

Single-Stage Business Case

Wellington Metro Railway Network Track Infrastructure Catch-Up Renewals



Document Information

Version	Description	Date
G1-G5	Final editing for draft release	6 th November 2017
H	Part B updated for draft release	9 th November 2017
1.0	Issue version to Ministry of Transport and NZ Treasury	10 th November 2017
2.0	Issue version two to Ministry of Transport and NZ Treasury	15 th November 2017

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Executive Summary

This Business Case has been jointly sponsored by KiwiRail, as the network asset owner, and Greater Wellington Regional Council, as the predominant network asset funder and user. It Business Case supports a Crown investment in a package of track and civil engineering infrastructure catch-up renewals throughout the Wellington Metro Railway Network (WMRN).

The WMRN is a key contributor to the region's economy through provision of an effective transport service to move people from where they live to their places of work, education and leisure. It provides over 13 million passenger journeys per year for the approximate 500,000 people who live in the region. The passenger trains provide peak period capacity for the required movement of people that would not be achievable on the roading network alone.

The proposed investment is to renew key track assets which are approaching the end of their useful lives. The pending peak of renewals work exceeds the capacity of the current funding models to address. If managed within current funding restrictions by maintenance rather than renewal, the condition of the WMRN track will deteriorate over the next five years, with significant adverse impacts on service levels.

It also proposes to improve safety and resilience on the network by treating slopes identified as at high risk of slips.

The primary focus is on the Wairarapa Line as well as addressing other critical track infrastructure in the busiest parts of the network.

This is one of a series of related business cases which together will help form an integrated 12 year programme for the development of passenger rail in Wellington. Ensuring that the underlying track infrastructure is "fit for purpose" is a critical foundation for the follow-on investment cases to improve service capacity and encourage passenger use.

Together these business cases act as modular building blocks to create a flexible, responsive and adaptable programme for the development of the WMRN and Wellington commuter rail services. This programme can evolve to meet changing circumstances.

This Business Case is independent of and separate from current discussions with the Crown regarding KiwiRail Group funding and investment.

i. Background and Objective

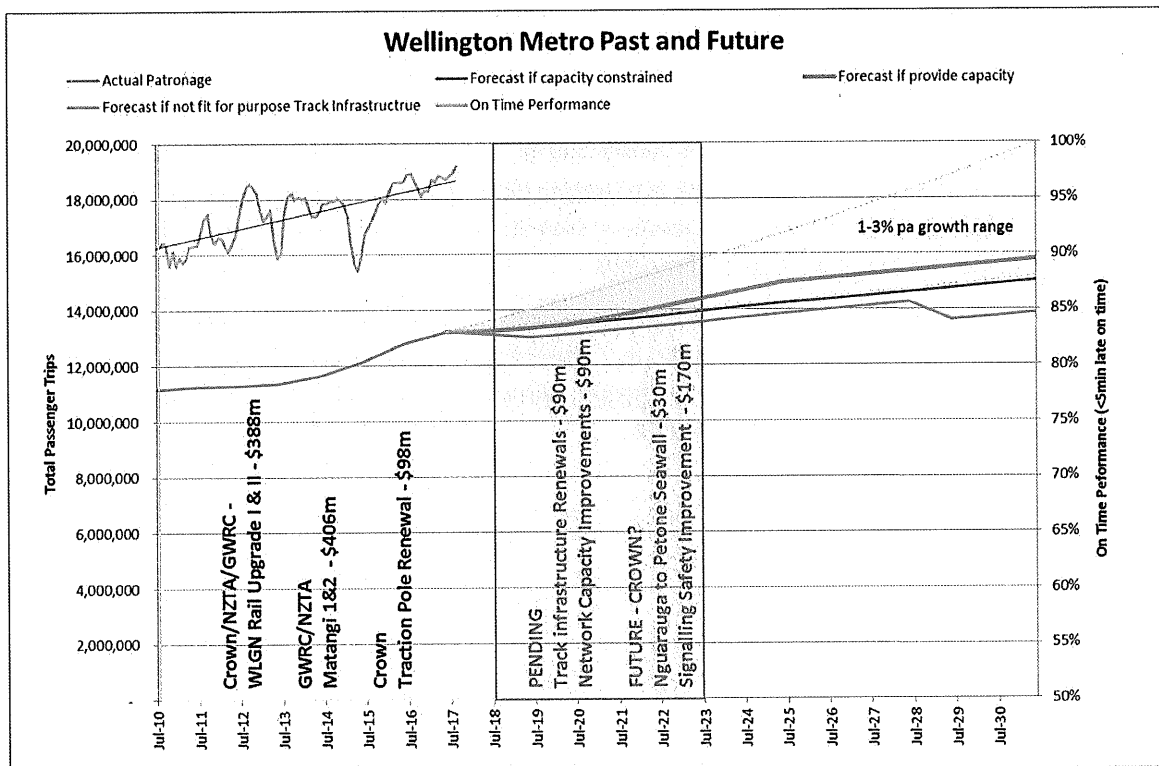
Greater Wellington and KiwiRail have a shared objective of a modern passenger rail system in Wellington that is well used and relevant and supports Greater Wellington, NZTA and Crown policies in this area. These policies are set out in Part B of this Business Case.

Planning and delivering the complex infrastructure investments required to support this objective involves long lead times. Therefore KiwiRail and Greater Wellington are developing a coordinated programme for the next four funding trienniums¹, to reach this objective.

Previous and current Crown and Greater Wellington supported investment programmes since 2008, together with the improved focus encouraged by the Metro Rail Operating Model (MROM), have combined to rejuvenate the Wellington passenger rail system and lift its performance.

Figure 1 below presents the combined effect of these programmes on patronage and on-time performance (OTP) to date.

Figure 1 – Wellington Metro Rail Investments and Results Achieved



¹ T3 FY19-21, T4 FY22-24, T5 FY25-27 and T6 FY28-30



The picture is one of sustained improvements in network and rolling stock performance, seen as improved Level of Service by customers, hence delivering matching improvements in patronage (and revenue).

In addition, customer satisfaction now scores firmly in the 93% range, with Greater Wellington, Transdev Wellington and KiwiRail all committed to lifting this score to 96% in 1% annual steps.

Figure 1 also illustrates forecast patronage growth and the future investments proposed.

ii. The developing challenge to service quality

While the performance described above represents success as a return for the capital investment and customer focus, there are underlying trends that will undermine this success if not addressed.

Track infrastructure was not addressed in any of these previous deferred maintenance and catch-up renewal investments, except where additional track was required².

Due to the limitations of the current funding model and the point the life cycle of the Wellington track asset has reached, deferred or due renewals are building to a point that Temporary Speed Restrictions (TSR's) will increase and on-time performance overall will suffer.

Large quantities of track infrastructure assets are at or near the end of their lives due to both the timing of when they were installed (i.e. large sections of track commissioned at the same time) plus historically (pre 2000) low levels of investment in the WMRN Network related to previous railway ownership (funding) models.

This has resulted in a situation where there is a large 'bow wave' of renewals for certain long life assets that need to be delivered in a short timeframe. This is frequently referred to as catch-up renewals. The cost of this large spike in renewals is outside the normal funding mechanisms provided through the MROM.

² Double tracking north of McKay's Crossing (Paekakariki) to Waikanae and a third main track into Wellington Railway Station.

Figure 2 – Wellington Metro Railway Network Funding Forecast

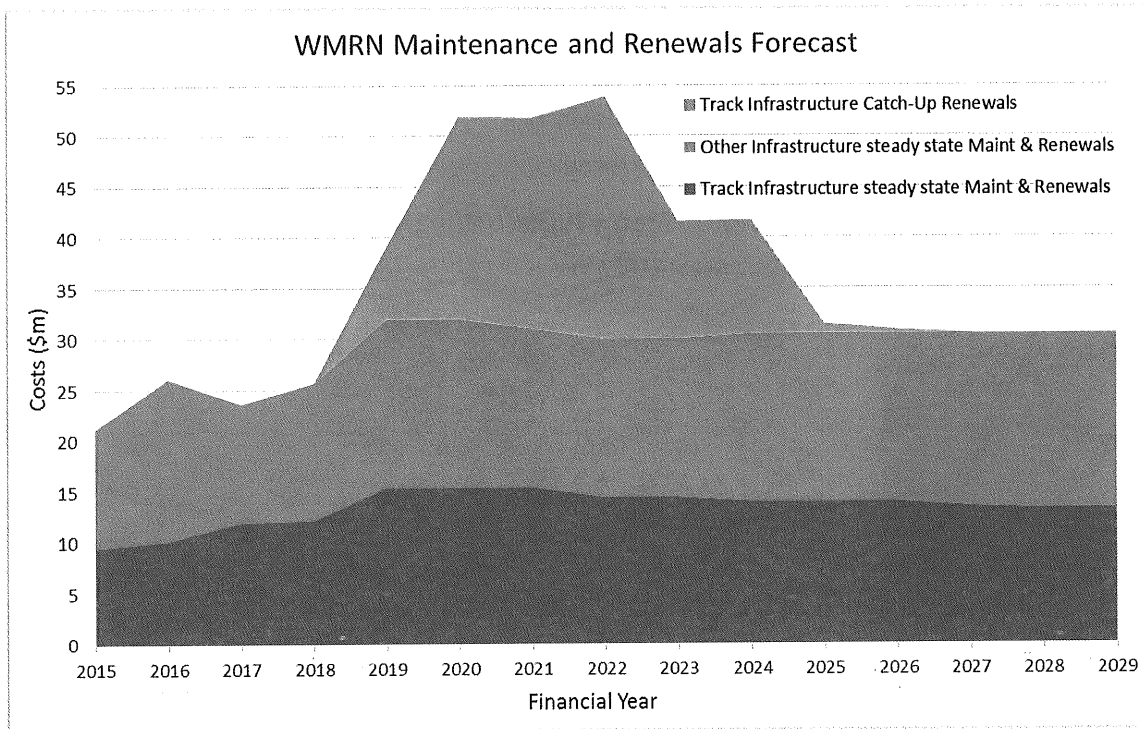


Figure 2 depicts the ‘bow wave’ of track infrastructure catch-up renewals (covered in this Business Case) that are over and above the steady state maintenance and renewals funded through user charges. Note that blue represents an assumption of “affordable” under current MROM funding arrangements. These are currently under review and a change to this could alter the boundary of “affordable”.

As part of the improved asset planning required of MROM and WNA, KiwiRail identified this renewals workload and funding constraint mismatch during the first MROM Funding Triennium (FY13-FY15).

The preferred approach as life expiry approaches is for asset renewal, timed at the optimum value point, early for routes requiring very high level of service, later in the cycle for those in which lower service levels are tolerable.

To manage the asset within existing funding envelopes the KiwiRail response was to spread the available funding thinly, to repair rather than renew and thus to maintain service levels in the short to medium term. This was a deliberate focusing of resources but only to “buy time” while work was done to better understand the issue and explore funding options.

If prolonged, this approach serves to further build up the size of the approaching ‘bow wave’, with an unmanageable volume of unavoidable renewals being required in a short timeframe.

The Wairarapa Line (north of Upper Hutt) has the largest concentration of life expiring track infrastructure. In addition, available funding is concentrated on the more heavily used electrified routes, where delays affect significantly more customers.



The consequence of this rationing of resources is a noticeable and well publicised deterioration in the punctuality of the passenger services on the Wairarapa route relative to the other routes, as illustrated in Figure 3. This is a consequence of a significant rise in TSR's.

Figure 3 – Wellington Metro Punctuality Performance by Line

TSR's are a major cause of delays, but not the only reason.

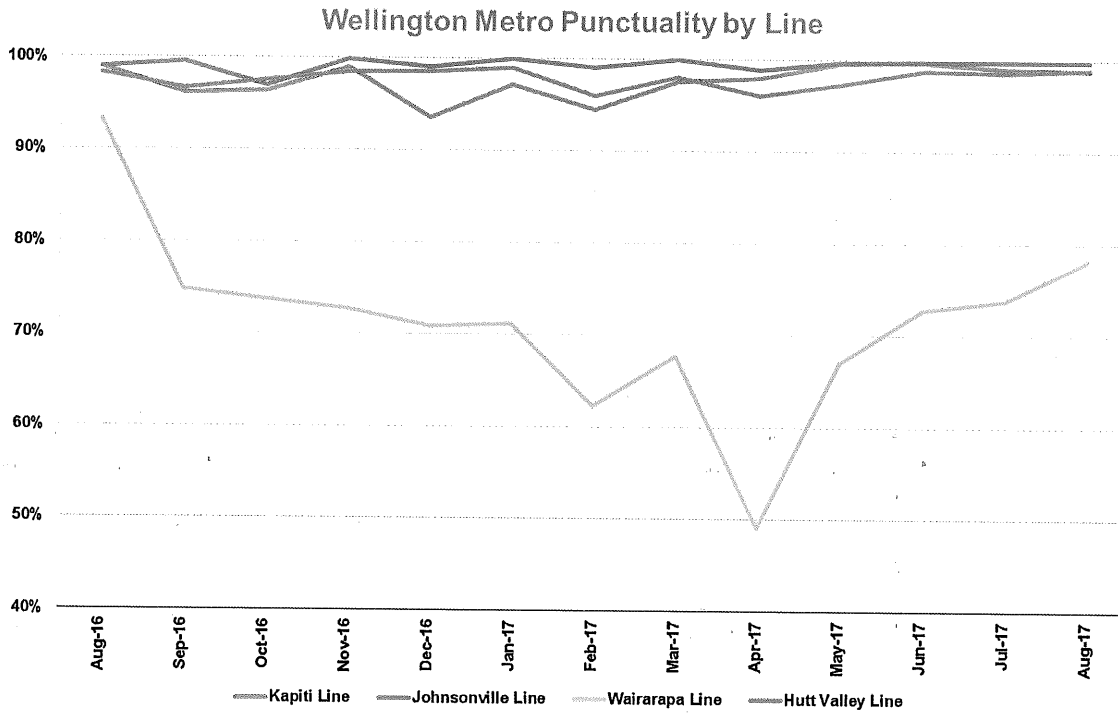
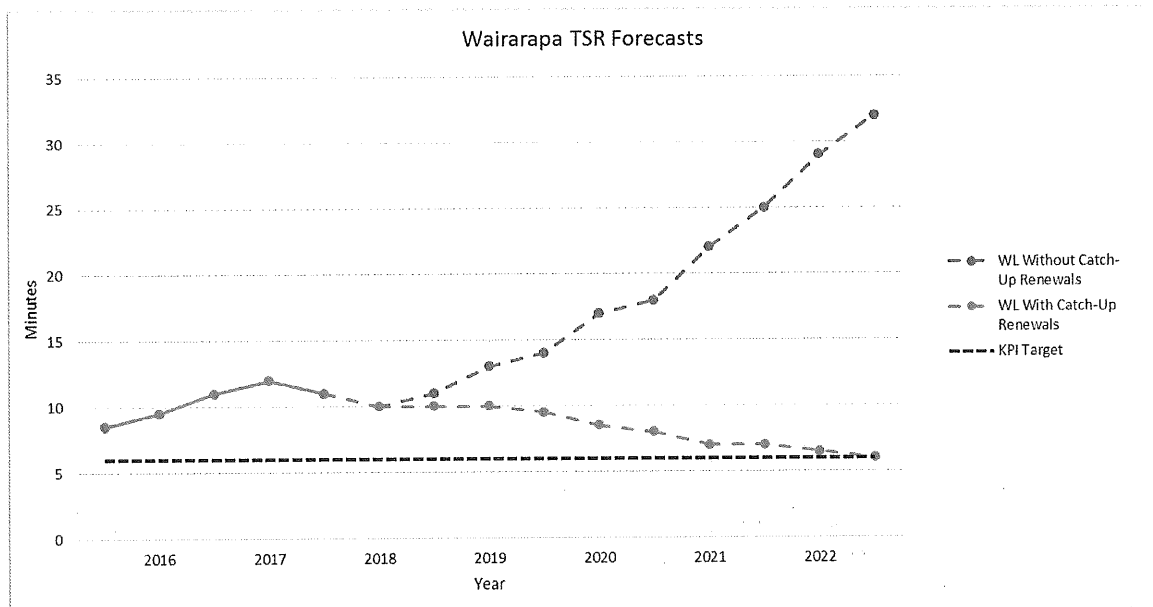


Figure 4 presents a forecast of TSR levels on this route as an illustration of the general pattern for the entire WMRN.

Figure 4 - Temporary Speed Restrictions on the Wairarapa Line With and Without Catch-Up Renewals



The Wairarapa Line is thus a highly visible early example of the TSR related performance problems which will affect all routes if renewals are continually deferred.

If the track infrastructure catch-up renewals are not undertaken, the result will be a significant increase in speed restrictions throughout the network. TSR's have a direct and tangible negative impact on customer's travel experience by increased journey times.

Delivery of the track infrastructure catch-up renewals will hold, then reduce and minimise the impact of TSR's on the WMRN.

iii. BAU funding model cannot deliver the desired level of service

As a key part of establishing the Metropolitan Rail Operating Model (MROM) in 2009, the Crown agreed to fund the investment to bring the network to a functional, safe and reliable standard³, with steady state maintenance and renewals to be funded by user charges.

So far as user charges are concerned, the MROM ensures that the cost of commuter operations and KiwiRail Group's own operations are visible without cross subsidy in either direction.

Accordingly, users of the Wellington Metro Rail Network pay for the network operating, maintenance and "steady state" renewal costs, in proportion to the use they make of the assets – full and fair user pays.

Given the intensive passenger use of the network Greater Wellington Regional Council (GWRC) operating and steady state charges for their use of the WMRN are assessed at an average of 80% of the total.

The remaining portion is assessed against KiwiRail services. The GWRC contribution is broadly funded 50% from fare revenue, 25% region wide rates and 25% NZTA National Land Transport Fund⁴.

Applying this model and tackling some asset deficiencies have resulted in GWRC's contribution to the Track Access Charges increasing from \$15m per annum in FY12 to over \$24m in FY19 (proposed budget).

While some further increases targeted at holding performance are budgeted for the coming funding Triennium (FY19 – FY21), GW and KiwiRail have reached the limit of their capacity to fund maintenance and renewals.

The agreements setting up the MROM were on the basis that the Crown would meet the cost of the additional investment to achieve this "functional, safe and reliable standard".

On this basis, and following significant analysis, previous Wellington and Auckland "Catch-Up" renewals aimed at working towards this standard have previously been funded by the Crown in the period 2011 - 2017.

At the time of gaining funding for these previous initiatives, the need for further catch-up renewal investment, including this initiative, was indicated⁵.

The MROM and rail funding models are currently under Crown review but this is not anticipated to materially change the situation with respect to Catch-Up renewals in the near future.

³ <http://www.treasury.govt.nz/downloads/pdfs/b11-2011436.pdf>, item 3.3

⁴ contributions can fluctuate across funding categories depending on mandated Funding Assistance Rates (FAR) and Fare Recovery Ratios

⁵ Wellington Metro Rail Network Traction Catch-Up Renewals. 11 November 2016. In particular Appendix B.

Business Case Summary:

THIS SECTION BOTH RECAPS THE PREVIOUS POINTS AND SUMMARISES THE FULL BUSINESS CASE

SIX OPTIONS WERE INITIALLY ASSESSED. THE PREFERRED OPTION TO TAKE FORWARD IS:

OPTION 4: TRACK CATCH-UP RENEWALS & SLOPES

THE INVESTMENT COST FOR THIS OPTION IS \$95.8M

iv. Background and context

Significant lengths of Wellington long life track assets are nearing life expiry over a relatively short time period. This is a difficult to avoid consequence of these long life track assets having been built/renewed over relatively short time periods in the past.

This natural concentration or “bow wave” has been further intensified by previous railway funding models and the inability of the MROM to deal with Catch-Up or peaky renewals, following it being made operational in Wellington in 2011.

While normal background levels of renewal continue unabated, the MROM model is not able to extend to funding the increased renewals needed to deal with a peak or bow-wave of intergenerational or long cycle life expiry of this nature.

In the absence of a confirmed programme to renew the end of life and near end of life, the volumes of track in poor condition will continue to increase as maintenance interventions are unable to keep up with deterioration.

As this trend continues, reactive ad hoc maintenance becomes unmanageable, disruptive and inefficient.

The result will be a significant increase in speed restrictions and increasing unscheduled short duration closures, both of which combine to deliver a level of service that makes catching the train increasingly unappealing for customers.

Ultimately, in the absence of sufficient funding for these volumes of renewal, speed restrictions and unscheduled closures for reactive repair will accumulate until they become endemic, with consequences explained below.

A concentrated programme of Catch Up renewals is proposed to address this.

Table 1 (Proposed Programme of Catch Up Renewals)

S9(2)(b)(i)

Scope	Lines	Cost	Estd. comp
35km of track renewals (including replacing 58,000 sleepers, 25km rail and 12 Level crossings)	85% Wairarapa Line plus key sections of the Kapiti and Hutt Valley	████████	FY24
Formation and drainage upgrades up to 50km	85% Wairarapa Line plus Kapiti and Hutt Valley	Included above	FY24
Renewal of track in 5 tunnels (14km)	Wairarapa and Kapiti Line	████████	FY24
Sleeper renewals in 11 tunnels (1.84km)	Johnsonville and Kapiti Lines	████████	FY21
Renewal of 4 bridges with timber elements	3 on Wairarapa and 1 on Kapiti Line	████████	FY22
Slope stabilisation works on 18 high risk slopes (rating 200+)	Mostly Kapiti and Johnsonville Lines	████████	FY26
Total		\$95.8m	FY26

v. Strategic Case

Over 13 million rail passenger journeys were taken in 2016 by the 500,000 people who live in the region

This reflects the fact that the rail network forms an integral part of the overall transport system in the Wellington region. Improvements to the rail network accrue benefits to the wider transport system. Metro rail makes several specific contributions to the overall transport task:

- Relieving peak pressure on the road network;
- Reducing peak long distance travel times on the roading network; and
- Improving safety by reducing peak vehicle travel – significantly on routes like the Rimutaka Hill Road (SH2).

In particular the WMRN assists the NZTA highway programme in a constrained corridor segment where it has only limited practical options for traffic capacity improvements⁶ - SH2 south of Petone and SH1 south of Johnsonville.

The current and required levels of customer service in the Wellington network cannot be sustained under the business as usual funding model.

A concentrated programme of renewals is required, as described above.

Under current MROM funding streams, GWRC and KiwiRail could likely maintain funding for maintenance and steady state renewals in the electrified Wellington Metro Rail Network but cannot extend this to the Wairarapa Line.

Services on the Wairarapa Line are likely to become untenable within five years without a change to this approach.

However, the level of service provided on the electrified lines will also decrease over time due to the key renewals that cannot easily be addressed under the MROM streams.

In the absence of a confirmed investment programme to address this renewals bow-wave, the reduction in network performance will reduce levels of service.

The result will likely be a peak period mode shift from rail to already congested roads over the next 5 - 10 years.

SAFETY

Safety is not the primary driver of this business case; however risks are increased by the approach of deferring renewals.

Speed restrictions and closures are used to manage the risk of track deterioration and failure. However, running infrastructure closer to failure does increase risk. With overall condition poor, there is a risk of missing a critical fault amongst many or, with margins small, misjudging how close a fault is to failure and it failing before the next inspection.

⁶ The mooted Petone – Grenada highway will allow Hutt-Kapiti traffic to bypass this capacity limited and congested corridor, providing some additional capacity for Hutt/Kapiti – Wellington traffic volumes.

vi. Economic Case

Existing central and local government strategies and legislative requirements provide a strong mandate to provide a useful and safe passenger rail network in the Wellington region.

Option 4 – address the growing track renewals backlog in a planned and steady but concentrated programme, well integrated with other works, is recommended as the best value option. This has a BCR of 2.7.

Table 2 – BCR Comparison

S9(2)(b)(i)

	Option 2	Option 3	Option 4	Option 5	Option 6
	Continue Business as Usual	Tunnels & Slopes	Track Catch-Up Renewals & Slopes PREFERRED SOLN.	Wairarapa Line Enhancements	Wairarapa Line Face Renewal & Enhancements
Estimated Present Value of Benefits	Base option				
Estimated Present Value of Costs	Base option				
Option BCR	Base option				

The Wellington Region, including Wairarapa, and the national economy are expected to benefit as a whole as a result of the investment in track infrastructure catch-up renewals, slope stability and resilience works.

vii. Financial Case

Greater Wellington and KiwiRail currently meet business as usual maintenance and renewals expenses for the WMRN, as required under the MROM.

GWRC’s annual contribution to the network through on-going track access charges have increased from \$15 million in FY12 to a draft budget of over \$24 million for FY19. There is no additional ability for GWRC to fund the upgrade under current arrangements.

The recommended option is for the remaining investment of \$98.5 million to be funded by the Crown.

This aligns with the commitment made by the Crown as part of the 2011 Wellington Metro Rail Package where the Crown (through KiwiRail) retain ownership of the rail network, and continues to fund investment to maintain the network at a resilient, reliable standard.

Previously in Auckland and Wellington the Crown has accepted the need to fund such works, due to infrastructure under investment from previous railway network funding models and changing demands by the communities they serve.

viii. Commercial Case

Based on inspections and assessments the identified track infrastructure must be renewed in the next ten years and selected elements within the next five years (completion by 2027 at the latest) to avoid this significant increase in speed restrictions and unplanned service outages throughout the network.

Renewal work disrupts operations – trains cannot operate during the critical site delivery period of each renewal. However, with sufficient lead time, a planned and steady rolling programme of renewals can be scheduled that limit shut downs to “time windows” away from high-demand periods and times.

Conversely, taking deferred renewal to the extreme, with large volumes (lengths) of the corridor life-extended to the point they all fail together, the only option available is to close the route for a prolonged period - months – so the backlog can be cleared.

In addition, a planned and steady but intensive programme of works allows the economic application of high productivity machinery such as ballast cleaner trains or a sleeper laying train reducing cost per unit of renewal and increasing safety and quality.

Finally, a planned and steady programme of works allows these renewals to be coordinated with routine renewals and other programmes. Each planned bus replacement window can be used to deliver multiple tasks from this and other proposed or funded programmes.

Running to failure will lead to a long period of worsening degraded service, increased safety risk and a prolonged route closure - probably many months long. If the rail service is to be retained, the overall value of this approach is assessed as poor.

ix. Management Case

Assuming Crown funding is approved for these infrastructure upgrades, it is intended that KiwiRail procures and manages the works as per previous successful catch-up renewal programmes.

This incorporates competitive procurement, incentives to drive continuous improvement and comprehensive governance and reporting structures. A significant portion of the works will also be delivered by KiwiRail staff.

The KiwiRail Wellington Area management team will manage the delivery of work on a day-to-day basis. This will provide seamless integration and co-ordination with routine maintenance and renewals and with the other initiatives.

Further significant benefits and synergies will accrue if these works are undertaken in conjunction with other programmed substantial works due to be completed over the next five years – specifically the traction pole replacement programme (\$98.4 million), and the proposed Unlocking Network Capacity programme (\$100.7 million).



Appropriations to KiwiRail will be made based on actual costs. Budget forecasts will be regularly updated to assist with managing cash flow.

The performance of the initiative will be monitored through KiwiRail and GWRC governance and reporting – with a focus on monthly and annual KPI reports against punctuality, patronage and customer satisfaction.

x. Summary

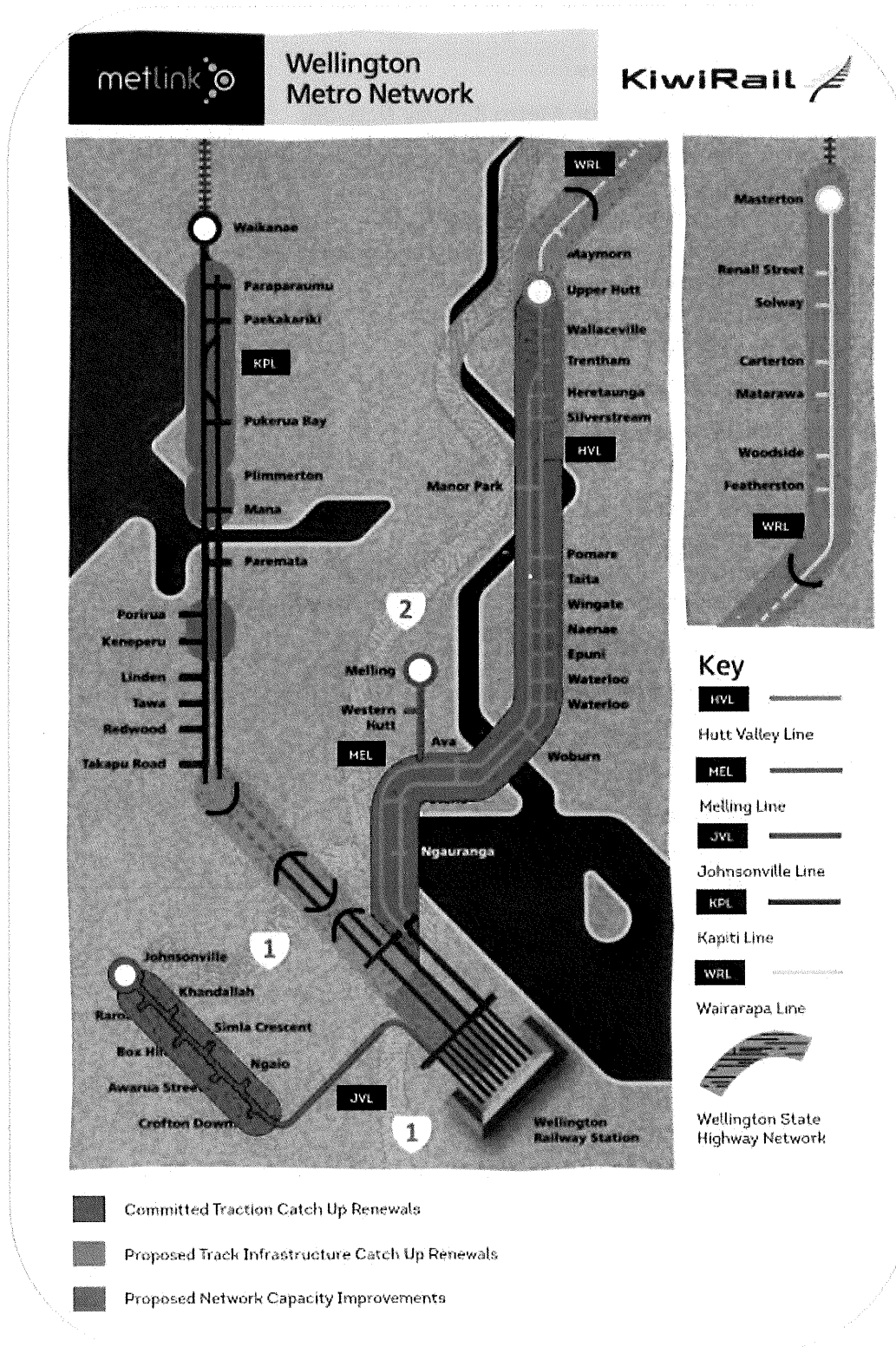
If this Business Case is successful in gaining funding the following key investment objectives will be achieved:

1. Ensure ongoing connectivity and performance of the railway network to avoid degradation in service levels forcing peak commuters into private vehicle travel;
2. Maintain and improve resilience of the railway network avoiding and minimising transport wide system disruptions from unplanned events; and
3. Maintain and improve the safety of the railway network for passengers, staff and adjacent property owners and adjacent network users (i.e. road users).

Decisions Sought

- **Agree** that Option 4 is the best outcome and best value for money under this business case
- **Agree** Crown funding of Option 4 to the value of \$95.8 million
- **Agree** that KiwiRail procure and deliver the works with funding provided by the Crown through the Ministry of Transport.
- **Agree** that, together, capacity upgrades (separate business case), and track infrastructure catch-up renewals (this business case) provide the best BCR

Figure 5 – Wellington Rail Network Investments (Proposed and Committed)





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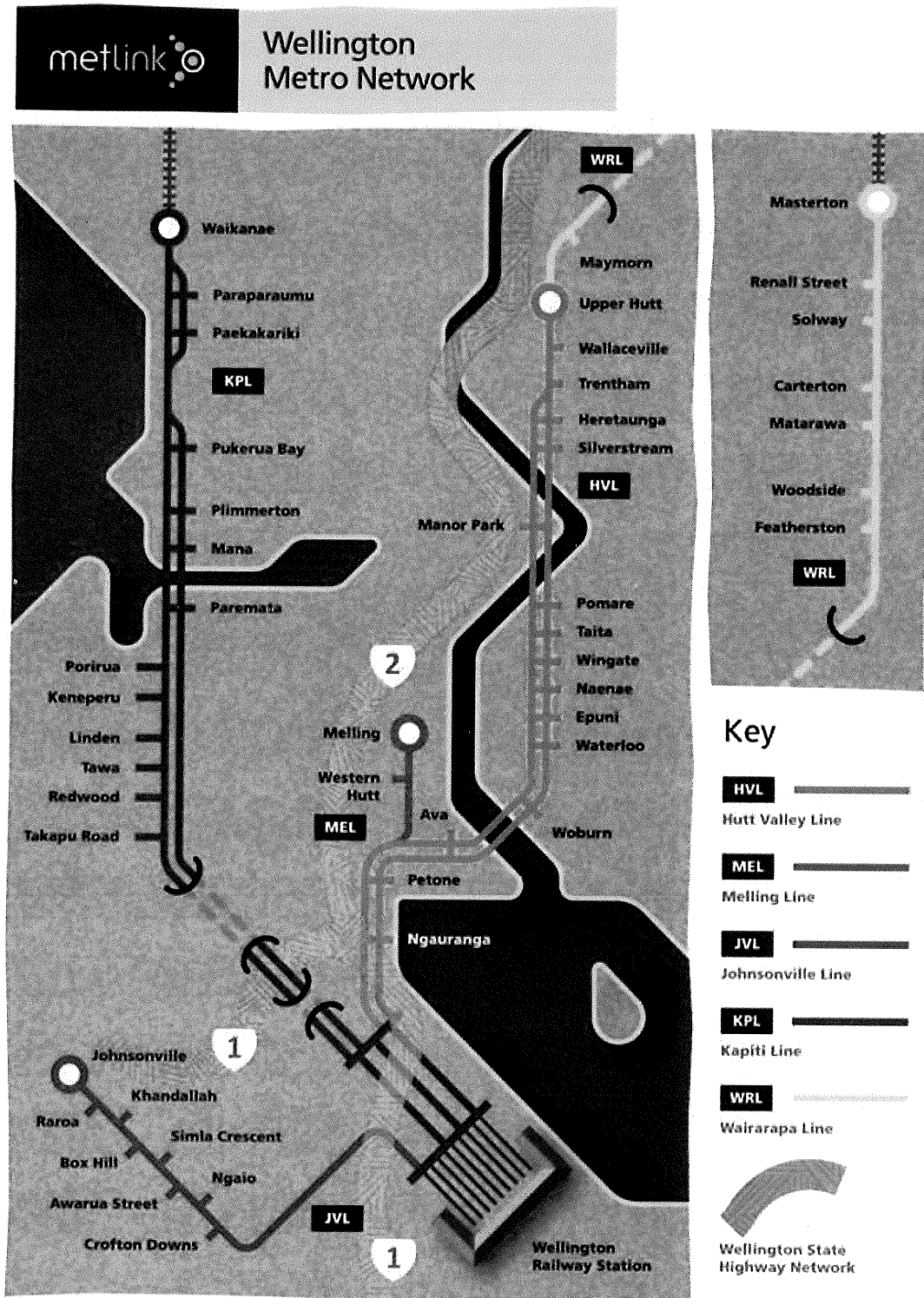


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Glossary

Abbreviation/ Term	Expansion/ Definition
ATAP	Auckland Transport Alignment Process
BBC	Better Business Case
BC	Business Case
BCA	Benefit Cost Analysis
BCR	Benefit Cost Ratio
Capex	Capital Costs
EMU	Electric Multiple Unit
Face Renewal	Full replacement of all components with modern equivalents
FY	Financial Year
GTK	Gross Tonne Kilometers
GWRC	Greater Wellington Regional Council
ILM	Investment Logic Map
MoT	Ministry of Transport
MROM	Metropolitan Rail Operating Model
NIMT	North Island Main Trunk
NZ Transport Agency, NZTA	New Zealand Transport Agency
Opex	Operating Costs
PBC	Programme Business Case
PDS	Prematurely Decayed Sleepers
RLTP	Regional Land Transport Plan
RS1	Rail Scenario 1
SH1	State Highway 1
SH2	State Highway 2
SSBC	Single-Stage Business Case
STK	Single Track Kilometers
TAC	Track Access Charge
TPR	Treated Pinus Radiata (Sleeper)
TSR	Temporary Speed Restriction
WMRN	Wellington Metro Railway Network
WMUP	Wellington Metro Upgrade Programme
WRRP	Wellington Regional Rail Project
WNA	Wellington Network Agreement

Figure 6 – Wellington Metro Railway Network Diagram



Overview

This Business Case supports a Crown funded package of track infrastructure “catch-up” renewal and slope treatment works throughout the Wellington Metro Rail Network (WMRN). It is jointly sponsored by Greater Wellington Regional Council (GWRC) (primary user) and KiwiRail (owner).

The Business Case document is divided into two parts:

Part A: Background This section provides *the context of the passenger railway and rail services in the Wellington region*. Part A also describes the track infrastructure and provides details of the track infrastructure issues and impacts. *It includes information that may be considered relevant to the Strategic Case.*

Part B: The Business Case This includes six sections covering the *investment assessment and rationale*. Its structure follows Treasury guidelines for Better Business Cases.

Note that this business case is independent and separate from other Crown funding proposals with KiwiRail Group that relate to the wider freight network only.

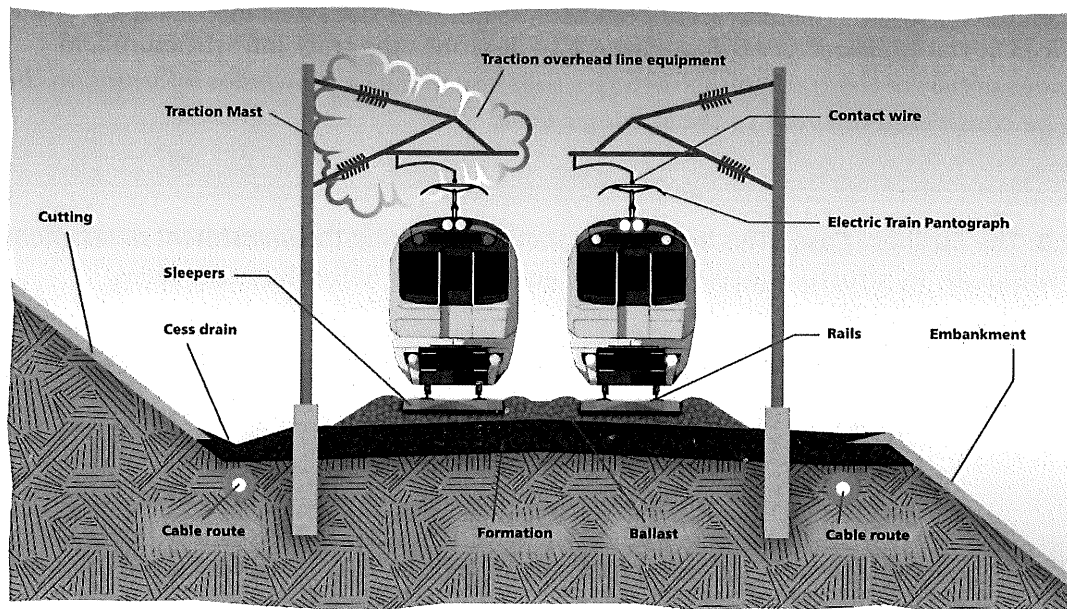
FACE RENEWAL OF THE 8.8KM LONG RIMUTAKA TUNNEL IS A CORE ELEMENT OF THE WORKS PROPOSED IN THIS BUSINESS CASE. IF CATCH UP INVESTMENT IS NOT APPROVED TO ALLOW RENEWAL OF THIS TUNNEL TO BE COMPLETED WITHIN FIVE YEARS, THE CONDITION OF TRACK IN THIS TUNNEL WILL LIKELY REQUIRE THE SUSPENSION OF MASTERTON PASSENGER TRAIN SERVICES DURING THIS TIME PERIOD. DUE TO THE DURATION OF WORKS – CARRIED OUT DURING ANNUAL SHUT DOWNS - THE RENEWALS PROGRAMME WILL NEED TO COMMENCE WITHIN TWO YEARS AVOID THIS OUTCOME.

Part A – Background

1 Track Infrastructure Overview

The following figure shows typical WMRN rail corridor infrastructure, highlighting the core elements.

Figure 7 - A Typical Cross Section of Track Infrastructure in the WMRN



For the purpose of this Business Case the relevant track infrastructure is split into the following asset classes:

- Track;
- Tunnel track;
- Civil engineering “Civils”;
- Bridges; and
- Slopes.

Track includes rail, fastenings, sleepers, turnouts, switches, level crossings and ballast (including on ballast deck bridges).

Tunnel track includes rail, fastenings, sleepers, concrete track slabs and ballast within tunnels. It is separated from general track in this Business Case for clarity and because of the additional challenge of working in tunnels.

Civils includes everything below ballast, including formation, lineside “cess” drains, culverts and other stormwater and drainage infrastructure.

Bridges include steel, timber and/or concrete structures used to traverse waterways and roads.

Slopes include cuttings, embankments and natural slopes above and below the railway.

Other infrastructure not discussed in this Business Case includes platforms, network control and monitoring, signalling, telecommunications and traction systems.

Figure 8 – New track-set being laid for Beach Road Level Crossing





2 Introduction to the Wellington Metro Railway Network

2.1 Overview of the Wellington Metro Railway Network (WMRN)

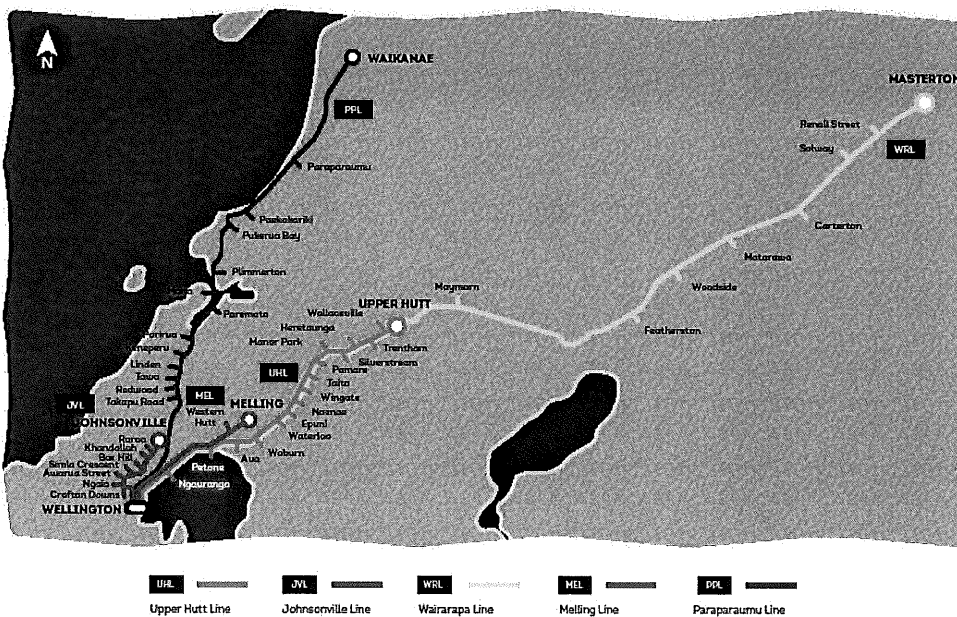
The WMRN's five lines or routes connect regional suburbs and towns and the main centres of Wellington City, Lower Hutt, Johnsonville, Upper Hutt, Waikanae and Masterton. Four of these lines are electrified, providing efficient environmental impact public transport. GWRC operates diesel hauled passenger trains on the Wairarapa Line between Wellington and Masterton.

The WMRN consists of approximately 160 route kilometres. This includes:

- 10km Johnsonville Line
- 56km Kapiti Line (part of the North Island Main Trunk Line)
- 3km Melling Line (from Petone to Melling)
- 30km Hutt Valley Line (from Wellington to Upper Hutt)
- 60km Wairarapa (from Upper Hutt to Masterton)
- All passenger train-storage yards and the train maintenance depot

The Wellington network also caters for KiwiRail's Tranz Scenic services (long-distance passenger services) and freight services. These services rely on the shared infrastructure.

Figure 9 - Wellington Metro Rail Network



2.2 WMRN Patronage Growth

Following a post “2008 Global Financial Crisis” slump, from 2010 to 2017 Wellington rail patronage has grown from approximately 11 million to over 13 million trips per year, an average of 2.5% per annum. This is a consequence of:

- the introduction of the new Matangi electric trains
- a steady improvement in infrastructure performance due to the payoff from previous investment programmes
- increased focus on performance driven by the new operating model
- general population and economic growth
- increased road congestion due to construction works and increased road traffic

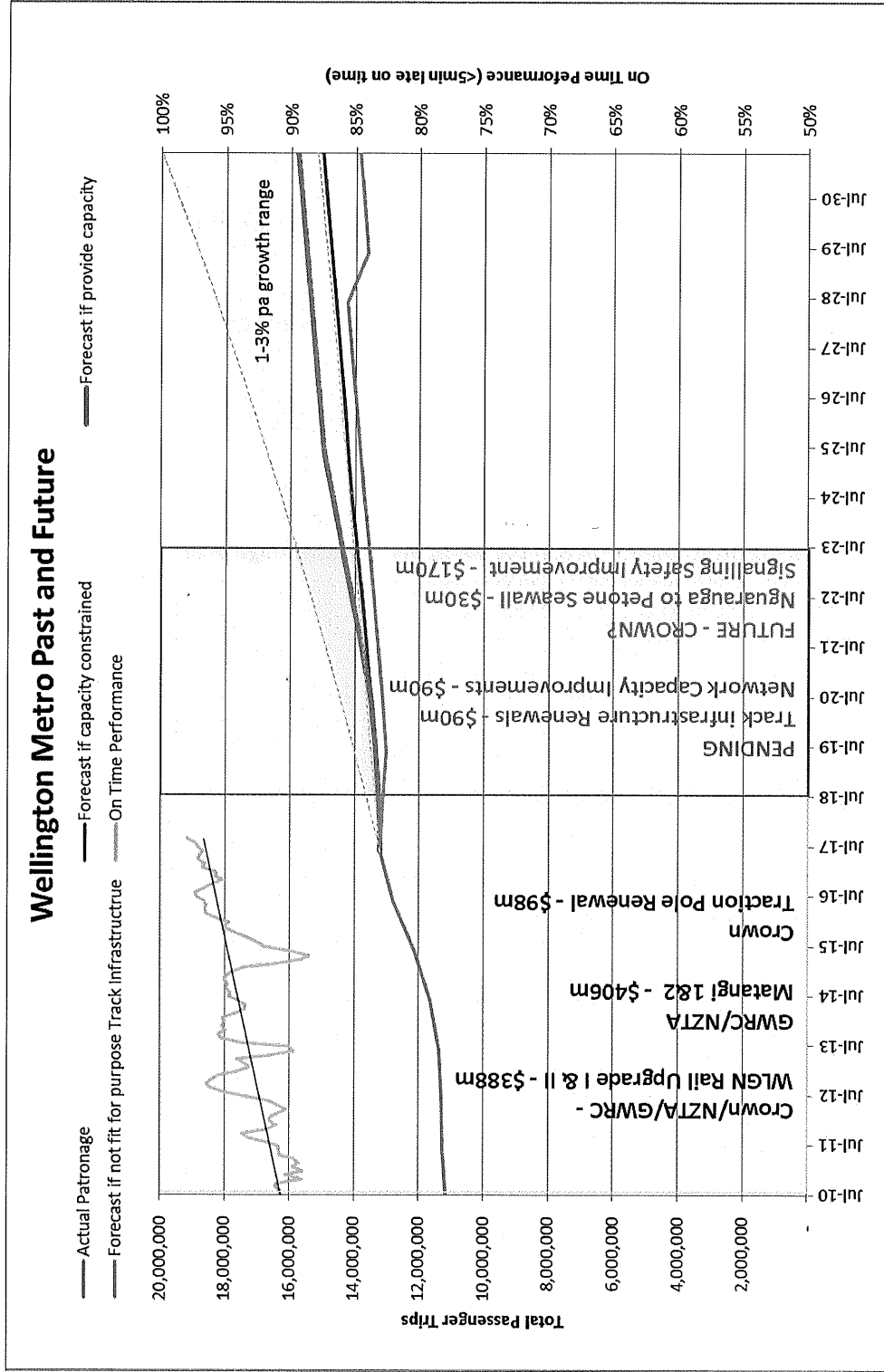
In the last three years:

- overall growth in passenger numbers has been 4.5% per annum
- average peak-time patronage has grown 13%.

This growth has been fueled by confidence in the performance and reliability of the service, unachievable without recent Crown investments. Refer to Figure 10 .

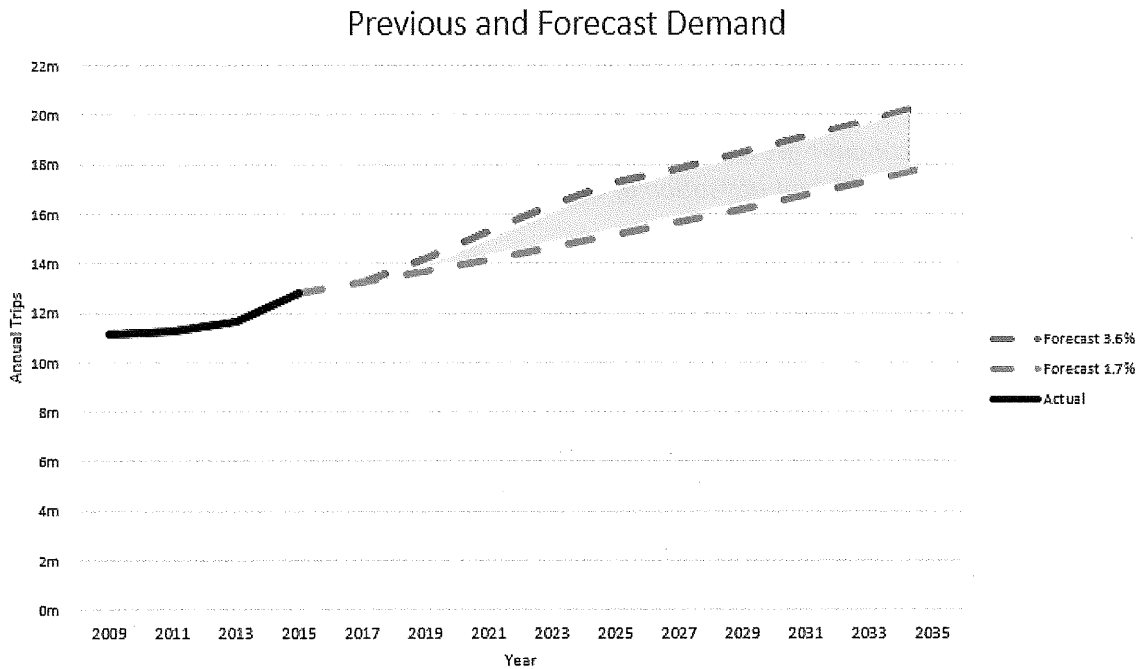


Figure 10 – Trend in Patronage Against the Timing of Recent Major Investments. Bands of Future Potential growth are also shown



Assuming continued investment in rail infrastructure, passenger growth is forecast to continue into the future at a rate of between 1.7% and 3.6% per annum (refer to Figure 11). This excludes increases that would result from improving levels of service, such as increases in capacity, more frequent services and improvements in punctuality.

Figure 11 – Previous and Forecast Demand



This performance is a reflection the important role that passenger rail plays in Wellington. This role is particularly crucial in in peak times, or times of disruption, when the rail network provides capacity that supplements the congested road network.

2.3 Roles and Responsibilities for the WMRN

2.3.1 Parties involved in operation of Wellington Commuter Rail

Wellington metro railway services are provided by Metlink, GWRC’s umbrella Public Transport brand, under which commercial providers operate rail, bus and harbour ferry services. Metlink rail services are provided by GWRC’s partners, KiwiRail Networks and Transdev Wellington Ltd.

2.3.2 The Metropolitan Rail Operating Model

The WMRN is administered by a group of organisations mandated by the Crown to undertake defined roles.

The 2009 Metropolitan Rail Operating Model (MROM) is the framework for the parties responsible for delivering a passenger railway in the Wellington Metropolitan Area.

When setting up the MROM, the Cabinet Economic Growth and Infrastructure Committee agreed that the key public policy transport objectives for the metro rail transport system should be to⁷:

- *Increase economic growth and productivity by reducing congestion on urban roads and by more efficient utilisation of the transport network;*
- *Provide transport choice for users;*
- *Integrate rail with other modes of transport; and*
- *Reduce the environmental impact of the transport system.*

Underpinning the MROM is improved definition of the roles of the parties, the introduction of contestability, the use of performance based contracts and improved transparency⁸. It should be noted that the MROM is applied in both Auckland and Wellington.

Appendix A – MROM Structure and Roles sets out the operating model structure and the roles and responsibilities the parties play⁹.

2.3.3 Wellington Metro Rail Package

After establishment of the MROM framework, in 2011 the Crown and GWRC negotiated the details of the Wellington Metro Package.

This Package saw GWRC taking ownership of and liability for passenger rolling stock and significantly lifting their funding contribution.

The Crown accepted the need to undertake catch-up renewals and upgrades on the rail network.

Before agreeing to the MROM in 2011, Greater Wellington consulted with the public as part of its Proposed Annual Plan 2011-12, on the basis that *“an important part of the deal involves continued network upgrades by the Government. Significant work would be programmed in, with secured funding.”*

⁷ Adapted from the following MoT webpage: <http://www.transport.govt.nz/rail/metro-rail/>

⁸ Cabinet Economic Growth and Infrastructure Committee on the Metropolitan Rail Operating Model <http://www.transport.govt.nz/assets/Import/Documents/Metro-rail-Oct-09.pdf>

⁹ Adapted from various sources including: <http://www.transport.govt.nz/assets/Import/Documents/Metro-rail-Oct-09.pdf>

The MROM and Wellington Metro Package were enabled through the Wellington Network Agreement (WNA). The WNA sets out funding and maintenance obligations between the Crown (and KiwiRail) and GWRC.

DURING THE NEGOTIATIONS FOR THE CURRENT METROPOLITAN RAILWAY OPERATING MODEL FRAMEWORK, IT WAS AGREED THAT THE GOVERNMENT WOULD FUND REQUIRED CATCH UP MAINTENANCE. THIS BUSINESS CASE LOOKS AT THE NEED FOR FUTURE CATCH UP MAINTENANCE.

2.3.4 Wellington Network Agreement (WNA)

The WNA between GWRC and KiwiRail sets out:

- The required levels of service;
- KiwiRail inspection, maintenance and renewal activities necessary to deliver the service; and
- Required/ agreed funding contributions for these infrastructure services.

As part of the WNA services, KiwiRail provides codified inspection systems for managing the infrastructure assets. These are intended to ensure that the target levels of service are met and the railway is safe for passenger and freight transport.

Additionally, the information acquired from asset assessments is used to determine the maintenance and renewals required for the network. Asset trends and forecasts also form part of this work.

The WNA requires an asset management plan looking at least ten years forward be produced. This is known as the Network Management Plan (NMP). It is the work to produce and maintain an NMP that has delivered the improved asset knowledge that is driving this business case.

Metro Rail Maintenance Types and Funding

3 Wellington Rail Infrastructure Funding

3.1 Overview

The Wellington Network Agreement groups funding types for the rail infrastructure into the following broad categories:

- **Maintenance** – day to day work to undertake fault repairs, preventative maintenance and inspections. This work is funded through the WNA contributions from GWRC and KiwiRail Freight.
- **Renewals** – Like-for-like replacement of rail infrastructure components when they reach the end of life. Funded through the WNA contributions from GWRC and KiwiRail Freight. Also sometimes known as “Sustaining Capital”;
- **Upgrades** – projects or programmes of work where extra capability is added to the railway network (for example double-tracking, signaling improvements, safety enhancements, etc.). This is not currently allowed for within the WNA contributions; and
- **Deferred or Catch-Up Renewals** – Infrastructure renewals which have been deferred due to underinvestment under previous funding models and large ‘bow waves’ of renewals when an entire asset group reaches the end of its useful life. ***This business case relates to this category of work.***

3.2 Maintenance & Renewals

Maintenance and renewals works are undertaken to keep the WMRN operating at a steady state.

The level of contribution is apportioned between KiwiRail and GWRC on the level of use, as prescribed in the WNA.

These user charges are known as the Track Access Charge (TAC).

For the 2017 financial year, the apportionment overall was approximately 20% KiwiRail and 80% GWRC. The TAC is an operating cost to GWRC despite contributing towards capex as the rail network is not GWRC’s asset.

Table 3 details the gross rail infrastructure budgets and apportionment between GWRC and KiwiRail Freight for financial years 2014 to 2018. Over five years this contribution will total over \$113m.

Table 3 - Steady State Budget Figures for the Last 5 Years

S9(2)(b)(i)

		GWRC Contribution	KiwiRail Freight Contribution	Total
FY14	Opex			\$11.3m
	Capex			\$9.5m
				\$20.8m
FY15	Opex			\$10.8m
	Capex			\$9.4m
				\$20.2m
FY16	Opex			\$11.4m
	Capex			\$11.4m
	Special*			\$2.3m
				\$25.1m
FY17	Opex			\$11.4m
	Capex			\$11.3m
				\$22.7m
FY18**	Opex			\$12.3m
	Capex			\$12.4m
				\$24.7m

Notes

- Opex does not include KiwiRail Freight's Wellington contribution to operating overheads as this is not easily separable, but would equate to \$1 – 2 million extra per year
- Depreciation is not included as part of the Track Access Charges that GWRC and KiwiRail freight contribute to for maintenance and steady state renewal.
- *This item was a one-off extra contribution to help maintain rail infrastructure levels of service for Wairarapa Line passenger trains.
- ** Budget for FY18

S9(2)(b)(i)

Overall, GWRC spends about \$95m per annum on the provision of rail services for Wellington. This includes the TAC, service operations, train maintenance and station expenditure.

GWRC's funding for the rail system comes from a combination of fares, rates and grants/subsidies. GWRC does not earn a net income from its role in rail.



The proposed budget for FY19 and beyond is a further 25% increase in Capex funding and a 10% increase in Opex from FY18's budget. This is to attempt to better meet the level of service required in the WNA and ensure it can be met in the future.

GWRC contributes a significant amount annually towards the WMRN infrastructure asset and to the operation of metro rail services. GW has advised they may be able to stretch its normal funding sources to cover this 25% increase, but no more.

GW has advised that it is unlikely to be able to fund the "bow wave" of work identified in this business case under the current funding model. This is addressed in the Financial Case.

3.3 Upgrades or Betterment

Upgrade works increase the capability or capacity of the rail network.

In recognition of the need to provide a reliable transport system with sufficient capacity to support the Wellington and national economies, the Crown has previously invested in upgrades of the WMRN¹⁰.

The most recent upgrade (the Wellington Regional Rail Project (WRRP) ran from 2008-2011. This prepared the network for the new Matangi trains, removed key choke points and extended network reach (to Waikanae). This WRRP project is described in Section 8.1.

It should be noted that upgrades often require the condition of the existing infrastructure to meet a certain level for the new post-upgrade operations to be successful. During WRRP, some renewals were brought forward to ensure that the surrounding infrastructure would support the new infrastructure.

3.4 Deferred or Catch-Up Renewals (Crown Funding)

At the commencement of the MROM, there was acceptance there had been several decades of under-funding in the WMRN under previous railway operating models. This results in a significant amount of deferred capital expenditure, manifested as delayed renewals.

It was agreed that the Crown would fund these "Catch-Up" renewals. The objective of this Catch Up investment was to bring the railway up to "a functional, safe and reliable standard" that could be maintained on a steady state basis within the constraints of the MROM.

Subsequently, the NMP process has helped quantify the issue of long-life assets dating from the 1950's – 1980's reaching the end of their life. Not deferred maintenance as such, but many decades of "depreciation" coming due over a relatively short period to create a "bow wave" of renewal spending before another long "investment holiday".

Finally, the limited ability of the post 2011 MROM to fund this slowly rising renewals demand has seen the leading edge of this 'bow wave' start adding to the deferred

¹⁰ Refer to the GWRC Business Case to Land Transport New Zealand 'Request for Funding of Double Tracking and Electrification from McKay's Crossing to Waikanae', 11 June 2007.

maintenance workbank. I.e. there are now outstanding renewals which should have been completed within the last five years (and are beginning to impact performance).

Collectively these items create a multi-year 'bow-wave' in the funding required to continue safe and reliable passenger operations. The funding required to address these catch ups is beyond the level affordable through MROM user charges, hence the specific Catch-Up categorisation.

3.5 GWRC Investment in the Wellington Metro Railway Network

Additional to the investment outlined above, there has been significant recent or planned investment in other areas such as:

- GWRC purchase and commissioning of 83 new two car EMUs (\$405m);
- Ongoing investment by GWRC into station building and shelter replacements and upgrades, pedestrian over-bridges and subway upgrades (>\$3.5m annually);
- Improved security systems with 24/7 CCTV monitoring of all stations, additional customer help points and other WMRN rail systems (i.e. real-time train information) to improve customer service, amenity and positive perception of passenger rail (>\$5m)
- Park & Ride expansions, which are increasingly in demand as car users living remote from stations choose the train service;
- Improved service for the Wairarapa Line – 18 new SW carriages, a longer 4.25pm train to meet demand and deployment of modified cars onto this route;
- Better integration of train and bus timetables to make Wellington's Metlink public transport network easier to use.

Service Level Depends On Asset Condition

4 WMRN Track Condition and Performance

4.1 Condition drives Asset Performance

Service performance is directly related to track infrastructure condition.

Track infrastructure condition begins to degrade service performance when:

- The sleeper condition, including fastenings, deteriorates the point where the section of track cannot be maintained to hold gauge¹¹ and other geometry requirements;
- Rail wears beyond acceptable limits;
- The ballast profile deteriorates and/ or becomes contaminated and cannot effectively support the track to meet geometry requirements;
- All three above contribute to reduced track “stability” in hot weather, requiring speed restrictions of 40 km/h when rail temperatures exceed 40 degrees, common on hot days October – Easter.
- Formation and embankments deteriorate and cannot effectively support the ballast and track to meet geometry requirements;
- Lineside “cess” drains, culverts and other stormwater and drainage infrastructure lack capacity, become blocked or are ineffective, saturating and contaminating and weakening the formation and ballast.

There are a number of deficiencies prevalent in the existing WMRN track infrastructure including over aged Treated Pinus Radiata (TPR) sleepers, Prematurely Decayed Sleepers (PDS), timber bridge elements, insufficient formation and poor drainage.

Section 5 below summarises the characteristics and condition status of each WMRN route. Appendix C provides more detail.

4.2 TSR's and Asset Management

As track assets approach life expiry, deterioration in condition accelerates. This requires increased planned and then reactive maintenance interventions and the application Temporary Speed Restrictions to maintain safe operations over deteriorated track.

TSR's are imposed to maintain safety when travelling over track sections that have defects requiring maintenance or renewal. They ensure a train moves slowly over a length of rough, weak or twisted track, reducing forces that worsen damage and motions that risk

¹¹ The distance between rails – very important because if this gets wider than the fixed distance between the wheels on a rail vehicle, a derailment results.

derailment. The reduced speed to be applied for various magnitude of defect is mandated in KiwiRail codes.

TSR's are a practical management to allow a route – or sections of a route - that are well through their life cycle to remain in service pending repair or renewal.

The preferred approach as life expiry approaches is for asset renewal, timed at the optimum value point. This is early for routes requiring very high level of service, later in the cycle for those in which lower service levels are tolerable.

5 Line by Line Assessment

5.1 *The Wairarapa Line*

The 58.8km non-electrified single track “Wairarapa Line”¹² runs between Upper Hutt and Masterton. Annual traffic from last financial year was over 110 million Gross Tonne Kilometers (GTK), with 63 million GTK or 56% contributed by metro passenger services.

Significant features include two major tunnels, four large bridges and long sections of straight track.

General overall condition of the line is poor and is deteriorating. It is the worst condition route on the network. There are significant numbers of decayed sleepers, with poor fastenings, and over 5km of rail at or close to wear limits. Need for renewal primarily reflects the track and formation time in service.

The line typically has 10 – 12 minutes of speed restrictions¹³ in place to mitigate poor track infrastructure condition. The route KPI for Temporary Speed Restrictions (TSR's) is 6 minutes. Track condition continues to deteriorate and performance on this line will drop further as additional long speed restrictions have to be applied to mitigate condition.

The line has had little major renewal activity since it was face-renewed with Treated Pinus Radiata (TPR) sleepers over a relatively short period between the 1960's and early 1980's. Deferred maintenance, driven by MROM funding limitations, has further served to build this “bow wave” of work. This concentration of similar aged assets falling due over a limited period is behind the scale of renewal required.

The most significant single issue is the poor condition of the original 1950's track in the 8.8km long Rimutaka Tunnel. Since 2016 track in this tunnel has been subject to a 60km/h TSR, down from original line speed of 80km/h.

Installed in 1955, and largely original, this asset is due for major renewal. The long tunnel environment allows limited opportunity for life extension and lead times are significant. If

¹² The official KiwiRail definition of the “Wairarapa Line” (WL) runs from Kaiwharawhara to Woodville via Masterton. In the context of the WMRN, the WL is the portion dedicated to Masterton passenger trains.

¹³ Additional journey time compared with the timetabled journey time from Wellington to Masterton (or reverse) due to reduced-speed sections of track.



face (bulk) renewal is deferred, it will be relatively easy to reach a condition/lead time situation where recovery requires a prolonged closure (six months or more).

Overall, the main deficiencies of the line relate to:

- Approximately 30km of end of life TPR sleepers;
- Poor ballast and formation throughout, in places exacerbated by poor drainage;
- End of life and poor condition track in Tunnel 1 and (major) Tunnel 2;
- 3 bridges with end of life timber elements; and
- 1 high risk slope¹⁴.

The level of work required to address these significant renewal issues over the next 10 years is over and above normal maintenance and steady state renewal levels, and as such cannot be accommodated within current steady state funding envelopes.

Rectification of all of the deficiencies listed above is included in the catch up programme.

5.2 Kapiti Line

The 55.6km mostly double track (109.3 STK¹⁵) "Kapiti Line", forms part of the North Island Main Trunk (NIMT) Line. Metro services and electrification finish at Waikanae.

Annual traffic is over 500 million GTK with 270 million, GTK or 45% being metro traffic.

It is the only line in the WMRN that carries significant freight traffic, with 230 million GTK of freight and long-distance passenger traffic in FY 2017.

Much of the line is located against or into hillsides with tight curves and steep and unstable slopes. It includes a particularly challenging single-track section between Pukerua Bay and Paekakariki with exposure to the coastal environment and seven tunnels. These factors have an influence on the overall condition and performance of the line.

The condition of the line is currently adequate for service requirements and performance targets. More consistent investment has gone into the Kapiti Line than the other WMRN lines and the general condition of the majority of components is better. The rate of component wear, however, is comparatively high due to the geometry, higher use and environmental factors.

The main deficiencies of the line relate to:

- Sections of TPR sleepers and contaminated ballast including in Wellington junction and Wellington platforms track¹⁶ ;

¹⁴ Risk rating over 200, this is explained later in Appendix C

¹⁵ Single track kilometres. One km of double track is equivalent to two STK.

¹⁶ The Kapiti Line/NIMT starts in Wellington Station and the Wellington Station track is considered to be part of this line. The Hutt/WL officially commence where they branch off the NIMT at Kaiwharawhara.

- End of life and poor condition track in Tunnels 1, 2 and 7;
- Prematurely Decayed Sleepers (PDS) through the single track North – South junction section;
- 9 bridges coming due for significant capital maintenance work;
- 1 bridge with end of life timber elements; and
- 13 high risk slopes.

Proposed catch up works include TPR and PDS renewals in key areas as well renewal of the timber bridge and slope remediation. All other work forms part normal maintenance and steady state renewals.

5.3 Hutt Valley Line

The 32.4km mostly double tracked (57.9 STK) Hutt Valley Line, forms the first section of the line onwards to Masterton. The total traffic on the Hutt Valley Line is approximately 190 million GTK per year, with nearly 85% being passenger services.

It includes three large bridges over the Hutt River, a challenging 5km coastal section along the Wellington Harbour and a 3.5km section of single track between Trentham and Upper Hutt. It is relatively flat and less curved than the other electric lines. The Melling Line branch diverges just north of Petone station.

The Hutt Valley Line condition is adequate for the current service requirements and performance targets. Investment and management of the line is adequate in the short-term. However, the line has a high percentage of old sleepers, rail and turnouts, with some of these assets located in speed sensitive areas.

The main deficiencies of the line relate to:

- Sections of speed sensitive track containing life expired sleepers and rail;
- Sections of poor formation and ballast, evident by mud spots; and
- The major (Ngauranga) seawall along the Wellington Harbour between Kaiwharawhara and Petone which has low resilience to storms and wave action.
- An over-bridge clearance issue at Ava requiring 1.4km of track lowering and realignment with associated formation and drainage works.

Steady state maintenance and renewals will address most of these issues in the coming five to ten years except for the Ava clearance and Ngauranga seawall issues.

It is being assumed that the Ngauranga seawall will be addressed as a part of the NZTA Ngauranga – Petone public pathway project, a project well in excess of \$50 million. However this project has reached a scale well in excess of original pathway assumptions and it may be necessary for railway investment to be added into the funding mix. This is outlined in Appendix D.



5.4 Melling Line

The 3km Melling line is a short single-track branch line, a shortened remnant of the former Upper Hutt mainline, and runs parallel to State Highway 2. It is a passenger only line, with 5.1 million GTK in FY 2017.

The general overall condition of the line is poor, though it still meets current requirements for service, which are undemanding.

The entire length of track has old TPR sleepers, 80% are older than 40 years with equally old rail and fastenings. The ballast is also poor and contaminated across the whole line. In early 2017 the speed was reduced to 40kph for full length of the line, due to multiple locations of out of code rail.

The main deficiencies of the line relate to:

- Worn rail sitting on life expired sleepers and poor ballast.

There are currently no works that are considered outside of maintenance and steady state renewals on this line.

5.5 Johnsonville Line

The single track, with three crossing loops, 10.5km Johnsonville line is a challenging and high maintenance route due to its very steep grades, near continuous sharp curvature and the steep and unstable slopes it traverses.

It is a passenger-only line with 36.4 million GTK last financial year.

The condition of the line is adequate for the current service requirements and performance targets. A significant portion of the line has been renewed in the previous 10 years, and received significant work during WRRP.

The main deficiencies of the line relate to:

- 945m of PDS sleepers in Tunnels 1 to 7;
- Areas of poor formation and drainage; and
- 4 high risk slopes.

Proposed catch up renewals will address the PDS sleepers in the tunnels and high-risk slopes. All other work will be done as part of steady state maintenance and renewals.

5.6 Summary

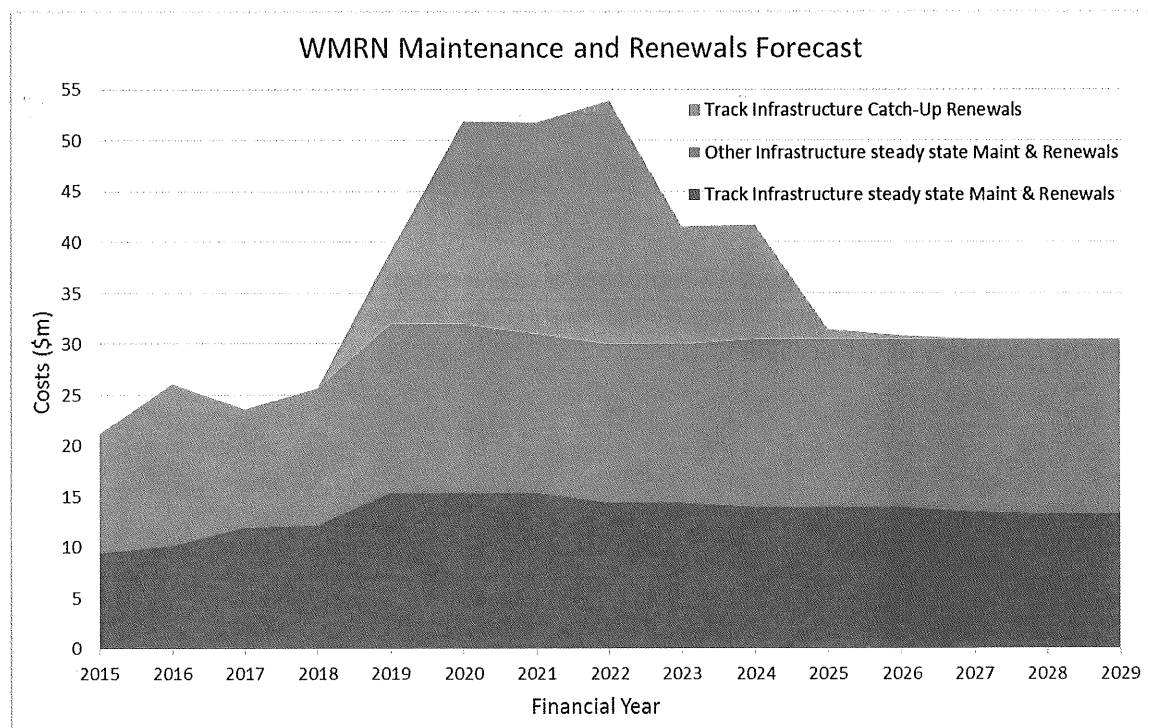
Large quantities of track infrastructure assets are at or near the end of their lives due to both the timing of when they were installed (i.e. large sections of track commissioned at the same time) plus historically (pre 2000) low levels of investment in the WMRN Network related to previous railway funding models.

Due to the limitations of the current funding model and the point the life cycle of the Wellington track asset has reached, deferred or due renewals are building to a point that Temporary Speed Restrictions (TSR's) will increase and on-time performance overall will suffer.

This has resulted in a situation where there is a large 'bow wave' of renewals for certain long life assets that need to be delivered in a short timeframe. This is frequently referred to as catch-up renewals. The cost of this large spike in renewals is outside the normal funding mechanisms provided through the MROM.

Figure 12 depicts the 'bow wave' of track infrastructure catch-up renewals (covered in this Business Case) that are over and above the steady state maintenance and renewals funded through user charges.

Figure 12 – Wellington Metro Railway Network Funding Forecast



The green "Catch Up" area of Figure 12 is built up from the following specific workbank in Table 4.



Table 4 - Workbank: Catch up renewals

S9(2)(b)(i)

Scope	Lines	Cost	Estd. comp
35km of track renewals (including replacing 58,000 sleepers, 25km rail and 12 Level crossings)	85% Wairarapa Line plus key sections of the Kapiti and Hutt Valley	\$49.9m	FY24
Formation and drainage upgrades up to 50km	85% Wairarapa Line plus Kapiti and Hutt Valley	Included above	FY24
Renewal of track in 5 tunnels (14km)	Wairarapa and Kapiti Line	\$31m	FY24
Sleeper renewals in 11 tunnels (1.84km)	Johnsonville and Kapiti Lines	\$2.3m	FY21
Renewal of 4 bridges with timber elements	3 on Wairarapa and 1 on Kapiti Line	\$5.2m	FY22
Slope stabilisation works on 18 high risk slopes (rating 200+)	Mostly Kapiti and Johnsonville Lines	\$7.4	FY26
Total		\$95.8m	FY26

Note that the blue areas in Figure 12 represent an assumption of “affordable” under current MROM funding arrangements. These are currently under review and a change to this could alter the boundary of “affordable”.

6 Infrastructure Condition Impact on Level of Service

6.1 Elements driving performance

Customer Service Quality – reliability and punctuality - is affected by operator, rolling stock and infrastructure performance, plus natural events and vandalism.

Infrastructure contribution to performance consists of two elements;

- First the designed in or specified performance, the allowable running speeds and capacity of the physical infrastructure.
- Second there is the reliability or condition of that infrastructure. Faster running routes can be degraded by condition deteriorating and speed restrictions having to be applied. Unlike other faults, TSR's affect every service to some degree, and other faults can compound the delays experienced.

This second issue is the developing challenge for the WMRN.

Track infrastructure issues, particularly ones that manifest as speed restrictions, can have a detrimental effect on the level of service provided. This results in poor customer experiences as a consequence of increasing journey time.

6.2 TSR's as a Performance Measure

A good measure of track infrastructure condition and how it affects service performance is the level of temporary speed restrictions (TSR's).

While they are applied over a length of track, TSR's are performance measured in minutes. This represents the additional journey time of a train compared to the same train using the same route if it had no TSR's imposed¹⁷.

Individual speed restrictions on a line are added up to give a total. As they are imposed as a response to unsatisfactory track condition and delay a train passing over them, this total is good measure of the condition of and utility of a route.

For this reason, TSR minutes are one of key KPIs in the Wellington Network Agreement.

6.3 TSR Status and Forecast in WMRN

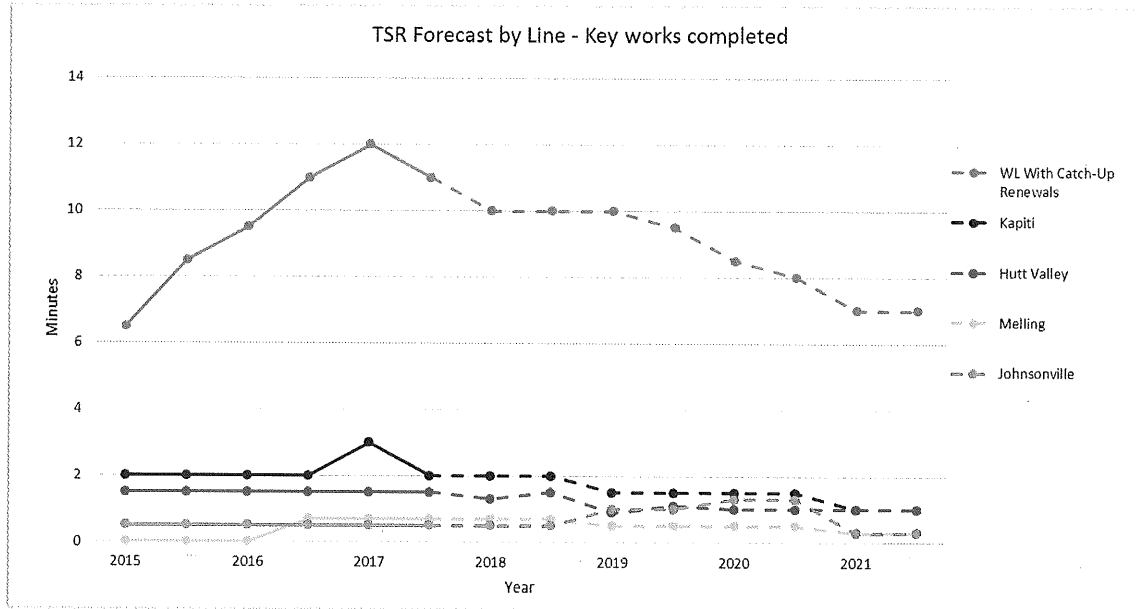
Figure 13 below shows the average TSR's¹⁸ for each line in the WMRN over the last three years and the forecast to 2022 (assuming this business case is approved). As an outcome of

¹⁷ Calculated by a performance programme which simulates the braking, slow running and acceleration times of a train over a TSR and then compares this to the time taken by an unchecked train over the same piece of track without the reduced speed.

¹⁸ Lines typically have a few weeks per year where they have higher TSR's than targeted limits – allowed for in WNA KPI limits - but the average is representative of the overall effect on train services and therefore impact felt by passengers.

focusing available WMRN funding on TSR mitigation, be this short term in some cases, all lines currently have TSR's under their respective KPI targets, aside from the Wairarapa Line north of Upper Hutt.

Figure 13 - Temporary Speed Restrictions for all Lines on the WMRN



6.4 The Wairarapa Line is most affected

Figure 13 shows the Wairarapa Line is currently by far the worst performing line in terms of speed restrictions, with 20 kilometers, or a third of the line, currently under a speed restriction.

This equates to over **11 minutes** of temporary speed restrictions due to poor condition track infrastructure.

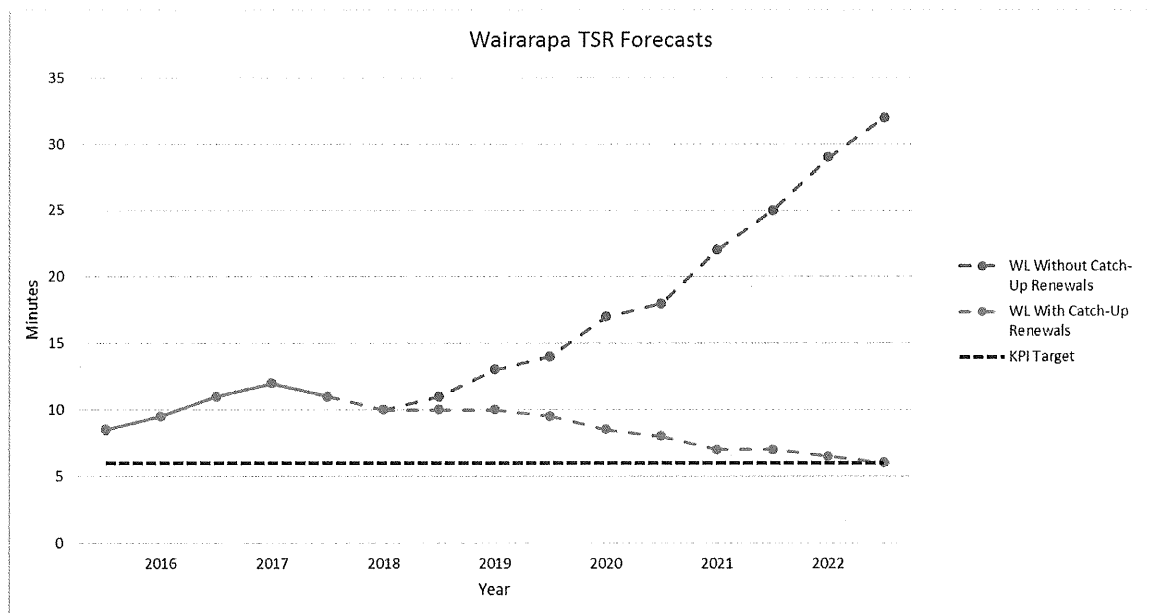
Additionally, there are 1.5 minutes of temporary speed restrictions on the Hutt Valley Line which also affect the Wairarapa services.

This is well above the six-minute KPI target, as:

1. available funding has been and is being focused onto the more intensively used electrified lines
2. short term interventions are less able to hold the situation on this line, which is more affected by the growing asset renewal 'bow wave'.

Wairarapa TSR's are forecast to **increase to 13 minutes by 2019 if an accelerated works programme to rapidly improve the condition of the line is not implemented**. Past 2020, TSR's on the Wairarapa Line increase more rapidly. This is represented in Figure 14.

Figure 14- Temporary Speed Restrictions on the Wairarapa Line With and Without Catch-Up Renewals



A key issue for this route is poor track condition in the 8.8km long Rimutaka tunnel which currently has a 60 km/h TSR. This TSR is predicted to reduce to 40 km/h by 2019. This alone will add a further 2.3 minutes of TSR's if the proposed tunnel track renewal is not completed.

There is a significant risk of complete closure if this tunnel track is not renewed within 5 years, due to the impracticality of partial maintenance interventions in this long tunnel. There are no realistic options for mitigation aside from complete renewal.

Figure 15 - Deteriorated Treated Pinus Radiata (TPR) sleepers. These are endemic on the Wairarapa Line, with the sleepers replaced during significant volumes of renewals nearly 40 years ago now having run through their life cycle



Figure 16 – A mudspot – failed formation under track - leading to loss of track geometry and the need for repeated intervention (continual repairs) in the absence of proper renewal.

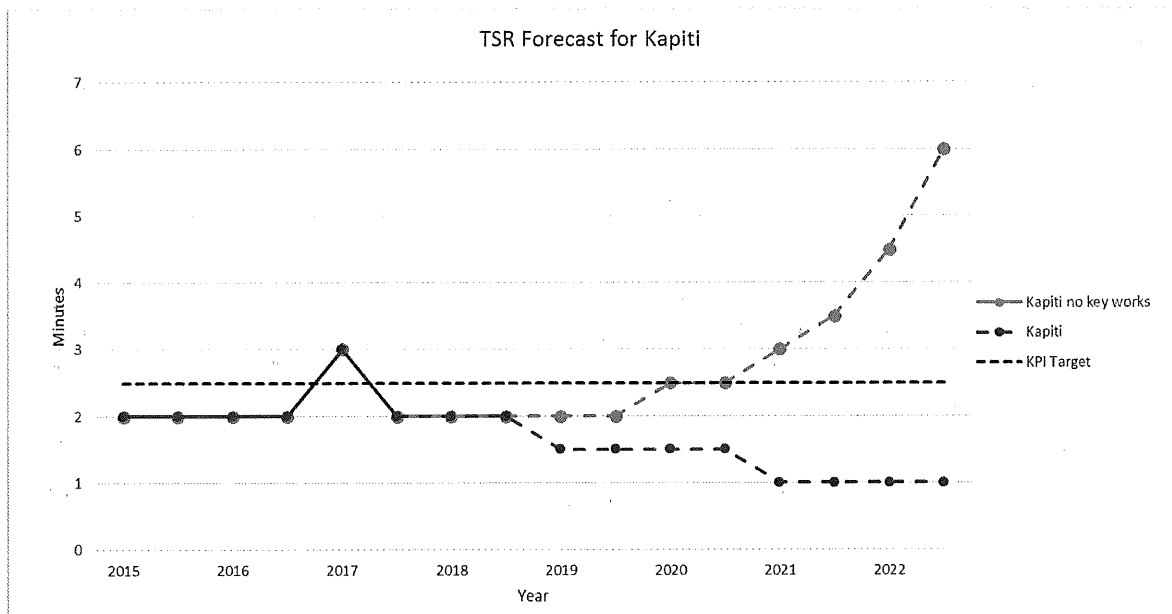


6.5 Other lines

The Kapiti Line will be significantly affected if the proposed works, particularly tunnel track renewals, do not proceed, as shown in Figure 17.

The Hutt Valley and Johnsonville Lines will also be affected and could exceed their KPI targets in the coming years if the proposed track infrastructure catch-up renewals are not delivered in time.

Figure 17 - Temporary Speed Restrictions on the Kapiti Line with and without Catch-Up Renewals

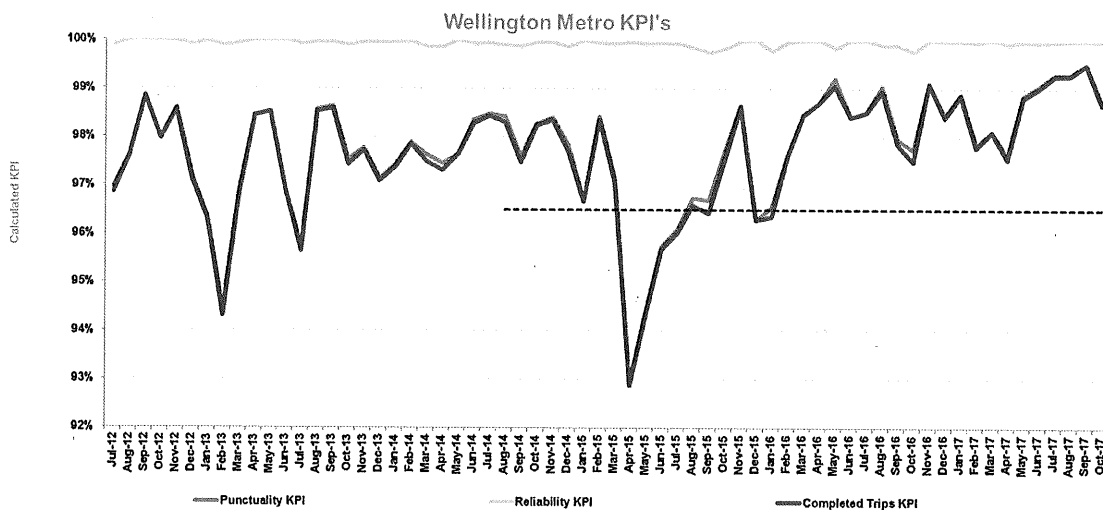


6.6 Level of Service Analysis

While patronage is consistently growing, overall the WMRN is not currently greatly affected by infrastructure delays. Performance is generally good and improving, as the packages of initiatives have taken effect. This is shown on Completed Trips graph¹⁹ Figure 18.

In addition, customer satisfaction now scores firmly in the 93% range, with Greater Wellington, Transdev Wellington and KiwiRail all committed to lifting this score to 96% in 1% annual steps.

Figure 18 – Wellington Metro Completed Trips - Five Years



However, this graph does not reflect the developing situation that forms the reason for this business case.

The KiwiRail response to encountering the leading edge of the renewals ‘bow wave’ described above has been to spread the available funding more thinly.

This means repair rather than renew and to maintain service levels. This was a deliberate focusing of resources but only to “buy time” while work was done to better understand the issue and explore funding options.

If prolonged, this approach serves to further build up the size of the approaching ‘bow wave’, with an unmanageable volume of unavoidable renewals eventually being required in a short timeframe.

¹⁹ WNA KPI3 “Completed Trips” reflects the number of services that ran as scheduled less those delayed more than 5 minutes or cancelled by infrastructure failure.

$$CT = (\#timetabled\ services - 2 \times \#cancelled\ services - \#late\ services) / \#timetabled\ services.$$

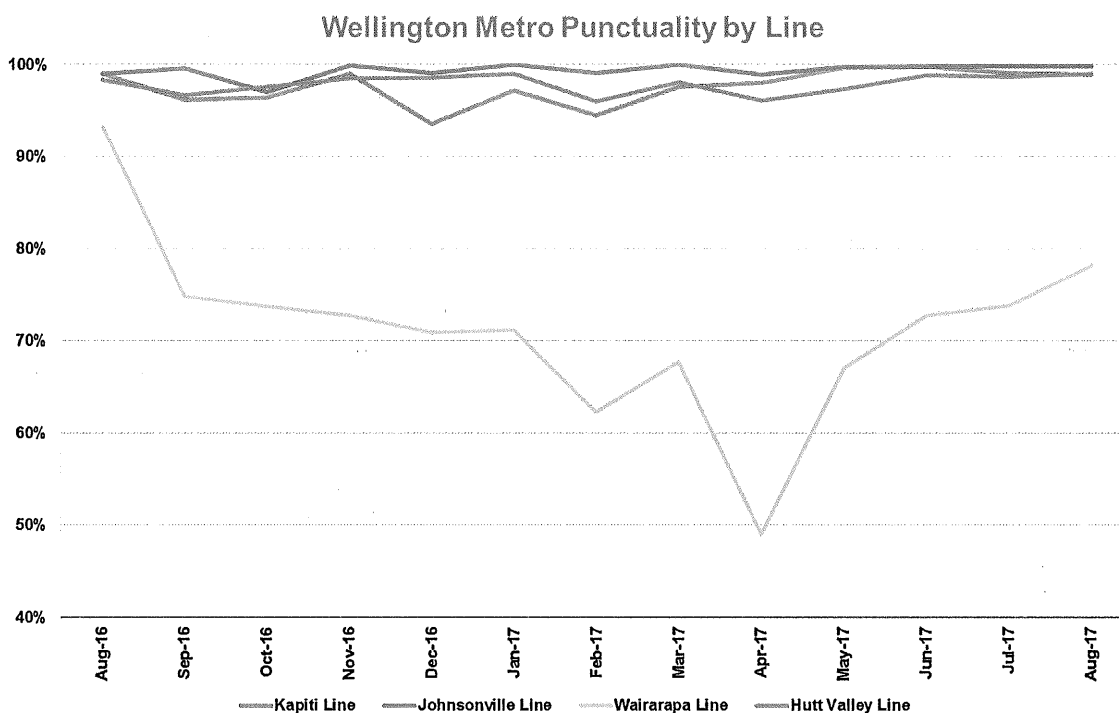
Achieve KPI is a band between 96.5% - 97.5%. The marked drop in performance mid 2015 was a result of TSR’s imposed following major works at Easter.

Closer analysis better illustrates the developing challenge which sits behind this, to date, successful holding position.

The Wairarapa Line (north of Upper Hutt) has the largest concentration of life expiring track infrastructure. In addition, available funding is being concentrated on the more heavily used electrified routes, where any delays affect significantly more customers.

The consequence of this is a noticeable and well publicised deterioration in the punctuality of the passenger services on this route relative to the other Line routes, as illustrated in Figure 19.

Figure 19 – Wellington Metro Punctuality Performance by Line



Note that significantly worse than average timekeeping performance on the Wairarapa line has little impact on overall Wellington metro statistics (refer Figure 20 and Figure 21). There are just under 2100 scheduled Wellington metro services per week and only 60 of these are Wairarapa services (2.9%). Performance on this route can be extremely poor and have little effect on the overall performance score.

However, most months, over 50% of all Wellington delays attributed to infrastructure arise from the relatively few Wairarapa trains being TSR delayed. The forecasts of future TSR's shown in Figure 14 point to the performance on this line worsening over the next five years.

The Wairarapa Line is a highly visible and early example of the performance problems which will affect most routes, to a greater or lesser extent, if renewals are continue to be deferred.

If the proposed track infrastructure catch-up renewals are not undertaken, the result will be a significant increase in speed restrictions throughout the network.

Delivery of the proposed track infrastructure Catch-Up renewals will hold, then reduce and minimise the impact of TSR's on the WMRN.



What do Wairarapa customers think about service levels?

Recent customer satisfaction surveys²⁰ clearly show that the Wairarapa Line is performing well below other WMRN lines.

Overall customer satisfaction of regional commuter train services on the Wairarapa Line was 71% compared to 77% to 79%²¹ for other lines.

Service reliability on the Wairarapa Line was rated at 65% compared to 74% to 78% for other lines.

Responses for likelihood of recommending this service to others was 74% compared to 79% to 82% on other lines.

The combined effect is to demonstrate the Wairarapa Line is performing well below other WMRN lines.

This clearly corresponds to the poor reliability and punctuality on the Wairarapa Line mentioned above.

6.7 A Kapiti Line Example of Insufficient Resilience

While the Wairarapa Line is the most immediately impacted, similar issues are latent on other routes, including the heavily used Kapiti Line.

In addition, natural events are excluded from delays attributed to the Access provider thus are not visible on network KPI performance graphs.

However, after November 2016 earthquake the Kapiti Line was subject to significant and prolonged (several months) of TSR's resulting from the failure of the drainage system in Tawa Tunnel Two resulting in flooding. Weak (soft) formation also allowed the track to twist as a result of the earthquake, exacerbated by the flooding.

Complete renewal of the track and drainage asset in this tunnel, scheduled in three stages 2011 – 2014, was deferred when the new MROM based budgeting model was unable to fund these works.

The most immediately pressing works were completed or patched 2011/12²² but renewal of the underlying formation and refurbishment of the original (1936 clay pipes) drainage system was one of those elements deferred indefinitely.

It is very unlikely that the planned new drainage system would have failed as a result of this earthquake.

This illustrates how the effect of a deferred renewal can be quickly moved from latent to impacting levels of service by events. Progressive deterioration is not the only route to reduced levels of service.

²⁰ 2016-17 Metlink Public Transport Passenger Satisfaction Survey

²¹ Slightly different measurement basis than the 93% quoted elsewhere, but relative comparison valid.

²² Down main track face relayed, Up Main cracked sections cut out and replaced.

Figure 20 - WMRN Overall Reliability and Punctuality²³

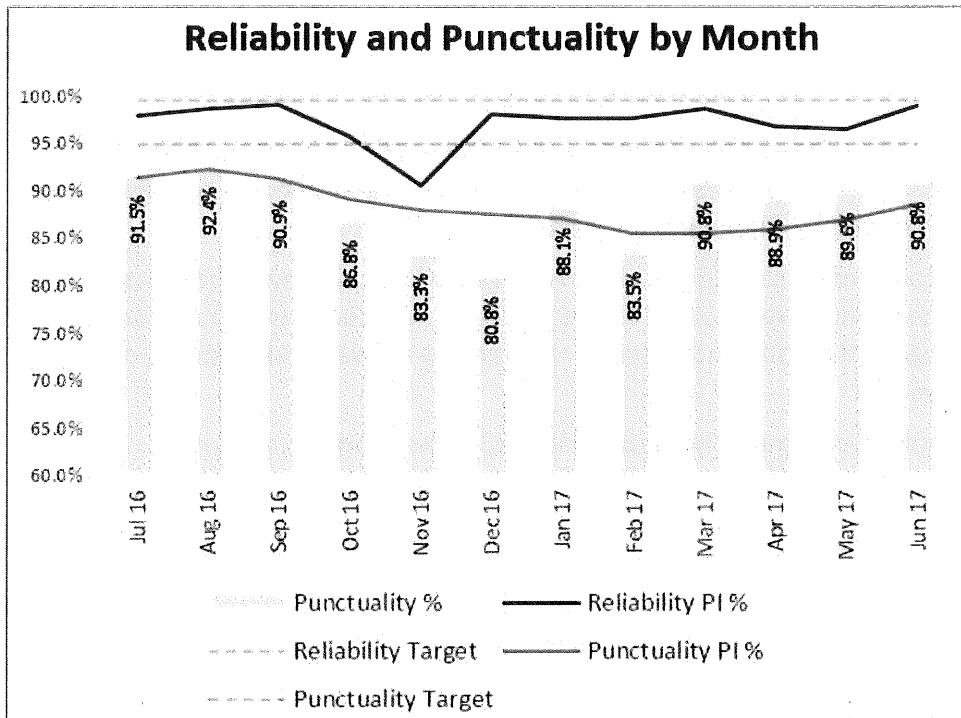
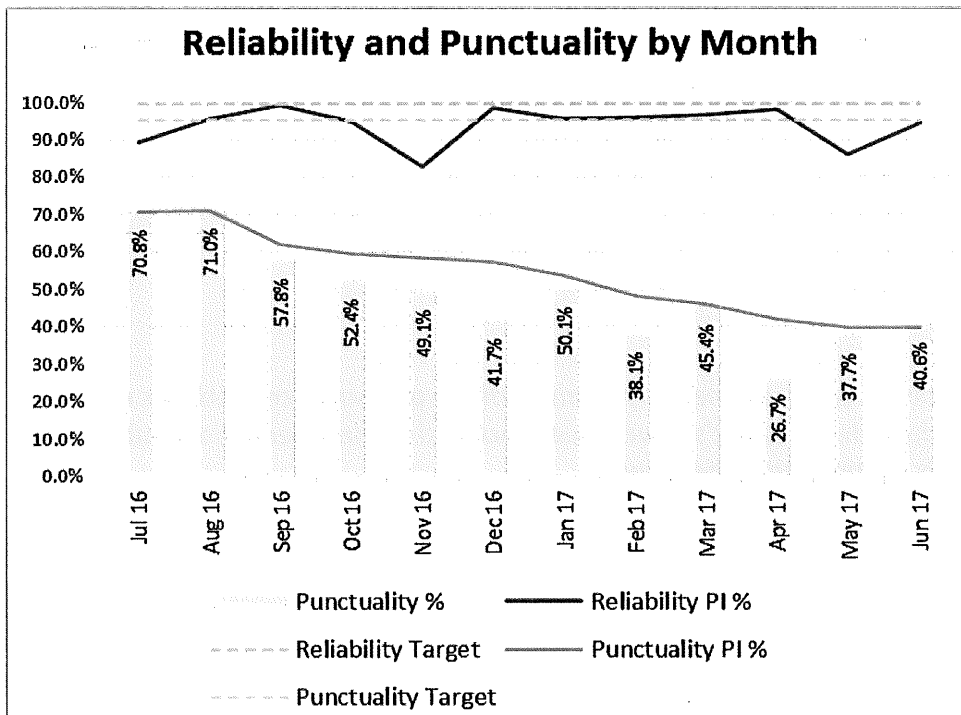


Figure 21 - Wairarapa Line Reliability and Punctuality



²³ Transdev Wellington Annual Performance Report FY 2017. All delay factors, not just infrastructure.

6.8 Impact when the Railway is Not Available

The importance of rail's contribution to the Wellington transport system is clearly demonstrated when it is unavailable. There are few transport alternatives and the other transport systems – effectively the State Highway system - quickly become congested and ineffective when passenger rail services are disrupted.

This was dramatically demonstrated when the Hutt Valley Line was severed by a storm event in 2013. During the event, severe sea conditions washed away sections of the seawall between Ngauranga and Petone and with it the underlying railway 'foundations', closing the railway for six days.

There was significant disruption to both the road and rail networks as a result.

A Ministry of Transport report²⁴ assessed the effects of the railway's closure:

- 27% of commuters did not make their journey on the first day of disruption (i.e. did not travel to work);
- People used private cars instead of trains, causing increased congestion and disruption on the road network;
- Congestion on the adjoining SH2 was significant with the morning peak **lasting two hours longer than usual** (weighted increase in travel time of between 14 minutes and 20 minutes for SH2 traffic);
- 80% of people from the Hutt Valley experienced a longer trip than usual;
- **32% of people experienced a delay of over an hour;** and
- The estimated economic impact of the event was between \$12m and \$43m for the 6-day period.

Note that resilience is further addressed in the following section.

6.9 Summary

The Wairarapa Line is a highly visible early example of the performance problems which will affect all routes, degrade customer's travel experience and erode recent strong patronage growth if renewals continue to be deferred.

If the proposed track infrastructure catch-up renewals are not undertaken, the result will be a significant increase in speed restrictions throughout the network.

²⁴ The Transport impacts of the 20 June 2013 Storm, Ministry of Transport, November 2013. Available from: <http://www.transport.govt.nz/assets/Uploads/News/Documents/Transport-impacts-in-Wellington-storm-June-2013.pdf>

TSR's have a direct and tangible negative impact on levels of service. Reliability and punctuality issues will worsen and impact lines other than the Wairarapa Line if the renewals 'bow wave' is allowed to continue to grow.

WMRN patronage growth is currently strong and this is forecast to continue in the future. This spread of poor performance will reduce the level of service below that required if Wellington passenger rail is to meet and lead these growing demands.

The only practical alternative for most customers who are no longer adequately served by a reduced performance WMRN is private vehicle travel on increasingly congested peak time roads. Alternative bus services will also have their service quality degraded by the increased congestion.

7 Resilience

The ability of a transport system to function during adverse conditions and quickly recover to acceptable levels of service after an event is fundamental to the wellbeing of communities and the economy. Existing central and local government strategies put a high importance on improving transport system resilience.

The WMRN is a network. Failure on one part of a route affects services on much or all of a route. Routes and services are interconnected so asset failure on one route easily spills over into service disruptions on other routes. This can then affect the entire transport network, due to the interdependencies of the road and rail networks.

In the context of this Business Case, resilience can be thought of as a number of components that can be grouped into two broad categories which are set out in Table 5.

The track works proposed in this Business Case also serve to improve the resilience of the asset and thus the resilience of the WMRN. Deteriorated assets are fragile, close to failure and natural events can easily tip them over the limit.

In addition this business case proposes that investment be made to reduce the risk of slopes identified as having a rating of greater than 200 in KiwiRail's slope risk ranking system. Having an elevated risk of slope failure (slips) reduces the resilience of the WMRN. Historically failures on major slopes of the type ranked above 200 have resulted in prolonged outage of the railway network.

As in the case of the track renewals "bow wave" the current MROM has been unable to fund the investment required to systematically reduce this risk. No major slope risk reduction works have been completed on the WMRN since programmes were adjusted to take account of the new arrangements in 2012²⁵.

²⁵ And, in consultation with MOT, the limited budget of WMUP I was reprioritised to address a greater volume of immediately pressing traction system renewals. Slope and Platform investment was reduced to accommodate this. Not because they were unimportant, but because the traction needs were immediate.



Table 5 - Resilience Summary

Component	Description	Comment
Asset Resilience		
Assets	Having railway assets that are robust enough to withstand reasonably foreseeable events.	Renewing assets with properly specified modern equivalents will better enable them to withstand reasonably foreseeable events.
Slope Stability	Having slopes adjacent to the railway corridor that are robust enough to withstand reasonably foreseeable events.	Completing slope remediation works on high risk slopes will enable these slopes to withstand reasonably foreseeable events and, for larger events, result in less disruptive smaller failures.
Network Resilience		
Timekeeping	Having fit for purpose track infrastructure to allow services to keep time or recover lost time.	<p>Completing track infrastructure catch-up renewals will enable services to keep and recover lost time to maintain reliability and punctuality throughout the whole network.</p> <p>The WMRN is interconnected and a delay on one service can cause secondary delays on other services which can compound throughout the network.</p>
Peak Transport Demand	Having an efficient and effective passenger rail network to take some of the peak transport demand that the road network cannot handle on its own, including providing surge capacity to absorb demand in the event of road disruption.	Completing track infrastructure catch-up renewals will maintain and improve an efficient and effective passenger rail network that can take significant peak demand which the road network cannot handle on its own without significant congestion.
Component	Description	Comment
Alternative Routes	Providing an alternative transport mode when there are incidents on the road network.	<p>Completing track infrastructure catch-up renewals will maintain and improve essential alternative transport routes that can be used when there are incidents on the road network.</p> <p>For example, when the Rimutaka Hill Road is closed due to high</p>



Component	Description	Comment
		winds, snow, a landslide or an accident, the 90 minute 100km road trip to Masterton turns into a three hour 225km road trip via Palmerston North.

Figure 22 – Resilience and Slopes in Action – Wairarapa passenger train derailed after exiting a tunnel and hitting a rainfall-triggered landslide in 2009, stranding about 300 passengers in the tunnel for several hours and closing the line for several days.



Why Should The Crown Agree To Fund This Upgrade

8 Previous Crown Wellington Rail Infrastructure Funding

8.1 Wellington Regional Rail Programme (WRRP) Upgrades 2008 - 2011

These major infrastructure upgrade works were undertaken to improve the capability of the WMRN after a 25 year gap in such investment²⁶. This unusually prolonged gap was a consequence of ownership and funding models introduced from the mid 1980's that did not facilitate or encourage such investment in rail.

The amount of Crown funding was approximately \$319 million.

WRRP delivered significant benefits for the WMRN including:

- A well-performing rail service which has increased passenger demand for metro rail. This has been particularly so for the Kapiti service, which has increased peak period patronage by a total of almost 20% since the upgrades to the line have been completed
- A safe and reliable rail service providing a viable transport alternative to road transport
- An improved passenger experience and shorter journey times.

A summary of the works and the outcomes are outlined in Table 6. Similar upgrade investments were also made to the Auckland Metropolitan Railway Network over the same period.

The companion business case "Unlocking Network Capacity" promotes another wave of upgrade investment to build on the growth that WRRP unlocked.

²⁶ The purchase of the Ganz Mavag EMU fleet (in service 1982 -1983), with related power system strengthening, and extension of the electrified network from Paekakariki to Paraparaumu (1983) were the last major WMRN investments prior to WRRP, as opposed to "sustaining capital".

Table 6 - Wellington Regional Rail Project (2008-2011) - WRRP

Item	Summary
Double Track from McKay's Crossing to Waikanae and Electrify to Waikanae	Increased catchment of the WMRN passenger system and improved rail reliability and capacity for this section of track. Decreased pressure on State Highway 1 resulting in less congestion and improved road safety.
Triple Track Entrance to Wellington Station	Increase capacity and reduce passenger train delays resulting in improved efficiency and capacity.
Lower Johnsonville Tunnels and Extend Passing Loops	Works to increase the clearance in tunnels and platforms to accommodate the new Electric Multiple Units (EMUs), allowing GWRC to standardise on one type of train, increase passenger capacity with 6 car passing loops (up from four) and improve reliability and safety with modern rolling stock.
Traction and Signaling Upgrades	Essential works to the traction and signaling systems to accommodate modern electric rolling stock (Matangi EMUs).
Platform and Station Upgrades	Essential works to platforms to accommodate new EMUs, plus some enhancements to the poorest condition platforms to improve station amenities for rail customers.
EMU Depot	Construction of a new EMU and passenger carriage depot and related facilities for the introduction of the new fleet.

8.2 Previous Crown Funded "Catch Up" Renewals

Table 7 sets out a summary of the prior Wellington Metro Upgrade²⁷ Programme I (WMUP I) catch up works that have been funded.

A sum of \$88.4m was provided from the NZ Treasury to KiwiRail over the 2011 to 2018 financial years for the first tranche of deferred renewals (referred to as Wellington Metro Upgrade Programme 1), the majority of which have been successfully completed²⁸.

²⁷ An imprecise and confusing use of language. WMUP I funded catch up works, not "upgrades".

²⁸ Last two WMUP I projects to be closed-out by the end of February 2018.



Table 7 – Wellington Metro Network Catch-Up Works (2011-2018 Financial Years) – WMUP I

Item	Description	Outcome
Replace Life Expired Traction Assets	<p>With the primary driver of replacing life expired timber traction poles, a face renewal²⁹ of the traction system was undertaken at the following locations:</p> <ul style="list-style-type: none"> ○ The two Tawa tunnels; and ○ Redwood to McKays Crossing. <p>Replacement of the Petone mercury arc rectifier (life expired and unreliable power supply substation, due to be completed 2017).</p>	Address traction safety and passenger train reliability risks on these parts of the network.
Signalling and Communications Assets	<p>Complete replacement of the original signalling systems power supply system between Kaiwharawhara to Plimmerton and Ava Stations towards Upper Hutt (still in progress).</p> <p>Complete replacement of the signalling system (including its central processors) at Porirua and Petone.</p> <p>Replacement of a significant number of other life expired assets such as points machines, lineside boxes and signalling masts/ lights.</p>	Address signalling systems and communications passenger train reliability risks on these parts of the network.
Platform Assets	<p>Complete refurbishment of Naenae, Tawa and Upper Hutt platforms. Resealing of Mana platform.</p>	Improve station safety, amenity and attractiveness for rail customers.
ka Tunnel	<p>\$6.5m was added to the funding package for the Rimutaka Tunnel safety upgrade programme following urgent changes to Health and Safety legislation/ KiwiRail tunnel safety policies subsequent to the Pike River Mine tragedy.</p>	Improve safety systems to allow continued operation of passenger trains to the Wairarapa.

²⁹ Face renewal of traction poles includes replacement of all the timber poles, fittings, insulators, wires, switches and conversion to balanced weight tensioning from Point A to Point B.

The second tranche of catch-up renewals, Wellington Metro Upgrade Project 2 (WMUP II), is focused on replacing all remaining life expired timber traction poles by face renewal of the overhead line system with new, modern infrastructure.

\$98.4m of Crown investment in WMUP II was approved in 2017 following a Single Stage Business Case³⁰ submitted in November 2016.

These catch-up renewals will be completed on the Hutt Valley, Johnsonville and Melling Lines and the Wellington Station approach and yards, and include:

- Replacement of all remaining life expired timber traction poles with modern steel equivalents on reinforced concrete foundations;
- Replacement of remaining end of life legacy electric traction fittings, insulators, wires and switches with modern equivalents; and
- Conversion from fixed termination to balanced weight wire tensioning³¹.
- Elimination of all remaining aerial 3.3kV signals power lines, hung from legacy traction poles, in favour of buried 600 volt lines.

This project is currently in the procurement phase. It is anticipated that a preferred contractor will be selected by late 2017, with works commencing in April 2018 for expected completion in June 2021.

³⁰ Wellington Metro Rail Network Traction Catch-Up Renewals Single-Stage Business Case, November 2016

³¹ Overhead wires kept at constant and ideal tension regardless of low or high temperatures.



8.3 Summary of Previous Wellington Metro Railway Network Investment Outcomes

BENEFITS ACHIEVED FROM PREVIOUS RAIL INVESTMENTS:

- **SIGNIFICANT INCREASE IN OPERATIONAL PERFORMANCE, AS MEASURED BY PUNCTUALITY AND RELIABILITY AND EXPRESSED AS “COMPLETED TRIPS”;**
- **INCREASED RAIL PASSENGER TRIPS (4.5% PER ANNUM INCREASE OVER THE LAST THREE YEARS EQUATING TO ALMOST HALF A MILLION ADDITIONAL PASSENGER JOURNEYS);**
- **INCREASED CAPACITY AND REACH TO MEET GROWING POPULATION AND TRANSPORT DEMANDS;**
- **DECREASED ROAD CONGESTION AT PEAK TIMES BY PROVISION OF A RELIABLE AND FREQUENT PASSENGER RAIL SERVICE;**
- **PASSENGER RAIL PROVIDING A VIABLE TRANSPORT ALTERNATIVE TO AVOID OR DEFER MAJOR ROAD INVESTMENT;**
- **REPLACEMENT OF ASSETS AT THE END OF THEIR SERVICEABLE LIFE TO ENSURE CONTINUITY OF SERVICES AND MINIMISE SAFETY RISKS; AND**
- **INCREASED CUSTOMER SATISFACTION.**

Crown investment in Rail Upgrade and in Catch Ups 2008 – 2017 has contributed to a significantly more reliable and robust system and enabled the infrastructure to support achieving the service levels that underpin growth in operating performance, ridership and satisfaction.

WMUP II will avoid a significant worsening in traction overhead system performance 2018 – 2021 that would have reversed this performance.

Together Figure 10 plus Section 2.2, tell the story of the success that this Crown investment has underpinned

9 Lack of Affordability under MROM

THE ABSENCE OF A CONFIRMED PROGRAMME TO RENEW END OF LIFE, NEAR END OF LIFE AND POOR PERFORMING TRACK INFRASTRUCTURE THROUGHOUT THE WMRN WILL SEE PUNCTUALITY AND RELIABILITY CONTINUE TO DEGRADE AND RISK CLOSING THE WAIRARAPA LINE TO PASSENGER SERVICES BY 2027 OR EARLIER.

As a key part of establishing the Metropolitan Rail Operating Model (MROM) in 2009, the Crown agreed to fund the investment to bring the network to a functional, safe and reliable standard³², with steady state maintenance and renewals to be funded by user charges.

So far as user charges are concerned, the MROM ensures that the cost of commuter operations and KiwiRail Group's own operations are visible without cross subsidy in either direction.

Accordingly, users of the Wellington Metro Rail Network pay for the network operating, maintenance and "steady state" renewal costs, in proportion to the use they make of the assets – full and fair user pays.

Given the intensive passenger use of the network GWRC operating and steady state charges for their use of the WMRN are assessed at approximately 80% of the total. The remaining portion is assessed against KiwiRail services.

GWRC contribution is broadly funded 50% from fare revenue, 25% region wide rates and 25% NZTA National Land Transport Fund³³.

Applying this model and tackling some asset deficiencies have resulted in GWRC's contribution to the Track Access Charges increasing from \$15m per annum in FY12 to over \$24m in FY19 (proposed budget).

The initial increase was a consequence of imposition of this full and fair user pays charging. The subsequent rise is significantly driven by improved asset knowledge and the drive to a performance level that delivers the level of service required by customers and that is dramatically evident on Figure 10.

While some further increases targeted at holding performance are budgeted for the coming funding Triennium (FY19 – FY21), GW and KiwiRail have reached the limit of their capacity to fund maintenance and renewals.

The agreements setting up the MROM were on the basis that the Crown would meet the cost of achieving this "functional, safe and reliable standard".

³² <http://www.treasury.govt.nz/downloads/pdfs/b11-2011436.pdf>, item 3.3

³³ contributions can fluctuate across funding categories depending on mandated Funding Assistance Rates (FAR) and Fare Recovery Ratios



On this basis, and following significant analysis, Wellington and Auckland “Catch-Up” renewals aimed at working towards this standard have previously been funded by the Crown in the period 2011 - 2017.

At the time of gaining funding for these previous initiatives, the need for further catch-up renewal investment, including this initiative, was indicated³⁴.

The MROM and rail funding models are currently under Crown review but this is not anticipated to materially change the situation with respect to Catch-Up renewals in the near future.

10 Economic Value

Part B of this business case sets out the economic justification for Crown funding of this investment but in summary:

THE PREFERRED OPTION TO TAKE FORWARD IS:

OPTION 4: TRACK CATCH-UP RENEWALS & SLOPES

THE INVESTMENT COST FOR THIS OPTION IS \$95.8M

THE BENEFIT COST RATIO FOR THIS OPTION IS 2.7

³⁴ Wellington Metro Rail Network Traction Catch-Up Renewals. 11 November 2016. In particular Appendix B.

Miscellaneous

11 NZ Transport Agency

NZ Transport Agency has an interest in ensuring that the rail mode of transport is complementary to their road transport objectives and vice versa. Passenger rail provides a viable transport alternative to avoid or defer major road investment.

NZTA policy and Wellington focussed Business Cases, (including NZTA's long-term strategic view- (<https://nzta.govt.nz/assets/Planning-and-investment/long-term-strategic-view.pdf>) all highlight the importance of rail within the wellington transport network given the road network's constrained ability to expand.

Table 16 expands on the dependencies and interdependencies of NZTA's road network with regard to this business case.

This business case has also been reviewed by key NZTA personnel.

12 How KiwiRail Assesses Condition

12.1 Condition Assessment Overview

While routine inspections are delivered on a weekly/3 monthly cycle, detailed inspections on some assets are only completed on a semi-regular (e.g. every 6 years for bridges) or on an as-and-when required basis. Additionally, as assets reach the end of their lives deterioration can accelerate.

Of particular note are assets that are not visible for easy objective inspection such as ballast and formation. These assets can require intrusive investigations to assess condition and quality and to determine remediation works required. In addition, these inspections are generally only undertaken as part of a confirmed programme of works to renew these assets. It is therefore difficult to have absolutely up to date information or absolutely precise about current asset condition.

Appropriate allowances need to be made for investigations, condition assessments, design and contingency when embarking on programmes for these types of work.

Condition inspection and assessments for each asset type are described in Appendix B.

12.2 Condition Assessments Limitations

There are a number of limitations to condition assessments, including:

- Only the top layer of ballast is visible and can be inspected so it can be difficult to determine the depth of ballast, especially if it is contaminated;
- Formation (which is below ballast and not visible) does not receive any testing (such as test pits or bore-holes) to assess condition or quality;
- Continuous rail wear measurements are not yet taken, typically only the curves are measured and are only measured in 2 or 3 locations per curve;
- The underside of rail and sleepers are not able to be easily viewed³⁵ and may be in a worse condition than the visible sections suggest (such as corrosion or rot);
- Some culverts are inaccessible or cannot be properly inspected; and
- Slopes do not receive scheduled periodic inspections and assessments, therefore a change in the slope stability and risk rating may not be identified.

In relation to this Business Case, the largest “unknown” is the quantity and scope of renewal works required for the ballast, formation and drainage. Renewing the sleepers, fastenings and rail without renewing or treating the ballast, formation and drainage will be ineffective and can make the overall track quality (such as geometry) worse than before it was ‘disturbed’. Appropriate allowances for investigations, condition assessments, design and contingency have been allowed for with respect to these aspects of the proposed works.

WHILE THE INSPECTION AND CONDITION ASSESSMENTS EMPLOYED THROUGHOUT THE WMRN FOLLOW GOOD INDUSTRY PRACTICE, DUE TO INHERENT LIMITATIONS THERE ARE SOME UNKNOWNNS IN THE CONDITION AND QUALITY OF SOME ASSETS. THEREFORE THE SCOPE OF THE REQUIRED REMEDIATION WORKS ARE SUBJECT TO REFINEMENT ONCE A FULL ASSESMENT PROGRAMME HAS BEEN COMPLETED.

13 Independent Assessments

During 2014 and 2015 Vitruvius, a specialist railway design consultancy, completed independent condition assessments of the WMRN. Their reports suggested ten-year programme to renew end of life, near end of life and poor performing track infrastructure throughout the WMRN. The proposed works included in the Business Case began with Vitruvius’ suggested works and were adjusted by KiwiRail for updated condition findings and renewal techniques.

³⁵ In specific locations where severe corrosion is known to occur, such inspections are undertaken. Visual and using a hand held measuring device.

14 Other Investments for the Wellington Metro Railway Network under Consideration

14.1 Greater Wellington Regional Council-Led and Funded

Following the introduction of the MROM, GWRC has invested significantly to improve services and the network. The result of this, alongside Crown-funded upgrades, has seen significant increases in patronage and customer satisfaction.

In parallel with this initiative, GWRC are looking to continue to improve the quality of service, with the following initiatives currently in planning:

- Encourage off-peak travel through the fare policy (i.e. discounted off-peak fares)
- Increase 'inter-peak' off peak service frequencies (planned for mid-2018), so the service will be more convenient and accessible to passengers.
- Plan to renew the Wairarapa Carriage fleet with Diesel Multiple Units in approximately 2021. This will enable increased capacity, service frequency, vehicle quality, and increase regional connectivity.
- Continue to expand Park & Ride facilities to enlarge reach and accessibility of public transport.
- Changing fare policy to provide free feeder bus services to rail monthly pass holders.
- Promotion of walking and cycling to stations, including improved cycle parking facilities
- Plan to increase bicycle facilities at outer stations, and commence a bike hire scheme in Wellington to reduce cartage of bicycles on peak trains.
- Sustainable Transport team to work with workplaces to encourage flexible work hours

14.2 Other Related Transport Corridor Investments

The main purpose of this business case is to ensure existing WMRN infrastructure is fit for purpose to support current service levels and serve as the basis for other proposed enhancements intended to provide for growth in future demand.

Other planned investment being considered for both rail and road is summarised in Part B. This is included to provide visibility of possible future funding requirements. Separate business cases will be prepared for these possible future investments as or when required.

This business case is not dependent on these possible investments.

There will also be significant benefits and synergies if proposed works are undertaken in conjunction with other programmed substantial works due to be completed over the next five years – specifically the approved traction pole replacement programme (\$98 million) and the proposed Unlocking Network Capacity initiative (est. \$100.7 million).

These synergies include being able to employ a single programme management office, coordination of line closure blocks and the completion of certain packages simultaneously.

Figure 23 – Water ingress in Rimutaka Tunnel leading to deterioration in track and formation.



Part B – Business Case

15 Strategic Case – Making the Case for Change

THE STRATEGIC CASE OUTLINES THE STRATEGIC CONTEXT AND CASE FOR INVESTMENT

15.1 Summary of Part A

KEY POINTS FROM 'PART A – BACKGROUND' SECTION ARE:

- SIGNIFICANT AND ENDURING BENEFITS HAVE BEEN ACHIEVED FROM PREVIOUS RAIL INVESTMENTS;
- THE WMRN IS A KEY ELEMENT OF LAND TRANSPORT IN THE WELLINGTON REGION AND IS RELIED UPON BY A WIDE RANGE OF PEOPLE, FOR WORK, STUDY AND LEISURE.
- PASSENGER RAIL FORMS AN IMPORTANT PART OF AN INTEGRATED LAND TRANSPORT SYSTEM BY PROVIDING CAPACITY, ESPECIALLY DURING PEAK TIMES, THAT COMPLEMENTS THE ROADING NETWORK;
- CONFIDENCE IN THE PERFORMANCE AND RELIABILITY OF SERVICE ASSISTED BY RECENT CROWN RAIL INVESTMENTS HAS RESULTED IN RECENT SIGNIFICANT GROWTH IN PASSENGER NUMBERS PER ANNUM, EXCEEDING PREVIOUS GROWTH FORECASTS;
- THERE ARE CURRENTLY LARGE QUANTITIES OF TRACK INFRASTRUCTURE ASSETS THROUGHOUT THE NETWORK, PARTICULARLY ON THE WAIRARAPA LINE, THAT ARE AT OR NEAR THE END OF THEIR LIVES, CAUSING PERFORMANCE ISSUES AND LEADING TO POOR CUSTOMER SATISFACTION;
- CURRENT WAIRARAPA LINE PERFORMANCE ISSUES WILL WORSEN AND SPREAD TO OTHER LINES IF THIS IS NOT ADDRESSED.
- SIGNIFICANT INVESTMENT IS REQUIRED TO RENEW THE IDENTIFIED TRACK INFRASTRUCTURE TO PROVIDE A "FIT FOR PURPOSE" METRO NETWORK THAT WILL REMAIN A KEY CONTRIBUTOR TO THE REGION'S ECONOMY THROUGH PROVISION OF AN EFFECTIVE, EFFICIENT AND RELIABLE TRANSPORT SERVICE;
- THE COST OF THIS LARGE VOLUME OF CATCH-UP RENEWALS IS OUTSIDE THE NORMAL FUNDING MECHANISMS PROVIDED FOR IN THE MROM AND CROWN FUNDING IS REQUIRED; AND
- UNLESS A FUNDING PROGRAMME TO RENEW THE IDENTIFIED TRACK INFRASTRUCTURE IS CONFIRMED IN THE NEAR FUTURE, THE LEVEL OF SERVICE WILL DROP THROUGHOUT THE NETWORK AND PASSENGER SERVICES ON THE WAIRARAPA LINE ARE EXPECTED TO CEASE AS SOON AS WITHIN 5 YEARS.

15.2 The Strategic Context - Key Stakeholders and Strategies

15.2.1 Key Stakeholders

Key stakeholders were involved in the preparation of this Business Case.

Refer to Table 29 in Appendix A for a summary of stakeholder roles and responsibilities.

15.2.2 Purpose and performance of WMRN

A safe, resilient and reliable metro rail network is critical to the Wellington region and New Zealand as a whole.

Providing over 13 million passenger journeys per year, and with a forecast growth of between 1.7% and 3.6% per annum, it is essential that passenger rail remains a viable public transport provider.

Additionally, the role that rail plays is interdependent with other transport modes – the roading network. Failures and incidents on either transport network have a significant impact on each other.

15.2.3 Alignment to Existing Strategies

National, regional and organisational strategies support the continued investment in rail infrastructure.

Table 8 summarises strategies that align with and/ or support the case for having a safe, reliable and efficient metro railway in the Wellington region.

Further details of each strategy, relevant extracts and document sources are provided in Appendix E.

15.2.4 Existing Strategies Conclusion

LEGISLATIVE REQUIREMENTS AND EXISTING ORGANISATIONAL STRATEGIES PROVIDE A STRONG MANDATE TO CONTINUE TO PROVIDE A HIGHLY FUNCTIONING AND SAFE PASSENGER RAIL NETWORK IN THE WELLINGTON REGION.

15.2.5 Environmental Considerations

The Wellington electric train system results in a reduced environmental impact when compared to other transport modes. Furthermore, this increases New Zealand's ability to reduce the effects of climate change in accordance with the Paris Agreement (ratified October 2016).

With respect to road congestion (discussed in various sections of this Business Case), emissions will increase if investment is not made in catch-up renewals due to passenger frustration resulting in private vehicle use instead of taking passenger trains.

Table 8 - Strategies Identified Which Support Investment in the Wellington Metro Rail Network

Organisation	Strategy Identified	Description	Relevance to Passenger Rail/ This Business Case
Ministry of Transport	Connecting New Zealand – summary of transport policy	The Crown's objective for transport – an effective, efficient, safe, secure, accessible and resilient transport system that supports the growth of our economy, in order to deliver greater prosperity, security and opportunities for all New Zealanders.	An effective, efficient, safe and reliable rail passenger system in Wellington is a key enabler to help achieve this objective.
Ministry of Transport	Government Policy Statement on Land Transport, 2015/16 – 2024/25	Highlights the need, and provides investment guidance, for public transport. This is to help unlock the potential of our urban areas by providing additional capacity on key corridors and a choice of ways to move around, particularly during peak commuting periods.	Supports the Wellington region in having a resilient and safe commuter rail system that complements the road system, provides choice, and mitigates effects on the environment.
Ministry of Business, Innovation and Employment	Business Growth Agenda Toward 2025	Encourages appropriate, resilient infrastructure which supports future investment, growth and quality of life in all parts of New Zealand.	Rail investment contributes to quality of life through provision of fast, regular and safe passenger rail services. Confidence in wider regional investment is underpinned by robust transport networks. Track infrastructure catch-up renewals will make the overall transport system more resilient by: <ul style="list-style-type: none"> • Making the railway network more reliable/ robust; • Providing overall transport system passenger capacity; and • Providing an alternative transport mode to complement adjacent road corridors.
GWRC	Wellington Regional Rail Plan 2010 – 2035 (2013 Revised Edition)	Vision is to deliver a modern, reliable and accessible rail system that competitively moves people and freight in an economic, environmental, integrated and socially sustainable way.	Critical to the achievement of this plan is the provision of a safe and resilient infrastructure to deliver rail passenger services. Track infrastructure catch-up renewals is a prerequisite for delivery of this plan and cater for growth on the network. Refer also to Wellington Metro Railway – Unlocking Network Capacity and Improving Resilience Business Case discussed in Section 8.1 above.
GWRC	Regional Land Transport Plan 2015 (RLTP)	Priority is to improve rail's reliability, capacity and frequency, and over the longer term to further improve journey times and reach.	Track infrastructure catch-up renewals is essential to ensure a reliable and resilient rail network to achieve the goals of the RLTP.
GWRC	Wellington Regional Public Transport Plan 2014	The Plan notes the core rail routes provide high-capacity, long-distance, time-competitive commuter services connecting key urban areas across the region. Their primary functions are to reduce severe road congestion on State Highways 1 and 2 and meet the demand for travel from key suburban and town centres to the Wellington CBD during peak periods.	This Business Case supports this plan and the provision of a high-capacity, long-distance, time-competitive commuter services to avoid increased congestion on SH1 and SH2.
NZ Transport Agency	Integrated Planning Strategy 2010	Promote complementary land use patterns such as transit-oriented developments to support urban rail intensification.	Track infrastructure catch-up renewals will ensure rail passenger services continue to provide efficient commuter transport services and avoids the need for significant investment in additional road transport capacity.
(Legislation)	Health and Safety at Work Act 2015 and Railways Act 2005	The Acts outline the responsibilities for providing a safe rail network in New Zealand.	Kiwirail is responsible for provision of a safe railway. Without funding for track infrastructure catch-up renewals over the next 10 years they will likely be obliged to close parts of the network, the Wairapa Line in particular, to avoid a breach of these Acts.
Kiwirail	Kiwirail Network Strategic Plan	Be a trusted provider of safe, reliable and efficient track infrastructure meeting Kiwirail and customer needs.	Kiwirail's obligation to provide a safe and reliable WMRN is dependent on funding – the purpose of this Business Case.

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15.2.6 Freight and Long Distance Passenger Trains on the WMRN

While this Business Case is focused on track infrastructure renewals driven primarily by the needs of metro passenger trains, KiwiRail freight and long-distance passenger trains use the Kapiti, Hutt Valley and Wairarapa Lines. Freight trains are an important driver for the region and country's economy.

The role and benefits of freight trains include:

- Provide vital capacity for the overall national freight task that the road network could not handle on its own;
- Provide a key part of the overall transport network including: regional and inter-regional connections, inter-island and international freight transport;
- Reduce congestion on roads by being a high capacity and efficient alternative to trucks (e.g. reducing over 16,000 log truck trips over the Rimutaka Hill Road each year³⁶); and
- Increase road safety by removing heavy vehicles from the road network.

While benefits of the track infrastructure catch-up renewals will benefit KiwiRail freight and long-distance passenger services, they pay their fair share of railway operating, maintenance and steady state renewals through the WNA, as shown in Part A.

If the track infrastructure catch-up renewals are not undertaken, there are potential negative impacts for freight and long-distance passenger services should the track infrastructure become unreliable or unavailable. If speed restrictions increase, freight and long-distance passenger trains will also be impacted as will eventually not be able to accommodate these delays within their timetables.

Further, if a metro passenger train is unable to keep to timetable due to network related delay issues, there may be consequential delays to freight or long-distance passenger trains. This results in freight inefficiencies/costs and the potential for connections to be missed such as the inter-island ferries and/or compounding delays to metro passenger services already impacted by speed restrictions.

Finally, if the railway is closed because of a track infrastructure or slope failure, temporary road bridging of freight will either add to the road congestion or will not occur, with follow-on economic consequences as a result.

The National Freight Demand Study 2014³⁷ forecasts that the freight task as measured in tonnage will increase by 58% over the next 30 years. The consequence of this increase is that the importance of both rail and road freight transport will only increase in the future, making it important that the overall transport corridors are available, reliable and efficient.

³⁶ <http://www.centreport.co.nz/information-library/news/173-new-waingawa-log-hub-underpins-regional-growth-and-trade>

³⁷ <http://www.transport.govt.nz/assets/Uploads/Research/Documents/National-Freight-Demand-Study-2014-executive-summary.pdf>

15.3 Investment Logic Mapping

An Investment Logic Map (ILM) workshop was held on 11 August 2017.

Participants at the workshop included senior representatives from GWRC, KiwiRail, Carterton District Council, Masterton District Council, NZ Transport Agency, Ministry of Transport and professional advisors.

NZ Treasury officials were unable to attend but were briefed after the workshop.

15.3.1 Problem Identification

Workshop discussion identified that track infrastructure catch-up renewals are required for ensuring Wellington track infrastructure can maintain regional connectivity and enable growing demand.

A forecast for continued growth in track infrastructure renewals, combined with the lead time and capacity limits for delivering these renewals, means there is only limited time to address the issues set out in this business case if level of service is to be maintained within acceptable levels.

The ILM workshop then put further definition around the track infrastructure issues. The ILM output is shown in Appendix F. The relative importance of each problem to each other were considered and ranked (indicated by the percentage assigned to each problem).

THE PROBLEM STATEMENTS DERIVED FROM THE ILM ARE AS FOLLOWS:

- 1. TRACK INFRASTRUCTURE ASSETS COMING TO THE END OF ECONOMIC LIFE, AND THE PIECEMEAL REPLACEMENT APPROACH NOT KEEPING UP, IS THREATENING REGIONAL CONNECTIVITY, IMPACTING TRAVEL REALIABILITY AND CAPACITY UPGRADES (80%)**
- 2. LACK OF RAIL CORRIDOR STABILITY AND THE WELLINGTON VULNERABILITY TO FORCES OF NATURE RESULTS IN THE RISK OF LINE CLOSURE AND MAJOR DISRUPTION TO THE WHOLE REGIONAL TRANSPORT SYSTEM (20%)**

15.3.2 Potential Benefits

An analysis of the potential benefits of the investment proposal were developed as part of the ILM workshop and are detailed in Table 9.

Table 9 - Benefits Assessment

Benefit	Description
Maintain Regional Connectivity (30%)	Benefits of intervention will be: <ul style="list-style-type: none"> • High network availability with nil or rare unplanned network outages relating to track infrastructure • Maintain current network reach • Enable greater mode share between road and rail
Maintain and Improve Service Quality (30%)	Benefits of intervention will be: <ul style="list-style-type: none"> • The network provides consistent and reliable journey times • Customer satisfaction is improved
Better Value for Money (10%)	Benefits of intervention will be: <ul style="list-style-type: none"> • Minimising the unit cost and disruption of renewing the track infrastructure • Reduction in track infrastructure inspections and maintenance costs
Support Regional Growth (15%)	Benefits of intervention will be: <ul style="list-style-type: none"> • The network provides for increased rail patronage • The network provides easy and efficient access to regional centers and more affordable housing
Improve Safety for Public and Staff (15%)	Benefits of intervention will be: <ul style="list-style-type: none"> • Nil or very rare safety incidents relating to track infrastructure failures • Very few operational safety controls such as speed restrictions relating to track infrastructure



15.4 Investment Objectives

Investment objectives were derived following the ILM workshop. Each investment objective sets a platform for assessing the options. Three investment objectives were identified to meet the aspirations for the WMRN and organisational needs.

THE INVESTMENT OBJECTIVES DERIVED FOLLOWING THE ILM ARE AS FOLLOWS:

- 1. ENSURE ONGOING RELIABILITY OF THE RAILWAY NETWORK TO AVOID DISRUPTIONS ACROSS THE INTERDEPENDENT TRANSPORT SYSTEM**
- 2. MAINTAIN AND IMPROVE RESILIENCE OF THE RAILWAY NETWORK TO AVOID OR MINIMISE DISRUPTIONS ACROSS THE INTERDEPENDENT TRANSPORT SYSTEM FROM UNPLANNED EVENTS**
- 3. MAINTAIN AND IMPROVE SAFETY OF THE RAILWAY NETWORK**

Further details of the investment objectives are provided in the subsequent three tables.

Table 10 – Investment Objective 1

<i>Ensure ongoing reliability of the railway network to avoid disruptions across the interdependent transport system</i>	
Existing Arrangements	<p>Parts of the Wellington Metro Rail Networks track infrastructure is coming to the end of its life. There is a risk that an accumulation of speed restrictions across the network could mean that parts of the network become untenable for passenger services and inoperable. This would cause disruption to the whole interdependent transport system at great cost to the region.</p> <p>Part A of the document describes the impacts of when the WMRN is not available due to infrastructure failures.</p>
Business Needs	<p>Fit for purpose track infrastructure is required in order to provide a reliable railway network and avoid disruptions across the interdependent transport system.</p>

Table 11 – Investment Objective 2

<i>Maintain and improve resilience of the railway network to avoid or minimise disruptions across the interdependent transport system from unplanned events</i>	
Existing Arrangements	<p>There is a risk that track infrastructure and slope failures will shut down the rail network causing disruption to the whole interdependent transport system at great cost to the region.</p> <p>Part A of the document describes the impacts of when the WMRN is not available due to infrastructure failures.</p>
Business Needs	A resilient railway network is required in order to avoid disruptions across the interdependent transport system.

Table 12 – Investment Objective 3

<i>Maintain and improve safety of the railway network</i>	
Existing Arrangements	<p>Parts of the Wellington Metro Rail Network track infrastructure is coming to the end of its life. Additionally, there are a number of high risk slopes throughout the network. This presents increasing risk of failure and the possibility of serious safety incidents.</p> <p>Refer to Part A of the document describing the extent of the track infrastructure issues.</p>
Business Needs	Passengers, the public and railway staff have an expectation that the railway system is safe.

15.5 Risks

Table 13 presents the key risks relating to not pursuing the investment outlined in this Business Case.

Key risks identified relating to not realising the benefits outlined in this Business Case are presented in Appendix G.



Table 13 – Risk Assessment Summary

Main Risks	Consequence	Likelihood	Comments and Impacts
Failure to Invest Results in Closure of the Wairarapa Line	High	High	If funding is not available, the Wairarapa Line will be closed due to journey times not being operationally viable ³⁸ , resulting in poor patronage support. Closing this line would go against national, regional and organisational strategies and be detrimental to the regional and national economies.
Failure to Invest Results in Reduced Patronage	High	Medium	If funding is not available essential catch-up renewals won't occur, speed restrictions will significantly increase and unplanned outages will become common. Patronage will reduce due to increasing journey times and poor timekeeping.
Reduced Capacity of Wellington's Transport Corridors	High	Medium	The overall passenger demand on Wellington's transport corridors relies on both the rail and road networks, especially during peak periods. If passenger rail were unavailable, the impact on road congestion and overall transport corridor capacity would be significant ³⁹ .
Previous Investment by the Crown is not Fully Realised	High	Medium	Previous funding provided by NZ Treasury has been successfully invested in rail infrastructure. In the event that funding is declined benefits from previous investment will not be fully realised.

³⁸ In reality then line would likely be "severed" before overall delays made it unviable due to track condition within the Rimutaka Tunnel

³⁹ Refer to companion business case "Unlocking Network Capacity" for more explanation of rail's contribution to the transport task

Main Risks	Consequence	Likelihood	Comments and Impacts
Part of the Network is Closed Following a Slip	High	Medium	Lines may be closed as a result of a slip following heavy rain or an earthquake. If part of the network was unavailable, impact on the road congestion and overall transport corridor capacity would be high.
The Reviewed Strategies do not Present a Valid Case for Investment	High	Low	All strategies assessed support maintaining a safe, functioning and efficient WMRN.

The risk assessment summary shows that if this business case proposal is deferred or declined, the consequences arising from the current condition of the track infrastructure will have significant impacts on railway passengers, the roading network and the Wellington regional and national economies.

15.6 Constraints and Dependencies

The following tables indicate the high-level constraints and dependencies of the existing WMRN.

Table 14 - Constraints

Constraints	Notes
Contracted Railway Services	Transdev Wellington Ltd are contracted by GWRC for a minimum of nine years to provide passenger rail services in the region. This requires a safe, functioning and efficient railway and associated maintenance by way of appropriate investment. Failing to provide fit for purpose track infrastructure will have financial and contractual consequences.
Lead Time	Track infrastructure renewals delivery requires long lead times. It takes time to undertake necessary planning, investigations, condition assessments, design and procurement to complete works in and around an operating railway network in a planned, controlled and safe manner. The amount of work delivered in a given period has to be limited if the impact works have on service levels does not become damaging.
Other WMRN Works	There are potential significant benefits and synergies if these works are undertaken in conjunction with other programmed substantial works on the network due to be completed over the next 5 years – specifically the <i>Traction Pole Catch-Up Renewals</i> programme (\$98.4m), and the proposed <i>Unlocking Network Capacity and Improving Resilience</i> programme (\$107.7m).

Table 15 - Dependencies

Dependencies	Notes and Management Strategies
Customer Service	<p>The WMRN is relied upon by a wide range of people for work, study and leisure. In particular, passenger trains provide critical capacity during the morning and afternoon 'rush hour' peaks (currently more than 35,000 passenger trips are taken on the network during morning and afternoon peak periods each day).</p> <p>Customers across the Wellington region require that the railway delivers a safe, reliable and efficient level of service. Additionally, railway providers are obliged to provide safe infrastructure by law.</p>
Road Network (NZ Transport Agency)	<p>The overall passenger demand of Wellington's transport corridors relies on both the rail and road networks. If passenger rail were unavailable, the impact on the road congestion and overall corridor capacity would be significant.</p> <p>The NZ Transport Agency has completed two Programme Business Cases for the SH2 corridor. These Business Cases highlight the need for a complementary passenger rail service as part of providing regional resilience and transport choice in the short and long term.</p>
Strategic Goals	<p>All strategies identified in the research and background analysis of this Business Case identify an efficient and effective WMRN as being a key part of the transport system in the region.</p>
Other WMRN Investments	<p>Other proposed WMRN investments, which are presented in Table 35 in Appendix D, are not specifically dependent on the investment covered in this Business Case but are all dependent on a functioning, efficient and reliable WMRN.</p> <p>If investment covered in this Business Case does not proceed, benefits from previous rail investments will not be fully realised.</p>

15.7 Related Transport Corridor Investments

In order to provide background and context, other planned investment being considered for both rail and road are summarised in Table 16.

It should be noted that the proposed track infrastructure investment discussed in this Business Case is not dependent on these other projects proceeding. However, these other investments are all dependent on a functioning, reliable and fit for purpose railway network.

Table 16 – Other Related Transport Investments

Sponsor Organisation	Possible Other Investments and Studies
GWRC and KiwiRail	Refer to Part A and Appendix D for details.
NZ Transport Agency	<p>State Highway 2 Ngauranga to Te Marua Programme Business Case</p> <p>This business case highlighted the fact that SH2 is a vital transport corridor in the national network and that it is currently congested, of lower safety and lacks resilience with significant exposure to natural events. With significant traffic congestion in the morning peak and passenger trains approaching capacity. Part of the strategy to improve the performance for this section of SH2 includes improving capacity on rail. It highlights that there is a critical dependency to upgrade the public transport network (particularly rail) prior to investing in significant road improvements.</p>
NZ Transport Agency	<p>State Highway 2 Te Marua to Masterton Programme Business Case</p> <p>This business case highlighted the fact that SH2 transport corridor plays a critical transport accessibility role, connecting the Wairarapa and Wellington enabling access to hospitals, employment and other services. SH2 provides the only direct road link between these areas and due largely to the topography of the Rimutaka Hill section, delays and closures due to snow, high winds and other events often occur. Rail is an essential complement to this route.</p>
NZ Transport Agency	<p>Melling Interchange Upgrade</p> <p>This project is specifically highlighted, as during planned road intersections works rail passenger demand increased from Melling Station to and from Wellington Station. This mode shift is because commuters wanted to avoid road works congestion and reduce their overall commute travel time.</p>
NZ Transport Agency	<p>Wellington to Hutt Valley Cycle and Pedestrian Link Detailed Business Case</p> <p>This business case investigated options to provide improved cycling and pedestrian facilities between Wellington and the Hutt Valley along the Hutt Road and SH2 transport corridor. The study identified the seaside</p>

Sponsor Organisation	Possible Other Investments and Studies
	option as being the recommended option as it provides an opportunity for a high-quality shared facility, and offers the opportunity to contribute more directly to the regional economy through resilience and tourism benefits. KiwiRail is pursuing an opportunity to ease a number of tight curves along this section of the network to increase train speeds and efficiency. The project is currently at investigation and design stage.
NZ Transport Agency	Accessing Wellington’s Port Area Programme Business Case This business case investigated a number of options for improving the movement of freight to and from the Wellington Port. The study went so far as to consider rail as a viable option for displacing/ relocating freight off the road network onto the rail network.

15.8 Timeliness of the Investment Decision

Condition assessments indicate that the track infrastructure needs catch-up renewals to be completed within the next 10 years (completion by 2027 at the latest), and selected elements prior to this. It should also be noted that passenger services to the Wairarapa will need to cease within 5 years, due to track condition issues in the Rimutaka Tunnel, unless a renewal takes place.

An investment decision is required as soon as possible, in order to make the necessary arrangements to complete the catch-up renewals in a planned and controlled manner within this timeframe.

Table 17 outlines the proposed strategic timeline.

Table 17 - Strategic Timeline

Approximate Date	Event
2 Oct 2017	Preliminary budget initiative scoping document submitted to Ministry of Transport Funding Review Panel
Nov 2017	SSBC submitted to the Ministry of Transport & NZ Treasury
Nov 2017 – May 2018	Discussions between NZ Treasury, project sponsors and other relevant stakeholders
May 2018	Investment approved/ declined
July 2018	Assuming funding is approved planning for works commences
Varies (2019)	During 2019 works programme commences.
2026	Completion of Track Infrastructure Catch-Up Renewals

INVESTMENT DELAYED UNTIL AFTER MAY 2018 OR DECLINED MEANS:

- **SPEED RESTRICTIONS WILL INCREASE THROUGHOUT THE WMRN.**
- **UNPLANNED OUTAGES WILL INCREASE.**
- **PASSENGER SERVICES CEASING ON THE WAIRARAPA LINE BY 2027 OR AS SOON AS FIVE YEARS IF RIMUTUKA TUNNEL TRACK FAILS.**

INVESTMENT APPROVED BY MAY 2018 MEANS:

- **TRACK INFRASTRUCTURE CATCH-UP RENEWALS COMMENCE IN JULY 2018 AND ARE DELIVERED EFFICIENTLY BY 2027 – A FULLY FUNCTIONING WMRN CONTINUES.**

15.9 Strategic Case Overview and Conclusion

Central and local government strategies provide a strong mandate to provide a safe, reliable and resilient metro railway network in the Wellington region. Current performance (overall) is good, patronage is growing and is forecast to continue growing.

Review of the current track infrastructure condition and performance suggests there is a case for investment to

- renew end of life, near end of life, and poor performing track infrastructure and
- improve safety, reliability and resilience through treating identified high risk slopes.

This will assist the network being able to provide the level of service expected from passenger rail in the Wellington region.

Given the significant quantities of track infrastructure catch-up renewals required and the timeframe that they need to be achieved within. Additionally, given the complications of working around an operating railway while minimizing disruptions to passengers, an accelerated renewals programme is required.

Given the length of time capital rail investments take to implement and the need for intervention, an investment decision is required as soon as possible. This is so planning and procurement can proceed to ensure that the track infrastructure catch-up renewals can be completed in a planned and controlled manner by 2027 and selected elements prior to this.

This would avoid the negative effects expected from the Wairarapa Line being closed within the next ten years (or earlier), due to asset condition and safety concerns inside the Rimutaka Tunnel, as well as low passenger support as a result of poor service reliability.

A decision on the investment is anticipated by May 2018 to align with budgeting cycles and providing certainty on safely managing the track infrastructure.



16 Economic Case – Exploring the Preferred Way Forward

THE ECONOMIC CASE IDENTIFIES THE INVESTMENT OPTION THAT OPTIMISES VALUE FOR MONEY AND PREFERRED OPTION.

16.1 Critical Success Factors

The critical success factors for this investment proposal have been identified, based on the discussion in Part A and the Strategic Case and confirmed by the project sponsors. These are detailed in Table 18. The critical success factors have been derived using the NZ Treasury Guidance.

Table 18 – Critical Success Factors

Generic Critical Success Factors	Business Case Specific Critical Success Factors
<p>Strategic Fit and Business Needs</p>	<p>Meets the requirements of the identified central and local government regional rail related strategies. Including:</p> <ul style="list-style-type: none"> • Improve passenger journey time reliability, particularly at peak travel times and in severely congested urban areas and on key freight routes; • Deliver an integrated land transport network that supports the region’s people and prosperity in a way that is economically, environmentally and socially sustainable; and • The track infrastructure enables safe and efficient movement of large volumes of people and freight at a time.
<p>Potential Value for Money</p>	<p>Economic benefits of the track infrastructure investment (or avoided economic dis-benefits) are higher than the costs to undertake the works.</p> <p>Works can be completed in a planned and controlled manner to increase value for money and minimise the unit cost and disruption of renewing the track infrastructure.</p>
<p>Supplier Capacity and Capability</p>	<p>KiwiRail can deliver selected works effectively without threatening their core maintenance works programme.</p> <p>Competitive tenders can be sought from competent contractors to deliver contracted works.</p>
<p>Potential Affordability</p>	<p>Affordability has a specific focus on the likelihood of funding and/ or the available funding mechanism.</p> <p>Affordability and funding is addressed in Section 17 Financial Case.</p>

Generic Critical Success Factors	Business Case Specific Critical Success Factors
Potential Achievability	The proposed track infrastructure catch-up renewals can be implemented fast enough to: <ul style="list-style-type: none"> • Maintain and improve journey times to meet target KPI's; and • Prevent the Wairarapa Line from becoming untenable to run passenger services on.

These critical success factors will be used to inform the options assessment.

16.2 Options Assessment

GWRC and KiwiRail senior managers and advisors have identified possible options to renew the end of life, near end of life and poor performing track infrastructure. The options available for resolving the problem are somewhat limited. This is due to there being few alternative long-lasting treatments to renewing the identified track infrastructure.

16.3 Assessment Process

As a result of the limited available options, a list of potentially viable options were identified and these are carried through to the assessment process in one step. That is, there was no Long List assessment to identify the Short List. These are presented in Table 19.

Two assessments were carried out on the list of options, these included:

- An attributes assessment (which outlines the function of each option) (Table 20); and
- Assessment against the Investment Objectives and Critical Success Factors (Table 21).

Key advantages and disadvantages of each option are then summarised in Table 22 with an overall assessment and **Preferred Option identified**.

The economic values stated in Table 20 come from the economic assessment which is described in more detail in Section 16.6.



16.4 Options Presented

The following options were identified.

Table 19 – Potential Options List

Option	Name	Taken Forward	Description
1	Do Minimum	No	Cease current maintenance and business as usual renewal expenditure on the Wairarapa Line and focus it on other WMRN lines.
2	Continue Business as Usual	Yes	Continue current maintenance and business as usual renewal expenditure on the WMRN.
3	Tunnels & Slopes	Yes	Option 2 plus renewal of end of life poor performing track within five of the tunnels on the WMRN and treating high risk slopes.
4	Track Catch-Up Renewals & Slopes	Yes	Option 2 plus renewal of end of life, near end of life and poor performing track infrastructure throughout the WMRN and treating high risk slopes.
5	Wairarapa Line Enhancements	Yes	Option 4 plus works to enable more regular train services to increase capacity (Upper Hutt to Masterton), and refurbishment of the Wairarapa Line north of Masterton to allow an alternative freight route and create train-free maintenance windows on Kapiti Line.
6	Wairarapa Line Face Renewal & Enhancements	Yes	Face renewal of the Wairarapa Line track infrastructure, renewal of end of life, near end of life and poor performing track infrastructure on other WMRN lines and treating high risk slopes. Plus, works to enable more regular train services (Upper Hutt to Masterton) and refurbishment of the Wairarapa Line north of Masterton.

Further details of each option are provided below for comparison and/ or reasons for discarding the option.

16.4.1 Option 1: Do Minimum (Cease trying to hold WL condition and focus resources on electrified lines)

This option has not been explored further as Do Minimum would see passenger services cease on the Wairarapa Line within 2 - 3 years⁴⁰ and lead to significant speed restrictions and poor levels of service on other WMRN lines within 5 years.

Ceasing current maintenance and renewal expenditure on the Wairarapa Line and focusing it on other WMRN lines will not fully address the necessary key renewal works required on the rest of the WMRN and will not address slope stability issues or increase resilience.

This approach will not allow the Wairarapa Line to remain operational to passenger services, even with speed restrictions, and the service will likely cease within 2 - 3 years (low speed freight may be able to continue if some maintenance is performed).

Speed restrictions on the other WMRN Lines will also increase, detracting customers due to increasing and unreliable journey times, and poor timekeeping. Recent strong patronage growth would slow or potentially reverse due to poor levels of service. This would be counter to national and local government strategies to increase metro rail patronage.

Such a move would not be rational given the prior investment in the WMRN. Additionally, closing the Wairarapa Line would still require ongoing inspection and maintenance expenditure required to ensure the rail infrastructure remains safe, even if minimally used for freight.

As identified in the Strategic Case, there is no alignment of this option with the relevant strategies and significant prior investment benefits would be greatly reduced.

16.4.2 Option 2: Continue Business as Usual

Continuing current maintenance and steady state renewal expenditure throughout the WMRN will not address the intergenerational renewal and slope stability issues or increase resilience.

Risks associated with end of life, near end of life and poor performing track infrastructure, slope stability and resilience, particularly on the Wairarapa Line, will continue to be an issue throughout the network. These include the potential to have sections of the network out for periods of time, increases in speed restrictions and unplanned service outages and the potential risk of derailments due to poor condition track infrastructure and slope failures.

Speed restrictions will dominate, especially on the Wairarapa Line, deterring customers due to increasing and unreliable journey times, and poor timekeeping. The level of service on the Wairarapa Line will likely degrade to the point this service would no longer be viable. This approach will not allow the Wairarapa Line to remain operational to passenger services, even with speed restrictions, and the service could cease as soon as 5 years.

⁴⁰ Or as soon as a critical fault is detected, could be within months without any maintenance



Recent strong patronage growth on other WMRN lines would slow or potentially reverse due to poor levels of service. This would go against national and local government strategies to increase metro rail patronage.

As identified in the Strategic Case, there is no alignment of this option with the relevant strategies and significant prior investment benefits would be greatly reduced.

16.4.3 Option 3: Limited Tunnels & Slopes

Increase expenditure to renew end of life and poor performing track within five tunnels⁴¹ and treating high risk slopes⁴² throughout the WMRN, while maintaining current maintenance and steady state renewal expenditure. This option will partially reduce the risk of increased speed restrictions, unplanned service outages, slope failures and increase resilience, but will not address the bulk of the intergenerational renewal issues. The design life of the tunnel track renewals and slope treatment works would be 50 years (with ongoing maintenance and possible renewal of some elements earlier such as rail).

Risks associated with end of life, near end of life and poor performing track infrastructure and resilience, particularly on the Wairarapa Line, will continue to be an issue throughout the network. This includes increases in speed restrictions, unplanned service outages and the potential risk of derailments due to poor condition track infrastructure.

Speed restrictions will not meet KPI targets, especially on the Wairarapa Line, deterring customers due to increasing and unreliable journey times, and poor timekeeping. The level of service on the Wairarapa Line will still likely degrade to the point this service would no longer be viable due to journey times not being operationally viable, resulting in poor patronage support. This approach will not allow the Wairarapa Line to remain operational to passenger services, even with speed restrictions, and the service will likely cease within 10 years.

Recent strong patronage growth on other WMRN lines would eventually slow or potentially reverse due to poor levels of service. This would go against national and local government strategies to increase metro rail patronage.

Such a move would not be rational given the prior investment in the WMRN. As identified in the Strategic Case, there is little alignment of this option with the relevant strategies and significant prior investment benefits would be greatly reduced.

16.4.4 Option 4: Track Catch-Up Renewals & Slopes

Increase expenditure to renew end of life, near end of life, and poor performing track infrastructure including track within five tunnels and renewal of four bridges as well as

⁴¹ Refer to Table 31 in Appendix C

⁴² Refer to Table 33 in Appendix C

treating high risk slopes⁴³ throughout the WMRN in a planned and controlled manner. This will significantly reduce the risk of increased speed restrictions, unplanned service outages and slope failures and increase resilience.

This will provide a fit for purpose WMRN, which will have increased resilience, and deliver the levels of service expected of passenger rail in the Wellington region.

The design life of this track infrastructure solution would be 50 years (with ongoing maintenance and possible renewal of some elements earlier such as rail), and will enable the users of the rail network (KiwiRail Freight and GWRC) to fund the necessary maintenance and steady state renewals of the WMRN track infrastructure into the foreseeable future⁴⁴.

This option aligns well with relevant strategies and enables continued realisation of benefits from prior investment.

16.4.5 Option 5: Wairarapa Line Enhancements

This option builds on Option 4 and includes works to enable more regular passenger train services to increase capacity on the Wairarapa Line through installing crossing loops and upgrading communications and signaling systems.

A moderate refurbishment of the Wairarapa Line north of Masterton is also proposed to create an alternative route for freight trains into Wellington, allowing uninterrupted evening and weekend maintenance windows for the Kapiti/North Island Main Trunk Line (currently has an average of 12 freight movements every day including during maintenance shut-downs).

Rail operations on the Wairarapa Line are currently controlled by Track Warrant Control where trains occupy the main line by instructions issued from Train Control and only one train is allowed on a section of track at a time to ensure safe operations, thus restricting service frequency and constraining capacity. Installing passing loops along the line and upgrading communications and signaling equipment will enable operations to be controlled by Automatic Signaling systems as used on all other WMRN lines. Automatic Signaling uses communications and signaling systems to detect the presence of rail traffic and prevent following and opposing rail traffic entering occupied sections of track and allows more regular service frequency. The passing loops will allow passenger and freight trains to pass other trains travelling in opposite directions and enable more intense and efficient use of the line.

Refurbishing the Wairarapa Line north of Masterton, which connects to the Palmerston North to Gisborne Line at Woodville, will create better evening and weekend maintenance windows for the Kapiti Line (also North Island Main Trunk) uninterrupted by normally busy freight traffic, on what will become a more intensively used passenger line.

⁴³ Refer to Appendix C for the scope of works for each item and by Line

⁴⁴ Likely more than 30 years for track renewals. More work is required to extend the renewals plans beyond the current 12 - year planning window

This section of the Wairarapa Line from Masterton to Pahiatua is in poor condition, has not carried regular services for some time and its condition now precludes intensive, if any, freight use. The current lack of any options for re-routing freight to create train-free maintenance windows adversely affects the efficiency and cost of maintenance and renewal works, hence the linkage to the proposed track infrastructure catch-up renewals.

There are synergies and efficiencies to be gained by undertaking these works at the same time as the track infrastructure catch-up renewals and slopes.

The design life of this solution would be 50 years (with ongoing maintenance and possible renewal of some elements earlier such as rail) with the refurbishment of the Wairarapa Line north of Masterton having a design life of approximately 20 years. This will enable the users of the rail network (KiwiRail Freight and GWRC) to fund the necessary maintenance and steady state renewals of the WMRN track infrastructure into the foreseeable future.

16.4.6 Option 6: Wairarapa Line Face Renewal and Enhancements

Undertake full face renewal of all track infrastructure on the Wairarapa Line between Upper Hutt and Masterton. Plus, renewal of end of life, near end of life, and poor performing track infrastructure, including track in tunnels and bridges, and treating high risk slopes on the remainder of the WMRN in a planned and controlled manner.

This option also includes the enhancements discussed in Options 5.

With a full face renewal, the condition and performance of the Wairarapa Line would be considerably higher than other metro lines in both Wellington and Auckland, and higher than would be justified given the rail traffic. The remainder of the WMRN would be fit for purpose, with increased resilience, and deliver service level expected for passenger rail in the Wellington region.

While this option will see the Wairarapa Line perform well and have very low maintenance and renewal requirements over the next few decades, it will have significantly higher capital expenditure and disruption to operations during construction.

16.5 Options Assessment Against Expected Attributes

Two tables are presented as part of the options assessment. Table 20 assesses the attributes, while Table 21 examines each option against the Investment Objectives and the five Critical Success Factors. Key advantages and disadvantages of each option are noted in Table 22 where the **preferred option is identified**. The Benefit Cost Assessment is highlighted in the table below but is described in more detail in Appendices H and I.

Table 20 – Option Attributes Assessment

Attributes	Option 1: Do Minimum	Option 2: Continue Business as Usual	Option 3: Tunnels & Slopes	Option 4: Track Catch-Up Renewals & Slopes	Option 5: Wairarapa Line Enhancements	Option 6: Wairarapa Line Face Renewal & Enhancements
<i>Considered</i>	No – Not rational	Yes	Yes	Yes	Yes	Yes
<i>Service:</i>						
<i>Wairarapa Line remains in service</i>	-	No – Closure by 2027 or earlier	No – Closure by 2030 or earlier	Yes	Yes	Yes
<i>Remainder of WMRN lines (excluding Wairarapa Line) remain in service</i>	-	Yes – Will soon fail target KPI's	Yes – Will soon fail target KPI's	Yes	Yes	Yes
<i>Consistent and reliable journey times provided</i>	-	No	No	Yes	Yes	Yes
<i>Increased resilience related to slope stability</i>	-	No	Yes	Yes	Yes	Yes
<i>Increased transport network resilience</i>	-	Nil	Minor	High	High	Very High
<i>Planned service outages to undertake construction with busses replacing trains</i>	-	Very Low Outages	Low Outages	Medium Outages	Medium Outages	High Outages
<i>Unplanned service outages expected due to track infrastructure condition</i>	-	High Unplanned Outages	Moderate Unplanned Outages	Low Unplanned Outages	Low Unplanned Outages	Very Low Unplanned Outages
<i>Enable increased capacity on the Wairarapa Line</i>	-	No	No	No	Yes	Yes
<i>Create maintenance windows on Kapiti Line</i>	-	No	No	No	Yes	Yes
Construction:						
<i>Design and project management efficiency</i>	-	Poor	Moderate	High	High	High
<i>Construction works and disruption efficiency</i>	-	Poor	Moderate	High	High	High
<i>Years to complete construction works</i>	-	-	6 Years	8 Years	8 Years	8 Years
Economics:						
<i>Present Value Capital Cost, including 3% optimism bias</i>	-	\$0m (BAU)	\$31.3m	\$80.6m	\$116.1m	\$134.3m
<i>Present Value Benefit (economic impact relative to Option 2: Continue Business as Usual)</i>	-	\$0m (Base)	\$149.7m	\$656.7m	\$656.7m	\$656.7m
<i>Overall Attribute Consideration (Service, performance, efficiency, value for money)</i>	-	Poor	Poor	Good	Good	Good
Ranking (based on attributes only)	-	5	4	1	2	3
Taken Forward for Options Assessment	No - Discarded	Yes	Yes	Yes	Yes	Yes

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Table 21 – Option Assessment Against Investment Objective and Critical Success Factors

Investment Objective/ Critical Success Factor	Option 2: Continue Business as Usual	Option 3: Tunnels & Slopes	Option 4: Track Catch-Up Renewals & Slopes	Option 5: Wairarapa Line Enhancements	Option 6: Wairarapa Line Face Renewal & Enhancements
Investment Objectives:					
<ul style="list-style-type: none"> Ensure ongoing reliability of the railway network to avoid disruptions across the interdependent transport system 	Fail – Unplanned service outages will increase having a negative impact on interdependent transport system	Fail – Unplanned service outages will increase having a negative impact on interdependent transport system	Pass – Achieved for Wairarapa Line once bulk of works are complete, all other lines will be maintained	Pass – Achieved for Wairarapa Line once bulk of works are complete, all other lines will be maintained	Pass – Achieved for Wairarapa Line once bulk of works are complete, all other lines will be maintained
<ul style="list-style-type: none"> Maintain and improve resilience of the railway network to avoid or minimise disruptions across the interdependent transport system from unplanned events 	Fail – High risk slopes not addressed, no increase in asset or network resilience	Partial – High risk slopes treated, minimal increase in asset or network resilience	Pass – High risk slopes addressed, increase in asset and network resilience	Pass – High risk slopes addressed, increase in asset and network resilience including alternative Kapiti/ NIMT route	Pass – High risk slopes addressed, increase in asset and network resilience including alternative Kapiti/ NIMT route
<ul style="list-style-type: none"> Maintain and improve safety of the railway network 	Fail – Safety will continue to drop as track infrastructure continues to deteriorate	Partial – Safety of selected slopes and tunnel track will improve but will continue to deteriorate for track infrastructure	Pass – Safety will improve with catch-up renewals and treating slopes	Pass – Safety will improve with catch-up renewals and treating slopes	Pass – Safety will improve with face renewal, catch-up renewals and treating slopes
Critical Success Factors:					
Strategic Fit and Business Needs					
<ul style="list-style-type: none"> Improve passenger journey time reliability, particularly at peak travel times and in severely congested urban areas and on key freight routes. 	Fail – Punctuality and reliability will continue to decrease especially at peak travel times	Fail – Punctuality and reliability will continue to decrease especially at peak travel times	Pass – Punctuality and reliability will increase, particularly on the Wairarapa Line once bulk of catch-up renewals are complete	Pass – Punctuality and reliability will increase, particularly on the Wairarapa Line once bulk of catch-up renewals are complete	Pass – Punctuality and reliability will increase, particularly on the Wairarapa Line once bulk of catch-up renewals are complete
<ul style="list-style-type: none"> Deliver an integrated land transport network that supports the region's people and prosperity in a way that is economically, environmentally and socially sustainable. 	Fail – Closure of the Wairarapa Line and poor levels of service on other lines will negatively affect land transport with negative economic and environmental consequences	Fail – Closure of the Wairarapa Line and poor levels of service on other lines will negatively affect land transport with negative economic and environmental consequences	Pass – An efficient and effective metro network will be maintained once bulk of catch-up renewals are complete that will support the region's people and prosperity	Pass – An efficient and effective metro network will be maintained once bulk of catch-up renewals are complete that will support the region's people and prosperity	Pass – An efficient and effective metro network will be maintained once bulk of catch-up renewals are complete that will support the region's people and prosperity
<ul style="list-style-type: none"> The track infrastructure enables safe and efficient movement of large volumes of people and freight at a time. 	Fail – Closure of the Wairarapa Line and poor levels of service on other lines will not be efficient	Fail – Closure of the Wairarapa Line and poor levels of service on other lines will not be efficient	Pass – Achieved for Wairarapa Line once bulk of works are complete, all other lines will be maintained	Pass – Achieved for Wairarapa Line once bulk of works are complete, all other lines will be maintained	Pass – Achieved for Wairarapa Line once bulk of works are complete, all other lines will be maintained

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Investment Objective/ Critical Success Factor	Option 2: Continue Business as Usual	Option 3: Tunnels & Slopes	Option 4: Track Catch-Up Renewals & Slopes	Option 5: Wairarapa Line Enhancements	Option 6: Wairarapa Line Face Renewal & Enhancements
Critical Success Factors:					
Potential Value for Money					
<ul style="list-style-type: none"> Economic benefits of the track infrastructure investment (or avoided economic disbenefits) are higher than the costs to undertake the works. Works can be completed in a planned and controlled manner to increase value for money and minimise the unit cost and disruption of renewing the track infrastructure. 	Fail – The disbenefits outweigh the cost of investment	Fail – The disbenefits outweigh the cost of investment	Pass – Positive BCR is anticipated	Pass – Positive BCR is anticipated	Pass – Positive BCR is anticipated
<ul style="list-style-type: none"> Works can be completed in a planned and controlled manner to increase value for money and minimise the unit cost and disruption of renewing the track infrastructure. 	Fail – Works will be completed in a reactive and ad hoc manner which is inefficient and expensive	Partial – Tunnel and slope treatment works will be completed in a planned and controlled manner. Other works will be completed in a reactive and ad hoc manner which is inefficient and expensive	Pass – Works will be completed in a planned and controlled manner with increased value for money reducing the unit cost and disruption of the works	Pass – Works will be completed in a planned and controlled manner with increased value for money reducing the unit cost and disruption of the works	Pass – Works will be completed in a planned and controlled manner with increased value for money reducing the unit cost and disruption of the works
Supplier Capacity and Capability					
<ul style="list-style-type: none"> KiwiRail can deliver selected works effectively without threatening their core maintenance works programme. Competitive tenders can be sought from competent contractors to deliver contracted works. 	Pass – KiwiRail can deliver selected works	Pass – KiwiRail can deliver selected works	Pass – KiwiRail can deliver selected works	Pass – KiwiRail can deliver selected works	Pass – KiwiRail can deliver selected works
<ul style="list-style-type: none"> Competitive tenders can be sought from competent contractors to deliver contracted works. 	N/A – No works to be contracted	Pass – Contracted works can be comparatively tendered	Pass – Contracted works can be comparatively tendered	Pass – Contracted works can be comparatively tendered	Pass – Contracted works can be comparatively tendered
Potential Achievability					
<ul style="list-style-type: none"> The proposed track infrastructure catch-up renewals can be implemented fast enough to maintain and improve journey times to meet target KPI's. The proposed track infrastructure catch-up renewals can be implemented fast enough to prevent the Wairarapa Line from being closed. 	Fail – Journey times will continue to deteriorate and fail target KPI's across the network	Fail – Journey times will continue to deteriorate and fail target KPI's across the network	Pass – High priority works will be completed early in the programme to maintain and then improve journey times to meet target KPI's	Pass – High priority works will be completed early in the programme to maintain and then improve journey times to meet target KPI's	Pass – High priority works will be completed early in the programme to maintain and then improve journey times to meet target KPI's
<ul style="list-style-type: none"> The proposed track infrastructure catch-up renewals can be implemented fast enough to prevent the Wairarapa Line from being closed. 	Fail – Wairarapa Line will be closed to passenger services by 2027 or earlier	Fail – Wairarapa Line will be closed to passenger services by 2030 or earlier	Pass – High priority works will be completed early in the programme to ensure Wairarapa Line remains open	Pass – High priority works will be completed early in the programme to ensure Wairarapa Line remains open	Pass – High priority works will be completed early in the programme to ensure Wairarapa Line remains open
Ranking	Fail	Fail	1	2	3

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Table 22 – Summary and Conclusion of Options Assessment

Option	Advantages	Disadvantages	Overall Assessment
Option 2: Continue Business as Usual	<ul style="list-style-type: none"> Lowest planned service outages to undertake construction Lowest Net Present Value cost 	<ul style="list-style-type: none"> Closing the Wairarapa Line will cause significant negative impacts to the overall transport network and the regional and national economies Deteriorating levels of service on other WMRN Lines will also cause significant negative impacts to the overall transport network 	Investment Objectives and Critical Success Factors Not Met
Option 3: Tunnels & Slopes	<ul style="list-style-type: none"> Tunnel track safety and performance issues will be resolved Resilience associated with slope stability increased Low planned service outages to undertake construction Low Net Present Value cost 	<ul style="list-style-type: none"> Closing the Wairarapa Line will cause significant negative impacts to the overall transport network and the regional and national economies Deteriorating levels of service on other WMRN Lines will also cause significant negative impacts to the overall transport network 	Investment Objectives and Critical Success Factors Not Met
Option 4: Track Catch-Up Renewals & Slopes	<ul style="list-style-type: none"> Delivers all investment objectives and critical success factors Wairarapa Line service issues will be resolved As noted in the next Section, Option 4 has better BCR than Options 5 and 6 	<ul style="list-style-type: none"> Less efficient method of achieving capacity increase on the Wairarapa Line at a later date compared to options 5 & 6 Less efficient to complete maintenance on Kapiti Line compared to options 5 & 6 	Preferred Option
Option 5: Wairarapa Line Enhancements	<ul style="list-style-type: none"> Delivers all investment objectives and critical success factors Will allow capacity increase on the Wairarapa Line when required with minimal future investment Will create uninterrupted maintenance windows for Kapiti Line 	<ul style="list-style-type: none"> Requires more capital investment than option 4 	Pass
Option 6: Wairarapa Line Face Renewal & Enhancements	<ul style="list-style-type: none"> Delivers all investment objectives and critical success factors Will allow capacity increase on the Wairarapa Line when required with minimal future investment Will create uninterrupted maintenance windows for Kapiti Line Very low maintenance and renewal requirements going forward 	<ul style="list-style-type: none"> Requires more capital investment than options 4 and 5 High planned service outages to undertake larger scope of works 	Pass

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16.6 Summary of Quantitative Economic Analysis

Quantitative analysis has been carried out to identify measurable and comparable benefits and costs. This section sets out the assumptions and results of this analysis.

16.6.1 Optimism Bias

To account for any overly optimistic project appraisal, an optimism bias has been included in the assessment. This economic case applies the 'Standard Civil Engineering' adjustment of 3% increase to capital expenditure as the Business Case assessment is sufficiently progressed as per The HM Treasury Green Book Guidance.

16.6.2 Components of Cost and Benefit Calculations

The costs and benefits have been calculated using standard methods. Appendix H contains more details of the costs and benefits. It should be noted that depending on the option, a benefit may eventuate as an avoided cost. Care should therefore be taken when interpreting the sign of numbers (positive or negative) in the economic analysis.

16.6.3 Low Growth Modelling

The benefits calculations are based on average low patronage growth of 1.3% per annum. In reality there will be a variety of adaptations depending on the options being considered. Overall, it is considered that the approach of low patronage growth is suitable for the purpose of this Business Case. The assumptions and calculations are conservative. Therefore, the benefits may be greater than those indicated in the model.

16.6.4 Indicative Costs and Benefits

The economic calculation spreadsheet (which this section refers to) is available on request. Table 23 shows the base adjusted indicative benefits, costs and Benefit Cost Ratios (BCRs) and Table 24 provides a summary of the incremental BCR calculations. Appendix I provides a more detailed summary of the economic assessment and includes a table of assumptions that have been used in the assessment.

The agreed benefits baseline was Option 2: Continue Business as Usual, because Option 1: Do Nothing was discarded and unavailable for comparison.

Table 23 – Base Adjusted Indicative Benefits, Costs and BCR

	Option 2	Option 3	Option 4	Option 5	Option 6
	Continue Business as Usual	Tunnels & Slopes	Track Catch-Up Renewals & Slopes	Wairarapa Line Enhancements	Wairarapa Line Face Renewal & Enhancements
Estimated Present Value of Benefits	Base option	\$154m	\$678m	\$678m	\$678m
Estimated Present Value of Costs	Base option	\$56m	\$242m	\$261m	\$276m
Option BCR	Base option	2.7	2.7	2.5	2.4

Assumptions that have been used in the economic analysis are included in Appendix I.

Table 24 – Incremental BCRs

Step	Base Option for Comparison	Next Higher Cost Option	Incremental BCR	Base Option for Next Step
1	Option 3	Option 4	2.7	Option 4
2	Option 4	Option 5	0.0	Option 4
3	Option 4	Option 6	0.0	Option 4



16.7 Summary and Conclusion of the Economic Case

The Economic Case discussion has established that from six initial options tabled (Table 19); only five were acceptable for further consideration. The Do Minimum option was not assessed further for the reasons documented earlier.

The calculated Benefit Cost Ratios for each option act as one of the factors the options are assessed on, alongside the attributes, investment objective and critical success factors evaluated in Table 20 and Table 21.

Option 2 fails significant elements of the attribute assessment. It does not go far enough to deliver the necessary result. Options 5 and 6 met the investment objectives and critical success factors, but at higher cost than Options 3 and 4.

Option 3 has a reasonable BCR due to having low capital costs and reasonable benefits, but this option does not satisfy the investment objectives or meet the critical success factors as outlined in Table 21.

So while in the economic assessment Options 3 and 4 have similar base adjusted BCRs, the incremental BCR analysis clearly identified Option 4 as the best option from a benefit and cost point of view.

Reflecting on all aspects of the Options assessment, the preferred way forward is **Option 4: Track Catch-Up Renewals & Slopes** for renewal of end of life, near end of life and poor performing track infrastructure throughout the WMRN and treating high risk slopes.

THE PREFERRED OPTION TO TAKE FORWARD IS:

OPTION 4: TRACK CATCH-UP RENEWALS & SLOPES

THE INVESTMENT COST FOR THIS OPTION IS \$95.8M

THE BENEFIT COST RATIO FOR THIS OPTION IS 2.7

17 Financial Case

THE FINANCIAL CASE ADDRESSES FUNDING OF THE PREFERRED OPTION, -

OPTION 4: TRACK CATCH-UP RENEWALS & SLOPES

17.1 Background

When the MROM was established in 2009, external experts were commissioned to undertake specific asset studies to estimate the value of deferred work. This work identified a value range of \$120m to \$140m in deferred work. This did not identify or take account of the coming “bow wave” in track renewals.

In 2009 the Crown agreed to fund the first tranche of deferred or catch-up renewals to ensure access charges paid by GWRC were within affordable budget envelopes. A sum of \$88.4m was provided by the NZ Treasury to KiwiRail over the 2011 to 2018 financial years. The scope of the works delivered is summarized in Sections 8 and 9.

The value of this appropriation was about \$30m to \$50m less than the value of the identified capital maintenance backlog at the time (primarily the traction poles now being funded in the second tranche described below). The amount provided for the WMRN reflected Crown funding constraints at the time and a wish to monitor the effectiveness of the programme before committing to further investment.

The second tranche of catch-up renewals includes replacing all remaining life expired timber traction poles and legacy overhead traction line equipment. \$98.4m of Crown funding was approved in May 2017 and will be provided by the NZ Treasury to KiwiRail over the 2018 to 2021 financial years.

This Business Case proposes further catch-up renewal investment to resolve the current and forecast future network track infrastructure issues (a different asset class than the previous investment targeted). The preferred investment initiative selected is **Option 4: track catch-up renewals & slopes**, totaling \$95.8M of Capital Investment. This option also improves the resilience of the network by resolving a number of high slip risk slopes in the same timeframe.

The proceeding sections address the proposed funding arrangements to undertake the preferred capital investment initiative.

17.2 Breakdown of Investment Estimates

The investment estimate for **Option 4: track catch-up renewals & slopes**, is outlined in Table 25.

This budget estimate has been developed by KiwiRail based on their network management plan with various condition assessments and studies conducted to inform this plan. Rates have been used based on delivery of recent maintenance and renewals of the same or similar assets and by taking into consideration site specific aspects. Investigations, design, procurement, project management, coordination, bus replacement for affected train services and contingencies are included in the budget estimates.

Table 25 – Estimate of Costs for Option 4: Track Catch-Up Renewals & Slopes

Item	Description	Cost Estimate \$M
1	Track and civil renewals	52.2
2	Tunnel specific track renewals	31
3	Replace remaining end of life timber bridge foundations	5.2
4	Slope risk reduction investment	7.4
TOTAL FUNDING REQUIRED		95.8

17.3 Funding Options Assessment

Six funding options have been identified and are considered in Table 26.

It is proposed that the recommended option is funded by the Crown.

This aligns with the commitment made by the Crown as part of the 2011 Wellington Metro Rail Package where the Crown (through KiwiRail) retained ownership of the rail network, and continues to fund investment to maintain the network at a resilient, reliable, fit for purpose standard.

Based on existing policy settings, and previous agreements with the Crown, GWRC have not planned to invest \$95.8m to contribute to the track infrastructure catch-up renewals.

THE ASSESSMENT IN Table 26 IDENTIFIES PREFERRED FUNDING OPTION AS OPTION F: CROWN FUNDS THE WORK. THIS IS IN LINE WITH PREVIOUS BUSINESS CASE OUTCOMES INCLUDING AUCKLAND METRO RENEWALS.

THE FUNDING OF THE OPTION WILL ENSURE AN ENVIRONMENTALLY SUSTAINABLE TRANSPORT OPTION CONTINUES TO PROVIDE A VIABLE ALTERNATIVE TO ROAD TRANSPORT.

Table 26 – Funding Options Assessment

Option	Funding Option	Description and Comments	Status/ Assessment
A	KiwiRail to Fund the Work	<p>The MROM establishes principles of transparency for identifying costs and who pays. KiwiRail freight and long distance passenger trains only use parts of the WMRN and to a much lesser degree than metro passenger trains. These services already pay their share of network costs through their portion of the WNA charge so it is inappropriate that freight revenue contributes to these catch-up renewals. The infrastructure performance needs that are driving the catch-up renewals are also less relevant for freight trains (freight timetables can be adjusted more easily to accommodate TSR's, for example). Without metro passenger operations, the Kapiti (and Hutt/Masterton) route infrastructure would be reduced to the same level that exists on the NIMT north of Waikanae. This is very basic compared to the level of provision for a busy commuter network. The simplified network has little need of special "catch up" investment and would have the same viability as other parts of the main freight rail network.</p> <p>Crown contributions to the wider national rail network are not used for funding WMRN passenger rail related works.</p>	Not Viable
B	GWRC to Fund the Work	<p>Note GWRC already fund rail infrastructure maintenance and steady state renewals in the \$20m p/a range, this Business Case is for funding required over and above this. If GWRC funded the work it would be:</p> <ul style="list-style-type: none"> • Funding the renewal of Crown owned assets, which are life expired. This is inconsistent with previous agreements between GWRC and the Crown (Metro Rail Package 2011); and • Funded via debt over 40 years. Assuming interest costs at 6%, this would amount to \$156m on the initial loan of \$95.8m. <p><u>Options to service this debt include:</u></p> <ol style="list-style-type: none"> i. Raise Fares <ul style="list-style-type: none"> • Fare contributions to passenger rail is already above NZTA targets, and significantly above most other regions in New Zealand; • In line with current arrangements, if NZ Transport Agency agreed to cover 51% of interest charges and fare payers on all WMRN lines serve the balance, rail fares would need to increase by approximately 6%. This is in addition to NZ Transport Agency's interest payments of \$79m over 40 years; • Increased fare prices have the effect of reducing passenger numbers using rail. This is counter to local and central government strategies to increase use of public transport. The impact of less people using rail transport will be increased pressure on the road network (already heavily congested at peak periods) driving needs for road investment likely exceeding that proposed for rail; and • GWRC is currently considering the next fare increase to adjust for inflation and other operational costs associated with providing improved rail passenger services. Taking into account the expected fare increase, the addition of track infrastructure catch-up renewal costs are very likely to prove unpalatable to the travelling public and will work against the local and national strategy of increasing patronage on public transport. ii. Raise Rates <ul style="list-style-type: none"> • Similarly, rates could be increased to pay back the debt, but GWRC rates are already facing rates increasing significantly higher than inflation to manage their commitments in the 2011 Wellington Metro Rail Package. This includes contributing to network maintenance and steady state renewals, replacing rolling stock, and significantly improving the station assets including buildings, shelters, park & ride facilities and pedestrian bridges. Avoiding large rate increases is desirable. iii. NZ Transport Agency Subsidy Increase <ul style="list-style-type: none"> • The Crown has recently had a practice of not funding infrastructure capital rail items from the National Land Transport Fund; and • It is a 'round-about' way for the Crown to contribute to rail infrastructure costs so is less transparent (i.e. not in line with the MROM principles). iv. Combinations of the above <ul style="list-style-type: none"> • For the reasons given under each option, combinations are not desirable. <p>Should GWRC become responsible for funding track infrastructure catch-up renewals, options for funding the works are undesirable, and counter to the 2011 Wellington Metro Rail Package.</p>	Undesirable

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Option	Funding Option	Description and Comments	Status/ Assessment
C	Mixture of Options A and B	As explained above, Option A is not viable therefore a combination of option A and B is not viable.	Not Viable
D	Crown Loan or KiwiRail to Provide Finance with GWRC Making Repayments Through Track Access Charge (or Other Similar Annuity Method)	This option comes back to GWRC's ability to service the debt. Refer to Option B. Under KiwiRail's SOE arrangements, they are not permitted to borrow for this purpose.	Undesirable Refer to Option B
E	NZ Transport Agency Fund the Work	As mentioned in Option B, this is a 'round-about' way for the Crown to contribute to rail infrastructure costs so is less transparent (i.e. not in line with the MROM principles). Additionally, the NZ Transport Agency does not have a funding policy/ framework for funding rail network infrastructure as this has been not been included in the National Land Transport Fund or the National Land Transport Plan.	Undesirable
F	Crown Funding	<p>As per the 2011 Wellington Metro Rail Package, the Crown (through KiwiRail) would retain ownership of the rail network and would continue to fund investment to bring the network up to a functional, safe and reliable standard⁴⁵.</p> <p>Similar to previous investments in WMRM catch-up renewals and upgrades, this option proposes that the Crown pay for the track infrastructure catch-up renewals. The reasons for this are:</p> <ul style="list-style-type: none"> Investment in track infrastructure helps achieve the Government's key policy objectives. Refer to Section 2 of Part A; Wellington as the capital city and the wider New Zealand economy are the ultimate beneficiaries of the works. Investment in the WMRN increases economic growth. Specific to this Business Case, the benefit cost analysis in Section 16 indicates positive benefits; As the benefits of investing in rail transcends across both road and rail transport networks plus the wider economy, it is not reasonable that GWRC be responsible for funding the railway above what it can sustainably afford; and Government policy requires the rail operating model be equivalent in Auckland and Wellington. Recent Auckland rail development work has seen the Crown agree to fund 100% of the basic track infrastructure from the consolidated fund. <p>For these reasons, the Crown is the preferred funder for these track infrastructure catch-up renewals.</p>	Preferred Option

⁴⁵ <http://www.treasury.govt.nz/downloads/pdfs/b11-2011436.pdf>, item 3.3

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17.4 Funding Assessment Summary

S9(2)(b)(i)

When the Wellington Metro Rail Package deal was formed, the Government accepted the need to undertake catch-up renewals due to infrastructure under-investment from previous railway funding models. While the situation of “deferred” renewals was not specifically described, where the majority of the life of a very long lasting asset has been consumed, these are catch-up renewals.

Through the WNA cost setting, GWRC is making increased contributions through the Track Access Charges (to complete steady state renewals and maintenance – refer definition below). **GWRC’s contribution to the TAC has increased from [REDACTED] in FY12 to a proposed budget of [REDACTED] for FY19 and going forward.** Therefore the cost of this “bow wave” in track infrastructure catch-up renewals covered in this Business Case is outside of the normal steady state funding mechanisms provided through the Wellington Network Agreement.

Steady state renewals and maintenance: Steady state renewals and maintenance are works undertaken to ensure the infrastructure nearing end of life is gradually replaced in a strategic manner before the asset performance becomes problematic.

Good asset management strategies will generally try to achieve a pure ‘steady state’ investment strategy with no extra investment required but this will never be fully achievable, particularly if there has been any previous underfunding or a significant asset group reaches end of serviceable life - and there is a ‘bow wave’ of investment needed

The increasing contributions are already a challenge for existing GWRC budget envelopes. If GWRC were required to pay for railway infrastructure catch-up renewals, it would put both their transport and wider council budgets under significant pressure. The scale of the investment required is beyond GWRC resources.

Completion of the identified track infrastructure catch-up renewals will allow KiwiRail and GWRC to maintain the track infrastructure in a steady state condition through user charges for the foreseeable future⁴⁶. This will ensure the level of service expected by passengers in the Wellington region can be maintained well into the future.

⁴⁶ Likely more than 30 years for track renewals. More work is required to extend the renewals plans beyond the current 12 - year planning window

17.5 Proposed Investment Cash Flow

Assuming funding is confirmed in the first half of the 2018 calendar year, investigations, design and some procurement would commence promptly. This would enable early track infrastructure catch-up renewals throughout the network, to help minimise safety and performance risks and reduce the need for additional speed restrictions.

Table 27 provides a forecast of the cash flow for the proposed works. The actual drawdown of funds will be based on the actual cost of works.

Table 27 – Assumed Cash Flow for the Preferred Option (totalling \$95.8m)

Financial Years							
2019	2020	2021	2022	2023	2024	2025	2026
\$7.08m	\$19.9m	\$20.8m	\$23.9m	\$11.5m	\$11.2m	\$0.97m	\$0.32m

GWRC and KiwiRail are committed to ensuring the investment and benefits highlighted in this business case can be realised in the proposed timeframe and within the constraints of the proposed estimate.

While a commitment is requested, it is emphasised that there may be possible minor adjustment of scope, cost, cash flow and programmes following further investigations and design to be undertaken during the investment period.

It should also be recognised that this will be a very busy period for rail work, as well as the wider transport network, therefore demand on resources could be high. There is room in the work programme to deliver some items later than currently proposed while still meeting the performance needs and targets.