Creating what matters for future generations

Greater Christchurch Public Transport Futures

MRT Interim Report - 18 June 2021 (final)

Question today
Imagine tomorrow
Create for the future

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Waka Kotahi ('Client') in relation to the preparation of an interim report to understand likely implications of various rapid transit scenarios in Greater Christchurch and in accordance with Contact 2052 – VOB dated 24/02/2021 ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

Greater Christchurch Public Transport Futures MRT Interim Report

Waka Kotahi NZ Transport Agency

WSP
Christchurch
12 Moorhouse Ave
Christchurch, 8011
New Zealand
wsp.com/nz

REV	DATE	DETAILS
1.0	12/02/2021	Status update for technical working group review
1.1	24/03/2021	Draft for client and technical working group review
1.2	08/06/2021	Final Draft
1.3	18/06/2021	Final

	NAME	DATE
Prepared by:	Chris Morahan, Katherine Eveleigh, John Falconer, Jane Rennie	18/06/2021
Reviewed by:	Theunis van Schalkwyk	18/06/2021
Approved by:	Theunis van Schalkwyk	18/06/2021

Table of Contents

Executive summary

Christchurch aspires to be a low-carbon city with transport choices, good urban amenity, and strong economic performance, particularly of the central city. Public transport has a key role to play in realising this.

The Greater Christchurch Partnership, therefore, agreed to the development of two business cases that explore an investment programme aimed at increasing the mode share of the public transport network in Greater Christchurch.

The first business case (Greater Christchurch Public Transport Combined Business Case) recommended a programme of improvements to increase the uptake of public transport over the next decade.

The second business case has a longer term focus and will consider the future role of rapid transit in Greater Christchurch. Rapid transit is different from conventional public transport, being a quick, frequent, reliable and high-capacity public transport service that operates on a permanent route (road or rail) that is largely separated from other traffic.

Work has commenced on the business case for rapid transit, with the following investment objectives identified:

- Investment objective 1: Increased proportion of the population within key prioritised locations and along identified transport corridors within Greater Christchurch with improved access to Christchurch's Central City by 2048;
- Investment objective 2: Improved journey time and reliability of public transport services relative to private vehicles within Greater Christchurch by 2048;
- Investment objective 3 : Reduce emissions from transport movements across Greater Christchurch by 2048.

The purpose of this Interim Report is to test the suitability of the selected investment objectives and associated performance measures to adequately inform decision makers on the impact that rapid transit might have against wider policy direction for the region. The Interim Report analyses a short list of agreed scenarios based on a number of assumptions. It is not intended to identify the preferred solution.

Three rapid transit scenarios were explored within the northern and south-western corridors (as described in this report). These scenarios were selected to balance access to the rapid transit system against the competitiveness of the system against private vehicles.

The report explores:

- A heavy rail scenario – with limited stop opportunities but very competitive travel times;
- A street running scenario with limited stops that focuses on competitive travel times and generally follows the motorway corridors; and
- A street running scenario with more frequent stops that focuses on more households within the walk-up catchment, at the expense of travel time competitiveness (especially for the communities at the edges of the line). This scenario generally follows urban arterials of Riccarton Road and Papanui Road.

Rapid transit systems are city shaping interventions. Its introduction into a city requires a rethink of the spatial allocation of forecast growth.

Initial tests show that current forecast land-use distribution would result in low utilisation of capacity provided. International evidence indicates that land would become more valuable within walking distance of rapid transit. This increase in land value supports higher utilisation of land parcels, resulting in an increase housing supply. Increased land value is therefore not expected to translate into less affordable housing.

Further analysis in this report, therefore, explores re-allocation of future growth within Greater Christchurch towards the rapid transit corridors, with and without some form of road pricing.

It shows that forecast growth, altered settlement and employment patterns, together with the scheme characteristics of the three scenarios, will enhance the competitiveness of public transport in Greater Christchurch and offer consistent peak and off peak journey times, resulting in the following summarised outcomes:

- The labour pool available to central city employers within a 30 minute public transport journey time increases by 81% for heavy rail scenario, 63% for the street running limited stops scenario and 64% for the street running corridor scenario;
- Enhanced mode share on public transport. The heavy rail scenario will result in a 37% public transport mode share to the central city, the street running limited stops scenario will achieve 39% and the street running corridor scenario 37%.

Executive summary

- The heavy rail scenario has the potential to increase public transport ridership from 20 million trips per annum in 2028 to 38 million per annum by 2048. It will carry 29% of all PT trips (11 million).
- The street running limited stops scenario has the potential to increase public transport ridership from 20 million trips per annum in 2028 to 39 million per annum by 2048. It will carry 33% of all PT trips (13 million).
- The street running corridor focused scenario has the potential to increase public transport ridership from 20 million trips per annum in 2028 to 38 million per annum by 2048. It will carry 31% of all PT trips (12 million).

The analyses done show that forecast land-use by 2048 will generate enough demand to warrant further investigation into some form of high capacity transit system – especially along the northern and south-western corridors within Greater Christchurch. Investment will, however, be sizeable.

The heavy rail scenario was analysed as an electric multiple unit train (EMU), running on upgraded electrified double track railway lines both to Rangiora and Rolleston. It assumes a direct connection into the central city (via open trench) with cross roads re-instated via bridge decks over the trench. The option is estimated to cost between $2.0 and $2.4 billion to implement. The analysis assumes a single EMU running every 7.5 minutes during the peak period. The scheme (combination of rail and some form of road pricing) would make land more attractive within 800m of station locations along the route and the land value uplift as a result of the scheme is estimated to be $1.7 billion.

The street running limited stops scenario was analysed as a bus rapid transit option and is estimated to cost between $1.8 and $2.3 billion to implement. The analysis assumes double decker buses running at least every 3 minutes during the peak period. The scheme (combination of busway and some form of road pricing) would make land more attractive within 800m of station locations along the route and the land value uplift as a result of the scheme is estimated to be $3.3 billion.

The street running corridor focused scenario was analysed as a street running light rail option and is estimated to cost between $3.8 and $4.4 billion to implement. The analysis assumes a 33m long vehicle running every 5 minutes during the peak period. The scheme (combination of light rail and some form of road pricing) would make land more attractive within 800m of station locations along the route and the land value uplift as a result of the scheme is estimated to be $ 2.7 billion.

It is not envisaged that the entire rapid transit system would be developed in one stage, but rather through incremental investments over multiple years. The Interim Report did not explore options to stage or optimise the investment as this will be the focus of the next stage. The results do, however, highlight opportunities for cost optimisation to be explored further during the next stage of the business case.

These include:

- Consideration to target rapid transit investment to areas along the corridor with the highest demand. The inner parts of the route generally attract higher ridership (within the Christchurch City boundary), with extension to the satellite towns showing lower utilisation;
- The south-western corridor generally attracts higher demands than the northern corridor suggesting the possibility of different approaches to the north and south west.

The Interim Report also did not explore the enhancement of the status quo (i.e. more priority on the existing core public transport routes). This requires further development in the business case to help inform incremental value for money from investment in rapid transit.

The Interim Report further explores (as a sensitivity test) the impact on rapid transit ridership for a future where urban form arrangements reflect the development opportunities within station catchments. This sensitivity test show that growth along the corridor to that extent could result in demands that exceed capacity provided by bus based systems.

Rapid transit will be a city-shaping investment for Christchurch that can help it achieve the urban form it aspires to. This Interim Report illustrates the importance of integrating land-use and rapid transit decisions, with utilisation of the scheme highly dependent on the land-use it services. It is recommended that the next phase of the business case aligns its development with the proposed development of a spatial plan for Greater Christchurch.


118A
119A
SPECIAL EVENT
METRO
BOARD HERE


Springfield

Strategic environment

This development of the MRT Business case is co-sponsored by Waka Kotahi, ECAN, WDC, CCC and SDC. Its development is, therefore, under the overarching strategic direction of the Canterbury Regional Land Transport Plan (CRLTP) 2015-2025 and Canterbury Public Transport Plan (CPTP) 2018-2028, with strong links to the GPS 2021 and National Policy Statement on Urban Development .

This section summarises how rapid transit is reflected in the recent national policy documents as well as Canterbury's regional public transport plan.

The Government Policy Statement on Land Transport (2021/22-2030/31) influences decisions on how funds from the National Land Transport Fund (NLTF) will be invested across activity classes, such as state highways and public transport. It defines rapid transit as:

"A quick, frequent, reliable and high-capacity public transport service that operates on a permanent route (road or rail) that is largely separated from other traffic."

The National Policy Statement on Urban Development 2020 provides direction to local authorities to remove all minimum carparking standards from District Plans. It also requires that all Tier 1 centres (such as Greater Christchurch) enable minimum 6 storey building heights in metropolitan centres and within a walkable catchment of existing and planned rapid transit stops. It defines a rapid transit service as:

"… any existing or planned frequent, quick, reliable and high-capacity public transport service that operates on a permanent route (road or rail) that is largely separated from other traffic." A rapid transit stop is defined as: "… a place where people can enter or exit a rapid transit service, whether existing or planned."

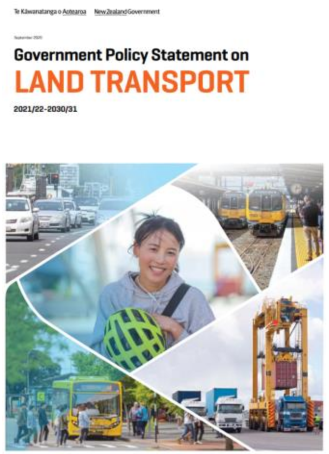
The Canterbury Regional Public Transport Plan (2018-2028): Core services are defined as frequent services connecting two or more key activity centres, trip attractors or tertiary institutions along strategic corridors. Frequencies should aim to be 10 minutes or better at peak times. The RPTP does not define a rapid transit category but acknowledges that "*rapid transit may be added to improve travel times along key corridors to and from the city*".

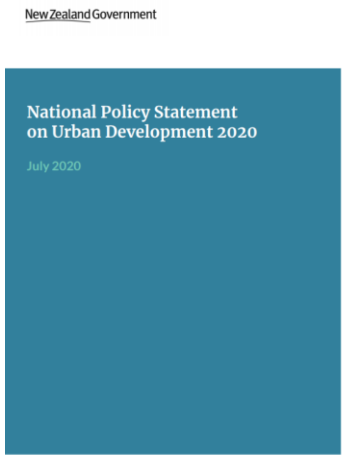
The Regional Mode Shift Plan: Greater Christchurch (GC MSP) was developed by Waka Kotahi and its local partners and endorsed by the Greater Christchurch Partnership in 2020. Climate change is a key issue with the GC MSP acknowledging that a significant proportion of greenhouse gas (GHG) emissions for Greater Christchurch are attributed to land transport, and that historic land-use patterns and investment have resulted in sprawling urban environments.

The plan highlights opportunities where mode shift can be initiated through integrated planning and design with urban form and PT to improve its efficiency and attractiveness.

District Plans: In 2020 the Greater Christchurch Partnership established 'Greater Christchurch 2050' which has the role of developing a long-term vision and plan for the Greater Christchurch area, driven by a partnership of local councils, Ngāi Tahu, the district health board and government agencies. It has the purpose of describing the kind of place wanted for future generations, setting a confident vision for the future and identifying the actions required over the next 30 years to make it happen.

Both Selwyn and Waimakariri are currently undergoing a District Plan Review Process. Both District Plan Reviews are anticipated to give effect to the outcomes sought by Our Space and the NPS-UD.





Agreed problems

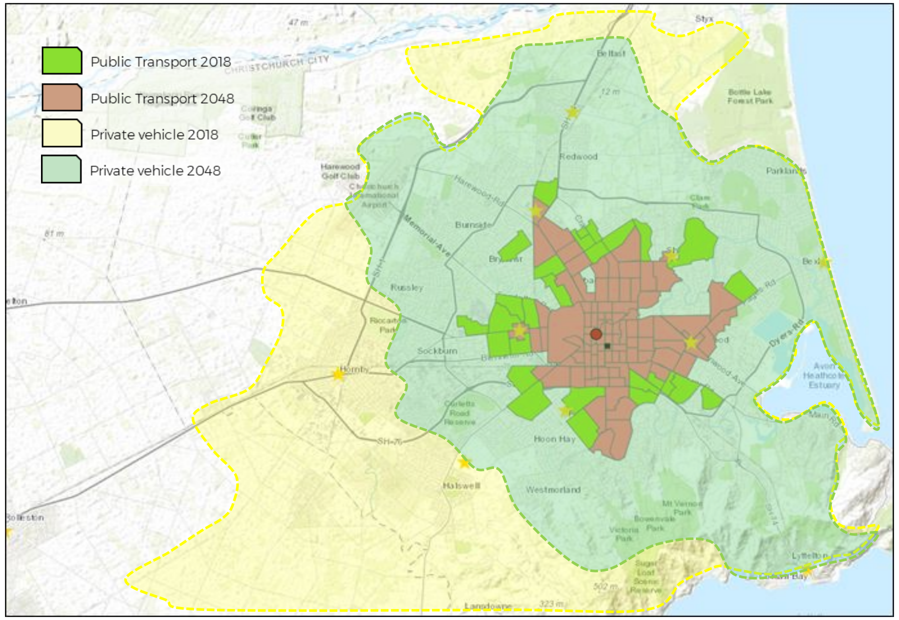
The Strategic Case provides evidence and analysis to show that the following three problems exist in Greater Christchurch and that they have scale and timing.

Problem Statement 1: Current and forecast residential and business settlement patterns perpetuate high car dependence with more people expected to drive long distances. This results in increased transport costs to users and the wider community, and a continuation of the low mode share for public transport. The evidence shows:

- Car trips comprise 83% of total trip legs in Christchurch compared to 68% in Wellington over the same period.
- 2018 Census data shows 76.1% of people used a car as their main means of travel to work in Christchurch (3% greater than the national average of 73%).
- Ministry of Transport Travel Analysis Report showed that "Christchurch residents each spend an average of 221 hours behind the wheel every year, compared with just 10 hours on public transport".
- With the exception of the Central City, the areas predicted to experience the largest percentage increase in population growth are all greenfield (and peripheral) locations (Halswell, Lincoln, Rolleston, Woodend and Rangiora).
- 20% of the population of Greater Christchurch are anticipated to live in the four larger towns in Waimakariri and Selwyn by 2048. In contrast, just 10% of all employment opportunities will be located within these town areas.
- Total vehicle kilometres travelled during the morning peak are forecast to increase by 52% from 790,000 v.km in 2018 to 1,200,000 v.km by 2048
- The average trip length during the morning peak is forecast to increase by 5% from 9.0km in 2018 to 9.46 km in 2048.

Problem Statement 2: The public transport system is not sufficiently attractive (in terms of travel time, reliability, convenience, comfort and cost) to encourage its use in preference to private vehicles. This results in a continuation of the low mode share for public transport and higher congestion, which will constrain access to the central city and other key destinations, increase public and private transport costs and restrict economic growth. The evidence shows:

- On average, each Wellingtonian makes 74 trips on PT per year, compared with those in the Greater Christchurch who make 27 trips per year.
- The modelled mode share for Greater Christchurch demonstrates that by 2048 PT mode share is forecast to equate to just 2.6% of all daily person trips.
- The generalised cost analysis demonstrates that on average the generalised cost in minutes of traffic from all zones to the Hospital Precinct (the zone with the highest employment numbers in 2048) is 16.2 minutes longer for PT than private car.



Comparison of private and public transport AM peak travel distance within 30 minutes

Problem Statement 3: As Greater Christchurch grows, a continuation of the current transport system is not sustainable, and fails our climate change mitigation and adaption responsibilities. Higher vehicle use will result in higher levels of embedded carbon, higher greenhouse gas and particulate emissions, and poorer public health outcomes. The evidence shows:

- Transport contributes 53% of Christchurch's emissions (higher than the national contribution of 47%)
- In 2016, Christchurch had the worst air pollution of any of New Zealand's main centres, at 21 PM10 (compared to 14 PM10 for Auckland and 13 PM10 for Wellington).
- Carbon Dioxide emissions from car and bus vehicle kilometres travelled in Greater Christchurch are forecast to increase from 11,329 tonnes a year in 2018 to 16,471 tonnes a year by 2048 (an increase of 45%), and emissions of NOx (nitrogen oxides) will similarly increase by 44%.

What is rapid transit

Rapid transit systems in major urban areas around the world play an important role within the transport system and overall urban structure. There are a range of factors that set these systems apart from existing forms of public transport. These factors include the impact of rapid transit on the user perceptions and experience as well as the built environment surrounding transit stations and stops and along corridors.

From a ***user perspective*** rapid transit is a service that results in the following outcomes relative to pre-existing public transport options:

- Reductions in travel time and high reliability relative to pre-existing public transport options
- Broad span of hours of service where relevant and coverage of system
- Increased frequency of service across all hours of operation
- Consistently high frequency of services during peak periods
- Increased capacity across the system
- Improved passenger experience and comfort
- Simplified route design
- Simplified ticketing and boarding systems
- An easily identifiable brand and a clear product differentiation of the rapid transit system from pre-existing systems.

Rapid transit service improvements also typically result in the following ***impacts on the built environment*** along routes of service and around stations:

- Land value uplift along routes of operation
- Value uplift for existing properties along routes of operation
- Land value uplift around key stations
- An impetus for changes to land-use along routes of operation and at stations
- An impetus for changes to the built form along routes of operation to accommodate changing needs, for example, more commercial space to service a higher demand for shopping
- An impetus for densification of residential development along the routes of operation and around stations.

Rapid transit projects typically consider the following five attributes in their design to ensure maximum impact on the aspects listed above.

Priority and dedicated right of way: This enables services to run reliably at consistently higher average speeds than other public transport services by avoiding the effects of congestion and conflicts with other vehicles.

Speed: To attract people to use rapid transit services, they must have the ability to offer users travel time reductions relative to other options. The system speed, frequency and stop spacing are all important factors contributing to this outcome. Rapid transit services should ideally achieve point-to-point speed to and from the CBD which is at least as fast as the private car.

Frequency: Rapid transit services must operate at frequencies that enable users to ‘turn up and go’ at most times of day, seven days a week. High frequency solutions enable the movement of larger volumes of people, faster travel times, and increased convenience and reduced waiting time for consumers.

Reliability: Reliability is a key differentiator which allows rapid transit services to compete with the private car as it provides users with the confidence and trust that they can get where they need to at the required time. In order to be considered rapid transit, a service or network should consistently achieve on-time service performance (departure and arrival time) of 95% or higher, regardless of mode or location.

Capacity: High capacity vehicles, coupled with high speed and frequency, allow the movement of large numbers of people in a short amount of time. Rapid transit systems that add an additional rapid transit corridor to the existing road corridor should enable more capacity than what could be achieved through an additional road lane to the corridor. For arterial and motorway corridors this implies enabled capacities in excess of 1,000 people per hour per direction and 2,000 people per hour per direction respectively.

Objectives of rapid transit

The strategic case identifies three *Investment Objectives* that articulates what the partners are seeking to achieve with a MRT investment in Christchurch:

Investment objective 1: Increased proportion of the population within key prioritised locations and along identified transport corridors within Greater Christchurch with improved access to Christchurch's Central City by 2048.

The main aim of this objective is for rapid transit to shape the urban form and growth. It should support the redevelopment to higher densities through allowing locations to have better access to employment and education opportunities and become more attractive places to live. This in turn increases land values and makes higher intensity developments feasible.

Rapid transit is particularly important in supporting high intensity employment areas, by creating large 'pools' of employees who can travel to the centre of employment in a reasonable amount of time and with a high level of reliability. Its 'space efficiency' also means that employment centres can be more intense, supporting higher productivity through agglomeration.

Measures of success:

- Increased number of households and jobs within 800 m of high frequency, reliable transit
- Improved accessibility to and from the central city
- Improved accessibility to key employment and activity centres and the larger towns along the corridor

Investment objective 2: Improved journey time and reliability of PT services relative to private vehicles within Greater Christchurch by 2048.

Reducing the impact of congestion on people's lives is a key component of improving accessibility and overall wellbeing.

Because it operates on dedicated corridors, rapid transit can still provide a fast and highly reliable travel option even when other parts of the transport network are under strain and highly congested.

Measures of success:

- Reduced use of single occupant vehicles along the corridor and Greater Christchurch
- Shift in trips to public transport and active modes for households along the corridor and Greater Christchurch
- More competitive journey times between PT and private vehicles for residents living along the corridor
- Improved public transport mode share to the central city
- Reduced public and private transport costs for households along the corridor and Greater Christchurch

Investment objective 3 : Reduce emissions from transport movements across Greater Christchurch by 2048.

As a consequence of mode shift to public transport, Greater Christchurch will be able to significantly reduce its carbon footprint and greenhouse gas emissions. With less people using cars and more taking advantage of efficient rapid transit, positive environmental outcomes and climate change impacts will be achieved.

Measures of success:

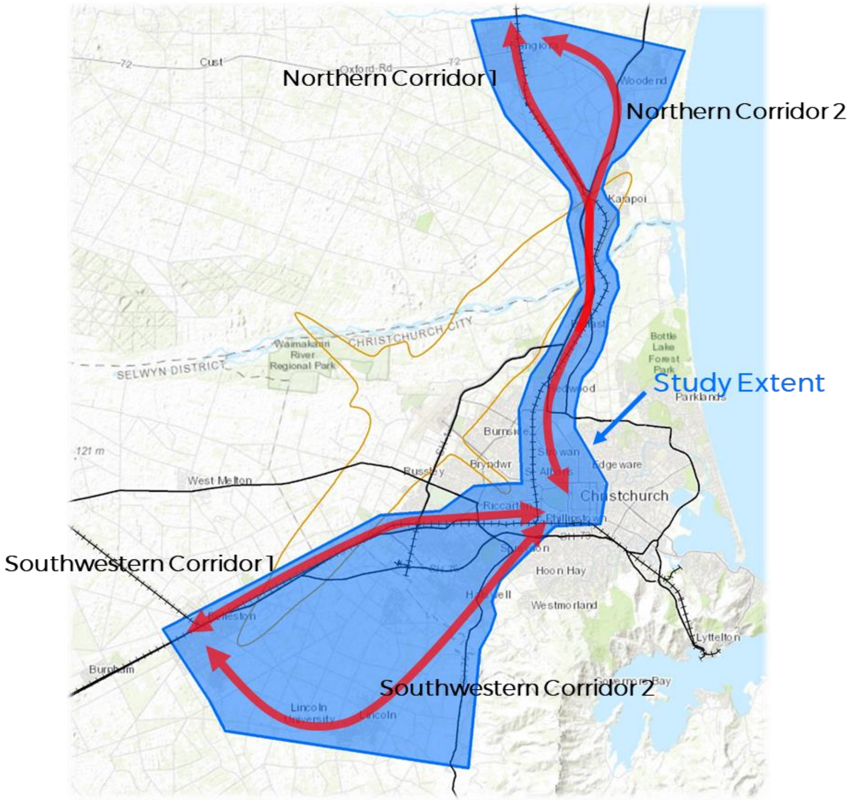
- Reduced private vkt/capita for households along the corridor and Greater Christchurch
- Reduced greenhouse gas emissions from transport along the corridor
- Reduced greenhouse gas emissions from transport for Greater Christchurch
- Improved air quality and better public health outcomes for households along the corridor

Approach for interim paper

The Interim Report aims to help decision makers understand the implications of these objectives and the likelihood of achieving them through investment in a MRT scheme.

It presents outcomes against these objectives based on agreed MRT scenarios within the Northern and South-western corridors in Greater Christchurch (as illustrated in the figure below) .

Note: it is not intended to identify the preferred MRT solution but develop understanding of the objectives and outcomes with the aim to enhance these prior to development of the full economic case.



Phase A

- Develop 2048 Do Minimum transport network and land-use scenario (*CTM18 and PTF medium term network*)
- Develop route and station location for each scenario
- Analyse likely operating speed for each MRT scenario

Phase B

- Assess catchment / likely 2048 ridership using CTM and applying turn-up and go frequencies
- Likely capacity (frequency and vehicle size) to generate ridership of at least 2,000 people per hour per direction (pphpd)
- Likely outcomes against Investment Objectives and KPIs
- High level estimate of the likely ridership of the system

Phase C

- Analyse the indicative land-value uplift and land-use change arising from the investment in the three rapid transit scenarios.
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes
- Further tests on this scenario with wider transport policy decisions (e.g. road pricing) on both land-value uplift and ridership (phases C2/C3)

Phase D

- Analyse the land-use opportunities and constraints within each station catchment area and identify the likely land-use opportunity that exist within the station catchment area. (Likely reflect Christchurch of 1 million people)
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes

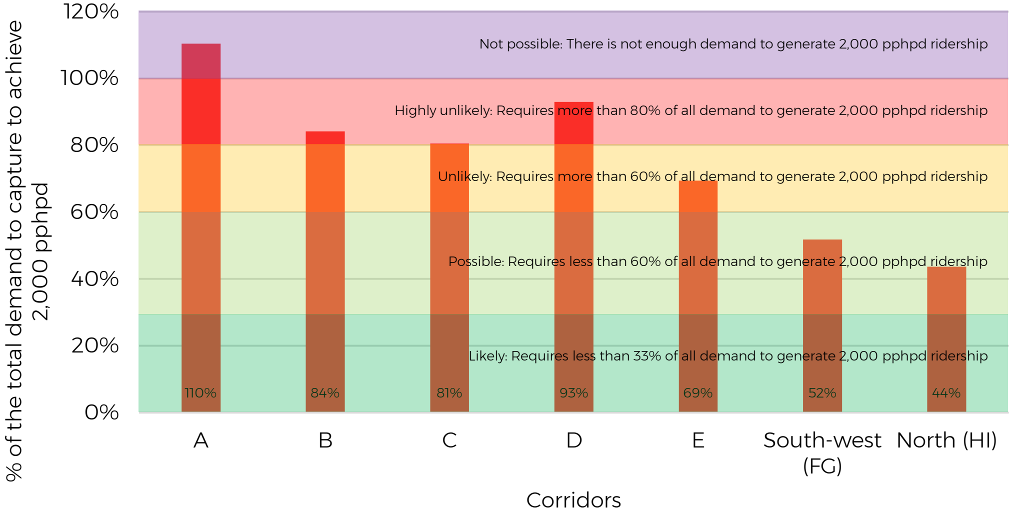
Why the selected corridors

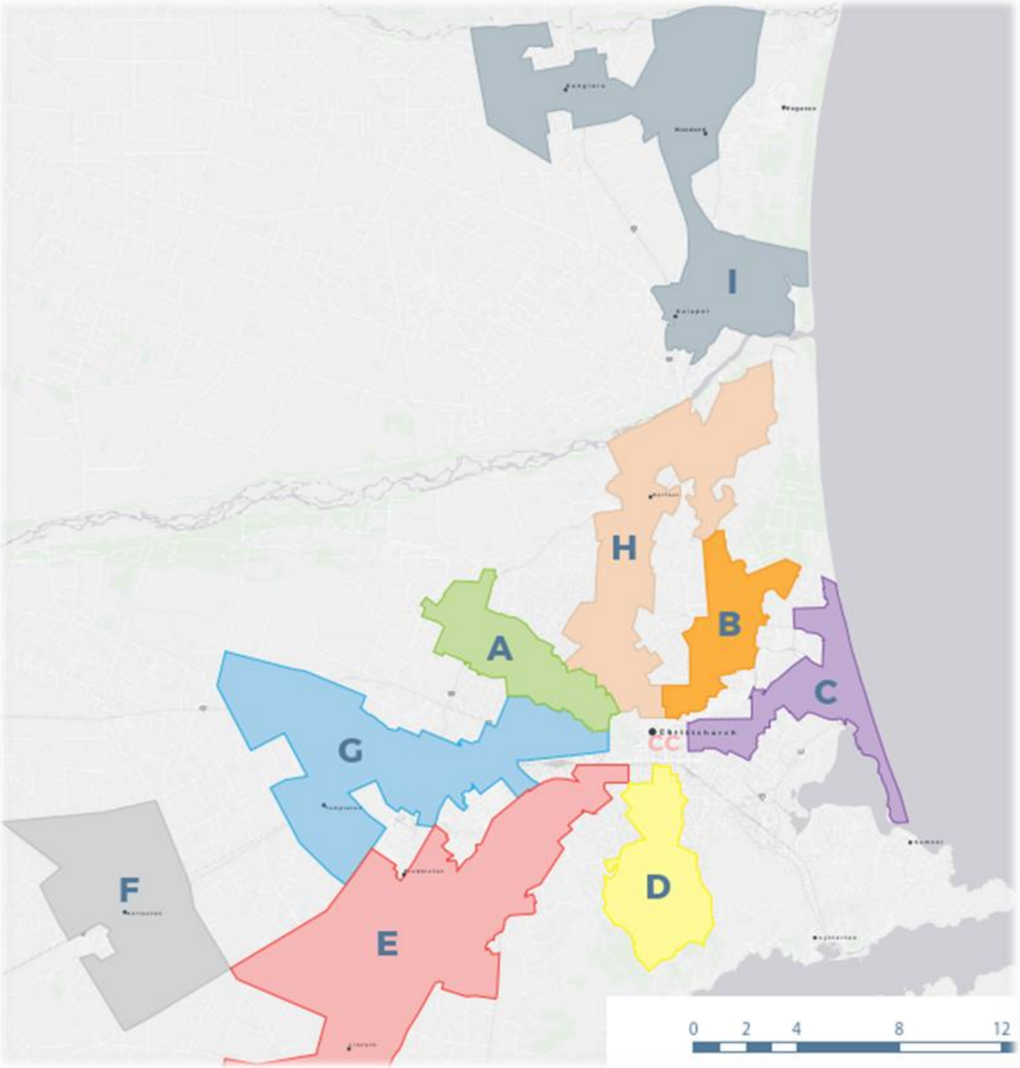
These two broad corridors will accommodate a significant proportion of Greater Christchurch's growth with the population within these corridors forecast to grow from 147,000 in 2018 to 220,000 by 2048 (+50% increase). By 2048, one third of Greater Christchurch's population will live within these corridors.

This report considered market conditions to attract a large number of people (at least 2,000 pphpd) to use the rapid transit system as critical to deliver on the wider suite of outcomes.

The diagram below illustrates the market share of the total person trip demand from the corridor to the central city required to generate 2,000 people per hour per direction. It illustrates that, by 2048, rapid transit along the south-western and northern corridors would need to capture less than 60% of the total demand to the central city. This scenario is considered likely as it has been achieved in other comparative cities. All other corridors require more than two thirds of the market share.

Total AM 1hr person demand by 2048 to city centre

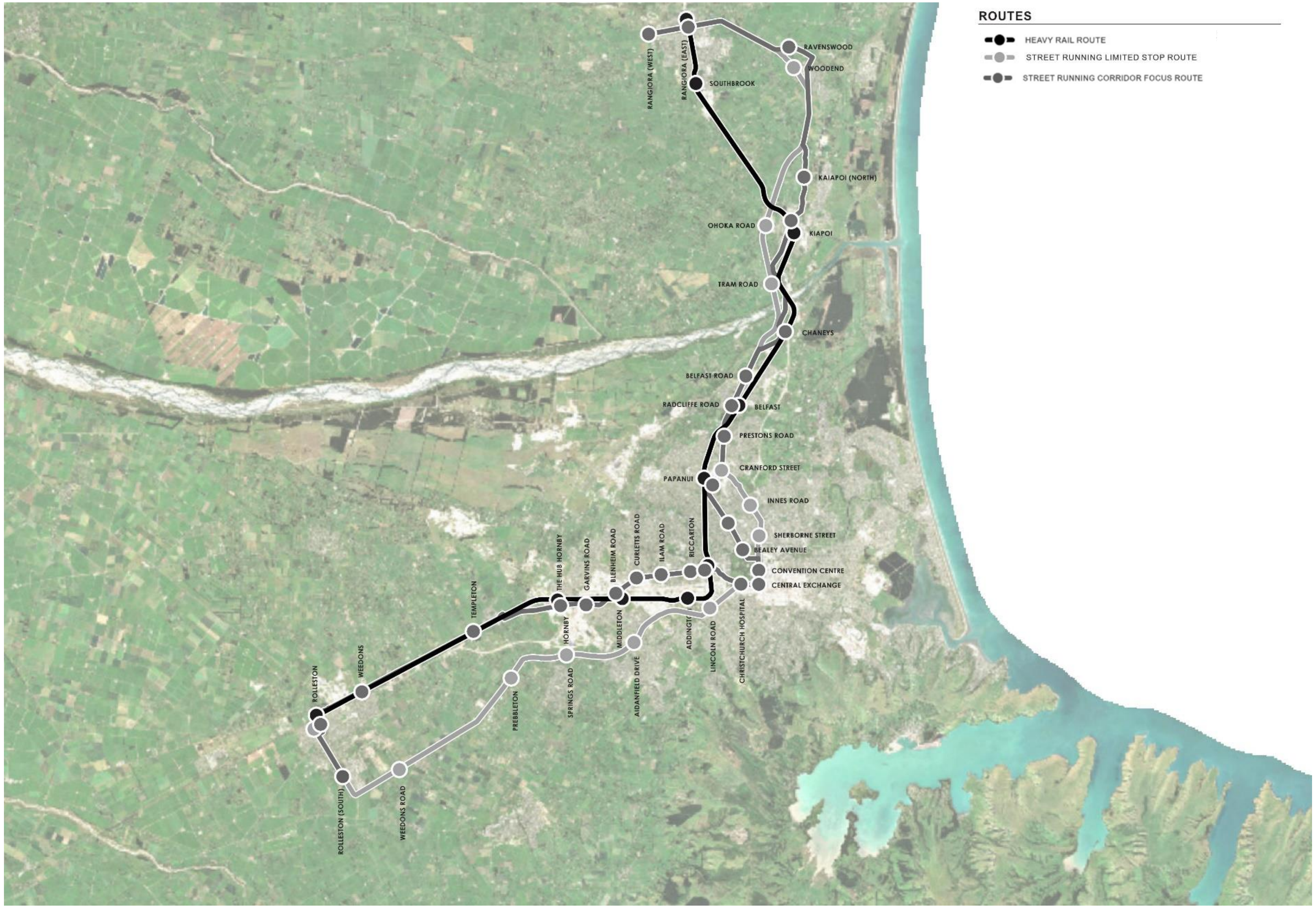




Map of potential corridors within Greater Christchurch

*pphpd = people per hour per direction

Description of rapid transit scenarios



Three rapid transit scenarios were, therefore, explored within the south-western and northern corridors. These scenarios were selected to test how speed, frequency and access to the rapid transit could influence urban form, improve attractiveness of public transport system, and contribute to the city's climate change responsibilities.

The three scenarios tested in this report are:

Heavy rail route: This scenario utilises and upgrades the existing heavy rail corridor and aims to reduce journey times for customers on the rapid transit system and, therefore, stop less often (approximately every 3.2km). It envisages through running services from Rangiora to Rolleston with either a direct link to the central city or a scheduled transfer from rail to a high quality connector service to link rail with central city.

Street running limited stop route: This scenario also follows existing arterial routes but with an aim to follow those parts where higher speeds can be achieved. The scenario aims to reduce journey times for customers on the rapid transit system and stop less often (approximately every 3.2km).

Street running corridor focus route: This scenario follows existing arterial routes, and aims to maximise access to the rapid transit system, passing through key activity centres and stop approximately every 1.6km through the Christchurch City section of the route.

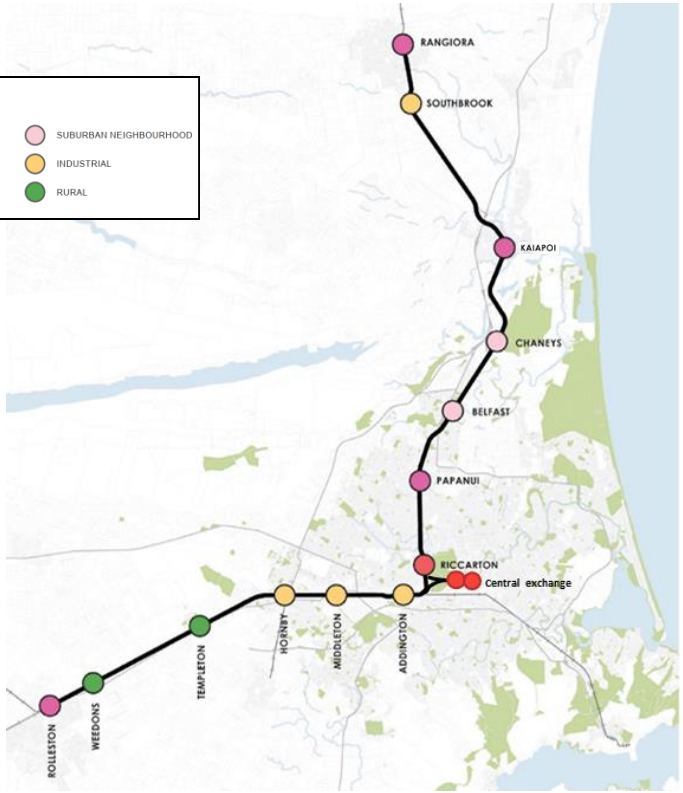
The routes assumes for the three corridors, their stop locations and integration with the wider public transport network are illustrated in Appendix A1.

Description of MRT scenarios

STOP CATEGORIES

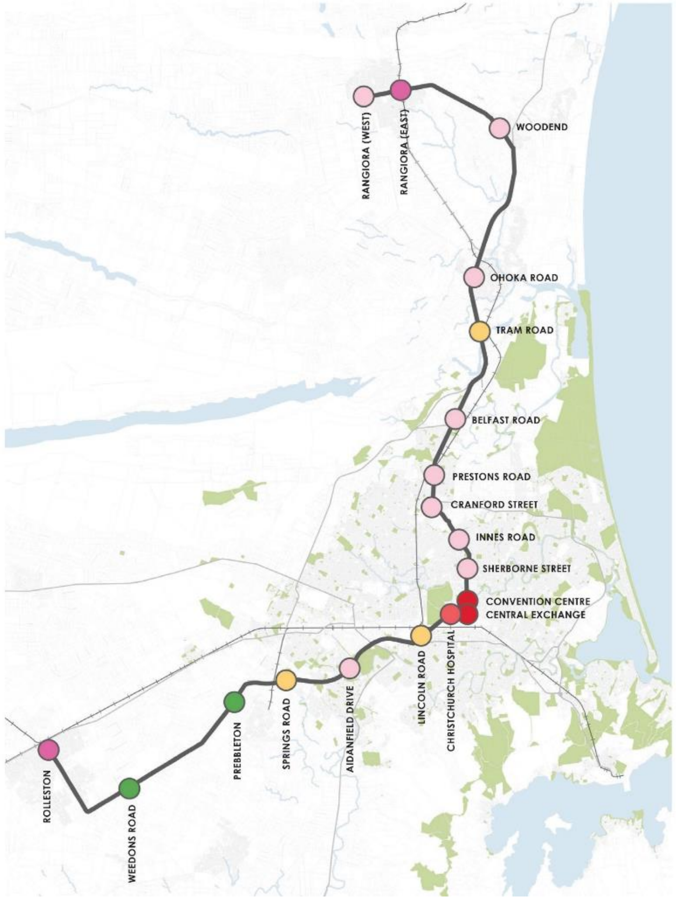
- CENTRAL CITY
- TOWN CENTRE / KEY ACTIVITY CENTRE (KAC)
- CITY FRINGE
- SUBURBAN NEIGHBOURHOOD
- INDUSTRIAL
- RURAL

1 HEAVY RAIL ROUTE
RANGIORA - CITY FRINGE - ROLLESTON



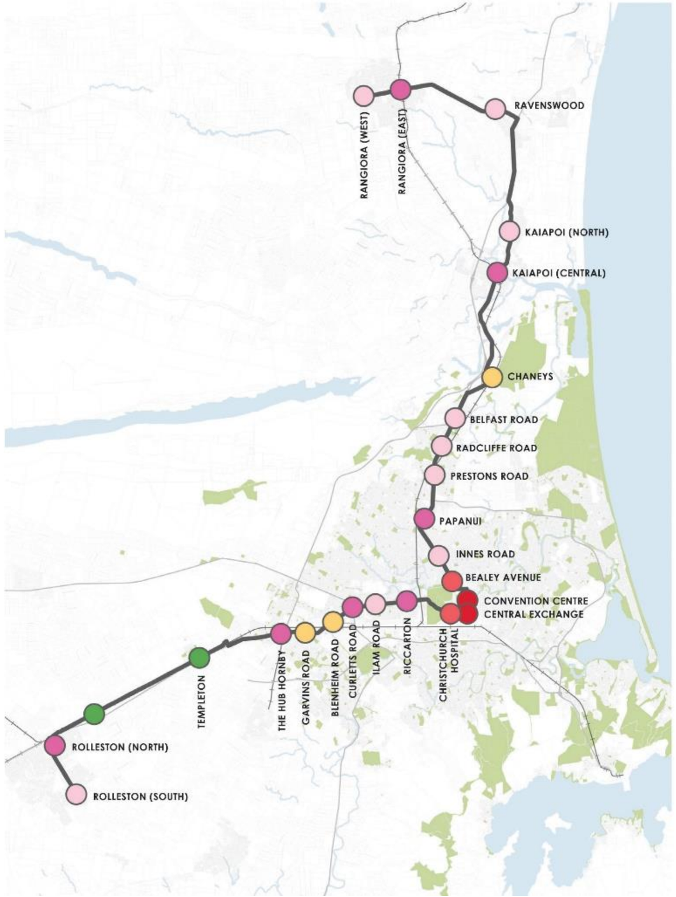
- South-western leg: Connecting Rolleston – Hornby – Addington - Central City via a 23.5 km rail corridor with 8 stations along the route.
- Northern leg: Connecting Rangiora – Kaiapoi – Papanui- Riccarton – Central City via a 31.2 km rail corridor with 9 stations along the route.

2 STREET RUNNING (LIMITED STOPS)
RANGIORA - CITY CENTRE - ROLLESTON



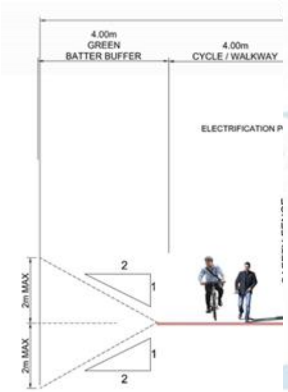
- South-western leg: Connecting Rolleston – Aidanfield – Addington and the central city via a 26.1 km street running corridor with 8 stations along the route.
- Northern leg: Connecting Rangiora – Woodend – Kaiapoi – St Albans – and the central city via a 33.6 km via street running corridor along with 12 stations along the route.

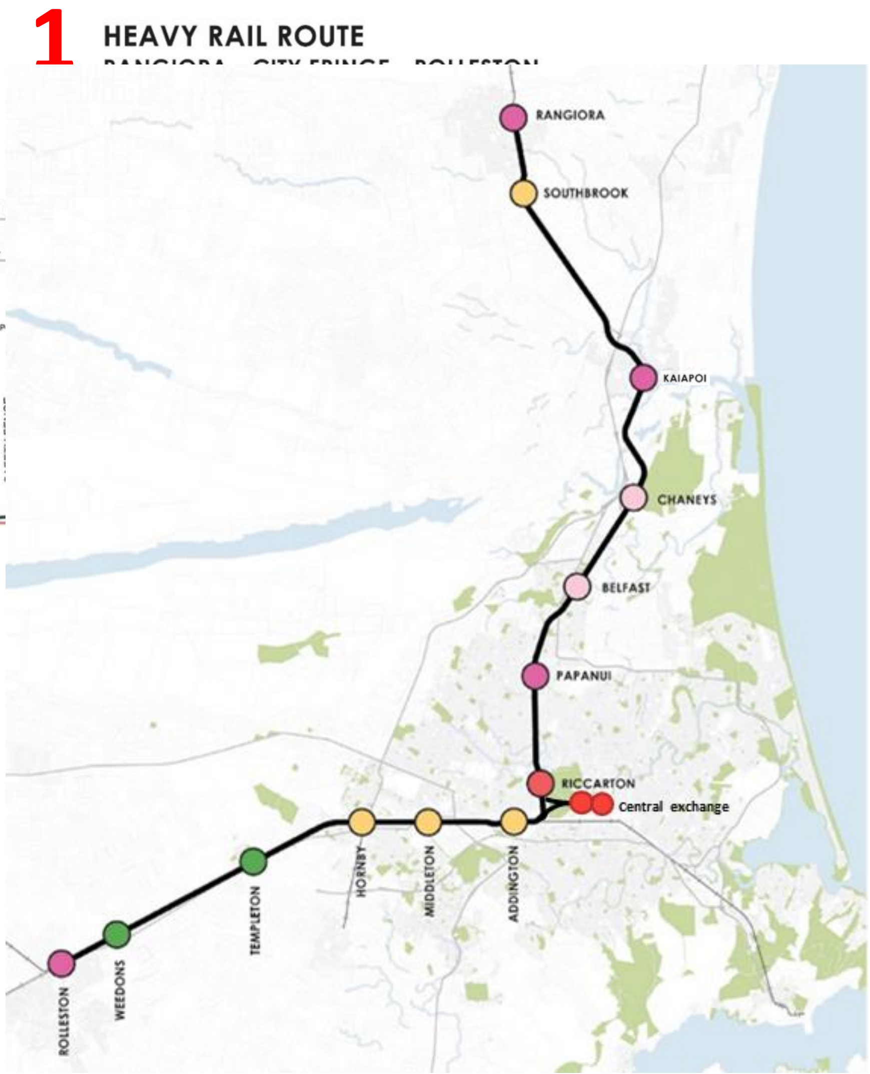
3 STREET RUNNING CORRIDOR FOCUSED
RANGIORA - CITY CENTRE - ROLLESTON



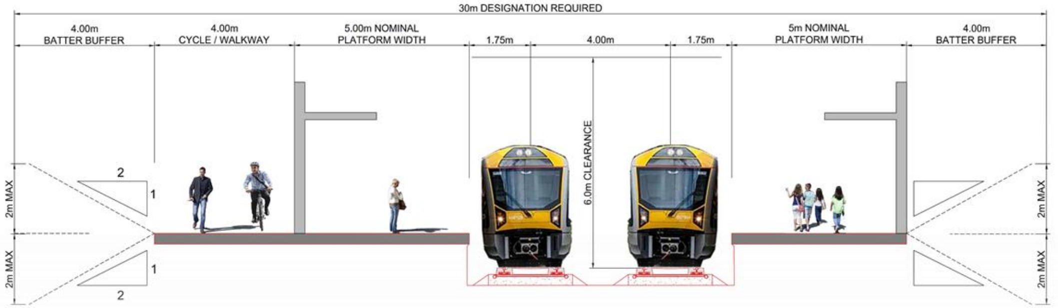
- South-western leg: Connecting Rolleston – Hornby – Riccarton and the central city via a 26 km street running corridor with 11 stations along the route.
- Northern leg: Connecting Rangiora – Woodend – Kaiapoi – Papanui – and the central city via a 35.5 km via street running corridor along with 14 stations along the route.

Description of MRT scenarios



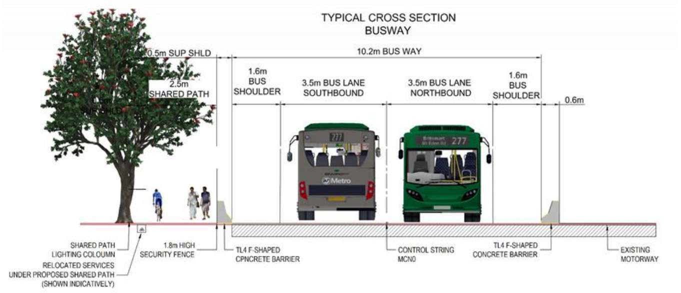


Heavy Rail				
Length	Southwestern leg = 23.5 km rail Northern leg = 31.2 km rail			
Travel time from city centre (afternoon peak)		Current car travel time (mins)	Current bus travel time (mins)	Proposed rapid transit travel time (mins)
	City centre to Hornby: City centre to Rolleston:	16-45 22-40	39 45	16 29
	City centre to Riccarton: City centre to Papanui: City centre to Kaiapoi: City centre to Rangiora:	9-24 12-26 20-35 26-45	20 24 40 39	6 10 24 35
Potential modes	Single EMU. EMU capacity 373 people (230 seated and 143 standing)			
Level of segregation	Double track with enhanced level crossings along rail corridor.			
Frequency	8 services per hour per direction (7.5 min headway)			
Potential operating speed	Average commercial speed over entire length: 55 km/h			
ROC – Opex (incl. station opex)	Direct to city centre: $126.0M per annum (approx. 3.8M service kilometres)		Heavy Rail (to Riccarton) + Busway (to City Centre): $120.0M per annum (approx. 3.6M service kilometres on the rail and approx. 30,000 service kilometres via bus)	
ROC - Capex	$2.0 billion - $2.4billion		$1.1billion - $1.5billion (if direct connection is replaced with bus transfer)	
ROC - Rollingstock	$216-227 million			



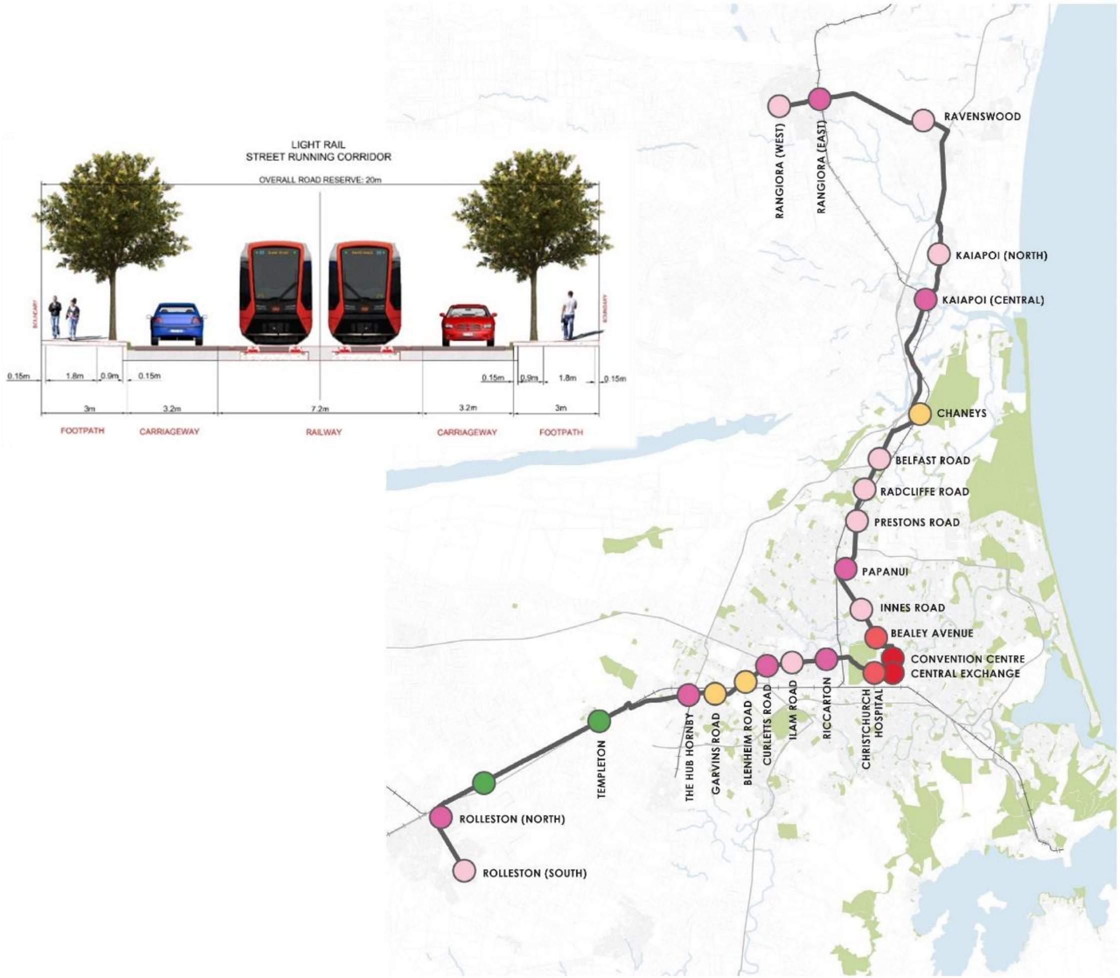
Description of MRT scenarios

Street running – limited stops				
Length	Southwestern leg = 26.1 km Northern leg = 33.6 km			
Travel time from city centre (afternoon peak)		Current car travel time (mins)	Current bus travel time (mins)	Proposed rapid transit travel time (mins)
	City centre to Aidanfield Drive: City centre to Prebbleton: City centre to Weedons Rd: City centre to Rolleston:	14-35 16-35 20-40 22-40	40 46 56 45	18 25 32 42
	City centre to Cranford Street: City centre to Kaiapoi (Ohoka): City centre to Woodend: City centre to Rangiora (East):	12-24 20-35 24-40 26-45	26 46 65 39	17 37 44 53
Potential modes	Double decker bus. Can also be advanced BRT systems (larger advanced articulated buses). DD bus capacity 101 people (86 seated and 15 standing)			
Level of segregation	Full separation from traffic through central running.			
Frequency	20-30 services per hour per direction (2 – 3 min headway)			
Potential operating speed	Average commercial speed over entire length: 34-36 km/h			
ROC – Opex (incl. station opex)	Busway $69.5M per annum (approx. 10.7M service kilometre)			
ROC - Capex (BRT)	$1.8billion - $2.3billion			
ROC - Rollingstock (BRT)	$118million			

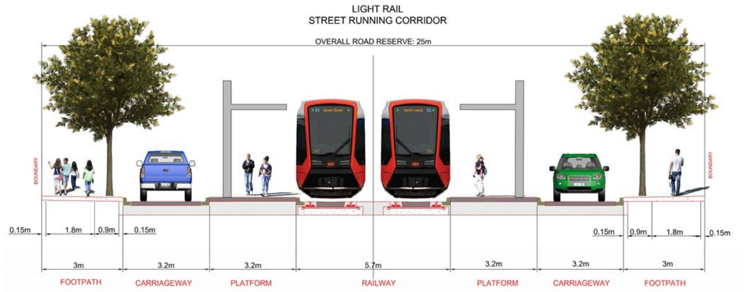


Description of MRT scenarios

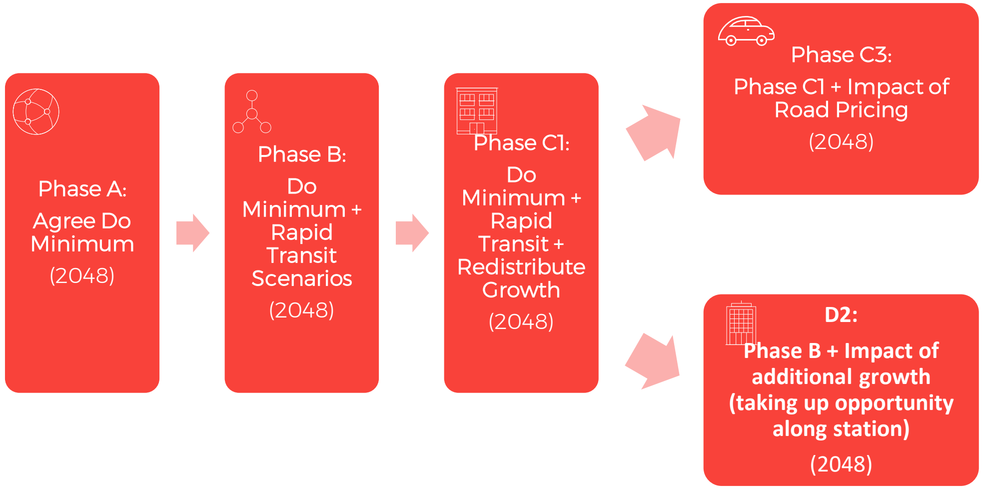
3 STREET RUNNING CORRIDOR FOCUSED
RANGIORA - CITY CENTRE - ROLLESTON



Street running – corridor focused				
Length	Southwestern leg = 26 km Northern leg = 35.5 km			
Travel time from city centre (afternoon peak)		Current car travel time (mins)	Current bus travel time (mins)	Proposed rapid transit travel time (mins)
	City centre to Riccarton: City centre to Hornby: City centre to Templeton: City centre to Rolleston (North):	9-24 16-45 18-35 22-40	20 39 50 45	10 29 35 43
	City centre to Papanui: City centre to Kaiapoi Central: City centre to Ravenswood: City centre to Rangiora (East):	12-26 20-35 26-40 26-45	24 40 65 39	15 41 53 60
Potential modes	LRT single unit (33m). Can also be BRT systems (double decker buses and or larger advanced articulated buses). LRT capacity 210 people (64 seated and 146 standing)			
Level of segregation	Full separation from traffic through central running.			
Frequency	12 services per hour per direction (5 min headway)			
Potential operating speed	Average commercial speed over entire length: 30 km/h			
ROC – Opex (incl. station opex)	As a busway: $79.0M per annum (approx. 10.9M service kilometres)		As LRT: $127.0 per annum (approx. 5.2 service kilometres)	
ROC - Capex (LRT) ROC - Capex (BRT)	$3.8billion - $4.4billion $2.5billion - $2.8billion			
ROC - Rollingstock (LRT) ROC - Rollingstock (BRT)	$275million $136million			



Methodology



The methodology in this interim report adopted the following process to develop an understanding of the likely potential for rapid transit in Greater Christchurch, as well as the impact of land-use and wider policy decisions on rapid transit ridership.

Phase B: Methodology

The base land-use scenario in this phase of the methodology assumes population forecast and distribution as contained in CTM 2018. This projects the population in the Greater Christchurch Region to reach 641,000 by 2048; employment to reach 307,000 and a student roll of 100,000.

The methodology used population and employment forecast numbers for CTM zones that fall within 800m of a stop/station along each of the corridors. A breakdown of these totals are provided in Appendix A2, with the image below providing an illustration of the MRT catchment within the Greater Christchurch region.

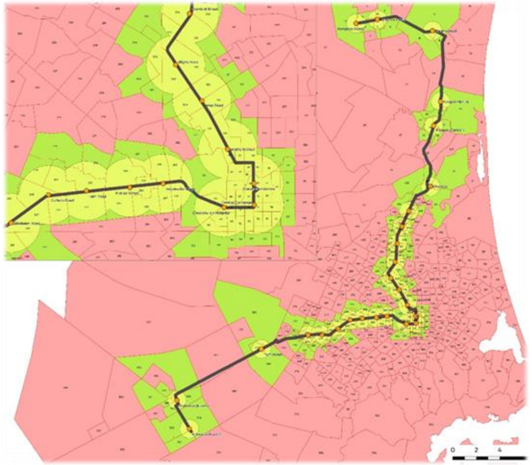


Illustration of the MRT catchment (green zones) for Street Running Corridor Focused Scenario relative to wider Christchurch zone structure in CTM model

The Phase B results showed that introducing rapid transit within the existing urban form will result in low utilisation of the capacity provided by 2048; i.e. they attract less than 2,000 pphpd. Heavy rail is estimated to attract between 500 and 600 pphpd; the limited stops scenario between 1,200 and 1,500 pphpd; and the corridor focused scenario between 1,200 and 1,300 pphpd.

However, international evidence* indicates land-use change around rapid transit stations. Phase C of the methodology explores the impact this could have on urban form and rapid transit utilisation.

Phase A

- Develop 2048 Do Minimum transport network and land-use scenario (*CTM18 and PTF medium term network*)
- Develop route and station location for each scenario
- Likely capacity (frequency and vehicle size) to generate capacity of at least 2,000 pphpd
- Analyse likely operating speed for each MRT scenario

Phase B

- Assess catchment / likely 2048 ridership using CTM and applying turn-up and go frequencies
- Likely outcomes against Investment Objectives and KPIs
- High level estimate of the likely ridership of the system

Phase C

- Analyse the indicative land-value uplift and land-use change arising from the investment in the three rapid transit scenarios.
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes

Phase D

- Analyse the land-use opportunities and constraints within each statin catchment area and identify the likely land-use opportunity that exist within the station catchment area. (Likely reflect Christchurch of 1 million people)
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes

*Analysis of Land-value uplift and land use change, PwC, 1 April 2021; Land Use Change – Sensitivity Analysis, PwC, 16 April 2021

Phase C1: Methodology

The introduction of rapid transit improves accessibility to employment and opportunities (for residents in the corridor) and make a positive impact on climate change KPIs.

PwC Reports** estimate the land-value uplift within an 800 m radius of each rapid transit station based on the modelled generalised transport cost relativities between each MRT option and the option of driving. Residential and non-residential land-use within each station's catchment area were modelled using the empirical relationship between land-use and land values.

Two land-use scenarios were tested in this phase:

- The first (Phase C1) assumed MRT in place and then estimated the change in land value, as well as the change in population and employment along the corridor.
- Rapid transit ridership and wider outcomes were then calculated based on this redistribution of growth. MRT is estimated to redistribute the forecast population growth towards the station catchment areas. The magnitude of this redistribution varies by between 5,000 and 9,000 (for population) and between 2,000 and 7,000 (for employment) depending on the MRT scenario tested.
- A further sensitivity (Phase C3) explored the impact on ridership and wider transport outcomes through the introduction of MRT plus wider policy levers, specifically in the form of a $5 city centre cordon congestion charge. The combination of MRT with a congestion pricing scheme is estimated to increase the redistribution of population and employment by 2048. The forecast population within the station catchment areas increase by between 15,000 and 20,000 depending on the MRT scenario tested. Employment increased by between 9,000 and 18,000.

The impact of these changes on the rapid transit system's ridership and other KPIs are reported on in the next few pages.

Phase A

- Develop 2048 Do Minimum transport network and land-use scenario (*CTM18 and PTF medium term network*)
- Develop route and station location for each scenario
- Analyse likely operating speed for each MRT scenario

Phase B

- Assess catchment / likely 2048 ridership using CTM and applying turn-up and go frequencies
- Likely capacity (frequency and vehicle size) to generate capacity of at least 2,000 pphpd
- Likely outcomes against Investment Objectives and KPIs
- High level estimate of the likely ridership of the system

Phase C

- Analyse the indicative land-value uplift and land-use change arising from the investment in the three rapid transit scenarios
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes
- Further tests on this scenario with wider transport policy decisions (e.g. road pricing) on both land-value uplift and ridership (phases C2/C3)

Phase D

- Analyse the land-use opportunities and constraints within each statin catchment area and identify the likely land-use opportunity that exist within the station catchment area. (Likely reflect Christchurch of 1 million people)
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes

**Analysis of Land-value uplift and land use change, PwC, 1 April 2021; Land Use Change – Sensitivity Analysis, PwC, 16 April 2021

Phase C1: Initial transport outcomes (for the 2048 horizon)

The additional capacity and accessibility improvements provided by the rapid transit scenarios is estimated to impact the land-use within the station catchment of each rapid transit scenario as summarised in the table below.

Scenario	Change in Land Value	Change in Population along the corridor	Change in Employment along the Corridor
1. Heavy rail	$461,000,000 (+13.8%)	5,400 (+4.4%)	2,000 (+2.6%)
2. Street running limited stop route	$873,000,000 (+14.4%)	8,900 (+4.7%)	7,000 (+5.5%)
3. Street running corridor focus route	$1,066,000,000 (+11.3%)	7,600 (+3.6%)	7,300 (+4.8%)

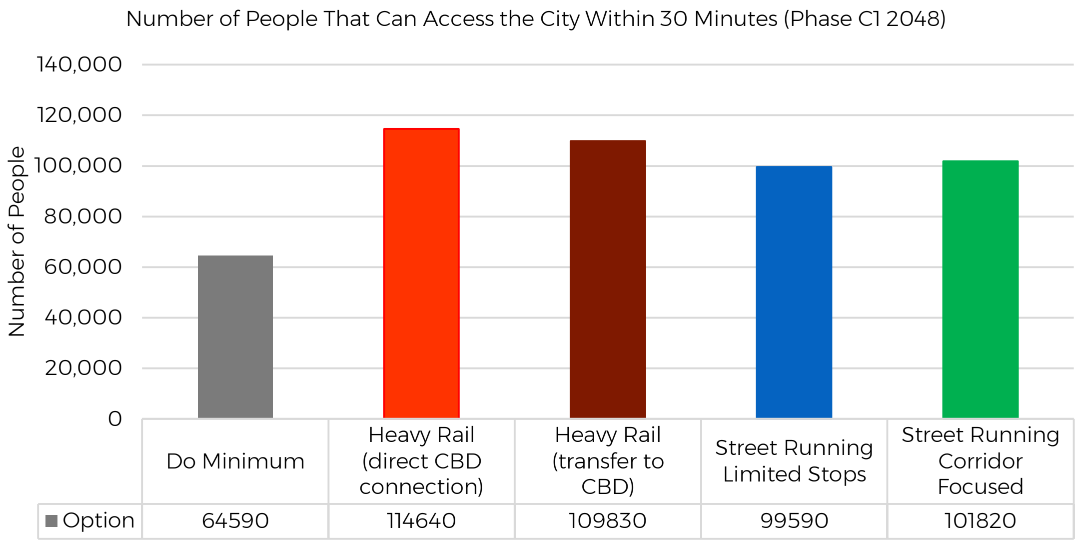
This change in land-use, together with the rapid transit scenario, is modelled to increase the labour pool available to city centre employers within 30 minutes using public transport by 77% (for the heavy rail scenario), 54% (for the limited stops scenario), and 58% (for the corridor focused scenario).

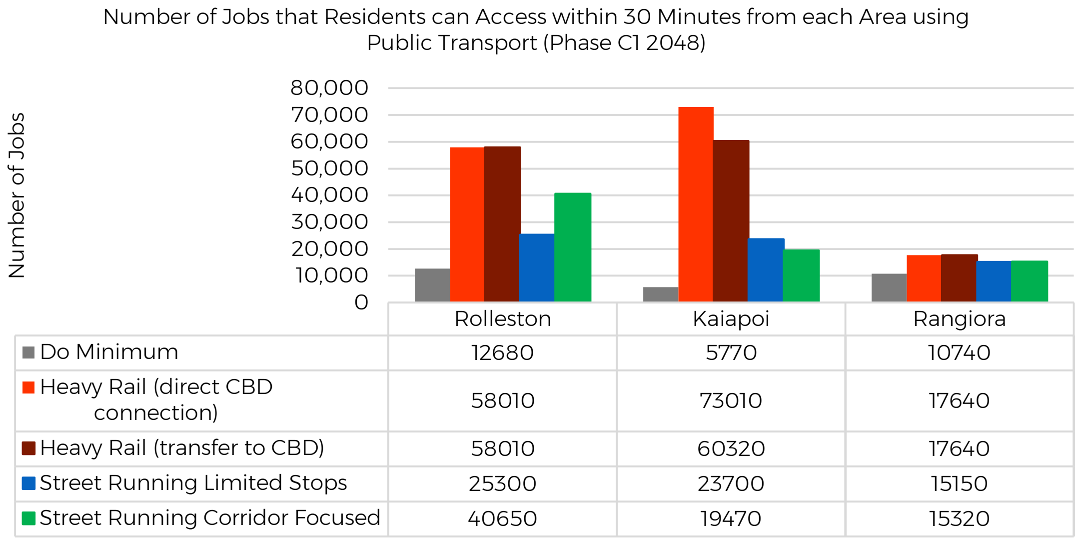
Residents of the three satellite towns (Rolleston, Kaiapoi and Rangiora) will also be able to access a larger number of jobs within 30 minutes using public transport. The heavy rail provides the largest impact to Rolleston and Kaiapoi, noting that Rangiora still falls outside the 30 minute journey time by rail.

Public transport trips from each corridor's catchment to the central city is also forecast to increase with the limited stops scenario increasing by 42% and the corridor focused scenario by 35%. This will result in a public transport's mode share from these corridors to the central city of between 38% and 43%.

Region wide ridership on the public transport network will increase by between 3.3% and 3.5%, resulting in a decrease in vehicle kilometres travelled by car and corresponding decrease in CO_2 emissions of between 8% and 11.

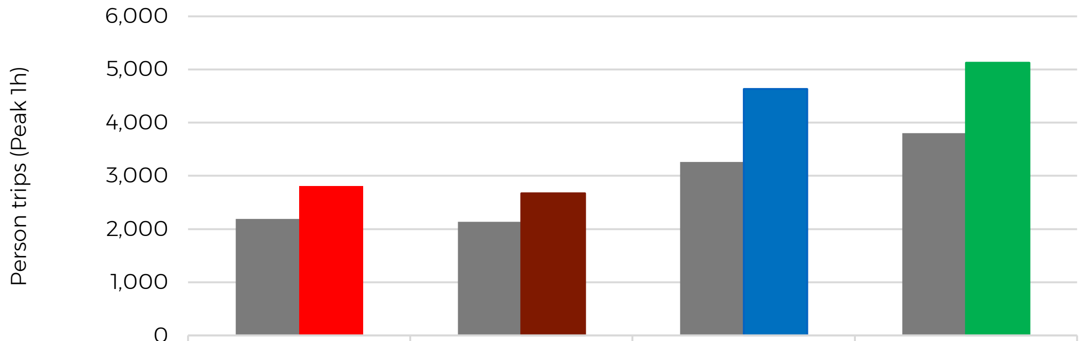
The peak ridership of heavy rail scenario (direct central city connection) is modelled as 1,500 and 1,800 pphpd for the northern and south-western corridors respectively with a daily ridership of 29,655. The peak ridership of the street running limited stops scenario is modelled as 2,100 and 1,800 pphpd with a daily ridership of 47,220. The peak ridership of the street running corridor focused scenario is modelled as 1,700 and 1,800 pphpd with a daily ridership of 42,937.





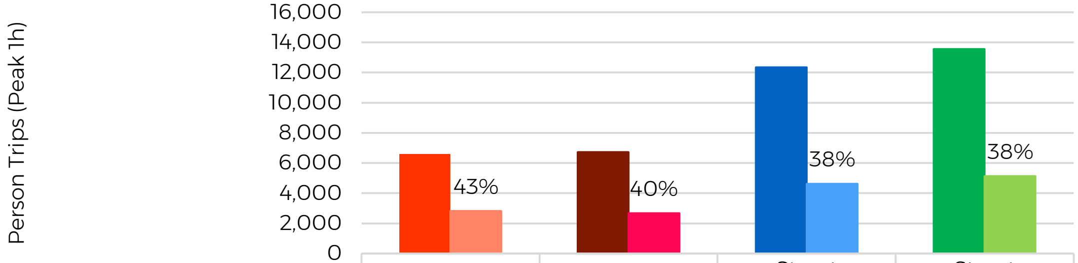
Phase C1: Initial transport outcomes

Public Transport Trips from each Station Catchment to Central City (Phase C1 AM 2048 Peak hr)



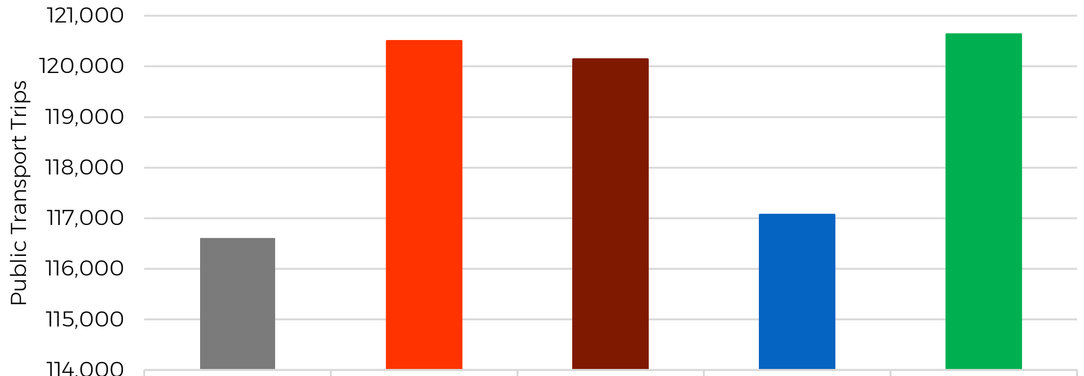
	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Do Minimum	2189	2137	3262	3801
Option	2810	2670	4631	5126

Public Transport Mode Share to the Central City from Station Catchments along the Corridor
(Phase C1 AM 2048 Peak hr)



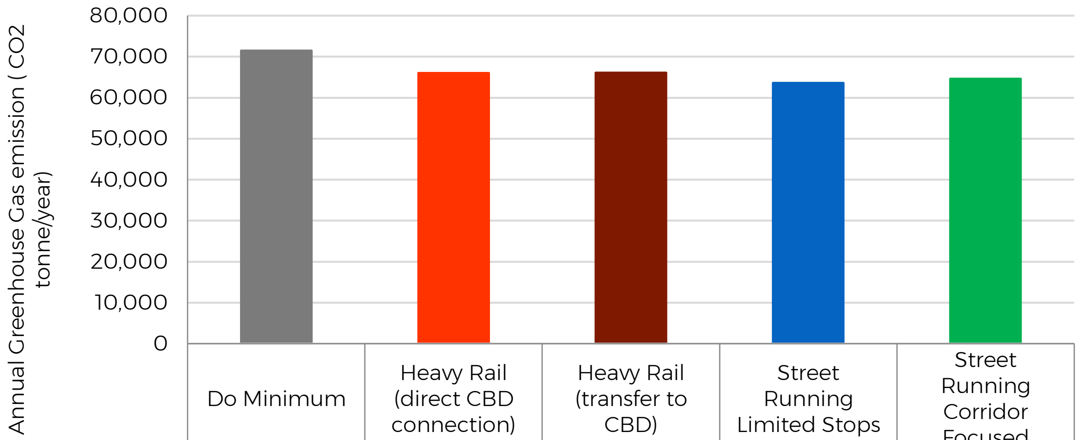
	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Total Person Trips (PT and Car)	6578	6716	12343	13549
PT Person Trips	2810	2670	4631	5126

Daily Ridership on the Entire Public Transport Network (Phase C1 2048)



	Do Minimum	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Option	116,604	120,501	120,140	117,070	120,633

Green House Gas CO2 along the Corridor (Phase C1 2048)

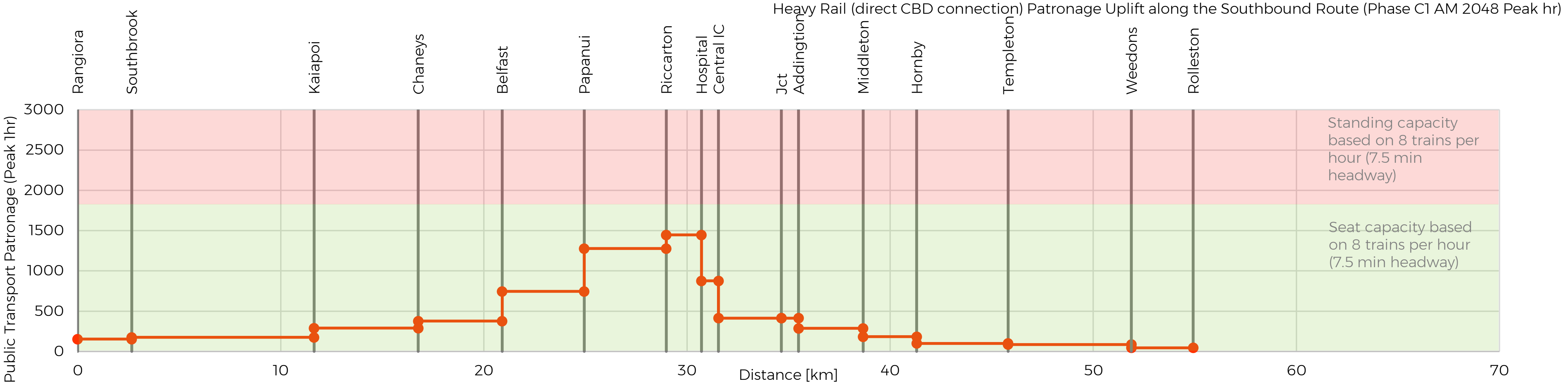


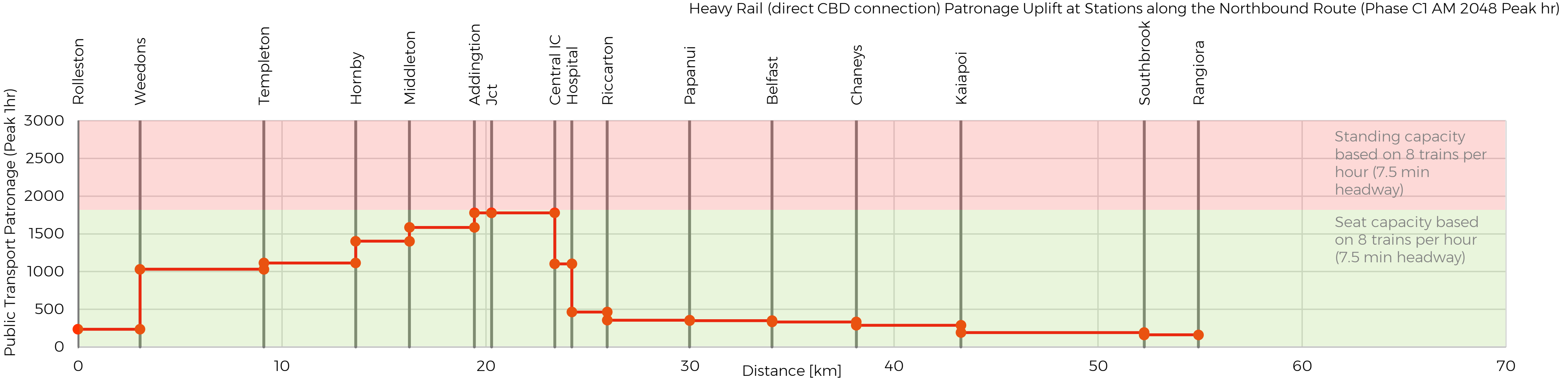
	Do Minimum	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Option	71,518	66,071	66166	63615	64654

Phase C1: Initial transport outcomes

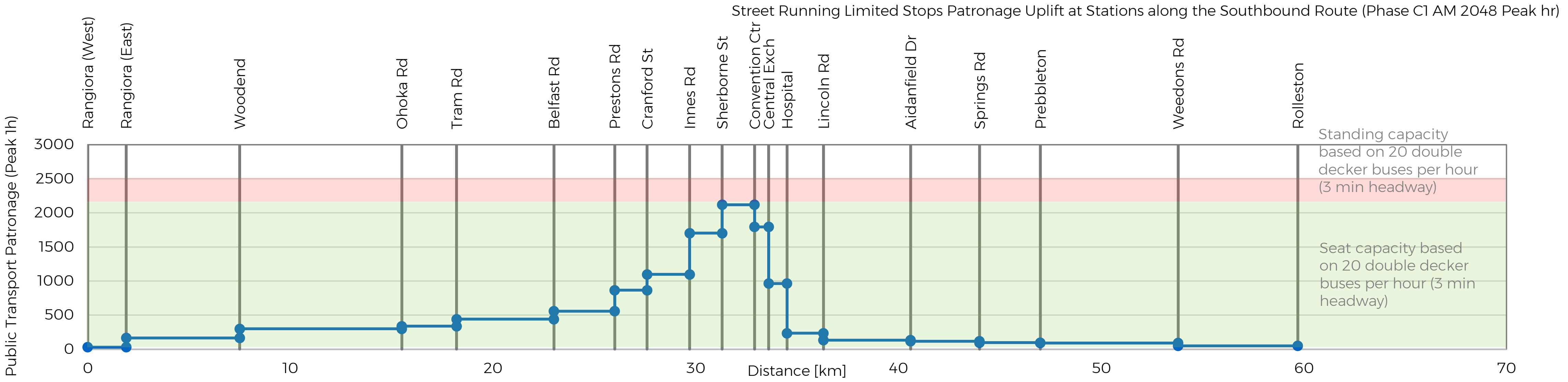
Investment Objective	Criteria	KPI		Outcomes: Heavy Rail (direct)	Outcomes: Street Running Limited Stops	Outcomes: Street Running Corridor Focused
Investment objective 1: Increased proportion of the population within key prioritised locations and along identified transport corridors within Greater Christchurch with improved access to Christchurch's Central City by 2048	Housing and employment growth	KPI: Increased number of households and jobs within 800 m of high frequency public transport		+4.4% residents (5,400 people) +2.6% employees (2,000 people)	+4.7% residents (8,900 people) +5.5% employees (7,000 people)	+3.6% residents (7,600 people) +4.8% employees (7,300 people)
	Ability to support high quality integrated community	Growth impact based on land value uplift		Land value uplift: $461M	Land value uplift: $873M	Land value uplift: $1,066M
	Increased access to opportunities	Population able to access the Christchurch City centre within 30 minutes using the PT system		77% (50,050) increase from 64,590 to 114,640	54% (35,000) increase from 64,590 to 99,590	58% (37,230) increase from 64,590 to 101,820
		Change in PT mode share for trips to the Central City from Greater Christchurch		3% increase from 33% to 36%	3% increase from 33% to 36%	4% increase from 33% to 37%
		Number of jobs accessible from satellite towns within 30 minutes by PT		409% (119,470) increase from 29,190 to 148,660	120% (34,960) increase from 29,190 to 64,150	158% (46,250) increase from 29,190 to 75,400
Investment objective 2: Improved journey time and reliability of PT services relative to private vehicles within Greater Christchurch by 2048;	Increased share of travel unaffected by congestion	Change in private vehicle trips along the rapid transit corridor(s) to Greater Christchurch		1% (263) decrease from 50,662 to 50,399	1% (633) decrease from 79,134 to 78,501	1% (647) decrease from 87,044 to 86,397
		Proportion of trips made by PT along rapid transit corridor(s) to the central city		8% increase from 35% to 43%	10% increase from 28% to 38%	9% increase from 29% to 38%
		More competitive journey times between PT and private vehicles for residents living along the corridor	CC to Rangiora (car vs RT)	26-45 min vs 35 min	26-45 min vs 53 min	26-45 min vs 1hr
			CC to Kaiapoi (car vs RT)	20-35 min vs 24 min	20-35 min vs 37 min	20-35 min vs 41 min
			CC to Hornby (car vs RT)	16-45 min vs 16 min		16-45 min vs 29 min
			CC to Rolleston (car vs RT)	22-40 min vs 29 min	22-40 min vs 42 min	22-40 min vs 43 min
	Ability to integrate efficiently and effectively with wider public transport network	Daily ridership on the rapid transit system		29,655 boardings	47,220 boardings	42,937 boardings
		Overall public transport mode share in Greater Christchurch		8%	7%	8%
Investment objective 3:Reduce emissions from transport movements across Greater Christchurch by 2048.	Impact on climate change	Change in private VKT/capita for households along the rapid transit corridor(s)		3% (407,683) decrease from 13,531,568 to 13,123,885	4% (511,108) decrease from 13,531,568 to 13,020,460	4% (477,331) decrease from 13,531,568 to 13,054,237
		Change in greenhouse gas emissions (tonnes of CO_2 and HC) from transport sources along transit corridor(s)		8% (5,447) decrease from 71,518 to 66,071	11% (7,903) decrease from 71,518 to 63,615	10% (6,864) decrease from 71,518 to 64,654
		Change in greenhouse gas emissions (tonnes of CO_2 and HC) from transport sources within Greater Christchurch		3% (6,872) decrease from 228,114 to 221,242	4% (8,616) decrease from 228,114 to 219,498	4% (8,046) decrease from 228,114 to 220,068
		Change in air quality and public health outcomes for households along the transit corridor(s)		3% (2) decrease from 72 to 70	3% (2) decrease from 72 to 70	4% (3) decrease from 72 to 69

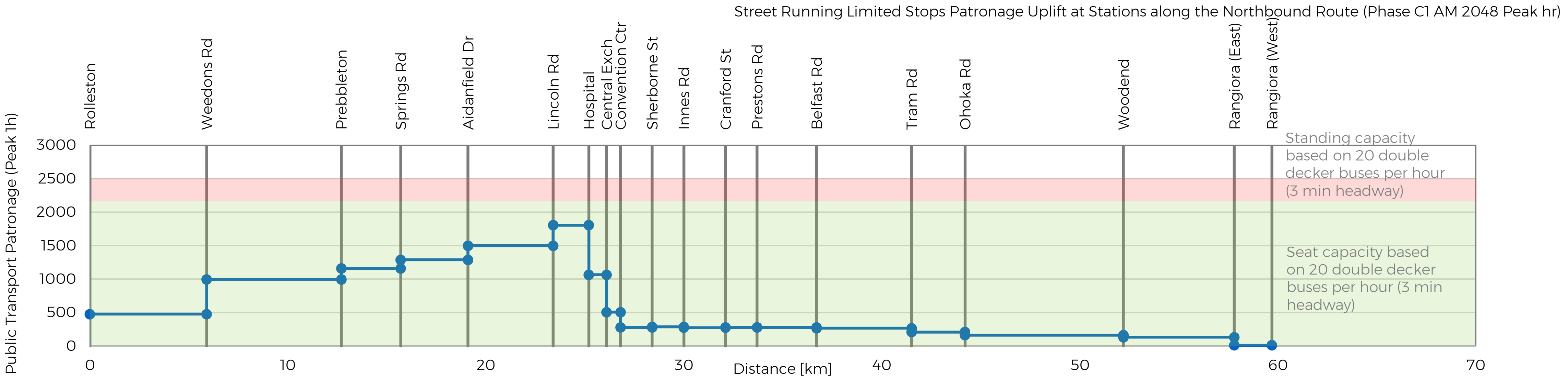
Phase C1: Demand for travel along heavy rail scenario



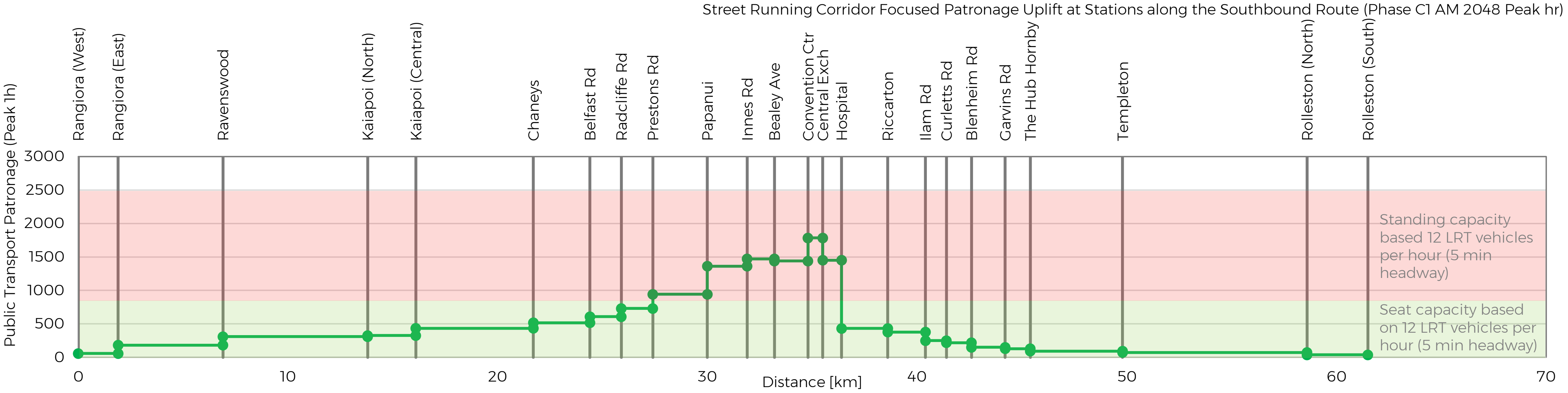


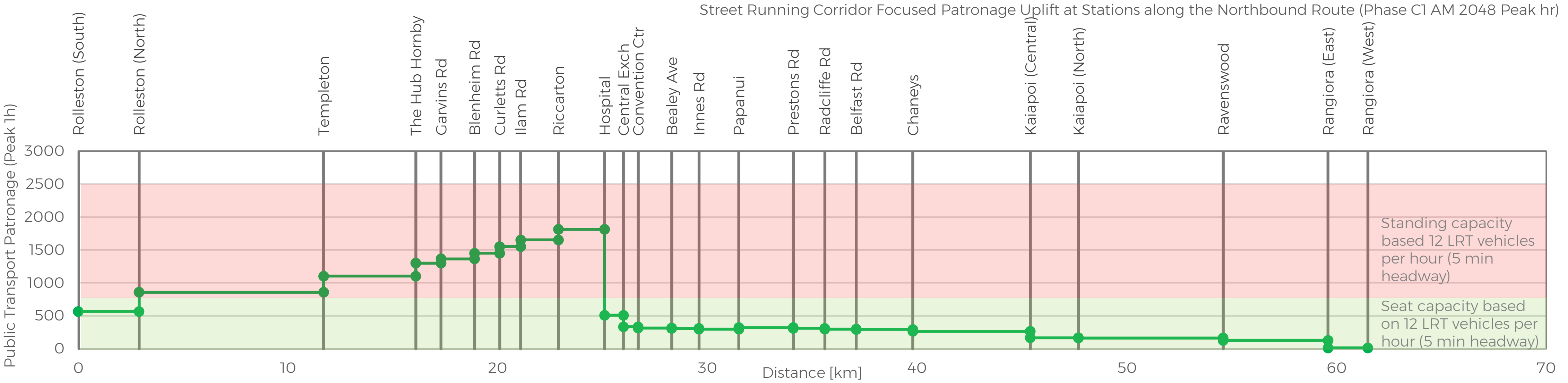
Phase C1: Demand for travel on street running – limited stops scenario





Phase C1: Demand for travel on street running - corridor focus scenario





Phase C3: Initial transport outcomes (for the 2048 horizon)

A road pricing scheme focused on the city centre cordon, together with the additional capacity and accessibility improvements provided by the rapid transit scenarios, is estimated to impact the land-use within the station catchment of each rapid transit scenario as summarised in the table below.

Scenario	Change in Land Value	Change in Population along the corridor	Change in Employment along the Corridor
1. Heavy rail	$1,727,000,000 (+33%)	17,700 (+12.3%)	18,400 (+12.1%)
2. Street running limited stop route	$3,278,000,000 (+32%)	18,300 (+9.8%)	14,800 (+11.4%)
3. Street running corridor focus route	$2,719,000,000 (+29%)	19,700 (+9.3%)	18,300 (+11.9%)

This change in land-use, together with the rapid transit scenario, is modelled to increase the labour pool available to city centre employers within 30 minutes using public transport by 81% (for the heavy rail scenario), 63% (for the limited stops scenario) and 61% (for the corridor focused scenario).

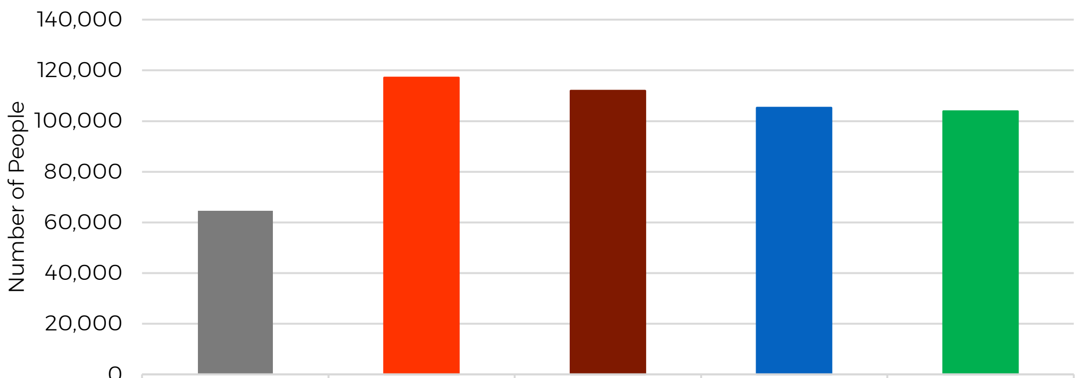
Residents of the three satellite towns (Rolleston, Kaiapoi and Rangiora) will also be able to access a larger number of jobs within 30 minutes using public transport. The heavy rail provides the largest impact to Rolleston and Kaiapoi, noting that Rangiora still falls outside the 30 minute journey time by rail.

Public transport trips from each corridor's catchment to the central city is also forecast to increase with the limited stops scenario increasing by 58% and the corridor focused scenario by 41%. This will result in a public transport's mode share from these corridors to the central city of between 39% and 44%.

Region-wide ridership on the public transport network will increase by between 3.4% and 9%, resulting in a decrease in vehicle kilometres travelled by car and corresponding decrease in CO_2 emissions of between 2.9% and 3.5%.

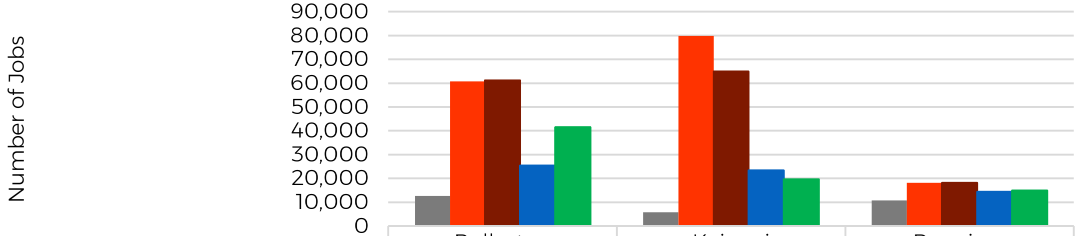
The peak ridership of heavy rail scenario is modelled as 1,500 and 1,800 pphpd for the northern and south-western corridors respectively with a daily ridership of 36,444. The peak ridership of the street running limited stops scenario is modelled as 2,400 and 2,000 pphpd with a daily ridership of 45,606. The peak ridership of the street running corridor focused scenario is modelled as 1,900 and 1,850 pphpd with a daily ridership of 41,896.

Number of People That Can Access the City Within 30 Minutes (Phase C3 2048)



	Do Minimum	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Option	64590	117120	111910	105270	103820

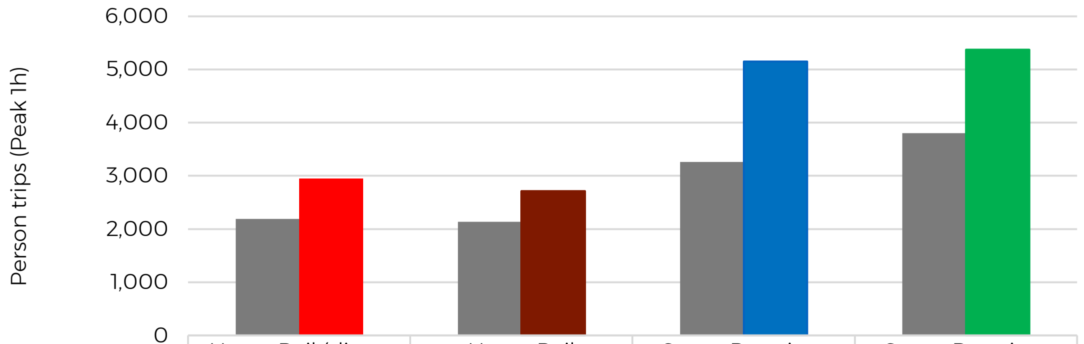
Number of Jobs that Residents can Access Within 30 Minutes from Each Area using Public Transport (Phase C3 2048)



	Rolleston	Kaiapoi	Rangiora
Do Minimum	12680	5770	10740
Heavy Rail (direct CBD connection)	60760	79880	18110
Heavy Rail (transfer to CBD)	61200	64880	18110
Street Running Limited Stops	25380	23410	14420
Street Running Corridor Focused	41590	19580	14890

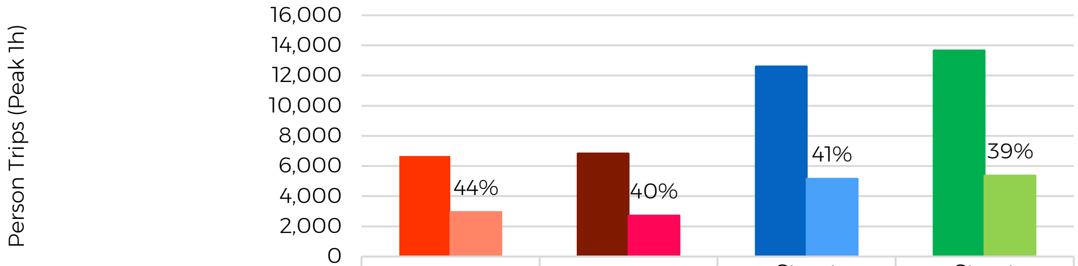
Phase C3: Initial transport outcomes

Public Transport Trips from each Station Catchment to Central City (Phase C3 AM 2048 Peak hr)



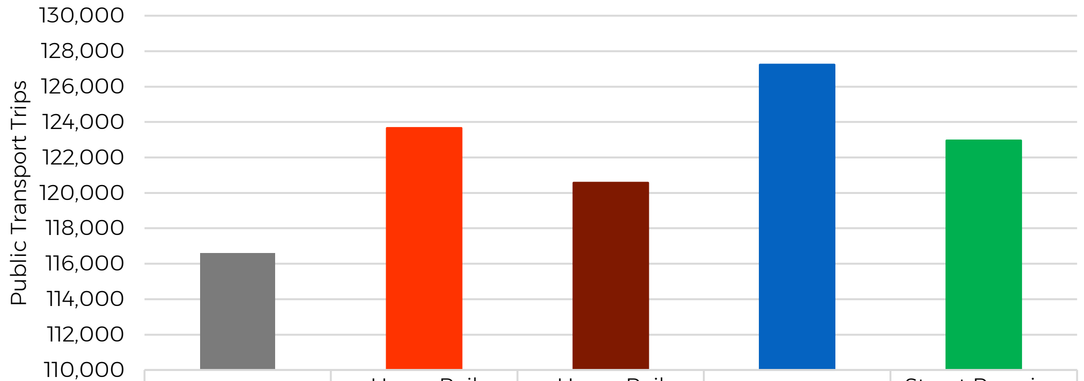
	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Do Minimum	2189	2137	3262	3801
Option	2946	2712	5152	5371

Public Transport Mode Share to the Central City from Station Catchments along the Corridor
(Phase C3 AM 2048 Peak hr)



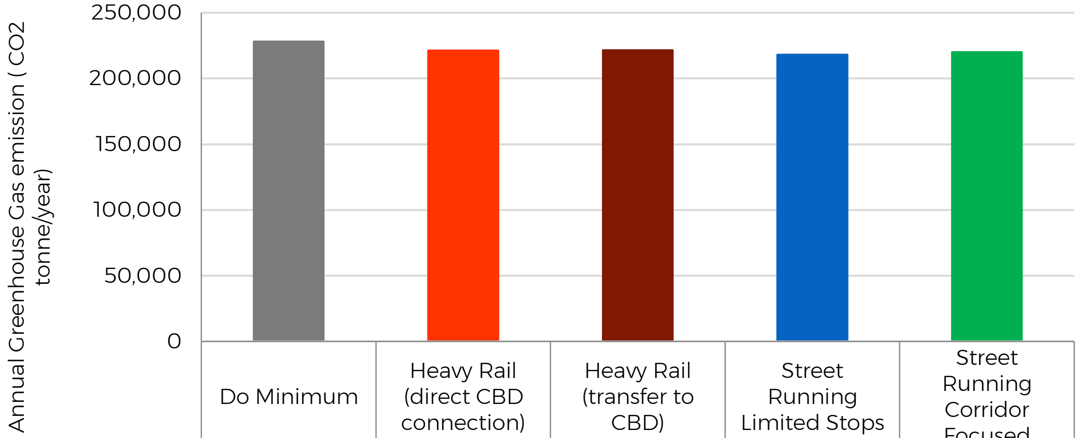
	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Total Person Trips (PT and Car)	6651	6831	12610	13673
PT Person Trips	2946	2712	5152	5371

Daily Ridership on the Entire Public Transport Network (Phase C3 2048)



	Do Minimum	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Option	116,604	123,661	120,576	127,243	122,964

Green House Gas CO2 (Phase C3 2048)

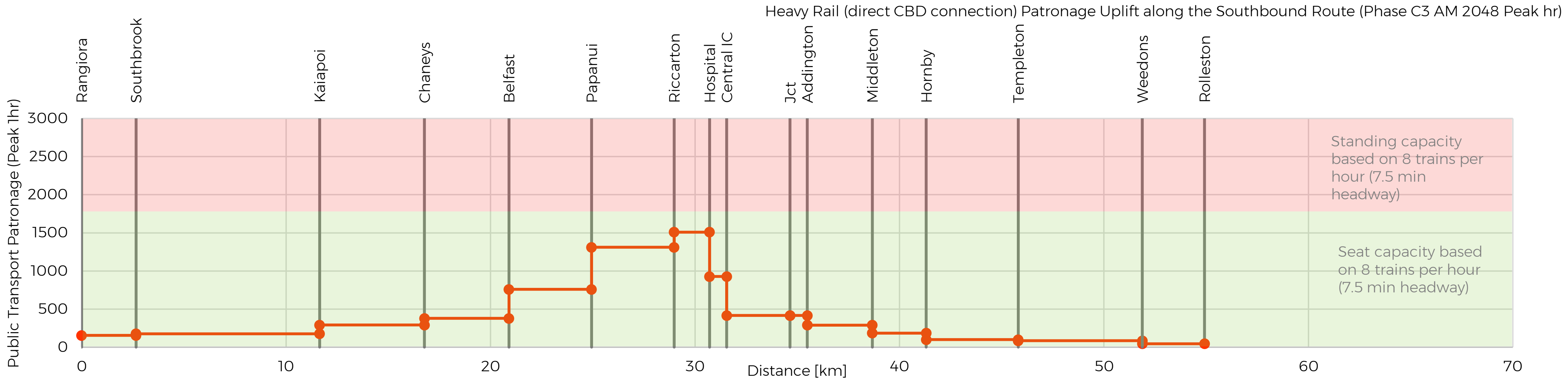


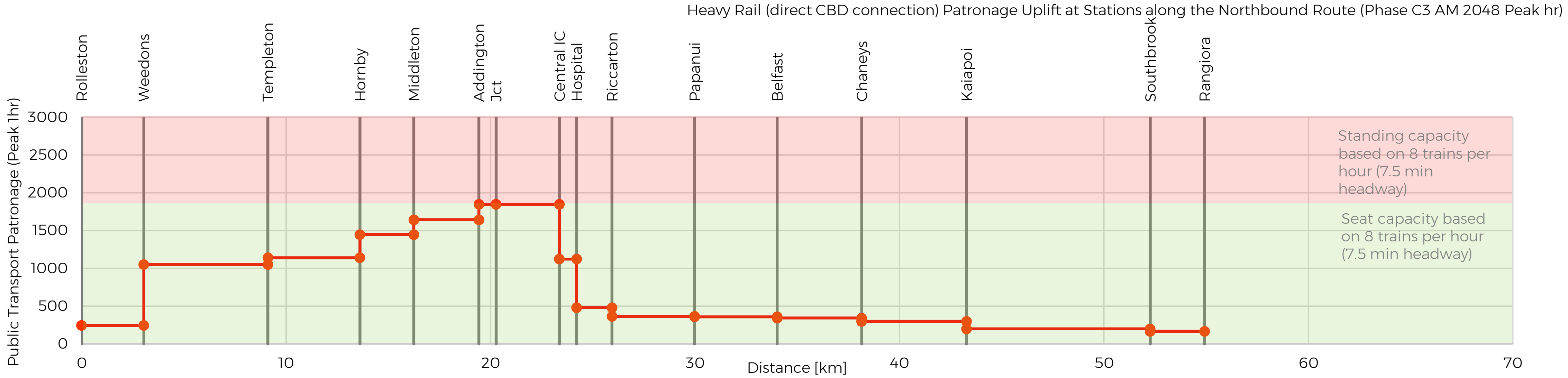
	Do Minimum	Heavy Rail (direct CBD connection)	Heavy Rail (transfer to CBD)	Street Running Limited Stops	Street Running Corridor Focused
Option	228114	221330	221502	218211	220116

Phase C3: Initial transport outcomes

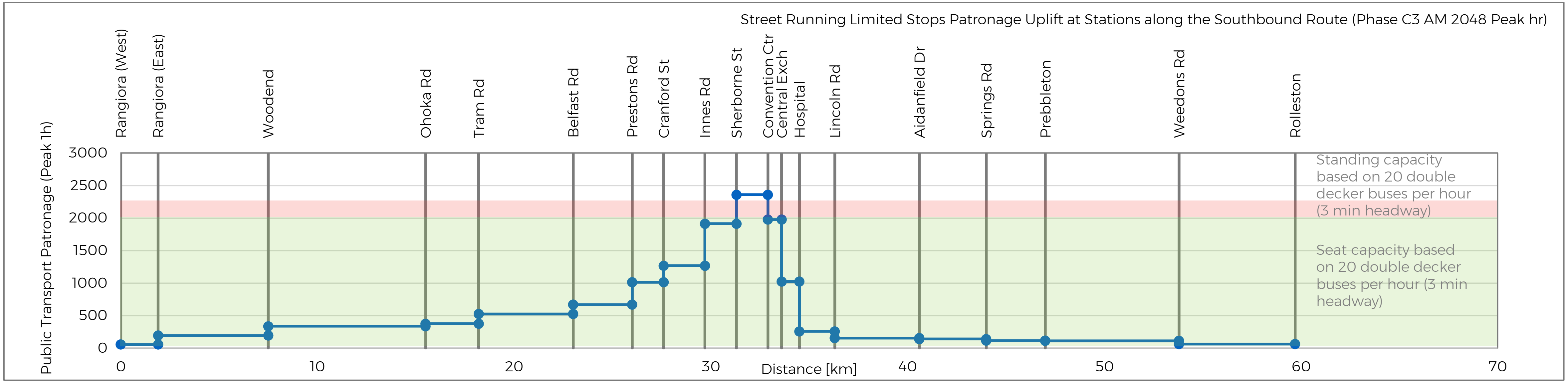
Investment Objective	Criteria	KPI		Outcomes: Heavy Rail (direct)	Outcomes: Street Running Limited Stops	Outcomes: Street Running Corridor Focused
Investment objective 1: Increased proportion of the population within key prioritised locations and along identified transport corridors within Greater Christchurch with improved access to Christchurch's Central City by 2048	Housing and employment growth	KPI: Increased number of households and jobs within 800 m of high frequency public transport		+12.3% residents (17,700 people) +12.1% employees (18,400 people)	+9.8% residents (18,300 people) +11.4% employees (14,800 people)	+9.3% residents (19,700 people) +11.9% employees (18,300 people)
	Ability to support high quality integrated community	Growth impact based on land value uplift		Land value uplift: $1,727M	Land value uplift: $3,278M	Land value uplift: $2,719M
	Increased access to opportunities	Population able to access the Christchurch City centre within 30 minutes using the PT system		81% (52,530) increase from 64,590 to 117,120	63% (40,680) increase from 64,590 to 105,270	61% (39,230) increase from 64,590 to 103,820
		Change in PT mode share for trips to the Central City from Greater Christchurch		4% increase from 33% to 37%	6% increase from 33% to 39%	4% increase from 33% to 37%
		Number of jobs accessible from satellite towns within 30 minutes by PT		444% (129,560) increase from 29,190 to 158,750	117% (34,020) increase from 29,190 to 63,210	161% (46,870) increase from 29,190 to 76,060
Investment objective 2: Improved journey time and reliability of PT services relative to private vehicles within Greater Christchurch by 2048;	Increased share of travel unaffected by congestion	Change in private vehicle trips along the rapid transit corridor(s) to Greater Christchurch		1% (330) decrease from 50,662 to 50,332	1% (991) decrease from 79,134 to 78,143	1% (795) decrease from 87,044 to 86,249
		Proportion of trips made by PT along rapid transit corridor(s) to the central city		9% increase from 35% to 44%	13% increase from 28% to 41%	10% increase from 29% to 39%
		More competitive journey times between PT and private vehicles for residents living along the corridor	CC to Rangiora (car vs RT)	26-45 min vs 35 min	26-45 min vs 53 min	26-45 min vs 1hr
			CC to Kaiapoi (car vs RT)	20-35 min vs 24 min	20-35 min vs 37 min	20-35 min vs 41 min
			CC to Hornby (car vs RT)	16-45 min vs 16 min		16-45 min vs 29 min
			CC to Rolleston (car vs RT)	22-40 min vs 29 min	22-40 min vs 42 min	22-40 min vs 43 min
	Ability to integrate efficiently and effectively with wider public transport network	Daily ridership on the rapid transit system		36,444 boardings	45,606 boardings	41,896 boardings
		Overall public transport mode share in Greater Christchurch		8%	8%	8%
Investment objective 3:Reduce emissions from transport movements across Greater Christchurch by 2048.	Impact on climate change	Change in private VKT/capita for households along the rapid transit corridor(s)		3% (402,442) decrease from 13,531,568 to 13,129,126	4% (587,454) decrease from 13,531,568 to 12,944,114	4% (474,457) decrease from 13,531,568 to 13,057,111
		Change in greenhouse gas emissions (tonnes of CO2 and HC) from transport sources along transit corridor(s)				
		Change in greenhouse gas emissions (tonnes of CO2 and HC) from transport sources within Greater Christchurch		3% (6,784) decrease from 228,114 to 221,330	4% (9,903) decrease from 228,114 to 219,211	4% (7,998) decrease from 228,114 to 220,116
		Change in air quality and public health outcomes for households along the transit corridor(s)		3% (2) decrease from 72 to 70	4% (3) decrease from 72 to 69	4% (3) decrease from 72 to 69

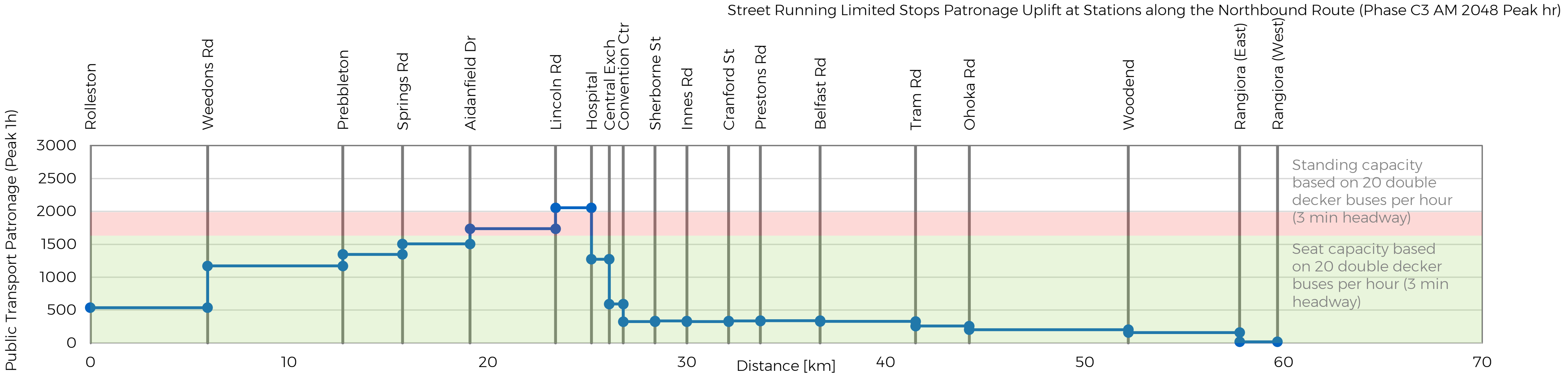
Phase C3: Demand for travel along heavy rail scenario



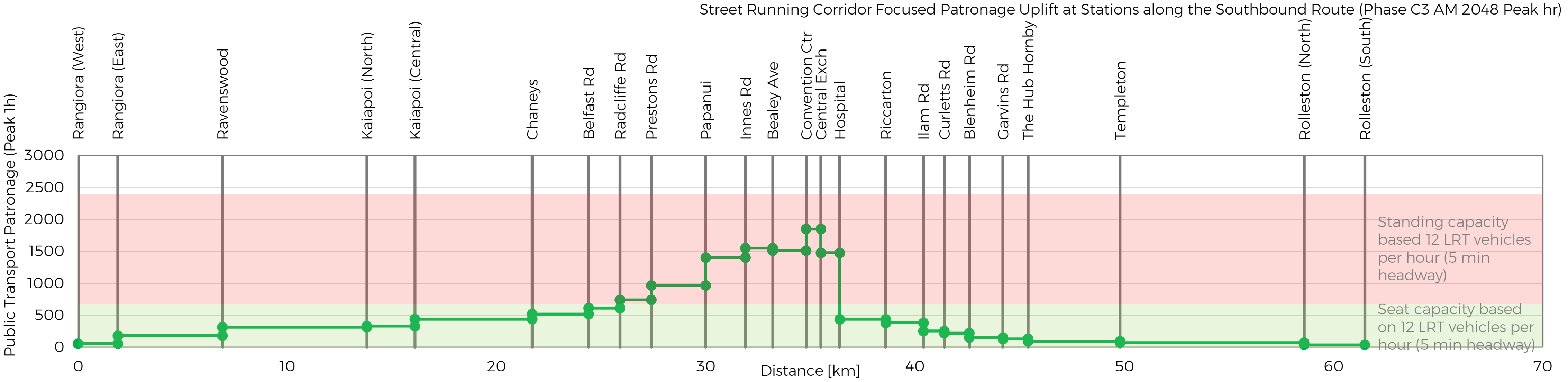


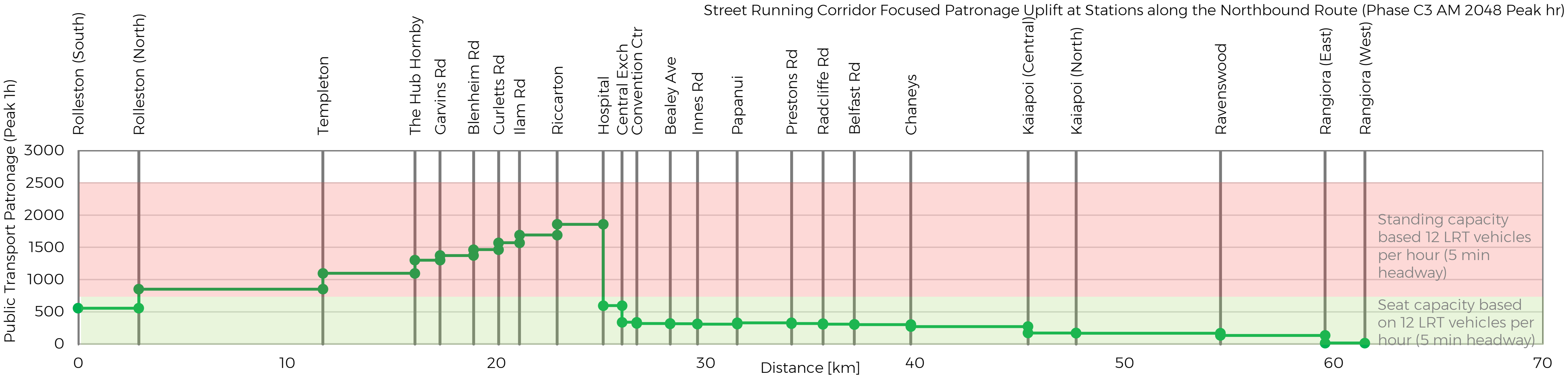
Phase C3: Demand for travel on street running – limited stops scenario





Phase C3: Demand for travel on street running - corridor focus scenario





Summary: Heavy rail scenario

- The heavy rail scenario was analysed as an electric multiple unit train (EMU), running on upgraded electrified double track railway lines both to Rangiora and Rolleston. It assumes a direct connection into the central city (via open trench) with cross roads re-instated via bridge decks over the trench. The option is estimated to cost between $2.0 and $2.4 billion to implement. The analysis assumes a single EMU running every 7.5 minutes during the peak period.
- The system enhances the competitiveness of public transport in Greater Christchurch and offers consistent peak and off peak journey times. During peak periods, the rail option will be faster than private vehicles across the inner parts of Greater Christchurch. Hornby will be 16 minutes by rail to the central city compared to car travel times of 45 min during the peak and 16 min in the off peak. Rolleston will be a predictable 29 minutes on rail compared to highly variable 22-40 minutes by car. Travel times to/from Rangiora will be 35 minutes on rail compared to 26-45 minutes by car.
- The scheme (combination of rail and cordon pricing in the city centre) would make land more attractive within 800m of station locations along the route and the land value uplift as a result of the scheme is estimated to be $1.7 billion.
- The higher attractiveness of this land is forecast to shift how the city will grow in future. The analyses estimate that approximately 200,000 people (or 32% of future population) will live in the rail corridor by 2048 (up from 180,000 without rail services). It will also attract employment to be concentrated along the corridor to a greater extent (190,000 or 62% of all future employment will be located within the corridor catchment area – up from 56% without the rail investment.)
- The forecast growth, altered settlement and employment pattern together with the scheme characteristics (rail and road pricing) have the potential to increase public transport ridership from 20 million trips per annum in 2028 (PT Futures forecast) to 38 million per annum by 2048. The heavy rail system will carry 29% of all PT trips (11 million). The ridership of this future PT system will:
  - Reduce the vehicle kilometres travelled on the network by 3% (~400,000 vehicle km per day) – reducing emissions
  - Deliver 44% of motorised person trips to the central city, freeing up inner city corridor space for active modes and other uses and events.
  - Generate demand that will fully utilise all available seats by the time the services reach the central city. Spare capacity will still be available (standing capacity) to accommodate growth beyond the analysis period or for special events.
- There is a potential to reduce the initial investment by allowing (forcing) city centre trips to transfer from rail to enhanced bus at a new Riccarton station. This will lower the potential CAPEX investment envelop to $1.1 - $1.5 billion. The transfer is forecast to reduce the rail ridership by ~18% with 2048 annual trips on the rail decreasing to 9 million. It will also result in lower land value uplift by ~42% (or $710 million).
- There is also potential to run lower frequencies north of Chaneys Road, reducing the need to widen the bridge across the Waimakariri River.
- Key risks for a heavy rail scenario include impacts on rail freight operations, windows available for track maintenance, cycleways that utilise the rail corridor, safety and efficiency of traffic flows at level crossings, and consentability of a trenched rail connection to the city centre. These risks have not been quantified and reflected in the cost estimates for the scenarios.

Summary: Street Running Limited Stops Scenario

- The street running limited stops scenario was analysed as a bus rapid transit option and is estimated to cost between $1.8 and $2.3 billion to implement. The analysis assumes double decker buses running at least every 3 minutes during the peak period. It could also be an advanced BRT system using larger articulated buses.
- The system enhances the competitiveness of public transport in Greater Christchurch and offers consistent peak and off peak journey times. During peak periods the busway system will be competitive with private vehicles. Prebbleton will be 25 minutes by bus to the central city compared to car travel times of 35 min during the peak and 16 min in the off peak. Rolleston will be a predictable 42 minutes, Kaiapoi 37 minutes and Rangiora 53 minutes.
- The scheme (combination of busway and cordon pricing in the city centre) would make land more attractive within 800m of station locations along the route and the land value uplift as a result of the scheme is estimated to be $3.3 billion.
- The higher attractiveness of this land is forecast to shift how the city will grow in future. The analysis estimates that approximately 240,000 people (or 37% of future population) will live in the busway corridor by 2048 (up from 220,000 without a busway). It will also attract employment to be concentrated along the corridor to a greater extend (168,000 or 55% of all future employment will be located within the corridor catchment area – up from 50% without the busway investment.)
- The forecast growth, altered settlement and employment pattern together with the scheme characteristics (busway and road pricing) have the potential to increase public transport ridership from 20 million trips per annum in 2028 to 39 million per annum by 2048. The busway system will carry 33% of all PT trips (13 million). The ridership of this future PT system will:
  - Reduce the vehicle kilometres travelled on the network by %4 (~590,000 vehicle km per day) – reducing emissions.
  - Deliver 41% of motorised person trips to the central city, freeing up corridor space for active modes and other uses and events.
  - Generate demand that will fully utilise all available seats on the buses (at 3 min headways). There is a risk that demand will exceed available capacity (in the peak) by the time the services reach the central city, requiring overlay services through the inner core.
- There is a potential to reduce the initial investment by reviewing the level of infrastructure (and frequency) of the system north of the Belfast Road station. A 10 minute frequency north of Belfast appears to better balance capacity and demand. The Belfast station will, therefore, require a layout that can accommodate layover. Similar, the station on the outskirts of current Rolleston, supported by park and ride, appears to be the optimal point for bus terminus at 3 minute frequencies, with 10 minute frequencies serving Rolleston (and lower level of bus/traffic segregation).
- Key risks for a street running limited stops scenario include impacts on traffic flows in the corridors and surrounding network, especially in the central city once it has left the motorway alignments, and capacity of the bus exchange and surrounding streets to accommodate increased bus volumes.

Summary: Street Running Corridor Focused Scenario

- The street running corridor focused scenario was analysed as a street running light rail option and is estimated to cost between $3.8 and $4.4 billion to implement. The analysis assumes a 33m long vehicle running every 5 minutes during the peak period.
- The system enhances the competitiveness of public transport in Greater Christchurch and offers consistent peak and off peak journey times. During peak periods light rail will be faster than private vehicles across the inner parts of Greater Christchurch. Riccarton will be 10 minutes by light rail to the central city compared to car travel times of 24 min during the peak and 9 min in the off peak. Hornby will be a predictable 30 minutes on light rail compared to highly variable 16-45 minutes by car. Travel times to/from Papanui will be a 15 minutes on light rail compared to 12-26 minutes by car.
- The scheme (combination of light rail and cordon congestion pricing in the city centre) would make land more attractive within 800m of station locations along the route and the land value uplift as a result of the scheme is estimated to be $ 2.7 billion.
- The higher attractiveness of this land is forecast to shift how the city will grow in future. The analysis estimates that approximately 250,000 people (or 39% of future population) will live in the MRT corridor by 2048 (up from 230,000 without light rail). It will also attract employment to be concentrated along the corridor to a greater extent (188,000 or 61% of all future employment will be located within the corridor catchment area – up from 55% without the light rail investment.)
- The forecast growth, altered settlement and employment pattern together with the scheme characteristics (light rail and road pricing) have the potential to increase public transport ridership from 20 million trips per annum in 2028 to 38 million per annum by 2048. The light rail system will carry 31% of all PT trips (12 million trips). This level of use on the rapid transit system will:
  - Reduce the vehicle kilometres travelled on the network by %3.5 (~470,000 vehicle km per day) – reducing emissions.
  - Deliver 39% of motorised person trips to the central city, freeing up corridor space for active modes and other uses and events.
  - Generate demand that will fully utilise all available seats on the light rail (at 5 min headways). Passengers boarding the service at Prestons Road (or further south) on the northern corridor will be required to stand for 23 minutes as no seats will be available under this arrangements. Similarly, passengers boarding in Rolleston will fill up available seats requiring all subsequent boarding to stand (35 minutes in case of Templeton boardings).

- There is a potential to reduce the initial investment by reviewing the technology and level of infrastructure (and frequency) of the system north of the Chaneys Road station. A 10 minute frequency bus system between Rangiora and Chaneys Rd station, that then express into the city (similar route to the direct services) appears to better balance capacity and demand, and also has the potential to offer better journey time service to Waimakariri customers.
- The scenario also warrants consideration as a bus rapid transit system, with lower investment range of $2.5 –$ 2.8 billion.
- Key risks for a street running corridor scenario include impacts on traffic flows in the corridors and surrounding network, wider street network adjustments to accommodate loss of right-turn movements, property impacts on built-up urban areas, and the wider implications of grade separating light rail and heavy rail in a constrained urban environment.

Phase D2: Methodology

Phase D is a sensitivity test that considered the direction of the National Policy Statement on Urban Development, which places a greater focus on land-use and public transport integration. The NPS-UD requires councils to make room for growth and directs Tier 1 urban environments to enable building heights of at least six storeys within walkable catchment of a planned rapid transit stop.

The sensitivity test explores urban form arrangements for each rapid transit scenario based on the development opportunities within station catchments, taking account of any planning and environmental constraints.

Six station 'types' have been identified based on the existing characteristics of each station catchment within the wider urban form of the city. This categorisation enables a high-level analysis of growth opportunity within walkable catchments around each stations based on the opportunities and constraints identified for existing land parcels within a 800 m catchment of each of these stations.

Key constraints link to land parcel redevelopment includes: designations; noise sensitivity; flood management; heritage sites; cultural areas; and walkable catchments to station locations.

The range of opportunities include the land development ratio; crown or council owned land; land parcel size; housing age and access to bus and cycle networks.

This methodology is documented in the Land Use Integration Analysis Report, 20 May 2021 prepared by Boffa Miskell.

The Phase D methodology effectively tests rapid transit ridership and wider outcomes at a higher population forecast than the base line forecast of 641,000 people by 2048.

The population ranges used in this test vary between 715,000 for the heavy rail scenario and 1,000,000 for the street running corridor focused scenario.

Phase A

- Develop 2048 Do Minimum transport network and land-use scenario (*CTM18 and PTF medium term network*)
- Develop route and station location for each scenario
- Analyse likely operating speed for each MRT scenario

Phase B

- Assess catchment / likely 2048 ridership using CTM and applying turn-up and go frequencies
- Likely capacity (frequency and vehicle size) to generate capacity of at least 2,000 pphpd
- Likely outcomes against Investment Objectives and KPIs
- High level estimate of the likely ridership of the system

Phase C

- Analyse the indicative land-value uplift and land-use change arising from the investment in the three rapid transit scenarios.
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes
- Further tests on this scenario with wider transport policy decisions (e.g. road pricing) on both land-value uplift and ridership (phases C2/C3)

Phase D

- Analyse the land-use opportunities and constraints within each statin catchment area and identify the likely land-use opportunity that exist within the station catchment area. (Likely reflect Christchurch of 1 million people)
- Apply changes to population and jobs to relevant CTM zones
- Repeat Phase B and determine impact on ridership and outcomes

Phase D2: Initial transport outcomes

In each of the three potential routes there is an opportunity for significant growth at a scale that is supportive of Rapid Transit. This resulted in the following population and employment scenarios (summarised in the table below):

Scenario	Rapid transit corridor catchment (population range)		Greater Christchurch Future population	Greater Christchurch Future employment
Base forecast	146,000 /23%	220,000 /34%	641,000	307,000
Heavy rail	194,888 /27%	259,850/36%	715,000	340,000
Street running limited stop route	307,541 /34%	410,054/45%	900,000	430,000
Street running corridor focus route	429,892 /43%	561,197/56%	1,000,000	480,000

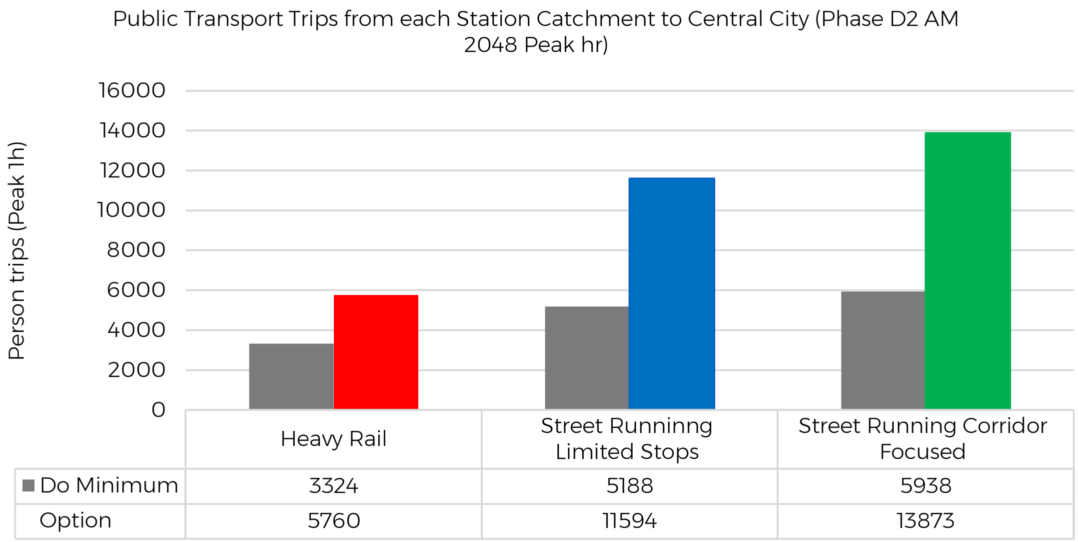
These growth numbers reflect the potential, and would require more analysis on the achievability and timeframe for their roll out. However, for the purposes of this report the sensitivity test explored impact on ridership and outcomes based on 2048 populations and employment numbers as shown above.

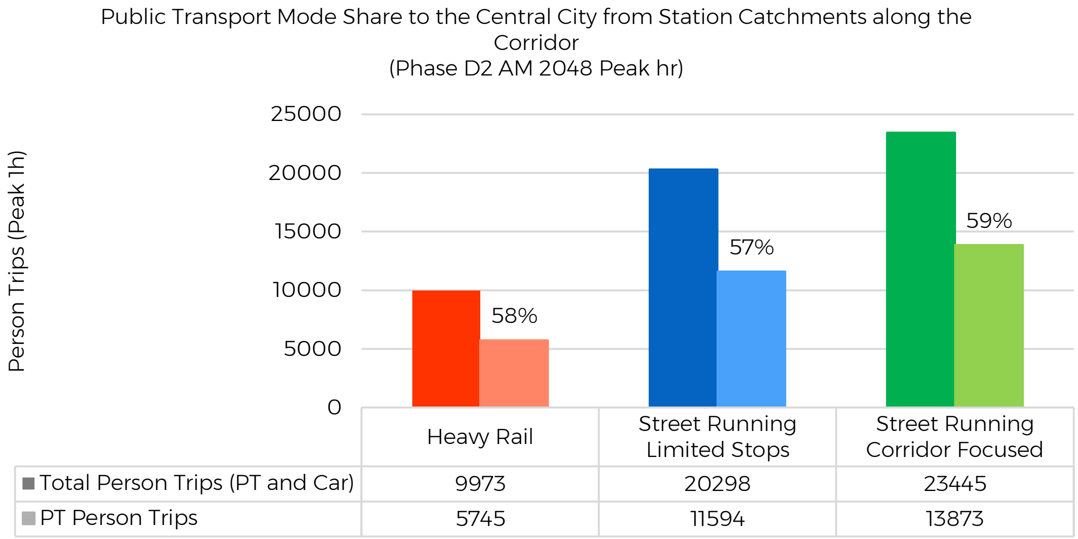
This change in land-use, together with the rapid transit scenario is modelled to increase the use of public transport to the central city, with public transport making between 57% and 59% of all motorised access to the central city.

It also shows a decline in car trips region wide, as public transport is used for other uses (over and above central city access). The uptake of public transport in the heavy rail corridor increases by 72%, and the street running corridors both experienced more than doubling in public transport trips compared to the scenario with no rapid transit.

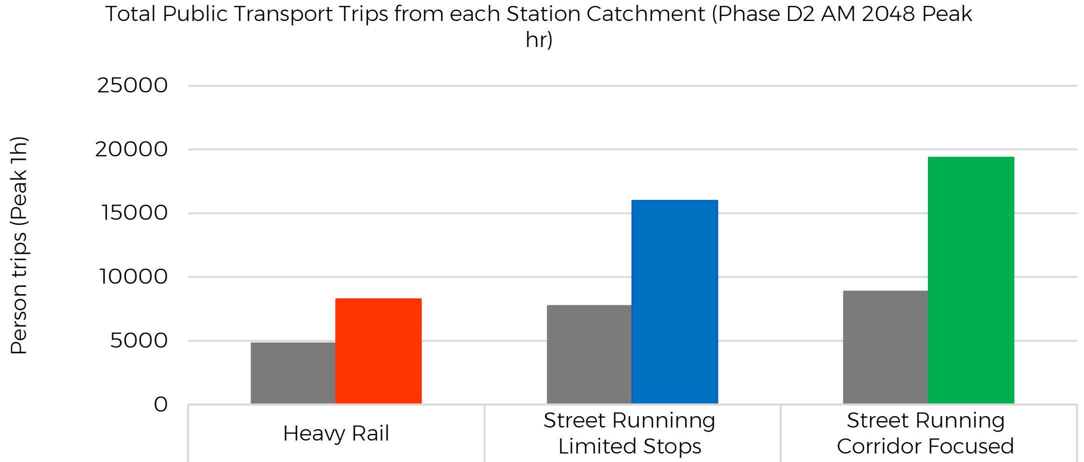
This increase in public transport ridership decrease the number of trips made by private vehicle, resulting in CO_2 emission reduction of between 10% and 15% when compared to the future without rapid transit.

The peak ridership of heavy rail scenario is modelled as 2,200 and 3,500 pphpd for the northern and south-western corridors respectively with a daily ridership of 51,650. The peak ridership of the street running limited stops scenario is modelled as 4,300 and 5,200 pphpd with a daily ridership of 94,835. The peak ridership of the street running corridor focused scenario is modelled as 4,900 and 6,000 pphpd with a daily ridership of 108,727.

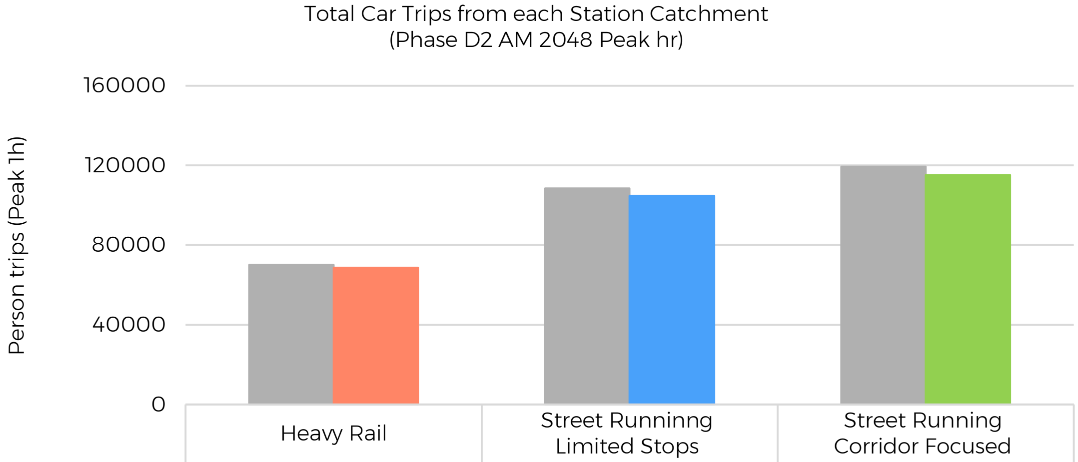




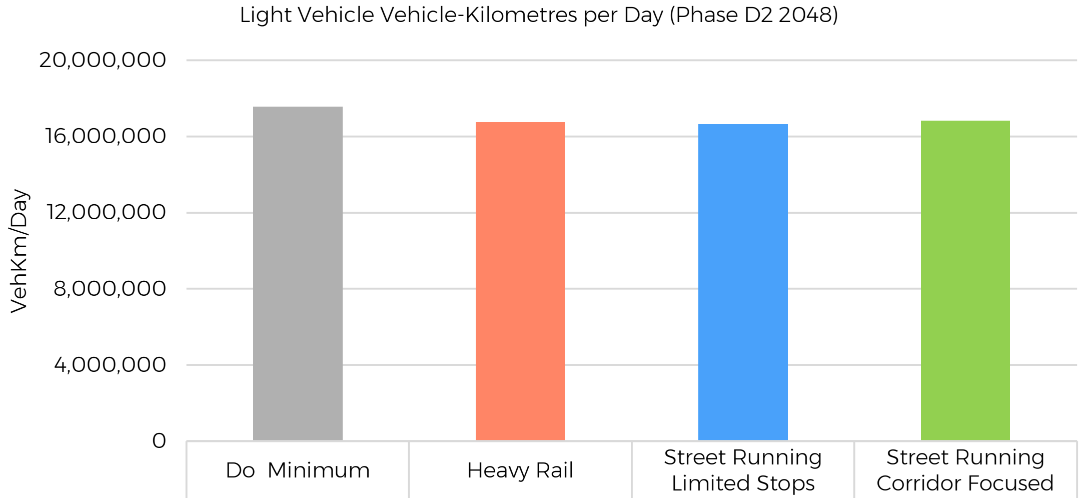
Phase D2: Initial transport outcomes



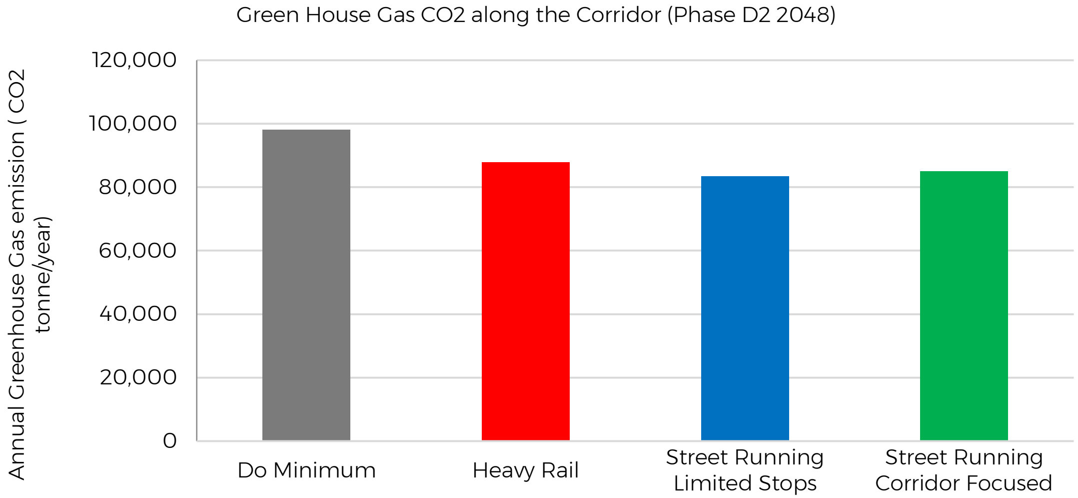
	Heavy Rail	Street Runninng Limited Stops	Street Running Corridor Focused
Do Minimum	4793	7717	8851
Option	8262	15961	19356



	Heavy Rail	Street Runninng Limited Stops	Street Running Corridor Focused
Do Minimum	70100	108523	119375
Option	68742	104791	115208



	Do Minimum	Heavy Rail	Street Running Limited Stops	Street Running Corridor Focused
Option	17,567,475	16,733,694	16,643,161	16,830,457

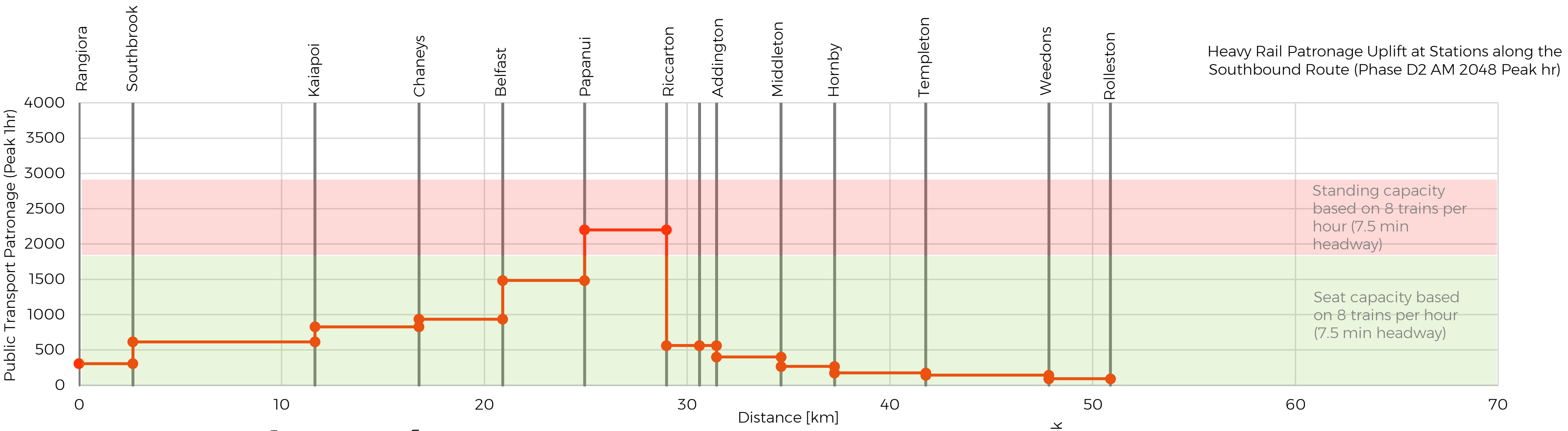


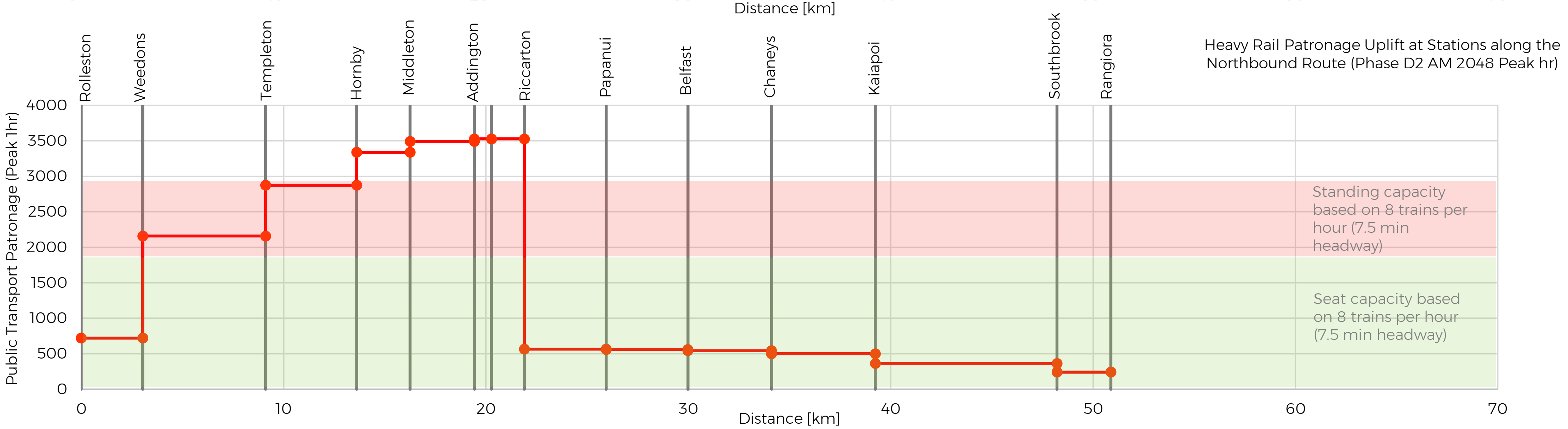
	Do Minimum	Heavy Rail	Street Running Limited Stops	Street Running Corridor Focused
Option	98101	87893	83500	84963

Phase D2: Initial transport outcomes

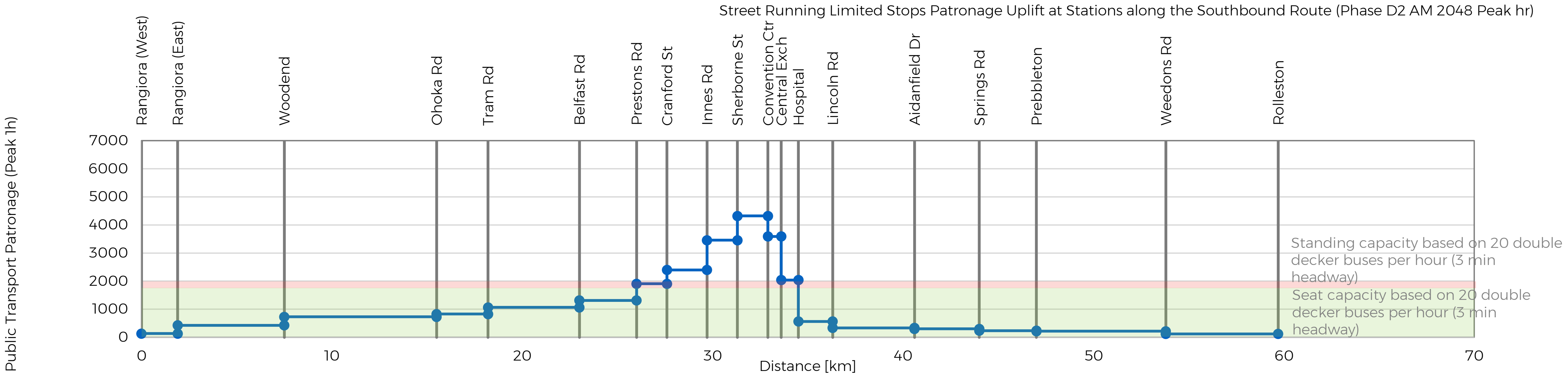
Investment Objective	Criteria	KPI		Outcomes: Heavy Rail	Outcomes: Street Running Limited Stops	Outcomes: Street Running Corridor Focused
Investment objective 1: Increased proportion of the population within key prioritised locations and along identified transport corridors within Greater Christchurch with improved access to Christchurch's Central City by 2048	Housing and employment growth	KPI: Increased number of households and jobs within 800 m of high frequency public transport		+50,000 extra residents + 33,000 jobs	+ 160,000 extra residents + 123,000 extra jobs	+280,000 extra residents +173,000 extra jobs
	Ability to support high quality integrated community	Growth impact based on land value uplift		Not calculated	Not calculated	Not calculated
	Increased access to opportunities	Population able to access the Christchurch City centre within 30 minutes using the PT system		14% (16,830) decrease from 117,740 to 100,910	47% (54,840) increase from 117,740 to 172,580	17% (19,490) increase from 117,740 to 137,230
		Change in PT mode share for trips to the Central City from Greater Christchurch		5% increase from 36% to 41%	10% increase from 36% to 46%	11% increase from 36% to 47%
		Number of jobs accessible from satellite towns within 30 minutes by PT		220% (101,100) increase from 45,900 to 147,000	148% (67,780) increase from 45,900 to 113,680	85% (38,990) increase from 45,900 to 84,890
Investment objective 2: Improved journey time and reliability of PT services relative to private vehicles within Greater Christchurch by 2048;	Increased share of travel unaffected by congestion	Change in private vehicle trips along the rapid transit corridor(s) to Greater Christchurch		2% (1,358) decrease from 70,100 to 68,742	3% (3,732) decrease from 108,523 to 104,791	3% decrease from 119,375 to 115,208
		Proportion of trips made by PT along rapid transit corridor(s) to the central city		19% increase from 39% to 58%	26% increase from 31% to 57%	17% increase from 32% to 59%
		More competitive journey times between PT and private vehicles for residents living along the corridor	CC to Rangiora (car vs RT)	26-45 min vs 35 min	26-45 min vs 53 min	26-45 min vs 1hr
			CC to Kaiapoi (car vs RT)	20-35 min vs 24 min	20-35 min vs 37 min	20-35 min vs 41 min
			CC to Hornby (car vs RT)	16-45 min vs 16 min		16-45 min vs 29 min
			CC to Rolleston (car vs RT)	22-40 min vs 29 min	22-40 min vs 42 min	22-40 min vs 43 min
	Ability to integrate efficiently and effectively with wider public transport network	Daily ridership on the rapid transit system		51,650 boardings	94,835 boardings	108,727 boardings
		Overall public transport mode share in Greater Christchurch		9%	10%	11%
Investment objective 3:Reduce emissions from transport movements across Greater Christchurch by 2048.	Impact on climate change	Change in private VKT/capita for households along the rapid transit corridor(s)		5% (833,781) decrease from 17,567,475 to 16,733,694	5% (924,314) decrease from 17,567,475 to 16,643,161	4% (737,018) decrease from 17,567,475 to 16,830,457
		Change in greenhouse gas emissions (tonnes of CO2 and HC) from transport sources along transit corridor(s)		10% (10,208) decrease from 98,101 to 87,893	15% (14,601) decrease from 98,101 to 83,500	13% (13,138) decrease from 98,101 to 84,963
		Change in greenhouse gas emissions (tonnes of CO2 and HC) from transport sources within Greater Christchurch		5% (14,056) decrease from 296,125 to 282,069	4% (12,425) decrease from 296,125 to 283,700	5% (15,582) decrease from 296,125 to 280,543
		Change in air quality and public health outcomes for households along the transit corridor(s)*		4% (4) decrease from 92 to 88	4% (4) decrease from 92 to 88	5% (5) decrease from 92 to 87

Phase D2: Demand for travel on heavy rail scenario

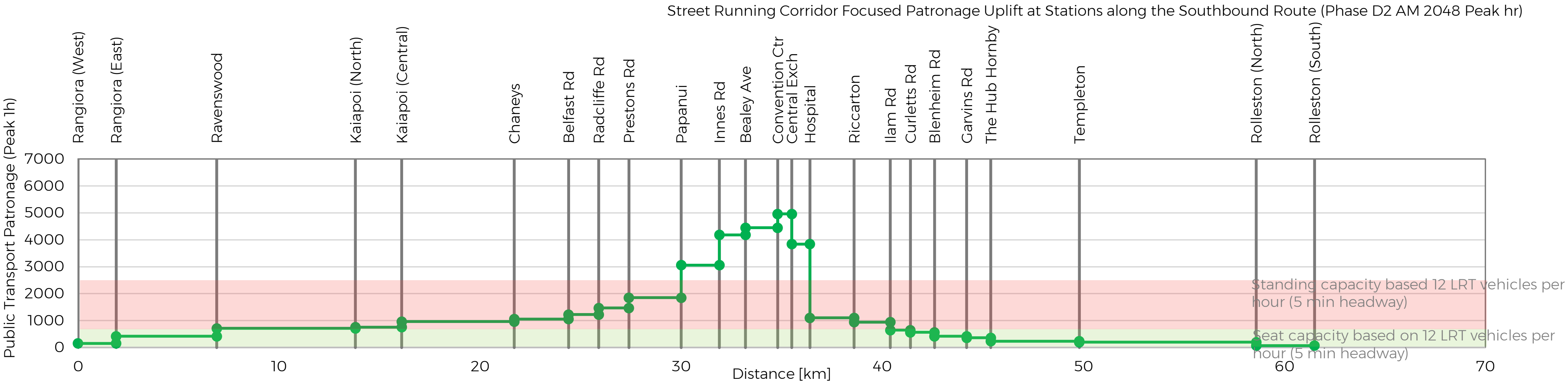




Phase D2: Demand for travel on street running – limited stops scenario

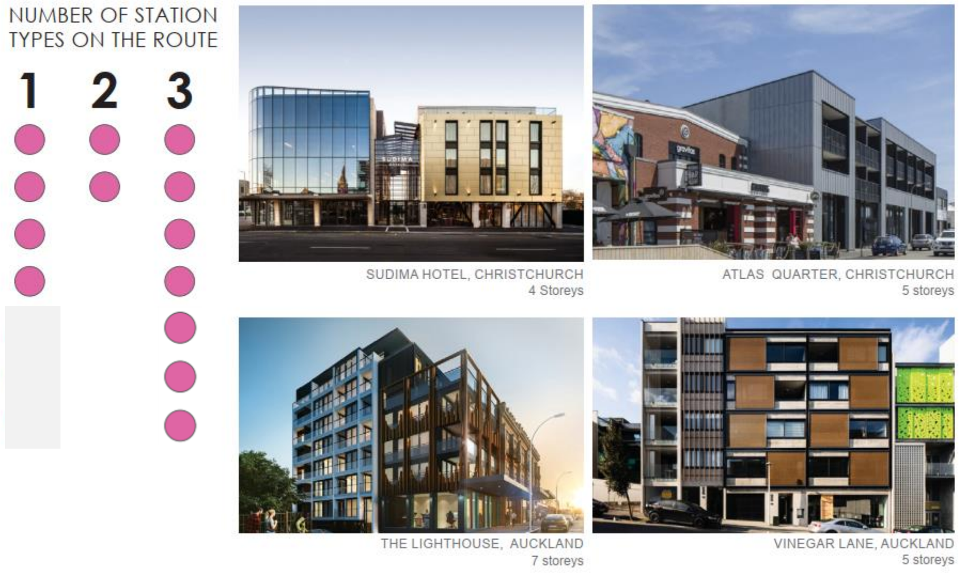


Phase D2: Demand for travel on street running - corridor focus scenario



Summary: Phase D2

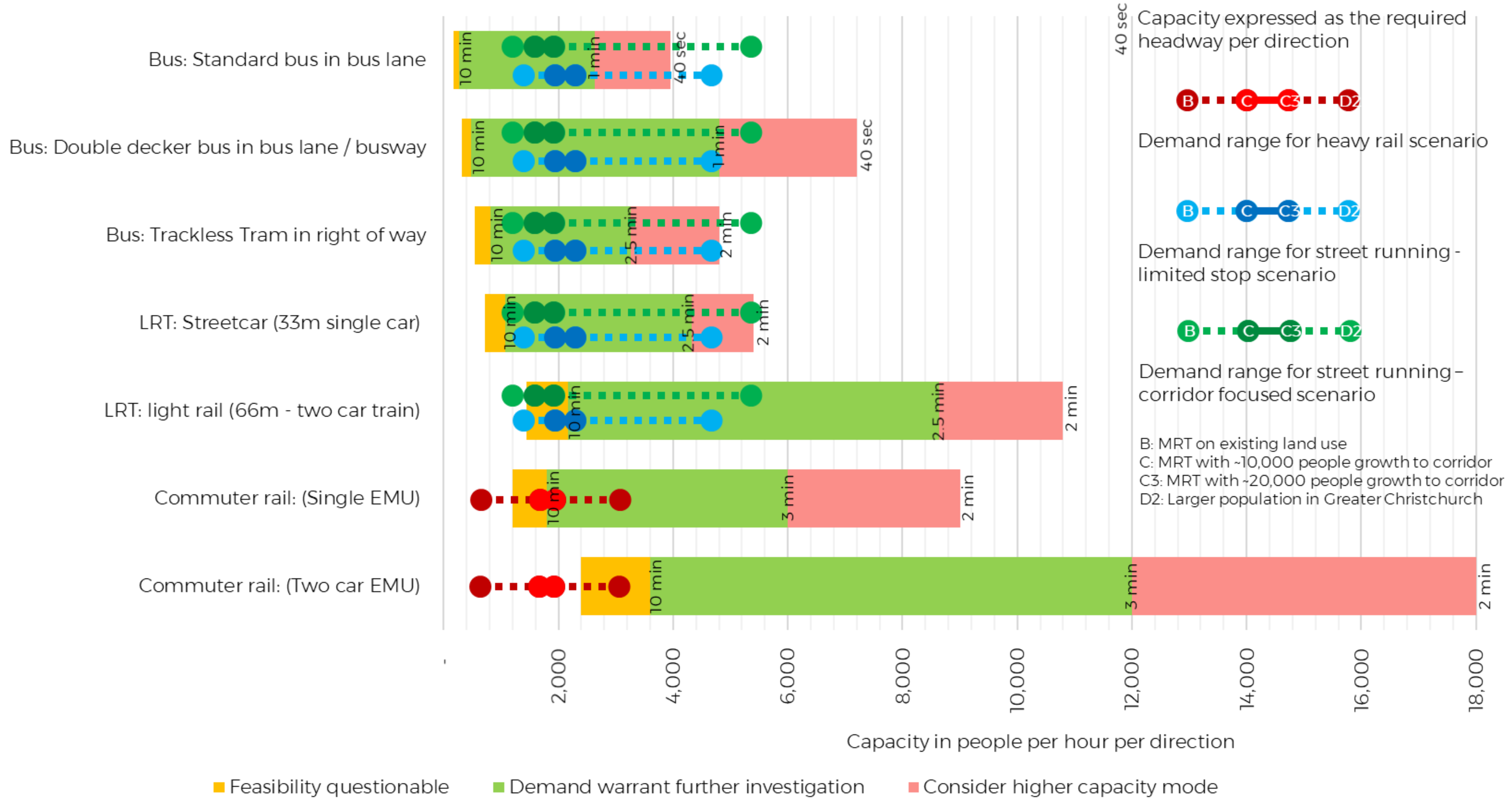
- Taking up land-use opportunity along the heavy rail route option would be a significant departure from current land-use plans and would structurally re-orient parts of the city to provide new KACs and anchors/activity generators as well as residential growth.
- It would also require relocation of some current industrial activities to peripheral urban areas in order to unlock the potential to create high density mixed use development on sites currently used for freight and rail logistics functions.
- The demand modelling indicates a single EMU at 7.5 min headways would provide enough capacity for the northern corridor. Demand on the south-western corridor would exceed this capacity and requires consideration of either larger vehicles (double EMUs) or higher frequencies.
- The Street Running Corridor Focused route has the most stations and as a result can support the greatest increase in population, tapping into a greater population pool.
- This corridor also has the benefit of aligning with more key destinations, including Key Activity Centres which will be important in promoting greater accessibility to employment centres and establishing a more defined urban form for the city.
- This scenario also indicates higher demand along the south-western corridor when compared to the northern corridor. Demand on the south-western corridor will exceed the capacity provided through a 33m light rail vehicle at 5 min headways. The ability to increase capacity is available through increasing the light rail vehicle length (66m long). The headway could also be optimised further, but this will depend on the ability to achieve signal priority through the street running operations.
- The Limited Stops scenario will exceed the capacity provided through double decker buses at 3 min headways. The demand implies a bus frequency of 1 double decker per minute from each corridor (north and south-west). This will place considerable pressure on the central city to accommodate that volume of buses, in addition to frequent services from other locations.
- This scenario requires further analysis on the vehicle technology to be used to ensure future proofing as the city grows. Options exist through trackless tram or advanced buses that enable higher people carrying capacity per vehicle.
- The chart on the next page overlays the modelled demands for the various scenarios explored in this report against capacities and operational conditions in rapid transit schemes from other cities.
- The Boffa Miskell report advises that opportunities exist for each corridor to optimise station locations and also consider the potential for additional stations, other than those assumed in this report.
- These optimised station locations could unlock greater areas of developable land, achieve better land-use integration and connect better with the wider public transport network.
- Further exploration and refinement of optimisation opportunities and station locations will be explored at the next stage of the Business Case process.
- This sensitivity test shows significantly higher ridership on the rapid transit when compared to the Phase C analysis. It indicates the importance of land-use within the station catchment to the success of rapid transit investment.
- The ongoing rapid transit work will, therefore, require close alignment with the ongoing spatial planning work stream – ensuring it informs and is informed by land-use decisions.



Extract from Land Use Integration Analysis Report (Boffa Miskell) illustrating densities ranging from 70-150 hh/Ha

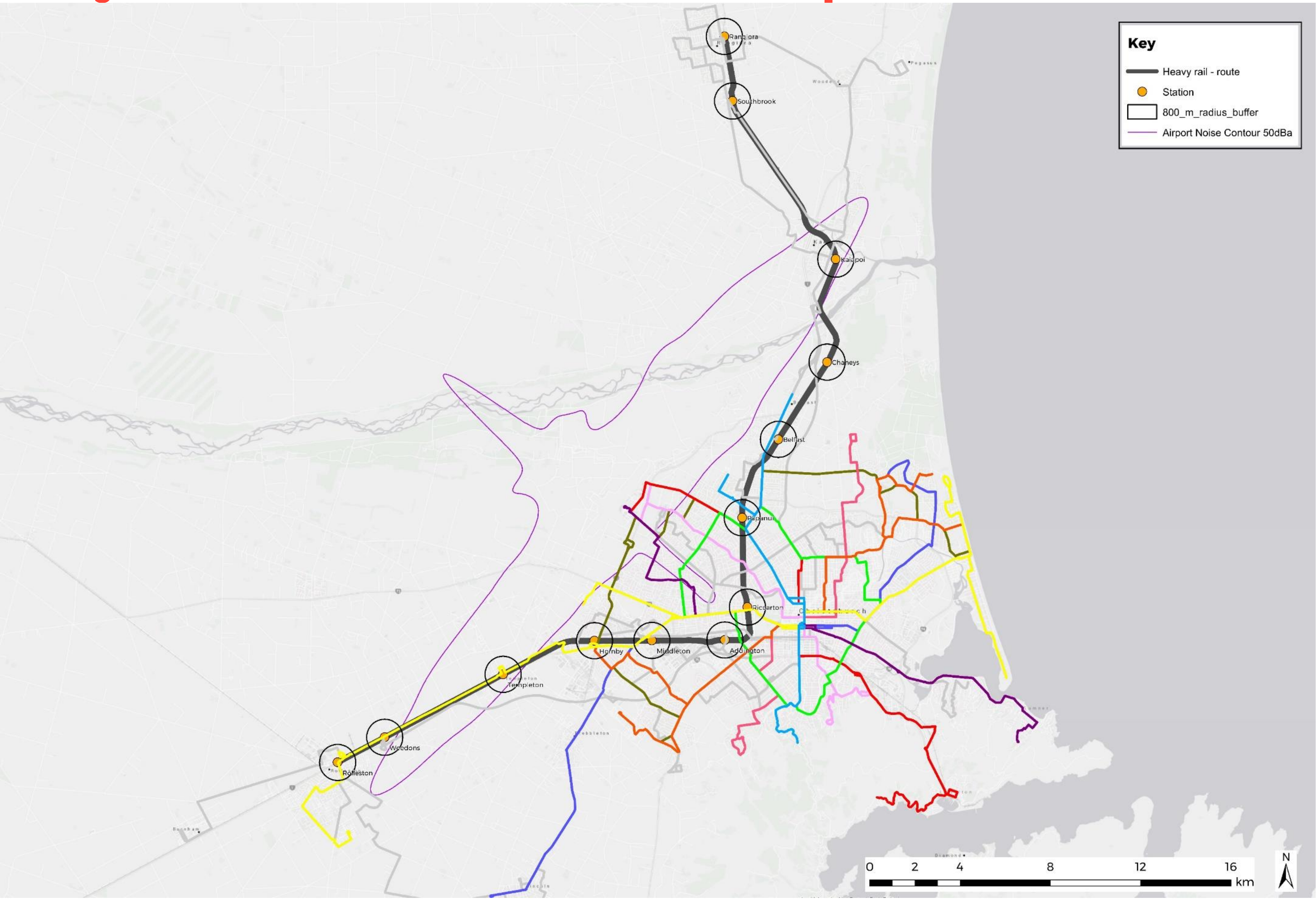
Summary: Rapid Transit Demand (Phase B,C1,C3 and D2)

Demand vs capacity for Rapid Transit Corridor Scenarios

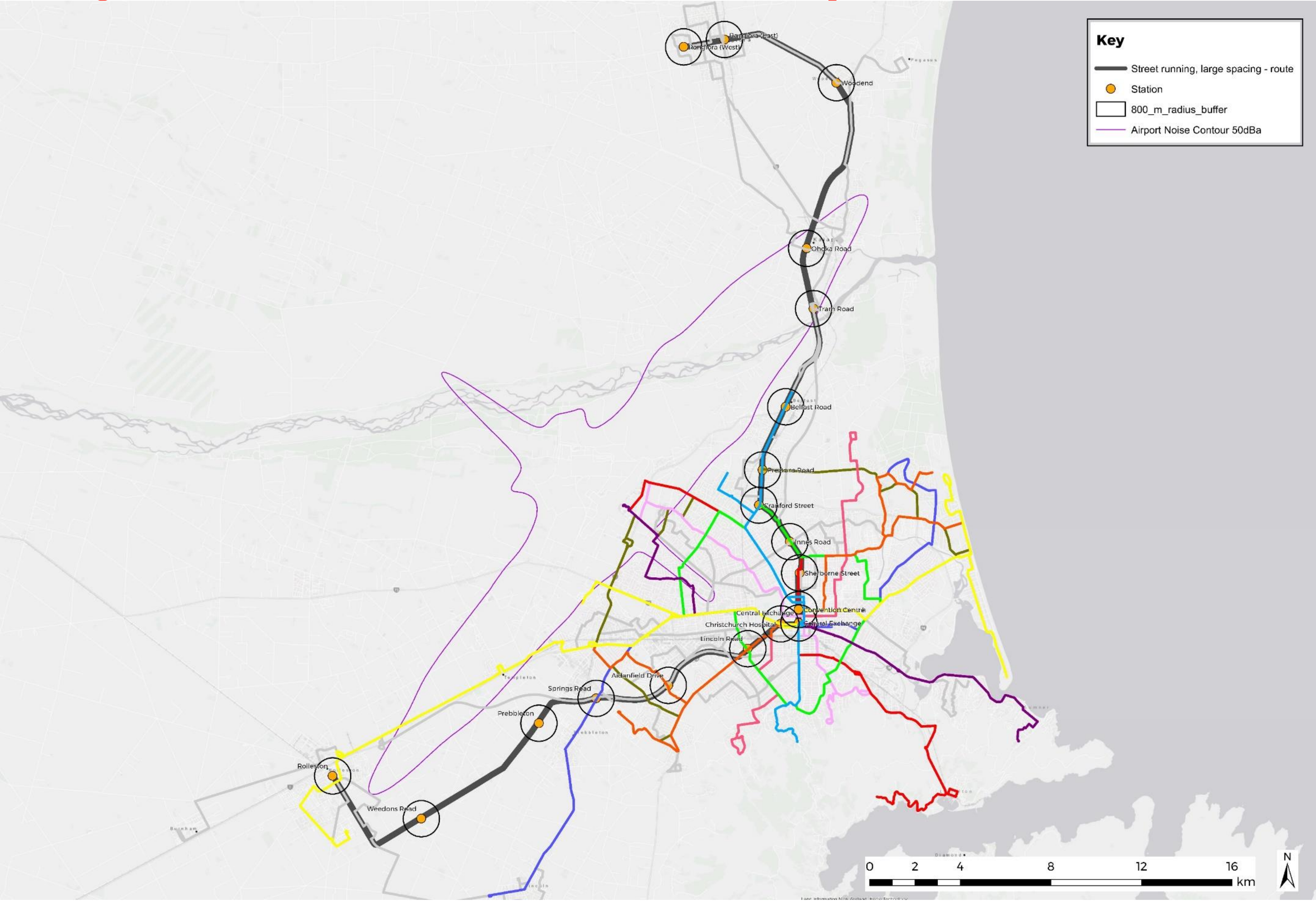


Appendices

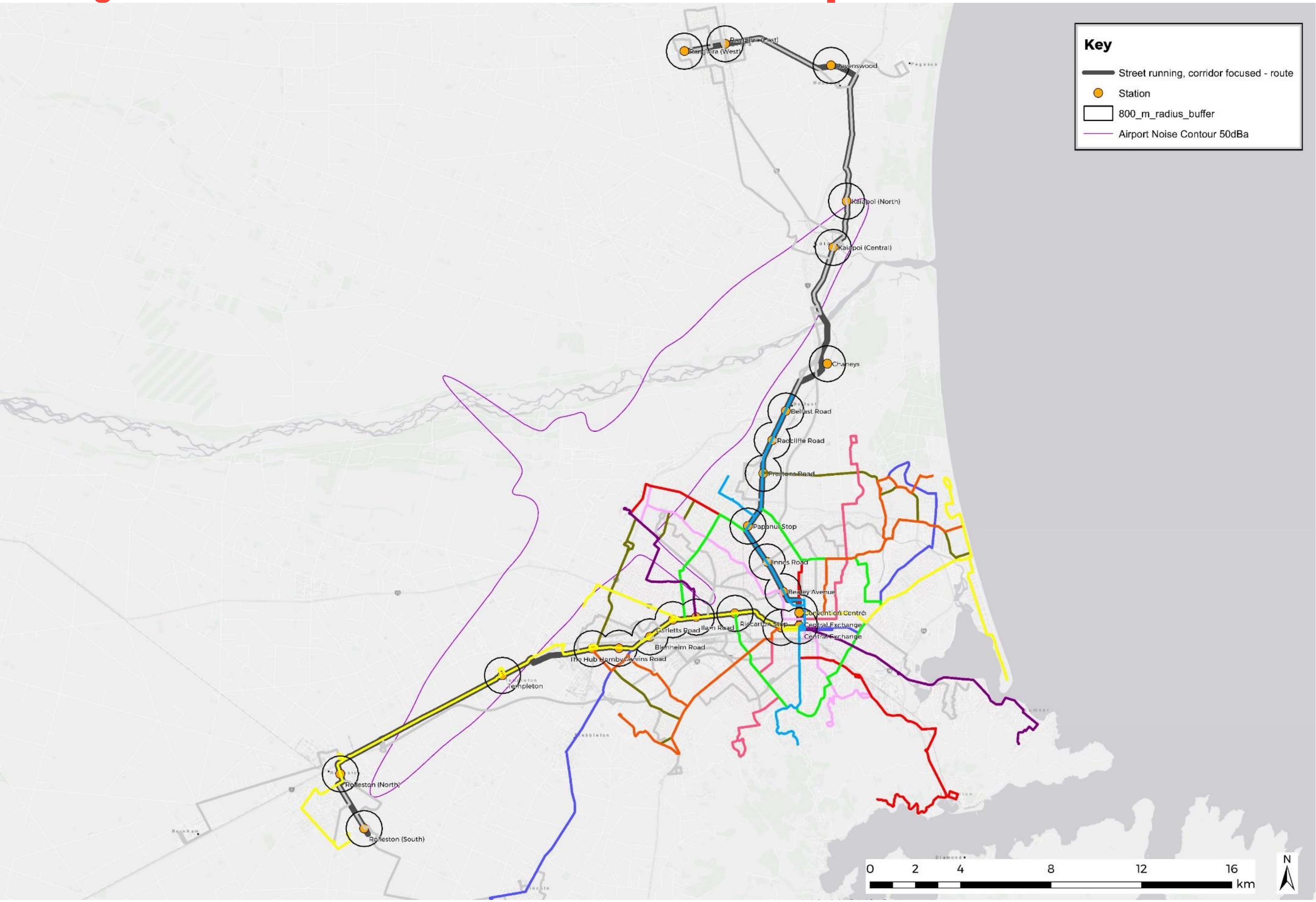
A1: Route layout and station location assumptions



A1: Route layout and station location assumptions



A1: Route layout and station location assumptions



A2: Growth assumptions

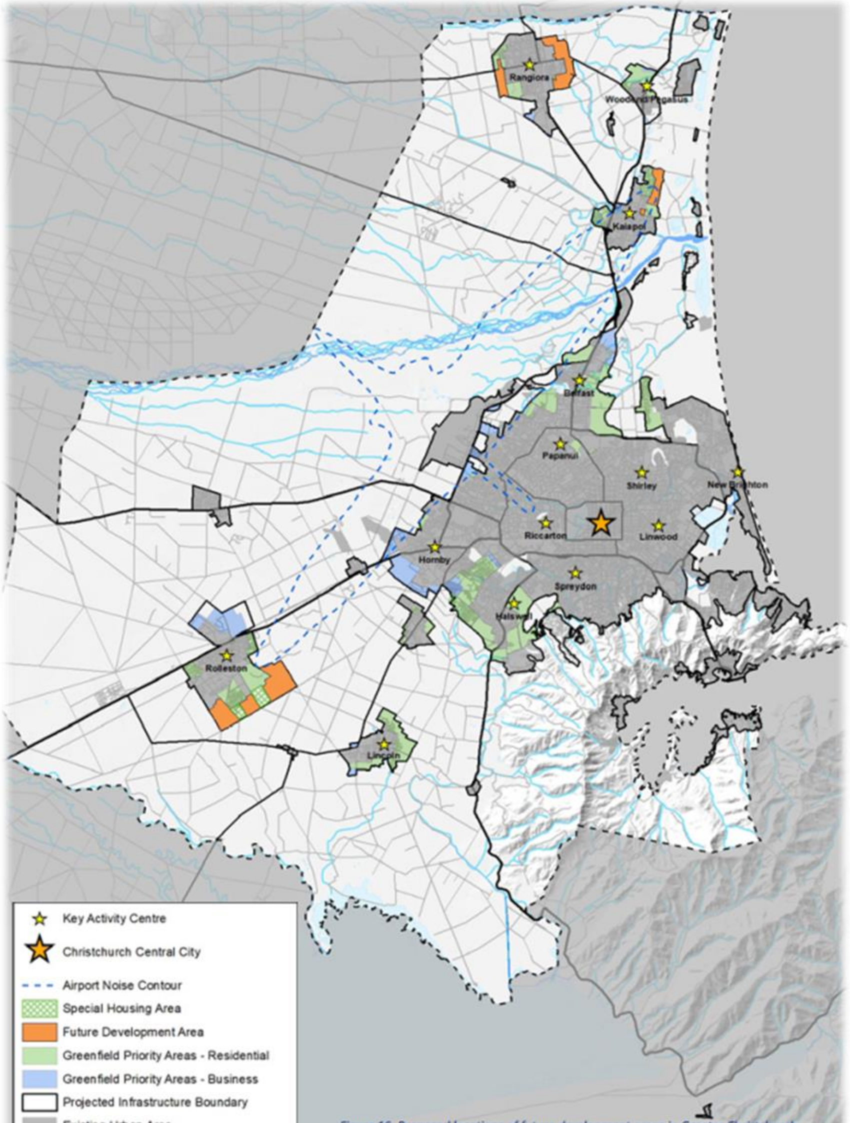
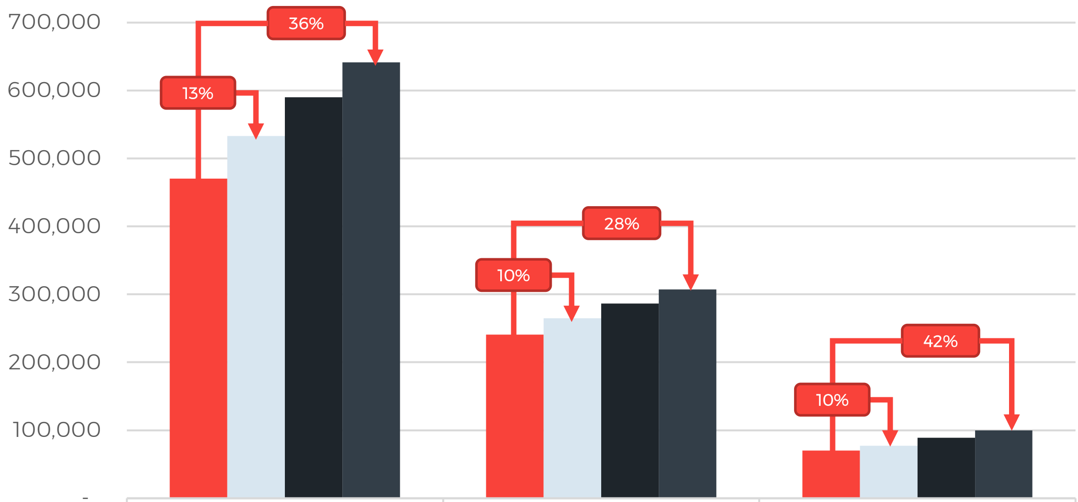


Figure 16: Proposed locations of future development areas in Greater Christchurch. While it is intended Our Space provides some direction to inform future RMA processes, Figure 16 is indicative only

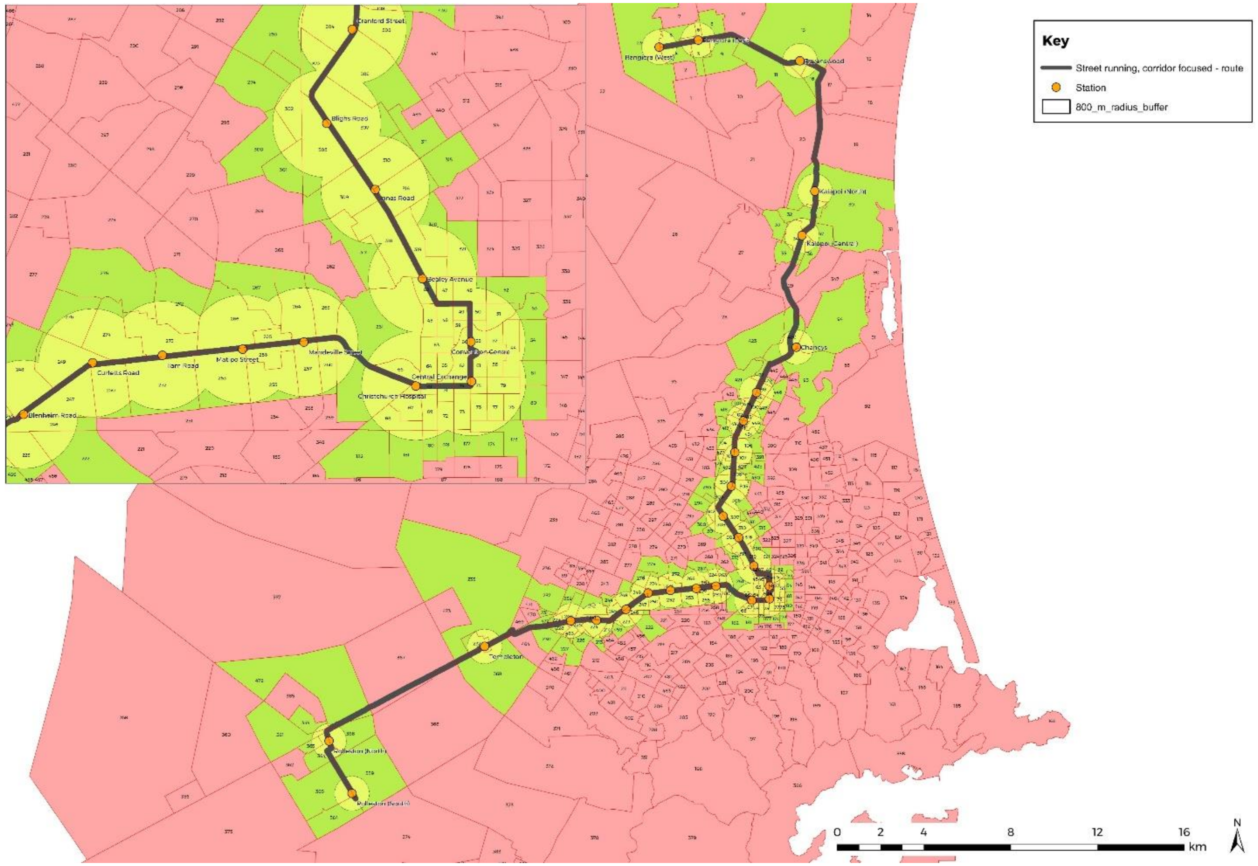
- Between 2018 and 2048, the population in the Greater Christchurch Region is projected to grow by 36% from 470,000 to 641,000.
- Employment is forecast to grow by 28% from 240,000 to 307,000 by 2048.
- Student roll is forecast to grow by 42% from 70,000 in 2018 to 100,000 by 2048.

Greater Christchurch forecasted growth



	Population	Employment	Student
2018	470,030	240,586	70,218
2028	533,015	264,805	77,280
2038	590,130	286,322	88,959
2048	641,218	307,099	99,998

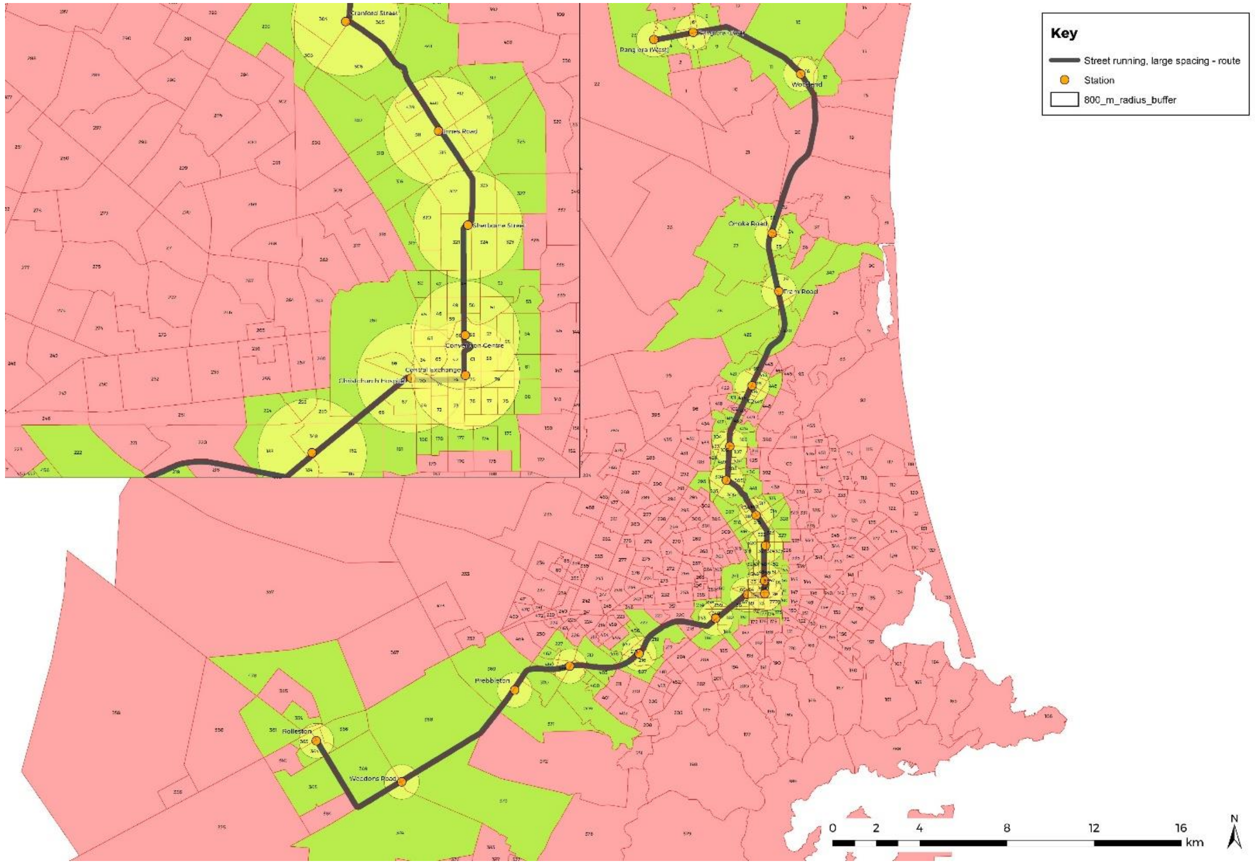
A2: Growth assumptions along street running corridor



NORTH					
	ESTRESPOP	Workers	Students	TOTALHH	EMPTOT
2018	75,304	38,606	13,752	30,252	30,624
2028	88,571	45,333	15,985	36,348	31,928
2038	99,772	50,813	17,481	41,651	34,146
2048	109,365	55,419	18,672	46,241	36,571
2048-C	114,246	57,881	19,489	48,328	38,223
2048-D2	263,057	133,066	45,643	110,522	57,189

SOUTHWEST					
	ESTRESPOP	Workers	Students	TOTALHH	EMPTOT
2018	61,309	31,896	13,836	22,407	44,688
2028	73,108	38,478	16,365	26,635	44,839
2038	79,654	42,022	17,363	29,542	48,113
2048	86,388	45,714	18,360	32,719	51,593
2048-C	89,580	47,413	19,023	33,937	53,206
2048-D2	254,208	132,688	51,760	97,567	80,680

A2: Growth assumptions along large spacing street running corridor



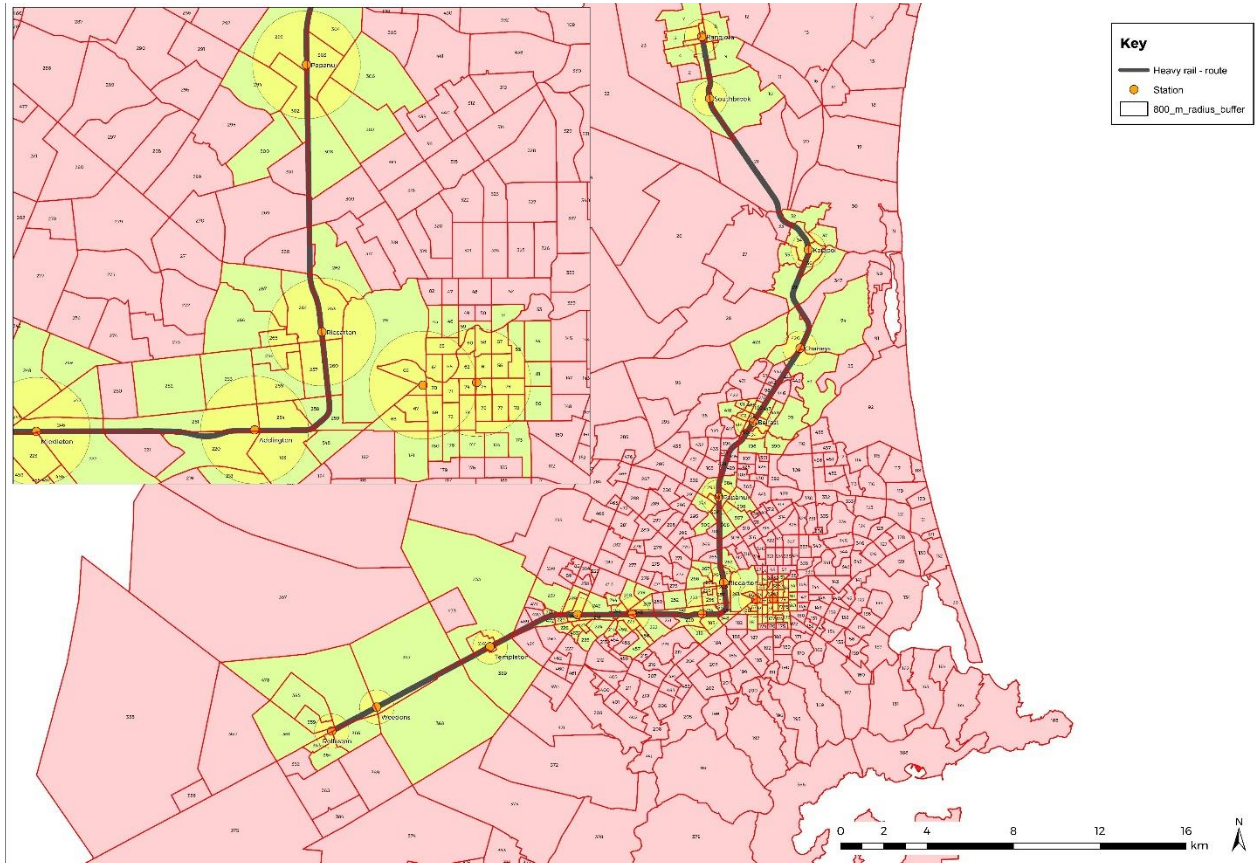
NORTH

	ESTRESPOP	Workers	Students	TOTALHH	EMPTOT
2018	73,963	38,496	13,292	30,059	26,812
2028	86,655	45,040	15,347	35,965	27,891
2038	96,838	50,107	16,596	40,880	29,888
2048	105,491	54,328	17,544	45,120	32,086
2048-C	111,607	57,474	18,558	47,740	33,989
2048-D2	181,230	92,752	29,156	79,245	44,589

SOUTHWEST

	ESTRESPOP	Workers	Students	TOTALHH	EMPTOT
2018	39,587	21,539	8,637	14,412	27,821
2028	55,577	30,474	12,006	20,373	28,465
2038	62,624	34,196	13,036	23,585	30,953
2048	70,410	38,375	14,258	27,245	33,547
2048-C	74,634	40,678	15,113	28,879	35,142
2048-D2	177,696	95,434	36,319	67,826	46,619

A2: Growth assumptions along heavy rail corridor



NORTH					
	ESTRESPOP	Workers	Students	TOTALHH	EMPTOT
2018	50,674	25,327	9,450	20,055	21,800
2028	57,150	28,377	10,622	23,334	22,709
2038	63,269	31,122	11,468	26,444	23,986
2048	68,413	33,380	12,117	29,113	25,362
2048-C	71,834	35,049	12,723	30,568	26,122
2048-D2	92,627	46,149	17,755	37,807	28,029

SOUTHWEST					
	ESTRESPOP	Workers	Students	TOTALHH	EMPTOT
2018	41,419	21,593	8,978	15,359	47,873
2028	43,188	22,593	9,132	16,078	46,940
2038	47,366	24,831	9,741	17,885	50,352
2048	50,812	26,717	10,154	19,506	53,662
2048-C	53,352	28,053	10,662	20,482	55,271
2048-D2	100,640	55,248	19,812	38,057	59,305

A3: Extract from Land-use integration analysis report (Boffa Miskell)

ROUTE CHARACTER

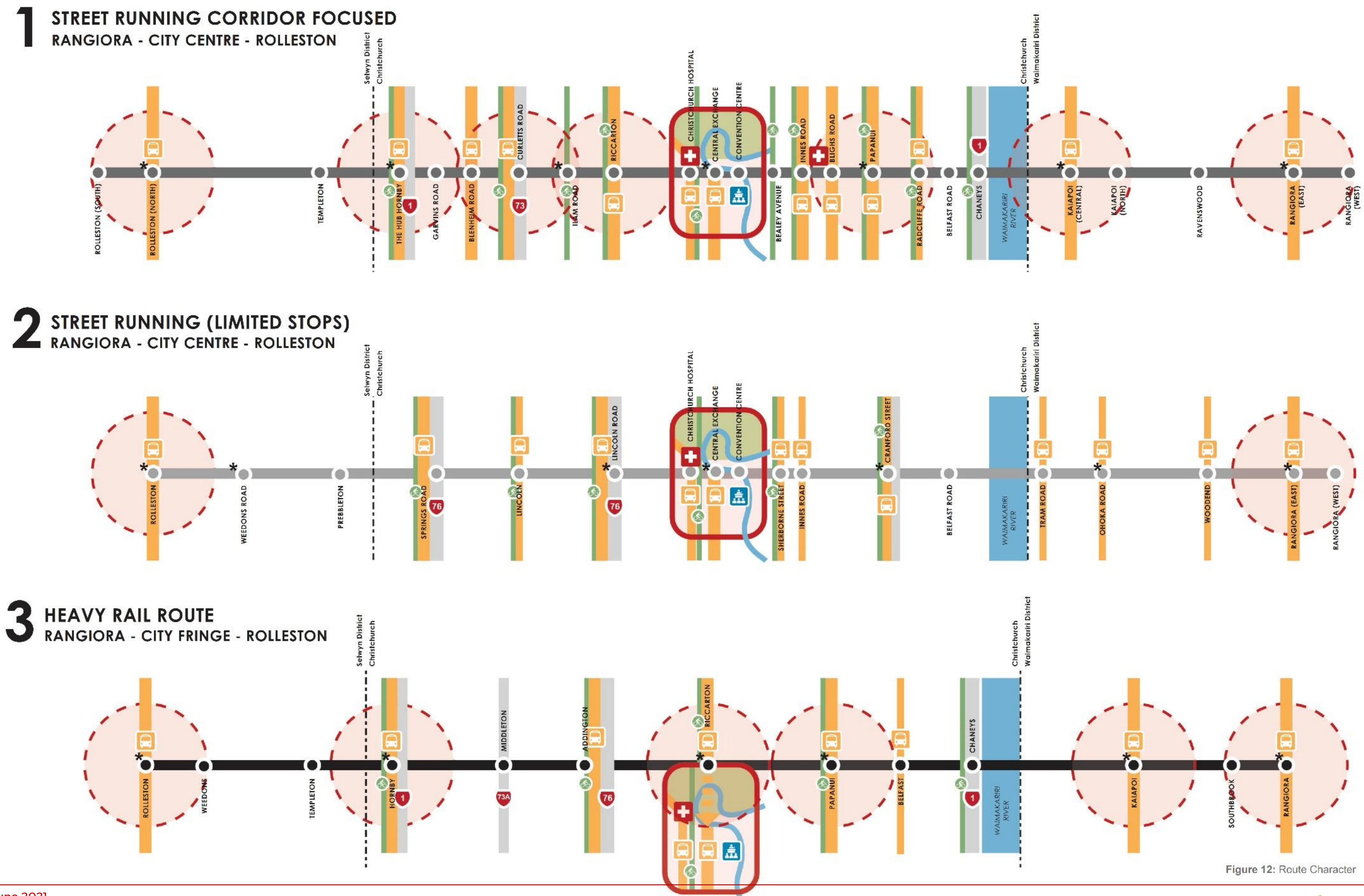
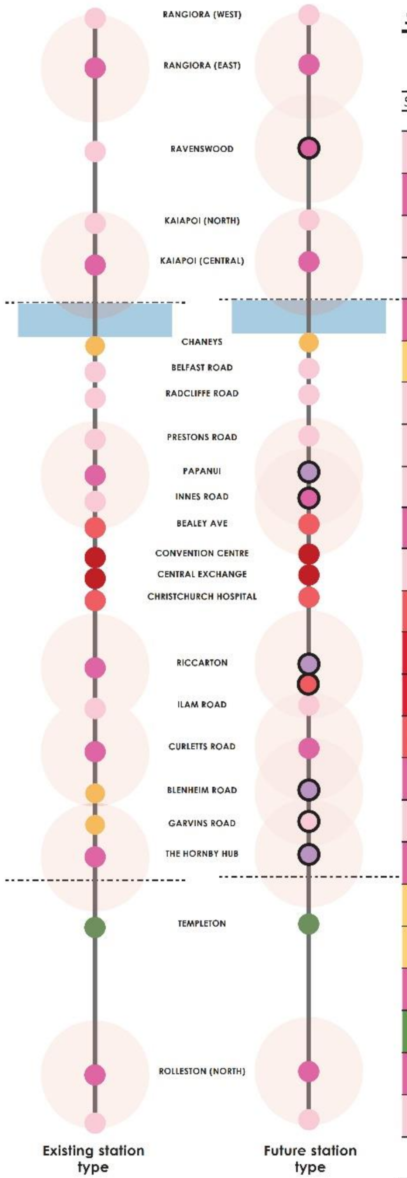


Figure 12: Route Character

1 STREET RUNNING CORRIDOR FOCUSED



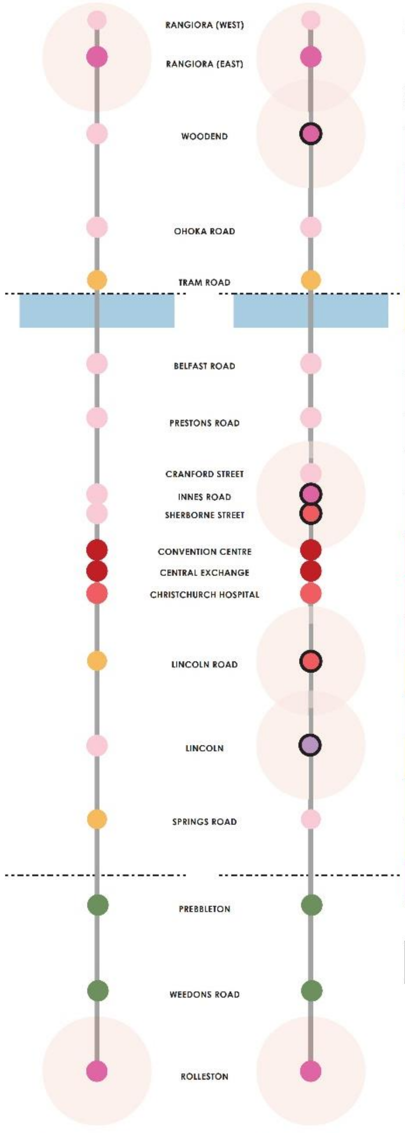
Street Running Corridor Focus

Station and Station Type		Scenario A: 2048 Do-Min		Scenario C: 2048 + 10,000 people into the corridor		Future Station Type	Scenario D: 2048 + 3 x different density scenarios					
							D1: 50 hh/ ha		D2: 70 hh/ ha		D3: 150 hh/ ha	
		Household size		Household size			Household size		Household size		Household size	
		1.8	2.4	1.8	2.4		1.8	2.4	1.8	2.4	1.8	2.4
Rangiora (West)	HH/Ha	25	33	27	35	50 hh/ha						
	Population Range	3,914	5,219	4,319	5,624		12,006	16,008	17,723	23,630	40,613	54,151
Rangiora (East)	HH/Ha	27	35	30	39	150 hh/ha						
	Population Range	3,924	5,232	4,424	5,732		11,365	15,154	16,677	22,236	37,948	50,597
Ravenswood	HH/Ha	2	3	4	5	70 hh/ha						
	Population Range	315	420	720	825		14,297	19,063	20,239	26,986	43,978	58,637
Kaiapoi (North)	HH/Ha	24	32	32	40	50 hh/ha						
	Population Range	1,148	1,531	1,553	1,936		3,697	4,930	5,429	7,238	12,370	16,493
Kaiapoi (Central)	HH/Ha	14	19	19	24	70 hh/ha						
	Population Range	1,446	1,928	1,946	2,428		7,544	10,058	11,205	14,940	25,808	34,411
Chaneys	HH/Ha	-	-	2	2	Industrial Employment area						
	Population Range	-	-	95	95		4,761	6,348	6,660	8,880	14,272	19,030
Belfast Road	HH/Ha	27	36	33	42	50 hh/ha						
	Population Range	1,757	2,342	2,161	2,747		4,657	6,209	6,993	9,324	16,362	21,816
Radcliffe Road	HH/Ha	28	37	32	41	50 hh/ha						
	Population Range	3,019	4,026	3,424	4,431		7,130	9,506	10,940	14,587	26,168	34,891
Prestons Road	HH/Ha	28	37	31	40	50 hh/ha						
	Population Range	3,859	5,146	4,264	5,551		8,847	11,796	13,869	18,492	33,919	45,226
Papanui	HH/Ha	33	45	37	48	TOD Station Type 150+ hh/ha						
	Population Range	4,694	6,259	5,194	6,759		9,248	12,331	14,234	18,979	34,223	45,631
Innes Road	HH/Ha	45	60	48	63	150 hh/ha (Merivale)						
	Population Range	5,980	7,973	6,384	8,378		7,853	10,471	12,596	16,795	31,613	42,151
Bealey Ave	HH/Ha	97	130	102	134	150 hh/ha						
	Population Range	10,236	13,648	10,736	14,148		4,586	6115.2	8,368	11,158	23,528	31,370
Convention Centre	HH/Ha	134	178	144	189	150 hh/ha						
	Population Range	8,625	11,500	9,315	12,190		3,521	4,694	5,850	7,800	15,147	20,196
Central Exchange	HH/Ha	22	30	33	40	150 hh/ha						
	Population Range	1,498	1,997	2,188	2,688		5,638	7,517	8,066	10,754	17,732	23,642
Christchurch Hospital	HH/Ha	27	36	36	45	150 hh/ha						
	Population Range	1,507	2,009	2,007	2,509		4,525	6,034	6,521	8,695	14,522	19,363
Riccarton	HH/Ha	57	75	61	79	TOD Station Type 150+ hh/ha						
	Population Range	6,873	9,164	7,373	9,664		6,107	8,143	10,496	13,994	28,006	37,342
Ilam Road	HH/Ha	34	45	37	49	50 hh/ha						
	Population Range	3,955	5,273	4,359	5,678		7,159	9,545	11,360	15,146	28,215	37,620
Curtletts Road	HH/Ha	28	38	32	42	70 hh/ha						
	Population Range	3,714	4,952	4,214	5,452		8,212	10,949	12,899	17,198	31,687	42,250
Blenheim Road	HH/Ha	11	15	12	16	TOD Station Type 150+ hh/ha						
	Population Range	1,677	2,236	1,772	2,331		11,480	15,307	16,749	22,332	37,823	50,431
Garvins Road	HH/Ha	15	20	15	20	50 hh/ha						
	Population Range	2,232	2,976	2,327	3,071		11,507	15,343	16,981	22,642	38,882	51,842
The Hornby Hub	HH/Ha	26	35	31	39	TOD Station Type 150+ hh/ha						
	Population Range	3,252	4,336	3,752	4,836		8,698	11,597	13,129	17,506	30,820	41,093
Templeton	HH/Ha	16	21	18	23	50 hh/ha						
	Population Range	1,194	1,592	1,384	1,782		6,914	9,218	9,677	12,902	20,740	27,653
Rolleston (North)	HH/Ha	13	17	16	21	150 hh/ha						
	Population Range	1,805	2,406	2,305	2,906		10,732	14308.8	15,786	21,048	35,978	47,971
Rolleston (South)	HH/Ha	8	10	11	13	50 hh/ha						
	Population Range	1,076	1,434	1,481	1,839		11,531	15374.4	16,472	21,962	36,236	48,314
						Growth Range	192,015	256,020	288,920	385,226	676,591	902,122

Corridor Growth Range	Scenario A 1.8	Scenario A 2.4	Scenario C 1.8	Scenario C 2.4
Corridor Growth Range	77,700	103,600	87,700	113,600

Corridor Growth Range (Densities based on station type)	1.8	2.4
Corridor Growth Range (Densities based on station type)	429,892	561,197

2 STREET RUNNING (LIMITED STOPS)



Existing station type

Future station type

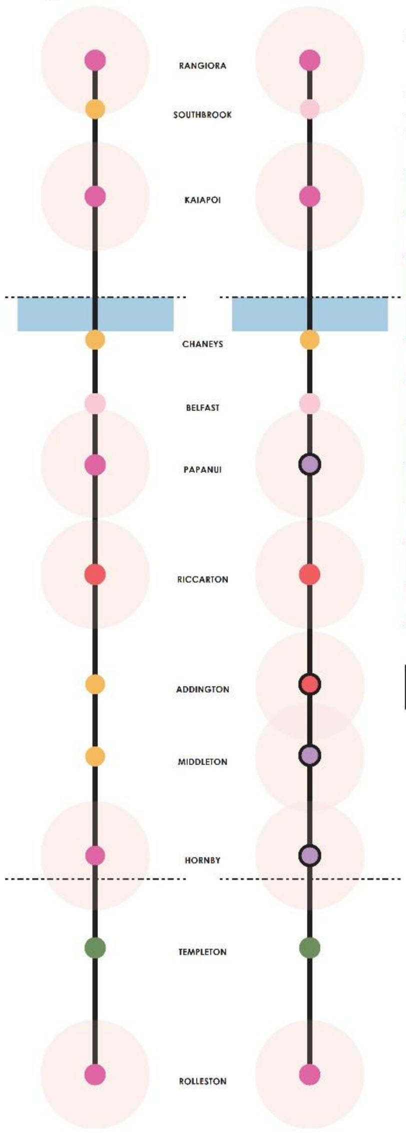
Street Running Limited Stops

Station and Station Type		Scenario A: 2048 Do-Min		Scenario C: 2048 + 10,000 people into the corridor		Future Station Type	Scenario D: 2048 + 3 x different density scenarios					
							D1: 50 hh/ ha		D2: 70 hh/ ha		D3: 150 hh/ ha	
		Household size		Household size			Household size		Household size		Household size	
		1.8	2.4	1.8	2.4		1.8	2.4	1.8	2.4	1.8	2.4
Rangiora (West)	HH/Ha	25	33	28	36	50 hh/ha						
	Population Range	3,914	5,219	4,477	5,782		11,365	15,154	16,677	22,236	37,948	50,597
Rangiora (East)	HH/Ha	27	35	31	40	150 hh/ha						
	Population Range	3,924	5,232	4,620	5,928		12,006	16,008	17,723	23,630	40,613	54,151
Woodend	HH/Ha	6	9	10	12	70 hh/ha						
	Population Range	1,059	1,412	1,622	1,975		13,597	18,130	19,543	26,057	43,349	57,799
Ohoka Road	HH/Ha	18	24	22	28	50 hh/ha						
	Population Range	2,592	3,456	3,155	4,019		10,750	14,333	15,860	21,146	36,295	48,394
Tram Road	HH/Ha	-	-	2	2	Industrial Employment area						
	Population Range	-	-	132	132		6,898	9,197	9,655	12,874	20,689	27,586
Belfast Road	HH/Ha	28	37	36	45	50 hh/ha						
	Population Range	1,761	2,348	2,324	2,911		4,579	6,106	6,880	9,173	16,105	21,473
Prestons Road	HH/Ha	28	37	32	41	50 hh/ha						
	Population Range	3,852	5,135	4,414	5,698		8,798	11,731	13,799	18,398	33,772	45,029
Cranford Street	HH/Ha	27	36	31	41	50 hh/ha						
	Population Range	3,494	4,658	4,057	5,221		8,764	11,686	13,284	17,712	31,378	41,837
Innes Road	HH/Ha	34	45	38	49	70 hh/ha						
	Population Range	4,777	6,369	5,340	6,932		8,615	11,486	13,658	18,211	33,836	45,115
Sherbourne Street	HH/Ha	80	106	84	111	150 hh/ha						
	Population Range	10,892	14,523	11,455	15,086		4,946	6595.2	9,850	13,133	29,489	39,319
Convention Centre	HH/Ha	134	179	149	194	150 hh/ha						
	Population Range	8,663	11,551	9,623	12,511		3,519	4,692	5,846	7,795	15,156	20,208
Central Exchange	HH/Ha	22	30	37	44	150 hh/ha						
	Population Range	1,498	1,997	2,458	2,958		5,639	7,519	8,069	10,759	17,732	23,642
Christchurch Hospital	HH/Ha	28	37	41	50	150 hh/ha						
	Population Range	1,523	2,030	2,218	2,725		4,460	5,947	6,437	8,582	14,315	19,087
Lincoln Road	HH/Ha	49	65	50	67	70 hh/ha						
	Population Range	4,888	6,518	5,021	6,650		5,922	7,896	9,511	12,682	23,872	31,829
Lincoln	HH/Ha	25	33	31	40	TOD Station Type 150+ hh/ha						
	Population Range	2,045	2,727	2,608	3,290		5,557	7,409	8,519	11,359	20,390	27,187
Springs Road	HH/Ha	0	0	2	2	50 hh/ha						
	Population Range	30	40	162	172		8,001	10,668	11,212	14,950	24,046	32,062
Prebbleton	HH/Ha	2	2	3	4	50 hh/ha						
	Population Range	289	386	554	651		16,601	22,135	23,265	31,020	49,912	66,550
Weedons Road	HH/Ha	-	-	1	1	50 hh/ha						
	Population Range	-	-	265	265		17,071	22,762	23,899	31,865	51,215	68,287
Rolleston	HH/Ha	14	19	20	24	150 hh/ha						
	Population Range	1,943	2,591	2,638	3,286		10,026	13368	14,881	19,841	34,304	45,739
						Growth Range	167,116	222,821	248,567	331,423	574,418	765,890

Corridor Growth Range	Scenario A 1.8	Scenario A 2.4	Scenario C 1.8	Scenario C 2.4
Corridor Growth Range	57,144	76,192	67,144	86,192

Corridor Growth Range (Densities based on station type)	1.8	2.4
Corridor Growth Range (Densities based on station type)	307,541	410,054

3 HEAVY RAIL ROUTE



Existing station type

Future station type

Heavy Rail Corridor

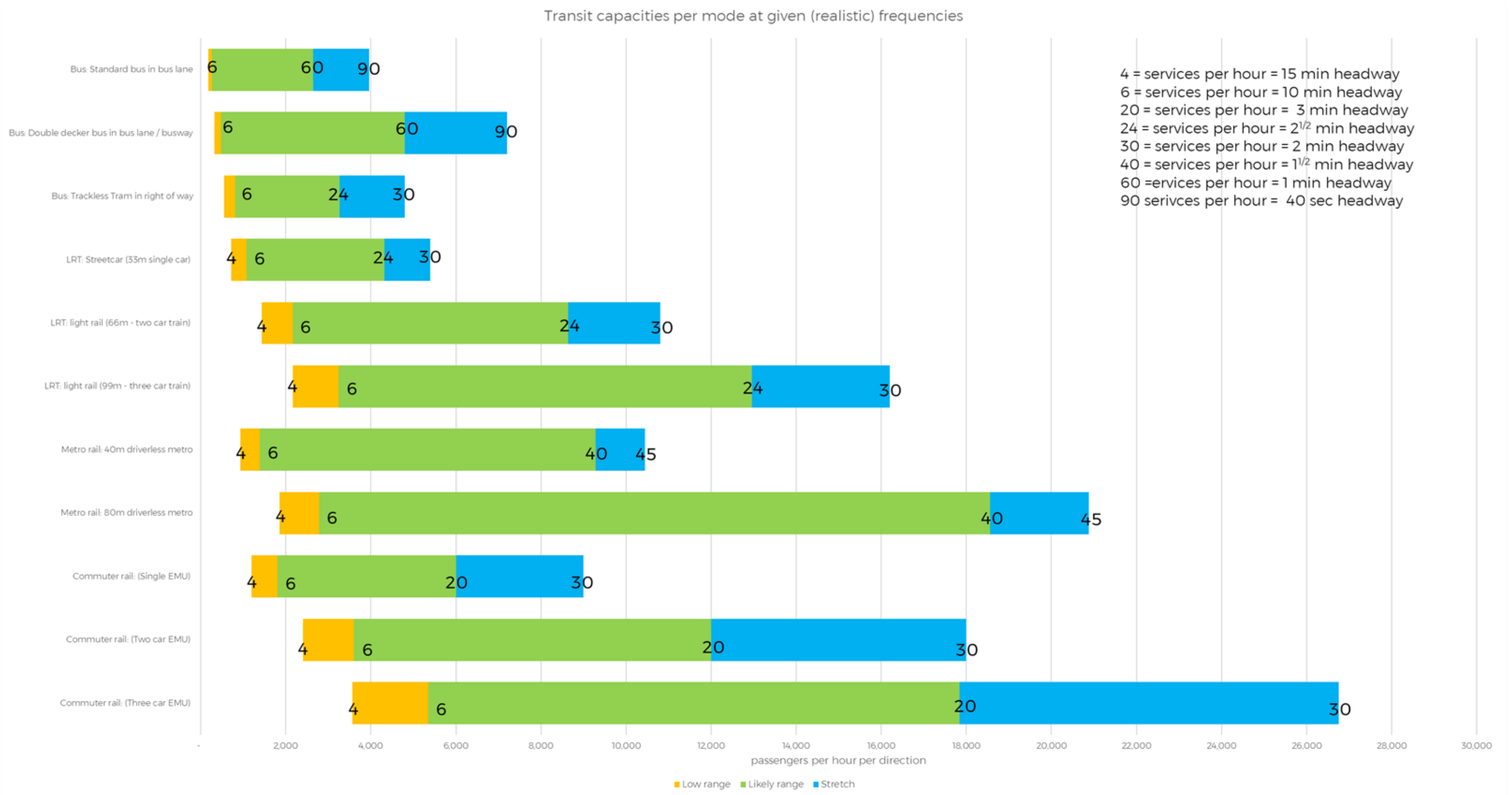
Station and Station Type		Scenario A: 2048 Do-Min		Scenario C: 2048 + 10,000 people into the corridor		Future Station Type	Scenario D: 2048 + 3 x different density scenarios					
							D1: 50 hh/ ha		D2: 70 hh/ ha		D3: 150 hh/ ha	
		Household size		Household size			Household size		Household size		Household size	
		1.8	2.4	1.8	2.4		1.8	2.4	1.8	2.4	1.8	2.4
Rangiora	HH/Ha	22	29	31	38	150 hh/ha						
	Population Range	3,342	4,456	4,671	5,785		11,367	15,156	16,560	22,080	37,336	49,781
Southbrook	HH/Ha	1	2	3	3	50 hh/ha						
	Population Range	237	316	490	569		9,164	12,218	12,929	17,239	27,994	37,325
Kaiapoi	HH/Ha	12	17	28	33	70 hh/ha						
	Population Range	1,021	1,361	2,350	2,690		5,204	6,938	7,735	10,313	17,843	23,791
Chaneys	HH/Ha	-	-	5	5	Industrial Employment area						
	Population Range	-	-	253	253		2,992	3,989	4,185	5,580	8,971	11,962
Belfast	HH/Ha	32	43	43	54	50 hh/ha						
	Population Range	3,281	4,375	4,357	5,451		6,757	9,010	10,280	13,706	24,368	32,491
Papanui	HH/Ha	31	41	40	51	TOD Station Type 150+ hh/ha						
	Population Range	4,358	5,811	5,687	7,140		8,600	11,467	13,370	17,827	32,438	43,250
Riccarton	HH/Ha	54	72	69	87	150 hh/ha						
	Population Range	4,966	6,621	6,295	7,950		5,047	6,730	8,350	11,134	21,537	28,716
Addington	HH/Ha	22	30	25	32	150 hh/ha						
	Population Range	2,236	2,982	2,489	3,235		4,117	5,489	6,475	8,633	15,908	21,211
Middleton	HH/Ha	7	10	9	12	TOD Station Type 150+ hh/ha						
	Population Range	1,022	1,363	1,275	1,616		4,907	6,542	7,292	9,722	16,803	22,404
Hornby	HH/Ha	24	33	27	35	TOD Station Type 150+ hh/ha						
	Population Range	2,907	3,876	3,160	4,129		5,359	7,145	8,307	11,076	20,088	26,784
Templeton	HH/Ha	14	19	20	25	50 hh/ha						
	Population Range	1,154	1,539	1,661	2,046		7,385	9,847	10,337	13,783	22,153	29,537
Rolleston	HH/Ha	6	9	15	18	150 hh/ha						
	Population Range	959	1,278	2,288	2,607		4,916	6554.4	7,283	9,710	16,745	22,327
						Growth Range	75,814	101,086	113,103	150,804	262,184	349,579

Corridor Growth Range	25,483	33,977	34,977	43,471

Corridor Growth Range (Densities based on station type)	194,888	259,850

A4: Capacity assumptions

Mode	lower bound assumptions	realistic upper bound asssumptions	stretch target assumptions
Car	arterial: 900 cars per arterial lane at 1.2 people per car.	motorway: 2,000 cars per motorway lane at 1.2 people per car	motorway: 2,000 cars per motorway lane at 1.4 people per car
Bicycle	based on 1 cyclist every 10 sec	based on 1 cyclist every 3 sec	based on 1 cyclist every 3 sec
Bus: Standard bus in bus lane	55 people per bus (80% full) running at 10 min freq.	55 people per bus (80% full) running at a bus a minute	55 people per bus (80% full) running at a bus every 40 sec
Bus: Double decker bus in bus lane / busw	100 people per DD bus (80% full) running at 10 min freq.	100 people per DD bus (80% full) running at a bus a minute	100 people per DD bus (80% full) running at a bus every 40 sec
Bus: Trackless Tram in right of way	170 people per ART bus (80% full) running at 10 min freq.	170 people per ART bus (80% full) running at a bus every 2.5 minut	200 people per ART bus (80% full) running at a bus every 2 minute
LRT: Streetcar (33m single car)	225 people per 33m LRV (80% full) running every 10 minutes	225 people per 33m LRV (80% full) running every 2.5 minutes	225 people per 33m LRV (80% full) running every 2 minutes
LRT: light rail (66m - two car train)	450 people per 2 car LRV (80% full) running every 10 minutes	450 people per 2 car LRV (80% full) running every 2.5 minutes	450 people per 2 car LRV (80% full) running every 2 minutes
LRT: light rail (99m - three car train)	675 people per 3 car LRV (80% full) running every 10 minutes	675 people per 3 car LRV (80% full) running every 2.5 minutes	675 people per 3 car LRV (80% full) running every 2 minutes
Metro rail: 40m driverless metro	290 people per 40m metro car (80% full) running every 10 minutes	290 people per 40m metro car (80% full) running every 90 second	290 people per 40m metro car (80% full) running every 80 seconds
Metro rail: 80m driverless metro	580 people per 40m metro car (80% full) running every 10 minutes	580 people per 40m metro car (80% full) running every 90 second	580 people per 40m metro car (80% full) running every 80 seconds
Commuter rail: (Single EMU)	375 people per two car EMU (80% full) running every 10 minutes	375 people per two car EMU (80% full) running every 3 minutes	375 people per two car EMU (80% full) running every 2 minutes
Commuter rail: (Two car EMU)	750 people per two car EMU (80% full) running every 10 minutes	750 people per two car EMU (80% full) running every 3 minutes	750 people per two car EMU (80% full) running every 2 minutes
Commuter rail: (Three car EMU)	1,115 people per three car EMU (80% full) running every 10 minutes	1,115 people per three car EMU (80% full) running every 3 minutes	1,115 people per three car EMU (80% full) running every 2 minutes

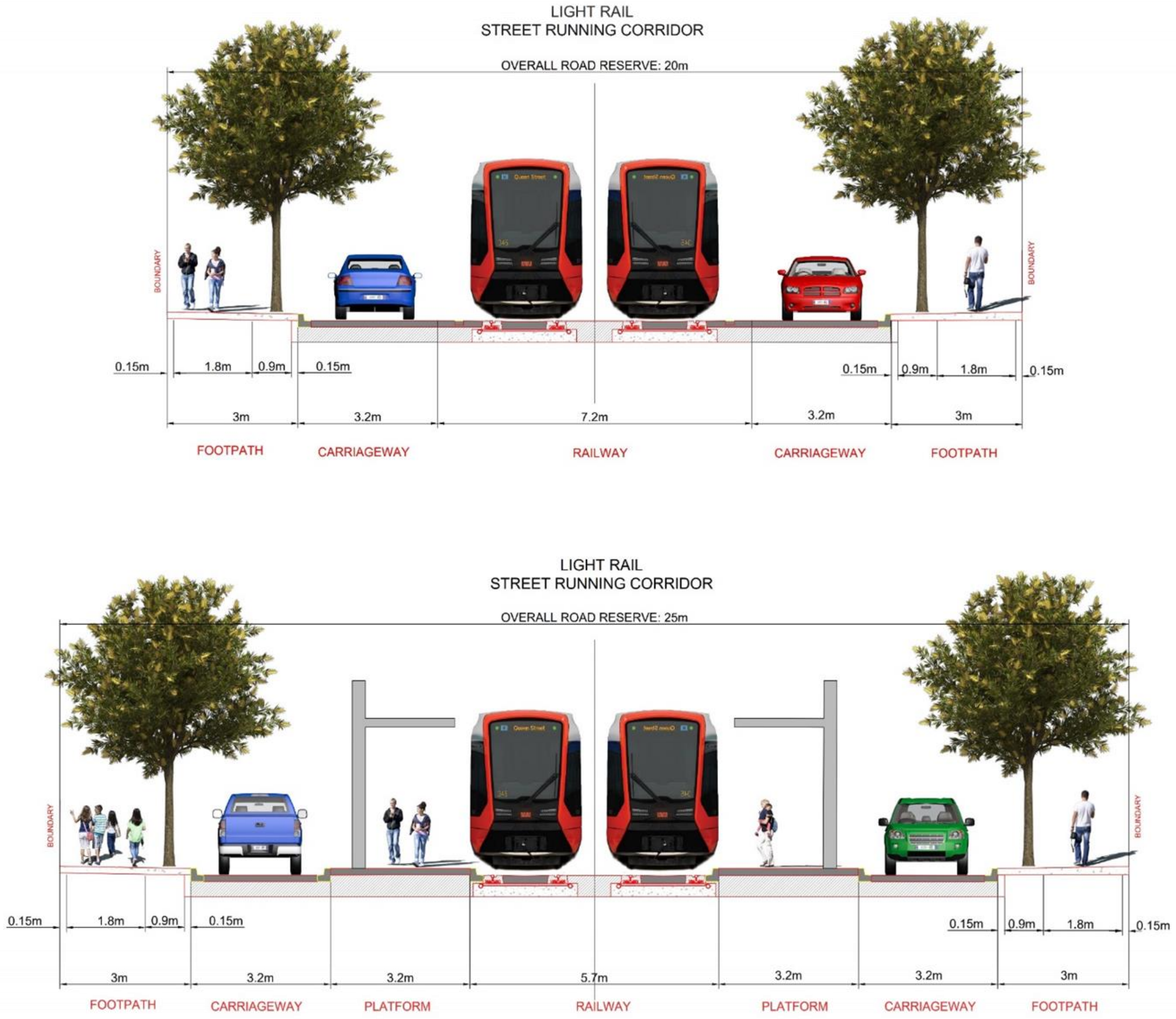


Mode / capacity considerations

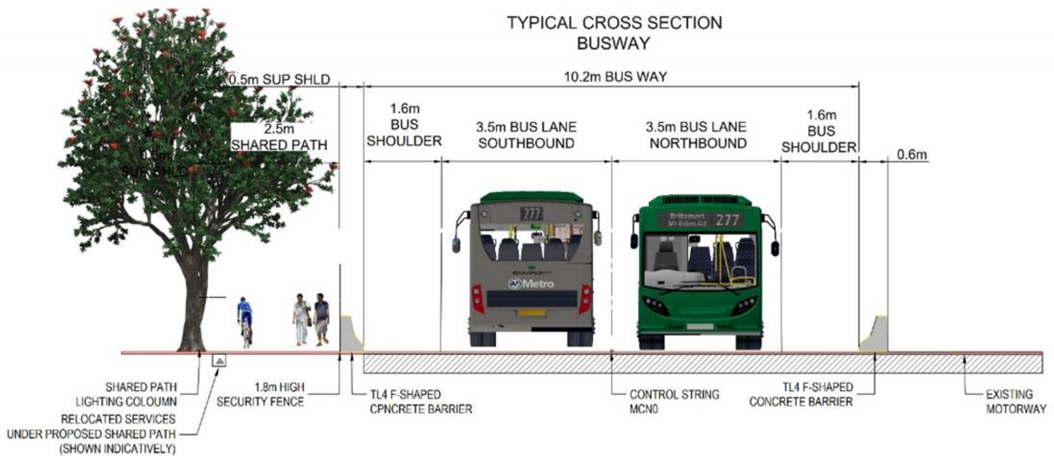
Provide initial implication of likely modes for consideration based on estimated end state demand.

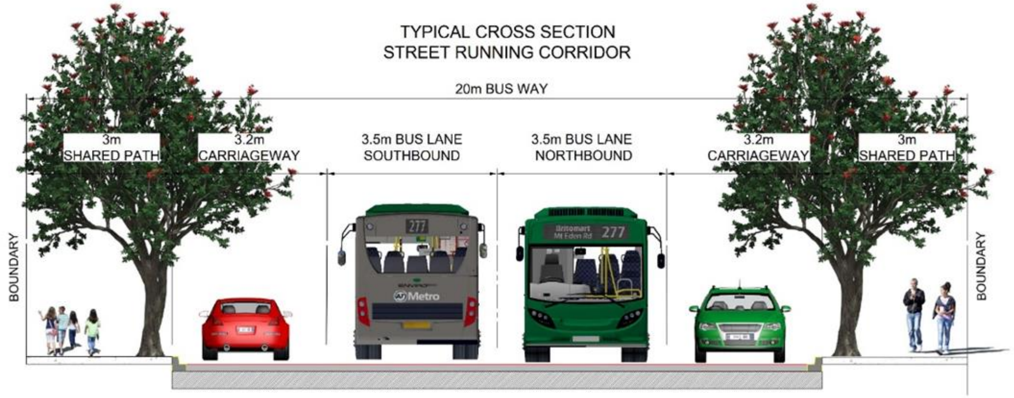
(Note rapid transit might require minimum of 10 minute headways i.e 6 services per hour)

A5: Typical cross sections

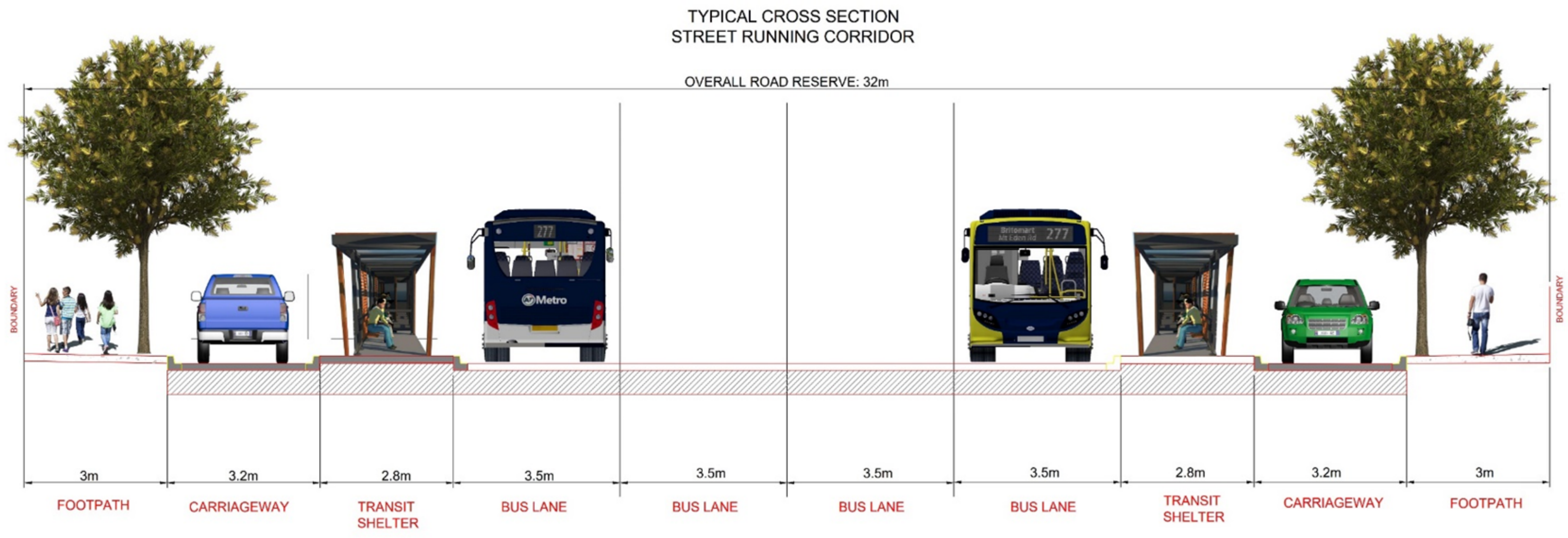


A5: Typical cross sections

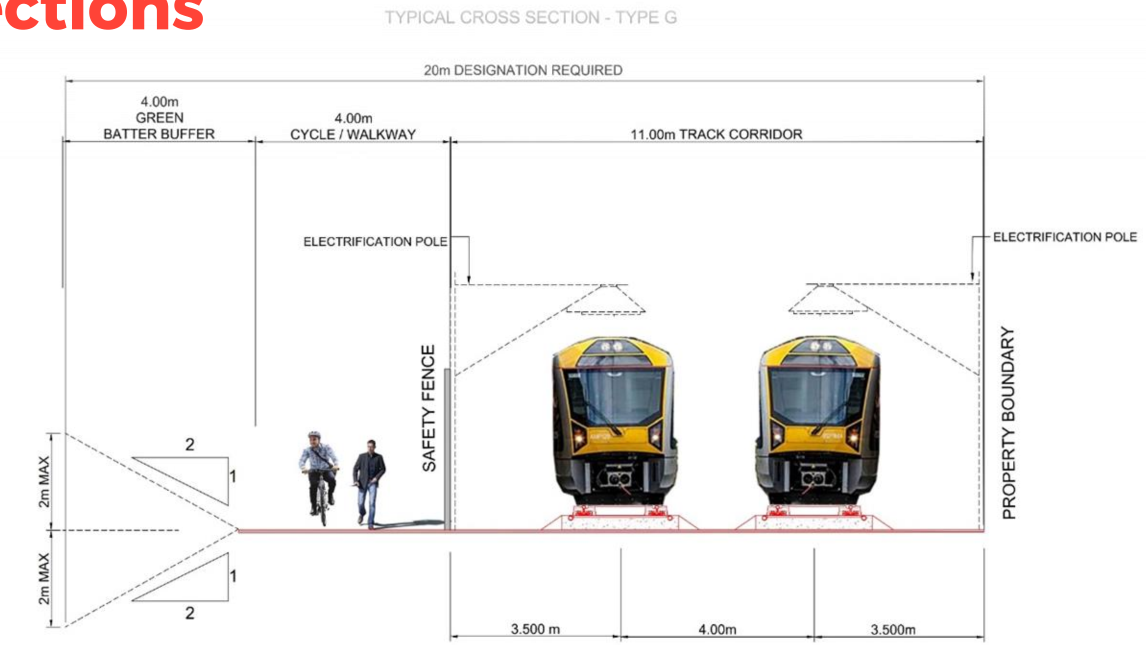


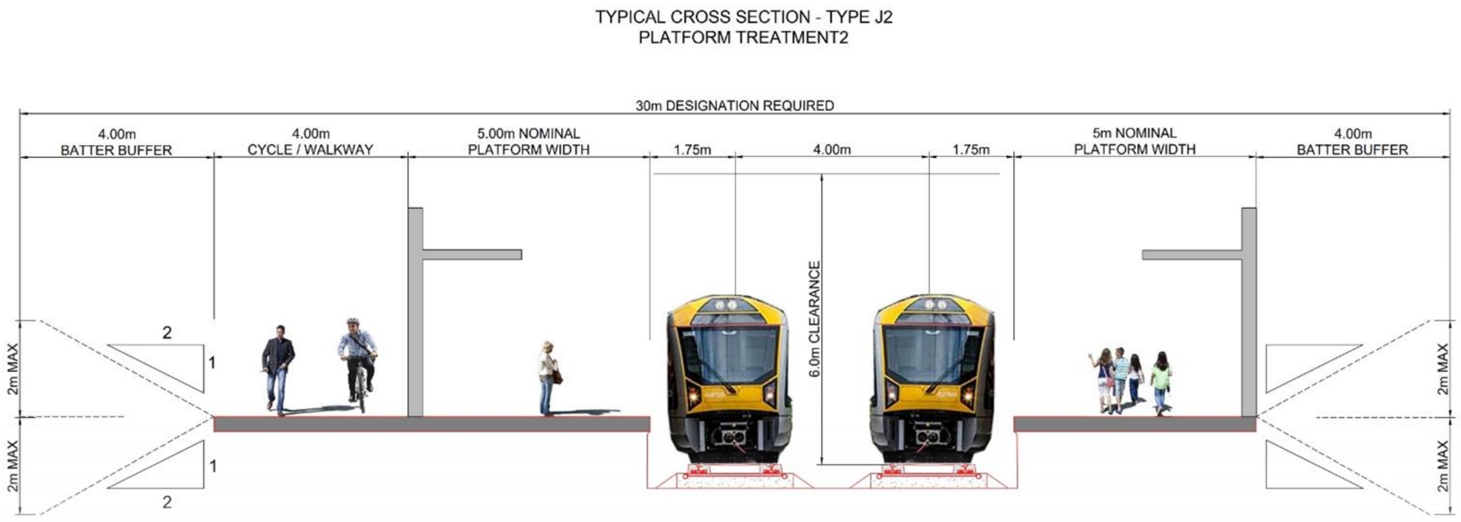


A5: Typical cross sections



A5: Typical cross sections





A6: Rough Order Cost Estimate

Cost estimates are high level only, not informed by corridor-specific designs. They are provided for the sole purpose of comparing scenarios with each other, and are not intended to be used for budgetary purposes. The next phase of the business case will develop the design and quantify risks and contingency in more detail and provide more certainty for budgeting purposes.

Key Assumptions in Rough Order Cost Estimate:

- Bottom up methodology uses item rates based on similar items in recent projects to inform a base estimate
- Top down methodology uses unit distance rates base on recent projects in New Zealand and Australia to build a benchmark to other projects
- Temporary Traffic Management – assume 15% of physical works
- Preliminary & General – assume 20% of physical works
- Pre-implementation and Implementation – assume 11% of physical works

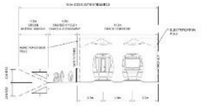
Key Exclusions:

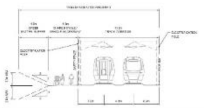
- Escalation (estimates provided in 2021 dollars)
- GST
- Heavy Rail doesn't include costs for major earthworks, ground improvements, and drainage
- Street Running limited stops (sections on existing road) doesn't include costs for relocating services (due to current level of detail in design), drainage, major earthworks
- LRT doesn't include costs for major earthworks and ground improvements over and above concrete slab for LRT tracks

Option 1 - Heavy Rail

Feb-2021

TOTAL COST OPTION 1 $ 1,545,590,440





Northern Line

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	m2	950	26,531	$ 25,204,450		Base on Halswell Rd DBC property cost per m2
	Station Properties	m2	950	16,000	$ 15,200,000		Assume 10m wider and 100m long per station
	TOTAL Nett Project Property Cost					$ 40,404,450	
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 12,277,265		
	Development Phase Client Costs		1.000%	1	$ 6,138,633		
	Detailed Design		5.000%	1	$ 30,693,163		
	TOTAL Project Development Phase					$ 49,109,060	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 613,863		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 1,227,727		
	TOTAL Pre-Implementation Phase					$ 1,841,590	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 12,277,265		
	Implementation Phase Fees		0.100%	1	$ 613,863		
	Implementation Phase Client Costs		0.500%	1	$ 3,069,316		
	TOTAL Pre-Implementation Phase					$ 15,960,445	
Sub Total	Physical Works						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	30.8	$ 7,700,000		Assume entire length
1.2	Contaminated Land Removal	m3	$ 300		$ -		
	TOTAL Environmental Compliance					$ 7,700,000	
2	EARTHWORKS						
	EXCLUDED		$ -		$ -		
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
	EXCLUDED		$ -		$ -		
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	EXCLUDED		$ -		$ -		
	TOTAL Drainage					$ -	
5	PAVEMENT AND SURFACING						
	Shoulder Widening (up to 3m)	m	$ 7,000	0	$ -		
	TOTAL Pavement and Surfacing					$ -	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000	0	$ -		
	Bridge (small creek/gully)	m	$ 142,500	105	$ 14,962,500		Assumed 15m per crossing, 7 stream crossings
	Bridge (River)	m	$ 150,000	500	$ 75,000,000		2 @ Waimakariri River, Kaiapoi Rivner, Styx River
	TOTAL Bridges/Structures					$ 89,962,500	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	0	$ -		
8.2	Fencing	km	$ 50,000	30.8	$ 1,540,000		Security Fence
8.3	Level Crossing Improvements	ea	$ 150,000	32	$ 4,800,000		
8.4	Road Signage/Marking	m	$ 1,000	0	$ -		
8.5	Upgrade Signalised Intersection	ea	$ 300,000	0	$ -		
	TOTAL TRAFFIC SERVICES					$ 6,340,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Electrification	km	$ 2,000,000	30.8	$ 61,600,000		
9.2	Signals and ITS	km	$ 1,000,000	30.8	$ 30,800,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 92,400,000	
13	Extraordinary Construction Costs						
	Train station - A		$ 30,000,000	2	$ 60,000,000		
	Train station - B		$ 30,000,000	3	$ 90,000,000		
	Train station - C		$ 30,000,000	2	$ 60,000,000		
	Park and Ride		$ 7,500,000	2	$ 15,000,000		
	Tracks - New	km	$ 1,000,000	30.8	$ 30,800,000		
	Turnouts	ea	$ 1,000,000	20	$ 20,000,000		Assume every 1.5km
	Rail Trench (single rail) including all services	m					
	Infrastructure Maintenance Base						
	Rolling Stock Depot						
	Contruct New KiwiRail Middleton Yard						
	TOTAL Extraordinary Construction Costs					$ 275,800,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	10%	$ 472,202,500	$ 47,220,250		
	TOTAL Traffic Management and Temporary Works					$ 47,220,250	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 472,202,500	$ 94,440,500		
	TOTAL Preliminaries and General					$ 94,440,500	
	TOTAL FOR PHYSCICAL WORKS					$ 613,863,250	
	TOTAL FOR WORKS					$ 721,178,794	

South-western Line

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	ea					
	Station Properties	ea					
	TOTAL Nett Project Property Cost						
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 10,130,380		
	Development Phase Client Costs		1.000%	1	$ 5,065,190		
	Detailed Design		5.000%	1	$ 25,325,950		
	TOTAL Project Development Phase					$ 40,521,520	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 506,519		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 1,013,038		
	TOTAL Pre-Implementation Phase					$ 1,519,557	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 10,130,380		
	Implementation Phase Fees		0.100%	1	$ 506,519		
	Implementation Phase Client Costs		0.500%	1	$ 2,532,595		
	TOTAL Pre-Implementation Phase					$ 13,169,494	
Sub Total	Physical Works						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	8.6	$ 2,150,000		Assume entire length of r
1.2	Contaminated Land Removal	m3	$ 300		$ -		
	TOTAL Environmental Compliance					$ 2,150,000	
2	EARTHWORKS						
	EXCLUDED		$ -		$ -		
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
	EXCLUDED		$ -		$ -		
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	EXCLUDED		$ -		$ -		
	TOTAL Drainage					$ -	
5	PAVEMENT AND SURFACING						
	Shoulder Widening (up to 3m)	m	$ 7,000		$ -		
	TOTAL Pavement and Surfacing					$ -	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000	0	$ -		
	Bridge (small creek/gully)	m	$ 142,500	0	$ -		
	Bridge (River)	m	$ 150,000	0	$ -		
	TOTAL Bridges/Structures					$ -	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	0	$ -		
8.2	Fencing	km	$ 50,000	8.6	$ 430,000		
8.3	Level Crossing Improvements	ea	$ 150,000	5	$ 750,000		
8.4	Road Signage/Marking	m	$ 1,000	0	$ -		
8.5	Upgrade Signalised Intersection	ea	$ 300,000	0	$ -		
	TOTAL TRAFFIC SERVICES					$ 1,180,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Electrification	km	$ 2,000,000	18.4	$ 36,800,000		
9.2	Signals and ITS	km	$ 1,000,000	18.4	$ 18,400,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 55,200,000	
13	Extraordinary Construction Costs						
	Train station - A		$ 30,000,000	2	$ 60,000,000		
	Train station - B		$ 30,000,000	1	$ 30,000,000		
	Train station - C		$ 30,000,000	3	$ 90,000,000		
	Park and Ride		$ 7,500,000	1	$ 7,500,000		
	Tracks - New	km	$ 1,000,000	8.6	$ 8,600,000		
	Turnouts	ea	$ 1,000,000	5	$ 5,000,000		Assume every 1.5km
	Rail Trench (single rail) including all services						
	Infrastructure Maintenance Base	ea	$ 22,500,000	1	$ 22,500,000		
	Rolling Stock Depot	ea	$ 7,500,000	1	$ 7,500,000		
	Contruct New KiwiRail Middleton Yard	ea	$ 100,000,000	1	$ 100,000,000		Based on Depot cost in A
	TOTAL Extraordinary Construction Costs					$ 331,100,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	10%	$ [illegible]	$ 38,963,000		
	TOTAL Traffic Management and Temporary Works					$ 38,963,000	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 389,630,000	$ 77,926,000		
	TOTAL Preliminaries and General					$ 77,926,000	
	TOTAL FOR PHYSCICAL WORKS					$ 506,519,000	
	TOTAL FOR WORKS					$ 561,729,571	

Busway (Riccarton to City Centre)

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	ea					
	Station Properties	ea					
	TOTAL Nett Project Property Cost						
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 643,500		
	Development Phase Client Costs		1.000%	1	$ 321,750		
	Detailed Design		5.000%	1	$ 1,608,750		
	TOTAL Project Development Phase					$ 2,574,000	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 32,175		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 64,350		
	TOTAL Pre-Implementation Phase					$ 96,525	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 643,500		
	Implementation Phase Fees		0.100%	1	$ 32,175		
	Implementation Phase Client Costs		0.500%	1	$ 160,875		
	TOTAL Pre-Implementation Phase					$ 836,550	
Sub Total	Physical Works						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	2.6	$ 650,000		Assume entire length of r
1.2	Contaminated Land Removal	m3	$ 300	0	$ -		
	TOTAL Environmental Compliance					$ 650,000	
2	EARTHWORKS						
	EXCLUDED		$ -		$ -		
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
	EXCLUDED		$ -		$ -		
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	EXCLUDED		$ -		$ -		
	TOTAL Drainage					$ -	
5	PAVEMENT AND SURFACING						
	Shoulder Widening (up to 3m)	m	$ 7,000	2,600	$ 18,200,000		
	TOTAL Pavement and Surfacing					$ 18,200,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000	0	$ -		
	Bridge (small creek/gully)	m	$ 142,500	0	$ -		
	Bridge (River)	m	$ 150,000	0	$ -		
	TOTAL Bridges/Structures					$ -	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500		$ -		
8.2	Fencing	km	$ 50,000		$ -		
8.3	Level Crossing Improvements	ea	$ 150,000	-	$ -		
8.4	Road Signage/Marking	m	$ 1,000	2600	$ 2,600,000		
8.5	Upgrade Signalised Intersection	ea	$ 300,000	6	$ 1,800,000		
	TOTAL TRAFFIC SERVICES					$ 4,400,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Electrification	km	$ 2,000,000		$ -		
9.2	Signals and ITS	km	$ 1,000,000		$ -		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ -	
13	Extraordinary Construction Costs						
	Train station - A		$ -	0	$ -		
	Train station - B		$ 1,500,000	1	$ 1,500,000		
	Train station - C		$ -	0	$ -		
	Park and Ride		$ -	0	$ -		
	Tracks - New	km	$ 1,000,000	0	$ -		
	Turnouts	ea	$ 1,000,000	0	$ -		Assume every 1.5km
	Rail Trench (single rail) including all services						
	Infrastructure Maintenance Base	ea	$ 22,500,000	0	$ -		
	Rolling Stock Depot	ea	$ 7,500,000	0	$ -		
	Contruct New KiwiRail Middleton Yard						
	TOTAL Extraordinary Construction Costs					$ 1,500,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	10%	$ 24,750,000	$ 2,475,000		
	TOTAL Traffic Management and Temporary Works					$ 2,475,000	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 24,750,000	$ 4,950,000		
	TOTAL Preliminaries and General					$ 4,950,000	
	TOTAL FOR PHYSCICAL WORKS					$ 32,175,000	
	TOTAL FOR WORKS					$ 35,682,075	

Trench to CBD (Riccarton to City Centre)

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Lower Range	Upper Range	Comments
A	Nett Project Property Cost								
	Corridor Properties	ea							
	Station Properties	ea							
	TOTAL Nett Project Property Cost								
B	Project Development Phase								
	Development Phase Fees		2.000%	1	$ 15,953,860				
	Development Phase Client Costs		1.000%	1	$ 7,976,930				
	Detailed Design		5.000%	1	$ 39,884,650				
	TOTAL Project Development Phase					$ 63,815,440			
C	Pre-Implementation Phase								
	Pre-Implementation Phase Fees		0.100%	1	$ 797,693				
	Pre-Implementation Phase Client Costs		0.200%	1	$ 1,595,386				
	TOTAL Pre-Implementation Phase					$ 2,393,079			
D	Implementation Phase								
	Implementation Fees								
	MSQA		2.000%	1	$ 15,953,860				
	Implementation Phase Fees		0.100%	1	$ 797,693				
	Implementation Phase Client Costs		0.500%	1	$ 3,988,465				
	TOTAL Pre-Implementation Phase					$ 20,740,018			
Sub Total	Physical Works								
1	ENVIRONMENTAL COMPLIANCE								
1.1	Enviro Controls	km	$ 250,000	2.7	$ 675,000		$ 405,000	$ 945,000	Assume entire length of
1.2	Contaminated Land Removal	m3	$ 300		$ -		$ -	$ -	
	TOTAL Environmental Compliance					$ 675,000			
2	EARTHWORKS								
	EXCLUDED		$ -		$ -		$ -	$ -	
	TOTAL Earthworks					$ -			
3	GROUND IMPROVEMENTS								
	EXCLUDED		$ -		$ -		$ -	$ -	
	TOTAL Ground Improvements					$ -			
4	DRAINAGE								
	EXCLUDED		$ -		$ -		$ -	$ -	
	TOTAL Drainage					$ -			
5	PAVEMENT AND SURFACING								
	Shoulder Widening (up to 3m)	m	$ 7,000		$ -		$ -	$ -	
	TOTAL Pavement and Surfacing					$ -			
6	BRIDGES/STRUCTURES								
	Bridge - Complex Urban	m	$ 225,000	0	$ -		$ -	$ -	
	Bridge (small creek/gully)	m	$ 142,500	0	$ -		$ -	$ -	
	Bridge (River)	m	$ 150,000	0	$ -		$ -	$ -	
	TOTAL Bridges/Structures					$ -			
8	TRAFFIC SERVICES								
8.1	Lighting	km	$ 1,500		$ -		$ -	$ -	
8.2	Fencing	km	$ 50,000	2.7	$ 135,000		$ 135,000	$ 270,000	
8.3	Level Crossing Improvements	ea	$ 150,000	-	$ -		$ -	$ -	
8.4	Road Signage/Marking	m	$ 1,000		$ -		$ -	$ -	
8.5	Upgrade Signalised Intersection	ea	$ 300,000		$ -		$ -	$ -	
	TOTAL TRAFFIC SERVICES					$ 135,000			
9	SERVICE RELOCATIONS/PROTECTION								
9.1	Electrification	km	$ 2,000,000	2.7	$ 5,400,000		########	$ 10,800,000	
9.2	Signals and ITS	km	$ 1,000,000	2.7	$ 2,700,000		########	$ 5,400,000	
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 8,100,000			
13	Extraordinary Construction Costs								
	Train station - A		$ 30,000,000	2	$ 60,000,000		$ -	$ -	
	Train station - B				$ -		$ -	$ -	
	Train station - C			0	$ -		$ -	$ -	
	Park and Ride		$ -	0	$ -		$ -	$ -	
	Tracks - New	km	$ 1,000,000	2.7	$ 2,700,000		########	$ 2,700,000	
	Turnouts	ea	$ 1,000,000	2	$ 2,000,000		########	$ 4,000,000	Assume every 1.5km
	Rail Trench (single rail) including all services	km	$ 200,000,000	2.7	$ 540,000,000				
	Infrastructure Maintenance Base	ea	$ 22,500,000	0	$ -		$ -	$ -	
	Rolling Stock Depot	ea	$ 7,500,000	0	$ -		$ -	$ -	
	Contruct New KiwiRail Middleton Yard								
	TOTAL Extraordinary Construction Costs					$ 604,700,000			
11	TRAFFIC MANAGEMENT								
11.1	Temporary Traffic Management	%	10%	$ 613,610,000	$ 61,361,000		$ -	$ -	
	TOTAL Traffic Management and Temporary Works					$ 61,361,000			
12	PRELIMINARIES AND GENERAL								
12.1	Preliminary and General		20%	$ 613,610,000	$ 122,722,000		#REF!	#REF!	
	TOTAL Preliminaries and General					$ 122,722,000			
	TOTAL FOR PHYSCICAL WORKS					$ 797,693,000			
	TOTAL FOR WORKS					$ 884,641,537			

Code	Descripton	Unit	Rate	Quantity	SubTotal
13	Rolling Stock				
	Assume $12M per train, Assume need 23 units		18 No	12,000,000	216,000,000
	Assume $1M per bus. Assume need 23 units		11 No	1,000,000	11,000,000

Assumptions

1. Assume cost of new train is $12M
2. Total one-way travel time for train is 0:56 hrs, two-way travel time is 1:52 hrs, with 7.5 minute headway
3. Total one-way travel time is 0:09 hrs, two-way travel time is 0:18 hrs, with 2 minute headway
4. Assumed 2% TTM as much of the construction will be outside of traffic lanes and 7% for construction in traffic.

Cycle Time	Recovery Time	Headway	No. of units
112	16.8	7.5	18
18	2.7	2	11

Heavy Rail					
Station	Distance to next station (km)	Treatment	Cost	Electrification	Cost
Rangiora	2.9	Double Track	0.039	Electrification	0.004
Southbrook	8.5	Double Track	0.113	Electrification	0.012
Kaiapoi	5.0	Double Track	0.066	Electrification	0.007
Chaneys	4.1	Double Track	0.054	Electrification	0.006
Belfast	3.9	Double Track	0.052	Electrification	0.006
Papanui	4	Double Track	0.053	Electrification	0.006
Riccarton	2.4	Double Track	0.032	Electrification	0.003
Addington	3.2			Electrification	0.005
Middleton	5.3			Electrification	0.008
Hornby	4.4			Electrification	0.006
Templeton	5.9	Double Track	0.078	Electrification	0.009
Weedons	2.3	Double Track	0.031	Electrification	0.003
Rolleston					
Infrastrucutre Sub-Total	51.9		0.52		0.08
Depo			0.10		
Rolling Stock			0.216		
Train Stations			0.45		
Property			0.04		
TOTAL			1.40		

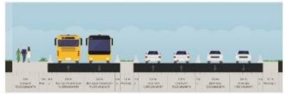
Assumptions

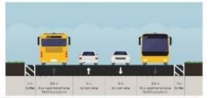
1. Assume cost of new track is $8M euro / km
2. 1 euro = 1.66 NZD base on conversion 9/03/21
3. Electrification cost 750k / stk (Pounds)
4. 1 pound = 1.94 NZD based on conversion 9/03/21

Street Running Large Spacing - Busway

Feb-2021

TOTAL - BUSWAY $ 1,961,410,054





Reallocate traffic lane to bus lane (ORANGE)

Code	Description	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	m2	950	33,068	$ 31,414,600		Base on Halswell Rd DBC property cost per m2 Assume 11.4m wider and 100m long per station
	Station Properties	m2	950	21,660	$ 20,577,000		
	TOTAL Nett Project Property Cost					$ 51,991,600	
B	Project Development Phase						
	Development Phase Fees	%	2.000%	1	$ 5,921,502		
	Development Phase Client Costs	%	1.000%	1	$ 2,960,751		
	Detailed Design	%	5.000%	1	$ 14,803,755		
	TOTAL Project Development Phase					$ 23,686,008	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees	%	0.100%	1	$ 296,075		
	Pre-Implementation Phase Client Costs	%	0.200%	1	$ 592,150		
	TOTAL Pre-Implementation Phase					$ 888,225	
D	Implementation Phase						
	Implementation Fees						
	MSQA	%	2.000%	1	$ 5,921,502		
	Implementation Phase Fees	%	0.100%	1	$ 296,075		
	Implementation Phase Client Costs	%	0.500%	1	$ 1,480,376		
	TOTAL Pre-Implementation Phase					$ 7,697,953	
Sub Total	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	13.3	$ 3,325,000		Assume entire length
1.2	Contaminated Land Removal	m3	$ 300	0	$ -		
	TOTAL Environmental Compliance					$ 3,325,000	
2	EARTHWORKS						
	Site Clearance and Demolition and earthworks (Busway)	m	$ 8,000	0	$ -		
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
	EXCLUDED		$ -		$ -		
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	EXCLUDED	$ 6,000		$ -		
	TOTAL Drainage					$ -	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	0	$ -		
	Shoulder Widening (up to 3m)	m	$ 7,000	13300	$ 93,100,000		
	TOTAL Pavement and Surfacing					$ 93,100,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000	400	$ 90,000,000		Busway over Cranford Street Roundabout
	Busway: Cut and Cover Tunnel	m	$ 123,000	0	$ -		
	Bridge (River)	m	$ 150,000	0	$ -		
	Bridge - Bridge Widening	m	$ 18,000	485	$ 8,730,000		Main N Rd overbridge, Avon River @ Colombo
	TOTAL Bridges/Structures					$ 98,730,000	
8	TRAFFIC SERVICES						
8.1	Lighting	EXCLUDED	$ 1,500		$ -		relocating lighting for wider corridor
8.2	Barrier	m	$ 800	0	$ -		
8.3	Road Signage/Marking	m	$ 1,000	13300	$ 13,300,000		Remarking road
8.4	Modify Non-signalised Intersections	ea	$ 225,000	0	$ -		
8.5	Upgrade Signalised Intersection	ea	$ 300,000	35	$ 10,500,000		
8.6	Provide signage and road marking to restrict turning to left in and out only		$ -	25	$ -		
8.7	Modify Motorway On-ramps (Tram Rd, Ohoka Road, Lineside Rd)						
	TOTAL TRAFFIC SERVICES					$ 23,800,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	EXCLUDED	$ 2,500		$ -		
9.2	Water	EXCLUDED	$ 800		$ -		
9.3	Wastewater	EXCLUDED	$ 350		$ -		
9.4	Chorus	EXCLUDED	$ 1,100		$ -		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ -	
13	Extraordinary Construction Costs						
	Bus station - A	ea	$ 1,575,000	9	$ 14,175,000		
	Bus station - B	ea	$ -		$ -		
	Bus station - C	ea	$ -		$ -		
	TOTAL Extraordinary Construction Costs					$ 14,175,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	7%	$ 233,130,000	$ 16,319,100		
	TOTAL Traffic Management and Temporary Works					$ 16,319,100	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 233,130,000	$ 46,626,000		
	TOTAL Preliminaries and General					$ 46,626,000	
	TOTAL FOR PHYSCICAL WORKS					$ 296,075,100	
	TOTAL FOR WORKS					$ 380,338,886	

Code	Description	Unit	Rate	Quantity	SubTotal
13	Rolling Stock Assume $1M per bus, Assume need 118 units	118 No		1,000,000	118,000,000

Busway Springs Road to Lincoln Road (BLUE)

Code	Description	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties						
	Station Properties						
	TOTAL Nett Project Property Cost						
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 12,766,802		
	Development Phase Client Costs		1.000%	1	$ 6,383,401		
	Detailed Design		5.000%	1	$ 31,917,005		
	TOTAL Project Development Phase					$ 51,067,208	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 638,340		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 1,276,680		
	TOTAL Pre-Implementation Phase					$ 1,915,020	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 12,766,802		
	Implementation Phase Fees		0.100%	1	$ 638,340		
	Implementation Phase Client Costs		0.500%	1	$ 3,191,701		
	TOTAL Pre-Implementation Phase					$ 16,596,843	
Sub Total	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	10	$ 2,500,000		Assume entire length
1.2	Contaminated Land Removal	m3	$ 300	5000	$ 1,500,000		Assume 5% of entire leng
	TOTAL Environmental Compliance					$ 4,000,000	
2	EARTHWORKS						
	Site Clearance and Demolition and earthworks (Busway)	m	$ 8,000	10,000	$ 80,000,000		
	TOTAL Earthworks					$ 80,000,000	
3	GROUND IMPROVEMENTS						
	EXCLUDED		$ -		$ -		
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	m	$ 6,000	10,000	$ 60,000,000		
	TOTAL Drainage					$ 60,000,000	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	10,000	$ 105,000,000		
	Shoulder Widening (up to 3m)	m	$ 7,000		$ -		
	TOTAL Pavement and Surfacing					$ 105,000,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000	255	$ 57,375,000		Bridge: Wrights Rd, Curle
	Busway: Cut and Cover Tunnel	m	$ 123,000	90	$ 11,070,000		Underpass: Springs Rd, A
	Bridge (River)	m	$ 150,000	0	$ -		
	Bridge - Bridge Widening	m	$ 18,000	0	$ -		
	TOTAL Bridges/Structures					$ 68,445,000	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	10	$ 15,000		
8.2	Barrier	m	$ 800	10,000	$ 8,000,000		
8.3	Road Signage/Marking	m	$ 1,000	10,000	$ 10,000,000		
8.4	Modify Non-signalised Intersections	ea	$ 225,000	0	$ -		
8.5	Upgrade Signalised Intersection	ea	$ 300,000	1	$ 300,000		Lincoln Rd on/off ramp
8.6	Provide signage and road marking to restrict turning to left in and out only		$ -	0	$ -		
8.7	Modify Motorway On-ramps (Tram Rd, Ohoka Road, Lineside Rd)						
	TOTAL TRAFFIC SERVICES					$ 29,385,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	m	$ 2,500	10,000	$ 25,000,000		
9.2	Water	m	$ 800	10,000	$ 8,000,000		
9.3	Wastewater	m	$ 350	10,000	$ 3,500,000		
9.4	Chorus	m	$ 1,100	10,000	$ 11,000,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 65,800,000	
13	Extraordinary Construction Costs						
	Bus station - A		$ -		$ -		
	Bus station - B		$ -		$ -		
	Bus station - C	ea	$ 30,000,000	3	$ 90,000,000		
	TOTAL Extraordinary Construction Costs					$ 90,000,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	7%	$ 502,630,000	$ 35,184,100		
	TOTAL Traffic Management and Temporary Works					$ 35,184,100	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 502,630,000	$ 100,526,000		
	TOTAL Preliminaries and General					$ 100,526,000	
	TOTAL FOR PHYSCICAL WORKS					$ 638,340,100	
	TOTAL FOR WORKS					$ 707,919,171	

Busway Tram Road to Lineside Road via SH1 (BLUE) Shoulder running Linesdie Road to Rangiora (GREEN)

Code	Description	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	ea					
	Station Properties	ea					
	TOTAL Nett Project Property Cost						
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 9,943,991		
	Development Phase Client Costs		1.000%	1	$ 4,971,995		
	Detailed Design		5.000%	1	$ 24,859,977		
	TOTAL Project Development Phase					$ 39,775,963	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 497,200		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 994,399		
	TOTAL Pre-Implementation Phase					$ 1,491,599	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 9,943,991		
	Implementation Phase Fees		0.100%	1	$ 497,200		
	Implementation Phase Client Costs		0.500%	1	$ 2,485,998		
	TOTAL Pre-Implementation Phase					$ 12,927,188	
Sub Total	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	14.6	$ 3,650,000		Assume entire length
1.2	Contaminated Land Removal	m3	$ 300	1900	$ 570,000		Assume 5% of entire leng
	TOTAL Environmental Compliance					$ 4,220,000	
2	EARTHWORKS						
	Site Clearance and Demolition and earthworks (Busway)	m	$ 8,000	3,800	$ 30,400,000		
	TOTAL Earthworks					$ 30,400,000	
3	GROUND IMPROVEMENTS						
	EXCLUDED		$ -		$ -		
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	m	$ 6,000	3,800	$ 22,800,000		
	TOTAL Drainage					$ 22,800,000	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	3,800	$ 39,900,000		
	Shoulder Widening (up to 3m)	m	$ 7,000	10,800	$ 75,600,000		
	TOTAL Pavement and Surfacing					$ 115,500,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000		$ -		
	Busway: Cut and Cover Tunnel	m	$ 123,000		$ -		
	Bridge (River)	m	$ 150,000	160	$ 24,000,000		@ Kaiapoi River
	Bridge - Bridge Widening	m	$ 18,000	40	$ 720,000		@ Cam River
	TOTAL Bridges/Structures					$ 24,720,000	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	3.8	$ 5,700		
8.2	Barrier	m	$ 800	3,800	$ 3,040,000		
8.3	Road Signage/Marking	m	$ 1,000	14,600	$ 14,600,000		
8.4	Modify Non-signalised Intersections	ea	$ 225,000	1	$ 225,000		High St roundabout
8.5	Upgrade Signalised Intersection	ea	$ 300,000	2	$ 600,000		At Woodend, High St (Ra
8.6	Provide signage and road marking to restrict turning to left in and out only		$ -	0	$ -		
8.7	Modify Motorway On-ramps (Tram Rd, Ohoka Road, Lineside Rd)	ea	$ 1,000,000	3	$ 3,000,000		Includeds 2 new signals, rearrange lanes
	TOTAL TRAFFIC SERVICES					$ 46,190,700	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	m	$ 2,500	3800	$ 9,500,000		
9.2	Water	m	$ 800	3800	$ 3,040,000		
9.3	Wastewater	m	$ 350	3800	$ 1,330,000		
9.4	Chorus	m	$ 1,100	3800	$ 4,180,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 39,515,000	
13	Extraordinary Construction Costs						
	Bus station - A		$ -		$ -		
	Bus station - B	ea	$ 9,075,000	2	$ 18,150,000		
	Bus station - C	ea	$ 30,000,000	3	$ 90,000,000		
	TOTAL Extraordinary Construction Costs					$ 108,150,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	7%	$ 391,495,700	$ 27,404,699		
	TOTAL Traffic Management and Temporary Works					$ 27,404,699	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 391,495,700	$ 78,299,140		
	TOTAL Preliminaries and General					$ 78,299,140	
	TOTAL FOR PHYSCICAL WORKS					$ 497,199,539	
	TOTAL FOR WORKS					$ 551,394,289	

Shoulder running Prebbleton to Rolleston (GREEN)

Code	Description	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	ea					
	Station Properties	ea					
	TOTAL Nett Project Property Cost						
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 3,674,621		
	Development Phase Client Costs		1.000%	1	$ 1,837,310		
	Detailed Design		5.000%	1	$ 9,186,551		
	TOTAL Project Development Phase					$ 14,698,482	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 183,731		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 367,462		
	TOTAL Pre-Implementation Phase					$ 551,193	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 3,674,621		
	Implementation Phase Fees		0.100%	1	$ 183,731		
	Implementation Phase Client Costs		0.500%	1	$ 918,655		
	TOTAL Pre-Implementation Phase					$ 4,777,007	
Sub Total	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	13.4	$ 3,350,000		Assume entire length
1.2	Contaminated Land Removal	m3	$ 300		$ -		Assume 5% of entire len
	TOTAL Environmental Compliance					$ 3,350,000	
2	EARTHWORKS						
	Site Clearance and Demolition and earthworks (Busway)	m	$ 8,000	-	$ -		
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
	EXCLUDED		$ -		$ -		
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	EXCLUDED	$ 6,000		$ -		
	TOTAL Drainage					$ -	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	-	$ -		
	Shoulder Widening (up to 3m)	m	$ 7,000	13,400	$ 93,800,000		
	TOTAL Pavement and Surfacing					$ 93,800,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000		$ -		
	Busway: Cut and Cover Tunnel	m	$ 123,000		$ -		
	Bridge (River)	m	$ 150,000		$ -		
	Bridge - Bridge Widening	m	$ 18,000		$ -		
	TOTAL Bridges/Structures					$ -	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	13.4	$ 20,100		
8.2	Barrier	m	$ 800	-	$ -		
8.3	Road Signage/Marking	m	$ 1,000	13,400	$ 13,400,000		
8.4	Modify Non-signalised Intersections	ea	$ 225,000	3	$ 675,000		Change priority at 3 intersections
8.5	Upgrade Signalised Intersection	ea	$ 300,000	2	$ 600,000		Lowe Rd Rounabout, Rolleston Dr
8.6	Provide signage and road marking to restrict turning to left in and out only		$ -		$ -		
8.7	Modify Motorway On-ramps (Tram Rd, Ohoka Road, Lineside Rd)						
	TOTAL TRAFFIC SERVICES					$ 14,695,100	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	EXCLUDED	$ 2,500		$ -		
9.2	Water	EXCLUDED	$ 800		$ -		
9.3	Wastewater	EXCLUDED	$ 350		$ -		
9.4	Chorus	EXCLUDED	$ 1,100		$ -		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 14,675,000	
13	Extraordinary Construction Costs						
	Bus station - A		$ -		$ -		
	Bus station - B	ea	$ 9,075,000	2	$ 18,150,000		
	Bus station - C		$ -		$ -		
	TOTAL Extraordinary Construction Costs					$ 18,150,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	7%	$ 144,670,100	$ 10,126,907		
	TOTAL Traffic Management and Temporary Works					$ 10,126,907	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 144,670,100	$ 28,934,020		
	TOTAL Preliminaries and General					$ 28,934,020	
	TOTAL FOR PHYSCICAL WORKS					$ 183,731,027	
	TOTAL FOR WORKS					$ 203,757,709	

Assumptions

1. Assume that existing give-way intersections willl become left in left out only
2. Assume that roundabouts will become signalised intersections where median running
3. Assume cost of new double decker bus is $1M
4. Total one-way travel time is 1:42 hrs, two-way travel time is 3:24 hrs, with 2 minute headway
5. Assume where we are building a busway that there willl be service relocations.

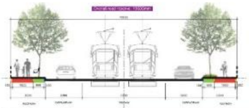
Cycle Time	Recovery Time	Headway	No. of units
204	30.6	2	118

	Street Running, limited stops						
	Station	Distance to next station (km)	Treatment	Cost ($bn)	Station Treatment	Cost ($bn)	Cost ($bn)
	Rangiora (West)	1.9	Existing Streets				
	Rangiora (East)	5.6	Existing Streets				
	Woodend	8	BRT - Highway Sh	0.43		INCLUDED	
	Ohoka Road	2.7	BRT - Highway Sh	0.14		INCLUDED	
	Tram Road	4.8				INCLUDED	
	Belfast Road	3	BRT - Median rur	0.12		INCLUDED	
	Prestons Road	1.6	BRT - Median rur	0.06		INCLUDED	
	Cranford Street	2.1	BRT - Median rur	0.08		INCLUDED	
	Innes Road	1.6	BRT - Median rur	0.06		INCLUDED	
	Sherborne Street	1.6	BRT - Median rur	0.06		INCLUDED	
	Convention Centre	0.7	BRT - Median rur	0.03		INCLUDED	
	Central Exchange	0.9	BRT - Median rur	0.04		INCLUDED	
	Christchurch Hospital	1.8	BRT - Median rur	0.07		INCLUDED	
	Lincoln Road	4.3	BRT - Highway	0.45		INCLUDED	
	Aidenfield Drive	3.4	BRT - Highway	0.35		INCLUDED	
2.3	Springs Road	3.0	BRT - Highway	0.31		INCLUDED	
	Prebbleton	6.8					
	Weedons Road	5.9					
	Rolleston						
	Total	*59.7*		*2.22*			*0.00*
	Property			0.05			
	Rolling Stock			0.118			
	TOTAL			2.39			

Street Running Corridor Focused - LRT

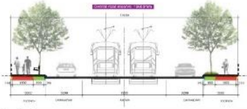
Feb-2021

TOTAL - LRT $ 4,111,834,280



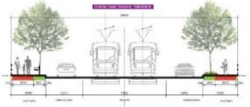
Section A — Median running The Hub Hornby to Belfast Road

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	m2	950	18500	$ 17,575,000		
	Station Properties	m2	950	11500	$ 10,925,000		Assume 5m wider and 100m long per station
	TOTAL Nett Project Property Cost					$ 28,500,000	
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 37,364,760		
	Development Phase Client Costs		1.000%	1	$ 18,682,380		
	Detailed Design		5.000%	1	$ 93,411,900		
	TOTAL Project Development Phase					$ 149,459,040	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 1,868,238		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 3,736,476		
	TOTAL Pre-Implementation Phase					$ 5,604,714	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 37,364,760		
	Implementation Phase Fees		0.100%	1	$ 1,868,238		
	Implementation Phase Client Costs		0.500%	1	$ 9,341,190		
	TOTAL Pre-Implementation Phase					$ 48,574,188	
Sub To	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	24.4	$ 6,100,000		
1.2	Contaminated Land Removal	m3	$ 300		$ -		
	TOTAL Environmental Compliance					$ 6,100,000	
2	EARTHWORKS						
			$ -	EXCLUDED			
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
			$ -	EXCLUDED			
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	m	$ 6,000	24400	$ 146,400,000		
	TOTAL Drainage					$ 146,400,000	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	24400	$ 256,200,000		
			$ -		$ -		
	TOTAL Pavement and Surfacing					$ 256,200,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000		$ -		
	Bridge - Bridge Widening	m	$ 18,000	550	$ 9,900,000		M North Rd, Avon River, M South Rd
	Property Underpasses	km	$ 75,000		$ -		
	Bridge (River)	m	$ 150,000		$ -		
	TOTAL Bridges/Structures					$ 9,900,000	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	24400	$ 36,600,000		
8.2	Barrier	m	$ 800	24400	$ 19,520,000		
8.3	Road Signage/Marking	m	$ 1,000	24400	$ 24,400,000		
8.4	New Signalised Intersection	ea	$ 300,000	2	$ 600,000		Blenhiem Road roundabout, Yaldhurst Rd/Riccarton Rd
8.4	Alter existing intersection signals to accommodate LRT		$ -	53	$ -		
8.5	Provide signage and road marking to restrict turning to left in and out only		$ -	102	$ -		
8.6	Intelligent Transport Systems (ITS)	m	$ 800	24400	$ 19,520,000		
	TOTAL TRAFFIC SERVICES					$ 100,640,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	m	$ 2,500	24400	$ 61,000,000		
9.2	Water	m	$ 800	24400	$ 19,520,000		
9.3	Wastewater	m	$ 350	24400	$ 8,540,000		
9.4	Chorus	m	$ 1,100	24400	$ 26,840,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 115,900,000	
13	Extraordinary Construction Costs						
	City Centre Platform	ea	$ 1,050,000	4	$ 4,200,000		
	Town Centre Platform	ea	$ 770,000	2	$ 1,540,000		
	Neighbourhood Platform	ea	$ 750,000	8	$ 6,000,000		
	Aboveground Stations Assume 100m, long, 30m wide, 7m high, inclusive of all station facilities, tracks, line services, power and lighting, ventilation, fire protection, drainage, communications, plant	ea	$ 165,000,000	1	$ 165,000,000		At Hornby Hub
	Park and Ride	ea	$ 7,500,000		$ -		
	Rail Trench (single rail) including all services	m	$ 30,000	800	$ 24,000,000		Riccarton Road Lxing assume 1:60 gradient and 5.5m clearance givers 330m either side of crossing plus 70m under road
	Construct LRT Rate inclusive of concrete slab, tracks, line services, power and lighting, drainage, communications, plant.	m	$ 20,000	24400	$ 488,000,000		
	Construct Depot and Stabling area excluding property	ea	$ 60,000,000	1	$ 60,000,000		
	TOTAL Extraordinary Construction Costs					$ 748,740,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	15%	$ 1,383,880,000	$ 207,582,000		
	TOTAL Traffic Management and Temporary Works					$ 207,582,000	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 1,383,880,000	$ 276,776,000		
	TOTAL Preliminaries and General					$ 276,776,000	
	TOTAL FOR PHYSCICAL WORKS					$ 1,868,238,000	
	TOTAL FOR WORKS					$ 2,100,375,942	



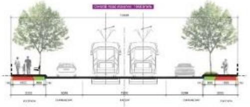
Section B — Median running Kaiapoi Section

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	ea					
	Station Properties						
	TOTAL Nett Project Property Cost					$ -	
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 7,681,500		
	Development Phase Client Costs		1.000%	1	$ 3,840,750		
	Detailed Design		5.000%	1	$ 19,203,750		
	TOTAL Project Development Phase					$ 30,726,000	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 384,075		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 768,150		
	TOTAL Pre-Implementation Phase					$ 1,152,225	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 7,681,500		
	Implementation Phase Fees		0.100%	1	$ 384,075		
	Implementation Phase Client Costs		0.500%	1	$ 1,920,375		
	TOTAL Pre-Implementation Phase					$ 9,985,950	
Sub To	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	5.3	$ 1,325,000		
1.2	Contaminated Land Removal	m3	$ 300		$ -		
	TOTAL Environmental Compliance					$ 1,325,000	
2	EARTHWORKS						
			$ -	EXCLUDED			
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
			$ -	EXCLUDED			
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	m	$ 6,000	5,300	$ 31,800,000		
	TOTAL Drainage					$ 31,800,000	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	5,300	$ 55,650,000		
			$ -		$ -		
	TOTAL Pavement and Surfacing					$ 55,650,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000		$ -		
	Bridge - Bridge Widening	m	$ 18,000	60	$ 1,080,000		
	Property Underpasses	km	$ 75,000		$ -		
	Bridge (River)	m	$ 150,000		$ -		
	TOTAL Bridges/Structures					$ 1,080,000	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	5300	$ 7,950,000		
8.2	Barrier	m	$ 800	5,300	$ 4,240,000		
8.3	Road Signage/Marking	m	$ 1,000	5,300	$ 5,300,000		
8.4	New Signalised Intersection	ea	$ 300,000	4	$ 1,200,000		
8.4	Alter existing intersection signals to accommodate LRT		$ -	0	$ -		
8.5	Provide signage and road marking to restrict turning to left in and out only		$ -	15	$ -		
8.6	Intelligent Transport Systems (ITS)	m	$ 800	5300	$ 4,240,000		
	TOTAL TRAFFIC SERVICES					$ 22,930,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	m	$ 2,500	5,300	$ 13,250,000		
9.2	Water	m	$ 800	5,300	$ 4,240,000		
9.3	Wastewater	m	$ 350	5,300	$ 1,855,000		
9.4	Chorus	m	$ 1,100	5,300	$ 5,830,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 25,175,000	
13	Extraordinary Construction Costs						
	City Centre Platform	ea	$ 1,050,000	0	$ -		
	Town Centre Platform	ea	$ 770,000	2	$ 1,540,000		
	Neighbourhood Platform	ea	$ 750,000	0	$ -		
	Aboveground Stations Assume 100m, long, 30m wide, 7m high, inclusive of all station facilities, tracks, line services, power and lighting, ventilation, fire protection, drainage, communications, plant		$ -		$ -		
	Park and Ride	ea	$ 7,500,000	2	$ 15,000,000		
	Rail Trench (single rail) including all services	m	$ 30,000	800	$ 24,000,000		William St Lxing assume 1:60 gradient and 5.5m clearance givers 330m either side of crossing plus 70m under road
	Construct LRT Rate inclusive of concrete slab, tracks, line services, power and lighting, drainage, communications, plant.	m	$ 20,000	5300	$ 106,000,000		
	Construct Depot and Stabling area excluding property						
	TOTAL Extraordinary Construction Costs					$ 146,540,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	15%	$ 284,500,000	$ 42,675,000		
	TOTAL Traffic Management and Temporary Works					$ 42,675,000	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 284,500,000	$ 56,900,000		
	TOTAL Preliminaries and General					$ 56,900,000	
	TOTAL FOR PHYSCICAL WORKS					$ 384,075,000	
	TOTAL FOR WORKS					$ 425,939,175	



Section C — Median running Rangiora Section

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	ea					
	Station Properties						
	TOTAL Nett Project Property Cost					$ -	
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 4,435,020		
	Development Phase Client Costs		1.000%	1	$ 2,217,510		
	Detailed Design		5.000%	1	$ 11,087,550		
	TOTAL Project Development Phase					$ 17,740,080	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 221,751		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 443,502		
	TOTAL Pre-Implementation Phase					$ 665,253	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 4,435,020		
	Implementation Phase Fees		0.100%	1	$ 221,751		
	Implementation Phase Client Costs		0.500%	1	$ 1,108,755		
	TOTAL Pre-Implementation Phase					$ 5,765,526	
Sub To	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	2.7	$ 675,000		Assume entire length
1.2	Contaminated Land Removal	m3	$ 300		$ -		Assume 5% of entire length
	TOTAL Environmental Compliance					$ 675,000	
2	EARTHWORKS						
			$ -	EXCLUDED			
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
			$ -	EXCLUDED			
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	m	$ 6,000	2,700	$ 16,200,000		
	TOTAL Drainage					$ 16,200,000	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	2,700	$ 28,350,000		
			$ -		$ -		
	TOTAL Pavement and Surfacing					$ 28,350,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000		$ -		
	Bridge - Bridge Widening	m	$ 18,000		$ -		
	Property Underpasses	km	$ 75,000		$ -		
	Bridge (River)	m	$ 150,000		$ -		
	TOTAL Bridges/Structures					$ -	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	2700	$ 4,050,000		
8.2	Barrier	m	$ 800	2,700	$ 2,160,000		
8.3	Road Signage/Marking	m	$ 1,000	2,700	$ 2,700,000		
8.4	New Signalised Intersection	ea	$ 300,000	2	$ 600,000		
8.4	Alter existing intersection signals to accommodate LRT		$ -	1	$ -		
8.5	Provide signage and road marking to restrict turning to left in and out only		$ -	12	$ -		
8.6	Intelligent Transport Systems (ITS)	m	$ 800	2700	$ 2,160,000		
	TOTAL TRAFFIC SERVICES					$ 11,670,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	m	$ 2,500	2700	$ 6,750,000		
9.2	Water	m	$ 800	2700	$ 2,160,000		
9.3	Wastewater	m	$ 350	2700	$ 945,000		
9.4	Chorus	m	$ 1,100	2700	$ 2,970,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 12,825,000	
13	Extraordinary Construction Costs						
	City Centre Platform	ea	$ 1,050,000	0	$ -		
	Town Centre Platform	ea	$ 770,000	2	$ 1,540,000		
	Neighbourhood Platform	ea	$ 750,000	0	$ -		
	Aboveground Stations Assume 100m, long, 30m wide, 7m high, inclusive of all station facilities, tracks, line services, power and lighting, ventilation, fire protection, drainage, communications, plant		$ -		$ -		
	Park and Ride	ea	$ 7,500,000	2	$ 15,000,000		
	Rail Trench (single rail) including all services	m	$ 30,000	800	$ 24,000,000		High St Lxing assume 1:60 gradient and 5.5m clearance givers 330m either side of crossing plus 70m under road
	Construct LRT Rate inclusive of concrete slab, tracks, line services, power and lighting, drainage, communications, plant.	m	$ 20,000	2700	$ 54,000,000		
	Construct Depot and Stabling area excluding property						
	TOTAL Extraordinary Construction Costs					$ 94,540,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	15%	$ 164,260,000	$ 24,639,000		
	TOTAL Traffic Management and Temporary Works					$ 24,639,000	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 164,260,000	$ 32,852,000		
	TOTAL Preliminaries and General					$ 32,852,000	
	TOTAL FOR PHYSCICAL WORKS					$ 221,751,000	
	TOTAL FOR WORKS					$ 245,921,859	



Section D — Median running Rolleston Section

Code	Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments
A	Nett Project Property Cost						
	Corridor Properties	ea					
	Station Properties						
	TOTAL Nett Project Property Cost					$ -	
B	Project Development Phase						
	Development Phase Fees		2.000%	1	$ 4,164,480		
	Development Phase Client Costs		1.000%	1	$ 2,082,240		
	Detailed Design		5.000%	1	$ 10,411,200		
	TOTAL Project Development Phase					$ 16,657,920	
C	Pre-Implementation Phase						
	Pre-Implementation Phase Fees		0.100%	1	$ 208,224		
	Pre-Implementation Phase Client Costs		0.200%	1	$ 416,448		
	TOTAL Pre-Implementation Phase					$ 624,672	
D	Implementation Phase						
	Implementation Fees						
	MSQA		2.000%	1	$ 4,164,480		
	Implementation Phase Fees		0.100%	1	$ 208,224		
	Implementation Phase Client Costs		0.500%	1	$ 1,041,120		
	TOTAL Pre-Implementation Phase					$ 5,413,824	
Sub To	*Physical Works*						
1	ENVIRONMENTAL COMPLIANCE						
1.1	Enviro Controls	km	$ 250,000	3	$ 750,000		Assume entire length
1.2	Contaminated Land Removal	m3	$ 300		$ -		Assume 5% of entire length 1m deep 10 m wide corridor
	TOTAL Environmental Compliance					$ 750,000	
2	EARTHWORKS						
			$ -	EXCLUDED			
	TOTAL Earthworks					$ -	
3	GROUND IMPROVEMENTS						
			$ -	EXCLUDED			
	TOTAL Ground Improvements					$ -	
4	DRAINAGE						
	Drainage	m	$ 6,000	3,000	$ 18,000,000		
	TOTAL Drainage					$ 18,000,000	
5	PAVEMENT AND SURFACING						
	Pavement	m	$ 10,500	3,000	$ 31,500,000		
			$ -		$ -		
	TOTAL Pavement and Surfacing					$ 31,500,000	
6	BRIDGES/STRUCTURES						
	Bridge - Complex Urban	m	$ 225,000		$ -		
	Bridge - Bridge Widening	m	$ 18,000		$ -		
	Property Underpasses	km	$ 75,000		$ -		
	Bridge (River)	m	$ 150,000		$ -		
	TOTAL Bridges/Structures					$ -	
8	TRAFFIC SERVICES						
8.1	Lighting	km	$ 1,500	3000	$ 4,500,000		
8.2	Barrier	m	$ 800	3,000	$ 2,400,000		
8.3	Road Signage/Marking	m	$ 1,000	3,000	$ 3,000,000		
8.4	New Signalised Intersection	ea	$ 300,000	3	$ 900,000		
8.4	Alter existing intersection signals to accommodate LRT		$ -	4	$ -		
8.5	Provide signage and road marking to restrict turning to left in and out only		$ -	14	$ -		
8.6	Intelligent Transport Systems (ITS)	m	$ 800	3000	$ 2,400,000		
	TOTAL TRAFFIC SERVICES					$ 13,200,000	
9	SERVICE RELOCATIONS/PROTECTION						
9.1	Orion - Power	m	$ 2,500	3000	$ 7,500,000		
9.2	Water	m	$ 800	3000	$ 2,400,000		
9.3	Wastewater	m	$ 350	3000	$ 1,050,000		
9.4	Chorus	m	$ 1,100	3000	$ 3,300,000		
	TOTAL SERVICE RELOCATIONS/PROTECTION					$ 14,250,000	
13	Extraordinary Construction Costs						
	City Centre Platform	ea	$ 1,050,000	0	$ -		
	Town Centre Platform	ea	$ 770,000	2	$ 1,540,000		
	Neighbourhood Platform	ea	$ 750,000	0	$ -		
	Aboveground Stations Assume 100m, long, 30m wide, 7m high, inclusive of all station facilities, tracks, line services, power and lighting, ventilation, fire protection, drainage, communications, plant		$ -		$ -		
	Park and Ride	ea	$ 7,500,000	2	$ 15,000,000		
	Rail Trench (single rail) including all services	m	$ 30,000	0	$ -		
	Construct LRT Rate inclusive of concrete slab, tracks, line services, power and lighting, drainage, communications, plant.	m	$ 20,000	3000	$ 60,000,000		
	Construct Depot and Stabling area excluding property						
	TOTAL Extraordinary Construction Costs					$ 76,540,000	
11	TRAFFIC MANAGEMENT						
11.1	Temporary Traffic Management	%	15%	$ 154,240,000	$ 23,136,000		
	TOTAL Traffic Management and Temporary Works					$ 23,136,000	
12	PRELIMINARIES AND GENERAL						
12.1	Preliminary and General		20%	$ 154,240,000	$ 30,848,000		
	TOTAL Preliminaries and General					$ 30,848,000	
	TOTAL FOR PHYSCICAL WORKS					$ 208,224,000	
	TOTAL FOR WORKS					$ 230,920,416	

Street Running Corridor Focused - LRT

Feb-2021

TOTAL - LRT

Descripton	Unit	Rate	Quantity	SubTotal	Total	Comments	Unit	Rate	Quantity	SubTotal	Total	Comments
	Section E Running parallel to road, Belast to Kaiapoi and Kaipoi to Rangiora						Section F Running parallel to road, Hornby to Rolleston					
Nett Project Property Cost												
Corridor Properties	ea						ea					
Station Properties												
TOTAL Nett Project Property Cost					$ -						$ -	
Project Development Phase												
Development Phase Fees		2.000%	1	$ 9,090,500				2.000%	1	$ 5,944,250		
Development Phase Client Costs		1.000%	1	$ 4,545,250				1.000%	1	$ 2,972,125		
Detailed Design		5.000%	1	$ 22,726,250				5.000%	1	$ 14,860,625		
TOTAL Project Development Phase					$ 36,362,000						$ 23,777,000	
Pre-Implementation Phase												
Pre-Implementation Phase Fees		0.100%	1	$ 454,525				0.100%	1	$ 297,213		
Pre-Implementation Phase Client Costs		0.200%	1	$ 909,050				0.200%	1	$ 594,425		
TOTAL Pre-Implementation Phase					$ 1,363,575						$ 891,638	
Implementation Phase												
Implementation Fees												
MSQA		2.000%	1	$ 9,090,500				2.000%	1	$ 5,944,250		
Implementation Phase Fees		0.100%	1	$ 454,525				0.100%	1	$ 297,213		
Implementation Phase Client Costs		0.500%	1	$ 2,272,625				0.500%	1	$ 1,486,063		
TOTAL Pre-Implementation Phase					$ 11,817,650						$ 7,727,525	
Physical Works												
ENVIRONMENTAL COMPLIANCE												
Enviro Controls	km	$ 250,000	14.4	$ 3,600,000		Assume entire length	km	$ 250,000	8	$ 2,000,000		Assume entire length
Contaminated Land Removal	m3	$ 300		$ -		Assume 5% of entire length 1m deep 10 m wide corridor	m3	$ 300		$ -		Assume 5% of entire length 1m deep 10 m wide corridor
TOTAL Environmental Compliance					$ 3,600,000						$ 2,000,000	
EARTHWORKS												
		$ -	EXCLUDED					$ -	EXCLUDED			
TOTAL Earthworks					$ -						$ -	
GROUND IMPROVEMENTS												
		$ -	EXCLUDED					$ -	EXCLUDED			
TOTAL Ground Improvements					$ -						$ -	
DRAINAGE												
Drainage	m	$ 6,000		$ -			m	$ 6,000		$ -		
TOTAL Drainage					$ -						$ -	
PAVEMENT AND SURFACING												
Pavement	m	$ 10,500		$ -			m	$ 10,500		$ -		
		$ -		$ -				$ -		$ -		
TOTAL Pavement and Surfacing					$ -						$ -	
BRIDGES/STRUCTURES												
Bridge - Complex Urban	m	$ 225,000		$ -			m	$ 225,000	300	$ 67,500,000		
Bridge - Bridge Widening	m	$ 18,000		$ -			m	$ 18,000	0	$ -		
Property Underpasses	km	$ 75,000		$ -			km	$ 75,000	0	$ -		
Bridge (River)	m	$ 150,000	360	$ 54,000,000			m	$ 150,000	0	$ -		
TOTAL Bridges/Structures					$ 54,000,000						$ 67,500,000	
TRAFFIC SERVICES												
Lighting	km	$ 1,500		$ -			km	$ 1,500		$ -		
Barrier	m	$ 800		$ -			m	$ 800		$ -		
Road Signage/Marking	m	$ 1,000	-	$ -			m	$ 1,000	-	$ -		
New Signalised Intersection	ea	$ 300,000	5	$ 1,500,000			ea	$ 300,000	0	$ -		
Alter existing intersection signals to accommodate LRT		$ -	0	$ -				$ -	0	$ -		
Provide signage and road marking to restrict turning to left in and out only		$ -	0	$ -				$ -	0	$ -		
Intelligent Transport Systems (ITS)	m	$ 800		$ -			m	$ 800		$ -		
TOTAL TRAFFIC SERVICES					$ 1,500,000						$ -	
SERVICE RELOCATIONS/PROTECTION												
Orion - Power	m	$ 2,500	0	$ -			m	$ 2,500	0	$ -		
Water	m	$ 800	0	$ -			m	$ 800	0	$ -		
Wastewater	m	$ 350	0	$ -			m	$ 350	0	$ -		
Chorus	m	$ 1,100	0	$ -			m	$ 1,100	0	$ -		
TOTAL SERVICE RELOCATIONS/PROTECTION					$ -						$ -	
Extraordinary Construction Costs												
City Centre Platform	ea	$ 1,050,000	0	$ -			ea	$ 1,050,000	0	$ -		
Town Centre Platform	ea	$ 770,000	1	$ 770,000			ea	$ 770,000	1	$ 770,000		
Neighbourhood Platform	ea	$ 750,000	1	$ 750,000			ea	$ 750,000	0	$ -		
Aboveground Stations Assume 100m, long, 30m wide, 7m high, inclusive of all station facilities, tracks, line services, power and lighting, ventilation, fire protection, drainage, communications, plant		$ -		$ -				$ -		$ -		
Park and Ride	ea	$ 7,500,000	2	$ 15,000,000			ea	$ 7,500,000	1	$ 7,500,000		
Rail Trench (single rail) including all services	m	$ 30,000	0	$ -			m	$ 30,000	0	$ -		
Construct LRT Rate inclusive of concrete slab, tracks, line services, power and lighting, drainage, communications, plant.	m	$ 20,000	14400	$ 288,000,000			m	$ 20,000	8000	$ 160,000,000		
Construct Depot and Stabling area excluding property												
TOTAL Extraordinary Construction Costs					$ 304,520,000						$ 168,270,000	
TRAFFIC MANAGEMENT												
Temporary Traffic Management	%	5%	$ 363,620,000	$ 18,181,000			%	5%	$ 237,770,000	$ 11,888,500		
TOTAL Traffic Management and Temporary Works					$ 18,181,000						$ 11,888,500	
PRELIMINARIES AND GENERAL												
Preliminary and General		20%	$ 363,620,000	$ 72,724,000				20%	$ 237,770,000	$ 47,554,000		
TOTAL Preliminaries and General					$ 72,724,000						$ 47,554,000	
TOTAL FOR PHYSCICAL WORKS					$ 454,525,000						$ 297,212,500	
TOTAL FOR WORKS					$ 504,068,225						$ 329,608,663	

	Descripton	Unit	Rate	Quantity	SubTotal
13	Rolling Stock Assume $5M per 2 car LRT, Assume need 55 units	55	No	5,000,000	275,000,000

Assumptions

1 Assume that existing give-way intersections willl become left in left out only

2 Assume that roundabout will be replaced with signals

Assume mazimum grade for a freight train is 1:60 based on the information below. We have assume where light rail crosses the

https://at.govt.nz/media/310975/ATCOP_Section_21_Public_

3 Transport_Rail.pdf

4 Assume cost of new LRT car $5M, unit has 2 cars

Assume a LRT depot is required - use Hornby or Belfast, say

5 60,000 m2 needed

Total one-way travel time is 1:58 hrs, two-way travel time is

6 3:56 hrs, with 5 minute headway

7 Assume 55 LRT units required to meet frequencies

Assume LRT construction is $20k/m from Auckland Light Rail

8 2015 with cost escalation applied range from $15k/m - $18k/m

Assume that there will be service relocations when there is

9 meidan running LRT

10 Assume PnR is $30k/ per carparking. Assume 250 car park.

Cycle Time	Recovery Time	Headway	No. of units
236	35.4	5	55

Street Running, corridor focused (Light Rail)

	Station	Distance to next station (km)	Treatment	Cost ($bn)	Station Treatment	Cost ($bn)
	Rangiora (West)	1.9	LRT - Median runnir	0.11		Included in E
	Rangiora (East)	5	LRT - Running near I	0.44		Included in E
	Ravenswood	6.9	LRT - Running near I	0.60		Included in E
5.3	Kaiapoi North	2.3	LRT - Median runnir	0.13		Included in E
	Kaiapoi Central	5.6	LRT - Median runnir	0.31		Included in E
	Chaneys	2.7	LRT - Running near I	0.24		Included in E
20.7	Belfast Road	1.5	LRT - Median runnir	0.08		Included in E
	Radcliffe Road	1.5	LRT - Median runnir	0.08		Included in E
	Prestons Road	2.5	LRT - Median runnir	0.14		Included in E
	Papanui Stop	1.7	LRT - Median runnir	0.09		Included in E
	Innes Road	1.3	LRT - Median runnir	0.07		Included in E
	Bealey Ave	1.6	LRT - Median runnir	0.09		Included in E
	Convention Centre	0.7	LRT - Median runnir	0.04		Included in E
	Central Exchange	0.9	LRT - Median runnir	0.05		Included in E
	Hospital	2.2	LRT - Median runnir	0.12		Included in E
	Riccarton	1.8	LRT - Median runnir	0.10		Included in E
	Ilam Road	1	LRT - Median runnir	0.06		Included in E
	Curletts Road	1.2	LRT - Median runnir	0.07		Included in E
	Blenheim Road	1.6	LRT - Median runnir	0.09		Included in E
	Garvins Road	1.2	LRT - Median runnir	0.07		Included in E
3.7	The Hub Hornby	4.4	LRT - Running near I	0.39		Included in E
	Templeton	8.8	LRT - Running near I	0.77		Included in E
	Rolleston (North)	2.9	LRT - Median runnir	0.16		Included in E
	Rolleston (South)					
	Infrastructure Sub-Total	***61.2***		***4.29***		
	Depo			0.06		
	Rolling Stock			0.275		
	Property			0.03		
	TOTAL			**4.66**		

Cycle Time	Recovery Time	Headway	No. of units
236	35.4	2	136

Street Running, corridor focused (Busway)

Station	Distance to next station (km)	Treatment	Cost ($bn)	Station Treatment	Cost ($bn)
Rangiora (West)	1.9	BRT - Median runni	0.08		
Rangiora (East)	5	BRT - Highway	0.29		
Ravenswood	6.9	BRT - Highway	0.41		
Kaiapoi North	2.3	BRT - Median runni	0.09		
Kaiapoi Central	5.6	BRT - Highway	0.33		
Chaneys	2.7				
Belfast Road	1.5	BRT - Median runni	0.06		
Radcliffe Road	1.5	BRT - Median runni	0.06		
Prestons Road	2.5	BRT - Median runni	0.10		
Papanui Stop	1.7	BRT - Median runni	0.07		
Innes Road	1.3	BRT - Median runni	0.05		
Bealey Ave	1.6	BRT - Median runni	0.06		
Convention Centre	0.7	BRT - Median runni	0.03		
Central Exchange	0.9	BRT - Median runni	0.04		
Hospital	2.2	BRT - Median runni	0.09		
Riccarton	1.8	BRT - Median runni	0.07		
Ilam Road	1	BRT - Median runni	0.04		
Curletts Road	1.2	BRT - Median runni	0.05		
Blenheim Road	1.6	BRT - Median runni	0.06		
Garvins Road	1.2	BRT - Median runni	0.05		
The Hub Hornby	4.4	BRT - Median runni	0.18		
Templeton	8.8	BRT - Highway	0.52		
Rolleston (North)	2.9	BRT - Median runni	0.12		
Rolleston (South)					
Infrastructure Sub-Total	***61.2***		***2.83***		
Depo					
Rolling Stock			0.118		
Property			0.042		
TOTAL			**2.99**		