LOWER NORTH ISLAND LONGER-DISTANCE ROLLING STOCK BUSINESS CASE

PREPARED FOR GREATER WELLINGTON REGIONAL COUNCIL

26 September 2019

Stantec

QUALITY STATEMENT

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REVISION SCHEDULE

Rev No.	Date	Description	Authorisation			
			Prepared by	Checked by	Reviewed by	Approved by
1	27/07/18	First Draft Final	DW, AL	JW	JW	DW
2	24/10/18	Updated First Draft Final	DW	JW	JW	DW
3	05/08/19	Revised Draft Final (Sustainable Transport Committee)	DW	DW	PP	DW
3	20/08/19	Updated Revised Draft Final	DW	DS	PP	DW
4	26/09/19	Amended Draft Final	DW	DW	PP	DW

Executive Summary

Introduction

This business case has been prepared by Stantec New Zealand and Greater Wellington Regional Council (GWRC), with input from key stakeholders including KiwiRail, Transdev, Horizons Regional Council and the NZ Transport Agency (NZTA), and economic peer review by Transport Futures Limited. It assesses the case for replacing the rolling stock fleets that provide longer-distance rail passenger services on the Wairarapa and Manawatu lines, and using the replacement fleet to improve service levels and increase the overall capacity of GWRC's Metlink rail network to address serious and urgent capacity constraints. It follows a 2017 business case that assessed the case for continued short-term public investment in the Palmerston North-Wellington rail passenger service, and two 2017 infrastructure-focused business cases that assessed the case for catch-up track renewals and capacity and resilience enhancements on the Wellington metro rail network, which includes the Wairarapa Line and the southern end of the Manawatu Line. These will be supported by and incorporated into a new Wellington Regional Rail Plan (WRRP), which is currently under development.

Background

The Wairarapa and Manawatu lines are an established, integral and well-utilised component of the lower North Island transport system. They serve areas that are experiencing significant ongoing population growth, which is forecast to continue in the future, and the longer-distance services that operate on the lines fulfil very important transport system access and capacity roles.

The Wairarapa Line links Masterton and Wellington. It is one of only two transport links between the Wairarapa sub-region and the rest of the Wellington region, and it has a critical role connecting Wairarapa residents to many employment, educational and other opportunities and services that are not available locally. Its direct route under the Remutaka Range is safer, more efficient and more resilient than parallel State Highway 2, which crosses the range via a steep, winding and narrow route that is very busy at peak times and has a high crash risk, low average speed and susceptibility to weather-related closure. Rail passenger services on the line consequently have an important road substitute role and a high mode share of commuting trips, including a very high 60% share of trips to the Wellington CBD, which is around half of the journey to work trips between Wairarapa and the entire Wellington region. This provides consequent congestion, parking and environmental benefits in the Hutt Valley and Wellington city. Wairarapa Line services also provide access and vital extra capacity to supplement the electrified metro rail services in the Hutt Valley, where they are an integral part of the rail service offering.

The Wairarapa Line is operated as part of the Metlink public transport network. It is currently served by three peak direction services in each weekday peak, two weekday off-peak services in each direction, an additional service in each direction on Friday nights, and two in each direction on weekend days. These carried approximately 625,000 peak passengers and 154,000 off-peak passengers in the 2019 financial year. Peak services are close to capacity, and changes were made to carriage allocation to provide short term relief on the most-crowded afternoon service in April 2019. Further options to improve asset utilisation are being investigated but are limited.

Wairarapa Line services are provided by a mixed fleet of conventional locomotive-hauled rolling stock consisting of two types of rebuilt ex-British Rail carriages that date from the 1970s. GWRC is about to commence a light mid-life refurbishment of both types, which will extend the carriages' life to the mid-2020s. This could be expanded to allow the fleets to remain in service for a longer period if required. All carriages will be life-expired and require replacement by 2032.

The Manawatu Line links Palmerston North and Wellington. It serves a large catchment in the northwest of the Wellington region and south of the Horizons region, and connects residents to many employment, educational and other opportunities and services that are not available elsewhere on the corridor. Services also provide vital extra capacity to supplement the electrified metro rail services south of Waikanae. The line parallels State Highway 1 for much of its length, which carries large traffic volumes and is geographically constrained, making it vulnerable to congestion and resilience events. The road is currently being upgraded to expressway to north of Otaki, which is expected to both alleviate these problems along some of the corridor in the short to medium term and increase population and general transport demand on the corridor.

The Manawatu Line is currently served by the Capital Connection, a weekday commuter train operated by KiwiRail, which runs a single peak direction service in each weekday peak. This carried approximately

134,000 passengers in the 2019 financial year and is increasingly operating at capacity on some days of the week. Capacity is constrained by rolling stock availability and cannot be increased.

Manawatu Line services are provided by a fleet of conventional locomotive-hauled rolling stock, similarly to the Wairarapa Line. Although the Manawatu Line carriages were rebuilt from the same 1970's-era ex British Rail carriage source as the Wairarapa Line carriages, they differ from and are incompatible with them. Critically, the carriages are close to the end of their service life and require either extensive refurbishment or replacement prior to mid-2021 to enable continued operation of services after that point. A decision on whether to proceed with refurbishment will be required within six months.

Regional and National Context

Investment in longer-distance rail passenger rolling stock, and reliability, capacity, frequency and journey time improvements is foreshadowed and supported by Wellington and Horizons transport plans and supported by spatial planning and regional economic development programmes in both regions.

Regional Land Transport Plans (RLTPs) are especially relevant as they provide the strategic context and investment programme for land transport (including public transport) in each region. Both RLTPs prioritise investment in the improvements noted in this business case. Both RLTPs are also due for review, which is timely as this business case can be used to confirm the investment programme for rail long distance rail in both regions.

Regional Public Transport Plans (RPTPs) are also integral to this discussion. The existing Wellington RPTP sets out the key elements of the existing WRRP, including Rail Scenario 1 with a focus on unlocking capacity across the network. This business case builds on current initiatives and foreshadows longer term ideas and plans to increase supply. As with the reviews of RLTPs, the current review of the WRRP and upcoming reviews of both RPTPs provide an ideal opportunity to set out the key delivery components of this business case in much greater detail.

Investment in improvements is consistent with the NZTA's strategic view and investment priorities for each corridor in both regions, where the rail modal option is seen as being an important component of the multi-modal transport mix. It is also consistent with the Government's higher-level land transport priorities as expressed in the Government Policy Statement on Land Transport, addressing objectives associated with the key 'Access' strategic priority, which commits to increased investment in urban and inter-regional public transport in both peak and off-peak periods, and the supporting 'Environment' strategic priority, which commits to increased investment in lower emission modes of transport such as public transport. Investment in longer-distance rolling stock and services achieves these objectives by enhancing connectivity, capacity, reliability and resilience at several critical points on the network, on existing commuter rail services that support housing and employment and, in the case of the Wairarapa Line, are close to capacity. Investment in rail services that are at capacity or support housing and employment is a specific GPS focus.

Investment in improvements is also likely to meet all key requirements for the Provincial Growth Fund (PGF), including sustainable economic development, social inclusion and participation, climate change and environmental sustainability, and resilience objectives. The Horizons Region and Wairarapa and Kapiti areas of the Wellington Region are eligible for PGF funding.

Problem Definition

A stakeholder assessment at an October 2017 workshop found that there are three clear problems associated with the existing longer-distance rail rolling stock fleet, which need to be addressed with some urgency. These relate to train condition, fleet capacity, and operational (in)efficiencies.

Train Condition

All existing longer-distance rail rolling stock dates from either the early 1970s (carriages) or late 1970s (luggage / generator vans). Although all have been subsequently rebuilt to varying degrees and are equipped to current amenity and safety standards, the bulk of the fleet is now approaching 50 years in age and nearing the end of its service life.

The Manawatu Line carriages are of most concern. These have been in continuous post-rebuild service for nearly 20 years and increasing age-related maintenance costs are reflected in a current [redacted] million short-term funding gap. The carriages will either require full refurbishment at an estimated cost of [redacted] million, replacement, or withdrawal from service prior to mid-2021. This timeframe places some urgency on an investment decision and subsequent implementation of the chosen option.

The Wairarapa Line carriages are less of an immediate concern. However, they are looking increasingly tired due to their heavy use, are increasingly unable to cope with demand, and several components are

approaching end of life. GWRC is about to commence a light mid-life refurbishment, which will enable them to continue operating until the mid-2020s as previously noted, but a more extensive refurbishment to enable them to operate until 2032 will be avoided if they are replaced at that point.

Fleet Capacity

Wairarapa Line patronage has grown substantially over the last decade, increasing by 15% to 780,000 boardings in the decade ending in the 2019 financial year. Peak patronage increased by 24% over the same period, and it has been close to or greater than seated capacity over much of the decade, despite the introduction of additional capacity in 2013. Figure 1-1 shows that peak services are again approaching seated capacity and indicates that crowding can be expected to become an increasing problem unless significant capacity improvements are made to cater for future demand, particularly if the recent four-year average annual peak growth rate of 3.3% is sustained. This rate is well above the current forecast.

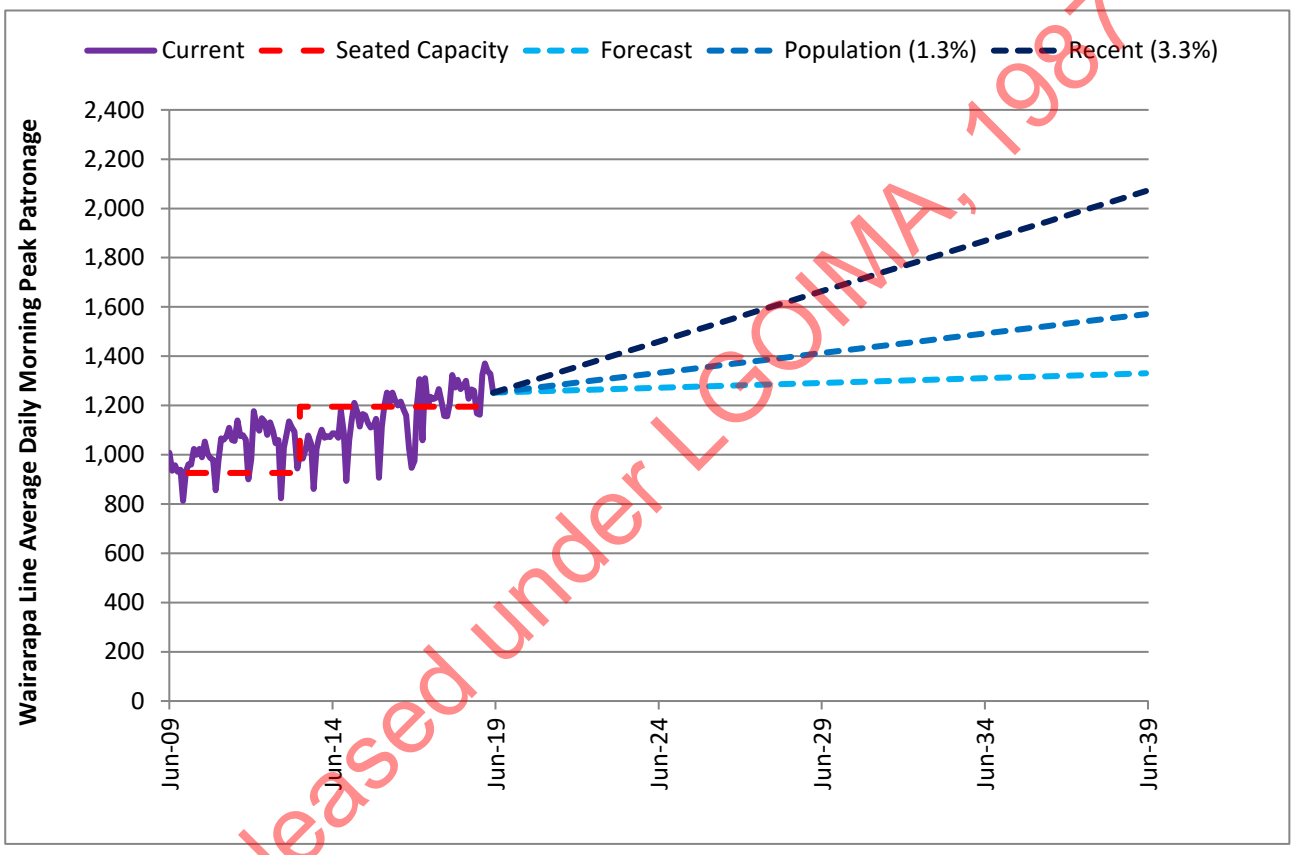

Figure 1-1: Wairarapa Line morning peak patronage and projected demand

Manawatu Line patronage fluctuated over the decade ending in the 2019 financial year, reflecting the impact of electrification of the Paraparaumu-Waikanae section of the Kapiti Line in early 2011, the existing service's low frequency, worn rolling stock and uncertain future, and fare increases necessitated by its commercial nature. However, traffic congestion and increased urban development and population growth are again driving strong patronage growth, resulting a recent four-year average annual growth rate of 3.1%. The existing service carried 136,000 passengers in the 2019 financial year and is increasingly operating at capacity on some days.

Patronage on the electrified Hutt, Johnsonville and Kapiti Lines has grown substantially over the last decade, similarly to the Wairarapa Line, increasing by 21% to 13.5 million boardings in the 2019 financial year. This growth reflects population growth on the corridors that the lines serve, and investment in improvements in infrastructure, rolling stock and services that have improved service quality, frequency and reliability, including the complete replacement of the previous obsolete electric fleet by the new Matangi fleet between 2010 and 2016.

Electrified area patronage growth has been most significant at the peak, with Hutt Line, Johnsonville Line, and Kapiti Line average daily morning peak patronage increasing by 16%, 11% and 29% respectively

between mid-2009 and mid-2019. Figure 1-2 shows that the peak period increase has been most acute since mid-2015, reflecting similar trends to the Wairarapa and Manawatu lines since that point, and it indicates that capacity improvements are likely to be required to cater for future demand, particularly if recent the recent four-year average annual peak growth rate of 5.5% is sustained. This rate is well above forecast.

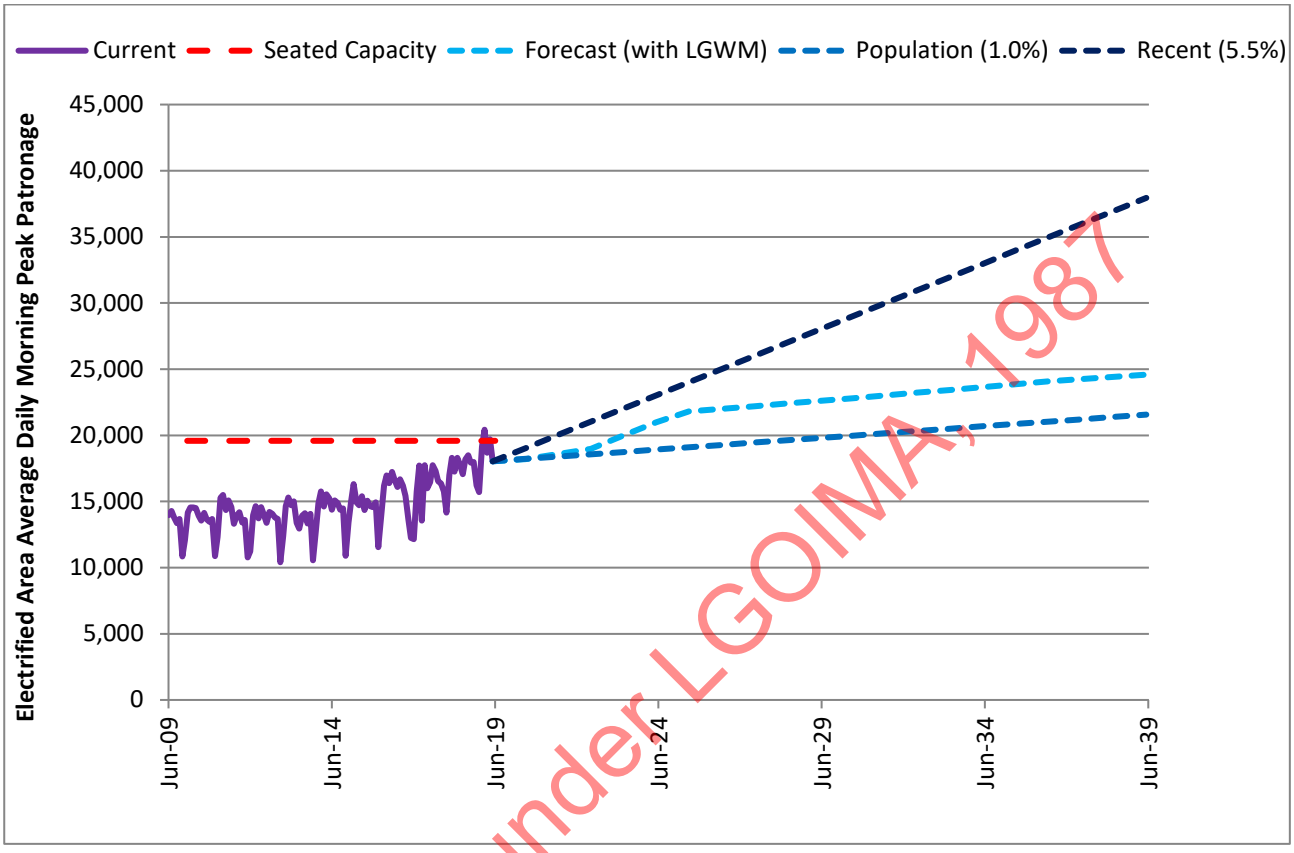

Figure 1-2: Electrified area morning peak patronage and projected demand

Figure 1-3 shows that the capacity issue is particularly acute between 7:30 and 8:30, where ideal capacity could be exceeded by 2024, and standing capacity by 2029, if there are no further initiatives beyond proposed RS1 timetable changes, which will maximise utilisation of the Matangi fleet once associated infrastructure is in place. This will require additional peak capacity if crowding and mode shift away from public transport is to be avoided.

Rolling stock lead times place urgency on resolution of this problem, but a small metro EMU order is expected to be unattractive to rolling stock manufacturers. However, there is an opportunity to address this capacity issue efficiently and promptly through resolution of the longer-distance capacity issue, since longer-distance services are an integral part of the metro service offering and are already used to provide much needed capacity within the electrified area.

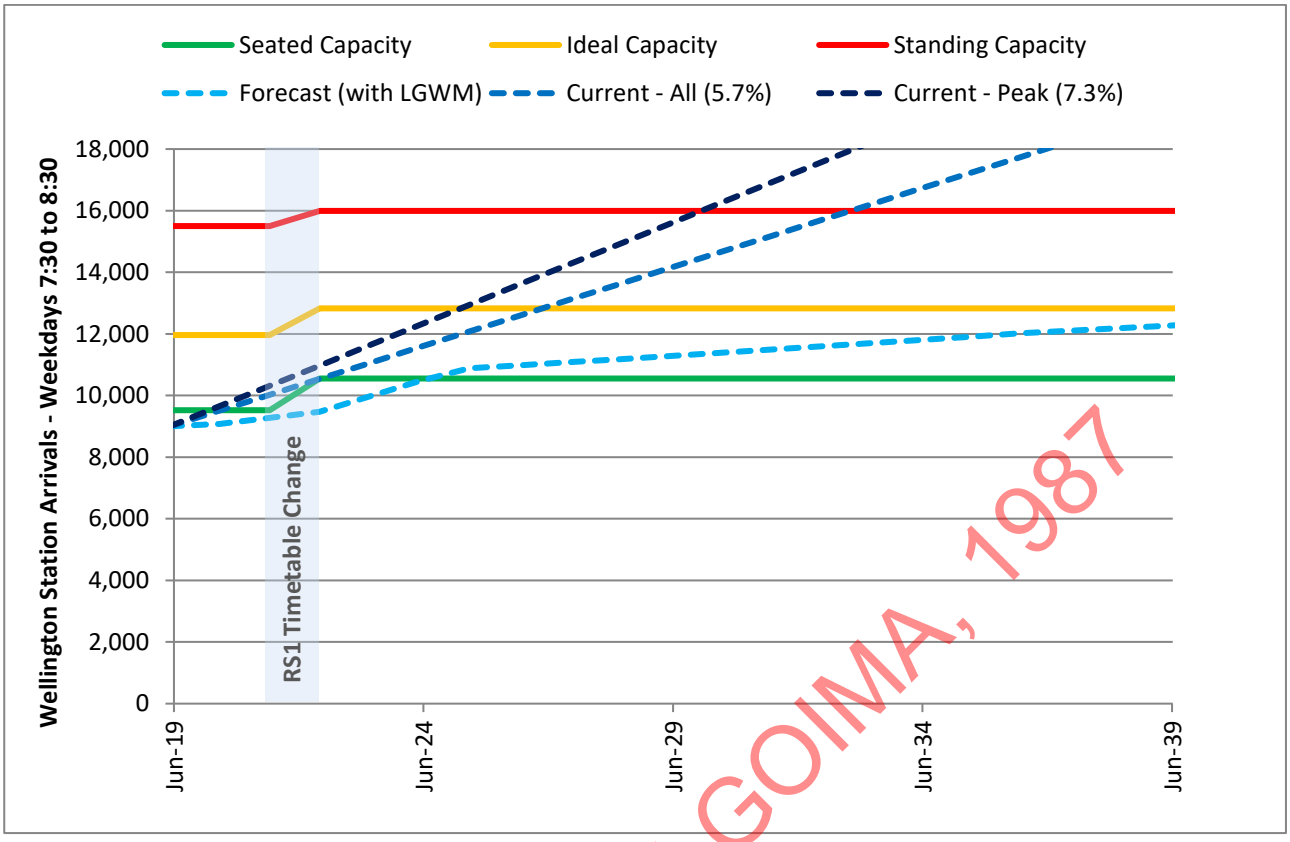

Figure 1-3: Projected Wellington Station morning peak hour demand and capacity (all Metlink lines)

Operational Efficiencies

The Wairarapa and Manawatu lines are run as separate operations, which is inflexible and inefficient. There is no ability to manage operations between the two lines, nor is there the ability to manage rolling stock fleet allocation and maintenance in an effective way. Maintenance is further complicated by a complex set of contractual relationships.

The mixed rolling stock fleet of three different and incompatible carriage types across the two lines is also an issue. This limits interoperability and does not provide the economies of scale that might be available if the fleet was composed of a single type.

Existing services on both lines are locomotive hauled and consequently expensive to operate. The locomotives require special safety features that limits the pool that are available run services, which in turn necessitates extras to provide redundancy to cover failures, increasing fleet requirements. The locomotive hire cost is consequently a sizeable proportion of the cost of running services on both lines and the cost of providing additional services is therefore high.

Locomotive-hauled trains are also very operationally limiting. They require long turnaround times that are a considerable constraint, particularly in Wellington where there is conflict with other services that limits the efficient operation of all services at peak times, and they are consequently a barrier to frequency enhancements that might otherwise help to address capacity issues. The locomotive turning requirement also necessitates that two locomotives must be used instead of one when a train runs for only part of a line's length, which has consequent cost impacts.

Benefits of Investment

A stakeholder assessment found that investing to address the problems is expected to provide four major benefits: enhanced regional connectivity, improved rail service quality, a more resilient transport network, and investment value for money. These benefits link closely to the objectives of key central and local government strategies and plans, and provide strategic justification for investing in a rolling stock solution, as summarised in Table 1-1.

Table 1-1: Links between investment benefits and relevant strategies and plans

	Enhanced Regional Connectivity	Improved Rail Service Quality	More Resilient Transport Network	Value for Money
Wellington Regional Rail Plan	✓	✓	✓	✓
Wellington Regional Public Transport Plan	✓	✓	✓	✓
Wellington Regional Land Transport Plan	✓	✓	✓	✓
Wairarapa Economic Development Strat	✓	✓		
Horizons Regional Public Transport Plan	✓			✓
Horizons Regional Land Transport Plan	✓	✓	✓	✓
Horizons Accelerate25 Growth Programme	✓		✓	✓
NZTA Long Term Strategic View	✓	✓	✓	✓
NZTA Investment Proposal	✓	✓	✓	✓
Govt Policy Statement on Land Transport	✓	✓	✓	✓
Provincial Growth Fund	✓		✓	✓

Enhanced Regional Connectivity

Investment will maintain existing connectivity into the future and then further strengthen it if used to improve capacity and service levels in the growth areas served by the two lines. This will improve liveability and quality of life and help to drive local economic activity and growth in the areas served by them, as identified in the regional economic development plans. Additional capacity will also strengthen the capacity of Metlink's core electrified rail corridors by providing additional capacity and travel options at key stations, helping to manage connectivity on those lines as demand increases.

Improved Rail Service Quality

Investment will ensure that the services remain running and running reliably into the future, that they can cope with current and ongoing growth, and that they remain attractive to and a preferred choice for users, the majority of whom spend two to four hours a day travelling by train.

More Resilient Transport Network

Investment will offer transport system-level resilience benefits by providing a modal and route alternative to the road network, and public transport network-level resilience benefits by utilising a different power source from the electrified network if the chosen option does not solely rely on an overhead power source. This benefit will be enhanced if the fleet can be managed between the two lines to allow resilience-related capacity issues to be managed.

Value for Money

Direct value for money benefits from investment are likely to come from the elimination of some impending heavy maintenance, maintenance and operational economies of scale, and if chosen in an option, from replacement of locomotive haulage with a more-efficient motive power source. These would allow the same level of service to be provided at lower cost, or more service to be provided at the same level of investment, with either scenario providing better value for money than at present.

Value for money will also be provided at the public transport network level, by allowing patronage growth to be accommodated without requiring other additional capacity, and transport system level, by allowing transport system growth to be accommodated without additional road capacity. Figure 1-4 shows how investment in an expanded longer-distance rolling stock fleet and associated services might address the morning peak hour capacity issue shown in Figure 1-3, delaying the requirement for additional EMU capacity until the Matangi fleet is replaced and so offering network level value for money.

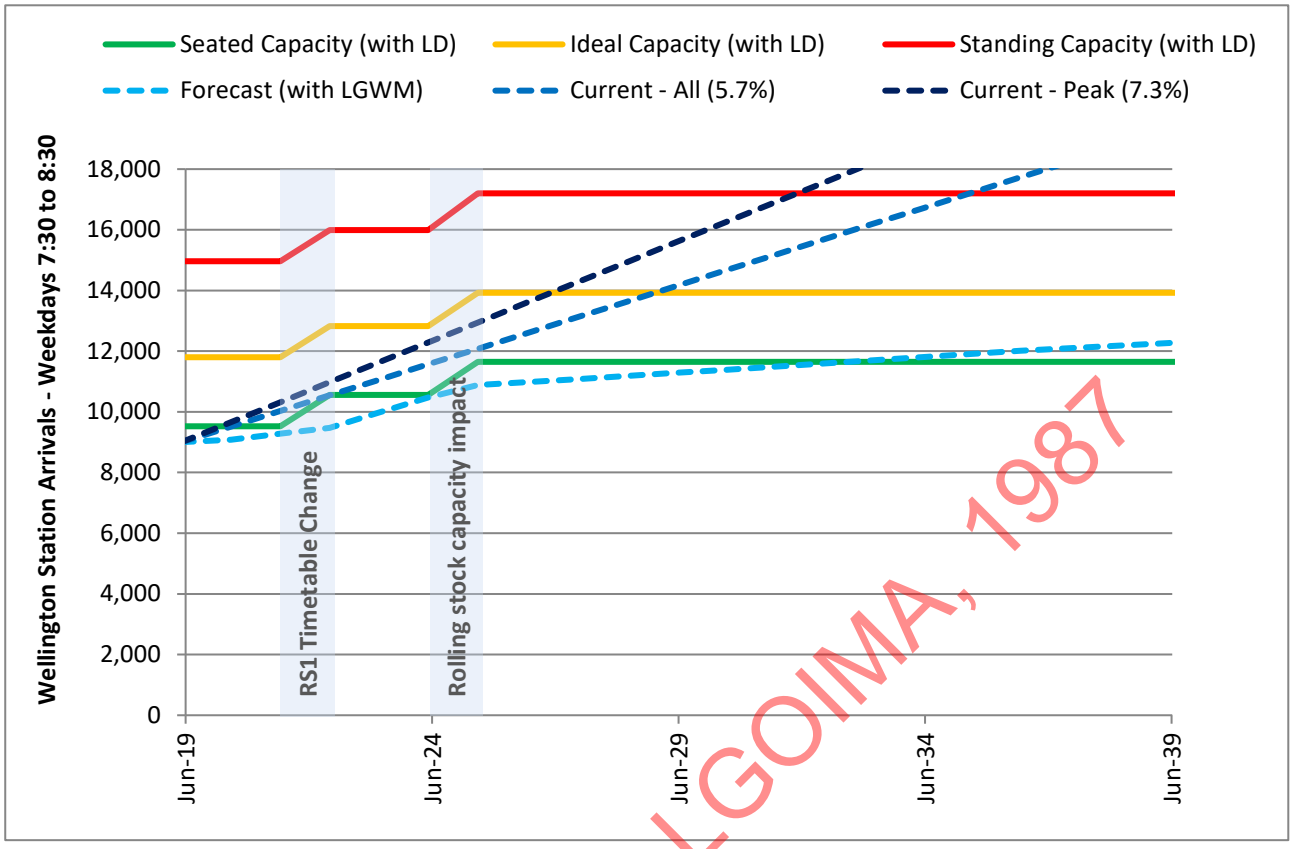

Figure 1-4: Projected Wellington Station morning peak hour demand and extra capacity (all Metlink lines)

Finally, value for money may be gained from joint procurement of a replacement fleet with other regions and/or the ability the use a new Wellington fleet to run trials in other parts of the country.

Option Selection

Six investment options have been identified from a long list of sixteen potential mode/fleet and nine potential service level responses by stakeholders. These are:

- Option 1: maintain the existing Wairarapa Line fleet and services and allow Manawatu Line services to cease operating (the do-minimum option);
- Option 2: improve the Wairarapa Line fleet and service levels by purchasing additional used rolling stock and maintain the existing Manawatu Line fleet and service levels (the enhanced status quo option);
- Option 3: electrify to Featherston and Otaki, extend electric multiple unit (EMU) operations to those points and improve service levels, with bus connections from outer points;
- Option 4: replace existing fleets with a diesel multiple unit (DMU) fleet at the earliest opportunity and improve service levels;
- Option 5: replace existing fleets with a dual-mode multiple unit (DMMU) fleet at the earliest opportunity and improve service levels; and
- Option 6: electrify to Masterton and Palmerston North, extend EMU operations to those points at earliest opportunity and improve service levels.

Figure 1-5 summarises and compares the timing (financial year) and level of service provided by the operational elements of the options.

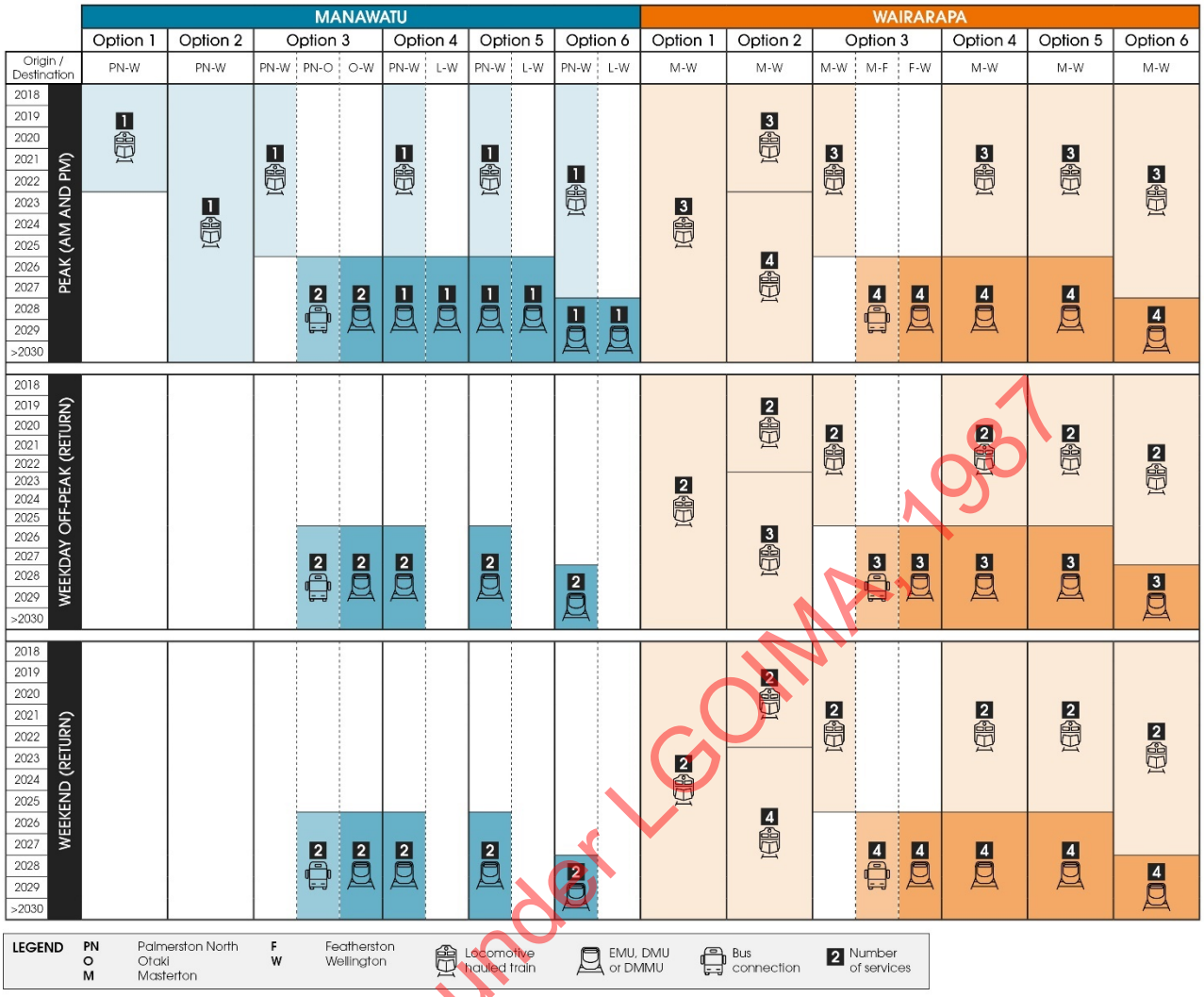

Figure 1-5: Summary of the timing and level of service provided by each option at key periods

The options have been assessed against the assessment framework shown in Table 1-2, which consists of:

- Four investment objectives identified by stakeholders, which show the options' likely response to the problems and benefits relating to service capacity, customer satisfaction, operational flexibility (which includes resilience) and whole of life costs;
- Seven critical success factors identified by stakeholders, which are essential to the successful implementation of any option, relating to strategic alignment, affordability – capital costs, affordability – operational costs, technical achievability, resilience, environmental sustainability, and public acceptability (which includes timeframe and environment); and
- Four option characteristics, which allow the options to be compared further, relating to indicative cost, indicative economics, implementation timeframe, and key risks.

The DMU and DMMU options have been found to be best performing across all three aspects of the assessment. The DMU option is more affordable and provides a slightly better economic return, but the DMMU option best meets the scored assessment criteria, with better scores against the investment objectives and crucial Strategic Alignment critical success factor. The DMMU option is consequently ranked ahead of DMU, although both options are viable.

Table 1-2: Option assessment summary

	Weighting	Option 1: Maintain Wairarapa Fleet	Option 2: Maintain & Boost Existing Fleets	Option 3: Partial EMU Fleet	Option 4: New DMU Fleet	Option 5: New DMMU Fleet	Option 6: Full EMU Fleet
Investment Objectives							
Increase service capacity	25%	L	M	M	H	H	H
Improve customer satisfaction	15%	L	L	L	H	H	H
Maximise operational flexibility	10%	L	L	L	M-H	H	M
Minimise whole of life costs per passenger[1]	10%	H	M	M-H	H	H	L
Critical Success Factors							
Strategic alignment	10%	L	L-M	M	M-H	H	M-H
Affordability - capital	5%	H	M	M	M	M	L
Affordability - operational	5%	H	L-M	M-H	M	M	M
Technical achievability	5%	H	H	H	H	M-H	H
Resilience	5%	L	M	M-H	H	H	M-H
Environmental sustainability	5%	L	L	M	L-M	M-H	H
Public acceptability	5%	L	L-M	L	M	M-H	M
Characteristics[2]							
Indicative 30-year net cost over do-minimum (2018 $m)		-	$227 - $386	$200 - $364	$176 - $343	$202 - $381	$454 - $754
Indicative 30-year BCR over do-minimum[3]		-	0.9 - 2.2	0.9 - 2.2	1.2 - 3.3	1.1 - 2.9	0.5 - 1.2
Indicative 60-year BCR over do-minimum		-	1.1 - 3.1	1.1 - 3.3	1.4 - 5.0	1.3 - 4.2	0.7 - 2.0
Indicative implementation timeframe		13 years	3 years	7 years	7 years	7 years	9 years
Key Risks		Environment Resilience Customer Growth	Environment Resilience Customer Growth	Complexity Resilience Customer Growth	Environment	Technology	Cost Infrastructure
MCA score	100%	2.0	2.3	2.7	4.4	4.7	3.9
Overall Ranking		6	5	4	**2**	**1**	3

[1] Based on the discounted net cost per passenger over a 60-year assessment period.
[2] Costs, benefits and BCR ranges are based on 80% of the modelled costs and high patronage and revenue growth (see Section 5.4.1), 120% of costs and low growth, and a 4% discount rate.
[3] BCRs are indicative high-level 'first cut' BCRs, which were used to test the options at the option selection stage. They differ from those that support the recommended option, which were the result of detailed analysis of benefits and costs.

Recommended Option

The investment proposal entails the replacement of all existing longer-distance rail rolling stock with a fleet of 15 four-car DMUs or DMMUs, which will be owned by GWRC and enter service in the 2025 financial year. The new rolling stock will operate all services on the Wairarapa and Manawatu lines, which will run at improved frequencies to provide better access and capacity between Masterton/Palmerston North and Wellington, including much needed additional capacity at key stations within the electrified area. Supporting improvements will be made to maintenance facilities, stations and network infrastructure. Existing rolling stock will be maintained in acceptable operating condition until the introduction of the new rolling stock and then be retired.

The DMMU option is the primary preferred and recommended option due to its better alignment with the investment objectives and key success factors. A detailed assessment has found that this has:

- medium growth 30-year discounted benefits of $551.7m compared to costs at the same level of $291.2m, and a projected BCR range of 1.3 to 2.6 (compared to a DMU BCR range of 1.5 to 3.0); and
- a higher BCR range of 2.2 to 4.1 (compared to a DMU BCR range of 2.5 to 5.1) if the cost of network infrastructure, which is required to restore infrastructure that was previously removed and catch up for past underinvestment, is excluded.

Assessment against the NZTA's 2018-21 Investment Assessment Framework gives a recommended results alignment rating of Very High and a BCR rating of Low, which give both options a priority order rating of 1, the highest priority for NLTP funding. The Very High rating relates to the ongoing improvement in access that the investment proposal enables for large numbers of passengers on the Wellington region's main northern corridors.

GWRC would lead implementation and be responsible for procuring the new DMMU rolling stock fleet and station-related infrastructure improvements, along with overall programme management. GWRC would also be responsible for long-term operation of services on both lines, including Manawatu Line services, which would be incorporated into its existing rail contract and operated on behalf of HRC north of the regional boundary. KiwiRail would be responsible for network-related infrastructure improvements in accordance with the Metropolitan Rail Operating Model. Key risks around timeframe, funding, KiwiRail's commercial interests, costs and revenue would be managed through the project management process and contractual mechanisms.

The investment proposal includes expected project capital expenditure of $415.3m, with a [redacted] confidence estimate of $449.2m. It is proposed that network infrastructure will be funded by the NZTA at a [redacted] FAR, rolling stock, maintenance facility and station improvements receiving a special [redacted] FAR, and ongoing maintenance and operations receiving a standard [redacted] FAR. Cost and revenue will be shared between GWRC and HRC based on the share of vehicle service km in each region. An urgent funding decision is required to enable the specification and procurement process to commence in mid-2020 and ensure that sufficient capacity is in place when required to meet projected demand pressures, given the long lead times for rolling stock and supporting infrastructure.

In conclusion, the investment proposal has been shown to clearly respond to significant problems and offer significant benefits to the lower North Island. These link closely with national transport and economic development priorities and provide a strong case for investment. It is therefore recommended that investment decision makers:

- approve this proposal to replace existing Wellington longer-distance rail rolling stock with a fleet of 15 four-car dual-mode DMMU units, and associated infrastructure and service enhancements;
- approve funding through appropriate channels at appropriate FAR rates by June 2020; and
- prioritise these approvals, to allow project planning to commence and enable the new rolling stock to be brought into service in the 2025 financial year and service improvements to be implemented the following financial year.

Decision Sought

- Agree that Option 5 - replace existing fleets with a dual-mode multiple unit fleet at the earliest opportunity and improving service levels once the fleet is in place is the best outcome for this business case;

- Agree funding of the preferred option's capital investment of $415.3m (or the [redacted] confidence estimate of $449.2m), fully or partially co-funded through the NLTP at a full FAR (network infrastructure) and special FAR rate (other capital investment), or potentially through another source such as the PGF, subject to funding approval;
- Agree that GWRC procure and deliver the new DMMU rolling stock fleet and above-track infrastructure, along with overall programme management; and
- Agree that KiwiRail to procure and deliver network infrastructure-related improvements
- Confirm funding arrangements by June 2020, to enable specification, design and procurement processes to commence immediately and ensure that the rolling stock is in place when required to help manage demand.

Abbreviations

DMMU	Dual Mode Multiple Unit
DMU	Diesel Multiple Unit
EDMU	Electro-Diesel Multiple Unit
EEM	Economic Evaluation Manual
EMU	Electric Multiple Unit
FAR	Funding Assistance Rate
FY	Financial Year
GPS	Government Policy Statement on Land Transport
GWRC	Greater Wellington Regional Council
HRC	Horizons Regional Council
LGWM	Let's Get Wellington Moving
LTMA	Land Transport Management Act
MOT	Ministry of Transport
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NZRP	New Zealand Rail Plan
NZTA	New Zealand Transport Agency
PGF	Provincial Growth Fund
RGF	Regional Growth Framework
RIC	Rail Infrastructure Consultants
RLTP	Regional Land Transport Plan
RPTP	Regional Public Transport Plan
RNIP	Rail Network Investment Plan
RS1	Rail Scenario 1
TAIP	Transport Agency Investment Proposal
WMUP	Wellington Metro Upgrade Programme
WRRP	Wellington Regional Rail Plan

Greater Wellington Regional Council

Lower North Island Longer-Distance Rolling Stock Business Case

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1. Introduction

This business case has been prepared by Stantec New Zealand and Greater Wellington Regional Council (GWRC), with economic peer review by Transport Futures Limited. It assesses the case for replacing the rolling stock fleets that provide longer-distance rail passenger services on the Wairarapa and Manawatu lines, which are nearing end of life, and using the replacement fleet to improve service levels and increase the overall capacity of GWRC's Metlink rail network to address serious and urgent capacity constraints. It follows a 2017 business case that assessed the case for continued short-term public investment in the Palmerston North-Wellington rail passenger service, and two 2017 infrastructure-focused business cases that assessed the case for catch-up track renewals and capacity and resilience enhancements on the Wellington metro rail network, which includes the Wairarapa Line and the southern end of the Manawatu Line. These will be supported by and incorporated into a new under-development Wellington Regional Rail Plan (WRRP), which will provide a future investment pathway for the Metlink network.

The business case takes the form of a single-stage business case following the NZ Transport Agency (NZTA) Business Case Approach. It therefore combines elements of the activity Strategic, Indicative and Detailed business cases into a single document, which has the following structure:

- Chapter 2 describes the strategic context;
- Chapter 3 presents the strategic assessment, which combines with the strategic context to form the Strategic Case;
- Chapter 4 assesses the option selection process that forms the basis of the Indicative Case; and
- Chapter 5 details the recommended option, completing the overall Detailed Case for investment.

The business case has been developed collaboratively by stakeholders. These include GWRC, which has a key interest as the organisation that is responsible for planning and funding public transport in the Wellington Region, Horizons Regional Council (HRC), which is responsible for planning and funding public transport in the Horizons Region (Manawatu-Whanganui), and the NZTA, which has an interest both as the Government's transport investor and as the state highway network operator. Input has also been provided by Transdev, the Wellington rail passenger service operator, KiwiRail, the network operator and operator of the existing Palmerston North-Wellington service, and local councils on both corridors, all of whom participated in one or more of the previous business cases. Additional input has been sought from other parties as required.

2. Strategic Context

2.1 Background

The lower North Island is served by an extensive network of public transport services, which include Wellington urban area bus, rail and ferry services, Wairarapa bus services, Palmerston North bus services, and longer-distance rail services. The latter extend Wellington's core public transport corridors beyond the Wellington electrified area rail termini of Upper Hutt and Waikanae, to link Masterton on the Wairarapa Line, and Palmerston North on the Manawatu Line, with Wellington. Both lines have had continuous rail passenger service since they were completed in the 1880s and are consequently an established and integral part of the transport system in the communities that they serve, and the services that operate on them are well-patronised.

The two lines are shown in Figure 2-1 and are described further in the following sections.

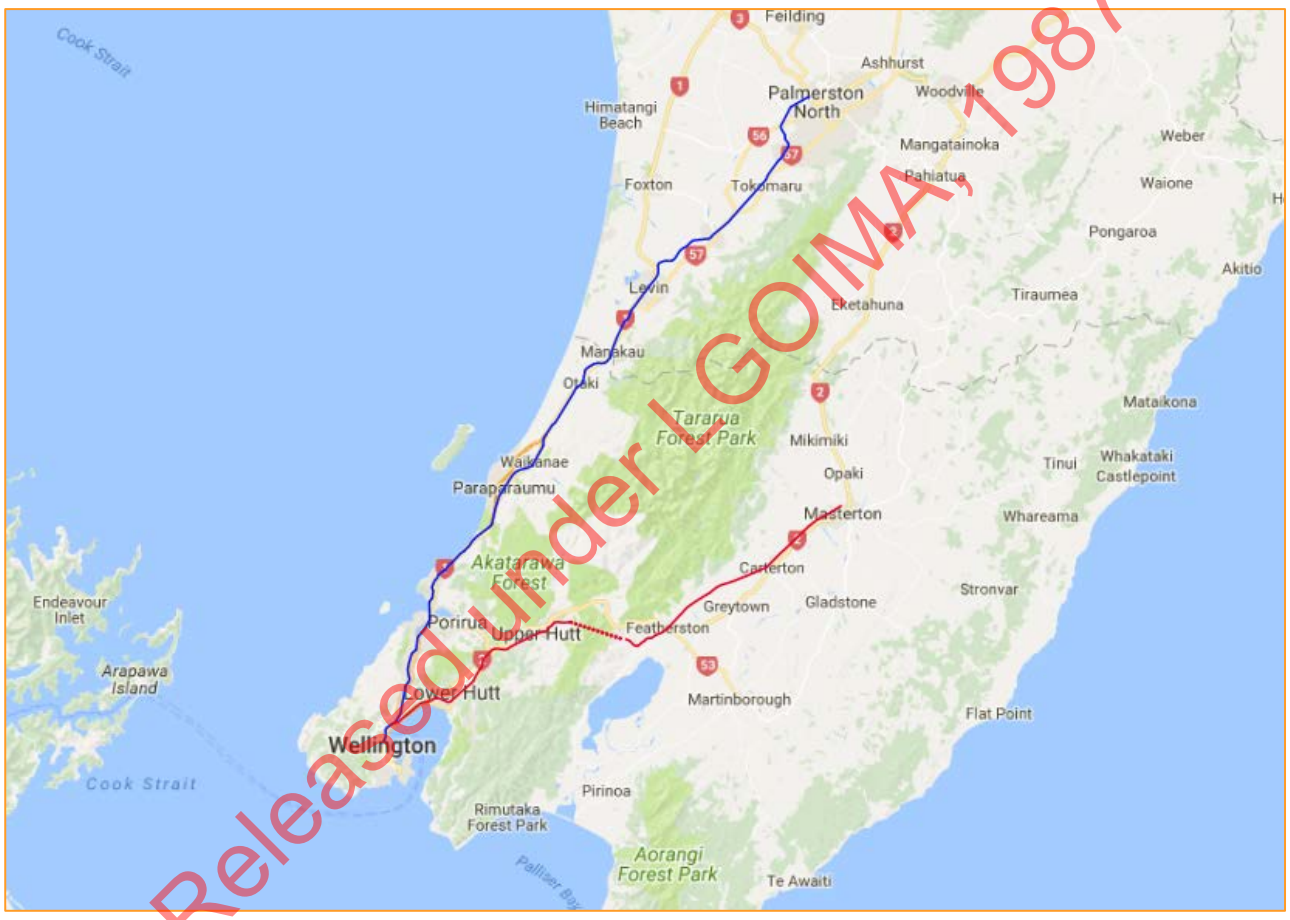


Figure 2-1: Wellington longer-distance rail lines - Wairarapa (red) and Manawatu (blue)

2.1.1 Wairarapa Line

The Wairarapa Line is located on the eastern side of and entirely within the Wellington Region, and primarily serves the Wairarapa sub-region, which is a predominantly rural area that encompasses 73% of the region's land area. Its population of 45,500[4] (approximately 9% of the region's population) is experiencing significant ongoing growth, which is forecast to continue in the future. The line links Masterton (three stations), Carterton, Matarawa, Woodside (Greytown), and Featherston (with connecting bus services from Martinborough), and surrounding areas of the Masterton, Carterton and South Wairarapa districts, with each other and Wellington. Services also call at Maymorn (where they are the only form of public transport), Upper Hutt, Waterloo and Petone in the Hutt Valley, to provide access to local destinations and vital extra capacity to supplement the electrified metro rail services that serve the population of 149,600[4] there, and are an integral part of the rail service offering.

[4] Statistics New Zealand subnational population estimate as at 30 June 2018.

The link is very important to Wairarapa residents, given that the Hutt Valley and Wellington provide many employment, educational and other opportunities and services that are not available locally. Approximately one quarter of Wairarapa residents commute to other parts of the region for work.

The Wairarapa Line has a critical role as one of only two transport links between the Wairarapa and the rest of the Wellington region. Its direct route under the Remutaka Range via the 8.8 km Remutaka Tunnel is safer, more efficient and more resilient than parallel State Highway 2, which crosses the range via a steep, winding and narrow route over a 555-metre summit. This road is very busy at peak times and has a high crash risk[5], low average speed[6] and susceptibility to weather-related closure[7]. Rail passenger services on the line consequently have an important road substitute role, which is exemplified by the high rail mode share of commuting trips, including a very high 60% share of trips to the Wellington CBD[8], which is around half of the journey to work trips between Wairarapa and the entire Wellington region. This provides consequent congestion, parking demand and environmental benefits in the Hutt Valley and Wellington city.

The Wairarapa Line is currently served by three peak direction services in each weekday peak, two weekday off-peak services in each direction, an additional service in each direction on Friday nights, and two in each direction on weekend days. Each takes between 1 hour and 40 minutes and 1 hour and 50 minutes to travel the 90.96 km between the line's end points, which is competitive with the car alternative. In total, they carried approximately 625,000 peak passengers and 154,000 off-peak passengers in the 2019 financial year[9] (FY), which equated to an average of around 420 peak passengers and 100 off-peak passengers per trip. Peak services are close to capacity, and changes were made to carriage allocation to provide short term relief on the most crowded afternoon service in April 2019. Further options to improve asset utilisation are being investigated but are limited.

Wairarapa Line services are currently operated as part of the Metlink public transport network by Transdev, under contract to GWRC, using a mixed fleet of GWRC-owned[10] conventional locomotive-hauled rolling stock. Hyundai Rotem provides rolling stock maintenance as a subcontractor to Transdev through an Operator Maintenance Partnering Contract. KiwiRail provides locomotives and locomotive crews through a hook and tow arrangement.

The rolling stock fleet is made up of the following carriage types:

- The SW type, illustrated in Figure 2-2, which were remanufactured specifically for Wairarapa Line service from ex-British Rail Mark 2 carriages dating from the early 1970s prior to entering New Zealand service in 2007. The carriages can be identified by their large windows and modern seating and interiors, and they feature a mix of airline style and table seating, at-seat power outlets, air conditioning, automatic doors and a public-address system. The type consists of:

12 SW class carriages, which have 64 seats and a single toilet;

3 SWS class carriages, which have 37 seats, a servery (unused), a wheelchair hoist on each side, an audio induction loop system and an accessible toilet; and

3 SWG class carriages, which have 37 seats, a luggage compartment and a diesel generator to power the carriages.

- The SE type, illustrated in Figure 2-3, which were refurbished from ex-British Rail Mark 2 carriages dating from the early 1970s prior to entering New Zealand service in 2009, although much less extensively than the SW type. Further modifications were made prior to their introduction on Wairarapa Line services in 2013. The carriages can be identified by their original small windows and British Rail-based seating and interiors, and they feature generally similar amenities to the SW carriages, although they were initially

[5] New Zealand Road Assessment Programme KiwiRAP) collective and personal risk scores for this section of road have varied between Medium High and High over the last decade. Both scores are at the high end of the five-point risk scale.

[6] The 2016 NZ Transport Agency SH2 Te Marua to Masterton Programme Business Case notes that this section of State Highway 2, which has a nominal 100 km/h speed limit, has an average speed of 58 km/h.

[7] The 2016 NZ Transport Agency SH2 Te Marua to Masterton Programme Business Case notes that State Highway 2 had 19 closures due to unplanned natural events (snow/ice, wind, slip) in the prior five-year period. Each closure had an average duration of 36 hours, indicating that the road is closed for an average of 5.7 days a year (i.e. nearly a week) due to weather related events.

[8] This compares to between 44% and 50% in Kapiti, Hutt Valley and Porirua. Based on Statistics New Zealand journey to work data from the 2013 Census.

[9] 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.

[10] The carriages are owned by Greater Wellington Rail Ltd, which is a subsidiary of Greater Wellington Regional Council.

used to provide additional capacity in the electrified area and have a higher-density seating arrangement. The type consists of:

4 SE class carriages, which have 75 seats and a single toilet;

1 SES class carriage, which has 63 seats, a wheelchair hoist on each side, an audio induction loop system and an accessible toilet; and

1 SEG class carriage, which has 44 seats, a luggage compartment and a diesel generator to power the carriages.

- A single AG type luggage / generator van, which dates from the late 1970s and is used to supplement or replace the SWG or SEG carriages on an as needed basis.

Figure 2-2: SW carriage type

Trains typically operate with between five and nine carriages, providing a seated capacity of between 266 and 599 passengers per train. Each consist requires a SWS/SES and SWG/SEG, with the balance of SW/SE types. The largest consists are allocated to the most heavily used peak services, which depart Masterton at 6:20 and Wellington at 16:25. Two SWs, one SWS and one SWG are typically held as spares to facilitate maintenance.

The SW and SE types are based on the same source carriage but were previously incompatible due to differences in suspension systems (bogies), electrical connections and brake systems. Trains therefore had to operate in all-SW type or all-SE type sets, which limited flexibility and consequently capacity on some trains, particularly when SE type carriages were removed from service for maintenance. Compatibility modifications, which were completed in early-2019, have addressed this issue, allowing the introduction of the nine car consist.

GWRC is about to commence a light mid-life refurbishment of the SW and SE fleets, which will take eighteen months to complete and extend the carriages' life to the mid-2020s. The scope of the overhaul

could be expanded if this business case determines that the fleets need to remain in operation for a longer period. All carriages will be life-expired require replacement by 2032.

Figure 2-3: SE carriage type

2.1.2 Manawatu Line

The Manawatu Line is located on the western side of the Wellington Region and extends beyond the regional boundary into the Horizons Region. It primarily serves the Kapiti Coast and southern Manawatu areas, which together have a catchment population of approximately 174,900[11] (75% of which lies north of Waikanae), which is experiencing significant ongoing growth that is forecast to continue in the future. The line links Palmerston North, Shannon, Levin, Otaki, Waikanae and Paraparaumu, and surrounding areas of the Palmerston North city and Horowhenua and Kapiti Coast districts with each other and Wellington, and services provides vital extra capacity to supplement the electrified metro rail services south of Waikanae. The link is important to residents, since it provides access to many employment, educational and other opportunities and services that are not available elsewhere on the corridor.

The Manawatu Line parallels State Highway 57 north of Levin and State Highway 1 south of that point. State Highway 1 carries large traffic volumes south of Levin, and geographical constraints restrict it to a single lane and limit road alternatives for much of its length, which makes it vulnerable to congestion and resilience events. State Highway 1 is currently being upgraded (see Section 2.2.2).

The Manawatu Line is currently served by the Capital Connection, a weekday commuter train operated by KiwiRail, which runs a single peak direction service in each weekday peak. It is the only rail passenger service on this corridor north of Waikanae[12], and currently the only long-distance commuter train that crosses a regional boundary in New Zealand. The train takes 2 hours and 5 minutes to travel the 136.23 km between the line's end points, which is competitive with the car alternative. It carried approximately 134,000 passengers in the 2019 FY, which equated to an average of around 280 passengers per trip. It is increasingly operating at capacity on some days of the week, reflecting day to day patronage variations associated with long-distance commuting, but its capacity is constrained by rolling stock availability and cannot be increased.

[11] Statistics New Zealand subnational population estimate as at 30 June 2018.

[12] KiwiRail also runs the tourism-focused thrice-weekly Auckland-Wellington Northern Explorer on the corridor, which runs in the opposite direction to peak commuter requirements and stops at Palmerston North and Wellington only.

The Capital Connection uses KiwiRail-owned conventional locomotive-hauled rolling stock, with locomotives and locomotive crews being provided through an intra-company hook and tow arrangement. The rolling stock fleet is made up of:

- The S type, illustrated in Figure 2-4, which were rebuilt from ex-British Rail Mark 2 carriages dating from the early 1970s prior to entering New Zealand service in 1999, although differently from the SW and SE cars, which they are not compatible with. The carriages can be identified by their original small windows and upgraded seating and interiors, and they feature generally similar amenities to the SW and SE carriages. The type consists of:

7 standard S class carriages, which have 60 seats and a single toilet; and

1 S class servery carriage, which has 28 seats and a toilet.

- A single AG type luggage / generator van, which dates from the late 1970s and is equipped with a wheelchair hoist.

The train currently operates in an eight-car configuration between Friday afternoon and Tuesday morning, with six standard cars, the servery car, and luggage / generator van, to provide a seated capacity of 388. It operates with one less standard car at other times to allow for maintenance, providing a seated capacity of 328. One standard car is inoperable due to significant structural issues. No spares are held, so the train operates at reduced capacity when additional maintenance is required.

The S type carriages are close to the end of their service life, and either require extensive refurbishment or replacement prior to mid-2021 to enable continued operation of services after that point. A decision on whether to proceed with refurbishment will be required within six months (see Section 3.1.1).

The Capital Connection is classified as an exempt service under the Land Transport Management Act 2003 (LTMA) (see Section 2.2.3) and operates as a stand-alone service with a separate fare structure. It operated without public subsidy between its introduction in 1991 and July 2015. [redacted]

Figure 2-4: S carriage type (source: nzrailphotos.co.nz)

2.2 Regional Context

2.2.1 Regional Rail Investment

2.2.1.1 Existing

GWRC's rail investment plans are detailed in the Wellington Regional Rail Plan, which supplements the Regional Public Transport Plan and Regional Land Transport Plan (see Section 2.2.3). The most recent 2013 update of the plan updated the preferred growth pathway known as Rail Scenario 1 (RS1), although it focused on upgrades to the electrified network that were underway at that time and future infrastructure upgrades that would enable frequency increases. The 2013 WRRP noted ongoing patronage increases on the Wairarapa Line but did not propose frequency or capacity increases beyond the electrified area termini in the short or medium term. In the longer-term, it envisaged reduced journey times on all lines under Rail Scenario A and network extensions in the form of shuttle or non-electrified interlined services on both the Wairarapa and Manawatu lines under Rail Scenario B. The WRRP also determined that electrification beyond Upper Hutt and Waikanae would not be warranted.

Recent planning has revolved around three separate business cases. The first is the Palmerston North-Wellington Rail Passenger Business Case, which was completed in October 2017. This assessed the case for continued public investment in a Palmerston North-Wellington rail passenger service beyond June 2018 when the existing arrangement was due to expire, making it a key supporting reference for this business case. It considered six options: withdrawal of the train at that point, continued operation of a conventional locomotive-hauled through train, replacement with a Diesel Multiple Unit (DMU) through train, replacement with a DMU through train with improved service levels, replacement with a connecting DMU service north of Waikanae, and replacement with a connecting coach (bus) north of Waikanae. It determined that the best return on investment would be achieved by retaining through rail services and improving them in the medium term, by replacing existing rolling stock with DMUs and improving service levels. The business case recommended that $6.2 million in Crown funding be sought to enable continued operation of the existing train until the 2022 financial year (when rolling stock refurbishment and replacement is required as noted in Section 2.1.2) and allow sufficient time for the longer-term solution to be confirmed and implemented. This recommendation has not yet been fully realised, being dependent on agreement around contractual and funding arrangements, [redacted] he current business case is investigating the longer-term options as part of its wider remit.

The next is the Wellington Metro Railway Network Track Infrastructure Catch-up Renewals Single Stage Business Case, which was completed in November 2017. This recommended that $95.8 million be sought to enable essential track renewals, bridge renewals, slope stabilisation works, and formation and drainage upgrades across the GWRC network. This investment programme was funded through the 2018 National Land Transport Programme (NLTP) and associated works have commenced. A significant proportion of the investment is required to enable continued operation of the Wairarapa Line and improve its resilience and safety, and the current business case and its options are consequently dependent on the programme being completed.

The last is the Wellington Metro Railway – Unlocking Network Capacity and Resilience Single Stage Business Case, which was also completed in November 2017. This recommended that $97.7 million be sought to enable track, power supply and signalling upgrades, to in turn improve network resilience and enable the RS1 frequency improvements that maximise the utilisation of and capacity provided by existing rolling stock within the electrified area. This investment programme was funded through the 2018 NLTP and associated works have commenced. Wairarapa Line and Manawatu Line services will directly benefit from this work, particularly through the double-tracking of the Upper Hutt-Trentham section, which will help enable increased Wairarapa Line frequencies, and through Wellington Station improvements, which will improve the operational efficiency of this bottleneck. These upgrades will be completed in conjunction with the renewal work to maximise efficiency.

2.2.1.2 Future

GWRC is currently developing a new WRRP to replace the existing WRRP, using a business case process to identify a preferred 30-year rail investment pathway for the Wellington region to a Programme Case level. The new plan's focus will be on actions beyond the current work programme (10 plus years), but it will include the above committed investment, and incorporate the investment programme associated with this business case and other short to medium term investment as identified.

To date, problems with high demand growth (60% of the overall problem), resilience, safety and security, and customer journey experience have been identified. Associated benefits of any related investment are expected to include improved capacity to increase economic activity, improved customer experience,

improved network resilience, and a safer rail network. In combination, these are expected to increase passenger and freight rail use and mode share, which will further improve transport system access and capacity, and minimise the detrimental effects of growth, particularly those associated with increased motor vehicle use, such as congestion and greenhouse gas emissions.

A key consideration is the impact of the Let's Get Wellington Moving (LGWM) investment programme, which includes a range of active mode, public transport and road-based initiatives that are expected to appreciably increase rail network demand. The public transport initiatives include implementation of proposed RS1 rail timetable improvements and rail capacity enhancements north of Wellington Station, as well as some form of rapid transit south of the station. All LGWM initiatives are subject to further detailed assessment.

The scale of the demand growth problem that the new WRRP must respond to is significant, although it will provide connectivity, mode share and customer experience benefits if addressed. Metlink network-wide annual rail patronage growth for the 2019 FY was 5.7% across all periods and 7.3% at peak periods. Peak period growth was higher on the Hutt and Kapiti lines at 8.5% and 8.7% respectively, and lower on the Wairarapa Line where patronage growth is constrained by capacity, at 3.3%. Current demand growth is significantly higher than forecast growth, including that forecast through LGWM (see Section 3.1.2).

2.2.1.3 'Future of Rail', the New Zealand Rail Plan and the Rail Network Investment Plan

The Ministry of Transport (MOT) and KiwiRail are working on changes to the LTMA to allow National Land Transport Fund (NLTF) investment in KiwiRail to support a resilient and reliable rail system. To date, the metro rail providers, namely GWRC and Auckland Transport, have had minimal governance level engagement in this process. GWRC and Auckland Transport are supportive of more investment in the national rail network if it does not negatively impact on the metro networks, which are experiencing significant passenger growth pressures, increasing costs, and a need for further network improvements.

A key component of the changes signalled by the 'Future of Rail' workstream is the development of a New Zealand Rail Plan (NZRP) and a Rail Network Investment Plan (RNIP). The inaugural NZRP is being developed by KiwiRail and the Ministry of Transport (alongside input sought from GWRC and AT). GWRC understands the NZRP will set out a high-level vision for and description of the New Zealand rail network, with specific sections for the two metro railways. GWRC understands that it is proposed that feedback on the NZRP will be sought via the next draft Government Policy Statement on Land Transport (GPS) process in 2020.

GWRC expects the Wellington regional metro rail component of the NZRP will be largely reflective of the WRRP, which forms part of the Wellington Regional Public Transport Plan (RPTP) and is being developed by GWRC in conjunction with KiwiRail, the NZTA and Transdev. Similarly, GWRC expects that the projects and programmes contained within the WRRP will also appear in KiwiRail's RNIP, which GWRC understands will set out how KiwiRail will plan and deliver the national rail network.

GWRC understands that the following statutory relationships will be included in the changes to the LTMA:

- KiwiRail will include proposed RNIP activities in the draft Regional Land Transport Plan (RLTP);
- NZTA will check RNIP is consistent with the purpose of the LTMA, the GPS and value for money;
- Auckland Transport and the Wellington Regional Transport Committee will discuss, prioritise and consult on proposed RNIP activities;
- KiwiRail will need to take into account the final Auckland and Wellington RLTPs and RPTP when finalising the RNIP; and
- the Minister of Transport will approve the RNIP.

2.2.2 Regional Road Investment

The Wairarapa and Manawatu lines parallel State Highway 2 and State Highway 1 respectively, as noted in Section 2.1 and shown in Figure 2-1.

The Wairarapa section of State Highway 2 has been the subject of several investigations over recent years. The most significant to this business case is the SH2 Te Marua to Masterton Programme Business Case, which was completed in October 2016. This noted that the road provides the only direct road link between the Wairarapa and Wellington, and that its long-term weather and seismic resilience is of regional concern. It recommended that $20-$25 million be invested on primarily safety-related capital improvements in the short term (five year) period. A further $60-$75 million in medium term (6-10 year) and $30-$40 million in long term (11+ years) capital improvements were also recommended, the most significant of which is an

estimated $50-$100 million over ten years for horizontal curve realignment to "achieve a consistent speed environment". This $110-$140 million investment is unlikely to significantly address the resilience issue or meaningfully improve road capacity.

The southern section of the State Highway 2 corridor has also been the subject of several investigations over recent years and was the subject of the State Highway 2 Ngauranga to Te Marua Programme Business Case, which was completed in August 2016. This recommended a $1.4-$2.1 billion investment programme of road and rail capacity, travel demand management, road safety and resilience improvements, the most significant of which are grade-separated interchanges at Melling in the short term, Kennedy Good in the medium term, and Silverstream in the long term, and four-laning of the Silverstream to Upper Hutt section of State Highway 2 in the medium term. These initiatives would increase capacity and reduce travel times on this section of the road corridor if implemented, but they have not been prioritised in the current 2018 NLTP and are now regarded as longer-term priorities.

State Highway 2 terminates just north of the Wellington CBD at Ngauranga, where it converges with State Highway 1, which continues through the CBD and beyond to Wellington Airport. This section of the road corridor handles large traffic volumes and is subject to significant congestion at peak times.

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. The most significant projects to this business case include (from south to north) the $850 million 27 km Transmission Gully Motorway between Porirua and Mackays (under construction), the $630 million 18 km Mackays to Peka Peka section of the Kapiti Expressway (completed), the $330 million 14 km Peka Peka to Otaki section of the Kapiti Expressway (under construction), and future Otaki to north of Levin improvements, which are expected to include an offline highway, the timing of which is yet to be determined[13]. These are expected to increase capacity, reduce travel times and improve safety and resilience on this section of the road corridor as the remaining projects are progressively completed between 2020 and 2025. However, congestion continues to be an issue during construction.

The Wellington Northern Corridor is expected to increase urban development and population growth in the Kapiti and Horowhenua districts, since it will make Wellington relatively more accessible from those areas by road than it is at present. This growth will increase overall transport demand on the corridor, which can be expected to counter some or all of the impact of mode switching from reduced road travel times on Manawatu Line services in the short to medium term, and increase demand for Manawatu Line services in the long term, as induced traffic increases road congestion, particularly at the Wellington end of the corridor.

2.2.3 Regional Transport Plans

2.2.3.1 Wellington Region

2.2.3.1.1 Wellington Regional Public Transport Plan

The existing Wellington Regional Public Transport Plan dates from 2014, although it has been varied three times since being adopted and is presently being reviewed. It 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, with a primary function of reducing severe road congestion on State Highways 1 and 2.

RPTPs specify the services that are integral to the public transport network, and the policies, procedures, information and infrastructure that supports them. The existing Wellington RPTP indicates that Wairarapa Line services are integral to the network, but it does not identify any plans to increase current service levels on either line, or replace/increase rolling stock or other infrastructure, other than as noted in the WRRP. The RPTP is soon to be reviewed, providing an opportunity to set out in more detail the delivery and investment programme associated with this business case.

The existing RPTP notes that the Capital Connection is an exempt service under the LTMA, due to its inter-regional nature. However, inter-regional public transport services are becoming more common[14], and can now be included in formal public transport networks if identified as being integral to the network in both regions' RPTPs. It is therefore possible to define Manawatu Line services as such if desired, providing a funding and procurement mechanism for rolling stock, supporting infrastructure and services.

[13] It is now envisaged that the Otaki-Levin corridor will have a multi-modal solution, with bus and/or rail improvements as well as roading improvements.

[14] They include a trial off-peak bus service between Levin (in the Horizons Region) and Waikanae (in the Wellington Region), which is the subject of one of the variations to the existing RPTP.

2.2.3.1.2 Wellington Regional Land Transport Plan

Higher level regional strategic direction is provided by the Wellington RLTP, which was reviewed in 2018 in accordance with the LTMA. This identifies rail as being an efficient way to move large numbers of people over longer distances and indicates that GWRC will continue to build on the region's established rail network, with a priority to improve reliability, capacity, frequency, journey times and reach.

The RLTP has eight strategic objectives. Three have a short-term focus and two of these are particularly pertinent to this business case – resilience and public transport. Connections between Wellington and the Wairarapa and Wellington and the Kapiti Coast are identified as crucial resilience areas of focus, and rail capacity and infrastructure, particularly on the Wairarapa Line as crucial public transport areas of focus.

The RLTP prioritises significant projects into three programme bands. The Wellington Metro Railway Network Track Infrastructure Catch-up Renewals and Unlocking Network Capacity and Resilience projects noted in Section 2.2.1, and Wairarapa service and capacity enhancements (the Wairarapa Line component of this business case), have been given a Priority 1 (top 10) programme ranking. Palmerston North-Wellington passenger rail (the Manawatu Line component of this business case) has been given a Priority 2 ranking. All four programme items have therefore been identified as being of high importance by the Regional Transport Committee. The Wellington RLTP is due for review, which is timely as this business case can be used to confirm the investment programme for rail longer distance rail passenger services.

2.2.3.2 Horizons Region

2.2.3.2.1 Horizons Regional Public Transport Plan

The existing Horizons RPTP dates from 2015 and is due for revision. It notes the Capital Connection as being an exempt service and (at that time) unsubsidised, but indicates that consideration would be given to subsidising the train if it was to be identified as the most efficient and effective means of providing a commuter service between Palmerston North, Horowhenua and Wellington. As noted in Section 2.2.3.1, it is now possible to define Manawatu Line services as being integral to both regions' public transport networks, providing a funding and procurement mechanism rolling stock, supporting infrastructure and services that was previously unavailable.

2.2.3.2.2 Horizons Regional Land Transport Plan

The Horizons RLTP was reviewed in 2018 in accordance with the LTMA. It identifies five strategic priorities that will be the focus of the future work programme, two of which are particularly pertinent to this business case:

- improve connectivity, resilience and the safety of strategic routes to and from key destinations linking north-south and east-west, while factoring in demographic changes and impacts on land use; and
- (provide) effective, efficient, accessible and affordable multi-modal transport networks.

Key programmes to achieve the former include Accessing Central New Zealand (see Section 2.2.4), Wellington Northern Corridor (see Section 2.2.2), and integrated road and rail networks. Key programmes to achieve the latter include continuous improvements in the integrated public transport network, passenger rail services between Palmerston North and Wellington, and investigation into improved long-distance passenger rail services.

The RLTP notes that the continuation of the Palmerston North and Wellington service will be important in achieving the multi-modal approach of the Plan. To support this, it commits to a specific action to investigate the feasibility of retaining or improving the service and identifies the Capital Connection as a programme item to facilitate NZTA subsidy and enable its continuation in the short term.

2.2.3.3 Spatial Planning - Regional Growth Framework

The GWRC and Horowhenua District Council (part of the Horizons Region) are working with iwi, the NZTA and the Ministry of Housing and Urban Development on a Regional Growth Framework (RGF) spatial planning exercise. The RGF will integrate land use and transport planning and provide the spatial context for the Wellington RLTP. It is expected to meet the requirements for a future development strategy under the proposed National Policy Statement on Urban Development.

The RGF will recognise that the Wellington Region has experienced significant growth over the last 20 years and is experiencing a shortfall of housing leading to increased new development in the Wairarapa, Kapiti and Horowhenua Districts. The Wellington CBD currently provides, and is likely to for the foreseeable future, a key employment centre for many of these people as noted in Section 2.1. As a result, public transport use has grown significantly during this time, but there are capacity and reliability issues that, alongside road congestion, place a strain on the wider regional transport network. The RGF will provide a 30 and 100-

year view of where and how future growth can be accommodated, and the infrastructure needed to support it. Improvements to the public transport network will be needed to enable this growth in a way that minimises environmental impacts and fits with the Government's goals to improve safety and access and reduce emissions and reliance on private vehicles.

While the development of the RGF is still only in its initial stage, investment in rolling stock, supporting infrastructure and services will at minimum contribute to improving the transport connectivity for these already growing communities. If the RGF highlights that further improvement to the transport network is required, further business cases will be prepared.

2.2.4 Regional Economic Development

2.2.4.1 Wellington Region

A new Wairarapa Economic Development Strategy and Action Plan was completed by GWRC and the three Wairarapa territorial authorities in late 2018. It identifies the Wairarapa Line as a key lifeline for the sub-region but notes that the existing limited service levels are a significant inhibitor to economic growth. Rail track, rolling stock and timetable improvements that deliver a "mature rail connection" are therefore identified as key components of the recommended infrastructure programme, which has the following objectives with respect to rail:

- an all-day timetable, allowing free movement across the day and week (including weekend):
- a diverse mix of passenger types and counter-cyclical patronage (including tourists and day visitors);
- reduced travel time; and
- improved punctuality.

The Wairarapa Economic Development Strategy and Action Plan is a regional economic development programme for investment assessment purposes (see Section 5.5.1).

2.2.4.2 Horizons Region

A regional growth programme known as Accelerate25 is currently being implemented within the Horizons Region. Its supporting economic action plan identifies Distribution and Transport as one of four key enablers of economic growth, which seeks to provide a well-planned, efficient and strategically connected transport network that will support other growth opportunities. Supporting priority initiatives include rail tourism, the use of Palmerston North-Wellington rail passenger services to improve regional and inter-regional connectivity, and the Accessing Central New Zealand initiative, which aims to align all land transport projects to create a connected, resilient and integrated transport system within the region and across its boundaries.

The Accelerate25 implementation programme is a regional economic development programme for investment assessment purposes

2.3 National Context

2.3.1 Long Term View

The Long Term View (LTV) sets out the NZTA's view on the future demands and pressures that are likely to shape the issues and opportunities facing the land transport system. The first LTV (then known as the Long Term Strategic View) was developed in early 2017, and it will be replaced by a new version that reflects the priorities of the current Government, but it provides useful national context to supplement the regional transport plans at a corridor level.

With respect to the three strategic corridors that the Wairarapa and Manawatu lines are a component of within the Wellington Region, its long-term vision is (amongst other aspects):

- Wairarapa Strategic Corridor: the local road network will provide access to the state highway and rail networks, which in turn, will connect those areas with the Wellington CBD and other regional centres and basic, but reliable, local passenger transport services will be easily accessible;
- Hutt Strategic Corridor: State Highway 2 and the Wairarapa railway line will provide a high level of access and reliability for both passengers and freight, be effectively supported by local and regional connector routes, and high-quality rail and bus services will accommodate the large number of people using public transport to commute along this corridor in peak periods; and

- Western Strategic Corridor (Ngauranga to Otaki): State Highway 1 and the North Island Main Trunk Line will provide a high level of access and reliability for passengers and freight travelling within and through the region, and a high-quality rail service will accommodate the large number of people using public transport to commute along this corridor in peak periods.

The implication is that Wairarapa Line rail passenger services will continue to be supported by the NZTA as a key means of providing reliable and high-quality access along the length of the Wairarapa and Hutt strategic corridors, and that that some form of Manawatu Line rail passenger service may be supported by the NZTA as a means of providing reliable and high-quality access beyond Waikanae on that corridor.

The LTV identifies the overall Palmerston North to Wellington corridor as a nationally significant 'key inter-regional journey', one of only four in the lower half of the North Island. The NZTA expects future demand pressures on the corridor will be managed through network optimisation, demand management, mode share and new infrastructure. The Manawatu Line is implicit as the modal alternative that can be used to manage passenger demand pressures north of Waikanae.

2.3.2 Transport Agency Investment Proposal 2018-27

The draft Transport Agency Investment Proposal (TAIP), which was issued in advance of the 2018 GPS, set out a 10-year programme of activities that the NZTA proposed for inclusion in the 2018 NLTP, through which most Government contributions to land transport investment are prioritised and delivered.

The TAIP identifies several rail passenger priorities across the country, including the Wellington Metro Network Track Infrastructure Catch-up Renewals and Unlocking Network Capacity and Resilience projects. It also specifically signals that the NZTA will consider proposals for inter-regional commuter rail services, "such as between...Wellington and Palmerston North" through the Public Transport funding activity class. More generally, the TAIP signals the types of activities that the NZTA are looking to invest in each region within each activity class, together with potential investment opportunities. The relevant Wellington and Horizons regional priorities and opportunities are shown in Table 2-1.

Table 2-1: Relevant activity class investment priorities and opportunities

Activity Class	Investment Priorities	Investment Opportunities
Public Transport	• Maintaining and improving service levels and improving infrastructure • New public transport services • Co-funding operational costs.	Wellington: • Continue to invest in public transport services across the region Horizons: • Investigate potential for improved public transport services within Palmerston North and to surrounding townships.
Regional Improvements	• Supporting regional economic development outside of major metropolitan areas	Horizons: • Improvements to support economic development and tourism • Improve network resilience to deliver reliable connections into the region from the north, east, south and west.
Transitional Rail	• Supporting urban and interregional rail services that improve access to housing and employment opportunities.	Wellington: • Invest in improvements to Wellington Metro Rail regional infrastructure to provide greater reliability and capacity • Accelerate investigation in increasing capacity and services Horizons: • Investigate opportunities to support inter-regional public transport connections.

2.3.3 Government Policy Statement on Land Transport

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 NLTP.

A new GPS was released in June 2018, and specifies four strategic priorities – Safety, Access, Environment, and Value for Money – each with supporting objectives and results. The Access and Environment priorities have the clearest direct link to this investment case. Their objectives and applicable long-term results are shown in Table 2-2.

Table 2-2: GPS access and environment strategic priorities, objectives and applicable results

Strategic Priority	National Land Transport Objectives	Applicable Long-Term Results
Access	• A land transport system that provides increased access for economic and social opportunities.	• Metropolitan and high growth urban areas are better connected and accessible • Sustainable economic development of regional New Zealand is supported by safer and better transport connections.
	• A land transport system that enables transport choice and access.	• Increased mode shift from private vehicle trips to walking, cycling and public transport in our towns and cities • More transport choice (including for people with less or limited access to transport).
	• A land transport system that is resilient.	• Improved network resilience for the most critical connections.
Environment	• A land transport system that reduces greenhouse gas emissions, as well as the adverse effects on the local environment and public health.	• Reduce greenhouse gas emissions from transport.

The Access strategic priority is one of two key strategic priorities in the GPS, along with Safety[15]. It is of most importance to the investment case, as it specifically commits to increased investment in public transport, to improve connectivity, capacity (through availability and frequency), and access to economic and social opportunities in both peak and off-peak periods. This includes an emphasis on improving regional transport connections, as provided by the Wairarapa and Manawatu lines. The priority also commits to a whole-of-system approach to resilience, including the use of alternative routes and modes to manage resilience at the most critical points on the network.

The Environment strategic priority is one of two supporting strategic priorities in the GPS, along with Value for Money. It specifically commits to increased investment in lower emission modes of transport such as public transport, to improve services and encourage mode shift, as part of a whole-of-system approach to the reduction of greenhouse gas emissions and other harmful effects of transport.

The Value for Money strategic priority seeks to provide the right infrastructure and services to the right level at the best cost. This priority does not identify specific public transport (or other) initiatives, but instead encourages investment that makes best use of resources and is supported by rigorous investment appraisal that takes account of the full range of costs and benefits.

The GPS places some emphasis on investment in rapid transit[16] and indicates that rail will have an increasingly important public transport role to play. To support this, it includes new rapid transit and

[15] The Safety strategic priority focuses on road safety and does not identify associated public transport-related goals, other than in relation to personal safety and security. It is therefore less relevant to this investment case than the other strategic priorities. However, rail passenger services provide a safe alternative to road-based travel and can therefore be considered to indirectly contribute to this priority.

[16] Rapid transit typically refers to urban heavy rail (including metro and underground), light rail and bus rapid transit.

transitional rail activity classes[17]. The former supports investment that enables urban development in high growth areas, primarily using the light rail and bus rapid transit modes. The latter supports investment in urban rail services, particularly where demand is outstripping capacity or there is a need to reduce conflict between freight and passenger trains, and in existing and new inter-regional commuter rail services that support housing and employment opportunities, including in the capital costs associated with rolling stock. This allows the NZTA to fund operational and capital costs from the transitional rail activity class, but it does not preclude funding from the public transport activity class. Further funding will be considered in a second stage GPS.

The case for Wellington longer-distance rail passenger investment is therefore consistent with the GPS, since it responds strongly to the Government's strategic priorities by enhancing public transport connectivity, capacity, reliability and resilience at several critical points on the network, on existing services that support housing and employment opportunities, and in the case of the Wairarapa Line and Wellington electrified network, are close to capacity. Such improvements could be funded from either the transitional rail or public transport activity classes.

2.3.4 Provincial Growth Fund

The Provincial Growth Fund (PGF) has been introduced by the current Government to provide funding to support investment in regional economic development. It supports three investment types:

- regional: support for economic development projects, feasibility studies and capability building identified within regions, based around regional economic development plans;
- infrastructure: regional infrastructure projects that enable regions to be well connected from an economic and social perspective, including transport (specifically rail); and
- sector: initiatives targeted at priority and/or high value sector opportunities, including tourism.

The PGF thus provides a potential complementary or alternative funding source for longer-distance rail passenger investment, providing that any investment proposal:

- lifts the productivity of a region or regions;
- contributes to the PGF objectives (which relate to job creation and sustainable economic development, social inclusion and participation, Māori development, climate change and environmental sustainability, and resilience);
- creates additional value and avoid duplicating existing efforts;
- has a link to the regional priorities and be supported by stakeholders; and
- is well managed, well-governed and have appropriate trade-offs between risk and reward.

The PGF is available to all provinces (outside of the three main cities), but particularly to several priority 'surge' regions, which includes the Horizons Region. The Wairarapa and Kapiti areas of the Wellington region are also eligible for PGF funding.

Wellington longer-distance rail passenger investment is likely to meet all the key PGF requirements, being rail investment that (in part) supports tourism and is supported by a regional economic development plan, meeting all criteria, including several PGF objectives, particularly sustainable economic development, social inclusion and participation, climate change and environmental sustainability, and resilience.

2.4 Conclusion

The Wairarapa and Manawatu lines are an established, integral and well-utilised component of the lower North Island transport system, and the longer-distance services that operate on them fulfil very important transport system access and capacity roles. However, these services are experiencing strong demand growth and are close to capacity, similarly to Wellington's electrified area rail network. The existing rolling stock fleet consists of several different types of conventional locomotive-hauled rolling stock is also nearing the end of its service life, and ownership and compatibility issues and limit operational flexibility. A decision is therefore required on whether to expand and refurbish or replace the fleet to address these issues. This has urgency, as some carriages are close to the end of their service life and will need to be withdrawn by

[17] Activity classes are essentially funding buckets through which the NZTA allocates transport investment. Some activities can be funded through more than one activity class and other sources of funding can be used to complement investment.

mid-2021 without refurbishment or replacement, requiring a decision on whether to proceed within six months.

Investment in rolling stock, and reliability, capacity, frequency and journey time improvements on both lines is supported by Wellington and Horizons regional transport plans and economic development programmes. Such investment is consistent with the NZTA's strategic view and investment priorities for each corridor in both regions, where the rail modal option is seen as being an important component of the transport mix, and with the Government's higher-level land transport priorities and objectives as specified in the GPS. It is also likely to meet all key PGF requirements, including sustainable economic development, social inclusion and participation, climate change and environmental sustainability, and resilience objectives.

3. Strategic Assessment

3.1 Problem Definition

The problems, the benefits of addressing them, and from these, the investment objectives for this business case, were determined at the first of two facilitated Investment Logic Map (ILM) workshops, which was held with key stakeholders on 10 October 2017. Participants included representatives of GWRC, HRC, NZTA, Transdev, and the Masterton and Carterton district councils.

The workshop identified three key problems:

- train condition (25% of the overall problem);
- fleet capacity (50% of the overall problem); and
- operational efficiencies (25% of the overall problem).

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 Train Condition

This problem is encapsulated by the problem statement:

Current longer-distance passenger trains coming to end of life is resulting in increasing maintenance costs, customer expectations not being met and risk of service withdrawal.

All existing longer-distance rail rolling stock dates from either the early 1970s (carriages) or late 1970s (luggage / generator vans), as noted in Section 2.1. Although all have been subsequently rebuilt to varying degrees and are equipped to current amenity and safety standards, the bulk of the fleet is now approaching 50 years in age and nearing the end of its service life.

The S type are of most concern. These carriages, which comprise 25% of the longer-distance carriage fleet, were rebuilt in 1999. They have thus been in continuous post-rebuild service for 20 years and increasing age-related maintenance costs are reflected in the [redacted] million short-term funding gap noted in Section 2.2.1.1. The carriages will require either full refurbishment at an estimated cost of [redacted] which will extend their service life by another 15 years, or replacement, prior to mid-2021. Manawatu Line services will otherwise be withdrawn from service at that point. This timeframe places some urgency on an investment decision and subsequent implementation of the chosen option.

The SW and SE types are less of an immediate concern, having been remanufactured in 2007 and refurbished in 2008 respectively. However, they are looking increasingly tired due to their heavy use, are increasingly unable to cope with demand (for example, air conditioning), and several components are approaching end of life. The carriages consequently suffered 53 faults that caused delay, cancellation, reduced capacity or passenger discomfort in 2017, which is reflected in negative customer feedback. GWRC is about to commence a light mid-life refurbishment of the SW and SE fleets, which will address some of these issues and extend the carriages' life to the mid-2020s as noted in Section 2.1.1. A more extensive refurbishment to enable them to operate until 2032 will be avoided if they are replaced at that point, but they will be life-expired and require replacement by 2032.

3.1.2 Fleet Capacity

This problem is encapsulated by the problem statement:

Growing passenger demand and difficulty adding capacity to existing fleet results in frustrated passengers and puts more pressure on the whole transport system.

3.1.2.1 Wairarapa Line

Wairarapa Line patronage has grown substantially over the last decade, from 680,000 boardings in the 2009 FY[18] to 780,000 in the 2019 FY, an increase of 15% over that period and 33% over the 2007 FY when the SW fleet replaced the previous rolling stock fleet.

[18] Wairarapa Line patronage figures include passengers that travel only within the Hutt Valley. However, their numbers are constrained by the lack of seated capacity in the morning peak, and by a minimum fare that is applied to all passengers in the northbound direction, which makes Wairarapa services more expensive for Hutt Valley passengers to use than electrified services.

The change in Wairarapa Line boardings has been even more significant at the peak, with an increase in average daily morning peak patronage of 24% over the same decade, from around 1000 in mid-2009 to around 1250 in mid-2019 as illustrated in Figure 3-1. This equates to an annual average growth rate of approximately 2.16%, which is well above the Wairarapa annual average population growth rate of 1.26%[19]. The year on year peak patronage increase was 3.3% between the 2018 and 2019 financial years, reflecting the average growth rate of the most recent four-year period.

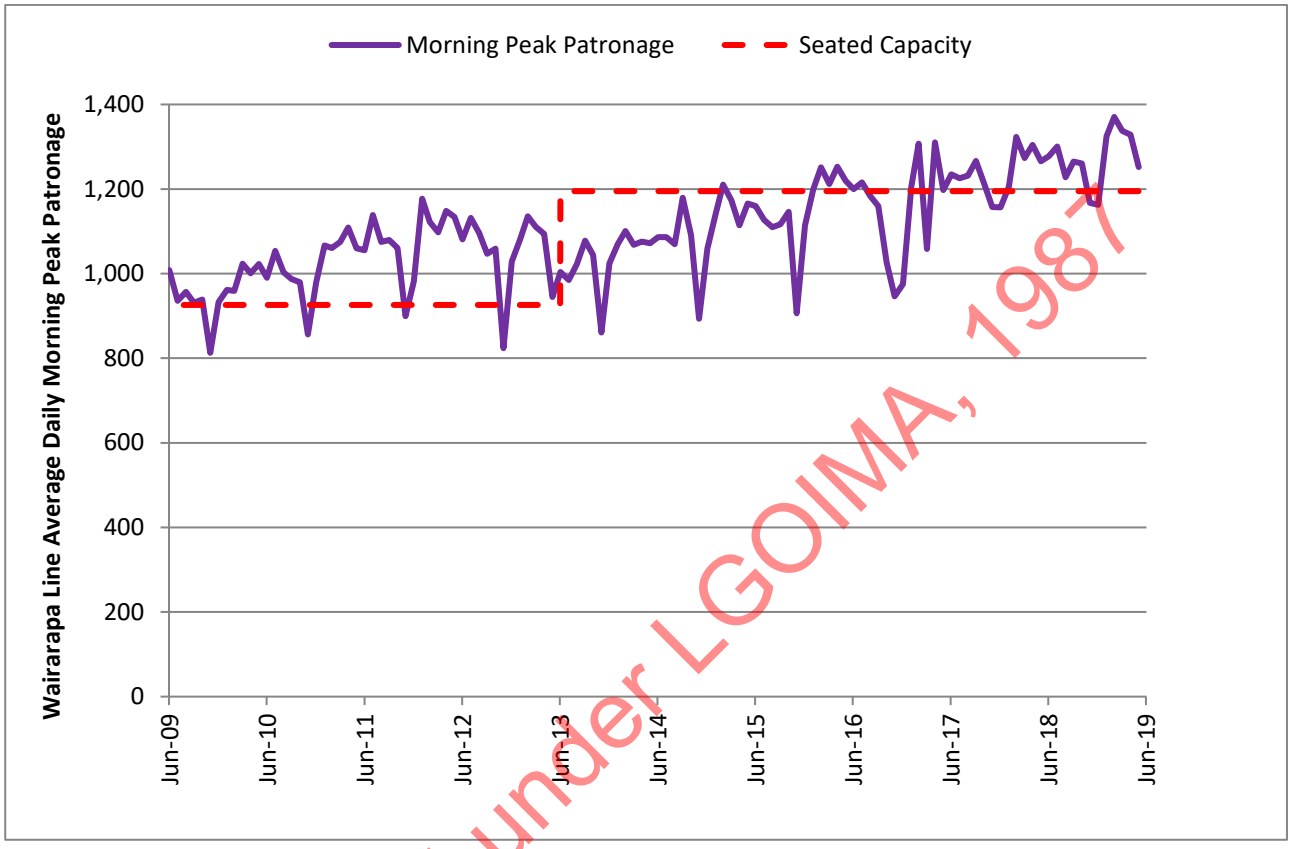


Figure 3-1: Wairarapa Line morning peak patronage and seated capacity

The chart shows that peak patronage has been close to or greater than seated capacity over much of the decade, although crowding was alleviated by the introduction of the SE fleet on the line in 2013. It also indicates that peak Wairarapa Line services are again close to their practical capacity limit, which is governed by seated capacity on longer-distance services, despite reliability and punctuality issues associated with the impact of previous infrastructure underinvestment that limit the dependability of services for passengers. Recent carriage compatibility modifications have allowed some capacity reallocation, providing short-term relief on some services as described in Section 2.1.1, but overall peak capacity has not changed.

Figure 3-1 indicates that peak crowding can be expected to again become an increasing problem and that additional capacity is likely to be required within a few years to respond to demand and maintain service quality[20]. Figure 3-2 reinforces this conclusion, showing the impact of projected peak period patronage growth at the forecast rate[21], which is constrained by current capacity, and at the potential future unconstrained growth tracks associated with a continuation of the previous decade's annual

[19] The combined annual average population growth rate for the Masterton, Carterton and South Wairarapa districts for the ten-year period ending June 2018, derived from Statistics New Zealand subnational population estimates.

[20] Longer-distance rolling stock is not designed to carry large numbers of standing passengers over extended distances, since they have narrow aisles and doorways to maximise the quality and availability of seating within the main passenger compartment. Standing passengers restrict circulation, access to toilets, and access to entry/exit doors at station stops, which increases station dwell times and overall trip times.

[21] The Wairarapa Line patronage forecast is based on WTSM/WPTM model outputs that assume the future implementation of integrated fares and ticketing and the network improvements specified by the Wellington Metro Railway Network Track Infrastructure Catch-up Renewals and Unlocking Network Capacity and Resilience business cases. The model outputs are based on older data and do not take account of recent growth.

average population growth rate of 1.3% and the recent (four-year average and current) annual peak patronage growth rate of 3.3%[22]. It indicates that significant capacity improvement is likely to be required to cater for future demand, particularly if the current peak growth rate is sustained. Previous capacity improvements have quickly been exhausted, which suggests that demand is being limited by the level of supply.

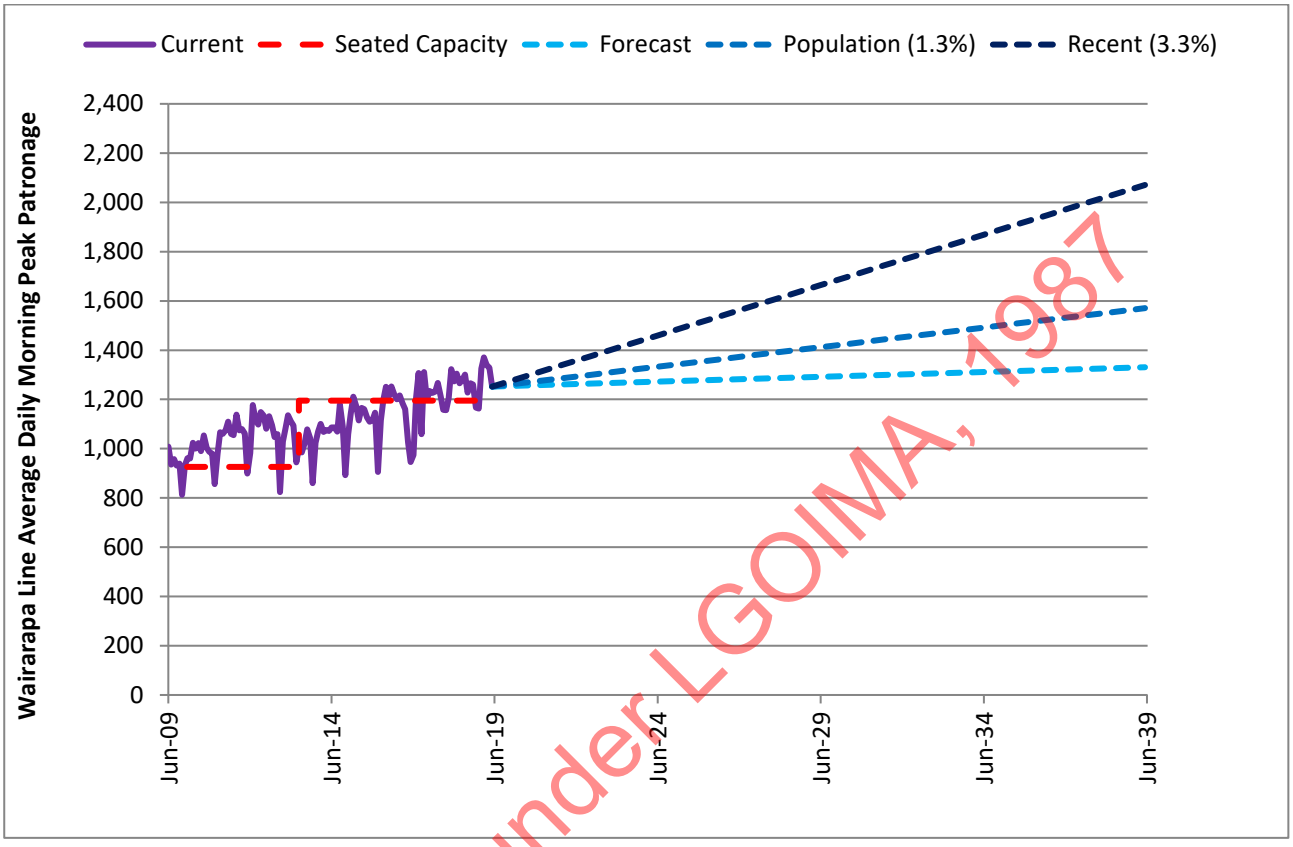


Figure 3-2: Wairarapa Line morning peak patronage and projected demand

Additional capacity is typically obtained by increasing train size, more effectively allocating capacity to demand, and/or increasing frequency. However, responses are currently limited by:

- rolling stock availability;
- train length restrictions that limit train length to nine carriages;
- long turnaround times at each terminus; which are linked to the requirement to turn locomotives (see Section 3.1.3) and affect round trip time; and
- passing limitations between Trentham and Masterton, which limit service headway along with signalling system constraints north of Featherston[23].

3.1.2.2 Manawatu Line

Manawatu Line patronage fluctuated over the last decade, with an overall reduction of 22% from 175,000 boardings in the 2009 FY to 136,000 in the 2019 FY, reflecting the patronage impact of electrification of the Paraparaumu-Waikanae section of the Kapiti Line and extension of associated Metlink services to Waikanae in early 2011. These patronage levels compare to 158,000 boardings in the 2007 FY and an earlier long-term growth trend.

The patronage change is illustrated in more detail in Figure 3-3, which shows how average daily morning peak patronage changed from around 350 in mid-2009, to around 240 in mid-2015, then rebounded to

[22] Future growth is shown arithmetically and excludes any additional patronage uplift associated LGWM.

[23] The short Trentham to Upper Hutt section of the line is about to be converted to double track, but passing opportunities will remain limited between there and Masterton. The Featherston-Masterton section of the line uses the radio-based Track Warrant Control system, which restricts train spacing.

around 300 in mid-2019. The train's current capacity is lower than at the beginning of the period and is further reduced at mid-week times. It increasingly operates at capacity on some days due to day to day patronage fluctuations. All operable carriages are in use as noted in Section 2.1.2.

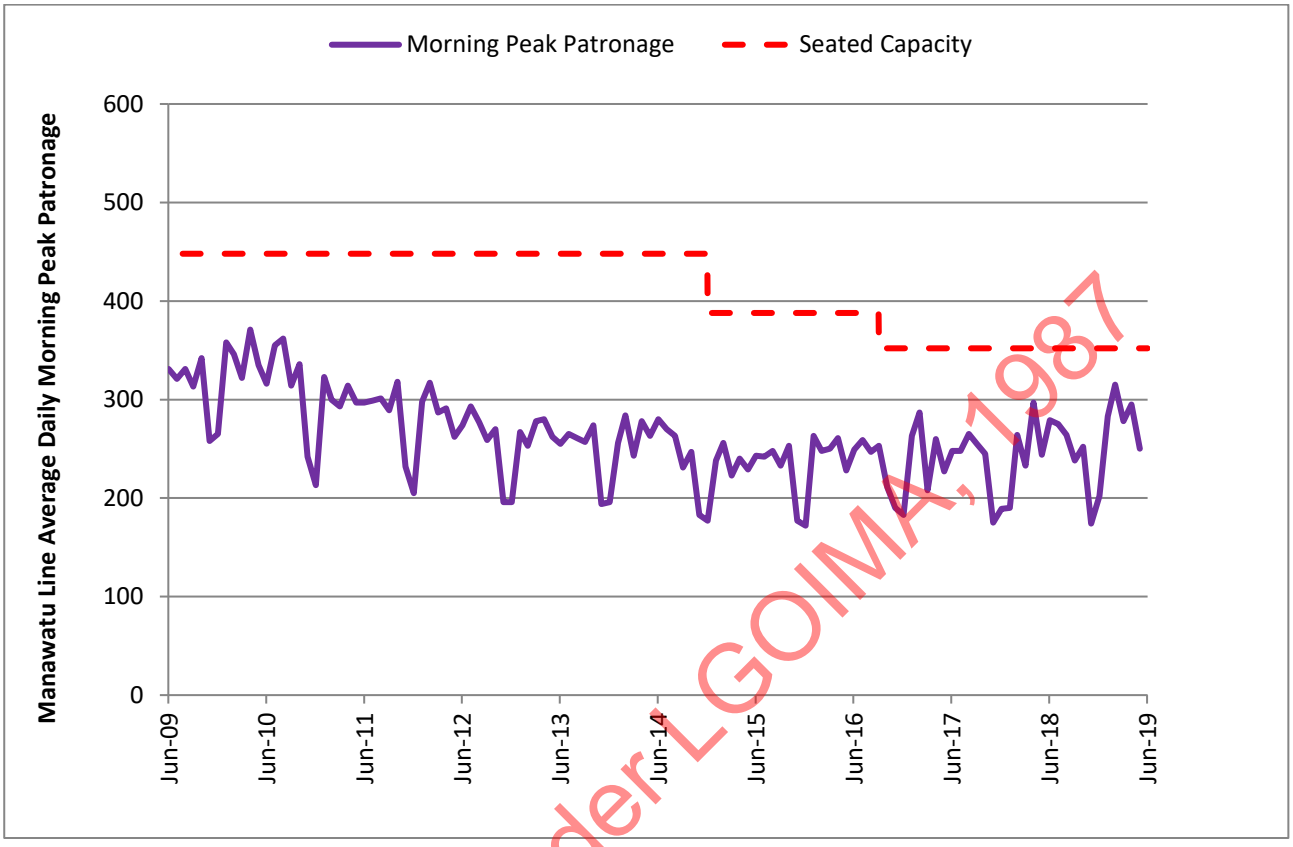


Figure 3-3: Manawatu Line morning peak patronage and seated capacity[24]

The post-electrification patronage decline was largely limited to Waikanae and Paraparaumu, which directly benefited from higher service levels associated with the extension of Metlink services to Waikanae. These stations previously accounted for around 48% of Capital Connection patronage, but now account for around 44% of patronage. The decline is likely to have been exacerbated by subsequent fare increases to recover lost revenue, which were necessitated by reduced revenue, increased costs, and the Capital Connection's commercial nature[25]. This increased the cost of the train as an option to passengers and the disparity between its higher fare levels and the standard Metlink fares from these stations.

While Manawatu Line patronage is considerably lower than Wairarapa Line patronage and does not show the same growth trend at present, it is still significant at its current level, given that only one train operates in each direction per day, its rolling stock is close to the end of its service life and quite worn, and its future has been uncertain for several years. These aspects are likely to have previously supressed passenger demand along with the fare increases noted above, but traffic congestion and the increased urban development and population growth on the corridor noted in Section 2.2.2 are again driving patronage growth.

Figure 3-4 shows the effect of projected peak period patronage growth at the same base forecast level as used for the Wairarapa Line[26] in Section 3.1.2.1, at an annual average population growth rate of 1.1%[27]

[24] April-June 2017 and April-June 2019 patronage was not provided by KiwiRail and is estimated. Capacity reduced from 448 to 388 in early-2015 and has varied by day since late-2016 (the latter trip-weighted average of 352 is shown).
[25] The train has a farebox recovery ratio of around 85%, which compares to a Wairarapa Line ratio of around 25%.
[26] Manawatu Line patronage growth is expected to be relatively low in the short term, with mode switching to road due to reductions in road travel times from the Wellington Northern Corridor projects being offset by increased urban development and population growth. Patronage is expected to increase in the longer-term, as increased road congestion at the Wellington end of the corridor and LGWM-related public transport enhancements take effect.
[27] The draft 2018 Horowhenua Growth Strategy 2040 projects that district population will increase by around 10,000 (from 32,000) over the 2016-40 period, in part due to transport improvements on the corridor, with an annual average

and at the recent (four-year average) annual peak patronage growth rate of 3.1%[28]. The resulting patronage remains within existing capacity for most of the 20-year period, although the growth tracks do not take account of day to day fluctuations or the growth effects of any potential service enhancements, which would be expected to lift patronage at higher rates through service level demand elasticities.

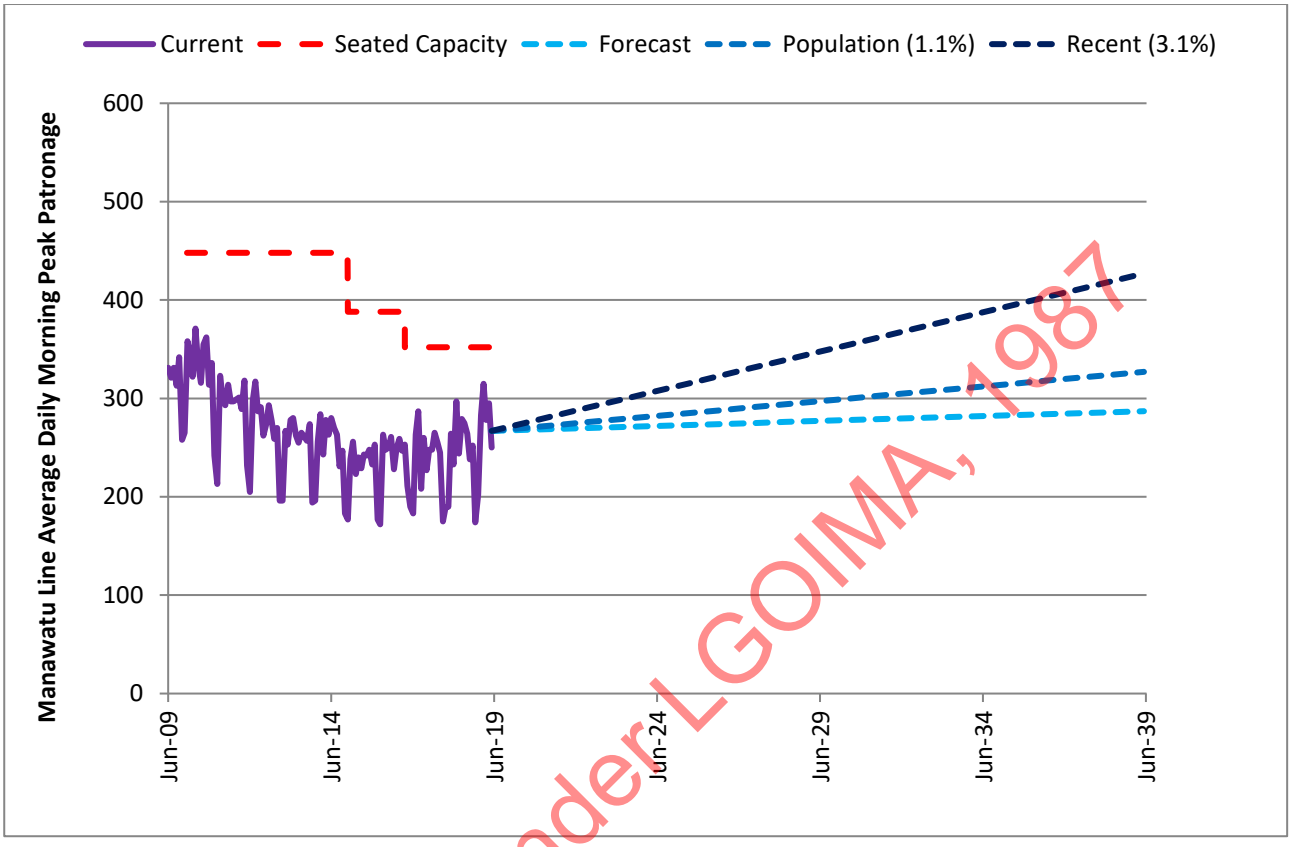


Figure 3-4: Manawatu Line morning peak patronage and projected demand

3.1.2.3 Electrified Area

Patronage has grown substantially on the electrified area Hutt, Johnsonville and Kapiti lines over the last decade, from 11.2 million boardings in the 2009 FY to 13.5 million in the 2019 FY, an increase of 21% over that period. This growth reflects population growth on the corridors that the lines serve, and investment in improvements in infrastructure, rolling stock and services that have improved service quality, frequency and reliability. The most significant initiative during this period was the progressive and complete replacement of the previous obsolete electric multiple unit (EMU) fleet by the new FP/FT class Matangi EMU fleet between 2010 and 2016, which is likely to have been a key driver of growth.

Patronage growth occurred across all lines and time periods, but it has been most significant at the peak, where Hutt Line, Johnsonville Line, and Kapiti Line average daily morning peak patronage increased by 16%, 11% and 29% respectively between mid-2009 and mid-2019. In the February to June 2019 period, average daily morning peak patronage averaged more than 8900 on the Hutt Line, 1900 on the Johnsonville Line, and 8300 on the Kapiti Line, for a combined electrified area total of 19,200 passengers per morning peak period. Figure 3-5 shows that the peak period increase has been most acute since mid-2015, reflecting similar trends on the Wairarapa and Manawatu lines since that point.

growth rate of 1.1%. This compares to an annual average population growth rate of 0.7% for Horowhenua for the ten-year period ending June 2018, and to 0.9% for Palmerston North, Horowhenua and Kapiti Coast combined for the ten-year period, and 1.1% for the five-year period ending June 2018, derived from Statistics New Zealand subnational population estimates.

[28] Future growth is shown arithmetically and excludes any additional patronage uplift associated LGWM.

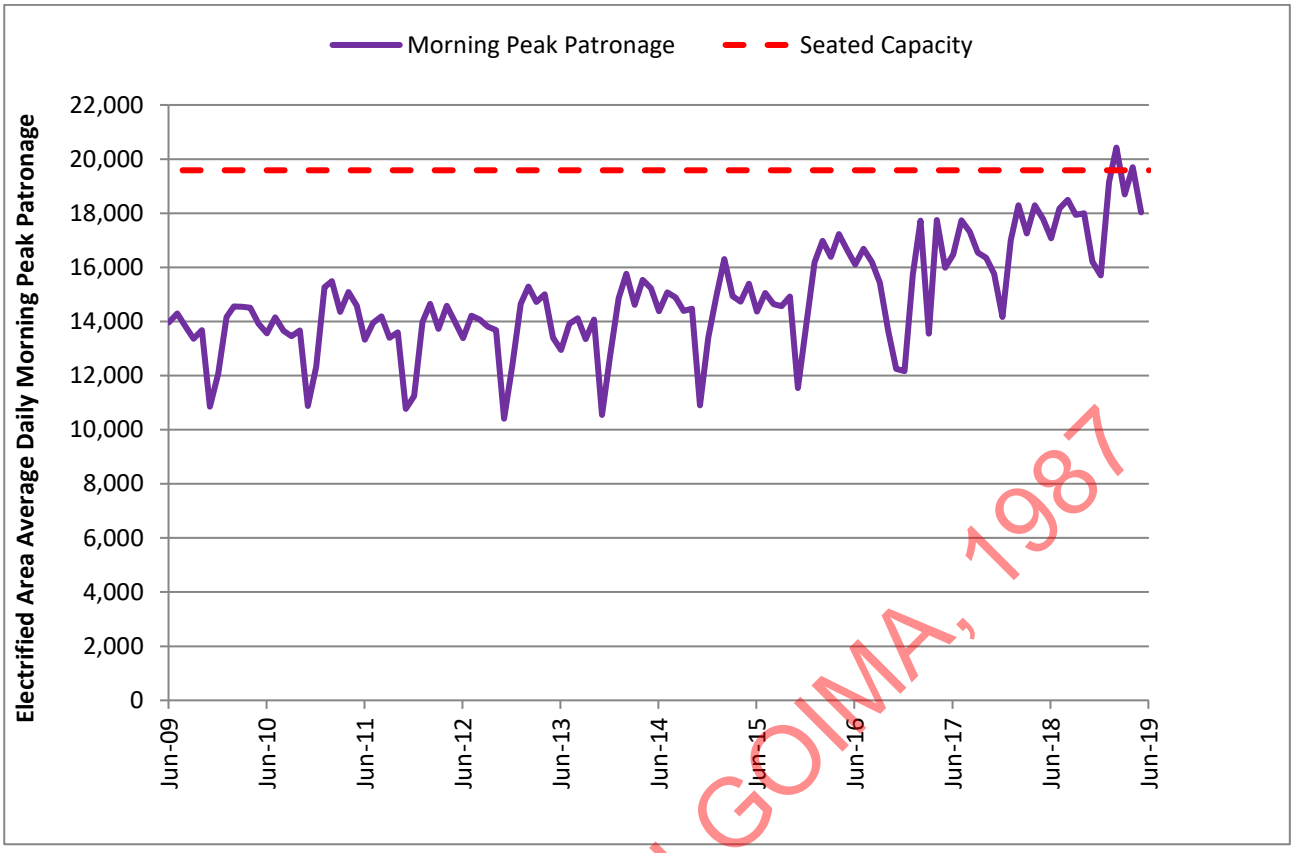


Figure 3-5: Electrified area morning peak patronage

Figure 3-6 shows the effect of projected electrified area peak period patronage growth at the forecast rate, which includes LGWM uplift between the 2023 and 2025 financial years, and at an annual average population growth rate of 1.0%[29] and the recent (four-year average) annual peak patronage growth rate of 5.5%, which both exclude any additional uplift that may result from LGWM[30]. The latter rate is lower than the year on year peak patronage increase of 7.6% between the 2018 and 2019 financial years, and lower than the peak growth rates of 8.5% and 8.7% on the Hutt and Kapiti lines, which account for the bulk of electrified area patronage. The chart indicates that capacity improvements are likely to be required to cater for future demand in the electrified area, particularly if recent growth is sustained.

The capacity issue is particularly acute between 7:30 and 8:30. Figure 3-7 shows the projected relationship between Wellington Station arrival demand and capacity across all Metlink services at this peak hour, at the current forecast rate (including the LGWM patronage uplift[31]), at the current all period growth rate of 5.7% (excluding LGWM uplift), and at the current peak period growth rate of 7.3% (also excluding LGWM uplift)[32]. It shows that ideal capacity[33] could be exceeded by 2024, and standing capacity by 2029, if there are no further initiatives beyond the proposed RS1 timetable changes, which will maximise utilisation of the existing EMU fleet once associated infrastructure is in place. This will require additional peak capacity if crowding and mode shift away from public transport is to be avoided.

Rolling stock lead times place urgency on resolution of this problem, but small scale EMU fleet expansion to provide this additional capacity is likely to be expensive and difficult to achieve in this timeframe, since a small metro EMU order is expected to be unattractive to rolling stock manufacturers. However, there is an opportunity to address this capacity issue efficiently and promptly through resolution of the longer-distance capacity issue, since longer-distance services are an integral part of the metro service offering.

[29] The combined annual average growth rate of the Wellington, Hutt, Porirua, Kapiti and Upper Hutt council areas for the ten-year period ending June 2018, derived from Statistics New Zealand subnational population estimates.
[30] Both growth rates are arithmetic.
[31] Modelling has shown that the LGWM programme could deliver an additional 5% to 10% uplift in patronage on top of the 15% to 20% increase that is currently forecast for the Metlink rail network.
[32] Future growth is shown arithmetically and (other than the forecast rate) excludes additional LGWM patronage uplift.
[33] Ideal capacity is GWRC's measure of the optimal level of fleet utilisation. It assumes that some passengers will stand from inner stations on both express and inner services.

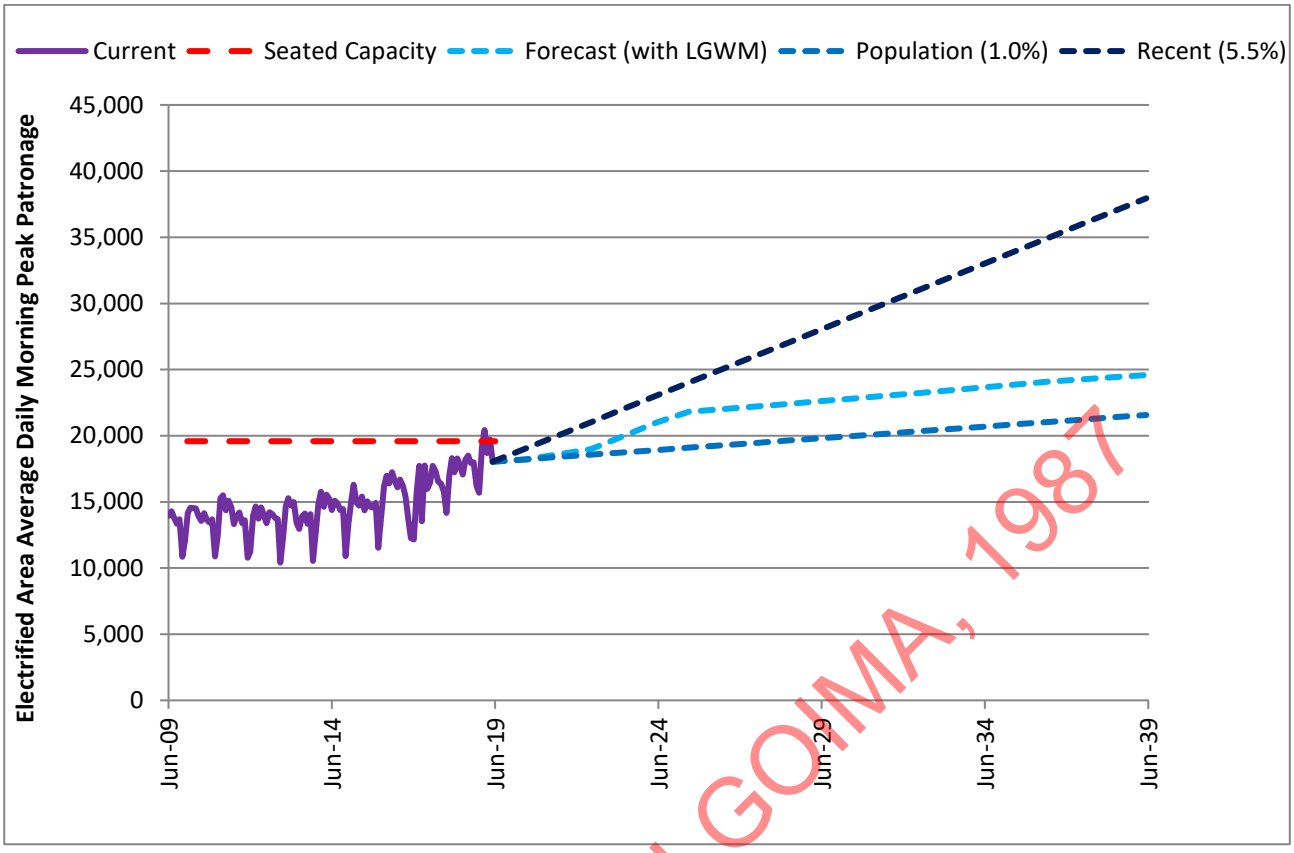


Figure 3-6: Electrified area morning peak patronage and projected demand

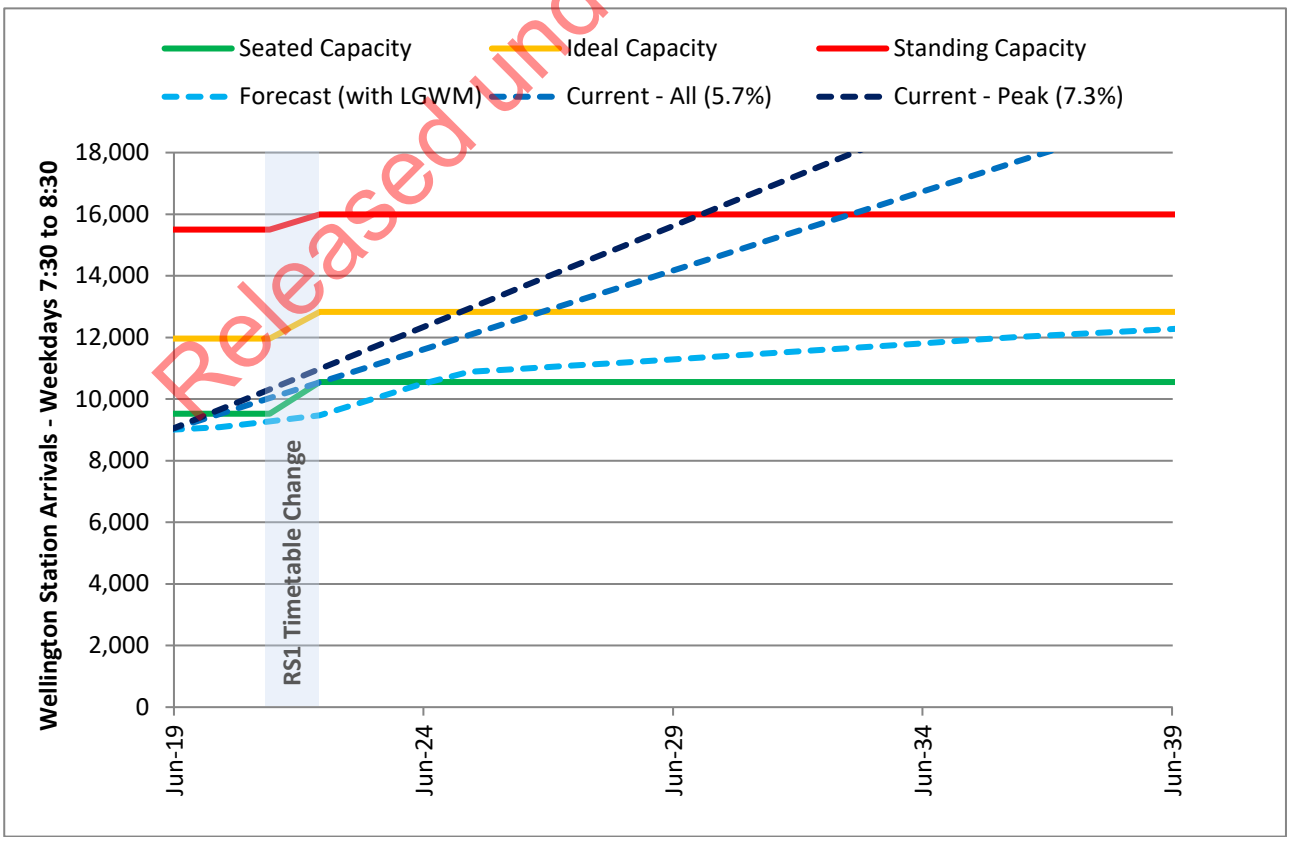


Figure 3-7: Projected Wellington Station morning peak hour demand and capacity (all Metlink lines)

3.1.3 Operational Efficiencies

This problem is encapsulated by the problem statement:

Current longer-distance passenger train configuration results in inflexibility and operational inefficiencies across the whole commuter network.

The Wairarapa and Manawatu lines are run as separate operations, as noted in Section 2.1. Wairarapa Line services are operated by Transdev under contract to GWRC using GWRC-owned rolling stock, while Manawatu Line services are operated by KiwiRail using KiwiRail-owned rolling stock. This arrangement reflects past differences between the two operations, where the Wairarapa Line had both a commuter and access focus with all-day service levels, and was subsidised accordingly, while the Capital Connection was run as commercial (unsubsidised) peak-only commuter service on the Manawatu Line. The latter now receives some public funding support, and there is continuing public request for greater frequency on the line, so the difference between the two lines is not as distinct as it was in the past.

The existing arrangement is inflexible and inefficient. There is no ability to manage operations between two lines, such as to minimise Wellington Station dwell times or match train capacity to demand. Nor is there the ability to manage rolling stock fleet allocation and maintenance in an effective way, with each fleet requiring its own maintenance arrangements and inventory. Both operations therefore carry a degree of overhead that would be reduced or eliminated if run as a single operation with inter-operability between the lines.

Maintenance is further complicated by a complex set of contractual relationships. Transdev subcontracts carriage maintenance to Hyundai Rotem and uses the KiwiRail-owned Wellington Carriage Depot through an access agreement as the location for this maintenance. A 2018 report by SNC- Lavalin[34] notes that maintenance of the Wairarapa fleet is highly sensitive to the ongoing shared use of this depot, which the report notes has an inefficient design and is also used by KiwiRail for carriage maintenance. Hyundai Rotem access to the depot is limited to a four-hour window on weekdays for safety reasons, which is a significant maintenance constraint.

The mixed rolling stock fleet is also an issue. The longer-distance fleet is relatively small in scale compared to the electrified fleet, but it is composed of three different carriage types (18 SW, 6 SE and 7 operable S) and two vans as noted in Section 2.1, with resulting compatibility and maintenance inefficiencies. In comparison, the 83 two-car (i.e. 166 car) EMU fleet that operates services in the electrified area is composed of a single type, providing interoperability benefits and significant economies of scale.

Existing services on both lines are locomotive hauled through hook and tow arrangements with KiwiRail, which offers some locomotive fleet management efficiencies. However, locomotives are expensive to run, and the hook and tow cost is a sizeable proportion of the cost of running services on both lines. The marginal cost of an additional train, such as to address capacity issues, is consequently also high.

Passenger locomotives are required to have special safety features, such as fire-suppression equipment for those that operate services through the Remutaka Tunnel. This limits the pool of locomotives that can be used on services and requires that additional so-equipped locomotives must be held as spares to cover maintenance and provide redundancy to cover failures. This significantly increases fleet requirements and consequently cost. For example, five locomotives are dedicated to the Wairarapa service, despite the current peak requirement for three.

Finally, and importantly, locomotive-hauled trains are also very operationally limiting. They require long turnaround times of at least 30 minutes at each terminus to allow the locomotive to be removed from, turned and reattached to a train, which may also need to be removed from the platform to allow the locomotive to leave and/or to refuel the generator. This process is complex, requires several steps and the involvement of several contractual parties, and differs at each terminus as described in the SNC-Lavalin report. It is considerable constraint in Wellington, where there is conflict with other services that limits the efficient operation of all services at peak times, and a barrier to frequency enhancements that might otherwise help to address capacity issues. The locomotive turning requirement also necessitates that trains that run for part of a line's length must have two locomotives to operate (either double-headed or at each end of the train), with consequent cost impacts.

[34] Investigation of Wairarapa Line Rail Services by SNC-Lavalin Rail & Transit NZ Ltd for GWRC.

3.2 Benefits of Investment

The October ILM workshop identified four key benefits that investing to address the problems would provide:

- enhanced regional connectivity (40% of the overall benefit);
- improved rail service quality (15% of the overall benefit);
- a more resilient transport network (25% of the overall benefit); and
- value for money (20% 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.

3.2.1 Enhanced Regional Connectivity

The longer-distance rail passenger services fulfil a critical regional connectivity role, providing residents of predominantly rural areas of the Wellington and Manawatu regions with affordable access to many employment, educational and other opportunities and services that are not available locally, as noted in Section 2.1. Investment in the rolling stock fleet that provides these services will firstly (and importantly) maintain this connectivity into the future, and then further strengthen it if used to improve capacity and service levels on the two lines, particularly to cater to the significant Wairarapa Line projected demand identified in Section 3.1.2.2. This will improve liveability and quality of life in these areas, and help to drive local economic activity and growth, particularly if improvements are also made to services that provide access to them from the urban parts of the Wellington Region (i.e. through improved counter peak-direction, off-peak and weekend services)[35] as specifically sought by the Wairarapa Economic Development Strategy and Action Plan and Accelerate25 regional economic development plans.

Any investment in the longer-distance rolling stock fleet that increases capacity and service levels will also strengthen the capacity of Metlink's core electrified area rail corridors – the Hutt Line and Kapiti Line – by providing additional capacity and travel options at key stations to cater to the significant electrified area projected demand identified in Section 3.1.2.3. This will maintain access and connectivity at those stations and release capacity to passengers at other stations, in turn improving access and connectivity there.

The benefit strongly aligns with the transport objectives of both regions, with the Wairarapa Economic Development Strategy and Action Plan and Accelerate25 integration and connectivity goals, with the NZTA's long term vision for each corridor as expressed in the LTV (and with its 'better connectivity' objective), and with its TAIP investment priorities and opportunities in the relevant activity classes, particularly with regards to improved transport connections. At the strategic level, it aligns with the Government's transport priorities and objectives as outlined in the GPS, particularly the Access strategic priority to which it is closely linked, and the Environment strategic priority, and with the PGF objectives and its 'job creation and sustainable economic development', 'social inclusion and participation', and 'climate change and environmental sustainability benefits'. The GPS and PGF alignment is of note, since the ILM at which the benefits were defined took place prior to the announcement of the Government coalition and its policies.

The impact of any investment will be able to be measured through changes in service frequency, seat kilometres (seat km) and rail patronage over time. Frequency is a measure of public transport level of service, and it is highlighted as a priority in the GPS. Seat km is a measure of public transport capacity, and it captures both the direct capacity of the rolling stock and the capacity provided through frequency enhancement. Patronage is a fundamental measure of response to any public transport investment, and it is therefore a key measure of success, particularly when assessed over the medium to long term.

3.2.2 Improved Rail Service Quality

The longer-distance rail rolling stock fleet is nearing the end of its service life, as described in sections 2.1 and 3.1 This has not yet affected service reliability in a major way (as opposed to Wairarapa Line infrastructure, which is affecting reliability), but the fleet is worn, is unable to provide sufficient capacity to meet demand on some services, and it is failing in some ways due to demand. Investment in the rolling stock fleet will ensure that the services remain running and operating reliably into the future, that they can cope with current and

[35] The existing services are already used for some business and tourism-related travel, and this would be enhanced by the improved travel options that are offered by service improvements.

ongoing growth, and that they remain attractive to and are a preferred choice for users, the majority of whom spend two to four hours a day travelling by train.

The benefit aligns with the transport objectives of both regions, with the Wairarapa Economic Development Strategy and Action Plan integration goal, with the NZTA's long term vision for each corridor as expressed in the LTV, and with its TAIP investment priorities and opportunities in the relevant activity classes, particularly with regards to service and reliability improvements. At the strategic level, it aligns with the Government's transport priorities and objectives as outlined in the GPS, particularly the Access and Environment strategic priorities, similarly to the regional connectivity benefit.

The impact of any investment will be able to be measured through journey dependability and customer satisfaction. Journey dependability is a measure of service reliability and punctuality and reflects the importance of those attributes to passengers. Customer satisfaction encompasses a myriad of attributes that are important to passengers, including perceptions of dependability, train interior features and functionality, ride quality, value for money, and overall perceptions of service quality, and it is likely to respond strongly to rolling stock and associated service improvements.

3.2.3 More Resilient Transport Network

The longer-distance rail rolling stock fleet and the services that it provides offer two types of resilience benefit. Firstly, it offers transport system-level resilience benefits by providing a modal and route alternative to the road network. This is particularly critical on the Wairarapa Line, where the services frequently fulfil this role when the parallel State Highway 2 is closed, whether due to weather or crash-related incidents. The fleet also offers public transport network-level resilience benefits (which also have a wider transport system-level impact), since it utilises a different power source from the electrified network and can continue operating when other services cease running due to a power fault or storm damage. Investment in the rolling stock fleet will ensure that these benefits are retained, particularly if the chosen option does not rely solely an overhead power source to operate, and even more so if the fleet can be managed between the two lines to allow short-term transport system or public transport network resilience-related capacity issues to be managed.

The benefit strongly aligns with the transport objectives of both regions, which identify system resilience as a priority, with the Accelerate25 resilience goal, with the NZTA's LTV 'system resilience' objective, and with its TAIP investment priorities and opportunities in the relevant activity classes, particularly with regards to network resilience, reliability and capacity. At the strategic level, it aligns with the Government's transport priorities and objectives as outlined in the GPS, particularly the Access strategic priority (to which it is closely linked as an existing example of a whole-of-system approach to resilience) and the Environment strategic priority, and with the PGF objectives and its associated 'resilience' benefit.

The impact of any investment will be able to be measured through the rolling stock fleet's compatibility and load capacity, which reflect its capacity to respond to resilience events when needed.

3.2.4 Value for Money

The longer-distance rail rolling stock fleet is becoming increasingly expensive to maintain as it nears the end of its service life, and it is more expensive to operate than it may need to be, as described in sections 2.1 and 3.1. Direct value for money benefits from an investment in replacement rolling stock are therefore likely to come from the elimination of some impending heavy maintenance, from maintenance and operational economies of scale provided by the elimination of a mixed-ownership and mixed-type rolling stock fleet, and, if chosen in an option, from replacement of locomotive haulage with a more-efficient motive power source. These would allow the same level of service to be provided at lower cost, or more service to be provided at the same level of investment, with either scenario providing better value for money than at present.

Value for money will also be available at the public transport network and transport system levels, particularly if additional capacity is provided by any replacement fleet. At the network level, this capacity may allow rail patronage growth to be accommodated without requiring additional EMU capacity until the Matangi fleet is replaced in the early 2030s. Figure 3-8 shows how this approach might address the morning peak hour capacity issue identified in Section 3.1.2.3 in this way. Similarly, the additional capacity may allow transport system growth to be accommodated without additional road capacity. It may also provide a potential 'carrot' to any future demand management 'stick' that might be used to gain value for money through better management of road capacity.

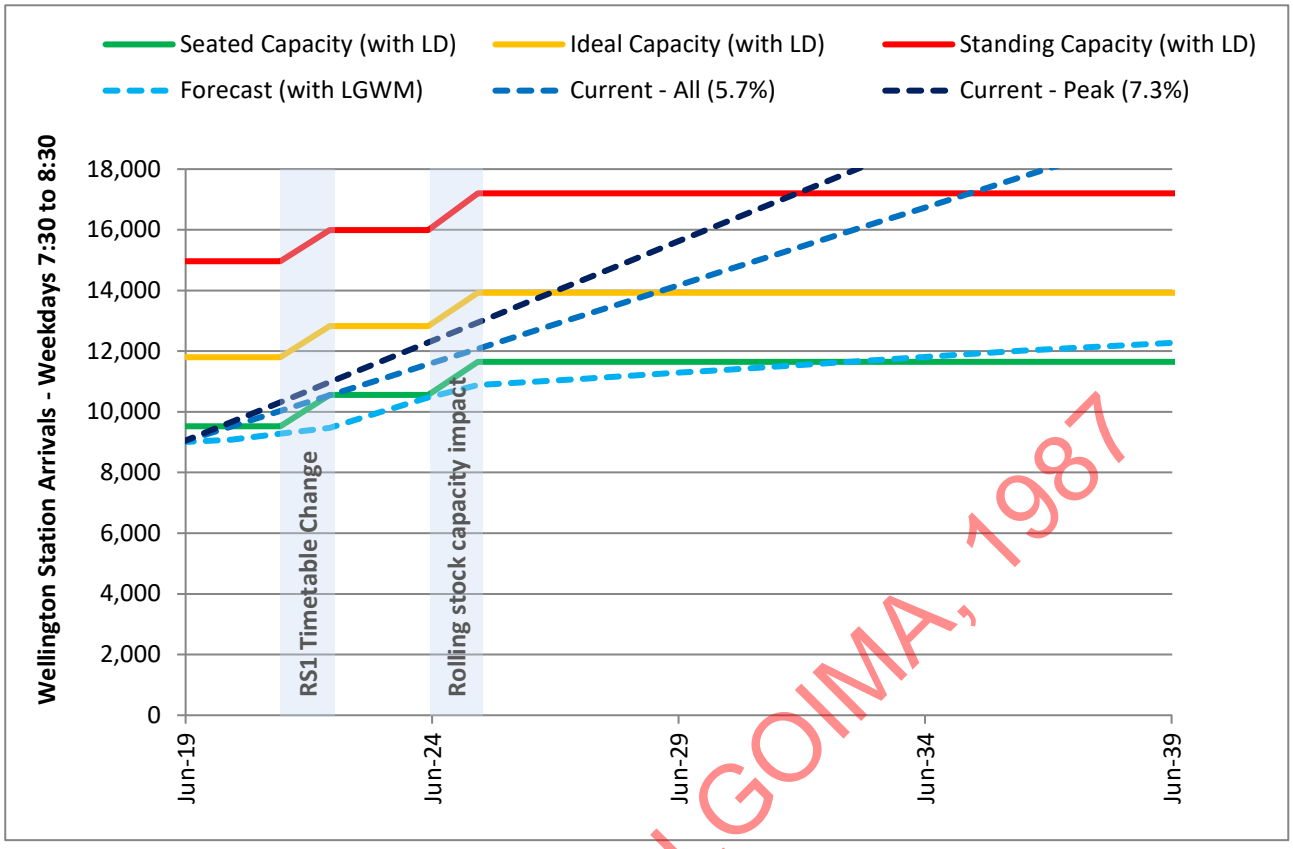


Figure 3-8: Projected Wellington Station morning peak hour demand and extra capacity (all Metlink lines)

In addition, value for money may be gained from joint procurement of a replacement fleet with other regions and/or the ability the use a new Wellington fleet to run trials in other parts of the country. This aspect is outside of the scope of this business case, but it is important to note that the Government has proposed new longer-distance rail passenger services for the Upper North Island (Hamilton-Auckland and possibly beyond) and made allowance for them (as new interregional commuter rail services) in the transitional rail funding section of the GPS. Economies of scale may be gained from procuring a single fleet that can operate across the different geographies.

The benefit aligns with the transport objectives of both regions, with the Accelerate25 efficiency goal, with a value for money expectation for new infrastructure in NZTA's LTV, and with the value for money expectation that is central to the TAIP. At the strategic level, it aligns with the with the Government's transport priorities and objectives as outlined in the GPS, particularly the overarching Value for Money strategic priority, and with the PGF objectives, particularly in relation to productivity.

The impact of any investment will be able to be measured through the level of maintenance and operational costs per unit of service delivered or per unit of benefit received, and potentially through other wider measures.

3.3 Investment Objectives

The October ILM workshop identified four SMART investment objectives to guide the selection and assessment of options and ensure that they would respond to the problems and achieve the benefits in an appropriate way. These were subsequently revised at a second ILM workshop on November 2017 and (as revised) are to:

- increase service capacity of longer-distance services;
- improve customer journey satisfaction on the longer-distance network;
- maximise operational flexibility of longer-distance passenger rolling stock; and
- minimise whole of life costs per passenger across the longer-distance network.

The investment objectives are described further in the following sections and summarised along with their relationship to the problems and benefits in the ILM map in Appendix A. Appendix B outlines the benefits realisation plan that will support monitoring of the investment objectives.

3.3.1 Increase Service Capacity

This investment objective seeks to increase the capacity of lower North Island longer-distance rail passenger services. It will be quantified by measuring the change in total morning peak seat kilometres provided across both lines, between the current baseline level and that provided in 2030.

3.3.2 Improve Customer Satisfaction

This investment objective seeks to improve customer journey satisfaction with services on the lower North Island longer-distance network. It will be quantified by measuring the change in overall customer satisfaction on longer-distance services, as surveyed through the annual Metlink customer survey, from the current level to a target of 95% satisfaction by 2030.

3.3.3 Maximise Operational Flexibility

This investment objective seeks to maximise the operational flexibility of longer-distance passenger rolling stock on and between the two lower North Island corridors. It will be quantified by measuring the change in longer-distance service dwell time at Wellington Station during the morning peak between the current level and that needed in 2030.

3.3.4 Minimise Whole of Life Costs Per Passenger

This investment objective seeks to minimise whole of life costs per passenger across the longer-distance network. It will be quantified by measuring the change in net cost per passenger per annum, between the current level and that achieved in 2030.

3.4 Conclusion

A stakeholder assessment has found that there are three clear problems associated with the existing longer-distance rail rolling stock fleet, which need to be addressed with some urgency:

- train condition;
- fleet capacity; and
- operational (in)efficiencies.

Investing to address the problems is expected to provide four major benefits to investors and the wider community:

- enhanced regional connectivity;
- improved rail service quality;
- a more resilient transport network; and
- value for money.

The four benefits of investment link closely to the objectives of key central and local government transport and regional growth strategies and plans, as summarised in Table 3-1.

Table 3-1: Links between the investment benefits and relevant strategies and plans

	Enhanced Regional Connectivity	Improved Rail Service Quality	More Resilient Transport Network	Value for Money
Wellington Regional Rail Plan	✓	✓	✓	✓
Wellington Regional Public Transport Plan	✓	✓	✓	✓
Wellington Regional Land Transport Plan	✓	✓	✓	✓
Wairarapa Economic Development Strategy	✓	✓		
Horizons Regional Public Transport Plan	✓			✓
Horizons Regional Land Transport Plan	✓	✓	✓	✓
Horizons Accelerate25 Growth Programme	✓		✓	✓
NZTA Long Term Strategic View	✓	✓	✓	✓
NZTA Transport Agency Investment Proposal	✓	✓	✓	✓
Govt Policy Statement on Land Transport	✓	✓	✓	✓
Provincial Growth Fund	✓		✓	✓

When considered alongside the wider considerations described in Chapter 2 these provide strategic justification for investing in a longer-distance rail rolling stock solution for the Wairarapa and Manawatu lines. Such investment is supported by the following clear investment objectives:

- increase service capacity of longer-distance services;
- improve customer journey satisfaction on the longer-distance network;
- maximise operational flexibility of longer-distance passenger rolling stock; and
- minimise whole of life costs per passenger across the longer-distance network.

4. Option Selection

4.1 Options Development

The options for responding to the problems identified in the first ILM workshop were determined at the second ILM workshop, which was held with stakeholders on 1 November 2017. Participants included representatives of GWRC, HRC, NZTA, Transdev, and the Masterton, Carterton and South Wairarapa district councils.

A wide range of long list responses was considered as part of the initial assessment by the group. These included a mix of demand, supply and productivity related responses, including variations in mode (bus versus rail) and fleet type (including life extension-related responses), and variations in service levels, including service frequency and timing. The responses were either discarded as being impractical or incorporated into the six potential options listed in Table 4-1, which were then taken forward for assessment. A summary of the most-realistic long list options and the rationale taking forward or not is provided in Appendix C.

Table 4-1: Potential options

Option	Name	Outline Description
1	Maintain existing Wairarapa fleet	Maintain existing Wairarapa Line fleet and services and allow Manawatu Line services to cease operating.
2	Maintain and boost existing fleets	Improve Wairarapa Line fleet and services by purchasing additional used rolling stock and maintain existing Manawatu Line fleet and services.
3	Partial EMU fleet	Electrify to Featherston and Otaki, extend EMU operations to those points and improve services, with bus connections from outer points.
4	New DMU fleet	Replace existing fleets with a DMU fleet at the earliest opportunity and improve services.
5	New DMMU fleet	Replace existing fleets with a dual-mode multiple unit (DMMU) fleet at the earliest opportunity and improve services.
6	Full EMU fleet	Electrify to Masterton and Palmerston North, extend EMU operations to those points at earliest opportunity and improve services.

All options assume that the Capital Connection will receive funding support to enable it to continue operating in its current form until mid-2021, when the S type carriages will reach the end of their service life. The options also assume the implementation of the infrastructure upgrades identified by the Wellington Metro Railway Network Track Infrastructure Catch-up Renewals and Unlocking Network Capacity and Resilience business cases.

An overview of each option is provided in the following sections.

4.2 Options Description

4.2.1 Option 1: Maintain Existing Wairarapa Fleet

This option is the do-minimum option, which the NZTA defines as the *most likely transport situation over the course of the appraisal period if no intervention were to occur.* It is the status quo option that uses existing rolling stock and entails:

- maintaining existing Wairarapa Line service levels on an ongoing basis, with rolling stock refurbishment by the end of the 2022 financial year and replacement with DMUs (or other suitable rolling stock as determined at that time) by the end of the 2032 financial year; and

- maintaining existing Manawatu Line service levels until mid-2021, when services will be withdrawn when the S type carriages reach the end of their service life.

Table 4-2 summarises the operational (service) and fleet and infrastructure attributes of this option.

Table 4-2: Option 1 operational and fleet and infrastructure requirements

Category	Attributes
Operations	• Maintain existing Wairarapa service levels on an ongoing basis: Weekday peak: 3 morning and 3 afternoon peak-direction trips Weekday off-peak: 2 (plus 1 Friday evening) trips in each direction Weekend days: 2 trips in each direction. • Maintain existing Manawatu service levels until end 2022 FY, when the rolling stock must be withdrawn: Weekday peak: 1 morning and 1 afternoon peak-direction trips.
Fleet and Infrastructure	• Refurbish SW and SE fleets by end 2022 FY. • Replace SW and SE fleets with 8 new 4-car DMUs by end 2032 FY. • Construct new DMU maintenance facilities and stabling yard in Wellington area by end 2032 FY.

The differing treatment of each line under this option reflects their different focus and status. Existing Wairarapa Line services have both a commuter and access focus, an important road substitute role, are identified as being integral to the Wellington public transport network in the region's RPTP and operate under contract. Existing Manawatu Line services have a peak-only focus, they are not currently considered to be integral to the network in either region, and they are commercially operated, albeit with some public funding support.

The option would respond to the train condition problem, but only on the Wairarapa Line, and only to the extent required to maintain services to an adequate standard. It would not address the fleet capacity or operational efficiency-related problems. It would therefore have significant regional connectivity, rail service quality and resilience disbenefits, while making no meaningful improvement in value for money.

4.2.2 Option 2: Maintain and Boost Existing Fleets

This option is the enhanced status quo option, which improves Wairarapa Line services and maintains Manawatu Line services using an expanded fleet of existing rolling stock. It entails:

- improving Wairarapa Line service levels, initially through improved asset utilisation that is enabled by compatibility upgrades, then again once rolling stock fleet expansion and refurbishment has been completed by the end of the 2022 financial year, then maintaining the higher service levels on an ongoing basis, with replacement with DMUs (or other suitable rolling stock as determined at that time) by the end of the 2032 financial year; and
- maintaining existing Manawatu Line service levels on an ongoing basis, with rolling stock refurbishment by the end of the 2022 financial year and replacement with DMUs (or other suitable rolling stock as determined at that time) by the end of the 2032 financial year.

Table 4-3 summarises the operational and fleet and Infrastructure attributes of this option.

Table 4-3: Option 2 operational and fleet and infrastructure requirements

Category	Attributes
Operations	• Increase Wairarapa service levels in 2023 FY once fleet refurbishment and expansion is completed: Weekday peak (2019 FY): 3 morning and 3 afternoon peak-direction trips Weekday peak (2023 FY): 4 morning and 4 afternoon peak-direction trips (all full corridor), and 1 morning and 1 afternoon counter peak-direction trips Weekday off-peak (2019 FY): 2 (plus 1 Friday evening) trips in each direction Weekday off-peak (2023 FY): 3 (plus 1 Friday evening) trips in each direction Weekend days (2019 FY): 2 trips in each direction Weekend days (2023 FY): 4 trips in each direction. • Maintain existing Manawatu service levels on an ongoing basis: Weekday peak: 1 morning and 1 afternoon peak-direction trips.
Fleet and Infrastructure	• Refurbish SW and SE fleets by end 2022 FY. • Purchase S fleet and refurbish by end 2022 FY. • Purchase 16 additional BR Mark 2 cars and refurbish to SE standard by end 2022 FY. • Change Featherston, Carterton and Maymorn track arrangements to enable frequency enhancements by end 2022 FY. • Extend full signalling system from Featherston to Masterton to enable frequency enhancements by end of 2022 FY. • Expand Masterton stabling facilities by end 2022 FY. • Upgrade Manawatu Line stations by end 2022 FY • Replace SW, SE and S fleets with 14 new 4-car DMUs by end 2032 FY. • Construct new DMU maintenance facilities, and stabling yards in Wellington area by end 2032 FY.

Manawatu Line services would cease to be commercially operated under this option. They would be formally included in each regions' public transport network (i.e. identified as being integral to the public transport networks in the respective RPTPs as required by the LTMA) and operated under contract to GWRC. Rolling stock would be owned by GWRC. Rolling stock and services would be funded jointly by GWRC, HRC and the NZTA in accordance with the NZTA's prevailing funding assistance rate.

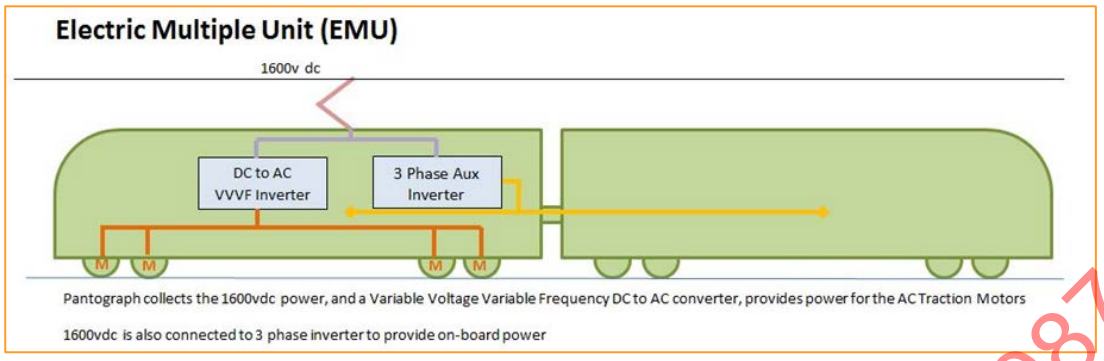
The option differs from subsequent options in two ways. Firstly, it would delay the replacement of rolling stock until the current fleets reach the end of their service life, which would require full refurbishment of the S fleet to enable Manawatu Line services to continue operating beyond mid-2021 and align replacement with the SW and SE fleets. Secondly, additional used rolling stock would be purchased and refurbished to provide increased capacity in the intervening period. The delayed replacement is expected to result in a lower level of patronage growth than subsequent options, and in turn require one less DMU than those in the long run. Subsequent options align capacity enhancement with fleet replacement, and schedule this for the earliest opportunity.

The option would respond to the train condition problem on both lines, but only to the extent required to maintain services to an acceptable standard[36]. The purchase of additional used rolling stock would address the fleet capacity problem. Joint ownership and operation of the fleets would also offer some operational efficiencies through better fleet management, although the mixed fleet and locomotive haulage requirement

[36] For this purpose, acceptable standard is defined as being clean and tidy and in full operating condition, but not an improved condition as would be the case with new rolling stock.

would limit this response. The option would consequently offer partial regional connectivity, rail service quality, resilience and value for money benefits.

4.2.3 Option 3: Partial EMU Fleet



This option improves services on both lines by extending EMU operations to Featherston and Otaki and replacing existing rolling stock fleets with a larger fleet of EMUs. It entails:

- improving Wairarapa Line service levels, initially through improved asset utilisation that is enabled by compatibility upgrades, then again once electrification is completed to Featherston and new EMU rolling stock is available for service by the end of the 2025 financial year, then maintaining the higher service levels on an ongoing basis; and

- maintaining existing Manawatu Line service levels until the end of the 2025 financial year, then improving them once electrification is completed to Otaki and new EMU rolling stock is available for service, then maintaining the higher service levels on an ongoing basis.

A key characteristic of the option is the use of high-quality, high-capacity bus connections to all rail services at Featherston and Otaki, to maintain public transport links to all towns that currently have rail services on each corridor north of those points. Patronage on the bus links is expected to remain relatively high, but additional park and ride capacity would be provided to cope with an expected increase in park and ride demand at those stations.

Table 4-4 summarises the operational and fleet and Infrastructure attributes of this option.

Table 4-4: Option 3 operational and fleet and infrastructure requirements

Category	Attributes
Operations	• Increase Wairarapa service levels in 2026 FY once fleet and infrastructure changes are completed (all post-2025 FY trips are Featherston-only): Weekday peak (2019 FY): 3 morning and 3 afternoon peak-direction trips Weekday peak (2026 FY): 4 morning and 4 afternoon peak-direction trips, and 1 morning and 1 afternoon counter peak-direction trips Weekday off-peak (2019 FY): 2 (plus 1 Friday evening) trips in each direction Weekday off-peak (2026 FY): 3 (plus 1 Friday evening) trips in each direction Weekend days (2019 FY): 2 trips in each direction Weekend days (2026 FY): 4 trips in each direction. • Maintain existing Manawatu service levels until 2025 FY, then increase in 2026 FY once fleet and infrastructure changes are completed (all post-2025 FY trips are Otaki-only): Weekday peak (2019 FY): 1 morning and 1 afternoon peak-direction trips Weekday peak (2026 FY): 2 morning and 2 afternoon peak-direction trips Weekday off-peak (2019 FY): no service Weekday off-peak (2026 FY): 2 trips in each direction Weekend days (2019 FY): no service Weekend days (2026 FY): 2 trips in each direction. • Contract connecting Masterton-Featherston and Palmerston North-Otaki bus services by end of 2025 FY
Fleet and Infrastructure	• Refurbish SW and SE fleets by end 2022 FY. • Undertake life extension activities on S fleet by end 2022 FY • Replace SW, SE and S fleets with 15 new 4-car EMUs by end 2025 FY. • Extend overhead catenary and supporting infrastructure to Featherston and Otaki by end 2025 FY. • Change Featherston and Maymorn track arrangements to enable frequency enhancements by end 2025 FY • Construct new stabling facilities in Featherston and Otaki by end 2025 FY. • Expand park and ride and bus transfer facilities in Featherston and Otaki by end 2025 FY. • Expand EMU maintenance facilities and stabling yards in Wellington area by end 2025 FY.

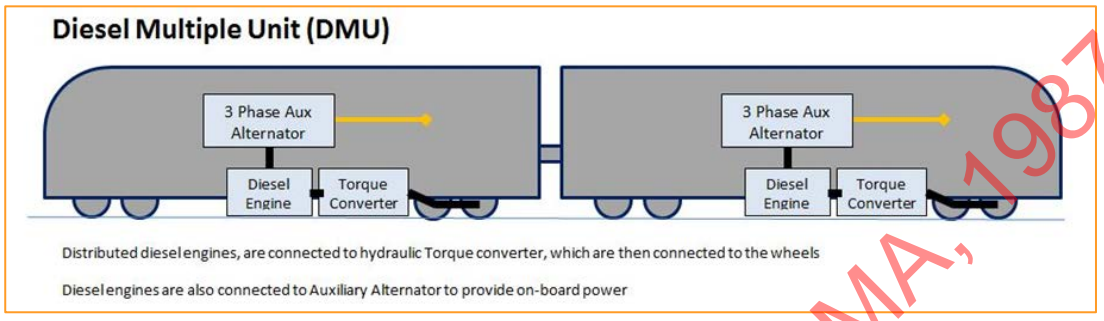
As with Option 2, Manawatu Line services would cease to be commercially operated under this option, although only after replacement of existing rolling stock with EMUs. They would be formally included in each regions' public transport network (i.e. identified as being integral to the public transport networks in the respective RPTPs as required by the LTMA) and operated under contract to GWRC. Rolling stock would be owned by GWRC. Rolling stock and services would be funded jointly by GWRC, HRC and the NZTA in accordance with the NZTA's prevailing funding assistance rate. Connecting bus services would be contracted to GWRC on the Wairarapa corridor and HRC on the Manawatu corridor.

The time required to complete EMU procurement and construction, and construction of electric overhead infrastructure, is a major constraint of this option. This would delay the introduction of rolling stock and service improvements by several years compared to Option 2, and in turn require the refurbishment of existing rolling

stock to enable services to continue operating in the intervening period. However, a countering advantage is that it could potentially be a stage in a phased electrification programme.

The option would respond to the train condition and operational efficiencies problems, although not completely until the 2026 financial year. It would also address the fleet capacity problem, but only after the same point, which may be problematic on the Wairarapa Line and in the electrified area. The option would consequently offer regional connectivity, rail service quality, resilience and value for money benefits, particularly from the 2026 financial year. However, the replacement of rail services with bus services could be perceived by existing passengers as reducing connectivity and quality, and EMU-run services would be subject to the same resilience constraints as other EMU-run services on the network.

4.2.4 Option 4: New DMU Fleet



This option improves services on both lines by replacing existing rolling stock fleets with a larger fleet of DMUs. It entails:

- improving Wairarapa Line service levels, initially through improved asset utilisation that is enabled by compatibility upgrades, then again once new DMU rolling stock is available for service by the end of the 2025 financial year, then maintaining the higher service levels on an ongoing basis; and
- maintaining Manawatu Line service levels until the end of the 2025 financial year, then improving them once new DMU rolling stock is available for service, then maintaining the higher service levels on an ongoing basis.

Table 4-5 summarises the operational and fleet and Infrastructure attributes of this option.

Table 4-5: Option 4 operational and fleet and infrastructure requirements

Category	Attributes
Operations	• Increase Wairarapa service levels in 2026 FY once fleet and infrastructure changes are completed: Weekday peak (2019 FY): 3 morning and 3 afternoon peak-direction trips Weekday peak (2026 FY): 4 morning and 4 afternoon peak-direction trips (all full corridor), and 1 morning and 1 afternoon counter peak-direction trips Weekday off-peak (2019 FY): 2 (plus 1 Friday evening) trips in each direction Weekday off-peak (2026 FY): 3 (plus 1 Friday evening) trips in each direction Weekend days (2019 FY): 2 trips in each direction Weekend days (2026 FY): 4 trips in each direction. • Maintain existing Manawatu service levels until 2025 FY, then increase in 2026 FY once infrastructure changes are completed: Weekday peak (2019 FY): 1 morning and 1 afternoon peak-direction trips Weekday peak (2026 FY): 2 morning and 2 afternoon peak-direction trips (1 Levin-only) Weekday off-peak (2019 FY): no service Weekday off-peak (2026 FY): 2 trips in each direction Weekend days (2019 FY): no service Weekend days (2026 FY): 2 trips in each direction.
Fleet and Infrastructure	• Refurbish SW and SE fleets by end 2022 FY. • Undertake life extension activities on S fleet by end 2022 FY. • Replace SW, SE and S fleets with the 15 new 4-car DMUs by end 2025 FY. • Change Carterton, Featherston and Maymorn track arrangements to enable frequency enhancements by end 2025 FY. • Extend full signalling system from Featherston to Masterton to enable frequency enhancements by end of 2025 FY. • Expand Masterton stabling facilities and construct new stabling facilities in Levin by end 2025 FY. • Upgrade Manawatu Line stations by end 2025 FY. • Construct new DMU maintenance facilities and stabling yards in Wellington area by end 2025 FY.

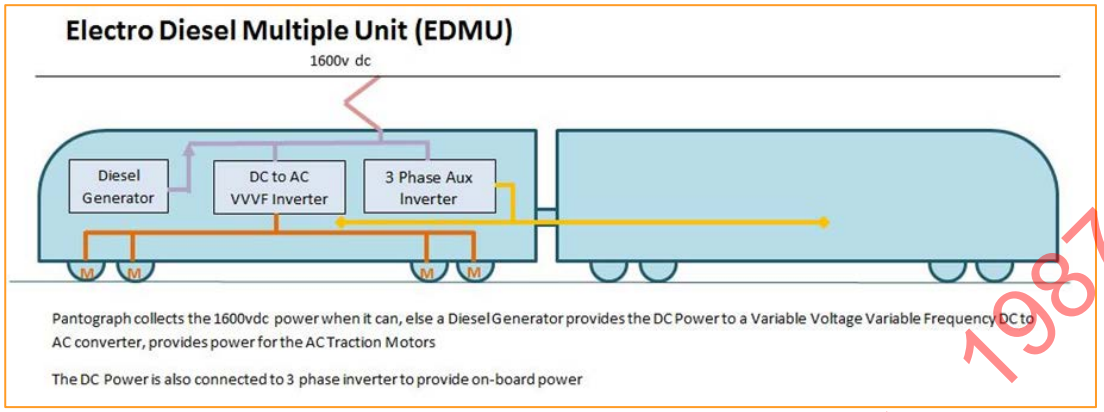
As with Options 2 and 3, Manawatu Line services would cease to be commercially operated under this option, although only after replacement of existing rolling stock with DMUs. They would be formally included in each regions' public transport network (i.e. identified as being integral to the public transport networks in the respective RPTPs as required by the LTMA) and operated under contract to GWRC. Rolling stock would be owned by GWRC. Rolling stock and services would be funded jointly by GWRC, HRC and the NZTA in accordance with the NZTA's prevailing funding assistance rate.

The time required to complete DMU procurement and construction is a major constraint of this option. This would delay the introduction of rolling stock and service improvements by several years compared to Option 2, and in turn require the refurbishment of existing rolling stock to enable services to continue operating in the intervening period.

The option would respond to the train condition and operational efficiencies problems, although not completely until the 2026 financial year. It would also address the fleet capacity problem, but only after the

same point, which may be problematic on the Wairarapa Line and in the electrified area. The option would consequently offer regional connectivity, rail service quality, resilience and value for money benefits, particularly from the 2026 financial year. The ability of DMUs to operate without electricity is a significant resilience benefit over most other options.

4.2.5 Option 5: New Dual-Mode Multiple Unit (DMMU) Fleet



This option improves services on both lines by replacing existing rolling stock fleets with a larger fleet of dual mode multiple units (DMMU). The electro diesel multiple unit (EDMU) is used to provide a baseline for this option, but other alternatives could include battery-powered and hydrogen-powered units, which are becoming more feasible as technology improves. These would be reviewed and considered during the specification and procurement process. The DMMU option entails:

- improving Wairarapa Line service levels, initially through improved asset utilisation that is enabled by compatibility upgrades, then again once new DMMU rolling stock is available for service by the end of the 2025 financial year, then maintaining the higher service levels on an ongoing basis; and
- maintaining Manawatu Line service levels until the end of the 2025 financial year, then improving them once new DMMU rolling stock is available for service, then maintaining the higher service levels on an ongoing basis.

Table 4-6 summarises the operational and fleet and Infrastructure attributes of this option.

Table 4-6: Option 5 operational and fleet and infrastructure requirements

Category	Attributes
Operations	• Increase Wairarapa service levels in 2026 FY once fleet and infrastructure changes are completed: Weekday peak (2019 FY): 3 morning and 3 afternoon peak-direction trips Weekday peak (2026 FY): 4 morning and 4 afternoon peak-direction trips (all full corridor), and 1 morning and 1 afternoon counter peak-direction trips Weekday off-peak (2019 FY): 2 (plus 1 Friday evening) trips in each direction Weekday off-peak (2026 FY): 3 (plus 1 Friday evening) trips in each direction Weekend days (2019 FY): 2 trips in each direction Weekend days (2026 FY): 4 trips in each direction. • Maintain existing Manawatu service levels until 2025 FY, then increase in 2026 FY once infrastructure changes are completed: Weekday peak (2019 FY): 1 morning and 1 afternoon peak-direction trips Weekday peak (2026 FY): 2 morning and 2 afternoon peak-direction trips (1 Levin-only) Weekday off-peak (2019 FY): no service Weekday off-peak (2026 FY): 2 trips in each direction Weekend days (2019 FY): no service Weekend days (2026 FY): 2 trips in each direction.
Fleet and Infrastructure	• Refurbish SW and SE fleets by end 2022 FY. • Undertake life extension activities on S fleet by end 2022 FY. • Replace SW, SE and S fleets with the 15 new 4-car DMMUs by end 2025 FY. • Change Carterton, Featherston and Maymorn track arrangements to enable frequency enhancements by end 2025 FY. • Extend full signalling system from Featherston to Masterton to enable frequency enhancements by end of 2025 FY. • Expand Masterton stabling facilities and construct new stabling facilities in Levin by end 2025 FY. • Upgrade Manawatu Line stations by end 2025 FY. • Construct new DMMU maintenance facilities and stabling yards in Wellington area by end 2025 FY.

As with Options 2-4, Manawatu Line services would cease to be commercially operated under this option, although only after replacement of existing rolling stock with DMMUs. They would be formally included in each regions' public transport network (i.e. identified as being integral to the public transport networks in the respective RPTPs as required by the LTMA) and operated under contract to GWRC. Rolling stock would be owned by GWRC. Rolling stock and services would be funded jointly by GWRC, HRC and the NZTA in accordance with the NZTA's prevailing funding assistance rate.

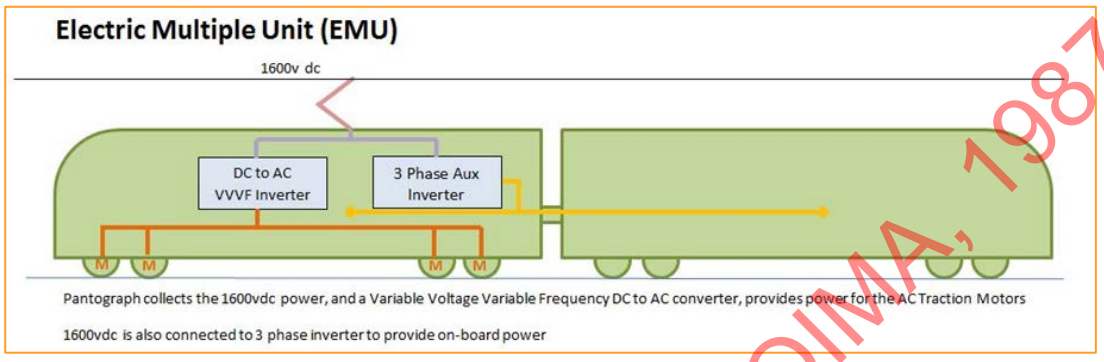
The time required to complete DMMU procurement and construction is a major constraint of this option. This would delay the introduction of rolling stock and service improvements by several years compared to Option 2, and in turn require the refurbishment of existing rolling stock to enable services to continue operating in the intervening period.

The option is very similar to Option 4, with the primary difference being the use of dual mode rather than single mode rolling stock. The DMMUs would use diesel power north of Upper Hutt and Waikanae, similarly to the

DMUs, and draw power from the electric overhead south of those points. They would therefore have the twin advantage of using a sustainable power source for part of their journey and the ability to operate both with and without electric power. The latter advantage is potentially very useful, as it could provide a means for gradually extending network electrification while maintain high service levels.

The option would respond to the train condition and operational efficiencies problems, although not completely until the 2026 financial year. It would also address the fleet capacity problem, but only after the same point, which may be problematic on the Wairarapa Line and in the electrified area. The option would consequently offer regional connectivity, rail service quality, resilience and value for money benefits, particularly from the 2026 financial year. The ability of DMMUs to operate without electricity is a significant resilience benefit over most other options.

4.2.6 Option 6: Full EMU Fleet



This option is the do-maximum option, which improves services on both lines by extending EMU operations the full length if each line and replacing existing rolling stock fleets with a larger fleet of EMUs. It entails:

- improving Wairarapa Line service levels, initially through improved asset utilisation that is enabled by compatibility upgrades, then again once electrification is completed to Masterton and new EMU rolling stock is available for service by the end of the 2027 financial year, then maintaining the higher service levels on an ongoing basis; and
- maintaining existing Manawatu Line service levels until the end of the 2027 financial year, then improving them once electrification is completed to Palmerston North and new EMU rolling stock is available for service, then maintaining the higher service levels on an ongoing basis.

Table 4-7 summarises the operational and fleet and Infrastructure attributes of this option.

Table 4-7: Option 6 operational and fleet and infrastructure requirements

Category	Attributes
Operations	• Increase Wairarapa service levels in 2028 FY once fleet and infrastructure changes are completed: Weekday peak (2019 FY): 3 morning and 3 afternoon peak-direction trips Weekday peak (2028 FY): 4 morning and 4 afternoon peak-direction trips (all full corridor), and 1 morning and 1 afternoon counter peak-direction trips Weekday off-peak (2019 FY): 2 (plus 1 Friday evening) trips in each direction Weekday off-peak (2028 FY): 3 (plus 1 Friday evening) trips in each direction Weekend days (2019 FY): 2 trips in each direction Weekend days (2028 FY): 4 trips in each direction. • Maintain existing Manawatu service levels until 2027 FY, then increase in 2028 FY once fleet and infrastructure changes are completed: Weekday peak (2019 FY): 1 morning and 1 afternoon peak-direction trips Weekday peak (2028 FY): 2 morning and 2 afternoon peak-direction trips (1 Levin-only) Weekday off-peak (2019 FY): no service Weekday off-peak (2028 FY): 2 trips in each direction Weekend days (2019 FY): no service Weekend days (2028 FY): 2 trips in each direction.
Fleet and Infrastructure	• Refurbish SW and SE fleets by end 2022 FY. • Undertake life extension activities on S fleet by end 2022 FY. • Replace SW, SE and S fleets with 15 new 4-car EMUs by end 2027 FY. • Extend overhead catenary and supporting infrastructure to Masterton and Palmerston North by end 2027 FY. • Change Carterton, Featherston and Maymorn track arrangements to enable frequency enhancements by end 2027 FY. • Extend full signalling system from Featherston to Masterton to enable frequency enhancements by end of 2027 FY. • Expand Masterton stabling facilities and construct new stabling facilities in Levin by end 2027 FY. • Upgrade Manawatu Line stations by end 2027 FY. • Expand EMU maintenance facilities and stabling yard in Wellington area by end 2027 FY.

As with Options 2-5, Manawatu Line services would cease to be commercially operated under this option, although only after replacement of existing rolling stock with EMUs. They would be formally included in each regions' public transport network (i.e. identified as being integral to the public transport networks in the respective RPTPs as required by the LTMA) and operated under contract to GWRC. Rolling stock would be owned by GWRC. Rolling stock and services would be funded jointly by GWRC, HRC and the NZTA in accordance with the NZTA's prevailing funding assistance rate.

The time required to complete EMU procurement and construction, and construction of electric overhead infrastructure, is a major constraint of this option in the same way as Option 3. This would delay the introduction of rolling stock and service improvements by several years compared to most other options, and in turn require the refurbishment of all existing rolling stock to enable services to continue operating in the

intervening period. However, the option could be combined with Option 3, to extend electrification to Featherston and Otaki and introduce new rolling stock by the end of the 2025 financial year, before opening it fully to Masterton and Palmerston North respectively by the end of the 2028 financial year, allowing benefits to be accrued earlier than would otherwise be the case. The option could also be combined with Option 5, with introduction of DMMUs by the end of the 2025 financial year (instead of EMUs at a later point) and gradual extension of the electric overhead, also allowing benefits to be accrued earlier than would otherwise be the case. Both sub-options are potentially viable but have not been explored in detail during the option assessment process.

As framed (i.e. un-staged), the option would respond to the train condition and operational efficiencies problems, although not completely until the 2028 financial year. It would also address the fleet capacity problem, but only after the same point, which is likely to be very problematic on the Wairarapa Line and in the electrified area. The option would offer regional connectivity, rail service quality, resilience and value for money benefits, particularly from the 2028 financial year. However, EMU-run services would be subject to the same resilience constraints as other EMU-run services on the network.

4.2.7 Option Summary

Figure 4-1 summarises and compares the timing (financial year) and level of service provided by the operational elements of the options.

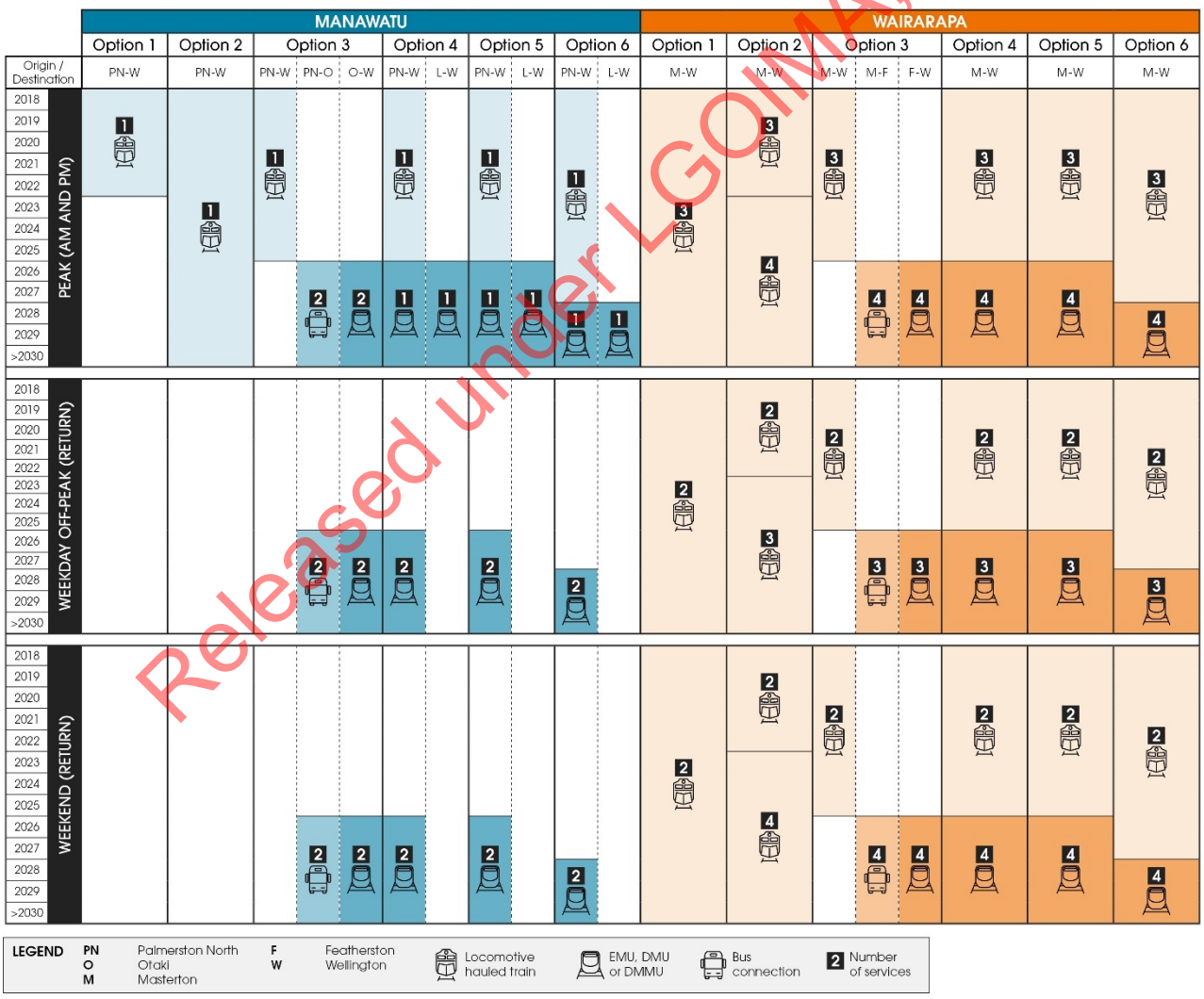


Figure 4-1: Summary of the timing and level of service provided by each option at key periods

Table 4-8 summarises and compares the fleet and infrastructure requirements of the options, and the timing of completion (financial year) required to support the service enhancements.

Table 4-8: Summary of the fleet and infrastructure requirements and completion financial year

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Rolling Stock						
Refurbish SW and SE fleets	2022	2022	2022	2022	2022	2022
Purchase S fleet and refurbish		2022				
Undertake life extension activities on S fleet			2022	2022	2022	2022
Purchase 16 additional BR Mark 2 cars and refurbish		2022				
Replace SW and SE fleets with 8 new 4-car DMUs	2032					
Replace SW, SE and S fleets with 14 new 4-car DMUs		2032				
Replace SW, SE and S fleets with 15 new 4-car EMUs			2025			2027
Replace SW, SE and S fleets with 15 new 4-car DMUs				2025		
Replace SW, SE and S fleets with 15 new 4-car DMMUs					2025	
Network Infrastructure						
Change Featherston and Maymorn track layout		2022	2025	2025	2025	2027
Change Carterton track layout		2022		2025	2025	2027
Extend full signalling from Featherston to Masterton		2022		2025	2025	2027
Extend overhead to Featherston and Otaki			2025			
Extend overhead to Masterton and Palmerston North						2027
Expand Masterton stabling facilities		2022		2025	2025	2027
Construct new stabling facilities in Featherston and Otaki			2025			
Construct Levin stabling facilities				2025	2025	2027
Station Facilities						
Upgrade Manawatu Line stations		2022		2025	2025	2027
Expand park and ride & bus facilities in Featherston/Otaki			2025			
Maintenance Facilities						
Construct Wellington DMU maintenance facilities/stabling	2032	2032		2025		
Construct Wellington EMU maintenance facilities/stabling			2025			2027
Construct Wellington DMMU maintenance facilities/stabling					2025	

4.3 Option Assessment

4.3.1 Assessment Criteria

The options were screened using an assessment framework based on the Better Business Case model, which tests options against the investment objectives and a set of critical success factors. This is consistent with the NZ Transport Agency Business Case Approach.

The investment objectives were identified at the October ILM workshop and revised at the November ILM workshop as described in Section 3.3. The critical success factors were identified at the November ILM workshop and subsequently expanded on. They are:

- strategic alignment: how well the option meets the investment objectives and associated service requirements, and fits with central and local government strategies, programmes and projects;
- affordability - capital costs: the scale of capital expenditure and the likelihood that this can be met from available funding;
- affordability - operational costs: the scale of the net operational costs (i.e. operating funding gap) and the likelihood that they can be met from available funding;
- technical achievability: the likelihood of successful implementation within the available timeframe, given constraints such as lead times and implementation risks;
- resilience: the ability of the option to support transport system and public transport network resilience, both day to day operational resilience and response and recovery from high impact events;
- environmental sustainability: the impact of the option on wider environmental sustainability, reflecting the RLTP objective of an efficient and optimised transport system that minimises environmental impact; and
- public acceptability: the expected degree of acceptance of the option by existing users, the wider public, and their political representatives.

4.3.2 Assessment

The November ILM workshop assessed each of the six options on its potential to achieve each investment objective and critical success factor over a 30-year period. Table 4-9 outlines the scoring system used to assess the performance of each option and, ultimately, to rank the options.

Table 4-9: Assessment framework scoring system

Description	Performance Against Criterion	Score
High (H)	High	5
Medium-high (M-H)	Above Average	4
Medium (M)	Average	3
Low-medium (L-M)	Below Average	2
Low (L)	Low	1

Table 4-10 summarises the results of this assessment, including the weighting applied to each criterion. The investment objectives and the crucial Strategic Alignment critical success factor received the highest weighting, reflecting the importance of these criteria. The service capacity-related investment objective received the highest weighting, reflecting the importance of the associated problem. Several criteria assess different aspects of cost/affordability, and collectively account for a similar weighting to the above investment objective. Subsequent sections outline the justification for the chosen scores.

The table also provides an indicative 30-year net cost (over the do-minimum) and associated 30-year and 60-year benefit cost ratio (BCR) ranges, an indicative implementation timeframe, and key risks for each option, to provide additional context. The 30-year evaluation period includes at least one rolling stock replacement cycle. The 60-year period includes at least two replacement cycles and tests how options with high fixed infrastructure costs compare with other options over a longer timeframe.

Table 4-10: Option assessment summary

	Weighting	Option 1: Maintain Wairarapa Fleet	Option 2: Maintain & Boost Existing Fleets	Option 3: Partial EMU Fleet	Option 4: New DMU Fleet	Option 5: New DMMU Fleet	Option 6: Full EMU Fleet
Investment Objectives							
Increase service capacity	25%	L	M	M	H	H	H
Improve customer satisfaction	15%	L	L	L	H	H	H
Maximise operational flexibility	10%	L	L	L	M-H	H	M
Minimise whole of life costs per passenger[37]	10%	H	M	M-H	H	H	L
Critical Success Factors							
Strategic alignment	10%	L	L-M	M	M-H	H	M-H
Affordability - capital	5%	H	M	M	M	M	L
Affordability - operational	5%	H	L-M	M-H	M	M	M
Technical achievability	5%	H	H	H	H	M-H	H
Resilience	5%	L	M	M-H	H	H	M-H
Environmental sustainability	5%	L	L	M	L-M	M-H	H
Public acceptability	5%	L	L-M	L	M	M-H	M
Characteristics[38]							
Indicative 30-year net cost over do-minimum (2018 $m)		-	$227 - $386	$200 - $364	$176 - $343	$202 - $381	$454 - $754
Indicative 30-year BCR over do-minimum[39]		-	0.9 - 2.2	0.9 - 2.2	1.2 - 3.3	1.1 - 2.9	0.5 - 1.2
Indicative 60-year BCR over do-minimum		-	1.1 - 3.1	1.1 - 3.3	1.4 - 5.0	1.3 - 4.2	0.7 - 2.0
Indicative implementation timeframe[40]		13 years	3 years	7 years	7 years	7 years	9 years
Key Risks		Environment Resilience Customer Growth	Environment Resilience Customer Growth	Complexity Resilience Customer Growth	Environment	Technology	Cost Infrastructure
MCA score	100%	2.0	2.3	2.7	4.4	4.7	3.9

[37] Based on the discounted net cost per passenger over a 60-year assessment period.

[38] Costs, benefits and BCR ranges are based on 80% of the modelled costs and high patronage and revenue growth (see Section 5.4.1), 120% of costs and low growth, and a 4% discount rate (see Section 5.4.1 for comment on discount rates).

[39] BCRs are indicative high-level 'first cut' BCRs, which were used to test the options at the option selection stage. They differ from those that support the recommended option, which were the result of detailed analysis of benefits and costs.

[40] Timeframe to delivery of new rolling stock (Options 1 and 3-6) and additional capacity (Option 2) from July 2019.

Overall Ranking		6	5	4	**2**	**1**	3

4.3.2.1 Option Assessment - Investment Objectives

Options 4-6 are expected to perform best against the Service Capacity investment objective with a high rating, since rolling stock is expected to be procured in sufficient quantities to accommodate expected future growth, be designed to meet specific local requirements, and provide improved service levels once in service. Option 3 is also expected to respond well for the same reasons, but the Featherston/Otaki bus connection is a likely capacity constraint (both north of and at those locations), which limits it to a medium rating. Option 2 also has a medium rating, as the additional used rolling stock is expected to have comparatively lower capacity than the above options despite its similarly improved service levels. Option 1 does not address the fleet capacity issue as identified in Section 3.1.2, with neither additional rolling stock capacity nor improved service levels on the Wairarapa Line, and withdrawal of service on the Manawatu Line, and it consequently receives a low rating.

Options 4-6 are expected to perform best against the Customer Satisfaction investment objective, with a high rating relating to the introduction of new rolling stock[41], associated improvements in vehicle reliability, and improved service levels. The bus connection is expected to be a significant barrier to some passengers under Option 3, which limits that option to a low rating despite its new rolling stock and improved service levels. Options 2 and 1 do not improve vehicle quality until much later than the other options, and consequently also have a low rating.

Options 4 and 5 are expected to perform best against the Operational Flexibility investment objective, with a high or medium-high rating respectively, relating to the dual cab, multiple unit and independent power characteristics (and dual-mode characteristics of the DMMU), which enable quick turnaround and provide a very high degree of versatility within a single fleet type to support the full operation of both corridors (and potentially elsewhere in the country). Option 6 is also versatile, but only within electrified areas and it consequently has a medium rating. Options 1-3 have a low rating, reflecting the reduced fleet size and reliance on the bus connection under Option 3, and the lower flexibility of locomotive-hauled trains under Options 1 and 2.

Options 1, 4 and 5 are expected to perform best against the Whole of Life Costs investment objective with a high rating, since their long run mix of operational and capital costs is expected to be much lower than the other options on a per-passenger basis. Option 3 achieves this by constraining capacity, so although it has a similar cost per passenger to Options 4 & 5, it achieves this by limiting patronage. Option 3 has a medium-high rating and Option 2 a medium rating, reflecting relatively higher costs per passenger. Option 6 performs poorly, reflecting its high infrastructure cost and later in-service implementation.

Options 4 and 5 are therefore the best-performing of the options against the full range of investment objectives, with Option 4 having a high rating against three of the four objectives and a medium-high rating against the other, and Option 5 having a high rating against all four objectives.

4.3.2.2 Option Assessment - Critical Success Factors

Options 4-6 are expected to perform best against the Strategic Alignment critical success factor with high (Option 5) or medium-high (Options 4 and 6) ratings, since all provide clear regional connectivity, rail service quality, resilience and value for money investment benefits, which in turn are closely linked to regional and national transport objectives as described in Section 3.2. Option 5 responds particularly strongly to the GPS Environment strategic priority and thus has a higher rating than Option 4, while Option 6 is hampered by its high cost, which would prohibit other strategic investment. Option 3 has a medium rating, because it responds less strongly than the above options against the connectivity and quality benefits. Option 2 has medium-low rating due to its partial response to the benefits, while Option 1 disbenefits give it a low rating.

Option 1 is expected to perform best against the Affordability – Capital Cost critical success factor with a high rating that is directly linked to its low cost, which in turn relates to the small rolling stock fleet size and delay of any significant investment until the post-2030 period. Options 2-5 have broadly similar capital costs and a medium rating, with Option 2 requiring both used rolling stock in the short run and new rolling stock in the post-

[41] Passengers perceive new rolling stock as being of higher quality, through a range of attributes that include appearance, comfort, smoothness and quietness, heating and air conditioning, lighting, and environmental impact. Good New Zealand evidence of the value of vehicle quality is provided in NZTA Research Report 565 – Pricing Strategies for Public Transport.

2030 period, Option 3 requiring some fixed infrastructure, and Options 3-5 all requiring rolling stock investment prior to the introduction of the main fleet. Option 6 has a low rating due to its high infrastructure costs.

Option 1 is expected to perform best against the Affordability – Operational Cost critical success factor with a high rating related to the low cost of its low level of service. Option 3 has a medium-high rating related to its smaller rail service area and introduction of electrification at an earlier point that Option 6. Options 4-6 have medium ratings, with Option 4 having a higher operating cost associated with its diesel power source but a countering lower maintenance cost, and Options 5 and 6 having lower operating costs but higher maintenance costs. Option 2 has a low rating since it relies on the use of less efficient locomotive haulage until the post-2030 period.

Options 1, 2, 3, 4 and 6 are expected to perform best against the Technical Achievability critical success factor with a high rating that relates to their use of a single fleet and established technology. Option 5 is restricted to a medium-high rating by its use of new (for New Zealand) dual-mode technology, which is likely to require the upskilling of operating and maintenance personnel, making implementation a little more difficult than the above options.

Options 4 and 5 are expected to perform best against the Resilience critical success factor, with a high rating that is linked to the flexibility of multiple unit rolling stock and the ability of the rolling stock to operate without electricity. Options 3 and 6 have the similar advantage of being multiple unit based, but a lower medium-high rating that reflects the limitations of the rolling stock being unable to operate when there is a problem with electrical systems. Option 2 has a medium rating, which recognises that a larger longer-distance rolling stock fleet will increase overall fleet capacity, which along with its diesel power source will provide some capacity to respond to resilience events, but also recognises that a refurbished fleet is essentially an old fleet that is more prone to failure and be the cause of events. Option 1 provides no resilience benefit beyond that provided at present.

Option 6 is expected to perform best against the Environmental Sustainability critical success factor, reflecting the environmental benefits of full electrification. Option 5 also performs well, with a medium-high rating that is linked to its electric base. Option 3 has a similar advantage, but it is hampered by the lower environmental quality of bus-based connections and expected increased park and ride use, and it consequently receives a medium rating. Option 4 receives a low-medium rating that reflects its diesel power source, which is less sustainable that the electric options, although it is more efficient than locomotive-based options. Options 1 and 2 offer no environmental advantage over the present fleet, which relies on inefficient diesel locomotive haulage.

Option 5 is expected to perform best against the Public Acceptability critical success factor with a medium-high rating that relates to its ability to deliver new and better capacity and frequency in the medium term. Option 4 can also deliver new and better capacity and frequency in the medium term, but it is inferior to the DMMU from an environmental perspective. Option 6 performs well from an environmental perspective, but its inability to address capacity issues in the medium term also limits it to a medium rating. Option 2 has a low-medium rating, since it delivers capacity in the short run, but of a relatively low quality, with new rolling stock arriving only in the long run. Options 1 and 3 are unlikely to be publicly acceptable and consequently have a low rating, since Option 1 would not respond to capacity issues on the Wairarapa Line and entail the withdrawal of Manawatu Line services, and Option 3 would eliminate single-train service for around 70% of existing passengers on both lines.

None of the options achieve a high rating across all critical success factors. Options 4 and 5 are best performing, with Option 4 having one high rating, one medium-high rating and three medium ratings, and Option 5 having one high rating, two medium-high ratings, and two medium ratings. Options 1, 3 and 6 have a low rating for at least one factor, which essentially discounts them as viable options despite Option 6 having both a high and a medium-high rating. Option 2 has been ruled out on the basis that it has the fewest medium and high scores of all options.

4.3.2.3 Option Assessment - Characteristics

Options 2-5 are broadly similar in cost compared to the do-minimum over 30 years, ranging from a low of $176m to $343m for Option 4, and a high of $227m to $386m for Option 2. The Option 6 cost is a step change higher and significantly more expensive than the other options with a range of $454m to $754m above the do-minimum, primarily due its high infrastructure requirements and particularly the cost associated with electrification to Palmerston North.

Option 4 provides the best economic return with an indicative BCR range over the do-minimum of 1.2 to 3.3 over 30 years and 1.4 to 5.0 over 60 years. Option 5 is the next best performing with slightly lower BCR ranges of 1.1 to 2.9 and 1.3 to 4.2 respectively. Options 2, 3 and 6 are the poorest performing from an economic perspective with BCRs of 0.9 to 2.2, 0.9 to 2.2, and 0.5 to 1.2 (30 years), and 1.1 to 3.1, 1.1 to 3.3, and 0.7 to 2.0 (60 years) respectively.

Table 4-11 provides the mid-range 30-year BCR and associated incremental BCRs for each option, based on mid-range costs, medium patronage growth (see Section 5.4.1), a 4% discount rate (see Section 5.4.1 for comment on the discount rates applied) and a target incremental BCR of 1.0. This identifies Option 4 as providing the optimal benefit-cost mix, as the highest cost option with an incremental BCR greater than the target incremental BCR, confirming that option as the best performing from an economic perspective. Option 5 would be the next best option in the absence of Option 4.

Table 4-11: Mid-range and incremental BCRs

	Option 2: Maintain & Boost Existing Fleets	Option 3: Partial EMU Fleet	Option 4: New DMU Fleet	Option 5: New DMMU Fleet	Option 6: Full EMU Fleet
Indicative benefits over do-minimum (2018 $m)	$468	$405	$539	$540	$513
Indicative net cost over do-minimum (2018 $m)	$306	$278	$255	$287	$600
Indicative 30-year BCR over do-minimum	1.5	1.5	2.1	1.9	0.9
Incremental BCR over Option 1	-	-	2.1	-	-
Incremental BCR over Option 4	-1.4	-5.9	-	0.0	-0.1

Option 2 has the shortest implementation timeframe for additional capacity of three years. The procurement and construction process delays Options 3, 4 and 5 by an additional four years and Option 6 by an additional six years over that option. Option 1 has the longest implementation timeframe of 13 years.

Options 4 and 5 are identified as the least-risky options, with Option 4 having an environmental risk associated with the reliance on a diesel power source, and Option 5 having a technology-related risk as described above. The cost and timeframe associated with full electrification is a significant risk under Option 6. Options 1-3 are the most-risky options, with all having a significant resilience-related risk and a customer growth-related risk relating to their ability to adequately address the problems. Options 1 and 2 also have an environment-related risk associated with the continued use of diesel locomotive haulage until the 2032 financial year, while Option 3 has a complexity-related risk as previously described.

Options 4 and 5 have the best performing characteristics overall, with the best economics, a relatively short implementation timeframe, and the fewest risks compared to other options.

4.3.2.4 Option Assessment - Overall Ranking

Options 4 and 5 are the best-performing options across all three aspects of the assessment as described above. Both score well against the investment objectives and critical success factors, with Option 5 having nine high or medium-high ratings compared to Option 4's seven. Option 5 also has more high ratings than Option 4. Neither option has any low ratings. Both provide a positive economic return, although Option 4 is best performing and more affordable. The two options are generally comparable in terms of timeframe and risk. Option 5 is ranked slightly ahead of Option 4 on balance, since it is the only option that fully achieves all investment objectives, it best meets the crucial Strategic Alignment critical success factor that ultimately defines overall success, and it has a higher overall score of 4.7, compared to Option 4's 4.4.

Option 6 is the third-ranked option with an overall score of 3.9 and six high or medium-high ratings, although it has two low cost-related ratings, a long implementation timeframe and a low BCR, which make it a

significantly less viable option than Options 4 or 5. The remaining options are ranked, but they perform poorly against the criteria with overall scores of 2.7 (Option 3), 2.3 (Option 2) and 2.0 (Option 1), score poorly against multiple investment objectives, and are riskier than Options 4-6, and they are consequently deemed to be unsuitable.

4.4 Conclusion

Six options have been identified from a long list of sixteen potential mode/fleet and nine potential service level responses by stakeholders . These are:

- Option 1: maintain the existing Wairarapa Line fleet and services and allow Manawatu Line services to cease operating (the do-minimum option);
- Option 2: improve the Wairarapa Line fleet and service levels by purchasing additional used rolling stock and maintain the existing Manawatu Line fleet and service levels (the enhanced status quo option);
- Option 3: electrify to Featherston and Otaki, extend EMU operations to those points and improve service levels, with bus connections from outer points;
- Option 4: replace existing fleets with a DMU fleet at the earliest opportunity and improve service levels;
- Option 5: replace existing fleets with a dual-mode DMMU fleet at the earliest opportunity and improve service levels; and
- Option 6: electrify to Masterton and Palmerston North, extend EMU operations to those points at earliest opportunity and improve service levels.

The options have been assessed against an assessment framework consisting of:

- four investment objectives identified by stakeholders, relating to service capacity, customer satisfaction, operational flexibility and whole of life costs;
- seven critical success factors identified by stakeholders, relating to strategic alignment, affordability – capital costs, affordability – operational costs, technical achievability, resilience, environmental sustainability, and public acceptability; and
- four option characteristics, relating to indicative cost, indicative economics, implementation timeframe, and key risks.

The DMU (Option 4) and DMMU (Option 5) are the best-performing options across all three aspects of the assessment. The DMU option is more affordable and provides a slightly better economic return, but the DMMU option best meets the scored assessment criteria, with better scores against the investment objectives and the crucial Strategic Alignment critical success factor. The DMMU option is consequently ranked ahead of DMU, but both options are viable, and both are considered further in the detailed component of this business case.

5. Recommended Option

5.1 Description

The investment proposal entails replacing all existing longer-distance rail rolling stock with DMMUs (the primary preferred option) or DMUs (the alternative preferred option) and using these to improve service levels on the Wairarapa and Manawatu lines and the overall capacity of the Metlink rail network. It consists of the following steps:

- 2020 financial year: investigate options to take advantage of the improved asset utilisation resulting from the recent SW and SE compatibility upgrades to improve interim service levels, and commence the specification and procurement of the new DMU/DMMU fleet and supporting infrastructure;
- 2022 financial year: complete refurbishment of the SW and SE fleets and S fleet life extension;
- 2025 financial year: complete construction of supporting infrastructure and introduce the new DMU/DMMU fleet on existing services, replacing the SW, SE and S fleets, which will then be retired; and
- 2026 financial year: introduce new higher-frequency timetables on each line.

A description of the fleet, infrastructure and service level aspects of the investment proposal are provided in the following sections, along with a discussion on its expected impact.

5.1.1 Fleet

The new rolling stock fleet will consist of 15 four-car sets, to allow eight to be used to provide four eight-car peak trains on the Wairarapa Line, three to be used to provide one eight-car and one four-car peak trains on the Manawatu Line, two to provide spare capacity to allow for anticipated patronage growth, and two spare sets to allow for maintenance. This fleet size is sufficient to allow for good fleet management and flexible enough to meet the projected patronage growth scenarios described in Section 5.4.1 (coupled with the service level improvements noted in Section 5.1.3). Fleet size will be reviewed during the specification process and updated if required at that point. Each four-car set is expected to:

- consist of two motor-equipped cars and two trailer cars;
- have a cab at each end of the set to enable quick turnaround at the termini;
- be equipped for multiple unit operation[42];
- include appropriate toilet, luggage, information and other passenger facilities; and
- provide a seating capacity of approximately 250 passengers (with additional standing capacity).

The new fleet will utilise low-emission diesel technology for its power source if the DMU option is selected and dual-mode technology if the DMMU option is selected. The DMU will use on-board diesel engines for propulsion, either directly through a diesel-mechanical or diesel-hydraulic transmission as shown in Figure 5-1, or indirectly through a diesel-electric transmission using a generator to power electric traction motors. A generator or alternator will power on-board systems such as lighting and air-conditioning.

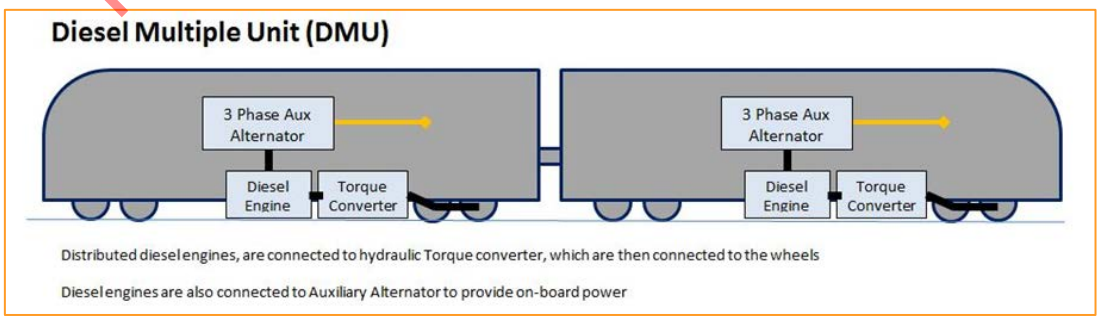


Figure 5-1: Characteristics of a DMU with diesel-hydraulic transmission

[42] Multiple unit operation will enable a single driver to control two or more four-car sets operating in a larger consist (i.e. as an eight or twelve car train).

The DMMU will use a similar transmission to a diesel electric DMU if the electro diesel EDMU alternative is selected through the specification and procurement process. However, it will have the ability to either draw power from the onboard diesel engine and generator, or from the electric overhead via a pantograph to operate in purely electric mode when in the electrified area, as shown in Figure 5-1. Each DMMU will require more equipment and be more expensive to procure and maintain than the equivalent DMU, but offer additional flexibility and environmental benefits, and better meet key critical success factors, as described in Sections 4.2.5 and Section 4.3.2.

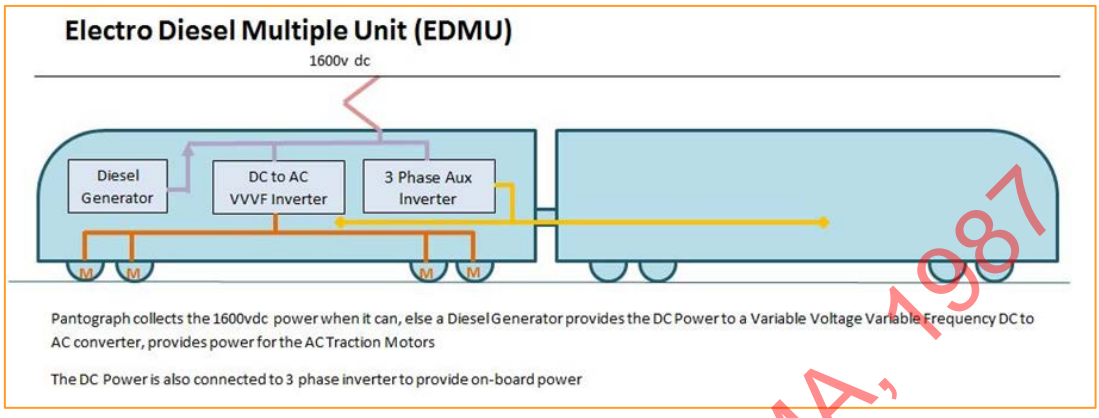


Figure 5-2: Characteristics of an EDMU

The new fleet will be introduced first on the Manawatu Line during the 2025 financial year. Priority will then go to increasing capacity and service levels by adding additional DMU/DMMU-run services on the Wairarapa Line and then replacing all Wairarapa Line rolling stock, before increasing service levels on the Manawatu Line. Existing rolling stock fleets will be retired one replaced.

The new fleet could be specified to be operable in other parts of the country, where different standards for such factors as platform height, clearances or electrical systems may apply. This would enable trial or permanent services to be established elsewhere, and potentially offer economies of scale, both at the procurement and design stage and in ongoing maintenance and operation. Interoperability is likely to be more workable under the DMU option, but it is also feasible under the DMMU option.

5.1.2 Infrastructure

Network infrastructure, station facility and maintenance facility upgrades will be required to support the introduction and ongoing operation of the new rolling stock and associated services. The maintenance facility will need to be completed prior to the arrival of the first DMU/DMMU. All other upgrades will need to be completed by the end of the 2025 financial year, to enable the service level enhancements to be implemented early in the following financial year.

The network infrastructure requirements have been independently assessed by Rail Infrastructure Consultants (RIC) for KiwiRail[43]. The RIC investigation considered the requirements of both the passenger service level enhancements identified in Section 5.1.3, and current and future freight requirements on both lines, particularly the Wairarapa Line, where there are existing infrastructure and operational constraints that limit train headway and passing opportunities.

The RIC investigation identified the following network infrastructure requirements, which in combination, will deliver capacity, frequency, journey time, punctuality, operational resilience and safety improvements for passenger and freight services on the Wairarapa Line and support operations on the Manawatu Line:

- extension of the existing Carterton siding to create a new 600m loop and allow passenger and freight trains to pass;
- construction of a new second platform at Featherston to allow two passenger trains to pass, offset from the existing platform to allow for future freight-related improvements;
- construction of a new 600m passing loop at Maymorn to allow passenger and freight trains to pass;

[43] EDMU Business case Support Infrastructure Response Technical Note, RIC report for KiwiRail, May 2019.

- replacement of the existing radio-based train management system between Masterton and Featherston with a full signalling system, to support the frequency and journey time enhancements (along with the new passing loops) and improve operational resilience and safety;
- rationalisation of level crossings and upgrades to remaining crossings to improve safety;
- construction of an improved stabling facility in Masterton, with capacity for four eight-car trains;
- construction of a new stabling facility in Levin, with capacity for one eight-car train[44]; and
- construction of a new stabling facility in the Wellington area, either separate from or as part of the DMMU maintenance facility.

The station facility requirements are limited to the Manawatu Line, where stations will need to be brought up to a consistent standard with those on the Wairarapa Line and supported with appropriate park and ride facilities.

The DMU/DMMUs will require a specific maintenance facility with appropriate capacity and equipment to support the full maintenance requirements of a 15-set fleet. This could be an extension of the existing EMU facility in Wellington, but space constraints are likely to prohibit this option, and the facility is therefore likely to be stand-alone and located elsewhere. Further work will need to be done to determine the optimal location of this facility and the associated Wellington stabling facility, which it might be co-located with.

The exact infrastructure requirements are subject to further investigation and dependent on the outcome of the rolling stock specification process. Some aspects depend on whether the final specified option is DMU or DMMU-based, and if the latter, which type of DMMU is ultimately specified. They may also include other changes, such as amendments to platforms north of Upper Hutt and Waikanae to optimise accessibility, which are dependent on rolling stock specification and design.

5.1.3 Service Levels

5.1.3.1 Proposed Service Levels

Investment in additional peak-direction services is a central element of the investment proposal. This will provide more capacity to respond to existing demand pressures, both outside of and within the electrified area, and better frequency, which will make the public transport option more attractive to existing and potential future peak passengers.

Investment in counter peak-direction, off-peak and weekend services on both lines is also an important element of the investment proposal. The additional off-peak services will support peak services by providing additional low marginal cost capacity through peak spreading at fringe peak periods, and by providing more travel options for those who must currently travel at the peak when capacity is constrained. These and new and improved counter peak-direction and weekend services will improve connectivity on both lines, and consequently improve access and support economic development and tourism in the regional areas that they serve.

The proposed service levels are based around a complex set of requirements, including the frequency needed to provide the capacity required to meet projected demand at peak times (coupled with the fleet size and capacity noted in Section 5.1.1), market segment-based service timing (e.g. Wellington-focused journey to work, education-based travel, business travel, tourist travel, access-based travel (particularly SuperGold timing)), the availability of train paths outside of and within the electrified area, and operational efficiency, particularly in efficiently delivering counter peak-direction, fringe peak, off-peak and weekend services. Timetables have been developed in sufficient detail to ensure that they meet these requirements, are operationally viable, and fit with future network plans, but are subject to further refinement and confirmation at the rolling stock specification stage, and later prior to implementation of any service change[45].

[44] Existing stabling facilities will be used in Palmerston North and have enough capacity to cater to requirements without expansion.

[45] Other service level options may be possible, particularly at off-peak times, but a higher level of service would increase operating costs (and capital costs if required at peak times), and a lower level of service would reduce access and fail to address economic development goals. Proposed Wairarapa Line service improvements are incremental steps on top of current service levels. Proposed Manawatu Line service improvements are incremental at the peak and focused from Levin southwards where demand is strongest, and similar to current Wairarapa Line services at off-peak times.

Table 5-1 shows the timing and extent of the proposed improvements to Wairarapa Line service levels. It indicates that:

- Weekday off-peak services will increase from two in each direction at present, to three in each direction in the 2026 financial year;
- Friday night services will be maintained at one in each direction; and
- Saturday and Sunday services will increase from two in each direction at present, to four in each direction in the 2026 financial year.

Table 5-1: Current and proposed service levels - Wairarapa Line

	Period	Current	2026 FY
From Masterton	Weekday morning peak	3	4
	Weekday afternoon peak	0	1
	Weekday off-peak	2	3
	Friday night	1	1
	Saturday	2	4
	Sunday	2	4
To Masterton	Weekday morning peak	0	1
	Weekday afternoon peak	3	4
	Weekday off-peak	2	3
	Friday night	1	1
	Saturday	2	4
	Sunday	2	4

Table 5-2 shows the timing and extent of the proposed improvements to Manawatu Line service levels. It indicates that:

- Weekday peak services will increase from one peak-direction service in each peak at present, to two peak-direction services in the 2026 financial year (one of which will run from/to Levin only);
- Weekday off-peak services will increase from none at present, to two in each direction in the 2026 financial year; and
- Saturday and Sunday services will increase from none in each direction at present, to two in each direction in the 2026 financial year (similarly to current Wairarapa Line weekend service levels).

Manawatu Line services do not currently stop at any stations between Paraparaumu and Wellington, although Porirua has been a scheduled stop in the past. However, the investment proposal seeks to integrate Manawatu Line services into the Metlink network in a similar way to the Wairarapa Line, and it therefore includes a plan to reintroduce this stop. This will provide better access to the employment, educational and other opportunities and services that are available there from the north, and additional capacity to supplement EMU-run services at Porirua, which is one of the Metlink networks' busiest stations.

Table 5-2: Current and proposed service levels - Manawatu Line

	Period	Current	2026 FY
From Palmerston North	Weekday morning peak	1	1 Palmerston Nth 1 Levin
	Weekday afternoon Peak	0	0
	Weekday off-peak	0	2
	Friday night	0	0
	Saturday	0	2
	Sunday	0	2
To Palmerston North	Weekday morning peak	0	0
	Weekday afternoon Peak	1	1 Palmerston Nth 1 Levin
	Weekday off-peak	0	2
	Friday night	0	0
	Saturday	0	2
	Sunday	0	2

Figure 4-1 provides a graphical comparison of service levels.

5.1.3.2 Integration with Future of Rail

As noted in Section, 2.2.1.3, the MOT and KiwiRail are working on changes in legislation to allow NLTF investment in KiwiRail to support a resilient and reliable rail system. To date, the metro rail providers have had minimal governance-level engagement in this process, and although they are supportive of more investment in the national rail network, they would like to ensure that it does not negatively impact on the metro networks. Both regions have 85-year network access agreements with KiwiRail (through to 2098), which clearly outline the priority rules for different rail services and the process to obtain increased access to the network.

The proposed timetable slots for the increased service frequency proposed in Section 5.1.3.1 have been shared and discussed with KiwiRail, and it has been agreed they are possible if the improvements to the rail network infrastructure outlined within this business case, and those already funded within the Unlocking Capacity and Improving Resilience business case, are provided.

In a similar manner, if KiwiRail proposes to increase freight service frequencies (particularly in the peak), they will need to reach agreement with GWRC, and potentially invest in improvements on the rail network to ensure that the network capacity and resilience is not degraded as a result. GWRC expects that these required investments are being planned and considered as part of any proposed increase in freight.

5.1.4 Impact

The investment proposal directly addresses the train condition problem, by replacing old rolling stock with new. This will minimise the cost of life extension work, and the increased cost of ongoing maintenance that will otherwise be required as the rolling stock ages and becomes more unreliable. It will therefore provide the service quality, resilience and value for money benefits that are sought, and achieve the objectives of improving customer satisfaction and minimising costs per passenger.

The investment proposal directly addresses the fleet capacity problem, by improving the frequency, timing and direct capacity of trains on both lines. This will provide greater overall capacity to respond to current and future demand pressures, and better convenience for current and potential future passengers. It will therefore provide the regional connectivity, service quality, resilience and value for money benefits that are sought, and achieve the objectives of increasing service capacity, improving customer satisfaction, and minimising costs per passenger (by accommodating patronage growth).

The investment proposal directly addresses the operational efficiencies problem, by utilising a consistent but flexible service delivery model and fleet. This will provide a more responsive and better coordinated service that is more efficient to maintain and operate. It will therefore provide the service quality, resilience and value for money benefits that are sought, and achieve the objectives of maximising operational efficiency and minimising costs per passenger.

Table 5-3 summarises the links between the investment proposal's response to each of the problems and the investment benefits and objectives.

Table 5-3: Links between the problem response, and investment benefits and objectives

	Train Condition	Fleet Capacity	Operational Efficiencies
Investment benefits			
Enhanced regional connectivity	N/A	✓	N/A
Improved rail service quality	✓	✓	✓
More resilient transport network	✓	✓	✓
Value for money	✓	✓	✓
Investment objectives			
Increase service capacity	N/A	✓	N/A
Improve customer satisfaction	✓	✓	N/A
Maximise operational flexibility	N/A	N/A	✓
Minimise costs per passenger	✓	✓	✓

5.2 Benefits

5.2.1 Road User Benefits

Road user benefits account for approximately 80% of the investment proposal's assessed benefits and include three components: congestion reduction, safety and environmental benefits. The benefits for each component are derived from the Wellington outputs of the Value of Rail assessment for the NZTA[46] and applied on a per passenger km basis[47] to new passengers on the Wairarapa Line and new and existing passengers on the Manawatu Line[48].

Congestion reduction accounts for most of the road user benefits and relates to the reduction in road travel time and cost that results from increased public transport use. It has an inflation-adjusted 2018/19 value of $0.9884 per passenger km derived from the Value of Rail assessment, which is in turn based on values of time sourced from the NZTA Economic Evaluation Manual (EEM). This provides a 30-year discounted congestion benefit of $410.2m over the do-minimum under both options, based on medium patronage growth (see Section 5.4.1) and a 4% discount rate[49].

[46] Value of Rail in New Zealand by EY (2016). See that report for the methodologies used to determine the underlying benefits.

[47] The passenger km approach is consistent with that used for Wellington Metro Railway Network Track Infrastructure Catch-up Renewals and Unlocking Network Capacity and Resilience business cases. Manawatu Line passenger km are based on an average trip to Waikanae only.

[48] Since Manawatu Line services would otherwise be withdrawn. The benefit values associated with new passengers are valued at half of those for existing passengers, in accordance with NZTA EEM guidance.

[49] The congestion benefit has been tested against and is broadly consistent with the combined value of time and vehicle operating cost outputs from the Northern Wellington Saturn Model, which extends across the whole Wellington Region from Wellington in the south, Masterton to the east and Otaki to the west. This model is a very good traffic assignment capability, which is used to establish forecast demand levels, but it is limited in terms of its ability to replicate detailed congestion effects. It is common for Saturn to underestimate actual road delays and to require the use of more detailed traffic models for localised areas. This together with rather generous coding conventions with respect to lane and intersection capacities also means that the model is highly likely to have underestimated de-congestion effects associated with improvements to rail services. Consequently, the benefits calculated using the model can be taken to be robust and to in all probability to underestimate actual economic benefits.

The safety benefit relates to the reduction in road traffic volumes and crash risk that will result from increased public transport use. It has an inflation-adjusted 2018/19 value of $0.0356 per passenger km[50] derived from the Value of Rail assessment. This provides a 30-year discounted safety benefit of $14.8m over the do-minimum under both options, based on medium patronage growth and a 4% discount rate.

The environmental benefit relates to the reduced motor vehicle emissions that result from reduced vehicle travel through increased public transport use. It has an inflation-adjusted 2018/19 value of $0.0022 per passenger km derived from the Value of Rail assessment. This provides a 30-year discounted environmental benefit of $0.9m over the do-minimum under both options, based on medium patronage growth and a 4% discount rate.

5.2.2 Public Transport User Benefits

Public transport user benefits account for approximately 20% of the investment proposal's assessed benefits and include three main components: frequency, health and new vehicle benefits. The benefits for each component are based on the guidance provided in Appendix A18 (frequency and new vehicle benefits) and Appendix A20 (health) of the EEM.

The frequency (or wait time) benefit accounts for approximately two thirds of the public transport user benefits and relates to the increased convenience of public transport as an option to existing and new passengers from increased headway. Existing service frequency on both corridors is very low, so a wait time benefit of 9.9 minutes per passenger has been applied[51] along with an inflation-adjusted 2018/19 value of time of $13.82[52]. This results in a frequency benefit of $4.56 per passenger for existing passengers and $2.28 per passenger for new passengers in accordance with the guidance in Section A18.4 of the EEM, providing a 30-year discounted frequency benefit of $87.8m over the do-minimum under both options, based on medium patronage growth and a 4% discount rate.

The health benefit relates to the increased active mode use that is associated with the first and last mile components of public transport-based journeys. This benefit applies to new passengers, who are assumed to increase their activity by around 33 minutes per day[53]. This results in an inflation-adjusted 2018/19 health benefit of $3.46 per passenger for new passengers in accordance with the guidance in Section A20.3 of the EEM, providing a 30-year discounted health benefit of $38.0m over the do-minimum under both options, based on medium patronage growth and a 4% discount rate.

The new vehicle benefit relates to the perceived comfort and feel of new rolling stock, which passengers place value on. This benefit is based on the guidance provided in Section 18.6 of the EEM and uses an average nine-year willingness-to-pay value of 2.95%[54] of the current weighted average fare to calculate a 30-year discounted new vehicle benefit of $0.9m over the do-minimum under both options, based on medium patronage growth and a 4% discount rate.

Other public transport user benefits may be available, such as from station improvements or additional rolling stock features that are not currently available (e.g. Wi-Fi). However, these cannot be quantified as the specific improvements and features are yet to be determined and the existing rolling stock already has most features that are valued by passengers. Public transport travel time benefits may also be available, particularly if track improvements and new rolling stock enable improved travel times. The latter benefit could be substantial if travel times are significantly reduced, but it is also dependent on rolling stock specification.

[50] The Value of Rail assessment shows a safety disbenefit for Wellington and a safety benefit for Auckland. The reasons for this difference are unclear since the Wellington model was used for both purposes, but no calculation details are available to allow the cause of the difference to be determined. However, a reduction of road traffic volumes is typically related to improved road safety, so the safety benefit in this business case has been defined as a patronage-based proportion of the Auckland safety benefit based on the advice of the economics peer reviewer.
[51] This is a patronage-weighted value based on the relevant peak and off-peak wait time benefits in EEM Table A18.2.
[52] This blended value of time is based on the trip purposes in EEM Table A2.4 (urban arterial AM peak) and the values of time in EEM Table A4.1(b) and reflects the arterial nature and diversity of trip purposes on longer-distance services.
[53] Based on the findings of Public Transport Use the Ticket to Health, a briefing paper by Bus Association of Victoria (2010). This active mode travel time equates to a return trip between Wellington Railway Station and Chews Lane.
[54] Based on the findings of NZTA Research Report 565 (Pricing Strategies for Public Transport) by Neil Douglas (2016) that passengers are willing to pay 5.9% higher fares for a new train, declining to 0% after nine years.

5.2.3 Other Benefits

A public transport vehicle carbon dioxide emissions benefit is also considered as part of the investment proposal benefit assessment. It is based on an inflation-adjusted 2018/19 EEM CO_2 value of $68 per tonne, with supporting assumptions around electricity and diesel consumption. This provides a 30-year discounted public transport emission disbenefit of $2.5m over the do-minimum under the DMU option, and a $1.0m disbenefit over the do-minimum under the DMMU option, based on medium patronage growth and a 4% discount rate. The emission increase relates to the increase in the number of public transport services over the do minimum, which counters the per-trip saving.

The investment proposal is likely to provide a wider range of social, economic, environmental and other benefits, in addition to the direct transport benefits described above. These include accessibility, productivity, resilience, option and non-use, consumer surplus, and agglomeration and other wider economic benefits. These benefits will contribute to and reflect the improved liveability of communities along the corridor, and the quality of life of their residents, and support the investment case and the broader objectives of the GPS. Most of these benefits are difficult to accurately quantify and have not been assessed, however, consumer surplus and agglomeration have been used for sensitivity testing purposes (see Section 5.4.3).

5.3 Costs

The investment proposal cost includes the following cost elements:

- fare revenue, including SuperGold reimbursement;
- rail contract passenger service fee costs, which are paid to the Metlink operational contractor (currently Transdev) and include onboard staff (and drivers after the new units are bought into service);
- locomotive hire costs, which are paid to KiwiRail and include locomotive crew and fuel costs until the new units are bought into service (includes a contract termination fee);
- energy costs, which include DMMU electricity and DMU/DMMU diesel fuel[55];
- network access charges;
- train maintenance costs, which include planned and unplanned maintenance, and capital heavy maintenance costs[56];
- station maintenance costs, which include maintenance, and like for like renewal costs;
- station construction costs, which include station asset upgrade costs and park and ride upgrade costs, primarily on the Manawatu Line;
- maintenance facility construction costs, including design and procurement-related costs;
- network infrastructure construction costs, including passing loops, signalling and stabling yards; and
- rolling stock purchase costs, including procurement, design and project management-related costs.

Each four-car set has an estimated undiscounted unit cost of [redacted] under the DMU option and [redacted] under the DMMU option, although these costs will not be confirmed until the procurement and design process has been completed. This equates to a total cost of [redacted] and [redacted] respectively for 15 four-car sets. Procurement, design and project management-related costs are expected to add [redacted] and [redacted] respectively.

On the infrastructure side, station upgrades are expected to have an undiscounted cost of [redacted] maintenance facilities [redacted] for the DMU and [redacted] or the DMMU, and network infrastructure [redacted][57], for a total estimated infrastructure cost of either [redacted] or [redacted] over and above current infrastructure investment requirements. These costs are also subject to confirmation through the procurement and design process.

[55] Based on the electricity rates used in the current network access agreement and diesel discounted retail rates sourced from MBIE weekly fuel price monitoring figures as at February 2017.
[56] Including capital heavy maintenance costs that include S fleet life extension works.
[57] Including contingency allowances ranging from 30 to 50%.

Undiscounted direct project costs consequently total $368.8m under the DMU option and $405.2m under the DMMU option.

Table 5-4 shows the modelled discounted cost of all DMU cost elements over the do-minimum requirements, under the low, medium and high patronage growth scenarios described in Section 5.4.1, assuming a 4% discount rate, and 30-year evaluation period. These costs account for planned future do-minimum expenditure that is avoided as a result of the current investment proposal.

Table 5-4: 30-year discounted cost of DMU cost elements over the do-minimum

Cost Element	Low Growth Costs (2018 $m)	Medium Growth Costs (2018 $m)	High Growth Costs (2018 $m)
Fare revenue	[redacted]	[redacted]	[redacted]
Passenger service fee	[redacted]	[redacted]	[redacted]
Locomotive hire	[redacted]	[redacted]	[redacted]
Energy	[redacted]	[redacted]	[redacted]
Network access charges	[redacted]	[redacted]	[redacted]
Train maintenance	[redacted]	[redacted]	[redacted]
Station maintenance	[redacted]	[redacted]	[redacted]
Total operational costs	**$74.00**	**$60.40**	**$57.60**
Station construction	[redacted]	[redacted]	[redacted]
Maintenance facility construction	[redacted]	[redacted]	[redacted]
Network infrastructure construction	[redacted]	[redacted]	[redacted]
Rolling stock purchase	[redacted]	[redacted]	[redacted]
Total project capital costs	**$199.30**	**$199.30**	**$199.30**
Total DMU investment proposal costs	**$273.30**	**$259.70**	**$256.90**

Table 5-5 shows the expected discounted cost of all DMMU cost elements over the do-minimum requirements, under the three patronage growth scenarios and the above discount rate and evaluation periods. These costs account for planned future do-minimum expenditure that is avoided as a result of the current investment proposal.

Table 5-5: 30-year discounted cost of DMMU cost elements over the do-minimum

Cost Element	Low Growth Costs (2018 $m)	Medium Growth Costs (2018 $m)	High Growth Costs (2018 $m)
Fare revenue	[redacted]	[redacted]	[redacted]
Passenger service fee	[redacted]	[redacted]	[redacted]
Locomotive hire	[redacted]	[redacted]	[redacted]
Energy	[redacted]	[redacted]	[redacted]
Network access charges	[redacted]	[redacted]	[redacted]
Train maintenance	[redacted]	[redacted]	[redacted]
Station maintenance	[redacted]	[redacted]	[redacted]
Total operational costs	**$77.00**	**$63.30**	**$60.70**
Station construction	[redacted]	[redacted]	[redacted]
Maintenance facility construction	[redacted]	[redacted]	[redacted]
Network infrastructure construction	[redacted]	[redacted]	[redacted]
Rolling stock purchase	[redacted]	[redacted]	[redacted]
Total project capital costs	**$227.90**	**$227.90**	**$227.90**
Total DMMU investment proposal costs	**$304.90**	**$291.20**	**$288.60**

The internal business changes required for GWRC to implement and operate the proposed fleet and service levels have also been assessed and determined to be minimal.

The costs represented in this business case were developed from a range of input sources to ensure their accuracy. Cost confidence has been assessed using a grading system from the New Zealand Water & Waste Association (NZWWA) Guidelines for Infrastructure Asset Grading Standards. The standards for each confidence grade are:

- Grade A - highly reliable: data based on sound records, procedures, investigations and analysis which is properly documented and recognised as the best method of assessment;
- Grade B – reliable: data based on sound records, procedures, investigations, and analysis which is properly documented but has minor shortcomings, for example the data is old, some documentation is missing and reliance is placed on unconfirmed reports or some extrapolation;
- Grade C – uncertain: data based on sound records, procedures, investigations or analysis which is incomplete or unsupported, or extrapolation from a limited sample for which grade A or B data is available; and
- Grade D - very uncertain: data is based on unconfirmed verbal reports and/or cursory inspection and analysis.

The confidence grades for each cost element have been assessed as summarised in Table 5-6.

Table 5-6: Cost confidence

Cost Element	Confidence	Comment
Fare revenue	B - reliable	Based on the current average fare applicable for these lines and conservative patronage growth forecasts.
Passenger service fee	B - reliable	Based on scaled costs from existing operational contracts.
Locomotive hire	B - reliable	Based on scaled costs from existing operational contracts.
Energy	B - reliable	Based on scaled costs from existing operational contracts.
Network access charges	B - reliable	Based on scaled costs from existing operational contracts.
Train maintenance	B - reliable	Based on scaled costs from existing operational contracts.
Station maintenance	B - reliable	Based on scaled costs from existing operational contracts.
Station construction	C - uncertain	Based on knowledge of the station asset condition north of Waikanae and the costs experienced in improving the condition of similar assets
Maintenance facility construction	C - uncertain	Based on the costs to construct and modify the existing EMU depot facility. As location of this facility is unknown at this time, a 50% contingency has been applied.
Network infrastructure construction	B - reliable	Several concepts for each infrastructure change were developed, and then detailed costs established for the preferred concept. Work undertaken by independent consultant Rail Infrastructure Consultants. A 30% contingency has been applied to reflect the high-level nature of the design.
Rolling stock purchase	B - reliable	Two separate manufacturers have provided indicative proposals and costs, which along with other recent procurement costs, have provided the basis for the rolling stock purchase cost, along with the procurement and project management costs applicable to the recent Matangi projects. A modest 5% contingency has also been applied.

While there is an element of uncertainty with costs that will not be resolved until procurement has been completed, they are based on known costs where possible, and an appropriate contingency has been applied where uncertainty is greater to ensure that the costs included in this business case are conservative. The sensitivity tests described in Section 5.4.3 show that BCRs remain positive even when costs are significantly higher than projected in this section. If an investment budget to 95% confidence is required, then it is proposed that an overall contingency of 8% be applied, as described in Section 5.7.

5.4 Economic Analysis

5.4.1 Inputs

The economic assessment is based on the change compared to the do-minimum in accordance with EEM guidance, and the following assumptions:

- a 30-year evaluation period from the start of the 2019 financial year, which accounts for one rolling stock replacement cycle under both options[58] (i.e. carriages with DMUs or DMMUs) and all associated infrastructure and service improvements;

[58] This evaluation period has been chosen for consistency with the Chapter 4 options selection evaluation period and is consistent with EEM guidance, which allows for a standard evaluation period of up to 40 years.

- a discount rate of 4%, with sensitivity testing at 2% and 6%, as advised by the NZTA (this is lower than the standard rates in the EEM, but reflects changes to funding costs that will be reflected in the procedures in the near future);
- the fleet, infrastructure and service change implementation points noted in Section 5.1;
- the benefit types noted in Section 5.2; and
- the cost elements noted in Section 5.3.

Both costs and benefits are sensitive to patronage growth assumptions. On the cost side, the rail contract passenger service fee costs and fare revenue have a direct link to patronage, while the fuel costs, train maintenance costs and track access charges have an indirect link, increasing as additional rolling stock is brought into service to provide capacity to respond to demand. All benefits have a direct link to patronage, except the public transport vehicle carbon dioxide emissions benefit, which has an indirect link that is also based on rolling stock use. Three distinct but realistic patronage growth scenarios have therefore been tested:

- a low patronage growth scenario, which assumes base growth on both lines of 0.6% per annum from the 2026 financial year with lower and fluctuating growth prior to that point[59], reflecting the conservative forecast growth rates that underpin the preferred option in the Wellington Metro Railway Network Track Infrastructure Catch-up Renewals business case;
- a medium patronage growth scenario, which assumes the same base growth rates as the low patronage scenario prior to the 2026 financial year, then 1.8% per annum on the Wairarapa Line and 1.2% per annum on the Manawatu Line, reflecting the expected base patronage impact of projected population growth on each corridor[60]; and
- a high patronage growth scenario, which assumes the same base growth rates as the low patronage scenario prior to the 2026 financial year, then 2.7% per annum on the Wairarapa Line and 1.8% per annum on the Manawatu Line, reflecting a general but conservative continuation of current patronage growth trends on each corridor[61].

All patronage growth projections are supported by a short run peak service level elasticity of 0.45, increasing incrementally to 0.75 in the long run, and a short run off-peak service level elasticity of 0.75, increasing incrementally to 1.25 in the long run. These elasticities are consistent with the international longer-distance commuter rail experience[62], with the higher off-peak elasticities reflecting the higher uptake that is typically available from off-peak improvements, which provide more travel options for existing and new peak and off-peak passengers and facilitate peak spreading and consequently increase peak capacity. Longer distance passengers tend to have different travel patterns from urban passengers, travelling less frequently on average, and often only for part days for specific appointments or meetings, so the availability of well-timed off-peak services is important to them.

The low patronage growth scenario is unconstrained, in that it does not require spare growth rolling stock to be brought into service or for patronage to be capped when capacity is reached. The higher growth scenarios require all rolling stock to be brought into service, by the 2043 financial year in the medium growth scenario and the 2038 financial year in the high growth scenario. The latter scenario also requires the capping of peak patronage or additional rolling stock from the 2046 financial year.

5.4.2 Output

Table 5-7 shows the results of the BCR assessment for the DMU investment proposal option under the three patronage growth scenarios, for the main 4% discount rate and the 2% and 6% tests. The table shows that the DMU option provides a positive BCR under all growth and discount rate scenarios, with a range of 1.2 to 3.0, indicating that it is expected to provide a positive return on investment. The BCR ranges between 1.5 and 2.3 at the main 4% discount rate. The BCRs are government BCRs, which show the value for money that the investment provides from a central and local government investment perspective.

[59] The base growth rates apply before the service level elasticity effect and patronage uplift associated with new trains.
[60] The Wairarapa Line rate is consistent with the Metlink network-wide all-period annual average growth rate of 1.9% between mid-2009 and mid-2019.
[61] The recent four-year average annual peak patronage growth rate is well above these levels on all lines as noted in Section 3.1.2. Peak periods account for most patronage at present.
[62] See Transfund New Zealand Research Report 248 (Review of Demand Elasticities) by Ian Wallis (2004) and TRL Report 593 (The Demand for Public Transport: A Practical Guide).

Table 5-7: Results of DMU cost benefit appraisal

	Low Growth	Medium Growth	High Growth
2% discount rate			
Benefits (present value – 2018 $m)	$545.6	$762.7	$841.6
Net costs (present value – 2018 $m)	$306.7	$287.6	$283.2
Benefit Cost Ratio	1.8	2.7	3.0
4% discount rate			
Benefits (present value – 2018 $m)	$399.6	$550.3	$601.5
Net costs (present value – 2018 $m)	$273.3	$259.7	$257.0
Benefit Cost Ratio	1.5	2.1	2.3
6% discount rate			
Benefits (present value – 2018 $m)	$300.1	$407.2	$441.1
Net costs (present value – 2018 $m)	$245.9	$236.1	$234.4
Benefit Cost Ratio	1.2	1.7	1.9

Table 5-8 shows the results of the BCR assessment for the DMMU investment proposal option under the three patronage growth scenarios, for the main 4% discount rate and the 2% and 6% tests, providing government BCRs similarly to above. The table shows that that option also provides a positive BCR under all growth and discount rate scenarios, with a range of 1.1 to 2.6, indicating that it is also expected to provide a positive return on investment. The BCR ranges between 1.3 and 2.1 at the main 4% discount rate.

Table 5-8: Results of DMMU cost benefit appraisal

	Low Growth	Medium Growth	High Growth
2% discount rate			
Benefits (present value – 2018 $m)	$547.6	$764.7	$843.6
Net costs (present value – 2018 $m)	$343.0	$324.0	$319.7
Benefit Cost Ratio	1.6	2.4	2.6
4% discount rate			
Benefits (present value – 2018 $m)	$401.0	$551.7	$603.0
Net costs (present value – 2018 $m)	$304.7	$291.2	$288.6
Benefit Cost Ratio	1.3	1.9	2.1
6% discount rate			
Benefits (present value – 2018 $m)	$301.2	$408.2	$442.1
Net costs (present value – 2018 $m)	$273.4	$263.7	$261.9
Benefit Cost Ratio	1.1	1.5	1.7

5.4.3 Sensitivity Testing

The above assessments do not consider the impact of changes to capital and operational costs, and they exclude the consumer surplus benefit and agglomeration wider economic benefit of the new services. These aspects have been used to sensitivity test the BCRs.

Table 5-9 shows the BCR impact of cost sensitivity testing under the 4% discount rate medium growth scenario at 120%, 100% and 80% of the modelled level of operational and capital costs. The resulting BCR remains

positive for both options, ranging from 1.7 to 2.9 for the DMU option and 1.5 to 2.6 for the DMMU option.

Table 5-9: Results of cost sensitivity testing with network infrastructure cost included

	High Cost	Low Cost
DMU		
Benefits (present value – 2018 $m)	$550.3	$550.3
Net costs (present value – 2018 $m)	$332.9	$186.6
Benefit Cost Ratio	1.7	2.9
DMMU		
Benefits (present value – 2018 $m)	$551.7	$551.7
Net costs (present value – 2018 $m)	$370.7	$211.9
Benefit Cost Ratio	1.5	2.6

Table 5-10 shows the impact on the BCRs of excluding the cost of the network infrastructure improvements that are needed to restore infrastructure that was previously removed (e.g. reinstatement of sidings), cater for current freight train lengths (e.g. siding extensions to allow for current freight train length), or catch up for past underinvestment (e.g. full signalling system), which are all primarily required to maintain a safe and efficient dual purpose (freight and passenger) railway network. This reduces the discounted cost by $97.0m and increases the BCR range significantly to 2.5 to 5.1 for the DMU option and 2.2 to 4.1 for the DMMU option, under the 4% discount rate medium growth scenario[63].

Table 5-10: Results of cost sensitivity testing with network infrastructure cost excluded

	High Cost	Low Cost
DMU		
Benefits (present value – 2018 $m)	$550.3	$550.3
Net costs (present value – 2018 $m)	$216.5	$109.1
Benefit Cost Ratio	2.5	5.0
DMMU		
Benefits (present value – 2018 $m)	$551.7	$551.7
Net costs (present value – 2018 $m)	$254.3	$134.3
Benefit Cost Ratio	2.2	4.1

Table 5-11 shows the BCR impact of benefit sensitivity testing, by including the consumer surplus and agglomeration benefits under the 4% discount rate medium growth scenario. The consumer surplus benefit is based on a long run fares elasticity of -0.6[64] and the average fare on each line. The agglomeration benefit has been tested at 30% of the modelled level of conventional benefits, based on the findings of the agglomeration effects of initiatives in Wellington and other cities[65]. In combination, these benefits increase the BCR by 41%, to 3.0 for the DMU and 2.7 for the DMMU.

[63] The benefits associated with these improvements, which are desirable but not essential for the enhanced passenger operation, have not been included in any of the benefit assessments.

[64] See Transfund New Zealand Research Report 248 (Review of Demand Elasticities) by Ian Wallis (2004) and Transport Elasticities by Todd Litman (2007).

[65] Estimates for City Rail Link and the Waitemata Harbour Crossing in Auckland found agglomeration benefits of 33% to be reasonable, while access improvements for the Leeds City Centre were estimated to have agglomeration benefits of 25%. A 30% agglomeration estimate has been used for the LGWM programme business case.

Table 5-11: Results of benefit sensitivity testing

	Conventional Benefits	Full Benefits
DMU		
Benefits (present value – 2018 $m)	$550.3	$778.6
Net costs (present value – 2018 $m)	$259.7	$259.7
Benefit Cost Ratio	2.1	3.0
DMMU		
Benefits (present value – 2018 $m)	$551.7	$780.4
Net costs (present value – 2018 $m)	$291.2	$291.2
Benefit Cost Ratio	1.9	2.7

Limitations of the economic model have prevented sensitivity testing around future changes in the price of carbon. However, it is expected that a carbon price increase would increase the cost of oil-based fuels, which would lead to mode shift and increased patronage, particularly for longer distance journeys, and in turn, increase both road user and public transport user benefits. It would also increase the operational cost of the diesel-based options, increasing the relative viability of the DMMU and (particularly) EMU options, but this cost increase is expected to be relatively minor compared to the expect patronage-related impact.

The overall sensitivity testing process reveals that high cost has a similar effect to low growth, and low cost has a similar effect to high growth or medium growth with full benefits. Taken together, this suggests that a DMU BCR range of 1.5 to 3.0 is appropriate, and a DMMU range of 1.3 to 2.6 is appropriate if full costs (i.e. including infrastructure costs) are included. These ranges are taken forward to the assessment profile, given that the medium and high growth scenarios seem most realistic given recent growth trends, the anticipated effect of the LGWM initiatives on public transport demand generally, and current government transport priorities.

5.5 Assessment Profile

The investment proposal has been assessed against the NZTA's June 2018 Investment Assessment Framework[66] for the 2018-21 NLTP, given its expected alignment with NLTP investment criteria based on the signals provided in the TAIP and the June 2018 GPS, as noted in Section 2.3. The PGF has similar criteria, which the proposal can be expected to meet to the same degree if that instrument is used as a funding source.

The NZTA's Investment Assessment Framework rates a proposal on two factors: results alignment and cost benefit appraisal. The ratings are then brought together to form an overall assessment profile that determines a proposal's priority for NLTP investment. The following sections indicate how this proposal is considered to meet them.

5.5.1 Results Alignment

Results alignment is an assessment against the outcomes sought from the GPS. There are four rating bands – Low, Medium, High and Very High – each with criteria that are specific to the activity class. The investment proposal improvements have been assessed against the public transport, rapid transit and transitional rail activity class criteria.

Table 5-12 shows the outcome of this assessment, based on the appraisal of the problems, benefits and investment objectives described in this business case and alignment with the strategic planning documents outlined in Chapter 2. It indicates that the investment proposal responds strongly to the outcomes sought by the GPS, with three recommended Medium ratings, nine High ratings and one Very High rating against thirteen criteria across three of the four results alignment categories. These provide a recommended overall results alignment rating of Very High.

The Very High recommended rating relates to the 'enables a substantial increase in access to social and economic opportunities for large numbers of people along dedicated key corridors and enables transit-

[66] The NZTA and MOT are currently reviewing the investment decision making framework and changes are expected to take effect in late-2019, in time to support the development of the 2021 GPS and subsequent RLTPs and NLTP.

oriented development' criterion, which supports the 'access to opportunities, enables transport choice and access, and is resilient - liveable cities' priority. Its selection is based on the significantly improved access that will be enabled by the investment proposal's capacity and frequency improvements, both outside of and within the electrified area, where it will help address the significant network capacity constraints noted in Section 3.1.2.3, and improve overall access and connectivity as a result, as noted in Section 3.2.1. The investment proposal is also expected to increase the viability of transit oriented development at the key stations used by the services within the electrified area, where land use intensification is currently being actively investigated and the longer-distance Wairarapa and Manawatu services are integral to the overall capacity and service offering.

Table 5-12: GPS results alignment

GPS Priority	Criteria	Alignment
Access to opportunities, enables transport choice and access, and is resilient - thriving regions	• Addresses a significant gap in level of service in accessing social or economic opportunities and is identified in an approved regional economic development programme as making a significant contribution • Makes best use of the public transport service operations in a multi-modal context with land use • Addresses significant resilience gap in the public transport network • Addresses an unplanned loss of an existing significant public funded transport connection.	High
	• Addresses a significant gap for inter-regional public transport.	Medium
Access to opportunities, enables transport choice and access, and is resilient - liveable cities	• Enables a substantial increase in access to social and economic opportunities for large numbers of people along dedicated key corridors and enables transit-oriented development.	Very High
	• Supports agreed integrated land use, multi-modal plans and mode shift in major metros • Improves intermodal connectivity where this enhances the appropriate use of public transport • Makes best use of the public transport service operations and connection to other services • Addresses significant risk to continued operation of the public transport network.	High
	• Addresses a significant gap in level of service in accessing social or economic opportunities and is identified in an approved programme.	Medium
Environment - reduce adverse effects on the climate, local environment and public health	• Enables long term reductions in greenhouse gas emissions from land transport.	High
	• Enables significant reductions in harm to the environment and people, particularly arising from land transport-related air pollution and noise.	Medium

5.5.2 Cost Benefit Appraisal

The Investment Assessment Framework classifies BCR ratings into four bands – Low (1.0 to 2.9), Medium (3.0 to 4.9), High (5.0 to 9.9), and Very High (10 and above). The investment proposal has a DMU BCR range of 1.5 to

3.0 and a DMMU BCR range of 1.3 to 2.6 as recommended in Section 5.4.3, and it is therefore classified as being in the Low band under both options[67]. This essentially defines both options as being the same from an Investment Assessment Framework perspective. All BCRs except that assessed for the DMU very high growth and low discount rate scenario fall within this classification, confirming it as appropriate.

The recommended results alignment rating of Very High and cost benefit appraisal rating of Low or above give the investment proposal a priority order rating of 1 in the improvement activity scale of 1 to 8, which is the highest priority for NLTP funding. The final assessment profile and funding approval is subject to the NZTA's funding approval process.

5.6 Commercial Case

5.6.1 Procurement and Contractual Arrangements

5.6.1.1 Existing Services

Wairarapa Line services are currently operated by Transdev under contract to GWRC, using a mixed fleet of GWRC-owned rolling stock, with Hyundai Rotem providing rolling stock maintenance and KiwiRail providing locomotives and locomotive crews through a hook and tow arrangement, as noted in Section 2.1.1. This arrangement will continue while existing rolling stock remains in operation.

Manawatu Line services are currently commercially operated by KiwiRail as noted in Section 2.1.2, and may continue to be operated in this way while existing rolling stock remains in operation. [redacted]

5.6.1.2 Capital Investment

5.6.1.2.1 Rolling Stock and Maintenance Facility Procurement

Rolling stock and maintenance facility procurement will be undertaken by GWRC in accordance with the NZTA's and the council's internal procurement policies. A detailed Procurement Strategy Overview will be developed, with the following likely content:

- Introduction
  - Background
  - Objectives of This Document
  - Procurement Documents
  - Project Timescale
- Procurement Process – Issues and Risks
  - General
  - Key Risks and Issues
- Contract Approach
  - General
  - Conventional Contract
  - Alliance Contract
  - Adoption of Conventional Contract Approach
- Whole Life (Cycle) Issues – Effect on Procurement Process and Contract Approach
  - General

[67] The top end of the DMU range would also qualify it for a Medium rating. The ratings move to Medium to High (DMU) and Medium (DMMU) if the cost of network infrastructure is excluded (see Section 5.4.3).

- Key Requirements
- Contract Options
- Context Issues
- Greater Wellington Regional Council's Approach

- Procurement Process
  - General
  - Pre-Tender Market Investigations
  - Procurement Phase 1 - Expressions of Interest and Prequalification (EOI)
  - Procurement Phase 2 - Request for Tenders
- Other Issues
  - Local Industry Involvement
  - Tender Assessment Team
  - Probity.

Prior to commencing the rolling stock procurement process, GWRC will assess a range of contracting options, including Design-Build, Design-Build-Maintain, Design-Build-Finance, etc. GWRC will also consider the scope, interaction and interdependencies for existing and future rail operating and maintenance contracts.

It is envisaged that rolling stock procurement will be competitively tendered and follow a similar procurement process to that successfully used for EMU procurement over the last decade. During the initial EMU procurement in mid-2000's, GWRC received expressions of interest from approximately 10 companies, and expects a similar level of interest from the international market given the similar proposed order size, including the following manufacturers: Hyundai-Rotem – South Korea, CRRC - Changchan Railway Vehicle Company - China, Bombardier - Australia, Downer - Australia, Stadler - Switzerland, and Construcciones y Auxiliar de Ferrocarriles (CAF) Spain. GWRC is intending to again to undertake a two-stage procurement process (i.e. EOI and RFT).

In addition to the proposed procurement of 60 cars (15 – 4 car sets), it may be possible to jointly procure the new rolling stock with other regions, as noted in Sections 3.2.4 and 5.1.1, which would offer value for money benefits through improved economies of scale. The proposed start-up Hamilton-Papakura service will use a locomotive-hauled carriage fleet, but investigations into higher-speed longer-term replacement options are about to commence and it may be possible to align requirements. Opportunities for coordination with other regions like this will be explored during the specification stage.

Existing rolling stock will require overhaul to remain in operation at an appropriate standard until 2025-26 replacement. Light refurbishment of the SW and SE fleets will shortly commence as part of GWRC's business as usual programme, as noted in Section 2.1.1. The life extension work required to enable operation of the S fleet beyond mid-2021 is dependent on confirmation of funding through this business case, and contractual and funding agreement between the parties, and is likely to be carried out by KiwiRail through an intra-company procurement arrangement.

5.6.1.2.2 KiwiRail Network Infrastructure Improvements

KiwiRail will follow its own procurement and project management processes for network infrastructure improvements. It is expected that physical works will be undertaken using KiwiRail resources where applicable, and competitively tendered following a similar approach to that used for the delivery of the Wellington Metro Upgrade Programme (WMUP). The WMUP is delivering the improvements identified in the Wellington Metro Network Track Infrastructure Catch-up Renewals and Unlocking Network Capacity and Resilience business cases. Significant synergies may be gained by aligning delivery of the infrastructure required by this business case with that scheduled for the WMUP, which will be delivered over a similar period, particularly on the Wairarapa Line where major works are required to support this business case (sidings and signalling) and the Track Infrastructure Catch-up Renewals business case (track and bridge renewals).

5.6.1.3 Long-Term Maintenance and Operation

The new rolling stock fleet will be owned by GWRC through its Greater Wellington Rail Ltd subsidiary. Maintenance will be provided either directly by the manufacturer (i.e. through a design-build-maintain or

build-maintain contract) or through a variation to the existing Operator Maintenance Partnering Contract. Services on both corridors are likely to be operated by Transdev as part of the Metlink network under the existing Wellington rail contract, which commenced in mid-2016 and runs for fifteen years.

Manawatu Line services are likely to be incorporated into the Wellington rail contract when the existing rolling stock is replaced by the DMU/DMMU fleet, to provide the operational flexibility and efficiencies sought by this business case. This will require GWRC to include Manawatu Line services south of the regional boundary in the existing rail service unit in its RPTP, and for HRC to define a corresponding rail service unit covering Manawatu Line services north of the regional boundary in its RPTP, to meet the requirements of the LTMA and provide a funding and procurement mechanism. A formal agreement between the councils will cede responsibility for Manawatu Line services within the Horizons Region to GWRC and define the allocation of operating costs between the councils (see Section 5.7).

5.6.2 Risk Management

The key identified risks of the investment proposal are summarised in Table 5-13 below, along with their expected probability, impact and rating, and an associated response. The rating is based on a simple risk matrix with a nine-point scale, where high probability high impact risks have a score of 1 and low probability low impact risks have a score of 9, and scores of 1-3 are deemed unacceptable, 4-6 undesirable, and 7-9 acceptable.

Table 5-13: Key risks

Risk	Probability	Impact	Rating	Comment
The new rolling stock is not ready by the 2025 financial year and delays subsequent service improvements	Low	High	4	A four-year lead time is required to enable the specification, procurement, design, construction and delivery of the new rolling stock fleet, requiring funding confirmation by the end of the 2020 financial year (see Section 5.8). This will require prompt funding decision making by the investment partners, timely procurement and design decisions, and good project management, so that the new rolling stock can be introduced into service when required. Failure to meet the deadline and provide the required capacity on the Wairarapa Line and to support the electrified network will lead to a significant reduction in service quality and discontent and mode shift from passengers, which will in turn increase congestion and undermine access and economic growth. Additional investment may also be required for further life extension of the carriage fleets.
Supporting infrastructure is not ready when required to support the introduction of the new rolling stock	Low	High	4	There is enough time to design, procure and construct the required infrastructure within the available timeframe, so this timeframe risk is generally low, although it is reliant on similar factors to above. However, service improvements are also dependent on completion of the WMUP improvements, particularly the Track Infrastructure Catch-Up Renewals, Upper Hutt-Trentham double-tracking and Wellington Station improvements projects. Their prompt completion is therefore also very important.
Public funding support is not confirmed by all investment partners	Low	High	4	The key investment partners (GWRC, HRC and NZTA) have participated in the development of this business case and previous assessments of both corridors and recognise the need for further

				investment to address the problems. All will consider the financial implications of the investment against their own priorities before committing financial support, particularly in relation to future service enhancements. It would not be appropriate for investment proposal to proceed without suitable contributions from both regional councils relative to the benefit provided within their jurisdiction, and from national level funding sources to reflect the wider national benefit. Agreement on appropriate contractual and funding arrangements for the existing Manawatu Line service is important to enable its continued operation until the rolling stock is replaced.
KiwiRail wishes to continue operating the Capital Connection as a stand-alone service	Low	High	4	Increased service capacity and operational flexibility are key investment objectives for this business case. Both would be undermined by the continued operation of a stand-alone service on the Manawatu Line, so such an outcome would be undesirable, particularly if such a service continued to receive public funding support. [redacted]
Operating and/or capital costs are higher than projected	Med	Med	5	Operating and capital cost forecasts for existing services are based on the current contract provisions (Wairarapa Line) and forecasts provided by KiwiRail (Manawatu Line). Longer-term costs are based on detailed analysis by GWRC (rolling stock and stations) and investigation by RIC (network infrastructure). These are subject to further confirmation through the design and procurement process, but conservative capital costs have been deliberately used to allow for a higher than anticipated cost and/or higher specification. Operating costs are closely linked to patronage and will be higher when patronage and revenue are higher and lower when they are lower, reducing relative operating cost risk. Scenario testing shows that low growth DMU and DMMU BCRs remain positive if costs are 35% and 25% higher than anticipated respectively. This increases to 80% and 65% higher under the medium growth scenario, and 90% and 75% higher under the high growth scenario.
Patronage grows at a slower rate than anticipated, resulting in lower revenue and reduced benefits	Low	Med	7	The high-growth nature of both corridors and recent growth trajectory support the use of the high patronage growth projection. However, the BCRs remain positive if patronage growth is at the medium growth projection and at the conservative low growth projection. Economies of scope are likely to result from incorporating Manawatu Line operation into the Metlink operation and can be expected to drive further patronage and revenue through better marketing and coordination of services on that line,

				potentially driving much stronger growth than projected.
DMMU dual-mode technology causes implementation problems	Low	Low	9	Dual mode DMMU rolling stock is new to New Zealand, although relatively common overseas. Care will need to be taken to ensure that adequate training is given to operating and maintenance personnel to ensure that this implementation risk is mitigated.

Risk will be allocated to the party that is best able to manage that risk, through existing contractual mechanisms in relation to operations and maintenance, and in accordance with an appropriate contractual risk allocation method in relation to rolling stock and infrastructure procurement.

5.7 Financial Case

The investment proposal will require co-investment from GWRC, HRC, the NLTF through the NZTA, and potentially the Crown through PGF, with GWRC as the lead organisation. It is identified in both regions' RLTPs as noted in Section 2.2.3, and as a significant activity in the 2018 programme update to the 2015 Wellington RLTP, with Wairarapa Line service and capacity enhancements (including associated rolling stock) being allocated to Priority Band 1 (the highest priority) and Manawatu Line improvements being allocated to Priority Band 2. Currently, no project funding is allocated by either region within the current 2018-21 NLTP, other than contribution to the continued short-term operation of the Capital Connection.

Table 5-14 summarises the key capital investment components for each option over the implementation period between the 2021 financial year and the 2026 financial year, both without and with an additional contingency that provides 95% confidence in costs.

Table 5-14: Capital investment components without and with additional contingency

	DMU			DMMU		
	Expected Estimate	Contin-gency	95th Percentile Estimate	Expected Estimate	Contin-gency	95th Percentile Estimate
Rolling stock	[redacted]	10%	[redacted]	[redacted]	10%	[redacted]
Maintenance facility	[redacted]	10%	[redacted]	[redacted]	10%	[redacted]
Stations	[redacted]	5%	[redacted]	[redacted]	5%	[redacted]
Network infrastructure	$120.3m	5%	$126.3m	$120.3m	5%	$126.3m
Capital Connection capex	[redacted]	0%	[redacted]	[redacted]	0%	[redacted]
Total capital funding	**$379.0m**	**8%**	**$409.3m**	**$415.3m**	**8%**	**$449.2m**

Some or all costs are likely to be co-funded from the NLTF through the Public Transport activity class, and/or the Transitional Rail activity class (or its replacement), for which Wellington regional and inter-regional rail investment is specifically highlighted. Some or all could also be funded through the PGF, given the alignment with its requirements noted in Section 2.3.4 and the key role that rail plays in the transport network linking Wairarapa and Manawatu with Wellington as noted elsewhere in this business case. There is a particularly strong case for PGF funding of the required network infrastructure, which supports both improved passenger and improved freight services, the latter generating productivity increases for the target forestry sector in addition to the tourism and other benefits provided by the improved passenger services.

The following national-local funding share of the capital investment components is proposed (assuming NLTF investment:

- Rolling stock, maintenance facility and stations improvements: A special [redacted] FAR, which is consistent with the FAR applied previously under the Matangi funding model. This reflects the large share of benefits that accrue to wider society (i.e. central government) from the proposed investment,

including the congestion, safety, environmental, and health[68] benefits described in Section 5.2, which collectively account for around 84% of all conventional benefits.

- Capital Connection rolling stock: A [redacted] FAR from the Transitional Rail activity class for the capex required to refurbish KiwiRail's Capital Connection S type carriage fleet and enable continued operation until the GWRC-owned DMU/DMMU fleet arrive.
- Network infrastructure: A [redacted] FAR, on the basis that this investment is primarily needed to restore infrastructure that was previously removed, cater for current freight train lengths, or catch up for past underinvestment, and is primarily required to maintain a safe and efficient dual purpose railway network as described in Section 5.4.3. This reflects the wider national interest in ensuring that network infrastructure capacity and resilience is provided at an appropriate standard to enable enhanced passenger and freight operations on a growth corridor. The proposed FAR is consistent with that provided for state highway infrastructure.

As indicated in Table 5-15, [redacted] will be required within the current 2018-21 NLTP to support the DMMU project. This consists of:

- [redacted] to enable procurement of rolling stock to commence to achieve contract signing by June 2021; and
- [redacted] to ensure that the Capital Connection rolling stock can remain in service beyond June 2021.

Table 5-15: DMMU capital investment cash flow

	Proposed FAR Rate	Total Project Capital Investment Cash Flow					
		2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Rolling stock, maintenance facility and stations	90%	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
KiwiRail network infrastructure upgrades	100%	-	-	-	[redacted]	[redacted]	-
Capital Connection rolling stock	100%	[redacted]	-	[redacted]	[redacted]	-	-
Total		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The GWRC-Horizons funding share of rolling stock, maintenance facility and station capital costs is proposed at approximately 86% to 14% respectively. The proposed split reflects vehicle service kilometres by region and the benefit provided by the share of service within each region. Table 5-14 summaries the DMMU loan repayment cashflow and funding split, based on the assumptions of the proposed FAR split noted above, 4.9% interest rate, 10-year repayment period for the Capital Connection Capex, and 30-year repayment period for all other capital investments. The DMU cash flow and funding split breakdown is similar, but with 13% lower project costs than those shown for the DMMU.

Table 5-16: DMMU loan repayment cashflow and funding split

	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
NZTA	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GWRC	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
HRC	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The national-local funding share of the operational investment is proposed at the regional councils' standard FAR rate, which is currently 51% for both councils. Table 5-17 summarises the resulting DMMU

[68] The health benefit is regarded as a public transport user benefit, but its value actually accrues to the health system.

operational cash flow and funding split over the implementation period, excluding Capital Connection operational costs. Appendix D provides a full breakdown of these costs over the ten-year period ending in the 2029 financial year.

Table 5-17: DMMU change in operational costs (revenue, operating/maintenance/renewal costs)

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
NZTA	-	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GWRC	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
HRC	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The proposed capital investment FAR contribution ensures that the regions have sufficient 'skin in the game', since both regional transport rates and fares will need to increase to contribute to the investment cost. The proposed FAR contribution will minimise this increase and consequently maximise the patronage and associated benefits impact of the investment. A low level of central government funding support would necessitate large fare increases, which would counter much of the demand and therefore reduce the benefits delivered. Indicative calculations show that GWRC would need to increase regional transport rates by at least 1.1% and rail fares by at least 2.7% under the proposed FAR regime. If the standard 51% FAR was be applied to capital investment instead of the proposed FARs, GWRC's regional transport rates would need to increase by 3.6% and overall rail fares by 8.7%. It is reasonable to assume that this level of fare increase would significantly impact the forecast patronage growth, and hence benefit realisation.

5.8 Management Case

5.8.1 Project Management

GWRC will lead implementation of the investment proposal, which will be overseen by joint GWRC-HRC governance group and GWRC's Project Management Office. There are several reasons for GWRC being the lead agency: (1) GWRC has considerable experience managing rail operations, (2) GWRC will operate the bulk of the new DMU/DMMU fleet on Wairarapa Line services, (3) GWRC has existing maintenance facilities in Wellington that will be expanded to support the new trains, and (4) operating the services are part of the Metlink network will leverage the best coordination and efficiencies.

A GWRC project team will be responsible for day to day project management, including detailed project management and risk planning, and provide oversight of rolling stock and infrastructure specification and design, construction and implementation. This team will contract professional service expertise as required to provide specialist input, particularly during the rolling stock specification and design process, and engage directly with the key implementation partners: HRC, KiwiRail, Transdev, and once confirmed, the rolling stock manufacturer and the maintenance provider.

KiwiRail will be responsible for network-related infrastructure improvements in accordance with the Metropolitan Rail Operating Model. Significant synergies may be gained by aligning delivery of the infrastructure required by this business case with that scheduled for the WMUP as noted in Section 5.6.1.2, and it may be appropriate to manage delivery of the required network improvements as an extension of the WMUP programme.

Service changes will be managed by GWRC and Transdev through existing mechanisms, separately from (although dependent on) the rolling stock and infrastructure development process.

5.8.2 Key Milestones

A minimum four-year lead time is required to enable DMU/DMMU specification, procurement, design, construction and delivery. Funding will therefore need to be confirmed by the end of the 2020 financial year (June 2020) to enable this process to commence and ensure that the delivery of the new rolling stock begins early in the 2025 financial year and is completed by the end of that year, as required to enable service levels to be improved at the beginning of the 2026 financial year. A similar timeframe is required for the specification, design, procurement and construction of supporting network infrastructure, station

facility and maintenance facility upgrades, with the later needing to be completed prior to the delivery of the rolling stock and the remainder required prior to the introduction of service improvements.

Table 5-18 outlines the key milestones that will form the basis of the project plan. The completion dates are indicative only and subject to further project planning and subsequent specification and design processes.

Table 5-18: Key milestones

Key Milestone	Indicative Date
Formal submission of a funding proposal to the NZTA	December 2019
Confirmation of funding and partnering arrangements	June 2020
Formal project inception	July 2020
DMU/DMMU specification and tender development completed	December 2020
DMU/DMMU tender process completed	June 2021
S fleet life extension completed	June 2022
Infrastructure design and procurement completed	June 2022
DMU/DMMU maintenance facility completed	June 2024
Initial DMU/DMMU delivery completed	July 2024
Introduction of DMU/DMMU rolling stock on existing Manawatu Line services	October 2024
Introduction of DMU/DMMU rolling stock on existing Wairarapa Line services	January 2025
Final DMU/DMMU delivery completed	May 2025
Network infrastructure improvements completed	June 2025
Manawatu Line station and park and ride upgrades completed	June 2025
Service level improvements commence	July 2025

5.9 Conclusion and Final Recommendation

The investment proposal entails the replacement of all existing longer-distance rail rolling stock with a fleet of 15 four-car DMUs or DMMUs, which will be owned by GWRC and enter service in the 2025 financial year. The new rolling stock will operate all services on the Wairarapa and Manawatu lines, which will run at improved frequencies to provide better access and capacity between Masterton/Palmerston North and Wellington, including at key stations within the electrified area. Supporting improvements will be made to maintenance facilities, stations and network infrastructure. Existing rolling stock will be maintained in acceptable operating condition until the introduction of the new rolling stock and then be retired.

The DMMU option is the primary preferred and recommended option due to its better alignment with the investment objectives and key success factors as described in Section 4.3.2. A detailed assessment has found that this has:

- medium growth 30-year discounted benefits of $551.7m compared to costs at the same level of $291.2m, and a projected BCR range of 1.3 to 2.6 (compared to a DMU BCR range of 1.5 to 3.0); and
- a higher BCR range of 2.2 to 4.1 (compared to a DMU BCR range of 2.5 to 5.1) if the cost of network infrastructure, which is required to restore infrastructure that was previously removed and catch up for past underinvestment, is excluded.

Assessment against the NZTA's 2018-21 Investment Assessment Framework gives a results alignment rating of Very High and a BCR rating of Low, which give both options a priority order rating of 1, the highest priority for NLTP funding. The Very High rating relates to the ongoing improvement in access that the investment proposal enables for large numbers of passengers on the Wellington region's main northern corridors.

GWRC would lead implementation and be responsible for procuring the new DMMU rolling stock fleet and station-related infrastructure improvements, along with overall programme management. GWRC would also

be responsible for long-term operation of services on both lines, including Manawatu Line services, which would be incorporated into its existing rail contract and operated on behalf of HRC north of the regional boundary. KiwiRail would be responsible for network-related infrastructure improvements in accordance with the Metropolitan Rail Operating Model. Key risks around timeframe, funding, KiwiRail's commercial interests, costs and revenue would be managed through the project management process and contractual mechanisms.

The investment proposal includes project capital expenditure of $415.3m, with a [redacted] confidence estimate of $449.2m. It is proposed that network infrastructure will be funded by the NZTA at a [redacted] FAR, rolling stock, maintenance facility and station improvements receiving a [redacted] targeted enhanced FAR, and ongoing maintenance and operations receiving a standard [redacted] FAR. Cost and revenue will be shared between GWRC and HRC based on the share of vehicle service km in each region. An urgent funding decision is required to enable the specification and procurement process to commence in mid-2020 and ensure that sufficient capacity is in place when required to meet projected demand pressures, given the long lead times for rolling stock and supporting infrastructure.

In conclusion, the investment proposal has been shown to clearly respond to significant problems and offer significant benefits to the lower North Island. These link closely with national transport and economic development priorities and provide a strong case for investment. It is therefore recommended that investment decision makers:

- approve this proposal to replace existing Wellington longer-distance rail rolling stock with a fleet of 15 four-car dual-mode DMMU units, and associated infrastructure and service enhancements;
- approve funding through appropriate channels at appropriate FAR rates by June 2020; and
- prioritise these approvals, to allow project planning to commence and enable the new rolling stock to be brought into service in the 2025 financial year and service improvements to be implemented the following financial year.

Appendices

Appendix A Investment Logic Map

Appendix B Benefits Realisation Plan

Appendix C Summary of Long List Options

Summary of long list options including rationale for discounting

Option	Description	Assessment
Mode and Fleet Options (shortlisted options highlighted)		
1	Discontinue longer distance rail service – i.e. people use private cars to access electrified rail network – increased park and ride facility required, and improved road network	Similar option assessed as part of Palmerston North-Wellington Rail Passenger Business Case and determined not to be viable
2	Discontinue longer distance rail service – encourage a commercial bus service to connect to electrified network	Similar option assessed as part of Palmerston North-Wellington Rail Passenger Business Case and determined not to be viable
3	Life extend current Wairarapa fleet – cease Manawatu Line	Take forward as do minimum, Option 1 going forward
4	Refurbish Manawatu and Wairarapa fleets	Will not address growth
5	Refurbish Manawatu and Wairarapa fleets and buy additional carriages (for example SA trains from Auckland)	Include as an option – Option 2 going forward
6	Existing locomotives and new carriages	Overall journey time be longer than a multiple unit option, locomotive hauled trains are also less operationally efficient (time to turn services), and less flexible (require infrastructure like turntable to turn locomotive)
7	New locomotive and new carriages	Similar issues to option above, however flexibility could be improved with a double cab locomotive
8	New locomotive and refurbished carriages	Similar issues to the above two options
9	Full bus replacement on Manawatu Line	Similar option assessed as part of Palmerston North-Wellington Rail Passenger Business Case, and determined not to be viable
10	Bus feeders into existing electrified network on Manawatu and Wairarapa	Similar option assessed as part of Palmerston North-Wellington Rail Passenger Business Case and determined not to be viable
11	Extend electrification to Featherston/Levin, buy new EMUs and provide bus connections north of those points	Include as an Option for assessment – Option 3 going forward
12	Buy new DMUs	Included as an Option for assessment – Option 4 going forward
13	Buy new Dual Mode trains	Included as an Option for assessment – Option 5 going forward
14	Full electrify to Masterton and Palmerston North and new EMUs	Included as an Option for assessment – Option 6 going forward
15	Buy new high-speed train	Not included as perceived to be cost prohibitive, and technically challenging for New Zealand rail environment

16	Buy new LRT vehicles	Light rail vehicles are not able to co-operate on the rail network with heavy rail (freight trains), so would require significant investment in creating a parallel light rail network – perceived no benefit.
Service Level Options (shortlisted options highlighted)		
1	Keep current service pattern	Would be unlikely to meet demand – reduced mode share. Used as base option in assessment
2	Keep current service pattern – but trains longer in the peak (more trains and platform extensions)	While would provide increased capacity, does not provide customer flexibility and convenience
3	Increase peak services only	Provide capacity in the peak and focus on customers working a typical 9-5 job – would not provide flexibility for other travel options (i.e. half days), does not cater for tourism and other activities, and conflicts with strong desire from communities to increase off peak and weekend services
4	Increase both peak and off-peak service frequencies	Service offering included in Option 2 – 6 for further assessment
5	Shuttle services in peak	Does not provide increased capacity within the electrified area, which is already approaching capacity
6	Shuttle services in off peak	While possible, it does not provide as good of a customer experience, as requires people to change services – do not see significant savings/benefits with this option
7	Shuttle services in peak and off peak	Does not provide increased capacity within the electrified area, which is already approaching capacity
8	Change land use policy to reduce demand and need for longer distance transportation	Does not align with strategic objectives
9	Change fares to reduce demand and need for longer distance transportation	Does not align with strategic objectives

Appendix D Investment Cash Flow

Capital and operating cost cashflow and funding split for the ten years ending in the 2030 FY (2019 $m)

	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
Project cashflow funding										
KR Network base network upgrade project capex	-	-	-	[redacted]	[redacted]	-	-	-	-	-
Rolling stock, maintenance facility & station project capex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-	-	-	-
Capital Connection Capex	[redacted]	[redacted]	[redacted]	[redacted]	-	-	-	-	-	-
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	-	-	-
Loan repayments contributions										
NZTA (other funder) loan repayments	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GWRC loan repayments	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
HRC loan repayments	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total loan repayment	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Change in opex + capex (renewal) contributions (excluding loan repayments and Capital Connection)										
Change in NZTA opex + capex (renewal)	-	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Change in GWRC opex + capex (renewal)	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Change in HRC opex + capex (renewal)	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total loan repayment	-	-	-	-	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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