

NIRP - NORTH ISLAND REGIONAL PASSENGER RAIL CONNECTOR

High Level Feasibility Study of Regional Passenger Rail Services



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EXECUTIVE SUMMARY

The recent development of Passenger Rail Services beyond urban boundaries, between Auckland and Hamilton (Te Huia) and between Palmerston North and Wellington (LNIRIM), presents central government with a new opportunity to investigate a North Island Regional Passenger Rail Service (NIRP).

This high-level feasibility study, building on the analysis done for the LNIRIM Detailed business case, confirms that:

- There is a realistic opportunity to successfully deliver a regional passenger rail service that will transform the communities located along the North Island Main Trunk Line, from Auckland to Wellington, to deliver the benefits sought.
- The window of opportunity to maximise benefits and minimise costs is tied to the LNIRIM Investment currently being sought by Greater Wellington Regional Council and Horizons Regional Council.
- Further study of the NIRP opportunity through a Business Case is justified by this initial high-level analysis, and must start early in 2022 to confirm a case for investment in time to leverage off the GWRC LNIRIM rolling stock procurement process.

With a timely investment, there is a unique opportunity to enable a more equitable development of rural areas along the North Island Main Trunk line.

Strategically aligned

NIRP is strongly aligned with the current strategic context driving government budgets. It would contribute to the balanced development of Aotearoa New Zealand by defusing the current demographic pressures contrasted across the urban – rural divide. This would happen by making land and communities along the NIMT more attractive as an alternative to urban sprawl.

NIRP aligns with all the newly issued strategic priorities and policies, including the Government Policy Statement on land transport 2021-2031, Rautaki Hanganga o Aotearoa, the Draft New Zealand Infrastructure Strategy, and Te hau mārohi ki anamata, the Emission Reduction Plan issued for consultation.

Recent COVID 19 related impacts on Transport and the economy are not identified as long-term modifiers. The long-term need remains unchanged by COVID 19.

A good case for change

The overall problem that an investment in NIRP is aiming to solve is a growing inability of the existing connectivity solutions to support an equitable development of rural communities and small townships necessary to balance constrained urbanisation.

Current connectivity systems are not sufficient. Professions, employment and leisure activities are all transforming to include a significant digital component, changing communities. While much of this change compounds the need for growth in urban centres, it also allows new opportunities for the revival of rural communities.

Facing the inevitable costs of transforming transport systems, New Zealand can maximise the value it creates and captures outside urban areas by exploiting the capacity of its existing North Island railway network for Passenger Transport.

A defensible scope

The scale of change required to allow New Zealand to become the equitable, sustainable, and successful land it aspires to be justifies an equally bold approach to the investigation of passenger rail options. This must include the potential for extended networks and technologically advanced rolling stock technology.

Current investigations into Intercity Services, coupled with life expiry of 1970s rolling stock used on Capital Connection and Te Huia focuses the long term purpose of an NIRP fleet on regional services as opposed to long distance connections. However, the NIRP initiative serves three purposes:

- To be a 'connector' between Hamilton and Palmerston North, between Te Huia and LNIRIM.
- To be an 'integrator' of services between Auckland and Wellington,

- To be an early activator of patronage enabling demand growth for an intercity service.

A minimum of 3 daily Auckland -Wellington return services is proposed by integrating 3 daily Auckland - Palmerston North return services delivered by a new fleet to the proposed LNIRIM fleet to promote patronage growth and mode shift from 2028. A fleet of 14 x 4 cars Tri-Mode Multiple Unit should be considered initially with tri-mode fitting to avoid reliance on overhead line electrification. A Maintenance Depot and Infrastructure upgrades (passing loops) will be required by a further analysis.

Economic, financial and delivery considerations

Initial high-level estimates indicate a realistic possibility for a BCR ranging from 0.9 to 1.3.

The economic profile of the NIRP investment improves when it is considered as part of a programme of investments, suggesting an opportunity for the government to consider a Programme Business Case approach for further investigation the NIRP initiative.

Timing of the NIRP initiative is essential to meet the opportunity offered by the LNIRIM investment, suggesting that a fast-tracked Business Case for investment in the 'connector' and Te Huia services 'rolling stock may be appropriate.

Regional Rail is expected to deliver a range of benefits for the region

 <p>Provide a critical community link, the only commuter alternative to road, to enable inclusive access to economic, social and health opportunities.</p>	 <p>Support economic growth by enabling regional land use plans with transport infrastructure, balancing growth outside of urban area.</p>
 <p>Promote mode shift by enhancing the attractiveness of public transport. It diverts millions of trips from the roads, avoids millions of tonnes of carbon emissions.</p>	 <p>Reduce greenhouse gas emissions with decarbonised propulsion outside of electrified networks. A new tri-mode train can emit as little as 8x less carbon than current diesel locomotives hauled trains.</p>
 <p>Improve public transport attractiveness and mode choice with new amenities. It will provide comfortable, clean and modern trains and facilities.</p>	 <p>Improve safety by reducing reliance on cars with safe and accessible rollingstock. It will prevent crashes resulting in serious injuries or death</p>
 <p>Enable value for money with reduced operating risk and increased operating efficiency by adopting a national regional rail standard.</p>	 <p>Improve the overall transport corridor resilience and capacity with an alternative to road transport.</p>

1 INTRODUCTION

There have been repeated calls for regional rail services in New Zealand, particularly by the communities living along the North Island Main Trunk (NIMT) that have lived with a developed freight rail operation for generations but cannot currently enjoy the benefits of this line for public transport.

Cross agency efforts have led to the start of the Te Huia service between Hamilton and Auckland and recently to the commitment of Crown funding to ensure the future of the Capital Connection between Palmerston North and Wellington. Between these two commuter-focused services, communities of the NIMT between Hamilton and Palmerston North are not serviced.

While this is part of an ongoing national discussion about regional rail, this study focuses mainly on the Central North Island part of NIMT, extending north to Auckland and south to Wellington. In particular it concerns the feasibility of establishing the missing link to Hamilton and Palmerston North.

This study follows the 2020 high-level feasibility report for *Regional Passenger Rail “The Connector” Wellington to Auckland* prepared by KiwiRail in its initial exploration of the possible options for implementing a North Island inter-regional passenger rail service operating on the North Island Main Trunk (NIMT). It updates the perspectives taken then on public transport, transport emissions, and mode shift from a new perspective, made possible by the recent publication of the government draft Infrastructure Policy and Emission Reduction Plan and is informed by the work carried out by Greater Wellington Regional Council in the planning of an investment for the future of regional rail on the Wairarapa and Manawatu services through the Lower North Island Rail Integrated Mobility (LNIRIM) project.

This report aims to inform the Mayors and Chairs of Councils on the NIMT, through Ruapehu District Council, in their engagement with Iwi, communities, the Crown, funding agencies, and commercial partners about a possible North Island Regional Passenger Rail Connector (NIRP) project.

2 IMPROVED STRATEGIC OPPORTUNITY FOR CHANGE

CHAPTER SUMMARY AND CONCLUSIONS:

- Building on earlier analysis done for the 'Connector' and the Hamilton to Auckland (H2A), the case for regional rail on the NIMT between Auckland and Wellington (NIRP) is strongly aligned with the current strategic context driving government budgets.
- NIRP and regional rail in general would contribute to the balanced development of Aotearoa New Zealand by defusing the current demographic pressures contrasted across the urban – rural divide. This would happen by making land and communities along the NIMT more attractive as an alternative to urban sprawl.
- NIRP aligns with all the newly issued strategic priorities and policies, including the Government Policy Statement on land transport 2021-2031, Rautaki Hanganga o Aotearoa, the Draft New Zealand Infrastructure Strategy, and Te hau mārohi ki anamata, the Emission Reduction Plan issued for consultation.
- NIRP faces an opportunity to benefit from the GWRC LNIRIM investment in Rolling Stock designed as a National Regional Passenger Rail Platform.
- NIRP and regional rail in general will benefit from alignment with investment decisions within the Auckland Rail Development Plan and Route Utilisation Strategy. This strategic planning work is currently underway. Securing reliable, congestion free pathways through the Auckland region, will substantially enhance customer appeal.
- Recent COVID 19 related impacts on Transport and the economy are not identified as long-term modifiers. The long-term need remains unchanged by COVID 19.

The alignment of Regional Rail services on the NIMT with strategic governmental objectives has been discussed in previous reports² and isn't reproduced in full detail in this study. Recent new publications have been reviewed and their relevance to the potential NIRP project discussed below.

2.1 Full alignment with strategic policy frameworks

The legal framework that guides the strategy, management, and funding of land transport activities include the Land Transport Management Act 2003 (LTMA), the Local Government Act 2002 and the Resource Management Act 1991. Other relevant legislations include the Railways Act 2005, the Climate Change Response Act 2002 and the Land Transport Act 1998.

NIRP aligns with and contributes to the strategic direction of the future transport priorities, reflected in critical government plans and policies, including the Government Policy Statement. Regional rail supports the government facilitate mode shift, safety, decarbonisation, access and enable future economic opportunities.

Following the development of the 'Connector', both national and local governments issued a range of new strategic policies and frameworks to guide the long-term direction of the transport sector.

National strategy/policy/plan

- Government Policy Statement on land transport
- New Zealand Rail Plan
- National Land Transport Plan
- Rail Network Investment Programme
- Climate Change Commission Advice for Consultation
- New Zealand Upgrade Programme – Transport
- Road to Zero: New Zealand's Road Safety Strategy
- Keeping Cities Moving: A Plan for Mode Shift
- Arataki Version 2

² High Level Feasibility Study Report, Regional Passenger Rail "CONNECTOR" Wellington to Auckland, December 2020 for KiwiRail and Hamilton to Auckland Intercity Connectivity, Interim Indicative Business Case, 7th July 2020

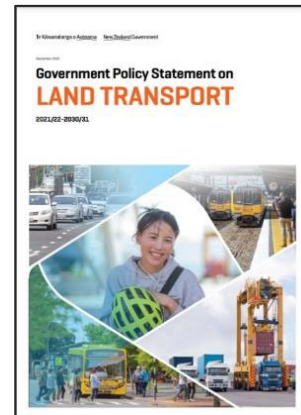
This section provides summaries of the key relevant national and local government strategic frameworks, policies and plans. **Error! Reference source not found.** on page **Error! Bookmark not defined.** also outlines LNIRIM’s alignment with these documents.

2.2 Government Policy Statement on land transport 2021-2031

This Government Policy Statement on land transport 2021-2031 (GPS 2021) outlines the government’s strategy to guide land transport investment over the next 10 years (2021/22-2030/31). It is consistent with the purpose of the LTMA 2003 ‘to contribute to an effective, efficient, and safe land transport system in the public interest’. It was released in September 2020 and informs the subsequent development of the National Land Transport Plan (NLTP).

Through GPS2021 the Government identified four strategic priorities for land transport investment, which NIRP fully aligns with. The strategic priorities are:

- Safety - developing a transport system where no-one is killed or seriously injured. NIRP, by offering a safer alternative to road transport would participate in saving lives.
- Better travel options - providing people with better transport options to access social and economic opportunities, would be supported by regional rail.
- Climate change - developing a low carbon transport system, by offering access to decarbonised rail services and shifting trips away from an ageing, polluting private vehicle fleet.
- Improving freight connections - improving freight connections for economic development. The provision of regional rail services would contribute to freeing the road network at peak traffic times and ease the access of urban areas to freight. Long term investment in rail also benefits rail freight.



2.3 Te Waihanga - Rautaki Hanganga o Aotearoa, Draft New Zealand Infrastructure Strategy

The draft strategy describes the infrastructure issues New Zealand is facing. These include long term challenges like climate change and growing population as well as the opportunities posed by changing technology.

It sets a vision for the role infrastructure can have in supporting New Zealand’s future, and several objectives and recommendations for change.

The strategy is focused on five objectives to achieve a thriving New Zealand:

1. Enabling a net-zero carbon Aotearoa through greater development of clean energy and reducing the carbon emissions from infrastructure.
2. Supporting towns and regions to flourish through better physical and digital connectivity and freight and supply chains.
3. Building attractive and inclusive cities that respond to population growth, unaffordable housing and traffic congestion through better long-term planning, pricing and good public transport.
4. Strengthening resilience to shocks and stresses by taking a coordinated and planned approach to risks based on good quality information.



- Moving to a circular economy by setting a national direction for waste, managing pressure on landfills and waste recovery infrastructure and developing waste-to-energy options.



NIRP aligns with the objectives of the strategy.

In a direct way, it would contribute to enabling a zero carbon Aotearoa through decarbonised rail services and shifting trips away from an ageing, polluting private vehicle fleet.

It would support the strategy's objective to support towns and regions to flourish through better physical connectivity and freight and supply chain.

Rautaki Hanganga o Aotearoa also notes the pressures placed on the whole country by the consequences of underinvestment in rural communities:

Our infrastructure must adapt to our changing needs and aspirations.

The New Zealand of 2050 will be a very different place to live. Within the next three decades our cities could be home to 1.7 million new Kiwis, roughly the size of another Auckland. Our regions face considerable change too, with some parts of New Zealand growing, while others will need to adjust to declining populations. No matter where we live, technology will continue to bring us closer together, altering our expectations of how we connect to each other and the way we work.

In a less direct but perhaps more important way, NIRP and regional rail in general would contribute to the balanced development of Aotearoa by defusing the current demographic pressures contrasted across the urban – rural divide. This would happen by making land and communities along the NIMT more attractive as an alternative to urban sprawl. It would improve the efficient use of existing infrastructure and participate in reducing the need for further land development on the fertile land surrounding cities.

2.4 Te hau mārohi ki anamata, the Emission Reduction Plan for consultation

The first emissions reduction plan will be published in May 2022 and will set out the policies and strategies Aotearoa New Zealand will take to meet its first emissions budget, helping to transition to a low-emissions future in a way that is achievable and affordable.

The October 2021 consultation plan is highly supportive of decarbonised transport solutions and further supports the underlying intentions of making a better use of existing infrastructure, by avoiding carbon built, to achieve government's objectives.

NIRP fits with, supports or benefits from the following proposed strategies and policies:

- Developing a strategy to embed Te Tiriti o Waitangi (Treaty of Waitangi) principles in future emissions reduction plans.
- Developing an Equitable Transitions Strategy to drive a well-signalled and inclusive transition, which maximises opportunities and minimises disruption and inequities.
- Promoting business and job opportunities in low-emissions sectors.
- Integrating emissions reduction into land-use planning and investments as part of the resource management reforms currently underway.
- Integrating emissions into urban planning and funding.
- Introducing four transport targets³:
 - reduce vehicle kilometres travelled (VKT) by cars and light vehicles by 20 per cent by 2035 through providing better travel options, particularly in our largest cities
 - increase zero-emissions vehicles to 30 per cent of the light fleet by 2035
 - reduce emissions from freight transport by 25 per cent by 2035
 - reduce the emissions intensity of transport fuel by 15 per cent by 2035.
- Integrating land use, urban development and transport planning and investments to reduce transport emissions.
- Implementing mode-shift plans for our largest cities and begin planning for other urban areas.
- Improving the reach, frequency and quality of public transport.
- Providing national direction to deliver a step-change in cycling and walking rates.
- Supporting local government to accelerate widespread street/road reallocation to support public transport, active travel and placemaking.
- Making school travel greener and healthier.
- Improving access and travel choice for the transport disadvantaged.
- Investigating the potential for public transport, walking and cycling in rural and provincial areas.
- Enabling congestion pricing and investigate how we can use other pricing tools to reduce transport emissions.



³ Since the publication of the ERP, the New Zealand Government's pledge made at the United Nations Climate Change Conference (COP26) as gone beyond the targets presented here, reinforcing the strategic case for investment in decarbonised public transport.

- Ensuring further investment in additional highway and road capacity for light private vehicles is consistent with climate change targets.
- Implementing community-based solutions to make low-emission vehicles (including e-bikes) more accessible for low-income New Zealanders and others facing transport disadvantage.
- Introducing measures to avoid Aotearoa becoming a dumping ground for high-emitting vehicles rejected by other countries.
- Investigating how the tax system should be used to avoid disadvantaging clean transport options.
- Partnering on solutions to supply constraints for low-emissions vehicles.
- Determining whether there are legislative barriers to the use of some types of low-emission vehicles.
- Developing a Freight and Supply Chain Strategy.
- Implementing the New Zealand Rail Plan (...)

2.5 Lower North Island Rail Integrated Mobility (LNIRIM) Detailed Business Case.

The LNIRIM projects seeks the replacement of ageing fleets used for regional rail services to the capital on the Manawatū and Wairarapa lines.

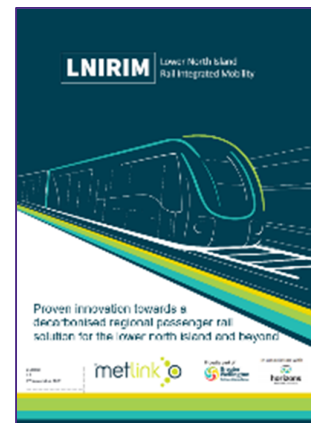
The DBC was completed in October 2021 and is currently being reviewed by funding agencies as part of the National Land Transport Plan (NLTP) and the Carbon Emission Reduction Fund (CERF).

The scope of the preferred solution includes a new fleet of 22 four-car tri-mode (electric, combustion ignition and battery) trains, a simulator to support crew training, a maintenance depot located at Masterton, stabling facilities located at Wellington, Masterton and Palmerston North, station upgrades north of Upper Hutt and Waikanae and allowance for additional passing loops and other track infrastructure.

The DBC includes detailed analysis of a wide range of service levels and rolling stock technologies that are highly relevant to the NIRP.

Beyond the technical relevance of the LNIRIM DBC for the NIRP's solution design, the GWRC DBC sets a timeline for investment, justified by the need for replacement rolling stock, that would see GWRC approach the supplier market in 2022 to allow for a new fleet to be in service in 2028.

This timeline is highly relevant to define the timing of NIRP as it identifies an opportunity for the GWRC LNIRIM investment to support other regional rail initiatives by designing the Wairarapa and Manawatu fleet in a modular way that would allow significant benefits to be realised on other lines, electrified or not.



2.6 Auckland Rail Development Plan (ARDP) Program Business Case

To assist with rejuvenating the Auckland Rail Development Plan (ARDP), Auckland Transport (AT) and KiwiRail are developing a PBC. It is to be consistent with Waka Kotahi's Business Case Approach (BCA while recognising AT's business case requirements). In parallel with the PBC, a Route Utilisation Strategy (RUS), also known as a Long-Term Planning Process (LTPP), is also being developed.

The 'Third Main' is a package of infrastructure upgrades currently taking place on the Auckland rail network. The scope incorporates a series of improvements between Quay Park and Wiri, including, in strategic locations; a third mainline rail track. The work is due to be completed in readiness for the City Rail link (CRL). The focus is on supporting the existing AT commuter rail network.

It was identified in earlier work, that peak time congestion free access through Auckland, for regional rail, will require an additional package of investment, defined as the "Fourth Main". Out of stakeholder workshops on NIRP, there is understanding at AT, on the importance of securing Auckland network pathways for regional rail. There is opportunity for regional rail including Te Huia and NIRP, to be aligned with the ARDP and RUS. It is proposed that there should be input into current planning and investment timeframes.

There is potential to achieve a 24/7 365 days-per-year 25-minute journey time between central Auckland and Papakura with regional rail rolling stock. This was the scheduled time for regional rail, up until the 1980s. Given current and future roading congestion, restoration of the Auckland-Papakura 25-minute journey time, will make a major impact on the customer appeal of regional rail such as Te Huia and NIRP.

2.7 COVID 19 Pandemic impact and recovery

The coronavirus 2019 (COVID-19) pandemic has had wide-ranging impacts on New Zealand. In terms of the impact of the COVID-19 pandemic on population projections, population is expected to grow almost 9 percent in the next 10 years, with an increasingly diverse and aged demographic. Population is expected to experience slowed growth in the near term (2021–23) due to the impacts of COVID-19, including reduced migration flows and economic activity in the region. Population growth will then likely recover to levels experienced in the region in recent years

In terms of the impact on the transport sector, COVID-19 impacted safety recommendations for public transport. Public transport patronage significantly decreased due to COVID-19 in the short term. However, the analysis of the COVID-19 impacts on land transport in New Zealand published by Waka Kotahi indicates that given the relative resilience of the economy, no significant changes are expected in the nature, scale and location of transport demand over the medium to long-term. The ten-year outlook for transport demand remains largely unchanged.

3 DEMAND DRIVEN CHANGE

CHAPTER SUMMARY AND CONCLUSIONS:

- The key problem NIRP aims to solve is a growing inability of the existing connectivity solutions to support an equitable development of rural communities and small townships necessary to balance constrained urbanisation.
- Professions, employment, and leisure activities are all transforming towards a more digital make up that changes communities. The places where people live, train, work, get treated or have fun change. While much of this change compounds the need for growth in urban centres, it also allows new opportunities for the revival of rural communities.
- Current systems of communication, transport and trade have been established as insufficient to provide the connectivity solutions necessary for a prosperous development of the communities along the NIMT.
- Freight and passenger transport systems are set to undertake a revolutionary transition to a decarbonised world but continue to be required to grow in volume and productivity. Facing the inevitable costs of transforming transport systems, New Zealand can maximise the value it creates and captures outside urban areas by exploiting the ability of its existing North Island Main Trunk railway line for Passenger Transport.
- Current investigations and procurement of Regional Rail Rollingstock open a unique window of opportunity to investigate the NIRP service in 2022 and enable the benefits of economies of scale and coordinated approach with network development and special growth areas.

3.1 A system thinking approach to NIRP

The constraints to the systems underpinning the development of Aotearoa New Zealand, including in land planning and transport network planning, are well documented and detailed in the context of Regional Rail in previous reports⁴. This analysis isn't reproduced in full detail in this high-level study. Further analysis of these systems and constraints would form part of a Business Case.

This section only provides a high-level identification of the key parameters pertinent to the NIRP initiative. It identifies a set of initial indicative problem statement that can be used to inform the inevitable conversation required to decide if NIRP should be further invested into. Some high-level indicative benefits and investment objectives that appeared through our analysis are also presented in a draft ILM format.

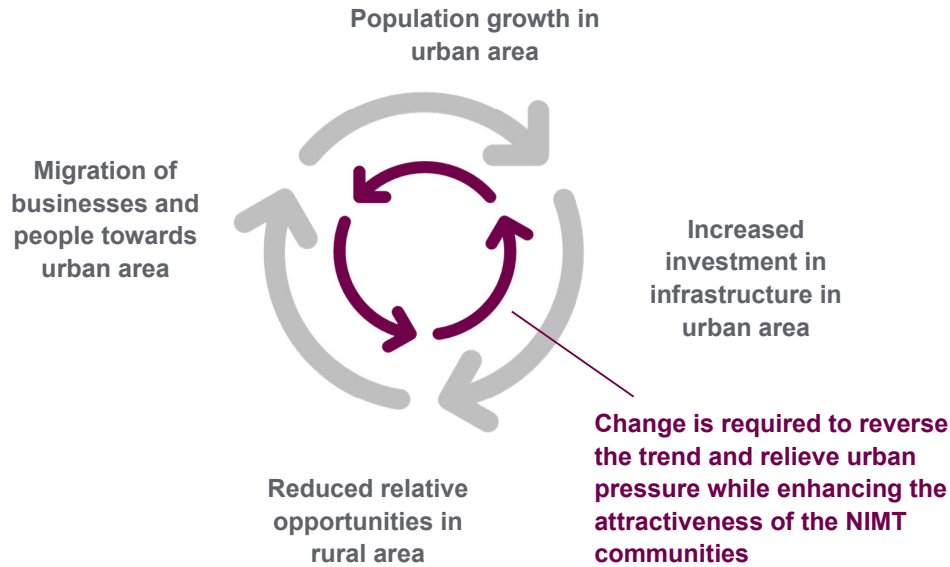
At the heart of the NIRP initiative is the idea that Transport needs are interrelated to Land planning needs. From an ethnographic perspective, people only need transport solution because they cannot fulfil all their needs where they are.

Professions, employment and leisure activities are all transforming towards a more digital make up that changes communities. The places where people live, train, work, get treated or have fun change. While much of this change compounds the need for growth in urban centres, it also allows new opportunities for the revival of rural communities.

Current systems of communication, transport and trade have been established as insufficient to provide the connectivity solutions necessary for a prosperous and sustainable development of New Zealand.

We only need transport solution because people cannot fulfil all their needs where they are.

⁴ High Level Feasibility Study Report, Regional Passenger Rail "CONNECTOR" Wellington to Auckland, December 2020 for KiwiRail and Hamilton to Auckland Intercity Connectivity, Interim Indicative Business Case, 7th July 2020



3.2 Change to re-balance Aotearoa

Roughly 2.5 million people currently live alongside the North Island Main Trunk (NIMT) railway line. According to information provided by StatsNZ (Tatauranga Aotearoa), more than three out of four people live in Te Ika-a-Māui - North Island. The population of North Island will increase by an average of 0.9 percent a year between 2018 and 2048, from 3.8 million to 4.8 million (medium projection). International case studies show that these population numbers can suit passenger rail networks.

Freight and passenger transport systems are set to undertake a revolutionary transition to a decarbonised world but continue to be required to grow in volume and productivity. Facing the inevitable costs of transforming transport systems, New Zealand can maximise the value it creates and captures by these investments outside urban areas by exploiting the ability of its existing NIMT railway line for Passenger Transport.

NIRP intends to reverse the current trend and relieve urban pressure while enhancing the attractiveness of the NIMT communities. While doing so it provides the crown an opportunity to fulfil its Te Tiriti o Waitangi engagement through restorative development on the central north island.

NIRP can participate in providing a new life to many communities along the NIMT.

As a result, Māori communities that wilfully provided access to their land in 1885 in exchange for the promise of economic benefits may have a chance to see their tamariki grow and flourish on their land rather than in a distant city.

However, Aotearoa New Zealand must invest into Passenger Rail only if it is proving to be advantageous to other transformative investments into its future. Resources are constrained. As rail investments are typically initially capital heavy and only return benefits in the very long term. Investment in rail therefore bear a large opportunity cost on benefits which makes their net present value low.

3.3 NIRP customers and beneficiaries

To demonstrate its viability and advantageous benefit to cost ratio, NIRP will have to demonstrate its ability to create places of opportunity, and connect people to places, in a thorough Business Case process. To justify a sizeable investment, a deep understanding of the customers of NIRP is required to inform the quantifiable benefits expected from the investment.

3.3.1 Customer Profiles

Although around 2.5 million people currently live alongside the NIMT, the numbers are heavily weighted towards the Northern end, and to a lesser extent, the Southern extremity of the NIMT railway line. However, the mission statement for NIRP is the equitable development of rural communities and small townships necessary to balance constrained urbanisation. From this dynamic, the following ideas may be observed:

1. Achieving critical mass on customer numbers in the short term, may rely on predominantly leisure travel between northern and southern conurbations. However, a much greater effort will be expected to be made than in recent times, on finding customers that will get on and off the train in rural communities and small townships
2. In the medium term, the size of the market will build towards a rural focus. A developing customer base will travel between rural communities, and small townships in the centre, and medium and large urban centres, located towards the extremities of the NIMT.
3. The long-term outcome must include attractive and well used connections, between thriving rural communities and small townships. NIRP can play a crucial role, in a resilient, de-carbonised and digitised Te Ika-a-Māui - North Island.

To address the task of re-balancing Aotearoa, NIRP investment decisions will be cognisant of the end goal. The implementation plan needs to support the strategy, with an evidence-based approach to gathering information, about who our customers are.

Essential to establishing the potential demand patterns for future rail travellers in the Connector areas, an analytics approach that addresses the market for the currently non-existent options will be required.

Traditional patronage demand forecast will not be able to forecast the development of services that do not yet exist. To get this detail right, rather than relying solely on basic research, a detailed analysis is required to address the specifics of customer profiling, combining a range of sources including demographic profiles via StatsNZ data, likely patterns of rural and regional users from rail demand research elsewhere in the world and, combining these with known customer data patterns from Wellington and Auckland feeder services.

Additionally bespoke customer research (both stated preference 'survey' data and econometric revealed preference, via conjoint analysis to empirically research elasticity values for rail travel across different segments).

The expectations of the output of this process will provide a set of market sizes of different customer types and a set of elasticity values for each of the segments. Only this approach can allow precise demand to be estimated at different fares and journey time interactions.

Institutional experience gained on work with Auckland and Wellington customers data, and demand patterns of rural/regional railway networks across the world is that:

- There will be a range of journey purpose users, including:
 - **business users** (travel for work),
 - **social users** (travel to visit friends/family),
 - **student users** (travel to/from school or university),
 - **tourist users**.

The key dynamics that will need to be addressed for each segment will be the propensity to pay and the service planning to credibly compete with alternatives (considering journey time, on-board amenity, stopping patterns, connection with other modes and price),

- There will be some "**never user**" (detractor) groups to be carefully identified and discounted, for whom the railway will never be something they will use,
- As with all segmented price models, there will need to be some consideration in terms of optimal pricing mechanism for segments without abstracting from other fares (e.g., stopping people with high propensity to pay from taking low-cost ticketing options),
- There will be some existing demand (which can be diverted from other current modes) and some induced demand (creating demand based on an offering level). The ramp-up of each demand type will need to be modelled over time. Destination marketing options may be included in this induced demand (potentially opening parts of the regions that will now have easier access from major cities).

- Both inbound and outbound (long-distance) and local service types, which are likely to have different patterns of use overall, should be included,
- Similarly, bespoke research will be required to identify demand for new service types (which is very hard to measure by survey as people don't necessarily know what they will do for unique or innovative service types when none exists now).

3.3.2 Special Growth Zones

When assessing the benefits associated with the NIRP initiative, some specific consideration should be given to special economic growth zones.

These could be specific investment types to 'supercharge' demand in certain areas, and could include, for example:

- central Government functions that could relocate to regions with high-quality transport services connecting major cities.
- Rail industry hubs including Passenger Rail and Intercity rolling Stock assembly and maintenance, facilitating economies of scale.
- Freight hub concepts designed to take freight off roads, connecting ports of Tauranga, Auckland, Taranaki and Wellington with a purpose-built central distribution hub, facilitating more efficient access to ports across the North Island.
- Specific park and ride locations, or car-train (transporting vehicles) hubs could be established (as is done in Europe or Australia) allowing passengers to consider taking their cars to their destinations. Electric cars might travel on predominantly electric freight trains, re-charging enroute. Passengers would travel by low-carbon regional connector train-sets.
- Central business hubs, manufacturing hubs or economic centres could be purpose-built around station precincts to induce demand and create a reason for travel. These would all be developed as mini-investment cases, where the economic benefits in terms of job creation or economic activity generation would justify the spend over the medium-term.

Overall, these types of inputs will build a set of demand profiles under different conditions to build a view of the potential demand that is likely to come from new train service types.

3.3.3 Digital Disruption in Retail

'Digital disruption in retail' is a global phenomenon that has changed how we shop over the last decade. COVID-19 has accelerated the growth of eCommerce, and a de-emphasis on "bricks and mortar" retail.

The trend to online retail could support the re-balancing of Aotearoa, away from exclusivity of growth within urban areas. However, rural Aotearoa requires a reliable, low-carbon delivery service as well as high-speed broadband.

The configuration of regional passenger rolling stock could allow for inclusion of a low-carbon retail freight support platform. Recent initiatives in Great Britain make use of the wide doors and level boarding typical of a regional rolling stock platform. This facilitates roll-on roll-off unitised freight handling.

Logistics hubs scaled to suit rural communities and small townships will be required. Upgraded railway stations might include luggage lockers for local drop-off, pick-up and distribution. The skills of a specialist retail courier freight partner will be essential in the design and operation.

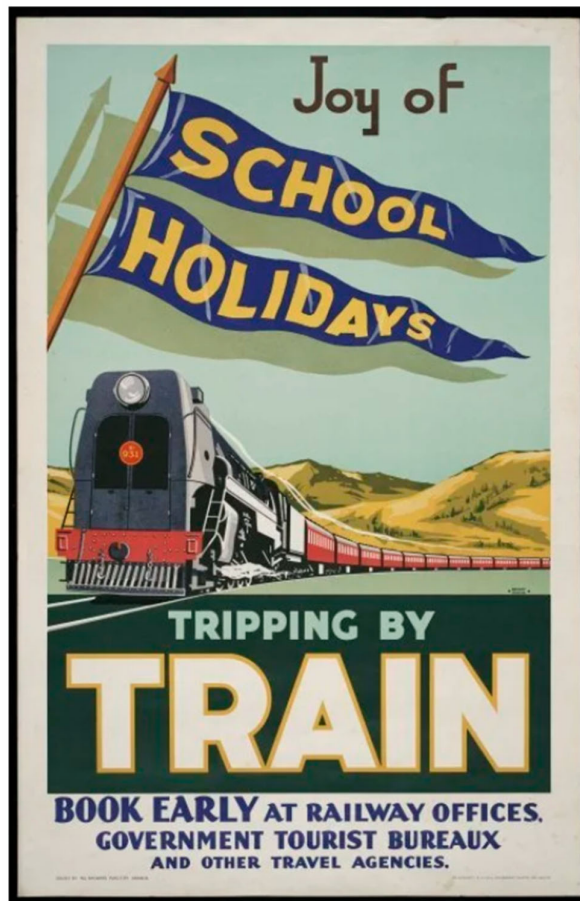
Within the context of the overall NIRP plan, the incorporation of a unitised retail freight element, may support the economics of minimum service frequency thresholds for passenger service. As outlined in Section 4.2, three services each way per day, are considered to be the minimum frequency needed. Lower levels of service are insufficient to change travel habits.

3.3.4 Leisure rail

Access from large cities by leisure rail enables measurable economic development, for rural communities and small townships.

Leisure rail, including but not limited to tourism, has been the core market for New Zealand's long distance passenger rail services in recent decades. KiwiRail's South Island trains strongly target international visitors. However, the NIMT Northern Explorer, the Metlink Wairarapa service, or the Saturday Hamilton to Auckland Te Huia service, all carry a substantial number of domestic leisure rail customers. Access for regional communities; through a "leisure rail" component, to special events in larger cities, has consistently proven to be popular. Leisure rail is safe, sociable and a low-carbon mode of transportation. A 2015 Ruapehu District Council commissioned study demonstrated an associated \$200 value to an average visitor night with regional rail, and up to \$500 per visitor night, for high ends travellers spending on activities and accommodation.

NIRP, linking the northern and southern conurbations of the NIMT, can provide connectivity to a wealth of recreation activities in the central regions and be part of the "slow travel" movement, putting an emphasis on authentic and sustainable connection: to local people, cultures, food, events, sports and outdoor pursuits.



New Zealand Railways. Publicity Branch: Joy of school holidays, Railway Studios. Issued by New Zealand Railways Publicity Branch. By authority, E V Paul, Government Printer, Wellington [ca 1940]

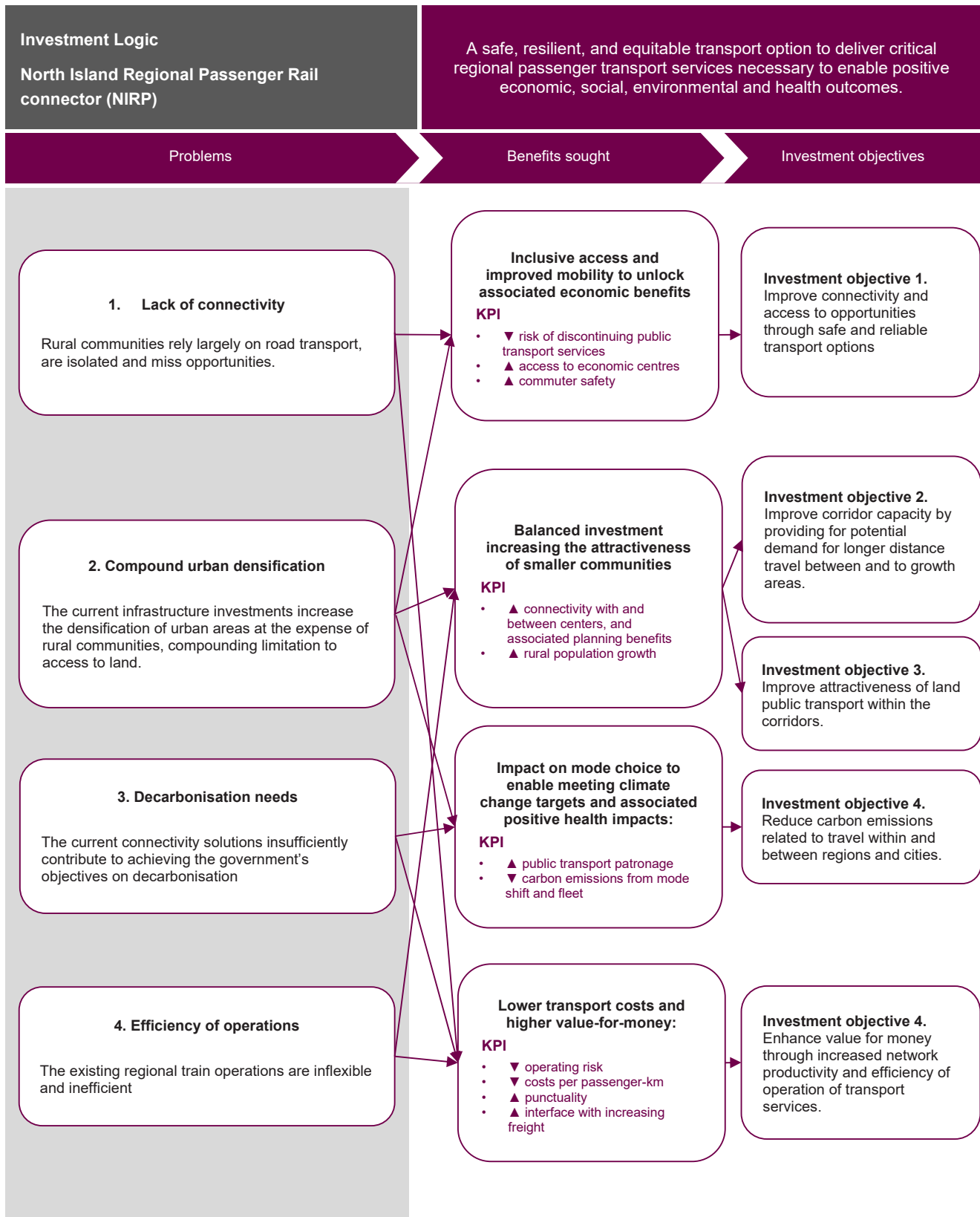
3.4 Investment Logic

The **overall problem** that an investment in a north island regional passenger rail service is aiming to solve is a growing inability of the existing connectivity solutions to support an equitable development of rural communities and small townships necessary to balance constrained urbanisation.

The overarching problem can be further defined and articulated as follows:

#	Problem	Causes	Effects
1	The current connectivity systems are not providing safe and equitable transport solutions to communities living outside of urban areas	<ul style="list-style-type: none"> Most communities rely uniquely on road transport. Most investments in alternative connectivity are focused on fast growing urban areas. of the rolling stock has approached 50 years in age Digital connectivity alone is not sufficient to access all opportunities 	<ul style="list-style-type: none"> Increased risk of inability to connect regions with social and economic opportunities Increased road safety risks Limited accessibility Longer travel time
2	The current infrastructure investments are focused on fast growing urban areas.	<ul style="list-style-type: none"> Infrastructure Investment Prioritisation Methods favour higher impact investment to long term planning solutions The population of rural township communities is decreasing, making the case for investment in better connectivity solutions harder by current prioritisation methods. 	<ul style="list-style-type: none"> Population growth in urban areas is fuelled by population migration toward well connected areas, compounding the causes of the problem. Reduced economic development of non-urban areas. Limited potential to release affordable land for housing. Communities are split by migration of younger generations. Decreased transport network resilience
3	The current regional public transport services insufficiently contribute to achieving the government's objectives on decarbonisation	<ul style="list-style-type: none"> Higher emissions from road transport Incentivisation on unaffordable EVs will increase the average age of private vehicles Retrofit to meet modern standards is uneconomical and technically challenging 	<ul style="list-style-type: none"> Increased emissions for longer periods Investment in road transport anchors higher emissions for longer
4	The existing regional train operations are incompatible, unconscionable, and inefficient	<ul style="list-style-type: none"> Fleets' incompatibility Separate operations Complex operational and maintenance arrangements Limited locomotive performance capability and fleet incompatibility High cost of recurrent refurbishment approach past expected lifespan. 	<ul style="list-style-type: none"> Poor network coverage. Poor attractiveness Failure to meet latest crashworthiness and accessibility standards Reduced reliability and punctuality Reduced interoperability Higher maintenance and operational costs

We present below an initial indicative mapping of the NIRP investment to be further refined through a future business case process.



4 OPTIONS FOR PASSENGER RAIL CONNECTION

CHAPTER SUMMARY AND CONCLUSIONS:

- The scale of change required to allow New Zealand to become the equitable, sustainable, and successful land it aspires to be justifies an equally bold approach to the investigation of passenger rail options. This must include the potential for extended networks and technologically advanced rolling stock technology.
- Current investigations into Intercity Services, coupled with life expiry of 1970s rolling stock used on Capital Connection and Te Huia focuses the long term purpose of an NIRP fleet on regional services as opposed to long distance connections. However, the NIRP initiative serves three purposes:
 - To be a ‘connector’ between Hamilton and Palmerston North, between Te Huia and LNIRIM.
 - To be an ‘integrator’ of services between Auckland and Wellington,
 - To be an early activator of patronage enabling demand growth for an intercity service.
- A minimum of 3 daily Auckland -Wellington return services is proposed by integrating 3 daily Auckland - Palmerston North return services delivered by a new fleet to the proposed LNIRIM fleet to promote patronage growth and mode shift.
- A fleet of 14 x 4 cars Tri-Mode Multiple Units should be considered initially with tri-mode fitting to avoid reliance on line electrification. A Maintenance Depot and Infrastructure upgrades (passing loops) will be required by a further analysis.

The scale of change required to allow New Zealand to become the equitable, sustainable, and successful land it aspires to be justifies an equally bold approach to the investigation of passenger rail options. This must include the potential for extended networks and technologically advanced rolling stock technology.

This chapter only defines a hypothetical scenario by presenting an overview of the key technical features of a proposed solution within a wider opportunity. It includes high level details of proposed services, rollingstock, associated facilities and infrastructure upgrades. The scope of the solutions considered in this study relate to the recent feasibility and planning work delivered in the sector over the past years. Several studies and business cases related to passenger rail investments are relied upon and referenced but their content not reproduced. A Better Business Case approach to option selection ought to be followed in the future to confirm this initial analysis.

In response to the problems, benefits and investment objectives defined above, the proposed solution includes:

- the use of the initial service development pattern defined by the 2020 “Connector” High Level Feasibility Report, as a starting point for the definition of an initial service offer.
- the use of Electric Multiple Unit trains based on the specifications produced by the LNIRIM project as part of a Detailed Business Case completed in November 2021. Importantly, the scope of the LNIRIM studies underpinning the selection of its preferred option included the consideration that its design could become the basis of a “National Platform for Regional Rail”. Accordingly, LNIRIM’s option selection, service requirement analysis, rolling stock design and energy analysis are broadly accepted as relevant to this study. Together, they define an opportunity for New Zealand to leverage off the procurement of the LNIRIM fleet and thus benefits from the advantageous commercial terms that can be negotiated for a larger order. Accordingly, NIRP is an opportunity to influence the definition of this National platform.
- Consideration for the end of serviceable life of the current 1970s carriages used in the current Capital Connection, Te Huis and Wairarapa lines.
- Consideration for the potential development of intercity fast trains in the coming decades.

4.1 Frame of the opportunity

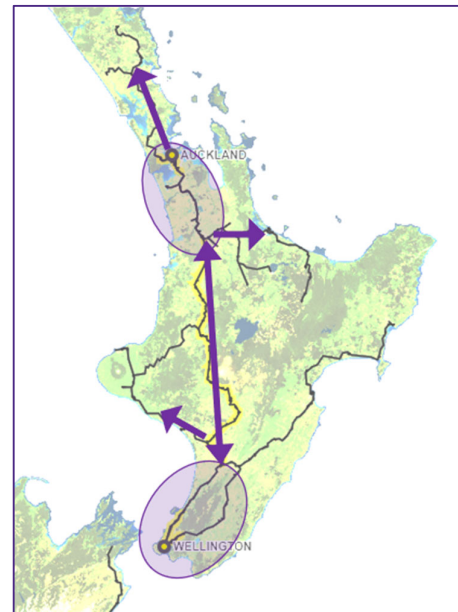
4.1.1 Network of links

Current passenger rail services have been centred on solving extended commuting issues south of Auckland and North of Wellington. These solutions are driven by benefits extracted from the reduction of congestion on the state highway network and have proven their ability to shape the development of land beyond urban centres.

Current investments in Te Huia and in the Lower North Island Rail Integrated Mobility (LNIRIM) Project are justified on maximising the opportunity to develop smaller urban centres by overflow from Auckland and Wellington.

To support Emission reduction, poverty and transport policy goals, the next generation of passenger rail investment must consider a less urban centric lens to the problem and will benefit from adopting a north island network approach to achieve an optimal impact on the long-term development of underused land by using innovative rail technologies.

A network extending from Whangarei to Wellington and from Wanganui to Tauranga initially appears to allow opportunities of scale.



4.1.2 Intercity vs. Regional services



The 2020 Interim Indicative Business case for the Hamilton to Auckland Intercity Connectivity initiative provides a strong analysis of the importance of an alternative to Air travel between the large urban centres of the North Island. It also highlights the importance of fast service between these destinations, indicating objectives that are very different from those of a regional service aimed at connecting rural communities to urban centres and between themselves.

Further, the indicative business case makes the case for a new corridor to be developed between the cities. A long-term extrapolation of the use of intercity rail suggest that a similar approach would be required to achieve an efficient Auckland Wellington intercity service. The resulting magnitude of such a project can be compared to other international projects and indicates a timeline for first intercity services in the mid to late 2030s. Adopting assumptions of a continuous development of the mode, a full Auckland Wellington Intercity fast rails service could be envisaged by the mid to late 2040s., as indicated in the National Passenger Rail Timeline below.

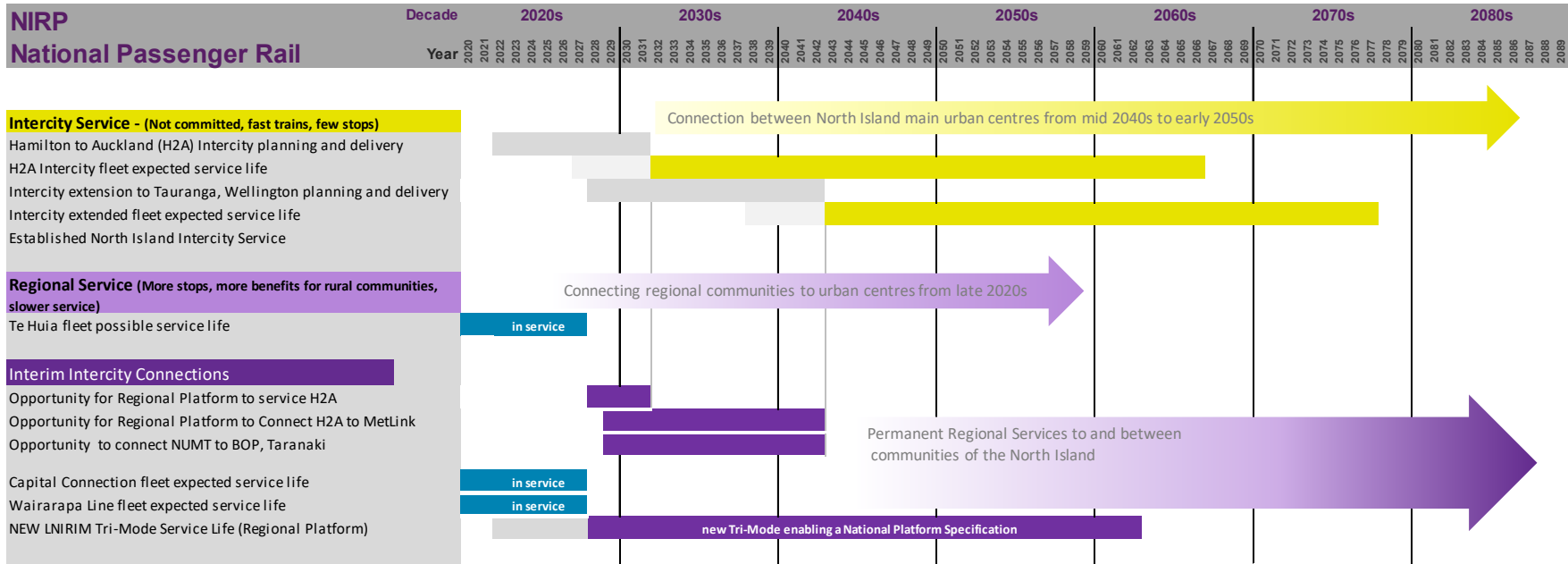
4.1.3 Initial benefits and long-term goals

The LNIRIM DBC provides a timeline built on the need for replacement rolling stock for the Wairarapa Line and Manawatu line that allows no delay in the procurement of Rolling Stock. The DBC also builds on supplier engagement and technical procurement advice indicating an earliest possible service start in 2028. This timeline is sufficient to define the time opportunity of NIRP and identify its levels of services as:

- A connector between Hamilton and Palmerston North
- An integrator of services between Auckland and Wellington
- An early activator of patronage enabling demand growth for an intercity service.



REPORT



The above timeline is indicative only and built from the sources detailed in previous sections. It is sufficient however to understand the opportunity arising from the LNIRIM Tri modes trains to be designed as a National Regional Rail Rolling Stock platform because:

- It would enable the production of alternate versions at low added costs that can establish a service across the North Island.
- It would mitigate the risk of low patronage development, inherent to all rail projects, by the resulting modularity of the fleet when considered as a national asset.

4.2 Service patterns and service options

The understanding of the supply side of the equation will be essential to the definition of a long-term service for the central North Island. Initially, a range of service patterns can be envisaged, that should be included in a future detailed analysis, articulating around:

- origin/destination pairs,
- journey times (duration),
- service frequency,
- timetable times (time of day),
- fleet type and comfort,
- interchange with rail,
- interchange with other modes.

All of these 'above rail' components have a requirement for some interaction with the "below rail" infrastructure (track etc.) which will also be modelled from a 'what is possible' perspective.

In a comprehensive set of scenario plans, the cost and benefit of capturing each demand type should be modelled (and then ruled in or out empirically based on criteria).

While departing from traditional transport planning modelling, an advanced simulation approach can quickly evaluate service pattern impacts, necessary infrastructure to deliver them and their likely benefits.

In a very practical sense, much of the rail network across the North Island is single track railway, which means that trains cannot pass each other (either faster passenger trains overtaking slower freight trains in the same direction, or trains coming from opposite directions). A full set of scenarios, including relatively minor infrastructure changes, such as adding additional passing loops for passenger trains or station platforms, can be evaluated to allow timetables that deliver enhanced benefits.

One such example could be considering a more frequent passenger service from Taumarunui to Auckland. The current line configuration will be quite restrictive in terms of freight movements because of the extensive single-track services. It may be that a 2-hourly service to Auckland via Hamilton would be worth considering on an induced-demand basis, but that operationally it would be problematic to get paths without disturbing freight train movements, but by placing a passing loop at Ongarue could allow that level of service (given the double-tracks within the Te Kuiti township).

Similarly, the cost of reinstating passenger or car freight facilities at the likes of Te Kuiti may allow the opening up of economic hubs or tourism that is currently restrictive.

These are just concepts, and the actual decisions would be based on the analysis of empirical data, but in considering the network, the following concepts would be expected:

- More frequent services to Auckland
- More frequent services to Wellington
- Connector services to the current Te Huia services
- A mix of stopping and express services to mix local traffic
- Freight hub between Hamilton and Te Kuiti
- Wellington/Auckland sleeper services
- Tourism hub at Ohakune
- Vehicle train services from the likes of Te Kuiti, Otorohanga, Ohakune, Palmerston North, Hamilton
- Military connection services to Waiouru.

There may be a number of blended options too, including, for example running passenger coaches on sleeper trains, allowing for early customer pick-ups for morning arrivals into cities. These will all feed a supply model which will identify how demand could be met under different scenarios.

4.2.1 NIRP “connector”

The 2020 “Connector” proposed service option (Connector mid plus⁵) included daily return trips provided through 2 consists. This service level is not significantly different than the current Capital Connection service between Palmerston North and Wellington. The service option proposed by the LNIRIM DBC for the Manawatu line is built on the detailed analysis of the patronage growth on the Manawatu corridor and shows that doubling the frequency of peak services and adding an interpeak service provides an optimal patronage growth.

Combined, these two studies suggest that a minimum service between Hamilton and Palmerston North should include a minimum of three consists in each direction every day. Relevant insight from the Te Huia service confirms that below a certain threshold, lower levels of service do not foster patronage growth.

NIRP ‘connector’ Service level alignment with other proposed or existing service options

Daily services	“Connector Mid Plus”	Capital Connection (current)	LNIRIM Extended service (Manawatu Line)	Proposed minimum “connector” NIRP service
Auckland to Wellington	1			
Wellington to Auckland	1			
Wellington to Palmerston North		1	5	
Palmerston North to Wellington		1	5	
Palmerston North to Hamilton				3
Hamilton to Palmerston North				3

A high-level estimation of 6 four cars Tri-Mode Multiple Units consists and 2 spares would be required to allow the proposed minimum initial NIRP “connector” service.

4.2.2 NIRP “integrator”

Beyond the possible “connector” role that an NIRP investment could take to link the existing Te Huia and Capital Connection services, there are advantages in framing an NIRP investment as an opportunity to integrate existing services into a unified Auckland to Wellington service.

The benefits expected from an NIRP investment would be best delivered early by maximising the initial customer pool on which patronage growth can be built. Using an Auckland to Wellington approach to NIRP service definition therefore allows appropriate consideration for the much larger size of market in the Auckland and Wellington conurbanisations, and the increased appeal an end-to-end service offers.

Further to section 4.1 above, the binary paradigm of an intercity service being fast between main urban centres, as opposed to a slow, rural connectivity focused regional service, would only become a reality in the 2040s. Until then NIRP can hold the role of integrator of service between Auckland and Wellington.

While its fundamental strategic objective, as described in section 2, would be the balanced development of Aotearoa New Zealand by defusing the current demographic pressures contrasted across the urban – rural divide, an interim objective related to the Auckland-Wellington service for the 2030/2040s period can strongly support the NIRP initiative.

Based on the minimum ‘connector’ service defined above and high level assumption on a largely similar pattern for the Hamilton – Auckland service, the NIRP ‘integrator’ initiative would require a total of 14 consists and 2 spares. This high level estimation is carried forward into the economic dimensions section below.

⁵ For a definition of the “Connector mid plus” service, please refer to the High-Level Feasibility Study Report, Regional Passenger Rail “CONNECTOR” Wellington to Auckland, December 2020 for KiwiRail

4.3 Rolling stock options

4.3.1 Current Capital Connection, Wairarapa and Te Huia rolling stock

The asset management practice of refurbishing 1970s rolling stock relied upon in the past decades has brought the current fleet beyond the end of its reasonably expectable serviceable life.

Most of the rolling stock in use for passenger rail outside of metro areas in New Zealand has approached 50 years in age. For example, the Wairarapa Line's rolling stock fleet of SW and SE type carriages and the Manawatū Line's S type fleet are refurbished and modified 1970s ex-British Rail Mark 2 carriages that entered New Zealand service in 2008, 2010 and 1999, respectively, and have reached the end of service life, which is currently being extended through costly refurbishments.

The modern standards and expectations for passenger rail services have evolved over the past decades.

It is uneconomical and technically impossible to retrofit the existing 50-year-old rolling stock with modern features, which are expected in a rail carriage. These include current international crashworthiness standards which feature crumple zones. A retrofit is not technically feasible because it would require a complete rebuild of the car body structure making it more economical to build brand new carriages.

Therefore, refurbishing second hand and third hand 1970s carriages has become an unconscionable short-sighted approach that results in:

- Reduced reliability negatively impacting patronage growth.
- Whole of life costs significantly higher than the purchase of new rolling stock.
- Increased maintenance costs to counter decreased reliability.
- Obsolete rolling stock safety standards.
- There are numerous tunnels, bridges, viaducts and narrow cuttings on the network. There is no provision for passenger evacuation out the end of the train on the current fleet.
- Service frequency constraints due to emissions in tunnels and air quality in carriages.
- A critical element in the justification for passenger rail investment, is support of carbon emissions reduction targets. The on-going use of gas-guzzling freight locomotives, that do not meet any emissions standards, on passenger rail service is untenable.

4.3.2 LNIRIM Investment and National Platform opportunity

The LNIRIM Preferred solution includes the purchase of 22 Tri-Mode Multiple Units. This option assumes utilisation of the existing 1600 V DC network in place on the Wellington commuter network and a CI engine as well battery on the non-electrified parts on the lines. The battery technology is expected to advance with the passage of time, allowing the battery range to be further extended in the later lifecycle of the trains, while reducing reliability on any form of fuel over time. It follows the high-level specification below:

LNIRIM rolling stock specification

Parameter	Requirement
New Zealand topography	Narrow gauge (1,067mm)
Fleet size	22 units
Formation	4 vehicles per unit. (Ability for operation in multiple units)
Length, width	Car length between 21-23 m, body width 2.75 m
Route compatibility	Wellington – Masterton (Wairarapa line) & Wellington – Palmerston North (Manawatū line). To comply with NRSS/6, potentially defining the foundations to a future national standard.
Service type	Regional
Train type	Tri-mode (1600 V DC + compression ignition generator + battery)
Pantograph	1 per 4-car unit

Parameter	Requirement
CI generator	390 kW x 2 per 4-car unit possibility, built to latest emissions stage, expected to meet Euro V standards (to be confirmed by manufacturer)
On board energy storage (OBES) range	700 kWh battery possible (80 km assumed) (to be confirmed by manufacturer)
Maximum speed	120 km/h (both 1600 V DC overhead line OHLE mode and self-power mode)
Regeneration / energy storage	Yes, minimising overall energy consumption, enabling emission-free station stops, dwells and restarts (emission free while any part of the unit is in the station)
Power supply changeover time	Automatic changeover with unit/train in uninterrupted motion.
Air conditioning	Yes
Driving cab	One at each end, offset driving position to allow end door access, space for instructor seat
Train Manager's office	Yes
Unit gangways	End door exit (allowing required tunnel evacuation)
Floor height	Low floor (at least two doors each side to cater for level boarding at a platform height of 680 mm above rail level, ARL)
Passenger doors	2 doors per side at ends (or equivalent to manage dwell times)
Powered bogies	Expected 4 of 8 per unit (to be confirmed by manufacturer)
Automatic selective door opening, and correct side door enabled	Yes
Dwell time	Expected 7 - 33 minutes (intermediary station)
Fixed seats	250 per unit
Wheelchair spaces	4 per 4-car unit
Storage	Overhead racks and luggage stacks, bicycle storage of 6 bicycles per 4-car unit
Toilets	2 in total per 4-car unit, 1 or 2 to be accessible
Catering provision	No

The LNIRIM DBC further states that *A key opportunity from the LNIRIM project is to exploit synergies between the Connector, Te Huia and LNIRIM projects, by designing the LNIRIM fleet as a national platform for Passenger Rail and leverage more advantageous supply conditions from train manufacturers by increasing the size of the order or including options for further units.*

In its Management Case, it outlines how the Benefits Improvement Working Group will be created to manage the interface between the LNIRIM project and other Stakeholders to identify and deliver initiatives that can enhance the benefits delivered by the investment. The listed initiative includes the assessment and scoping of potential opportunities of scales through the design of a National Platform for Regional Passenger Rail services. This will inform the LNIRIM Rolling Stock RFT and allow options for the supply of additional units to be integrated in its scope.

4.3.3 NIRP Rolling Stock

Building on the opportunities provided by the unavoidable LNIRIM investment, NIRP would engage with KiwiRail and GWRC, both members of the LNIRIM Governance Group's Benefits Improvement Working Group to influence the future National Platform for Regional Passenger Rail Standard. By doing so, LNIRIM will be able to extract significant modularity in design to allow for variations of specification on:

- Interior Design and configuration. This will allow the necessary differences between a commuter focused service and a connector service.
- Propulsion mode mix. This will allow the structural allowances required to fit vehicle bodies with a range of propulsion and energy solutions that best fit the short- and long-term constraints of the lines. In the case of LNIRIM, to dispense of the Combustion Ignition generators required initially to cover the non-electrified distance to Masterton and Palmerston North.

An NIRP Rolling Stock, using the same shell than the LNIRIM service could therefore be fitted with bespoke features tailored to the needs of its users and be powered by 25KVAC overhead lines across the central north island to both Hamilton and Palmerston North.

A national approach to the regional rail opportunity may however favour maintaining the LNIRIM Battery and CI configuration with a 25KV system instead of a 1600VAC source, to reach beyond Hamilton to Auckland and Tauranga. This would similarly allow a design for a Taranaki service from Palmerston North via Wanganui.

A range of configurations across a national fleet would also allow the connection of units using different power source to facilitate timetable integrations between zones. It would improve service offers by, for example, allowing an Auckland 25kv tri-mode to travel to Wellington central by connecting to a 1600V Tri-mode unit from Palmerston North.

As the battery packs fitted on commercial Tri-Mode Multiple Units need replacement after 8 to 10 years, these trains would all be designed to allow the retrofitting of different power packs at lower costs. LNIRIM envisages to use this approach to remove CI generators once battery technology advances allows or if the NIMT was to be fully electrified.

4.3.4 NIRP Maintenance Depot

The proposed solution would include a new depot facility to support the associated new rollingstock. A maintenance strategy detailed in further study would drive the specifics of the future depot requirements. However, it is possible to note that a project including a small fleet tends to attract high costs if it requires a dedicated depot. Several solutions can be explored to identify alternative solutions:

- Use existing depot facilities and fit them with the appropriate maintenance equipment.
- Use new depot facilities built and equipped for similar trains.
- Invest in a larger depot and provide maintenance services to other fleets of similar trains.

With consideration for the LNIRIM preference to build its depot at the end of the Wairarapa line, in Masterton, the approach to the selection of maintenance facilities for the NIRP initiative is likely to exclude the use of the LNIRIM depot. If long term investment in regional rail is committed, it is likely that a maintenance depot built along the NIMT would be preferred to cater for the long-term development of regional rail services. A maintenance depot located at Taumarunui would likely offer the advantages of a central location and similar synergies with those provided by Masterton for the LNIRIM depot.

4.3.5 Network upgrades

Network upgrades are likely to be required to enable passenger services to operate along the freight services. A detailed analysis of service patterns, as described in 4.2 above, will identify such needs. This was not carried out as part of this high-level feasibility study.

The high-level feasibility study brings attention to the opportunities for alignment between NIRP, and network upgrades, envisaged within the Auckland Rail Development Plan. There may be similar possibilities in achieving synergies with long term Greater Wellington network plans for the Kapiti Coast rail corridor.

5 ECONOMIC, FINANCIAL, COMMERCIAL AND MANAGEMENT CONSIDERATIONS

CHAPTER SUMMARY AND CONCLUSIONS:

- Initial high-level estimates of costs and benefits indicate a realistic possibility for a 0.9 to 1.3 Benefit-Cost Ratio.
- The economic profile of the NIRP opportunity improves when it is considered as part of a programme of investments, suggesting an opportunity for the government to consider a Programme Business Case approach for further investigation the NIRP initiative.
- A thorough investigation of benefits that can be secured from NIRP will have to include a clear definition of benefits beyond those gained by commuters and road users to include long term community benefits not typically quantified.
- Timing of the NIRP initiative is essential to meet the opportunity offered by the LNIRIM investment, suggesting that a fast-tracked Business Case for investment in the 'connector' and Te Huia services 'rolling stock may be appropriate.

5.1 Economic dimensions

New Zealand must invest into Passenger Rail only if it is proving to be advantageous to other transformative investments into its future.

This high-level feasibility study has not included a complete Cost Benefit Analysis that will be required to justify an investment of public funds. However, it provides below an outline of some high-level indicative ranges of costs, benefits, Benefit Cost Ratio, and Net Present Value for the purpose of providing a base for discussions only.

At a high level, the application of the Waka Kotahi MCBM to the NIRP 'connector' proposed solution outlined above unsurprisingly results in a low benefit cost ratio and a net present cost. This is expected since transformational investments in rail outside of the congested urban area are typically disadvantaged by the accepted method for the evaluation of benefits.

Assessed as 'connector', in isolation from LNIRIM and Te huia, NIRP would likely have a BCR of 0.3 with a significant negative net present value.

NIRP 'connector' high level economic appraisal (Indicative range only, PV, \$m)

NIRP 'Connector' (8 units, high end \$ range)	
Total costs (PV)	\$500m
Avoided costs (PV)	-
Net costs (PV)	\$500m
Total benefits (PV)	\$175m
BCR	< 0.3
NPV	-\$325m

An outline of the high-level cost assumptions used for this approximative assessment can be found in the cost section below.

Assessed as an 'integrator' however, in combination with the LNIRIM and Te huia initiatives, NIRP would likely have a much higher BCR and a more palatable net present value. The expected effect of a network-wide analysis would likely return a BCR superior to 1 for a full analysis of regional rail between Auckland and Wellington.

REPORT

A detailed economic appraisal of selected combinations of North Island service patterns, as described in section 3, is required to establish the economic value of NIRP. To inform the conversation required to fund further analysis, a high-level estimation of that integration can be outlined as below:

NIRP 'integrator' high level economic appraisal (Indicative range only, PV, \$m)

	LNIRIM (22 units)	NIRP 'Connector' (8 additional units)	NIRP 'Te Huia' integration (6 additional units)	Combined analysis Auckland – Wellington + Wairarapa (36 units)
Total costs (PV)	\$1066m	Up to \$500m	Up to \$450m	Up to \$2020m
Avoided costs (PV)	\$803m	-	Marginal	\$803m
Net costs (PV)	\$263m	Up to \$500m	Up to \$450m	Up to \$810m
Total benefits (PV)	\$481m	Circa \$175m	Circa \$450m	Circa \$1110m
BCR	1.83	From 0.4	From 1	From 0.9 to 1.3
NPV	\$218m	-\$325m	Balanced (\$0)	-\$107m

All quantified costs and benefits in the table above are to be taken as indicative high-level estimates only and should not be relied on for the purpose of investment decisions. An outline of the high-level cost and benefits assumptions used for this approximative assessment can be found in the cost and benefits sections below.

5.1.1 Benefits

The real value of an investment of rail should be including further benefits, in particular the increased value of land in rural areas that would develop from the revive local economy brought by the investment. The assessment of this land value benefit should also contribute to a full analysis in a future Business Case.

Increasingly around the world, rail services are being used to unlock economic potential of regions. Rather than stand-alone economic models that work separately from transport plans, NIRP and other regional passenger rail investment require the development of an integrated economic benefits model.

This NIRP Economic Benefits "Handbook", would be based on the empirical research detailed above, combined with the already existing economic benefits modelling done by Kiwirail, Waka Kotahi, GWRC and other participating councils and central Government bodies.

This would build a model that bakes in the economic benefits from different service patterns, which can be used on an ongoing basis to evaluate new service types. This would in effect form a handbook for the region, or the whole north island, to consider the implications of different service types and the segmentation models, allowing a very rapid initial assessment of potential under different circumstances.

This handbook would form the basis for a long-term investment approach in enhanced rail services befitting a low-carbon future for economic development.

5.1.2 Costs

Benchmarking of the NIRP 'connector' solution defined above against recent LNIRIM DBC data allows the following indicative cost range breakdown:

NIRP 'connector' Indicative range of capital costs, proposed solution (undiscounted, \$m)

Capital cost element	Indicative range
Implementation	2 to 3
Rollingstock	100 to 150
Infrastructure	50 to 70
Contingency (P50)	40 to 55 (based on LNIRIM QRA only)
Total	190 to 280

REPORT

NIRP 'connector' Indicative range of operating costs over 40 years, proposed solution (undiscounted, \$m)

Operating cost element	Indicative range
Operating	300 to 380
Maintenance	100 to 150
Network maintenance	25 to 45
Client/owners costs	5 to 9
Contingency (P50)	120 to 170 (based on LNIRIM QRA only)
Total	550 to 755

The costs provided above as a range are built on a high-level estimation of components related to the indicative description of an initial NIRP investment. It includes 8 four car Tri-Mode Multiple Units, a maintenance depot and an allowance for network infrastructure development and stations safety upgrades.

While very high level it is important to note that the range of costs provided would be impacted downwards by Economies of scale from a joint LNIRIM – NIRP – Te Huia procurement. Accordingly, and taking high level assumptions adequate at this stage of analysis, a summary of costs and benefits related to an NIRP 'integrator' service analysis would include the LNIRIM investment, the NIRP 'connector' investment outlined above and additional allowances for the Te Huia service.

With consideration for the ability of a LNIRIM tri-mode design to service non electrified parts of the network with minimal electrification infrastructure costs, and an assumption that network capacity improvement infrastructure requirement costs can be borne by the ARDP and other network improvement initiatives over time, a simplified quantification of the Te Huia integration can be summarised as:

NIRP Te Huia integration indicative range of capital costs, proposed solution (undiscounted, \$m)

Capital cost element	Indicative range
Implementation	1 to 2
Rollingstock	75 to 120
Infrastructure	Network capacity excluded, No depot or significant electrification required.
Contingency (P50)	30 to 50 (based on LNIRIM QRA only)
Total	100 to 180

NIRP Te Huia integration indicative range of operating costs over 40 years, proposed solution (undiscounted, \$m)

Operating cost element	Indicative range
Operating	270 to 340
Maintenance	90 to 135
Network maintenance	20 to 40
Client/owners costs	4 to 8
Contingency (P50)	100 to 160 (based on LNIRIM QRA only)
Total	485 to 700

Important note: all quantified costs and benefits in section 5.1 are to be taken as indicative high-level estimates only and should not be relied on for the purpose of investment decisions.

5.2 Affordability and alternative funding options

There are a number of value capture and alternative funding options which could potentially be implemented to defray the cost of the program.

Public transport projects often provide benefits to a broad range of beneficiaries beyond those that use the additional services provided. Examples include increases in local property prices (e.g., increase in local housing or retail property values because of additional transit amenity) and increases in local economic activity, productivity and profitability (e.g., increased profitability of local businesses due to increased accessibility or increased property development profitability due to increased transit amenity and planning changes which enable higher and better use). Value capture aims to share some of the increased value created by the project with government to defray the cost of the project.

Value capture is sometimes also coupled with changes in policy to affect desired changes in behavior (e.g., parking fee levy to defray the cost of the project but also to increase public transport and decrease private vehicle usage).

Value capture options

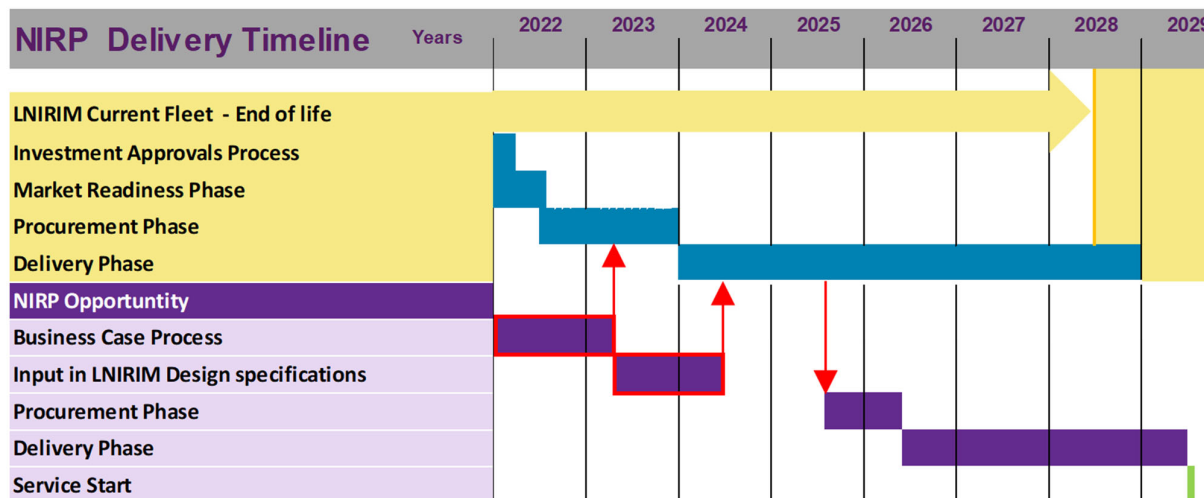
Mechanism	Description
Transport (public) transport infrastructure levy	<ul style="list-style-type: none"> • A broad-based levy (i.e., typically covering the whole of the local government area) used to fund a number of transport initiatives including the project. • Often collected via the local government rating system (although may be able to be collected by central government). • Mechanism does not have a direct nexus to project beneficiaries but rather all transport users in the region. • May require some exemptions. • Provides a relatively high, stable and potentially long-term funding source (albeit may be diluted as is normally justified to support a number of projects).
Benefit area levy	<ul style="list-style-type: none"> • A geographically focused levy (e.g., within walking distance to station) used to fund the project. • Often collected via local government rating system. • Mechanism does have a direct nexus via increase in property value and service level enjoyed by local property owners. • Can be focused upon certain property owners or all captured within the area (e.g., commercial properties only). • Revenue is stable and predictable and may be significant depending upon the application and the level of levy charged.
Developer contributions	<ul style="list-style-type: none"> • A geographically focused fee (e.g., within 400 metres of a station) used to fund the project. • Mechanism does have direct nexus via the increase in property development outcomes able to be achieved via the increase in transit amenity. • Recurring but potentially volatile revenue stream that relies on real estate development activity. • Potential to implement via existing infrastructure charging system, by a new regulated system or by commercial negotiation.
Parking fees	<ul style="list-style-type: none"> • A geographically focused parking fee (e.g., within walking distance to station) used to fund the project. • Can be applied to street or off-street parking facilities. • Mechanism does have a strong nexus to project however exemptions may need to be made (e.g., local residents and owners of commercial off-street parking facilities). • Revenue is stable and predictable.

There are also several potential alternative funding options which could be implemented to defray the cost of the project other than rates and taxes.

Alternative funding options are non-traditional funding options, which typically include additional charges or fees to users (e.g., public transport fare increase due to the increase in service provision) and or use of assets created by the project to generate revenue as well as providing services (e.g., advertising or station precinct development). The potential for private sector funding to supplement government and council funding and provide short term cashflow relief from financing delivery phase costs can also be considered.

5.3 Opportunity window and programme management

The LNIRIM DBC provides a timeline built on the need for replacement rolling stock for the Wairarapa Line and Manawatu line that allows no delay in the procurement of Rolling Stock. The DBC also builds on supplier engagement and technical procurement advice indicating an earliest possible service start in 2028. As discussed above this timeline sets the window of opportunity for NIRP to benefit from LNIRIM’s approach to the design of its rolling stock.



The indicative delivery timeline provided above shows that an NIRP Business Case process must be completed sufficiently early by mid-2023 for a potential NIRP procurement process to be built into the LNIRIM process by mid-2025 at the latest.

This commercial approach would de-risk significantly NIRP and LNIRIM by:

- Increasing the size of the order from 22 to 30, thus increasing more competition of the process
- Limiting design and development costs to a single occurrence, thus reducing the final cost per unit
- Strengthening the Regional Passenger Rail National Platform approach promoted by the LNIRIM governance group, including GWRC, KiwiRail and Horizons Regional Council.

Delaying the further study of NIRP beyond the window of opportunity presented by the LNIRIM investment will inevitably result in higher costs and delayed benefits.

6 CONCLUSIONS AND RECOMMENDATIONS

It is recommended that local and central government be informed by this High-Level Feasibility study and note:

- There is a realistic opportunity to successfully deliver a regional passenger rail service that will transform the communities located along the North Island Main Trunk Line, from Auckland to Wellington, to deliver the benefits sought.
- The window of opportunity to maximise benefits and minimise costs is tied to the LNIRIM Investment currently being sought by Greater Wellington Regional Council and Horizons Regional Council.
- Further analysis of the NIRP opportunity outlined in this high-level study, including its scale and scope, must start in 2022 and follow the Waka Kotahi business case approach to complete the assessment of the opportunity in time to participate into the LNIRIM procurement process.

Cover photography:

First sod lifted on the main trunk railway - This photograph⁶ was taken at the ceremony held on 15 April 1885 to mark the digging of the 'first sod' for the main trunk railway in Ngāti Maniapoto territory. The group stands at the confiscation line, the southern bank of the Pūniu River. Rewi Maniapoto, with a white beard and wearing a top hat, is in the centre behind the barrow. Immediately to the left is his daughter, Te Kore, behind whose shoulder stands the bearded figure of Premier Robert Stout.

⁶ Retrieved from New Zealand History website <https://nzhistory.govt.nz/media/photo/first-sod-lifted-on-the-main-trunk-railway>