Wiri to Westfield

The Case for Investment

WSP | Parsons Brinckerhoff

DECEMBER 2016

APPROVAL

PREPARED BY	REVIEWED BY	ENDORSED BY	ENDORSED BY
[redacted]	[redacted]		
Technical Executive	Team Leader	Proposal sponsor	P&I Case Manager
Date: December 2016	Date: December 2016	Date:	Date:

s9(2)(a)

REVISION STATUS *

REVISION NUMBER	IMPLEMENTATION DATE	SUMMARY OF REVISION
A	12/08/2016	Discussion draft
B	07/12/2016	Final draft

Delete revision status table on production of final version

TEMPLATE VERSION

REVISION NUMBER	IMPLEMENTATION DATE	SUMMARY OF REVISION

CONTENTS

EXECUTIVE SUMMARY

The Wiri to Westfield (W2W) section of the North Island Main Trunk railway (NIMT) in South Auckland is a key link in the national and regional rail network. It carries a mix of suburban passenger services, inter-regional freight trains and freight shuttles between Ports of Auckland Wiri. It is a major conduit for the movement of goods across New Zealand and a key public transport artery connecting South Auckland with the CBD and the wider region.

The current twin track configuration has reached the maximum operational capacity. At the same time, the parallel State Highway network operates over-capacity during extended periods of the day. Consequently the transport system in South Auckland is under significant pressure and suffers from poor levels of resilience.

To address this situation, NZ Transport Agency, KiwiRail and Auckland Transport have collaborated to prepare this Case for Investment. All parties acknowledge the need for additional capacity and improved resilience on the W2W section of the transport system, to deliver improved operational efficiency for both freight and passenger trains and cater for anticipated growth. A highly collaborative approach was adopted that involved the sharing of knowledge, the testing of ideas and the exchange of technical data to define the underlying problems and develop solutions.

As an exporting nation, the efficient movement of freight is critical to the economic health of New Zealand. The freight task is substantial, moving the equivalent of about 50 tonnes per year for each member of the population. It is also growing. According to the 2015 Government Policy Statement on Land Transport, New Zealand's freight task is forecast to grow by 58% in tonnes by 2042 with the greatest increases expected in Auckland, Canterbury, the Waikato and the Bay of Plenty.

Service reliability is fundamental to the overall efficiency of the national freight task and a high degree of reliability is required to attract and retain customers. This is particularly the case for rail freight, where 30 minutes is the threshold of 'on time'. Therefore it is imperative that significant bottlenecks on the system that adversely affect the reliable movement of goods across the country are removed. W2W is one such bottleneck.

W2W works together with State Highways 1 and 20 to provide the major transport links into Auckland from the south. These routes are operating close to or over-capacity. Auckland Transport anticipates a doubling of rail passenger throughput by 2025 which will create further demand for rail services. At the same time, the Upper North Island Freight Story forecasts a doubling of the Upper North Island freight task by 2035. This is likely to involve significantly more freight traffic moving into Auckland, together with additional shuttle freight movements between Wiri and the Port of Auckland.

The investigation undertaken by the project partners concluded that completing the 3rd Main Line for the W2W section of the NIMT would best meet the investment objectives for the project and to address the agreed problems affecting the network. This option is economically efficient, as the forecast benefits significantly exceed the expected costs, with a predicted Benefit to Cost (BCR) ratio in a range between 1.5 and 2.3. Completing the 3rd Main Line significantly reduces the W2W constraint by separating passenger and freight services on this critical section of the national rail network and in so doing it:

- creates additional train paths to accommodate the majority of forecast short to medium-term demand scenarios for both passenger and freight services – including those scenarios developed for the proposed post-CRL passenger timetable
- adds resilience into this busy section of the network – allowing the potential for continued operation of up and down train services during planned (i.e. maintenance) or unplanned shutdowns on any one particular line
- addresses the operational problems that arise from the current mixed use railway over the short to medium term demand forecasts

The 3rd Main Line between Wiri and Westfield is compatible with any future requirement for more capacity and operational flexibility on the critical portion of the Auckland rail network spanning the Port of Auckland through to Westfield/Southdown and further south to Wiri and ultimately to Pukekohe.   This would likely involve the construction of a 4th Main Line, possibly in combination with, or as a substitute for, other improvements at Westfield Junction which is another significant constraint in the Auckland rail network. The preferred timing for implementation of the 4th Main (or other intervention) was not the subject of this business case and continues to be assessed by Auckland Transport and KiwiRail as part of the Auckland Rail Development Program (ARDP) work.

Completing the W2W Third Main will immediately deliver the following outcomes:

- 300 hours pa freight travel time savings due to increased reliability
- 3 minute travel time saving for five million rail passenger journeys per annum
- Additional 3-car EMU made available for use on the network
- At least 400 fewer heavy vehicles on the State Highway network each week with associated decongestion and road safety benefits
- An increase in safety of this, one of the busiest sections of mixed traffic railway on the Auckland network, as non ETCS fitted freight trains will not be sharing the track with ETCS fitted EMUs
- A step change in the performance of the national freight rail network for key journeys such as Wellington and Tauranga to Auckland
- An overall increase to the public value of rail in New Zealand

The 3rd Main Line Project will unlock the benefits of previous investments in the national transport system, including improvements to the NIMT and the East Coast Main Trunk (ECMT) between Hamilton and Tauranga, by improving travel times and reliability for rail customers across New Zealand. It will also support planned improvements such as the Auckland City Rail Link, by complementing the additional capacity that will be introduced to the network. It will support land development and economic activity in the industrial heart of Auckland and the South Auckland Future Growth Zone by improving accessibility and the efficient movement for rail and road across the transport system.

Without improvements to the Wiri to Westfield section of the NIMT, the current mixed use section of rail will continue to adversely affect passenger and freight rail services, with additional delays and reduced reliability for customers and operators. As demand for transport increases into the future, the current network constraints will be further exacerbated, which in turn will suppress economic growth. Accessibility to the Onehunga / Penrose industrial area will be diminished. Opportunities for further development at the Port of Auckland will be constrained. Benefits from investment in the Auckland City Rail Link will potentially be diminished, as passenger trains from South Auckland will be restricted to the current level of service (which is already affected by delays imposed to provide access to freight trains). Additional timetable restrictions to freight services will likely be required to provide the level of service for expected post-City Rail Link passenger demand, further impacting the competitiveness of rail freight.

Overall, the outcome from implementing the 3rd Main Line between Wiri and Westfield will be to increase the public value of the national rail network and enhance the economic development of the Auckland Region. Without the 3rd Main Line improvement, the current bottleneck on this busy section of the transport network will impose greater adverse impacts as demand for travel by passengers and freight increases into the future.

As planning for the 3rd Main project continues further integration with the planning for the 4th Main should also occur to ensure that the design supports ultimate delivery of the 4th Main. Land acquisition is critical to this, and any land purchases or swaps done to support the 3rd Main should also include design of the 4th. As such preliminary design for the 4th Main should continue in lockstep with the 3rd Main design process. Furthermore, while the majority of the benefits of getting the 4th Main built early were assessed as being too far in advance of demand, the synergies between the two projects and some of the immediate benefits it would deliver suggest that further consideration of the preferred timing of the 4th Main (or some level of staged delivery) within the ongoing development of the Auckland regional rail network is warranted.

PART A – THE CASE FOR THE PROJECT

1 INTRODUCTION

1.1 Background

The Wiri to Westfield (W2W) section of the North Island Main Trunk railway (NIMT) in South Auckland is a key link in the national and regional rail network. It carries a mix of suburban passenger services, inter-regional freight trains and freight shunts between the Ports of Auckland and Wiri. It is a major conduit for the movement of goods across New Zealand and a key public transport artery connecting South Auckland with the CBD and the wider region.

The current twin track configuration (one up line and one down line) has reached the maximum operational capacity during peak periods as a result of the mixture of freight and passenger traffic. At the same time the parallel road network operates over-capacity during extended periods of the day. Consequently the transport system in South Auckland is under significant pressure and suffers from poor levels of resilience.

Improvement to the Wiri to Westfield section of the NIMT has been recognised as an important project in the Auckland Regional Land Transport Plan 2015-2025 and most recently in the Auckland Rail Development Programme (ARDP)[1]. It was also recognised as a critical factor in the Upper North Island Freight Story, the Ports of Auckland Future Study and the NZ Transport Agency East West Connection Business Case.

This Case for Investment follows principles of the NZ Transport Agency Economic Evaluation Manual (EEM) as far as possible, modified to recognise the specific features of the project. For example, international research has been drawn upon where appropriate to assess the relative costs and benefits of road and rail based transit. This case also makes reference to the emerging findings of the ongoing project to assess the wider Public Value of Rail to the national economy.

1.2 Developed in Collaboration

The Case for Investment has been developed as a collaborative effort between KiwiRail, the NZ Transport Agency and Auckland Transport, by applying the NZ Transport Agency Business Case approach. The key roles, interests and input to the business case are summarised in Table 1 overleaf.

---

[1] The programme of works in the ARDP (including enhancements to the rail network between Wiri and Westfield) have been included in the recent Auckland Transport Alignment Project (ATAP) recommendations

ORGANISATION	ROLE	INTERESTS	INCORPORATION INTO BUSINESS CASE
KiwiRail	Asset Owner Rail Network, Freight Train Operator Strategic Guidance: KiwiRail Turn Around Plan (2012)	Confirmation of freight train reliability and utilisation of train paths Confirmation of deteriorating performance due to increased demand for passenger services and mixed use operation	Mix of passenger and freight traffic sharing same tracks creates fundamental operational issues. Opportunity to separate the two types of traffic onto separate tracks would be very desirable.
NZ Transport Agency	State Highway Operator, NLTF Administrator, Business Case Process Strategic Guidance: Government Policy Statement on Transport (2015)	Statement of Intent to integrate road and rail to improve freight system productivity Recognition of EWC and its impact upon the Westfield Southdown Freight 'node' upon completion. Pressure for onward connections in freight supply chain	System based assessment of freight movement. Opportunity to get the 'right freight on the right mode' Consider Westfield / Southdown termini as a strategic 'node' within the freight supply chain, which is expected to become more attractive upon completion of EWC. Completion of EWC, including delivery of travel time savings is complementary to W2W as the next strategic link in the supply chain.
Auckland Transport	Auckland Region Transport Services including passenger train services Strategic Guidance: Auckland Rail Development Plan	Delays built into the passenger timetable to accommodate freight train paths. 'Clock face' operation not currently possible Desire to introduce 'semi-fast' passenger trains (not calling at all stations) in future	W2W section at operational capacity in peak periods Opportunity to develop tighter and more flexible passenger timetable in the future by separating out the two types of railway traffic Opportunity to operate additional passenger services in line with CRL business case and ATAP projections

Table 1 – Project Partners Roles and Interests

Through a series of meetings and workshops, a highly collaborative process was applied that involved the sharing of knowledge, the testing of ideas and the exchange of technical data.

All participants in the process acknowledged that steps need to be taken to provide additional capacity and improve resilience on the W2W section of the railway to cater for anticipated growth and to deliver improved operational efficiency for both freight and passenger trains.

It was decided that the investment case would:

- Confirm the core problem(s);
- Examine the consequences of not addressing the problem(s);
- Explore a range of solutions and their potential benefits;
- Recommend an option that delivers the investment objectives;
- Assess the potential benefits together with the parallel investigation into the public value of rail to the New Zealand economy

Key elements of the business case were developed through the workshops including the identification of problems and benefits, the development of alternatives and consensus building around the recommended option.

Operational details for the railway were provided by KiwiRail together with data to support the freight traffic demands. Auckland Transport provided travel demand forecasts and network analysis for train paths, network delays and regional demand forecasts.

2 STRATEGIC CONTEXT

2.1 National Context

As an exporting nation, the efficient movement of freight is critical to the economic health of New Zealand. The freight task is substantial, moving the equivalent of about 50 tonnes per year for each member of the population. It is also growing. According to the 2015 Government Policy Statement on Land Transport, New Zealand's freight task is forecast to grow by 58% in tonnes by 2042 with the greatest increases expected in Auckland, Canterbury, the Waikato and the Bay of Plenty.

The freight logistics industry has been going through rapid change in recent years. In line with global trends there has been a move towards more consolidated operations utilising hub and spoke arrangements. For example, the inland terminals at Wiri and Southdown distribute container based freight shuttled in by rail from Port of Auckland and Port of Tauranga respectively.

Figure 2 - National Rail Network

Freight customers now look for transport solutions that are integrated across the whole supply chain and utilise the wider transport system to deliver goods on time and in a cost effective manner. Road, rail and, to a lesser extent coastal shipping, all have a role to play, with the relative mode shares driven by the timeliness and cost efficiency of each mode.

Service reliability is fundamental to the overall efficiency of the national freight task and each transport mode has to have a high degree of reliability to attract and retain customers. This is particularly the case for rail freight, where 30 minutes is the threshold of 'on time' for KiwiRail's freight performance reporting to customers and stakeholders. For rail freight to play a significant role in the national freight task, it is therefore imperative that significant bottlenecks on the system that adversely affect the reliable movement of goods across the country are addressed. W2W is one such bottleneck.

2.2 W2W A Major Constraint in the National Network

W2W is a vital link in the national rail network. Each year some 4-5 million tonnes of freight pass through this link, equivalent to approximately-15% of HCV freight on State Highway 1 at Mt Wellington.

The North Island Main Trunk (NIMT) is New Zealand's most important rail route. It connects Auckland to Hamilton, Palmerston North and Wellington. At Hamilton, the connecting East Coast Main Trunk (ECMT) provides access to Tauranga, which is New Zealand's largest export port. At

Wellington, the Inter-Islander ferry provides an onward connection to the South Island, completing a strategic rail freight network linking Auckland with Christchurch and beyond.

In 2010, KiwiRail's Turn-around Plan identified the need to reduce freight transit times between Auckland and Wellington from 13.5 hours to 11.5 hours to maintain competitiveness with road freight, which takes around 9 hours for the same journey. Improved operation and access to and from terminals and other rail facilities are important in achieving this goal.

The NIMT through Auckland, including the W2W section, plays a crucial role in New Zealand's economic performance. The NIMT north of Hamilton and ECMT are the most heavily used part of New Zealand's rail freight network. Within this network, the double-track W2W section is increasingly constraining freight movements between Auckland and Tauranga, Wellington and the South Island.

Having now reached its operational capacity, W2W is a well- known bottleneck in the national rail network. It leads to increasingly unreliable freight services and creates inefficiencies (and therefore extra costs) in the logistics supply chain. A typical example of the problem being caused is seen with northbound freight services heading into Auckland. In the three years from July 2013 to June 2016, some 600 freight services that were measured as on time on the outskirts of Auckland were then delayed beyond the acceptable "delivery within 30 minutes" customer promise following the traversal of the W2W constraint area.

2.3 Regional Context

W2W works together with State Highways 1 and 20 to provide the major transport links into Auckland from the south. These routes are all operating close to or over-capacity causing significant delays for large parts of the day. Auckland Transport anticipates a doubling of passenger throughput by 2025 which will create further demand for rail services. At the same time, freight demands are expected to double by 2035. This is likely to involve significantly more freight traffic moving into Auckland, together with additional freight movements between Wiri and the Port of Auckland.

The passenger timetable for the South Auckland Rail Lines is compromised by freight and passenger rail services sharing the W2W corridor. Passenger train delays are built into the timetable to accommodate freight train paths, to the extent that some 5 million passengers per annum experience journey times at least three minutes longer than would otherwise be the case.

The interaction of passenger and freight trains also causes unreliability in journey times for freight services travelling through the W2W corridor, which results in further unscheduled delays to passenger services. For example, in the 4 months between February and May 2016, approximately 600 rail passenger services were delayed.

W2W Rail Network

As shown in figure 2, the northern end of the W2W lies within the industrial area south west of Mount Wellington. This area encompasses the Southdown Container Terminal including the MetroPort Terminal at Westfield. The MetroPort Terminal caters for Auckland-based road to rail transfer for freight traffic to and from the Port of Tauranga.

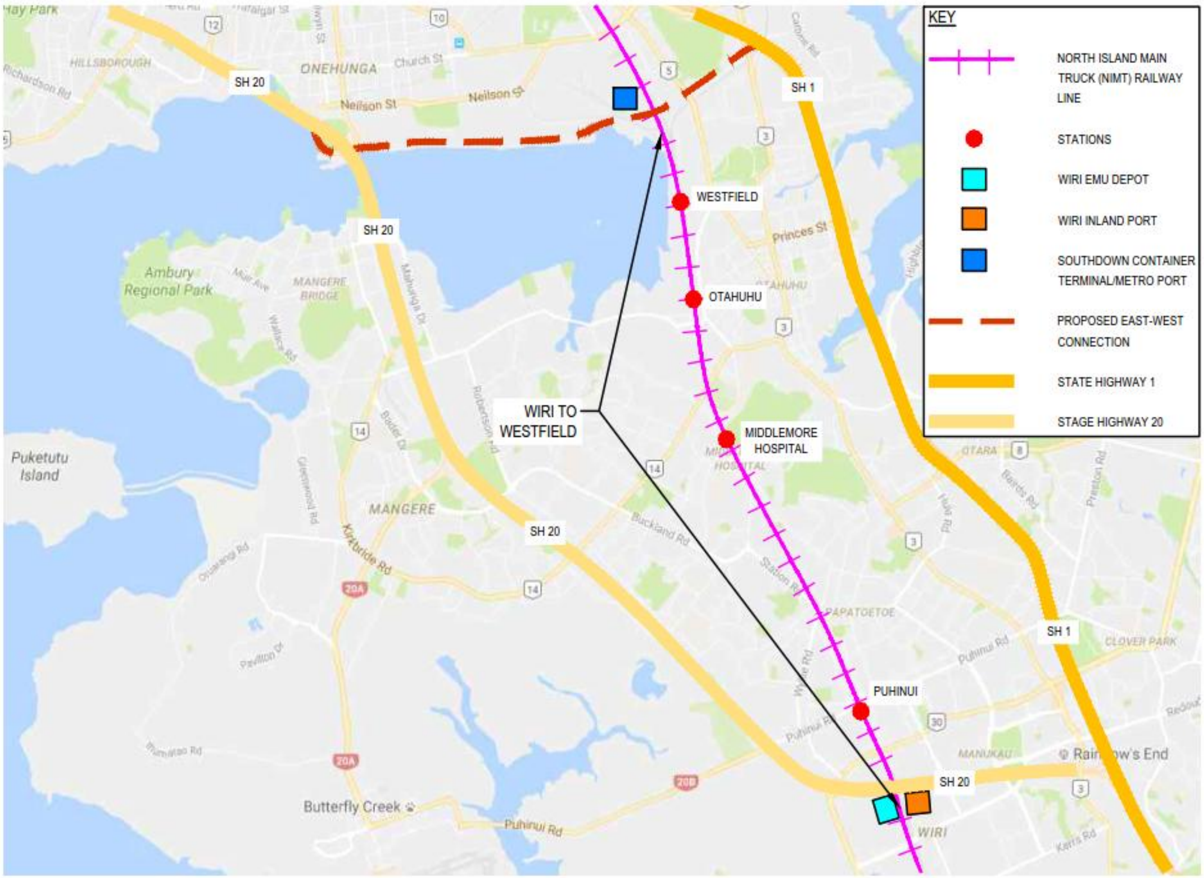


Figure 3: Regional Context

Heading south, W2W passes through the residential suburbs of Middlemore and Papatoetoe, each of which is served by a railway station. These residential areas generally have a higher demand for public transport services by comparison to the rest of Auckland. Therefore, passenger rail services in the area provide important transport links for local communities to employment, education and other social amenities.

Middlemore Station is situated immediately adjacent to Middlemore Hospital, which is the largest hospital in Auckland. It employs around 4,700 staff and serves a catchment area with a population of over half a million people. The rail link provides an important public transport connection for patients, staff and visitors.

The Wiri Inland Port lies at the southern end of the W2W section of the NIMT. The port caters for rail freight shuttle services to and from the Port of Auckland, which is transferred to and from road-based destinations in and around Auckland. The site of the Wiri Inland Port includes the new depot for the Electric Multiple Unit (EMU) passenger train fleet.

Strategic Road Network

Strategic road movements through South Auckland are catered for by State Highways 1 and 20. Figure 3 illustrates the current and forecast levels of service on the local state highway network from the present day up to 2046. This illustrates that even after completion of major road improvements in the area, traffic growth will result in the state highway network operating close to or over-capacity in future.

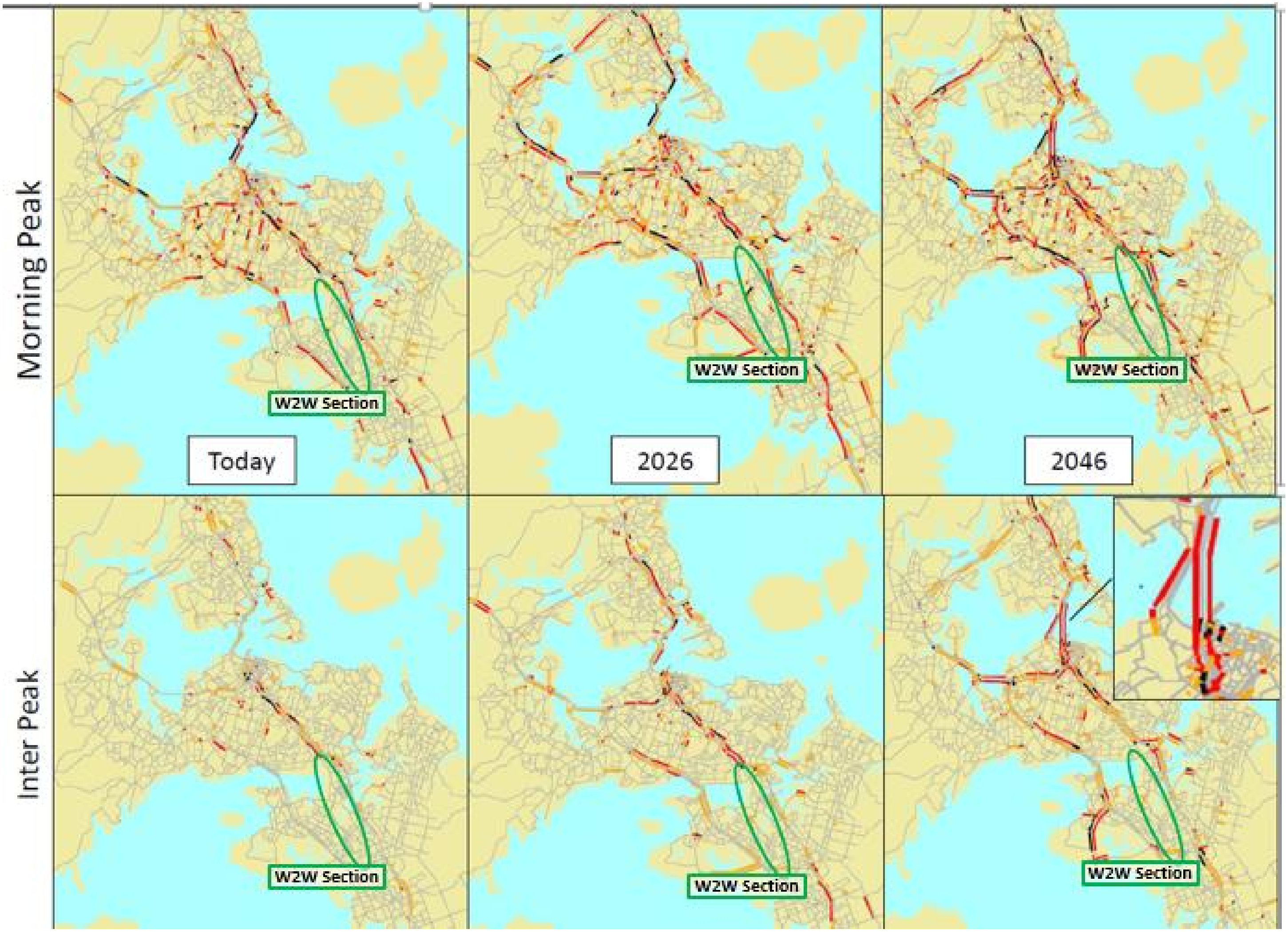


Figure 4 - Strategic Highway Network: Forecast Levels of Service (LoS)

Upper North Island Freight Story

The Upper North Island Freight Story was prepared by a group of local bodies and transport agencies to examine how to reduce the cost of doing business in NZ, through an upper north island lens. It highlights the strategic importance of Auckland and the immediately adjoining regions of New Zealand in generating over 50% of national GDP, and in turn, over 50% of the national freight task. The Upper North Island Freight task is predicted to double by 2035.

The Freight Story recognises the strategic importance of both road and rail links to provide north and south connections to the Port of Auckland. The benefits potential to be realised through future investment in Auckland’s north-south highway corridor is ranked as ‘High’ and the corresponding benefits potential for Auckland’s north-south rail corridor is ranked ‘Medium’.

The story recognises that increased public transport demand on the rail corridor will further limit freight capacity. Amongst proposed strategic responses, are

- A 3rd track on the Eastern Line, to the north-east of Westfield, as a short-term intervention (2013 to 2018)
- Triple tracking of the NIMT from the Port of Auckland to Wiri to Papakura as a long-term intervention (beyond 2023)
- Other interventions include City Rail Link, optimisation of the existing network and improved freight handling capacity within the port.

Strategic Employment Hub: East Tamaki / Penrose / Onehunga / Mangere

The industrial area bounded by East Tamaki, Penrose, Onehunga, and Mangere (highlighted in Figure 2) is recognised as being of strategic significance at a national level as an industrial hub. This area currently employs over 130,000 people and contributes more than $10bn annually towards New Zealand's economy. It provides a prime location for the MetroPort Terminal and Southdown Container Terminal at Westfield, due to the concentration and close proximity of end users such as manufacturing and distribution businesses and freight consolidators.

Recent changes in freight logistics and demand growth are contributing towards increased highway congestion in the Onehunga-Penrose area, resulting in increasing journey times and reduced reliability for the onward supply chain from Westfield. Increased consolidation of distribution activities, larger warehousing and distribution centres and increasing consumer demands for 'just in time' delivery are resulting in intensified use of the Southdown Container Terminal and Metroport.

The Auckland Plan identifies the Onehunga-Penrose area as a key employment area with future growth potential, and recognises proposed improvements to East-West Connections Project (EWC) between Onehunga and Penrose as one of the top three priority transport projects for the Auckland region.

East West Connections Programme (EWC)

EWC is a joint programme between the NZ Transport Agency and Auckland Transport, and is being progressed as an accelerated project. The programme has two key elements:

- A new staged highway connection between SH1 and SH20, to improve connections into and out of Onehunga-Penrose, including one or two potential intersections near the Metroport terminal at Westfield
- Bus Priority corridor between Māngere, Otahuhu and Sylvia Park.

EWC is aimed at improving freight efficiency, commuter travel and sustainable transport options within this area, and the business case for EWC recognises the significant benefits that could be achieved through improving connections to the State Highway Network. This would include benefits for the onward supply chain from the Southdown Container Terminal to the wider Auckland area, in accordance with the NZ Transport Agency's strategic priority to improve road-rail integration.

South Auckland Future Growth Zone

W2W is located within the South Auckland Future Growth Zone, where some 54,000 new dwellings and 23,000 new jobs are planned over the next 30 years between Manukau and Pukekohe. The area has a significant opportunity to leverage off the existing rail network.

Several transport projects proposed to support this future growth area will impact upon the W2W section. These include:

- A number of new railway stations to the south of W2W
- Park and Ride facilities at new and existing stations
- An extension of rail electrification from Papakura to Pukekohe
- Closures of a number of level crossings

Auckland City Rail Link (CRL)

At the time of writing in July 2016, construction has begun on the City Rail Link (CRL) project, which will double the current passenger capacity at the CBD terminal station at Britomart, by providing a continuous connection between Britomart and Mount Eden. This will result in a substantial increase in passenger trains throughout the entire Auckland rail network, including the Auckland Southern Lines through W2W to Manukau and Papakura.

The CRL is recognised as contributing towards a wide range of benefits, over and above direct user benefits such as improved accessibility and resilience within the wider transport network. These include modal shift from road-based transport, increased agglomeration, and improved labour supply to the CBD and influence towards encouraging sustainable land use patterns.

3 OUTLINING THE NEED FOR INVESTMENT

3.1 Problem Definition

Current Operations

As illustrated in Figure 4 below, the W2W section of the NIMT provides rail freight connections into the Southdown Container Terminal and the MetroPort Terminal at Westfield and the Inland Port at Wiri. The new depot for the Electric Multiple Unit (EMU) passenger fleet is located approximately opposite the Wiri Inland Port.

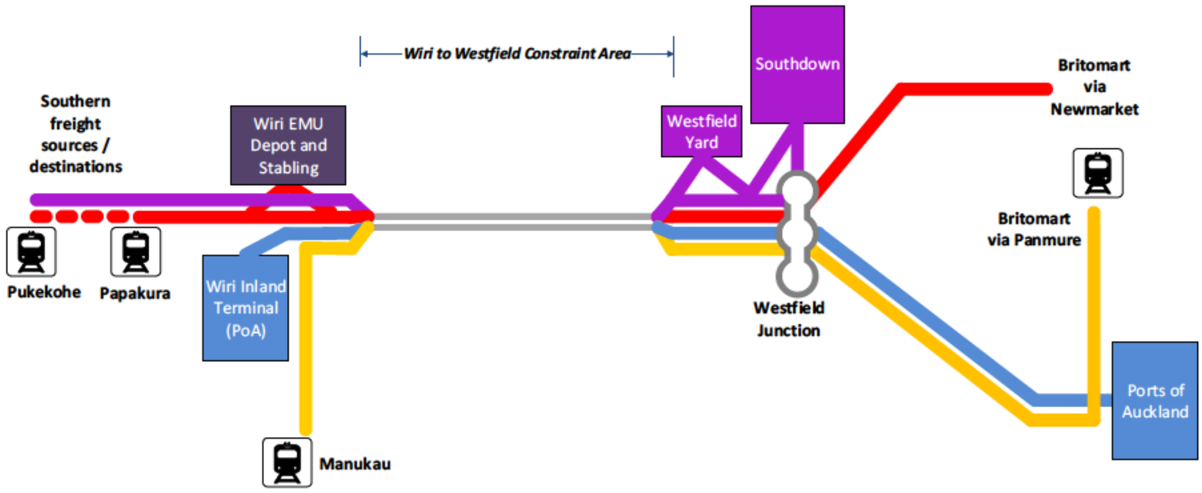


Figure 5 Wiri to Westfield Rail Network

The following passenger services currently operate over the W2W route:

- Eastern Line Services between Britomart and Manukau (via Panmure) – up to 6 trains per hour
- Southern Line Services between Britomart and Papakura (via Newmarket) – up to 6 trains per hour
- The Northern Explorer tourism service between Auckland Strand (east of Britomart) and Wellington – 3 trains per week each way (Monday, Thursday & Saturday)

Current passenger demand generally creates a total of 12 peak hour passenger trains in either direction between Wiri and Westfield. The current passenger train pattern is shown in Figure 5 below.

Figure 6: Current Passenger Train Movements; Peak Hours

Information available from KiwiRail and Auckland Transport confirms the following current and planned freight services over the W2W section of the NIMT:

- Port of Auckland to Wiri Inland Port shuttles – currently 2 return workings 5 days per week, potentially increasing to 8 return workings daily, 7 days per week, within 3 – 5 years
- MetroPort to Port of Tauranga services – as of August 2016, 78 trains per week between Westfield and Tauranga, potentially increase to 100+ trips per week over next 3 – 4 years if further contracts for post-Panamax ships are secured for the Port of Tauranga
- Other NIMT services to/from Westfield – currently 14 return workings per day
- [redacted] s9(2)(b)(ii)
- Miscellaneous shunting services.

During peak passenger periods, two freight paths per hour (per direction) are provided through the W2W section with a larger number of paths available in the interpeak and offpeak periods once passenger service levels drop.

Problem 1 Inefficiencies for Passengers and Freight

The two tracks in the Wiri to Westfield (W2W) section are congested with limited capacity to reliably carry more traffic. It is the mixture of passenger and freight services which is the primary cause of the constraint; mixed use railways have an intrinsically lower effective carrying capacity due to differences in train performance. Significant bodies of research have been carried out across the world over many decades to analyse the performance of mixed used railways with the intention of resolving the sort problems being experienced on the W2W section.

The conflicting operational requirements for passenger and freight train services already result in undesirable delays being factored into passenger timetables, which in turn increases the likelihood of further delays and reduced scope for timetable recovery for passenger operations. For the freight network, the challenges of managing a national operation where a very small, but critical section of the operation needs to coexist within the imposed constraints of a passenger prioritised network causes numerous problems too. Although freight curfews are not in place (as they are in a number of cities) freight paths during peak periods are limited to two per hour per direction. This limits the ability of KiwiRail to offer services to meet demand for services during these periods. Furthermore, the priority rules in place for the metropolitan network have the effect of compounding any schedule variances as corrections to day of operations problems can only be accommodated to the degree provided for by the slots available between prioritised passenger services. Similarly, any problems with the passenger operation will often ripple out to impact following freight services. Significant disruptions to the passenger operation become often significant disruptions to the freight operation too.

Due to the time-sensitive requirements for certain freight services, delays of up to 30 minutes if a freight train misses its scheduled slot can seriously impact upon the onward supply chain, particularly when this includes onward connections at ports.

Problem 2 Capacity Constraints for Inter-Regional Rail Freight

The current timetable operates with two 9-minute paths per hour for freight train services during the AM and PM peak passenger periods, which are separated by 30 minutes. In the event of a freight train arriving at the entry point any later than a few minutes after the "to the minute" arrival time, it is then required to wait until the next freight path. Unless the next freight paths is unused, any following freight train is then automatically penalised by the same amount of time. This can potentially ripple through the entire day depending on the planned utilisation of freight paths for that day. This type of situation is normally classified as a "hot spot" that causes a delay that impacts on delivery times. In a 'just in time' environment this can be critical where goods have a shelf life or where road or ferry based onward transportation is involved.

This situation means that freight trains have to operate within very tight parameters if they are to avoid missing critical time slots for their overall journey. This problem will be exacerbated by growth in demand for freight movements in the future.

Unscheduled Delays to Freight Services

Data supplied by KiwiRail confirms that congestion on the W2W section has long been a cause freight trains failing the "within 30 minutes" customer promise. Northbound services into Auckland are particularly effected with 600 trains in the last three years being "on-time to 30" until the south of Auckland but were then delayed to the point of being outside the acceptable 30 minute performance indicator after traversing the W2W section.

The data also shows that:

- In FY 15/16 alone congestion on W2W caused 150 hours of delay for northbound freight services, impacting the supply chain;
- In 35 of the last 36 months schedule performance for on-time freight trains through W2W (in both directions) has degraded as a result of traversing this section of track

The figure below shows graphically the degradation in performance

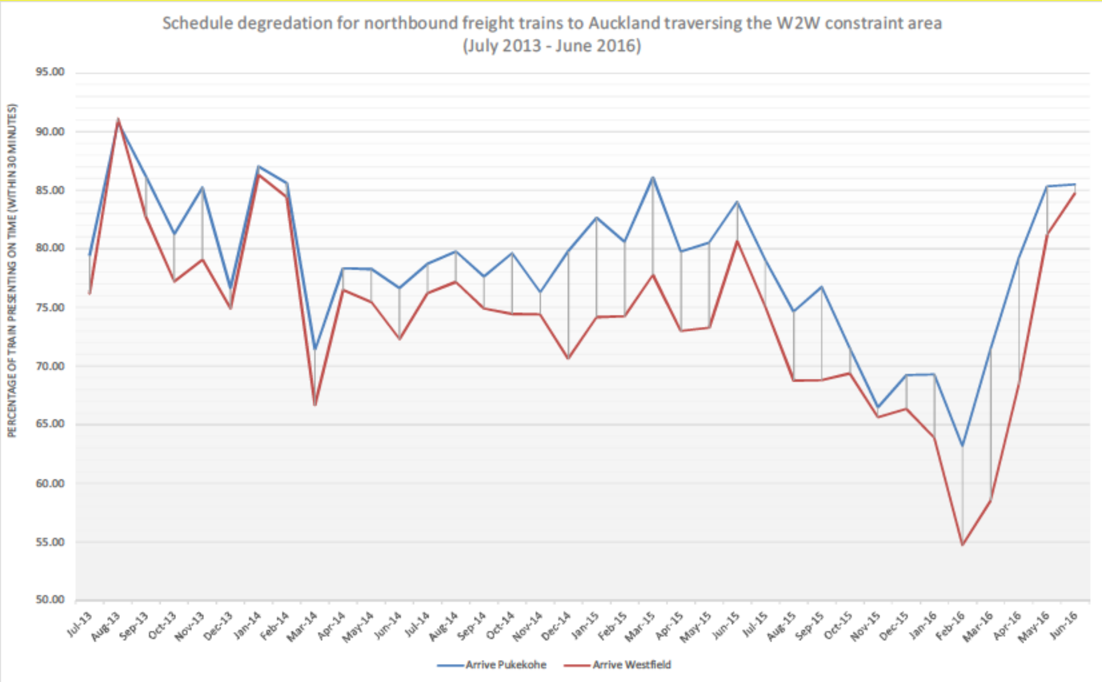


Figure 8: Degradation of "30 minute on time" performance for northbound freight services

Rail Freight Leakage to Road

Evidence from KiwiRail indicates that a proportion of freight that under normal circumstances would be carried by rail (in line with current contractual arrangements) is not able to be transported for operational reasons. Key freight routes (such as Tauranga-Auckland and Wellington-Palmerston North-Auckland) operate in the manner of a conveyor belt of trains cycling backwards and forwards through the network. While the freight timetables and supporting rail infrastructure have some resilience in them to compensate for unscheduled delay, once this is used up any additional delays have a significant ripple effect resulting in some trains simply not being able to run as there are no more available paths available. In this situation freight is forced onto road in order to satisfy customer requirements for delivery. The operational data suggests that the W2W constraint is causing unscheduled cancellations of four or more services per week equating to some 400 trucks worth of freight on average moving onto road.

If the W2W constraint is not resolved, it is expected that this figure will rise as contracted freight paths into Auckland increase and the congestion makes recovery of schedule slippage increasingly more difficult.

Problem 3 Capacity Constraints for Passenger Services

The current passenger timetable was developed for the introduction of electric services in 2015 and provides for 12 passenger and 2 freight paths per hour in either direction over the W2W section.

In order to accommodate the two freight paths, each of 9-minutes wide, it is necessary to increase dwell time for passenger trains at some stations. This creates a 'staggered' scheduling pattern through the Westfield area that results in passenger trains on both the Southern and Eastern lines running at consecutive intervals of 12 / 8 / 10 minutes, as opposed to (a more desirable and efficient) consistent 10-minute interval.

The inter-play between passenger and freight traffic over the W2W Section of the NIMT results in two types of delays to rail services; namely scheduled delays and unscheduled delays. These delays in turn impact upon the utilisation of nominated train paths for freight trains in particular.

The current two-track mainline infrastructure over the W2W section constrains future growth and operational flexibility for both passenger and freight services. W2W capacity constraints have already been highlighted as a barrier to additional passenger train services at the desired 'clockface' timetable frequency and this will be further exacerbated when CRL opens (which is expected around 2023/24 based on current information). Unless addressed, the W2W constraint will lead to sub-optimal timetable design for the new network and provide a barrier to additional trains being added to service expected demand.

Furthermore, any additional freight services would exacerbate existing pressures over the W2W section of line in the short-term.

Scheduled Delays to Passenger Services

Delays are introduced onto the Southern Line and Eastern Line passenger services to accommodate freight trains. The Southern Line delay is introduced between Middlemore and Penrose, while on the Eastern Line the delay is introduced between Middlemore and Sylvia Park. The effect of these modifications to the timetable is that over 5 million passengers experience an average delay of 3 minutes on the W2W section of the NIMT in 2016 (based on AT HOP Card data).

A secondary impact of the need to systematically slow passenger trains is that an even-interval or 'clockface' timetable cannot be delivered to stations on the Eastern and Southern lines. This has a number of disbenefits including:

- Confusion to current and potential passengers
- Increased challenges in operations with greater potential for error if incorrect timetable is operated

At present, the deviation from clockface is relatively minor (1-2 minutes). However, to cater for increased passenger services in the future, on the current two-track configuration, further deviation from the clockface timetable would be required.

Unscheduled Delays to Passenger Services

Passenger services also experience unscheduled delays when freight trains are slow running through the W2W section or incorrect priority rules are invoked by train controllers. Once the train controller provides a train path into the section between Wiri and Pukekohe there are no passing loops available to correct any pathing problems. Any problematic freight train (i.e. slow or late) will by definition impact following passenger services. (The converse is also true, any problems with a passenger service will impact following freight trains).

Based on data supplied by KiwiRail, approximately 1,800 passenger services experienced unscheduled delays in the past year as a result of abnormal freight train activity in the W2W section. In addition there are a significant number of passenger train cancellations that are attributable to freight train activity; the annual figure is estimated to be in the order of 150.

Sub-Optimal Fleet Utilisation

The additional delay factored into the passenger train scheduling means an extra 3-car Electric Multiple Unit (EMU) is needed to operate the passenger timetable, in comparison to corresponding fleet requirements in the absence of scheduled delays. If these scheduled delays were removed, the extra EMU could be re deployed on services on other parts of the network where it would best help meet unmet demand (e.g. on particular service being operated with a single 3-car unit that may be regularly experiencing overcrowding).

Forecast Travel Demands; Freight and Passengers

The last 15 to 20 years have seen significant demand growth for travel on the Auckland Transport System. The Auckland Unitary Plan and National Freight Story highlight that further travel demand growth will be strong over the next 20 to 30 years. This demand will exacerbate problems due to existing capacity constraints were they occur.

Figure 6 below illustrates the predicted growth of passenger and freight demands for the next 30 years, as they are likely to affect the transport network in the vicinity of W2W. The freight task in the upper north island will directly affect the volume of freight using this section of the rail network. The projected number of passengers between Wiri and Westfield will increase in line with growth in the South Auckland Future Growth Zone.

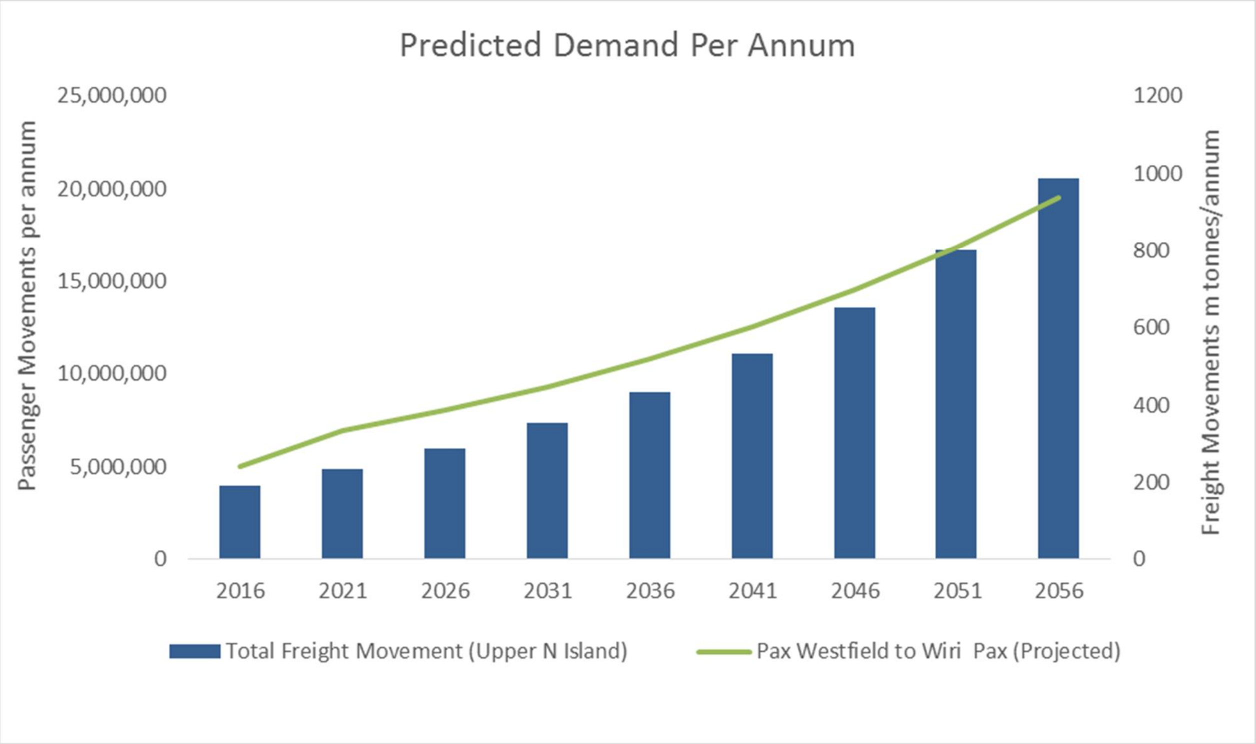


Figure 10 Forecast Future Freight and Passenger Demands

Clearly the current operational problems on the W2W section of the rail network will only deteriorate as demand for both modes increases into the future.

3.2 Problem Statements

Workshops were held with the Project Partners to discuss the implications of the available evidence and agree the specific problems affecting the W2W Section of the NIMT. Three problems were identified, as follows:

- Problem 1: The integration of freight and passenger services on the constrained Trunk Line between Wiri and Westfield causes inefficiencies for both passengers and freight
- Problem 2: Capacity constraints on the main Trunk Line between Wiri and Westfield are limiting the future growth of inter-regional rail freight creating adverse impacts on the road network
- Problem 3: Capacity constraints on the main Trunk Line between Wiri and Westfield will limit the provision of more attractive and frequent rail passenger services on the Southern and Eastern rail corridors creating adverse impacts on the road network

A subsequent process of evidence collation and assessment was undertaken to confirm these problems and how benefits could be realised by investing in the network if these problems were rectified.

3.3 Benefits and Opportunities of Investment

The Stakeholders identified and agreed the following key categories of benefits which would be realised through an investment activity to address the problems:

- Benefit One: Improved reliability for freight and passenger rail.
- Benefit Two: Reduced travel times for rail passengers.
- Benefit Three: Increased capacity and resilience of the transport system.

These key benefits and corresponding outcomes and opportunities that they would be expected to create are elaborated upon below

Improved Reliability for Freight and Passenger Rail.

Tackling the congestion on the mixed use railway will enable passenger and freight trains to be operated independently. This will significantly reduce the impact of each on the other across the W2W section leading to a major reduction in unscheduled delays.

Reduced Travel Times for Rail Passengers.

Addressing the constraints between Wiri and Westfield will facilitate the implementation of a more efficient passenger timetable that eliminates scheduled delays and delivers reduced travel times for more than 5 million passengers per annum.

Reduced travel times will help make rail travel more attractive to more people and provide the opportunity to achieve a higher public transport mode share for journeys to/from and within the South Auckland growth areas.

Increased Capacity and Resilience of the Transport System.

An increase in passenger throughput could include the following outcomes and opportunities:

- One less 3-car EMU being required to run the current services on the Southern and Eastern Lines, based on rail simulation modelling of improved operational efficiency.
- The ability to accommodate the desired post-CRL Passenger timetable
- The potential introduction of 'Express' passenger trains, which only call at selected stations along the route, which is currently of interest to Auckland Transport.
- Improvements to passenger service efficiency, enabling the operation of a 'clockface' timetable with even intervals between passenger services, speeding up some services by up to two minutes, and improving service attractiveness.
- Improvements to train punctuality, reducing both the occurrence and durations of incidents resulting in delays to services.
- An increase in freight throughput, allowing for future growth, allowing for rail transport to retain its competitiveness within the freight supply chain and enhancing road-rail integration.
- Improvements to efficiency and reliability, allowing for greater flexibility in freight supply chain, particularly in the event of freight trains missing one of their scheduled half-hourly slots during peak hours. Improved efficiency and reliability could also provide opportunity to enhance road-rail integration

3.4 Investment Objectives

Once the current problems and benefits had been confirmed, the project partner workshops were also used to agree Investment Objectives for the W2W project.

SMART investment objectives were developed with reference to the key objectives sought. Investment objectives must provide enough information to enable an investor to make a sound investment decision. Three investment objectives were identified as follows:

- Investment Objective 1: The frequency and duration of delays experienced by freight trains passing between Wiri and Westfield on the main Trunk Line will be reduced such that on-time performance over this stretch is no less than 90%, by 20xx
- Investment Objective 2: Travel times for passengers on the Southern and Eastern rail corridors whose journeys traverse the Wiri to Westfield section of the route will be reduced by up to 3 minutes, by 20xx.
- Investment Objective 3: Road/rail integration will be optimised for the forecast growth in rail traffic (both freight and passengers) helping to reduce the impact of HCVs on the road network from 20xx.

The objectives do not as yet feature a specific time frame by which the objective will be achieved, as the funding mechanism for investment is not yet know. However the project partners agreed that all of the objectives should be satisfied as soon as is practicable, so the benefits of investment can be realised sooner.

Figure 9 below summarises the relationships between the identified problems, benefits and investment objectives

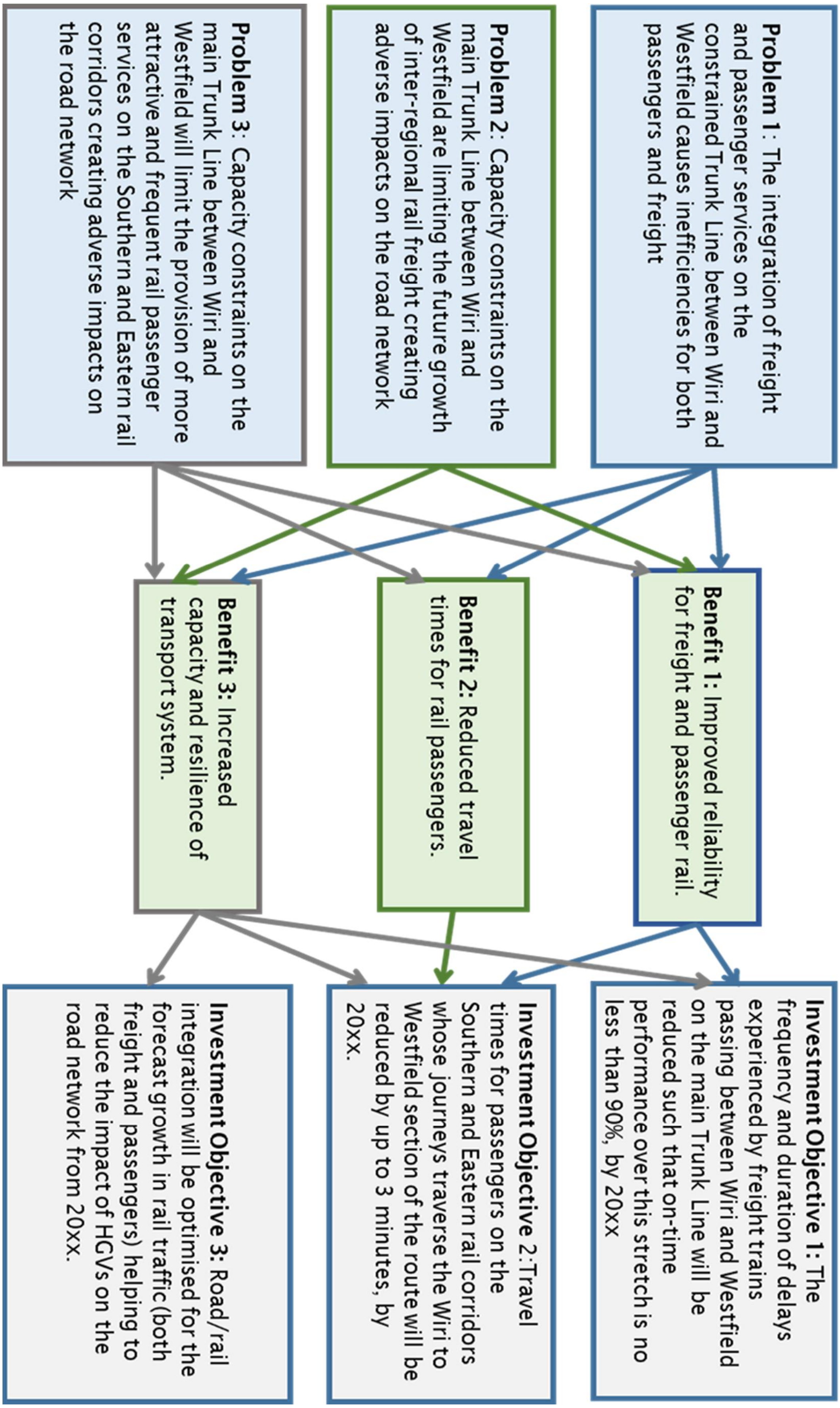


Figure 11: Problems Benefits and Investment Objectives

3.5 Issues and Constraints

In conjunction with the Project Partners, several matters that could affect the project background or justification for investing in W2W were identified. Uncertainties around issues and constraints that could be material to the Case for Investment in the project are set out in Table 2 below.

Issues

- The lack of a recognised funding mechanism for new rail infrastructure
- Uncertainty over forecast growth in rail freight traffic on NIMT
- Uncertainty over forecast growth in both passenger traffic on NIMT, particularly following completion of CRL
- Timing and implications of planned growth in south Auckland
- Uncertainty over future role and location of Port of Auckland

Constraints

- The Proximity of Middlemore Hospital to W2W section of NIMT, potentially constraining options for increasing the width of the rail designation
- Future Capacity Constraints at Inland Ports at Westfield and Wiri

Table 2: Uncertainty Log

Factor	Time	Uncertainty	Impact on Activity	Comments	Sensitivity Test
Factors affecting demand					
Forecast rail passenger growth	Post 2021	Near Certain	High	Influenced by future land use patterns and the evolution of the Auckland transport system City Centre Future Access Study forecasts some 30,000 inbound trips by 2041 (in 2 hour morning peak with CRL)	S1
Forecast rail freight growth	Present onwards	More than likely	High	UNI Freight Story predicts doubling of UNI freight task by 2035. Auckland Port Futures Study forecasts 2 million TEU by 2052 Influenced by rapidly changing approach to NZ freight logistics – more consolidated operations;	S2

				move towards 'hub and spoke' arrangements	
Southern Auckland Future Growth	Next 30 years	More than likely	High	Planned housing and employment growth will increase demand for passenger rail services	S1
Future role of Port of Auckland in Upper North Island Freight task – Potential relocation away from CBD area	Present onwards	Hypothetical	Medium	Port strategy currently under development. A number of options are available to meet the multi-cargo needs including relocation of some of the freight task	S2
Factors affecting supply					
Uncertainty over source of funding	Present	Likely	High	Current lack of appropriations for funding rail infrastructure through the NLTF.	
Completion of Auckland City Rail Link (CRL)	2021	Near Certain	High	CRL removes the current cap of 15000 passenger movements in the peak. Up to 30000 passenger movements in the peak will be possible depending on the future service pattern.	S1
Completion of Auckland Southern Corridor Improvement	October 2018	Near Certain	Medium	Under construction, completion may affect modal choice for strategic North – South freight and passenger trips through South Auckland	S2
Future Capacity Constraints at inland ports at Westfield and / or Wiri	Likely beyond 2020	More than likely	High	Failure to provide additional capacity could result in reduced efficiency of freight supply chain and undesirable transfer of freight to road	S2
The proximity of Middlemore Hospital to the NIMT, potentially constraining options for increasing width of rail designation	Present	Near Certain	High	Options involving additional tracks at this location are unlikely to be feasible, without acquiring land outside the current rail designation	

New EWC road link Onehunga to Penrose	2021	More than likely	Low	Reduced costs of freight supply chain through improved onward roading connections, potentially making rail freight via Westfield Metroport terminal more attractive	S2
Factors affecting cost					
Scope and extent of required infrastructure	Present	Likely	High	Concept designs for track, signalling and electrification finalised. Detailed design may reveal increased volume of work required. Contingency applied to cost estimate to mitigate risk	S3
Land acquisition	Present	Possible	Medium	Discussions with Health Board have been previously held to discuss land exchange at Middlemore Hospital. Possibility that changed circumstances may increase net cost to project of acquiring the necessary land	S3

The matters highlighted in this log were used to identify the key factors affecting the economic efficiency of the recommended option and were used in a sensitivity analysis of the project economics (as noted in the table above). The results of this analysis are included in section 5.

4 PART B - OPTION GENERATION AND ASSESSMENT

4.1 Option Development

Options for improving the W2W section of the NIMT were developed in conjunction with the Project Partners at the business case workshops. A strong emphasis was placed on identifying options for operational changes or infrastructure improvements that could address the agreed W2W problems whilst complementing other known strategies and initiatives.

A Multi-Criteria Analysis (MCA) was used to compare the effectiveness of the options in meeting the investment objectives, together with social and environmental impact, option cost and the scale of any risks.

The options were identified under four main alternatives as shown in the diagram below, noting the Do Nothing scenario was used for comparison purposes. A total of 10 options were identified, as noted in Table 3 below.

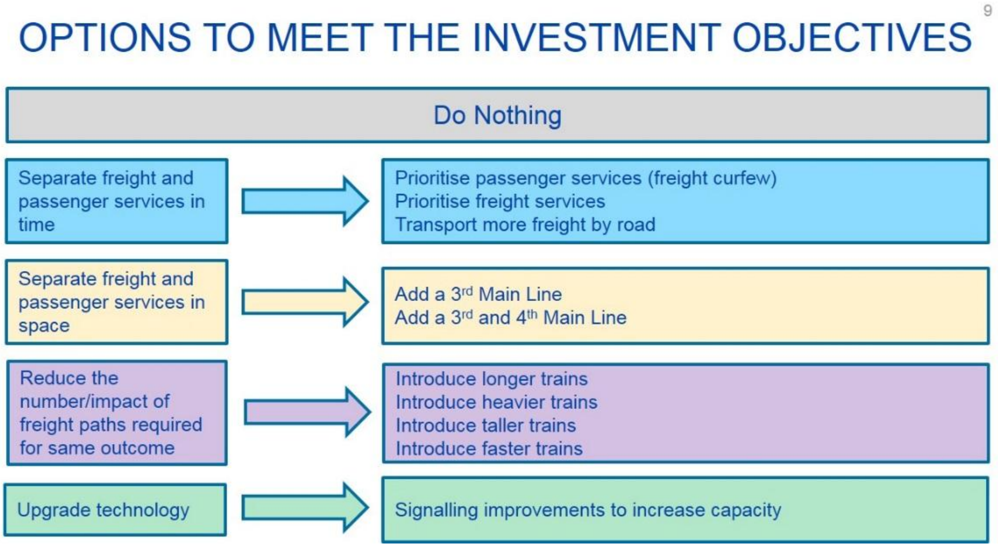


Table 3: Improvement Options

4.2 Options Description

Do Nothing

The Do Nothing scenario assumes that W2W continues to operate as a mixed use railway with the existing two track configuration. As the section has already reached its maximum vehicle operating capacity during peak periods, it is evident that W2W will become an increasing constraint on growth. The existing fleet of passenger trains will quickly start to suffer over-crowding whilst the movement of rail freight will become increasingly unreliable adding to costs and forcing more goods to be moved by road.

Rail will become a less attractive mode of transport for both passengers and freight distributors. This runs contrary to strategies to increase the use of public transport for trips to/from and within the Auckland Urban area. It is also inconsistent with supporting an efficient and resilient national freight network which requires a flexible, dynamic and integrated road/ rail system.

Without improvements to W2W, the benefits of the Auckland City Rail Link will be constrained, as there will be no capacity to introduce more passenger trains from South Auckland. Also, previous investments to the national rail network will not operate to their full potential. Therefore the public value of rail to the national economy will be limited.

Alternative: Separate Freight and Passenger Services in Time

Option 1 – Prioritise Passenger Services (Peak Period Freight Curfew)

Passenger services using the W2W section during peak periods are already granted priority over freight services under the terms of the existing access agreement (Common Access Terms 2012). While these rules are applied as faithfully as possible, the practical limitations of the approach are such that significant problems are being experienced, as described in previous sections.

In Option 1, the idea is to prohibit freight trains from utilising the metropolitan sections of the Auckland rail network during peak hours to absolutely ensure that no interference occurs to passenger operations during the most heavily utilised (and hence economically important) time of the day for rail commuters. Clearly a curfew during peak periods (i.e. approximately 6 hours per day) doesn't completely separate freight and passenger operations in time, but it does ring-fence the most critical times of the daily passenger operations from potential impact from freight operations.

The idea of utilising a peak period freight curfew through critical parts of a city's metropolitan rail network is not new – the method has been in place in a number of Australian cities for many years including key portions of the metropolitan rail networks in Adelaide, Melbourne, Brisbane and Sydney.

The impact on freight operations across New Zealand would be significant with this option. A curfew would limit the ability of rail freight to meet both current demand (in terms of both volume and on-time delivery) as well as restricting additional growth.

To compensate for the throughput penalty imposed by the curfew there would also be substantial impacts to the overall rail freight network and associate supply chain. The rail freight network operates in many respects like a conveyor belt and relies on freight trains essentially moving in a continuous cycle through the network. A three hour, twice a day freight curfew imposes a total six hour stop to the "conveyor belt" for all return journeys that include Auckland. Making this work (as best as possible) would require significant changes to the main trunk across the North Island. This would likely take on the form of additional loops and holding roads across the network and large changes to terminals to handle more "peaky" arrivals of freight trains. Instead of trains arriving at regular intervals for unloading or loading, they would tend to cluster, requiring terminals that could handle more trains at the same time. The flow on effects to the supply chain would be commensurate. Additional costs imposed upon the rail operator would be passed to customers, which would make rail less competitive and potentially reduce its' market share.

These same problems have long have been identified as constraints for growing the rail freight market in Australia and substantial amounts of government funds are currently being invested to build additional infrastructure to remove altogether the need for freight curfews. In Sydney for example more than $2B has been invested in two major programs - the Southern Sydney Freight Line and Northern Sydney Freight Corridor.

Rail freight competes primarily with the road sector and freight forwarders have a tendency to favour road over rail as the mode of transport. With a peak period curfew in place, rail network availability would be likely to be reduced to 18 hours a day (with significant costs incurred to make those 18 hours more effective), whilst road operators would be able to maintain 24-hour access of the road network. The rail market would therefore incur a competitive disadvantage.

A peak period freight curfew would have the effect of dampening the competitiveness of rail freight and ultimately putting more pressure onto the already congested state highway network. Other cities who have used a freight curfews to limit the interference of passenger and freight operations are now actively investing in infrastructure to remove the curfew and allow freight services to move at the times of day that make the most economic sense.

Option 2 – Prioritise Freight Services

Under this option, freight services would get priority over passenger services through the Auckland rail network. This would give rail freight operations greater flexibility to operate in a manner best suited to meeting the end to end needs of the freight supply chain. With passenger operations always “giving way”, it would be expected that significant reduction in unscheduled delays to freight trains would be experienced with commensurate improvements in on time reliability. With a freedom to rapidly adapt rail freight services to meet market demands it is likely that freight rail’s mode share would also grow.

The prioritisation of freight operations would clearly result in significant disruption to passenger services for long periods during the day and it would become very difficult to operate a passenger timetable which would be attractive and reliable. This would adversely affect the journeys of thousands, if not tens of thousands of people on many days throughout the year.

Reliability and service attractiveness are key factors in attracting passengers on to public transport and any steps taken that lead to poorer reliability would be contrary to wider strategies to promote an efficient integrated transport system. One consequence would be more traffic on the Southern Motorway.

This option would require substantive changes to the existing access agreement which in practice would be difficult, if not impossible to achieve. There are no known examples of where an agreement of this nature has been achieved in cities of comparable size and transport need.

Option 3 – Transport More Freight by Road

Option 4 would be to remove freight trains altogether from W2W and move freight to Westfield by road. As noted in the regional context the Auckland State Highway Network is at or close to capacity in all future scenarios, even with programmed improvements. It is estimated that this option could result in an increase of up to 15% in HCVs on the Southern Corridor bringing forward a requirement for substantive investment in additional highway infrastructure, such as additional lanes on the Southern Motorway between Mt Wellington and Manukau. At the same time the environmental and social impacts would be significant.

Making this option work would also require significant investment in terminal infrastructure at the outskirts of Auckland in order to facilitate the move from rail to road. The poor economics of introducing an additional lift of freight into the supply chain (i.e. from rail to road) before transporting it via truck to the distribution point where it would need to be lifted again, also contributes to making this option highly unattractive.

Alternative: Separate Freight and Passenger Services Spatially

Option 4 – 3rd Main Line

This option involves completion of the third electrified main rail line between Westfield Junction and the Wiri Inland Port including all associated track work, overhead wiring and signalling changes together with platform alterations at Middlemore.

Completing the third main line enables passenger and freight services to be separated out over the W2W section, significantly simplifying operations on this critical part of the network. It facilitates much more independent timetabling of freight and passenger trains thereby reducing the impact of each rail mode on the other with resultant improvements in reliability and journey time savings.

The third main line increases capacity for both freight and passenger trains by creating more train paths throughout the day. It also enables a move to clock face running for passenger trains, simplifying the timetable and helping to improve the overall passenger experience.

Option 5 - 3rd and 4th Main Line Combined

Planning for the Auckland Rail network envisages that in the longer term it will be necessary to have a four-track solution south of Auckland in order to accommodate the projected demand for both passenger and freight movements. This planning is based on the twin notions of:

- The 3rd main being completed as per current designs on the western side of the existing two-track corridor
- A 4th main being built on the eastern side of the existing two-track corridor

Planning work from both an engineering feasibility and timing perspective for the 4th Main is ongoing and is being carried out as part of the ARDP work. For this business case an assessment was carried out to determine the degree to which the 4th Main (in addition to the 3rd Main) would address the problems as defined.

The key finding from the analysis is that while the 4th Main is complementary to the 3rd Main (as a logical next step in the ongoing provision of appropriate rail capacity) the benefits provided are not well aligned to the agreed problem statements. This is because:

- The additional capacity provided by the 4th Main is in excess of current and medium-term demands. (Current ARDP work has the 4th Main being necessary in the 20+ year horizon).
- The additional operational flexibility provided by the 4th Main is primarily focussed on the resolution of a looming capacity constraint at Westfield Junction which is outside the W2W constraint area

Delivering the 3rd and 4th Main at the same time would in general create capacity in advance of demand (as it is currently projected) but the combined project would also deliver some level of immediate passenger journey time benefits (through the removal of other flat-junction conflicts on the corridor) and an attractive, largely conflict free path from the Port of Auckland to Wiri.

The capital costs involved would likely be significantly more than the 3rd Main higher given that the 4th Main has not yet been started (as compared to the 3rd Main which, by length, is approximately one third complete). However, building the 3rd Main and 4th Main (or some component parts) together could result in cost synergies. As a minimum though, it would be prudent to ensure any land purchases made for the 3rd Main also take account of the 4th Main too.

Full exploration of the benefits in bringing forward the 4th Main (or some component parts) were not within the scope of this business case but the synergies between the two projects and some of the immediate benefits it would deliver suggest that further consideration of the preferred timing of the 4th Main (or some level of staged delivery) within the ongoing development of the Auckland regional rail network is warranted.

Alternative Reduce the Number/Impact of Freight Paths Required

Option 6 Introduce Longer Trains

Increasing the train length would increase container capacity and in turn increase utilisation of each train path. However, the current maximum freight train length is 750m and the rail network is designed around this parameter. Therefore accommodating longer trains would require additional investment for;

- Extensions to the lengths of passing loops on the national freight network
- Reconfiguration of terminals, ports and marshalling yards, to be able to accommodate longer trains

In addition to the infrastructure requirements, the majority of trains are designed to ensure maximum loading for the locomotive power. Any increase in train length would therefore require an additional locomotive, and increase costs to the rail operator that would then flow onto the customer. As an example, if a train length was to increase from 750m to 900m and require haulage by two locomotives rather than one, the locomotive utilisation would decrease from 90% to 65%.

A longer train will also require additional time to travel over the W2W section, potentially resulting in delays to other trains, or in a reduction in capacity to the passenger network.

The additional lengths of passing loops and reconfiguration of terminals would be costly and would take several years to implement.

Option 7 - Introduce Heavier Trains on Key Routes

The current maximum Tonne Axle Load (TAL), or the weight divided by the number of rolling stock axles, is 18t on key routes such Auckland-Tauranga and Auckland-Palmerston North-Wellington. This equates to 72 gross tonnes per wagon for KiwiRail's 4-axle wagon fleet. In principle, an increase in TAL could allow an increase in the utilisation of the container train slots thereby increasing throughput.

The W2W section of the NIMT is already 20TAL (to allow for a small number of heavier trains from Mission Bush to Auckland), so introducing heavier trains would require an upgrade to substantial components of the NIMT and ECMT in order for this to become a possibility. Significant investment would be required to upgrade track infrastructure and bridges along the length and breadth of these routes. This would be at significant cost and would take many years to implement.

Even once completed additional throughput would only be realised if there were capacity on the trains to increase the number of containers loaded onto each service. The current train slot utilisation rate is high, so even if the track was upgraded there would be limited benefit as there are minimal slots available. Furthermore, anecdotal evidence suggests that while some customers (such as dairy) may take advantage of any additional carrying capacity, the vast majority of freight is more bulky than it is heavy, meaning in practice there would only be limited improvement in throughput on a “per train” basis.

Option 8 - Introduce Taller Trains

The current maximum height for a train service is 3.81m. Increasing the maximum height to 6.5m would allow for double-stacked container trains, thus increasing capacity by way of the number of containers per train rather than train paths. In turn, this would reduce the number of trains required to move the same volume of freight.

However, the infrastructure and operational implications of this change would be substantial, and require a ‘whole of network’ approach. These implications would include increasing clearance under bridges and tunnels (including the 8km Kaimai Tunnel between Hamilton and Tauranga), increasing the height of overhead line equipment and changes to train fleets, to allow pantographs to extend higher.

This option has been included for completeness, but in practical terms can be considered a virtual impossibility given the impacts, costs and timescales involved for such a wide-ranging program.

Option 9 – Introduce Faster Freight Trains

In a general sense, faster trains can be a viable technique for improving network throughput. In modern metro systems for instance, achieving higher throughput is often achieved by introducing a single fleet of high performance trains which accelerate to cruising speed and then decelerate quickly. If all trains have the same accelerating and stopping performance, the throughput can be maximised. In freight networks, where long distances are often a primary consideration, being able to introduce freight trains which can travel at an average of 80-100km/h rather than 40-60km/h makes a clear improvement in throughput by substantially reducing travel times.

In the case of the New Zealand rail freight network, KiwiRail has recognised the value of higher speed freight trains and has, over a number of year, invested heavily new rolling stock (and the infrastructure it runs on) to reduce the average travel time of key journeys such as Auckland-Wellington and Auckland-Tauranga. However, on the relatively short W2W section, where different rolling stock types with variable acceleration and stopping performance are mixed, seeking to introduce higher performance freight trains as a means of creating additional capacity would yield no benefit. The typical movement of a freight train through the section is for the train to be sandwiched between two all-stopping passenger trains and being faster can therefore make no difference in the capacity calculation. A faster freight train would simply catch up sooner to the passenger service in front and would be forced to slow as there were no overtaking opportunities anyway.

Alternative Upgrade Technology

Option 10 – Signalling Improvements to Increase Capacity

All signalling systems are designed to provide for the safe separation of trains whilst maximising capacity for the intended rail operation. The braking distance of the worst performing train using the network is often a major limiting factor in the achievable capacity. In mixed traffic environments, where heavy freight trains with large stopping distances are mixed with more nimble passenger services, the achievable headway is significantly less than would be achieved in a homogenous environment where only suburban services run. This is the situation in Auckland where the signalling has been designed to cater for the needs of both traffic types.

The Auckland rail network was re-signalled as part of the Auckland Electrification Project (AEP) with the objective to optimise the capacity of the network for the mix of freight and passenger operations. During the AEP re-signalling, ETCS Level 1 was also introduced as a safety initiative to prevent suburban trains from running past red signals or the trains being driven at unsafe speeds.

Further improvements in capacity or safety would require the implementation of an advanced signalling system such as ETCS Level 2. These systems dynamically take into account each train's braking performance and allow trains to follow each other at the limits of their braking ability, optimising throughput irrespective of the mix of traffic. However, the total network throughput is also affected by the physical track layout (including the number and type of junctions) and the traffic mix.

Over a relatively short distance (W2W is approximately 10km) and with the same mix of relatively long, heavy freight trains intermingled with passenger services, the capacity improvements offered by a system such as ETCS L2 would be marginal and insufficient to address the existing constraints or provide for future growth. Furthermore, introducing ETCS L2 on a relatively short section of track would not be a realistic proposition. Implementing advanced signalling such as ETCS Level 2 are typically done across whole networks (or major parts of a network) and requires substantial operational changes to the below rail infrastructure owner and all above rail operators. Programs to implement advanced train control technology are typically envisaged as decade+ endeavours and come with substantial costs. By way of example, the Brisbane suburban rail network is currently undergoing a process to procure ETCS Level 2 over an 8-10 year program at a cost of approximately $600m.

4.3 Option Assessment - Multi-Criteria Analysis

A Multi Criteria Analysis was undertaken of all the options. The attributes used in the MCA were the three investment objectives, plus:

- Feasibility
- Affordability (Cost)
- Public / Stakeholders effects
- Cultural, social, environmental effects
- Safety
- Economic benefits

The options were scored against each of these attributes, using a 7 point ranking system, from +3 (significantly positive) to -3 (significantly adverse) compared to the do minimum. This allowed each of the options to be ranked from 1 to 10. The MCA is summarised in Figure 10 below.

Wiri to Westfield	**Options**										
	Do Min	**No Commuter Peak Freight**	**Freight priority in Commuter Peak**	**Freight by Road**	**Faster Freight Trains**	**Longer Freight Trains**	**Taller Freight Trains**	**Heavier Frieght Trains**	**4th Main**	**3rd Main**	**Signalling Improvements**
	0	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**
Summary											
Objective 1 - Freight delays	0	- -	+	-	+	+	+	+	+ + +	+ +	+
Objective 2 - PT Travel times	0	+ +	- -	+ +	+	+	+	+	+ +	+ +	+
Objective 3 - Reduced freight on road	0	-	+	- - -	+	+	+	+	+ + +	+ +	-
Feasibility	0	0	-	0	-	-	- -	- -	- -	-	- -
Affordability	0	0	-	0	-	-	- -	- -	0	0	- -
Public / Stakeholders	0	-	- -	-	-	-	-	-	+	+	-
Cultural, Social and Environmental Effects	0	0	0	0	0	0	0	0	0	0	0
Safety	0	+	0	-	-	-	-	-	+ + +	+ +	+
Economy	0	0	-	0	+	+	+	+	+ + +	+ +	+
Ranking	3	8	11	10	4	4	7	6	1	2	9
Average score	**0.0**	**-1.6**	**-4.6**	**-4.6**	**-0.4**	**-0.4**	**-1.4**	**-1.3**	**12.5**	**10.1**	**-1.7**
Cost (Lower Bound)	0	$50	$20	$100	$50	$50	$350	$250	$150	$65	$100
Cost (Upper Bound)	0	$70	$30	$150	$70	$70	$450	$300	$200	$80	$200
Cost (Lower Bound) NPV	0	$45	$18	$89	$45	$45	$312	$223	$134	$58	$89
Cost (Upper Bound) NPV	0	$62	$27	$134	$62	$62	$401	$267	$178	$71	$178
Benefits NPV	0	$40	-$20	-$200	$30	$30	$50	$50	$150	$105	$50
BCR upper	0	**0.9**	**-1.1**	**-2.2**	**0.7**	**0.7**	**0.2**	**0.2**	**1.1**	**1.8**	**0.6**
BCR lower	0	**0.6**	**-0.7**	**-1.5**	**0.5**	**0.5**	**0.1**	**0.2**	**0.8**	**1.5**	**0.3**
Sensitivity Score		**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**
Objective 1 - Freight delays	3	9	10	11	4	4	7	6	1	2	8
Objective 2 - PT Travel times	3	10	8	11	4	4	7	6	1	2	9
Objective 3 - Reduced freight on road	3	4	11	8	6	6	10	9	1	2	5
Feasibility	7	9	10	11	3	3	6	5	1	2	8
Affordability	8	9	10	11	3	3	5	5	1	2	7
Public / Stakeholders	5	6	10	11	3	3	8	7	1	2	9
Cultural, Social and Environmental Effects	3	6	11	10	4	4	8	7	1	2	9
Safety	3	4	10	11	6	6	9	8	1	2	5
Economy	5	9	11	10	3	3	7	6	1	2	8

Figure 12 : Multi Criteria Analysis Summary

The initial analysis confirmed that some options did not meet the investment objectives. This included all of the freight operations options which did not meet the public transport objective, nor was there a substantive improvement in freight performance. This was reflected in options P4-P7 having a negative score in the MCA.

The separation of freight and public transport services in time addressed some, but not all, of the investment objectives. The removal of freight services during peak periods has benefits for public transport services, but does not meet the freight investment objective.

The signal improvement option also did not meet all of the investment objectives. Whilst there would be some level of improved reliability, no significant capacity increases would be created.

The best performing options were the two that separate the freight and public transport services spatially, being the 3rd Main and 4th Main options. These both performed well against all investment criteria and the impacts were not assessed as being significant.

The 4th Main option was the best performing option in the MCA, with the 3rd Main option second. Sensitivity testing of the MCA criteria was also undertaken for all of the options and involved doubling the weighting of specific criteria in the MCA. This showed that the 4th Main option remained the first ranked option under each of these tests, with the 3rd Main ranked 2nd in all of the tests. The sensitivity testing confirmed that these two options were the two best performing options in the MCA.

Whilst overall the 4th Main option was the best performing option against the MCA criteria, it is likely to be significantly more expensive than the 3rd Main option. The incremental additional costs of the 4th Main do not deliver the same level of incremental benefits within the assessment timeframe. (The 4th Main will be almost certainly be required in the medium to long term horizon). Therefore the 3rd Main option is more economically efficient. However, it is noted that building the 3rd Main and 4th Main (or some component parts) together could result in cost synergies and as a minimum it would be prudent to ensure any land purchases made for the 3rd Main also take account of the 4th Main too. Furthermore, while the majority of the benefits of getting the 4th Main built early were assessed as being too far in advance of demand, the synergies between the two projects and some of the immediate benefits it would deliver suggest that further consideration of the preferred timing of the 4th Main (or some level of staged delivery) within the ongoing development of the Auckland regional rail network is warranted.

Therefore the conclusion of the MCA is that the 3rd Main is the recommended option, as it provides the required separation of freight and public transport services and responds best to the investment objectives sought from the project. This option is consistent with National and Regional Transport strategies and programmes and will support previous investments around the national rail network.

The 4th Main has been found to be an important project too and it is clear that it will be a critical piece of infrastructure as the Auckland rail network develops, delivering substantial passenger and freight benefits. As planning for the 3rd Main project continues further integration with the planning for the 4th Main should occur to ensure that the design supports ultimate delivery of the 4th Main. Land acquisition is critical to this, and any land purchases or swaps done to support the 3rd Main should also include design of the 4th. As such preliminary design for the 4th Main should continue in lockstep with the 3rd Main design process.

5 RECOMMENDED OPTION - ECONOMIC ASSESSMENT

5.1 Overview

The Economic Assessment uses the full procedures of the Transport Agency's Economic Evaluation Manual (EEM) as far as possible, adapted where necessary to be relevant to rail. The assessment adopts a first principles approach to monetise the costs and key benefits associated with the project. This approach was agreed with the stakeholders as proportionate to the size of the project. A conservative approach has been adopted throughout the assessment to minimise the risk of benefits being overstated. Care has also been taken to isolate the costs and benefits of the project from other projects that are likely to be implemented within the appraisal period.

The assessment also draws on international research in two areas with suitable adaption and benchmarking to the New Zealand context;

- the relative economic costs of moving freight by road and rail;
- The economic cost of delays to freight trains

A sensitivity analysis has also been included to test the implications of key factors identified in the uncertainty log, as they may affect the economic efficiency of the project.

The assessment recognises a range of benefits that the investment may achieve but have not been possible at this stage to quantify; for example wider area benefits or agglomeration. Other benefits that may be realised by the project further afield, such as on the North Island State Highway Network outside of Auckland are also acknowledged.

Concurrent with this investment case, NZTA and other stakeholders have been working to assess the pubic value of the rail network to New Zealand. This investigation has the purpose to:

"Develop an understanding of the macro/NZ wide value that the rail network and operations brings, and whether this is greater than the current combination of KiwiRail's commercial returns, plus any subsidy through a combination of NLTF subsidies for public transport and direct Crown funding".

The relationship of this work to this investment case can be characterised as the former addressing the economic value to NZ of the current network, while this investment case assesses the additional economic benefit of improving the current network.

Emerging findings from the public value assessment indicate that at a macro level the value of the rail network to the NZ economy is significant. It then follows that investing in improvements like the 3rd Main Line will provide a marginal increase in the overall public value that is equivalent to the benefits assessed for the scheme.

In broad terms there is a high degree of complementarity in the two approaches particularly in relation to the externalities considered which include the cost of traffic congestion, emissions, maintenance and accidents.

5.2 Do Minimum

The do minimum represents the most likely view of the transport network without the investment under consideration. The do minimum includes any relevant committed schemes together with the best indication of future land use extracted from relevant planning documents.

For the 3rd Main Line appraisal the do-minimum assumes that the City Rail Link is constructed to the current programme and that travel demand in the Auckland Region will be in line with forecasts used in the City Centre Future Access Study.

5.3 Economic Summary for 3rd Main Rail

Table 5 below summarises the results of the Economic Assessment. In line with EEM procedures a 40 year assessment period has been used with a 6% discount rate.

Timing	
Earliest implementation start date	2018
Expected duration of implementation	24 Months
Economic efficiency	
Time zero	August 2016
Base date for costs and benefits	2016
Present value net total project cost of recommended option	$ 60.6m
Present value net benefit of recommended option (exc. WEBs)	$ 106m
Expected BCR	1.8
First year rate of return (FYRR)	16.5%

Table 5: Economic Assessment Summary

5.4 Project Cost Estimate

KiwiRail has investigated the recommended option for some years and has prepared cost estimates for completing the project.

For appraisal purposes, the total project cost for capital expenditure and property acquisition is estimated to be $65m including a 10% contingency. Additional maintenance costs have been assessed to be $100k per annum. Construction is assumed to take place during the 2017-18 financial year with the benefit streams commencing directly thereafter.

5.5 Benefit Streams

The economic assessment monetises the benefits flowing from the five key streams described below.

Freight Delay Savings

By separating out freight and passenger trains through the W2W section, the 3rd Main Line will free up the passage of some 4-5 million tonnes of freight over this stretch of the NIMT. This will have a significant impact on the overall reliability of between 9,000 and 10,000 freight trains per annum that rely on this sole connection between Auckland and all regional destinations including the South Island.

The regular and unpredictable delays currently experienced by freight trains caused by interactions with passenger trains will be eliminated. As a result, the declining trend in the scheduled performance for on-time freight trains through W2W will be reversed and there will be an annual reduction of some 250 hours in unscheduled delays to freight trains.

Freight System Benefits

The 3rd Main Line addresses freight train reliability by both removing a widely recognised bottleneck and bringing more resilience to the W2W section of the rail network. This section of railway carries some of the heaviest freight train movements in the country and features in all rail freight movement between Auckland and destinations to the South. Therefore it will have a benefit to a large portion of the national rail network.

The 3rd Main Line delivers significant improvement because of the current nature of freight logistics. The movement of goods now operates through a tightly managed blend of road and rail based transit that is fully integrated with the supply chain. Reliability of delivery time sits at the heart of decision making around the choice of transport mode for any given part of the supply chain and ‘delivery within 30 minutes’ is the typical benchmark used to assess performance. Evidence shows that poor freight train reliability leads to a significant amount of freight being transported by road that otherwise would be carried by rail.

The benefits to the freight system from the 3rd Main Line reliability improvements are expected to lead to a clawback of rail freight leakage to road based transit, equivalent to 8 freight trains per week on average. As a result some of the most heavily congested sections of the State Highway Network including SH1 and SH20 will benefit from a reduction of around 400 HCVs per week.

Baseline passenger movements have been extracted from 2016 Hopcard data supplied by Auckland Transport whilst baseline freight data has been derived from a number of sources including KiwiRail records.

Within the assessment the assumed growth in passenger numbers reflects the current Auckland Transport Statement of Intent with extrapolation over the longer term. Growth forecasts for freight movement reflect the findings of the recently published Auckland Port Future Study.

Induced growth in either passenger or freight numbers as a direct result of the project has not been quantified at this stage. However there will be a level of travel demand for freight and passenger transport that will be created by this option. This effect will create an additional benefit from the project.

Passenger Journey Time Savings

The 3rd Main Line enables passenger and freight trains to run on separate tracks over the W2W section. As a result it will be possible to completely rework the passenger timetable without the need to consider the constraints imposed by mixed use operations. This means that headways between passenger trains can be tightened up bringing journey time savings to around 5 million passengers per annum. It also facilitates a move towards 'clock face' operation which simplifies the timetable for rail users and is consistent with making rail travel a more attractive option.

On average the 3rd Main Line will deliver journey time savings of 3 minutes to all passengers whose journeys traverse the W2W section of the route. As the current timetable is based around mixed use operation throughout the day, these journey time saving benefits will accrue during all hours of the day.

Passenger Reliability Improvements

The 3rd Main Line addresses passenger train reliability by removing the interaction with freight trains and bringing more resilience to the W2W section of the rail network. It is expected to deliver annual passenger time savings of over 660,000 minutes by removing the unscheduled delays caused by freight trains sharing the mixed use lines.

With the current mixed railway operation unscheduled delays are imposed on passenger trains by late running freight trains or if freight trains are given incorrect priority through the W2W section. Not only do the unscheduled delays affect the next scheduled passenger train but also subsequent trains when the timetable gets knocked 'out of sync'. Often the system can take several hours to get back on schedule.

Passenger Train Fleet Efficiencies

The 3rd Main Line will facilitate a complete reworking of the passenger train timetable without the need to consider the constraints imposed by mixed use operations. It will be possible to tighten up the headways between passenger trains and as a result it has been assessed that less rolling stock will be required to meet the needs of the timetable. As such, construction of the 3rd Main line will free up a three car EMU that will then become available for other uses once a new passenger timetable is introduced.

5.6 Other Non-Quantified Benefits

Induced Rail Freight Demand

The benefits to the freight system arising from more reliable freight trains will be significant. With such a dynamic freight logistics sector there is also a strong likelihood that improving rail freight reliability will result in an overall increase in the demand for movement of goods by rail. Quantifying such induced demand would require complex modelling beyond the scope of this appraisal and so the freight system benefits have been based solely around the clawback of rail freight known to be leaking onto road.

State Highway Decongestion Benefits

In time, without the 3rd Main Line, conditions for passengers travelling on the W2W section will deteriorate to the point at which some will switch mode to car based travel as a result of overcrowding and worsening reliability. This will add to the congestion on the State Highway Network.

The 3rd Main Line will allow passenger train capacity to cater for this increased demand.

Wider Economic Benefits

These are the economic benefits of transport schemes that are additional to the transport user benefits. Where there is a significant change in the spatial distribution of employment and residential locations, direct user benefits may not capture all the impacts of a transport scheme

The EEM identifies three main types of Wider Economic Benefit (WEBs); Agglomeration where firms and workers cluster for some activities that are more efficient when spatially concentrated; Imperfect Competition where a transport improvement causes output to increase in sectors where there are price margins; Increased Labour Supply where a reduction in commuting costs removes a barrier for new workers accessing areas of employment.

WEBs associated with the 3rd Main Line have not been quantified but are likely to stem from increased clustering of freight distribution activity in the vicinity of the W2W section. In addition, the improved journey times for passengers travelling from the south Auckland housing growth areas will improve public transport accessibility and provide increased opportunities for some workers to access jobs in the CBD.

The EEM indicates that WEBs can add up to 10% over conventional benefits but in the case of the 3rd Main Line it is likely that they will amount to a more modest amount.

5.7 Distribution of Costs and Benefits

The chart below shows the distribution of costs and benefits expressed in terms of net present value.

It can be seen from the chart that freight system benefits are one of the most significant benefit elements. At the same time these benefits are perhaps the most difficult to quantify – for example they are influenced by the type and value of goods being transported. This point is addressed below through sensitivity analysis but it is encouraging to note that a BCR above unity can still be achieved even if these benefits are put to one side.

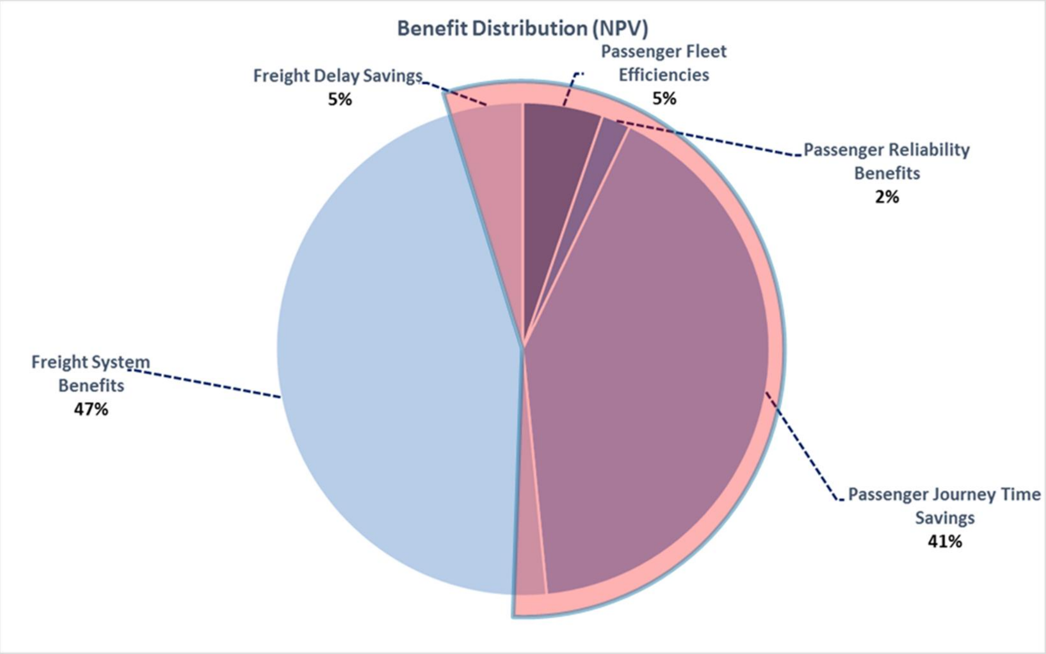


Figure 13: Benefit Distribution

5.8 Sensitivity Analysis

Sensitivity tests have been undertaken around the main issues raised in the Uncertainty log (section 3), to see how they may affect the conclusions of the economic assessment. The key issues tested were as follows:

Test S1 – variation in passenger growth assumptions

Test S2 – variation in freight growth assumptions

Test S3 – variation in project costs

Test S4 – Variation in freight system costs

Test S1 Variation in Passenger Growth Assumptions

The core economic analysis assumes that passenger growth will be in line with the Auckland Transport Statement of Intent which indicates 17% growth for 2016/17, 7% for 2017/18 and 3.8% for 2018/19. This is extrapolated at 3% per annum over the medium term. The core scenario also includes a cap on passenger growth at 10 million passengers per annum based on a broad assessment of the train capacity over the W2W section with the current rolling stock.

For the S1 test the medium term growth forecasts were adjusted to 2% (lower bound) and 5% (upper bound). Additionally the cap on passenger growth was removed. The results are summarised in the table below and produced a BCR range between 1.7 and 2.2.

Test S2 Variation in Freight Growth Assumptions

For the core analysis rail freight growth was set at 4% per annum in line with the forecasts set out in the 2013 Upper North Island Freight Story and the June 2016 Auckland Port Futures Study. Growth caps were also used towards the end of the appraisal period to limit overall growth to an approximate doubling of current rail freight movement as a proxy for the current system capacity.

For the S2 test the rail freight growth forecasts were adjusted to 2% (lower bound) and 5% (upper bound). Additionally the cap on growth was removed. The resultant BCR range is 1.6 and 2.3

Test S3 Variation in Project Costs

A project cost of $65m was used in the core analysis and distributed over a period of 2 years between 2017 and 2018. The project cost included a contingency allowance of 20% on top of the preliminary scheme estimates developed by KiwiRail.

For the S3 test the project cost was adjusted to $55 (lower bound) and $80 (upper bound) producing a BCR range between 1.6 and 2.3.

Test S4 Variation in Freight System Costs

The core economic analysis requires a value to represent the relative cost of transporting freight by road and rail. As no such value exists in the EEM it was necessary to derive one by researching international examples. The research identified a range of values and in turn these values needed to be contextualised to New Zealand. For the core analysis a value of $0.85 per lorry km was adopted.

For the S4 test upper and lower bound values for the relative costs of transporting freight by road and rail were set at $0.60 per lorry km and $1.14 per lorry km respectively. This produced a BCR range of 1.5 to 2.3, as shown in table 5 below.

Sensitivity testing			
Test Reference	BCR		
	Base Case	Lower Bound	Upper Bound
S1 – Variation in passenger growth assumptions	1.8	1.7	2.2
S2 - Variation in freight growth assumptions	1.8	1.6	2.3
S3 – Variation in project costs	1.8	1.4	2.1
S4 – Variation in freight system costs	1.8	1.5	2.1

Table 6: Economic Assessment Summary

Economic Assessment Summary

The sensitivity tests confirm that the main uncertainties related to implementation of this project do not compromise the Case for Investment. The expected range of Benefit Cost Ratios for the 3rd Main Trunk is between 1.5 and 2.3.

6 RECOMMENDATION

6.1 Summary

The investigation described in this report concludes that completing the 3rd Main Line would best meet the investment objectives for improving the Wiri to Westfield section of the NIMT Line (W2W) agreed by the project parties, KiwiRail, NZ Transport Agency, and Auckland Transport. This option is economically efficient, as the Benefit to Cost Ratio is expected to be between 1.5 and 2.3. A sensitivity analysis confirms this conclusion is still valid for a range of uncertainties that could affect the project.

Completing the electrified 3rd Main Line removes the W2W constraint by separating passenger and freight services on this critical section of the national rail network and in so doing it:

- creates sufficient additional train paths to accommodate forecast medium-term future demands for both passenger and freight services
- adds resilience into this busy section of the network by providing an extra line, so that if there are problems on any of the tracks, trains can still travel in both directions at the same time through this busy section of the network. Electrifying the 3^{rd} Main ensures that this resilience applies equally to both freight and passenger services.[2]
- addresses the operational problems that arise from the mixed use railway

The 3rd Main Line is also compatible with any likely future requirements for further capacity on this section of the NIMT. This would involve a 4th Main Line, possibly in combination with improvements to Westfield Junction. Building the 3^{rd} Main and 4^{th} Main (or some component parts) together could result in cost synergies and as a minimum it would be prudent to ensure any land purchases made for the 3^{rd} Main also take account of the 4^{th} Main too. Furthermore, while the majority of the benefits of getting the 4^{th} Main built early were assessed as being too far in advance of demand, the synergies between the two projects and some of the immediate benefits it would deliver suggest that further consideration of the preferred timing of the 4^{th} Main (or some level of staged delivery) within the ongoing development of the Auckland regional rail network is warranted.

As planning for the 3^{rd} Main project continues further integration with the planning for the 4^{th} Main should occur to ensure that the design supports ultimate delivery of the 4^{th} Main. Land acquisition is critical to this, and any land purchases or swaps done to support the 3^{rd} Main should also include design of the 4^{th}. As such preliminary design for the 4^{th} Main should continue in lockstep with the 3^{rd} Main design process.

---

[2] For the 3^{rd} Main to provide full resilience for passenger services, a third platform would be required at all stations along the three track section. This is not currently provided for in the envisaged design of the 3^{rd} Main, with the exception of Middlemore where the current side-platform configuration naturally provides the opportunity for a 3^{rd} platform by creating an island platform on the western side once the 3^{rd} Main is built.

6.2 Outcomes

Completing the W2W Third Main will immediately deliver the following outcomes:

- 300 hours pa freight travel time savings due to increased reliability
- 3 minute travel time saving for five million rail passenger journeys per annum
- Additional 3-car EMU made available for use on the network
- At least 400 fewer heavy vehicles on the State Highway network each week
- An increase in safety of the rail network as non ETCS fitted freight trains will not be sharing the track with ETCS fitted EMUs
- A step change in the performance of the national freight rail network for key journeys such as Wellington and Tauranga to Auckland
- An overall increase to the public value of rail in New Zealand

The 3rd Main Line Project will unlock the benefits of previous investments in the national transport system, including improvements to the NIMT and the ECMT, by improving travel times and reliability for rail customers across New Zealand. It will also support improvements to planned projects such as the Auckland City Rail Link, by complementing the additional capacity that will be introduced to the network. It will support land development and economic activity in the industrial heart of Auckland and the South Auckland Future Growth Zone by improving accessibility and the efficient movement for rail and road across the transport system.

Without improvements to the Wiri to Westfield section of the NIMT, the current mixed use section of rail will continue to adversely affect passenger and freight rail services, with additional delays and reduced reliability for customers and operators. As demand for transport increases into the future, the current network constraints will be further exacerbated, which in turn will suppress economic growth. For example, accessibility to the Onehunga / Penrose industrial area will be diminished. Opportunities for further development at the Port of Auckland will be constrained. Benefits from investment in the Auckland City Rail Link will be limited, as passenger trains from South Auckland will be restricted to the current level of service, which is already affected by delays imposed to provide access to freight train.

Overall the outcomes from implementing the 3rd Main Line between Wiri and Westfield will be to increase the public value of the national rail network and enhance the economic development of the Auckland Region. Without the 3rd Main Line improvement, the current bottleneck on this busy section of the transport network will impose increasingly adverse effects as demand for travel for passengers and freight rises.

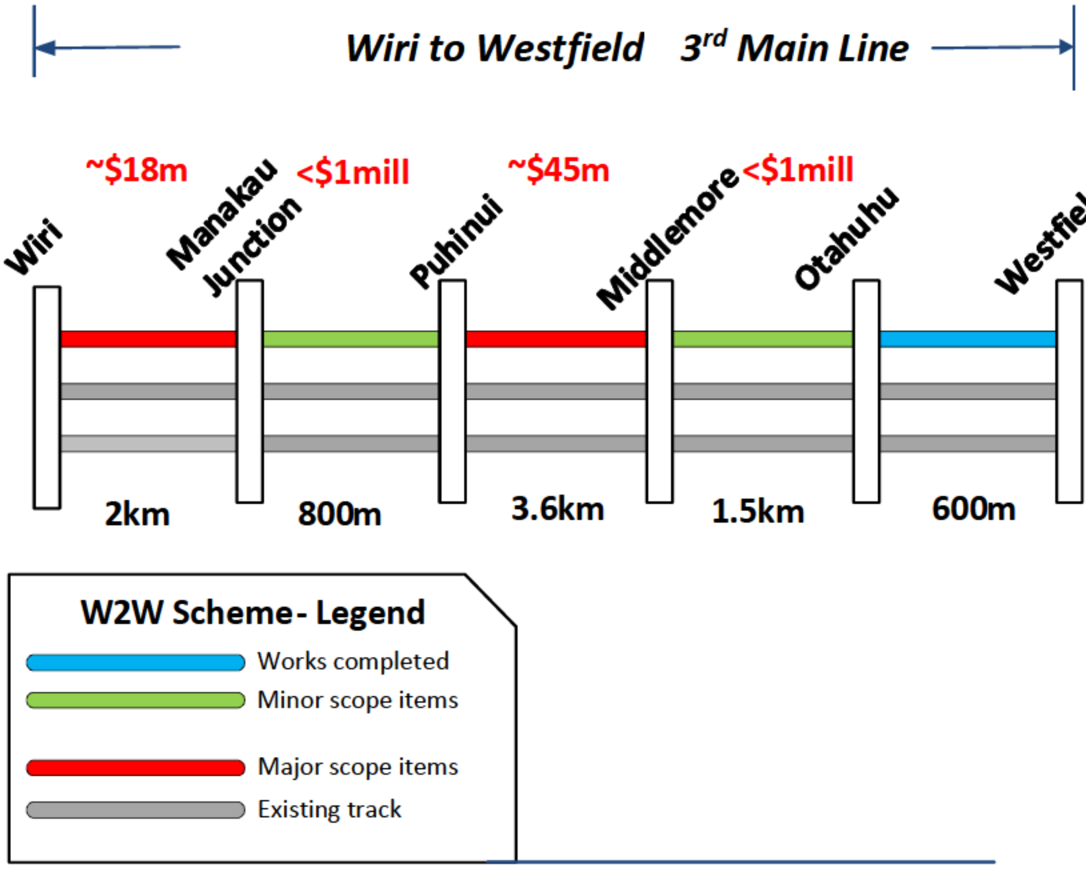
6.3 Implementation

Completion of the 3rd Main Line between Westfield Junction and the Wiri Inland Port requires the following new infrastructure:

- New section of 3rd track Middlemore to Puhinui (3.6km)
- Manukau Junction high-speed crossovers
- A third platform at Middlemore Station, designed to take account of future hospital plans

- A land exchange with Counties Manukau District Health Board for the 3rd Main Line. (Any negotiations around a land exchange should also take full account of the requirements for a future 4th Main).
- Overhead wiring and signalling changes across full scheme length (~8km)
- Track work between Wiri and Manukau Junction

The recommended option requires a capital investment of approximately $65m (including property and contingency), as summarised in the diagram below:



Design work for the 3rd Main Line is reasonably well advanced. Concept designs for all track, signalling and electrification has been finalised. Completion of the detailed design will take approximately 6 months.

Negotiations with Counties Manukau District Health Board for the land exchange required around Middlemore Hospital will need to be completed. Consents for implementing the project would involve approval of an Outline Plan of Works. It is anticipated that completion of these tasks would take less than 6 months and could run in parallel with completion of the detailed design and procurement of construction contracts.

A key consideration for the construction planning is the safe delivery of the construction services in and around an operating railway. Much of the large civil works will need to be done during "blocks of line" which planned periods where whole sections of the line are closed for maintenance purposes. These are planned many years in advance and require careful programming with other projects. The exact timeframes for construction of the 3rd Main will therefore depend on how the works can be coordinated with the blocks of line and other maintenance windows. A construction timeframe of 18months to two years could reasonably be expected.