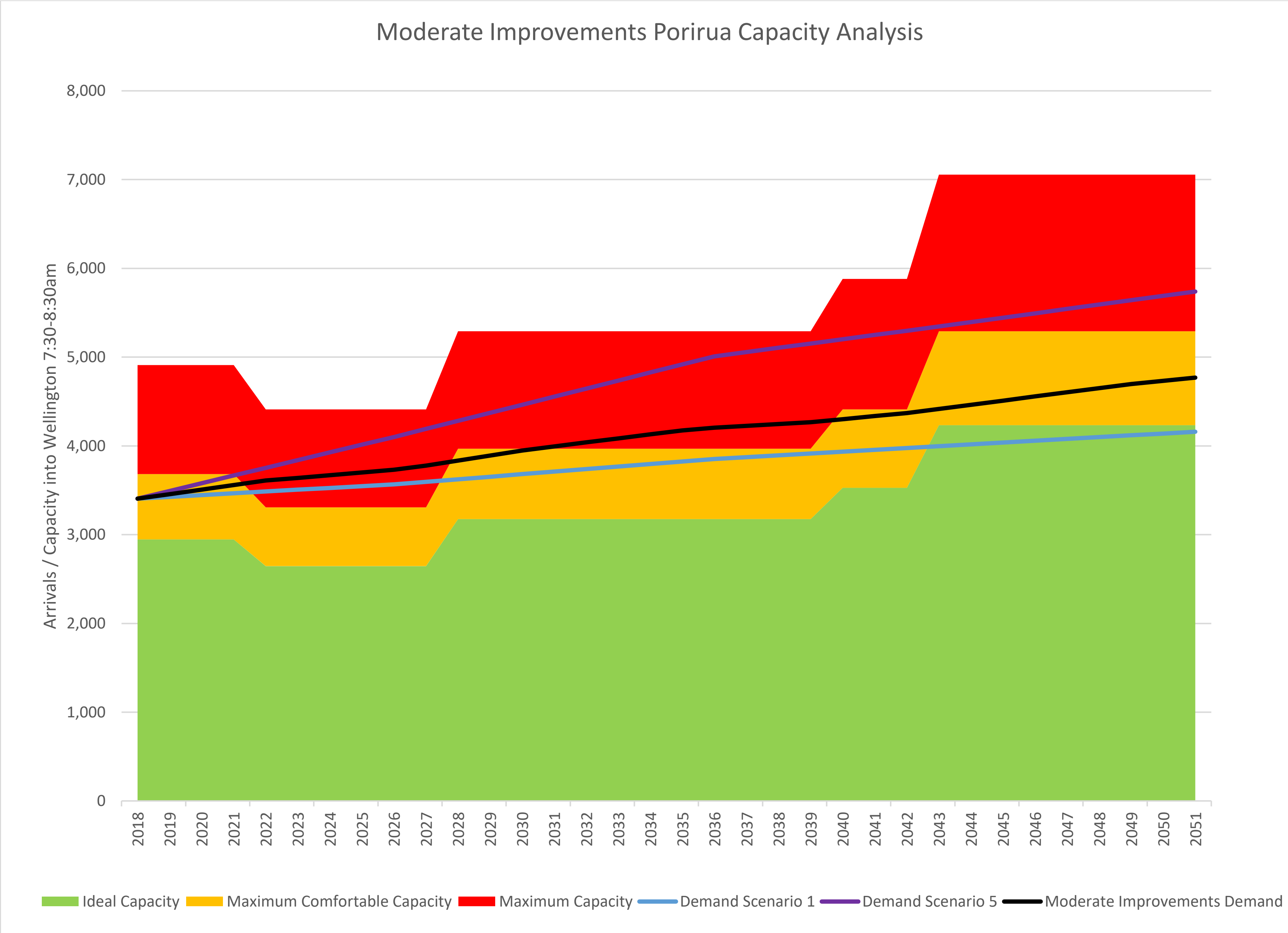
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Moderate Improvements Demand



Moderate Improvements Porirua Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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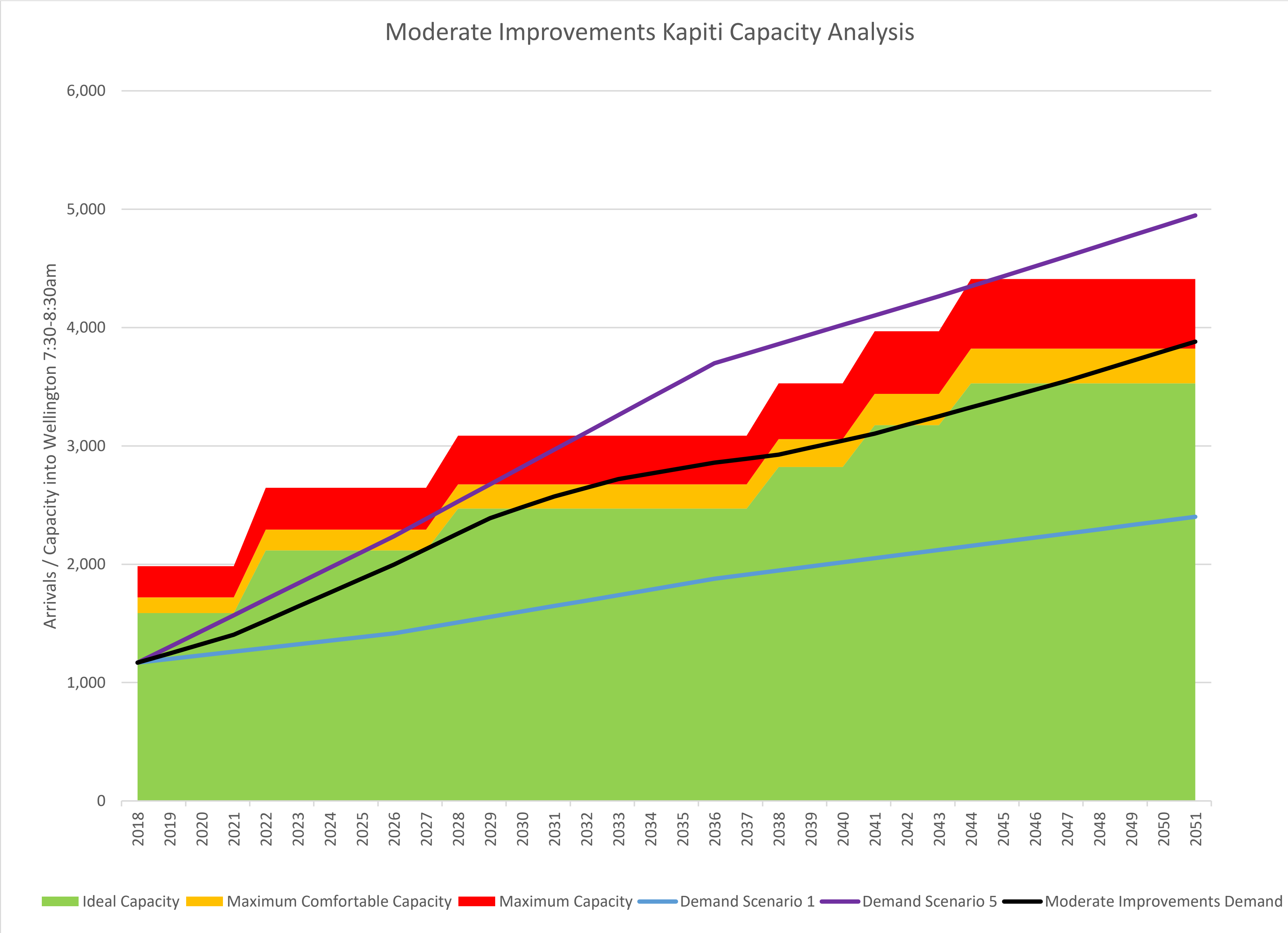
Demand Scenario 1
Demand Scenario 5
Moderate Improvements Demand


Moderate Improvements Kapiti Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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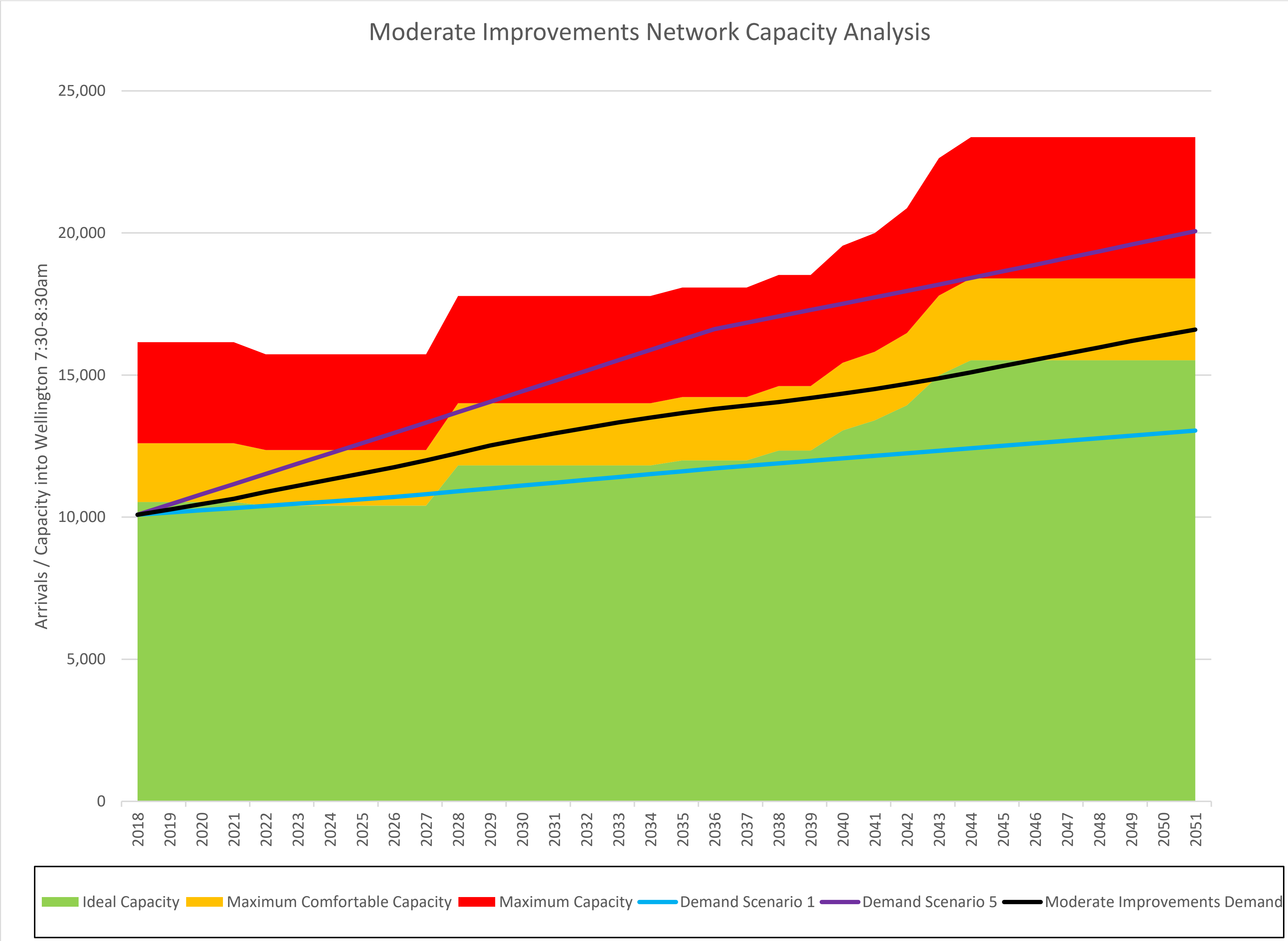
Demand Scenario 1
Demand Scenario 5
Moderate Improvements Demand



Moderate Improvements Network Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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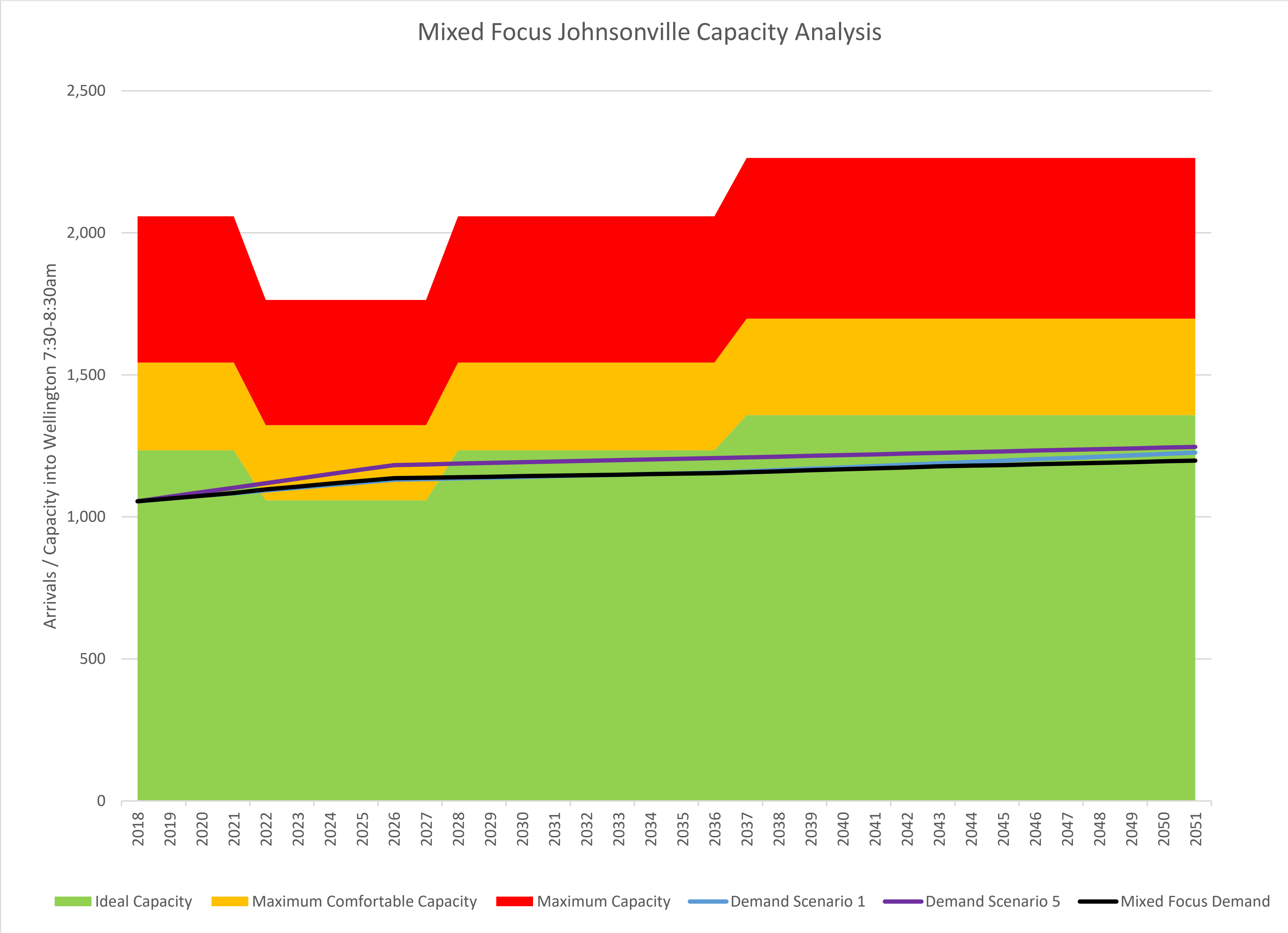
Demand Scenario 1
Demand Scenario 5
Moderate Improvements Demand


Mixed Focus Johnsonville Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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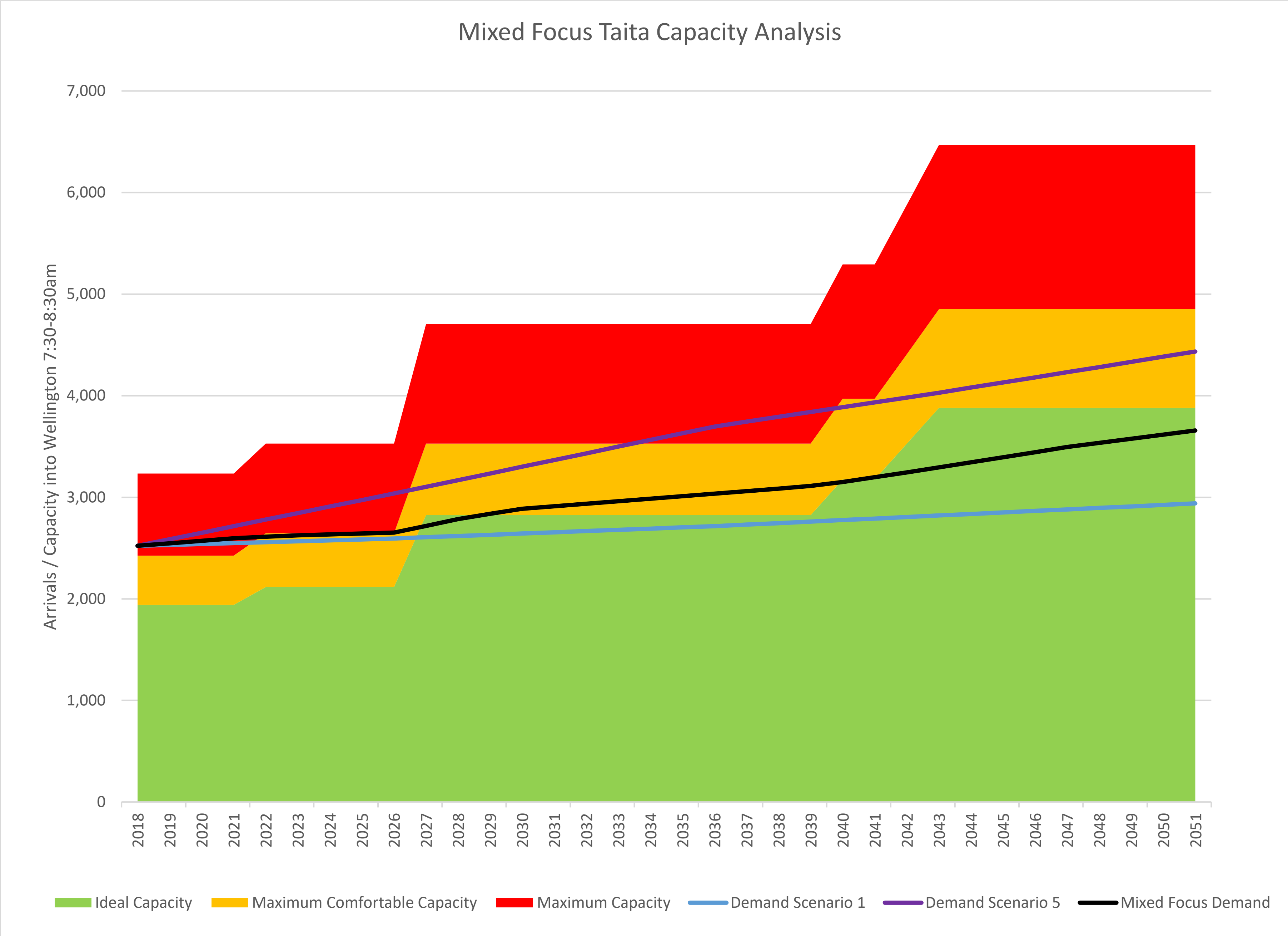
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Mixed Focus Demand



Mixed Focus Taita Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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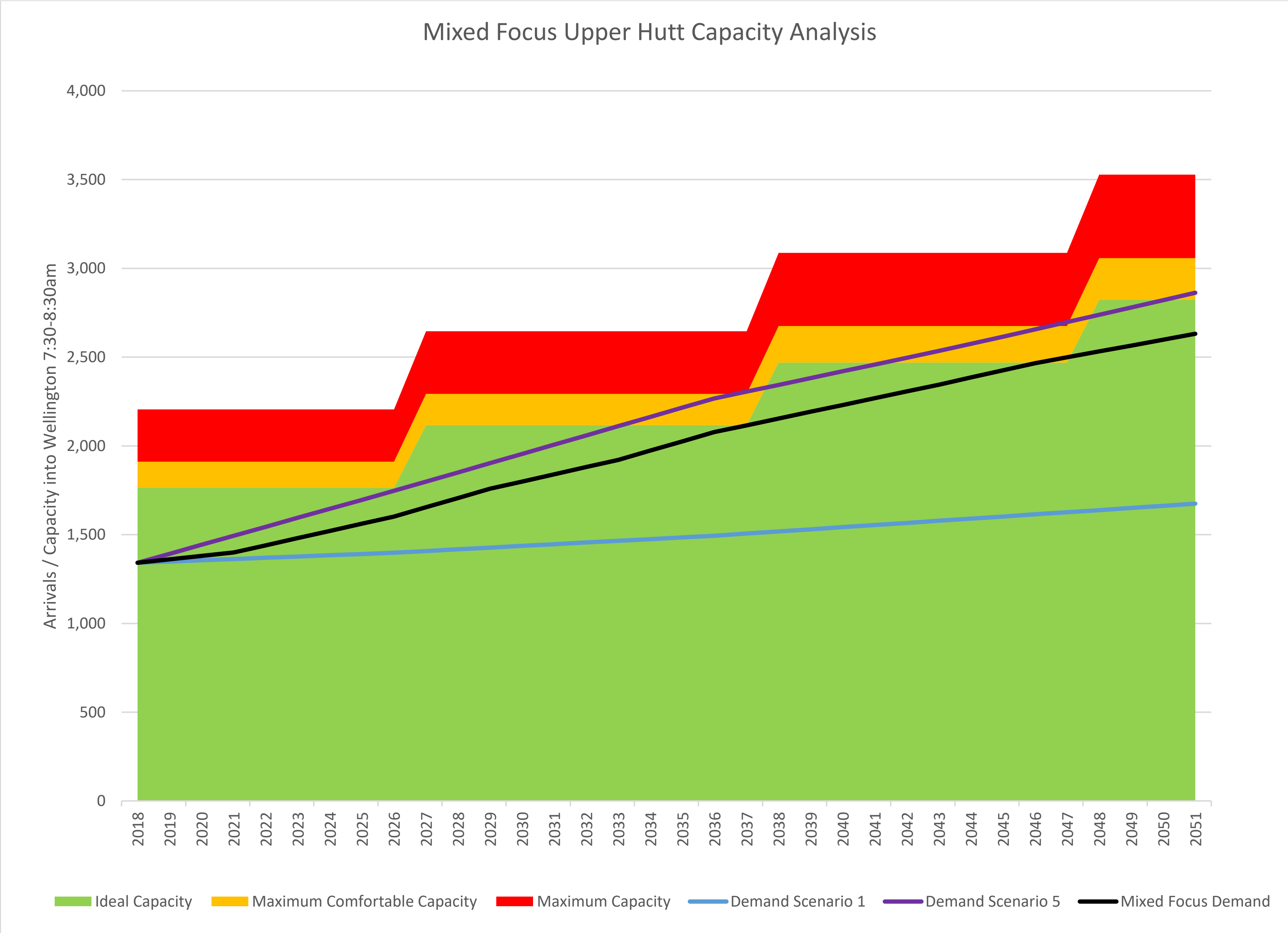
Demand Scenario 1
Demand Scenario 5
Mixed Focus Demand



Mixed Focus Upper Hutt Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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Ideal Capacity
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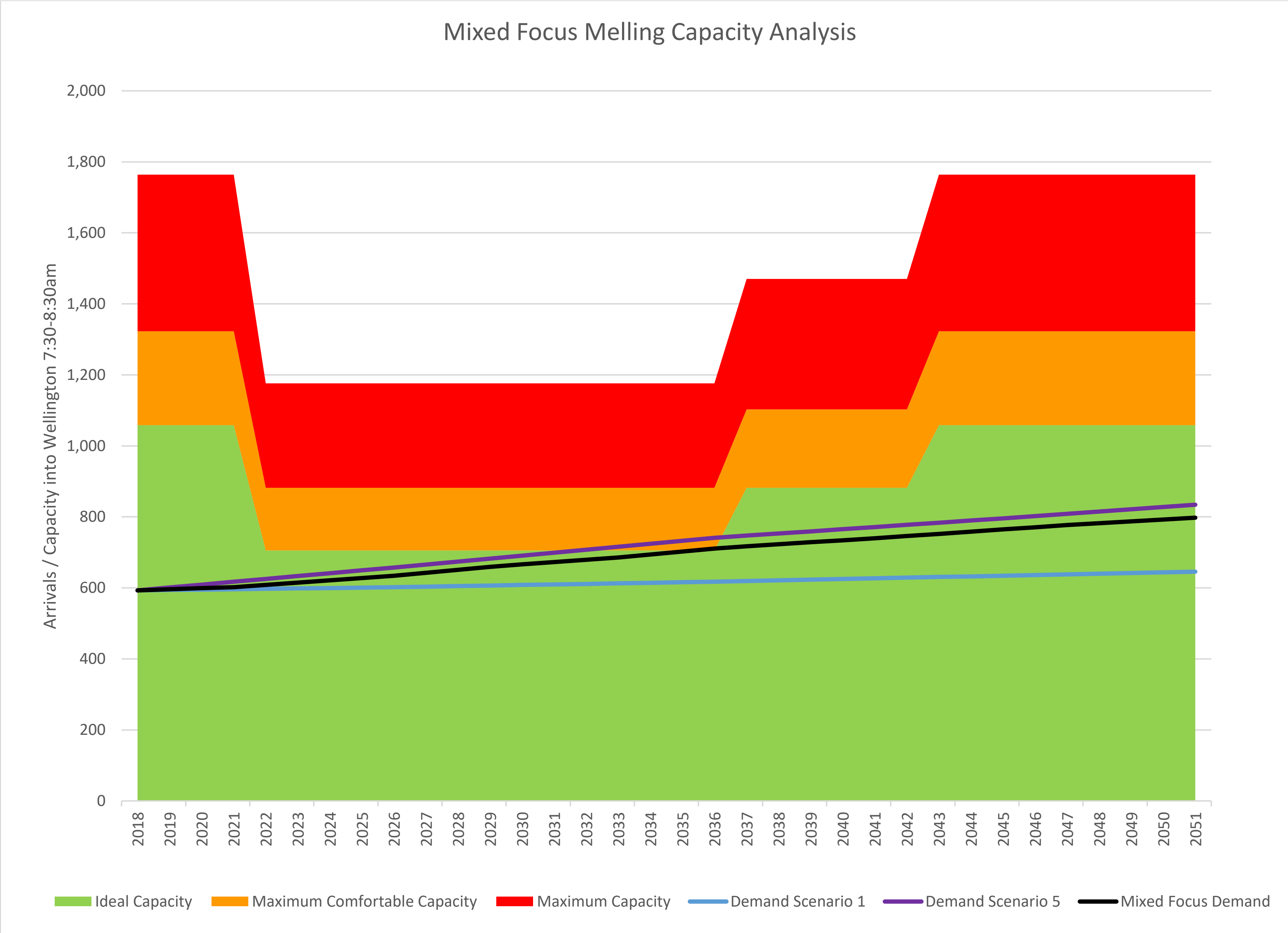
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Mixed Focus Demand


Mixed Focus Melling Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051
Ideal Capacity
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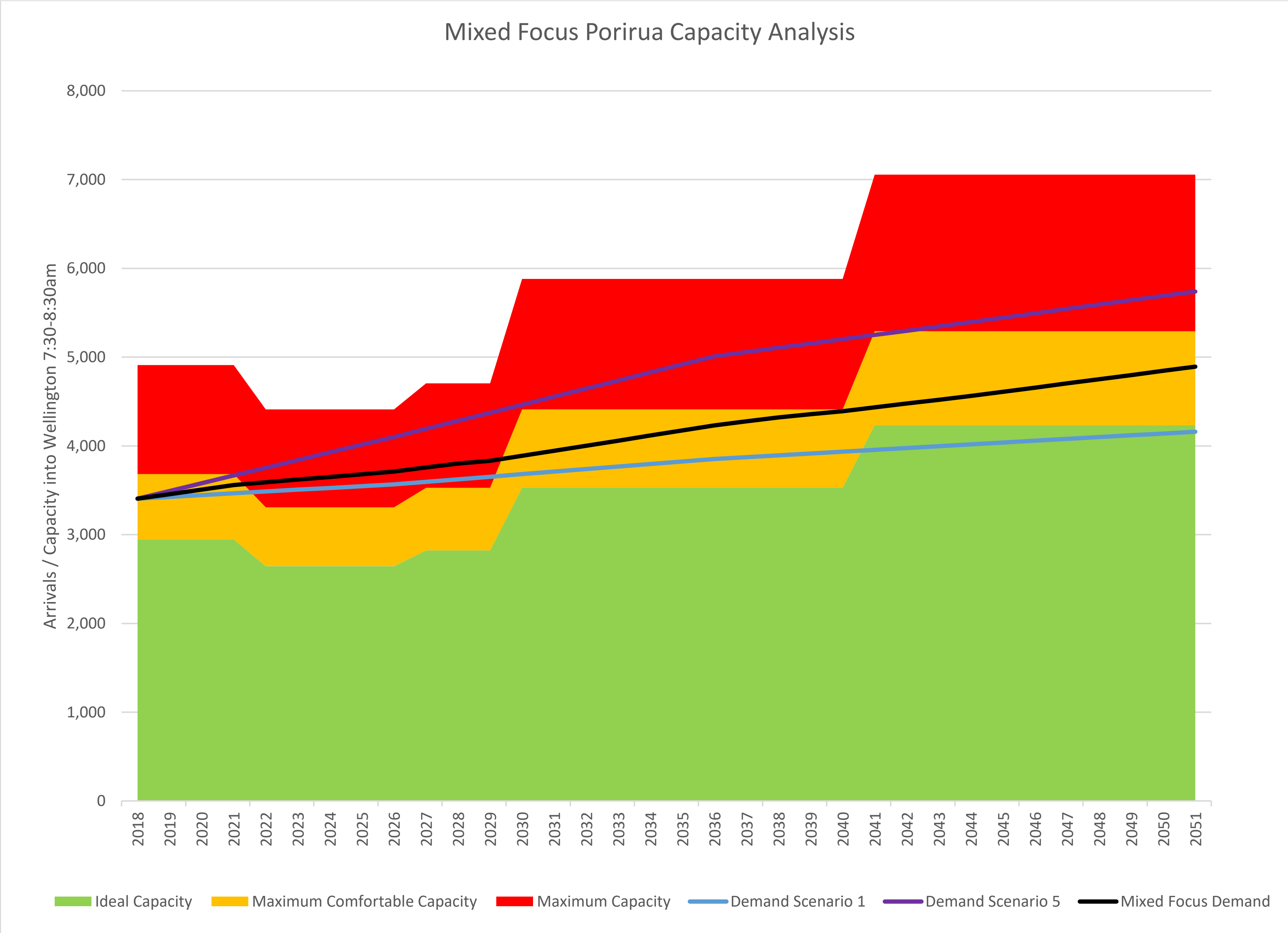
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Mixed Focus Demand



Mixed Focus Porirua Capacity Analysis
Arrivals / Capacity into Wellington 7:30-8:30am
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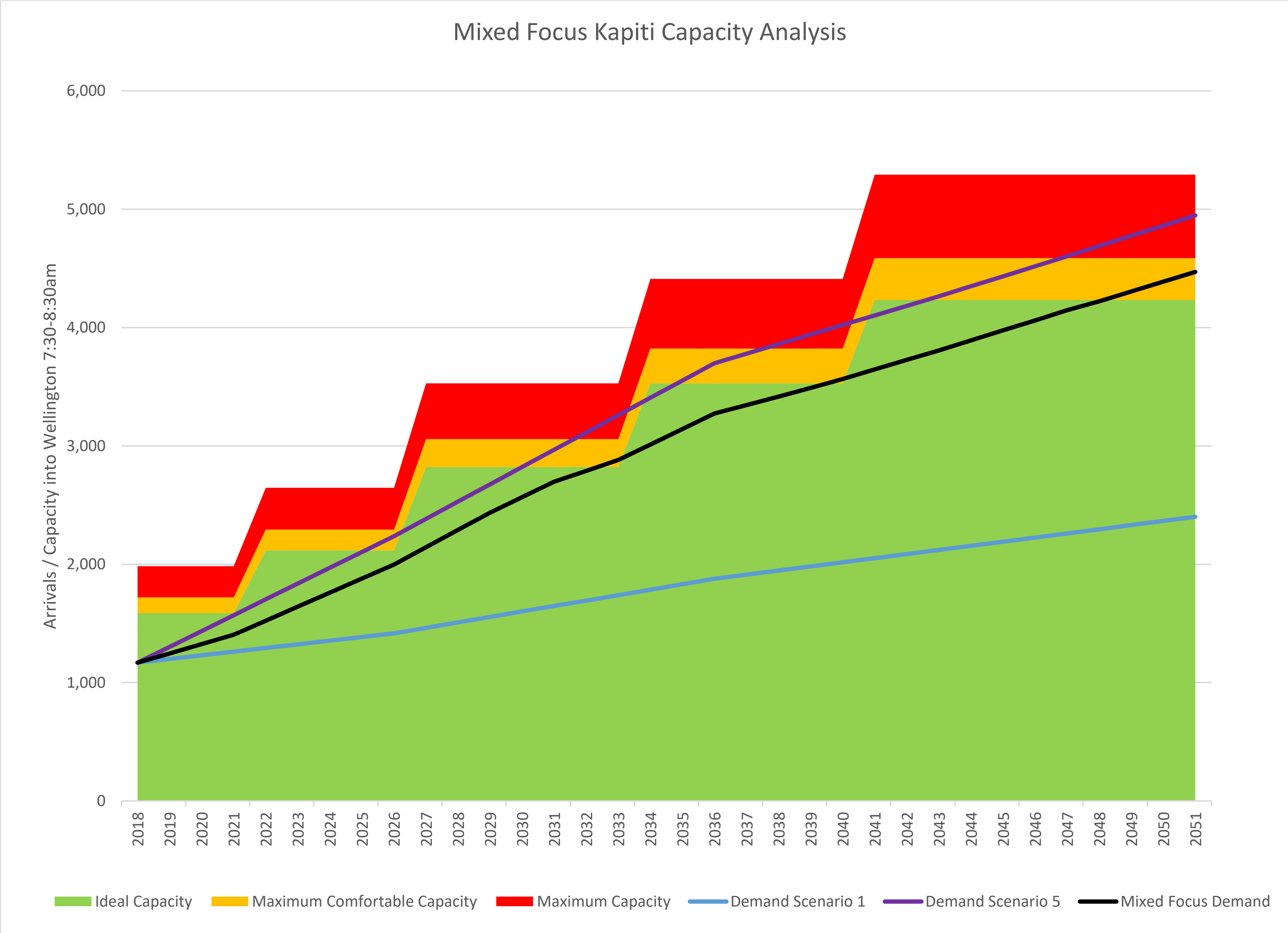
Ideal Capacity
Maximum Comfortable Capacity
Maximum Capacity
Demand Scenario 1
Demand Scenario 5
Mixed Focus Demand


Mixed Focus Kapiti Capacity Analysis
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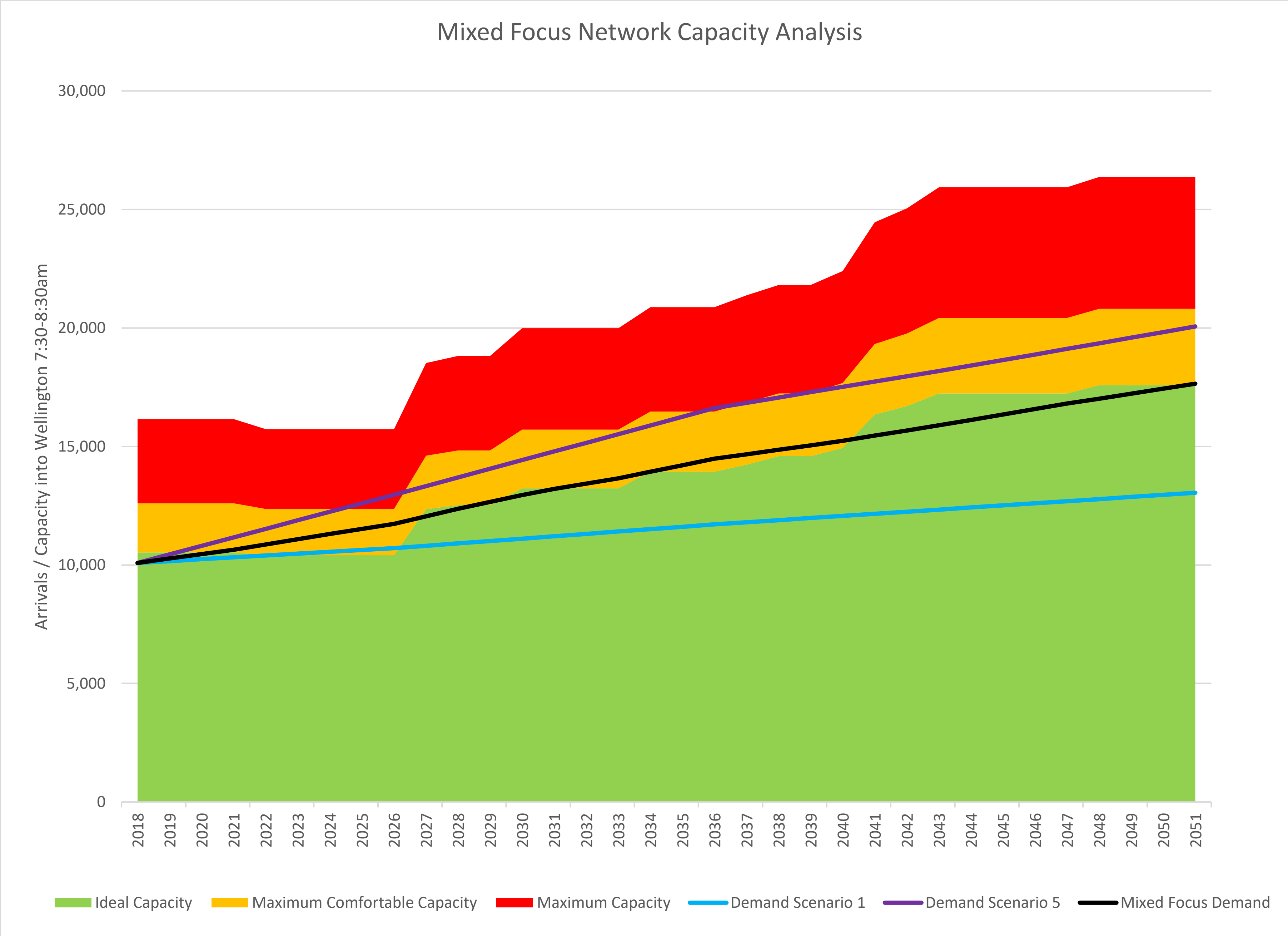
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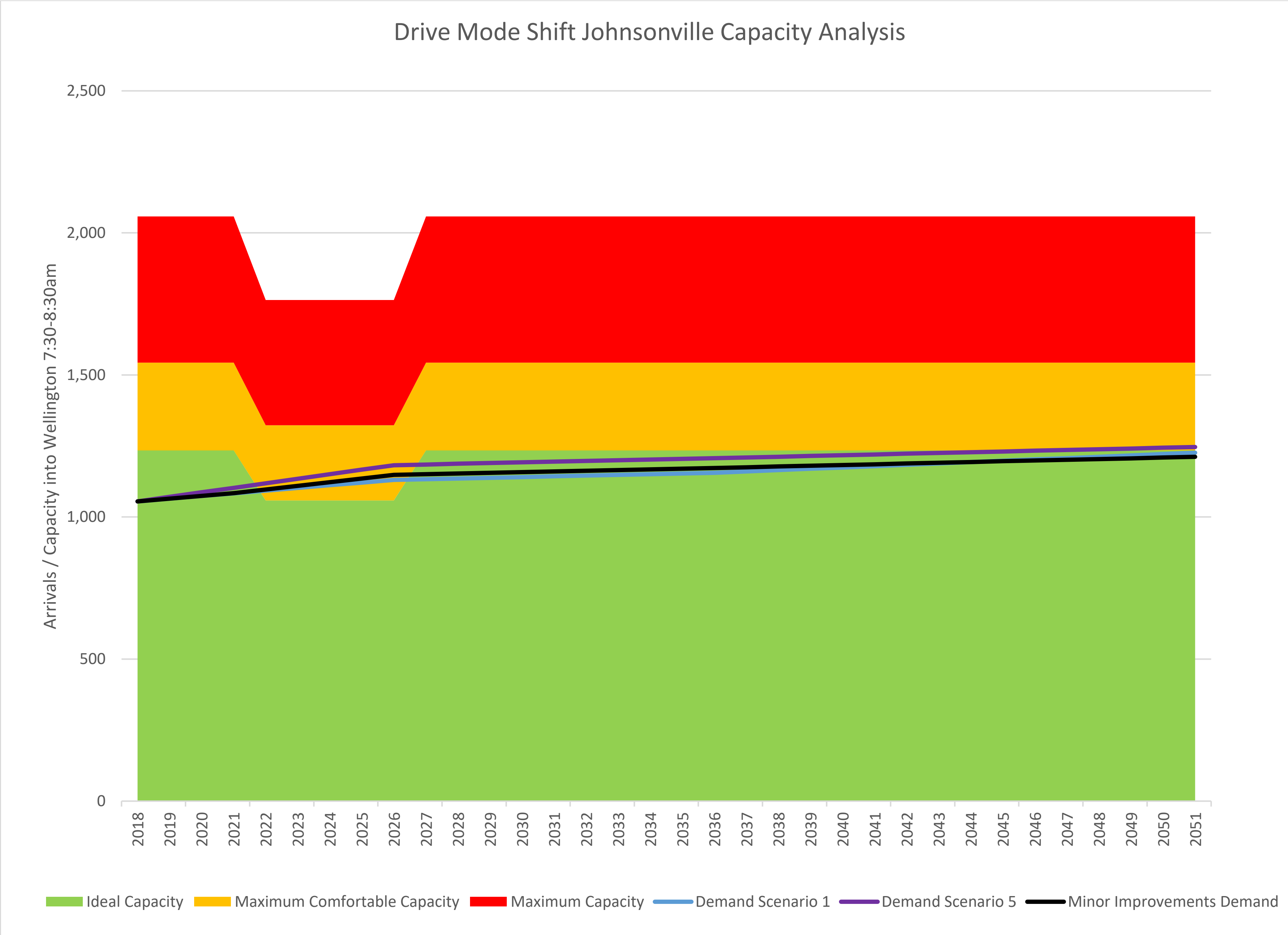

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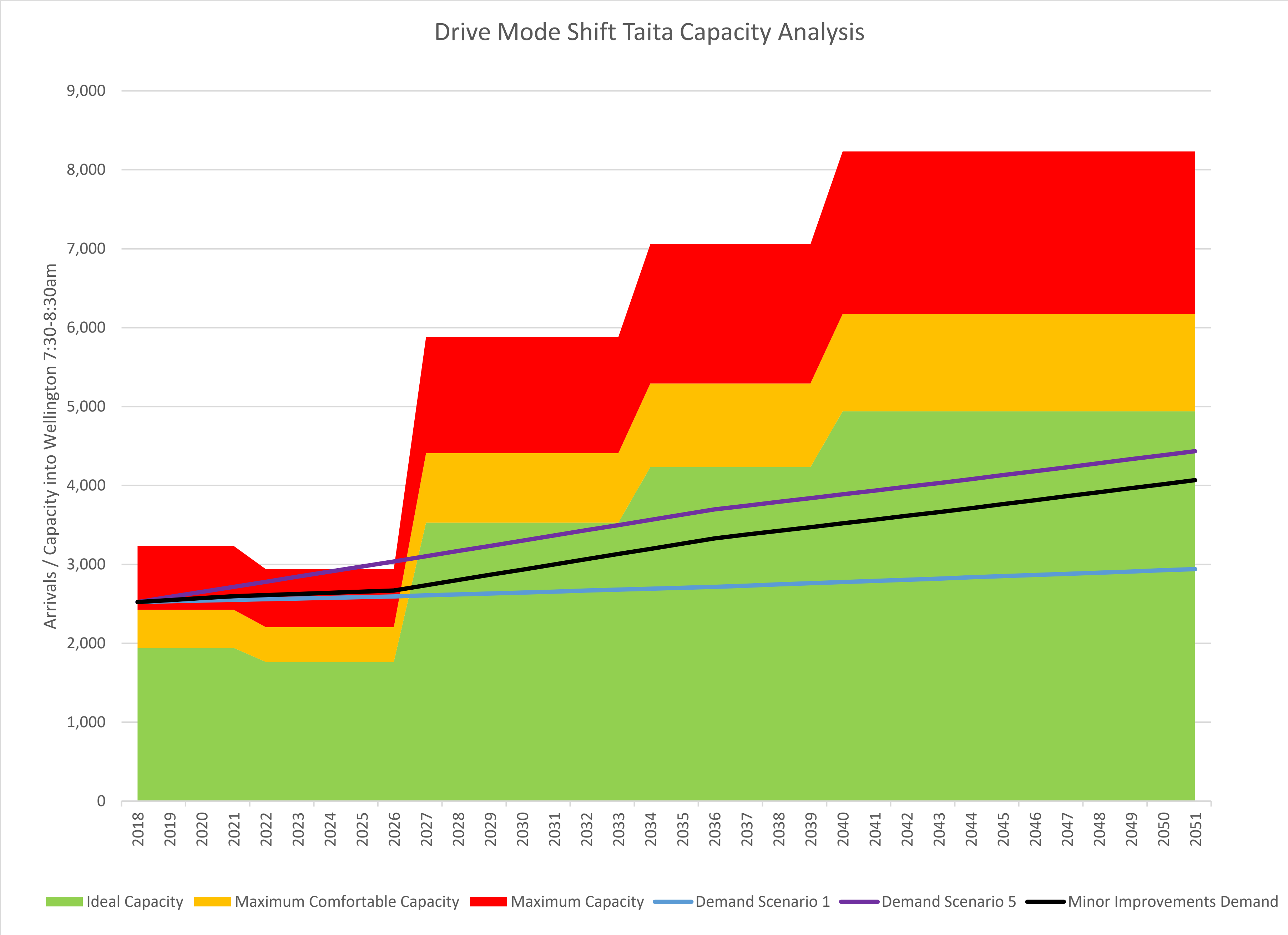
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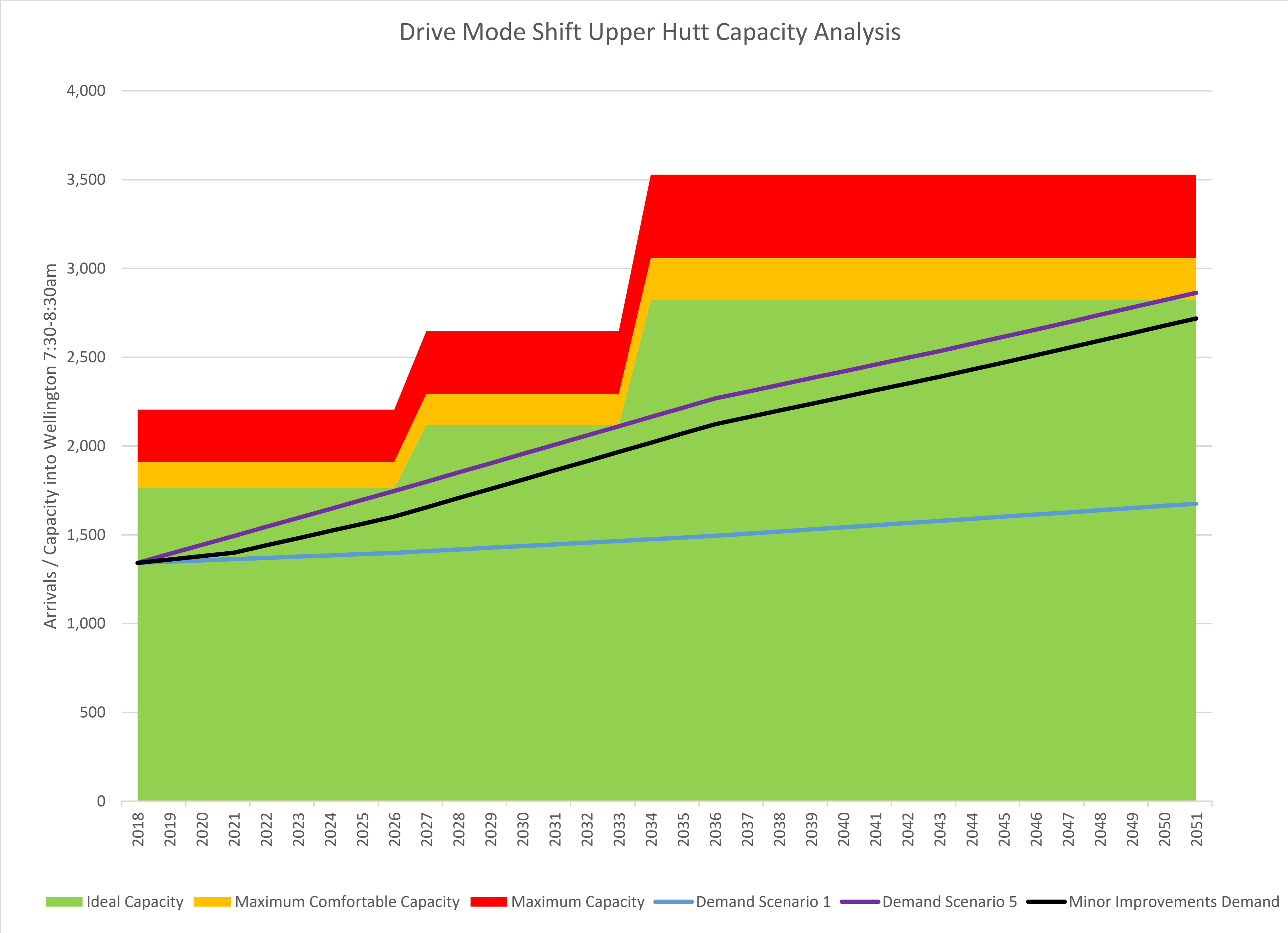

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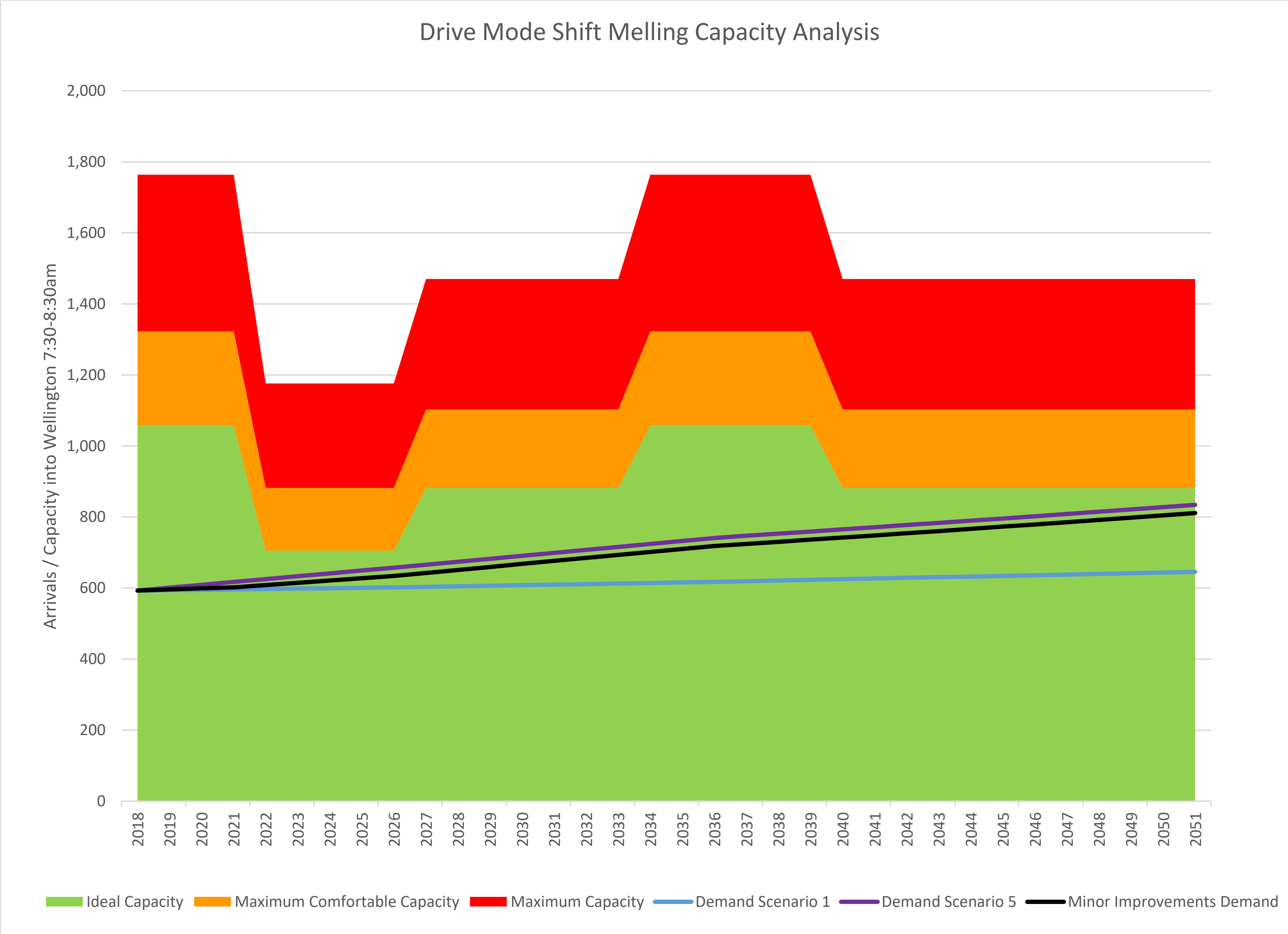

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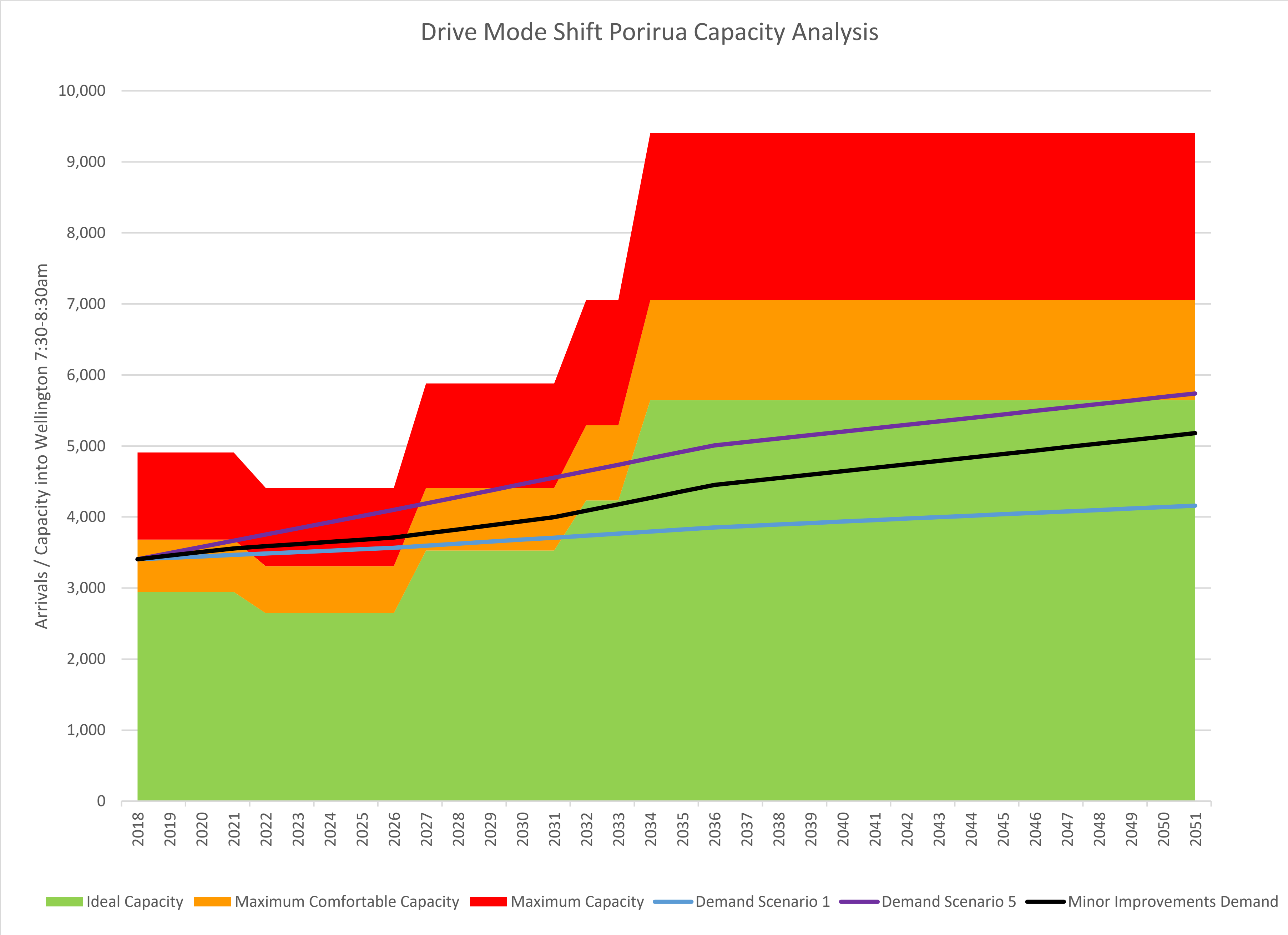
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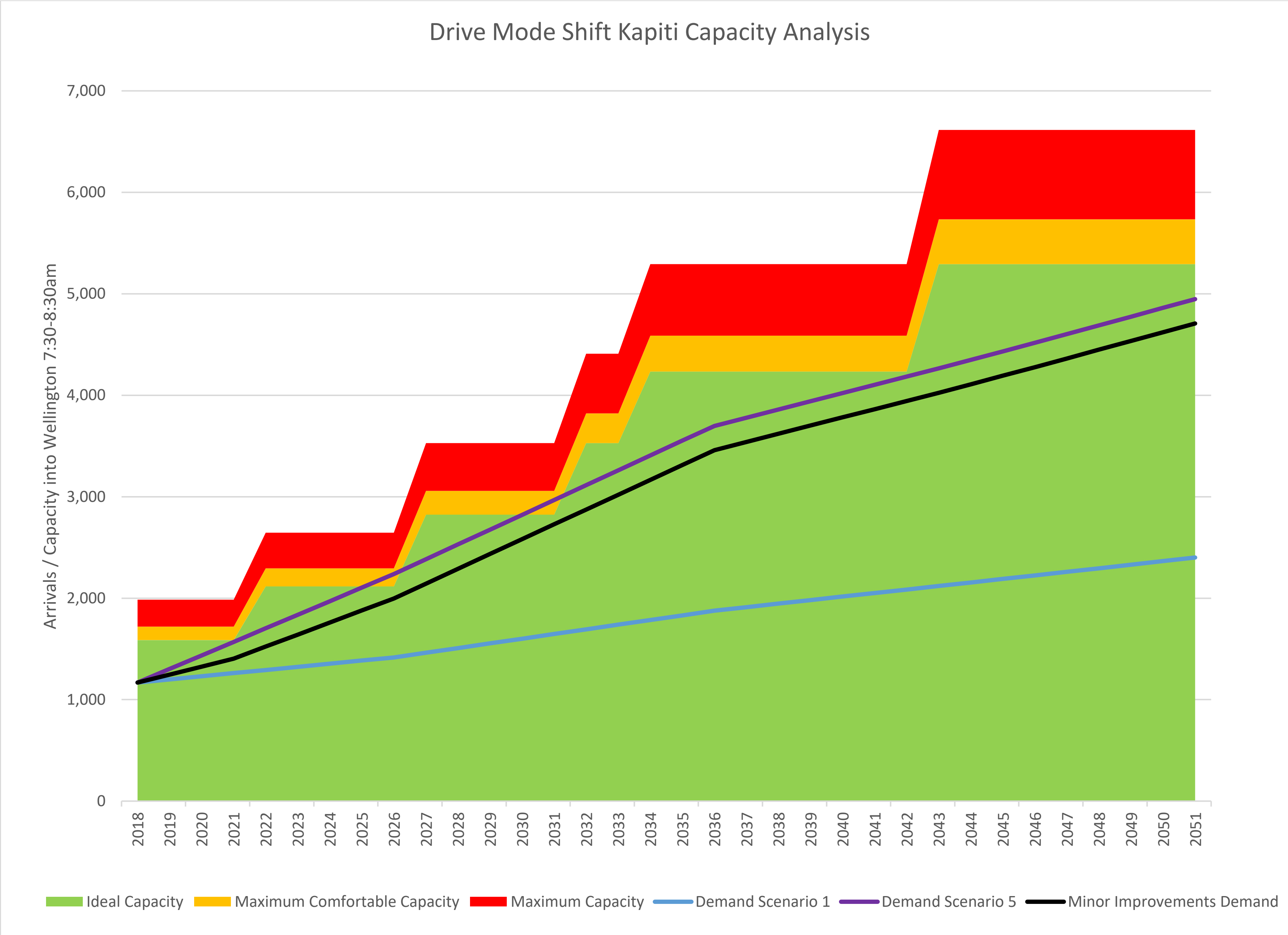

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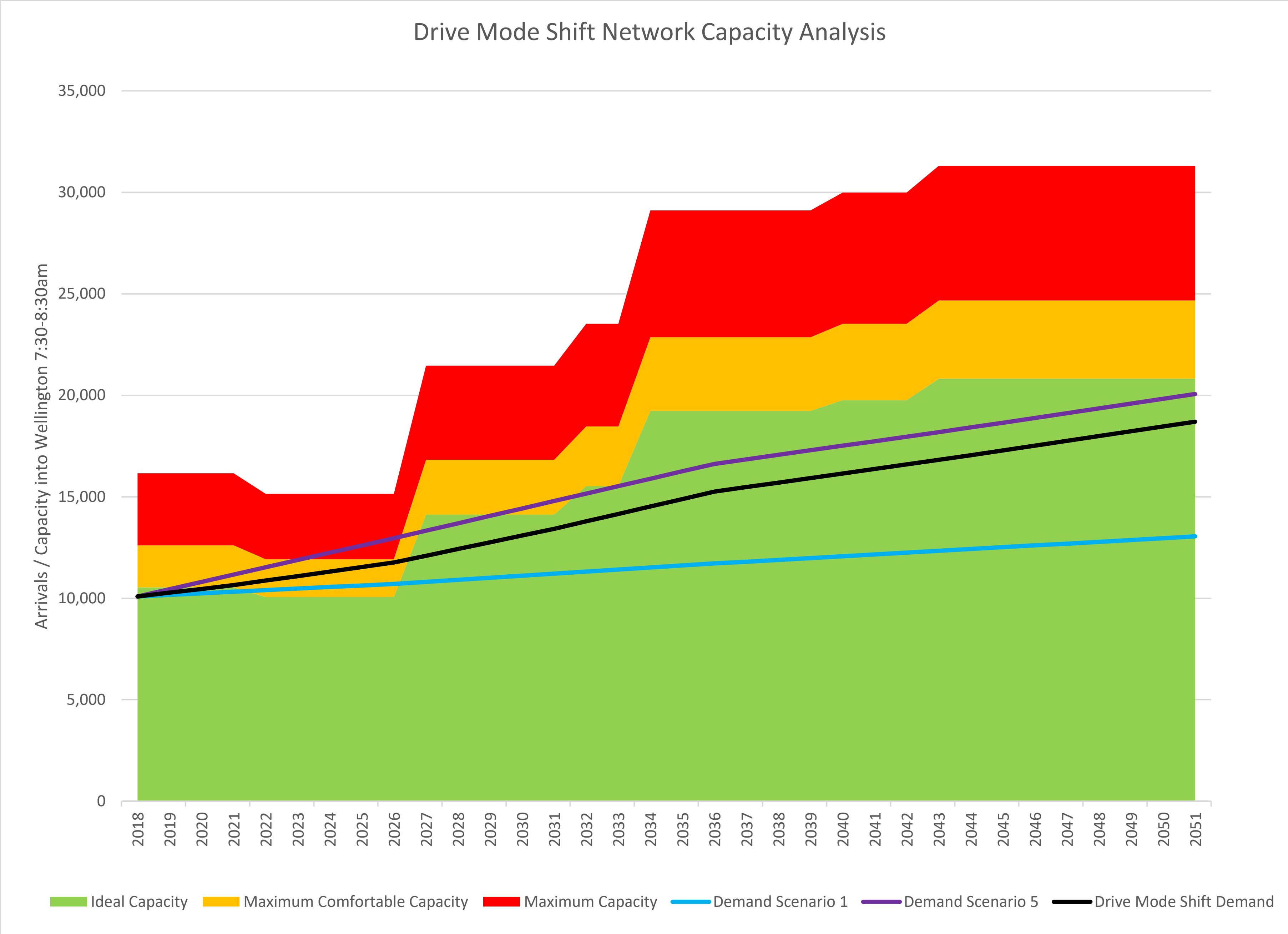
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Appendix D Waka Kotahi MCA Guidance

MULTI-CRITERIA ANALYSIS: USER GUIDANCE

AUGUST 2020

Multi-criteria analysis (MCA) can be used to evaluate multiple criteria, both quantitative and qualitative, and to assess different alternatives and options to inform decision making.

The MCA guidance and template is recommended for use in most business case optioneering processes to evaluate alternatives and options at the longlist and shortlist phases.

Contents

INTRODUCTION

Multi-criteria analysis (MCA) can be used to assess multiple criteria, both quantitative and qualitative. MCA can be used to compare different alternatives and options and assist with conversations between investors and stakeholders to help inform decision making.

An MCA template (Excel spreadsheet) and accompanying instructions for users are available to download from InvestHub.

https://invest.nzta.govt.nz/course/view.php?id=26

The MCA guidance in this document, and the template:

- provide a best practice process and approach to ensure robust and holistic assessment when moving from the longlist to shortlist of alternatives and options
- support investment decisions being made consistently and transparently across business cases
- embed the intervention hierarchy which ensures that a broad range of alternatives and options have been considered
- seek to create a replicable approach to scoring, such that a different group could apply the same assessment methodology and produce comparable results
- help identify environmental impacts and opportunities and aligns investment and Resource Management Act 1991 (RMA) and Public Works Act (PWA) obligations. In particular, this relates to the need for a robust, transparent and well-documented optioneering process throughout the entire business case development process, from the strategic case through to the implementation of the preferred option.

The integrity and robustness of MCA processes largely rely on the way they are done. To provide consistency and transparency across the process and methodology used, it is recommended you use this guidance and the template. It is acknowledged that all business cases have their own unique characteristics and the approach taken needs to align with the size and complexity of the problem/opportunity.

This guidance provides for flexibility in approach to accommodate a project’s specific circumstances. If variations to this guidance are considered appropriate, or another MCA-type approach is preferred, the project team should clearly document the variations or different approach as part of the business case.

It is anticipated that MCA will be used as part of most business case optioneering processes to help investors and project teams evaluate alternatives and options at the longlist and at the shortlist phase to help identify a preferred solution. It is not intended to be applied when making detailed design decisions post the identification of the preferred solution.

MCA outputs support making trade-off decisions between different alternatives or options. MCA does not provide definitive answers about which is the best alternative or option. Critical thinking is important, especially when considering the right-sizing of possible solutions.

Key considerations when undertaking MCA include:

- Alternatives and options need to address the root causes of the problems identified in the strategic case.
- Only alternatives and options with true fatal flaws should be discounted at this stage.
- Synergies and conflicts between alternatives and options should be considered if packaged together.

BEFORE CONDUCTING AN MCA

To enable an MCA to be applied as part of the optioneering process, there are several things to do first.

The strategic case

The strategic case is the cornerstone for successive business case phases, and it will become the first section of the programme business case (PBC) or single-stage business case (SSBC) document. The strategic case should clearly articulate the problem or opportunity and identify the benefits sought.

Generate alternatives and options

After the strategic case has been created, a broad range of alternatives and options are generated using the intervention hierarchy and systems thinking.

Do-minimum

Assessment involves examining different options or courses of action. The 'do-minimum' must be defined before MCA is commenced. Comparing option criteria scores to the do-minimum could be accomplished by assigning a neutral score to a do-minimum and comparing all other option criteria scores against it.

Early Assessment Sifting Tool (EAST)

Prior to conducting the MCA, it may be useful to run the alternatives/options through the EAST. The EAST supports an initial 'coarse screening' of alternatives and options. The EAST is designed to quickly and robustly rule out alternatives and options, allowing for a more manageable MCA exercise. The EAST also assists in documenting why decisions have been made.

It is important that the rationale for discarding an alternative or option is well documented. This includes where an alternative or option does not align with investment objectives or there are fatal flaws.

ROLES AND RESPONSIBILITIES IN THE MCA PROCESS

It is important to have the right stakeholders involved when developing and assessing alternatives and options. A typical MCA assessment will include a range of different groups whose involvement will evolve over time.

Involvement of investment decision makers will ensure alignment to desired investment objectives. The involvement of investment partners, iwi and relevant stakeholders is strongly encouraged at appropriate times in MCA processes since it creates a stronger business case and ensures that issues to be addressed reflect different perspectives, which will in turn drive more robust outcomes.

In all cases the MCA process will be led by the project team, who may be advised by a relevant specialist or specialists. There may be instances where other parties complete specific assessments. The Waka Kotahi Environmental and Social Responsibility Standard[1] provides guidance on the scope of additional assessments.

Subject matter experts (SMEs) may be used to provide specialist input on their topic to the assessment of options.

Depending on the scale and complexity of the activity, legal advice may be sought at different points in the process. **Appendix 1** provides further guidance on the roles and responsibilities when undertaking MCA.

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[1] The Environmental Standard is currently state highway focused; however, it is currently being updated to provide guidance on the scope of additional activities. The link to the current version is https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-social-responsibility/national-standards-guidelines-and-specifications/esr-standard/

Te Ao Māori

Iwi have a special relationship with the Crown as Treaty of Waitangi partners and therefore have a partnership role with Waka Kotahi across the business case phases and project life cycle.

The project team should consider the timing, nature and extent of iwi involvement in the optioneering process. Relevant iwi should be consulted regarding their participation in the optioneering processes. This may include identification or preparation of Cultural Impact Assessment(s) and/or taking a more holistic perspective on activity impacts through their participation at optioneering workshops. The timing, nature and extent of iwi input will depend on the specific circumstances but as a rule the earlier the better to ensure both positive and negative Te Ao Māori impacts can be scoped.

It should be noted that multiple iwi and hapū groups may be affected by a project and may wish to contribute their own assessments separately from one another.

Different iwi groups may have different perspectives on optioneering processes. Practitioners should be aware that iwi may not wish to be involved in optioneering processes that could be perceived to not adequately represent iwi interests. Early engagement with iwi prior to starting an optioneering process, and a flexible approach, are encouraged to determine how iwi may wish to be involved.

REPLICABILITY AND TRANSPARENCY

The MCA assessment process used should be both transparent and replicable so that a different specialist would be able to follow the logic and methodology set out in the supporting documentation and replicate the result. Well-documented MCA processes mean that decision makers will be readily able to determine whether legal requirements (eg under the Resource Management Act (RMA) and Public Works Act (PWA)) have been met.

Where specialists have been involved, their background notes or reports presented at a decision conference should be included.

Where, in the course of developing the business case, an element changes – for example, new options or specialists are introduced, or material changes in the background environment occur – the change must be adequately referenced and assessed, including going back to consider all or relevant options afresh if necessary.

NEW OPTIONS/CHANGE CIRCUMSTANCES

If a viable and substantive new option arises after an MCA has been completed, specialists should be asked to complete a review of the new option using the same methodology used for the prior MCA, and fully document the outcomes. To the extent practicable, the same specialists who completed the original MCA should be involved.

Changed circumstances after an MCA has been completed should be addressed through a review of the prior MCA processes and a documented assessment of any changes necessary. For example, if, after an MCA process has been completed, a significant earthquake altered a coastline on which an MCA process was premised, a review of the MCA assessment would be required.

All specialists involved in assessment processes would also need to review and revise their assessments if necessary.

MCA GROUP ASSESSMENT TECHNIQUES

MCA is often a group-based assessment activity, since it typically requires input from a range of different specialists. Although a single, informed participant could complete low complexity and low risk MCA assessments, for the majority of activities it is anticipated that multiple participants will be involved in the MCA process.

There are two main methods of group decision-making techniques used for MCA scoring and selecting shortlists/preferred options. These can be broadly defined as decision conferencing, a structured format among individuals in a meeting; and the Delphi method, where participants are physically remote and identify and evaluate ideas/scores independently.

Where practicable, it is recommended that a decision conferencing workshop method is used when undertaking MCA.

DECISION CONFERENCING

Decision conferencing provides for a structured format among individuals in a facilitated workshop, or across several workshops. A fundamental requirement is a comprehensive understanding of the activity or project involved. The exercise should be undertaken on the basis of agreed criteria and scoring approach.

SMEs may first independently establish provisional scores based on known evidence. This step may be completed prior to the meeting. At the workshop, each SME presents their own ideas and scores. These scores are then discussed, challenged and moderated to reach a consensus during the workshop.

The key features required for a decision conference are:

'Attendance by key players, impartial facilitation,…. and an interactive and iterative group process.[2]'

MCA CRITERIA

The project team should select the appropriate criteria for their activity on a case-by-case basis. Investment objectives and critical success factors need to be included as part of all assessments. The reasoning for selection should be discussed and documented in the MCA report. If necessary, to understand the potential social and environmental impacts of the activity, the Waka Kotahi Environmental and Social Responsibility Standard can be used to guide environmental and social criteria in the longlisting and shortlisting process[3].

Care should be taken to avoid double counting in selecting and evaluating criteria. Specialists involved in an MCA should discuss and agree the scope of the criteria and the boundaries of their assessment to remove double counting.

The aim of criteria selection is to define:

- whether an alternative or option has strategic alignment with transport system objectives (including regional land transport plans (RLTPs) and Government Policy Statement on land transport (GPS)), strategies, plans and policies
- whether an alternative or option will deliver net benefits, ie benefits greater than costs
- the relative effects of the alternatives and options under consideration, and
- whether the alternative or option is achievable in relation to applicable legislation and regulations.

As the business case develops, a project may require more refined criteria, and criteria that may have been important at the commencement of the investigation may become less applicable. For example, an investigation of sub-aspects of a new route, such as connections to the local roading system at the indicative business case (IBC) stage, may require a substantially different set of MCA criteria from those that are applied during identification of the preferred route at the PBC stage. The criteria applied should always be reviewed for successive MCAs.

The identification and description of the criteria must be discussed and agreed upfront by the project team and, where necessary, key stakeholders. Further definition of a criterion may require the input of SMEs, as specific circumstances may need to be reflected.

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[2] Phillips, 2006) http://eprints.lse.ac.uk/22712/1/06085.pdf

[3] The Environmental Standard is currently state highway focused, however it is currently being updated to provide guidance on the scope of additional activities. The link to the current version is https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-social-responsibility/national-standards-guidelines-and-specifications/esr-standard/

For activities likely to require approvals under the RMA, Part 2 of the RMA is relevant. Part 2 outlines the RMA's purpose and principles. In identifying appropriate criteria for consideration, practitioners should ensure that relevant Part 2 matters are addressed through the specialist criteria selected. Advice should be sought from RMA planning specialists and/or legal counsel to ensure Part 2 matters are adequately provided for.

The table below provides a list of possible MCA criteria. Not all the criteria will be relevant to every activity or at every stage of business case development. Stakeholders/customer perspectives should not be a criterion in and of itself. The root causes of objections or support should be captured within the relevant criterion. It may be relevant to include specific issues of interest to stakeholders (ie road safety or visual impacts).

If appropriate, a project team may wish to add intermediate and maximum ranges in addition to the do-minimum to enable greater granularity.

The upfront cost of an activity should be included in an MCA process but should not be scored. The cost and fundability require a robust assessment separate to the MCA process.

Table 1: MCA criteria to select from

Programme business case	Indicative business case	Considerations
	Investment (critical success factors)	
Investment objectives How well does the alternative or option achieve investment objectives?		Alternatives and options need to be assessed for their ability to deliver against investment objectives. Investment objectives are derived from problem statements and benefit maps as part of investment logic map (ILM) sessions and are determined by a project team, based on stakeholder workshops.
Potential achievability (critical success factor) What is the potential achievability of the alternative or option? *Care needs to be taken not to double count. If consenting has environmental considerations, best practice is to exclude and ensure those key considerations are covered by environmental effects criteria. Note that consentability does not include assessment of environmental effects, which should be covered in the 'environment' criteria below.*	**Technical**	What are the technical or practical considerations that may prevent an option from achieving investment objectives, for example local site geography or existing contracts? What are the technical risks involved in developing or implementing this option?
	Safety and design	Are there significant health and/or safety risks associated with the option in its design, implementation, operation or maintenance? Does this option comply with the safe system approach? Can the risks be addressed in the design process to control it?
	Consentability	What is the level of consenting complexity/difficulty? Are there risks of this adversely impacting on required project timeframes or other aspects of delivery?
Potential affordability (critical success factor) What is the potential affordability of the alternative or options?	**Capital/operational/maintenance**	Does the cost of this option fit within the likely funding available? What factors might affect the ability of the project owner to afford the cost to operate and maintain the option over its projected life?
Potential value for money (critical success factor) What is the potential value for money of the alternative or options?		Consideration of the balance between costs and benefits, usually through cost–benefit analysis. When a proposed project does not yet have a calculated benefit–cost ratio (BCR), the

	Indicative Efficiency Rating (IER) tool can be used to calculate an IER for the project. The IER tool provides a rough estimate of monetised costs and benefits.
Supplier capacity and capability (critical success factor) What is the potential level of supplier capacity and capability of the alternative or options?	Any external resourcing challenges, for example dependency on local construction firms or IT skills, including interdependencies across projects.
Scheduling/programming (critical success factor) What is the potential scheduling/programming of the alternative or options?	When the alternative/option could be delivered and other timing requirements.
Opportunities and impacts	
Environment effects There are a variety of environmental criteria that may be relevant, depending on the project. Where an effect is likely to be significant, it should have its own line within the MCA. In some cases, there may be opportunities to improve environmental outcomes as a result of a project. **Note: impact (climate change mitigation and adaptation) is a separate criterion identified below**	What environmental effects are associated with this option? Environmental effects could include those related to ecology, water quality, stormwater, noise and vibration, visual impact, urban design, natural hazards, contaminated land, landscape, heritage (including archaeology), biodiversity, resource efficiency and air quality.
Social and cultural impacts There are a variety of criteria that may be relevant, depending on the project. Where an effect is likely to be significant, it should have its own line within the MCA.	What social or cultural impacts are associated with this option? Social or cultural impacts may include, for example, human health, impacts on community in relation to jobs, recreation, services and severance, impacts on farming and business operations.
Climate change mitigation	What is the long-term carbon emissions impact of the alternative or option? That is, consistent with carbon budgets once available.
Mandatory	
Climate change adaptation	Is the alternative or option exposed to climate change risk or other natural hazards over time?
Cumulative impacts	What cumulative impacts are there, if any, are associated with the option? Cumulative effects may be insignificant on their own, but may accumulate over time or space with other effects to become significant. Consider implementation, operation and maintenance phases. For example, air quality accumulating from increasing use of diesel engines in built up urban environments.
Impacts on Te Ao Māori	What, if any, impacts are there on Te Ao Māori? This includes areas of significance for Māori, Māori land and Kaitiakitanga (recognition that the environment is a taonga).
Property impacts	How does the option impact on property? Can the necessary property rights be obtained?

*Cost included as part of value for money; however, project teams may wish to record the cost of each option.

Number of criteria

The number of criteria should generally reflect the risk, opportunity, complexity and variety of the options assessed. As a rule, practitioners should aim for about 8 to 12 criteria in an MCA – and no more than 15. Including too many criteria can result in criteria scoring 'balancing out', or key criteria being outweighed by multiple other criteria. Also, double counting is more likely to occur if too many criteria are included. Some MCA will require fewer criteria than others; for example, a simple MCA process may use only four or five criteria, while a complex MCA could have significantly more.

Assessing criteria

SMEs advising on each criterion can provide indicative assessments for each option independently prior to the workshop. They should ensure that their assessment relates only to the specifics of the criterion as they have been applied to the particular activity, and that they do not comment on a matter or take into consideration a matter that is being considered in a different criterion.

SCORING: PURPOSE AND METHOD

Scoring allows for differentiation between options. The scoring system used needs to have sufficient range to sufficiently discern the benefits, disbenefits and/or effects of the various options.

There are a variety of scoring systems available. A 7-point scoring system, as detailed in table 2 below, will be appropriate for most activities. It can be used to rate quantitative and qualitative measures within the MCA template. The rating scale comprises a 7-point scale from -3 to +3. A summary of option performance can be obtained by adding these scores together. If desired, the total score or relative ranking of each option can be reported as part of the MCA table.

While Waka Kotahi recommends a 7-point scale as the standard approach, a 9- or 5- point scale can be applied where more or less granularity in scoring would better represent the evidence available.

If a project team deems the use of another scoring system more appropriate, this should be discussed and agreed with MCA technical specialists and the reasons for adopting that system well documented.

Scoring systems should be used consistently through the MCA and the activity lifecycle to enable fair comparison between options. Hence, if a new option is introduced or a reassessment is required, the same scoring system should be used.

Figure 2: 7-point scoring system

Magnitude	Definition	Score
Large positive (+ve)	Major positive impacts resulting in substantial and long-term improvements or enhancements of the existing environment.	3
Moderate positive (+ve)	Moderate positive impact, possibly of short-, medium- or long-term duration. Positive outcome may be in terms of new opportunities and outcomes of enhancement or improvement.	2
Slight positive (+ve)	Minimal positive impact, possibly only lasting over the short term. May be confined to a limited area.	1
Neutral	Neutral – no discernible or predicted positive or negative impact.	0
Slight negative (-ve)	Minimal negative impact, possibly only lasting over the short term, and definitely able to be managed or mitigated. May be confined to a small area.	-1
Moderate negative (-ve)	Moderate negative impact. Impacts may be short, medium or long term and are highly likely to respond to management actions.	-2
Large negative (-ve)	Impacts with serious, long-term and possibly irreversible effect leading to serious damage, degradation or deterioration of the physical, economic, cultural or social environment. Required major rescope of concept, design, location and justification, or	-3

	requires major commitment to extensive management strategies to mitigate the effect.	

The colours used above may allow a useful visual assessment to be undertaken as part of the MCA. This system is clear in its relationship with the do minimum, in that the neutral score is equivalent to the do-minimum.

SENSITIVITY ANALYSIS

Weights represent beliefs about how important a particular criterion is compared to other criteria. If all criteria are considered to be equally important then all weights are the same. However, some criteria are often considered more significant/material to an activity than others.

To both ensure transparency and recognise the significance/materiality of different criterion, the following steps should be followed:

- **Step one:** Undertake scoring with all criteria having equal weighting.
- **Step two:** Undertake sensitivity analysis. This enables the robust examination of the results by exploring their sensitivity to weighted changes to different criteria. All changes to weighting/data should be done systematically to assess their effect on results.
- **Step three**: Document the results and the reasoning applied.

While weighting can be used as part of sensitivity analysis, it should not be applied unilaterally to criteria to identify a ‘preferred option’ based on the scoring.

FATAL FLAWS

It may be beneficial to include a fatal flaw score in an MCA. A fatal flaw is a condition or circumstance that means the option will not be achieved or that a risk is so great that the option is not worth pursuing. Options that are highly difficult but not fatally flawed should remain in the mix and be scored accordingly.

If the EAST tool has been used, some fatal flaws should have already been identified and filtered.

Many fatal flaws relate to aspects which are not consentable under the RMA, or where property cannot be acquired, or where unresolvable legal challenges may arise. Engineering complexity is rarely a fatal flaw, although natural hazard exposure may be. Financially expensive options in and of themselves should not be considered fatally flawed.

CONSIDERING MITIGATION IN AN MCA

As part of option development and refinement, alternatives for avoiding significant adverse effects should be considered. If avoidance is not practicable then the reasons for this should be documented.

Individual specialists should first undertake an MCA assessment including standard ‘best practice' mitigations (eg in a stormwater context, using erosion and sediment control measures to mitigate sediment runoff effects). Once completed, specialists must consider whether additional mitigation is required.

If additional practicable mitigation is identified, specialists should revisit their assessment and indicative scores to reflect this. This information should be recorded in the reporting materials, along with a description of the process by which agreement on mitigation was reached.

Mitigation for one criterion may result in changes to another. For example, adding a bridge to avoid an ecologically sensitive area may change whole-of-life costs and visual impacts.

If there is doubt about whether the additional mitigation or its flow-on impacts on other criterion is practicable and/or fundable, this should be discussed with the project team.

While the identification and assessment of effects and measures to avoid, remedy or mitigate them may be relevant at various stages of the optioneering process, it is more likely to be relevant later in the process (eg shortlist assessment) when more detailed information on the options is available.

Social and distributional effects

If an alternative or option has negative effects on particular vulnerable social groups (elderly, low income, disabled, etc.), the project team should consider whether additional measures can be introduced to avoid, remedy or mitigate this.

CRITICAL STATUTORY REQUIREMENTS FOR THE OPTIONEERING PROCESS

There are a number of legislative requirements to consider during all business case optioneering and decision-making processes. In particular, robust, transparent and well documented optioneering and decision-making processes are critical to meet the statutory requirements under the Land Transport Management Act (LTMA), Resource Management Act 1991 (RMA) and Public Works Act 1981 (PWA). Rather than adding unnecessary layers of complexity, these legislative obligations generally reflect best practice and are likely to enhance business case processes and outcomes.

Land Transport Management Act 2003

The LTMA sets out the legislative requirements that govern Waka Kotahi investment from the National Land Transport Fund (NLTF). When Waka Kotahi is approving proposed activities or a combination of activities, it must be satisfied that key legislative requirements under section 20 have been met, including that an activity or combination of activities:

- is consistent with the GPS
- is efficient and effective
- contributes to Waka Kotahi objectives
- has, to the extent practicable, been assessed against other land transport options and alternatives.

In addition, the LTMA places a number of obligations on the way Waka Kotahi undertakes its functions. In particular it requires Waka Kotahi to:

- exhibit a sense of environmental and social responsibility
- facilitate participation by Māori in land transport decision making
- ensure transparency in decision making, use of revenue and expenditure.

Resource Management Act 1991 and Public Works Act 1981 considerations

Investment proposals requiring approvals under the RMA, and/or requiring compulsory acquisition of land under the PWA, may be required to meet certain tests associated with optioneering and decision-making processes. This influences business case development processes and decisions across the entire business case development process – a thread that runs from the strategic case through to the implementation of a preferred solution.

These RMA and/or PWA requirements mean Waka Kotahi and its investment partners must clearly demonstrate:

- adequate consideration of alternatives throughout the entire optioneering process, from longlisting onwards. It is not necessary to consider all possible alternatives and options or evidentially eliminate alternatives that are clearly speculative or suppositious. In terms of the requirements under the RMA, an organisation is also not required to select the 'best' option. What is necessary is to demonstrate that an appropriate broad range of alternatives has been adequately considered.
- systematic and transparent optioneering and decision-making processes

- a sound argument for why any proposed physical works are 'reasonably necessary' (under the RMA) including the ability to demonstrate 'reasonable need' for any land required (PWA)
- appropriate recognition and provision for the principles of Te Tiriti o Waitangi in relation to managing the use, development, and protection of natural and physical resources and the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga
- consideration of a proposal's social, cultural, environmental and economic effects and appropriate action considered to avoid, remedy or mitigate any adverse effects.

While the specific RMA and/or PWA requirements associated with a particular project are not known until at least the indicative business case (IBC) stage, it is necessary to ensure that all optioneering and decision-making processes meet these requirements from the outset, to ensure they are sufficiently robust to support any subsequent RMA approval or PWA requirements.

Seeking early input from Waka Kotahi property, RMA planning, technical and legal specialists into the business case process (particularly from longlisting onwards) will help support integrated decision making and ensure these processes meet the necessary legislative requirements.

The process of refining alternatives and options from a longlist to a shortlist, then to a preferred solution involves an increasingly refined sifting process with progressively more detailed and focused investigations and information filtering. The inclusion of 'environmental' criteria in optioneering processes will almost always be appropriate from the longlist stage onwards with increased granularity required at the shortlist stage.

It is likely that specific environmental criteria will be required to assess different physical options (eg different greenfield transport corridors). Identification of appropriate environmental criteria should be based on an assessment of constraints, opportunities and risks applicable to the area in question.

MCA OUTPUTS

The output from an MCA process will be a report detailing the methodology followed, the assessment of the options by criteria, the scoring of options by criteria and the basis for the scores, any further analysis, such as application of weighting through the sensitivity analysis, next steps and recommendations. For large or complex activities with complex MCA processes, undertaking a peer review on an MCA process is recommended.

The documentation of the MCA process may contain the following elements:

Summary of prior business case development (updated if EAST used)

- overview of project
- how previous spatial planning and strategic assessment outputs have been considered
- past optioneering work, including EAST outputs
- discussion on do-minimum
- discussion of objectives.

Methodology and approach

- description of agreed process for undertaking MCA, including stakeholder input
- description of methodology, including scoring (identifying departures from previous methodology, if relevant)
- description of assumptions
- identification and description of criteria.

MCA outputs

- assessment of criteria for each alternative or option (using MCA template)
- mitigation discussion

- sensitivity analysis
- appended reports, and
- decisions/discussions, including synergies and conflicts between alternatives and/or options if packaged together.

DEFINITIONS

Alternatives

An alternative is a strategic way of responding to a problem or opportunity applying a whole-of-system approach (can include corridor or network planning), such as exploring the potential for different land use arrangements or encouraging greater use of other modes to address projected growth in network demand. Alternatives may have been identified as part of development strategies and spatial plans but may also be developed as part of the Business Case Approach (BCA). In addition, the assessment of alternatives needs to meet RMA and PWA requirements as described above. In developing alternatives, it is important to consider the intervention hierarchy, which addresses:

- **demand** – for example, ways in which the need for travel can be reduced
- **productivity** – for example, by making sure the current system is optimised as far as reasonably practicable
- **supply** – for example, provision of new services or infrastructure.

Options

Options represent different ways to achieve an outcome or objective. For example, if it had been decided that the best way to address a particular problem was to improve an intersection for safety or efficiency reasons, options could include building a roundabout, installing traffic signals, or grade separation. The assessment of options needs to meet RMA and PWA requirements as described above.

Fatal flaws

A fatal flaw is a condition or circumstance that means the option will not be able to be achieved or that the risk is so great that the option is not worth pursuing. Fatal flaw analysis involves a high bar. Options that are highly difficult but not fatally flawed should remain in the mix and be scored appropriately.

Many fatal flaws relate to aspects which are not consentable under the RMA, where property cannot be acquired, or where unresolvable legal challenges may arise. Engineering complexity is rarely a fatal flaw, although natural hazard exposure may be. Financially expensive options in and of themselves should not be considered fatally flawed.

Investment objectives

The investment objectives specify the strategic outcomes for the proposed investment. Investment objectives are easily derived from information gathered during conversations in the development of the strategic assessment, around the identified problem/opportunity and the benefits associated with solving the problem. This information is entered into a ‘formula’ as follows:

[the effect of the problem] + [the selected benefit] + [the baseline and forecast impact on the benefit measure] = SMART investment objective.

Project objectives

Project objectives are those objectives specific to the preferred solution. These are important from an RMA perspective as they will be required to support the designation and consenting phase and are the objectives against which a consent application or notice of requirement is evaluated. The project objectives will be strongly informed by the investment objectives and while the purpose, framing and focus of investment and project objectives are different they should not significantly diverge. Planning and legal input on project objectives should be sought to ensure they are pitched correctly and reflect relevant case law.

APPENDIX 1: ROLES AND RESPONSIBILITIES IN THE MCA PROCESS

Role	Investment objectives	Project objectives	MCA options	
Investor/Project team	Develop investment objectives	Develop project objectives	Input into MCA process	Investor may provide background and investor context to support expert evidence on alternatives. Project team ongoing role in MCA processes as activity is developed and refined prior to lodging of a notice of requirement (NOR) and/or consent applications. Activity planner or MCA expert adviser may give evidence on alternatives assessment process.
Stakeholder	May provide input to development of investment objectives	May provide input to development of project objectives	May provide input to MCA process	May have ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
Iwi/Māori	May provide input to development of investment objectives	May provide input to development of project objectives	May provide input to MCA process Input to assessment of cultural impacts Complete Cultural Impact Assessment if required	May have ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
SME		May provide input to project objectives	Undertake provisional scores Input into MCA process	Ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications. Specialists may be used to provide specialist input on their topic to the assessment of options. If the process involves decision conferencing, they must be properly briefed, given time to undertake relevant investigations and to present and discuss their findings in the decision conference.

Role	Investment objectives	Project objectives	MCA options	
Legal advisor		May provide input into project objectives and should review consenting objectives	May advise on MCA process	Depending on the scale and complexity of the activity, legal advice may be sought at different points in the process. It may be desirable to seek high-level legal advice or review when the methodology for the MCA process is being developed for an activity, and also when the consenting strategy is being prepared. For large or complex activities, it may be helpful to engage more specific legal advice early in the process, for example, to assist in defining activity objectives against which an MCA process can be completed. The Waka Kotahi planning team should be contacted (consents@nzta.govt.nz) to work through the activity-specific requirements in this regard. May have ongoing role in review of MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
SMEs within Waka Kotahi	May provide input to development of investment objectives	May provide input to project objectives	May advise on and provide specific input to MCA process. Input into MCA process	Ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
Consenting specialists within Waka Kotahi		May provide input to project objectives and/or help project team to develop/review NOR objectives	Advise on and provide specific input to MCA process	Ongoing role in MCA processes as activity is developed and refined prior to lodgement of NOR and/or consent applications.
Alternatives or MCA specialist		Input to development of project objectives	Advise on MCA process	Depending on the scale and complexity of the activity, it may be advisable to appoint an alternatives specialist. This role runs the alternatives assessment process, including coordinating the specialist inputs, facilitating workshops, undertaking subsequent analysis and ultimately preparing an overarching report on the process. They may also be required to give evidence at a hearing on the process followed. A vital role of this specialist, if appointed, will be to ensure consistency of approach both between specialists and throughout MCA processes at different stages of the activity.

Appendix I Short List to Preferred Programme Workshop Outcomes

Wellington Regional Rail Plan:
Short List to Preferred Programme Workshop Outcomes

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
0.1	30/11/21	Draft	CL, SR, SC	SR	DW	DW
1.0	06/12/21	For circulation	CL, SR, SC	SR	DW	DW

1 Introduction and Purpose

This report summarises the outcomes from the Wellington Regional Rail Plan (RRP) Programme Business Case (PBC) Short List to Preferred Programme workshop, which was held on 23 November 2021. It provides a brief description of the process the evaluators used to assess the different programmes and identify the preferred programme.

The RRP PBC is a Greater Wellington Regional Council (GWRC) initiative to set out the long-term direction of investment in the rail network. This investment is a cornerstone of the Regional Land Transport Plan (RLTP), Regional Public Transport Plan (RPTP), and Regional Mode Shift Plan (MSP), and it will help enable the outcomes sought by the preferred direction of the Wellington Regional Growth Framework (RGF). The RRP has a 30-year timeframe for investment and is expected to be updated throughout this period.

The RRP Strategic Case was endorsed by Waka Kotahi in early 2021, allowing the programme development process to recommence. Individual interventions, which had been developed with the input of a range of stakeholders, were subsequently assessed using the Waka Kotahi Early Assessment Sifting Tool (EAST) and allocated into a set of long list programmes. The project team then worked with key stakeholders to refine the long list to a short list at a shortlisting workshop held on 15 April 2021.

The resulting short list comprised of the moderate improvements programme, the mixed focus programme, and the drive mode shift programme, which were carried forward along with the agreed ‘do-minimum’ programme. These programmes have since been refined and further analysed to understand timing and exact requirements of interventions, as well as their operational, reliability, and financial implications.

Representatives of the organisations involved in the shortlisting process participated in the process to determine the preferred programme.

2 MCA Process

A Multi-Criteria Analysis (MCA) process was used to determine the preferred investment programme. The Short List to Preferred MCA process involved scoring the programmes against the investment objectives and other key criteria, similarly to the previous Long List to Shortlist MCA. There is a greater level of understanding of the programmes compared to the earlier assessment, and a greater number of effects-type criteria have consequently been used in the current assessment. Refer to the long to short list MCA outcomes report for full details of the earlier assessment.

2.1 Options Assessed

The short list consisted of four different programme options, inclusive of the do-minimum, as noted in Section 1:

- Do-Minimum
- Moderate Improvements
- Mixed Focus
- Facilitate Mode Shift.

The short list options are summarised in Table 2-1 below. For full details and projects included in each of the programmes, refer to the Preferred Programme Workshop Briefing document, dated 22 November 2021.

Table 2-1: Summary of Short Listed Programmes

Programme	Summary
Baseline	• The rail network in its current state in November 2021.
Do-Minimum	• Includes publicly committed projects as well as projects deemed to be essential to maintain an acceptable level of service for the rail network • Includes projects announced as part of the Wellington railway upgrade as part of the New Zealand Upgrade Programme.
Moderate Improvements	• Takes a managed approach to growth • Seeks to make more use of demand management tools such as charging for park and ride to delay the need to make capacity improvements and places an increased emphasis on the use of passenger data to prioritise and target investment • Includes a mix of fleet, infrastructure, and service improvements beyond the Do-Minimum programme.
Mixed Focus	• Takes a pragmatic approach to provision of the capacity needed to enable mode shift and growth • Provides frequency where it is easier to do in the short term and delays it where significant investment is required to enable it • Includes a mix of fleet, infrastructure, and service improvements, which are more extensive and undertaken more quickly than the Moderate Improvements programme.
Drive Mode Shift	• The 'do maximum' programme, where all efforts to increase rail patronage are accelerated, so that capacity can be increased quickly through both frequency train size improvements • Includes a mix of fleet, infrastructure, and service improvements, which are more extensive and undertaken more quickly than the Mixed Focus programme.

2.2 Criteria

The short list programmes were scored against ten assessment criteria, five of which are investment objectives and five of which were developed by the project team. These criteria are described in Table 2-2.

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Table 2-2: Assessment Criteria

Assessment Criteria		Description
Investment Objectives and Critical Success Factor (CSF)	Support a sustainable future	• Increase rail passenger and freight mode share • Reduce rail carbon emission per passenger.
	Provide capacity that supports access and growth	• Improve access by increasing peak passenger capacity • Maintain freight access by retaining existing freight paths throughout the day and ensuring capacity for growth.
	Attractive and easy to use	• Increase frequency throughout the day • Improve peak punctuality • Improve overall satisfaction of rail passengers • Maintain ease of access and improve accessibility for impaired users.
	Adaptable to disruptions	• Reduce passenger impact of high impact low probability events • Reduce passenger impact of unplanned events.
	Improve safety for all	• Reduce the rate of safety incidents • Increase public and user perception of safety of rail.
	Overarching critical success factor	• Increase rail usage (passenger & freight).
Policy Alignment	National policies	• Programme alignment with national policies, as outlined in the Zero Carbon Act, Government Policy Statement on Land Transport, the New Zealand Rail Plan, and other documents.
	Regional policies & investment	• Programme alignment with regional policies such as the RLTP, RPTP, MSP, and RGF, as well as significant regional investments, such as the Let's Get Wellington Moving programme.
Other Criteria	Funding availability	• Whether or not the programmes will have significant sustained funding requirements or whether it can be managed to improve affordability.
	Construction/engineering difficulty	• The difficulty of delivering the required infrastructure from an engineering perspective, particular attention given to: ○ Geotechnical considerations ○ Waterway considerations ○ Services ○ Traffic management ○ Market capability and capacity.
	Consenting degree of difficulty	• Alignment to district plans and regional standards • Relevant national policy statements • Impacts of and difficulty of designation.
	Programme impacts from delays	• Impact to the programme outcomes of delay to individual projects.
	Economic impacts	• Disruption costs from delivering the programme • Long term economic benefits from the programmes.
	Impacts to services during construction[1]	• Considers both passenger and freight impacts while delivering the key projects within the programme.

[1] This criterion was added just before the workshop and was not described in the workshop briefing document.

2.3 MCA Assessors

In addition to the project team, who led the discussion, the MCA assessors were:

Greater Wellington Regional Council:

- Barry Fryer, Manager, Rail Asset, Metlink/GWRC: to provide input from a Metlink rail asset expectation perspective as a Future Asset Owner
- Daniel Pou, Manager, Rail Operations, Metlink/GWRC: to provide input from a Metlink rail operations expectation perspective as a Future Service Delivery Owner
- Alex Campbell, Principal Advisor Network Design, Metlink/GWRC: to provide input on wider Metlink public transport network (particularly in relation to bus services)
- Rhys Hayward, Senior Asset Engineer – Rail, Metlink/GWRC: to provide an additional Metlink rail asset perspective
- Jarred Foster, Senior Investment Analyst, Metlink/GWRC: to provide a Metlink investment perspective.

KiwiRail:

- John Skilton, Programme Director: Future Rail Systems, KiwiRail: to provide input into current investment and as the likely delivery agent for future funding
- Michael McKeon, Project Director – Future Rail: to provide input into current investment and as the likely delivery agent for future funding
- Manjot Singh, Rail Infrastructure Manager Wellington Metro, KiwiRail – Manager of the Wellington Metro Network Infrastructure: to provide input as a Future Network Owner
- Eswar Nouthalapati, Business Manager Lower North Island and RNIP, KiwiRail: to provide input as a Future Network Owner.

Transdev:

- Ian Ladd, Managing Director, Transdev: to provide operational input as the current Metlink service delivery provider

Waka Kotahi:

- David Shepherd, Manager Rail and Freight, Waka Kotahi: to provide input from a transport system perspective
- Chris Young, Principal Advisor Multimodal, Rail and Freight, Waka Kotahi: to provide input from a transport system perspective
- Andrew Washington, Principal Investment Advisor, Local Government Partnerships, Waka Kotahi: observer of the process and as the ultimate receiver of the Programme Business Case.

3 MCA Scores

3.1 Workshop scoring system

The eleven-point scoring system used for the assessment is outlined in Table 3-1.

Table 3-1: Workshop Scoring System

Score	Scoring Description
5	Substantial benefits and a high degree of confidence of benefits being realised and/or long term / permanent benefits
4	High extent of benefits and confidence of benefit being realised and/or medium - long term benefits
3	Good benefits and/or medium term
2	Low or localised benefits and/or short term
1	Very low benefits and/or very short term
0	No change in benefits, impacts or difficulties from current situation
-1	Few difficulties, very low cost, or low impact on some resources/values and/or very short term
-2	Minor difficulties, low cost, or minor impacts on resources/values and/or short term
-3	Some difficulties, moderate cost, or some impact on resources/values and/or medium term
-4	Clear difficulties, high cost or high impact on resources/values and/or medium - long term
-5	Substantial difficulties, very high cost, or substantial impact on resources/values and/or long term / permanent

Programmes were scored for their expected performance in 2040 (i.e., after 20 of the planned 30 years of investment). All programmes, including the do-minimum, were compared to a baseline of the current rail network and operation.

The approach and scoring system are consistent with that used recently for the ‘Let’s Get Wellington Moving’ Programme assessment.

3.2 Workshop Scores

The programme scoring from the workshop is shown in Table 3-2.

Table 3-2: Long List Workshop Scores

Assessment Area	Programme				
	Baseline	Do-Minimum	Moderate Improvement	Mixed Focus	Drive Mode Shift
Investment Objectives and CSF					
Support a sustainable future	0	0	2	3	4
Capacity that supports access & growth	0	0	1	3	5
Attractive and easy to use	0	-3	1	3	5
Adaptable to disruptions	0	-1	2	4	5
Improve safety for all	0	-3	3	4	4
Critical Success Factor	0	1	3	4	5
Policy Alignment					
National Policies	0	-4	1	3	4
Regional Policies & Investment	0	-4	1	5	5
Deliverability and Wider Outcomes					
Funding availability	0	-1	-2	-3	-5
Construction/engineering difficulty	0	0	-2	-3	-5
Consenting degree of difficulty	0	0	-1	-4	-5
Programme impacts from delays	0	0	-1	-2	-5
Economic outcomes	0	-3	2	4	5
Impacts to services during construction	0	0	-1	-3	-4

The Drive Mode Shift and Mixed Focus programmes scored highest against nine of the criteria (sustainable future, capacity, attractive and easy to use, adaptable, improve safety, increased use (critical success factor), alignment with national and regional policies, and economic outcomes), but scored the poorest against implementability, risks and affordability. The Moderate Improvements programme had a more balanced profile. The existing situation (baseline) option was left at zero, and the Do-Minimum programme was given the almost entirely negative scores.

3.3 Commentary on Scores

Commentary on each of the assessed criteria is outlined below.

Sustainable Future

Under this criterion, the Do-Minimum programme was scored at zero, Moderate Improvements at +2, Mixed Focus at +3 and Drive Mode Shift at +4. There was some discussion as to whether Do-Minimum should score at zero or +1. It was decided to score it at zero given the disparity of outcomes between the different programmes. The Do-Minimum programme offers only a very slight increase in network capacity, which means rail's mode share will not be able to climb significantly to support this sustainability objective, and most of the capacity uplift comes by a fleet expansion during the end-of-life replacement of the Matangi units in the 2040s. All programmes fall short of the Climate Change Commission mode shift target of a 60% increase in passenger kilometres, so no programme was able to be scored at +5.

Capacity

Under this criterion, the Do-Minimum programme was again judged to score zero, with Moderate Improvements being given +1. Mixed Focus and Drive Mode Shift scored higher, at +3 and +5 respectively. The Moderate Improvements programme does provide a fourth line into the Wellington Station, however only the Mixed and Drive Mode Shift programmes provide full separation of freight and metro services in the section between Ngauranga and Wellington Station. This separation has a notable impact on reducing network constraints and the conflict between services. Drive

Mode Shift scored higher than Mixed Focus due to its much earlier introduction of higher frequencies, which provide capacity as well as improved service levels. It was acknowledged that the Drive Mode Shift programme offered a “do maximum” approach, which necessitated giving it a +5 score. A +5 score was deemed appropriate here as, while the current forecasts do not indicate that the Climate Change Commission mode shift target will be met, the capacity to meet it is provided with as minimal conflict between freight and metro services as possible.

Attractive and Easy to Use

Under this criterion, the Do-Minimum programme was scored at -3, noting that the delayed procurement of new trains under this scenario would lead to the Matangi Electric Multiple Units (EMUs) remaining in full-time service until they reach replacement age, which would lead to declining reliability as they reach the end of their service lives. Additionally, many of the services, including services from Upper Hutt and Kāpiti would have standing passengers for much of their 30+ minute journey, which falls outside of GWRC’s ‘ideal capacity’ goals for outer tier services. Reliability would also be hindered by the slower pace of upgrades to the signalling system, which would further 7degrade public confidence in the system. The higher scores of the Mixed Focus and Drive Mode Shift programmes, again at +3 and +5, was proportional to their respective levels of investment in signalling systems (improved reliability), station upgrades (improved amenity), and fleet expansion (improved amenity), making these services more attractive to customers.

Adaptable to Disruptions

Upgrades to signalling systems were excluded from this criterion to avoid double counting the benefits with the previous investment objective. Regardless, the Do-Minimum was scored at -1, Moderate Improvements at +2, Mixed Focus at +4, and Drive Mode Shift at +5, since all programmes except Do-Minimum allow for bi-directional running, which will greatly improve disruption response. Mixed Focus and Drive Mode Shift include more crossovers than the Moderate Improvements programme, and so score higher in this regard as trains would not need to travel on the opposite track for as long. Drive Mode Shift was scored at the maximum of +5 due to inclusion of sections of triple tracking, as well as remediation of all sites at high- or high-medium-risk of slips.

Improve Safety

Under this criterion, it was judged that the Do-Minimum programme would not maintain the existing level of service, as without a range of improvements there is a risk of the Rail Regulator shutting the network down in the medium term. It was consequently scored at -3. This score was selected to demonstrate the required level of investment, without giving an unwarranted impression that the network is *unsafe* in its current form, but simply that the standards for safe rail operation will change over time. It was noted that all programmes provided for improvements to slope stability on high-risk slopes, and to safety at level crossings and at stations, but that level and speed of safety improvements is linked to the scale of investment, which is higher in the Mixed Focus and Drive Mode Shift programmes. Moderate Improvements was scored at +3, with Mixed Focus and Drive Mode Shift both scoring +4. It was noted that despite upgrading to ETCS Level 2 with Automatic Train Protection, it is impossible to claim that a rail network is ever totally risk-free, and so a score of +5 could not be awarded to any of the programmes.

Critical Success Factor

Under this criterion, to increase rail usage for both passenger and freight, the Do-Minimum programme was scored a +1. Even with little investment, passenger volumes are forecast to continue growing over the medium term until the network reaches capacity. The Moderate Improvements, Mixed Focus, and Drive Mode Shift programmes were scored at +3, +4, and +5 respectively, reflecting their forecast resultant passenger growth levels and capacity for freight.

Strategic Alignment – National Policies

Under this criterion, the Do-Minimum programme scored at -4, due to its inability to enable the changes needed under the Zero Carbon Act. It also fails to address the North-South Junction constraint, which is a major capacity constraint on a nationally significant freight corridor. The Drive Mode Shift programme falls short against the Climate Change Commission’s target but scored a +4 in recognition of the fact it does as much as is reasonably practicable within reasonable budget constraints. Moderate Improvements scored at +1 and Mixed Focus at +3.

Strategic Alignment – Regional Policies

The scores under this criterion were the same for Do-Minimum and Moderate Improvements as for the National Policies criterion, at -4 and +1 respectively. Mixed Focus and Drive Mode Shift both scored at +5, as they both have the capability to deliver the step change in passenger numbers required under current regional policies. It was noted that regional policies are more passenger focussed than national policies.

Funding Availability

Under this criterion, the Do-Minimum scored -1. This is due to the programme still containing substantial financial commitment, mostly the requirement to replace the Matangi fleet in the 2040s. However, this is a standard lifecycle cost of the asset and so did not warrant a lower score. Moderate Improvements scored at -2 and Mixed Focus at -3, with neither programme requiring more than $400m of expenditure in a single year. The Drive Mode Shift programme is the least affordable programme, since it is necessary to purchase new EMUs, longer-distance rolling stock, and perform major capacity network improvements in a short timeframe to facilitate the step change in capacity required under this programme. This will lead to several consecutive years of over $700m investment per year, and so the programme was scored at a -5.

Construction/Engineering Difficulty

The Do-Minimum was scored at zero under this criterion. Apart from standard end-of-life fleet replacement, there are no significant engineering challenges under this programme. Moderate Improvements was scored -2, since this programme includes shortening the single-track section at North-South Junction, which is a manageable task involving earthworks and laying new track, but no significant tunnelling or bridging. Mixed Focus was scored at -3 and Drive Mode Shift at -5. These programmes include many of the same projects, but Mixed Focus scored better as it gives several more years of planning time. Drive Mode Shift includes fully double tracking North-South Junction almost immediately, as well as constructing a third main through the Tawa basin.

Consenting Degree of Difficulty

This criterion followed a similar pattern to Construction/Engineering Difficulty. The Do-Minimum was scored at zero as there is very little work involved which would require consent. Moderate Improvements was scored at -1 as, while the tasks involved have difficulty, they can be considered manageable due to the timeframes available for consultation, engagement and solving issues, since there is time to address issues before items become critical path interventions. The Mixed Focus and Drive Mode Shift programmes include many of the same projects, including North-South Junction duplication, which will be difficult to consent whether the bridge or tunnel option is progressed. The additional time available makes the task easier for Mixed Focus as with Construction/Engineering Difficulty, so it scored -4 with Drive Mode Shift at -5.

Programme Impacts from Delays

The Do-Minimum scored zero under this criterion. The only major delay risk here is the delay to Matangi replacement, but with adequate maintenance the existing fleet should be able to last longer. The Moderate Improvements programme was scored at -1 as there is still relatively little delay risk under this programme. Drive Mode Shift was scored at -5, as there are numerous large projects which will all have to commence shortly after the programme being adopted, and all are on the critical path. For example, a delay in level crossing replacements (grade separation) poses a substantial risk that high peak frequencies are unable to be adopted as planned. The Mixed Focus programme was scored at -2, since many of the projects planned are the same, but there is more contingency time inherent in the programme as many of the infrastructure works will be completed several years before corresponding service frequency upgrades are scheduled.

Economic Outcomes

This criterion considered the disruption costs as well as any consequential benefits created by each programme. The Do-Minimum was scored at -3 as the service offering would increasingly become fragile, which would result in users switching to alternative modes to rail, resulting in significant congestion and other disbenefits. The Moderate Improvements programme was scored at +1 as it was felt while it was providing a positive outcome, albeit only a small improvement over what should be expected from the rail network. Mixed Focus and Drive Mode Shift were scored at +4 and +5 respectively, as the increased service levels and greater separation of freight and passenger services provide the best ability to serve the economic needs of the region.

Impacts to Services during Construction

The Do-Minimum once again scored zero, due to the lack of works that cause disruption. Moderate Improvements was scored at -1, Mixed Focus at -3, and Drive Mode Shift at -4, due to the increasing levels of construction required to enhance the network under each successive option. It is hoped that fully bi-directional signalling with crossovers will allow for some mitigation of construction disruptions, by allowing reduced services to continue operating through work zones which would otherwise have to be closed in both directions under current arrangements, however this cannot be assured and will be determined fully at a future stage of the business case process and so a cautious view was taken.

4 Weighting Systems

A range of weighting systems was used to understand the preferred programme and test the impact of the emphasis of different priorities.

4.1 Workshop Weighting

At the workshop, participants gave each criterion a score between 0 and 10, with zero being considered least important and 10 being considered most important. A second weighting was also applied to the criteria groupings: Investment Objectives and CSF, Policy, and Deliverability and Wider Outcomes. This created a double-weighted workshop priority weighting, where the weighting of individual criteria contributed a grouping's weighting.

The Investment Objectives and CSF grouping received a weighting of 10, and Deliverability and Wider Outcomes a weighting of 7.5. Policy received a weighting of 2.5 to avoid double-counting, recognising that the investment objectives are heavily influenced by policy.

Within the Investment Objectives and CSF grouping, the CSF received a sub-weighting of 10. This was largely by definition, as the critical success factor is a measure of the effectiveness of a programme in delivering against all investment objectives. Safety was determined to be the single most important investment objective and received a sub-weighting of 9, since poor safety outcomes have the potential to shut the network down entirely. The sustainable future, and attractive and easy to use investment objectives received sub-weightings of 8, and the disruption and capacity related investment objectives received sub-weightings of 5.

Within the Policy grouping, regional policies & investment was given a sub-weighting of 6, and national policies a sub-weighting of 4. This recognises that national policies influence regional policies to a significant extent.

Within the Deliverability and Wider Outcomes grouping, funding availability received a sub-weighting of 2, recognising that current funding availability should not determine the worth of a long-term programme. At the other end of the scale, economic outcomes received a sub-weighting of 10, reflecting its importance to a long-term investment programme. The remaining criteria received mid-range scores, with construction/engineering difficulty receiving a sub-weighting of 5, consenting degree of difficulty receiving a sub-weighting of 8, reflecting its potential to delay some aspects, impacts from delays receiving a sub-weighting of 6, and impacts to services during construction receiving a sub-weighting of 4.

Two secondary workshop weightings were also developed. One used the scores for each individual criterion, and the other assigned equal weighting to all criteria within an assessment area (investment objectives and CSF, policy alignment, and deliverability and wider outcomes) and weighted the area of assessment only.

Table 4-1 outlines the base weighting, resulting workshop priority weighting, and the two workshop weightings.

Table 4-1: Workshop weighting scenarios

Criterion	Base Weighting	Workshop Priority	Workshop Secondary 1	Workshop Secondary 2
Support a sustainable future	8	10.8%	8.9%	8.3%
Capacity that supports access and growth	5	6.8%	5.6%	8.3%
Attractive and easy to use	8	10.8%	8.9%	8.3%
Adaptable to disruption	5	6.8%	5.6%	8.3%
Improve Safety for all	9	12.2%	10.0%	8.3%
Critical success factor	10	13.6%	11.1%	8.3%
National policies	4	1.4%	4.4%	6.3%
Regional policies & investment	6	2.0%	6.7%	6.3%
Funding availability	2	2.0%	2.2%	6.3%
Construction/engineering difficulty	5	5.1%	5.6%	6.3%
Consenting degree of difficulty	8	8.1%	8.9%	6.3%
Programme impacts from delays	6	6.1%	6.7%	6.3%
Economic outcomes	10	10.2%	11.1%	6.3%
Impacts to services during construction	4	4.1%	4.4%	6.3%

4.2 Other Weighting Systems

In addition to these workshop weighting scenarios, the project team developed additional weighting systems. These were designed to understand the impact of emphasis different aspects of the programme, and all except the equal weighting scenario followed the same procedure of emphasising certain criteria. The additional weighting scenarios are outlined below and summarised in Table 4-2.

Equal Weighting

In this weighting system, all criteria were given an equal weight to remove any potential bias towards individual criteria. All criteria consequently received a weighting of 7.1%.

Investment Objectives as a Singular Criterion (Investment Objective as Single)

This weighting system did not emphasise a criterion but averaged the five investment objectives scores to enable them to be treated as a single criterion. This resulted in more emphasis on the deliverability compared to the outcomes.

Safety Emphasis

This weighting system sought to understand which programmes were preferred when safety was given the most consideration. This gave the safety-related investment objective a 33.3% weighting and then equally distributed the remaining 66.7% of the weighting.

Capacity Emphasis

This weighting system sought to understand which programmes were preferred when capacity was given the most consideration. This gave the capacity-related investment objective a 33.3% weighting and then equally distributed the remaining 66.7% of the weighting.

Success Factor Emphasis

This weighting system sought to understand which programmes were preferred when the critical success factor was given the most consideration. This gave the critical success factor a 33.3% weighting and then equally distributed the remaining 66.7% of the weighting.

Customer Focus Emphasis

This weighting system sought to understand which programmes were preferred when the customer experience and use were given the highest priority. This gave the capacity that supports access and growth, and attractive and easy to use criteria, as well as critical success factor, an 11.1% weighting each, with the 66.7% remaining divided equally among the remaining criteria.

Delivery Emphasis

This weighting system sought to understand if there was a change to the preferred programme when the ease of delivery was the key consideration, noting that if programme cannot be delivered for any reason, then there are no benefits from investment. This gave an 11.1% weighting each to the funding availability, construction/engineering difficulty, and consenting degree of difficulty criteria, and equally distributed the remaining 66.7% among the remaining criteria.

Customer and Delivery Focus

This weighting system combined the two above systems, seeking to understand under which programmes are deliverable yet still achieve the desired customer outcomes. This gave 8.3% each to the attractive and easy to use, critical success factor, construction/engineering difficulty, and consenting degree of difficulty criteria and distributed the remaining 66.7% equally among the remaining criteria.

Consenting Focus

This weighting system sought to understand which programmes were preferred when consentability was given the most consideration. This gave that criterion a 33.3% weighting and then equally distributed the remaining 66.7% of the weighting.

Policy Alignment

This weighting system sought to understand which programmes were preferred when policy alignment was given the most consideration. This gave the two strategic alignment criteria a 16.7% weighting each and then equally distributed the remaining 66.6% of the weighting.

Equal Weighting by Area

This weighting system sought to understand which programmes were preferred when each grouping of criteria was given an equal weighting of 33.3%. Each criterion within the group was given an equal weighting to make up the 33.3% subtotal. Coincidentally, this system gave the same weightings as the policy alignment weighting system.

Table 4-2: Additional weighting systems used to assess the programmes

	Equal Weighting	Investment Objective as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Consenting Focus	Policy Alignment	Equal Weighting Area
Support a sustainable future	7.1%	2.0%	5.1%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	5.6%	5.6%
Capacity that supports access and growth	7.1%	2.0%	5.1%	33.3%	5.1%	11.1%	6.1%	6.7%	5.1%	5.6%	5.6%
Attractive and easy to use	7.1%	2.0%	5.1%	5.1%	5.1%	11.1%	6.1%	8.3%	5.1%	5.6%	5.6%
Adaptable to disruption	7.1%	2.0%	5.1%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	5.6%	5.6%
Improve Safety for all	7.1%	2.0%	33.3%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	5.6%	5.6%
Critical success factor	7.1%	10.0%	5.1%	5.1%	33.3%	11.1%	6.1%	8.3%	5.1%	5.6%	5.6%
National policies	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	16.7%	16.7%
Regional policies & investment	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	16.7%	16.7%
Funding availability	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	11.1%	6.7%	5.1%	5.6%	5.6%
Construction/engineering difficulty	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	11.1%	8.3%	5.1%	5.6%	5.6%
Consenting degree of difficulty	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	11.1%	8.3%	33.3%	5.6%	5.6%
Programme impacts from delays	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	5.6%	5.6%
Economic outcomes	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	5.6%	5.6%
Impacts to services during construction	7.1%	10.0%	5.1%	5.1%	5.1%	6.1%	6.1%	6.7%	5.1%	5.6%	5.6%

5 Results

The post-weighted scores for all scenarios and the rankings are presented in Table 5-1 and Table 5-2 respectively.

The analysis shows that the Drive Mode Shift programme is consistently ranked as the best programme in all outcomes-focused weighting scenarios. Only in cases where the outcomes were not considered did other programmes rank higher. The Mixed Focus programme also scores well, particularly under the safety and delivery focus weighting systems, but generally sits in second place to the Drive Mode Shift programme. Based on these findings, it is recommended that the Drive Mode Shift programme is taken forward for further investigation as the preferred programme option.

Stantec

Table 5-1: Final weighted scores for all weighting scenarios

	Workshop Weighting Primary	Workshop Weighting Secondary 1	Workshop Weighting Secondary 2	Equal	Investment Objective as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Consenting Focus	Policy Alignment	Equal By Assessment Area
Baseline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Do-Minimum	-1.08	-1.31	-1.25	-1.29	-1.24	-1.77	-0.92	-0.64	-1.19	-1.14	-1.23	-0.92	-1.89	-1.89
Moderate Improvements	1.21	1.04	0.81	0.64	0.18	1.31	0.74	1.31	0.80	0.29	0.62	0.18	0.72	0.72
Mixed Focus	1.92	1.82	1.56	1.29	0.44	2.05	1.77	2.05	1.60	0.59	1.20	-0.21	1.89	1.89
Drive Mode Shift	2.25	2.03	1.71	1.29	-0.04	2.05	2.33	2.33	1.85	0.33	1.20	-0.49	2.00	2.00

Table 5-2: Final weighted rankings for all weighting scenarios

	Workshop Weighting Primary	Workshop Weighting Secondary 1	Workshop Weighting Secondary 2	Equal	IO as Single	Safety Emphasis	Capacity Emphasis	Success Factor Emphasis	Customer Focus Emphases	Delivery Emphasis	Customer and Delivery Focus	Consenting Focus	Policy Alignment	Equal By Assessment Area
Baseline	4	4	4	4	3	4	4	4	4	4	4	2	4	4
Do-Minimum	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Moderate Improvements	3	3	3	3	2	3	3	3	3	3	3	1	3	3
Mixed Focus	2	2	2	1	1	1	2	2	2	1	2	3	2	2
Drive Mode Shift	1	1	1	2	4	1	1	1	1	2	1	4	1	1

6 Next Steps

The next step is for GWRC to further consider this report and confirm that the Drive Mode Shift programme is the preferred programme for inclusion in the Regional Rail Plan and that the PBC is to be completed with this as its outcome.

It is important to note that the MCA outcomes are not the only factor that GWRC will consider in making decisions on the preferred programme. It may also consider a range of other matters including cost and funding availability, risk, opportunities, and stakeholders.

Appendix J Preferred Programme Overview

Study Name	Items Considered/Procured	Drive-Mode Shift Programme Anticipated Physical Works Start Date	Indicative Implementation Cost
Customer Habit and Optimisation Study	Study into optimisation of stations and station additions - e.g. Glenside, Queen Elizabeth Park, Raumati as well as reduction where the stations are too close together	0-5	s7(2)(b)(ii)
	Look at how station zoning changes habits in accessing station. E.g. people driving further to get a cheaper zone	0-5	
	Extend the suburban service frequency span in response to developments and patronage	5-10	
Future Network Form Study	Improve Johnsonville Line track configuration to improve capacity	30+	s7(2)(b)(ii)
Network Constraints and Capacity Study	Study on future rail lines and use of existing lines. Evaluation of Extension of Melling, changes to Johnsonville, Wainuiomata Line, East-West Links etc	0-5	
	Second Remutaka tunnel	30+	
	Convert Johnsonville branch to Light rail deploy displaced EMUs on rest of network	30+	
	Study into the network constraints which prevent additional services. Looks at signalling, single & double track sections and express services	0-5	
	Tram-Trains able to run over both heavy rail network and future light rail south of Station	30+	
North-South Junction Capacity Improvement	North-South Junction Capacity Improvements (Generic Study)	0-5	s7(2)(b)(ii)
Rail Network Resilience & Operations IBC	Slope Stabilisation- address seismic/storm risk	0-5	s7(2)(b)(ii)
	Improve resilience of rail bridges across network to seismic events	0-5	
	Reduce foreshore risk to low lying Porirua to Plimmerton section of Kapiti Line - sea level rise and storm events	10-20	
	Improve condition and capacity of drains and culverts	0-5	
	New multiple Unit depot out of Central Wellington e.g. tsunami risk and land value optimisation	30+	
	Improved freight loop at Porirua to ensure freight trains can continue to operate between more frequent services	0-5	
	Increased train stabling capacity at outer stations for operational efficiencies	5-10	
	More crossovers	0-5	
	Invest in higher quality track to reduce risk of speed restrictions in hot weather	5-10	
	New interlocking for Woburn siding access to reduce track occupancy time for shunts	0-5	
Kāpiti Rail IBC	Duplicate NIMT overbridge south of Waikanae and approach	5-10	s7(2)(b)(ii)
	Second platform at Waikanae station	5-10	
	Double Track Waikanae to Otaki	5-10	
Rail Network Segregation IBC	Install automatic gates on all pedestrian level crossings	0-5	s7(2)(b)(ii)
	Close or grade separate level crossings - Hutt Valley	10-20	
	Close or grade separate level crossings - Wairarapa	20-30	
	Close or grade separate level crossings - Kapiti	0-5	
	Close or grade separate level crossings - Johnsonville	30+	
	Segregrate network from surroundings to improve safety of infrastructure; platforms, level crossings, fences, walls	0-5	
Matangi Replacement SSBC	Wifi on trains or provide 4G cell phone coverage through tunnels	0-5	s7(2)(b)(ii)
	Platform train interface without ramps	10-20	
	Replace existing Matangi fleet 2040 onwards (oldest trains will be 30 years old by 2040)	10-20	
	Train capacity indicators for passengers	5-10	
	Additional EMUs for increased service frequency (may be part of the Matangi replacement)	5-10	
Rail Network Electrification SSBC	Electrification North of Upper Hutt - Featherston	30+	s7(2)(b)(ii)
	Electrification North of Waikanae (To Otaki)	5-10	
	Long term power supply upgrade - Kapiti Line	5-10	
	Long term power supply upgrade - Hutt Valley Line	5-10	
	Long term power supply upgrade - Melling Line	5-10	
	Long term power supply upgrade - Johnsonville Line	5-10	
	Electrification North of Featherston - Masterton	30+	
	Electrification Otaki to Levin	5-10	
	Electrification Levin to Palmerston North	5-10	
Wellington Station Approach IBC	Provide a northern access to the Wellington EMU stabling yard	0-5	s7(2)(b)(ii)
	Improve mainline access to Wellington freight terminal to reduce performance impact on passenger train services (at grade)	5-10	
	Reconfigure Wellington station 'throat' Layout (Kaiwharawhara to Wellington Station section) (Short term, NZUpgrade)	0-5	
	Protect operational land such as the easement of land on west side of KiwiRail corridor through Thorndon area which may have future operational benefits	0-5	
	Wellington to Kaiwharawhara Quadruplication including grade separation of Freight yard access	10-20	
Signalling DBC	Wellington A signal Box Upgrade (short-term to enable RS1 timetable)	0-5	s7(2)(b)(ii)
	Network wide resignalling	0-5	
Smarter Connections	Improvements to station subway drainage to reduce flooding risk	0-5	s7(2)(b)(ii)
	Interchange locations in suburban areas where services can be terminated to facilitate for maintenance or service disruptions	5-10	
	Station access planning+D15 to maximise connections to communities and catchments	0-5	
	Covered secure cycle\multi modal facilities at all stations	0-5	
	Change facility for cyclist at stations	0-5	
	Electric Car charging in station carparks	0-5	
	Improve bus connnections to stations to maximise efficiency and access to communities/ catchments	5-10	
Station Improvements SSBC (by line)	Staff amenities at outer stations	5-10	s7(2)(b)(ii)
	All stations to be accessible for mobility impaired and other users e.g. prams etc	0-5	
	Increased shelter at stations that match passenger flows	0-5	
	Crime prevention through environmental design at stations (including access points, carparks, train replacement stops etc)	0-5	
	Platform screen Doors/ gates	30+	
	Station sustainability (More extensive)- solar panels for lighting power- LED lighting -Recycling	5-10	
	Wayfinding signage & digital signagesolutions to increase information at stations	0-5	
	Platform markers for Wheelchair bikes 8/6/4/2	0-5	
	Ongoing investment to improve stations and trains to meet growing customer expectations (high quality)	0-5	
	Develop stations as community hubs / TOD	5-10	
Improved Maintenance Practices	New infrastructure maintenance technologies to enable safe and efficient maintenance	0-5	s7(2)(b)(ii)
	Fleet maintenance overnight - enabler	10-20	
Analytics Package	Improved collection and analysis of passenger data	0-5	s7(2)(b)(ii)
	Automated analytics from CCTV data for improved customer security	0-5	
Operational	Wellington Metro Rail operations centre Train Control , Rail operations and Station security (neutral - independent of operators)	5-10	s7(2)(b)(ii)
	Integrated/electronic ticketing -One pass - all modes - tickets	0-5	
	Train crews dedicated to specific routes during peak periods	5-10	
	Off peak service offering improvements (frequency and operational hours)	5-10	
	Deploy additional infrastructure maintenance staff outside of Wellington	5-10	
Wellington Transport Network Operational Re	Bi directional running	5-10	
Outside of GWRC Control, input to Rail Netw	Increase use of electric traction propulsion for freight	5-10	
LNIRIM	Additonal rolling stock (variation to LDRS order) to respond to demand and service requirements on the WEMN	5-10	
	Long distance rolling stock for Wairarapa and Palmerston North services	0-5	
Transport Network Resilience	Wider Transport Network Resilience Plan to best serve the community'	0-5	s7(2)(b)(ii)
Additional Track Costings	Costed Track Improvements		s7(2)(b)(ii)

Appendix K Economic Analysis

Wellington Rail Plan

Economics Appendix (Background Paper)

v4-9 12-4-2022

Contents

1.0 Introduction

1.1 This Appendix describes the approach taken to the economic appraisal of the Wellington Rail Plan (WRP) and describes the associated forecasting and sensitivity testing undertaken.

1.2 The purpose of the appraisal is to test the strategic feasibility of identified Rail Plan Scenarios in economic terms.

1.3 Large-scale and long-term plans are not commonly subjected to comprehensive economic appraisal. The Let's Get Wellington Moving (LGWM) investment package is complementary to the WRP and is an example of strategic economic appraisal[1] incorporating a wide range of benefits to describe the conditions needed to generate net positive benefits. It is suggested that the WRP appraisal is interpreted in similar fashion.

1.4 This Appendix has been revised in response to peer review and stakeholder comments. Consequently, additions were made to the content of the Appendix, and an ''*Annex 2, Peer Review: Specific Responses''* added.

2.0 Approach

Basis

2.1 The base year (time zero in economic terms) is 2020, the appraisal period 60 years and the discount rate applied 4%.

2.2 Monetised benefits were derived by comparing the do-minimum (DM) scenario with three do-something (DS) scenarios. The latest undiscounted scenario costings[2] used in the appraisal are as follows:

i) Do Minimum $5.01b

ii) Do Something scenarios

- Moderate $6.83b
- Mixed $9.15b
- Mode Shift $12.31b

2.3 Monetary values were derived from the Monetised Costs and Benefits Manual (MBCM[3]) with application of MBCM update factors (to July 2020).

2.4 The benefit assessment methodology used for the WRP is consistent with the approach to the earlier Wellington Rail Signalling[4] economic appraisal and associated sensitivity testing. However, the WRP appraisal includes additional benefits, to reflect the more widespread effects of a larger and more comprehensive complementary investment programme.

Discussion

2.5 As the WRP Scenarios are considered within the context of a long-term Programme Business Case (PBC), several uncertainties have been recognised in the appraisal, including:

i) The description of scenario elements and their timing has been assessed in strategic, rather than detailed terms, in keeping with a programme development appraisal. This

[1] LGWM Economics Report (Appendix K) and Additional Transport Benefits Report (NZ 2344), September 2018,
[2] 2021 CAPEX and OPEX 50th percentile cost estimates excluding revenue.
[3] MCBM August 2021, v1-5 Waka Kotahi
[4] WMUP V Wellington Signalling Business Case (IBC) and Peer Review

means that working assumptions of implementation timings and the type / scale of WRP investment elements are applied.

ii) Causal relationships between WRP scenario elements and transport-related benefits have been assessed in broad terms. For example, decongestion effects associated with modal change have been analysed using available regional traffic models and factoring has been applied to estimate periods not specifically modelled. Although appropriate for PBC purposes, more extensive modelling and analysis is likely to be needed for detailed business case appraisal purposes.

iii) The appraisal methodology includes allowances for demand forecasting uncertainties, in the form of lower and upper (patronage and traffic growth) forecast demand estimates[5]. This represents a very broad potential range of demand, with additional sensitivity testing applied at both ends of the demand forecast ranges, to ensure a robust approach was adopted.

2.6 Matters to consider when interpreting results, include:

i) Large scale programme appraisal can be difficult, partly due to the timing of some investment elements. This is because major programme elements expected to be implemented relatively late in the investment timescale, will incur costs without associated benefits being fully realised within the appraisal period. For example, some major track capacity changes are programmed to be completed 20 years into the appraisal period, meaning the appraisal period for these elements could have been extended from 60 to 80 years. If this approach had been adopted, it would have increased the value of economic benefits.

ii) The benefit ranges in this appraisal are intended to be robust, rather than precisely accurate, which is appropriate in the context of a PBC. The appraisal considers the likely effects of WRP implementation, in the context of potential demand variation and taking account of cost uncertainties.

Demand Forecasting

2.7 Current patronage data was derived from the following sources: GWRC 2017 Rail Survey Analysis, March 2018, Table 2: GWRC Wellington CBD Cordon Public Transport (PT) Survey, March 1999-2019, AM passenger count: GWRC, March 2019, Wellington Rail Station (WRS) AM peak exit data by location. The appraisal has taken account of patronage estimates for peak and non-peak periods. More recent trends show a temporary (COVID related) fall-off in demand of just under 20% in the weekday AM peak 2 hr period approaching WRS in 2020 and 2021.

2.8 For the purposes of this appraisal, future DM patronage has been capped at the pre-COVID 2019 demand of 10,300 passengers per hour (08.00-09.00 hrs inbound to WRS) due to operational constraints (signalling economics assumption).

2.9 For DS scenarios, no patronage growth has been included between 2019 and 2022 due to COVID effects. DS scenario patronage ramp-up has then been included from 2022 to 2031, but then capped (in future years) for the core analysis, when 160% of total seated capacity is exceeded. Sensitivity tests of varying patronage demand levels and the effects of raising the capping limit to 180% (Annex A.1) have also been undertaken.

[5] For example, due to potential fluctuations in economic conditions and/or future variations in locational activities.

2.10 The methodological approach used in this appraisal tests effects for lower and upper demand ranges (for PT patronage and traffic demand) to account for forecasting uncertainties. Further sensitivity testing has been undertaken on demand and cost assumptions to assist in the interpretation of presented results.

Lower Range Demand Forecasts

2.11 The DS scenario patronage forecasts applied in the appraisal are consistent with Wellington Transport Strategy Model (WTSM) 2046 scenario demand differentials, increased proportionately comparing surveyed passenger counts with forecast DM WTSM patronage demand to WRS in the AM peak period.

2.12 AM peak hour inbound patronage to WRS in 2031 is forecast to grow at 2.45% p.a., to 12,900 passengers per hour (signalling economics assumption) for all DS scenarios under the lower forecast range, with growth permitted beyond 2031 (consistent with the increased WTSM forecasts) as follows: Moderate Scenario to 15,100 passengers per hour, Mixed Scenario to 15,300 passengers per hour, Mode Shift Scenario to 15,600 passengers per hour. The passenger growth rates applied post 2031 for the lower range: Moderate Scenario 1.45% p.a., Mixed Scenario 1.65% p.a., Mode Shift Scenario 1.9% p.a.

2.13 Decongestion and other traffic related increases beyond 2031 are based on the regional traffic model, North Wellington SATURN Model (NWSM) vehicle kilometres travelled (VKT) growth forecast of 0.57% p.a.

Upper Range Demand Forecasts

2.14 Future passenger growth, post 2031, is applied in the appraisal for the upper demand range testing as follows: Moderate 1.9% p.a., Mixed Scenario 2.45% p.a., Mode Shift 3.4% p.a.[6]

2.15 Decongestion and other traffic related increases beyond 2031 based on a NWSM modelled delay growth forecast of 1.9% p.a.

Appraisal Methodology

2.16 The three DS scenarios (Moderate, Mixed, Mode Shift) are each compared with the cost and operational performance of the DM scenario, by applying the lower and upper demand forecast ranges, to estimate the economic value of DS scenarios. This represents the core analysis and excludes potential revenue.

2.17 Capitalised (CAPEX and OPEX) costs for each scenario remain constant across the appraisals undertaken for the lower and upper range demand forecasts. Revenue has been excluded from all core analysis (T1).

2.18 Sensitivity testing (excluding revenue) has been undertaken by applying:

i) Alternative discount rates (3% and 6%), as required by the MBCM (T2).

ii) Varying patronage demand by -10%, +10% and to reflect Transit Oriented Development demand (+28.1% source WTSM testing, T3).

iii) Varying CAPEX costs (-10% and +20%, T4).

iv) Worst Case (-10% demand +20% CAPEX and testing to establish cost increases required to result in a BCR of 1.0, T5).

v) Best Case (+28% demand -10% CAPEX, T6).

[6] The growth in WRS inbound AM peak rail trips (from surveys) averaged 3.4% p.a. over the period 2003-2019

2.19 A Wider Economic Benefits (WEBS) sensitivity test (excluding revenue) has been undertaken, to present results without WEBs, as required by MBCM (T7).

2.20 In response to peer review comments, three further sensitivity tests (excluding revenue) have been undertaken:

a) Without Land Use benefits (T8).

b) Induced traffic effects (limiting benefits to a 10-year period, T9).

c) Peak spreading, patronage retiming from main peak hour to secondary peak hour, T10).

2.21 In response to a request from Waka Kotahi, a further sensitivity test of a 40-year appraisal period has been undertaken (T11).

2.22 A benefit cost ratio (BCR) including revenue effects is also included in the sensitivity testing results (T12).

2.23 Incremental analysis has also been undertaken, as required by MBCM (T13).

3.0 Signalling Economics Comparison

3.1 This section is provided for consistency and to assist interpretation, as several benefits were subject to earlier Waka Kotahi and peer review during considerations for the Wellington Rail Signalling appraisal.

3.2 **Overall Changes**

i) Wider Economic Benefits[7] (WEBS) are now included in the WRP appraisal, expressed as a proportion of total benefits, previously (for the signalling economics) these were identified only as reserve (potential) benefits.

ii) Rail freight benefits are now included, previously identified only as reserve (potential) benefits.

iii) Rail safety benefits are now included, previously treated only as potential sensitivity test benefits.

iv) Passenger wait time reduction, is an additional benefit category, reflecting reduced headways generated by each DS scenario.

v) Road/rail grade separation delay saving, is an additional benefit, reflecting the replacement of currently at-grade rail/road crossings, now included in the road decongestion benefit category.

vi) Road reliability, is an additional benefit, now also included in the road decongestion benefit categories.

vii) The public transport (PT) value of time (VoT) for BCR calculation purposes is adopted, (replacing modelling values) in keeping with MBCM advice.

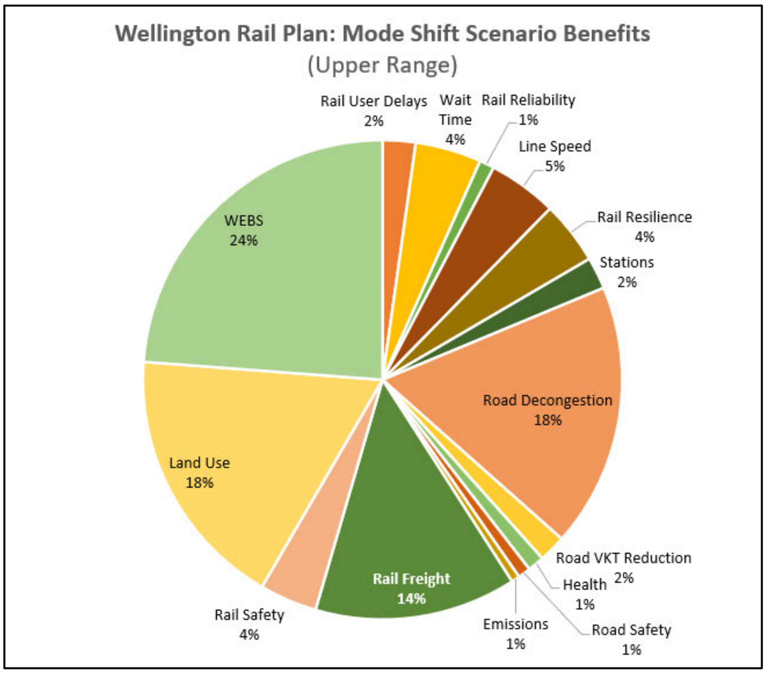
viii) Emission benefits are calculated using (typical) higher carbon values, as included in latest MBCM. Approximations have been used for 2031 and 2041 values to represent these changes.

ix) Land Use, an additional benefit category, is expressed as a proportion of total benefits.

[7] Primarily agglomeration benefits (see Annex 2, A2.4.1).

4.0 Detailed Methodology

4.1 Further details on methodology were contained within the appraisal worksheets, as issued for peer review purposes. A wide range of (15) benefits have been assessed, illustrated below, for the Mode Shift, Upper Demand Range, Scenario:



PT User Benefits

4.2 Rail user delay reduction: Improved rail signalling facilitates increased system capacity and generates benefits from reduced train delays, as follows:

- In future, the DM scenario, is expected to result in instability when late running occurs and required spacings (for recovery) between services are unavailable. Consequently, under the DM scenario, sections of the current rail network are forecast[8] to be overcapacity on a regular basis, with delays for appraisal purposes taken to be equivalent to headway spacing requirements under stable operational conditions. International literature confirms rail signalling has the potential to increase the capacity of rail infrastructure by up to 40%[9].
- A peak delay saving (for DS Scenarios) of 1 minute 20 seconds per train, is applied to the 4 over-capacity line sections (the same approach used for rail signalling economics). The delay saving was derived by applying the minimum spacings required for different types of trains, taking account of the time required for train paths. When the sum of these times exceeds the total time available, unstable operational conditions occur and train delays are generated. When at capacity, the absence of required headway gaps affects all subsequent peak services.

4.3 Rail station wait time reduction: Reflecting the effects of reducing train headways as train frequencies increase, in comparison to DM frequencies, differentiated by section and by service type (electrified and long-distance).

[8] Wellington Metro Rail Network Capacity Consumption Operating RS1 to UIC 406 (August 2020).
[9] ERTMS, Increasing Infrastructure Capacity, Factsheet 10, UNIFE.

- Planned passenger train frequencies for the DM scenario and for each future DS scenario have been derived, based on random passenger station arrivals for frequent services, assuming average waiting times are half of train headways.
- Account has been taken of higher proposed inner service frequencies under the DS scenarios at key stations, such as Porirua, Taita and Waterloo, which are served by both stopping and semi-fast services.
- For longer distance (infrequent) passenger train services, a reduction in wait time of 20 mins has been applied, as a proxy benefit for increased travel timing options. It should be noted that this only affects a small proportion of passengers and the scale of benefits generated by this working assumption is very small.

4.4 Improved rail reliability: From literature[10], this approximates to 15% of delay reduction benefits (approach used for signalling economics).

4.5 Rail line speed increase: Time savings arising from higher operating speeds, have been based on a sample of known opportunities on the network, to relax current speed restrictions. Savings are factored to reflect different levels of investment in the DS scenarios (approach used for signalling economics).

4.6 Rail station improvements: Improved station 'willingness to pay' MBCM attribute values for better facilities, applied to a maximum of 3.0 in vehicle time (IVT) minutes, phased in, and factored, to reflect different DS scenario investment levels.

4.7 Rail resilience: Based on assumed reductions in planned and unplanned line occupation times, factored to reflect different levels of investment for different DS scenarios, similar approach to rail signalling appraisal.

Road User Benefits

4.8 Road decongestion: Using the with-TG regional traffic model North Wellington SATURN Model (NWSM) outputs (rail signalling economics approach). This model was developed for NZTA (now Waka Kotahi) and includes state highways and substantial local roads.

- Road traffic volumes and network conditions (travel times and delays) were derived from the 2020 NWSM for AM and PM peak hours
- Increased rail patronage in the DS scenarios results in road decongestion benefits as 50% of new rail users are assumed to be former car drivers. Modal transfer from road was allocated by traffic zone, based on the distribution of current rail demand.
- Adjustments to the NWSM SATURN demand matrix were made to forecast reductions in road trip making. The resultant modelled DS scenario on the 2020 NWSM for AM and PM peak hours which was compared to the DM scenario to estimate the effects of mode change in terms of overall travel time.
- Changes in future conditions (in terms of VKT, travel time and delay) were derived from the 2021, 2031 and 2041 NWSM models to derive traffic related growth factors.
- Adjustments were made to estimate outputs for the two-hour peak periods, taking account of rail patronage in the secondary peak hour and in the evening peak.

[10] Forecasting Travel Time Variability, Eliasson J, 2009 European Transport Conference.

4.9 Specific additional aspects were also applied in the road decongestion appraisal as follows:

- Estimated typical grade separated rail crossing based on road delay reduction (using SIDRA modelling) and different levels of investment in DS scenarios.
- Improved road reliability: which approximates to 15% of delay reduction benefits (as used for signalling economics[11]).

4.10 Reduced VKT: Derived from the regional SATURN traffic model (NWSM), based on forecast changes in travel distance and vehicle operating costs, due to mode transfer from road to rail, with DS scenario option implementation (rail signalling economics approach).

Wider Economic Benefits

4.11 Wider economic benefits (WEBs): Agglomeration and increased productivity are typical outcomes from intensified mass transit services to high density centralised locations. For population to continue to grow in the region and job growth to be focussed on Wellington CBD / other major centres, rail investment is needed otherwise planned growth will not be possible. The WRP represents a transformational programme of works, with key drivers being to enable and unlock population and economic growth opportunities.

4.12 In certain circumstances, the incorporation of WEBs benefits can be up to 30% of conventional economic benefits[12]. The WRP appraisal assumes a rising level of WEBs, scaled in proportion to increasing scenario investment levels, as follows: Moderate Scenario 5.7% (of total benefits), Mixed Scenario 13.3%, Mode Shift Scenario 23.8%. *See also specific responses on WEBs in Annex 2.*

Other Benefits

4.13 Health benefits: Based on mode transfer to rail, resulting in additional walking activity capped at half the annual benefit per new user (MBCM), patronage-based approach, as used for the rail signalling economics.

4.14 Road safety: NWSM model estimates (method used for signalling economics) based on relationship between the social costs of crashes (all modes, source: MoT 2019 update) and VKT changes, derived from the regional traffic model.

4.15 Emissions: Model derived changes in fuel consumption, using recommended factored and updated CO_2 values (MBCM), method used for signalling economics.

4.16 Rail freight: The DS scenarios generate benefits to freight services in peak and non-peak periods. Based on literature[13] and in context of known freight operations, freight benefits have been taken to be 13.6% of total benefits.

4.17 Rail safety: Based on the same literature source[14] and in the context of the (major event) sensitivity test undertaken for the signalling economics, rail safety benefits have been taken to be 3.9% of total benefits.

[11] Forecasting Travel Time Variability, Eliasson J, 2009 European Transport Conference.

[12] NZTA Transformative Transport Projects (Dynamic Webs and Land Use Benefits and Costs) Technical Paper for Investment Decision Making Framework Review, December 2019.

[13] Value of Rail in New Zealand, MoT (2021), NZTA (2016).

[14] Value of Rail in New Zealand, MoT (2021), NZTA (2016).

4.18 Land Use: Based on the NZTA Transformative Transport Projects Technical Paper[15]. In certain circumstances, the incorporation of Land Use benefits can be up to 30% of conventional economic benefits[16]. The WRP appraisal assumes a rising level of Land Use benefits, scaled in proportion to increasing scenario investment levels, as follows: Moderate Scenario 4.3% (of total benefits), Mixed Scenario 10.0%, Mode Shift Scenario 17.8%. *See also specific responses on Land Use benefits in Annex 2.*

Potential Additional Benefits

4.19 Extended appraisal periods could be applied reflecting actual investment timing. At present, investments can be made late in the appraisal period with an associated shortened benefit accrual period.

4.20 Inclusion of potentially higher central Wellington (where the NWSM SATURN network is currently in buffer representation only) decongestion benefits.

4.21 Inclusion of non-peak station wait time reductions.

4.22 Inclusion of 'cascading train delays', where delayed trains would disproportionately affect subsequent trains, likely to increase benefits

4.23 Inclusion of crowding effects, likely to increase benefits.

4.24 Inclusion of additional attribute values for those transferring to rail from other modes.

Benefit and Cost Profiles

4.25 Benefit and cost profiles throughout the appraisal period have been developed for each scenario as illustrated, for the Mode shift Upper Range scenario, below:

s7(2)(b)(ii)

[redacted]

[15] NZTA Transformative Transport Projects (Dynamic Webs and Land Use Benefits and Costs) Technical Paper for Investment Decision Making Framework Review, December 2019.

[16] NZTA Transformative Transport Projects (Dynamic Webs and Land Use Benefits and Costs) Technical Paper for Investment Decision Making Framework Review, December 2019.

Treatment of Benefits

4.26 The benefit profile was derived from the individual assessments for each component benefit.

- For annually calculated benefits namely: Rail User Delay, Wait Time, Station Attributes, Resilience, Line Speeds, Decongestion (including Grade Separations), VKT Reduction, Health, Road Safety, Emissions, these were totalled for each appraisal year.
- For estimated benefits, namely: Rail Reliability (Road and Rail), Rail Freight, WEBS and for the calculated overall benefits of Rail Safety and Land Use: these were distributed in the same proportions to the annually calculated benefit profile.

Treatment of Costs

4.27 An allowance for cost escalation between July 2020 (time zero) and December 2021 (cost estimate issue) has been allowed for at a rate of 4% p.a. (total 6%), however, the actual cost escalation is likely to be higher, due to COVID related material supply constraints.

4.28 The cost profile was taken from the Business Case CAPEX and OPEX forward cost programme for the DM and DS scenarios.

4.29 Apart from one sensitivity test *(See T12 in 5.28 below)* revenue effects are excluded from the appraisal.

5.0 Results

5.1 Scenario Description

SCENARIO	LOWER RANGE	UPPER RANGE
Moderate	Moderate Patronage Growth, Lower Congestion Level, Lower Investment	Higher Patronage Growth, Higher Congestion Level, Lower Investment
Mixed	Moderate Patronage Growth, Lower Congestion Level, Intermediate Investment	Higher Patronage Growth, Higher Congestion Levels, Intermediate Investment
Mode Shift	Moderate Patronage Growth, Lower Congestion Level, Higher Investment	Higher Patronage Growth, Higher Congestion Levels, Higher Investment

5.2 **Core Results** (including CAPEX and OPEX, excluding revenue).

SCENARIO	LOWER RANGE BCR (NPV)	UPPER RANGE BCR (NPV)
Moderate	**1.7** ($767m)	**2.2** ($1,308m)
Mixed	**1.1** ($314m)	**1.5** ($1,038m)
Mode Shift	**1.1** ($197m)	**1.5** ($2,007m)

5.3 'Low BCRs' (defined by Waka Kotahi as being ≤2.9) can be expected for very large investments (programmes/projects), as BCRs have been found (typically) to decline as the scale of costs increase[17].

5.4 The Rail Plan Core Analysis BCRs for the various scenarios are estimated to be in the range 1.1 to 1.7 for the lower demand forecast scenario and between 1.5 and 2.2 for the upper forecast demand scenario.

5.5 The Mode Shift scenario generates the highest (combined/average) potential net value estimate in NPV terms. A summary breakdown of the appraisal of the Mode Shift Scenario, Upper Demand Range, is shown below:

Mode Shift High Scenario (NP $m)	
Benefit category	**NPB ($m)**
Rail User Delays	$133.2
Wait Time	$267.3
Rail Reliability	$60.1
Line Speed	$267.8
Rail Resilience	$283.9
Stations	$130.4
Road Decongestion	1036.3
Road VKT Reduction	$101.5
Health	$55.4
Road Safety	$37.2
Emissions	$33.8
Rail Freight	$798.8
Rail Safety	$228.7
Land Use	$1,049.1
WEBS	$1,402.7
Total Benefits (NPB)	$5,886.1
Discounted Costs (NPC)	$3,879.3
BCR	**1.5**
NPV	$2,006.9

5.6 Detailed core results are as follows:

T1	**LOWER FORECAST RANGE (NP $m)**			
Scenario	BCR	Benefits	Costs	NPV
Moderate	1.71	$1,842.40	$1,075.20	$767.20
Mixed	1.14	$2,485.80	$2,172.30	$313.50
Mode Shift	1.05	$4,076.50	$3,879.30	$197.20
	UPPER FORECAST RANGE (NP $b)			
Scenario	BCR	Benefits	Costs	NPV
Moderate	2.22	$2,383.50	$1,075.20	$1,308.30
Mixed	1.48	$3,209.80	$2,172.30	$1,037.50
Mode Shift	1.52	$5,886.10	$3,879.30	$2,006.80

[17] Economic Re-evaluation of New Zealand Transport Investments, Australasian Transport Research Forum, November 2017.

5.7 **Sensitivity Testing** (including CAPEX and OPEX, excluding revenue)

5.8 Alternative discount rates (3% and 6%) for Mode Shift Scenario.

T2	LOWER FORECAST RANGE (NP $m)			
RATE	BCR	Benefits	Costs	NPV
3%	1.03	$4,564.40	$4,448.20	$116.20
4%	1.05	$4,076.50	$3,879.30	$197.20
6%	1.17	$3,490.50	$2,985.50	$505.00
UPPER FORECAST RANGE (NP $B)				
RATE	BCR	Benefits	Costs	NPV
3%	1.50	$6,651.30	$4,448.20	$2,203.10
4%	1.52	$5,886.10	$3,879.30	$2,006.80
6%	1.67	$4,985.60	$2,985.50	$2,000.10

5.9 Lower Forecast Demand Range 1.01 to 1.17, Upper Forecast Demand Range 1.50 to 1.67.

5.10 Varying patronage demand by -10%, +10% and to represent Transit Oriented Development (TOD) demand (+28.1%, source WTSM) for the Mode Shift Scenario.

T3	LOWER FORECAST RANGE (NP $m)			
Patronage	BCR	Benefits	Costs	NPV
Minus 10%	1.04	$4,036.80	$3,879.30	$157.50
Plus 10%	1.06	$4,117.90	$3,879.30	$238.60
TOD +28.1%	1.08	$4,197.40	$3,879.30	$318.10
	UPPER FORECAST RANGE (NP $b)			
Patronage	BCR	Benefits	Costs	NPV
Minus 10%	1.49	$5,777.70	$3,879.30	$1,898.40
Plus 10%	1.55	$6,002.20	$3,879.30	$2,122.90
TOD +28.1%	1.61	$6,232.90	$3,879.30	$2,353.60

5.11 Lower Forecast Demand Range 1.04 to 1.08, Upper Forecast Demand Range 1.49 to 1.61.

5.12 Varying CAPEX costs (-10% and +20%) for the Mode Shift Scenario.

T4	LOWER FORECAST RANGE (NP $m)			
CAPEX CHANGE	BCR	Benefits	Costs	NPV
Minus 10%	1.17	$4,076.50	$3,491.37	$585.13
Plus 20%	0.88	$4,076.50	$4,655.16	-$578.66
	UPPER FORECAST RANGE (NP $b)			
CAPEX CHANGE	BCR	Benefits	Costs	NPV
Minus 10%	1.69	$5,886.10	$3,491.37	$2,394.73
Plus 20%	1.26	$5,886.10	$4,655.16	$1,230.94

5.13 Lower Forecast Demand Range 0.88 to 1.17, Upper Forecast Demand Range 1.26 to 1.69.

5.14 Worst Case (-10% demand, +20% CAPEX, with BCR at unity) for the Mode Shift Scenario.

T5		LOWER FORECAST RANGE (NP $m)			
Demand	**Costs**	BCR	Benefits	Costs	NPV
Minus 10%	CAPEX +20%	0.87	$4,036.80	$4,655.16	-$618.36
Minus 10%	BCR Break CAPEX +4%	1.00	$4,036.80	$4,034.40	$2.40
		UPPER FORECAST RANGE (NP $b)			
Demand	**Costs**	BCR	Benefits	Costs	NPV
Minus 10%	CAPEX +20%	1.24	$5,777.70	$4,655.16	$1,122.54
Minus 10%	BCR Break CAPEX +49%	1.00	$5,777.70	$5,780.10	-$2.40
NOTE: FACTORS TO REDUCE CORE ANALYSIS MODE SHIFT SCENARIO BCRS TO 1.0 ARE: 1.04 X COSTS FOR LOWER FORECAST RANGE AND 1.49 X COSTS FOR UPPER FORECAST RANGE.					

5.15 Lower Forecast Demand Range 0.87, Upper Forecast Demand Range 1.24.

5.16 Best Case (+28.1% TOD demand, -10% CAPEX) for the Mode Shift Scenario.

T6		LOWER FORECAST RANGE (NP $m)			
Demand	**Costs**	BCR	Benefits	Costs	NPV
TOD +28.1%	CAPEX Minus 10%	1.20	$4,197.40	$3,491.37	$762.00
		UPPER FORECAST RANGE (NP $b)			
Demand	**Costs**	BCR	Benefits	Costs	NPV
TOD +28.1%	CAPEX Minus 10%	1.79	$6,234.30	$3,491.37	$2,798.90

5.17 Lower Forecast Demand 1.20, Upper Forecast Demand 1.79.

5.18 No WEBs testing for the Mode Shift Scenario.

T7	LOWER FORECAST RANGE (NP $m)			
Demand	BCR	Benefits	Costs	NPV
With Webs	1.05	$4,076.50	$3,879.30	$197.20
No Webs	0.80	$3,105.90	$3,879.30	-$717.60
	UPPER FORECAST RANGE (NP $b)			
Demand	BCR	Benefits	Costs	NPV
With Webs	1.52	$5,886.10	$3,879.30	$2,006.80
No Webs	1.16	$4,483.40	$3,879.30	$659.90

5.19 Lower Forecast Demand Range 0.80 to 1.05, Upper Forecast Demand Range 1.16 to 1.52.

5.20 No Land Use benefits testing for the Mode Shift Scenario.

T8	LOWER FORECAST RANGE (NP $m)			
Demand	BCR	Benefits	Costs	NPV
Land Use	1.05	$4,076.50	$3,879.30	$197.20
No Land Use	0.86	$3,350.60	$3,879.30	$472.90
	UPPER FORECAST RANGE (NP $b)			
Demand	BCR	Benefits	Costs	NPV
Land Use	1.52	$5,886.10	$3,879.30	$2,006.80
No Land Use	1.25	$4,837.00	$3,879.30	$1,013.60

5.21 Lower Forecast Demand Range 0.86 to 1.05, Upper Forecast Demand Range 1.25 to 1.52.

5.22 Patronage Peak Spreading to secondary peak hour for the Mode Shift Scenario.

T9	LOWER FORECAST RANGE (NP $M)			
Patronage Cap	BCR	Benefits	Costs	NPV
No Cap (*2079)*	1.05	$4,076.50	$3,879.30	$197.20
	UPPER FORECAST RANGE (NP $b)			
Patronage Cap	BCR	Benefits	Costs	NPV
2058 Cap	1.52	$5,886.10	$3,879.30	$2,006.80
2068 Cap	1.62	$6,271.50	$3,879.30	$2,392.20

5.23 Lower Forecast Demand 1.05, Upper Forecast Demand Range 1.52 to 1.62.

5.24 Induced Traffic testing for the Mode Shift Scenario.

T10	LOWER FORECAST RANGE (NP $M)			
Induced Effect	BCR	Benefits	Costs	NPV
As Modelled	1.05	$4,076.50	$3,879.30	$197.20
10-year Cap	0.95	$3,702.80	$3,879.30	-$176.50
	UPPER FORECAST RANGE (NP $b)			
Induced Effect	BCR	Benefits	Costs	NPV
As Modelled	1.52	$5,886.10	$3,879.30	$2,006.80
10-year Cap	1.35	$5,220.20	$3,879.30	$1,340.90

5.25 Lower Forecast Demand Range 0.95, Upper Forecast Demand Range 1.35 to 1.52.

5.26 40 Year Appraisal Period testing for the Mode Shift Scenario.

T11	LOWER FORECAST RANGE (NP $M)			
Appraisal	BCR	Benefits	Costs	NPV
As Modelled	1.05	$4,076.50	$3,879.30	$197.20
40-year Period	0.95	$3,698.10	$3,879.30	-$181.20
	UPPER FORECAST RANGE (NP $b)			
Appraisal	BCR	Benefits	Costs	NPV
As Modelled	1.52	$5,886.10	$3,879.30	$2,006.80
40-year Period	1.34	$5,192.30	$3,879.30	$1,313.00

5.27 Lower Forecast Demand Range 0.95 to 1.05, Upper Forecast Demand Range 1.34 to 1.52.

5.28 Revenue included BCR for the Mode Shift scenario (revenue applied as cost reduction)

T12	LOWER FORECAST RANGE (NP $m)			
INCLUDING REVENUE	BCR	Benefits	Costs	NPV
	1.08	$4,076.50	$3,764.40	$312.10
	UPPER FORECAST RANGE (NP $b)			
INCLUDING REVENUE	BCR	Benefits	Costs	NPV
	1.56	$5,886.10	$3,764.40	$2,121.70

5.29 Lower Forecast Demand 1.08, Upper Forecast Demand Range 1.56.

5.30 **Overall Review of Results**: Core results range for the Mode Shift Scenario is from BCR 1.1 to 1.5. Sensitivity testing range for the Mode Shift Scenario is from BCR 0.8 to 1.8.

5.31 **Incremental Testing**

T13		NP $M				NP $M
		Incremental Scenarios				Mode Shift
		Moderate	Mixed	Mode Shift		Moderate based
	Discounted Costs	$1,075.20	$2,172.30	$3,879.30		$2,804.10
LOWER DEMAND RANGE	Discounted Benefits	$1,842.40	$2,485.80	$4,076.50		$2,234.10
	BCR	1.80	1.20	1.10		
	Incremental BCR		0.59	0.93		0.80
UPPER DEMAND RANGE	Discounted Benefits	$2,383.50	$3,209.80	$5,886.10		$3,502.60
	BCR	2.20	1.60	1.50		
	Incremental BCR		0.75	1.57		1.25

5.32 Lower Forecast Demand Range incremental BCRs for the Mode Shift Scenario are between 0.6 to 0.9 depending on the reference point, and for the Upper Forecast Demand Range incremental BCRs are between 0.8 and 1.6.

5.33 Care is needed in the interpretation of incremental analysis as the results focus on BCRs and are highly dependent on option selection and sequencing.

5.34 The First Year Rate of Return (FYRR) in 2031 has been estimated for the Mode Shift Scenario as follows: Low Forecast Demand Range 3.0% and High Forecast Demand Range 3.3%. Caution is needed when applying these figures to a long-term investment programme, such as the WRP, as this contains many individual projects that (collectively) have a relatively flattened benefit profile over an extended time period.

Annex 1 Adjusted Results

		Forecasting Parameters		
Demand Range		**Moderate**	**Mixed**	**Mode Shift**
Lower	Rail Patronage	• 2.45% p.a. (as derived for signalling economics) 2022-2031 common across all lower forecast scenarios. • 1.45% p.a. 2032 onwards to reflect WTSM modelled differentials – capped in 2074 at 180% of seated capacity.	• 2.45% p.a. (as derived for signalling economics) 2022-2031 common across all lower forecast scenarios. • 1.65% p.a. 2032 onwards to reflect WTSM modelled differentials – capped in 2076 at 180% of seated capacity.	• 2.45% p.a. (as derived for signalling economics) 2022-2031 common across all lower forecast scenarios. • 1.90% p.a. 2032 onwards to reflect WTSM modelled differentials – not capped.
	Traffic Growth	• 0.54% p.a. common across all lower forecast scenarios. • (long-term NWSM forecast VKT growth 2021-2041)	• 0.54% p.a. common across all lower forecast scenarios. • (long-term NWSM forecast VKT growth 2021-2041)	• 0.54% p.a. common across all lower forecast scenarios. • (long-term NWSM forecast VKT growth 2021-2041)
Upper	Rail Patronage	• 3.40% p.a. 2022-2031 common across all upper forecast scenarios (continuation of 2003-2019 growth trend). • 1.90% p.a. (Mode Shift derived lower demand range WTSM forecast) 2032 onwards, capped 2064 at 180% of seated capacity.	• 3.40% p.a. 2022-2031 common across all upper forecast scenarios (continuation of 2003-2019 growth trend). • 2.45% p.a. (continuation of lower demand range trend as derived for signalling economics)) 2032 onwards, capped 2058 at 180% of seated capacity.	• 3.40% p.a. 2022-2031 common across all upper forecast scenarios (continuation of 2003-2019 growth trend). • 3.40% p.a. 2032 onwards (continuation of 2003-2019 growth trend) capped 2058 at 180% of seated capacity.
	Traffic Growth	• 1.88% p.a. (long-term NWSM forecast traffic delay growth 2021-2041)	• 1.88% p.a. (long-term NWSM forecast traffic delay growth 2021-2041)	• 1.88% p.a. (long-term NWSM forecast traffic delay growth 2021-2041)

A1.1 For review purposes, a rechecked and adjusted version of the appraisal has been developed, including minor revisions, as follows:

SCENARIO	LOWER RANGE BCR (NPV)	UPPER RANGE BCR (NPV)
Moderate	**1.7** ($767m)	**2.2** ($1,308m)
Mixed	**1.1** ($314m)	**1.5** ($1,038m)
Mode Shift	**1.1** ($549m)	**1.5** ($1,882m)

A1.2 Comparing with the table in 5.2 above, the differences are relatively minor, namely: increasing The Lower Range Mode Shift NPV from $197m to $549m and reducing the Upper Range Mode Shift NPV from $2,007m to $1882m. The earlier set of results and sensitivity testing was therefore allowed to stand, as there were no material differences warranting a full reworking of the appraisal.

A1.3 More detail below, to compare with 5.6 above, showing the same pattern of results with the Mode Shift Scenario still generating the highest combined (or average) NPV.

T14	**LOWER FORECAST RANGE (NP $M)**			
Scenario	BCR	Benefits	Costs	NPV
Moderate	1.71	$1,842.40	$1,075.20	$767.20
Mixed	1.14	$2,485.80	$2,172.30	$313.50
Mode Shift	1.14	$4,428.70	$3,879.30	$549.40
	UPPER FORECAST RANGE (NP $B)			
Scenario	BCR	Benefits	Costs	NPV
Moderate	2.22	$2,383.50	$1,075.20	$1,308.30
Mixed	1.48	$3,209.80	$2,172.30	$1,037.50
Mode Shift	1.49	$5,761.20	$3,879.30	$1,881.90

A1.4 The Lower Forecast Demand BCR Range is 1.14 to 1.71, Upper Forecast Demand BCR Range is from 1.48 to 2.22.

Annex 2 Peer Review: Specific Responses

This Annex addresses the suggested actions arising from the peer review. Other more detailed changes have been made in response to the matters addressed in the peer review and these are included in the body of the Appendix.

A2.1 Description of the economic appraisal and method for estimating benefits

''Suggested actions:''

- *''Provide additional detail in the Economics Appendix to the business case of the method, key assumptions and calculations used to estimate benefits (for some benefit categories this may not be required e.g., where an overall percentage of conventional benefits has been assumed). However, for direct transport benefits to passengers and freight, a more comprehensive step by step description would help to understand the application.''*

Response: We have added provided written additional details in respect of methodology in Section 4.0 of the Appendix.

Information was also supplied for peer review purposes (in numerical terms) in the form of previously issued Scenario (Excel) worksheets.

- *''Provide a fuller description of the results breakdown for each option (low and high estimate) and the cost and benefit profiles.''*

Responses: *(See also paragraphs 4.25 to 4.28 above)*

- The cost profile was taken from the Business Case CAPEX and OPEX forward cost programme for each scenario.
- The benefit profile was derived from the individual assessments for each component benefit. For annually calculated benefits, namely: Rail User Delay, Wait Time, Station Attributes, Resilience, Line Speeds, Decongestion (including Grade Separations), VKT Reduction, Health, Road Safety, Emissions, these were totalled for each appraisal year. For estimated benefits, namely: Rail Reliability (Road and Rail), Rail Freight, WEBS and for the calculated overall benefits Rail Safety and Land Use: these were distributed in the same proportions to the annually calculated benefit profile.

A2.2 Overcrowding not included as a benefit

''Suggested actions:''

- *''Confirm that the detailed information is not available to readily estimate crowding benefits by applying an in-vehicle time multiplier approach.''*

Response: The WRP appraisal includes allowances for increased values of time for standing passengers, from the MBCM, but additional IVT crowding related values (for example from Australia[18]) have not been applied.

- *''Assess the likely impact of crowding benefits on the quantum of benefits through some broad order, what-if analysis of the expected impact of options on crowding and describe this impact as a source of uncertainty.''*

[18] Australian Transport Assessment and Planning Guidelines, M1 Public Transport: Parameter Values Technical Report, August 2021.

Response: For the core options appraisal (for feasibility reasons) patronage crowding has been capped at 180% of seated capacity, limiting the usefulness of crowding analysis. On the basis of information currently available, crowding benefits are not likely to be substantial.

A2.3 Benefits for road users-decongestion from mode shift and grade separations

''Suggested actions:''

- *''Clearly explain the limitations of the traffic modelling approach for measuring the impacts of induced demand.''*

Response: Future road traffic, trip retiming, redistribution and rerouting is already included in the modelling undertaken for the purposes of the WRP appraisal. Completely new generated road traffic demand can arise when additional system capacity (on any mode) is introduced. The induced trip procedures in the MBCM predominantly relate to the provision of new road capacity. There is no reference in the MBCM and very little literature on the topic) to the potential effects of PT improvements to induce road traffic. However, in theory, depending on the exact type of new capacity provided and the extent of suppressed demand, a change in the capacity of one mode can potentially, have effects on other modes, but when these are small, they are rarely calculated, as it is not usually either practical or worthwhile to do so.

It is possible that there may be a minor induced road traffic effect as a result of road to rail transfer, arising from the WRP, but this is likely to be very small in scale, and would occur marginally year on year (incrementally) as rail patronage grows.

Any induced traffic effects, if these were to occur, would also be dependent on whether or not other compensating actions are taken, for example, through changes to (say) the scale of CBD commuter car parking, road pricing, or other polices designed to limit peak period traffic growth[19].

- *''Include information on the potential impact of this and other sources of uncertainty on the evaluation outcomes (We do not think it is feasible or practical to incorporate induced demand in the modelling approach at this stage of the investment development).''*

Response: A sensitivity test has been undertaken to limit benefits potentially affected by induced traffic, namely: decongestion, grade separation, road reliability, VKT reduction, road safety and emissions, to limit benefits to a ten-year period[20] post 2031. This is provided in the Appendix, *see T10 and 5.24 above*.

A2.4 Wider Economic Benefits (WEBs) and Land Use benefits

''Suggested actions''

- *''Include in the business case a qualitative description and assessment of these potential benefits.''*

Response: WEBs and Land Use are separate categories of benefits: assessments are provided below in A2.5.1 and A2.5.2 respectively.

[19] See for example: Waka Kotahi, RFP 5847, ART/21/13, *Climate Change: interventions to reduce land transport greenhouse gas emissions-economic and behavioural instruments to effect mode change*. January 2022.
[20] VTPI, *Generated Traffic and Induced Travel, Implications for Transport Planning*, February 2022

- *''Report the core benefits without land use and WEBS impacts and, if an estimate is included, do this as part of the sensitivity testing.''*

Response: Sensitivity testing undertaken and included in Appendix, *see 5.18 for WEBs and 5.20 for Land Use.*

A2.4.1 Assessment: WEBs

i) Static WEBs

Static Agglomeration: Improved accessibility make places effectively denser, resulting in improved productivity. The WRP will improve accessibility for existing workers/businesses within existing CBDs, especially in central Wellington.

Imperfect Competition: Reducing business transport costs reduces barriers to entry for suppliers and generates additional output, representing benefits from additional consumer and producer surplus. Previous analysis of wider economic benefits for rapid transit projects suggests imperfect competition benefits are likely in the range 1% to 5% of total economic benefits.

ii) Dynamic WEBs

Dynamic agglomeration: Where the relocation of workers or firms results in an increase in net density, existing firms and workers become more productive. The WRP will improve accessibility and capacity, assisting activity / businesses located close to / within regional CBDs, including central Wellington.

Move to more productive jobs: Improving accessibility for commuters, to allow workers to change their location of work. When workers take up more productive jobs an additional benefit is generated. The WRP will improve accessibility to encourage workers to relocate where this is beneficial.

Waka Kotahi advice is that WEBs are typically generated within a range of 10% to 30% of total benefits[21]. Comparisons are provided in the Waka Kotahi advice for proportions of WEBs as a proportion of total economic benefits, as follows: Parramatta Light Rail 12%, Canberra Capital Metro Stage 1, 7% and for Stage 2, 39%.

Other examples of WEBs as a proportion of total economic benefits, include Auckland City Rail Link 21% LGWM (including additional benefits assessment) 50%, NZ Roads of National Significance 59%.

For the WRP a range of potential benefits was assumed, for PBC purposes, prior to undertaking specific modelling, within the context of likely effects for similar projects and in relation to current advice.

WEBs benefits have been scaled in direct proportion to the (relative) increase in scenario investment (compared to DM CAPEX and OPEX costs) as follows: Moderate Scenario 5.7% (of total economic benefits), Mixed Scenario 13.3%, Mode Shift Scenario 23.8%.

[21] NZTA *Transformative Transport Projects (Dynamic Webs and Land Use Benefits and Costs) Technical Paper for Investment Decision Making Framework Review*, December 2019.

The proportion of Static and Dynamic WEBs, in the assessment table below, was derived from LGWM economic appraisal results.

OUTCOMES

SCENARIOS	*Static WEBs*	*Dynamic WEBS*	**Total WEBS**
Do Minimum	*None (0%)*	*None (0%)*	**None (0%)**
Moderate	*Minor (3%)*	*Minor (2%)*	**Minor (6%)**
Mixed	*Minor (8%)*	*Minor (6%)*	**Sizeable (10%)**
Mode Shift	*Sizeable (14%)*	*Sizeable (12%)*	**Major (24%)**

Rating against key success factors				
Very Poor	Poor	Average	Good	Very Good

A2.4.2 Assessment - Land Use

Land value changes: When transport investments unlock development constraints, by relieving constraints, benefits from higher value land use are generated. More intensive land use delivers benefits equal to the value of the new land use. The WRP is a catalyst for a relaxation of planning constraints and an enabler of land use development. The WRP will facilitate and encourage growth which is accessible to improved rail services. As part of the WRP appraisal, testing was undertaken using the regional transport model (WTSM) to quantify the effect of higher accessibility in around major urban rail stations, by facilitating Transit Orientated Design. This is a proxy for land use intensification associated with implementation of the WRP Mode Shift Scenario. The results were an increase in patronage and related benefits of 28.1% over the DM Scenario in 2046.

Other potential land use benefits are in relation to greater cost efficiency associated with the provision of public infrastructure and public health.

Waka Kotahi advice is that Land Use benefits are typically generated within a range of 5% to 30% of total benefits[22]. Comparisons are provided in the Waka Kotahi advice for the proportions of Land Use benefits as a proportion of total economic benefits, as follows: Sydney Metro and South-West 8%, Capital Metro 31%.

For the WRP a range of potential benefits was assumed, for PBC purposes, prior to undertaking specific modelling, within the context of likely effects for similar projects and current advice.

[22] NZTA *Transformative Transport Projects (Dynamic Webs and Land Use Benefits and Costs) Technical Paper for Investment Decision Making Framework Review*, December 2019.

Land Use benefits were scaled in direct proportion to the (relative) increase in scenario investment (compared to DM CAPEX and OPEX costs) as follows: Moderate Scenario 4.3% (of total economic benefits), Mixed Scenario 10.0%, Mode Shift Scenario 17.8%.

	OUTCOMES
SCENARIOS	**Land Use**
Do Minimum	**None (0%)**
Moderate	**Minor (4%)**
Mixed	**Sizeable (10%)**
Mode Shift	**Major (18%)**

Rating against key success factors				
Very Poor	Poor	Average	Good	Very Good

A2.5 Potential impacts of peak spreading

"Suggested action"

- *"That the team cover the likelihood of this happening and the expected impacts in the business case commentary (potentially under risks and uncertainties)."*

Response: To a large extent, the peak spreading of road traffic is already incorporated into the demand forecasting models (for 2020, 2031 and 2041) including the GWRC regional transport model (WTSM) and the Waka Kotahi regional traffic model (NWSM).

For the NWSM, demand is modelled over four sub-periods within the two-hour weekday morning peak period (07.00-09.00 hrs) and within three sub-periods within the evening peak period (16.00-18.00 hrs). This means the proportion of peak hour traffic changes over time. Modelled changes in demand over time in the inter-peak period (09.00-16.00 hrs) are also accounted for in these models.

In response to the peer review, an additional sensitivity test has been undertaken of the potential effect of rail passengers changing their time of travel, from the busiest peak hour, to the secondary peak hour, once patronage loadings exceed 180% of seated capacity, *see T9 and 5.22 above.*

Appendix L Cost Estimation

Stantec

Wellington Regional Rail Plan: Cost Estimation Memo

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
0.1	21/12/21	First Draft	SR	DW	DW	DW
1.0	21/4/22	Final	SR	DW	DW	DW

1 Purpose and Introduction

This report summarises the procedure used for costing the capital elements and operational elements of the Welling Regional Rail Plan programme.

The RRP PBC is a Greater Wellington Regional Council (GWRC) initiative to set out the long-term direction of investment in the rail network. This investment is a cornerstone of the Regional Land Transport Plan (RLTP), Regional Public Transport Plan (RPTP), and Regional Mode Shift Plan (MSP), and it will help enable the outcomes sought by the preferred direction of the Wellington Regional Growth Framework (RGF). The RRP has a 30-year timeframe for investment and is expected to be updated throughout this period.

The RRP Strategic Case was endorsed by Waka Kotahi in early 2021, allowing the programme development process to recommence. Individual interventions, which had been developed with the input of a range of stakeholders, were subsequently assessed using the Waka Kotahi Early Assessment Sifting Tool (EAST) and allocated into a set of long list programmes. The project team then worked with key stakeholders to refine the long list to a short list at a shortlisting workshop held on 15 April 2021.

While initial estimates at costing were conducted within the EAST, the shortlisted programmes were subjected to a much greater level of assessment to give a greater understanding of the costs for the preferred programme workshop. Costs were where possible informed by previous analysis or other business cases about rail.

These cost estimates were then used for the economic analysis of the shortlisted options and sensitivity testing of the preferred option.

2 Maintenance & Operational Costing

This chapter outlines how the cost estimates for the maintenance of the rail network, the EMU maintenance and operational costs of the Rail Plan were estimated.

2.1 Rail Network Maintenance Costings

The Rail Network Maintenance Costings were informed by the existing Network Management Plan which provides for a 30-year forecast. This forecast was utilised in conjunction with discussions with the KiwiRail Wellington Network Maintenance team to inform the required maintenance requirements for the do min.

A meeting was held between the project team and the KiwiRail Wellington Asset Management team on 20 August 2020. The KiwiRail team provided indicative unit rates for key activities such as slope stabilisation, culvert renewals and bridge strengthening as well as the capability to deliver additional maintenance activities.

KiwiRail also confirmed that the networks maintenance requirements would not uniformly increases with the increase in passenger services as they place a lower demand on the rail network than the freight services. It was agreed that increasing the maintenance spend by 1/3rd the increase in EMU kilometres travelled was a reasonable approach (i.e. if EMU kms increased by 30%, the maintenance spend would increase 10%). This was applied on all track related maintenance. Maintenance for other aspects not influenced by use were increased up to 20% higher than the current network management plan rates. This was to reflect that as additional services were being operated, a high level of reliability from the network is required to avoid significant disruption.

2.2 EMU Maintenance

The base EMU maintenance costs were taken from the Metlink Asset Management Plan. As these reflect the actual incurred costs excluding extraordinary costs (i.e. repairs following collisions with slips). Each of the programmes annual EMU maintenance was scaled up in proportion to the number of new EMU's and LDRS included in the programme.

2.3 Operational Costs

Operational costings were based on the existing Metlink Asset Management Plan and adjusted based on the change in requirements.

Operator Costs
Operator costs were increased proportionally to the number of expected services operated. This was inclusive of inter-peak, off-peak and weekend services. It was considered to be proportional as it is expected that there will be efficiencies gained by having higher staff utilisation from additional and a reduction in proportion of their costs which are overheads.

Power Costs
Power was directly scaled by the change in EMU kms expected to be travelled annually.

GWRC Costs
GWRC costs were retained at 13.7% of the costs of the operational costs. Planning costs were retained at 0.9% of the annual spend.

Fixed Asset Costs
Fixed asset costs for operations and maintenance were uplifted 5-7.5% for increased spend on station maintenance and staffing.

2.4 Contingency

As the rates provided for the asset management plans and network management plans were well defined and consistent with previous spends, it was assumed that they included a 20% contingency. The funding risk contingency for maintenance type activities was assumed to be 30-35%, however, things such as new slope stabilisation included a higher funding risk contingency.

3 Capital Works Costings

The capital works were informed by a range of unit rates, prior estimates and KiwiRail information.

The project team held two sessions with a range of KiwiRail and GWRC staff to confirm that these costs were reasonable. The first session was held on 23 September 2021 and the base rates and outputs were discussed. Following the input from KiwiRail, the estimates were further refined, and in some cases a factor for 'rework' was added where the work was taking place in a space constrained environment and temporary arrangements would be required to enable the continued operation of rail services. Subsequently, a second workshop was held on 27 September at which point it was confirmed that the cost estimates were reasonable.

Contingency for the base estimate was based on the knowledge of the site and difficulty expected for the works. To obtain the P95 costings, reference was made to the UK Department for Transport Optimism Bias Study which recommends a funding risk contingency of 64% of the base estimate. For some projects it was judged that there was a significant chance of higher funding required, and it was judged that 64% should therefore be the minimum funding risk contingency. In cases with significant difficulties, a higher funding risk contingency was applied.

Where capital works have a sufficiently advanced piece of work informing costs, these were used, such as WMUP projects. For all other projects, cost estimates were built up based on key unit rates and the expected quantum of works.

For capital works projects two additional costs were added from the expected estimate. Preliminary and General costs were assumed to be 15% of the calculated cost and environmental management was assumed to be 1% expected estimate. These were added on top of the unit rates to determine the final cost estimates.

3.1 North-South Junction

The North-South Junction Capacity Improvements was costed as a dual track tunnel for 2 km and double tracking the remainder of the single tracked sections, including daylighting two tunnels.

The tunnel rate dominated the cost estimates and was based on factoring up the Waterview Tunnel costs, as well as referring to recent LGWM work which has estimated a long tunnel within Wellington. It is expected that it would be a single bored tunnel, which hosts two tracks resulting in this section being a triple tracked network.

A lower cost estimate using a viaduct was also prepared which was based on unit rates for structures.

3.2 Rail Network Segregation

Rail network segregation involved three key costs.

Rail fencing was estimated as a continuous programme over a 10 year programme. Not all fencing is required to be replaced, but this should result in a significant improvement to the quality of fence in key areas.

The remainder of the costs were to the grade separation of road and pedestrian crossings.

Pedestrian subways were based on the recently completed subways constructed as part of the Trentham to Upper Hutt Double tracking. While estimates for the single track crossings were provided, these are only expected to be used in the Wairarapa and north of Waikanae (prior to anticipated double tracking). At these locations at this point in time, the long distance services frequencies are not expected to be high enough to warrant installation for safety reasons. This does not preclude them being delivered for other reasons.

Road crossings had an expected estimate of [redacted] inclusive of some property. This was based on a road over rail scenario with no work done on the rail corridor. This rate was calculated from the unit rates provided from the Waka Kotahi elemental costing database which is considered appropriate as the estimates are based on a road bridge. The rates were uniform for all crossings. It is expected that these rates will be refined and customised to each crossing in the next phase.

3.3 Electrification Improvements

The electrification requirement was based on the need noted by GWRC to have a substation for each additional 10 EMU's using the network. The costings include the physical works for the grid connection.

These costings included the substation, grid connection (including upgrade allowance) as well as commissioning and isolation switches. It is expected that not all of the substations will require upgrading the wider power network, and that they can be built on KiwiRail or Greater Wellington owned land. The extent for wider network upgrades will fall out of the SSBC that looks at the required placement for the substations.

This rate has been applied uniformly for all substations required.

3.4 Other Projects

Projects such as the re-signalling and the Lower North Island Rolling Integrated Mobility have had costing estimates taken from the subsequent business cases. These were taken as is where possible, including contingency.

Station improvements and access planning rates were provided by GWRC and where no specific contingency was noted, a 30% contingency was assumed.

New crossovers were planned to be delivered as part of the maintenance programme, however, it was assumed that signalling changes would be done following the installation of several crossovers, not for each crossover installed to reduce multiple payments of the signal design and commissioning estimate.

Other project we're based on the same unit rates as the above discussed projects.

4 Base Unit Rates

Table 1 below outlines the base rates used in calculations. Rates were provided from a range of sources, including KiwiRail, GWRC and other projects the team had been involved in.

Table 1: Unit rates used in cost estimation

s7(2)(b)(ii)

[redacted]

s7(2)(b)(ii)

[redacted]

Cost estimates were broken into three key categories. Capital costs, network maintenance and service operation costs.

Capital costs were broken down into a further three sub-categories described below:

1. Below rail infrastructure, inclusive of all KiwiRail owned assets i.e. track, power supply and structures
2. Above rail infrastructure, inclusive of all Greater Wellington owned assets exclusive of rolling stock, i.e. amenity improvements to stations
3. Rolling stock, all physical rolling stock

Network maintenance consisted of all costs to keep the rail network operating in a safe manner.

Service operation costs consisted of all expenses to keep the public transport services running, inclusive of power, operator fees, EMU maintenance and planning costs.

5 Base, Expected and P95 Estimates

Using the unit rates noted earlier and the general methodology discussed earlier, an expected estimate for each major piece of work was calculated. Unit rates were then scaled up based on the expected difficulty, amount of rework, and an estimate into the share of 'unknown work' in addition to the base costed work to inform the base estimate. Quantities for the base estimate were informed by a range of sources and estimates. For example, the North South Junction tunnel length was informed by measuring an appropriate tunnel length from google maps, then using previous analysis to estimate the quantity of earthworks and double tracking required. Costs associated with stabling was developed at a unit rate of 50m of track, electrification per EMU required to be stabled, plus an allowance for altering signalling to provide for safe access to and from the new stabling areas.

The base estimate was converter to the expected estimate based on a high-level risk analysis of the project. Situations involving waterways or unknown consenting variables were assigned higher contingency. Where rates had been provided for maintenance, or extensions of 'business as usual' activities (such as station improvements), either the provided contingency was carried forward into the PBC or a lower rate of 20% was attributed. This was only done for projects with expected low-cost variations (such as the installation of cycle facilities at stations).

As discussed earlier, in line with the UK Department for Transport Optimism Bias Study, the funding risk contingency was assigned a minimum value of 64% of the base estimate. This was increased in areas where it was judged that there is a risk of a significant cost increase. Higher funding risk contingency was assigned to areas such as the Porirua Basin triple tracking where much of the work occurs near the Porirua Stream and there are unknown requirements about any consenting conditions which will need to be managed.

6 Cost Summary

As cost summary of the do-minimum and three shortlisted programmes is presented below for the expected and P95 cost ranges.

6.1 Do-Min Programme Cost Estimates

The expected costs for all expenses and the breakdown of capital costs for the Moderate Improvements programme in Table 2 and Table 3.

s7(2)(b)(ii)

[redacted]

6.2 Moderate Improvements Programme

The expected costs for all expenses and the breakdown of capital costs for the moderate improvements programme in Table 6 and Table 7.

s7(2)(b)(ii)

[redacted]

6.3 Mixed Focus Programmes

The expected costs for all expenses and the breakdown of capital costs for the mixed focus programme in Table 10 and Table 11.

s7(2)(b)(ii)

[redacted]

6.4 Drive Mode Shift Programme

The expected costs for all expenses and the breakdown of capital costs for the Drive Mode Shift programme in Table 14 and Table 15.

s7(2)(b)(ii)

[redacted]

Appendix A PBC Costing Summary

s7(2)(b)(ii)

[redacted]

Appendix B Drive Mode Shift Detail Cashflow

s7(2)(b)(ii)

[redacted]

Appendix C Cashflow Forecast All Programmes

s7(2)(b)(ii)

[redacted]

Appendix M Risk Matrix

Risk / Opportunity	Threat			Opportunity			Risk Owner	Mitigation	Residual Threat			Residual Opportunity		
	Likelihood	Consequence	Rating	Likelihood	Consequence	Rating			Likelihood	Consequence	Rating	Likelihood	Consequence	Rating
Demand:														
Covid-19 impacts travel patterns	5	3	HIGH	2	2	LOW	GWRC	Monitor public transport patronage and travel patterns; adjust timing of intervention implementation as needed.	5	3	HIGH	2	2	LOW
Population growth is away from / along rail corridors	3	4	HIGH	3	3	MEDIUM	GWRC	Support development that aligns with the Regional Growth Framework.	2	3	MEDIUM	3	3	MEDIUM
Population growth is below / above current expectations	3	3	MEDIUM	3	3	MEDIUM	GWRC	Monitor population growth against projections and adjust timing and outcomes as necessary.	3	3	MEDIUM	3	4	HIGH
Financial:														
Investment cashflow is not available when required	5	4	CRITICAL	N/A	N/A	N/A	GWRC / Waka Kotahi	Governance group to communicate with investing organisations and central government frequently so they understand cashflow requirements; prioritise the most impactful interventions; adjust intervention delivery timing as necessary.	4	4	CRITICAL	N/A	N/A	N/A
Investment required or investment sources are not available	4	4	CRITICAL	N/A	N/A	N/A	GWRC / Waka Kotahi	Governance group to communicate with investing organisations and central government frequently so they understand the investment requirements.	3	4	HIGH	N/A	N/A	N/A
Cost increases	3	4	HIGH	N/A	N/A	N/A	GWRC	Refine cost estimates of interventions as they are further developed through subsequent business cases; communicate changes to investors.	3	4	HIGH	N/A	N/A	N/A
Planning:														
Consenting delays or prevents outcomes	2	5	HIGH	N/A	N/A	N/A	GWRC	Involve planners and environmental specialists in projects early to identify and minimise potential consenting issues.	2	5	HIGH	N/A	N/A	N/A
Iwi concerns with required projects	2	5	HIGH	N/A	N/A	N/A	GWRC	Engage with tangata whenua early and work collaboratively to develop solutions.	2	5	HIGH	N/A	N/A	N/A
Heritage concerns delay or prevent outcomes	4	2	MEDIUM	2	2	LOW	GWRC	Engage with relevant organisations and the local community early and work collaboratively to develop solutions.	3	2	MEDIUM	3	2	MEDIUM
Subsequent business cases indicate some elements of the programme are not affordable	2	4	MEDIUM	N/A	N/A	N/A	GWRC	Implement alternative interventions that achieve similar outcomes but are economically justified where possible.	2	4	MEDIUM	N/A	N/A	N/A
Policy levers change (e.g. congestion charging, Zero Emissions)	2	2	LOW	1	5	HIGH	GWRC / TLA / Waka Kotahi	Implement policy levers that encourage and support sustainable transport and a low-carbon future.	2	2	LOW	2	5	HIGH
Let's Get Wellington Moving enhances public transport south of Wellington Station	N/A	N/A	N/A	4	3	HIGH	LGWM	Work with LGWM to ensure the two programmes are coordinated and integrated.	N/A	N/A	N/A	5	4	CRITICAL
Delivery:														
Long lead times delay the delivery of outcomes	4	4	CRITICAL	N/A	N/A	N/A	GWRC	Educate investors about the long lead times associated with rail projects; commence planning and procurement early.	3	4	HIGH	N/A	N/A	N/A
Delays due to interdependencies of programme elements	3	4	HIGH	N/A	N/A	N/A	GWRC	Communicate with lead organisations to minimise potential knock-on effects; carefully select governance group members to establish a champion of RRP projects within partner organisations.	3	4	HIGH	N/A	N/A	N/A
Market capability and capacity delay delivery	3	4	HIGH	N/A	N/A	N/A	GWRC	Consider the timing of other major projects when timing the delivery of interventions; understand supplier availability by requesting expressions of interest.	2	4	MEDIUM	N/A	N/A	N/A
Partner organisations do not prioritise delivery of programme elements	2	4	MEDIUM	N/A	N/A	N/A	GWRC	Communicate with delivery lead organisations periodically to ensure they understand the importance of delivery to the Wellington region; carefully select governance group members to establish a champion of RRP projects within partner organisations.	2	4	MEDIUM	N/A	N/A	N/A
General:														
Road investment reduces rail patronage	3	4	HIGH	N/A	N/A	N/A	Waka Kotahi	Prioritise investment and delivery of sustainable transport modes.	3	4	HIGH	N/A	N/A	N/A
Large scale natural hazard events occur	1	5	HIGH	N/A	N/A	N/A	GWRC	Incorporate climate change mitigation and adaption into interventions where appropriate; design elements that enable recovery from major events.	1	5	HIGH	N/A	N/A	N/A
Policy change: overall government direction	3	3	MEDIUM	3	4	HIGH	GWRC / Waka Kotahi	Scale interventions up/down and adjust delivery timing if required after changes of government, but ensure programme continuity.	3	3	MEDIUM	3	4	HIGH
Public perception and reputational risk	3	3	MEDIUM	2	3	MEDIUM	GWRC	Engage with the public and local communities and work collaboratively to develop solutions; communicate with the public and be realistic so they understand the expected timing, disruptions and benefits of projects.	3	3	MEDIUM	2	3	MEDIUM
Regulation changes affect timeframes, cost or outcome	3	3	MEDIUM	N/A	N/A	N/A	GWRC	Be aware of potential regulatory changes and adjust programme timing and costs as needed.	3	3	MEDIUM	N/A	N/A	N/A
Climate change happens more quickly / severely than predicted	3	2	MEDIUM	N/A	N/A	N/A	GWRC	Be aware of the potential need to accelerate the programme if climate change adaption measures are required earlier than expected, or if additional investment for sustainable transport is made available earlier than expected.	3	2	MEDIUM	N/A	N/A	N/A
Freight volumes increase sooner than anticipated	3	2	MEDIUM	2	3	MEDIUM	KiwiRail	Monitor freight volumes with reference to projections; bring forward delivery of interventions if required.	2	2	LOW	2	3	MEDIUM

Key	Likelihood	Consequence
1	Rare	Insignificant
2	Unlikely	Minor
3	Possible	Moderate
4	Likely	Severe
5	Almost Certain	Extreme

NZ Transport Agency Threat & Opportunity Risk Matrix												
		Threat					Opportunity					
		Insignificant	Minor	Moderate	Severe	Extreme	Extreme	Severe	Moderate	Minor	Insignificant	
Likelihood	Almost Certain	LOW	MEDIUM	HIGH	CRITICAL	CRITICAL	CRITICAL	CRITICAL	HIGH	MEDIUM	LOW	Almost Certain
	Likely	LOW	MEDIUM	HIGH	CRITICAL	CRITICAL	CRITICAL	CRITICAL	HIGH	MEDIUM	LOW	Likely
	Possible	LOW	MEDIUM	MEDIUM	HIGH	CRITICAL	CRITICAL	HIGH	MEDIUM	MEDIUM	LOW	Possible
	Unlikely	LOW	LOW	MEDIUM	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM	LOW	LOW	Unlikely
	Rare	LOW	LOW	LOW	LOW	HIGH	HIGH	LOW	LOW	LOW	LOW	Rare
		Insignificant	Minor	Moderate	Severe	Extreme	Extreme	Severe	Moderate	Minor	Insignificant	
		Consequence										

Table 4.6 NZ Transport Agency Threat and Opportunity Risk Matrix

CREATING COMMUNITIES

Communities are fundamental. Whether around the corner or across the globe, they provide a foundation, a sense of belonging. That's why at Stantec, we always **design with community in mind**.

We care about the communities we serve—because they're our communities too. We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

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