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Hamilton to Auckland Intercity Connectivity

Interim Indicative Business Case

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3.0	Incorporate Stakeholder and Client Feedback

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1 Introduction

The Hamilton-Auckland corridor (see Figure 1) is a partnership in the government's Urban Growth Agenda (UGA). The UGA seeks to address the fundamentals of land supply, development capacity and infrastructure provision by removing constraints in the urban planning system. To help achieve this, the UGA has mandated a role for central government to partner with local government and iwi to facilitate pace and scale in urban development and to ensure government investment in infrastructure is aligned to help deliver connected, thriving and sustainable urban communities.

The Ministry of Transport aims to understand how faster journey times could play a role in increasing the development capacity of this corridor, and enhance the economic performance of these two fast growing cities and their regions.

Transport infrastructure sets the patterns in which cities grow, with residential location decisions made in part on access to work, and commercial location decisions based on access to labour and customers. To date, these patterns in the Hamilton-Auckland corridor were largely set by the road network and specifically the Southern Motorway-Waikato Expressway.

Additional capacity improvements to the Southern Motorway-Waikato Expressway have brought short term travel time benefits. However, the approach taken to land use and transport planning across the metropolitan areas has not provided sufficient focus on improving inter-city connectivity, and delivered transport outcomes contrary to the strategic direction articulated in the Government's Policy Statement on Land Transport.

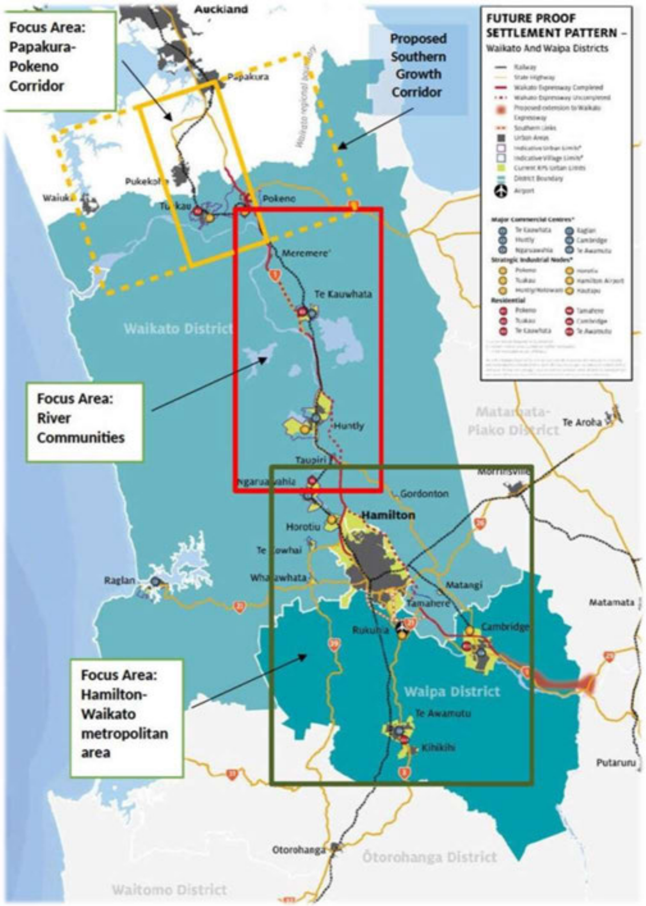


Figure 1: The Hamilton – Auckland Corridor[1]

[1] Report to Chair, Cabinet Economic development Committee, Appendix A (13 June 2019)

The shared spatial intent[2] for this corridor is to change the distributed land use pattern through the use of mass transit (fast rail), as it guides future urban growth towards more sustainable, resilient and affordable settlement patterns.

The spatial intent has already identified significant but specific development potential. The Papakura-Pokeno cluster has land zoned for future urban development around existing settlements and the Hamilton-Waikato metro cluster has significant employment and population growth potential both in its core and periphery. The river communities cluster has limited population growth potential, but opportunities exist around targeted development.

This interim Indicative Business Case explores how significantly reduced journey times between Hamilton and Auckland (particularly by rail) could unlock the corridor's full growth potential. It explores scenarios for improving journey times and capacity as well as the associated costs, the land use and likely economic impact.

Complementary initiatives are already underway in the Papakura-Pokeno cluster (Supporting Growth) and in the Hamilton-Waikato metro cluster (Metro Spatial Plan). A well-integrated approach with these initiatives will be essential to achieve the UGA's objective to:

- improve choices for the location and type of housing
- improve access to employment, education and services
- assist emission reductions and build climate resilience
- enable quality built environments, while avoiding unnecessary urban sprawl.

1.1 Purpose of the business case

The purpose of this business case is to:

- Develop and define a short list of fast rail scenarios for the Hamilton to Auckland Corridor
- Assess the potential transport benefits in accordance with Waka Kotahi NZTA's Economic Evaluation Manual (EEM) to enable a comparison with potential investment scenarios
- Assess the potential increase in the value of residential, commercial and industrial land in proximity to likely stations along the route
- Assess the potential land use change within the catchment of each station location for each short-listed scenario.

1.2 Business case format

The Interim Indicative Business Case has been prepared to provide decision makers with an early indication of the likely value of investing in faster rail journey times and how these might unite the economies of Hamilton and Auckland.

The business case is considered 'interim' as it is intended to provide insights into the value of faster rail journey times and does not explore a full range of indicative cost and benefits associated with alternatives to rail.

Cost and benefit ranges in this business case are also underpinned by several working assumptions due to the lack of an inter-regional demand model and limited design development.

This interim business case does not provide any information on the commercial, financial and management cases that typically explore the commercial viability, financial affordability and achievability associated with likely investment ranges.

[2] Hei Awarua kī te Oranga – Corridor for Wellbeing, 12 February 2019

The business case focuses on providing early inputs to the strategic and economic cases to inform a more comprehensive Indicative Business Case at a subsequent stage.

Section 2 of this report describes the overall strategic intention this intervention aims to support. It also outlines the growth and economic context for the corridor between Hamilton and Auckland and the current demand for travel between the two cities. It then describes the challenges associated with existing options.

These challenges are documented in three problem statements agreed through an Investment Logic Map workshop process. The section also contains the agreed investment objectives to respond to these challenges.

Section 3 provides a high level qualitative screen against the investment objectives for improving inter-city connectivity through likely rail and non-rail scenarios. Given the general focus on faster rail journey times in this interim business case, it also explores a wider range of improvements to the rail scenario.

Section 4 narrows these rail scenarios down to four short listed scenarios, selected to represent incremental journey time improvements from the base and assesses likely cost range, improvement in rail accessibility along the corridor and potential ridership uptake.

Section 5 provides an assessment of the potential transport benefits, potential increase in the value of land in proximity to stations, and the potential land use change as a result of the increase in accessibility and land value.

Section 6 summarises the overall findings and likely next steps.

2 Hamilton to Auckland Connectivity

2.1 Strategic context and vision

The success of New Zealand's cities affects the country's overall economic, social, cultural and environmental performance. However, key cities face ongoing challenges on a number of fronts.

Over the past 70 years, New Zealanders have become increasingly reliant on private vehicles to meet their travel needs. Whilst private vehicles are well suited to many transport tasks due to their flexibility and speed, such a high level of reliance in cities where space is constrained, and the population is growing, is not sustainable.

As a result, transport systems are not delivering the required capacity and connectivity between jobs and labour markets. The results are high levels of congestion, increasing transport emissions and street environments that are dominated by the private car. This places increasing pressures on health, safety, the environment and the economy.

As New Zealand transitions to a more sustainable, productive and inclusive economy, cities will play an increasingly important role by hosting a large share of the nation's labour market activity, business growth and connections with other countries.

Global trends see an ever-increasing portion of the world's population living in urban areas, with New Zealand no exception. Like much of the world, New Zealanders are heavily invested in their cities. According to the United Nations' publication - World Urbanization Prospects, the 2018 Revision - the bimodal distribution of Oceania's populations is projected to persist to 2050, at which point the median level of urbanisation for the region will have risen to 71%. Australia and New Zealand are both projected to become 91% urban.

Recognising the challenges with the ongoing urbanisation of New Zealand, the Urban Growth Agenda (UGA) has been established and was endorsed by Cabinet in August 2018. It is an ambitious and far-reaching programme designed to address the fundamentals of land supply, development capacity, and infrastructure provision.

The UGA will deliver medium to long-term changes needed to system settings to create the conditions for the market to respond to growth and seeks to bring down the high cost of urban land. It aims to improve housing affordability and support thriving communities.

The UGA's main objective is to improve housing affordability, underpinned by affordable urban land. This will be supported by wider objectives to:

- improve choices for the location and type of housing
- improve access to employment, education and services
- assist emission reductions and build climate resilience
- enable quality built environments, while avoiding unnecessary urban sprawl.

The aim is to plan to accommodate and manage growth instead of driving growth in the population. To achieve these objectives the UGA has five interconnected focus areas:

- infrastructure funding and financing — enabling a more responsive supply of infrastructure and appropriate cost allocation
- urban planning — to allow cities to make room for growth, support quality built environments and enable strategic integrated planning
- spatial planning (initially focused on Auckland and the Hamilton-Auckland Corridor) — to build a stronger partnership with local government as a means of developing integrated spatial planning
- transport pricing — to ensure the price of transport infrastructure promotes efficient use of the network

- legislative reform — to ensure that regulatory, institutional and funding settings are collectively supporting UGA objectives.

2.2 Hamilton to Auckland inter-city connectivity

The Hamilton-Auckland Corridor is an initial priority area for the spatial planning pillar of the UGA. It recognises that greater intercity connections will be key to improve access to jobs and opportunities, reduce transport's contribution to climate change and avoid unnecessary urban sprawl.

In November 2018 Cabinet mandated the Ministry of Transport to undertake a business case considering a full range of options for rapid transit to help deliver the Government's aspirations for growth and economic development in the Hamilton-Auckland Corridor.

Existing intercity connectivity is provided by state highway 1 (through a combination of the Southern Motorway and Waikato Expressway) as well as the 'start up' commuter rail service, Te Huia (commencing early 2021). See Figure 2 below.

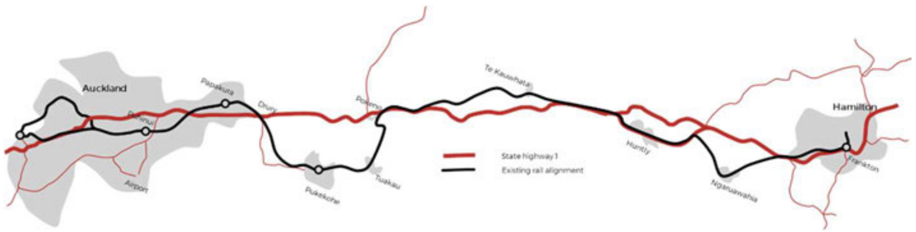


Figure 2: Hamilton - Auckland Corridor

The Ministry of Transport has developed a series of overarching objectives to guide the case for enhanced transport connectivity in the Hamilton-Auckland Corridor area as illustrated in Figure 1. These have been agreed by the stakeholders through a Technical Working Group established to support the Ministry in the initial stages of the project.

2.2.1 The strategic objectives are:

- harness the nationally significant economic contribution that the Corridor plays in increasing New Zealand's productivity, including supporting agglomeration and investment, and better integrating the regional economies of Hamilton and Auckland.
- enable a more efficient and affordable distribution of growth within the Corridor, for example by anchoring urban development and unlocking capacity for housing (especially affordable housing) at either end of the Corridor.
- improve access to opportunities for those within the Corridor, for example through increasing access to employment, improving transport choice and reducing congestion.
- reduce greenhouse gas emissions and the adverse effects of transport on the local environment and public health, for example through enabling sustainable transport choices.

This business case refines these strategic objectives further and narrows them down to focus only on the intercity connectivity element of the wider transport system within the Hamilton-Auckland Corridor. The investment objectives are discussed later in this section.

2.3 Economic context

A healthy economy requires good infrastructure – well-maintained roads, railway tracks, ports, airports, power plant and cabling – the physical assets that make it possible to travel, communicate and do business. Infrastructure is a critical facilitator for growth and productivity.

The shared spatial intent for the Hamilton-Auckland Corridor has identified this corridor as a nationally significant corridor to protect and grow. The corridor connects two of New Zealand's largest and fastest growing urban areas (Hamilton and Auckland) along a corridor with high natural and cultural importance and value.

Stats NZ population estimates for the entirety of New Zealand show an increase of 96,600 from 4,746,800 in 2017 to 4,843,400 in 2018. Auckland attacted the largest share of the growth (42%), followed by Canterbury (13%) and Waikato (10%).

Auckland is currently the largest regional economy in New Zealand, contributing 37.9% of New Zealand's GDP in 2018[3]. (Refer to Figure 3).

Waikato is the fourth largest regional economy in New Zealand behind Auckland, Wellington and Canterbury. It represents about 8.4%of New Zealand's GDP (Refer to Figure 3).

Both Auckland and Waikato regions experienced growth in GDP (between 2013 and 2018) at a higher rate than the national average of 30.9%. Auckland grew its GDP by 38.5% and Waikato by 31.8%. (Refer to Figure 4).

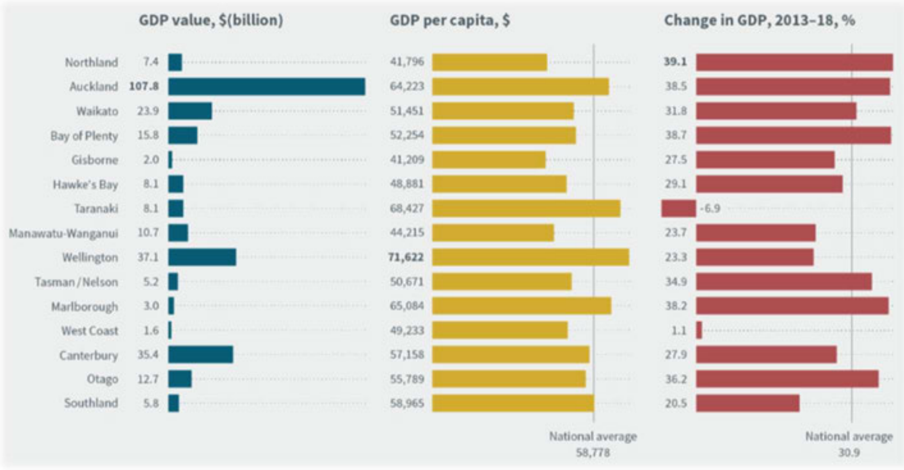


Figure 3: Growth Domestic Product by region, 2018 (Stats NZ)

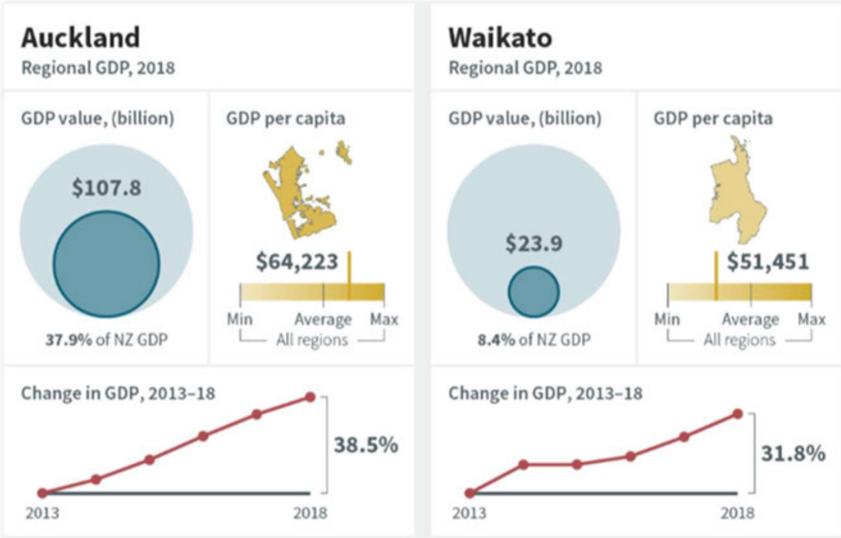


Figure 4: GDP comparison for Auckland and Waikato[4]

[3] Stats NZ website: Published 19 March 2019

[4] Source: Stats NZ website. Regional gross domestic product: Year ended March 2018

PwC's Competitive Cities Report evaluated several major economic shifts over a ten-year period between 2008 and 2018. In Auckland, falling discretionary income has occurred despite a rise in household income, as well as a rise in household costs. At the same time, Hamilton is primed to grow as a metropolitan centre, with increases in both household income and discretionary income over the past decade. (Figure 5 below):

Figure 5: Household Changes (PwC Competitive Cities Report)

A recent study[5] commissioned by Hamilton City Council found the potential roles and functions of the Hamilton Metro Area to be:

- Servicing for activities in primary sector hinterland
- Servicing for population in wider Waikato area
- Research and development activities, food innovation, and logistics related to the above
- A university centre

The study concluded that a status quo development scenario would likely see an ongoing dispersal of the current Hamilton Metro Area, with little focus on the four potential roles and functions. The largest impact on potential economic development could be from a compact and connected Hamilton Metro Area that is connected to the wider Waikato **and** connected to Auckland.

[5] Hamilton – Waikato Metropolitan Area, Role and function now and into the future, 2020, BERL

2.4 Baseline growth in the corridor

Under any growth scenario, the scale of projected population growth at both ends of the Hamilton-Auckland Corridor is likely to be significant.

Both the Auckland and the Waikato sub-region (comprising Hamilton City, Waikato and Waipa Districts) are currently experiencing very high population growth, particularly in Auckland and Hamilton but also in the small urban settlements located along the Corridor.

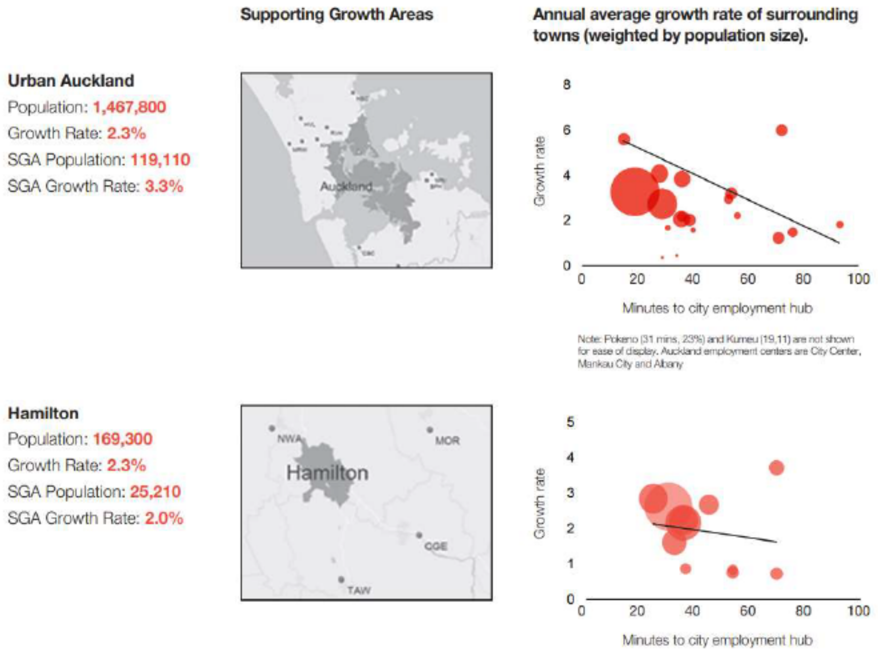


Figure 6: Growth cities and their supporting growth areas[6].

This is consistent with PwC's findings[7] that growth cities are often surrounded by smaller but generally faster growing supporting growth areas. These areas are generally located within a 40 minute commute of a major employment area and arise when residents trade off higher house prices for longer commutes (refer to Figure 6 above).

June 2019 estimates[8] of the population by region indicate both Auckland and Waikato Regions experienced annual population growth between 2017 and 2018 that exceed the New Zealand population growth rate of 2.0%. Auckland grew by 2.5% (the highest in NZ) and Waikato by 2.2%.

2.4.1 Auckland

The Auckland Forecasting Centre supplied employment and population data for 2016, 2028 and 2048 (based on Scenario i-11.4). This data shows that the population in the Auckland Region is projected to grow between 2016 and 2048 by 51% from 1.588 million to 2.395 million. Employment is forecast to grow by 43% from 690,000 to 986,000 by 2048.

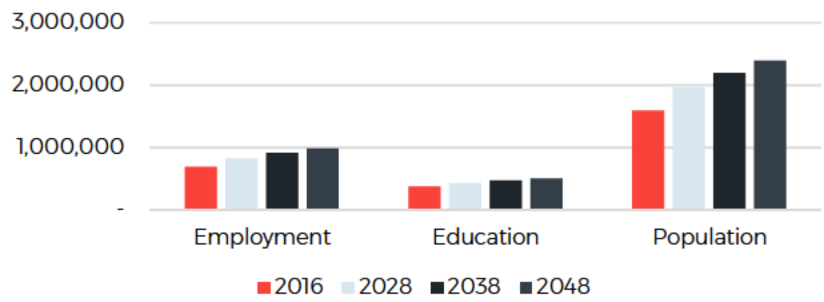


Figure 7: Auckland Scenario i-11.4 growth forecast[9]

[6] Source: Competitive Cities: A decade of shifting fortunes; PwC
[7] Source: Competitive Cities: A decade of shifting fortunes; PwC
[8] Source: Stats NZ: Published 19 March 2019
[9] Source: Auckland Foreasting Centre – Scenario I-11.4

2.4.2 River communities

Population growth is expected to occur along the Waikato river communities located within the Corridor as shown in Figure 8 below.

The northern communities are projected to experience higher growth than the communities located closer to Hamilton. Between 2021 and 2050 Tuākau's population is projected to grow between 53% and 109%, Pokeno between 70% and 146%, and Te Kauwhata between 86% and 152%.

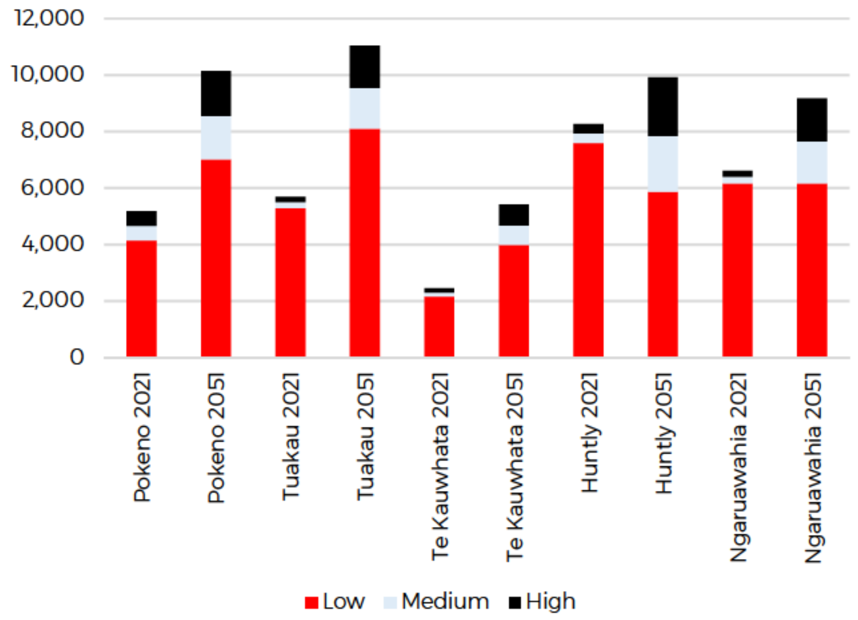


Figure 8: Population forecast for river communities[10]

Between 2021 and 2051 the Stats NZ projections show a 23% decline in Huntly's population (under the low growth scenario) and a a 31% increase under the high growth scenario. Similarly Ngaruawahia's population projection stays relatively flat under the low growth scenario and growing by 49% under high growth scenario.

2.4.3 Hamilton

Stats NZ data shows that between 2021 and 2051, the population in Hamilton City is projected to grow by between 20% and 60%, with the medium growth projection from 177,000 to 240,000, a 40% increase.

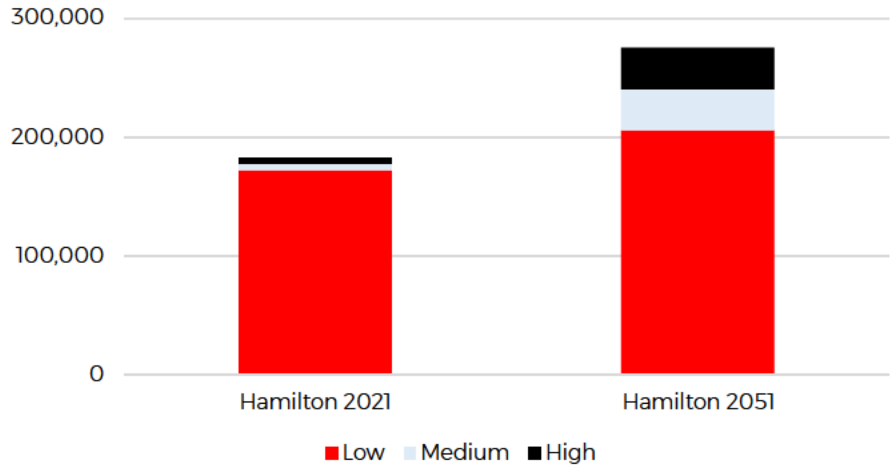


Figure 9: Population forecast for Hamilton City [11]

[10] Source: Stats NZ: projected resident population

[11] Source: Stats NZ projected resident population

2.5 Current corridor mode options

There are two main transport networks connecting Hamilton and Auckland, the Southern Motorway-Waikato Expressway section of state highway 1 and the Main Trunk rail line.

State highway 1 (SH1) is a nationally significant transport corridor (classified as a National High-Volume road under the One Network Road Classification (ONRC)).

Population growth is putting increased pressure on these networks as limited other options exist.

2.5.1 Demand for travel

Over the past six-year period (2013-2018) traffic volumes on SH1 grew by 32% and 28% as measured at the Bombay and Taupiri telemetry sites respectively. This represents a constant rate of traffic change over that period of approximately 5.7% per annum (Bombay) and 5.1% per annum (at Taupiri).

These annual growth rates outstripped population growth in both the Waikato region (2.0%) and the Auckland region (2.6%) over the same period[12].

The population and employment forecast within the two regions will result in further growth in the demand for travel between the two cities.

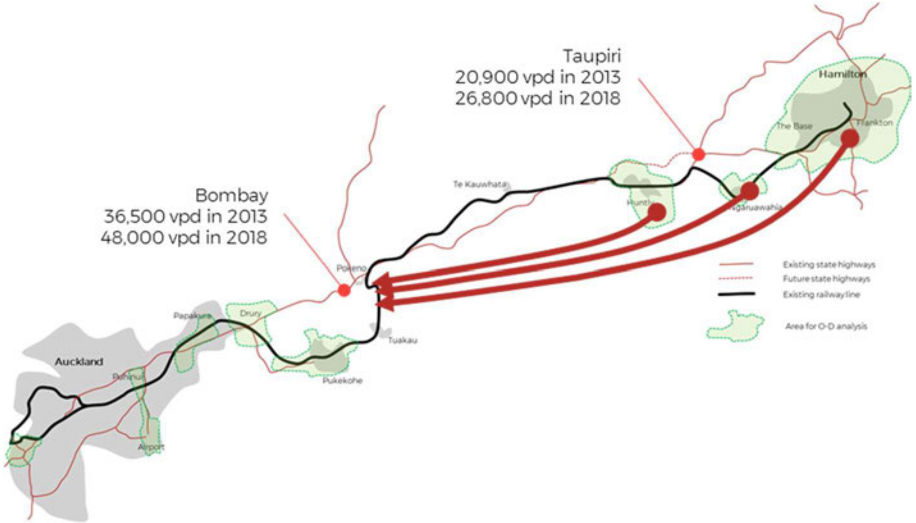


Figure 10: Travel demand

The demand forecast[13] indicates an increase of between 140%-150% in trips between the Waikato and Auckland regions over the next 30 years, from approximately 26,500 to over 64,000. This represents a constant rate of traffic change over that period of approximately 2.7%.

It is important to note that the current regional transport models for Waikato and Auckland only cover their respective areas and reflect inter-regional demands as a boundary input into the model. Origin to destination (O-D) patterns from key zones within each region to the Auckland-Waikato boundary were determined from each strategic model. However, the existing tools have restricted detailed O-D analysis from each neighbouring region to the city centre and key employment hubs of the other region.

[12] Source: Stats NZ population data for period 2013-2018

[13] WSP O-D analysis from Waikato Regional Transport Model, 2018-2051, using land use code BB

It was however possible to summarise from the regional model the origin of the inter-regional trips crossing the Auckland/Waikato boundary via SH1. Hamilton, Ngaruawahia and Huntly are projected to contribute less than 10% of the total daily volume entering the Auckland region.

This warrants further investigation in future stages (through the development of more comprehensive tools, such as an inter-regional model). However, the total journey time, together with significant variances in reliability will influence the level of the overall demand from these locations. These factors are explored further in the section below.

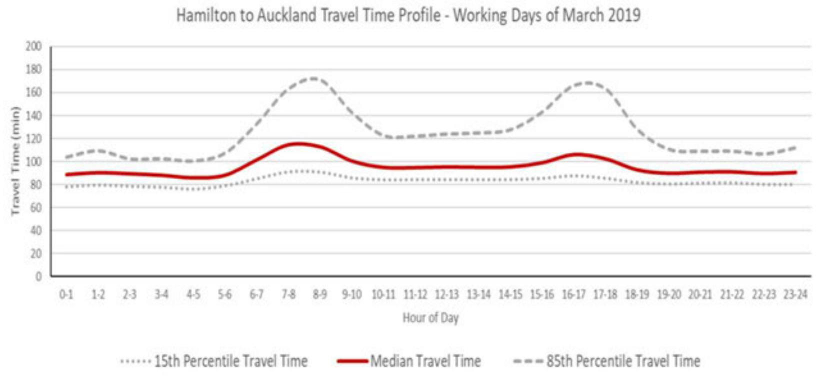
2.5.2 State highway 1

Both the Auckland Southern Motorway and Waikato Expressway have been subject to significant upgrades over the past decade, with the Huntly bypass the latest section to open in early 2020.

Tom-Tom data was sourced for vehicles travelling between Hamilton and Auckland along this corridor to gain a better understanding of the current journey time and reliability issues experienced by intercity travellers.

From the March 2019 Tom-Tom data, it is evident that the average travel time between Hamilton and Auckland is 130 minutes during the morning peak and 127 minutes during the afternoon peak, with a variance of 59% between the 15th and 85th percentile travel time for the morning peak and 62% variance for the afternoon peak.

Hamilton to Auckland	Morning peak (7am-9am)	Afternoon peak (4pm-6pm)
Average Travel Time	130 minutes	127 minutes
Median Travel Time	114 minutes	105 minutes
Travel Time Planning Index[14]	2.5 hours	2.7 hours



Based on Tom-Tom data the Southern Motorway-Waikato Expressway enables vehicle travel time of approximately 80 mins (1h20mins) between the two cities during off-peak times.

From a commuter perspective, these journey times (and travel time variability band) increase significantly during peak times, with the median journey time increasing to approximately 1h54 mins, and the 85th percentile travel time taking as long as 2h50 mins.

From a business traveller's perspective, the travel time during midday conditions currently takes approximately 95 minutes (1h 35mins). Variability of conditions along the corridor could increase the travel time by a further 30 mins - up to 125 mins (just over two hours).

[14] The planning time index represents the total travel time that should be planned when an adequate buffer time is included.

Looking at the travel times in a southbound direction (Auckland to Hamilton) the data shows the average travel time between Auckland to Hamilton is 121 minutes during the morning peak and 148 minutes during the afternoon peak, with a variance of 62% between the 15th and 85th Percentile Travel Time for the period 4pm-6pm.

Auckland to Hamilton	Morning peak (7am-9am)	Afternoon peak (4pm-6pm)
Average Travel Time	121 minutes	148 minutes
Median Travel Time	109 minutes	125 minutes
Travel Time Planning Index	1.8 hours	2.8 hours

Based on median journey time, South Auckland and Hamilton lie within a 90-minute band (1h30 mins) of each other with the two city centres approximately 1h50 mins from each other.

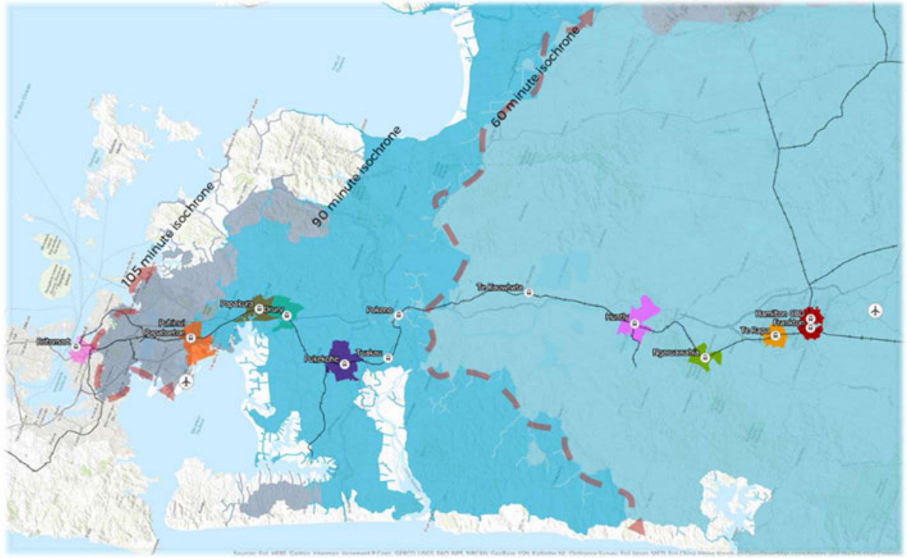


Figure 11: Journey time (median) isochrones from Hamilton city centre

2.5.3 Impact of growth on journey times

Significant investments in the Southern Motorway-Waikato Expressway is expected to bring short-term improvements to travel times.

The journey times on the Expressway section are not expected to deteriorate significantly over the next 30 years. However, journey times along the motorway section in Auckland (north of the Bombay Hills) are forecast to deteriorate by approximately 10%[15] between 2028 and 2048 in both the morning and inter-peaks.

This is forecast to occur despite current and planned investments in motorway widening: 70% of this section of the

[15] Journey time forecast based on AFC strategic modelling from southern boundary to Port section done for ATAP

route is forecast to be congested during the morning peak by 2048.

2.5.4 The main trunk railway line

The North Island Main Trunk (NIMT) route is a predominantly a double track rail line between Auckland and Hamilton, with some sections of single track (e.g. at Meremere and Taupiri).

The Auckland Metro rail network extends from Auckland's city centre to Papakura (soon Pukekohe), and the potential for a Hamilton Metro network is being considered (by others). The line is currently electrified between Auckland city centre and Papakura, with investment to extend the electrification as far south as Pukekohe confirmed through the New Zealand Upgrade Programme.

There is currently a tourist service between Auckland and Hamilton – the Northern Explorer, operated by KiwiRail. This runs southbound on Monday, Thursday and Saturday, and northbound on Wednesday, Fridays and Saturdays.

Waikato Regional Council is planning to introduce a 'start up' commuter service in 2021. This service will run between Frankton and Papakura and will consist of two Hamilton to Auckland services in the morning peak, and two Auckland to Hamilton return services in the afternoon peak. Passengers travelling to Auckland's city centre will be required to transfer at Papakura from the inter-regional service to the metro service.

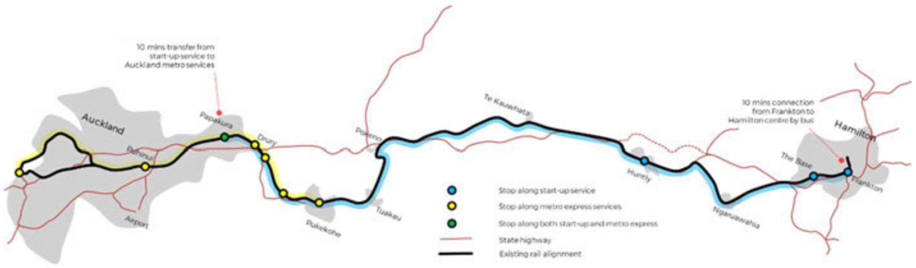


Figure 12: Hamilton – Auckland start-up service

The likely journey time for a passenger to complete the entire journey from Hamilton city centre to Auckland city centre is estimated at approximately 152 mins – or $2^{1/2}$ hours.

This estimate allows for approximately 10 mins from Hamilton city centre to Frankton, 82 mins on the train between Hamilton and Papakura, approximately 9-12 min transfer, then 50 mins from Papakura to Britomart.

Future investment in Auckland's metro express services would reduce this journey time by approximately 18 minutes to 134 minutes (Papakura to Britomart express service is expected to reduce to 32 minutes).

2.6 Corridor challenges and opportunities

The shared spatial intent[16] notes that the Corridor has significant potential: there is significant housing and employment growth potential in the Drury-Paerata-Pukekohe-Tuakau-Pokeno cluster in the north, and in the greater Hamilton area that stretches from Ngaruawahia in the north to Cambridge, Te Awamutu and Hamilton airport in the south.

However, it also has its challenges. Existing corridor management issues - such as congestion on the Southern Motorway and water discharge quality - have wide-reaching impacts across the Upper North Island and limit current and future potential unless addressed.

2.6.1 Unpredictable Travel Time

The amount of travel time between Hamilton and Auckland (by any mode) is limiting the opportunity to strengthen economic integration and productivity of the two metropolitan areas. This is evident in:

- Long and unpredictable travel times due to worsening traffic congestion
- Lower than expected demand between Hamilton and Auckland cities due to unpredictable travel times

The journey time and journey time reliability between the two cities are discussed in the previous section.

2.6.2 Lack of connectivity between the two city centres

The approach taken to land use and transport planning across the metropolitan areas of Auckland and Hamilton has not provided sufficient focus on improving inter-city connectivity. This is evident in:

- Limited focus on transport orientated developments (TOD) within the corridor and
- Car-dependent low-density urban form

Due to rising urban land prices, low-income households are being forced to move out of urban centres to locations that are generally low density and poorly connected by public transport to access affordable housing. This pattern increases car-dependency, which places a disproportionate financial burden on low-income households.

Developments at low densities along the Corridor are dependent on the private car. This has fuelled the demand for road-based interventions to combat congestion. Low densities also make the provision of public transport less viable, with many of those in the corridor having limited transport choice when accessing jobs, services and other aspects of life important for their wellbeing.

The quality of transport infrastructure plays a direct and vital part in driving business investment and business locating decisions. With increased inter-city connectivity, business location decisions can be influenced and increase job opportunities within the corridor. Focused TOD developments within the corridor with higher densities will support inter-city public transport.

2.6.3 Declining Wellbeing

The car-dependent and relatively low density urban developments within the Auckland and Hamilton metropolitan areas, combined with a road-vehicle dependent corridor between the two economies are hampering efforts to decrease greenhouse gas emissions, transport accidents, injuries or fatalities and improve health. This is evident in:

[16] Hei Awarua kī te Oranga – Corridor for Wellbeing, 12 February 2019

- Increases in deaths and serious injuries on roads are impacting on social wellbeing
- Car-dependent low-density urban form with low levels of active transport
- Growth in vehicle kilometres travelled per capita in both cities

A comparison of crash and casualty numbers per km in the last five years along the Auckland Southern Motorway and Waikato Expressway show sections of SH1 in relatively urban areas (Newmarket to Drury and Te Rapa to Frankton) are preforming worse against all other RoNS in terms of number of high severity crashes and casualties.

Regular aerobic exercise is known to cut the risk of heart disease, type-two diabetes, all types of cancer, high blood pressure and obesity[17], and evidence shows that New Zealand communities with higher numbers of people cycling and walking, especially for transport purposes, have better health profiles than those in less active neighbourhoods.[18]

The annual distance travelled in single occupancy vehicles in the two main urban areas on weekdays has increased by 14% since 2003/07 in Hamilton (recording the second highest growth level in NZ) and 4% in Auckland[19]. The distance travelled per capita in Hamilton is also 18% higher than the distance per capita in Auckland.

2.7 Positive outcomes investment in inter-city connectivity could achieve

Transport investment must enable the type of growth and outcomes that ensure the country prospers and that more people can share in that prosperity. The opportunity that inter-city connectivity brings to address the challenges listed in the previous section are:

2.7.1 *Improve economic integration and access*

Improve economic integration between Hamilton and Auckland through faster and more reliable inter-city connectivity to harness the benefits of agglomeration.

Catalyst for TOD that supports a compact and connected Hamilton Metro Area and assists with accessibility improvements to high-quality tier 1 services in the Hamilton Metro Area.

Enhanced access to jobs, education, amenities and other services necessary for thriving and resilient communities along urban areas within the Corridor.

2.7.2 *Support urban development strategies*

'Making room for growth' by ensuring that planning for urban development is integrated and aligned with infrastructure and transport investment.

High capacity transport corridor supports higher growth (especially in northern Hamilton) than through a business as usual approach, to assist with the transitioning to a compact and connected Hamilton Metro Area.

Inter-city connectivity could unlock land for housing and support new higher density, compact and vibrant urban centres. These are the essential elements of a strategy to reduce urban sprawl and make more efficient use of land.

[17] World Health Organisation 2002 A Physically active life through erveryday transport, Copenhagen, Demark.

[18] Genter, J.A., Donovan, S. and Petrenas, B. 2008 Valuing the health benefits of active transport modes, NZTA Research Report 35

[19] Ministry of Transport – Dashboard: RD012.

2.7.3 *Reduce the contribution inter-city travel makes to greenhouse gas emissions*

Reduce the contribution inter-city travel makes to greenhouse gas emissions by enabling sustainable transport options.

Through increased public transport mode share for inter-city travel, reduced CO_2 emissions can be achieved.

Overall, there is an opportunity for investment that stimulates and shapes growth in a way that reduces the need for travel by single occupant vehicles.

2.7.4 *Reduce the contribution inter-city travel makes to transport accidents, injuries and fatalities*

Reduce the contribution inter-city travel makes to transport accidents, injuries and fatalities (now and in the future) by enabling safer transport choices.

Increased public transport patronage has a positive effect on reduced transport accidents, injuries and fatalities with fewer vehicles travelling on SH1.

Increased wellbeing and productivity can therefore be achieved.

2.8 Investment objectives

A facilitated investment logic map workshop (ILM) was held to help define and validate the business need, and the benefits the solution is expected to deliver.

2.8.1 *Facilitated Investment Logic Map (ILM) workshop*

The ILM workshop[20] was held on Wednesday 14th October 2019 to facilitate agreement amongst the project partners on the articulation of the problem statements and potential benefits for investing in enhanced connectivity within the Hamilton to Auckland Corridor.

The following problem statements were agreed on between participants:

- Problem 1: The amount of time taken to travel between Hamilton and Auckland (by any mode) is limiting the individual and combined economic performance including productivity of the two metropolitan areas and impacting on social wellbeing (50%).
- Problem 2: The approach taken to land use and transport planning across the metropolitan areas has not provided sufficient focus on improving inter-city connectivity (30%).
- Problem 3: The car dependent and relatively low density of urban development within the Auckland and Hamilton metropolitan areas combined with a road-vehicle dependent corridor between the two economies is hampering our ability to decrease greenhouse gas emissions, transport accidents, injuries or fatalities and improve health (20%).

2.8.2 *Workshop participants*

Representatives from the following project stakeholders / partner organisations participated in the facilitated workshops:

- The Ministry of Transport is the government's principal transport adviser. The majority of their work is in providing policy advice and support to Ministers. (Project Owner)
- The New Zealand Treasury is the Government's lead economic and financial adviser.
- KiwiRail Holdings Limited (KiwiRail) is a limited liability company incorporated under the Companies Act 1993 and a state-owned enterprise (SOE) under the State-Owned

[20] Workhop facilitated by accredited ILM facilitator: Sue Powell

Enterprises Act 1986. KiwiRail moves around 25% of New Zealand's exports, transports more than one million tourists and helps enable 34 million commuter journeys a year.

- Waka Kotahi New Zealand Transport Agency (NZTA) is responsible for contributing to an efficient, effective and safe land transport system in the public interest as set out in the Land Transport Management Act 2003.
- The Ministry of Housing and Urban Development leads New Zealand's housing and urban development work programme. Its purpose is creating thriving communities where everyone has a place to call home.
- The role of Waikato Tainui is to achieve and support the existing and future settlements of the Treaty of Waitangi/Te Tiriti o Waitangi and/or raupatu claims of Waikato-Tainui. Waikato Tainui act as trustee of the Waikato Raupatu Lands Trust.
- Auckland Council oversees regional strategies, land use, unitary planning related to the council's area of jurisdiction.
- Auckland Transport is responsible for all of the region's transport services (excluding state highways), from roads and footpaths, to cycling, parking and public transport.
- Hamilton City Council oversees regional strategies, land use, unitary planning related to the council's area of jurisdiction.
- Waikato Regional Council oversees regional strategies, land use, unitary planning related to the council's area of jurisdiction.

2.8.3 Investment objectives

Following on from these problem statements, the project team developed a set of potential investment objectives and measures to guide scenario development:

Investment objective	KPIs
IO 1: Reduce travel time between Hamilton and Auckland to improve access and harness the benefits of agglomeration.	1. Improve access to labour markets, education and social activities 2. Improve commute times and reliability of journeys 3. Increase the size of the labour pool that can be drawn upon 4. Improve access to tertiary educational and health care opportunities
IO 2: Support urban development strategies for the metropolitan areas to reach their full potential.	1. Potential for enabled capacity (especially transit oriented development) within the catchment area of a strategic station location 2. Alignment with planned investment in the public transport systems in the metropolitan areas 3. Increase the corridor's transport network capacity and utilisation of this capacity
IO 3: Reduce the contribution inter-city travel makes to greenhouse gas emissions, transport accidents, injuries and fatalities (now and into the future) by enabling sustainable transport choices.	1. Increase public transport mode share for inter-regional travel 2. Increase public transport patronage in the corridor 3. Reduce CO2 emissions 4. Reduce harmful air pollutants

3 Strategic Options Scenarios

3.1 Approach and methodology

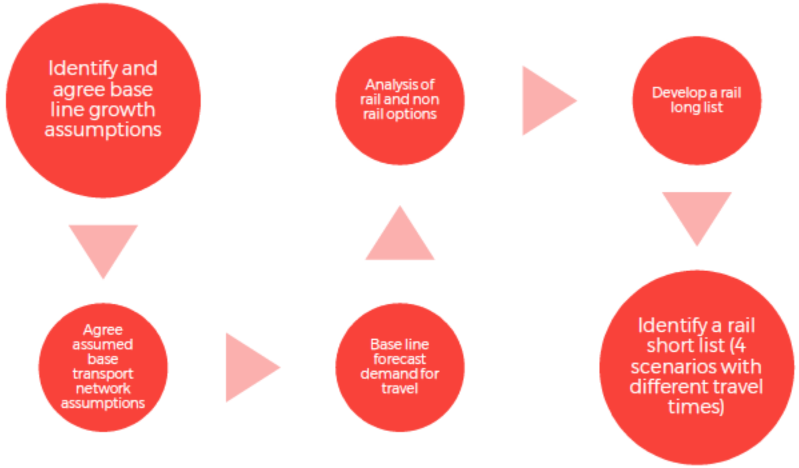
The success of any enhanced inter-city connectivity along this corridor is dependent on its ability to shape future land use patterns in a way that substantially contributes to the three investment objectives identified in the previous section.

The methodology in the business case identified the strategic direction and outcomes sought by the stakeholders for the Corridor. It then used the Auckland and Waikato strategic models to help inform the future patterns and demand for travel in each region. These models are underpinned by forecasted growth and land use distribution as described earlier in the report.

The methodology also included a best practice review of some international examples and the role fast rail plays in regional development and associated challenges with implementation. Summary slides of this review are included in Appendix D.

A high level qualitative assessment was then performed against the investment objectives identified through the ILM workshop. The aim of this assessment was to test the rationale for rail as a mode to improve intercity connectivity.

The rail development focused on a long list of incremental options to reduce journey time, with the selection of four short listed scenarios that reflect step changes in journey time reduction to inform the cost and benefit implication of these step changes.



3.1.1 *Auckland by 2048*

Baseline growth assumptions: For Auckland these were derived from the Scenario I-11.4 population and employment growth forecasts provided by the Auckland Forecasting Centre as discussed earlier under section 2.4.1.

Transport network assumptions by 2048 for Auckland assume the following (relevant to the Corridor):

- The rail corridor will be electrified between Pukekohe and Papakura, and express metro services will be introduced between Pukekohe and the city centre. These will deliver 30 min journey times from Papakura to Britomart.
- Four narrow gauge tracks will be available on rail corridor between Wiri and Pukekohe.
- The commuter and freight train schedules will have capacity for an hourly inter-city commuter services.
- Transport improvements to support southern growth area will be implemented (including Mill Road and additional rail stations at Drury, Drury West and Paerata).

- SH1 between Bombay and Takanini will be widened to allow for an additional lane in both directions.

3.1.2 Waikato by 2051

The Waikato baseline growth forecasts were provided by Stats NZ as discussed earlier in this business case.

Transport network assumptions by 2050s for Waikato assume the following (relevant to the Corridor):

- Expressway upgrades will be completed that allow for the Huntly bypass,
- Metro PT system will be available in Hamilton to serve the city centre from wider Hamilton metropolitan area,
- Inter-regional rail service between Hamilton and Papakura will be operational with peak hour services only (as discussed earlier).

3.2 Fast rail in Australia

High speed rail schemes linking the major capital cities along Australia's east coast have in the past been proposed as an alternative to air travel as the dominant inter-state means of transport. The last major Commonwealth study completed in 2013 estimated a cost of over A$100Bn to build a 1,750km dedicated high speed route connecting Melbourne, Canberra, Sydney and Brisbane.

More recently, both Commonwealth and State governments have proposed a series of Faster Rail schemes with a focus on regional development and improved servicing of existing demand from satellite cities to capital cities. These schemes are targeted at improving journey times with speeds up to 250 km/h rather than the faster than 250 km/h speeds typically associated with 'high speed' rail.

In Victoria, this involves the upgrade and service frequency improvements along the heavily used route between Melbourne and Geelong, and integration with the future Airport Link. The investment is looking to halve the existing 1-hour journey time between the cities. A private consortia proposal north to Shepparton from Melbourne is also being investigated by the Commonwealth Government.

In New South Wales, routes which head north towards Newcastle via Gosford, west towards Parkes via Orange and Bathurst, inland towards Canberra and south towards Nowra (Bomaderry via Wollongong) have been identified as potential areas for investment. These are in the development phase and the focus is on the upgrade of existing routes in the short to medium term, and on integrated high-speed routes in the future.

In Queensland, Faster Rail is being proposed by the state government on links from the capital city of Brisbane north to the Sunshine Coast, south to the Gold Coast and west to Toowoomba. This Fast Rail network is linked to well established settlement patterns and forms a critical piece of the transport solution for both the South East Queensland "City Deal" and its bid for the 2032 Summer Olympic Games.

In July 2019, the Commonwealth government established the National Faster Rail Agency to support the development of faster rail schemes by working closely with the state and territory governments. The Commonwealth has provided initial funding for the delivery of the Melbourne to Geelong route and business case funding for several other routes as part of a 20-year plan for Faster Rail.

These schemes are important to support regional economic development and take the pressures from growing populations away from city centres, through improved quality of transport along the corridors and providing access to more affordable housing. The improved connectivity looks to stimulate and increase the role that regional cities play in Australia's economy.

3.3 Fast rail in the United Kingdom

The core of the UK railway network which services the major cities operate at speeds up to 200km/h. These are routes which originate from the Victorian era and have been progressively modernised to improve capacity and journey times.

Tilting trains are used on the West Coast Main Line due to the track geometry, and the capacity constraints on this route are a key driver for the High Speed 2 (HS2) project. This will provide a new dedicated high speed route capable of 360km/h between London and Crewe, with subsequent expected extensions to Manchester and Leeds. Connections to the existing network will allow services to continue onto other destinations further north such as Newcastle, Glasgow and Edinburgh. Substantial improvements, as part of Northern Powerhouse Rail, are expected to be made to the TransPennine set of routes between Liverpool, Manchester, Sheffield, Leeds, Hull and Newcastle, to complement HS2.

High Speed 1 (HS1) was the first dedicated high speed route built in the UK, running from London to the Channel Tunnel with operating speeds up to 300km/h. It opened in two stages and allowed the international services travelling to/from the continent to save an hour on their journey times resulting in rail's modal share of well above 60%. Local services in the South East also benefitted through the introduction of faster trains operating at up to 225km/h which use the new infrastructure in/out of London and serve stations on the classic network such as Canterbury and Margate, in the county of Kent.

The HS1 route into London via the east tied into several economic development plans for the regeneration of Kings Cross St Pancras – the London terminus, Stratford – the site for the 2012 Olympic Games and Ebbsfleet – a new garden city for commuters. The plans at Kings Cross St Pancras and Stratford have both been great successes, and developments around Ebbsfleet are emerging, although considerably behind the other locations.

An important factor in the planning and development of HS1 and HS2 has been the role that these railways play as a catalyst for greater economic growth. In both cases, station location and route alignment planning have been vital to unlocking this potential and benefits away from the immediate line of route have been possible through connections onto the existing network.

3.4 Analysis of rail and non-rail options

A range of rail and non-rail interventions for improving inter-city connectivity were then qualitatively assessed against the investment objectives and desired outcomes.

This analysis (summarised in Table 1 below) concluded that inter-city rail is the only option that can contribute meaningfully towards each of the investment objectives.

The long list process then explored a range of likely rail scenarios further.

Table 1: Qualitative assessment of rail and non-rail scenarios

Revised Investment Objective	Outcome	Invest in motorway upgrades	Invest in inter-city bus services	Invest in inter-city rail services	Invest in more flights
IO 1: Reduce travel time between Hamilton and Auckland to improve access and harness the benefits of agglomeration.	1. Improve access to labour markets, education and social activities 2. Improve commute times and reliability of journeys 3. Increase the size of the labour pool that can be drawn upon 4. Improve access to tertiary educational opportunities	Current and future planned upgrades to the state highway corridor will provide some initial level of travel time reduction and reliability improvements between the two cities. However, these initial travel time improvements are expected to erode to similar (or slightly worse) times with forecasted growth in traffic volumes over a three-decade period.	Infrastructure improvements along the corridor can provide enduring improvements to travel time and reliability for bus journeys between the two cities. However, to enhance bus journey times between the two cities to a level where it improves meaningfully over the current private vehicle option would require an commercial speed between 80 km/h and 100 km/h which is unrealistic once allowed for strategic stops along the corridor.	Rail corridors are segregated with no vehicle and pedestrian interference, allowing for reliable journeys at very high operating speeds. Upgrades to the existing corridor to enable 160 km/h - 250 km/h trains have the potential to substantially reduce journey times between the two cities.	Air travel will not enhance journey times between the two cities compared to the current option (car). The complete journey requires connecting services of 30 mins and 20 mins between the respective airports and their city centres. The journey also entails substantial (30 mins) boarding / alighting times.
IO 2: Support urban development strategies for the metropolitan areas to reach their full potential.	1. Potential for enabled capacity (especially transit oriented development) within the catchment area of a strategic station location 2. Alignment with planed investment in the public transport systems in the metropolitan areas 3. Increase the corridor's transport network capacity and utilisation of this capacity	Upgrades to the motorway corridor are supportive of the current development strategies and will contribute to inter-city capacity. It does however have limited impact on promoting higher density transit-oriented development.	Increased bus services are supportive of the current development strategies and will contribute to inter-city capacity. It has the potential to support higher density transit-oriented development through integrated and accessible stations. Intercity bus services have the potential to support active travel through integrated and accessible stations	Increased and faster rail services are supportive of the current development strategies and will contribute to inter-city capacity. It has the potential to support higher density transit-oriented development through integrated and accessible stations. Rail has the potential to support active travel through integrated and accessible stations	The current development strategies do not focus on significant enabled residential capacity around the Auckland. And Hamilton airports. As these are hampered by the noise contours. The potential for significant commercial development are however incorporated within the Auckland airport precinct.
IO 3: Reduce the contribution inter-city travel makes to greenhouse gas emissions, transport accidents, injuries and fatalities (now and into the future) by enabling sustainable transport choices.	1. Increase public transport mode share for inter-regional travel 2. Increase public transport patronage in the corridor 3. Reduce CO2 emissions 4. Reduce harmful air pollutants	Motorway upgrades will largely retain the emissions per person trajectory of the do minimum with slight improvements possible due efficiency improvements. It also provides no significant incentive for increase in public transport mode share.	CO2 emissions per person km travelled on a bus is lower than emissions per person km travelled by private vehicle.	CO2 emissions per person km travelled on an electric train is lower than emissions per person km travelled by bus or private vehicle..	CO2 emissions per person km travelled on a plane is higher than emissions per person km travelled by private vehicle..
				Inter-city rail is the only option that has the ability to contribute meaningfully towards each of the investment objectives	

- Contributes to objective
- Moderately contributes to objective
- No contribution towards objective

3.5 Rail long list

The rail long list explored a number of scenarios to improve the journey time between the Hamilton and Auckland city centres.

The base journey time for people using the rail service was based on the start-up service running on the existing alignment. The complete city centre to city centre journey time was estimated at 134 minutes (2h14mins) by the 2040s as follows:

- Allow for a bus connection service from Hamilton city centre to Frankton Station including transfer time from the bus to the rail service (10 minutes).
- Model the journey time for rail service that runs from Frankton to Papakura along the existing rail alignment using diesel services. Travel time allowance is made for an additional stop at northern outskirts of Hamilton.
- Allow for a transfer from inter-regional service to the proposed Papakura to Auckland metro express service (10 minutes).
- The likely in-vehicle time for the express service between Papakura and Britomart (including a stop at Puhinui Station) as provided by Auckland Transport (32 minutes).

The rail long list process explored improvements to the journey times by retaining diesel services but providing various length of alignment improvements along the corridor, and reducing the Hamilton to Frankton transfer by extending the rail service to a new station in Hamilton city centre. This reduced the journey time by between 12 and 24 minutes to between 110 and 122 minutes (scenarios 1a-1e).

Further incremental travel time improvements were explored by replacing the DMUs with electrified services that operate on narrow gauge track with the ability to reach speeds along the corridor of up to either 110 km/h or 160 km/h. A continuous electrified network between the two cities allows for a single seat journey between Hamilton and Auckland with no need to transfer from the inter-regional train to the metro train services. This improved overall journey times by a further 9 – 16 minutes to between 94 and 101 minutes (scenarios 1d1-1d2).

Further incremental travel time improvements were explored by introducing a new alignment between south Auckland and north Hamilton. Alignments were explored that were able to support continuous 160 or 250 km/h speeds on narrow or standard gauge track respectively. This still envisages a single seat journey between the city centres. This reduces the journey times with a further 15 – 25 minutes to between 79 and 69 minutes (scenarios 2a1-2a2).

Exclusions / assumptions:

- This business case assumes utilisation of the existing rail corridor between Britomart and Papakura. It also assumes utilisation of Britomart station i.e. platform allocation exists for an inter-regional service.
- Four tracks and level crossing removal has been assumed in place between Wiri and Pukekohe with metro and freight train plans allowing for up to a half hourly inter-regional train service.
- Cost estimates in this report are underpinned by very high-level concept alignments. More detailed alignment concepts will be required as the project progresses to help inform topographical, environmental and cultural constraints. This will also narrow down the wide investment envelopes assumed in this report.
- Although a considerable expense, it was assumed that Hamilton will be served with a new underground station near the bus interchange in Hamilton City centre. This maximises transfer opportunities to the wider Hamilton Metro Area and reflects the concept in the spatial intent to have a Hamilton Central station. Further phases will have to test the incremental benefit of this assumption over a

lower cost scenario with a ‘central’ station located at Frankton.

Table 2 below summarises the various rail scenarios.

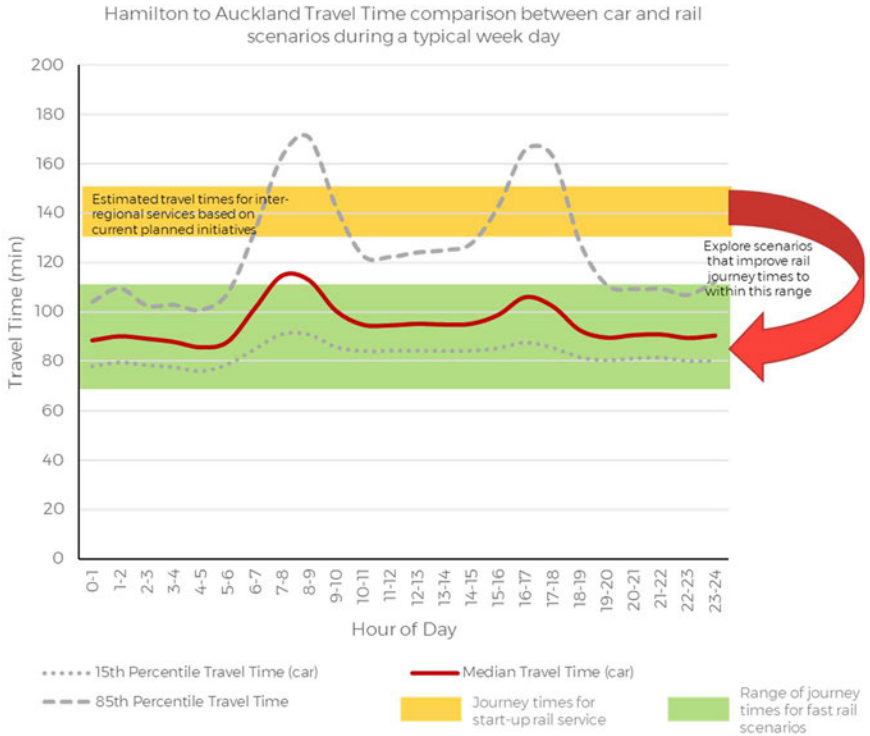
A short list of four options was then selected that deliver incremental step changes in overall journey time between the two cities. This allows for an analysis of the cost, benefit and change in land use pattern that different degrees of rail journey times between the cities can deliver.

Table 2: Rail long list scenarios

Item	Scenario	Infrastructure	Rolling Stock	Intermediate Stops	Frankton to Papakura (Optimised speeds)	Hamilton to Frankton	Hamilton Outskirts Stop	Diesel – Electric Interchange @ Papakura	Papakura Dwell	Papakura to Britomart	Total JT
1	Start up Service	Existing	Existing Diesel Loco	1. Rotokauri 2. Huntly 3. Papakura 4. Puhinui	*80*	10 (bus)	2	10	0	32	**134**
1a	Non-stop service	Existing	Existing Diesel Loco	1. Hamilton Outskirts 2. Papakura 3. Puhinui	*76*	2 (rail)	2	10	0	32	**122**
1b	Shorter route 1	Existing with bypass 1 - Pukekohe	Existing Diesel Loco		*66*	2	2	10	0	32	**112**
1c	Shorter route 2	Existing with bypass 2 - Ngaruawahia	Existing Diesel Loco		*74*	2	2	10	0	32	**120**
1d	Shorter route 3	Existing with bypasses 1&2	Existing Diesel Loco		*64*	2	2	10	0	32	**110**
1e	Straighten Route	Pukekohe Straightening	Existing Diesel Loco		*70*	2	2	10	0	32	**116**
1d1	Shorter route 3 – Electric Train 1	Existing with bypasses 1&2	Electric Train1 (Auckland EMU 110kph max)		*64*	2	2	0	1	32	**101**
1d2	Shorter route 3 – Electric Train 2	Existing with bypasses 1&2	Electric Train2 (160kph max)		*57*	2	2	0	1	32	**94**
1f	Line speed Improvements	Development from Option 1e	Electric Train2 (160kph max)		*51*	2	2	0	1	32	**88**
2a1	New Route 1	New Route 1 - to Papakura	Electric Train2 (160kph max)		*42*	2	2	0	1	32	**79**
2a2	New Route 1	New Route 1 - to Papakura	Electric Train3 (250kph max)		*31*	2	3	0	1	32	**69**
2a3	New Route 1	New Route 1 - to Papakura	Electric Train4 (320kph max)		*29*	2	3	0	1	32	**67**

4 Short list scenarios

Four rail scenarios were selected for further evaluation, each representing distinctly different journey times to allow decision makers and stakeholders the ability to trade off the enhanced accessibility and economic outcomes delivered by faster rail against lower investment requirements. The scenarios reflect a step-change over the anticipated journey times provided by the start-up service and aim to be competitive with car journey times between the two cities as illustrated in the diagram below.



Note this chart illustrates the journey time ranges for private vehicles based on 2019 Tom-Tom data. We expect annual variances for private vehicles over time with rail staying constant. Initially private vehicle journey times will show slight improvements as identified road investments take effect (i.e. Huntly Bypass and widening of Papakura to Bombay). However strategic modelling shows journey time savings will be eroded over time, as demand for travel grows.

4.1 Description of shortlist scenarios

Scenario A: Existing route: This scenario reflects a 113 minute (1h53) journey time between Hamilton city centre and Britomart. This is approximately 40 minutes faster than the estimated 2h30mins journey time for the start-up service and is aimed at competing with the median journey time by car during peak hours.

It reflects the lower end of the investment envelope and allows for a five-stop strategy with a single seat journey between the two city centres via the extension of the electrification from Pukekohe to Hamilton.

It also allows for three additional stops at Puhinui, southern Auckland and northern Hamilton to enhance connectivity from these areas to employment, social and educational opportunities in each city centre.

Scenario B: Enhancement to the existing route: This scenario reflects an 88 minute (1h28) journey time between Hamilton city centre and Britomart. This is approximately 25 minutes faster than Scenario A and is aimed at competing with the median journey time by car during the off-peak period.

It reflects an investment envelope associated with upgrading key sections along the corridor between southern Auckland and northern Hamilton to enable faster train speeds (up to 160 km/h). It allows for a similar stop strategy and operational pattern between the two cities as envisaged in Scenario A.

Scenario C: Provision of a new corridor between southern Auckland and northern Hamilton: This scenario reflects a 79 minute (1h19) journey time between Hamilton city centre and Britomart. This is approximately 10 minutes faster than Scenario B and is aimed at competing with the 15th percentile journey time by car during the off-peak period.

It reflects an investment envelope associated with providing a new narrow gauge corridor between southern Auckland and northern Hamilton to shorten the route and also enable consistent train speeds of up to 160 km/h along this section. It allows for a similar stop strategy and operational pattern between the two cities as envisaged in Scenario A.

Scenario D: Provision of a new corridor between southern Auckland and northern Hamilton: This scenario reflects a 69 minute (1h09) journey time between Hamilton city centre and Britomart. This is approximately 10 minutes faster than Scenario C.

It reflects an investment envelope associated with providing a new corridor on similar alignment envisaged for Scenario C between southern Auckland and northern Hamilton but provides for train speeds of up to 250 km/h on a standard gauge track. It also envisages upgrades to tracks within Auckland and Hamilton to enable both to accommodate narrow and standard gauge trains. It allows for a similar stop strategy and operational pattern between the two cities as envisaged in the previous scenarios.

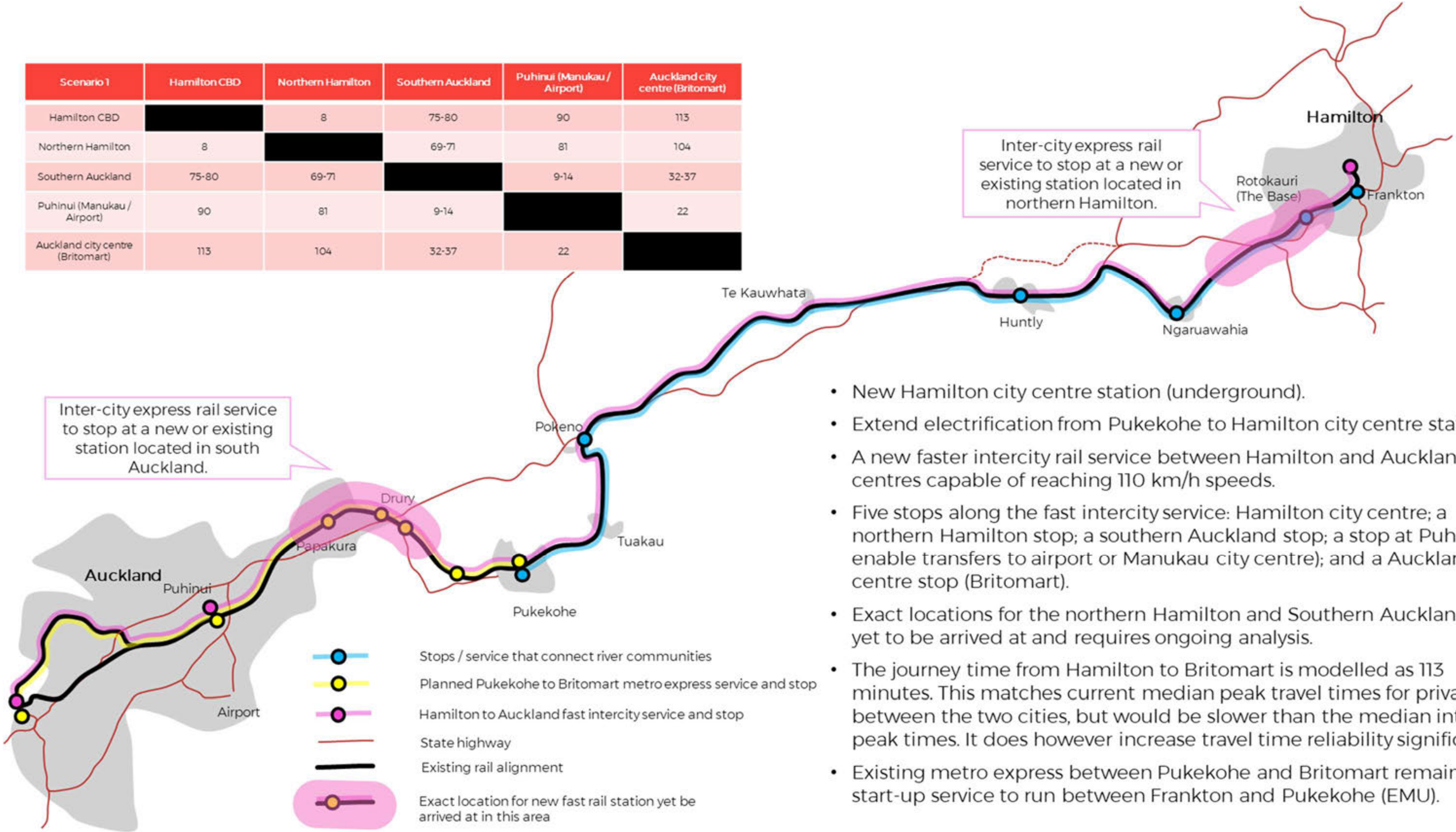
The scenarios are summarised in Table 3 below:

Table 3: Shortlist scenarios

Scenario	Train	Estimated city to city journey time	Note
A: Extend existing electrification with vehicles capable of running approx. 110 km/h to provide an overall journey time of 113 mins (1h 53min)	110 km/h electric train	113 mins (1h53)	
B: Upgrade the existing corridor to enable it to support train speeds of up to 160 km/h to provide an overall journey time of 88 mins (1h 28min)	160 km/h electric train	88 mins (1h28)	
C: Provide a new narrow gauge corridor between southern Auckland and northern Hamilton capable of supporting 160 km/h trains to provide an overall journey time of 79 mins (1h 19min)	160 km/h electric train	79 mins (1h19)	Narrow gauge option
D: Provide a new standard gauge corridor between southern Auckland and northern Hamilton capable of supporting 250 km/h trains to provide an overall journey time of 69 mins (1h 9min)	250 km/h electric train	69 mins (1h09)	Standard gauge option

4.2 Scenario A: Existing route

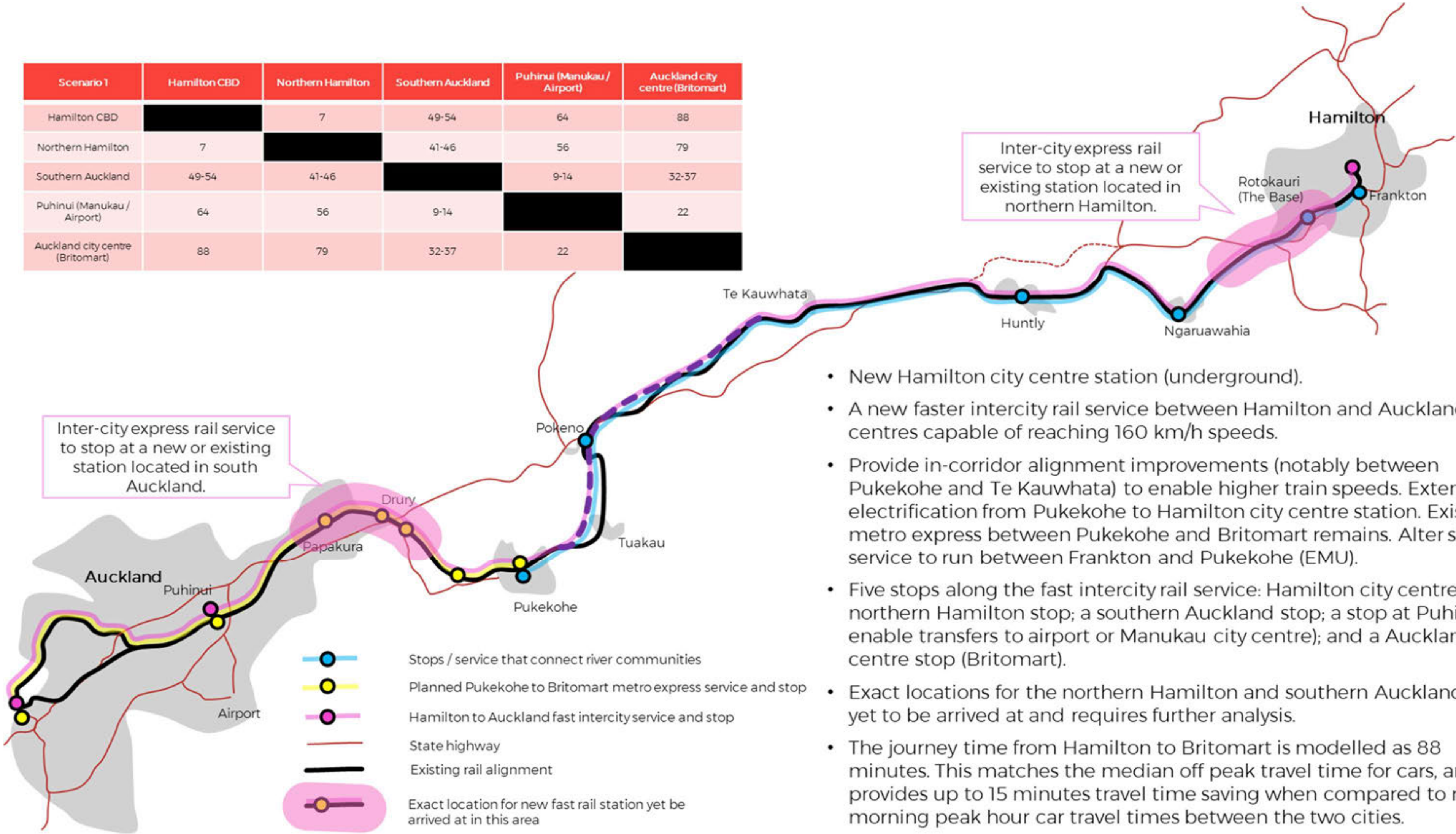
Scenario 1	Hamilton CBD	Northern Hamilton	Southern Auckland	Puhinui (Manukau / Airport)	Auckland city centre (Britomart)
Hamilton CBD		8	75-80	90	113
Northern Hamilton	8		69-71	81	104
Southern Auckland	75-80	69-71		9-14	32-37
Puhinui (Manukau / Airport)	90	81	9-14		22
Auckland city centre (Britomart)	113	104	32-37	22	



- New Hamilton city centre station (underground).
- Extend electrification from Pukekohe to Hamilton city centre station.
- A new faster intercity rail service between Hamilton and Auckland city centres capable of reaching 110 km/h speeds.
- Five stops along the fast intercity service: Hamilton city centre; a northern Hamilton stop; a southern Auckland stop; a stop at Puhinui (to enable transfers to airport or Manukau city centre); and a Auckland city centre stop (Britomart).
- Exact locations for the northern Hamilton and Southern Auckland stops yet to be arrived at and requires ongoing analysis.
- The journey time from Hamilton to Britomart is modelled as 113 minutes. This matches current median peak travel times for private cars between the two cities, but would be slower than the median inter-peak times. It does however increase travel time reliability significantly.
- Existing metro express between Pukekohe and Britomart remains. Alter start-up service to run between Frankton and Pukekohe (EMU).

4.3 Scenario B: Extended line speed improvements

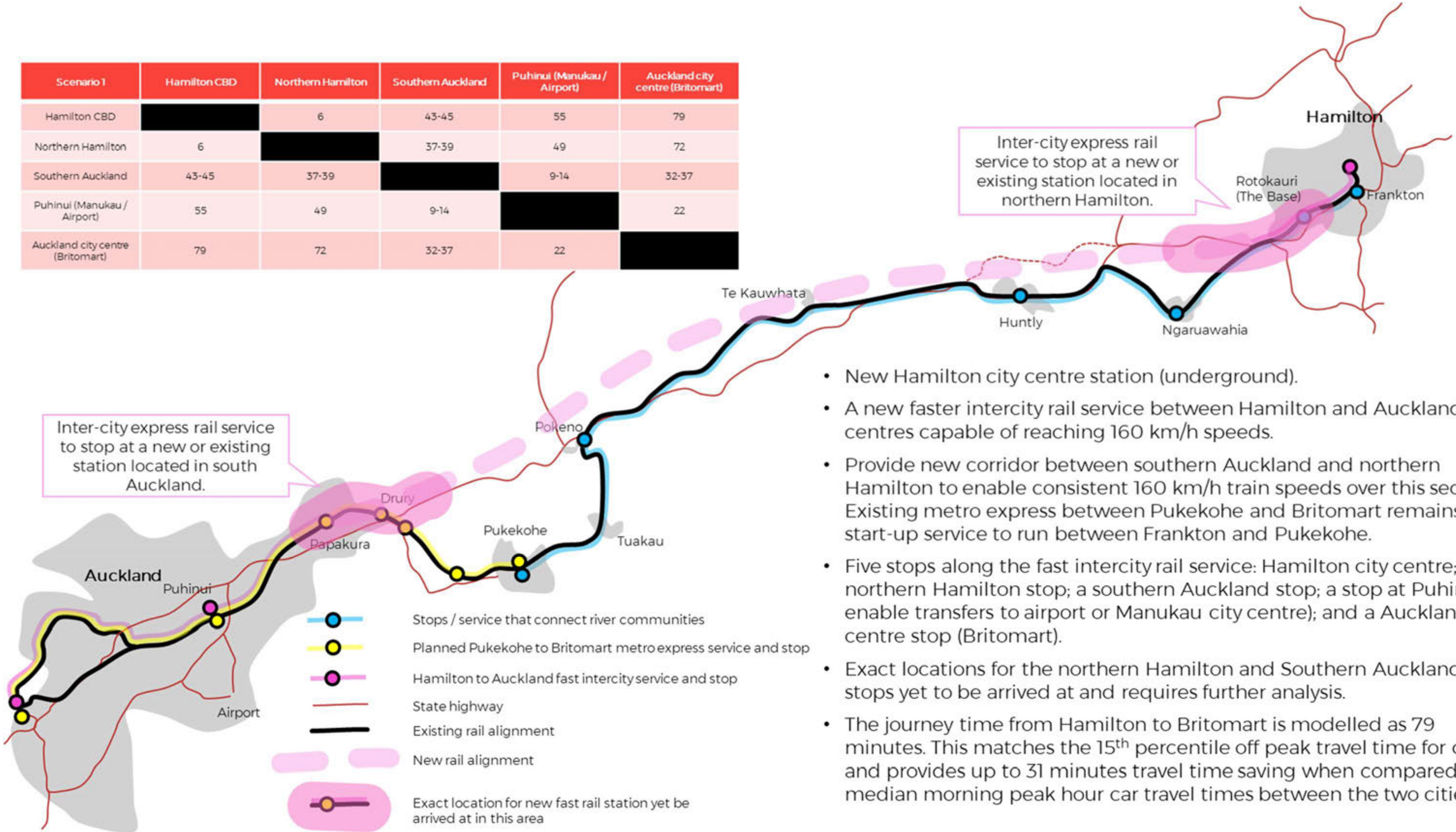
Scenario 1	Hamilton CBD	Northern Hamilton	Southern Auckland	Puhinui (Manukau / Airport)	Auckland city centre (Britomart)
Hamilton CBD		7	49-54	64	88
Northern Hamilton	7		41-46	56	79
Southern Auckland	49-54	41-46		9-14	32-37
Puhinui (Manukau / Airport)	64	56	9-14		22
Auckland city centre (Britomart)	88	79	32-37	22	



- New Hamilton city centre station (underground).
- A new faster intercity rail service between Hamilton and Auckland city centres capable of reaching 160 km/h speeds.
- Provide in-corridor alignment improvements (notably between Pukekohe and Te Kauwhata) to enable higher train speeds. Extend electrification from Pukekohe to Hamilton city centre station. Existing metro express between Pukekohe and Britomart remains. Alter start-up service to run between Frankton and Pukekohe (EMU).
- Five stops along the fast intercity rail service: Hamilton city centre; a northern Hamilton stop; a southern Auckland stop; a stop at Puhinui (to enable transfers to airport or Manukau city centre); and a Auckland city centre stop (Britomart).
- Exact locations for the northern Hamilton and southern Auckland stops yet to be arrived at and requires further analysis.
- The journey time from Hamilton to Britomart is modelled as 88 minutes. This matches the median off peak travel time for cars, and provides up to 15 minutes travel time saving when compared to median morning peak hour car travel times between the two cities.

4.4 Scenario C: New route between southern Auckland and northern Hamilton

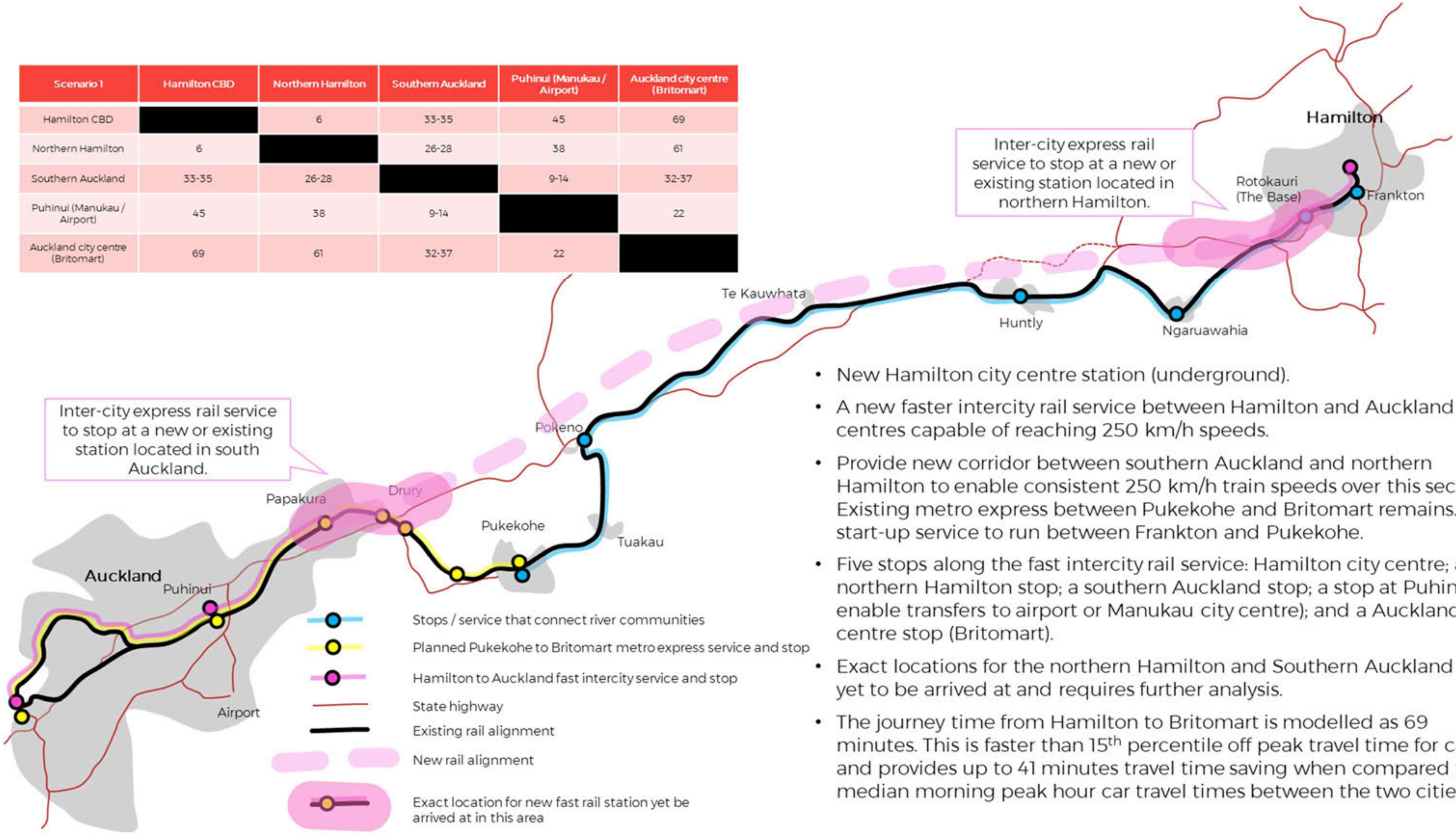
Scenario 1	Hamilton CBD	Northern Hamilton	Southern Auckland	Puhinui (Manukau / Airport)	Auckland city centre (Britomart)
Hamilton CBD		6	43-45	55	79
Northern Hamilton	6		37-39	49	72
Southern Auckland	43-45	37-39		9-14	32-37
Puhinui (Manukau / Airport)	55	49	9-14		22
Auckland city centre (Britomart)	79	72	32-37	22	



- New Hamilton city centre station (underground).
- A new faster intercity rail service between Hamilton and Auckland city centres capable of reaching 160 km/h speeds.
- Provide new corridor between southern Auckland and northern Hamilton to enable consistent 160 km/h train speeds over this section. Existing metro express between Pukekohe and Britomart remains. Alter start-up service to run between Frankton and Pukekohe.
- Five stops along the fast intercity rail service: Hamilton city centre; a northern Hamilton stop; a southern Auckland stop; a stop at Puhinui (to enable transfers to airport or Manukau city centre); and a Auckland city centre stop (Britomart).
- Exact locations for the northern Hamilton and Southern Auckland stops yet to be arrived at and requires further analysis.
- The journey time from Hamilton to Britomart is modelled as 79 minutes. This matches the 15th percentile off peak travel time for cars, and provides up to 31 minutes travel time saving when compared to median morning peak hour car travel times between the two cities.

4.5 Scenario D: New route between southern Auckland and northern Hamilton

Scenario 1	Hamilton CBD	Northern Hamilton	Southern Auckland	Puhinui (Manukau / Airport)	Auckland city centre (Britomart)
Hamilton CBD		6	33-35	45	69
Northern Hamilton	6		26-28	38	61
Southern Auckland	33-35	26-28		9-14	32-37
Puhinui (Manukau / Airport)	45	38	9-14		22
Auckland city centre (Britomart)	69	61	32-37	22	



- New Hamilton city centre station (underground).
- A new faster intercity rail service between Hamilton and Auckland city centres capable of reaching 250 km/h speeds.
- Provide new corridor between southern Auckland and northern Hamilton to enable consistent 250 km/h train speeds over this section. Existing metro express between Pukekohe and Britomart remains. Alter start-up service to run between Frankton and Pukekohe.
- Five stops along the fast intercity rail service: Hamilton city centre; a northern Hamilton stop; a southern Auckland stop; a stop at Puhinui (to enable transfers to airport or Manukau city centre); and a Auckland city centre stop (Britomart).
- Exact locations for the northern Hamilton and Southern Auckland stops yet to be arrived at and requires further analysis.
- The journey time from Hamilton to Britomart is modelled as 69 minutes. This is faster than 15th percentile off peak travel time for cars, and provides up to 41 minutes travel time saving when compared to median morning peak hour car travel times between the two cities.

4.6 Cost estimates

An infrastructure project of this scale will come with a high capital cost requirement, especially for the new route options. High level cost estimates have been developed for the scenarios presented in this business case to provide an indication of the scale of investment required and to allow comparisons between the options.

The cost estimates for each scenario have been built up in three parts: the capital costs for the railway infrastructure, the capital costs for the rolling stock, and the operating costs.

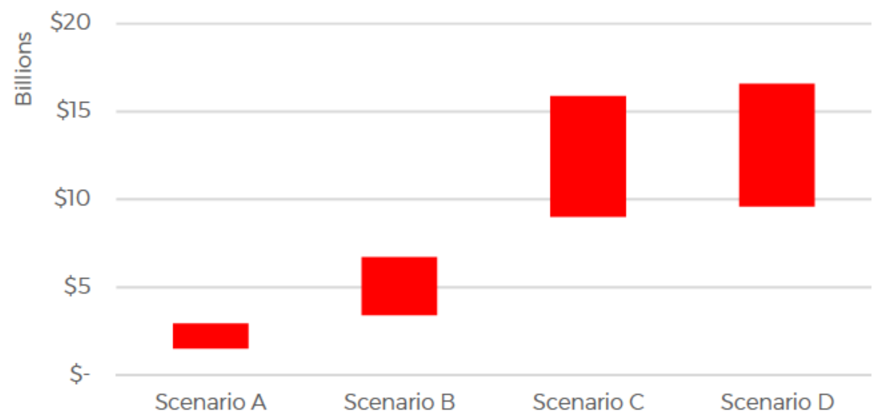
The infrastructure costs have been calculated by undertaking an assessment of the likely construction works required for each scenario. This comprises major civil scope such as the earthworks, structures, tunnels and depots, and railway systems works such as the trackwork, overhead line equipment and signalling. High level unit rates have been applied based on recent NZ infrastructure projects across approximately 35 categories, and allowances for property and indirect costs have been included.

Rolling stock costs have been estimated based on different rolling stock types for each scenario, and the number of units required to operate a service. Further operational analysis is required to refine these fleet assumptions. An operating cost of $40M per year has been assumed at this stage, as an assessment of staffing needs, infrastructure and rolling stock maintenance requirements has not been undertaken at this stage.

The cost estimates are not based on specific alignment designs due to the high level and strategic nature of this business case and are presented as a range which reflects the cost uncertainty at this stage of the project. These ranges increase in size as the magnitude and complexity of these scenarios increase.

Further design work will be required to test feasibility of alignments and station locations underpinning each scenario in this report. The costs estimate in this section are therefore considered as Rough Order Costs (ROC) and to be treated with caution. Further development to bring these up to a Feasibility Estimate (FE) – normally prepared during the feasibility phase as part of a project feasibility report – would be required prior to setting any specific project budgets.

The likely ROC capital investment range – based on the scenario description described in the previous section – is shown in the chart below.



4.6.1 Benchmarking

A review of the cost estimates was undertaken to determine whether the figures presented for each scenario are representative of the expected costs. Whilst there remains a large amount of uncertainty in the figures, they are considered to be the right order of magnitude appropriate for this assessment but will need to be developed in more detail for future stages of the project.

4.6.2 Electrification of the Existing Network

The March 2019 publication by the Railway Industry Association (UK) provides data for a number of electrification projects in the UK and Europe. It concludes that “a well delivered ‘simpler’ electrification project should cost £750k to £1m/stk (for the OLE, Power and associated costs) and more complex projects should not exceed £1.5m/stk". These figures exclude the route clearance works which are noted as contributing "30 – 40% of the cost of some electrification schemes" and would therefore be in addition.

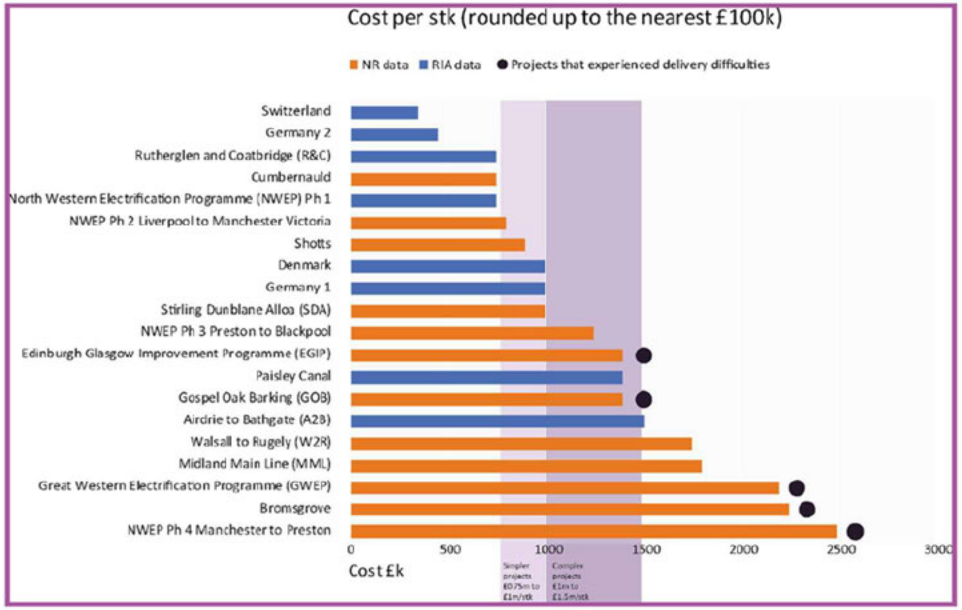


Figure 13: Unit costs of recent UK and International electrification projects (RIA Electrification Cost Challenge, March 2019)

A New Zealand comparator is the Papakura to Pukekohe (P2P) electrification project which is budgeted for $371M[21] or $19.5M/km and includes works at Pukekohe station in addition to the electrification of 19km of twin track railway.

The scenario presented in this document for the electrification of the approximately 90km route between Pukekohe and Hamilton, and civil works for a city centre station is estimated to cost between $1.5Bn and $2.9Bn, a mid-point of $24.4M/km. At high level this is comparable to the P2P figure and is considered to be an appropriate order of magnitude for the cost at this stage of development.

4.6.3 New High Speed Route

Examples of benchmark data for new high speed routes show a large spread which reflects the individual features of each project and their local environment. The costs will be heavily influenced by the topography and complexity of the routes, as well as the local labour and land costs.

Construction Costs of High Speed Rail (adapted from C. Nash, When to Invest in High Speed Rail, 2015)	
Country	$M/km (2020 NZD)
Belgium	36.2
France	10.6 – 42.3
China	7.2 – 42.3
Spain	17.5 – 45.1
Italy	57.5
Germany	33.8 – 64.9
Japan	45.1 – 69.7
Korea	77.1
Taiwan	89.1

The mid-point cost estimates for Scenarios C and D both at >$100M/km are at the extreme upper level when compared against these benchmarks. The estimates are however lower than the example referenced in the 2018 European Commission report at €89.6M/km, or $155M/km. Data from an Australian high speed route study show estimated costs of $60.5M/km similarly suggest that the estimates in this business case are high.

[21] Source: KiwiRail

Specific challenges which a new Hamilton to Auckland route would encounter include the approaches to the city centres, and the need for costly tunnelling to navigate the topology along the route. The tunnelling cost in particular is a significant influence in the estimates for these options – the high cost of tunnelling can been seen in the 2.4km twin bore Waterview road tunnels which cost $1.4Bn[22], and the 3.45km twin bore City Rail Link project expected to cost $4.4Bn[23].

Whilst the estimates are at the upper end of the benchmarking data, detailed alignment design and route optioneering is required to identify the specific challenges for a new route. The order of magnitude for the high speed option is therefore considered appropriate at this stage but should be refined though alignment design.

4.6.4 New Conventional Speed Route

The data from the European Commission report indicates that a larger differential would be expected between the conventional and high speed scenarios than presented in this document.

This is a result of the estimating methodology which has been used in this business case whereby the cost estimates have been calculated using a series of quantities and rates which would be expected for a new alignment.

Adjustments have been applied to account for the differences between the conventional and high speed alignment options, such as the additional works required to continue on the existing network, additional subgrade improvement, power requirements amongst others for the high speed option over the conventional option.

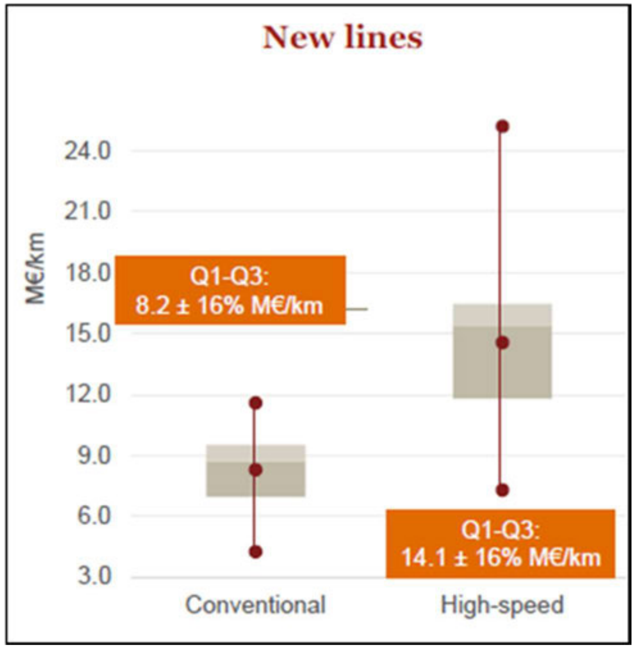


Figure 14: Total Investment Unit Cost Ranges (Assessment of Unit Costs of Rail Projects, European Commission, 2018)

This suggests that there may be opportunities to reduce the costs further for a new conventional speed option rather than for a high speed option. The costs for new high speed infrastructure shown in Figure 14 are significantly lower than those presented by Nash, and lower again for a conventional line.

However, a new alignment at either a conventional speed or high speed would encounter the same topographical challenges which may result in a significant portion of tunnelling, driving the cost. The less stringent geometric constraints of a conventional speed route may alleviate some of these needs which would result in lower costs. At

[22] Waka Kotahi NZTA

[23] CityRailLink

this stage, the current cost estimate is considered to be appropriate given the limited level of development.

Detailed alignment design and optioneering would provide better information for the cost estimates and may result in a greater level of differentiation between these options.

4.6.5 Upgrading the Existing Network

Scenario B involves a series of line-speed upgrades and bypasses, in addition to electrification to achieve faster journey times. The mid point cost estimate at $48M/km sits between the electrification scenario and the new route scenarios which is considered appropriate. This scenario assumes that the bypass works would involve an amount of tunnelling which would be a significant portion of the cost.

4.7 Ridership forecast

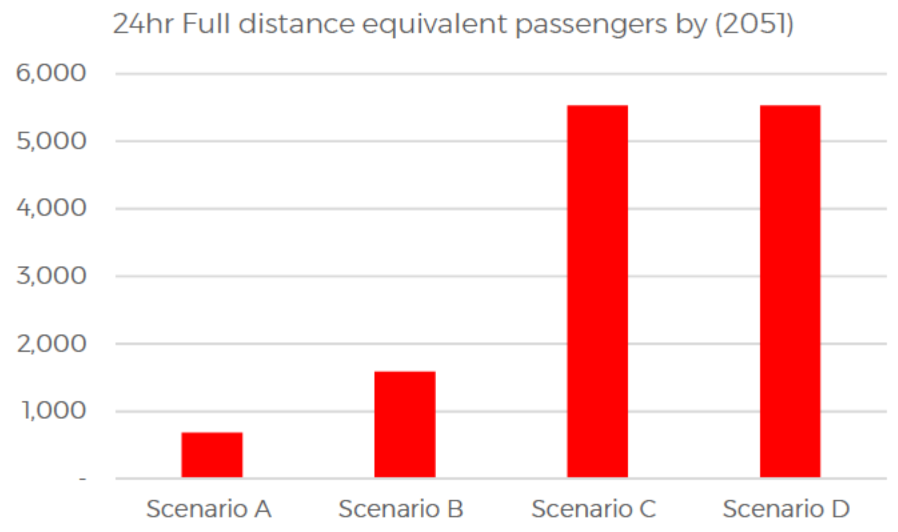
Initial ridership forecasts are based on a static land use forecast; i.e. not allowing for the effect of introducing a new rail service on land use patterns. Later sections in this business case explore the impact faster rail journeys may have on land values and growth patterns and the impact this may have on ridership.

These forecasts were based on origin destination patterns from the Auckland and Waikato strategic models and reflect the impact different journey times will have on diverting riders from the motorway choice to each specific rail scenario.

A 'passenger' is defined as someone who travels the full distance between the two cities (either from Hamilton to Auckland, or from Auckland to Hamilton). All passenger journeys not completing the entire route (e.g. Hamilton city to southern Auckland) were converted to a 'full distance equivalent' unit. Passengers who travel a shorter distance therefore effectively comprise less than one 'passenger'.

It shows the slowest scenario (Scenario A at 113min) picks up very little full distance demand as it is struggling to be competitive between southern Auckland and Hamilton when compared to the SH1 alternative.

Both fast train scenarios (scenarios C and scenario D) pick up similar demands suggesting optimal transfer from road to rail for journey time savings more than the 15th percentile motorway times.



4.8 Services and fleet

The same indicative service plan has been assumed in all four scenarios. The service plan assumes trains that carry up to 600 passengers and will operate 18 hours a day. The capacity can be adjusted based on the number of cars per train as shown below.

Eight cars per train	The carrying capacity of the train is approx. 640 seated and 270 standing

Four cars per train	The carrying capacity of the train is 320 seated and 135 standing

Operations have been broken into two plans:

- Peak busiest two hours to provide three trains per hour in both directions.
- Off-peak times to provide one train per hour in both directions.

4.9 Accessibility changes

The rail scenarios all link southern Auckland and northern Hamilton with major current and future employment, educational and health centres.

These communities will benefit to varying degrees from these scenarios. Waikato residents can board a train either in the city centre or in the northern Hamilton area. For the city centre two scenarios exists, boarding in the city centre itself or connecting to a Frankton stop via bus connection from the city centre. The city centre station enables slightly higher accessibility to jobs in the southern Auckland areas by approximately 15%-19% when compared to a Frankton station due to the removal of the bus journey and transfer.

For boardings in Hamilton City Centre:

- Accessibility to Auckland city centre jobs by 2050:
  - Neither Scenario A nor Scenario B provide accessibility to Auckland City Centre jobs within 90 minute threshold.
  - Journey times that reflect Scenario C will provide access to 70,000 jobs.
  - Journey times that reflect Scenario D will more than double that to 190,000 jobs.
- Accessibility to Manukau City centre and Auckland airport jobs by 2050
  - Scenario A will provide no accessibility to jobs in southern Auckland within 90 minutes
  - Scenario B will provide access to 31,000 jobs at the airport/Manukau city centre area.
  - Journey times that reflect Scenario C will increase job accessibility by 32% to 41,000.
  - Journey times that reflect Scenario D will increase that by a further 56% to 64,000 jobs.

For boardings in South Auckland:

- For Scenarios A and B by 2051, Drury residents will gain access to approximately 50% more jobs in Hamilton (within a 90 minute journey) with a station in Drury, than Papakura residents will gain through a station in Papakura.
- This incremental reduces under Scenarios C and D (to 2% and 1% respectively). This is due to increased accessibility potential within 90 minutes reaching beyond high employment areas under the faster scenarios.
- Scenario A: Drury residents could access approximately 29,000 jobs in Hamilton
- Scenario B: Drury residents could access approximately 81,000 jobs in Hamilton
- Scenario C: Drury residents could access approximately 91,000 jobs in Hamilton
- Scenario D: Drury residents could access approximately 101,000 jobs in Hamilton

A further breakdown of these are provided in the appendices, with a visual representation of the increased access illustrated in Figure 15 and 16.

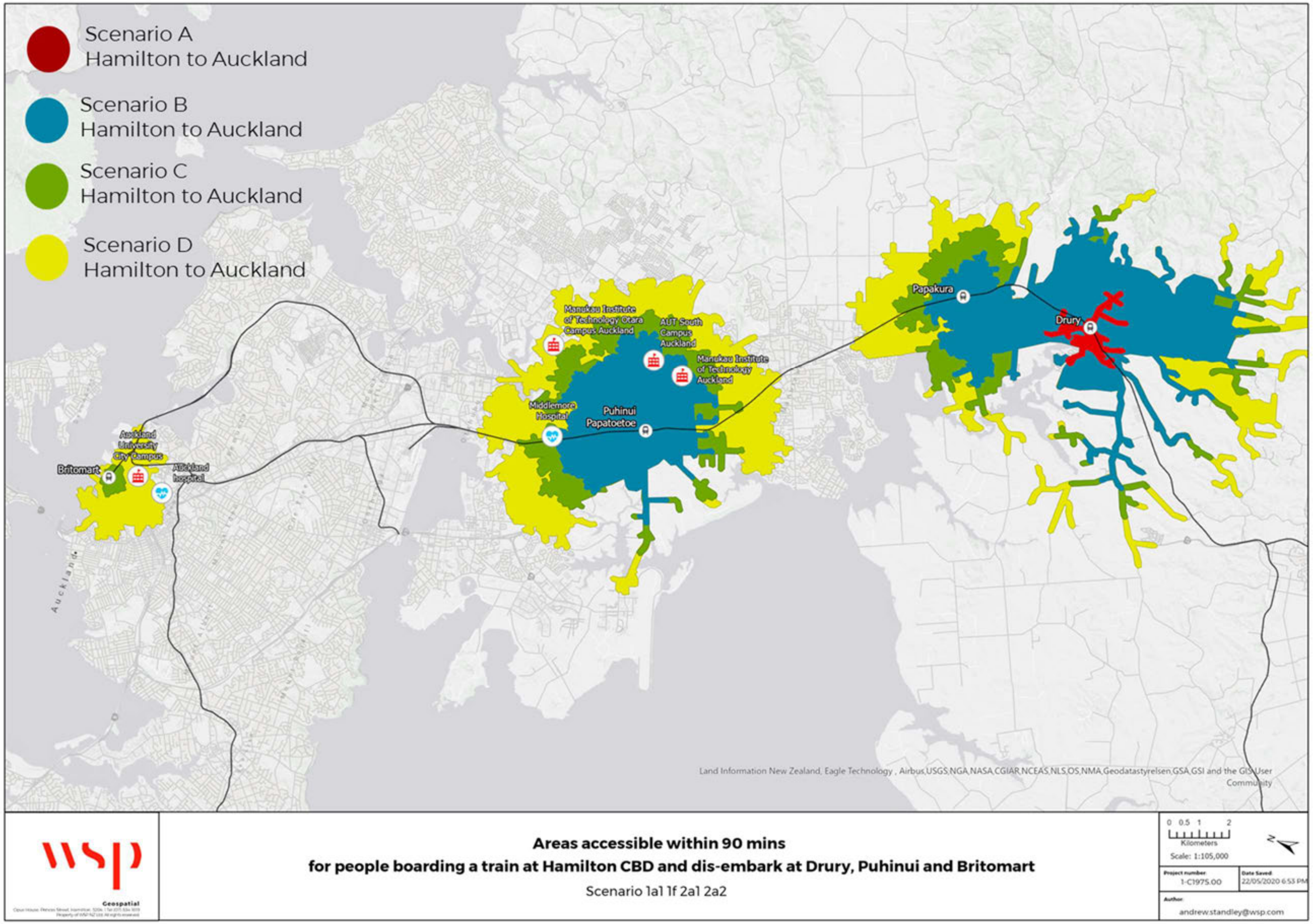


Figure 15: Auckland areas accessible for people boarding a train in northern Hamilton

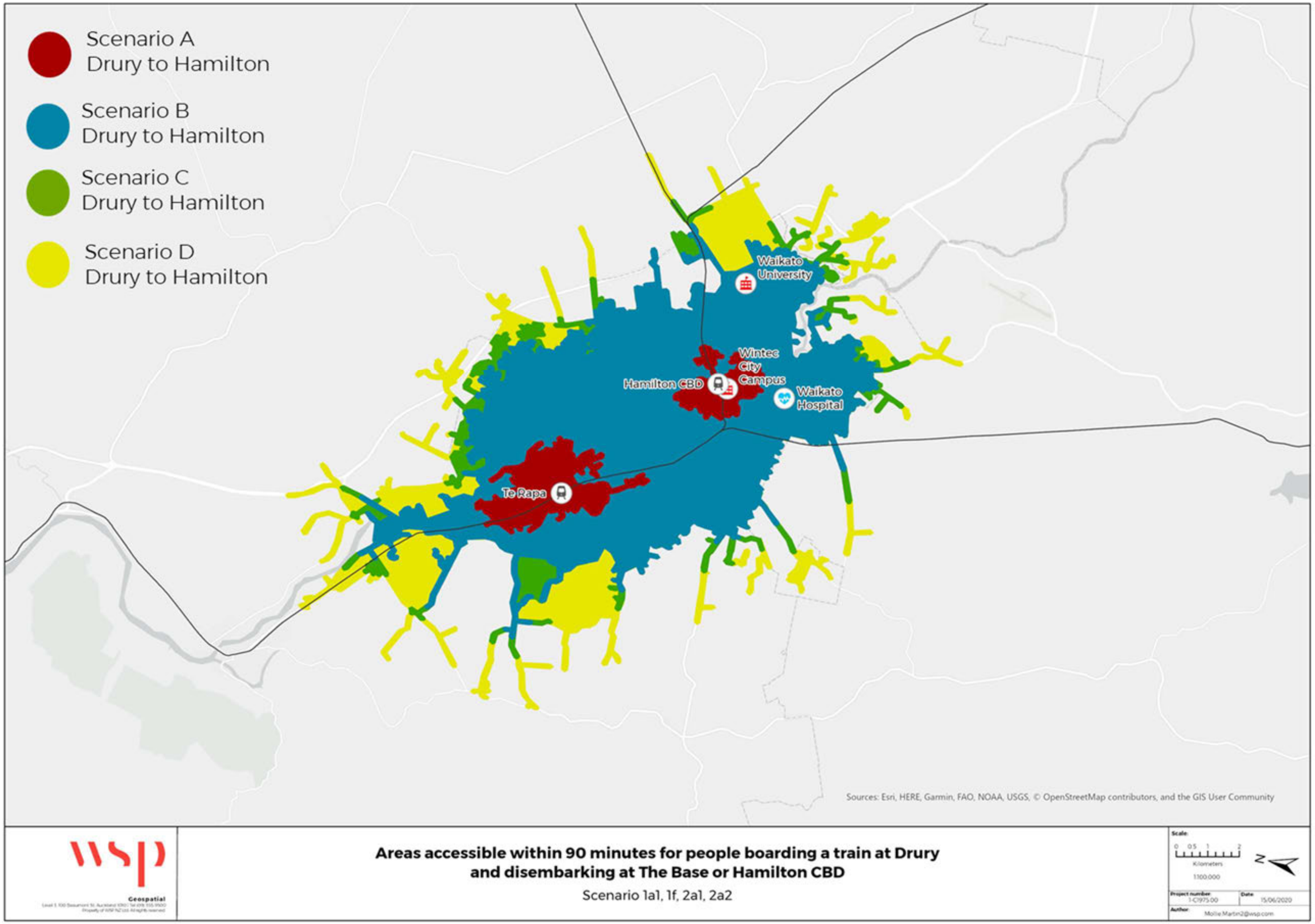


Figure 16: Waikato areas accessible for people boarding a train in southern Auckland

5 Economic Case

The approach to the development of an economic case for this interim business case involved the following:

- An assessment of the potential transport benefits to enable a comparison with potential costs. This is done in accordance with the NZ Transport Agency's Economic Evaluation Manual (EEM).
- An assessment of the potential increase in the value of residential, commercial and industrial land in proximity to likely station locations along the route, and
- An assessment of the potential land use change for that land.

A more detailed discussion of methodology, as well as more disaggregated outputs and the results of sensitivity testing, are included in the PwC Report attached in the Appendices.

5.1 Assessment of the potential transport benefits

5.1.1 Cost benefit analysis

The approach followed for this Interim Indicative Business Case applies a form of 'hurdle rate'. This entails an assessment of the number of passengers required for a given level of benefits to achieve a BCR of 0.6 or 1.0. The estimated ridership, allowing for land use change potential, is then compared against this 'required number of passengers'.

The focus of the benefit analysis is therefore on assessing the potential 'per-passenger' benefits of each scenario.

5.1.2 Daily full distance return equivalent

A 'passenger' is defined as someone who travels the full distance between the two cities (either from Hamilton to Auckland, or from Auckland to Hamilton), during both peak periods of the day (i.e. in the morning, and then return in the evening), every working day – a generalisation of a typical 'commuter'.

All passenger journeys not completing the entire route (e.g. Hamilton city to southern Auckland) were converted to a 'full distance equivalent' unit. So, passengers who travel a shorter distance effectively comprise less than one 'passenger'.

5.1.3 Travel direction

The travel time index for a morning peak journey from Hamilton to Auckland is more[24] than that of a journey from Auckland to Hamilton (index of 2.5 vs. 1.8).

The analysis therefore assigns more benefits to rail investment for a Hamilton-based traveller given similar rail journey times per direction for each scenario (i.e. the travel time saving will be greater for a Hamilton-based commuter).

5.1.4 New and existing travellers

The EEM specifies the benefit attributed to a new traveller is 50% of that estimated for an existing traveller. The analysis therefore allows for the distinction between the likely number of existing and new travellers.

Existing travellers are people who currently drive the route, who will take the train once it is available, and new travellers are people who do not currently travel this route by car, but who will do so by rail once the faster rail service is available.

[24] Refer to section 2.4 in this report

5.1.5 Benefit streams

The benefit estimates are comprised of five separate items as indicated in Table 4 below.

Table 4[25]: Benefit streams used in main estimates

Benefit stream	Existing travellers	New travellers
Travel time reduction	Yes	Yes
Travel time reliability	Yes	Yes
Vehicle operating cost	Yes	Yes
Emissions reduction	Yes	No
Wider economic benefits (WEBs)	Yes	Yes

Travel time reduction: This is the benefit gained by a reduction in travel time, because of switching from car to train. As per the EEM, new travellers are assessed as receiving 50% of the travel time benefits of an existing traveller.

Travel time reliability: Reflects a reduction in the variability of travel times, when switching from a car to the train. The congested nature of part of the vehicle route requires travellers to leave their origin earlier than they would need to on average, to ensure that they arrive on time.

Vehicle operating costs: The magnitude of the benefit is based on the distance of the current journey and an estimated vehicle operating cost per km (specified in the EEM), converted into a per-traveller figure using an average occupancy estimate.

Operating costs of the train are not netted off in deriving this benefit estimate. Instead, they are included within the overall costs of the investment.

[25] Source: PwC analysis

Emissions reductions: All four rail scenarios anticipate a full electrified service between the two cities. Travellers currently making the journey by car and switching to the rail service will therefore generate emission reduction benefits. No emission reduction benefits were assigned to new travellers.

The magnitude of the benefit is based on the current journey distance, values emitted per km of CO2, NOx, HC, CO and PM10 (specified in the EEM), and monetary estimates of cost per tonne of these gases (also specified in the EEM). Estimates are converted into a per-traveller figure using an average occupancy estimate.

Wider economic benefits (WEBs): In accordance with the EEM, WEBs are typically estimated at between 10% and 30% of the main benefits. We have applied a 20% value – the midpoint of that range.

5.1.6 Other potential benefit streams not included in main estimates

The following two potential benefit streams were not included in the analysis as part of this business case phase:

Mode choice and improved travel 'comfort': The main level of service improvements our approach includes reflect travel time savings and improved reliability. However, there is also the potential for the train service to be considered 'more comfortable', and hence worth taking even for the same travel time and reliability. For example, in some cases, travellers are better able to work, or undertake leisure activities such as reading or sleeping, on the train relative to driving a car.

The EEM methodology does not provide an obvious means for including this benefit stream, within its overall framework for transport benefits. There are difficulties in robustly estimating a value for it while some travellers will prefer the amenity of a train, others will prefer the amenity (including the convenience) of a car. Some train passengers will have chosen the train because of the travel time impacts, and be willing to accept a reduction in comfort, which makes it difficult to estimate and/or justify a positive net comfort benefit.

Decongestion: The analysis for this business case assumes the only materially congested part of the Hamilton to Auckland route (once the Waikato Expressway is fully open) is the Auckland Southern Motorway. Given the tools available at this early stage, the analysis excluded decongestion benefits, assuming any new capacity created by mode shift is likely to be negated by 'induced demand' over this section of the Corridor.

5.1.7 *Evaluation time period and discount rate*

The analysis was done using a 60 year evaluation time period with a 4% discount rate. This is consistent with current Waka Kotahi NZTA Guidance[26].

A residual value is calculated based on an expected life of the assets of 80 years. The discounted residual value was added to the benefits estimate over the 60 year period.

5.1.8 *Results*

The analyses show a potential lifetime benefit of fast rail of between $216,000 and $921,000 per passenger (in present value terms).

Table 5 below presents the per-passenger benefit values for each of the four rail scenarios estimated using the approach described above. It is important to note that these benefits are per passenger, where a passenger represents someone who makes a return journey on the service every working day of the year, for the life of the service (i.e. full distance equivalent passengers)

Table 5: Per passenger transport benefit (present values, $2018)[27]

Benefit stream	Scenario A		Scenario B		Scenario C		Scenario D	
	Exist	New	Exist	New	Exist	New	Exist	New
	Hamilton based traveller							
Travel time	$111	$55	$262	$131	$301	$150	$331	$166
Travel time reliabil ty	$39	$20	$39	$20	$39	$20	$39	$20
Vehicle operating cost	$357	$178	$357	$178	$357	$178	$357	$178
Emissions	$40	$0	$40	$0	$40	$0	$40	$0
WEBs	$109	$51	$139	$66	$147	$70	$153	$72
Total	$656	$304	$838	$395	$884	$418	$921	$436
	Auckland based traveller							
Travel time	$0	$0	$10	$5	$55	$27	$104	$52
Travel time reliabil ty	$0	$0	$0	$0	$0	$0	$0	$0
Vehicle operating cost	$360	$180	$360	$180	$360	$180	$360	$180
Emissions	$47	$0	$47	$0	$47	$0	$47	$0
WEBs	$81	$36	$83	$37	$92	$41	$102	$46
Total	$489	$216	$501	$222	$555	$249	$615	$279

5.1.9 *Number of passengers required*

The number of full distance equivalent passengers required to achieve certain benefit cost ratio were derived using the mid-point of the range of the estimated capital cost per scenario as well as an allowance for operating cost based on current

[26] Transformative transport projects (dynamic webs and land use benefits and costs, NZTA (2019)

[27] Source: PwC analysis

Auckland metro costs. The numbers are summarised in Table 6 below:

Table 6: Estimated total cost used for each scenario (present values)[28]

	Scenario A1	Scenario B	Scenario C	Scenario D
Capital costs	$2,157m	$5,000m	$12,157m	$13,627m
Operating costs	$725m	$725m	$725m	$798m
Total	$2,882m	$5,725m	$12,882m	$14,425m

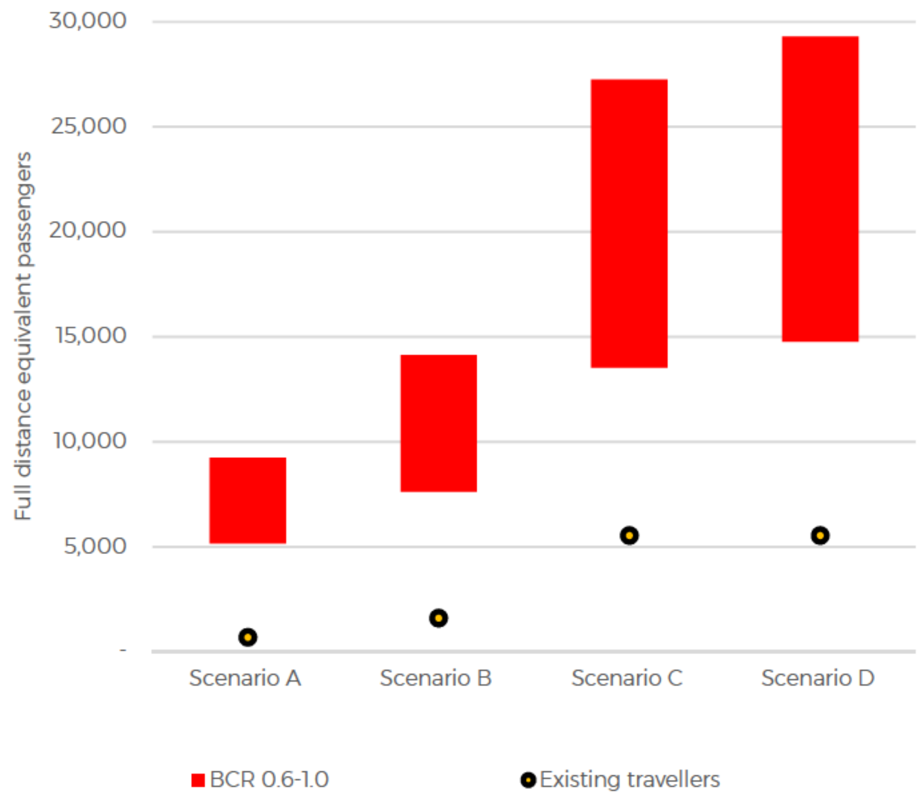
The number of 'full time equivalent' passengers required to achieve a BCR of 1.0, and a BCR of 0.6 are shown below.

Table 7: Indicative estimate of the number of full distance equivalent passengers required[29]

Fast rail scenario	Total number of passengers required	Passengers diverted from car	New passengers required
	To achieve a BCR of 1.0		
Scenario A	9,234	679	8,555
Scenario B	14,134	1,586	12,548
Scenario C	27,243	5,530	21,713
Scenario D	29,302	5,530	23,772
	To achieve a BCR of 0.6		
Scenario A1	5,147	679	4,468
Scenario B	7,620	1,586	6,034
Scenario C	13,529	5,530	7,999
Scenario D	14,762	5,530	9,232

Table 7 presents an indicative estimate of the number of full distance equivalent passengers that are required for benefits to equal costs, or 60% of the costs.

The chart below then illustrates the shortfall in likely existing passengers (diverted from car to rail) against the number needed to generate benefit cost ranges of between 0.6 and 1.0.



[28] WSP estimates, and PwC analysis

[29] PwC analysis

5.2 Assessment of the potential increase in the value of land in proximity to the proposed stations

The likely increase in land values because of the enhanced accessibility adjacent to the railway stations was determined by the following approach:

- Determine the relationship between the proposed infrastructure and the impact on land values. This is referred to as land value uplift.
- Calculate the demand response to the change in the attractiveness of the land and estimate how the land use could change as a result of the new transport infrastructure.

5.2.1 Land value uplift

Land values in the catchment area of the Hamilton to Auckland corridor were modelled using a Hedonic Pricing Model (HPM) specifically developed for this context by PwC.

The model sample was limited to residential, commercial and industrial properties within a 1.6km catchment area of the proposed stations. If a property's centroid is within the catchment area, the property is included in the model. In the case of the Hamilton-Auckland scenarios, this results in a sample of approximately 16,500 properties.

Quality attributes commonly reported as priorities for regional travellers are frequency, comfort, reliability, travel time, and network coverage. Network coverage and coordination are more prominent features in regional public transport, presumably because of the more dispersed nature of regional public transport networks. In relation to this, it has been assumed[30] that catchment areas for walking and cycling to high-quality regional public transport services can be substantially larger for regional services than the conventionally assumed 400 or 800 m radii. A 1.6km radius was therefore chosen as the catchment area around the proposed stations to approximate a twenty-minute walking catchment from a station, to home or work.

The estimated HPM was applied to determine how each proposed rail scenario could impact land values around likely stop locations.

Figure 17 below indicates the baseline average land value per square metre versus the distance from Auckland CBD (distance has been used as a proxy for time). Land values can be seen to decrease from the Auckland CBD, with a slight increase approaching Hamilton. *For the baseline of land values, all properties within 5km of the current railway line between Hamilton and Auckland, have been included. This large catchment area may result in an underestimation of land value per square metre in the (high-value) CBDs.*

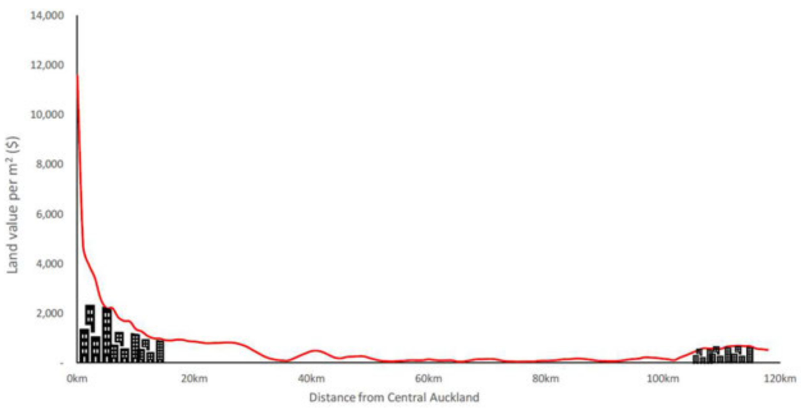


Figure 17[31]: Auckland to Hamilton average land value per square metre

[30] Hansson et al., European Transport Research Review (2019)

[31] (Sources PwC, Ministry of Housing and Urban Development, LINZ)

The analyses show that Auckland land values lose much of their value after approximately 35km outside the CBD. For Hamilton, it is approximately 20km outside the CBD.

It is also notable that Hamilton's land values are significantly lower than in Auckland. This has important implications for how much land both businesses and residents choose to consume.

Figure 18 illustrates the likely effect of an accessibility improvement on the land value within station catchment areas. The chart is however intended to be indicative rather than accurate, and Papakura and Rotokauri were used to illustrate the impact for a southern Auckland and northern Hamilton station respectively.

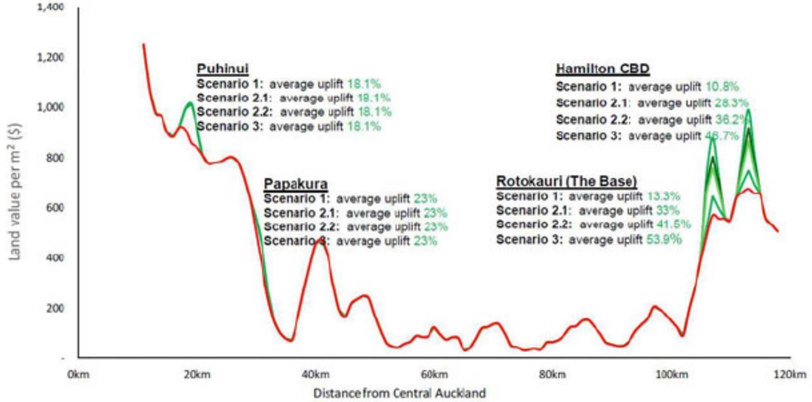


Figure 18[32]: Auckland to Hamilton average land value per square metre (baseline plus four scenarios)

The land value uplift estimates for the four Hamilton-Auckland scenarios are shown in Table 8 below:

Table 8: Estimated uplift in land value[33]

Properties located within 1.6 km of:	Scenario A	Scenario B	Scenario C	Scenario D
Puhinui	$659m	$659m	$659m	$659m
Southern Auckland (Papakura as proxy)	$751m	$751m	$751m	$751m
Northern Hamilton (Rotokauri as proxy)	$154m	$380m	$477m	$619m
Hamilton CBD	$383m	$976m	$1,244m	$1,600m
Total	$1,948m	$2,767m	$3,133m	$3,630m

The analyses show that land within proximity of the Hamilton city centre and northern Hamilton stop is likely to experience the greatest land value uplift under the faster rail scenarios.

Land value uplift in Puhinui and southern Auckland (Papakura) remain the same for all four scenarios since the travel time from each station (to Auckland CBD) is constant across the four scenarios. The availability of the service in the opposite direction (to Hamilton CBD), does not impact the land values in the Puhinui or Papakura station catchments.

5.2.2 Land use change

The land use change methodology considered building density (floor area ratio (FAR) and gross floor area (GFA)) as well as population density (number of residents/households and employees).

The approach followed for this business case firstly determined the relationship between land value and density and then used the expected change in land value resulting from different rail scenarios to estimate the change in density. The estimated

[32] Source: PwC analysis

[33] Source: PwC analysis

changes in density were then converted to expected changes in residents and employees.

The methodology does not predict when the land use change will occur. This would require more detailed modelling as the preferred option progresses beyond interim IBC stage.

Table 9 summarises the land use change results attributable to each scenario. The change in GFA, number of residents and number of employees increases as the travel time under each scenario decreases.

Table 9: Land use change – residential and employment growth[34]

Catchment located within 1.6 km:	Scenario A	Scenario B	Scenario C	Scenario D
Change in GFA (m2)	643,000	1,190,000	1,432,695	1,763,731
Change in number of residents	7,779 (+13.7%)	11,106 (19.6%)	12,595 (+22.2%)	14,644 (+25.9%)
Change in number of employees	3,633 (+7.4%)	7,945 (+16.1%)	9,849 (+20.0%)	12,425 (+25.2%)

5.2.3 Impact of land use change on full distance equivalent riders

The additional population and employment within the station catchments are expected to increase the full distance equivalent ridership on the corridor as follows:

- Scenario A: The likely FDE ridership increases from 700 to approximately 4,900.
- Scenario B: The likely FDE ridership increases from 1,500 to approximately 7,100.
- Scenario C: The likely FDE ridership increases from 5,500 to approximately 8,000.
- Scenario D: The likely FDE ridership increases from 5,500 to approximately 9,400.

Figure 19: below illustrates how these enhanced levels of full distance equivalent passengers compare against a threshold level to achieve a BCR of between 0.6 and 1.0.

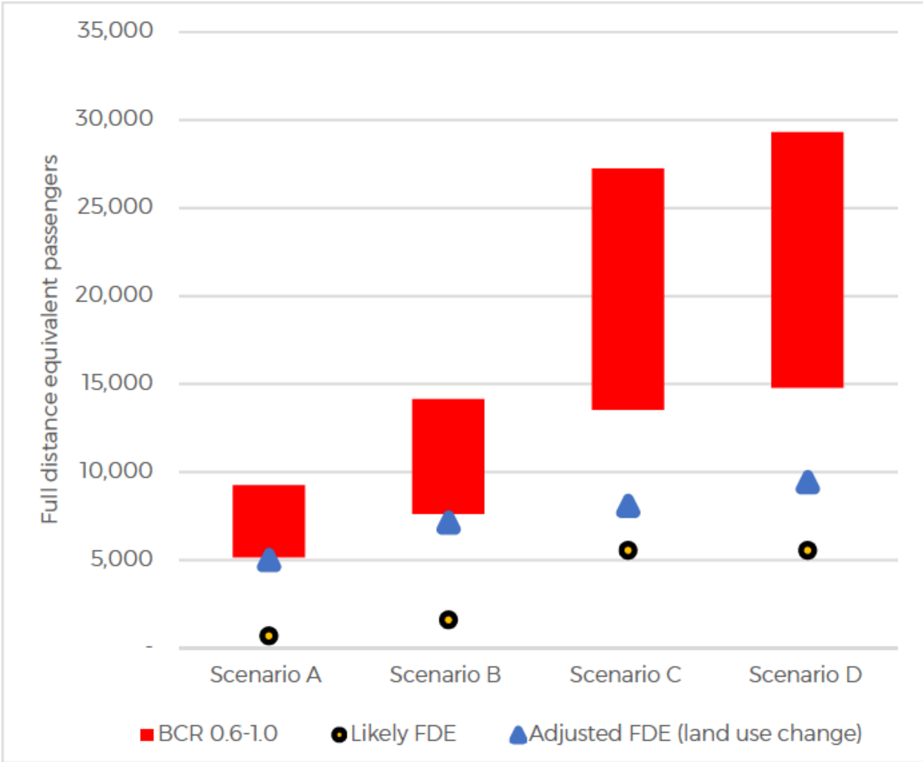


Figure 19: Comparison of likely FDE against thresholds to achieve BCR levels

[34] Source: PwC analysis

6 Conclusion from analysis

6.1 General

The overall findings from the business case are:

- Fast rail in the Hamilton to Auckland corridor warrants further investigation and analysis.
- Any significant enhancement in journey time requires a high level of investment and all scenarios are expected to attract ridership below the threshold level of what is needed for a BCR of 1.0.
- The analyses show that land within proximity of the Hamilton city centre and a northern Hamilton stop is likely to experience the greatest land value uplift under the faster rail scenarios.
- Changes in land value could stimulate additional growth within the station catchment areas reducing the gap in patronage needed to justify a BCR of 1.0.
- The higher investment scenarios (that require a completely new link between southern Auckland and northern Hamilton) fall significantly short of delivering ridership that generate a BCR of 1.0.
- All scenarios require further stimulus over and above what is expected through the introduction of fast rail only. The wider stimulus package should encourage growth within the station catchment areas to allow for ridership levels that support a BCR of 0.6 or higher.
- Complementary initiatives already underway in the Papakura-Pokeno cluster (Supporting Growth) as well as in the Hamilton-Waikato metro cluster (Metro Spatial Plan) should explore additional measures to support land use scenarios (especially through TOD scenarios) that are well-integrated with a fast rail corridor.
- A TOD approach should explore compact development around the station nodes. aligns with the findings in a recent BERL report[35] that notes that the largest impact on potential economic developments is expected from a compact and connected Hamilton Metro Area that is connected to the wider Waikato and Auckland.
- Increased connection between Waikato and Auckland together with a compact and connected Hamilton city would enable both cities to benefit economically.

6.2 Next steps

Based on the business case findings, key characteristics in future studies should include:

- Explore corridor options that use existing infrastructure where possible to drive down costs. This suggests the use of running speeds up to 160 km/h under Scenario B in this report.
- The ability to serve long distance commuter as well as business trips. Anchor stations at each end of the Corridor that serve business needs; and preferably include connections that enable transfers to Auckland airport and Manukau city centre, to enhance ridership potential.
- A stop in northern Hamilton and southern Auckland (preferably Drury area) that stimulate TOD development to enhance ridership.

Given the strategic nature of this business case we recommend further stages of business case development that prioritise:

- Design investigation to explore mitigation measures to topographical, environmental and cultural constraints to assist in cost refinement. This should also develop station concepts at both Frankton and Hamilton city centre to assist with further analyses

[35] Hamilton – Waikato Metropolitan Area, Role and function now and into the future, 2020, BERL

of the incremental benefit for extending the service from Frankton to a new underground stop in central Hamilton.

- Development of a more comprehensive inter-regional demand model to assist with more in-depth analysis of the potential benefits.
- Master planning to develop a comprehensive view of TOD style development within the catchment areas of stations in northern Hamilton and southern Auckland (preferably Drury area) that enhance ridership.

Appendix A: Changes in accessibility

Measure			Scenario A	Scenario B	Scenario C	Scenario D
	Origin	Destination	2051	2051	2051	2051
The number of additional jobs available within 90 minutes to people departing from the following stations	Hamilton CBD	Southern Auckland	2,000	26,000	32,000	39,000
		Puhinui		31,000	46,000	73,000
		Britomart			70,000	190,000
	Northern Hamilton	Southern Auckland	8,000	31,000	36,000	44,000
		Puhinui	500	43,000	62,000	153,000
		Britomart		55,000	151,000	239,000
	Southern Auckland (Papakura)	Northern Hamilton	9,000	39,000	68,000	92,000
		Hamilton CBD	16,000	75,000	89,000	100,000
	Southern Auckland (Drury)	Northern Hamilton	14,000	60,000	74,000	93,000
		Hamilton CBD	29,000	81,000	91,000	101,000

Measure				Scenario A	Scenario B	Scenario C	Scenario D
		Origin Station	Destination	2051	2051	2051	2051
The number of additional people that are available within 90 mins to Auckland based firms located within the following areas:	Auckland city centre	Northern Hamilton	Britomart			4,000	206,000
		Hamilton CBD					148,000
	Auckland Airport precinct	Northern Hamilton	Puhinui			221,000	251,000
		Hamilton CBD			6,000	192,000	245,000
	Manukau City Centre	Northern Hamilton	Puhinui		233,000	251,000	307,000
		Hamilton CBD			200,000	192,000	288,000
The number of additional people that are available within 90 mins to Hamilton based firms located within the following areas:	Hamilton city centre	Puhinui	Hamilton CBD		381,000	1,122,000	1,615,000
		Britomart					314,000
	Northern Hamilton	Puhinui	Northern Hamilton		1,026,000	1,418,000	1,922,000
		Britomart				106,000	945,000

Measure			Scenario A	Scenario B	Scenario C	Scenario D
Number of additional Tier 1 tertiary educational facilities available within 90 minutes to people departing from the following stations	Origin	Destination	Number of Facilities			
	Hamilton CBD	Southern Auckland				
		Puhinui		2	3	3
		Britomart			1	1
	Northern Hamilton	Southern Auckland				
		Puhinui		2	3	3
		Britomart			1	1
	Papakura	Northern Hamilton			1	1
		Hamilton CBD	1	2	2	2

Measure			Scenario A	Scenario B	Scenario C	Scenario D
Number of additional Tier 1 healthcare facilities available within 90 minutes to people living in the following areas	Origin	Destination	Number of Facilities			
	Hamilton CBD	Southern Auckland		1	1	1
		Puhinui				1
		Britomart				
	Northern Hamilton	Southern Auckland				
		Puhinui		1	1	1
		Britomart			1	1
	Southern Auckland	Northern Hamilton				1
		Hamilton CBD		1	1	1

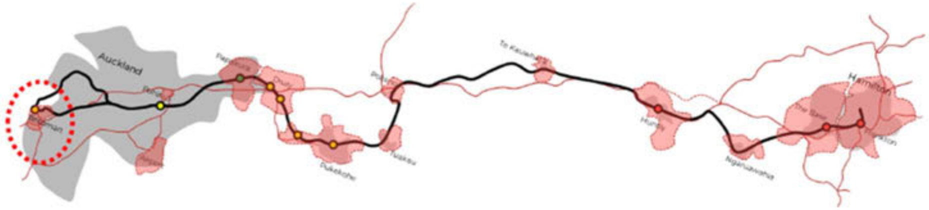
Measure				Scenario A	Scenario B	Scenario C	Scenario D
		Origin Station	Destination	2051	2051	2051	2051
Number of additional people that can access the following tier 1 healthcare facilities within 90 mins	Auckland and Starship Hospitals	Northern Hamilton	Britomart				
	Middlemore Hospital	Northern Hamilton	Puhinui			85,000	231,000
		Hamilton CBD				6,000	200,000
	Manukau Super Clinic	Northern Hamilton	Puhinui				130,000
		Hamilton CBD					27,000
	Waikato Hospital	Puhinui	Hamilton CBD			303,000	1,008,000

Measure			Scenario A	Scenario B	Scenario C	Scenario D
Number of all additional healthcare facilities available within 90 minutes to people living in the following areas	Origin	Destination	Number of Facilities			
	Hamilton CBD	Southern Auckland	9	20	20	20
		Puhinui		2	2	2
		Britomart			7	10
	Northern Hamilton	Southern Auckland	14	20	20	20
		Puhinui	1	2	2	2
		Britomart		6	10	10
	Southern Auckland	Northern Hamilton	2	9	21	26
		Hamilton CBD	6	23	25	26

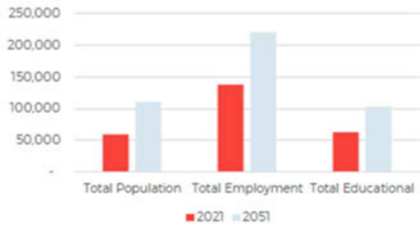
Measure				Scenario A	Scenario B	Scenario C	Scenario D
		Origin Station	Destination	2051	2051	2051	2051
Number of additional people that can access the following tier 1 tertiary education facilities within 90 mins	Auckland University Precinct (University of Auckland and AUT)	Northern Hamilton	Britomart				91,000
	MIT Otara Campus	Northern Hamilton	Puhinui			19,000	212,000
		Hamilton CBD					171,000
	MIT Manukau Campus	Northern Hamilton	Puhinui		233,000	251,000	307,000
		Hamilton CBD			200,000	245,000	288,000
	University of Waikato (Hamilton Campus)	Puhinui	Hamilton CBD				178,000
	Wintec CBD Campus	Puhinui	Hamilton CBD		221,000	770,000	1,418,000
		Britomart					106,000

Appendix B: Station catchment areas

Britomart Station

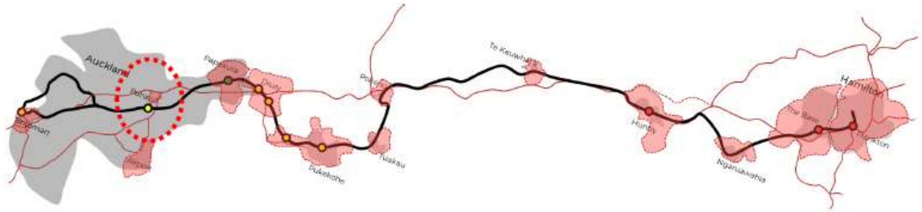


	2021	2051	2021-2051
Total Population	59,858	110,775	50,917
Total Employment	137,290	220,376	83,086
Total Educational	62,724	102,969	40,245

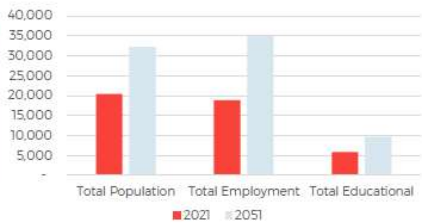


Planning Zone	Total Area (Ha)
Business	415.92
Open Space / Protected Areas	175.63
Residential	147.15
Special Purpose	18.48
Transport	273.57
Water	0.15

Puhinui Station

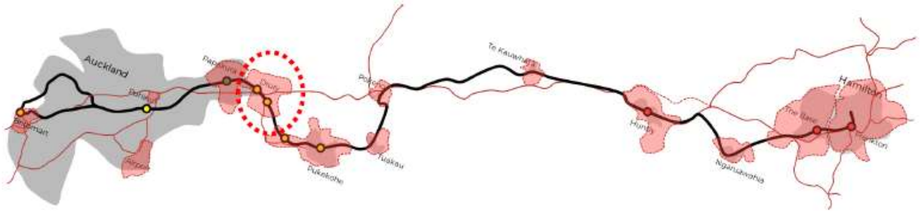


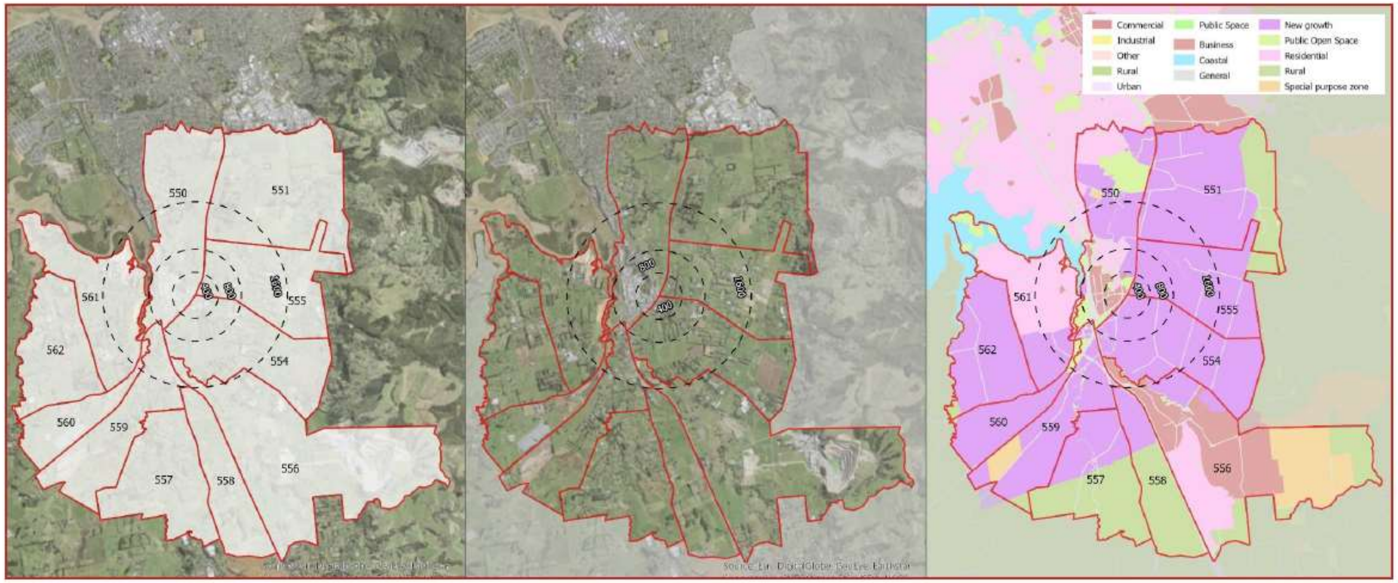
	2021	2051	2021-2051
Total Population	20,439	32,251	11,812
Total Employment	18,779	34,949	16,170
Total Educational	5,837	9,582	3,745



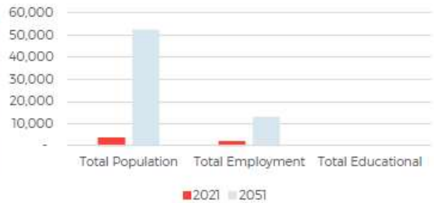
Planning Zone	Total Area (Ha)
Business	1463.31
Open Space / Protected Areas	1162.28
Residential	553.58
Special Purpose	1295.64
Transport	95.23
Water	3.90
Industrial	95.96

Drury Station



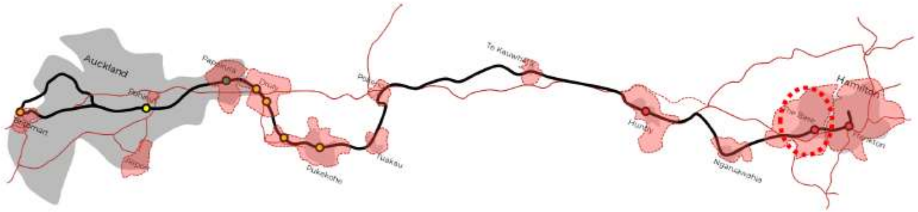


	2021	2051	2021-2051
Total Population	3,653	52,357	48,703
Total Employment	2,108	12,885	10,777
Total Educational			

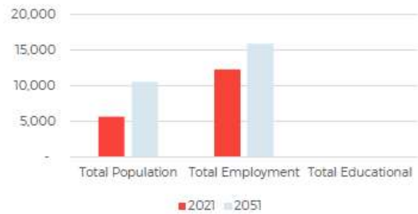


Planning Zone	Total Area (Ha)
Business	254.26
Open Space / Protected Areas	127.30
Residential	2624.50
Special Purpose	181.21
Transport	204.84
Water	22.17
Industrial	32.03

The Base Station

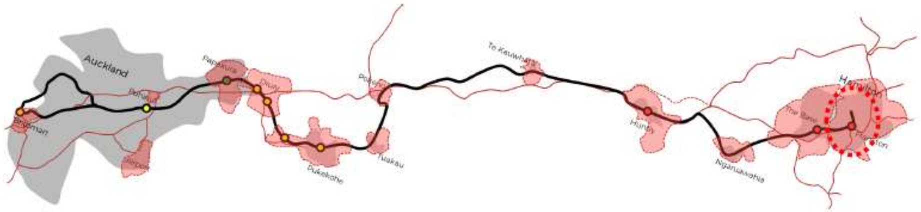


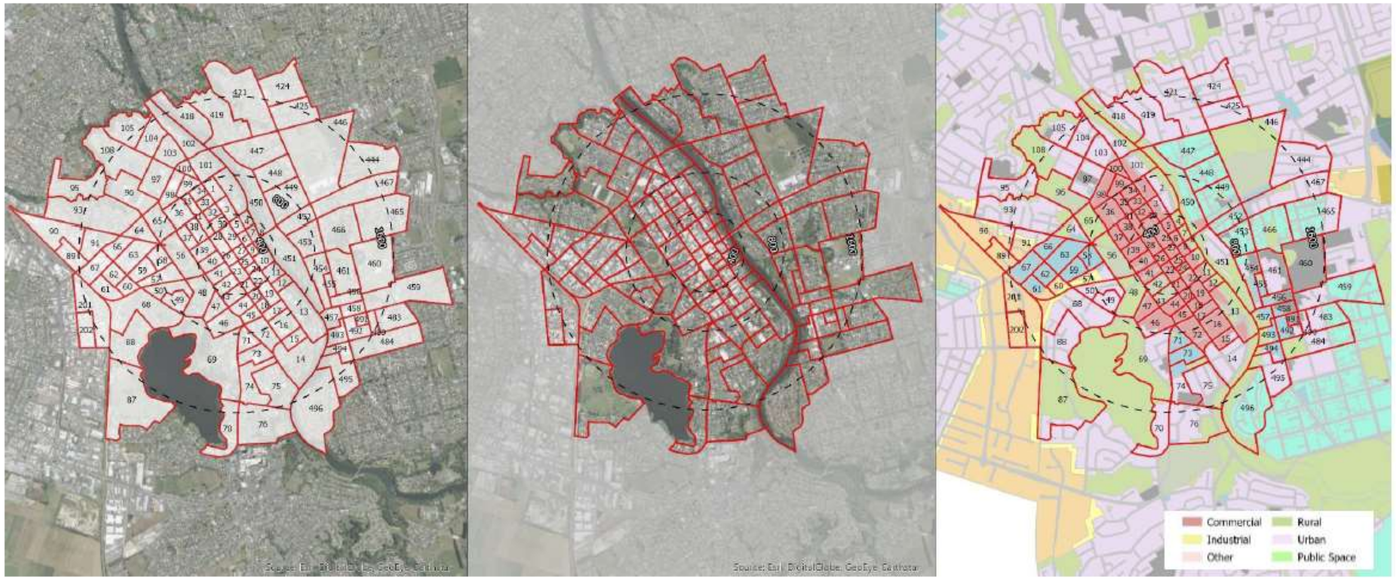
	2021	2051	2021-2051
Total Population	5,623	10,488	4,865
Total Employment	12,317	15,835	3,518
Total Educational	43	44	1



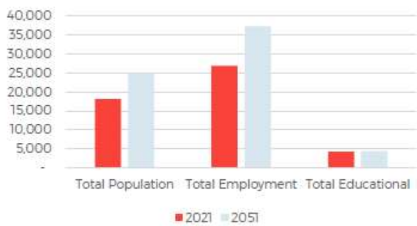
Planning Zone	Total Area (Ha)
Business	56.00
Open Space / Protected Areas	57.66
Residential	269.14
Transport	133.98
Industrial	495.95
Community Facilities	6.57
Special Character	34.10

Hamilton CBD Station





	2021	2051	2021-2051
Total Population	18,099	24,681	6,582
Total Employment	26,902	37,234	10,332
Total Educational	4,282	4,400	118



Planning Zone	Total Area (Ha)
Business	142.00
Open Space / Protected Areas	200.46
Residential	274.51
Transport	183.63
Industrial	79.12
Community Facilities	41.29
Special Character	99.32

Appendix C: Economic calculation sheets

Required passenger numbers

Model information

	refers to:	Input ce l
	refers to:	Calculation cell
	refers to:	Output cell

Analysis inputs

Ratio of Hamilton based travellers vs Auckland based travellers

Hamilton	%	75%
Auckland	%	25%

Number of existing travellers

	Scenario A	Scenario B	Scenario C	Scenario D
#.##	679	1,586	5,530	5,530

Required BCR

	Scenario A	Scenario B	Scenario C	Scenario D
	1.0	1.0	1.0	1.0

Cost inputs

PV of Costs ($2018)

	Scenario 1	Scenario 2.1	Scenario C	Scenario D
Capex	$2,157M	$5,000M	$12,157M	$13,627M
Opex	$725M	$725M	$725M	$798M
Residual value	$51M	$119M	$289M	$324M

Benefits per-passenger

Hamilton based traveller

	Scenario A	Scenario B	Scenario C	Scenario D
Existing travellers	$656,488	$837,692	$884,267	$920,533
New travellers	$304,132	$394,735	$418,022	$436,155

Auckland based traveller

	Scenario A	Scenario B	Scenario C	Scenario D
Existing travellers	$488,974	$500,946	$554,821	$614,682
New travellers	$215,994	$221,980	$248,917	$278,848

Weighted average traveller

	Scenario A	Scenario B	Scenario C	Scenario D
Existing travellers	$614,610	$753,506	$801,905	$844,070
New travellers	$282,098	$351,546	$375,746	$396,828

Number of passengers required to achieve BCR

	Scenario A	Scenario B	Scenario C	Scenario D
Existing travellers	679	1,586	5,530	5,530
New travellers	8,555	12,548	21,713	23,772

Required passenger numbers

Model information

	refers to:	Input cell
	refers to:	Calculation cell
	refers to:	Output cell

Analysis inputs

Ratio of Hamilton based travellers vs Auckland based travellers

Hamilton	%	75%
Auckland	%	25%

Number of existing travellers

	Scenario A	Scenario B	Scenario C	Scenario D
#.##	679	1,586	5,530	5,530

Required BCR

	Scenario A	Scenario B	Scenario C	Scenario D
	0.6	0.6	0.6	0.6

Cost inputs

PV of Costs ($2018)

	Scenario 1	Scenario 2.1	Scenario C	Scenario D
Capex	$2,157M	$5,000M	$12,157M	$13,627M
Opex	$725M	$725M	$725M	$798M
Residual value	$51M	$119M	$289M	$324M

Benefits per-passenger

Hamilton based traveller

	Scenario A	Scenario B	Scenario C	Scenario D
Existing travellers	$656,488	$837,692	$884,267	$920,533
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New travellers	$215,994	$221,980	$248,917	$278,848

Weighted average traveller

	Scenario A	Scenario B	Scenario C	Scenario D
Existing travellers	$614,610	$753,506	$801,905	$844,070
New travellers	$282,098	$351,546	$375,746	$396,828

Number of passengers required to achieve BCR

	Scenario A	Scenario B	Scenario C	Scenario D
Existing travellers	679	1,586	5,530	5,530
New travellers	4,468	6,034	7,999	9,232

Per-passenger benefits

PV, $2018

Hamilton based commuter		Scenario A		Scenario B		Scenario C		Scenario D	
		Existing	New	Existing	New	Existing	New	Existing	New
Travel time		$110,970	$55,485	$261,973	$130,987	$300,785	$150,393	$331,007	$165,504
Travel time reliability		$39,215	$19,608	$39,215	$19,608	$39,215	$19,608	$39,215	$19,608
Vehicle operating costs		$356,702	$178,351	$356,702	$178,351	$356,702	$178,351	$356,702	$178,351
Emissions		$40,186	-	$40,186	-	$40,186	-	$40,186	-
Decongestion		-	-	-	-	-	-	-	-
Comfort		-	-	-	-	-	-	-	-
Other		-	-	-	-	-	-	-	-
WEBs	20%	109,415	50,689	139,615	65,789	147,378	69,670	153,422	72,692
Total benefits		**$656,488**	**$304,132**	**$837,692**	**$394,735**	**$884,267**	**$418,022**	**$920,533**	**$436,155**

Auckland based commuter		Scenario A		Scenario B		Scenario C		Scenario D	
		Existing	New	Existing	New	Existing	New	Existing	New
Travel time		-	-	$9,977	$4,988	$54,872	$27,436	$104,756	$52,378
Travel time reliability		-	-	-	-	-	-	-	-
Vehicle operating costs		$359,990	$179,995	$359,990	$179,995	$359,990	$179,995	$359,990	$179,995
Emissions		$47,488	-	$47,488	-	$47,488	-	$47,488	-
Decongestion		-	-	-	-	-	-	-	-
Comfort		-	-	-	-	-	-	-	-
Other		-	-	-	-	-	-	-	-
WEBs	20%	81,496	35,999	83,491	36,997	92,470	41,486	102,447	46,475
Total benefits		**$488,974**	**$215,994**	**$500,946**	**$221,980**	**$554,821**	**$248,917**	**$614,682**	**$278,848**

Appendix D: International examples

Experience on Intercity Rail Projects

- **Future Transport 2056** – Regional NSW Services and Infrastructure Plan
  - Identified Fast Rail upgrades for **3 corridors**
  - Document the requirement for **corridor preservation** for Higher Speed connections
  - Developed a **hub and spoke** network of transport services
  - Outlined a **regional settlement pattern** supported by improved regional transport
- **Sydney to Newcastle Fast Rail Strategic Business Case**
  - Transport advisory services
  - Technical services
- **NSW Fast Rail Network**
  - Developed a network narrative for **4 Fast Rail corridors**
  - Supported by an evidence base of demographic analysis, land use and regional economic redevelopment strategies

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Experience on Intercity Rail Projects

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Figure 39: Options for connecting Global Gateway Cities to Sydney

Figure 24: Future Network

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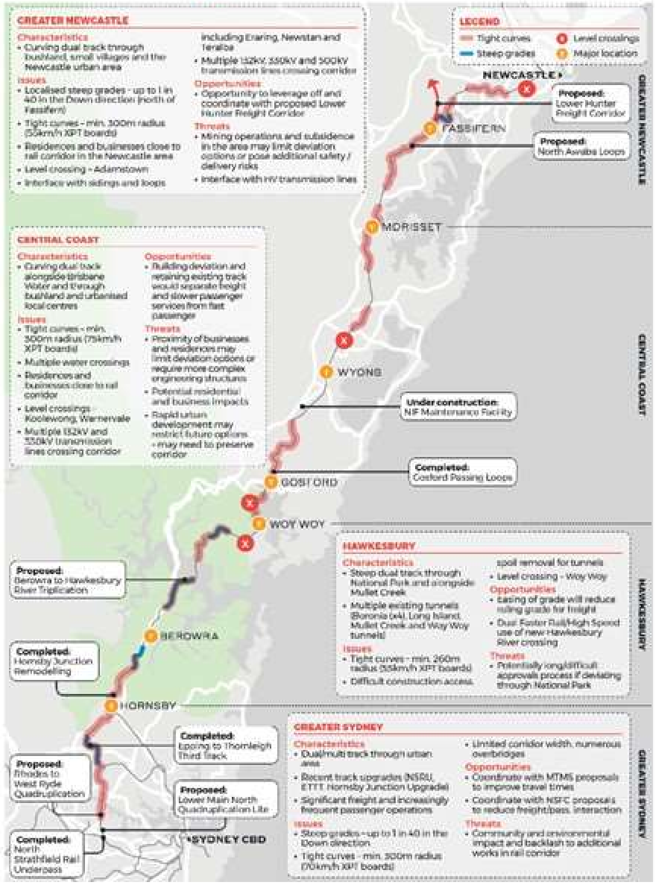
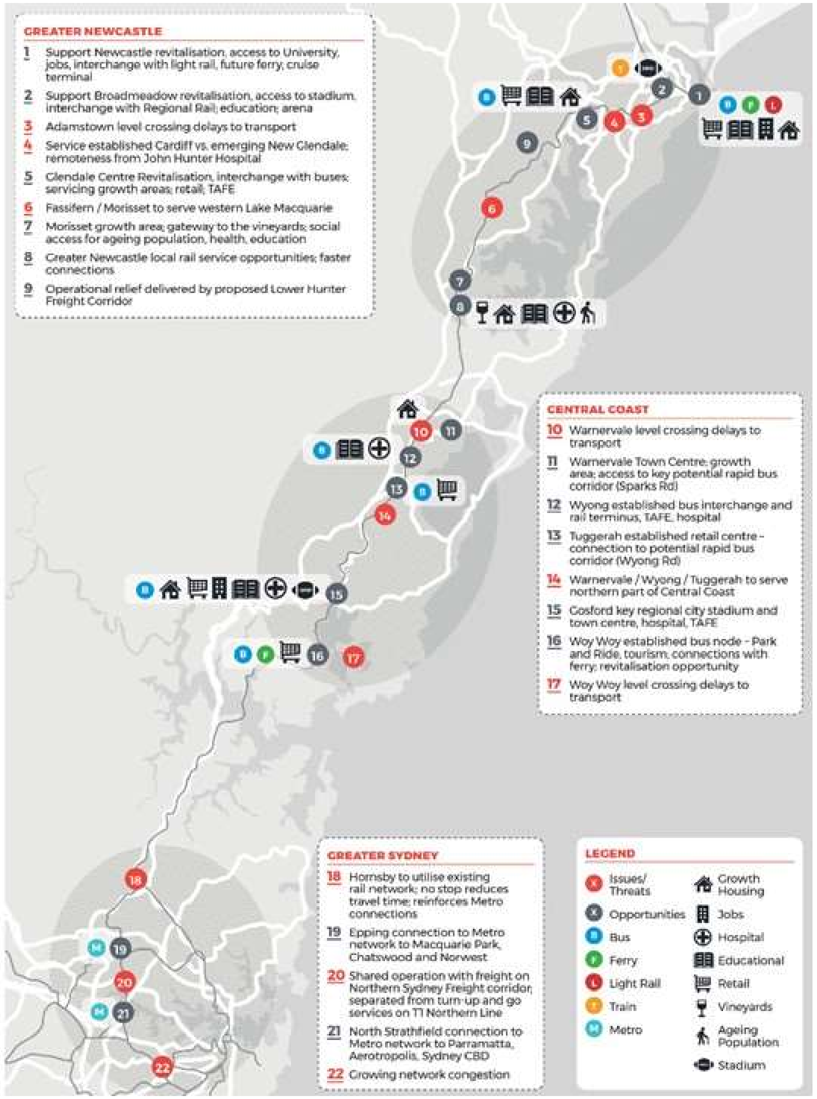
Experience on Intercity Rail Projects





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Experience on Intercity Rail Projects

Northern Corridor	Western Corridor
• Central Coast • Newcastle • Taree • Port Macquarie	• Lithgow • Bathurst • Orange / Parkes

Southern Inland Corridor	Southern Coastal Corridor
• Goulburn • Canberra	• Wollongong • Nowra

Journey	Current rail time	Faster rail <200km/h	High-speed rail >250km/h
Sydney to Canberra	4:07 hours	3:00 hours	1:00 hours
Sydney to Goulburn	2:31 hours	1:45 hours	0:30 hours
Sydney to Newcastle	2:35 hours	2:00 hours	0:45 hours
Sydney to Gosford	1:19 hours	1:00 hours	0:30 hours
Sydney to Wollongong	1:25 hours	1:00 hours	0:30 hours
Sydney to Nowra	2:39 hours	2:00 hours	0:45 hours

Political agenda / drivers

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Political agenda / drivers

- High Speed Rail has been **highly political** in Australia since the late 1960s
- Last major Commonwealth study was in 2014 which priced an east coast network between Melbourne, Canberra, Sydney and Brisbane **at $114B**
- Fast Rail is seen by the NSW government as a key **regional economic stimulus** project
  - Due to cynicism by the public NSW government said it would develop a network **independent of Commonwealth** government funding and not be High Speed Rail i.e. >300km/h
- Commonwealth has also sought to make Fast Rail a regional project. Commonwealth **opposition has long supported a policy of High Speed Rail**
- Fast Rail Network was a **key election commitment** for NSW government in December 2018 (re-elected in March 2019)
- Fast Rail connections became a **key election commitment** for Commonwealth government in April 2019 (re-elected in May 2019)
- Queensland Government sought to make Fast Rail a key component of their **SEQ City Deal** and potential Olympic Bid for 2032

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Political agenda / drivers

Figure 2: 20-Year plan for a Faster Rail Network

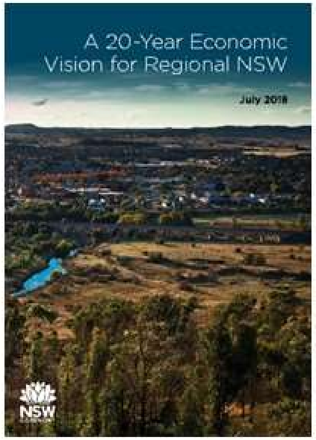

South East Queensland City Deal

Statement of Intent

Between

The Commonwealth of Australia and
the State of Queensland and
The Council of Mayors (South East Queensland)

Priority areas for action



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Urban Development features

- NSW Fast Rail network focuses on **travel to Sydney** from key regional cities
- Based upon existing demand which is strongest from **satellite cities** of Gosford and Wollongong which are currently 90 minutes by rail from Sydney
- Fast Rail initially envisaged as a way to solve **housing affordability** in Greater Sydney
- Also based upon the premise of a **30-minute city** based on personal travel time budgets of 1 hour daily (Marchetti's constant)
- Supporting urban development which is **moving towards the coast** throughout Australia
- **Topography of the Great Dividing Range** limits the ability for rail to traverse from the coast to inland Australia where settlement is more sparse

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Urban Development features

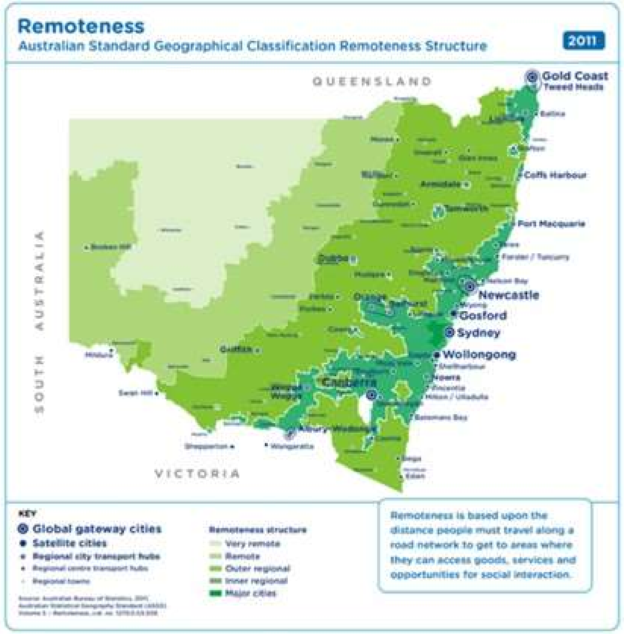

Figure 13: Remoteness (Source: Australian Bureau of Statistics)

Figure 23: Connecting cities and centres across the Great Dividing Range

Unlocking potential for cities and regions

- Regional Cities
  - **Regeneration of cities** in parallel with improvements to feeder transport networks
  - Regular investment in **hub and spoke services** for Regional Cities and Global Gateway cities served by Fast Rail
- The importance of **travel time budgets**
  - 30, 60 and 120 minute catchments
  - For both business and human interaction
- Fast Rail **is an enabler**
  - It is not a catalyst on its own
  - Needs to primarily benefit economic development in **knowledge based industries**
  - Tourism and services are **secondary beneficiaries**

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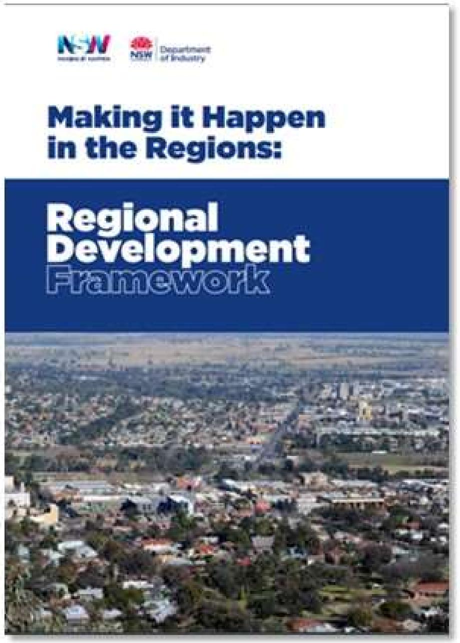
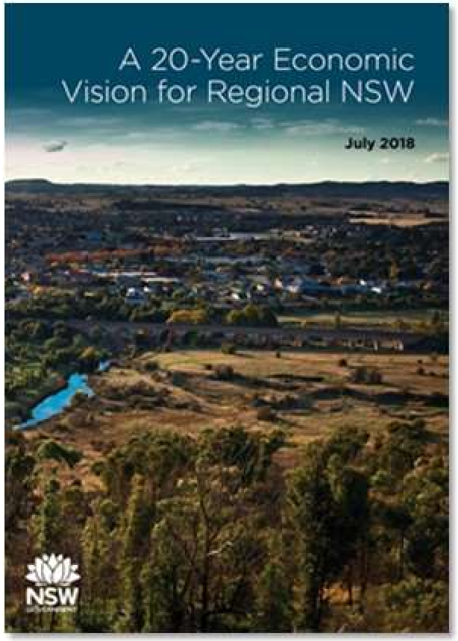
Unlocking potential for cities and regions





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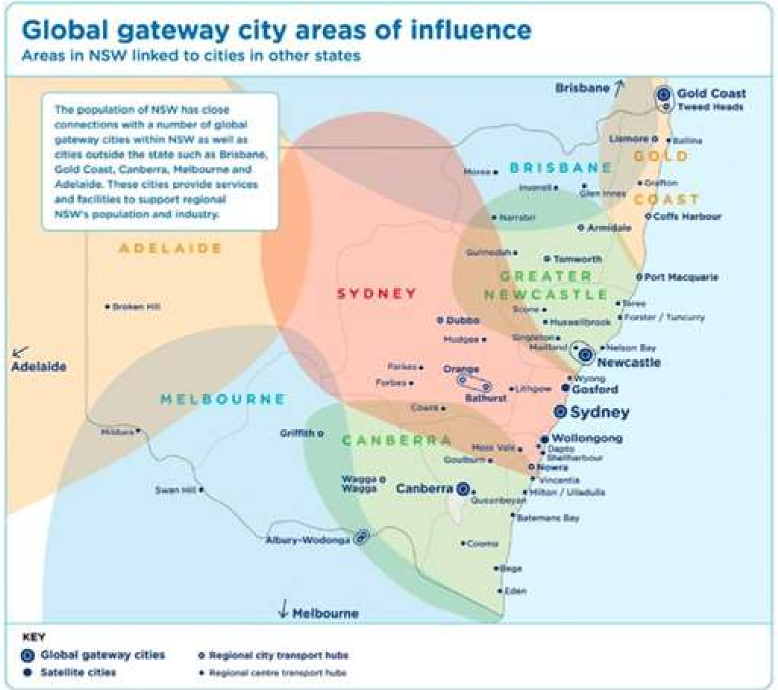
Unlocking potential for cities and regions



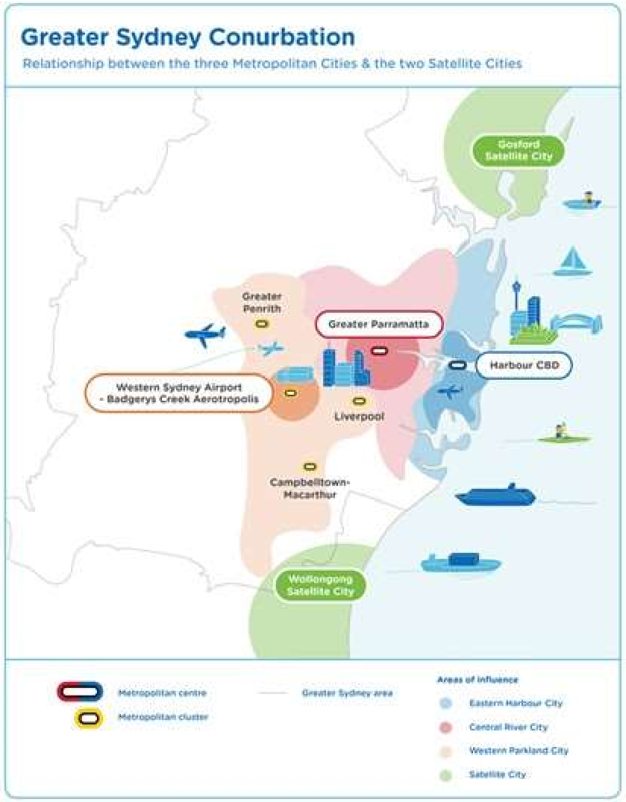


Figure 21: The five metropolitan cities of Greater Sydney by 2056

Managing and distributing growth

- Creates **global gateway** cities which can develop on their own and offer adjacent regions alternative access to **Level 1 services** in health, education, retail and travel than just Sydney
- Introducing higher speed rail services where regional **populations are growing** the fastest (coastal areas)
- Providing **competitive travel time for rail** when compared with private vehicle travel
- Supporting the **development of travel choices** in areas where air travel is less competitive in terms of journey time and convenience
- **Improve civic amenity and convenience** to attract and retain an educated workforce

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Managing and distributing growth

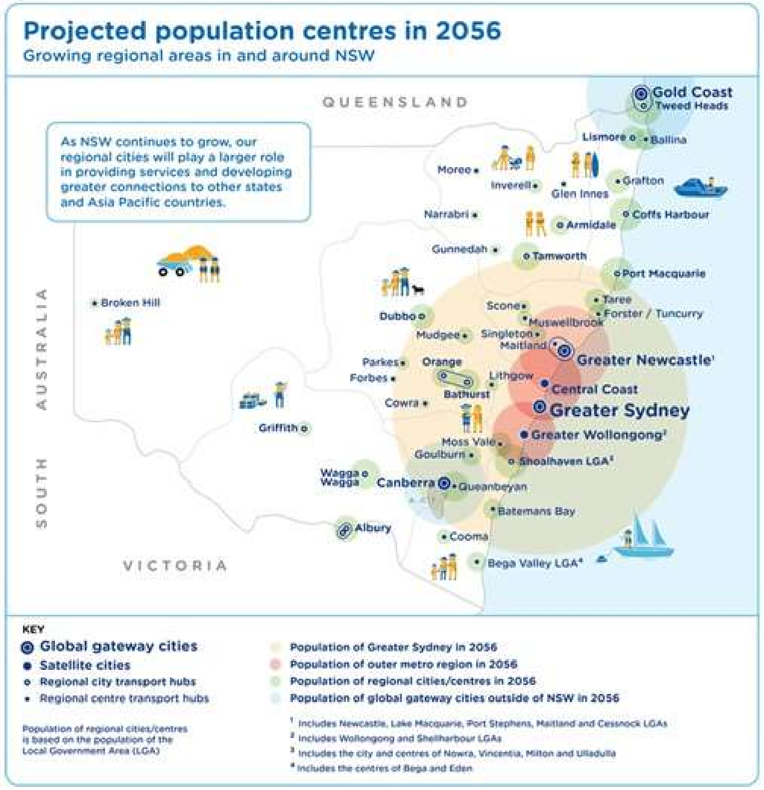
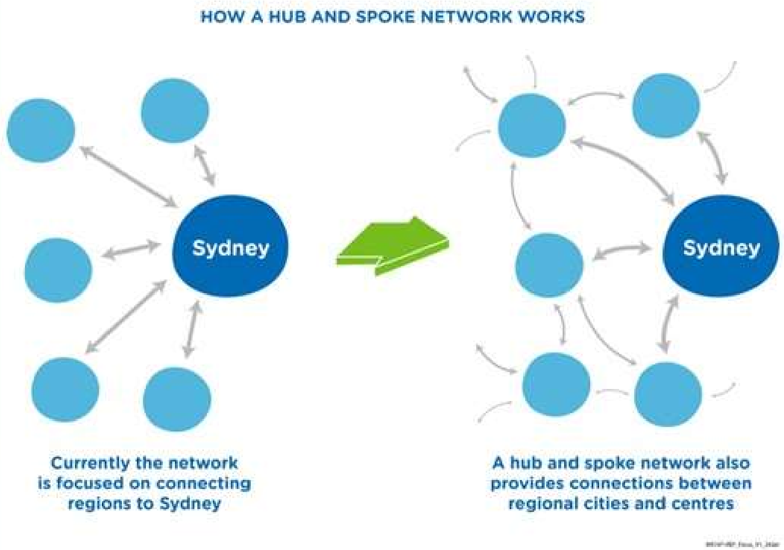


Figure 8: Expected population in 2056



Relevance to H2A corridor

- Sydney to Newcastle is **170km** apart by road approximately 1 hour 45 minutes
- Rail journey is **slower than car** at 2 hours 40 minutes
- Australia's **biggest regional city** that is not a capital (approx. 500,000)
- Desire to link cities to create a **globally economically competitive** connection of cities
- The **road corridor has limited capacity for expansion** or development of alternative routes
- Balance the desire to **redevelop centres between** two major cities (network anchors) and **trade-off for faster journey** times
- Requirement to **traverse challenging topography**
- Linking cities which **support knowledge industry jobs**
- Sharing **freight rail** network
- Navigating **complex metropolitan rail** network

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Hamilton to Auckland Connectivity Study
Experience from Europe
Workshop 1 – 23 October 2019
Edward O'Loughlin– Technical Director WSP UK

My experience on InterCity Rail Projects

- UK
  - 20 years in project, franchise and technical advice work
  - HS1 – only true high speed line, 300 kph
  - East and West Coast main lines, Great Western main line, 200kph
  - A large number of lines in the 160kph – 200kph bracket
  - HS2 and whatever that becomes!
- France
  - Led Steer's efforts in France for 4 years
  - First European country with high-speed lines (Paris - Lyon, 1981, now 300kph)
  - Now struggling with legacy of under investment in classic network and major renewals on the HS network.

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Experience on InterCity Rail Projects

A short history lesson

- Railway is primarily passenger although much was built for freight circa 150 years ago
- UK – substantial closures in 1960s, much of it driven by car ownership and the growth in motorways
- 1970s/80s - stagnation; 1990s privatisation, opening of Channel Tunnel, 2000s significant growth and innovation in services, 2010s continued growth but substantial structural and funding problems more evident in the industry
- France – much larger country with more domestic air travel traditionally. High-speed rail has been successful partly because of replacing domestic airlines (eg Paris – Lyon, Paris –Brussels – I know Brussels is Belgium!)
- So we do not start from a place of considering whether to introduce a passenger service between two major conurbations – we are thinking how to improve what we have to be more economically and financially viable and environmentally sustainable.

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Channel Tunnel and HSL

- Opened 1994
- Journey time 3h 15 to Paris
- Very slow operation between London and Channel Tunnel
- New line (HS1) opened in 2003 and 2007, with stations at St Pancras, Stratford, Ebbsfleet, Ashford
- Not only were Eurostar journey times reduced by an hour, but a dense network of high-speed 'Javelin' services was introduced across Kent, vastly improving the service to that poorly-served county

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Political agenda / drivers for CTRL/HS1

- Politically and financially unacceptable for line through south London
- President Mitterrand and the Queen on opening day
- Economic prosperity
  - King's Cross St Pancras redevelopment
  - Stratford and the Olympics, regeneration of East London
  - Ebbsfleet Garden City
  - Ashford

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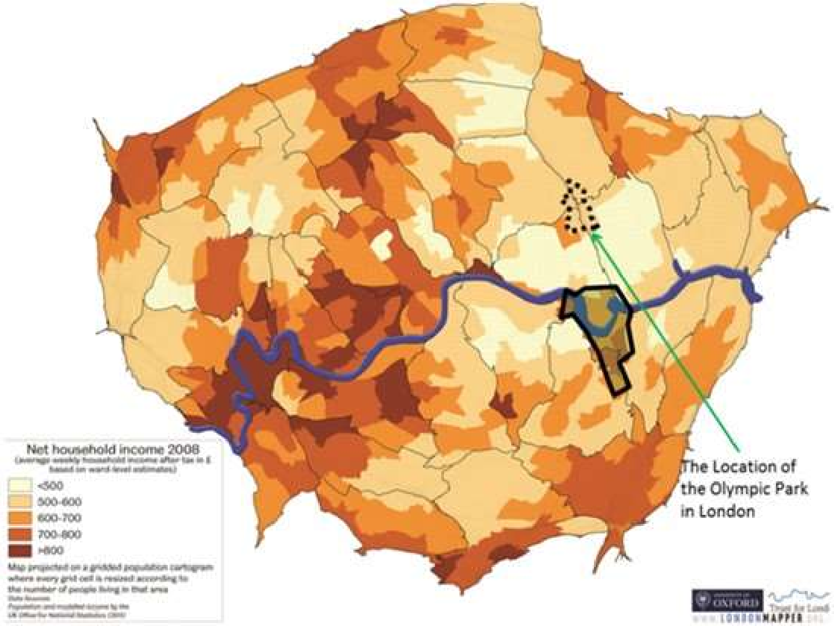
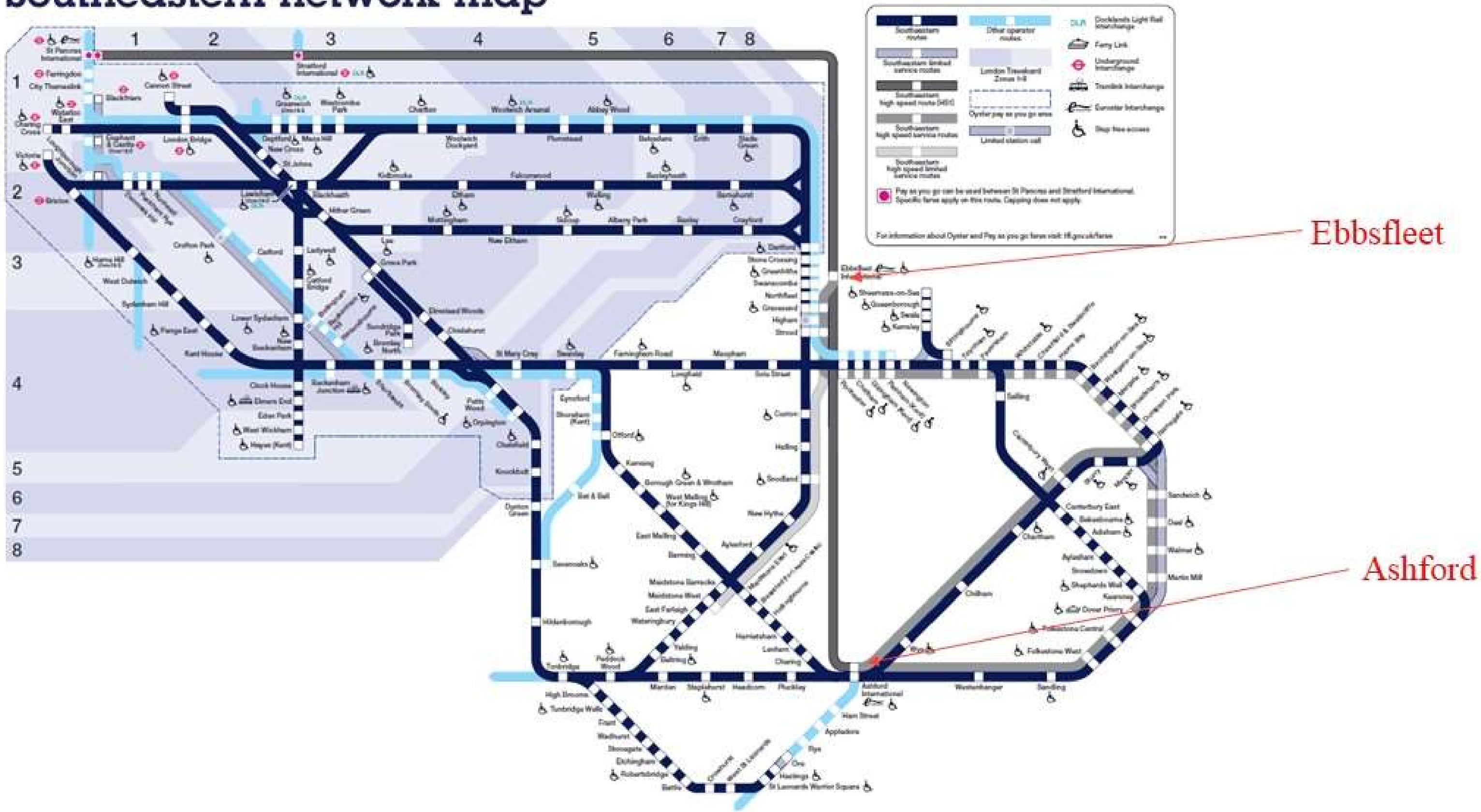
London - King's Cross and St Pancras / Stratford



Ebbsfleet and Ashford

Southeastern network map



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Economic growth

Securing Economic & Social Value at King's Cross:

Notable Achievements to Date

1. £3bn construction spend, including £590m in London supporting 1,300 jobs
2. 300 local suppliers in Central Impact Zone supporting 500 jobs
3. New construction training facility strengthening the local labour market and providing 600 apprenticeships and 450 NVQ L2 skills supports
4. 97% occupancy of commercial property completed
5. 8,500 people now working on the Kings Cross site
6. 50% increase in jobs across the Central Impact Zone1 over 5 years (vs18% in London)
7. 65% increase in 'knowledge' employment in Central Impact Zone (vs 22% in London)
8. Specialist recruitment and training project, KX Recruit has supported over 600 people into work since 2014, including 400 local people
9. Up to £100m of additional business rates income pa once complete
10. Over 300 residential units delivered to date (36% of all) have been either affordable or alternative provision[2], compared to inner London average of 25%
11. £77m of additional local spend per year from new residents in the estate
12. Footfall of around 7.5 million during 2016
13. 163 events on site during 2016
14. 600 young people & 420 business volunteers supported to volunteer in 2015/16
15. Total wellbeing benefits in excess of £12m enabled by volunteering, youth group and exercise programmes at King's Cross
16. Over the past decade, King's Cross has outperformed other inner London 'Opportunity Areas', in terms of employment growth & growth in residential and commercial values.

46,000 jobs provided across Stratford, including 7,400 jobs in the existing town centre, 3,500 on the Olympic site, and over 30,000 at Stratford City.

These include over 33,000 office jobs, 10,400 retail jobs, over 1,500 leisure/education and community jobs and also over 1,000 jobs in hotels and catering.

The largest proportion of these would be small businesses, though large companies will make the biggest contribution to job creation.

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France – international crossroads

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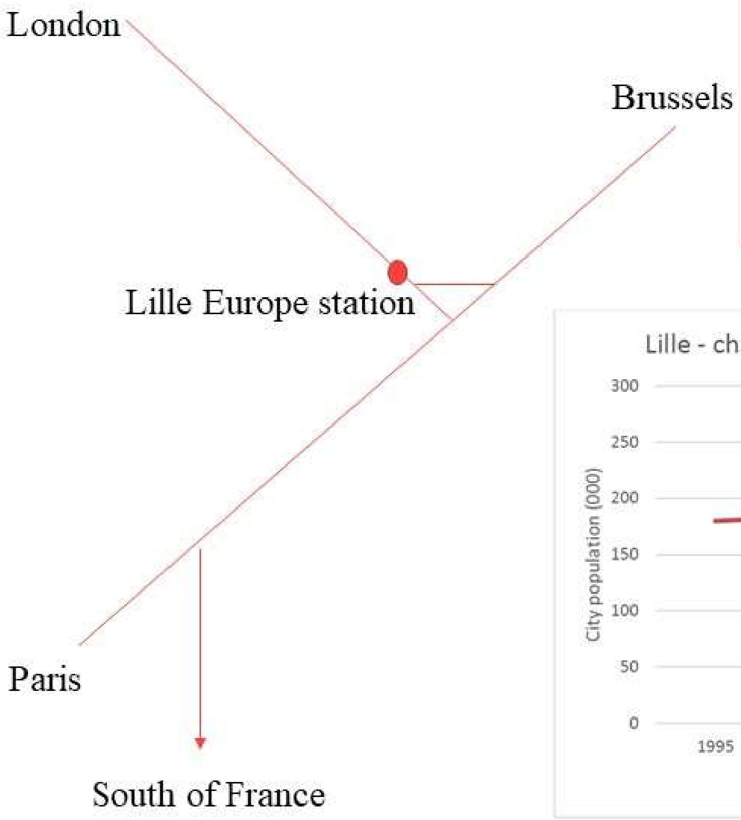
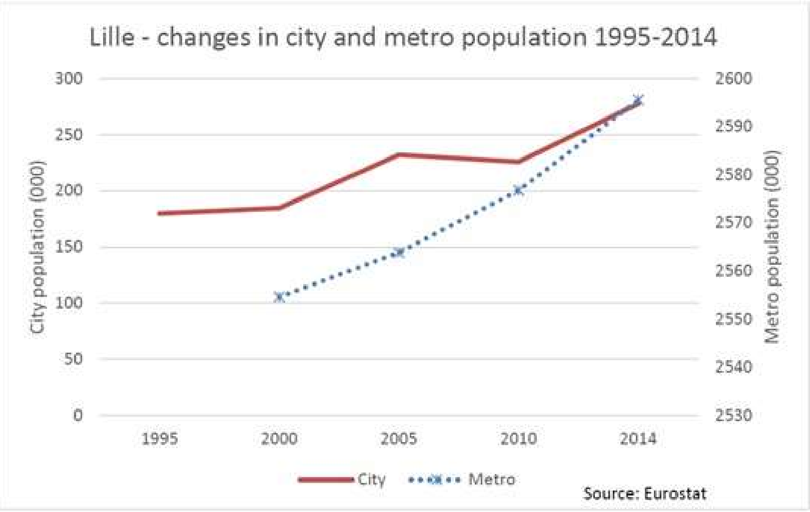
How to serve cities - Lille



Key facts

- Decline of mining and industrial jobs in 1970s and 1980s reversed by Eurostar from 1993 and the Euralille development
- Local region still deprived but city centre thoroughly regenerated
- On HSL but not on main Paris – Brussels line



How to serve cities - Berlin

Key facts

- One of the biggest elements in reunification programme of Berlin
- Reusing wasteland formerly in the no man's land, and near the Bundestag
- Allows through trains north to south and east to west over the Stadtbahn – vastly improved links to the capital from many cities

Unlocking potential for cities and regions in the future

- Looking ahead in the UK
  - High Speed 2 and ongoing reviews
  - Northern Powerhouse Rail
  - Locally-inspired lines (Scotland and Wales have a good record of line reopenings, England much less so)
- And some of the important questions for all of us:
  - City centre or out of town stations, or both?
  - Level of subsidy that should be provided for capital construction and/or operations – and why
  - Use of classic network, and ensuring optimum use of both new and classic infrastructure
  - Freight on rail and intermodal terminal facilities
  - Increasing focus on environmental sustainability and for the first time for a long time, passenger demand is falling overall.

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Relevance to H2A corridor

- Introducing higher speed rail services where regional **populations are growing** the fastest
- **Economic growth** is an essential component
- Providing **competitive travel time for rail** when compared with private vehicle travel
- **Road corridors have limited capacity for expansion** or development of alternative routes
- Supporting the **development of travel choices** in areas where air travel is less competitive in terms of journey time and convenience
- **Improve civic amenity and convenience** to attract and retain an educated workforce
- Desire to link cities to create a **globally economically competitive** connection of cities
- Balance the desire to **redevelop centres between** major cities (network anchors) and **trade-off for faster journey** times
- Sharing **freight rail** network
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