Greater Christchurch Public Transport Combined Business Case

WSP New Zealand Limited, Aurecon New Zealand Limited, QTP Limited and Boffa Miskell Limited

December 2020

Combined Business Case Parts A, B, C and D

WAKA KOTAHI NZ TRANSPORT AGENCY
Environment Canterbury Regional Council Kaunihera Taiao ki Waitaha
Christchurch City Council
WAIMAKARIRI DISTRICT COUNCIL
Selwyn DISTRICT COUNCIL

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TABLE OF CONTENTS

APPENDICES

GLOSSARY OF TERMS

TERM	Definition/Meaning
CCC	Christchurch City Council
CEMP	Construction Environmental Management Plan
CERA	Canterbury Earthquake Recovery Authority
Core routes	Blue Line, Orange Line, Purple Line, Yellow Line and The Orbiter
CPTP	Canterbury Public Transport Plan 2018-2028
CRLTP	Canterbury Regional Land Transport Plan 2015-2025
CRPS	Canterbury Regional Policy Statement 2013
CRPTP	Canterbury Regional Public Transport Plan 2018-2028
CVA	Cultural Values Assessments
DBC	Detailed Business Case
Frequent Route	A route achieving a frequency of 15 minutes all day (more frequent in peaks depending on demand)
GC MSP	Greater Christchurch Mode Shift Plan
GCTS	Greater Christchurch Transport Statement 2012
GPS	Government Policy Statement on Land Transport
hh/ha	Households per hectare
IBC	Indicative Business Case
ILM	Investment Logic Map
IMD	Index of Multiple Deprivation
Inner Core	The area within a 5km radius of the Central City where a high concentration of population resides.
KAC	Key Activity Centre
KPI	Key Performance Indicator
LTMA	Land Transport Management Act 2003
LTP	Long-Term Plan
LURP	Land Use Recovery Plan 2013
MaaS	Mobility-as-a-Service
MCA	Multi-Criteria Analysis
MCR	Major Cycle Route
NLTF	National Land Transport Fund
NOR	Notice of Requirement
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
Our Space	Our Space 2018-2048: Greater Christchurch Settlement Pattern Update
PBC	Programme Business Case
Project Team	WSP New Zealand Limited, Aurecon New Zealand Limited, QTP Limited and Boffa Miskell Limited
PT	Public transport
PTI	Planning Time Index
RTI	Real Time Information
SDC	Selwyn District Council
SH	State Highway
SOI	Statement of Intent 2018-2022
SOV	Single occupancy vehicle
SSBC	Single-Stage Business Case
TDM	Travel Demand Management
UDS	Greater Christchurch Urban Development Strategy
WDC	Waimakariri District Council

WHAKARĀPOPOTOTANGA MATUA / EXECUTIVE SUMMARY

Horopaki / Context

Te takiwā nei o Ōtautah kua tuatoru mai mō tōna rahi, he takiwā kua tuarua mai mō te tipu. E whakapae ana ka pēnei tonu, 470,000 tāngata i te tau 2018 ki te 641,000 tāngata i te tau 2048 (36%).

Ka tipu hoki ko ngā tūranga mahi mā te 28%. 239,600 ka piki ki te 307,100 i te wā ōrite. Te rahinga o ngā tūranga nei ka tū ki roto ake i te tāone o Ōtautahi.

Ki te tipu pēnei ngā nama me whai whakaaro ki ngā rautaki matapae hāerere. Mā te tau 2048 ka tū e 780,000 ngā haerenga hou ia te rā. Te rahinga o ēnei (94.8%) kei roto kē i ngā motoka motuhake, 2.3% noa iho o rātau he haerenga mā roto waka hāpori(public transport).

Te rahinga o ngā rautaki e aro ana ki te whakapiki nama waka hāpori o Ōtautahi he whakaritenga nō ngā hoa haere nei a Waka Kotahi New Zealand Transport Agency (Waka Kotahi), a Environment Canterbury (ECan), a Waimakariri District Council (WDC), a Christchurch City Council (CCC), a Selwyn District Council (SDC) hoki.

Te aronga matua / The Purpose of the Business Case

E whakāe katoa ana ngā hoa haere nei kei raro kē ngā nama whakamahi waka hāpori e pūtū ana. Ko tā mātau me noho tēnei hei aronga matua i te pae tata. Kua wāwahia ngā aronga matua ki ngā wāhanga e toru.

- E noho tōmuri ana ngā waka hāpori ki tā ngā waka motuhake. Ka hua ko te tōmuritanga o ngā waka hāpori e ngā waka motuahke, ā, ka takaroa te katoa
- Ka whara ngā waka hāpori o ēnei rā i ngā wāhi taupori nui, ngā taunga matua hoki. Ka hua ko ngā nama iti ō runga waka hāpori i ēnei wāhi
- E tū tonu ana ngā ārai whakamahi waka hāpori ki roto i a Ōtautahi. Ka hua ko ngā nama iti ō runga waka hāpori, te iti hoki o ngā tāngata hou e haere ana mā runga waka hāpori

E whakatau ana te rīpoata nei, me whakawai ngā hoa haere i tētahi mahere pūtea hei whakauru ki ngā mahere pae tawhiti o ia o rātau. Ngā aronga:

- He whakaputa hua mō ngā wāhi taupori nui, mō ngā wāhi kua rāhuitia hei takiwā tipu hoki
- Haepapangia ngā wā haerere o te waka hāpori kia rite ki tā te waka motuhake
- Kia manawa reka, ka rongo hoki te kiritaki i te māhana o te haumaru
- E hāngai ana ngā ara haere o ngā waka hāpori ki tā te kiritaki e hiahia ana, i te wā e tika ana mō rātau

Ka whakarite tūāpapa mō ngā whakamahinga whenua e haere ake nei.

Whakaritenga kōwhiri / Option Development

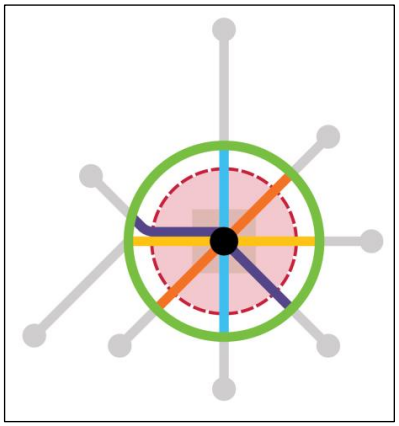
I whai whakaaro ngā whakaritenga kōwhiri ki ngā tono maha, ki ngā āhua turuki ārai e hāngai ana ki te whakatipu i te nui o ngā hunga whakamahi waka hāpori.

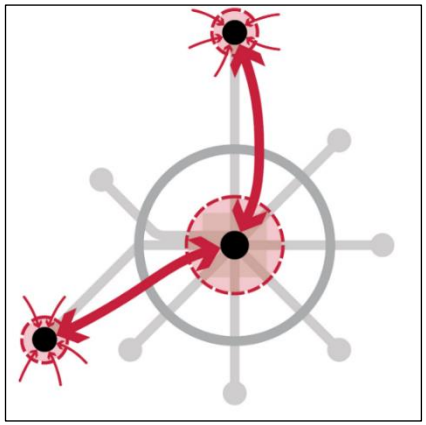
Ki te tipu ngā tāngata whakamahi waka hāpori i te tau 2028 me whakatere i ngā haerenga waka hāpori, me ranea hoki te rere o ngā waka nei.

Kua whaiwhakaaro ngā kaitito rīpoata ki ngā panonitanga ā hāpori, nō runga i ngā panonitanga nui kua hua kētia e kore e tino rerekē anō i te pae tata nei, ēngari ka rerekē anō a tōna wā.

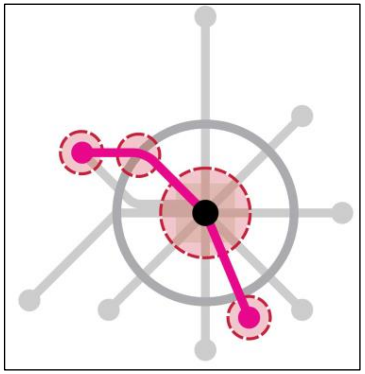
Ka puta ko ngā kōwhiritanga kua whakawehea ki ngā pae e rua, te pae tata, te pae tawhiti anō hoki.

Te Pae Tata / The Short Term Horizon (Ngā tau 1 - 6) e whaipānga ana ki ngā wāhanga o roto i a Ōtautahi ake kia puta ko ngā tino hua o te waka hāpori. E hāngai ana te rautaki nei ki ngā wāhi taupori nui, ngā wāhi mahi hoki. Ka aro hoki te pae nei ki ngā āheinga o te tāone o Ōtautahi me te tūhono i a ia ki ngā tāone iti, i a Selwyn, i a Waimakariri mā.





Ka whakakahangia ngā ara tumu mā te whakarite i te tūtohi auau kia wawe tāna kohi tāngata. Ka pai ake te wheako o ngā tāngata eke waka hāpori mā te hāngai o ngā whakaritenga pūkaha ki ngā hangarau whaiaro.



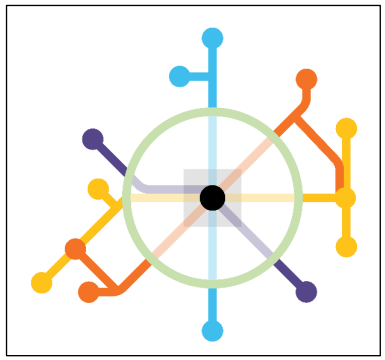
Ka tautokongia ngā mahi nei e te whakangao pūtea ki ngā pūnaha whakahaere. Ko tā te pūnaha nei he whakawhāiti i ngā hua kino o ngā waka hāpori rau e noho tōpū ana. Ka puta ko tētahi pūnaha kua whakahoahoa kia āio te rere o ngā waka katoa, kia mārire ngā nekenekehanga, kia matomato ngā hua taka iho. Ka māmā noa iho te whakauru i ngā haina ohorere ki ngā taunga matua kia mōhio whānuitia ngā kaieke i ngā karere tika i a rātou a tatari ana.

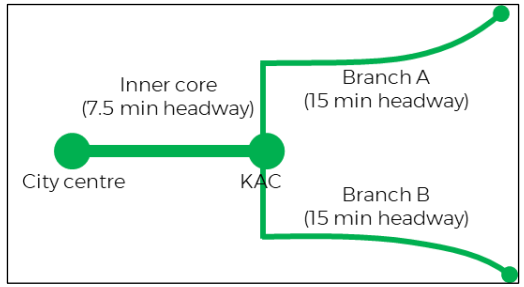
Ko te pae tata nei he mea whakariterite i te tūāpapa kia tika te kōkiri whakamua i te pae tawhiti.

Te Pae Tawhiti/ The Medium-Term Horizon (Ngā tau 7 - 10) Whakamahia ngā āheinga o roto i te tūāpapa kua hora e te pae tata ki te whakarauora i ngā āheinga ā hāpori, ā pākihi nei o te takiwā katoa.

Ka ranea ngā ara matua, ka uru mai ko ngā aka hou ki ngā huarahi matua kia wātea te tāpiri o ngā takiwā hou, kia tōtika hoki te hononga o ngā taunga matua.

Ka aro ngā wehenga pūkaha ki ngā ara e panoni ana. He haumaru, he haina, he waea pea.





Ka whai whakaaro ngā whakaritenga ki ngā taunga waka, ki ngā taunga pahikara o roto i ngā tāone iti kia haumaru te noho o ngā waka rā ia a rātau a noho puku ana. Ka hua ake ko te wairua tau ki roto i te hunga haerere ana mā runga waka hāpori.

Kāore e kore ka taumahatia te taunga pahi e ngā nekenekehanga hou nei. Ko te pae tawhiti he rautaki whakariterite i a ia kia tika tōna āhua mō te āpōpō o te waka hāpori. He āheinga pea o roto i te pae tata kia whaiwhakaaro ki ngā taumahatanga nei.

Ngā putanga matua

Anei ētahi o ngā putanga matua:

- Ka tāpiri kia 100 pea ngā pahi kia wawe ake te tae ki ngā tūranga, kia tipu hoki ngā tūru wātea o ia pahi
- 229 anō ngā haumaru pahi kia pai ake te noho o te hunga haerēre i a rātau e tatari ana
- 190 anō ngā haina raraunga kia kite ngā kaieke i te tūtohi auau
- He pānui oro, he papa pānui hoki ka tāpiri ki ia pahi kia mōhio ai ngā kaieke pahi ki ngā tūranga e whakatata mai ana

- Te takiwā o te 22 kiromita o ngā ara pahi ka tāpiri kia wawe ake te rere o ngā pahi
- Ka mātuatia ngā pahi i ētahi o ngā pūtahi mātua kia tae rātau ki ngā tūnga i te wā tika
- He tūnga waka ka tāpiri ki ētahi o ngā tāone nunui kia ngāwari ake the whakamahi i ngā pahi
- Mā ngā tūnga pahikara ka whakaturia ki ngā tunga pahi mātua ka tipu ngā āheinga o te whakamahi i ngā pahi

Ngā hōkai / Staging

Kua wehewehea ngā rautaki whanake kia puta ko ngā raukaha i ngā wā e tika ana, ka puta ngā hua whakangao pūtea kia taurite ngā hiahia o nāianei ki ngā hiahia o āpōpō, arā, ka toi tū ia wāhanga i tōna ake wā.

Kua whakatauria ngā hōkai o te pae tata mā te whai whakaaro ki ngā āheinga o nāianei, te utu, te nui o te hunga whaipānga ki ngā panonitanga, te hononga o ngā panonitanga ki ngā ara o nāianei, ngā taumahatanga o te tāpiri ara hou, ngā hinonga whenua hou anō hoki.

Ngā hua o te kōwhiringa nei / Outcomes from the Recommended Programme

Ka piki ngā haerenga waka hāpori mā te 3.5 miriona ia tau, he pikinga 4.9% karapipiti mai i te tau 2022 ki te tau 2028. He pikinga o te 44% mai i te tau 2018, 21% no te poke kore noa.

Kua huareretia ngā nama waka hāpori mō te tau 2028, ā, ki te whakawhenua ngā kōwhiringa nei ka piki ngā haerenga o ia tangata mai i te 31 ki te 36. Ka heke ngā haerenga o ngā waka motuhake o te takiwā nei mā te 19.7 miriona kiromita i te tau kotahi.

Ka whakamana ngā whakaritenga nei i ngā mahere whakangao pūtea:

Ka taurite ngā wā haere ki tā tērā o te waka motuhake i te tau 2028 / Improve journey time and reliability of PT services relative to private vehicles by 2028:

- Ka poto ake ngā wā haere no te tere o ngā waka hāpori me te tere kato i ngā kaieke. Ka hua ko te hono tika o te tangata ki ngā Key Activity Centre's (KACs). 94,000 anō ngā hunga e taea te uru ki te tāone i roto i ngā miniti 30
- Te wehenga wā o te waka hāpori ki tā te waka motuhake ka whāiti mā te 16% i ngā haerenga waiporoporo, 36% i ngā haerenga ārani, 21% i ngā haerenga kōwhai, 16% i ngā haerenga kahurangi, 13% i ngā haerenga tōtika mai i a Rangiora, 35% i ngā haerenga mai i a Rolleston

Hiki i te kounga o ngā waka hāpori mai ngā wāhi taupori nui mā te tau 2028 / Improve PT services to and from highly populated/high growth areas and key destinations across Greater Christchurch by 2028:

- Ka piki ngā kāinga e noho 30 miniti te tata ki te tāone mā runga waka hāpori ki te 168,000 i te tau 2028 ki te poke kore noa. Ka eke ki te 262,000 i te tau 2028 mā te whai i te mahere nei
- Ka eke ngā kāinga e noho 30 miniti te tawhiti ki ngā KACs ki te 317,000 mā te tau 2028 ki te whai i te mahere nei. Ki te kore, 202,000 noa iho ka waimarie. 90% o ngā takiwā apiapi ka uru ki te reanga nei
- Ka eke ngā tūranga mahi ki te 464,000, i te tau 2028, i roto i te 30 miniti mā te rautaki nei. Ka 355,000 noa iho ki te poka kore noa. Ko ngā wāhi whai turanga maha ka tino rongo i ngā hua (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington). 124,000 ngā kāinga kei roto i te reanga 30 miniti. 70,000 noa iho ka uru ki te kore
- Ka uru ngā kāinga 12,500 o Rangiora raua ko Rolleston ki te reanga 30 miniti te roa ki ō rātau ake KAC mā te tau 2028. 7,800 noa iho ki te kore e whai i te mahere nei

Turaki i ngā ārai mā te tau 2028 / Remove barriers to the uptake of PT by 2028

- Ka piki ngā takiwā e noho patatana (400m) ki ngā harerenga matua (he haerenga hou ia 15 miniti) mā te 39%. (164,000 ki te 184,000)
- Ka piki te tūhonotanga a ngā ratonga hauori, pākihi hoki
- Ka pai ake te tūtohi auau mā te whakauru i ngā pahi 100 anō
- 229 anō ngā tūnga pahi ka haumarungia. Ka whakatū kia 190 anō ngā haina raraunga kia kite ngā kaieke i te tūtohi auau
- Ka whakatū kia 44 ngā pouaka whakaata i ngā tūnga matua kia kite ngā kaieke i te tūtohi raraunga
- Ka whakarauora i te wheako a ngā kaieke mā te whakarite i ngā pānui oro hei whakatau i te tūnga e whakatata mai ana
- *Note: I whakapaengia e mātau ka whakatika te kāri metro i roto i ngā mahi 'poka kore noa' e te national integrated ticketing project*

Ngā hīraunga moni / Financial Implications

Kua whaiwhakaaro te whakatau tata o ngā hua, o ngā utu o ngā āhua kua kōrero kētia. Ka āta tuku ngā moni kia tū ngā whakaritenga hou i te wā tika.

Gross operational expenditure ka tipu mai i te $65.5 miriona i te tau kotahi (2020) ki te $118 miriona i te tau kotahi i te otinga o te rārangi mahi nei.

Intervention	Years 1-2	Years 3-4	Years 5-6	Years 7-8	Years 9-10
Gross operational expenditure (P50 Project cost estimates) (average per annum) (2020 dollars)					
Additional bus operational	$4.90M	$13.10	$17.30M	$38.20M	$50.70M
Travel demand measures	$0.45M	$0.60M	$0.38M	$0.51M	$0.82M
Information campaigns	$0.05M	$0.05M	$0.05M	$0.05M	$0.05M
Enforcement	$0.47M	$0.47M	$0.47M	$0.47M	$0.47M
Contract and network management	$0.37M	$0.37M	$0.37M	$0.37M	$0.37M
TOTAL (Gross)	**$6.24M**	**$14.59M**	**$18.57M**	**$39.60M**	**$52.41**
TOTAL (Net of farebox)	**$3.18M**	**$8.16M**	**$10.22M**	**$23.53M**	**$32.32**

79% o te utu nei e hāngai ana ki ngā nekenekehanga o roto i te tāone of Ōtautahi ake, 11% e hāngai ana ki a Waimakariri, 10% ki te rohe o Selwyn.

$115 miriona te utu ki te whakaoti i ngā āhua hangahanga, kua wāwāhia te utu nei.

Intervention	Years 1-3	Years 4-6	Years 7+	TOTAL
Capital expenditure in 2020 dollars				
Bus lane priority programme	$8.60M	$43.0M	$7.35M	$58.95M
Intersection improvement programme	$5.54M	$12.39M	$0.78M	$18.71M
Bus stop improvement programme	$5.98M	$6.49M	$4.80M	$17.27M
Park and ride programme	$0.55M	$2.0M	$3.2M	$5.75M
Bus interchange upgrades	$1.5M	-	$10.96M	$12.46M
Enhancement to bus management system	$0.26M	$0.63M	$0.98M	$1.87M
TOTAL (2020 dollars)	**$22.43M**	**$64.51M**	**$28.06**	**$115.01M**

Ngā utu nei ka wāwāhi ki ngā mana whakahaere:

Road controlling authority	TLA share (49%)	WK share (51%)	Total
Christchurch City Council	$37.36m	$38.89m	$76.25m
Waimakariri District Council	$1.0m	$1.04m	$2.04m[1]
Selwyn District Council	$3.58m	$3.73m	$7.31m
Environment Canterbury	$0.92m	$0.95m	$1.87m
Waka Kotahi (NZUP)		$27.54m	$27.54m

[1] Note Waimakariri District Council already allocated $4m in its current LTP to park and ride expansion to support direct services (excluded from this total).

Aronga ohaoha / Economic Analysis

Kua whakawehea ngā hua ohaoha ki te pae tata (1-6 tau), ki te katoa hoki o te rārangi mahi (1-10 tau). Te whakahekenga utu (discounted costs), BCRs (benefits and benefit ratios) kei te tēpu o raro. 6% te whakahekenga utu kua whakaurua ia tau.

Present value of net benefits – short term programme only	
Travel time cost savings (62%):	$426m
Reliability improvements (20%):	$137m
Road traffic reduction benefits (11%):	$73m
Walk benefits (5%)	$34m
TDM benefits (3%):	$21m
TOTAL BENEFITS	$693m
Present value of costs	
Additional Capex	$74m
Additional Opex	$229m
TDM	$2m
Additional staff	$8m
Additional maintenance	$<1m
TOTAL COSTS	$314m
Benefit cost ratio $_{(N)}$	2.2

Ka hua ko te BCR(N) 2.2 i te pae tata. 2.1 – 3.5 tōna reanga. 2.6 te BCR(G), 2.4 – 3.4 tōna reanga.

Kei raro kē ngā hua ohaoha ki tā ngā hiahia whānui o Waka Kotahi 1.0 ki te 3.0 te hua.

4.1% te FYRR (first-year rate of return) o te pae tata, 2.0% mō te 10 tau.

Mō te rārangi mahi katoa kua tātai te BCR(N) ka puta ko te 1.6, 1.5- 2.3 tōna reanga. Te BCR(G) kua tātai hei 1.9, 1.8 - 2.4 tōna reanga.

1.0 te $BCR_{(N)}$ o te pae tawhiti noa iho (tau 7 -10), 0.9 – 1.6 tōna reanga.

Present value of net benefits – full programme	
Travel time cost savings (59%):	$615m
Reliability improvements (21%):	$214m
Road traffic reduction benefits (10%):	$105m
Walk benefits (6%)	$64m
TDM benefits (4%):	$37m
TOTAL BENEFITS	$1,037m
Additional Capex	$86m
Additional Opex	$548m
TDM	$4m
Additional staff	$8m
Additional maintenance	$<1m
Present value of costs	
TOTAL COSTS	$647m
Benefit cost ratio $_{(N)}$	1.6

Covid-19

Kāhore ngā kōrero nei kia tino whaiwhakaaro ki ngā hua o te Covid-19 nō te nui o ngā pōhauhau ōna.

E ai ki te whakarāpopototanga o Arataki ka āta tipu ngā haererenga ā waka i roto i te pae tata. He hua tēnei o te āta tipu o te hāpori o Ōtautahi, o te mahi ki te kāinga hoki. Ōrite ana te pae tawhiti.

Nō runga i ngā kōrero nei me taurite ngā hokainga whakamua ki tā ngā nekenekehanga o te wā.

Hōkai tuatahi / Next Steps:

Ko tā te rīpoata nei a whai ana:

- Tāpiri ngā whakaritenga utu, whakaritenga kāwanatanga hoki ki ngā haepapa pae tawhiti o ia o koutou
- Kōkiri i ngā panonitanga PTOM e hāngai ana ki ngā whakaritenga pae tata
- Kōkiri i ngā whakaritenga pae tata kia taea te whakawātea pūtea mō te pae tawhiti

EXECUTIVE SUMMARY

Context

Greater Christchurch's population of 470,000[2] is projected to grow by 36% to over 641,000 by 2048. Employment is forecast to grow by approximately 28% over the same period from 239,600 to 307,100, with the majority of these (89%) in Christchurch's central city.

This growth will increase travel demand. Forecasts indicate there will be an additional 780,000 trips per day by 2048. The majority (95%) of these trips will be by private vehicles with low occupancy. Without intervention, trips made on public transport are expected to remain low at approximately 2.3% of all trips.

The Greater Christchurch Public Transport Futures programme comprising Waka Kotahi New Zealand Transport Agency (Waka Kotahi), Environment Canterbury (ECan), Waimakariri District Council (WDC), Christchurch City Council (CCC) and Selwyn District Council (SDC) was established to increase the uptake of public transport.

This PT Futures work is part of suite of programmes underway to support modal shift across Greater Christchurch and support wellbeing and liveability.

Increasing the share of travel undertaken by Public Transport in Greater Christchurch will improve urban mobility. For urban areas to thrive, people need to be able to move around easily and have a range of choices for how they get to work, connect with family and friends and access services. An increasing travel choice will reduce reliance on private vehicle use for all trips. A higher proportion of trips on modes other than the private car will improve congestion, carbon emissions, public health and travel costs. Consequently, a modern transport system with a mix of reliable transport options that help keep people and products safely moving is required.

The recently released 'Greater Christchurch Regional Mode Shift Plan' seeks to make both active and public transport more attractive with one of the five key focus areas to look to encourage the uptake of public transport though investment in infrastructure and services to make public transport more attractive.

The Programme Business Case (PBC) prepared in 2018 identified the role that Public Transport has for stimulating regeneration of Greater Christchurch and the benefits that it has for accessibility, reducing the need for more developable land to be set aside for transport corridors and car parks.

The PBC identified several integrated improvements to be undertaken in an integrated manner to achieve increased public transport patronage.

This Combined Business Case started out as the Greater Christchurch Public Transport Foundations Single-Stage Business Case (SSBC) and Greater Christchurch Public Transport Rest of Network Indicative Business Case (IBC). It combines with the Mass Rapid Transit (MRT) IBC to form the Greater Christchurch PT Futures programme. Note that the 'Foundations' and 'Rest of Network' terminology comes from the 'A Case for Investment' and these business cases have since been combined, with a short term and full programme emerging from that combined business case.

This combined business case is co-sponsored by the Waka Kotahi, ECan, WDC, CCC and SDC (the investment partners), who agreed the low public transport uptake is of concern and needs addressing over the short to medium term (by 2028) with a focus on the following three key problems:

- The current PT system can be unreliable, and many journey times are not competitive with the private vehicle, resulting in poor PT mode share and longer and less reliable journey times
- The current PT system is not effectively supporting highly populated/high growth areas and connections to key destinations, resulting in poor PT mode share within these areas
- There are a number of barriers to using PT in Greater Christchurch, resulting in a low uptake of new PT users and subsequent poor PT mode share

This business case recommends an investment programme for inclusion in the partner organisations Long Term Plans that:

- Delivers high-frequency PT options to existing Key Activity Centres (KACs) and planned growth areas
- Provides reliable services with journey times that are competitive with private vehicles
- Is attractive and safe to use for customers
- Takes people where they want to go, when they want to get there
- Provides a catalyst for desired land use development

Option development

The option development process considered supply and demand measures and interventions aimed at removing barriers to the uptake of public transport. This

[2] 2018 statistics

analysis indicated that increased frequency supported by measures that improve journey time and reliability would result in the highest patronage uplift to the PT system by 2028.

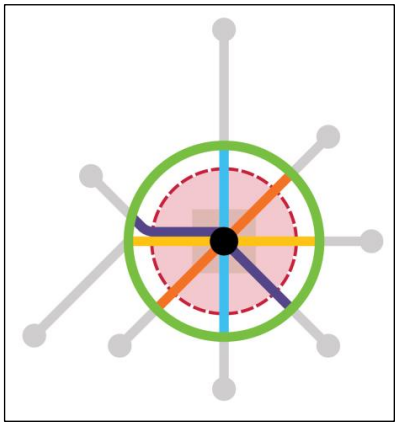
Significant changes in the settlement pattern are not anticipated over the short to medium term as a result of changes to the PT system. Settlement patterns are well advanced, and changes occur over a longer timeframe.

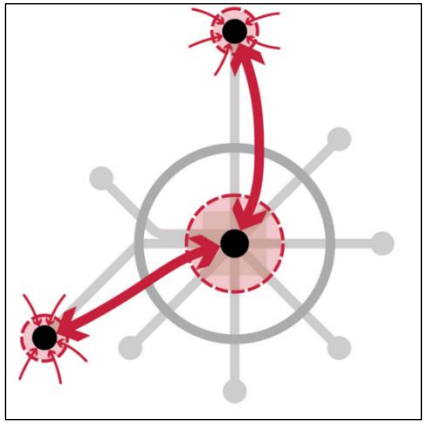
The recommended programme is staged over two horizons; a short-term horizon and a medium-term horizon.

Recommended programme

The short-term horizon (first 6 years of the programme) focuses improvements on the inner core of Greater Christchurch (an area within an approximate 5 km radius from the central city) as this is where the biggest potential market of future PT users exists. Presently, 67% of all boardings occur within 5 km of the Christchurch City centre and this area has 44% of the population of Greater Christchurch and 60% of all employment opportunities.

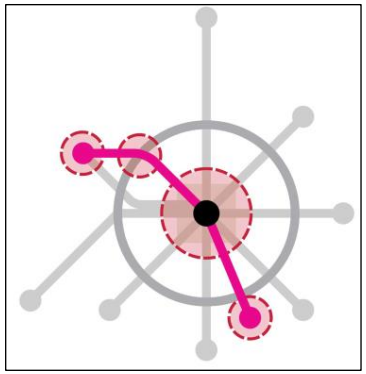
The philosophy for this horizon is to make best use of the existing network structure and assets that support the highest population and employment areas. Improved access to city centre opportunities would also be supported by more direct services from the larger towns in Selwyn (Rolleston and Lincoln) and Waimakariri (Kaiapoi and Rolleston).





The core network of frequent services (foundation routes) will be strengthened with extra capacity by moving towards a turn-up and go frequency along the inner core parts of the existing foundation routes. Infrastructure improvements that enhance the efficiency of the increased capacity will focus on the repurpose of road space and technology to improve user experience.

The number of routes classified as frequent will be expanded in the short term to include Routes 17, 28 and 29.

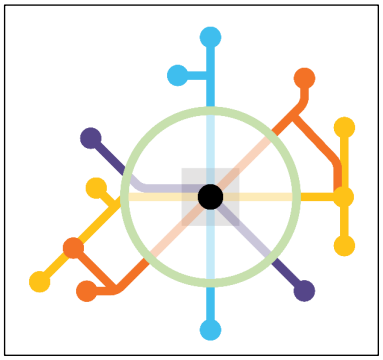


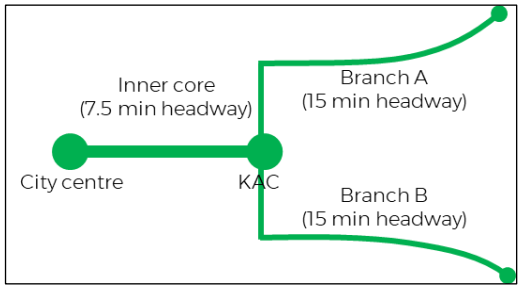
The higher frequencies would be supported by investment in improved operational management through headway management system. This is needed to help prevent bunching at the interchange as well as to ensure Orbiter routes (clockwise and anti-clockwise) maintain their headway to enhance transfer experience. Investment also allows for travel demand management and operation efficiency support to the increased frequencies, as well as enhanced customer information through on board announcements and real time information (RTI) at key stops.

The short-term horizon will be a building block for future expansion with minimum abortive investment when the option expands to the medium-term horizon.

The medium-term horizon (years 7-10) leverage capacity created in the short term to improve access to economic and social opportunities to residents in the outer suburbs.

It introduces 'branching' on key routes to increase direct connections from more residential areas to their key activity centre and the city centre. The number of routes classified as frequent will also be expanded by improving frequency on re-aligned routes 60 and 80 that connect new housing growth areas better to opportunities.





Bus stop infrastructure provisions are targeted at the changes to the existing frequent routes (as part of branching approach) as well as supporting new frequent routes (Route 80 and Route 60) with bus stop infrastructure (shelters, timetable displays etc).

Access to the park and rides in the larger towns in Selwyn and Waimakariri are further enhanced through the provision of secure cycle facilities.

The additional frequency throughout the network will place pressure on the city centre bus exchange. The medium-term horizon allows investment for changes to the bus exchange to expand its capacity with land purchase to protect the ability to do anticipated layout changes as part of the short-term horizon.

Key elements

Key elements in the programme include:

- Approximately 100 more buses providing more seats to more locations more often
- 229 more bus shelters providing better waiting facilities
- 190 more real time display units providing accurate information on bus arrival times
- On-board audio-visual announcements providing information on upcoming stops and transfers
- Approximately 22 kilometres of bus lanes making buses more reliable and faster
- Priority measures for buses at key intersections across the city making journeys more reliable
- Park and ride facilities at larger towns making it easier to access the bus network
- Secure bike parking at key stops providing more options with a greater catchment to frequent bus routes

Staging

A staged introduction of the service improvements was considered to ensure optimal value for money that allows for the timely provision of additional services. It balances the need to create room for growth with the risk of over-investing in too much capacity too early in the decade.

The sequencing within the short-term horizon has been determined by considering:

- The available capacity on existing services
- The current commercial ratio of the service
- The additional cost per new boarding; the number of people that will benefit from the improvement
- The impact it will make on existing service patronage
- The level of congestion experienced by current bus services and general vehicles
- The likely implementation timeframes of other committed projects
- Land use activities and how these improvements will integrate with those

Outcomes from recommended programme

The recommended option provides for the following enhancements:

- More services connecting residents more directly to social and economic opportunities
- Provision of approximately 100 more buses running more frequently across the network (in peaks and off-peak periods) providing users with enough available seats as well as improved scheduled hours (early and late in the day)
- 229 more bus shelters providing users with better waiting facilities
- 190 more real time display units across the network, providing users with accurate information on bus timetables and arrival times, as well as information about delays
- 44 RTI screens within key centres (i.e. shopping malls, hospital, libraries and airport) providing users with information on bus arrivals and departures screens

- Enhanced on-board experience through audio announcements on upcoming stops as well as opportunities to access / transfer at these stops
- *Note: enhancements to the metro card system was assumed in the Do-Minimum scenario as part of the national integrated ticketing project*

The recommended option is expected to increase annual PT trips by 3.5 million, growing at a 4.9% compound average rate from 2022 to 2028. This represents a 21% increase from 2028 Do-Minimum and a 44% increase from 2018.

The 2028 forecast annual PT trips per capita improves from 31 (under Do-Minimum scenario) to 38 annual PT trips per capita for the recommended option.

Total Private Vehicle Km travelled on the Greater Christchurch network decrease by 19.7 million per year, resulting in a corresponding reduction in environment measures from private vehicles.

The option is also effective in delivering against the Investment Objectives in the following ways:

Improve journey time and reliability of PT services relative to private vehicles by 2028:

- The vehicle journey time ratio between cars and PT is forecast, to a range between 0.6 to 1.2 across the routes, compared to a ratio range between 1.1 to 1.5 in the 2028 Do-Minimum.
- In vehicle journey times decrease, and alongside improved wait times this decreases the overall end-to-end journey times, which directly contributes to the accessibility improvements outlined below.

Improve PT services to and from highly populated/high growth areas and key destinations across Greater Christchurch by 2028:

- The number of households that can access the Central City within 30 minutes on PT increases by 56% (from 168,000 households in the 2028 Do-Minimum to 262,000 households)
  - Do-Minimum (by 2028): 168,000 households
  - Option Outcome (by 2028): 262,000 households
  - Improvement: 94,000 households
  - Percentage Improvement: 56%
- Household accessibility to Key Activity Centres increases across the region (i.e. the number of households that can access their nearest KAC within 30 minutes on PT compared to the 2028 Do-Minimum) by 56 % (from 202,000 to 317,000)
  - Do-Minimum (by 2028): 202,000 households
  - Option Outcome (by 2028): 317,000 households
  - Improvement: 114,700 households
  - Percentage Improvement: 56%

  In addition, over 90% of households in the high-density residential areas can access more than one KAC within 30 minutes by public transport.
- The number of jobs that can be accessed within 30 minutes of PT increases by 31% (from 355,000 to 464,000)
  - Do-Minimum (by 2028): 355,000 jobs
  - Option Outcome (by 2028): 464,000 jobs
  - Improvement: 109,000 jobs
  - Percentage Improvement: 31%
- The number of households able to access to high employment zones (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington) within 30 minutes on PT also increases by 57% (from 70,000 households 124,000)
  - Do-Minimum (by 2028): 79,000 households
  - Option Outcome (by 2028): 124,000 households
  - Improvement: 45,300 households
  - Percentage Improvement: 57%
- The number of households within Rangiora and Rolleston able to access a KAC within 30 minutes increases by 60% (from 7,800 households to 12,500 households)
  - Do-Minimum (by 2028): 7,800 households
  - Option Outcome (by 2028): 12,500 households
  - Improvement: 4,700 households
  - Percentage Improvement: 60%

Remove barriers to the uptake of PT by 2028

- Population catchments living within 400m of a frequent route (i.e. minimum PT frequency of 15 minutes) increase by 39% increase (from 132,000 households to 184,000)
  - Do-Minimum (by 2028): 132,000 population
  - Option Outcome (by 2028): 184,000 population
  - Improvement: 52,000 population
  - Percentage Improvement: 39%

Financial implications

The cost and benefits for the programme were estimated considering the required operational expenditure across the programme to increase the bus frequencies, as well as to support that with travel demand measures, enforcement and additional infrastructure.

The programme allows for improvements to be phased in over time. The staging keep pace with anticipated growth in demand as well as the ability and time needed to implement the recommended infrastructure changes. Gross operational expenditure is estimated to increase from a base $65.5 million per annum (in 2020) to $118 million per annum by the end of the programme. The farebox take is also forecast to increase with the increased ridership, and net of farebox the overall increase in operational expenditure is estimated to increase by approximately $32.32 million per annum to $71 million per annum. The breakdown is shown in the table below.

Intervention	Years 1-2	Years 3-4	Years 5-6	Years 7-8	Years 9-10
Gross operational expenditure (P50 Project cost estimates) (average per annum) (2020 dollars)					
Additional bus operational	$4.90M	$13.10	$17.30M	$38.20M	$50.70M
Travel demand measures	$0.45M	$0.60M	$0.38M	$0.51M	$0.82M
Information campaigns	$0.05M	$0.05M	$0.05M	$0.05M	$0.05M
Enforcement	$0.47M	$0.47M	$0.47M	$0.47M	$0.47M
Contract and network management	$0.37M	$0.37M	$0.37M	$0.37M	$0.37M
TOTAL (Gross)	**$6.24M**	**$14.59M**	**$18.57M**	**$39.60M**	**$52.41**
TOTAL (Net of farebox)	**$3.18M**	**$8.16M**	**$10.22M**	**$23.53M**	**$32.32**

Most (79%) of the increase in operational expenditure associated with bus service hours and kilometres travelled occur within the Christchurch City boundary area. Operational expenditure associated with bus service kilometres and hours in the Waimakariri and Selwyn Districts accounts for 11% and 10% of the total expenditure respectively.

The total physical works for the programme (costs to construct the improvements) have been estimated at $115 million, with the breakdown shown in the table below.

Intervention	Years 1-3	Years 4-6	Years 7+	TOTAL
Capital expenditure in 2020 dollars				
Bus lane priority programme	$8.60M	$43.0M	$7.35M	$58.95M
Intersection improvement programme	$5.54M	$12.39M	$0.78M	$18.71M
Bus stop improvement programme	$5.98M	$6.49M	$4.80M	$17.27M
Park and ride programme	$0.55M	$2.0M	$3.2M	$5.75M
Bus interchange upgrades	$1.5M	-	$10.96M	$12.46M
Enhancement to bus management system	$0.26M	$0.63M	$0.98M	$1.87M
TOTAL (2020 dollars)	**$22.43M**	**$64.51M**	**$28.06M**	**$115.01M**

These costs are allocated between the different partners as follows:

Road controlling authority	TLA share (49%)	WK share (51%)	Total
Christchurch City Council	$37.36m	$38.89m	$76.25m
Waimakariri District Council	$1.0m	$1.04m	$2.04m[3]
Selwyn District Council	$3.58m	$3.73m	$7.31m
Environment Canterbury	$0.92m	$0.95m	$1.87m
Waka Kotahi (NZUP)		$27.54m	$27.54m

Economic analysis

The economic benefits for the programme were calculated for a short-term programme (years 1-6) and for the full programme (years 1 – 10). The discounted costs, benefits and benefit ratios (BCRs) are shown in the tables below for the 6% discount rate per annum.

Present value of net benefits – short term programme only	
Travel time cost savings (62%):	$426m
Reliability improvements (20%):	$137m
Road traffic reduction benefits (11%):	$73m
Walk benefits (5%)	$34m
TDM benefits (3%):	$21m
TOTAL BENEFITS	$693m
Present value of costs	
Additional Capex	$74m
Additional Opex	$229m
TDM	$2m
Additional staff	$8m
Additional maintenance	$<1m
TOTAL COSTS	$314m
Benefit cost ratio (N)	2.2

The resulting BCR(N) for the short-term option alone is 2.2 with sensitivity in the range 2.1-3.5. BCR(G) is 2.6, with a sensitivity in the range of 2.4 to 3.4.

This BCR is between 1.0 and 3.0, therefore project is considered to have a 'low' rating for the Economic Efficiency component of NZTA's Investment and Revenue Strategy assessment profile.

The first-year rate of return (FYRR) for the short-term programme is calculated to be 4.1%.

The BCR(N) for the full 10-year programme (short and medium term) is calculated as 1.6 with sensitivity in the range of 1.5 to 2.3. The BCR(G) is calculated as 1.9, with a sensitivity in the range of 1.8 to 2.4.

The first-year rate of return (FYRR) for the full programme is calculated to be 2.0%.

This BCR is also considered to have a 'low' rating for the Economic Efficiency component of NZTA's Investment and Revenue Strategy assessment profile.

Present value of net benefits – full programme	
Travel time cost savings (59%):	$615m
Reliability improvements (21%):	$214m
Road traffic reduction benefits (10%):	$105m
Walk benefits (6%)	$64m
TDM benefits (4%):	$37m
TOTAL BENEFITS	$1,037m
Additional Capex	$86m
Additional Opex	$548m
TDM	$4m
Additional staff	$8m
Additional maintenance	$<1m
Present value of costs	
TOTAL COSTS	$647m
Benefit cost ratio (N)	1.6

[3] Note Waimakariri District Council already allocated $4m in its current LTP to park and ride expansion to support direct services (excluded from this total).

The incremental $BCR_{(N)}$ to implement the medium-term option after the short-term option is 1.0. This exceeds the target incremental BCR of 1.0. The sensitivity test range for the incremental BCR is 0.9 to 1.6.

Impact of Covid-19

The analysis supporting the recommended programme and staging have not taken account of the impact of Covid-19. Significant levels of uncertainty remain regarding the scale and duration of Covid-19 impacts, particularly in the medium to long-term.

Waka Kotahi Arataki Version 2 provides an overview of projected impacts of Covid-19 on employment and migration in the region. It anticipates an easing of growth in passenger transport demand over the short-term, due to slower population growth, and reduced employment and discretionary trips. However, no significant changes are expected in the nature, scale and location of transport demand over the medium to long-term. While work patterns for professional services may see a growth reduction in peak trips to city centre for example, due to more people working remotely), the overall 10-year outlook remains largely unchanged.

Due to this level of uncertainty, and some funding pressures amongst the partners, the proposed staging strategy may be adapted over time but the intent of the partners is to deliver this programme over the ten year period. Hence there is an ongoing monitoring plan to ensure a responsive approach that matches growth and demand and funding capacity.

Next steps:

The four councils have endorsed the strategic approach to public transport outlined in this business case, and requested Environment Canterbury, on behalf of the partners, to submit the combined business case to Waka Kotahi for its consideration and endorsement. Once the combined business case has been endorsed by Waka Kotahi, the partner councils will:

- Formalise the capital and operational investment in the respective partner organisation's long-term plans.
- Formally progress procurement activities to vary PTOM contracts for changes to the bus network anticipated within the short-term programme of this programme.
- Formally progress procurement for implementation of infrastructure improvements for the short-term programme that secure allocated funding through each organisation's LTP and gain co-investment from Waka Kotahi as necessary.

PART A – STRATEGIC CASE

1 STRATEGIC CASE (STRATEGY)

The Greater Christchurch Public Transport Futures programme was developed by Waka Kotahi New Zealand Transport Agency (Waka Kotahi), Environment Canterbury (ECan), Waimakariri District Council (WDC), Christchurch City Council (CCC) and Selwyn District Council (SDC) in recognition of the growth challenges occurring in Greater Christchurch following the 2010 and 2011 Canterbury earthquakes. The programme responds to the need for a public transport (PT) system with significantly increased patronage and mode share that:

- Delivers high-frequency PT options to existing Key Activity Centres (KACs) and planned growth areas
- Provides reliable services with journey times that are competitive with private vehicles
- Is attractive and safe to use for customers
- Takes people where they want to go, when they want to get there
- Provides a catalyst for desired land use development

The outcome of this Greater Christchurch Public Transport Combined Business Case is an integrated approach to addressing the transport challenges in Greater Christchurch that recognises the planned growth and responds with PT improvements, together with, or in advance of, this growth.

This combined Business Case (with additional detail on the short-term components):

- Is delivered in a staged approach, such that information is available to inform the upcoming Long-Term Plan (LTP) and the Canterbury Regional Land Transport Plan (CRLTP) 2021-2031 planning processes
- Reconfirms and updates the activity and strategic context for the proposed investment
- Re-examines and updates the evidence base for the key problems and rationale for investing
- Demonstrates how the potential benefits of investing may be assessed using SMART (Specific, Measurable, Agreed upon, Realistic and Time-related) transport Key Performance Indicators (KPIs)
- Provides an investment case that is prioritised, affordable, fundable and offers strong value proposition that is aligned with the Government Policy Statement on Land Transport (GPS) 2018/2019-2027/2028 (GPS 2018) 2018 and GPS 2021/2022-2030/2031 (GPS 2021)
- Recommends a programme of interventions that are sufficiently robust to deal with the rapidly changing transport environment of Greater Christchurch, including the financial, economic, commercial and management case

The Programme Business Case (PBC) prepared in 2018 identified the role that Public Transport has in stimulating regeneration of Greater Christchurch and the benefits that it has for accessibility, reducing the need for more developable land to be set aside for transport corridors and car parks.

The PBC identified several integrated recommendations including:

- Continuous public transport priority lanes and rapid transit
- State-of-the-art vehicles
- Improved bus stops
- Alignment with spatial planning initiatives
- Higher frequency and extended operating hours
- Improved information provision

The PBC outlines that the improvements need to be undertaken in an integrated manner to achieve increased public transport patronage.

The recommended programme from the PBC was staged to develop a flexible network that can respond to changes in travel demand through population growth, settlement patterns, and external factors such as emerging technology or pricing.

This Combined Business Case started out as the Greater Christchurch Public Transport Foundations Single-Stage Business Case (SSBC) and Greater Christchurch Public Transport Rest of Network Indicative Business Case (IBC). It combines with the Mass Rapid Transit (MRT) IBC to form the Greater Christchurch PT Futures programme (Figure 1). Note that the 'Foundations' and 'Rest of Network' terminology comes from the 'A Case for Investment' and these business cases have since been combined, with a short term and full programme emerging from that combined business case.

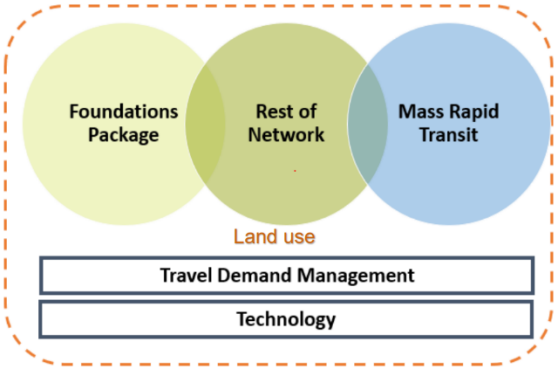


Figure 1: PT Futures Programme Implementation[4]

1.1 GEOGRAPHIC CONTEXT

The study area for this Combined Business Case is defined as Greater Christchurch, which includes and surrounds Christchurch City, the five existing core bus routes and the existing overall bus network. As illustrated in Figure 1, Greater Christchurch extends from Rangiora in the north to the Selwyn and Waimakariri Rivers in the south, and from Lyttelton in the east to Burnham in the west.

The study area also includes state highways and local road corridors in Greater Christchurch which currently, or in the future, will carry Metro PT bus services, as well as the residential, commercial, rural, industrial and open space land use areas in Greater Christchurch. This study area is illustrated below in Figure 2.

Christchurch City is the primary urbanised area in Greater Christchurch and is constrained by Pegasus Bay to the east, the Port Hills to the south and the Waimakariri River to the north.

The Greater Christchurch area is characterised by a large expanse of flat land to the west of the City which has enabled Christchurch City's urban area to spread. Despite this, a large portion of the Greater Christchurch population resides within 10km of the Central City, with growing outer areas dispersed approximately 18km and 24km from the Central City (Figure 3). When compared to Auckland and Wellington, this results in a much greater percentage of the population being located within a 10km radius of the central city, likely due to less geographical constraints for development.

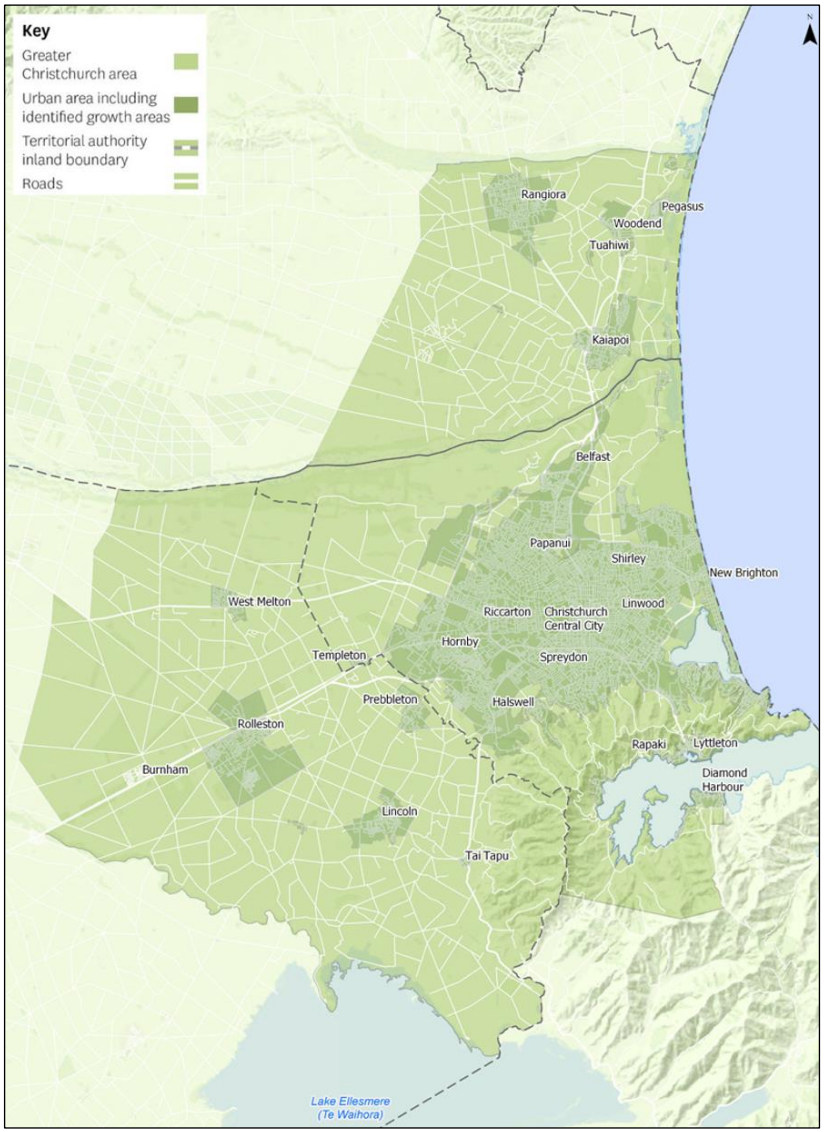


Figure 2: Greater Christchurch PT Combined Business Case study area[5]

[4] Figure 10, p. 17. (2018) Greater Christchurch Public Transport: A Case for Investment – Summary of Programme Business Case

[5] Greater Christchurch Area, Figure 1, p. 3 Our Space 2018-2048

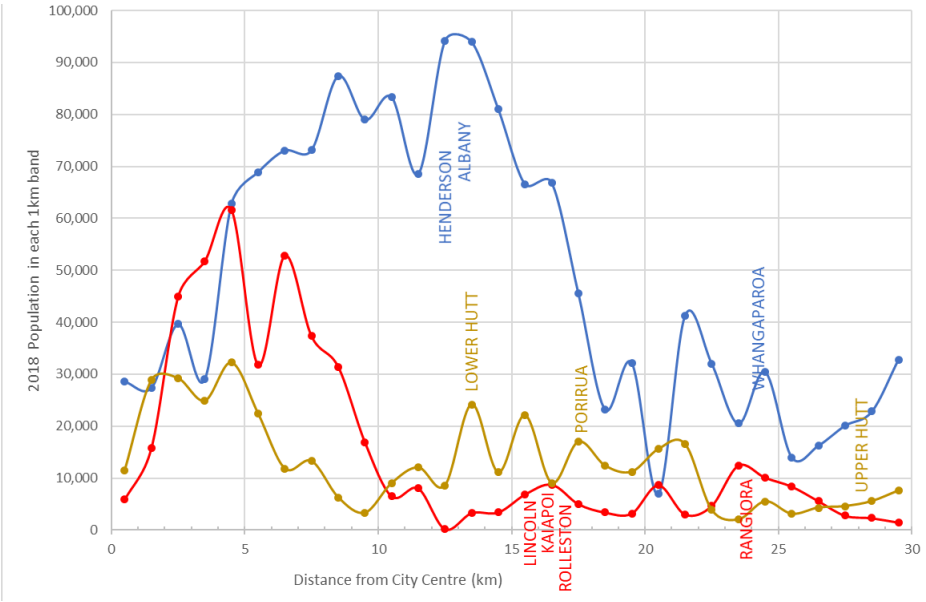


Figure 3: Distance of Population from City Centre - 2018 Census[6]

1.2 GOVERNANCE CONTEXT

This combined business case is co-sponsored by the Waka Kotahi, ECan, WDC, CCC and SDC. Development of this business case is under the overarching strategic direction of the Canterbury Regional Land Transport Plan (CRLTP) 2015-2025 and Canterbury Public Transport Plan (CPTP) 2018-2028, and with strong links to the GPS 2018 and GPS 2021.

This section explains how the scope of the proposed investment in the PT in Greater Christchurch aligns with the existing strategies of the investment partner organisations.

1.2.1 Organisational overview

Waka Kotahi, ECan, WDC, CCC and SDC are responsible for the planning, development, operation and maintenance of the road transport network for Greater Christchurch. In addition, they are responsible for informing land use patterns through the development and implementation of the Urban Development Strategy, Our Space 2018-2048, the Regional Policy Statement and District Plans.

Waka Kotahi NZ Transport Agency

Waka Kotahi is responsible for managing, operating, planning for and improving the state highway network and delivery of PT. It is a key investor in the transport system through funding contributions to transport projects, PT delivery, planning policies and programmes undertaken by ECan, CCC, SDC and WDC.

The strategic priorities for Waka Kotahi focus on creating a safer, more resilient and sustainable transport system that improves access to social and economic opportunities and improves the wellbeing of all New Zealanders. Its public transport function is integral to these strategic priorities and future outcomes.

As an investment partner to this combined business case, Waka Kotahi is fundamentally concerned with directing investment in PT to provide alternatives to cars, improve access to economic activities, ease congestion and help unlock the potential of our cities, as set out in the GPS 2021. Effective investment is needed to help solve the problems identified in the strategic case and move towards a *One Network* approach integrating land use and transport and achieving more value from PT investment.

Environment Canterbury

ECan is the lead agency responsible for advocating for Canterbury's regional transport needs nationally and planning and operating urban PT services in Greater Christchurch (Metro). Collaboratively ECan works with city and district councils to provide PT infrastructure to support its services. ECan has a pivotal role in driving and managing the future form and function of PT to improve patronage, coverage, efficiency and perception.

ECan is also responsible for the Regional Policy Statement which identifies urban housing development areas in Rolleston, Rangiora and Kaiapoi and associated policy provisions that direct District Plans and drive land use development patterns.

Christchurch City Council

CCC is responsible for PT infrastructure and for managing the local road network in Christchurch which forms, with the state highway, the land transport network in Christchurch. Investment by the CCC will be critical to provide the necessary improvements to the local road network, network management, parking provisions and PT infrastructure.

[6] Stats NZ, WSP Analysis

CCC is also responsible for the development and implementation of the Christchurch District Plan.

Waimakariri District Council

WDC is the asset owner and responsible for managing the local transport system, including PT facilities and infrastructure in the Waimakariri District. The Waimakariri District generates several trips to Christchurch City from the north, and WDC will be influential in ensuring a collaborative approach to the delivery of PT infrastructure and Greater Christchurch transport network efficiency.

WDC is also responsible for the development and implementation of the Waimakariri District Plan.

Selwyn District Council

SDC is the asset owner and responsible for managing the local transport system, including PT facilities and infrastructure in Selwyn District. The Selwyn District generates several trips to Christchurch City from the south, and SDC will be influential in ensuring a collaborative approach to the delivery of PT infrastructure and Greater Christchurch transport network efficiency.

SDC is also responsible for the development and implementation of the Selwyn District Plan.

1.3 TRANSPORT NETWORK CONTEXT

1.3.1 Public transport services

The Greater Christchurch's PT network consists of 25 bus services that operate as part of a radial network model, with 15 routes travelling to/through the central city and 10 across/around the city. As at July 2019, the network is operated by 208 buses and one ferry, which make almost 60,000 trips per year. This equates to almost 300,000km per week and over 15.5 million kilometres per year[7]. There are currently three contracted operators running the network's services (RedBus, Go Bus and Ritchies). These contracts have recently been re-awarded with the new contracts commencing September 28, 2020.

A new bus network was launched in 2014, offering three types of bus services, described below and shown in Figure 4.

- **High Frequency Lines** (formerly termed Metro Lines) - Five core routes run along Christchurch's major road corridors, connecting people to significant KACs, destinations and larger towns in Selwyn and Waimakariri including Rangiora, Kaiapoi, Lincoln, Templeton and Rolleston
- **City Connectors** (formerly termed Metro City Connectors) allow people to travel from outer suburbs/towns directly to the Christchurch Central City
- **Suburban Links** (formerly termed Metro Suburban Lines). Suburban links allow people to travel between the inner suburbs while bypassing the Christchurch Central City. People wanting to go to the Christchurch Bus Interchange need to transfer onto another bus at transfer points located throughout Christchurch

CCC provides bus lanes at some locations (i.e. along sections of Colombo Street south of the Central City, Papanui and Riccarton Road), which operate during peak commuting hours on some routes. While many of the existing road corridors have enough width to provide for priority bus lanes it is important to note that such changes require extensive public consultation and engagement to alter road prioritisation and for parking removal.

[7] ECan (2019). 22 July 2019 Trip Type Data

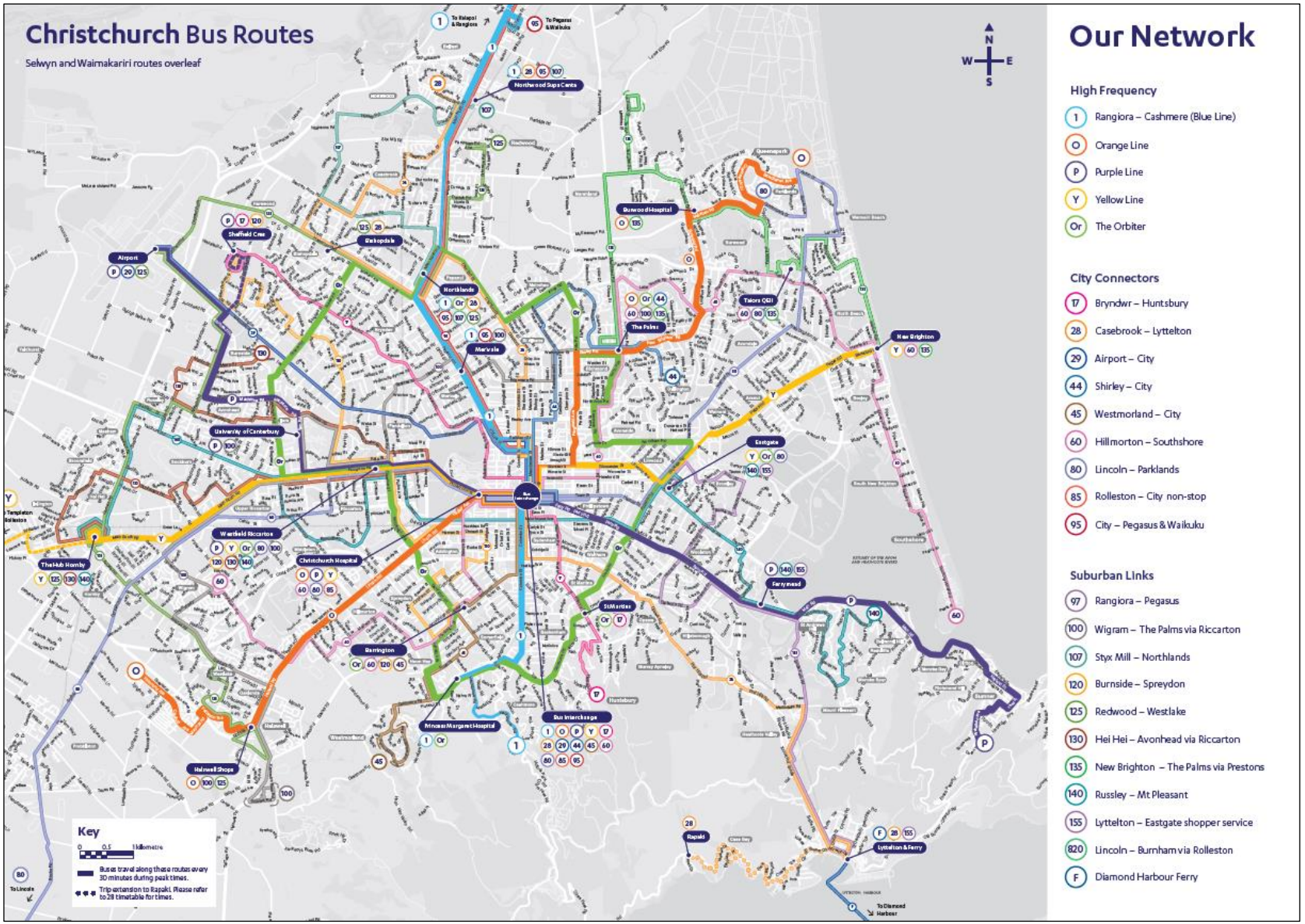


Figure 4: Greater Christchurch Metro (bus) Network Map[8]

[8] Metro (2020). Christchurch Metro Network Map. Retrieved September 2020, from https://www.metroinfo.co.nz/assets/Maps/chch-network-map.pdf

1.3.2 Public transport customer profile

The most recent annual Metro User Survey was undertaken by Environment Canterbury in 2019. This survey provides key insights into the current market served by Metro (those currently using PT) and provides cues into potential opportunities for increasing patronage, including potential target markets and hurdles to success. Results show the following:

- There is an increasing proportion of female riders on Christchurch's buses (58%, up from 50% in 2015)
- The proportion of elderly riders is also increasing (17% aged 65 years and over, up from 11% in 2015), while the share of younger riders is decreasing (33% under 25 years, down from 43% in 2015)
- Riders have high overall satisfaction with PT (96%), but the youth are significantly less satisfied, and the elderly are more satisfied
- Riders have a mix of incomes, with 42% of riders having annual incomes less than $40,000, 20% of riders have incomes between $40,000 and $80,000, and 7% of riders make more than $80,000
- There's a variety of trip purposes, with 38% of trips being for work, 22% for social/recreational purposes, 20% for shopping/personal/medical purposes, and 16% for education purposes
- 60% of riders have a driver's licence, and over three-quarters (77%) would have travelled by car had they not travelled by bus
- While most riders were satisfied with Metro, the most common reasons for dissatisfaction are frequency, unreliability, and cost

Further surveys are needed to confirm any bespoke findings associated with the target PT market (in acknowledgement that current PT users may have different perceptions to future PT users).

1.3.3 Historical growth, current uptake and recent trends

In the last three years (2017-2019), PT patronage has hovered at just under 14 million trips, despite population increases in Greater Christchurch.

According to the Christchurch Metro User Survey carried out in 2019, the main use of PT services in Greater Christchurch has for the last five years continued to be for work purposes (as shown in Figure 5). Those using PT for shopping, personal or medical increased slightly in 2019, with those using it for education declining slightly, reflecting fewer 16-24-year olds using PT in 2019[9].

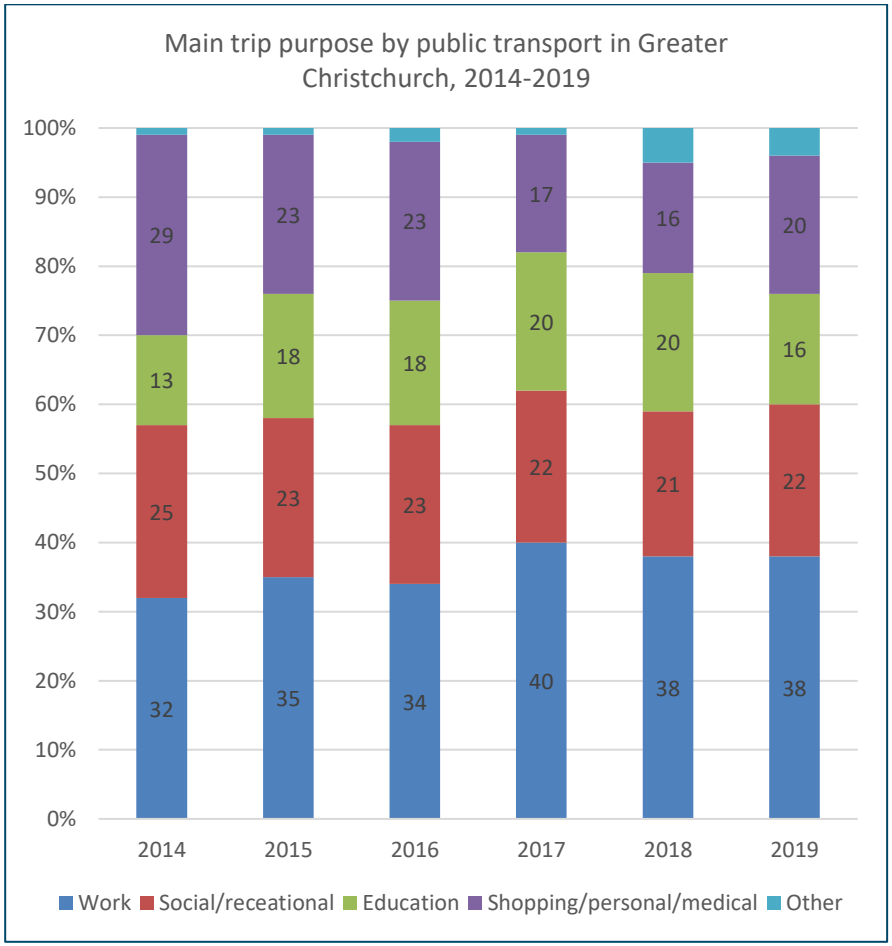


Figure 5: Main trip purpose by public transport in Greater Christchurch, 2014-2019[10]

[9] ECan (2019). Christchurch Metro User Survey 2019, p.14

[10] ECan (2019). Christchurch Metro User Survey 2019, p.14

Compared to Auckland and Greater Wellington, patronage per capita in Greater Christchurch is relatively low, as seen in Figure 6. Investment in PT has also been more significant in those centres, compared with Greater Christchurch (Figure 8 and Figure 9). Patronage in Greater Wellington is relatively high and has also remained static for a decade. On average, each Wellingtonian makes 74 trips on PT per year, around 2.8 times more than those in Greater Christchurch. Greater Christchurch had a similar level of patronage to Auckland in 2007, but Auckland's patronage has grown ever since. Following a sharp decline in patronage as a result of the 2010 and 2011 Canterbury earthquakes, Greater Christchurch experienced some initial recovery, but per capita patronage has fallen since 2014. On average, each person in Greater Christchurch makes 26.5 trips on PT per year[11]. As indicated, investment in Wellington and Auckland PT has been higher per capita in PT compared with Christchurch. Wellington and Auckland have also increased their spending significantly in the last 10 years, while Christchurch has kept spending relatively flat.

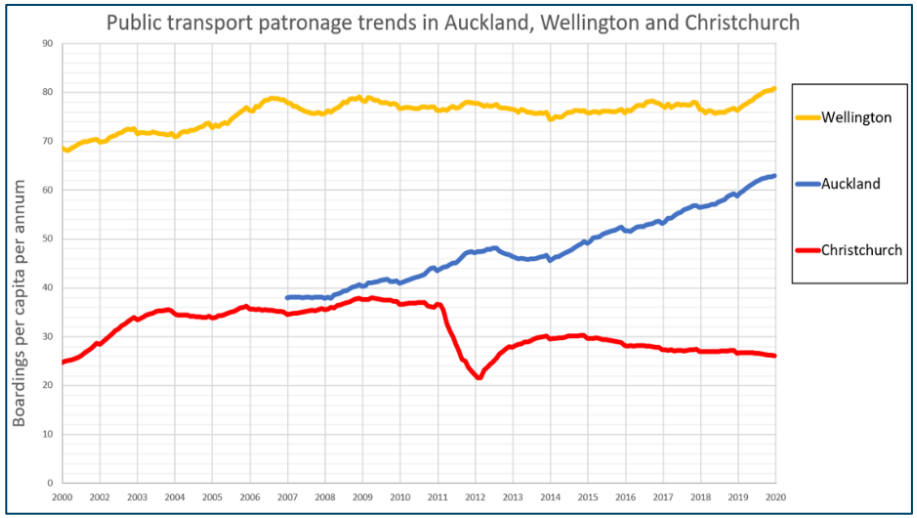


Figure 6: Public transport patronage per capita in Auckland, Greater Wellington and Greater Christchurch, January 2000-January 2019[12]

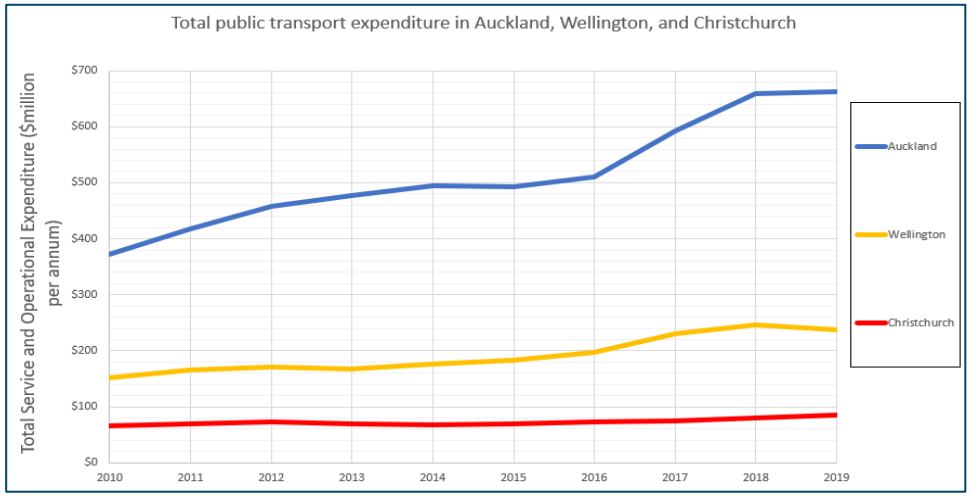


Figure 7: Total public transport expenditure in Auckland, Greater Wellington and Greater Christchurch, 2010-2019[13]

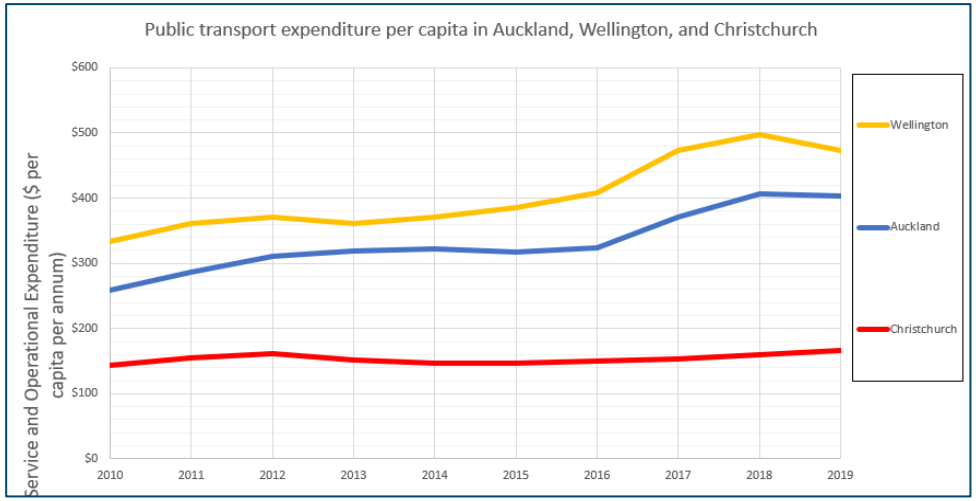


Figure 8: Passenger transport expenditure per capita by region[14]

[11] Calculated from boarding numbers published by Auckland Transport, Greater Wellington Regional Council and ECan, and population data from Statistics NZ

[12] Produced using boarding numbers published by Auckland Transport, Greater Wellington Regional Council and ECan, and population data from Statistics NZ

[13] Graphed using data from Transport Agency's Transport Investment Online (TIO) database

[14] Graphed using data from Transport Agency's Transport Investment Online (TIO) database

1.3.4 Future demand for public transport services

Christchurch has a firmly entrenched driving cultural norm. As at 2018, PT mode share in Greater Christchurch was around 2.3%[15]. Following the disruption of the Christchurch earthquakes which altered land use, the transport network, and travel patterns, Greater Christchurch has experienced increased travel by car and reduced public transport patronage (refer to the sharp drop in PT patronage in Figure 6). Based on Transport Demand Management (TDM) Customer Insight surveys undertaken in May 2019, 69% of the 871 respondents in Christchurch, whose primary mode of transport is car, van or truck, private or company vehicle, have no intention of changing to use alternative means of transport[16].

However, Greater Christchurch must achieve greater mode shift changes to ensure the transport network supports anticipated growth in the future. Based on the Do-Minimum modelling, from 2018 to 2028, total vehicle kilometres travelled (VKT) are forecast to increase by 17% (Figure 9). The increase in VKT is solely due to increase in private vehicle kilometres travelled, with VKT associated with PT remaining constant. Average journey time for PT, congestion at key intersections and bus crowding will also impact on PT under this scenario.

Based on the Do-Minimum modelling[17] undertaken for 2028, many intersections and road corridors during the AM and PM Peak would have a Level of Service (LoS) of D or worse (60) as a result of the increase in daily trips (Figure 10). The PM Peak is worse than the AM peak, with large areas of central and south-west Christchurch anticipated to be adversely impacted by the resulting reduced service (Figure 11).

Overall, from 2018 to 2048, the total daily modelled person trips are forecast to increase by 36%[15], provided travel behaviours and the network remains as outlined in the Do-Minimum scenario. The assumptions for the forecast for the Do-Minimum Modelling are outlined in Section 3.1 and outlined in (attached to of Appendix F) 'Ctmv18 Land Use Forecasting Report'. The forecast outlined is taken from a transport model (referred to as the CTM/CAST v18 model) which outputs for future planning years (2038 and 2048) that can be used to quantify growth in transport demands. The base population and land use projections (and associated transport modelling) that underpins the modelling was developed by the Greater Christchurch Partnership (GPC) at the Territorial Local Authority (TLA) level, within the UDS boundary area, in 2018. These projections/forecasts are reasonably consistent with Statistics NZ (sub-national) population forecasts released in 2017; when applying the Medium Growth projection within Christchurch City and the Medium-High projection to both Waimakariri and Selwyn Districts.

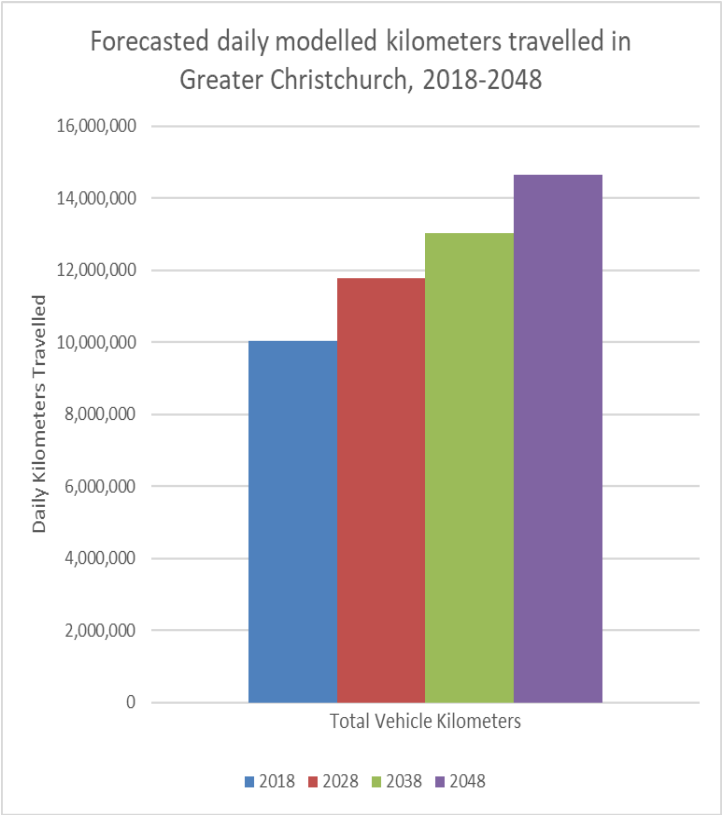


Figure 9: Forecast daily modelled vehicle kilometres travelled (VKT) private vehicle and public transport

Figure 12 to Figure 14, demonstrate that Do-Minimum modelling undertaken for the Future Development Strategy in 2018 shows how the number of 'poor performing intersections' increase across Greater Christchurch over time. The highlighted intersections are those intersections in the network where the average flow weighted delay (all approaches) is 40 seconds or later in the evening peak. Increasing PT mode share from 2.5% (Do-Minimum) could reverse this trend, as demonstrated in Figure 15 to Figure 18.

[15] QTP (2019). CTM v18 Update: Land Use Forecasting, May 2019

[16] Transport Agency (May 2019). Travel Demand Management Customer Insight: Qualitative and Quantitative Insights Summary - All Regions, p.16

[17] The assumptions for the Do-Minimum Modelling are outlined in Section 3.1 and outlined in the attachment to Appendix F.

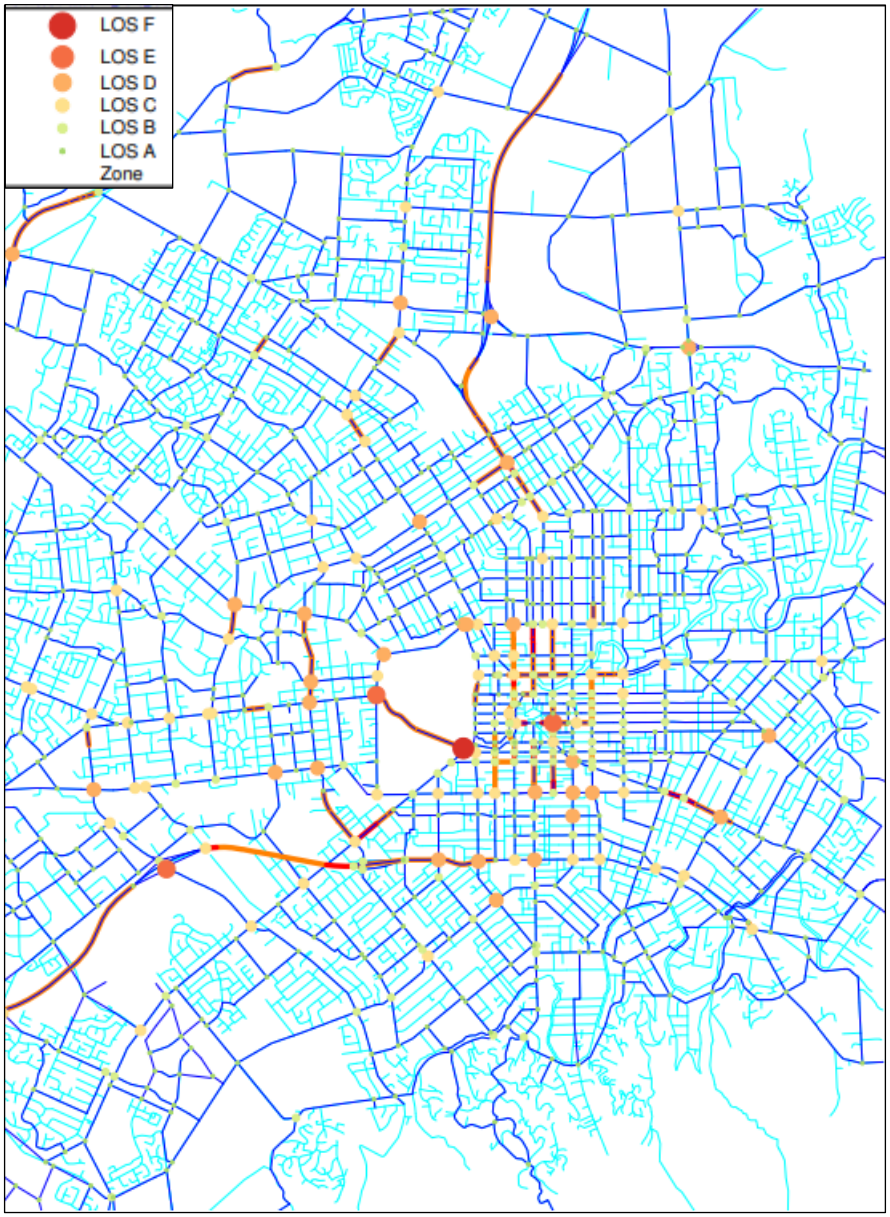


Figure 10: Level of service 2028 AM base

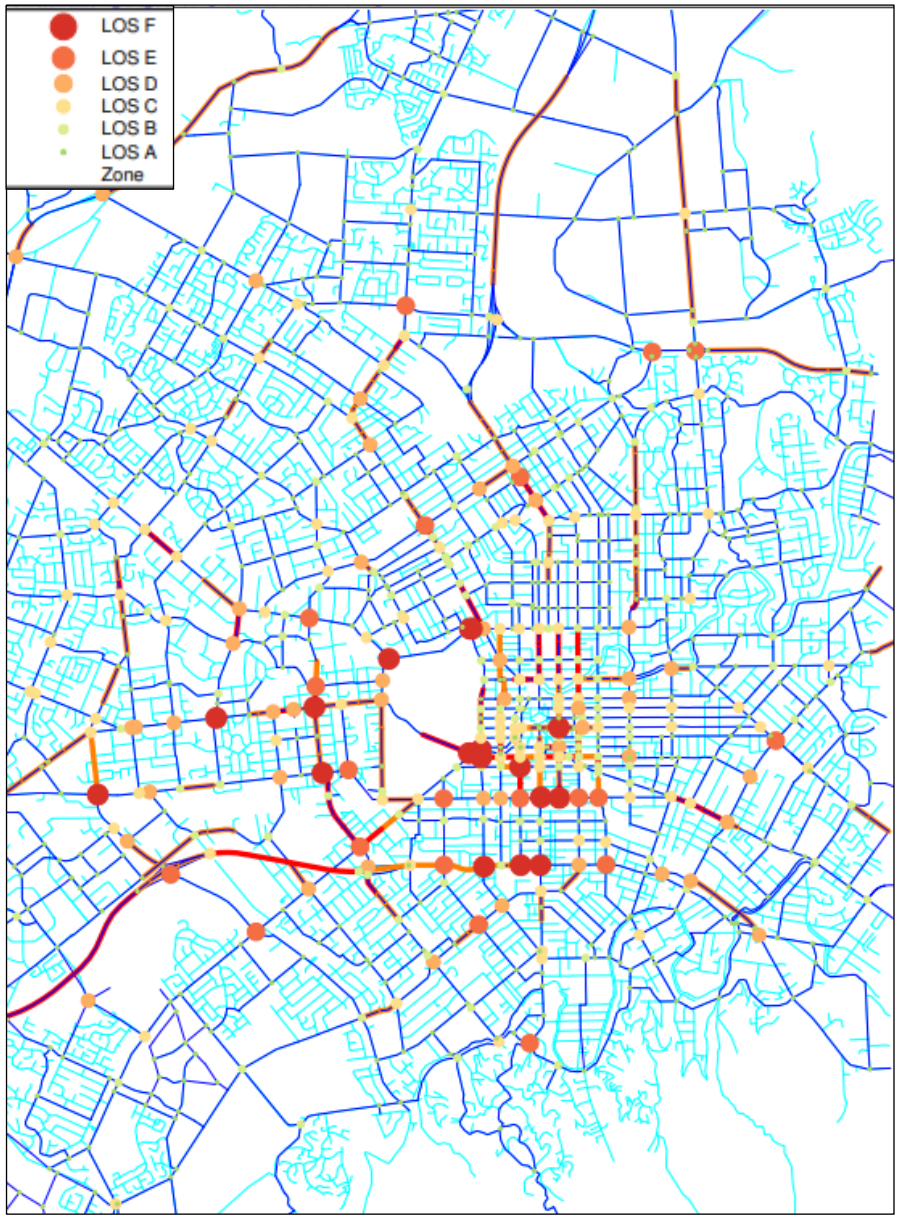


Figure 11: Level of service 2028 PM base

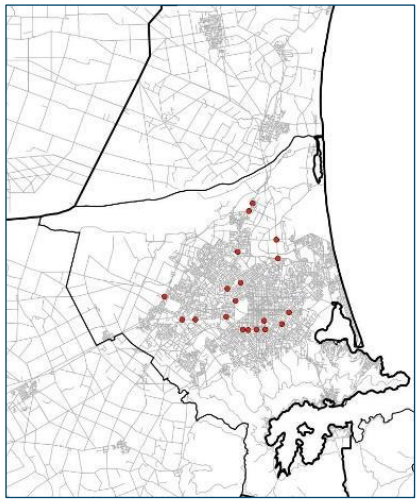


Figure 12: Poor performing intersections, 2016

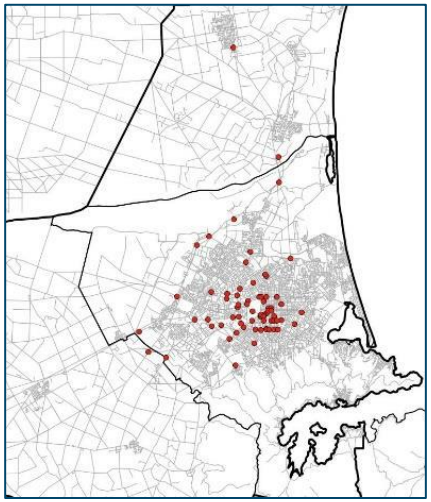


Figure 13: Forecast poor performing intersections, 2028

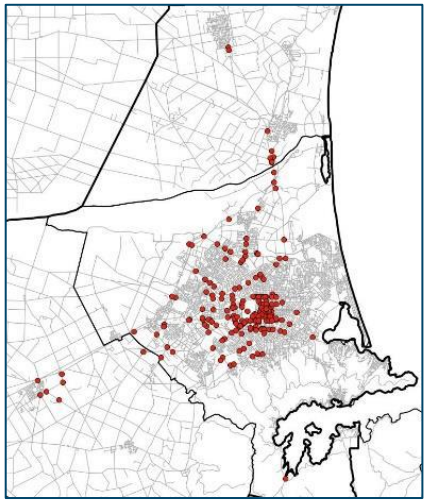


Figure 14: Forecast poor performing intersections, 2048

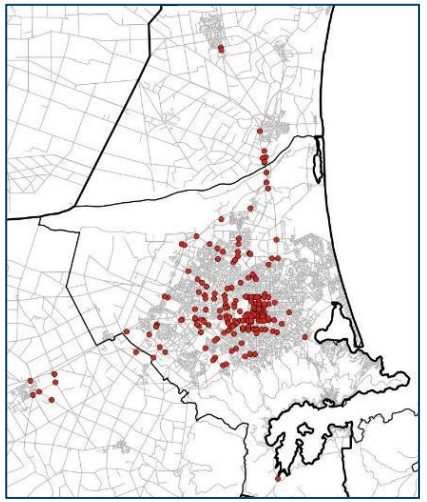


Figure 15: Do-Minimum forecast poor performing intersections, 2048 (2.5% PT mode share)

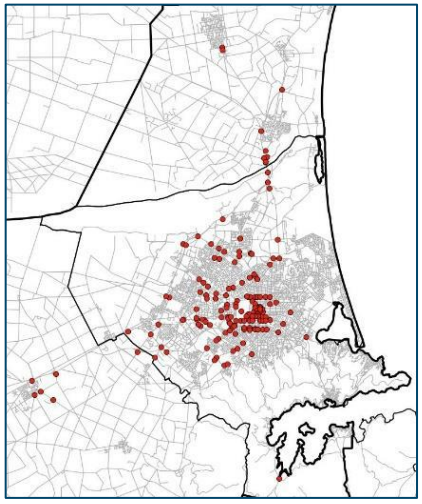


Figure 16: Forecast poor performing intersections, 2048 (5% PT mode share)

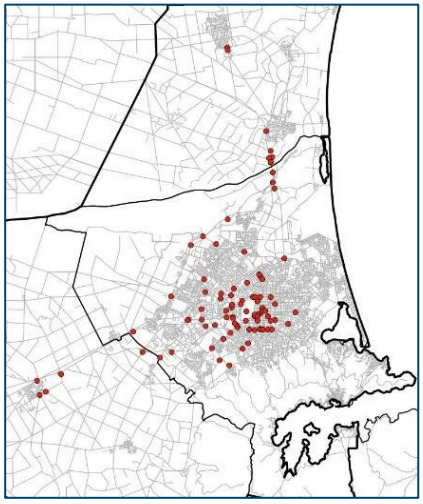


Figure 17: Forecast poor performing intersections, 2048 (10% PT mode share)

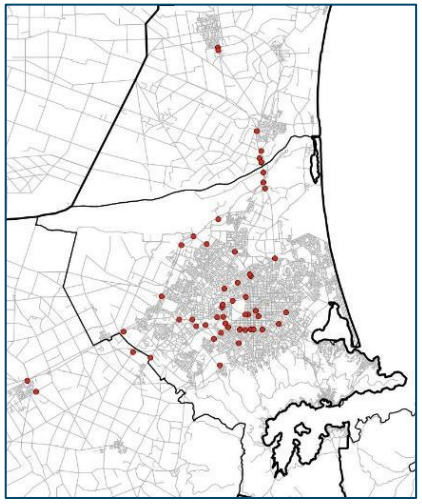


Figure 18: Forecast poor performing intersections, 2048 (15% PT mode share)

In addition, under the Do-Minimum modelling, bus crowding in Greater Christchurch in 2028 is anticipated to continue to get worse. Bus crowding would occur on certain PT routes during the morning and evening peak, with crowding affecting the morning peak the most (based on a bus standing capacity of 50ppl/bus) (Figure 19 and Figure 20).

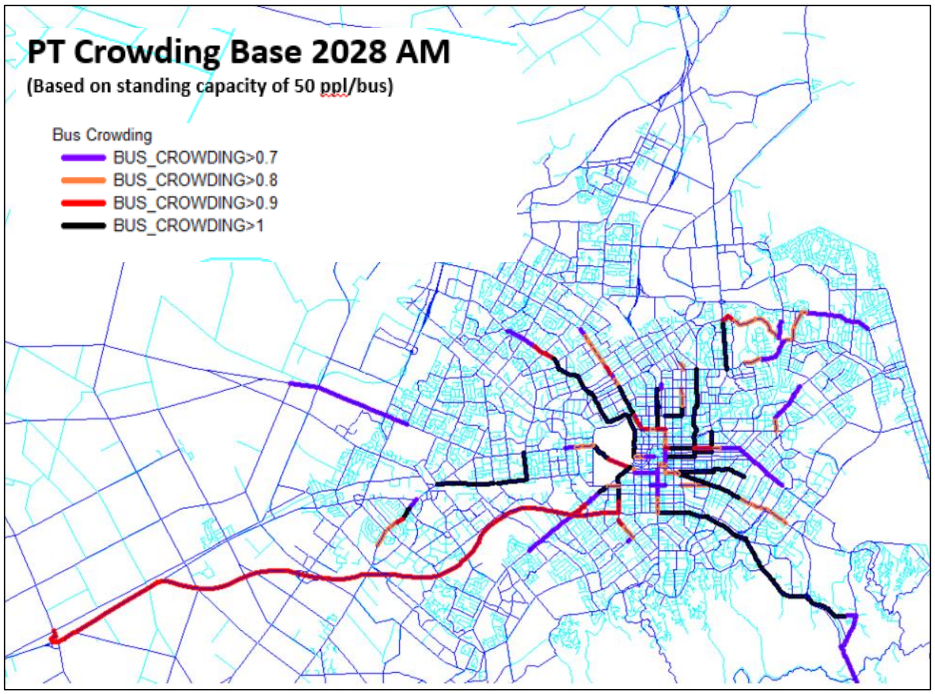


Figure 19: Public transport base crowding - 2028 AM

Much of this forecast congestion aligns with areas of increased intensification and growth within the 5-6km radius and along key corridors (see Figure 19).

This increase in trips and congestion is a result of total daily modelled person trips is forecast to increase by 14% in the Do-Minimum scenario between 2018-2028. This increase is compared a backdrop of a 13% increase in population (Figure 28) and 10% increase in employment (Figure 42) in Greater Christchurch over the same period. Daily PT trips are forecast to increase by 16% (Figure 21), which would outpace the total daily modelled person trip increase during this period. As a result, mode share would marginally increase from 2.3% to 2.4% (Figure 23)[15].

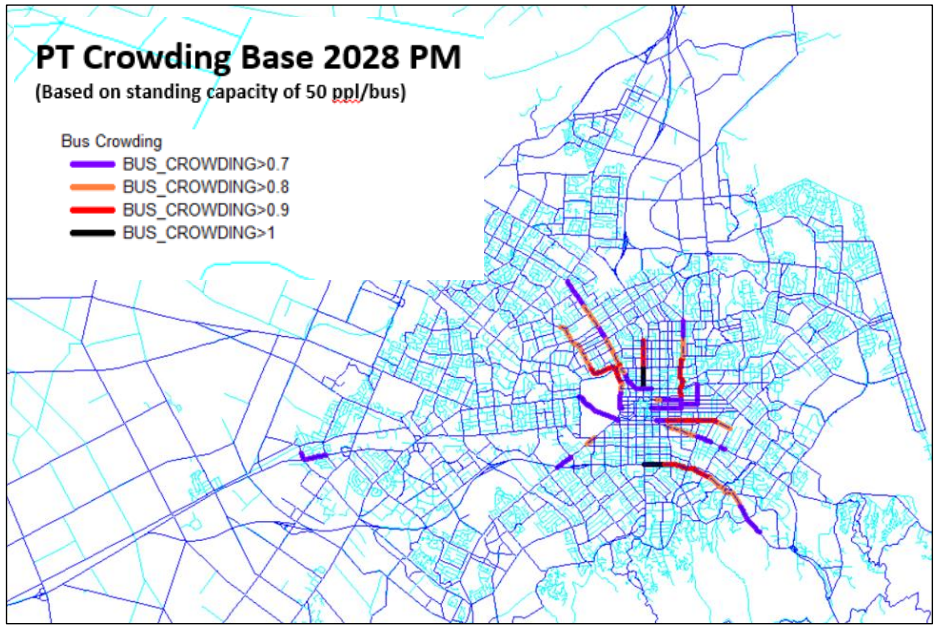


Figure 20: Public transport base crowding - 2028 PM

From 2028 to 2038, based on Do-Minimum modelling, the total daily modelled person trips are forecast to increase by 10% (Figure 21), against an 11% increase in population (Figure 28) and 8% increase in employment (Figure 42). Daily PT trips are forecast to increase by 9% from 52,668 in 2028 to 57,412[18] in 2038Figure 21. This would be slightly less than the overall daily modelled person trip increase during this period (10%). As a result, mode share would remain at 2.4% (Figure 23)[15].

From 2038 to 2048, the total daily modelled person trips are forecast to increase by 8% (Figure 21), compared to a 9% increase in population (Figure 28) and 7% increase in employment (Figure 42). Daily PT trips are forecast to increase by 7% (equating to a daily modelled person trips by PT of 61,600). This would be slightly less than the overall daily modelled person trip increase during this period. As a result, mode share would decrease from 2.4% to 2.3% (Figure 23)[15].

[18] For context, in 2006/2007 the city was averaging 52,900 weekday trips per day so this isn't a substantial increase on the volume of trips occurring prior to the earthquakes.

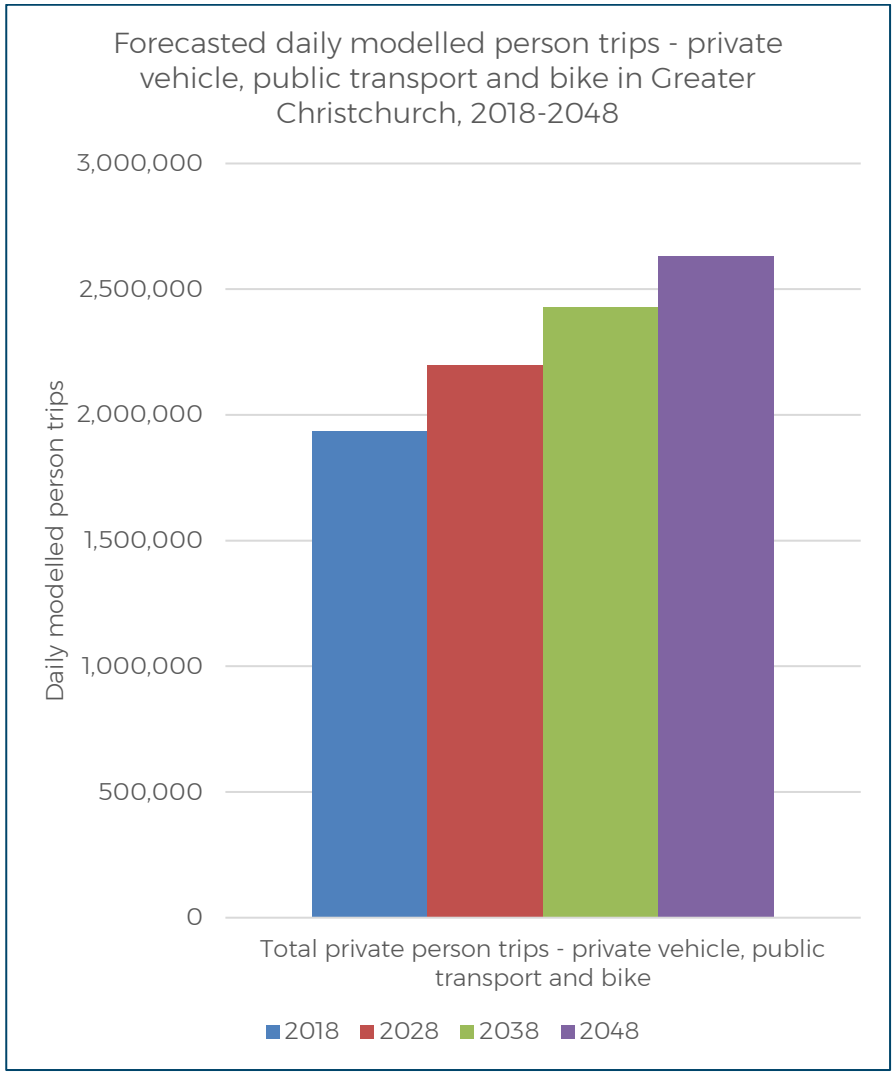


Figure 21: Forecast daily modelled person trips - private vehicle, public transport and bike in Greater Christchurch, 2018-2048[19]

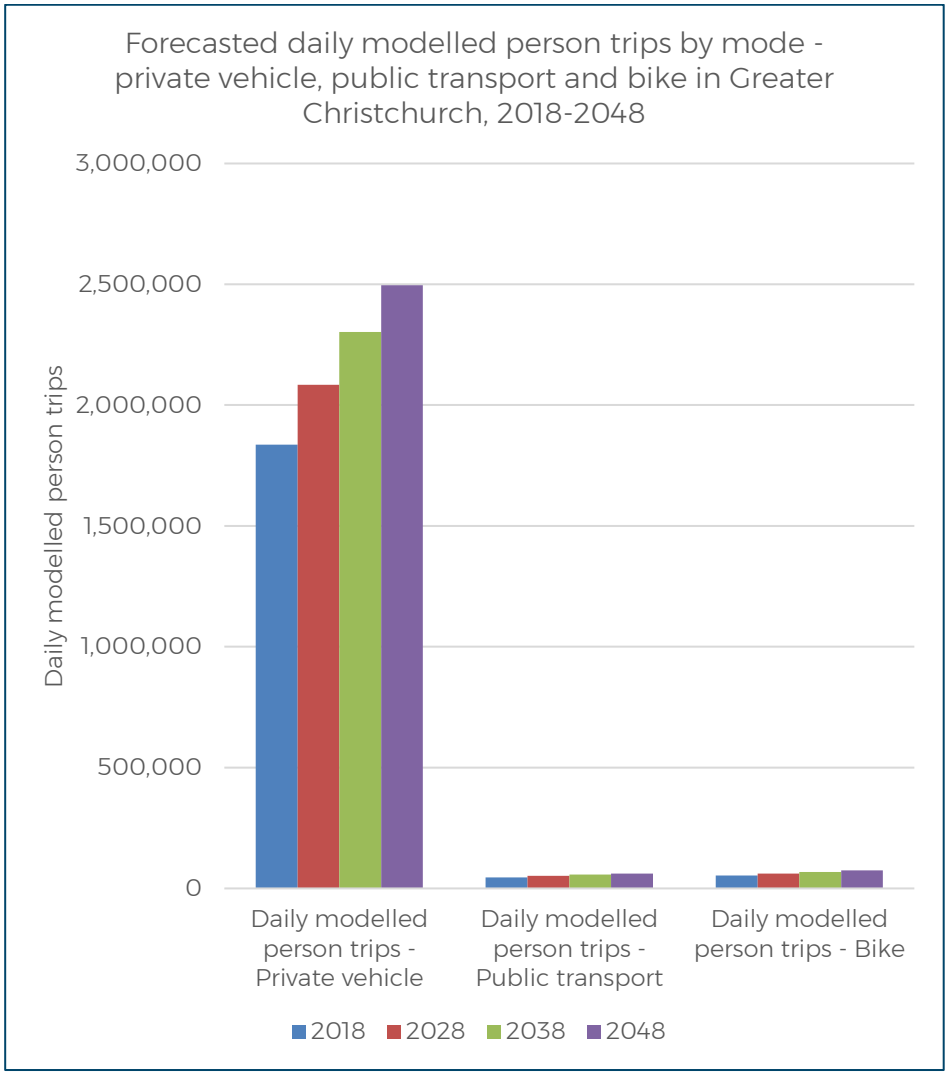


Figure 22: Forecast daily modelled person trips by mode - private vehicle, public transport and bike in Greater Christchurch, 2018-2048[19]

[19] QTP (2019). CTM v18 Update: Land Use Forecasting, May 2019

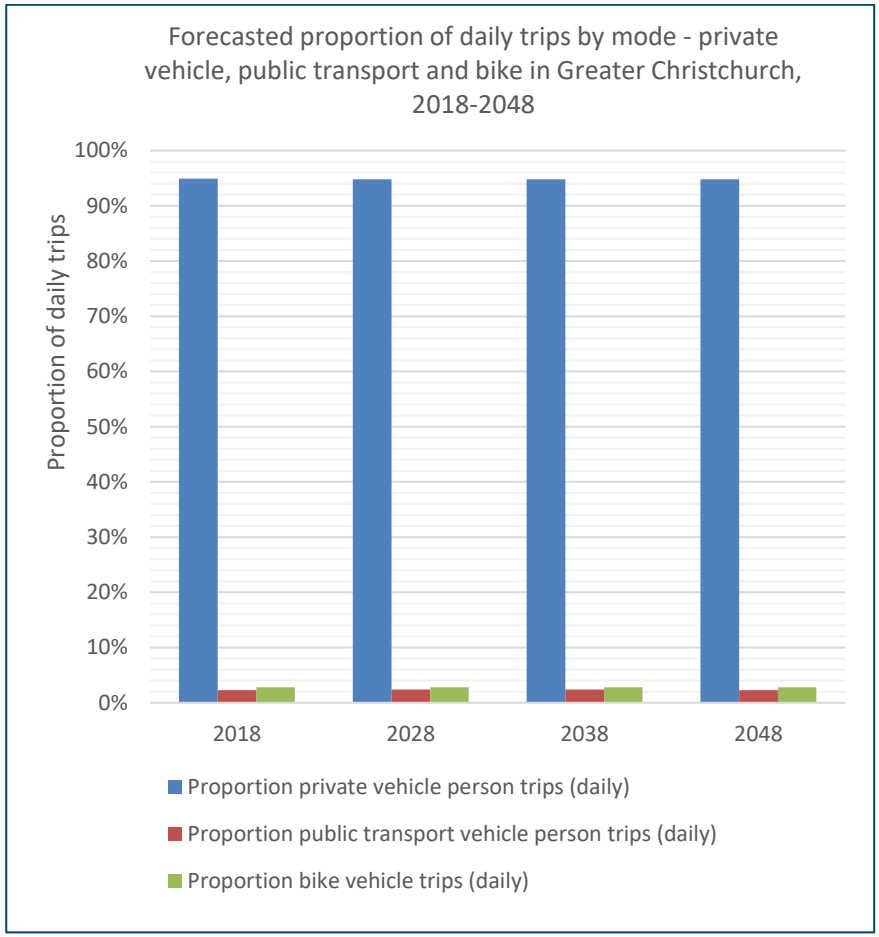


Figure 23: Forecast proportion of daily trips by mode - private vehicle, public transport and bike in Greater Christchurch, 2018-2048[20]

1.3.5 Surrounding transport network context

In recent years, investment has focused on legacy earthquake repairs, new State Highway capacity (Christchurch Northern and Southern Corridors) and cycling (CCC Major Cycle Routes (MCRs)) in Greater Christchurch, with relatively little investment in PT (other than the Christchurch Bus Interchange and bus lanes). This investment reinforces the existing mode share in which daily trips by private vehicles dominate.

Investment in roading programmes, such as the Christchurch Northern and Southern Corridors will make these corridors more attractive for single occupancy vehicles (SOVs). The Christchurch Northern Corridor will provide for direct PT services from the Waimakariri District to the Christchurch Central City.

Pricing mechanisms (i.e. availability and cost of carparking in the Central City and at other key destinations) are not used in CHCH as they are in other cities such as Auckland and Wellington to deter private vehicle use.

CCC have invested in cycling through the CCC Major Cycle Routes (MCRs) programme which looks to make active transport a more desirable, and competitive mode choice. The thirteen routes which are at various stages of implementation were developed in response to a community desire for more travel choice and safer cycling options following the 2010 and 2011 Canterbury earthquakes. Cycle trip numbers for the annual count across all of locations with counters in place in Christchurch City have increased 80 per cent since the MCR's began to open in 2016. This increase in cycle trip numbers has continued and from March 2019 to March 2020 cycle numbers at several locations were up nearly 20 percent (at 2,234 cycle trips in the morning peak compared to 1,869 cycle trips in 2019). Christchurch City now has a substantially higher percentage of people using the cycle as their main means to travel to work compared to the rest of New Zealand (Figure 24).

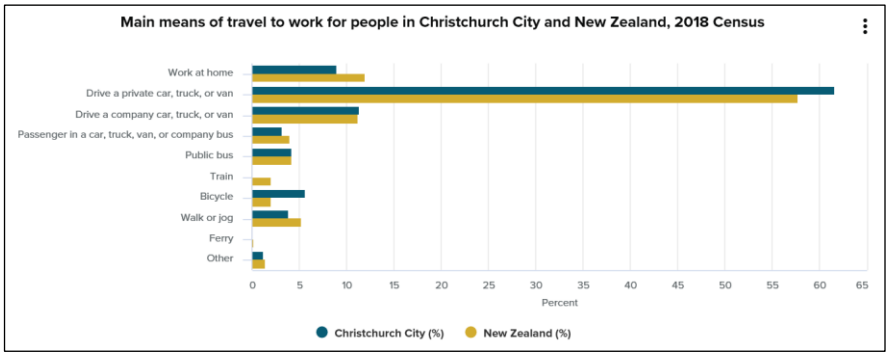


Figure 24: Main means of travel to work for people in Christchurch and New Zealand, 2018 Census[21]

Figure 25 demonstrates that those areas closest to the central city have the highest percentage of population that use active travel (biking and walking) as their mode to travel to work. Further the 2018 census data identifies that active modes of transport were more common than public transport for workers in the

[20] QTP (2019). CTM v18 Update: Land Use Forecasting, May 2019

[21] https://www.stats.govt.nz/tools/2018-census-place-summaries/christchurch-city#transport

Christchurch central city, with more than two times as many people walking, cycling, or jogging than catching the bus or ferry[22].

There is an opportunity for PT to be further support active travel in Christchurch to assist with continued mode shift from private vehicles.

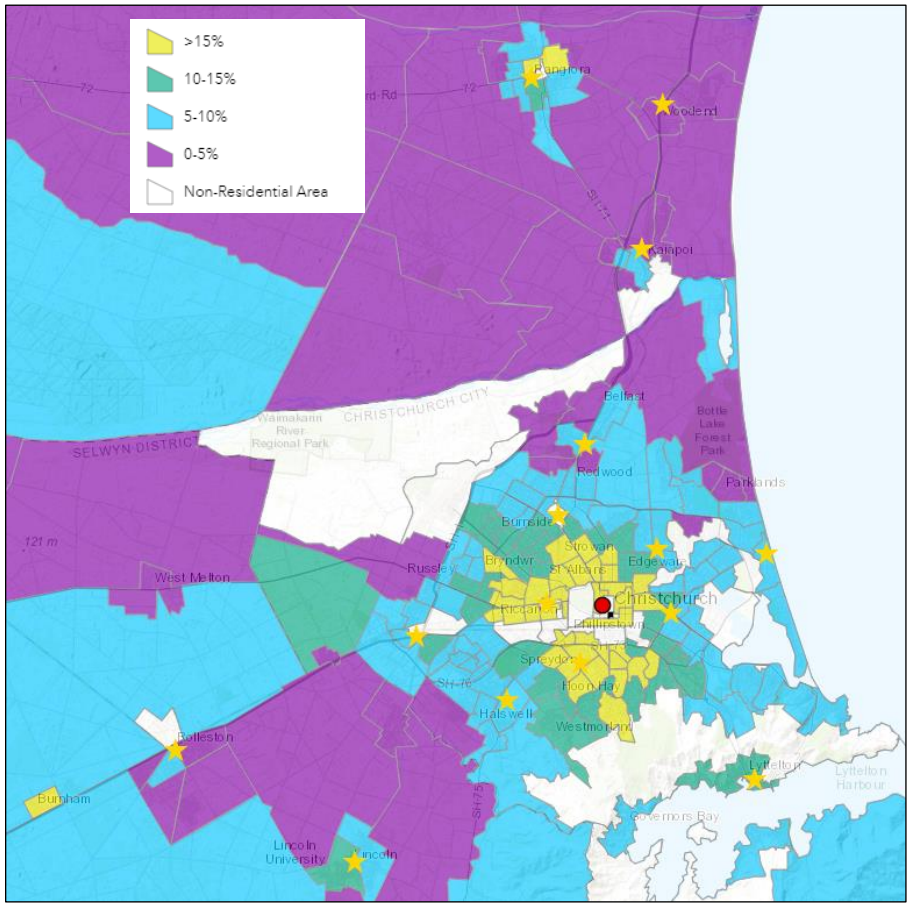


Figure 25: Percentage of workers that travel to work by active modes - Census 2018 Travel to Work

In contrast, Figure 26 demonstrates those areas with the highest percentage of population that use the public transport network as their mode to travel to work. This identifies the suburbs with the greater public transport uptake include those immediately surrounding central Christchurch especially to the east and south of the central city, and in the vicinity of the Riccarton Road/Blenheim Road corridor.

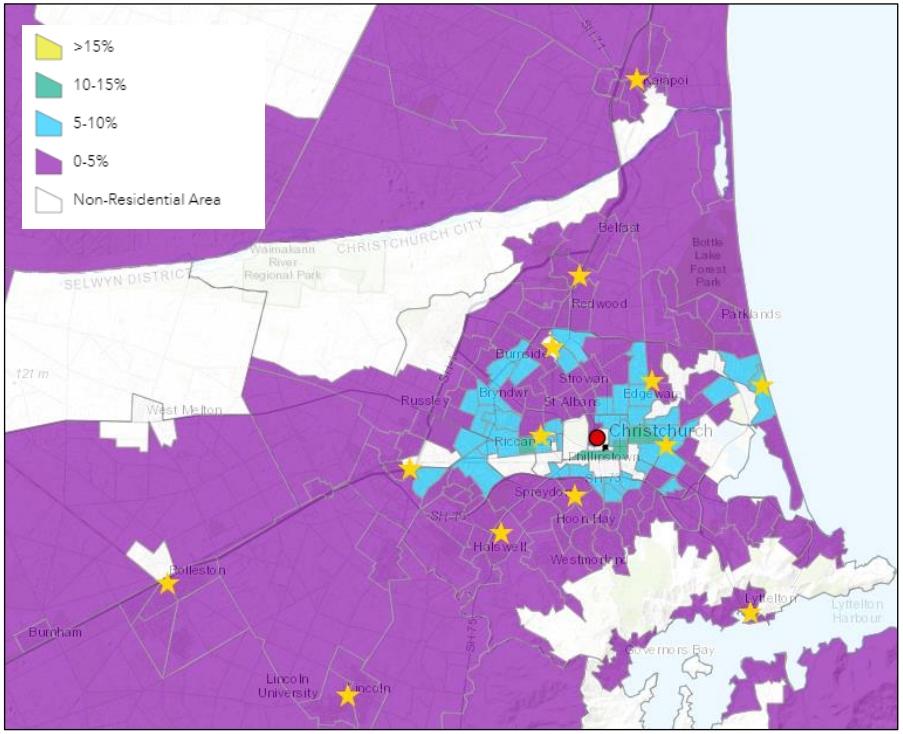


Figure 26: Percentage workers that travel to work by the bus - Census 2018 Travel to Work

Overall, these figures demonstrate that those areas located further out typically have a greater percentage of workers that travel to work by the car.

Mode Shift Plan

Waka Kotahi has developed a national mode shift plan 'Keeping Cities Moving'[23] to deliver on social, environmental and economic outcomes by growing the share of travel by PT, walking and cycling (activating a mode shift).

For urban areas to thrive people need to be able to move around easily and have a range of choices for how they get to work, connect with family and friends and

[22] https://www.stats.govt.nz/news/newly-released-census-data-shows-christchurch-cbd-bouncing-back

[23] https://www.nzta.govt.nz/assets/resources/keeping-cities-moving/Keeping-cities-moving.pdf

access services. Consequently, a modern transport system with a mix of reliable transport options that help keep people and products safely moving, is required.

Improving urban mobility

Improving urban mobility is one of several step changes included in the Waka Kotahi 10-year plan – Arataki to address key drivers affecting the land transport system. The step change of transforming urban mobility focuses on addressing the causes of car dependency and growing the share of travel by public transport, walking and cycling through:

- Shaping urban form
- Making shared and active modes more attractive
- Influencing travel demand and transport choices

Specific direction for this step change is set out in the Agency's mode shift plan 'Keeping Cities Moving'. Keep Cities Moving was developed to deliver on social, environmental and economic outcomes by growing the share of travel by PT, walking and cycling (activating a mode shift).

The plan outlines 35 interventions that seek to increase the pace of change in cities and ensure that investment is targeted to help provide more transport choice and ultimately reduce car dependency. In addition, the plan identifies a need for six area specific mode shift plans to be developed for place-based changes in the six high-growth urban areas with the highest potential to achieve mode shift. Out of this, the Regional Mode Shift Plan Greater Christchurch[24] (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 address and the GC MSP acknowledges that 41% 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 as evidenced with the shift of the population to the Selwyn and Waimakariri Districts. Significant investment in transport infrastructure has incentivised private vehicle use over other forms of transport which has made it more difficult to promote other modes like PT. The plan recognises these significant challenges but highlights opportunities where mode shift can be initiated through:

- Integrated planning and design with urban form and PT to improve its efficiency and attractiveness
- Promotion, support and provision for sustainable business, housing and public infrastructure that achieves high connectivity
- Investment in public and active transport to improve its attractiveness
- Initiating behavioural change through education, safety initiatives and enabling ease of use

Initial priorities for the GC MSP over the next three to six years are implementing the short-term improvements to PT identified in this business case, connecting the gaps in the existing cycleway network and encouraging behaviour change (through travel demand management activities). The GC MSP acknowledges that the key drivers for mode shift are environmental and safety concerns, with congestion a secondary consideration. The GC MSP outlines that while congestion is not currently a significant issue in Christchurch (compared to Wellington and Auckland) that as outlined in Section 1.3.4 if current travel patterns are continue then congestion will result given high car usage and increased trips will result in increasing congestion (and causing associated adverse effects such as increased emissions).

1.3.6 Covid-19 impact

Waka Kotahi commissioned research on the projected impacts of the Covid-19 pandemic on the transport system[25]. Early indications are that there will be slower population growth in the key metro areas (Greater Christchurch included) as a result to declines in immigration and internal migration.

The Canterbury regional summary for Arataki Version 2 states:

> *'Canterbury has the third largest tourism spend in the country, of which 40% comes from international visitors. The region will be disproportionately impacted by border closures. Christchurch is forecast to be slightly worse off than the rest of the country because of its role as a gateway for international tourists.'*

It states that supporting multi-modal access to Christchurch central city as the primary activity centre remains a priority. In addition. there will be an ongoing need for transport services to support COVID-19 recovery by improving access to employment and essential services for vulnerable communities

It also identifies that given the high reliance that Canterbury has on net migration for population growth, the reduction in immigration is anticipated to slow growth in and around Christchurch. Under the slower recover scenario (the worst-case scenario), employment levels are not forecast to even return to business as usual levels by 2031. The analysis notes that the impacts of the

[24] https://www.nzta.govt.nz/assets/resources/keeping-cities-moving/Christchurch-regional-mode-shift-plan.pdf

[25] https://www.nzta.govt.nz/assets/planning-and-investment/arataki/docs/key-drivers-step-changes-levers-interventions-august-2020.pdf, p. 6

downturn have the potential to be buffered by the scale of the primary sector located in Canterbury.

Despite this impact, no significant changes are expected in the nature, scale and location of transport demand over the medium to long term, although changes to work patterns for professional services may see a reduction in peak trips to city centre, because of more people working remotely. Overall, the 10-year outlook remains largely unchanged with it noted that the Covid-19 pandemic is a continuously evolving situation and recommendations within this business case are likely best managed through a dynamic approach to staging and an ongoing review process ahead of major investment decisions.

1.3.7 The evolving role of technology

There are emerging technologies in the form of autonomous vehicles, access to travel information and the way people can access or purchase travel and mobility. While many of these remain undefined at this time, there is also uncertainty of the effect these technologies will have on the way people travel and the needs people will have from a service and infrastructure perspective. Waka Kotahi have undertaken research on the latest transport technology and data background information as part of informing Arataki[26] and this is particularly relevant to a greenfield growth area as the urban form and transport dynamics may be influenced by these factors. For example:

- Mobility-as-a-service (MaaS) is enabled by smartphone technology and uses apps to allow a person to plan, book and pay for end to end journeys. It provides people with better real-time information on transport options, including the ability to purchase and pre-purchase mobility options tying together different modes of travel for single journeys. This can influence ridership patterns and access needs and has the potential to encourage mode shift and reduce congestion. It is seen as having high potential to serve fist mile/last mile options to link with public transport offerings
- On-Demand Transport. When On-Demand Transport is provided for public transport it can improve accessibility and reduce the number of single occupancy vehicles. It can improve access to public transport in areas not serviced by a traditional public transport model due to a lack of demand for a large-scale operation. Waka Kotahi note:

  On-demand transport may provide a more sustainable public transport service in places where at certain times, demand peaks and is predictable, but at other times, demand is inconsistent or low.

  Currently MyWay is an on-demand public transport service being trialled in Timaru (it uses minibuses that carry about 12 people and through advance bookings coordinates passengers heading in the same direction).

Further examples of future mobility technologies that may be relevant include:

- Autonomous private vehicles may affect arrival modes at stations, requiring less park and ride space and greater drop off space, or improve the efficiency of the motorway corridor and improving overall transport conditions. There are still numerous uncertainties on the role that automated vehicles will have in the future of the transport network and many regulatory and technology issues to overcome
- Autonomous PT vehicles may increase throughput and efficiency of bus rapid transit operation (recognising that many rail systems are already operating in this mode) or provide first and last-mile transport options and influence ridership as well as interchange and supporting corridor design
- Connected vehicle technologies enable vehicles to communicate with each other, infrastructure and road users using wireless communications which can enable efficiencies to be optimised within the transport network
- Advanced bus technologies, as referred to in the Waka Kotahi Advanced Bus Study, would enhance the ability to deliver greater reliability and capacity through reduced dwell times, higher capacities and greater control over operations. These technologies include contactless ticketing, off board ticket validation, all door boarding, along with the use of extra-long double-articulated buses

Overall, this Combined Business Case focuses on the short to medium term horizon and it is not anticipated that these evolving technologies will have a significant effect on public transport patterns or behaviours prior to 2028.

1.4 LAND USE POLICY CONTEXT

The overarching Urban Development Strategy for Greater Christchurch is outlined within Our Space 2018-2048: Greater Christchurch Settlement Pattern Update (Our Space). This Strategy was developed by the Greater Christchurch Partnership and builds on the work of the Urban Development Strategy 2007 (UDS) and the Land Use Recovery Plan 2013 prepared under the Canterbury Earthquake Recovery Act 2011. Land use patterns in Christchurch are quite ingrained, with most development occurring to the north and west of the city (with physical constraints being the Port Hills and the technical land development challenges to the east).

[26] https://www.nzta.govt.nz/assets/planning-and-investment/arataki/docs/arataki-technology-and-data-information-august-2020.pdf

The UDS 2007 was created following a three year-long consultation and development process that sought to provide a guiding vision for development in Greater Christchurch. The UDS sets a vision for Greater Christchurch to have a *"vibrant inner city and suburban centres surrounded by thriving rural communities and towns, connected by efficient and sustainable infrastructure"*. It outlined an urban limit and identified greenfield development areas, and an overall proposed settlement pattern where growth in Greater Christchurch to 2041 would be directed to 71% within Christchurch City, 16% in Selwyn District and 13% in Waimakariri District.

The Land Use Recovery Plan 2013 (LURP) was developed in response to the land use change following the earthquakes and identified several Greenfield Priority Areas agreed by CCC, WDC and SDC for implementation through district planning processes. Under the LURP, significant residential greenfield zones were planned to the south of Christchurch City in Rolleston and Lincoln, to the north of Christchurch City in Kaiapoi and Rangiora and within Christchurch at Hornby, Halswell, Casebrook, and Belfast/Redwood. Consequently, post-earthquake development resulted in growth around the urban fringes of the City and the larger towns in Selwyn and Waimakariri at a faster rate than anticipated by the UDS. It has resulted in additional demand on the existing road network along the western corridor, as well as on the northern and southern approaches to the Central City.

Our Space seeks the same development principles, themes and strategic goals for Greater Christchurch, including:

- Clear boundaries for urban development that are defined and maintained with the existing urban area consolidated through the redevelopment and intensification of existing urban areas and
- New urban development is well integrated with existing urban areas

It also acknowledges the following key growth issues for Greater Christchurch:

- Delivering new dwellings through redevelopment and intensification
- Meeting housing needs and preferences for current and future residents
- Recognising post-earthquake trends and anticipating future drivers
- Integrating land use and transport planning to shape desired urban form and
- Living with and mitigating climate change impacts

The proposed locations of future development areas in Greater Christchurch are indicated in Figure 27.

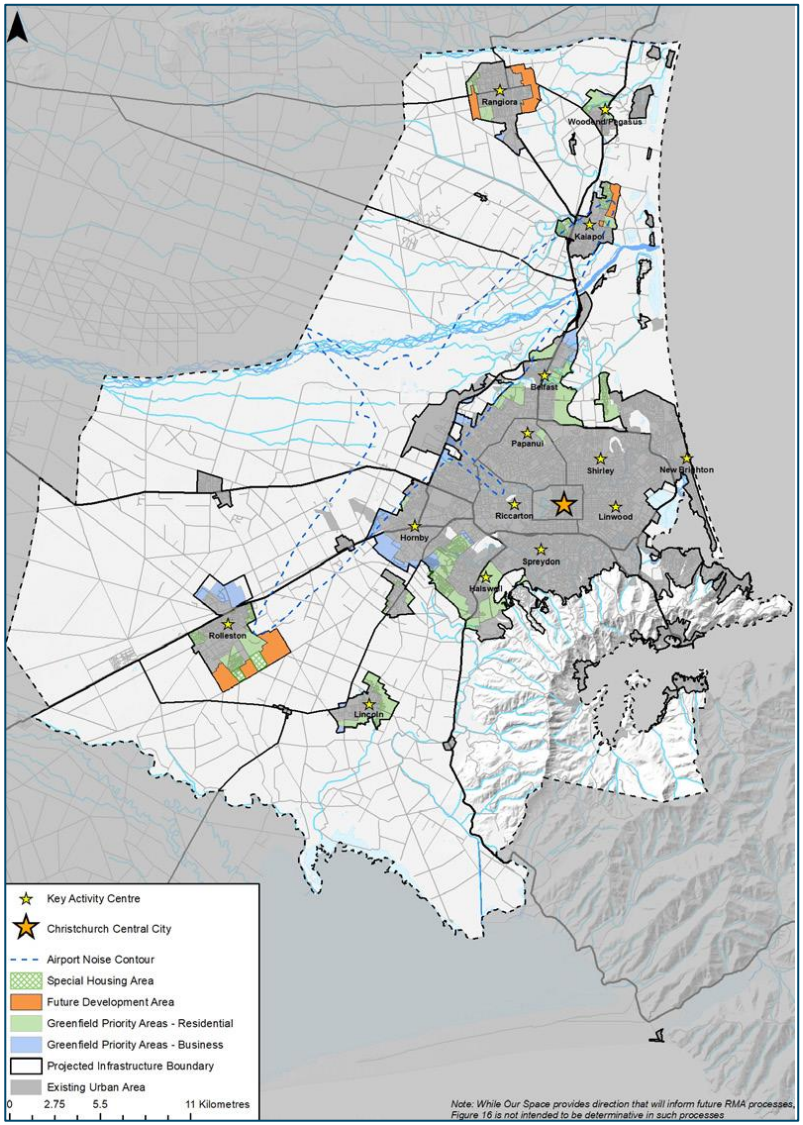


Figure 27: Proposed locations of future development areas in Greater Christchurch (indicative only)[27]

[27] Greater Christchurch Partnership (2019). Our Space 2018-2048: Greater Christchurch Settlement Pattern Update, p.30

1.5 POPULATION CONTEXT

1.5.1 The CTM/CAST V18 model

Transport models (referred to as the CTM/CAST v18 model) forms a basis of a lot of the projected population changes provided below. The transport models (CTM/CAST v18 model) enable outputs for future planning years (2038 and 2048) and is used to quantify growth in transport demands. The base population and land use projections (and associated transport modelling) that underpins the modelling undertaken was developed by the Greater Christchurch Partnership (GPC) at the Territorial Local Authority (TLA) level, within the UDS boundary area, in 2018.

These projections/forecasts are reasonably consistent with Statistics NZ (sub-national) population forecasts released in 2017; when applying the Medium Growth projection within Christchurch City and the medium-high projection to both Waimakariri and Selwyn Districts.

Representatives from each TLA worked with QTP Ltd (who were updating the CTM and CAST regional transport models) to allocate the projected population and employment to Census Meshblock level (with CCC using its own internally developed land use modelling process). The resulting updated population/land use projections and transport model update are collectively referred to as the CTM/CAST v18 update (referring to the 2018 year that this update was made).

1.5.2 Future population growth and distribution

As New Zealand's third largest and second-fastest growing region, Greater Christchurch's 2018 population of 470,000 is projected to grow to over 641,000 by 2048 (Figure 28)[28]. This equates to a population growth rate of around 36%. Notably, Christchurch's student population is forecast to grow by around 28% by 2048, from 93,000 to 120,000[28].

As shown in Figure 29, the population in Christchurch City is projected to grow by around 80,000 (21%) between 2018 to 2048. The Waimakariri District is projected to grow by around 29,400 (61%) during this period, while the Selwyn District is projected to grow by around 58,500 (147%)[28] during the same period.

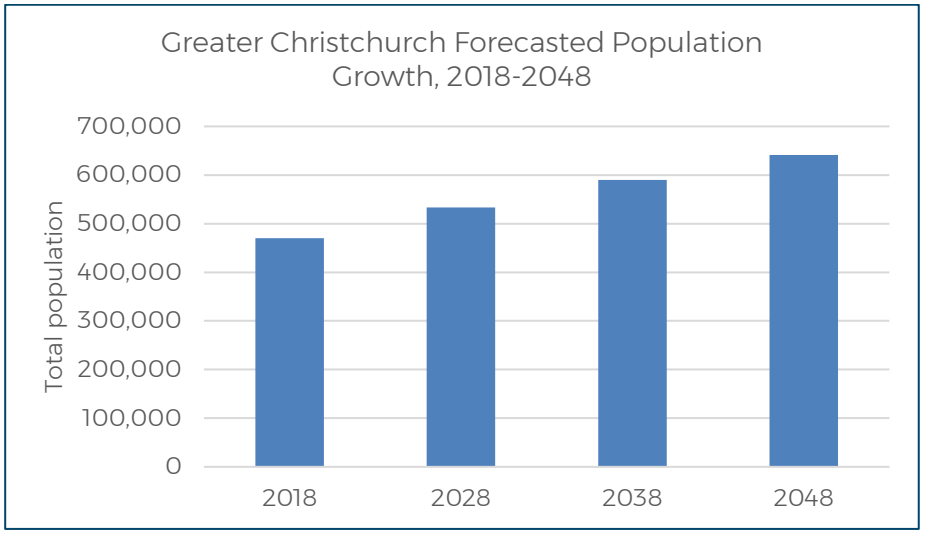


Figure 28: Forecast population growth in Greater Christchurch, 2018-2048[29]

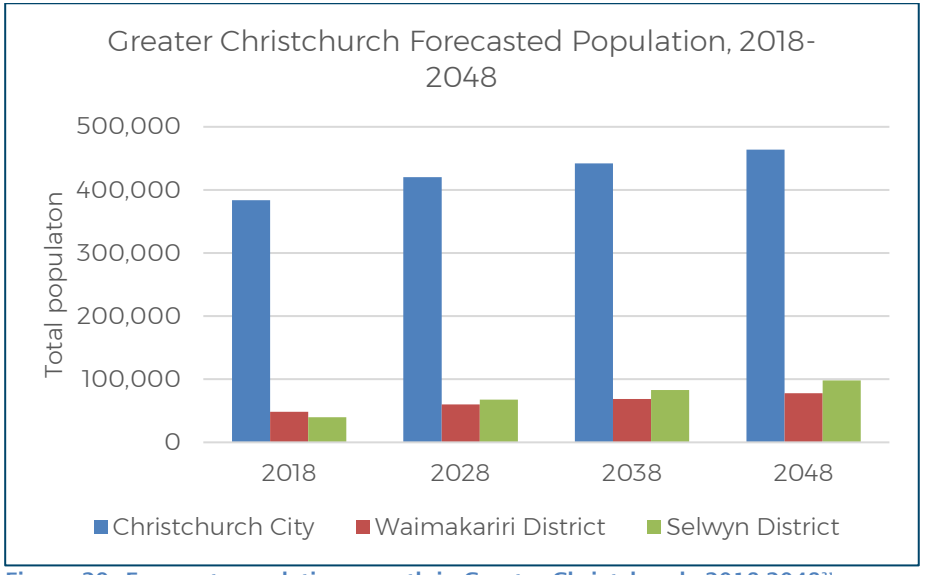


Figure 29: Forecast population growth in Greater Christchurch, 2018-2048[31]

[28] QTP (2019). CTM v18 Update: Land Use Forecasting, May 2019.

[29] QTP (2019). CTM v18 Update: Land Use Forecasting, May 2019

Population growth translates to approximately 74,000 new households in Greater Christchurch by 2048 (Figure 30), with 54% of this growth in Christchurch City, 28% in Selwyn and 18% in Waimakariri (Figure 31)[30]. This growth will inevitably increase travel demand in Greater Christchurch.

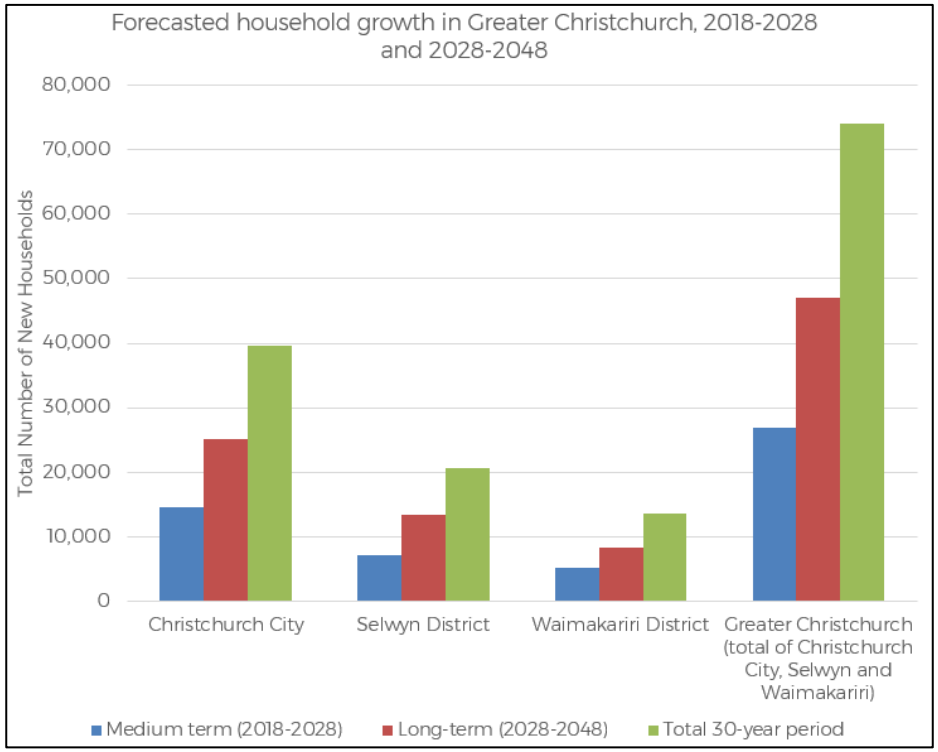


Figure 30: Forecast household growth in Christchurch City, Waimakariri District, Selwyn District, and Greater Christchurch, 2018-2028 and 2028-2048[31]

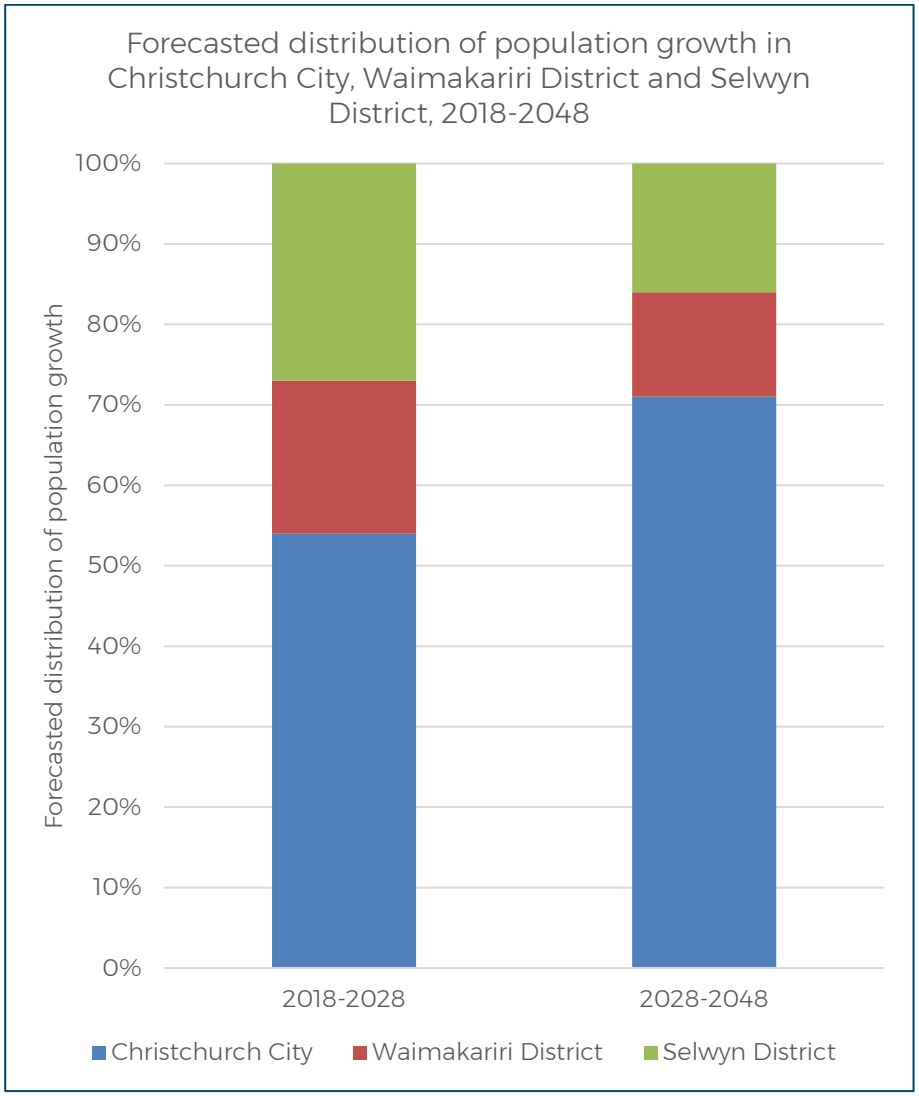


Figure 31: Forecast distribution of population growth in Christchurch City, Waimakariri District and Selwyn District, 2018-2048[33]

[30] Greater Christchurch Partnership (2019). Our Space 2018-2048: Greater Christchurch Settlement Pattern Update, p.11

[31] Greater Christchurch Partnership (2019). Our Space 2018-2048: Greater Christchurch Settlement Pattern Update, p.12

Residential growth is forecast to comprise a mixture of greenfield growth on the Christchurch City fringe and intensification in the existing urban area. Figure 32 shows that in 2028, residential density is forecast to be highest in the inner city and surrounding inner suburbs, with lower densities further out. The highest density areas (greater than 30 hh/ha) are largely located within a 4km radius from the central city.

Residential density has been calculated as the number of households per hectare. It utilises the CTM Model Zones and to align with the CCC spatial planning mapping methodology all non-residential zoned land was removed from each CTM (e.g. roads, reserves, commercial and industrial land are not included). The CTM Model Zones represent aggregated mesh blocks. The CTM Model aligns with census data (2018) and Stats NZ provides information about future growth projection (along with inputs from the Territorial Authorities).

The same figures have been prepared for Selwyn and Waimakariri and demonstrate that by 2028, despite the large growth in total population forecast in some areas, (with the exception of a very small area located to the south-west of Rolleston) all residential densities within this area will be at less than 20 hh/ha.

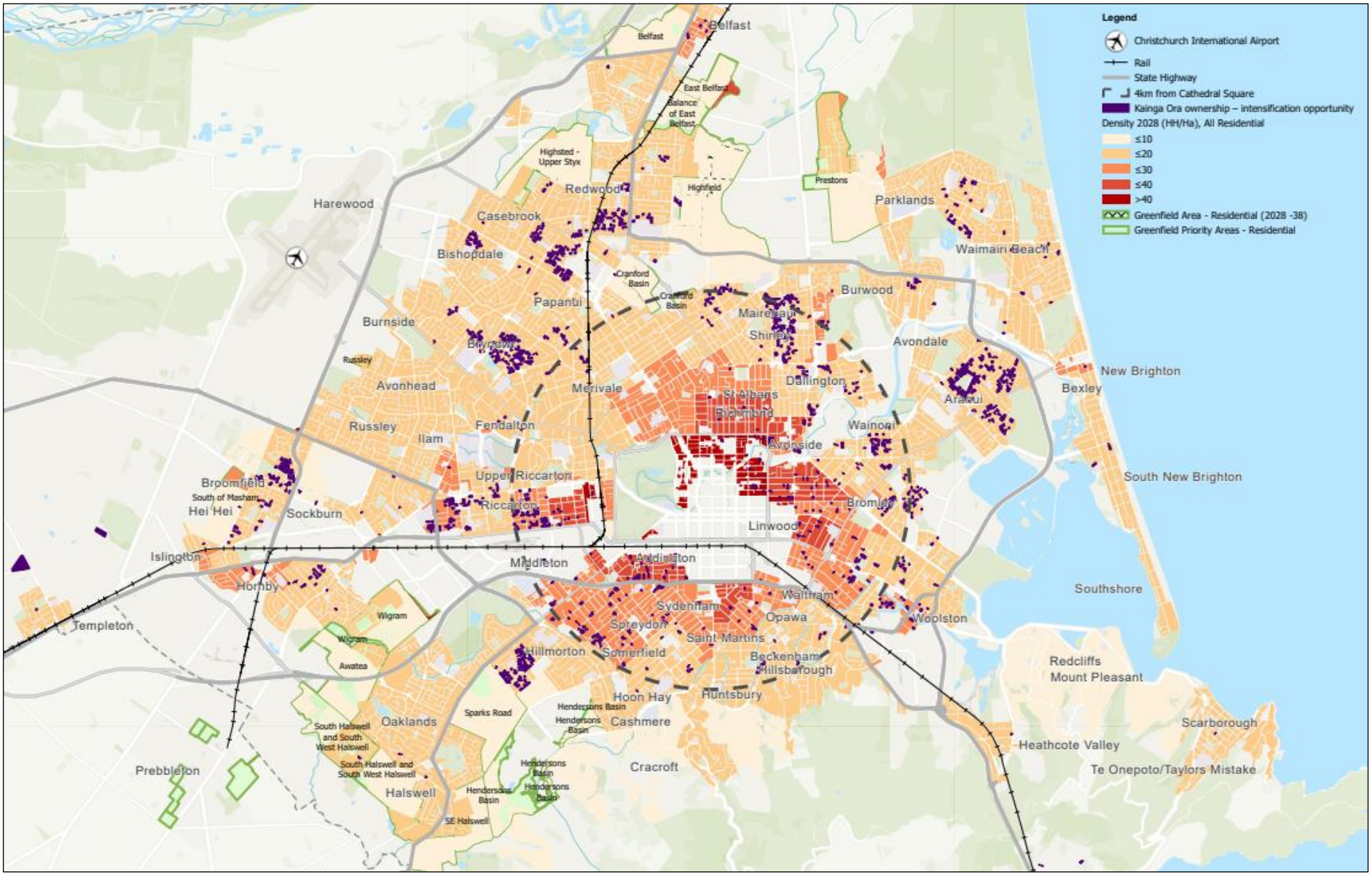


Figure 32: Christchurch residential density 2028[32]

[32] Source: Boffa Miskell Mapping using the CTM Model.

1.6 SOCIAL CONTEXT

1.6.1 Demographic context

The New Zealand Index of Multiple Deprivation (IMD) is a set of tools for identifying concentrations of deprivation in New Zealand. Maps of the weighted mean New Zealand IMD values for Greater Christchurch in 2018 are shown in Figure 33 to Figure 36.

Figure 33: Deprivation and Greater Christchurch Metro (bus) Network[33]

As illustrated in Figure 33, the areas with the highest deprivation (with values 9 and 10) in Christchurch City are located mainly to the east and south-west of the city, while areas with the lowest deprivation (with values 9 and 10) are located on and around the Port Hills and in large parts of the north-west of Christchurch City.

Figure 34 shows Christchurch's east, which has the highest deprivation, is only serviced by one CCC MCR – the Rapanui Shag Rock Cycleway - with limited transport choices compared to areas with lower deprivation.

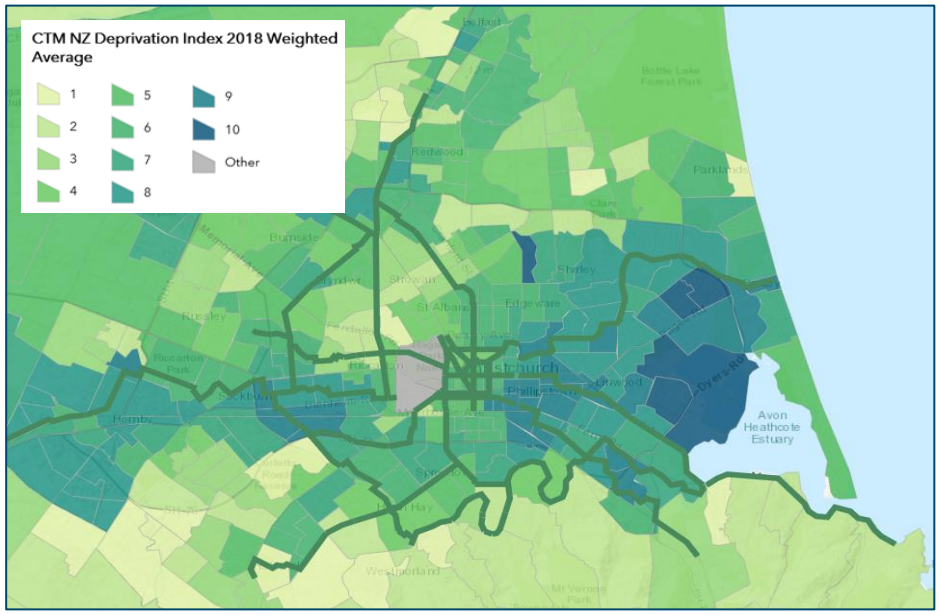


Figure 34: Deprivation and Christchurch City Council Major Cycle Routes[35]

The most deprived areas in the Waimakariri District (with values 8 to 10) are in a part of central Rangiora, Kairaki Beach/Pines Beach, and a part of eastern Kaiapoi (Figure 35). Areas of least deprivation (with values 1 and 2) include West Eyreton and Ohoka.

[33] Department of Public Health, University of Otago, Wellington (2018). NZDep2018 Statistical Area 1 (SA1) data

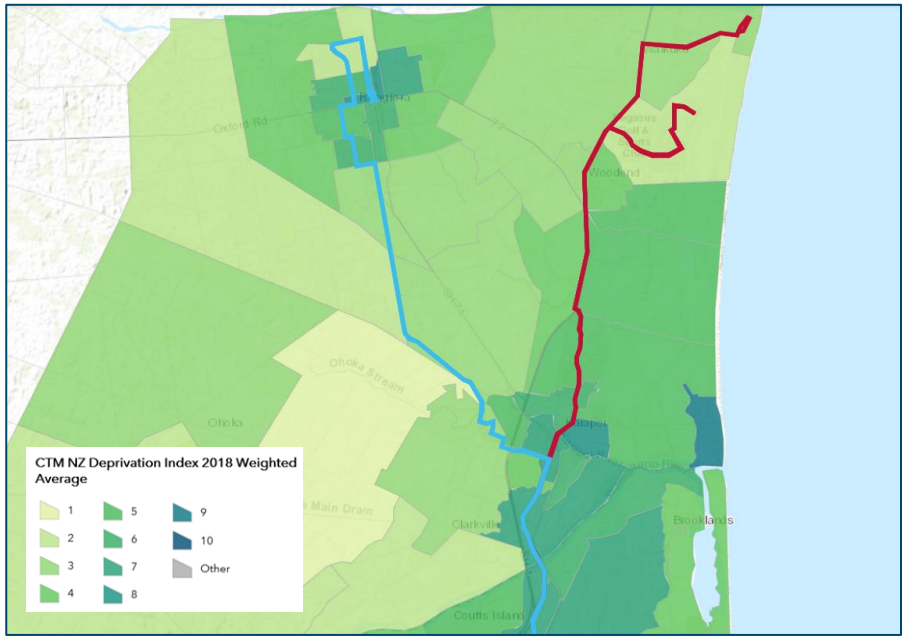


Figure 35: Deprivation Rangiora, Kaiapoi and Pegasus/Waikuku, 2018 and Greater Christchurch Metro (bus) Network[35]

In the Selwyn District, a large proportion of the population live in areas of low deprivation values (1 and 2), including Rolleston, West Melton and Prebbleton (Figure 36)[34]. There are no areas of high deprivation (with values 9 and 10) in the District.

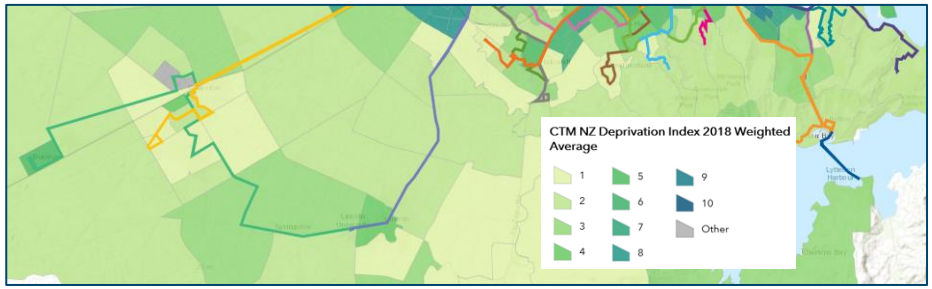


Figure 36: Deprivation Rolleston/Burnham, 2018 and Greater Christchurch Metro (bus) Network[35]

In Christchurch City, areas with the highest percentage of households with no motor vehicle (>10-22%) are scattered throughout the city, however there are is concentrations centrally located and within the east and south/south-west of the city (Figure 37). This data aligns with the city's weighted mean New Zealand IMD values, where areas with the highest deprivation (with values 9 and 10) are located mainly to the east and south-west of the city. In addition, the data suggests that within proximity to the Central City car ownership isn't required for good accessibility to goods, services and opportunities and consequently there are households choosing not to own a car.

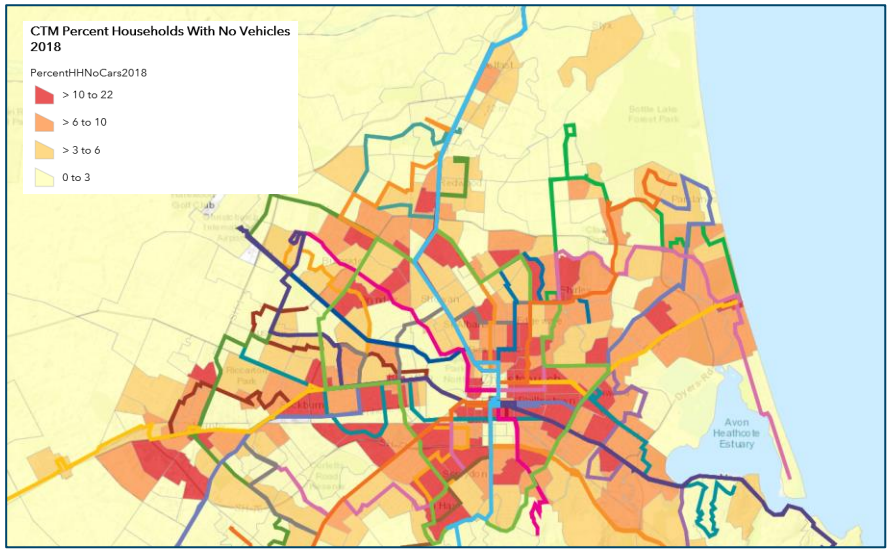


Figure 37: Percentage of households with no motor vehicle by CTM Model Zone - Christchurch City, 2018 and Greater Christchurch Metro (bus) Network[35]

Consideration of deprivation is significant given the GPS 2021 seeks to provide more transport choice, especially to people with less or limited access to transport. Access to a private motor vehicle is another proxy for deprivation and is summarised in the figures and commentary below.

Figure 38 shows that areas with the highest percentage of households with no motor vehicle (>10-22%) are reasonably well serviced by the CCC MCRs, except in the north-east (Shirley/Mairehau). Areas in the inner east are serviced by the Rapanui Shag Rock Cycleway, while areas in the south/south-west (including Addington, Spreydon, Hoon Hay, and Hornby South) are serviced by the Heathcote Expressway, Quarryman's Trail and Little River Link. The cycle route

[34] Department of Public Health, University of Otago, Wellington (2018). NZDep2018 Statistical Area 1 (SA1) data

[35] Statistics New Zealand (2020). Statistical area 1 dataset for 2018 Census – updated March 2020

traveling from the central city north-east to New Brighton is currently only serviced by a transitional shared use trail along the Avon/Ōtākaro River and is not up to the standard of the other formed MCRs.

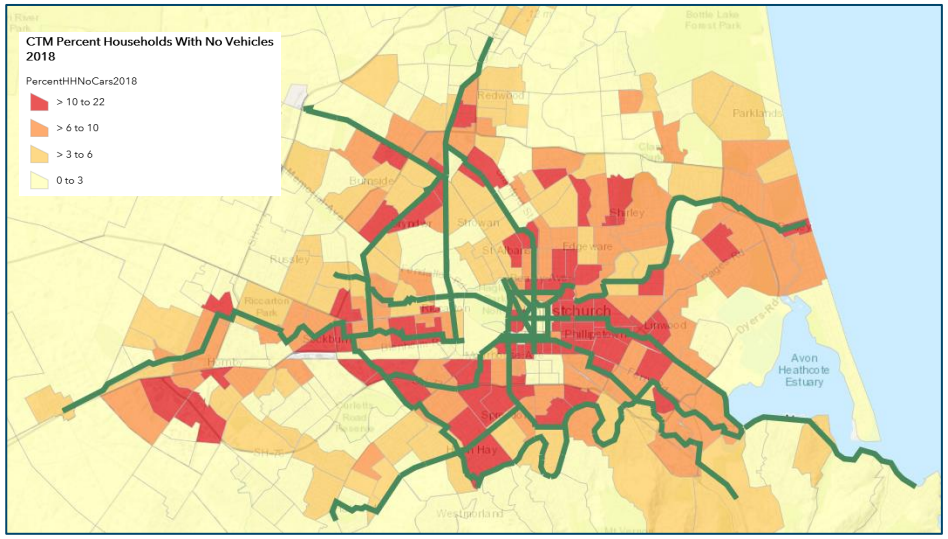


Figure 38: Percentage of households with no motor vehicle by CTM Model Zone - Christchurch City, 2018 and CCC Mayor Cycle Routes[35]

In the Waimakariri District, the area with the highest percentage of households with no motor vehicle (>10-22%) is the part of central Rangiora (Figure 39) that is one of the District's highest weighted mean New Zealand IMD value (value 8).

In the Selwyn District, less than 3% of households in the Selwyn District have no vehicle (Figure 40)[36]. This data aligns with the District's weighted mean New Zealand IMD values, where there are no areas of high deprivation (with values 8 and 10). The high private vehicle ownership rates in Rolleston make mode shift difficult with any alternative option required to be highly competitive and has implications for sustainable transport now and in the future.

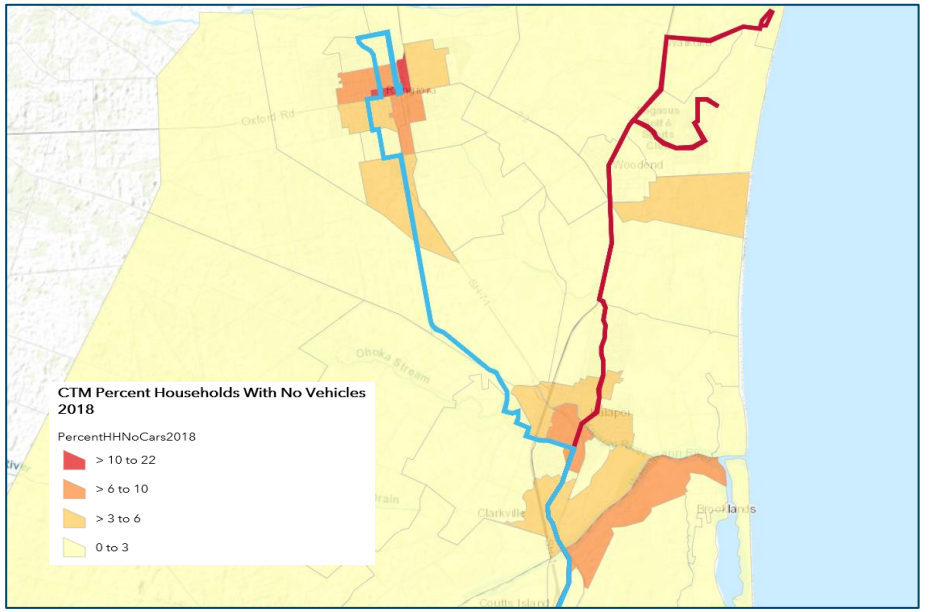


Figure 39. Percentage of households with no motor vehicle by CTM Model Zone – Rangiora and Pegasus/Waikuku, 2018 and Greater Christchurch Metro (bus) Network

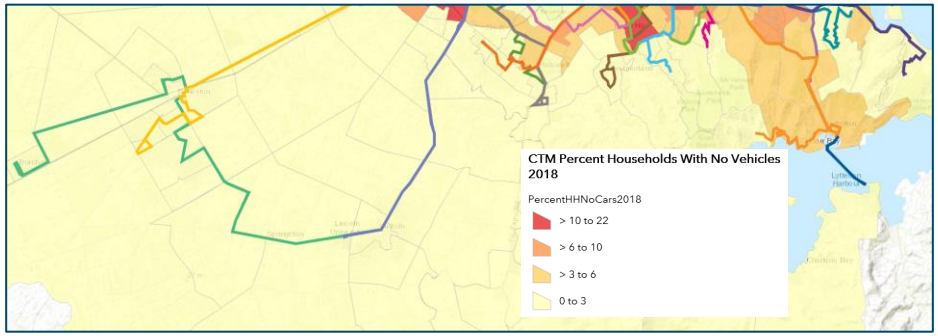


Figure 40: Percentage of households with no motor vehicle by CTM Model Zone – Rolleston/Burnham, 2018 and Greater Christchurch Metro (bus) Network[37]

Across New Zealand and in Greater Christchurch the population is ageing as the proportion of those over 65 years grows (Figure 41). The population structure is expected to continue to change. From 2018 to 2043 across Greater

[36] Department of Public Health, University of Otago, Wellington (2018). NZDep2018 Statistical Area 1 (SA1) data

[37] Statistics New Zealand (2020). Statistical area 1 dataset for 2018 Census – updated March 2020

Christchurch, the percentage of people aged 65 years and over is projected to increase from around 16% of the population to 24%[38].

The projected aging population increase will either be the result of the city attracting people aged 65 years and over for retirement or as a result of the existing city population aging. Regardless, it is noted that people aged 65 years and over typically have fewer mode choice options and are eligible for free PT during all off-peak Metro bus services.

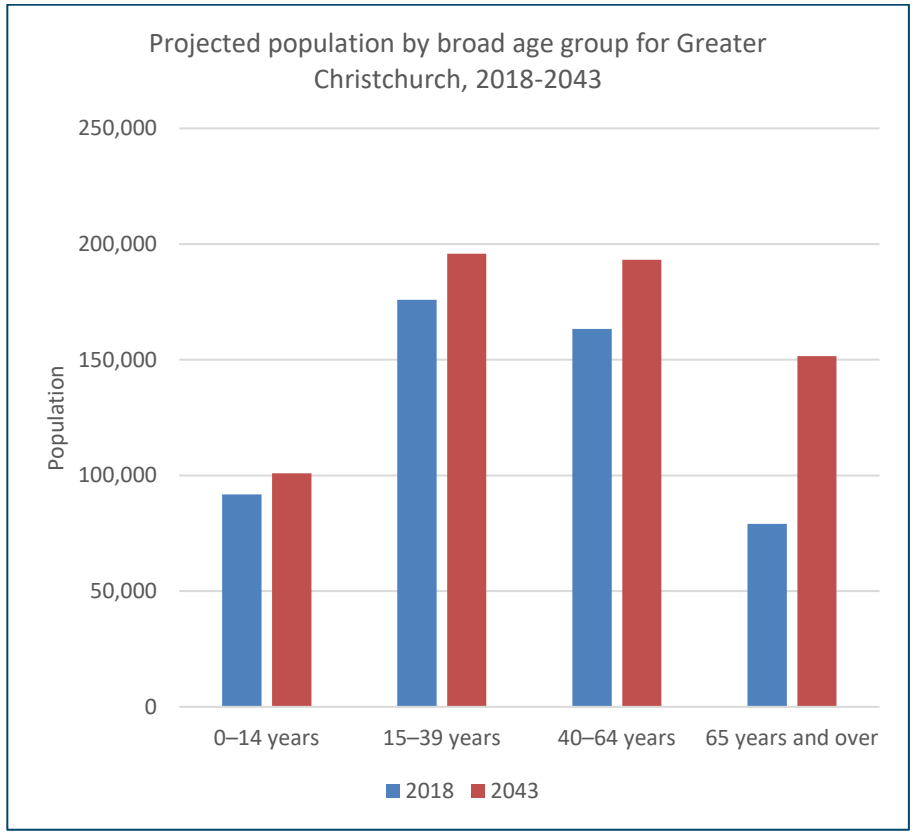


Figure 41: Projected population by broad age group for Greater Christchurch, 2018-2043[39]

1.7 ECONOMIC CONTEXT

The value of economic output in Greater Christchurch reached around $28.65 billion in 2018, representing 10.1% of New Zealand's nominal gross domestic product.

Christchurch Airport received record 6.93 million passengers in the 2019 financial year, with operating revenue growing 44.2% in the past five years, to $187.4 million[40]. Meanwhile, Lyttelton Port handled 437,413 containers in the 2019 financial year, up 2,9% on 2018 financial year levels[41]. Both are forecast to grow as the population increases which in turn will drive growth in demand for the movement of both people and goods.

The movement of freight plays a critical role for Greater Christchurch's economy in ensuring that goods reach both domestic and international markets. Road freight provides a flexible and dependable mode for freight operators and receivers. The estimated volume and value of freight moved through Greater Christchurch via road was $18.9 billion in 2014 - 31.6% of the total value of freight. It is crucial that Christchurch's strategic road network supports the movement of freight in and around Greater Christchurch.

Journey time reliability has been identified as a key problem impacting not only on private vehicle trips and PT, but also road freight trips. Network congestion and delays on key freight routes and access points impact on the movement of goods and the economic performance of Greater Christchurch. The development of a more efficient and effective PT network would likely release road capacity, assuming it attracts a significant modal transfer. This would have downstream benefits for freight trips on key corridors.

[38] Statistics New Zealand (2017). Subnational population projections 2013-2043 - Population by broad age group. Retrieved 28 February 2020, from https://figure.nz/table/jVx2x7BNjE3Tta9Z. Note the published StatsNZ data is based on the 'medium' projection, whereas the Greater Christchurch Partnership have adopted 'medium-high' projections for Waimakariri And Selwyn Districts and 'medium' for Christchurch TLA in the CTM Model so these projects are different.

[39] Statistics New Zealand (2017). Subnational population projections 2013-2043 - Population by broad age group. Retrieved 28 February 2020, from https://figure.nz/table/jVx2x7BNjE3Tta9Z

[40] Christchurch Airport (2019). Retrieved 24 March 2020, from https://www.christchurchairport.co.nz/about-us/who-we-are/facts-and-figures/

[41] Lyttelton Port Company (2019). Annual Report 2019, p.11

1.7.1 Future employment growth and distribution

Employment is forecast to grow by approximately 28% between 2018 and 2048, from 239,600 to 307,100 (Figure 42)[42]. In total, an additional 67,000 employment opportunities are projected by 2048, with most of these (89%) in Christchurch City (Figure 43)[42]. This would create additional demands for land and floorspace, and therefore opportunities to concentrate new development around PT.

It is noted the number of workers to households; and jobs to households is indicated to decline over time (smaller household sizes and aging population).

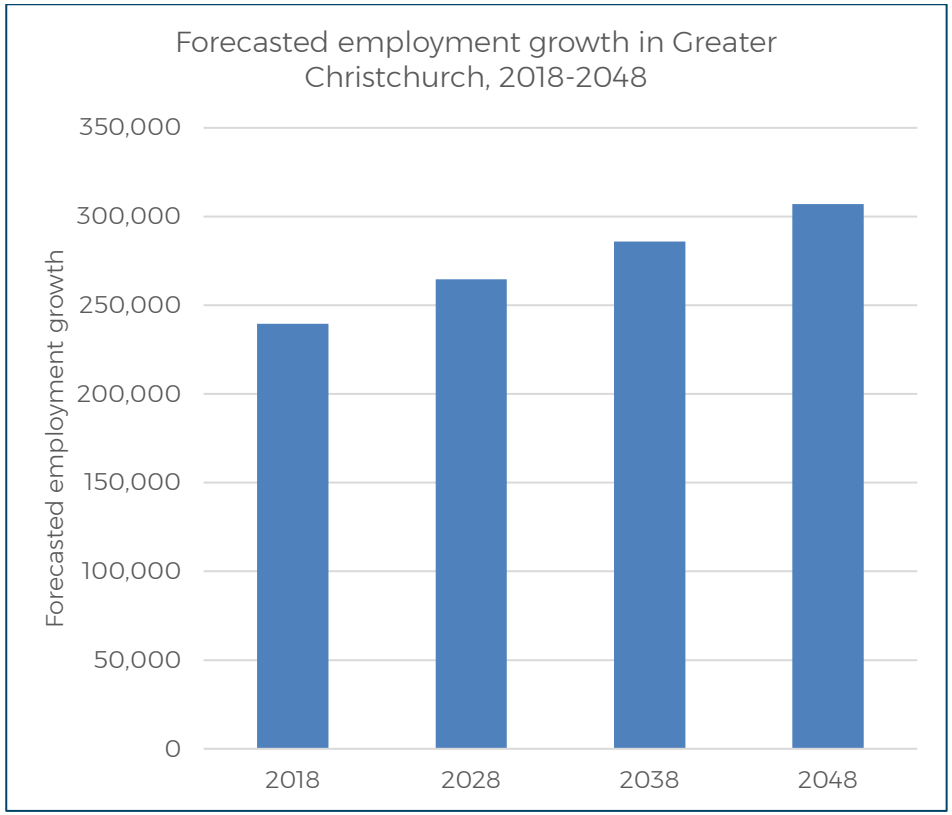


Figure 42: Forecast employment growth in Greater Christchurch, 2018-2048[42]

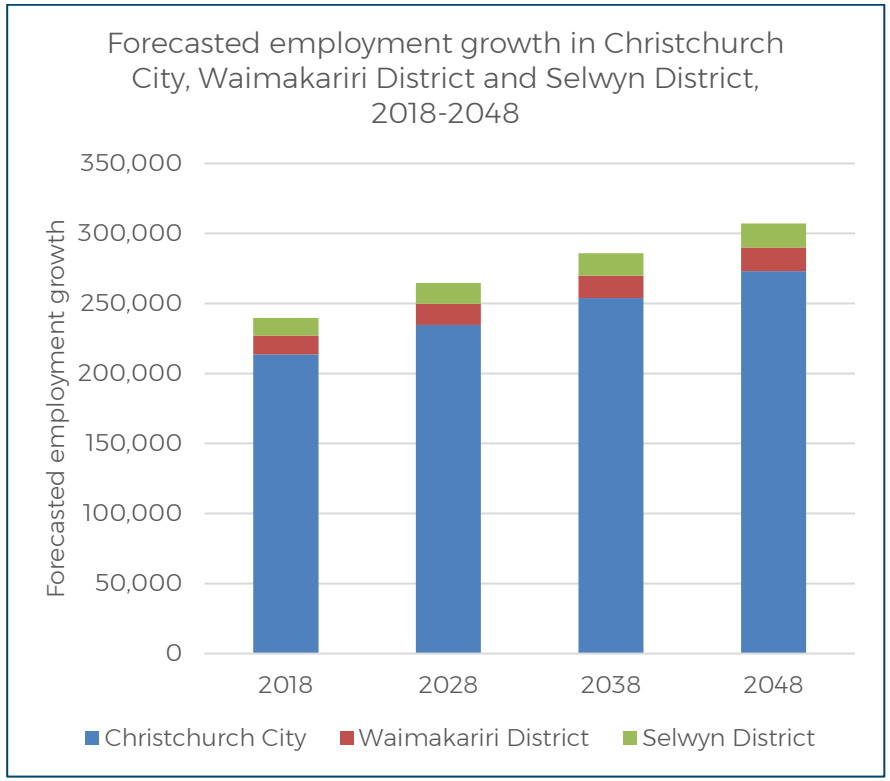


Figure 43: Forecast employment growth in Christchurch City, Waimakariri District and Selwyn District, 2018-2048[43]

By 2028, employment and tertiary education is forecast to be concentrated predominantly in the Christchurch Central City, at KAC's (i.e. Riccarton, Shirley, Hornby, Linwood and Papanui), at University of Canterbury and along the Blenheim Road southern industrial belt. Some areas are forecast to lose employment as dispersed activities return to the central city as it is progressively rebuilt. The key employment areas by CTM Zone (those with the greatest numbers of employees) are outlined in Table 1 below and the corresponding image.

Figure 45 also outlines that there are also concentrations of employment in Rolleston, Rangiora, Kaiapoi and Lincoln. Note that due to the change in CTM zone size area, some areas that are high employers are disproportionately shown due to their large CTM zone (i.e. the Airport and Surrounds is showing

[42] QTP (2019). CTM v18 Update: Land Use Forecasting, May 2019

[43] QTP (2019). CTM v18 Update: Land Use Forecasting, May 2019

as a low density employment hub when it is actually one of the key employment areas in Greater Christchurch.

Table 1 Forecast employment growth by CTM zone[43]

Area	CTM Zone	Employees (Total)			Description
		2018	2028	Difference	
Hospital Corner	66	7314	13174	5860	Hospital Corner
Airport and Surrounds	288	5103	5022	-81	Sir William Pickering Dr
	284	4988	4772	-216	Airport
Blenheim Road South	220	4233	3662	-571	Middleton: Birmingham Dr
	222	3411	3064	-346	Parkhouse Rd / Treffers Rd
	221	2998	2740	-258	Middleton: Annex Rd/Lunns Rd
Central City	61	1210	5807	4597	ANZ Centre / The Crossing
	62	2077	5307	3229	The Terraces / Cashel St
	58	1324	4186	2861	New Regent St / Performing Arts Precinct
	65	2608	3329	721	Cambridge Terrace South East
	71	2314	3065	751	Earthquake Memorial South
Addington	183	4050	4074	24	Raceway / Horncastle Arena / Stadium
Hornby	242	3728	3433	-295	Buchanans Rd / Waterloo Road
UC	272	2645	2694	49	University of Canterbury
Mandeville St	257	2677	2603	-74	Mandeville St

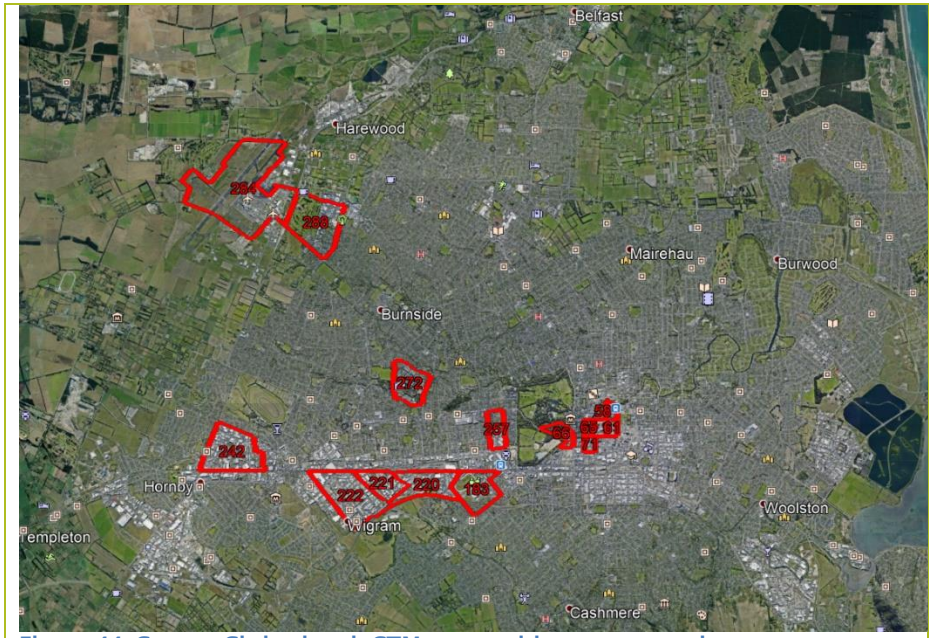


Figure 44: Greater Christchurch CTM zones with greatest employment

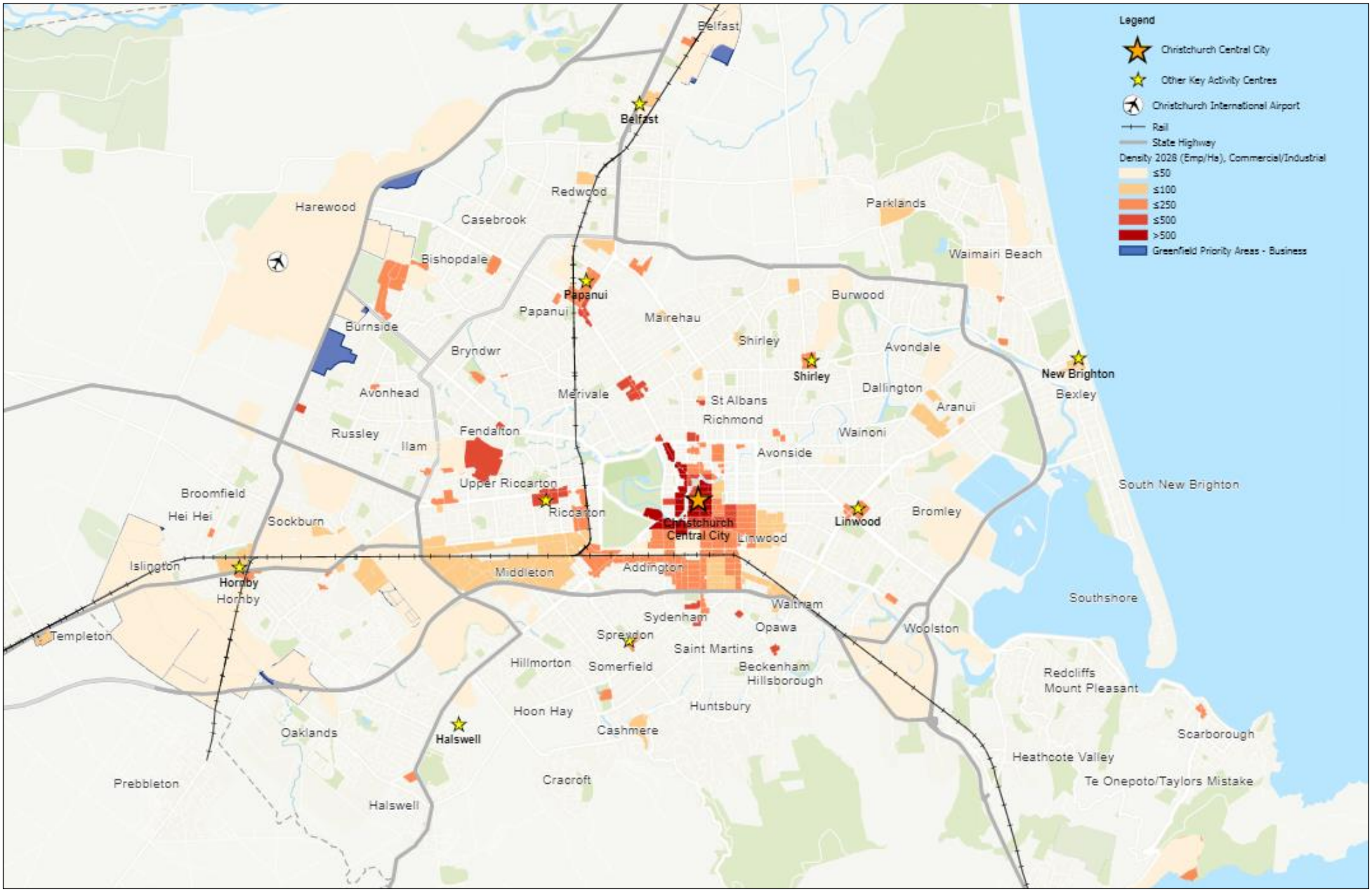


Figure 45: 2028 projected employment and tertiary density in Christchurch

1.7.2 Key activity centres and key destinations

There is an ongoing focus on new commercial growth and development within the Central City and KACs, of which there are eight across the Christchurch City. These centres, as set out in the CRPS and Our Space are identified as focal points for employment (including offices), but also community activities and the transport network and which are suitable for more intensive mixed-use development.

Beyond the Central City, Riccarton, Papanui/Northlands and Hornby KACs are the top three highest suburban employment generators with between 2,000 and 4,500 employees and offer a good range of social, community, hospitality and indoor recreation venues, with each having a shopping mall as a key anchor.

In addition to the Central City and KACs, it is evident from the total employment figures that there are several other key areas or destinations which represent significant employment clusters and where access to PT should be maximised. These include:

- Christchurch Hospital
- Christchurch Airport and surrounds
- Blenheim Road industry
- Wider Hornby area
- University of Canterbury

1.8 ENVIRONMENTAL CONTEXT

The environmental context is important to set the scene for the analysis of the potential impacts of different options, their costs and any possible consenting and construction issues.

The New Zealand Government and CCC are committed to reducing emissions and preparing for the opportunities and challenges presented by climate change. The Government's Climate Change Response (Zero Carbon) Amendment Act 2019 was introduced in late 2019 and sets the target of New Zealand having net zero greenhouse gas emissions by 2050, excluding biogenic methane.

CCC[44] and ECan[45] declared a climate emergency in May 2019. CCC agreed to set a target for Christchurch achieving net zero greenhouse gas emissions, excluding methane, by 2045 for the District.

Outputs from the Transport Model indicate that private Vehicle Kilometres Travelled (VKT) will increase by 1.7Million (17% increase from 10 Million to 11.7 Million) from 2018 to 2028 (Do-Minimum).

As part of the climate emergency declaration, ECan have committed to robustly and visibly incorporate climate change considerations into Council work programmes and decisions; provide strong local government leadership in the face of climate change, including working with regional partners to ensure a collaborative response; advocate strongly for greater Central Government leadership and action on climate change and lead by example in monitoring and reducing Council's greenhouse gas emissions.

ECan have recently renegotiated its Public Transport contracts, which has accelerated the move to new, low-emission buses[46]. This is projected to reduce the CO2 emissions by 14% within their first year with the introduction of 25 new electric buses and 39 new low-emission Euro 6 buses. This has been incorporated into the Do-Minimum scenario.

In Arataki Version 2 Waka Kotahi identify that climate change considerations are both a key driver and a step change required to deliver the change sought for the New Zealand Transport system. Arataki Version 2 notes:

> *Technological change and managing the impacts of climate change are the most significant drivers that will shape the future land transport system over the next decade[47].*

Climate change adaption must be integrated into future planning and investment in the land transport system and the next decade is considered critical for laying the foundation to meet targets that require a significant shift in transport modes away from private, carbon-fuelled vehicles towards shared, energy-efficient vehicles and changes to the way we plan and develop our urban areas. A step change is required to support the transition to a low-emissions economy.

Other key areas of consideration in summary include:

- Land use
- Noise associated from congestion of the transport network
- Geology

[44] https://newsline.ccc.govt.nz/news/story/christchurch-city-council-declares-climate-emergency
[45] https://www.ecan.govt.nz/get-involved/news-and-events/2019/environment-canterbury-declares-climate-emergency
[46] https://www.ecan.govt.nz/your-region/your-environment/climate-change/our-environmental-contribution/
[47] https://www.nzta.govt.nz/assets/planning-and-investment/arataki/docs/key-drivers-step-changes-levers-interventions-august-2020.pdf

- Vegetation
- Coastal environment
- Heritage and archaeology
- Social and recreation
- Freshwater environment
- Terrestrial environment.

If not appropriately managed, parts of the study area's environment may be subject to potential adverse effects resulting from any future proposed works. Environmental assessments specific to the recommended option will be required during the pre-implementation phase to support any future Notice of Requirement (NoR) and/or resource consent applications.

1.9 MANA WHENUA CONTEXT

The associations and values held by Mana Whenua in the study area require careful consideration in conjunction with ongoing engagement.

The Iwi identified as having Mana Whenua over the study area are Te Rūnanga o Ngāi Tahu. The range of cultural, spiritual and historical values which may be held require further consideration, in partnership with Mana Whenua.

An overview of key areas of interest include:

- Design – stormwater, park and ride opportunities
- Quality, urban design (native plant use)
- Possible naming of potential bus infrastructure
- Acknowledgement of Mana Whenua; cultural inductions, input to management plans/urban design, landscape plan, Construction Environmental Management Plan (CEMP), including earthworks, dust, noise, vibration, traffic, ecology
- Accidental discovery protocols/disturbance protocols, koiwi Mana Whenua heritage.\

Mana Whenua may desire to provide Cultural Values Assessments (CVAs) specific to any works proposed as part of the recommended option (subject of this combined business case). Alongside ongoing engagement, CVAs may assist with understanding the values that Mana Whenua may hold in relation to any site or place potentially affected by the recommended project option.

2 STRATEGIC CASE (ACTIVITY)

2.1 INVESTMENT LOGIC MAP, PROBLEM STATEMENTS, BENEFITS, INVESTMENT OBJECTIVES AND KEY PERFORMANCE INDICATORS (KPIS)

2.1.1 Investment logic map (ILM), problem statements and benefits

The key element of developing the strategic case is securing a consensus amongst investment partners and stakeholders to confirm the Problem Statements, Benefits and Investment Objectives.

A workshop was held on 20 February 2020 with representatives from Waka Kotahi, CCC, ECan, SDC and WDC to reconfirm the Problem Statements and potential benefits presented in the programme business case. The workshop reviewed and amended the previous ILM from the Future of PT in Greater Christchurch PBC and stress-tested the Problem Statements, Benefits and Investment Objectives previously identified for relevance and appropriateness based on more updated information.

Based on the outcomes of the workshop and post-workshop dialogue between participants and the facilitator, the ILM was amended as follows:

- The addition of the associated 'effects' to Problem Statements 1, 2 and 3, which were not included in the Greater Christchurch PBC Problem Statements
- Amendments to Problem Statement 2 and Benefit 2 to reflect the issue of poor PT mode share between highly populated/high growth areas and key destinations. Based on the evaluation of residential growth patterns, higher density areas, deprivation and vehicle ownership data through to 2028, a priority benefit of this combined business case is to enhance accessibility to and from key residential areas that align with these factors. This approach aims to provide better alignment of PT where there is greatest need and growth is occurring or anticipated, but also as a catalyst for further intensification in contributing to strategic goals around land use integration and a more compact urban form. Those areas which will be referred to as 'highly populated/high growth areas' include:
  - Outer suburbs (including St Albans, Linwood, Spreydon, Addington/Sydenham and Riccarton)
  - Greenfield areas (including North/Northwest Greenfield Areas and Halswell Greenfield Areas)
  - Larger towns in Selwyn and Waimakariri (including Rolleston, Lincoln, Rangiora and Kaiapoi)
- Changes to Problem Statement 3 and Investment Objective 3 to reflect the need to remove barriers to PT uptake

The detailed agreed ILM is attached in **Appendix A**.

2.1.2 Problems identified

Key identified issues are:

- Greater Christchurch will experience an increased need for travel due to the projected population and employment growth and this will result in growing congestion with associated negative environmental impacts associated with the transport network
- The uptake and use of PT in Christchurch is low and behind that of Auckland and Wellington (on a per capita basis)
- Low PT uptake relates to uncompetitive journey times of buses over private vehicles, the limited number of opportunities that bus users can access within an acceptable journey time, and the relative ease and comfort of using and understanding how the bus system operates and its benefits

The confirmed problems used in this business case are:

- **Problem Statement One** - The current PT system can be unreliable, and many journey times are not competitive with the private vehicle, resulting in poor PT mode share and longer and less reliable journey times (50%)
- **Problem Statement Two** - The current PT system is not effectively supporting highly populated/high growth areas and connections to key destinations, resulting in poor PT mode share within these areas (25%)
- **Problem Statement Three** - **T**here are several barriers to using PT in Greater Christchurch, resulting in a low uptake of new PT users and subsequent poor PT mode share (25%)

2.2 ALIGNMENT WITH EXISTING STRATEGIES AND ORGANISATIONAL GOALS

The sections below give an overview of the strategies and outcomes sought by the investment partners – Waka Kotahi, ECan, CCC, SDC and WDC that are of relevance to the proposed PT investment.

Strategies identified and reviewed for their context and alignment are included in Figure 46.

It is considered the Recommended Option is strongly aligned with these strategies and organisational goals as it will deliver a PT system that will make PT journey times increasingly competitive with private vehicle journey times, offers increased reliability, provides better accessibility to highly populated/high growth areas and key destinations, and attracts new and retain existing users to increase PT mode share.

A summary of the alignment of the Recommended Option with these strategies is provided in Table 2, and further details of the relevant goals contained in these strategies are outlined in **Appendix B.**

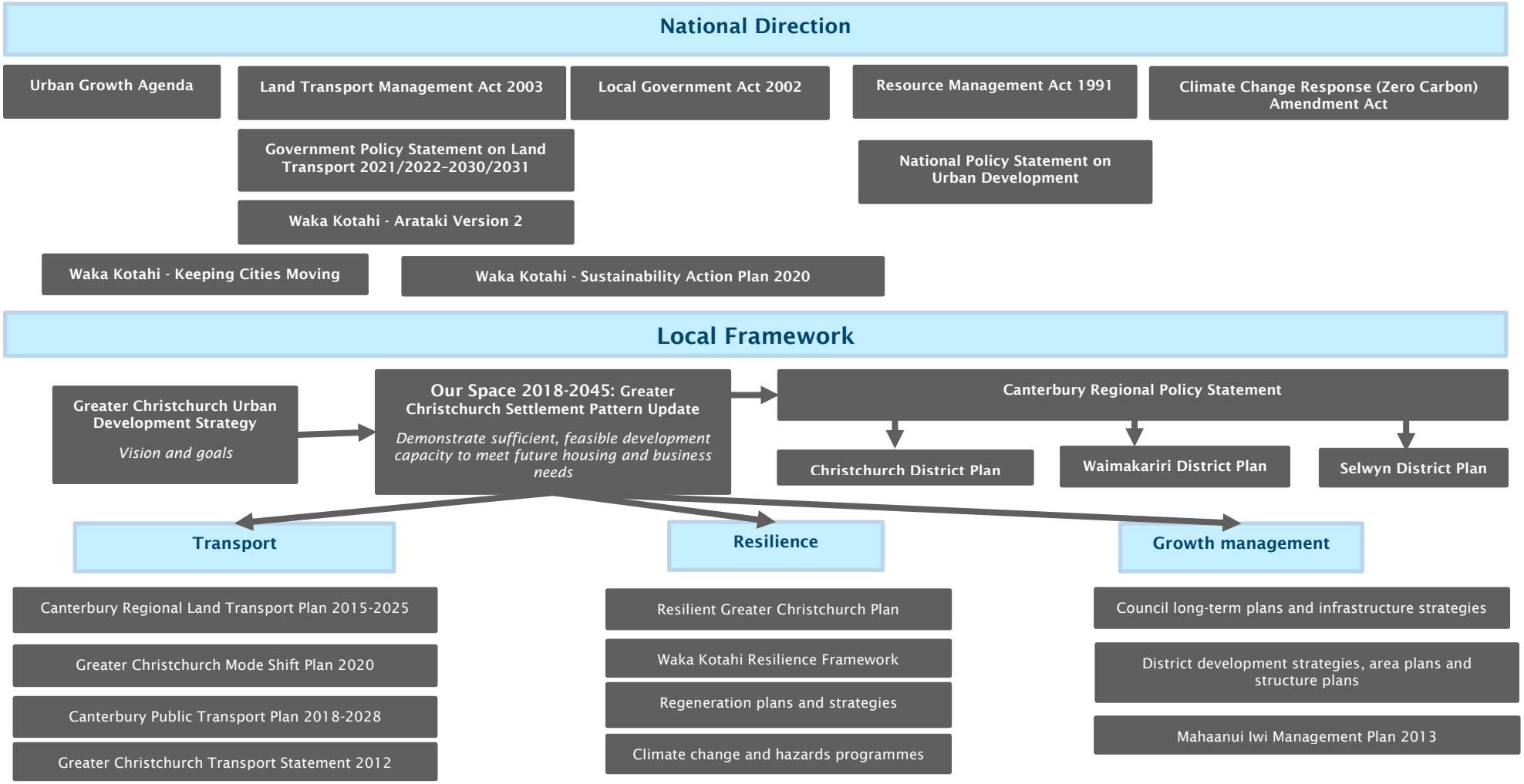


Figure 46: Overview of strategic framework

Table 2 Summary of alignment with existing strategies and organisational goals

National/Regional Strategy	Alignment of Recommended Option with existing strategies and organisational goals				
	Accessibility	Economy	Environment	Safety	Value for money
New Zealand Transport Agency Statement of Intent 2018-2022	✓	✓	✓		
Government Policy Statement on Land Transport 2021/2022-2030/2031	✓	✓	✓	✓	
Waka Kotahi Arataki Version 2	✓	✓	✓	✓	✓
Waka Kotahi Sustainability Action Plan			✓	✓	
Our Space 2018-2048: Greater Christchurch Settlement Pattern Update	✓				
Canterbury Regional Land Transport Plan 2015-2025 (revised June 2018)	✓		✓	✓	
Greater Christchurch Transport Statement 2012	✓		✓		
Canterbury Regional Public Transport Plan 2018-2028	✓	✓	✓		✓
Greater Christchurch Mode Shift Plan 2020			✓		

The Government Policy Statement on Land Transport 2021/2022-2030/2031 (GPS) specifically notes that to achieve the desired outcomes sought (which include an increased share of travel by public transport and active modes, reduced greenhouse gas emissions, reduced air and noise pollution and more available and accessible public transport modes and improved access to social and economic opportunities) that the work underway on developing a public transport system in Christchurch needs to continue[48].

[48] https://www.transport.govt.nz//assets/Uploads/Paper/GPS2021.pdf p.19

2.3 STATUS OF THE EVIDENCE BASE

2.3.1 Evidence to support problem statement 1 (journey time reliability)

The current PT system can be unreliable, and many journey times are not competitive with the private vehicle, resulting in poor PT mode share and longer and less reliable journey times.

Journey time reliability

Two indices have been used to assess journey time reliability:

- Planning Time Index (PTI) – PTI measures how much longer the total travel time is than the minimum travel time (i.e. ratio of 95th percentile to minimum travel time). The travel time is inclusive of any time associated with picking up and dropping off passengers at bus stops. The minimum travel time is the minimum travel time recorded during the assessed time period (i.e. during the AM and PM peak). This index indicates how much extra time a commuter may face in the bus journey alone. The closer the index is to 1.0 the better the reliability. While there does not seem to be any published data on what is an acceptable PTI, a PTI threshold of 1.5 has been used to report on the level of network reliability. 1.5 indicates where a bus journey time could be 50% longer than expected and this would need to be accounted for in user trip planning.

  Note that the timetable does not come into the planning time index assessment. The index shows how much extra in vehicle journey time a commuter may face during a chosen period (e.g. 7-9am), on a journey from A to B (e.g. Blue Line from Princess Margret to Bus Interchange).The timetable could be changed to account for variation in journey times during a chosen period, however, adjusting a timetable to incorporate variability to meet customer expectations does not fix any network issues that could be causing unreliable journey times. The adjustment simply accepts the variability without trying to identify the issue and fix it. The PTI, alongside the cumulative travel times were used to identify whether there were reliability issues and then narrow down the network segments that had the greatest variability.

- Buffer Time – this measures the extra time required in the journey (i.e. 95th percentile – median travel time). The closer the buffer time is to zero the better the reliability. A buffer time threshold of 10 minutes has been used to report on the level of network reliability.

Data analysis for the above indices used bus travel time data extracted from ECan's PowerBI interface, which collates real time information (RTI) from GPS pings (every 15 Seconds). The analysis used a sample size based on Thursdays during the month of August 2019, for the morning (7-9am) and evening (4-6pm) peak periods. The sample was considered representative of a busy commute weekday, where reliability is relatively more important to customers.

Seventy-two different trips (refer to **Appendix C**) have been assessed based on comparing bus journey times for the following:

- Two periods (AM peak and PM peak)
- Nine routes: Five core routes and four additional high frequency routes
- Four directions for each route: Outbound from city in two directions, Inbound to city from two directions, clockwise or anticlockwise for the Orbiter

Table 3 Description of outbound trips

Route	Direction	Origin	Destination
Outbound trips			
17	Northbound	Bus Interchange	Sheffield Cres
17	Southbound	Bus Interchange	Huntsbury
28	Northbound	Bus Interchange	Northwood
28	Southbound	Bus Interchange	Lyttelton Wharf
60	Eastbound	Bus Interchange	Southshore
60	Westbound	Bus Interchange	Corsair Drive
80	Eastbound	Bus Interchange	Queenspark Dr near Inwoods Rd
80	Westbound	Bus Interchange	Lincoln University
Blue	Northbound	Bus Interchange	Rangiora (Ashley St)
Blue	Southbound	Bus Interchange	Princess Margaret Hospital
Orange	Northbound	Bus Interchange	Queenspark
Orange	Southbound	Bus Interchange	Knights Stream Park
Purple	Eastbound	Bus Interchange	Ferrymead Shops
Purple	Westbound	Bus Interchange	Christchurch Airport
Yellow	Eastbound	Bus Interchange	New Brighton (Oram Ave)
Yellow	Westbound	Bus Interchange	Rolleston Terminus

Route	Direction	Origin	Destination
Inbound trips			
17	Northbound	Huntsbury	Bus Interchange
17	Southbound	Sheffield Cres	Bus Interchange
28	Northbound	Lyttelton Wharf	Bus Interchange
28	Southbound	Northwood	Bus Interchange
60	Eastbound	Corsair Dr - The Landing	Bus Interchange
60	Westbound	Rocking Horse Rd near Petrel Ln	Bus Interchange
80	Eastbound	Lincoln University	Bus Interchange
80	Westbound	Queenspark Dr near Inwoods Rd	Bus Interchange
Blue	Northbound	Princess Margaret Hospital	Bus Interchange
Blue	Southbound	Rangiora (Ashley St)	Bus Interchange
Orange	Northbound	Knights Stream Park	Bus Interchange
Orange	Southbound	Queenspark	Bus Interchange
Purple	Eastbound	Christchurch Airport	Bus Interchange
Purple	Westbound	Sumner	Bus Interchange
Yellow	Eastbound	Rolleston Terminus	Bus Interchange
Yellow	Westbound	New Brighton (Oram Ave)	Bus Interchange

Route	Direction	Origin	Destination
Circular trips			
Orbiter	Clockwise	Eastgate Mall	Northlands
Orbiter	Anti-Clockwise	Eastgate Mall	Northlands
Orbiter	Clockwise	Eastgate Mall	Westfield Riccarton
Orbiter	Anti-Clockwise	Eastgate Mall	Westfield Riccarton

Figure 47 shows the frequency of PTI across the routes analysed, indicating that majority of trips fall into the 1.6 to 2.2 bracket. There does not seem to be any published data on what is an acceptable PTI, but a more reliable system would see the grouping closer to the 1.5 threshold, with less spread.

The PTI across the 72 trips is summarised in Figure 48. The results indicate that 79% of the trips were above the PTI index threshold of 1.5.

Figure 47: Scatterplot: planning time index vs. distance

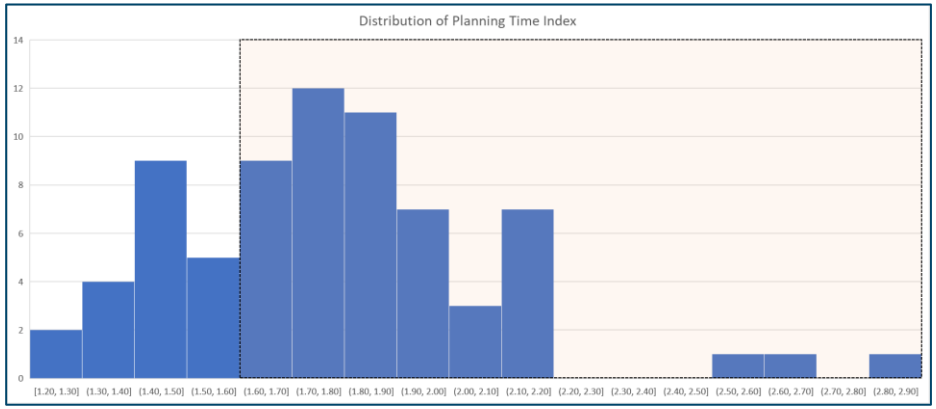


Figure 48: Histogram: planning time index vs. distance

The Buffer Time Index across the 72 trips is summarised in Figure 49. There does not seem to be any published data on what is an acceptable buffer index,

but results showed that 53% of the assessed trips were above the buffer index threshold of 10 minutes.

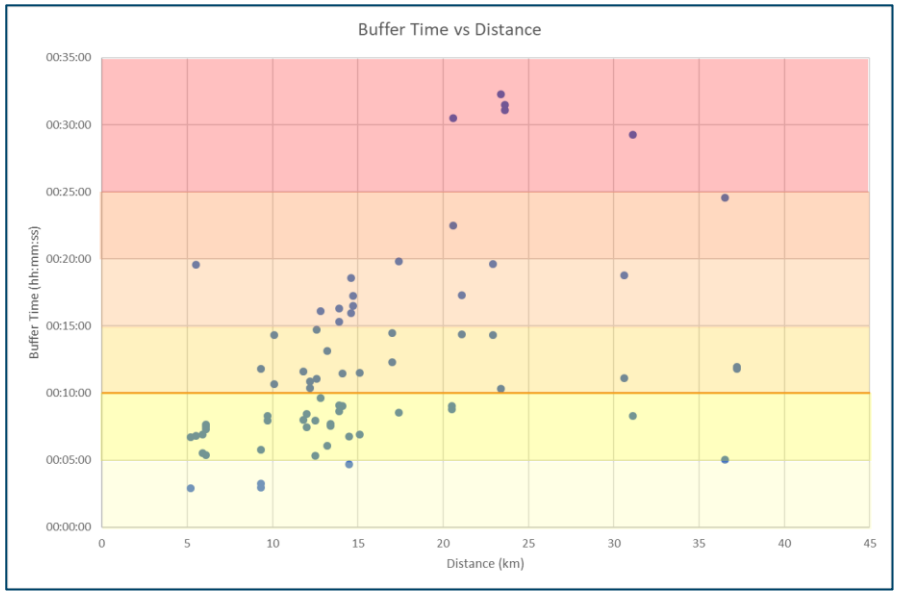


Figure 49: Buffer time vs. distance

Figure 50 further categorised the trips by the route and where it was an inbound, outbound or a circuit trip. This was to see whether there was any pattern relating to inbound and outbound trips. There was no significant difference or trend between the inbound and outbound trips regarding the Buffer Times, however the circuit route (i.e. Orbiter) was relatively worse in meeting the above thresholds.

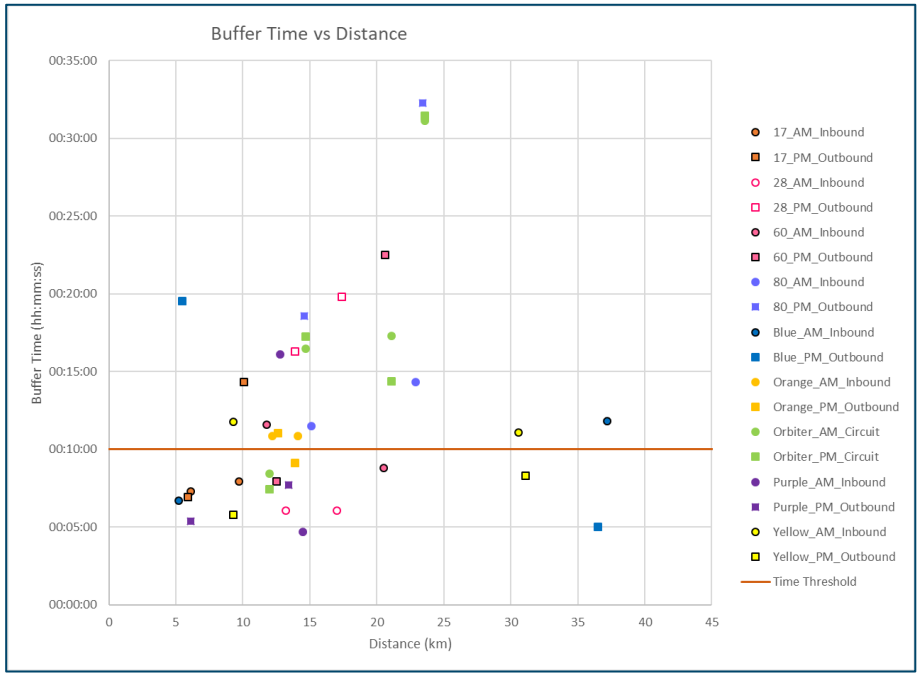


Figure 50: Buffer time vs. distance – by different routes at different peaks

Considering both the PTI and buffer time, analysis indicates the following ten route segments are the most unreliable (with further detail at Appendix D):

Table 4 Ten most unreliable route segments based on assessment

Route	Peak	Direction	Section to improve
Blue	PM	Southbound	Christchurch Bus interchange to the Princess Margaret Hospital
60	AM	Eastbound	Travis Road near Blue Gum Place to Southshore (end terminal of the route)
Orbiter	PM	Clockwise	Princess Margaret Hospital to Westfield Riccarton. Second segment from Burnside High School to Northland Platform B
Orbiter	AM	Clockwise	Princess Margaret Hospital to Westfield Riccarton. Second segment from Burnside High School to Northland Platform B
80	PM	Westbound	Prebbleton to Lincoln Uni
80	PM	Eastbound	Westfield Riccarton to Tuam Street/Fitzgerald, (travel through the Central City)
17	PM	Northbound	St Martin Shops to Christchurch Bus Interchange
28	PM	Northbound	Opawa to Bealey Avenue, through the Central City northbound
Yellow	AM	Westbound	Eastgate Mall to Christchurch Bus Interchange and Rolleston (Kidman Street) to Rolleston Terminus
Purple	AM	Eastbound	University (Ilam Road) to Westfield Riccarton. Second section from Christchurch Bus Interchange to Ferry Road Red Bus Depot

Lastly, Customer Insight Surveys (refer to Section 2.3.3) also reinforce poor user perceptions of journey time reliability for PT, with 69% of the 241 respondents in Christchurch, whose primary mode of transport is car, van or truck, private or company vehicle, considered journey time to be the key barrier to using PT as their preferred alternative means of transport[49].

Uncompetitiveness of PT with private vehicles

A comparison of the journey times using private vehicles vs. buses was also undertaken using the bus information extracted from ECan's PowerBI and car travel time from TomTom Route Analysis Application Planning Interface (API) (via Waka Kotahi). Note this only compares in-vehicle journey time, where walk time, wait time and transfer time are all components of the overall travel time.

The routes assessed are categorised by inbound to city, outbound from city, or clockwise/anticlockwise for the orbiter, as outlined earlier in Table 4. The results show that the total travel time in a private vehicle is always faster than the time taken by the bus. The total travel times of the journeys by the two different modes is shown in Figure 51 and Figure 52. The bus to car travel time ratio (Bus/Car) ranges from 1.2 to 2.2 across the routes and peak periods, confirming that bus journey times are not competitive with private vehicles.

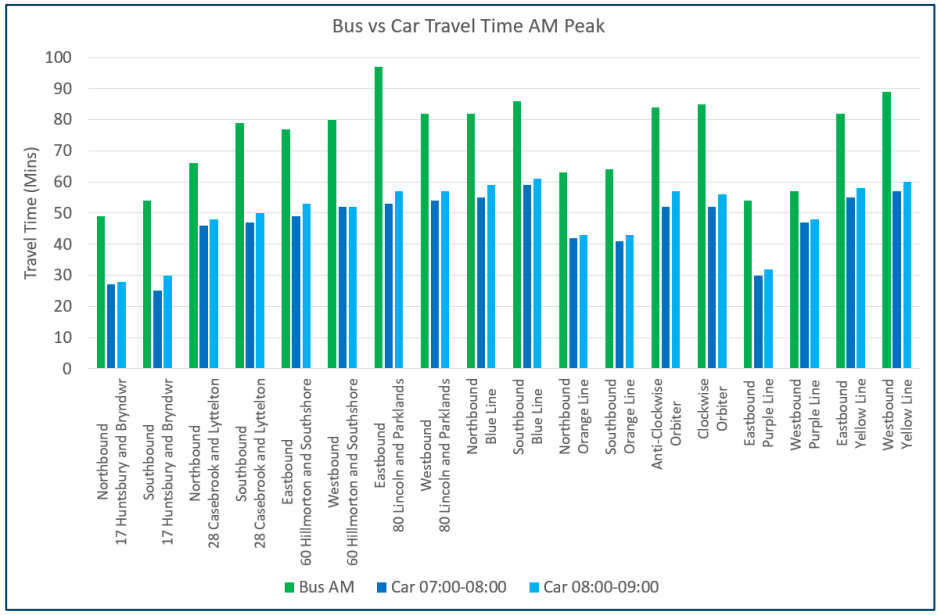


Figure 51: Bus vs. car travel time in AM peak

[49] Waka Kotahi. Travel Demand Management Customer Insight – Qualitative and Quantitative Insights Summary – All regions, 30 May 2019. p. 29

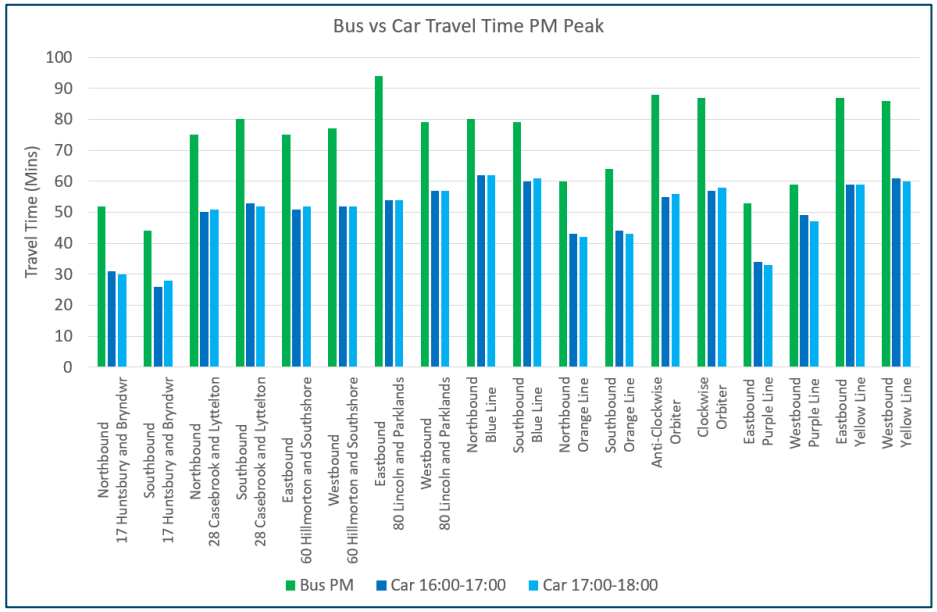


Figure 52: Bus vs. car travel time in PM peak

2.3.2 Evidence to support problem statement 2 (accessibility)

The current PT system is not effectively supporting highly populated/high growth areas and connections to key destinations, resulting in poor PT mode share within these areas.

The primary piece of evidence for Problem 2 is that current land use patterns, specifically new and emerging growth areas, some zones for urban intensification (redevelopment of existing areas with increased density) and existing high population areas are not as well supported by the current PT network and associated investment in PT as other areas. Better alignment between land use policy and PT investment will enable the delivery of a PT network that will be more accessible and help enable the desired urban form. A more connected PT system that is aligned with land use will improve accessibility (i.e. a PT network that more effectively connects origins and destinations will generate higher levels of demand). This in turn will help to reduce reliance on private vehicles and provide associated social, environmental and economic benefits for the community.

Figure 53 indicates the principles of a hierarchy of accessibility as a quantitative and qualitative measure of land use and transport integration based on an analysis of origin to destination travel. It is one of several ways used to identify where the problem exists in aligning key destinations with frequent PT services.

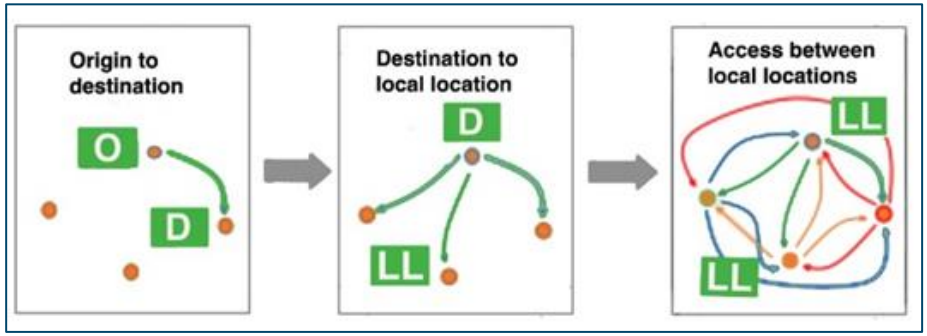


Figure 53: Hierarchy of accessibility as a measure of land use and transport integration (source: Boffa Miskell)

Many factors can affect accessibility to PT infrastructure in the urban setting. These include: geographic proximity (the distance from the origin to the desired destination), mobility (the physical movement), transport system diversity (the range of transport options available), transport network connectivity (the opportunity to transfer between services and/or modes), and substitutes to mobility (such as communication technologies).

The ability to access employment and services from some households is currently hindered by difficulties connecting principal centres by PT services as directly, rapidly and as frequently as possible. Origin/Destination Analysis indicates that links between key destinations and high trip generating activities are not currently possible, and opportunities for transfer points are not well aligned with the desired user experience.

Enhanced accessibility to the Central City, KACs and other primary destinations can be improved through continued efforts to establish a more legible network of well-connected nodes that can act as points of transfer. These are nodes supported by land use mix and intensification in these areas concentrating demand at key locations and achieving better alignment of land use.

In terms of alignment of the PT network with current growth patterns, *Our Space* provides direction on where growth is intended to occur (through intensification of key areas, redevelopment of older housing stock within existing areas, and greenfield and brownfield developments) and aims to proivde a platform for integration of existing and future planned land use in Greater Christchurch. This will encourage more effective forward planning that will enable certainty around PT routes and how growth areas are related to a high-level of PT permanence. Our Space encourages a settlement pattern focused on greater urban residential densities, particularly around key centres and along key PT corridors providing the greatest opportunity for people to live near rapid transit routes, increasing

the likelihood and attractiveness for people to adopt these transport modes. Within this context, growth can be accommodated by consolidation and targeted infill within existing urban areas, and development of greenfield areas (at a range of densities) across Greater Christchurch at a steady pace. However, some of these areas are not as well supported by the PT network and as such, potentially do not match latent demand for services. There is also an opportunity to provide enhanced PT infrastructure to further stimulate growth to achieve the desired urban form (growth in the strategically identified locations).

Gaps in the integration of land use with the PT network

In order to assess the extent to which current and enabled (development provided for by the planning framework) land use patterns within Greater Christchurch are integrated with the current PT network, GIS analysis has been undertaken to compare the location of the current PT network, particularly the core and additional high-frequency routes with:

- Current and future areas with residential densities in households per hectare (hh/ha), respectively, between 2018 and 2028 for both Christchurch City and the larger towns in Waimakariri and Selwyn Districts, in conjunction with identified greenfield growth areas and where the most significant intensification has been occurring within Christchurch City
- Current and future employment areas between 2018 and 2028 based on employment numbers, along with Greenfield Priority Areas for business for both Christchurch City and the larger towns in the Waimakariri and Selwyn Districts
- Areas where there is likely to be higher potential demand for PT services due to higher levels of deprivation and/or no car ownership

Figure 54 to Figure 56 indicate that as a result of overlaying of residential growth information with the five High Frequency PT routes and the City Connector routes, that there are several gaps in PT accessibility across the network, particularly where areas may be more than 800m from core PT routes. These gaps in accessibility limit the ease and convenience of use of highly frequent PT services on the roadways. These overlays also identify opportunities to target PT infrastructure to encourage further intensification sought through the land use planning context.

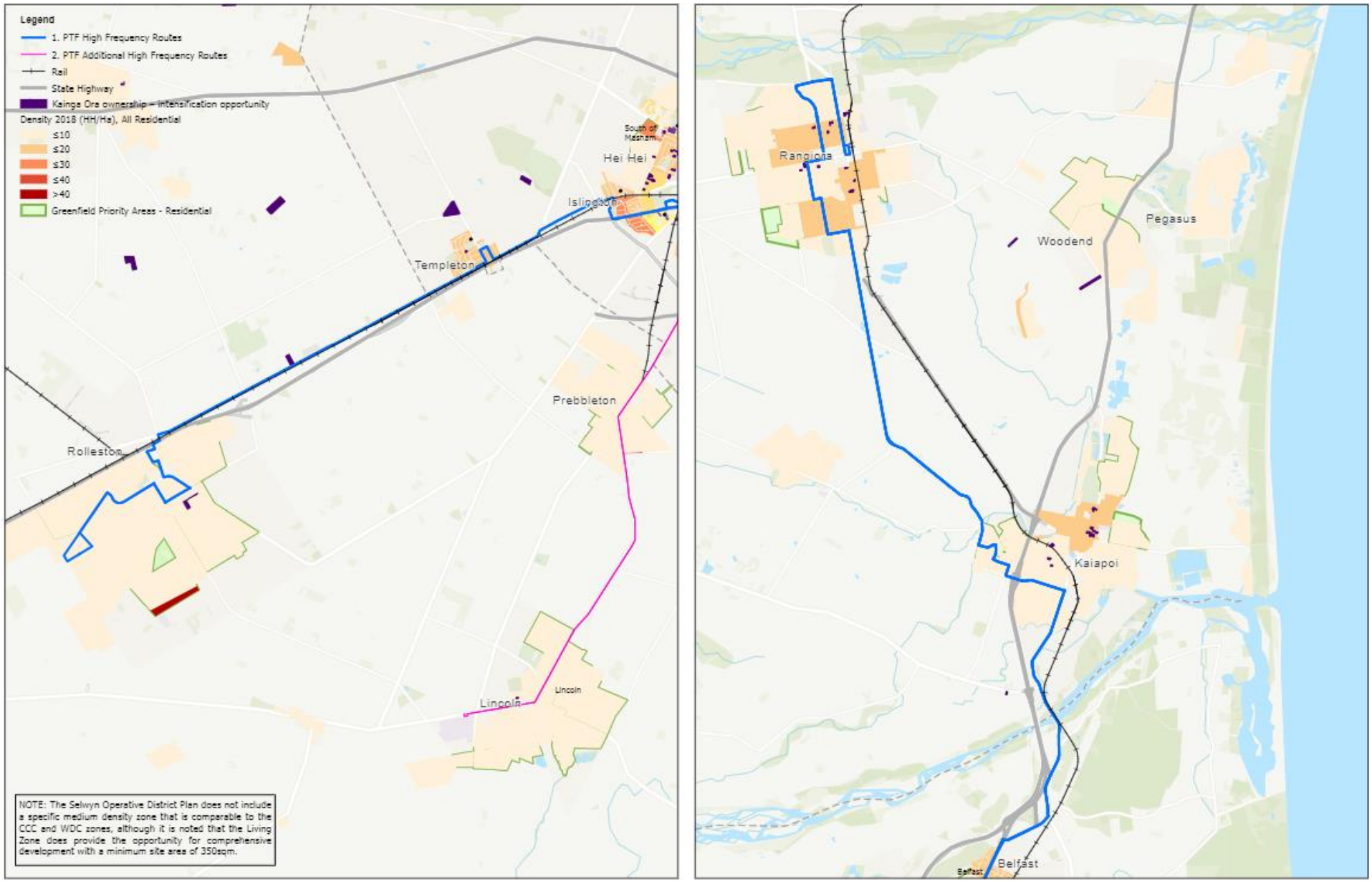


Figure 54: Selwyn and Waimakariri area 2018 residential density and existing high-frequency PT network

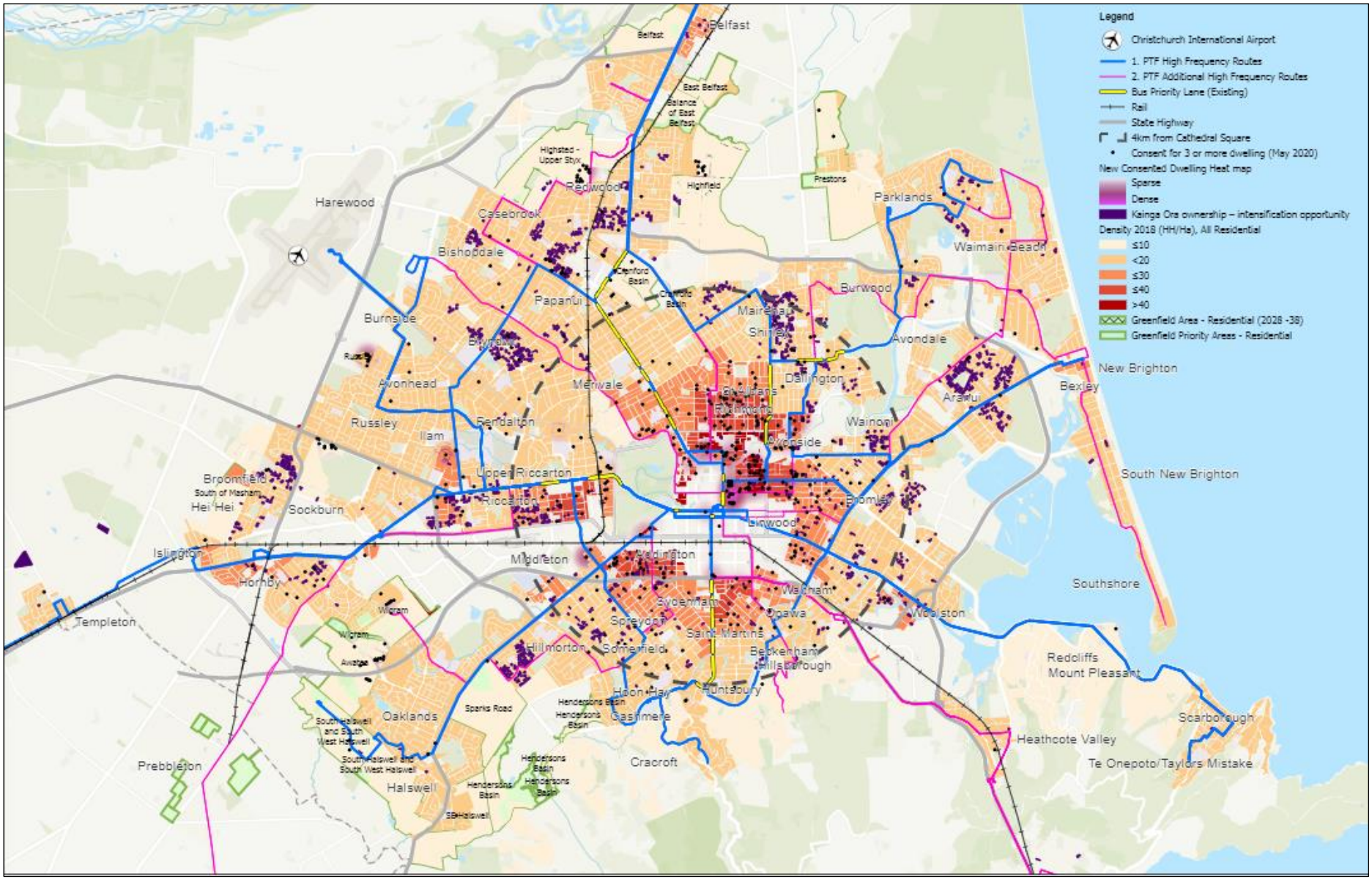


Figure 55: Christchurch residential density 2018, recently approved building consents and existing high-frequency PT network

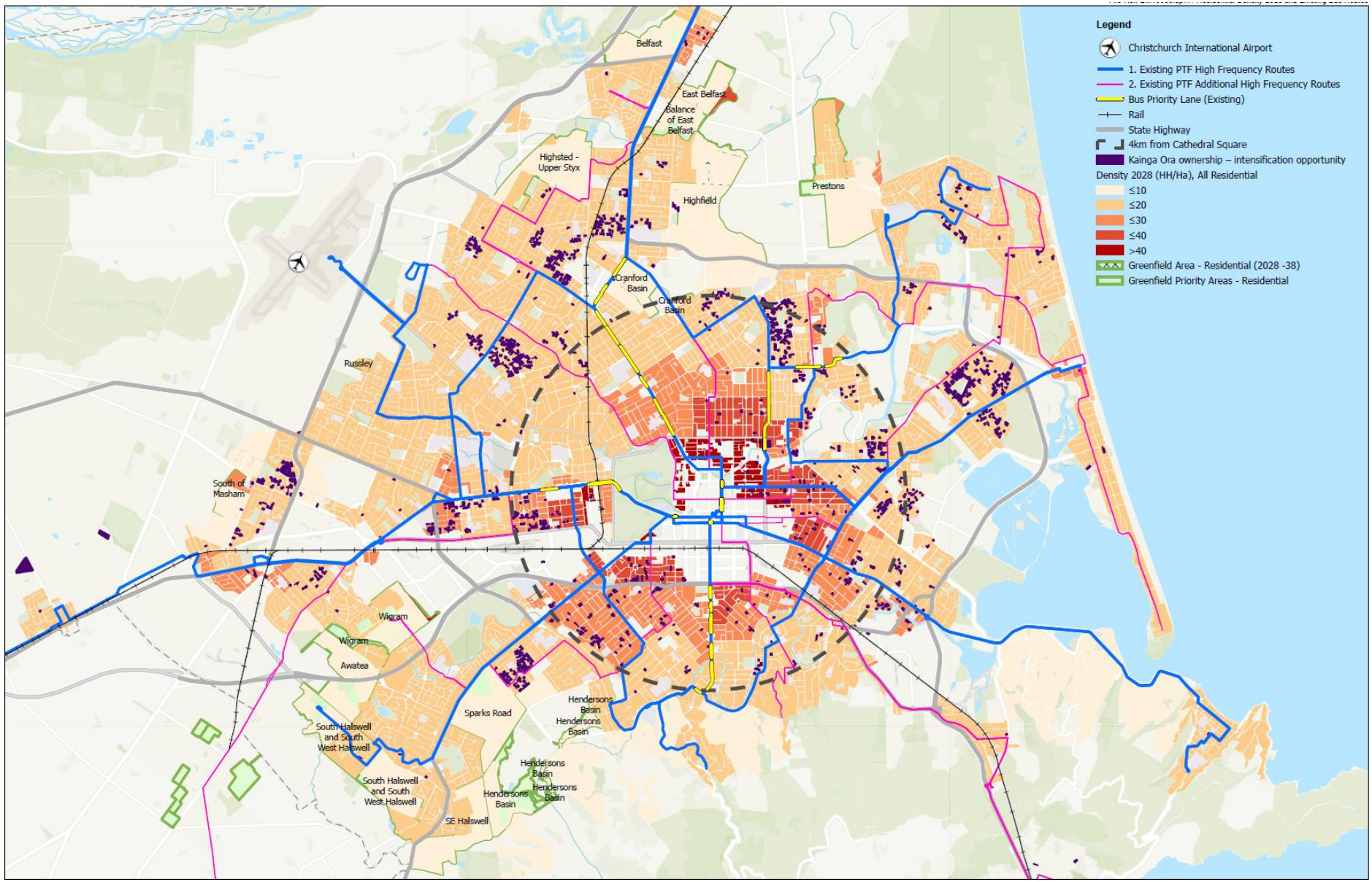


Figure 56: Christchurch projected 2028 residential density and existing PT network

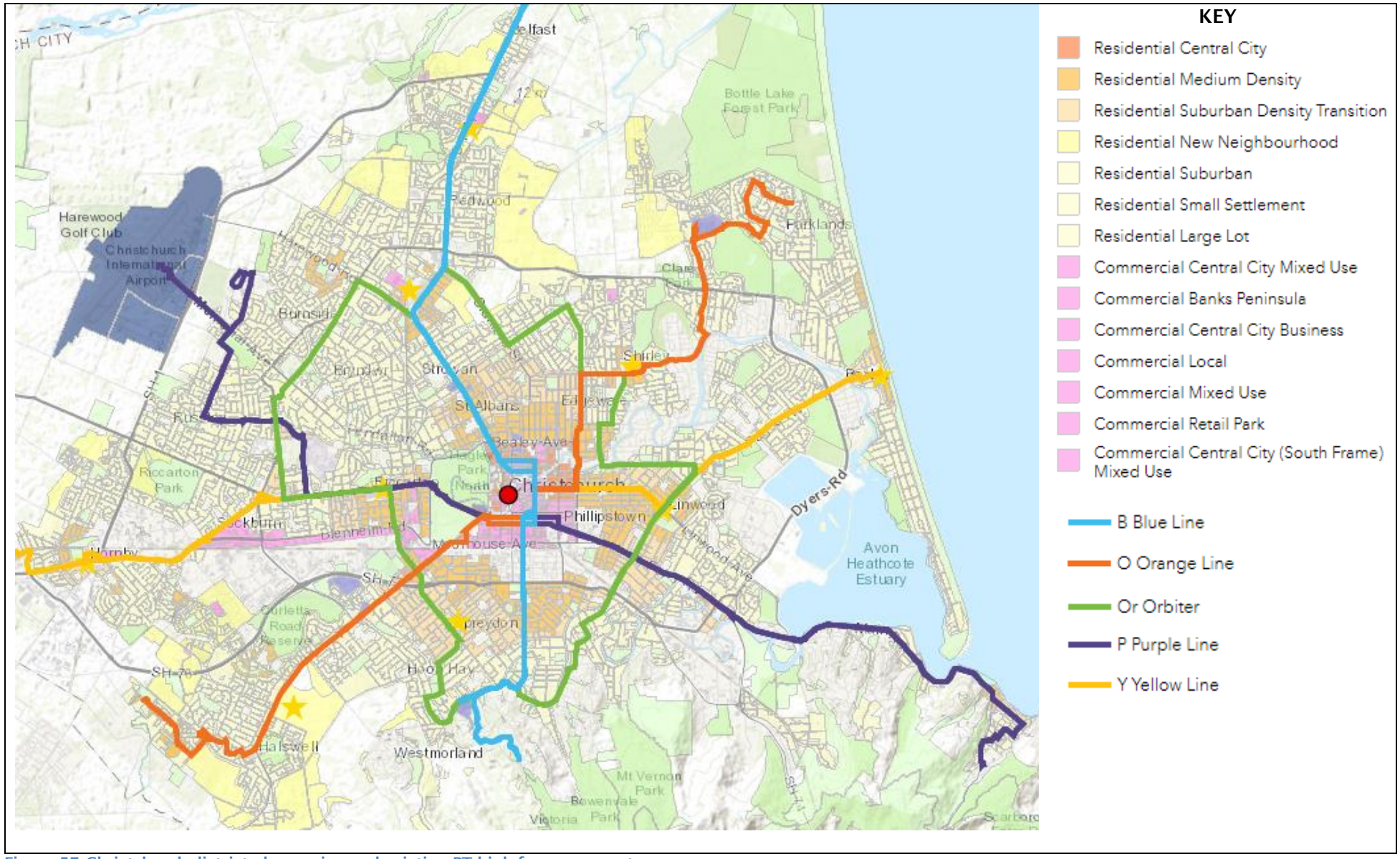


Figure 57: Christchurch district plan zoning and existing PT high frequency routes

Figure 55 to Figure 56 specifically outline where residential growth is planned for and anticipated between 2018 and 2028, with Figure 55 also demonstrating where infill/intensification is currently occurring through redevelopment (showing where building consents for three or more-unit developments is currently occurring within Christchurch (up to April 2020)).

The heat map analysis associated with recent building consent data outlines that there is a strong focus on intensification in the Central City and St Albans, Riccarton, Linwood, Sydenham and Addington. Although some of these areas are within proximity to the Central City where active transport modes may be more viable, there is an opportunity to provide enhanced PT accessibility in these locations.

Figure 57 shows the Christchurch District Plan Zoning, outlining those areas zoned Residential Medium Density where the greater density growth is anticipated. There are also several Greenfield Priority Areas that do not include any PT service (e.g. Lincoln or where services are infrequent). Future spatial planning seeks to create new neighbourhoods (greenfield areas) (i.e. Highfield) around the PT network, but in the short-term there is the challenge of better penetration into some of these areas to support current growth.

There are some areas where land use policies support intensification, but this uplift is not occurring and locations where the housing stock is reaching the end of its lifespan. By providing enhanced PT infrastructure there is the opportunity to support intensification efforts further. Over the longer-term (beyond the 2028 timescales of the combined business case), there is also the potential to better align growth and intensification along key parts of the high frequency PT corridors in locations that 'make sense' as part of wider aspirations to move towards mass rapid transit in the longer term. Ongoing investment in PT infrastructure improvements along the core high frequency PT routes will assist to further enhance the primacy of these routes, and signal to the community through increased frequency (e.g. that there is a commitment to moving toward mass rapid transit in the future along key corridors). This will require supportive planning strategies, including those that incentivise more efficient patterns of development to create a higher density, mixed use development at centres and key nodes and walkable catchments along major transit corridors. In addition, it is likely to require supportive policies that ensure the true cost of developing within unsustainable areas is reflected.

In terms of the larger towns in Selwyn and Waimakariri, there is a focus on encouraging more live and work opportunities as part of these towns becoming more self-sufficient, but in the short-term there continues to be a need to better support these areas in terms of access within the townships and the interfaces between internal routes and direct services into key destinations within Christchurch and Christchurch Airport, the University of Canterbury and key employment areas, such as Hornby.

In relation to identifying areas where there is likely to be higher potential to improve accessibility to opportunities through increased access PT services due to higher levels of deprivation and/or no car ownership an analysis of standard deprivation scores and car ownership data, Figure 58 and Figure 59 demonstrates that there is a strong correlation between the two within more central locations, within the east and around the University of Canterbury in Christchurch City. These areas broadly align with those areas of higher hh/ha in Figure 55 to Figure 56. There are some gaps in terms of network coverage around the Middleton and south of Hornby areas with the ability to improve accessibility.

Based on the evaluation of residential growth patterns, higher density areas, deprivation and vehicle ownership data through to 2028, a priority action of the business case is to improve accessibility to and from key residential areas that align with these factors. This approach aims to provide better alignment of PT where there is greatest need and growth is occurring or anticipated, but also as a catalyst for further intensification in contributing to strategic goals around land use integration and a more compact urban form. These areas which will be referred to in this combined business case as 'highly populated/high growth areas' include:

- Outer suburbs (including St Albans, Linwood, Spreydon, Addington/Sydenham and Riccarton)
- Greenfield areas (including North/Northwest Greenfield Areas and Halswell Greenfield Areas)
- Larger towns in Selwyn and Waimakariri (including Rolleston, Lincoln, Rangiora and Kaiapoi)

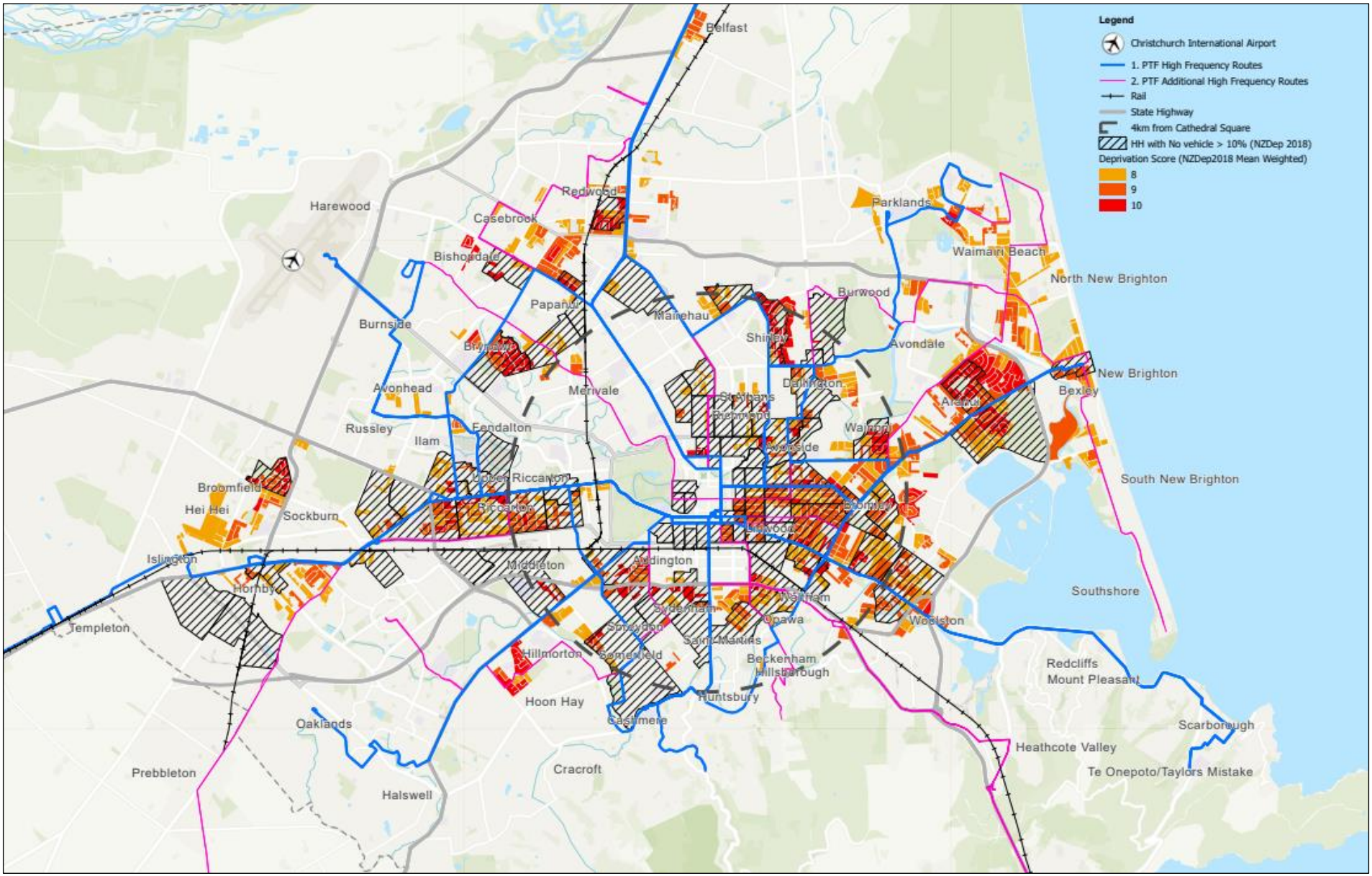


Figure 58: Deprivation and vehicle ownership in Christchurch city

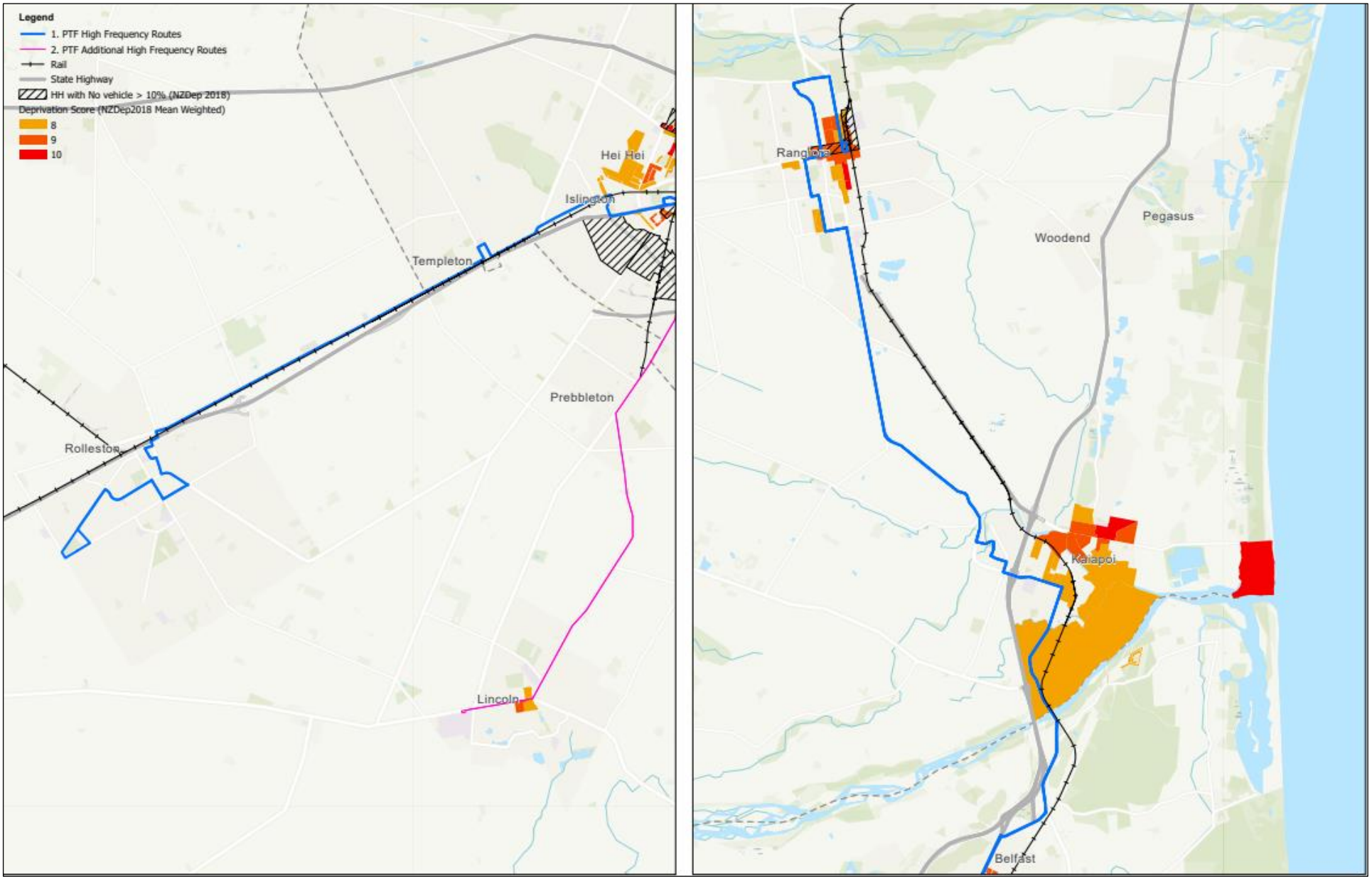


Figure 59: Deprivation and vehicle ownership in the Waimakariri and Selwyn districts

Overlaying key employment/tertiary areas, including KACs, new greenfield employment areas, and the highest employment/tertiary areas through to 2028 along with the existing high frequency and city connector PT routes enables identification of key employment and tertiary education clusters (Figure 60 to Figure 61). This analysis identifies a series of nodes beyond the Central City, including Christchurch Airport and the University of Canterbury, but also a clear zone of employment along the rail corridor aligning east west but where severance and linear dispersal is a challenge. This spatial distribution results in some gaps in accessibility to employment in some locations, such as the Blenheim Road area and parts of Hornby. Providing a more direct, connected network of key employment destinations (i.e. Hornby focuses on itself and a more defined cluster node at a midpoint between the Central City and Hornby) will support greater levels of connectivity and improved access to a range of employment opportunities for the community. Figure 62 and Figure 63 illustrate the density in employment and tertiary density for Selwyn and Waimakariri with noticeable increases in density at both Rolleston and Rangiora between 2018 and 2028.

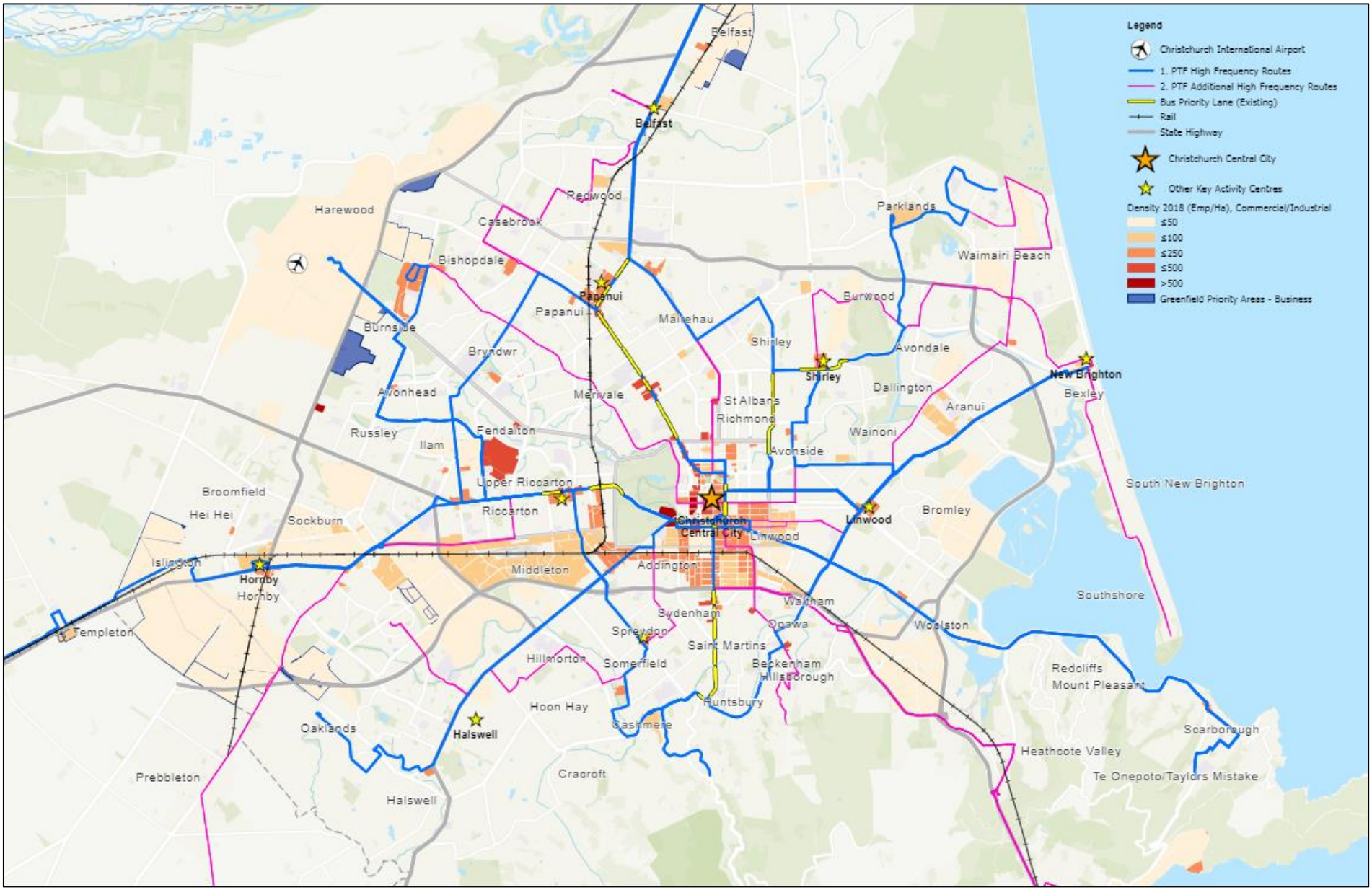


Figure 60: Christchurch tertiary and employment density 2018, and existing PT network

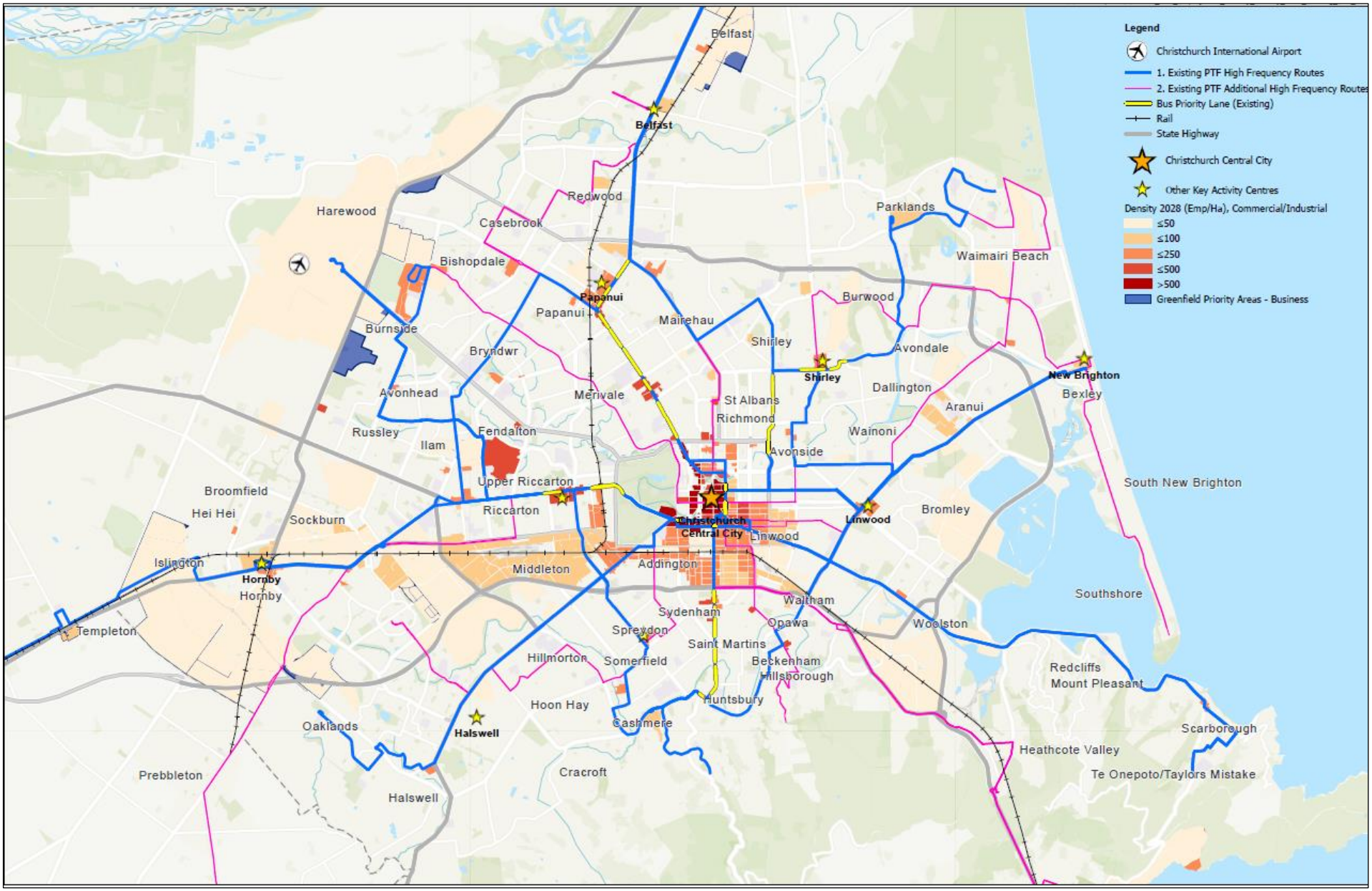


Figure 61: Forecast tertiary and employment density 2028 and existing PT network – Christchurch city

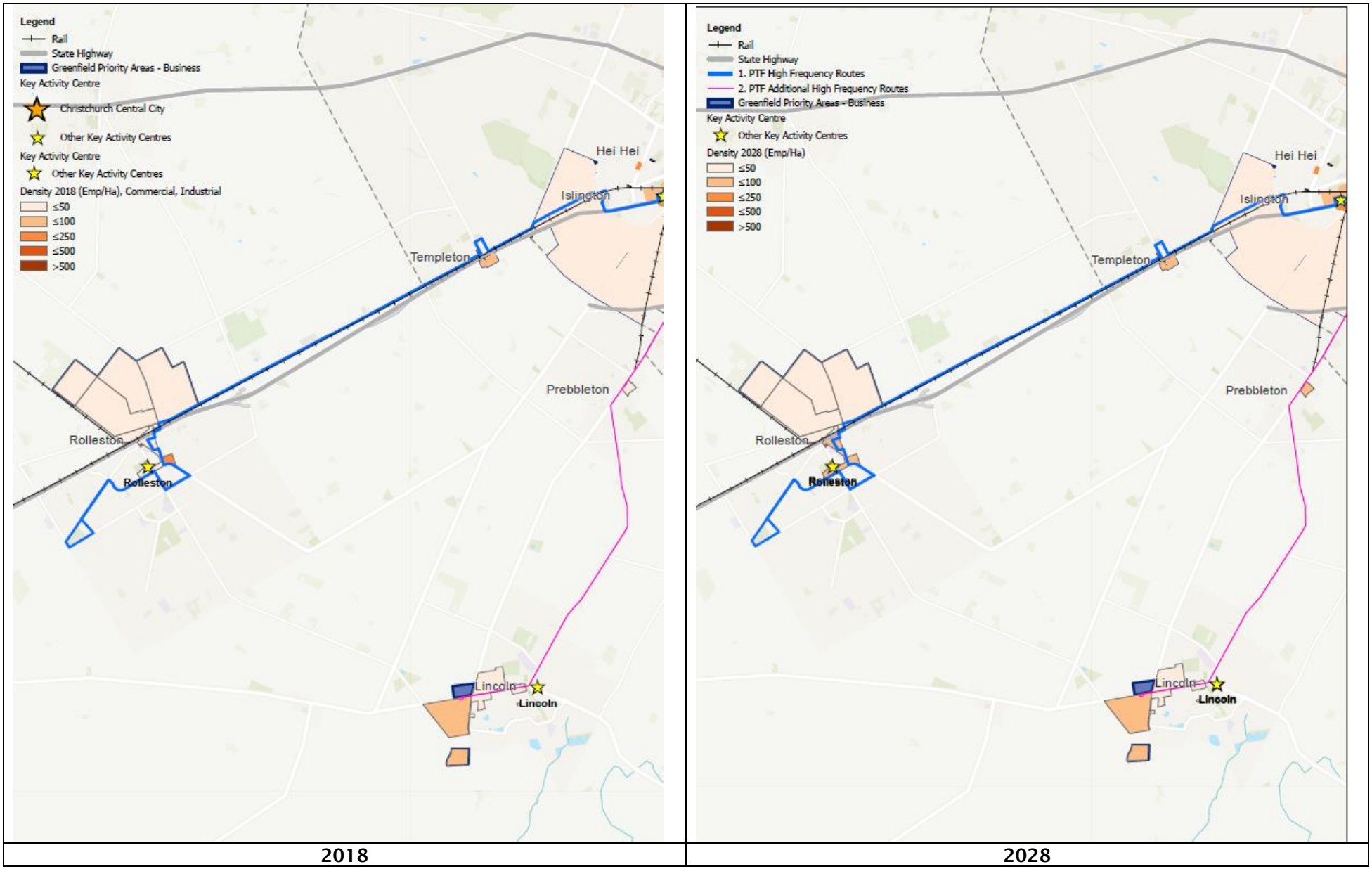


Figure 62: Key employment and tertiary areas in Selwyn 2018-2028 and existing PT network

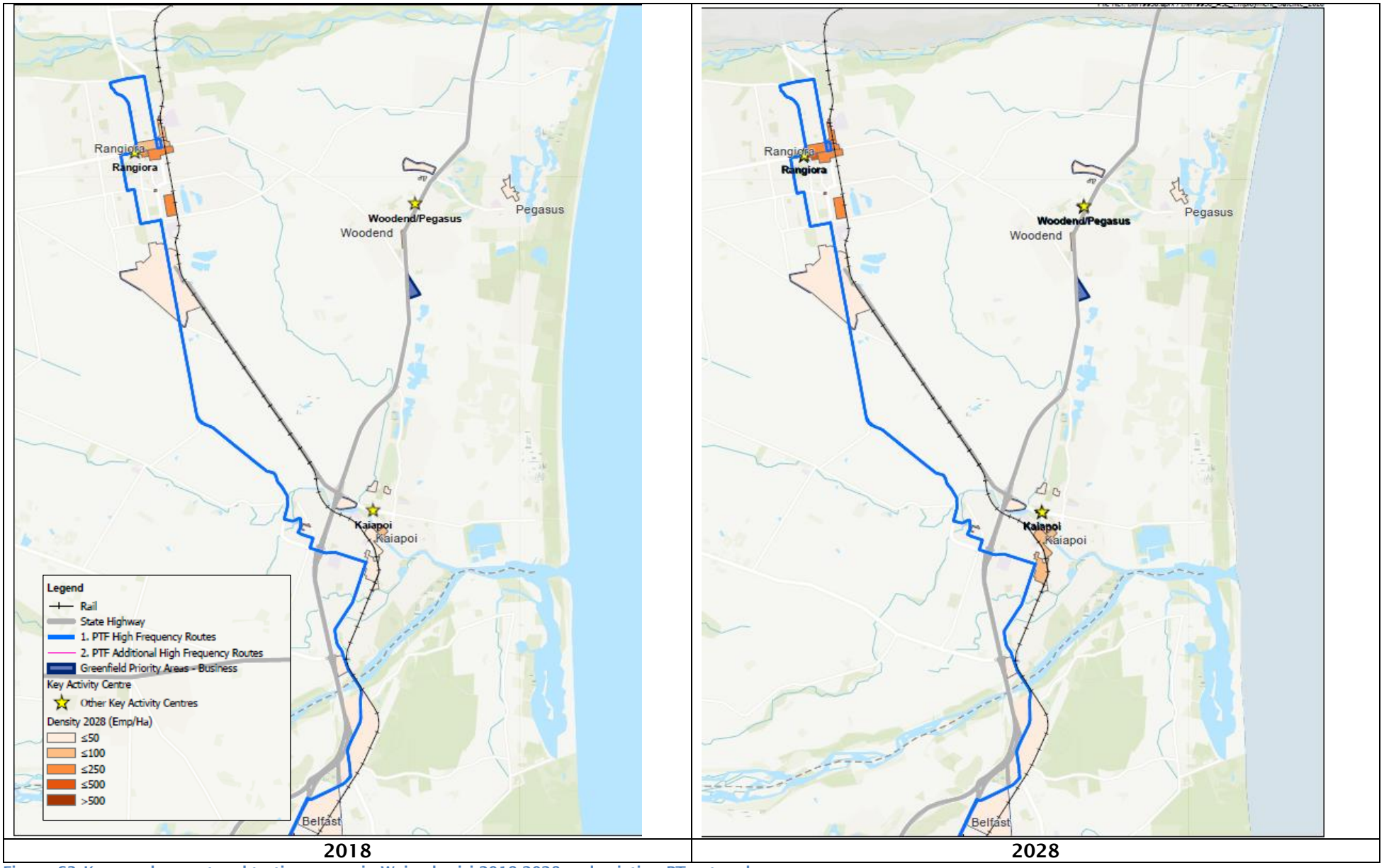


Figure 63: Key employment and tertiary areas in Waimakariri 2018-2028 and existing PT network

Not all employment areas are well connected to their labour markets by PT. Figure 64 and Figure 65 below show two examples of significant employment areas that currently have limited accessibility by PT, which this business case aims to address. The first shows the Christchurch Airport employment area (red) with surrounding zones colour-coded according to how many people travel to and from those zones and the airport each day (dark green is high travel demand; light green is lower travel demand).

Currently Christchurch Airport is serviced by three PT routes - the Purple Line and Routes 125 and 29. These link Christchurch Airport to some of the labour market, but not all. An example of how this could be improved is shown in Figure 65, whereby Routes 17 and 28 are extended to the airport (pink and orange), which gives more employees the option of using PT to travel to and from the Christchurch Airport employment area. Route 125 (yellow) could also be realigned to provide more coverage to areas south of the Christchurch Airport employment area.

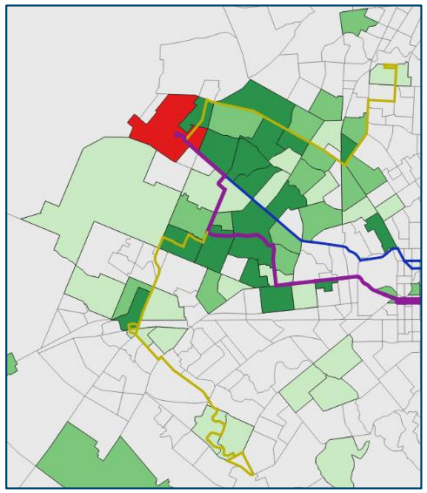


Figure 64: Existing PT routes servicing the Christchurch Airport employment area

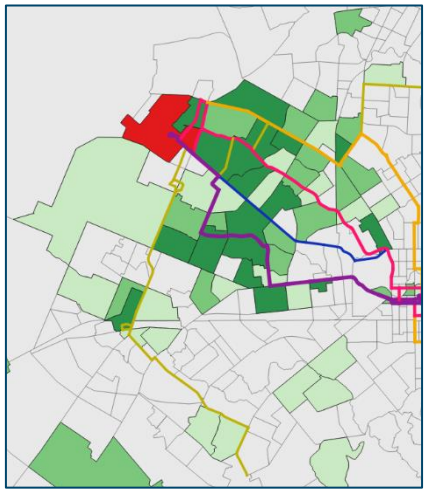


Figure 65: Potential improvements to PT routes servicing the Christchurch Airport employment area

A second example is the Middleton/Addington employment area. As shown in Figure 66, the Orange Line and Orbiter currently skirt the outside this employment area, and only Route 140 (blue) penetrates it.

Figure 67 shows one way of improving PT penetration would be to introduce a new route to Halswell (grey) that would connect workers living in the southwest to the full length of Birmingham Drive. Route 100 (yellow) could also be rerouted to provide a more direct connection to workers living in zones to the south-east.

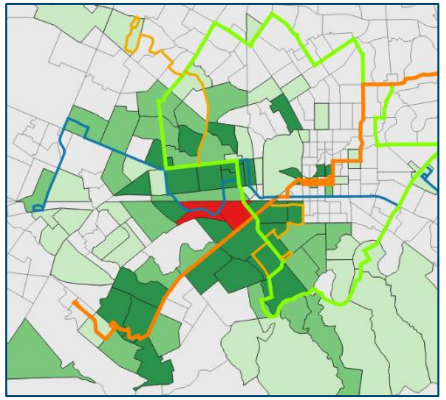


Figure 66: Existing PT routes servicing the Middleton/Addington employment area

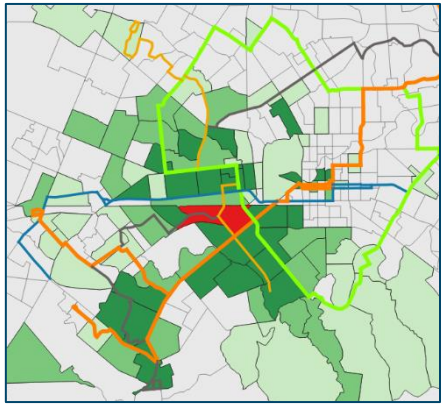


Figure 67: Potential improvements to PT routes servicing the Middleton/Addington employment area

2.3.3 Evidence to support problem statement 3 (barriers to uptake perception and experience)

There are several barriers to using PT in Greater Christchurch, resulting in a low uptake of new PT users and subsequent poor PT mode share

Although existing riders appear relatively well-satisfied with the service offering (2019 surveys indicated 96% satisfaction rates), the network is failing to attract new users.

Qualitative feedback from people who live in Christchurch has been received outlining the perception and experience barriers to public transport update. There has long been a poor public perception of PT in Christchurch. Helen Fitt identified this in her 2015 thesis, in which she interviewed 32 participants on 'social meanings' relating to PT. One of her key conclusions was:

> *Participants associated bus use with some positive social meanings, but more commonly and consistently buses were described as a stigmatised, low status mode of transport for people with no other options. Although participants commonly argued that negative social meanings did not influence their bus use, there is some evidence to suggest that a deeply*

embedded habitus led to participants not considering buses to be an appropriate option for travel[50].

Waka Kotahi commissioned customer insight surveys to help identify opportunities to enable self-occupancy vehicle (SOV) drivers to make better travel choices. Based on Customer Insight surveys undertaken in March and April 2019[51] (refer **Appendix E**), it was confirmed that the bus system in Christchurch has some social stigma associated with it and identified that some residents refer to the bus as the 'loser cruiser'. This has been associated with some bus users identifying that this perception creates a sense of shame and this can deter people from taking the bus. For example:

> *"I don't openly talk about it. It's a passionate subject. People would cut you down about a mode other than driving your car. Cars are a big thing here.…You're a loser if you catch the bus."*

> *"I've never taken the bus. I haven't heard good things- they're few and far between, and not cheap."*

Others identified problems with the network itself which contribute to journey time, cost and user exercise and further outline barriers to PT uptake:

In addition, the need to change between bus services is seen as complicated and adding additional stress and cost to PT journeys:

> *"Petra looked into taking the bus from Bishopdale to her workplace at Lincoln University instead of buying a second car, but it was more expensive than driving because she had to make three changes, and if she missed a connection she would run over the free transfer period. She bought a small, fuel efficient car (a Daihatsu they call "tin can" because it's so light and small), and unlike many, Ina did take into account the cost of insurance and registration, not just petrol. "It was still cheaper than the bus which was crazy."*

69% of the 241 respondents in Christchurch, whose primary mode of transport is car, van or truck, private or company vehicle, considered journey time to be the key barrier to using PT as their preferred alternative means of transport. For example:

> *"Mark (SOV) looked into taking the bus for this study to get to work in Addington from Marshlands but the bus would take 71 minutes compared to the 25 it takes him to drive."*

Getting wet when it rains, and unreliability were also key barriers, with 41% and 34% of respondents considering them drawbacks for PT as a preferred alternative[52]:

> *"I feel uncertain if the bus will come or not come… I often feel like I'm waiting there forever."*

As part of this combined business case, online surveys were completed by 764 participants living throughout Greater Christchurch answering various questions relating to PT use. Most of the respondents were people who did not regularly catch PT, with a focus of the survey asking them the reasons behind why they do not use PT. The most common answers were that buses did not go where they wanted to travel, low frequencies, comparatively long travel times and price.

Five of the survey participants who were classed as "potential new users" were then offered a ride on a bus accompanied by a surveyor who recorded their trip including actions, thoughts and feelings, to better understand the factors that need to change to attract them to the system. The anxiety of trying out a new mode of travel was a high barrier for many:

> *"I have to be somewhere by a particular time. So, there's a slight level of anxiousness. Particularly because it is the first time I am doing it."*

For some, the experience once they were on the bus was positive, but until now the barriers to getting on for the first time have been too high.

> *"The seating is good, room good, yeah no problem at all…"*

> *"I am a lot more likely to use it now if I could than I would have, because, as I say the traffic is crazy and the roads are stacked all the time and we are not doing the world any good with all the fumes we are throwing up there."*

Some fear poor social behaviours occurring on buses:

> *"First of all I don't need to walk to the bus stop, I don't need to depend on a driver, I don't need to share the space with too many people and over the year I can see on the buses there can be bad stuff, I saw that women fell on the bus floor, I saw how the driver would close the door and catch a person, I saw how people would shake their hand and the bus driver would fail to stop the bus."*

The Environment Canterbury Christchurch User Metro Survey 2019 (August 2019 by Research First), also provides insights. This annual monitoring report has a research objective of understanding who the users are and if the

[50] Fitt, Helen Marie (2015). The influences of social meanings on everyday transport practices, p. 267-268

[51] Transport Agency (May 2019). Travel Demand Management Customer Insight: Qualitative and Quantitative Insights – Christchurch

[52] Transport Agency (May 2019). Travel Demand Management Customer Insight: Qualitative and Quantitative Insights Summary - All Regions, p.16

demographic profile is changing; and investigating customer satisfaction with the network service (including considerations of frequency, reliability, value for money, accessibility, comfort, driver attitude and ease of use). The 2019 survey comprised 2,200 interviews of users on the bus. This outlined that bus users within Christchurch were highly satisfied with the level of the bus service, with almost 90% of those who use public transport are likely to recommend it. However, the survey identified the lowest areas of satisfaction were in both bus timetables and frequency, suggesting that improvements could be made here. It also identified that the quality and availability of bus shelters continue to receive the lowest satisfaction ratings regarding the bus system, along with information about delays or disruptions. This research demonstrates that existing PT users are in general happy with the PT network in Christchurch, and that the key barrier is attracting new users to the service.

2.3.4 Overall summary of problem statement evidence

Overall, the evidence outlined above demonstrates that there are multiple factors which contribute to low and flat (or declining) PT patronage in Christchurch (Figure 68), including user "perception" and "experience", journey time reliability and accessibility.

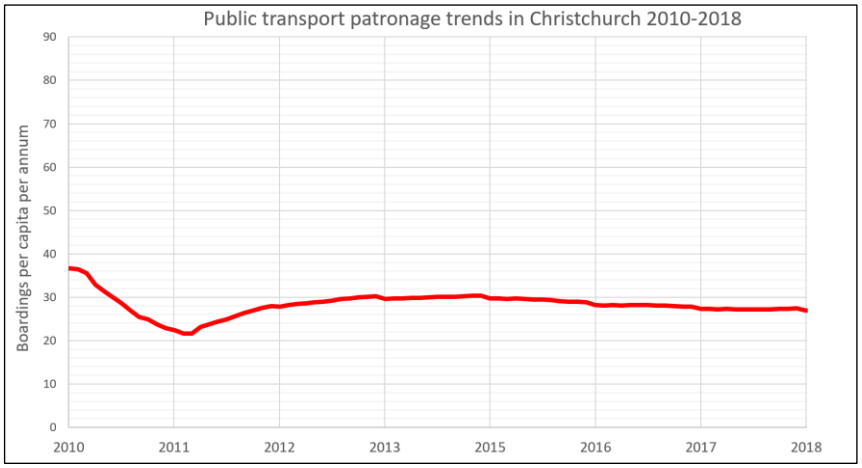


Figure 68: Annual public transport trips per capita in Christchurch 2010-2018[53]

2.3.5 Issues and constraints

The following section describes economic, financial, political, social, environmental, transport, stakeholder and other issues and constraints which could influence the scope of the project outcomes and outputs.

Issues

Issues are uncertainties / risks that may not be resolved during the business case development stage, while constraints are limiting factors such as time, cost, resources etc. Table 5 describes issues and uncertainties that may influence the outcomes of this combined business case. The uncertainty log aims to address risk and demonstrates the need for close monitoring and management.

Constraints

Misalignment with other projects

There is the potential for misalignment of the direction and timing of this combined business case and other projects in the study area (e.g. the outcomes of business case for other projects such as Brougham Street and Rolleston, the work of Christchurch 2050 and the Christchurch Spatial Plan) led by the other investment partners. Interface issues may arise if the timing and staging of any proposed works do not integrate with the planning for the other projects, for example the growth aspirations and urban spatial form sought by Christchurch 2050 needs to be consistent with any development that would be catalysed by investment in PT.

There is currently a high level of uncertainty around the timing for various investigations, funding and delivery of projects led by the investment partners. There is also a risk that with multiple client organisation involved each with their own driver and strategies regarding growth and transport planning that there are differencing project expectations. The investment partners are, however, aware of the challenges and are working together to minimise them.

Covid-19

Waka Kotahi investigated the potential long-term effects of Covid-19 on PT patronage. Across all geographies, PT has declined the most of all modes during the pandemic.

A series of research ongoing papers and reports have been commissioned by Waka Koha to consider the impact of Covid-19 on people's transport choices. A

[53] Produced using boarding numbers from ECan, and population data from Statistics NZ

continuous monitoring programme is currently underway across New Zealand for the duration of the pandemic with the most recent report 'Wave 22' released 20 October 2020[54].

The latest report was completed after Auckland was at 'Level 3' lockdown and the rest of the country at 'Level 2' and notes that while PT use was suppressed nationwide following the most recent restrictions, in the month following it appears to have recovered. As of the October 2020, the findings outlined that the proportion of public transport commuters working from home was at the lowest level recorded since the Covid-19 travel behaviour workstream began in New Zealand in May. In addition, stated weekly public transport usage grew for the first time in more than a month, with buses (as opposed to trains, ferry, planes or taxi/uber) contributing the most towards this increase.

Similarly, the Wave 18 report noted that while transmission concerns are a barrier to PT usage, there had also been a significant increase of people during the second New Zealand Covid-19 wave saying their reduction in PT usage is due to a reduction of need (I.e. less trip demand due to Working from Home (WFH)), as opposed to health concerns.. Wave 22 findings confirm that the three key reasons for respondents decreasing their public transport usage are 'reduced need', 'accessibility issues' and 'transmission concerns'.

During the initial stages of recovery from Covid-19 waves, PT mode share is projected to fall due to increased use of private vehicles and active modes, public anxiety associated with using PT and lower numbers of city centre commuters. However, as activity in urban centres increases and public anxiety wanes, private vehicle mode share is expected to decrease over time, active mode share is expected to continue to grow[55].

Overall, COVID-19 is not anticipated to have lasting effects on PT patronage. However, there are uncertainties surrounding the impact of COVID-19 on spending. To account for economic stimulus packages, client organisations may change their expenditure behaviour over the next 1-3 years.

[54] https://www.nzta.govt.nz/assets/resources/covid-19-impacts-on-transport/waka-kotahi-nzta-covid-19-tracking-core-report-wave-22-20201020.pdf

[55] https://www.nzta.govt.nz/assets/planning-and-investment/arataki/docs/waka-kotahi-rapid-transit-covid-19-scenarios-full-report.pdf

Table 5 Issues / uncertainty log

	Factor	Timing	Uncertainty	Impact	Comments
Factors affecting demand	Degree of travel time reliability across all modes	Ongoing	More than likely	Significant	Impacts the level of confidence customers have in the reliability of the transport network which will impact the uptake of PT services. Currently it is easy and convenient to drive in Christchurch and this creates a challenge in making alternative modes more attractive as they need to be able to compete with this high level of convenience.
	Degree of travel demand due to COVID-19 impacts.	Ongoing	Likely	Moderate	Impacts the trip demand profile for trips to the central city and an increase in office/working from home flexibility has the potential to impact the trip regularity.
	Desired population growth targets and spatial direction for intensification	Ongoing	More than likely	Significant	The nature of any new urban growth strategy identified by Christchurch 2050 will influence the anticipated growth and travel projections within Greater Christchurch. This requires careful monitoring to ensure the projected demand on the transport network and change in land use patterns is met by enough capacity.
	Forecast modelling may over or underestimate projected bus patronage	Ongoing	Likely	Moderate	The forecasting methodology is reliant on several inherent growth and behaviour assumptions and there is a risk that the modelling may be incorrect due to the incorrect elasticity used in traffic modelling and/or the incorrect conversion of an intervention not easily expressed. Sensitivity testing can be undertaken to address this.
Factors affecting supply	New legislation and policy direction	Political timeframes – ongoing	Certain	Significant	Central or local government policy may cause changes in infrastructure investment. For example, changes to funding assistance rates for public transport services, or more stringent controls over emissions from the transport fleet.
	PT Driver and Bus Availability	Ongoing	Certain	Moderate	The availability of buses for the network is restricted by: - Buses that are of a certain type to work with the bus interchange; - The drivers need to be trained in how to use the interchange; - Buses need to be equipped with the ticketing aspect; and - Buses need to display destinations in accordance with network requirements.
	Bus Interchange Bus Capacity	Future	Likely	Moderate	The 16-bus bay interchange facility has an estimated operational capacity of 115-120 buses per hour. Even at the current peak bus movements of 78 buses per hour there have already been occasions where buses have been unable to circulate efficiently through the interchange. Further work is recommended to confirm how to best optimise the bus interchange.

2.4 OUTCOMES

2.4.1 Benefits of investment

Better access to opportunities (education, employment, services and recreation) has the potential to be achieved through reduced road network congestion, mode shift and additional transport mode choice.

Addressing the problems associated with system performance, connections to land use and other barriers to entry to the PT system that potential customer face, will help attracting new PT users. Addressing the causes of the long and unreliable journey times for PT trips will result in increasingly competitive journey times with private car use.

The benefits are summarised below under each of the benefit statements (with their corresponding weighting from the ILM included):

PT journey times are increasingly competitive with private vehicle journey times and reliability is increased (25%)

This benefit is a result of addressing demonstrated performance issues with the PT system in Christchurch demonstrated in 2.3.1. There are clear differences in the travel time people enjoy using private cars compared to that endured by PT users. Addressing the causes of the long and unreliable journey times for PT trips will result in increasingly competitive journey times with private car use.

Enhancing PT accessibility to highly populated/high growth areas and key destinations (12.5%)

This benefit is the improved connection between land uses in Christchurch and its PT system. Improved directness, frequency and quality of PT services is key to improving access to KACs in Christchurch.

A PT system that attracts new and retains existing users, increasing PT mode share (62.5%)

The key benefit resulting from addressing problems with system performance, connections to land use and other barriers to entry to the PT system that potential customers face, is its attracting new users. This represents mode shift and underpins a range of strategically significant outcomes.

2.4.2 Investment objectives

In conjunction with the ILM, the Project Team developed a set of Investment Objectives which directly correlate with the Benefits, including in order of weighting:

- Improve journey time and reliability of PT services relative to private vehicles by 2028
- Improve PT services to and from highly populated/growth areas and key destinations across Greater Christchurch by 2028
- Remove barriers to the update of PT by 2028

2.4.3 Key performance indicators (KPIs)

It is important to determine how well options may perform against the problem statements identified in the ILM process. A useful tool to determine their performance is the development of KPIs, against which each option will be assessed to determine their performance against the investment objectives.

Table 6 shows a set of KPIs, which have been developed to align with the Investment Objectives confirmed through the ILM. Further explanation of the KPIs and associated measures is also outlined below. Expected results relating to these measures are outlined further in the Management Case:

In vehicle journey time and congestion

Measures relating to this objective consider in vehicle journey time and congestion parameters in relation to four high frequency (core) routes: Purple Line, Blue Line, Yellow Line and Orange Line.

For the purpose of focusing the analysis, the results under this measure are calculated on AM peak period only.

Congestion measures use the following thresholds:

- Volume/Capacity (V/C) ratio – a threshold of 50% (average across the peak hour) has been used, which for the peak flow period within the peak hour would likely represent a peak V/C closer to 60-70% where flow breakdown could be reasonably likely to occurs. This mostly reflects that intersections typically cause bottlenecks which cause congestion and (in many cases) these limit flows well below the available link capacity. By using a lower practical link V/C threshold value, more links are highlighted which results in a greater understanding of where potential changes in network performance are likely to occur
- Intersection level of service (LoS) – a threshold of 30 seconds has been used (again, this is an average value across the entire peak hour) representing a

LoS just a bit under level D, which for the peak flow period within the peak hour would likely represent a LoS D or worse. It also resulted in plots that gave (on balance) the most meaningful information (i.e. a higher threshold would simply highlight the worst performing intersections which are unlikely to ever change, while a lower threshold would highlight too many intersections, making it more difficult to identify where the most significant changes occur)

End-to-end journey time and accessibility to and from key areas

Destinations assessed under this benefit as key trip attractors include:

- Christchurch City Centre – Bus Interchange, Westend, Ara and Hospital
- High Employment Zones - Airport, University, Blenheim Rd Industry, Hornby, Addington
- KACs – Papanui, Riccarton, Hornby, Shirley and Linwood (Although for wider understanding further KACs are shown in the charts presented this business case)

Origins assessed under this benefit include all residential areas. However, for some KPIs, a focus has been given to identified key areas, based on the evaluation of residential growth patterns, higher density areas, deprivation and vehicle ownership data. Within Christchurch, these key residential areas referred to as 'highly populated and growth areas' include St Albans (North Inner Suburbs), Linwood, Sydenham, Barrington and Riccarton. In addition, the greenfield developing areas in the North East Suburbs, North Outer Suburbs and Halswell are also of key interest.

Greater Christchurch Regional accessibility, both locally and to Christchurch City Centre, is considered through specific metrics (2.6 and 2.7) relating to Rangiora, Kaiapoi, Rolleston and Lincoln.

Note accessibility to the three key education areas of University of Canterbury, Ara and Lincoln University are all covered across the metrics above.

All accessibility measures consider end-to-end journey time, which includes all components of the journey: walk time, wait time, transfer time and in vehicle journey time, where a 30-minute end-to-end journey time has been selected for comparative purposes between options.

Analysis was undertaken on the AM peak, except for accessibility to KACs where the interpeak period was analysed, reflecting the importance of KAC accessibility across the day.

Spatial coverage

Spatial coverage measure (3.0) reports on the population catchment area of high frequency route (i.e. routes with PT frequency of 15minutes or greater), where both a 400m and 800m walking catchments have been considered.

Environment

Vehicle kilometres travelled are intrinsically related to environmental measures, so sits beside a number of measures relating to vehicle emissions and air pollution. 'Environment' is considered under Problem Statement 3 'Barriers to the update of the PT system' given increased update of PT will coincide with a reduction of car trips which is better for the environment. Three environment measures have been used, in line with the Waka Kotahi Investment Performance Measures:

- Greenhouse gas emissions
    - Carbon Dioxide (CO2) - While CO2 occurs naturally, in the last 200 years the concentration of CO2 in the earth's atmosphere has increased by 25%. As these extra amounts of CO2 are added to the atmosphere they trap more heat causing the earth to warm. This extra warming is called the enhanced greenhouse effect and is predicted to significantly alter the earth's climate. CO2 makes up about half of the extra greenhouse gases and a significant proportion of this extra CO2 is emitted by motor vehicles.
- Air pollution from
    - Particulate matter (PM10 – smaller than 10μ m) - impacts predominantly on respiratory and cardiovascular systems. Effects can range from reduced lung function to increased medication use to more hospital admissions through to reduced life expectancy and death.
    - Nitrogen Dioxide (NO2) - is a gas that causes increased susceptibility to infections and asthma. It reduces lung development in children and has been associated with increasingly more serious health effects, including reduced life expectancy (COMEAP, 2015).

PT ridership

PT ridership has been measured in various forms to understand how this responds across the region and with reference to the central city. This has been reported on a per capita basis and as a resulting mode share %.

Perception in ease of use of PT system

Perception of use measures relate to key aspects resulting from the user surveys, not already covered by other KPI measures, including the nature and quality of bus stop information, on-bus information and trip planning information. It also considers aspects that relate to deprivation and those travel poor.

Table 6 Key performance indicators (KPIs)

Investment Objectives	Key performance indicator		Measures		
1	Improve journey time and reliability of PT services relative to private vehicles by 2028	KPI 1	In-vehicle journey time and congestion	KPI 1.1	Change in-vehicle journey time along a specific route for PT compared to general traffic
				KPI 1.2	Change in the percentage of the bus route exposed to vehicle congestion (V/C>0.5)
				KPI 1.3	Change in the number of intersections where PT experience a LOS worse than D
2	Improve PT services to and from highly populated/high growth areas and key destinations across Greater Christchurch by 2028	KPI 2	End-to-end journey time and accessibility to and from key areas	KPI 2.1	Change in the number of households able to access the Christchurch City (Christchurch Bus Interchange, West End, Ara Institute of Technology, Christchurch Hospital) within 30 minutes end-to-end travel time using the PT system
				KPI 2.2	Change in the number of households able to access high employment zones (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington) within 30 minutes end-to-end travel time using the PT system
				KPI 2.3	Change in the number of households able to access the Papanui, Riccarton, Hornby, Shirley and Linwood KACs within 30 minutes end-to-end travel time using the PT system
				KPI 2.4	Change in the number of households that can access more than one KAC from key residential areas within 30 minutes end-to-end travel time using the PT system
				KPI 2.5	Change in the number of jobs that can be accessed from key residential areas within 30 minutes end-to-end travel time using the PT system
				KPI 2.6	Change in the number of households able to access Rolleston and Rangiora centres within 30 minutes end-to-end travel time using the PT system
				KPI 2.7	Change in end-to-end journey time from Rangiora, Kaiapoi, Rolleston, and Lincoln to the Christchurch Bus Interchange using the PT system
		KPI 3	Spatial coverage	KPI 3.1	Change in the population that are located within 800m of a frequent route
3	Remove barriers to the uptake of PT by 2028	KPI 4	Environment	KPI 4.1	Change in the private vehicle kilometres travelled per capita

				KPI 4.2	Change in the greenhouse gas emissions (CO2) from all transport sources
				KPI 4.3	Change in the air pollution from PM10 and NO2
		KPI 5	PT ridership	KPI 5.1	Change in the number of PT trips originating in each area (aggregated zone)
				KPI 5.2	Change in the number of PT trips to the Christchurch Central City originating in each area (aggregated zone)
				KPI 5.3	Change in the PT trips per capita
				KPI 5.4	Change in the proportion of trips made by PT
		KPI 6	Perception in ease of use of PT system	KPI 6.1	Change in bus stop information
				KPI 6.2	Change in on-bus information
				KPI 6.3	Change in trip planning information (Metro website, phone apps)
				KPI 6.4	Change in availability of MetroCard (reduced cost, ease of signing up, locations where sold)

PART B – OPTIONS ASSESSMENT

3 ACTIVITY DEVELOPMENT – LONG-LIST

3.1 DO-MINIMUM

For the Do-Minimum approach, it is assumed that the existing PT infrastructure and current High Frequency, City Connectors and Suburban Link services would be maintained at existing levels (existing frequencies which are based on the Canterbury Regional Public Transport Plan (CRPTP) targets outlined in Table 7:

- **High Frequency Lines** (five colour coded core routes – Blue Line, Orange Line, Purple Line, Yellow Line and the Orbiter) run along Christchurch's major road corridors, connecting people to popular destinations including Rangiora, Kaiapoi, Lincoln, Templeton and Rolleston. These five routes were previously referred to as the 'Core Network' or 'Metro Lines'
- **City Connectors** (refer Figure 4) allow people to travel from outer suburbs and larger towns in Waimakariri and Selwyn directly to the Christchurch Central City. These routes were previously referred to as 'Metro Connectors'
- **Suburban Lines** (refer Figure 4) allow people to travel between the inner suburbs while bypassing the Christchurch Central City. People wanting to go to the Christchurch Bus Interchange need to transfer onto another bus at transfer points located throughout Christchurch. These routes were previously referred to as 'Metro Suburban Lines'

The Do-Minimum (Figure 69) also includes the use of existing bus lanes during peak hours. There are no new PT services or infrastructure except that currently committed, which includes:

- Main North Road Winston Ave to Grassmere St bus lanes
- Lincoln Road bus lanes phases 1 & 2 (Moorhouse Ave to Wrights Rd)
- Purple Line frequency increases
- Waimakariri direct services

ECan have recently renegotiated its public transport contracts, which has accelerated the move to new, low-emission buses[56]. This is projected to reduce the CO2 emissions by 14% within their first year with the introduction of 25 new electric buses and 39 new low-emission Euro 6 buses. This has also been incorporated into the Do-Minimum scenario.

Table 7 Summary of CRPT service levels

Network layer	High frequency	City connectors	Suburban links
Key features and hours	Weekday 6am-11pm Saturday 7am-11pm Sunday 7am-9pm)	Weekday 7am-9pm Saturday 8am-9pm Sunday 9am-6pm)	Weekday 7am-7pm Saturday 8am-8pm Sunday based on demand
Frequency	15 minutes all day (more frequent in peaks depending on demand)	20-30 minutes all day (more frequent in peaks depending on demand)	30 minutes (more frequent in peaks depending on demand)
Destinations	Connecting two or more KACs, trip attractors, or tertiary institutions along strategic corridors	Direct services along corridors connecting two or more neighbourhood centres with the central city	Coverage services linking areas of the city not well serviced by core or connector services

Forecast land use growth is based on projections prepared by the Greater Christchurch Partnership in 2018. These consider likely changes in population (consistent with Statistics NZ projections) and identified capacity to accommodate residential and commercial land use growth.

Road network infrastructure improvements included within TLAs Long Term Plans (and the Waka Kotahi National Land Transport Programme) and other identified projects likely to achieve funding, as agreed for the CTM/CAST v18 model update (in 2018).

The cost of parking within the Central City will increase in proportion to land use development (increase in employment) within the Central City, such that the cost of parking in Christchurch at 2038 is similar to Wellington currently (this

[56] https://www.ecan.govt.nz/your-region/your-environment/climate-change/our-environmental-contribution/

implies a doubling of parking related costs in real terms between now and 2038).

Bus crowding curves, adopted from Auckland, have been used to increase the perceived cost of travel once the seated capacity of buses has been exceeded.

Lastly, it is noted that the recent timetable and route changes made to the 1 Rangiora – Cashmere (Blue Line), 95 Pegasus/Waikuku – City, 97 Rangiora – Pegasus (new service) and 125 Redwood – Westlake services and given effect from 28 September 2020 have not been incorporated into the Do-Minimum. These changes were confirmed after modelling for this business case was completed but any effects associated with these are anticipated to be minor and unlikely to impact the numbers presented in this business case significantly.

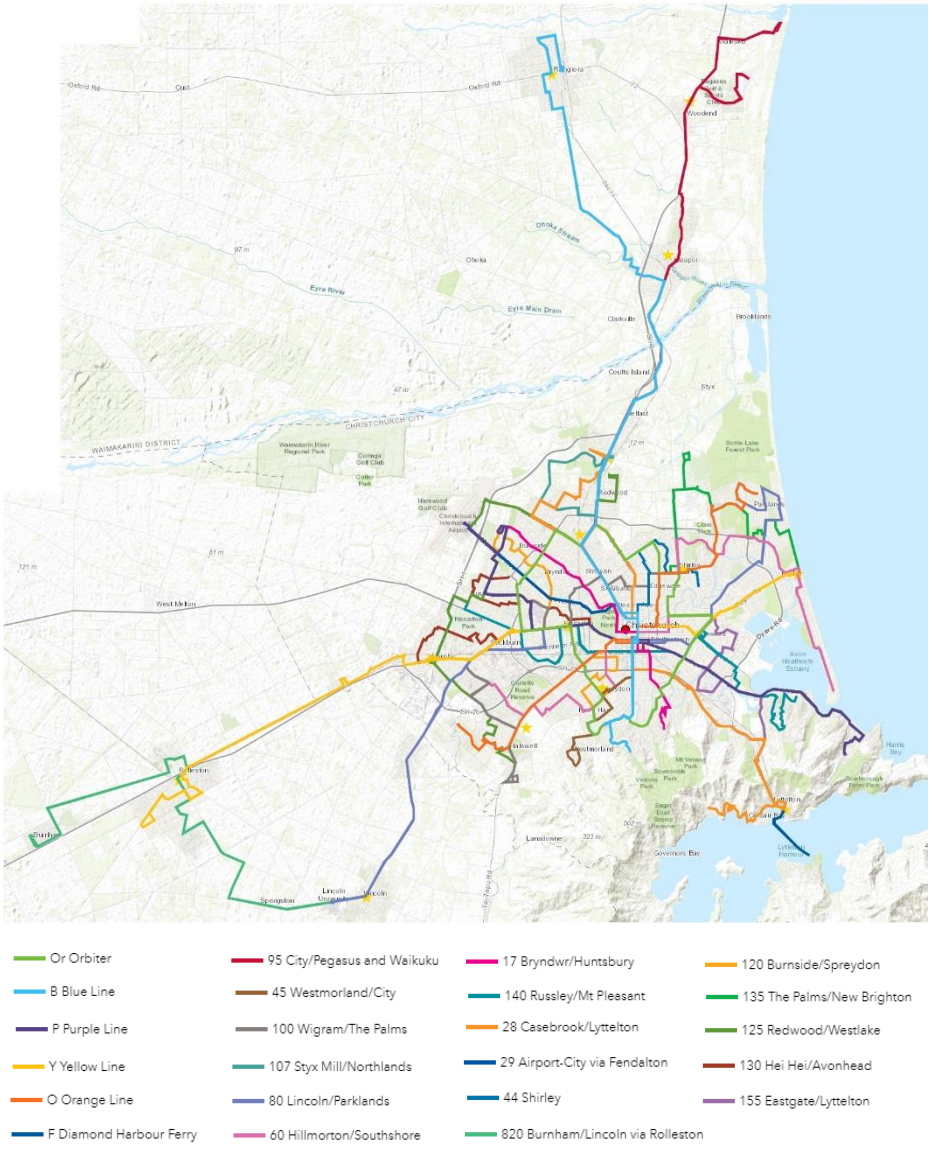


Figure 69: Do-Minimum – existing infrastructure and current high frequency, city connector and suburban link PT services

Lastly, it is noted that the recent timetable and route changes made to the 1 Rangiora – Cashmere (Blue Line), 95 Pegasus/Waikuku – City, 97 Rangiora – Pegasus (new service) and 125 Redwood – Westlake services and given effect from 28 September 2020 have not been incorporated into the Do-Minimum Modelling. These changes were confirmed after modelling was completed but any effects associated with these are anticipated to be minor and unlikely to impact the numbers presented in this business case significantly.

3.2 LONG LIST OPTIONS

The option development process considered an array of supply and demand measures, alongside interventions aimed at removing barriers to the uptake of PT. Figure 71 details the optioneering process that was undertaken to develop the options.

A long list of seven interventions were developed to consider services, access, corridor design and vehicle elements as outlined below:

1. Peak bus frequency increase
2. Interpeak bus frequency increase
3. Bus stop improvements
4. Transfer improvements
5. Bus priority improvements
6. Vehicle quality improvements
7. Park and ride improvements

The interventions were applied in two series, referencing the diagram (Figure 70) published in the Regional Public Transport Plan:

- A Series (A1-A7): Interventions applied to the five current high frequency (core) routes (Purple Line, Blue Line, Yellow Line, Orange Line and Orbiter)
- B Series (B1-B7): Interventions applied to the four additional high frequency city connector routes (17 Bryndwr-Huntsbury, 28 Casebrook-Lyttelton, 60 Hillmorton-Southshore and 80 Lincoln-Parklands)

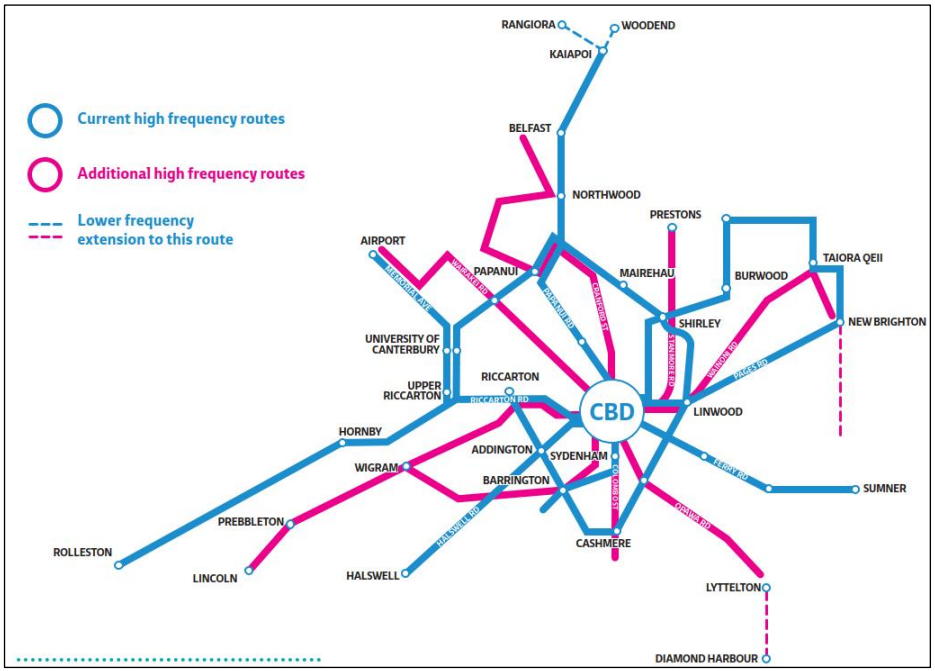


Figure 70: Canterbury regional public transport plan 30-year vision[57]

The interventions were applied to the existing network layout and developed in an order aligned with a traditional progression of PT improvement. The first five are ordered by approximate capital investment, with the options requiring no capital investment (service-only) being implemented first. Lower cost capital investments then follow, with the most expensive capital investment (bus priority) being introduced only after lesser cost options have been implemented and frequencies have been increased to a level that strongly justify bus priority. Vehicle quality improvements and park and ride were somewhat independent of the progression of the first five series, so were tested last.

Initial priority is also focused on the core routes; hence the B series is incrementally applied to the corresponding A series (e.g. B4 builds on Option A4 and B3).

[57] Canterbury Regional Public Transport Plan, p.9

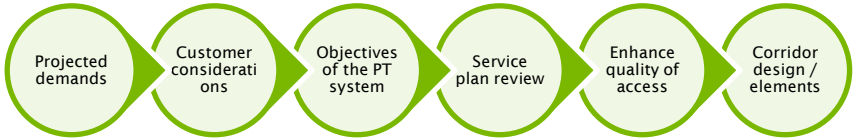


Figure 71: Optioneering process for long-list

Three series of sensitivity tests were undertaken as outlined below.

- **C Series:** Service and Network Interventions
  - C1- Provides all day direct services from Waimakariri and Selwyn District
  - C3 - Enhances existing cross-town connectors. i.e. specifically, upgrade route 130 to run through the central exchange
- **D Series:** Land Use Changes (D1) - Redistributing 2028-2038 estimated population growth from areas with low accessibility change to areas with high accessibility change
- **A0 Series:** Removal of Bus Fares (A0) - providing zero fares across the network

During the long list development, two facilitated workshops were held on 30 March and 14 April 2020 (via Skype) with representatives from Waka Kotahi, ECan, WDC, CCC and SDC, supported by members of the Project Team. The first workshop considered the long list series A & B, from which feedback was received and considered further to inform the additional sensitivity testing, which was then presented and discussed at the second workshop.

The interventions were applied to the existing network layout and developed in a logical order to maximise benefits relative to cost. Interventions were tested incrementally 1-7, leading with a service-based approach before considering infrastructure improvements. Initial priority was focused on the core routes; hence the B series is incrementally applied to the corresponding A series (e.g. Option B4 builds on Option A4 and B3).

The longlist options developed are outlined further in the following table and diagram.

Table 8 Long-list option descriptions

Intervention	1 – Peak freq.	2 – Interpeak freq.	3 - Access	4 - Transfer	5 – Bus priority	6 – Vehicle quality	7 – Park & ride
Summary and Intent	Taking a service-based approach using existing infrastructure with more buses and higher frequencies during the peak period (2 hr AM, 2 hr PM) to provide for capacity.	Taking a service-based approach using existing infrastructure with more buses and higher frequencies during the peak and interpeak (8 hr) period to provide for capacity.	Allowing a connected network and improving customer experience through access to the PT system.	Allowing a connected network and improving customer transfer experience through interchanges.	Providing bus priority as continuous as possible without the need to introduce a new alignment with consequential land and cost impacts.	Improving the vehicle quality to enhance the customer experience.	Providing park and ride infrastructure to improve accessibility to the PT system for users not within an 800m catchment of a frequent route.
Description	Keep the PT network structure but increase the frequency so that they all run at a 5 min headway during the morning and afternoon peaks.	Extending the frequency improvements on the routes to the inter-peak so the bus services run 5 min in peak and 10 min outside of peak times.	Enhancing the quality of access to the) routes (providing shelters, seats, cycle racks, and park and ride for outer stops).	Enhancing the transfer experience between two services (moving stops closer, better road crossings, etc).	Enhancing the journey time and reliability of services in the inner part of the city (5km from city centre). Provide bus lanes/borders or intersection priority at congested location on the routes.	Enhancing the quality of the vehicle (emission free and better riding quality, faster boarding and alighting, stop announcements, etc.).	Enhancing the quality of access to the routes by providing park and ride for outer stops.
A Series	Applied to five core high frequency routes (Blue, Purple, Yellow, Orange, Orbiter) only						
	Option A1 is applied to the five core routes (B, P, Y, O, Orbiter)	Option A2 builds on Option A1	Option A3 builds on Option A2	Option A4 builds on Option A3	Option A5 builds on Option A4	Option A6 builds on Option A5	Option A7 builds on Option A6
B Series	Applied to four additional high frequency city connector routes (Routes 17 (Bryndwr / Huntsbury), 28 (Casebrook/Lyttelton), 60 (Hillmorton/Southshore) & 80 (Lincoln/Parklands)).						
	Option B1 builds on Option A1	Option B7 builds on Option B1 and A2	Option B3 builds on Option B2 and A3	Option B4 builds on Option B3 and A4	Option B5 builds on Option B4 and A5	Option B6 builds on Option B5 and A6	Option B7 builds on Option B6 and A7

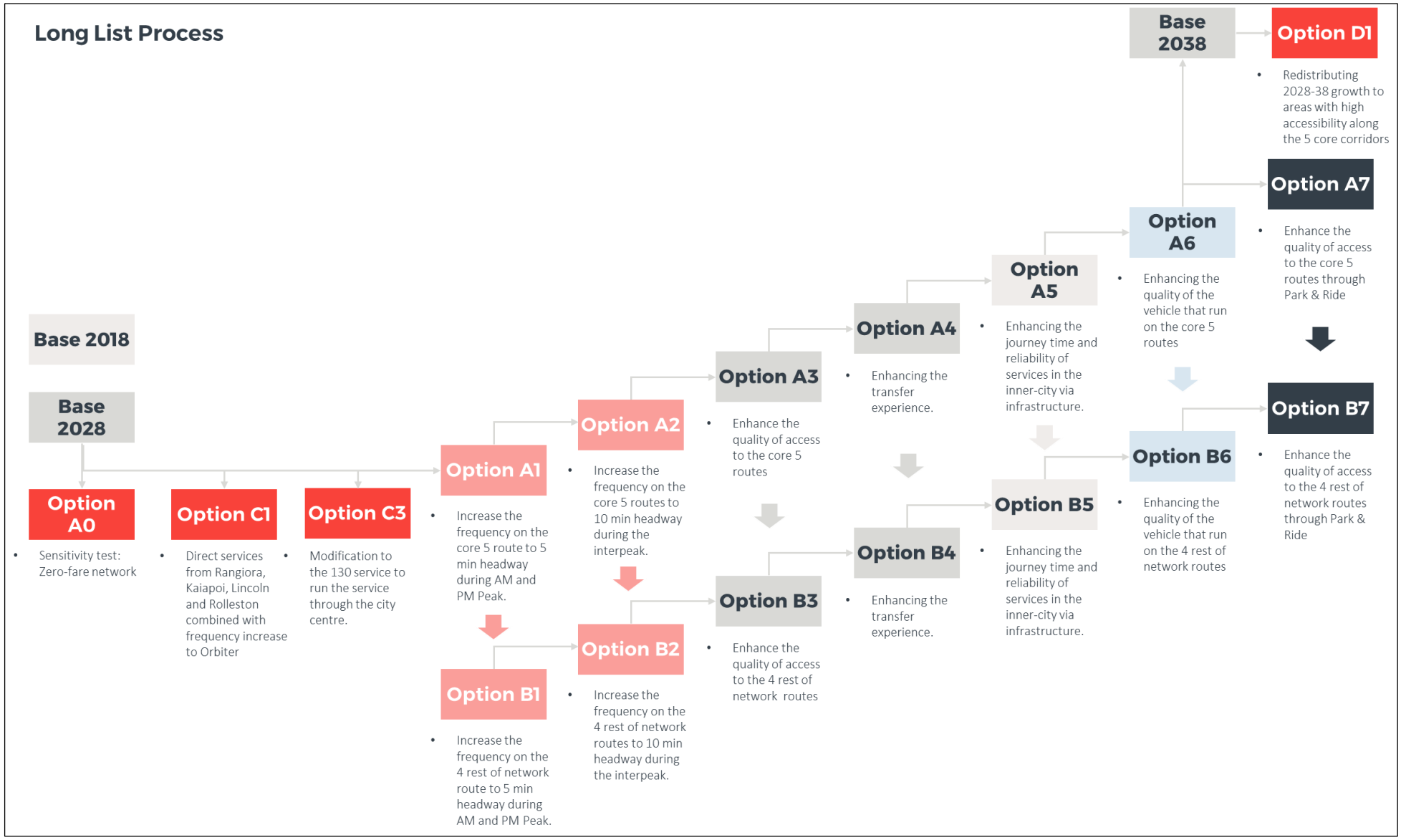


Figure 72: Long-list process

3.3 LONG-LIST OPTIONS ASSESSMENT

A full assessment of how each of the long-list options performed against each of the KPI measures is set out in full in **Appendix F** 'Transport Analysis Report'. A summary assessment of some key results is provided below with a summary table of the increase in annual number of PT trips outlined in Figure 73.

3.3.1 Comparative assessment against the investment objectives

Investment Objective 1: Improve journey time and reliability of PT services by 2028

The only options providing an improvement to in-vehicle journey time and/or congestion were Longlist Options A5 and B5 (Bus Priority). Both options resulted in only marginal improvement. It was identified that further work was required through the short list process to identify and optimise congested sections of the network.

Investment Objective 2: Improve PT services to and from highly populated/growth areas and key destinations across Greater Christchurch by 2028

Both the A and B series showed significant improvements to accessibility, with frequency interventions generally providing the biggest step change as summarised by various measures that assessed accessibility to:

- Central City – Accessibility significantly improves through frequency interventions (A1 & B1)
- High Employment areas – Accessibility improves through a combination of frequency interventions (A1 & B1) and bus priority (A5)
- KACs – Interpeak accessibility significantly improves through the A series, particularly frequency interventions (A2) and bus priority (A5)
- Job Accessibility - Accessibly to employment opportunities is increased across the regions, particularly through frequency interventions (A1) and some improvements from bus priority (A5)
- Within Rolleston and Rangiora - Significant improvements through the A series, particularly through frequency improvements and park and ride (A7)
- From larger towns in Selwyn and Waimakariri to Central City – Frequency interventions provided some improvements, but the most significant change was through the introduction of park & ride interventions (A7)

Note the long list interventions do not make any changes to route, nor population density and as such the catchment populations did not change across the long list options.

Investment Objective 3: Remove barriers to the uptake of PT by 2028

Despite an overall reduction in vehicle kilometres travelled the change in network emissions is very small, with buses contributing to less than 0.2% of all emissions.

Overall, the number of PT trips increase through both the A and B series. With the A Series providing approximately 2.3million additional trips annually to the 2028 Base (13% Increase) and the B Series a further 900,000 trips (overall 18% increase to the 2028 Base). As shown in the following figure, the biggest contributors to the increase in PT trips are Core Peak Frequencies (A1) and Core Bus Priority (A5).

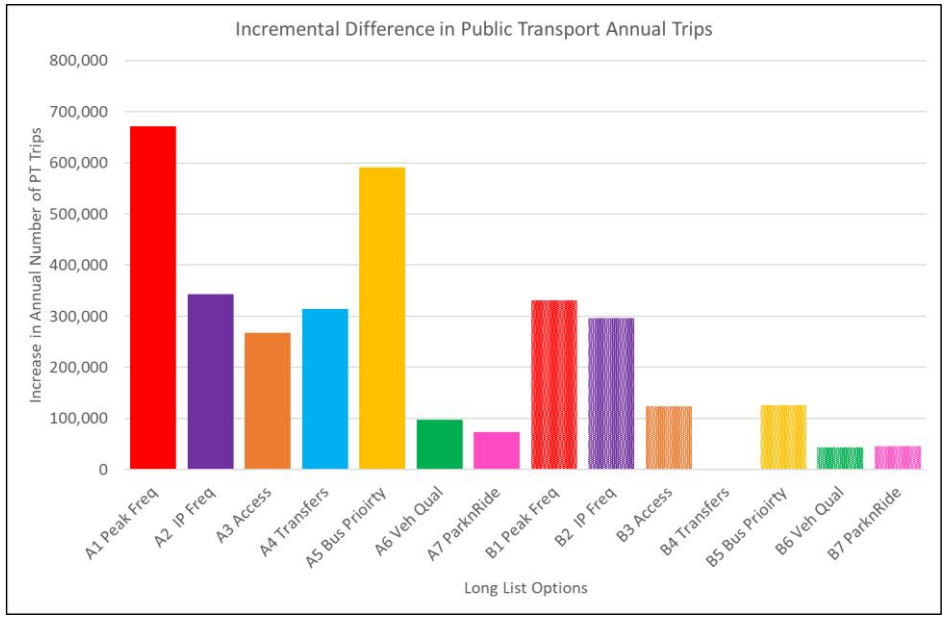


Figure 73: Difference in public transport annual trips

Softer barriers to PT uptake, such as those relating to ease of use, were effectively "modelled" through perceived travel times associated with walk and wait times. These also contributed to overall PT uplift as shown in the following figure through Series 3 and 4 interventions.

Overall, the A and B series interventions resulted in an increased mode split from 2.3% (2018) to 2.8 % (2028). Figure 74 shows the total annual public transport trips for the different series as columns, with the dots showing the corresponding trips per capita.

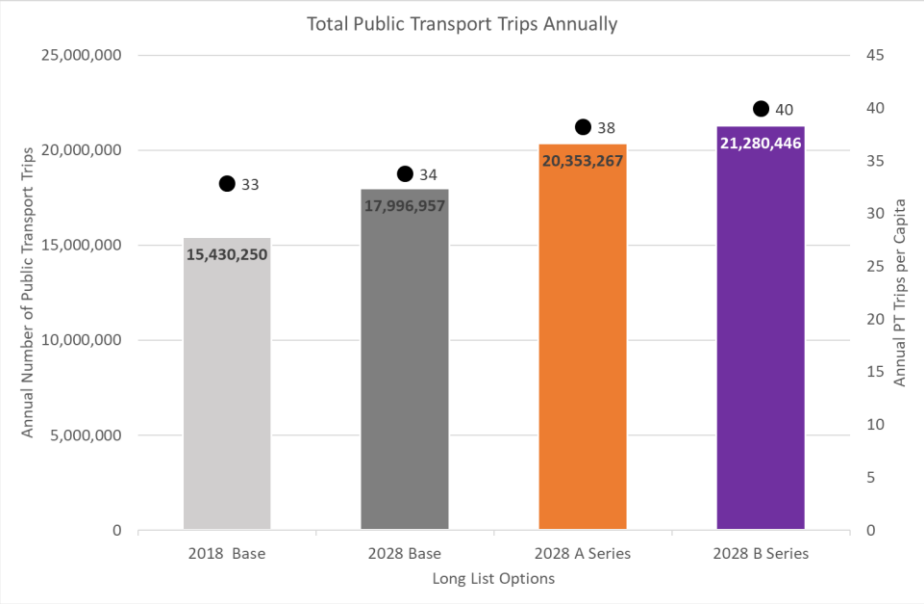


Figure 74: Total public transport trips annually

3.3.2 Sensitivity analysis

The outputs resulting from the long list analysis were shared at a workshop on 30 March 2020 with representatives from Waka Kotahi, ECan, WDC, CCC and SDC, supported by members of the Project Team. At the conclusion of the workshop there was a desire to investigate other interventions that could contribute further to an uplift in PT.

As such sensitivity analysis was undertaken to consider how the following interventions may contribute to PT uplift:

C Series: Service and Network Interventions

- C1- Providing an all-day direct service from Waimakariri and Selwyn District increases the number of overall trips
- C3 – Enhancing a cross-town connection (130) increases daily boarding on that route, but these are predominantly redistributed from adjacent services

D Series: Land Use Changes (D1) – Reallocating growth to the areas adjacent to a frequent PT corridor results in significant PT uplift (40% increase in PT Trips)

A0 Series: Removing fares has potential to increase ridership by approximately 50% (by 2028 when compared to the base). Combining these with higher parking costs in the city centre could increase ridership by 71% (the base case assumed parking costs remaining constant).

3.3.3 Implementation risk

An assessment relating to implementation risks, including costs was also undertaken as outlined in Table 9. The implementation risks are similar for both series, but to differing degrees given the different extent of network covered under the core routes and additional routes.

Frequency improvements (Series 1 (Peak Frequency) and 2 (Interpeak Frequency) can be implemented with much lower implementation risk and rolled out reasonably quickly given they don't require the same extent of consultation and infrastructure changes. It is noted that while implementation risk may be small, the reputation risk has the potential to be high given the additional Opex costs from frequency improvements will come from ECan rates.

Any changes to stop locations (Series 3 (Access), 4 (Transfers), 7 (Park and Ride)) all require consultation and potential risk of consents and property.

Series 5 (Bus Priority) also requires consultation and has the potential to be controversial, increasing the risk that this implementation measure may not be supported and /or it would take longer to be implemented. The benefit of bus priority lanes can also of less public benefit and/or be difficult to achieve if there are not a reasonable number of buses (i.e. high frequent services) to benefit from the change.

High level estimates of likely costs of the A and B series show that Series 3, 4, 5 and 7 (access, transfers, priority and park & ride) would primarily incur capital expenditure rather than operational expenditure. Of these, bus priority would be the costliest, with the others all being significantly lower cost. Series 1, 2 and 6 (peak frequency, interpeak frequency and vehicle quality) would incur primarily operational expenditure. Interpeak frequency and vehicle quality would be the highest cost options, with peak frequencies being lower. The B-series costs would be expected to be significantly higher than the A-series costs for most options, except for park & ride costs which would be identical across both series.

Table 9 Implementation risk

Intervention	1 – Peak freq.	2 – Interpeak freq.	3 - Access	4 - Transfer	5 – Bus priority	6 – Vehicle quality	7 – Park & ride
Implementation Risks							
A Series (High Frequency (Core) Routes) & B Series (Additional Four High Frequency (City Connector) Routes)	Frequency improvements can be implemented simply without route and/or infrastructure changes. Low risk option to execute and can be rolled out in stages. The capacity of the central city, bus interchange may be a constraint.	Frequency improvements can be implemented reasonably simply without route and/or infrastructure changes. Low risk option to execute and can be rolled out in stages. More surplus capacity currently available at the bus interchange off peak, so Bus interchange capacity is of a lesser constraint than the peak.	Any changes to bus stop/shelters requires public consultation and Community Board approval. This process can be lengthy and controversial.	Enhancing the transfer experience between two services (moving stops closer, better road crossings, etc) would likely require changes to stop locations and may need further consideration regarding safety and intersection operational constraints. Consultation and Community Board approval required.	Potential change to road corridor layout would be required, most likely affecting parking and intersection operation. Significant and likely controversial community engagement required.	Reliant on technology upgrades to provide real time info including bus GPS tracking and a supportive operations system.	Hide and ride (i.e. using existing on street areas informally as a park and ride service) can operate without any formalities. but risk to residential and business in area. Formalising Park and Ride sites may require consenting and property negotiations.
Cost							
A Series (High Frequency (Core) Routes)	OPEX $10-20m p.a.	OPEX $15-25m p.a.	CAPEX $5-10m	CAPEX $3-6m	CAPEX $50-100m	OPEX $15-25m p.a.	CAPEX $5-10m
B Series (Additional Four High Frequency (City Connector) Routes)	OPEX $25-40m p.a.	OPEX $40-65m p.a.	CAPEX $7-15m	CAPEX $6-12m	CAPEX $60-110m	OPEX $30-50m p.a.	CAPEX $5-10m

3.3.4 Conclusions and recommendations

Assessment of the long list options was undertaken to understand which of the proposed interventions would most significantly contribute to the project objectives. Although some interventions contributed more significantly than others, all interventions contributed in some way and hence none were discarded in totality. Rather critical conclusions were drawn to inform the short list options as outlined below:

- **High frequency (core) routes:** Improvements to the five high frequency (core) routes (Long list A-series) have the potential to increase patronage by 31% from 2018 by 2028. Most of this patronage uplift occurs in the inner portion of Christchurch City (within approximately 5km of the city centre)
- **Additional high frequency routes:** Expanding the number of high frequent routes from five to nine (Long List B-series) increases the number of people within 800m of frequent PT route by 20% from 334,000 to 402,000. The expansion however appears to divert growth from the five core routes and therefore only adds approximately a further 4% to the overall patronage uplift for Greater Christchurch over and above the forecast improvements from enhanced core routes. However, service improvements would still be required to ensure capacity meets demand and this was recommended further consideration at an individual route basis as part of short list option assessment. The long list analysis determined that the short list options needed to consider additional routes that complement the catchment of the core routes without overlapping catchments
- **Park and ride:** Park and ride located at larger towns in Selwyn and Waimakariri and or the fringe of Christchurch city has the potential to add a further 3% to the overall patronage uplift for Greater Christchurch.
- **Direct services:** Enhanced direct services from Waimakariri and Selwyn (C1) have the potential to achieve significant mode shift if these services are supported by frequency, service pattern and corridor improvements that ensure parity with vehicle traffic.
- **Third tier routes:** Optimising third-tier routes like Route 130 (Hei Hei / Avonhead) (C3) can provide patronage uplift, but it is unlikely to be of a scale that makes a meaningful impact on citywide mode share (0.2% uplift)
- **Land use:** Redistributing land use growth towards the five high frequency core routes has the potential to increase patronage by 40% in 2038 (D1). Population growth is a significant driver of future patronage uplift
- **Fares:** Reducing fares has potential to increase ridership by up to 50% (more than the impact of A and B series combined) and further consideration of this was required in the short list as sensitivity tests

The above conclusions were shared at the second long list workshop held 14 April 2020. Following the workshop, the following short list development philosophy was developed:

- **High frequency (core) routes:** Continue development of the five high frequency core routes to further leverage off existing and planned investment in both infrastructure and services along these routes. The routing of these services connects customers with key areas of importance and aligns well with customer insights that indicate that there are clusters of key destinations where potential new customers could shift from car to PT trips. The short list would further explore in detail improvements combinations of frequency, journey time and stop location along each section
- **Additional high frequency routes:** The short list would further explore four additional routes identified for frequency improvements. It would analyse the capacity constraints on these routes and explore increased frequencies to match projected demand with a possible staged approach to service improvements
- **Direct services:** Direct services from Selwyn (Rolleston and possibly Lincoln) and Waimakariri (Rangiora and Kaiapoi) would form part of all short list options, with a focus to achieve journey time parity with general vehicles to the city centre for these services. The short list would contain adjustments to the coverage of the routes (3-digit services) to support the five high frequency (core) routes and explore gaps in access to PT services
- **Network changes:** The short list would consider further opportunities to optimise the PT routes taking into consideration the following:
  - Any route change has possible wider network implications
  - Route adjustments to enhance access to city centre and other key employment areas and identified residential high density and growth areas
  - Potential benefits of converting some Suburban link routes to City Connector status
  - The network design philosophy in light of central city now being substantially re-established, including the bus interchange
  - Time associated with delivering any comprehensive revised network options
- **High density corridors:** Focus the short list improvements through the high-density areas on the five core routes, where the land use sensitivity testing has confirmed potential for future uplift and form a likely stepping stone into the eventual migration to mass transit corridors

In summary the short list network structure continues a focus on the five-high frequency (core) routes. Four additional routes (Routes 17 (Bryndwr / Huntsbury), 28 (Casebrook/Lyttelton), 60 (Hillmorton/Southshore) and 80 (Lincoln/Parklands)) will have targeted improvements and enhanced capacity and efficiency, but not be invested in/developed to the same extent as the core five.

The focus on the inner core

The rationale for focus on the inner core moving forward is due to the high concentration of the Greater Christchurch population that falls within a 5 km radius (Figure 75) from the central city as this is where the biggest potential market of future PT users exists. Presently, 67% of all boardings occur within 5km of the Christchurch city centre. This area has 44% of the population of Greater Christchurch and 60% of all employment opportunities.

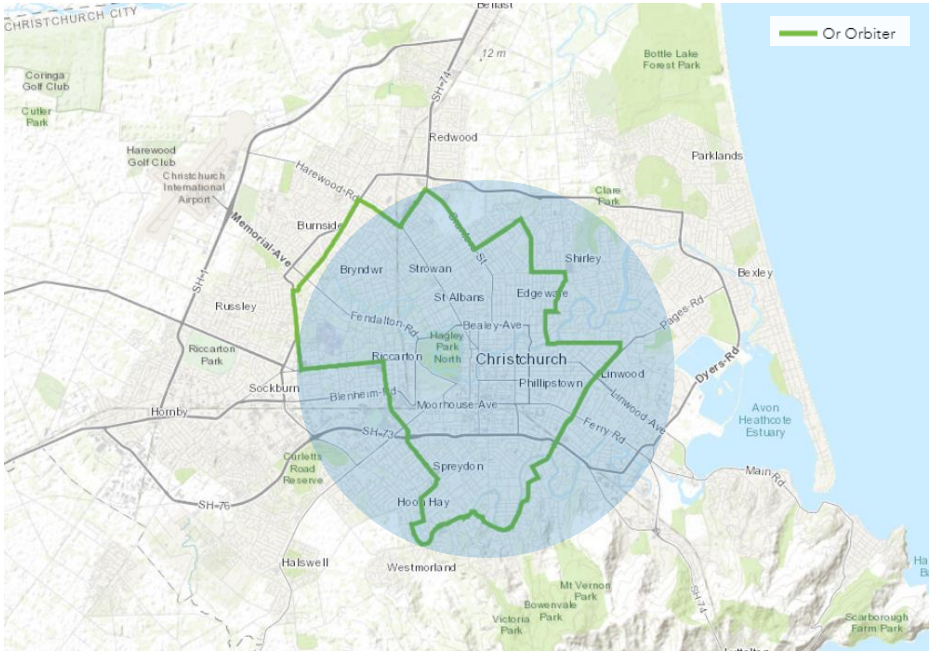


Figure 75: The Greater Christchurch inner core

Not only is the inner core, the area of greatest PT potential but it is also the area with the greatest congestion effects. As outlined in the Strategic Case (Part A Section 1.3.4), the existing and anticipated future congestion effects in Christchurch are anticipated to be the most pronounced within the Central City and immediately surrounding area. This inner core area is also largely within the area encircled by the existing Orbiter route.

In addition, the inner core of Greater Christchurch generally has the highest proportion of cycling trips. As a result, it is important that any public transport patronage increase within the inner core represents true mode shift (from private vehicles) as opposed to detracting from existing cycle trips.

While approximately half of all cycling trips in Christchurch are fully contained within the inner core, this represents just 4% of all person trips (excluding walking) fully contained within the core. The proportions of trips by Private Vehicle, PT and Cycle are indicated to remain similar before and after intervention. New PT users will comprise less than 1% of total trips (6,200 new PT users per day in context of >2.3m light vehicle person trips, 61,000 cycling trips and 54,000 bus trips).

Analysis undertaken identifies that within the inner core cycling is much more attractive than the bus (average actual cycling time is 40% of end to end bus journey time[58] within the inner core, while it is 58% between outer and inner) and that it is likely that only 10% of new PT trips would come from existing cycling trips (noting that some of these cyclists will be fair weather cyclists and the improved PT service will provide an option for winter travel). From the base 30,000 inner core cycle trips per day, this implies a loss of just 252 cycling trips (-0.8%). Even when assuming a much higher diversion rate such as 20%, only 500 cycling trips (1.6%) would divert. On this basis, a significant reduction to cycling numbers is unlikely as a result of the focus on the inner core for PT services.

[58] Journey time also allows for walk to and wait time at shelters/bus stops.

4 ACTIVITY DEVELOPMENT – SHORT-LIST

4.1 SHORT LISTED OPTIONS DESCRIPTION

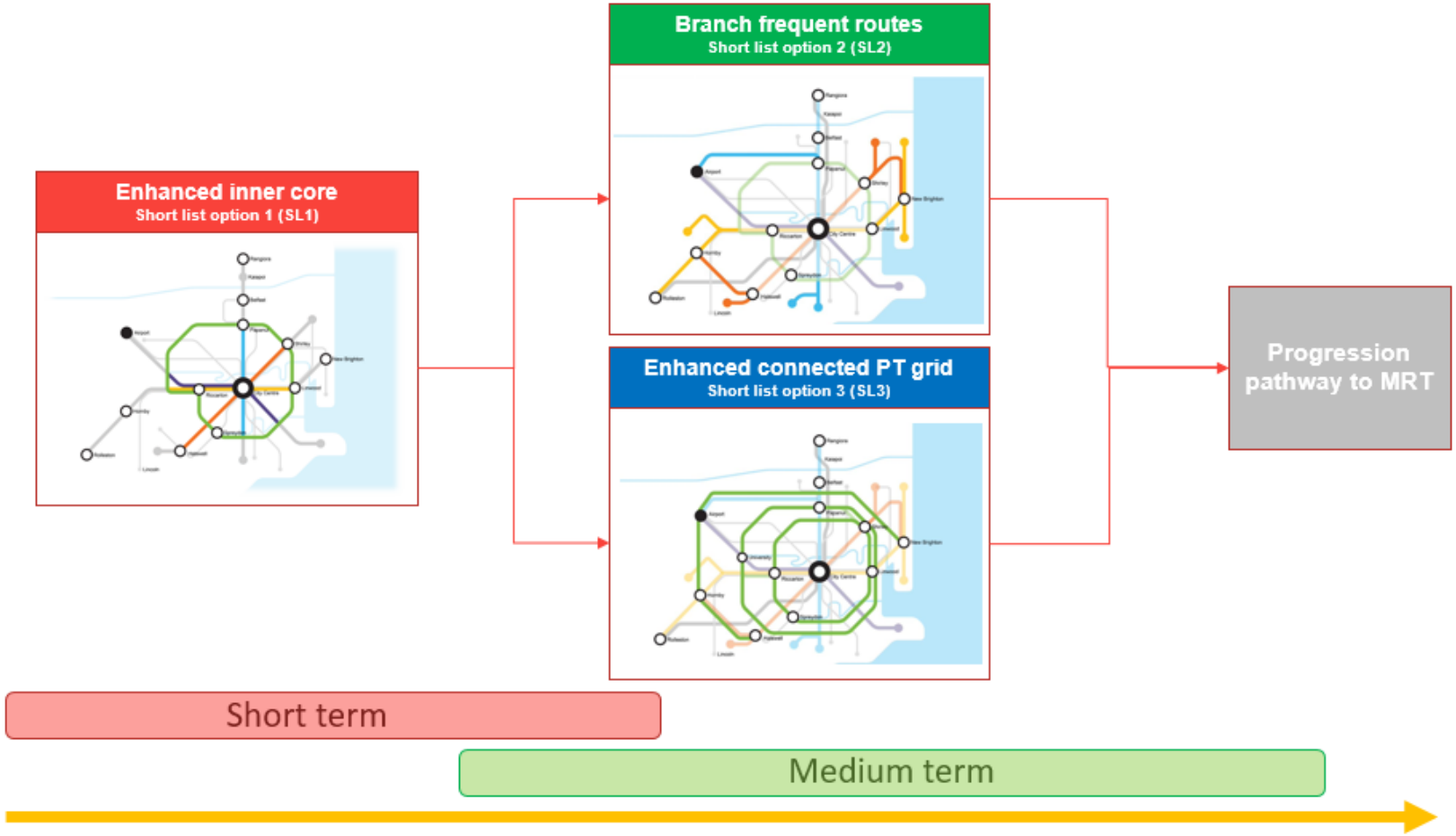


Figure 76: Short-list progression pathway

Three short list options (SL1, SL2, SL3) have been developed based on the results from the long list assessment and sensitivity test (Figure 76). The options are split into short term and medium-term options. It is noted that both SL2 and SL3 would be added to SL1 (i.e. the recommended option could comprise just SL1; SL1 and SL2; SL1 and SL3; or all three (SL1, SL2 and SL3).

Short Term is defined as an option that is implemented in one to six years, with medium term being an option implemented in seven to ten years. A brief description of these options is provided in the following diagram, followed by additional network diagrams to explain further the network concept associated with each option. Note these are headline interventions. All options are considered in the context of a range of supporting measures including frequency, access from the catchments within key growth areas to the PT system and improved supporting infrastructure.

4.1.1 Short-list option 1

Short list option 1 (SL1) focuses on improvements to the inner core, incorporating the following network philosophy design elements:

- Increased frequencies through the inner core of Greater Christchurch through adoption of short turns on the inner core (refer Figure 77)

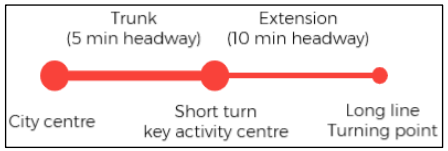


Figure 77: Inner core improvements theory

- Increased frequencies on the Orbiter route
- Increased frequencies and improved bus stop infrastructure on non-core routes with forecast capacity issues and no routes changes proposed in any other short list option (i.e. on Routes 17,28, 29)
- Expanded span and frequency of direct services from Rangiora, Kaiapoi, Rolleston and introduction of a direct service from Lincoln
- Bus priority through the inner core (bus lanes, intersection upgrades, signal pre-emption) and improved ease of transfers between frequent routes and Orbiter
- Improved operational management through headway management of high frequent services (Inner core and Orbiter)
- Enhanced customer information through on board announcements and expansion of RTI at key stops
- Provision of RTI at key centres (airport, university, key libraries, etc.)
- This option would require capacity upgrade at the central city bus interchange

The above enhancements are summarised in the following three network diagrams.

Figure 78 presents the enhanced Inner Core improvements relating to the core routes, including:

- Increased frequencies on the inner core of the existing network:
  - 5 min peak, 10 min inter-peak
  - Orbiter 5 min in peak and inter-peak

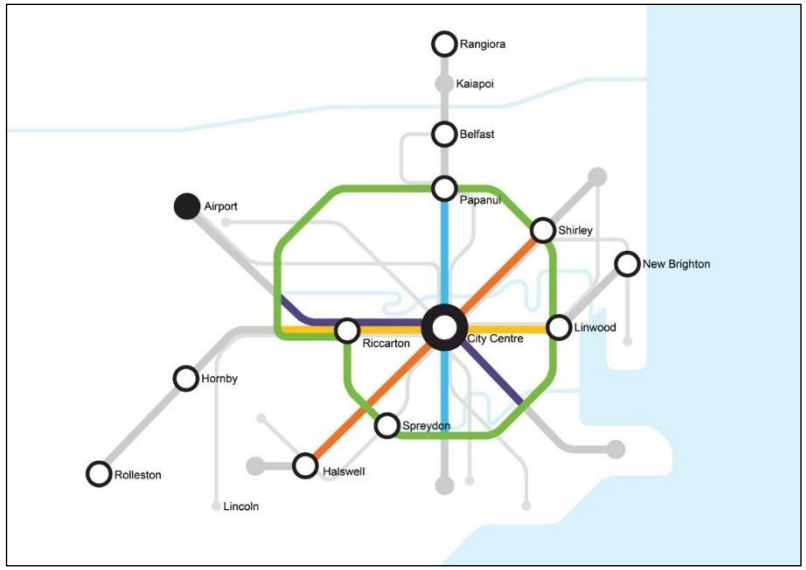


Figure 78: Short-list option 1- core routes

Figure 79 presents the enhanced improvements to non-core routes under SL1:

- Increased frequencies on routes 17 (Bryndwr/Huntsbury), 28 (Casebrook/Lyttelton) and 29 (City/Airport via Fendalton)
  - 7.5min headway in peak; 15 min during inter peak

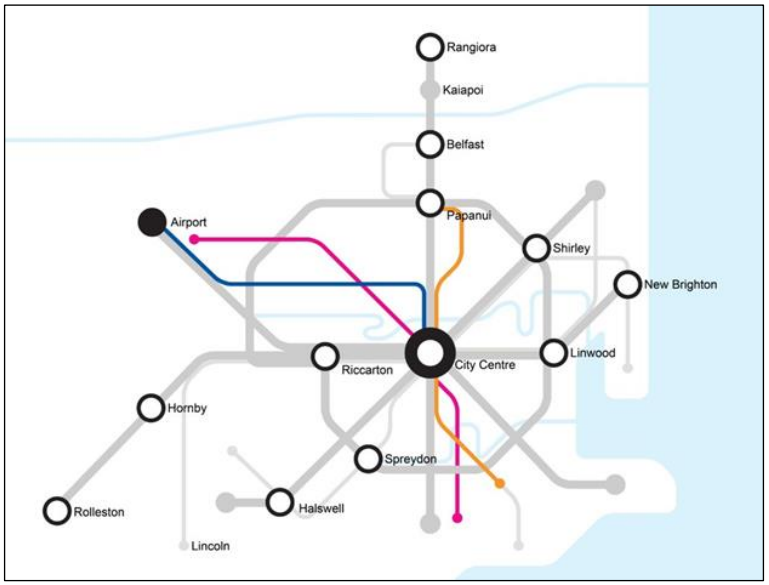


Figure 79: Short-list option 1- non-core routes

Figure 80 presents the enhanced improvements to direct services under SL1:

- All day direct services from Rangiora, Kaiapoi, Lincoln and Rolleston
- 10 min peak, and 20 min inter-peak
- These would be supported by enhanced park and ride facilities. This business case includes provision for improvements to the existing Rolleston sites at Foster Park and Kidman Street, and upgrading the Lincoln Events Centre Carpark to allow use as a park and ride facility. It assumes five park and ride facilities in the Waimakariri which are currently under development

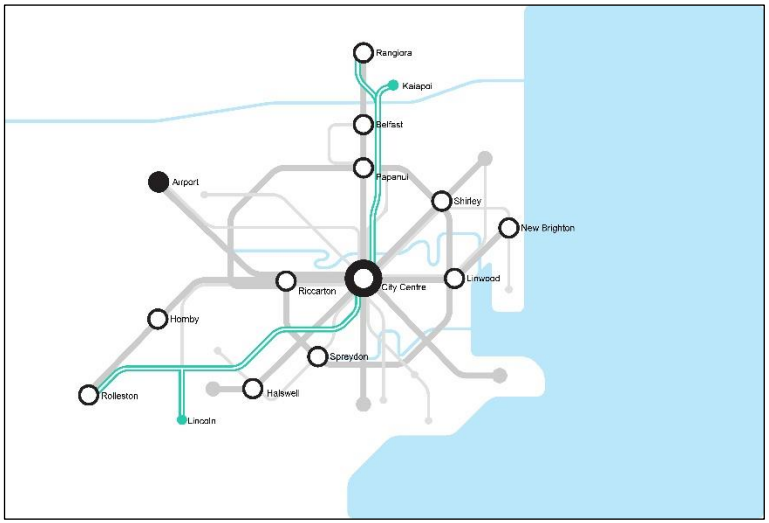


Figure 80: Short-list option 1- direct services

4.1.2 Short-list option 2

Short list option 2 (SL2) focuses on improvements beyond the inner core, incorporating the following network philosophy design elements:

- Retention of all features from the enhanced inner core, with focus on further enhancements to employment, especially to the central city
- Extended frequency improvements on the core routes to outer suburbs by adopting a branch approach to balance frequency with coverage (Figure 81)
- Restructured routes throughout the region to accommodate branches and improve their directness
- Re-align Route 60 (Hillmorton/Southshore) and Route 80 (Lincoln/Parklands) and improve their frequencies
- Improve accessibility to employment belt outside central city
- Improved operational management through headway management of high frequent services (Inner core and Orbiter)
- Enhanced customer information through on board announcements and expansion of RTI at key stops
- Provision of RTI at key centres (airport, university, key libraries, etc.)

- This option would require capacity upgrade at the central city bus interchange.

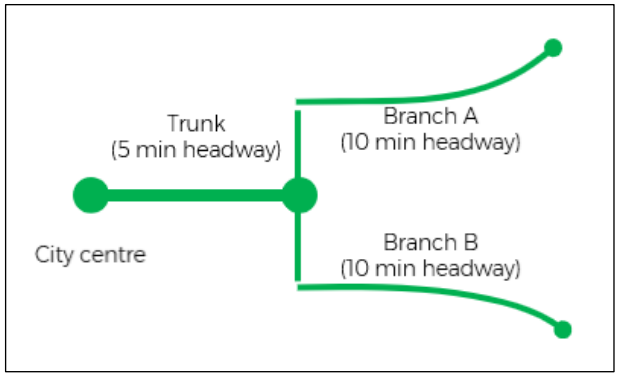


Figure 81: Short list option 2 - proposed branch approach

Figure 82 presents the branched frequent route improvements:

- Utilised higher frequency on inner core to branch out to suburbs
- Provide more single seat journeys to city centre, through a KAC
- Trigger network changes
- Frequencies:
  - Peak: each branch will run at 10 min headway, combining at inner core for the 5 min headway
  - Inter-peak: each branch will run at 20 min headway, combining at inner core for the 10 min headway

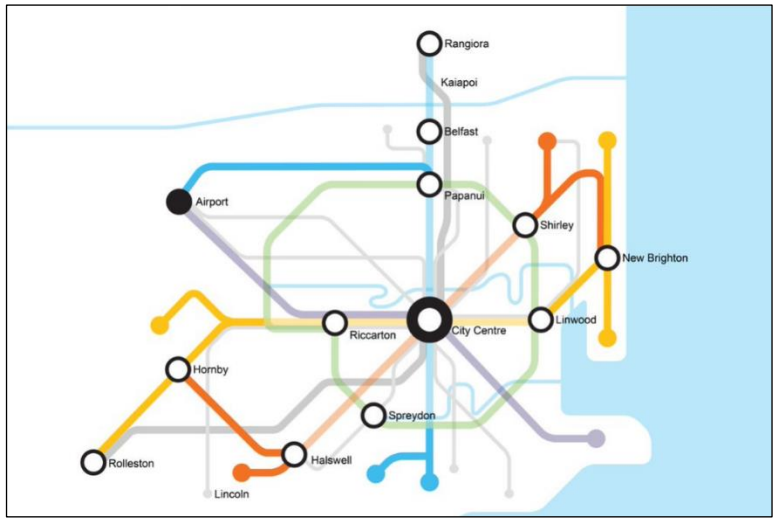


Figure 82: Short-list option 2- branched frequent routes

Figure 83 presents the enhanced improvements to non-core routes under SL2:

Figure 83: Short-list option 2 - non-core routes

4.1.3 Short-list option 3

Short list option 3 (SL3) is very similar to SL2 (i.e. still retain branches and changes to Routes 60 and 80 etc) but also incorporates the following:

- Focuses on improved accessibility to KACs and the university through the introduction of multiple orbiters to allow more convenient transfer opportunities
- Improved operational management through headway management of high frequent services (inner core and Orbiter)
- Enhanced customer information through on board announcements and expansion of RTI at key stops
- Provision of RTI at key centres (airport, university, key libraries, etc.)
- This option would require capacity upgrade at the central city bus interchange

Figure 84 presents the enhanced improvements to non-core routes under SL3:

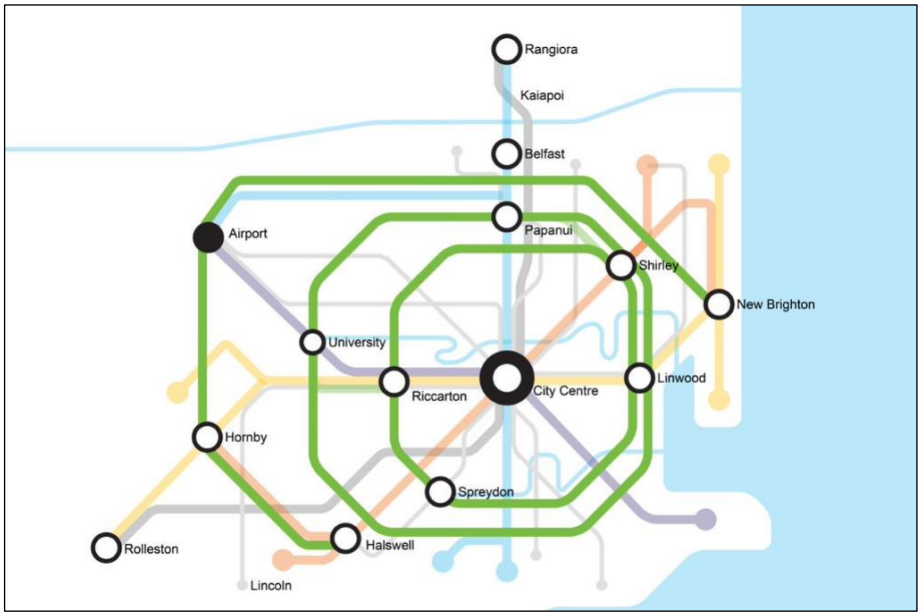


Figure 84: Short-list option 2- non-core routes

4.2 SHORT LIST ASSESSMENT AGAINST THE INVESTMENT OBJECTIVES

A full assessment of how each of the short-list options performed against each of the KPI measures is set out in full in **Appendix F** Transport Analysis Report. A summary assessment of some key results is provided below with a summary table of key statistical results provided in Table 10.

4.2.1 Short list comparative assessment against the Investment objectives

Investment Objective 1: Improve journey time and reliability of PT services by 2028

This metric was adjusted from the long list analysis to ensure it was relevant to the short list options. Given route changes are proposed under the short list options, it was more meaningful to only compare common key corridor sections of each route. Given the KPI was only analysed for the AM peak, only the city inbound directions were assessed as follows:

- Blue Northbound: Cashmere to City (Moorhouse)
- Blue Southbound: Belfast to City (Bealey)
- Orange Northbound: Halswell to City (Moorhouse)
- Orange Southbound: Dallington to City (Lichfield)
- Purple Eastbound: Ilam to City (Antigua)
- Purple Westbound: Heathcote to City (Madras)
- Yellow Eastbound: Ilam to City (Antigua)
- Yellow Westbound: Linwood to City (Lichfield)

All options showed a reduction in Bus/Car travel time ratio across the four core routes, (Purple, Orange, Yellow, Blue). This reduces to a range between 0.6 to 1.2 across the routes, compared to a ratio range between 0.9 and 1.4 in the 2028 Do-Minimum. The most significant reductions occur on the Purple Route eastbound and Yellow route eastbound.

The percentage of bus route exposed to congestion also reduces across all options, from a range between 0 and 11% compared to a range between 8% and 26% in the 2028 Do-Minimum.

The number of intersections with congestion reduces from 10 to 5.

Investment Objective 2: Improve PT services to and from highly populated/growth areas and key destinations across Greater Christchurch by 2028

SL1, SL2 and SL3 all showed significant improvements to accessibility, with frequency interventions generally providing the biggest step change as summarised by accessibility measures to:

- Central City – Significantly improved through SL1 and SL2 but no further improvements through SL3
- High Employment areas – SL1, SL2 and SL3 all contributed to improvements, to a differing degree across the various key employment areas
- KACs – SL1 provided the greatest change to KACs within the inner core (Riccarton, Papanui, Linwood, Shirley, Barrington), while SL2 extended improvements through to the outer KACs (Papanui and Halswell) SL3 showed the greatest change to Linwood and Shirley, where the two orbital routes would intersect
- Job Accessibility - Accessibility to employment opportunities increased across the region under all short list options. SL1 benefitted the inner core areas, with SL2 extending this benefit beyond the inner core
- Within Rolleston and Rangiora – Only SL2 (and SL3) improved local accessibility as a result of modifications to the local routes
- From larger towns in Selwyn and Waimakariri to Central City – Journey times improved from all regions to Christchurch City, by up to 35%. SL2 (and SL3) provided benefits to Rolleston with the improvement of the direct services
- The population catchment within (400m) of a high frequency route increased by 24%, 47% and 57% as a result of SL1, SL2 and SL3, respectively

Investment Objective 3: Remove barriers to the uptake of PT by 2028

All options tested showed a reduction in both total vehicle kilometres travelled, and vehicle kilometres travelled per capita, compared to the 2028 base, with SL1 showing the biggest step change from the base. However, despite the reduction in vehicle kilometres travelled (which indicates reduced demand for car travel), there was very little change in the environmental measures. Note that this business case did not assess the impact of a zero-emissions bus fleet as this is being progressed separately. It also did not assess the impact of peripheral changes that are enabled through high-quality public transport, such as a more compact city, improved urban form, and the possibility of introducing changes to road and parking pricing structures.

A range of interventions were included within the short list options, aimed at making the bus system easier to use, especially for new users. All three modelled short list options included improved provision of shelters, seats and cycle racks, along with network wide improvements such as improved on bus experience, trip planning information and additional driver training support. SL1 focused these improvements on the core routes and with SL2 and SL3 extending these to the rest of network.

Overall, the number of PT trips increased with SL1 and SL2, but no further incremental benefit was achieved under SL3. SL1 provided approximately 2.4million additional trips annually to the 2028 Base (14% Increase) and SL2 a further 1.8 million trips (overall 24% increase to the 2028 Base). This is whosn in Figure 85 with the columns depicting total annual public transport trips, and the dots depicting trips per capita.

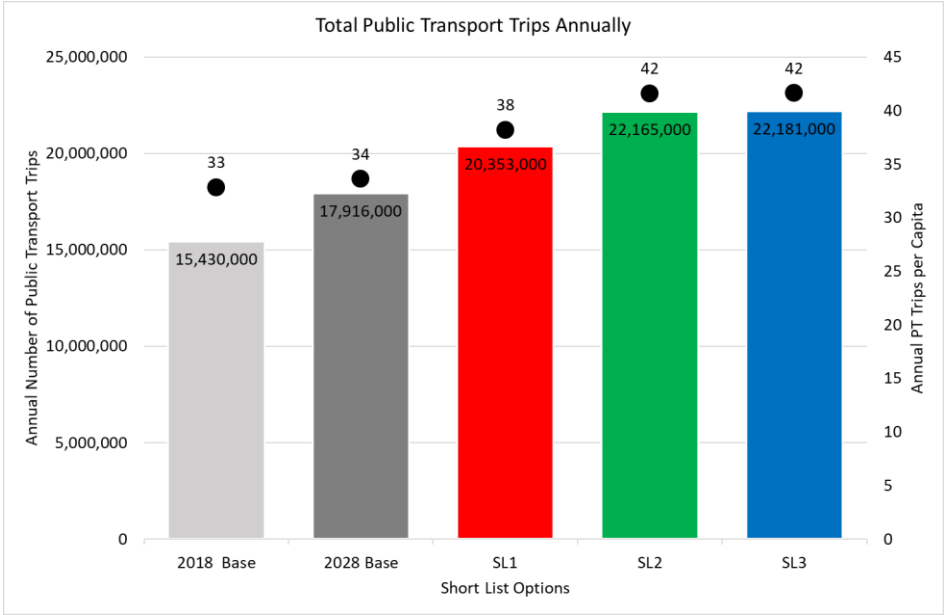


Figure 85: Total public transport trips annually

Overall SL1 resulted in an increased mode split from 2.3% (2018) to 2.7 % (2028) and SL2 and SL3 both provided an increase to 2.9% (Figure 86).

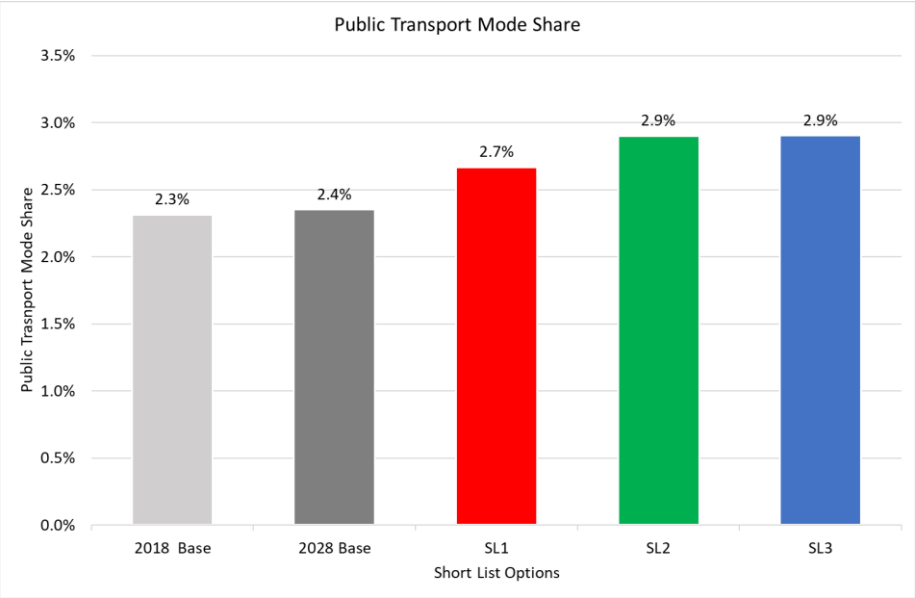


Figure 86: Public transport node share

Table 10 Short-List summary results compared to the 2028 base

Investment objective	Measure		Summary results		
			SL1	SL2	SL3
Improve journey time and reliability of PT services relative to private vehicles by 2028	In-vehicle journey time and congestion	Ratio of bus/car in-vehicle journey time along a specific route	Similar reduction across all options:		
			Blue Line Northbound 1.3 to < 1,	Blue Line Northbound 1.3 to < 1,	
			Orange Line Northbound 1.3 to < 1,	Orange Line Northbound 1.3 to < 1,	
			Purple Line Eastbound 1.4 to < 1,	Purple Line Eastbound 1.4 to < 1,	
			Yellow Line Eastbound 1.4 to < 1,	Yellow Line Eastbound 1.4 to < 1,	
		Percentage of the bus route exposed to vehicle congestion (v/c>0.5)	Similar reduction across all options:		
			Blue Line 8% to 6%		
			Orange Line 19% to 9%		
			Purple Line 26% to 11%		
			Yellow Line 16% to 0%		
		Number of intersections where PT experience a LOS worse than D	Reduces from 10 to 5 intersections		
Improve PT services to and from highly populated/high growth areas and key destinations across Greater Christchurch by 2028	End-to-end journey time and accessibility to and from key areas	Household accessibility*[59] to **Christchurch City** (Christchurch Bus Interchange, West End, Ara Institute of Technology, Christchurch Hospital)	Increase by 36% (from 160,000 to 218,000)	Increase by 64% (from 160,000 to 262,000)	Increase by 64% (from 160,000 to 262,000)
		Household accessibility* to **high employment zones** (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington)	Increase by 16% (from 76,600 to 102,000)	Increase by 30% (from 76,600 to 124,000)	Increase by 46% (from 76,600 to 150,000)
		Household accessibility* to **KACs** (Papanui, Riccarton, Hornby, Shirley and Linwood)	Increase by 36% (from 193,000 to 263,000)	Increase by 64% (from 193,000 to 317,000)	Increase by 72% (from 193,000 to 333,000)
		Household accessibility* to **more than one KAC** from key residential areas (North inner, Linwood and Sydenham)	Increase in average percentage of households from 81% to 96%	Increase in average percentage of households from 81% to 97%	Increase in average percentage of households from 81% to 97%

*All accessibility measures consider end-to-end journey time, which includes all components of the journey: walk time, wait time, transfer time and in vehicle journey time, where a 30-minute end-to-end journey time has been selected for comparative purposes between options.

		Job accessibility* from key residential areas (North inner, Linwood and Sydenham)	Increase by 28% (from 189,000 to 242,000)	Increase by 47% (from 189,000 to 279,000)	Increase by 49% (from 189,000 to 282,000)
		Household accessibility* to Rolleston and Rangiora centres	No change	Increase by 60% (from 7,800 to 12,500)	Increase by 60% (from 7,800 to 12,500)
		End-to-end journey time from Rangiora, Kaiapoi, Rolleston, and Lincoln to the Christchurch Bus Interchange using the PT system	Average 16% faster	Average 19% faster	Average 19% faster
	Spatial coverage	Population that are located within 400m of a frequent route	Increases by 24% (from 132,000 to 164,000)	Increases by 47% (from 132,000 to 194,000)	Increases by 57% (from 132,000 to 207,000)
Remove barriers to the uptake of PT by 2028	Environment	Private vehicle kilometres travelled per capita (Annual)	Decrease by 0.3% (from 6,820km to 6,800km)	Decrease by 0.6% (from 6,820km to 6,780km)	Decrease by 0.6% (from 6,820km to 6,780km)
		CO2 emissions from all transport sources (tonnes/yr)	Increase by 0.4% (from 737,000 to 740,000)	Increase by 1.1% (from 737,000 to 745,000)	Increase by 1.1% (from 737,000 to 745,000
		Air pollution from PM10 (tonnes/yr)	No Change (remains at 410)	No Change (remains at 410)	No Change (remains at 410)
		Air pollution from NO2 (tonnes/yr)	Increase by 5.6% (from 180 to 190)	Increase by 5.6% (from 180 to 190)	Increase by 5.6% (from 180 to 190)
	PT ridership	Number of PT trips originating in each area (aggregated zone)	Average 14% Increase	Average 28% Increase	Average 27% Increase
		Number of PT trips to the Christchurch Central City originating in each area (aggregated zone)	Average 14% Increase	Average 24% Increase	Average 24% Increase
		Number of PT trips	Increase by 14% (from 17.9M to 20.3M, or from 34 to 38 per capita)	Increase by 24% (from 17.9M to 22.2M, or from 34 to 42 per capita)	Increase by 24% (from 17.9M to 22.2M, or from 34 to 42 per capita)
		Proportion of trips made by PT	Increase by 14% (from 2.4% to 2.7%)	Increase by 24% (from 2.4% to 3.0%)	Increase by 23% (from 2.4% to 2.9%)
	Perception in ease of use of PT system	Improve perceived ease of use of PT system	Programme across core routes, 17, 28 & 29 including: Marketing, TDM, bus stop shelters, RTI screens, integration with cycling and park-n-ride.	Programme extended to core route branches, 60 & 80 including: Marketing, TDM, bus stop shelters, RTI screens, integration with cycling and park-n-ride.	Programme extended to additional orbiters including: Marketing, TDM, bus stop shelters, RTI screens, integration with cycling and park-n-ride.

4.3 PLANNING, ENVIRONMENTAL AND LAND REQUIREMENT ASSESSMENT

4.3.1 Introduction

This section provides a preliminary planning, environmental and land requirement risks/opportunities assessment for the short-listed options, covering:

- Environmental and planning assessment of environmental effects (noise, water, air, urban design)
- Likely consent requirements and consenting risks
- Consultation risks
- Land requirements

4.3.2 Environmental and planning assessment

Given majority of the proposed measures relate to network improvements (non-infrastructure) or improvements such as the establishment of minor infrastructure upgrades (i.e. new bus stops within the existing transport zone/road reserve)) any associated environmental effects of the three short list options are anticipated to have minimal adverse environmental effects, occurring within existing urban transport corridors. Any earthworks associated with the construction of new infrastructure to support the proposed upgrades should be managed appropriately with site specific erosion and sediment control and dust control measures. In addition, any corridor upgrades to improve bus priority should consider integration with the streetscape and urban environment.

4.3.3 Consenting requirements

Majority of the measures proposed in each of the three short list options (SL1, SL2 and SL3) are network improvements that do not require any changes to the existing transport infrastructure (i.e. improved frequencies of existing bus routes).

The measures with potential to result in a need to obtain resource consent are those that require land outside the transport zone (i.e. any new bus stops, park and rides, associated supporting infrastructure and an extension to the central city bus interchange). However, the intention is that any proposed infrastructure, such as bus lanes and bus shelters are provided within the existing road corridor (and within the Transport Zone where these would be a permitted activity under Rule 7.4.2.1 P14 of the Christchurch District Plan (CDP)).

It is assumed that any park and rides will be established council owned property (not requiring land acquisition). However, the locations of the park and rides is unknown and any consent requirements would be dependent on the specific planning zone within each district plan (CDP, Waimakariri District Plan or the Selwyn District Plan), and the nature of the works required (i.e. access arrangements, anticipated daily vehicle movements, earthworks, impervious service area, landscaping etc.).

An extension to the central city bus interchange (comprising the acquisition of 173 Tuam Street – Lot 2 DP 495013), is within the Ōtākaro Limited designation of the Bus Interchange. The purpose of this designation is 'bus interchange' which includes a concourse, bus platform, amenities, retail/food and beverage, staff facilities, cycle parking and ancillary activities. As the designation (and the Outline Plan of Works provisions of the RMA, which only apply to works undertaken by a requiring authority) is for Ōtākaro Limited it cannot be relied upon by CCC or any other party. However, s.180 of the RMA does enable a requiring authority the ability to transfer the designation to another requiring authority where the financial responsibility for a project has also been transferred. There are procedures that must be followed for this to occur but the provision the potential for the existing designation to be transferred from Ōtākaro to CCC.

Without the designation, consent may be required under the underlying Commercial Central City Business Zone. Regardless, the ability to use the designation would aid the approval process (by helping to override the provisions of the district plan and recognising that an extension to the bus interchange is in accordance with the activity anticipated by the designation).

Lastly, earthworks within 5m, or the felling of, any street tree within the road corridor that is greater than 6m in height will require consent as a restricted discretionary under the CDP.

Overall, SL1 is not anticipated to require resource consent (with any bus lanes located within existing road reserve/ transport zone). SL2 and SL3 may require consent given these include a potential extension to the central city bus interchange and the creation of formalised park and ride sites.

4.3.4 Consultation

No consultation has been carried out as part of the option development beyond other than informative presentation to key stakeholders within the Greater Christchurch Partnership forum. The intention is that the preferred option is consulted on as part of general consultation to be undertaken with the RLTP and

the council Long Term Plans. As projects are developed in more detail specific consultation will be required around the following components:

- Changes to bus routes
- Bus lane and bus priority provision (including any temporary or permanent on-street parking removal)
- Bus stops and bus shelters

SL1 scored most favourably under the stakeholder criteria given it doesn't propose upgrades to the bus interchange, or establishment of park and rides as per SL2 and SL3.

4.3.5 Land impacts

No specific property purchases have been identified other than property that may be required to extend the bus interchange under SL2, or for the establishment of park and ride facilities.

The intention is that any proposed infrastructure, such as bus lanes and bus shelters are provided within the existing road corridor.

4.4 ENGINEERING AND COST ASSESSMENT

This section provides information supporting the engineering assessment of the short-listed options. It supports the Constructability and Feasibility elements of the Short List MCA Assessment. The assessment criteria cover:

- Technical: Ability to encounter technical risks to implement the solutions and the ability to deliver the outcome in stages and as demand or funding allows. Also, the ability to deliver effective outcomes earlier
- Operability: Ability to operate effectively as part of the transport system and with other mode
- Feasibility: Complexity and risk in construction, including disruption to travel, services and business during construction
- Capital costs

4.4.1 Technical

All options scored equally in terms of potential technical risks that may be encountered when implementing the options. All three options are reliant on technology upgrades enabling the provision of real time info and bus GPs tracking.

SL1 scored the best in terms of stageability given it primarily focuses on frequency improvements, and isn't reliant on any specific bus network changes, making it easier to be implemented early. SL2 requires changes to bus routes and consequently is more complex to bring forward, with SL2 requiring further route changes.

4.4.2 Maintenance requirements

All options would require additional maintenance investment as a result of capital improvements, such as bus stop infrastructure. Options 2 and 3 would require further investment as a result of expanding capital investment around stops and bus interchange expansion.

4.4.3 Capital cost

The operating and capital cost estimates for each option are summarised in Table 11

The Capex costs benchmarked against similar projects under development in Auckland, including New North Road, Great North Road, Manukau Road, Sandringham Road and Remuera Road.

The operational expenditure was estimated based on rate ranges provided by ECAN for diesel and electric buses.

The following items have been included in the cost estimate:

- Bus lane provision, improvements to bus stops (shelters, information displays, etc.), additional devices to enable bus management system to do headway management and signal priority, park and ride upgrades in Rolleston and Lincoln, and improvements to the central bus interchange

Table 11 Capital and operational cost estimates

Option	OPEX (PER ANNUM)	CAPEX
SL1	$32M-$50M	$32M
SL2	$78M-$105M	$77M
SL3	$98M-$132M	$77M

To provide context, the operating expenditure of the current bus network is approximately $65.5m per annum. The previous 2015-2025 Regional Land Transport Plan allocated Christchurch City Council $56m for public transport expenditure (comprising central city interchange, Northlands hub and Riccarton Interchange). Selwyn and Waimakariri District Councils had no public transport expenditure.

4.4.4 Property cost

Property impact confined to SL2 and SL3, that require expansion of capacity to the central bus exchange. The estimates allow for $1.5m to acquire 173 Tuam Street.

Park and rides were assumed to be implemented through improvement on council owned property.

4.5 ASSESSMENT SUMMARY

This section provides a summary of the short list assessment carried out in the short list MCA workshop. It contains two main sections:

- An assessment of performance against weighted Investment Objectives drawn from the ILM, using a seven-point scale against the Do-Minimum, '-3' being significantly worse than the Do-Minimum and '3' being significantly better (Table 12)
- An assessment of feasibility and risk, including costs and economics has also been undertaken in Table 13 as per the three-point scale outlined

Table 12 Short-list MCA summary

Benefit	Investment objective	Measure		Rating (as per key)			
				Do Min	SL1	SL2	SL3
PT journey times are increasingly competitive with private car journey times and reliability is increased	Improve journey time and reliability of PT services relative to private vehicles by 2028	In-vehicle journey time and congestion	Ratio of bus/car in-vehicle journey time along a specific route	0	2	2	2
			Percentage of the bus route exposed to vehicle congestion (V/C>0.7)	0	2	2	2
			Number of intersections where PT experience a LOS>E	0	2	2	2
A PT system which better connects KACs and is sufficiently flexible to meet future needs	Improve PT services to and from highly populated/high growth areas and key destinations across Greater Christchurch by 2028	End-to-end journey time and accessibility to and from key areas	Household accessibility[60]* to **Christchurch City** (Christchurch Bus Interchange, West End, Ara Institute of Technology, Christchurch Hospital)	0	3	3	3
			Household accessibility* to **high employment zones** (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington)	0	1	2	3
			Household accessibility* to **KACs** (Papanui, Riccarton, Hornby, Shirley and Linwood)	0	2	3	3
			Household accessibility* to **more than one KAC** from key residential areas (North inner, Linwood and Sydenham)	0	3	3	3
			Job accessibility* from key residential areas (North inner, Linwood and Sydenham)	0	2	3	3
			Household accessibility* to Rolleston and Rangiora centres	0	0	3	3
			End-to-end journey time from Rangiora, Kaiapoi, Rolleston, and Lincoln to the Christchurch Bus Interchange using the PT system	0	3	3	3
		Spatial coverage	Population that are located within 400m and 800m of a frequent route	0	2	3	3
A PT system that attracts new and retains existing users	Remove barriers to the uptake of PT by 2028	Environment	Environment emissions: Private Veh km travelled per capita, CO2, PM10, NO2	0	0	0	0
		PT ridership	PT ridership: PT trips from each zone, PT trips to central city, PT Trips per capita, PT mode share	0	1	2	2
		Perception in ease of use of PT system	Improve perceived ease of use of PT system	0	2	3	3
			Weighted Score	**0**	2.0	2.5	2.5

*All accessibility measures consider end-to-end journey time, which includes all components of the journey: walk time, wait time, transfer time and in vehicle journey time, where a 30-minute end-to-end journey time has been selected for comparative purposes between options.

KEY:

Score	Description
-3	Significantly Worse than the Do-Minimum
-2	Moderately Worse than the Do-Minimum
-1	Slightly Worse than the Do-Minimum
0	Same as or equal to the Do-Minimum
1	Slightly better than the Do-Minimum
2	Moderately better than the Do-Minimum
3	Significantly better than the Do-Minimum

Table 13 Assessment scale - feasibility and risk

Implementability criteria	Measure	Score as per key			
		Do Min	SL1	SL2	SL3
Technical	Any technical risks to implementing the solutions	0	2	2	2
	Ability to deliver the outcome in stages and as demand or funding allows. Also, the ability to deliver effective outcomes early	0	3	2	2
Consentability	Ability to operate and maintain the option	0	3	2	2
Stakeholders	Risk of implementation as a result of potential objection from community and stakeholders	0	2	1	1
Maintenance Requirements	Ability to maintain the option without major additional costs	0	2	1	1
Affordability	The ability of all parties to afford the option	0	2	1	1
Financial	**BCR**		0.79-1.10	0.62-0.84	0.50-0.67
	CAPEX		$32M	$77M	$77M
	ADDITIONAL OPEX (ANNUAL)		$32M-$50M	$78M-105M	$98M-$132M

KEY:

	Scale		
Implementability criteria	**1**	**2**	**3**
Technical	Significant technical design difficulties and/or brand new technology required	Some technical design difficulties and/or technology to be worked through	Straight forward to implement, no technical design difficulties or new technologies required
	Cannot be staged	Complexities /timing risk associated with staging option	Easily and effectively staged
Consentability	Suite of complex consents required with risk of notification	May extend beyond road reserve, requiring further consents (non-notified)	Anticipated to be contained within road reserve, with only basic consents required
Stakeholders	Likely to impact other operational aspects (general traffic, cycling, bus stops, shelters and parking) alongside other infrastructure upgrades (interchange, park & ride) which may not have full Stakeholders/Community support	Likely to impact other operational aspects (general traffic, cycling, bus stops, shelters and parking) which may not have full Stakeholders/Community support	Negligible impact other operational aspects (general traffic, cycling, bus stops, shelters and parking) hence likely to have Stakeholder/Community support

Maintenance Requirements	Significant ongoing maintenance expenditure would be required to ensure safe and quality customer experience.	Requires a marginal increase in maintenance expenditure to ensure safe ongoing use of the asset.	Within current maintenance expenditure envelopes
Affordability	A significant increase in capital and operating expenditure would be required	An increase in capital and operating expenditure would be required, but in line with national investment trends	Within the envelope of historic annual capital investment in PT and operating expenditure across all parties

4.6 ASSESSMENT CONCLUSION

The results of the short list assessment were presented at the Short List workshop on the 3 June 2020. The conclusions drawn are summarised below:

- SL1 (the enhanced inner core option) provides improvements to accessibility and patronage. It scores the best in terms of implementation risk and there is value in taking it forward to preferred option development over the short term
- SL2 further improves accessibility and patronage, but there are additional implementation risks. There is value in taking this forward as the preferred option in the mid-term. Further refinement of the 'branching' option (SL2) is required as a next step to build on the enhanced inner core programme, and as a pathway to MRT
- SL3 also further improves accessibility, however without achieving further increase in patronage. Given its significant additional operational cost, no further development of the enhanced connected grid option (SL3) is proposed

In conclusion both SL1 and SL2 will be brought forward into the preferred option, as a short-term intervention (years 1-6) and medium-term intervention (years 7-10) respectively, with the following optimisation considerations will be incorporated:

4.6.1 Short List Option 1 Optimisation:

- Develop and optimise the capital programme ($32m over three years) for this in greater detail
- Identify required changes for the hospital stop
- Assess impact on airport stop (ability to accommodate other shuttle type services as well)
- Assess OPEX impact of fleet conversion to electric buses as per ECan policy
- Develop staging programme

4.6.2 Short List Option 2 Optimisation:

- Review the service pattern (frequencies) on the network with aim to reduce Opex expenditure and re-test benefits to optimise economic case for this option
- Develop staging programme to enhance affordability of the programme

PART C – RECOMMENDED OPTION ASSESSMENT

5 ACTIVITY DEVELOPMENT – RECOMMENDED OPTION

The recommended option comprises both short-term (Years One to Six) and medium-term interventions (Years Seven to Ten). Combined the short term and medium-term programmes complete the full programme (Years One to Ten).

The short-term interventions entail improved frequencies through the inner core of Greater Christchurch through the adoption of short turns on the inner core and improving the frequency of the Orbiter to improve transfer between routes.

The medium-term interventions focus on substantial route changes to keep pace with the forecast growth in population and economic activity in Greater Christchurch. The changes will create PT capacity across the region, improve coverage and reduce transfers. These improvements will leverage capacity created through the short-term programme to enhance access to economic and social opportunities to residents in outer suburbs. It does this by introducing branching of services on key routes.

The recommended option layout is provided at **Appendix G**.

Each of the various short-term and medium-term interventions are described in greater detail below.

5.1 DESCRIPTION OF SHORT TERM INTERVENTIONS

5.1.1 Design philosophy – short term

Short-term interventions are proposed for Years 1-6. The short-term interventions entail enhanced frequencies through the inner core of Greater Christchurch through the adoption of short turns on the inner core and improved frequency on the Orbiter to improve transfer between routes.

The philosophy for the short-term interventions is to make best use of the existing network structure and assets that support the highest population and employment areas. It is difficult for PT on its own to completely replace all trips that a car can provide for, but when combined with higher densities and good cycling infrastructure, together these modes can support a car-free or car-lite lifestyle for residents.

The core network of frequent services (the five core routes) will be strengthened with extra capacity by moving towards a turn-up and go frequency along the core routes.

Frequency will also be expanded where high demand for PT use exists and/or crowding is projected to occur.

Infrastructure improvements that enhance the efficiency of the increased capacity will focus on the repurpose of road space and technology to improve experience. The short-term infrastructure interventions will be a building block for future expansion with minimum abortive investment occurring upon implementation of the medium-term interventions.

The higher frequencies will be supported by investment in improved operational management through headway management system. This is needed to help prevent bunching at the interchange as well as to ensure Orbiter routes (clockwise and anti-clockwise) maintain their headway to enhance transfer experience.

It also allows for travel demand management and investment in improved customer information through on board announcements and RTI at key stops.

Direct services between Rangiora, Kaiapoi and Rolleston are already in operation and will receive slight frequency improvements to provide customers with options to also use these services during the inter-peak. The direct service offering will also be expanded to include Lincoln.

The services will use existing infrastructure (park and rides) where they exist or are under development with enhancements to the frequency of these services triggered by the use and crowding of the buses over time.

5.1.2 Land use integration

The recommended option of increased frequency (resulting partly because of associated branching along the core routes), bus lane investment and route changes (i.e. more direct routes)) in areas of intensification and planned growth and in connecting key destinations will result in additional passenger uptake in key areas of Greater Christchurch. This includes those areas within a 5-6km radius from the central city (St Albans, Sydenham, Spreydon, Riccarton), but also identified greenfield priority areas such as Halswell, Prestons and Belfast. This is a targeted approach to better align current land use planning and PT

investment, achieving improved integration and setting the scene for ongoing future investment in key growth locations and along key corridors.

The recommended option will result in a more comprehensive network of dedicated bus reinforcing key PT corridors and better supporting connections between the central city and KACs. For example in the southwest quarter of the city the Riccarton Road and Halswell Junction Road (and Colombo Street) corridors will largely include dedicated bus priority lanes linking the KAC's with the city centre (i.e. bus priority lanes proposed along Halswell Road linking to the new Halswell KAC and North Halswell Outline Development Plan future growth area).

These changes will provide journey time and reliability benefits, improved accessibility and remove barriers to uptake of PT. The new network will act as a forerunner to a future rapid transit system and establish PT as a competitive travel option in these areas. The network will reinforce the importance of the central city and provide the right signals to unlock further development opportunities in key locations.

The recommended option includes consolidation of some services to provide more direct routes. By better aligning services with employment and identified growth areas, KACs and communities with low private vehicle ownership the PT network becomes more equitable, serving diverse communities. For example, the 140-bus route currently runs from Mount Pleasant, a lower density neighbourhood through Linwood, the City Centre, Russley, Broomfield then finally to Hornby. The proposed realignment of this service will better connect existing industrial employment centres across the city and more directly connects fringe residential areas with the city centre encouraging sustainable transport choice. Journey times, frequency and customer experience will all see significant improvements (Figure 87).

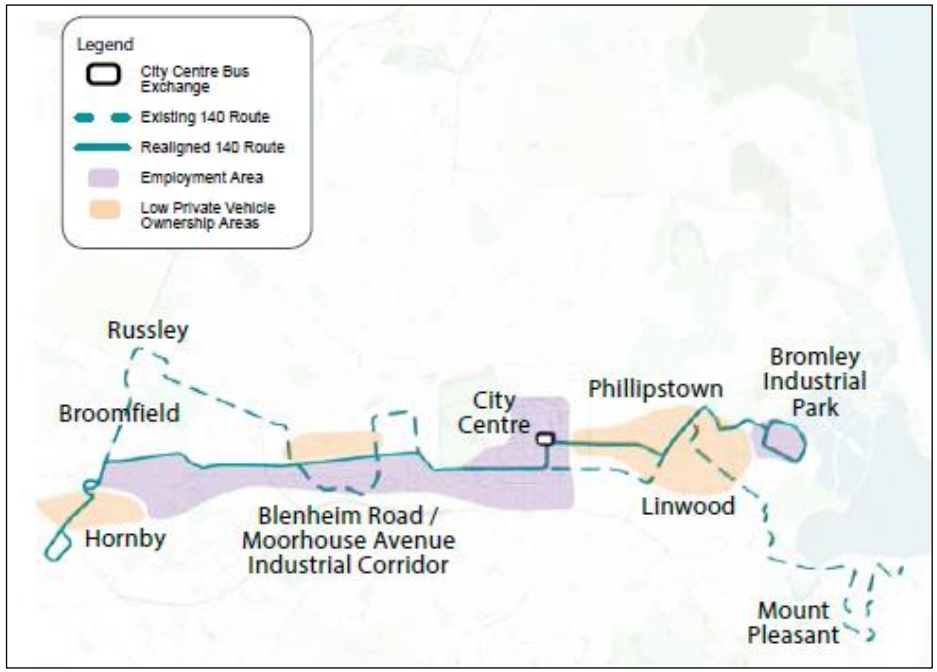


Figure 87: Proposed more direct 140 route

Finally, more direct services and improved bus stop and transfer opportunities will improve the overall quality of the travel experience for users. An enhanced interchange experience and opportunities to move between modes through modal integration signals a move towards greater choice for access and mobility and a more balanced approach to boost pedestrian priority within key streets. This will make walking more attractive and better enable connections with PT, challenging the trend of traffic dominated streets and starting to signal streets and space for people. This has a flow on effect with encouraging buildings to be designed to foster 'street life' and a more distinctive character of neighbourhoods focused around activity and access and choice.

5.1.3 Service improvements in the short term

Enhance the inner core route

Rationale for intervention

A high concentration of the Greater Christchurch population falls within a 5 km radius of the central city and this inner core area is also largely within the area encircled by the existing Orbiter route (refer to Figure 88). The approach is to focus in on where the biggest potential market exists. Presently, 67% of all boardings occur within 5 km of the Christchurch City centre. This area has 44% of the population of Greater Christchurch and 60% of all employment opportunities.

Key benefits

a) Improves journey time and reliability from increased frequency reducing the wait/transfer time
b) Aligns with land-use intensification of inner core areas
c) Enhances access to Central City
d) Targets neighbourhoods with existing low car ownership, and complements walking and cycling to facilitate further reductions to car ownership rates
e) Removes the need to consult timetables with true turn-up-and-go frequencies

This will be achieved by:

- Reduced wait time on the five core routes within the inner core area to achieve the following increased frequencies:
  - 7.5-minute peak (note this is higher than the 5-minute headways used in the short-list assessment – headways were subsequently refined to reduce costs while still achieving most of the benefits)
  - 10 minute off-peak
- Bus lanes that ensure fast reliable service even in peak periods
- Customer experience improvements

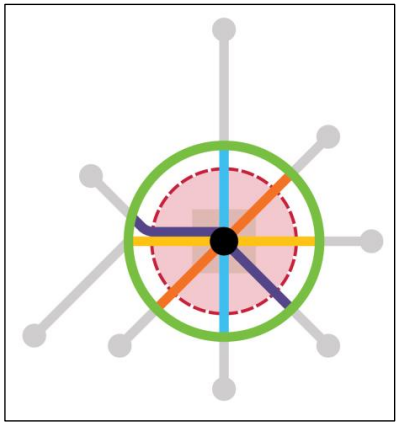


Figure 88: Enhancement of the inner core

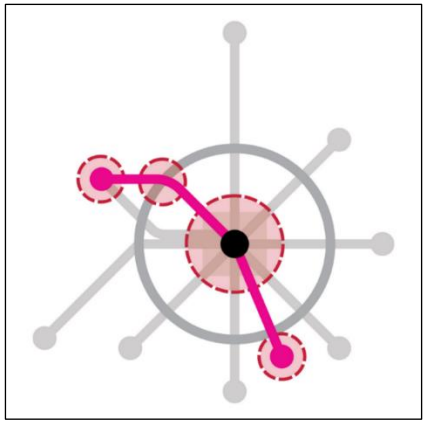


Figure 89: Short term targeted enhanced capacity on selected 'additional high frequency routes'

Targeted enhancement on additional high frequency routes

Rationale for intervention

Enhance PT capacity along several routes that experience bus crowding and have strong demand forecasts to the central city (Routes 17, 28, and 29).

Short-term enhancements are targeted at routes (and sections of routes) that will result in minimal abortive investment when further changes are made to the network structure in the medium term (refer Figure 89).

Key benefits

- Additional direct services to areas zoned for intensification and the central city centre
- Increased access to employment and retail areas
- Reinforces land use intensification and catalyst for growth
- High level of predictability and certainty
- Wait time minimised and increased opportunity to connect and transfer

This will be achieved by:

- Increased frequency initially on routes 17, 28, and 29
- 15-minute peak (except Route 29 - 10-minute peak due to special nature of servicing airport workers and passengers)
- 15 minute off-peak

Direct connections

Rationale for intervention

Part of Greater Christchurch's future development strategy is to not only intensify the inner core, but to also significantly develop the larger towns which are supported by the city. It will become increasingly important to provide sustainable transport options to these growing centres (refer Figure 90).

Rolleston is currently serviced by a direct service to the city centre providing three inbound services every weekday morning and three outbound services every weekday evening. Similar services are committed to begin imminently in Rangiora and Kaiapoi.

These larger towns are lower density than the inner core making it harder to viably service with PT. Park and ride sites are already proposed as part of the transport strategy for larger towns in Selwyn and Waimakariri.

In Waimakariri the direct services will link to Park and Ride facilities already under development at River Road; White Street; Southbrook Park; Wrights Road and Kaiapoi New World.

In Selwyn the services will utilise the temporary Park and Ride next to the Council building in Rolleston and upgraded facilities at Foster Park. Lincoln services will initially utilise the parking at the events centre, with expansion to provide additional parking in this location as demand grows.

Key benefits

- Direct services reduce journey time to be comparable with driving, by using new motorways and HOV lanes and having very few stops
- All-day services (seven days a week) give flexibility for a more diverse range of users
- Enhances access to the central city

This will be achieved by:

- All day 'direct' services to and from satellite centres (using motorways and with limited stops)
- New service to Lincoln introduced
- 20-minute peak
- 60-minute off-peak

These services will use high-occupancy vehicle priority lanes already planned.

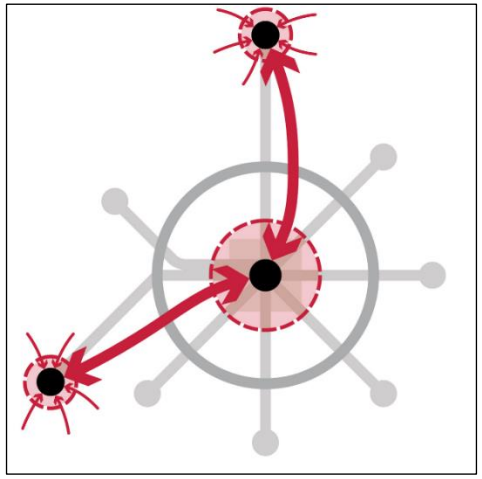


Figure 90: Short term direct connections to larger towns in Waimakariri and Selwyn

Summary of short-term service improvements

Overall, the short-term service improvements will:

- Make the best use of the existing network structure
- Strengthen the existing core network with extra capacity
- Move towards turn-up and go frequencies within the inner core
- Expand frequent network where high demand exists and crowding occurs

A summary of the increased network frequency following the short term improvements is outlined in Table 14 (note these frequencies have been refined since the short-list assessment to reduce costs while still achieving most of the benefits).

Table 14 Increased network frequency following short term improvements

Route	Existing frequency		Increased frequency	
	Peak	Inter peak	Peak	Inter peak
Blue (Route 1) /Yellow/Purple Orange Lines	10min	15min	7.5min	10 min
Orbiter	10min	10min	7.5 min	7.5 min
Route 29	30min	30min	10 min	15 min
Route 17	30min	30min	15 min	15 min
Route 28	15min	30min	15 min	15 min
Lincoln Direct	New Service		3 services	-
All direct services (Year 5 onwards)	New Service		20 min	1hr

In the short-term routes 17, 28 and 29 will all transition to frequent routes (achieve a frequency of 15 minutes during the day with greater frequency during the peaks depending on demand).

5.1.4 Infrastructure improvements in the short term

The scope of the infrastructure improvements for the short and medium term will correspond to the extent of service improvements.

Bus priority lanes

Rationale for intervention

Providing priority bus lanes on the five inner core routes will enhance journey times, ensure more reliable buses, a legible and trusted bus network, and improve operational efficiency of the bus network (refer Figure 91).

The five Inner core routes where bus priority will be provided align with Christchurch's long-term urban development planning. The inner core routes target identified growth and employment areas and improve access to the Central City.

Locations for bus priority interventions were selected by considering average congestion experienced by existing services, the number of services that will run along these sections under the short and medium term interventions, the ability for services running though these sections to keep to their scheduled time tables and comparison of travel times between bus services and general vehicles along the corridors. This is described in more detail in **Appendix L** 'Proposed Bus Priority Infrastructure in Christchurch City'.

Key benefits

- More reliable journey times for services, especially during morning and afternoon peaks
- More competitive travel times between bus and car journey
- More reliable services, and ability to retain headways which enhance transfers as well as wait time at the bus stops
- More efficient bus operations
- Kerbside bus lanes make for safe boarding and alighting

This will be achieved by:

- Utilise existing road carriageway width (i.e. kerb to kerb) to reduce capital expenditure on stormwater and utility relocation
- The road cross section (lane layout) will be altered to allow for reduced flush median, removal of on-street parking (during peaks) and advanced bus lanes to intersections
- Infrastructure changes at 7 key intersections to allow for bus priority measures

Figure 91: Visualisation of bus priority lanes

Real time information and headway management

Rationale for intervention

Environment Canterbury is already investing in an advanced bus positioning and RTI system to enhance information on real-time bus locations.

The short-term programme will build on this investment by expanding technology infrastructure to enable bus priority at signalised intersections along the frequent routes and enhanced headway management capability for the bus operators.

RTI displays at bus stops will means equitable access to information to everyone, with no need to own a smart-phone, or be technologically capable to use it. This is especially important to users who are older, or unfamiliar with how PT works.

Key benefits

- More reliable journey times for services, especially during morning and afternoon peaks
- Better headway management reduce wait times at stops for customers (especially for Orbiter route)
- The ability to retain a scheduled headway and reduce the risk of bus bunching at the bus exchange that might impact operational capacity (i.e. headway management will extend the service life of key bus stops/interchanges where a number of services contribute to high frequency/stop allocation demand)
- Enhanced productivity along key corridors where buses are stuck in congestion due to intersection capacity issues

This will be achieved by:

- Integration of the signal priority system (SCATS) and the bus RTI system to allow for 'virtual loops' to detect the presence of buses in a traffic stream and then allow for priority should the bus be behind schedule
- All buses along the frequent routes will be fitted out with tablets to enhance information to bus operators/drivers that will enable them to manage headways for specific services
- Transfer management information will be provided to drivers to help manage better transfers - tells drivers to wait if a transferring service is late

Core route bus stop infrastructure enhancements

Rationale for intervention

Improved bus stop infrastructure will play a significant role in enhancing customer experience (refer Figure 92). Focusing investment on the frequent inner core routes which have large user numbers will help to develop a bus network people can identify and rely on.

Key benefits

These improvements will:

- Provide all weather shelter to a larger number of customers
- Enhance the information available to customers while they wait for services at bus stops
- Increase personal security with lighting and planning at more locations across the network

This will be achieved by:

- Expansion of the number of shelters, seats, and service information along key routes, especially focused on the boarding stops (generally located along the inbound services)
- Much richer data will be available as a result of Environment Canterbury's RTI project. The benefits of this system will be further enhanced by

expansion of the rich real-time info to customers through expanded roll out of Papercast devices[61] at bus stops

- Installation of screens with RTI at key locations such as at the airport, shopping malls and the hospital
- Cycle racks have been allowed for at key locations where the bus network and priority cycle routes intersection to enable enhanced catchments to the PT network

Figure 92: Visualisation of core route bus stop infrastructure enhancements

Connected transfer points and multi modal catchment

Rationale for intervention

The ability to expand the catchment and usefulness of the fixed route PT services to areas beyond the immediate corridor requires the PT system to be attractive to customers from outside a walk-up catchment to a bus stop. These additional customers will largely arrive by another bus, a car, bike or electric scooter. Ease of bus transfer is an important element for these customers' experience.

Key benefits

These improvements will:

- Enhance the area of catchment able to access the frequent network
- Enhance the user experience and encourage transfers between services as well as modes

This will be achieved by:

- The bus ticketing system already allow for transfers between different services in the same zone at no extra fee. In addition to this the programme allows for:
  - Bilingual on-board announcements for frequent routes to advise customers of upcoming stop and what connections can be made at the stop
  - Park and ride expansion at Lincoln as well as shelter facilities shelters and RTI
- Several cycle storage facilities will be provided at key stop locations to enhance the attractiveness of cycling as a mode for 'first and last' mile trips. These include cycle storage cages at every park and ride location and cycle stands at bus stops that intersect with major cycle routes

Summary of short-term infrastructure improvements

Table 15 provides a summary of the scale of the recommended infrastructure improvements to support short term infrastructure improvements.

[61] A digital bus stop passenger information solution that uses solar powered wireless e-paper displays.

Table 15 Recommended short term infrastructure improvements

Improvement	Comment
Bus lane priority	Approximately 20 km
Bus management system (on board units)	Bus fleet increases from ~210 to 250
Intersection priority	7 upgrades plus ~ 100 signal priority linked with real time system
Bus stop infrastructure	159 shelters 130 RTI displays 12 Toilets
Park and Ride	Shelters at Lincoln events centre plus formalising Foster Park
Bus interchange	Allow for property purchase to secure this land for future upgrades within the short term (future proofing the full programme but noting that any upgrades would not be undertaken within the short term).

5.1.5 Supporting measures in the short term

Travel demand management

Rationale for intervention

The focus of the travel demand management envisaged as part of this programme is on redistributing demand away from private vehicle use to the PT system.

The TDM interventions will be specific to corridors and areas where PT improvements are proposed, and will focus on the PT elements of TDM, rather than the application of a suite of policies and strategies to reduce demand overall.

The TDM interventions that are recommended are being explored and budgeted for as part of a separate TDM Business Case. This comprises measures targeted at primary, secondary and tertiary students, employee travel planning, community travel planning, cycle training, e-bike/e-scooter promotion, development of park and ride strategy, parking policy and pricing review, development of freight policy, development of accessible city policy and development of neighbourhood plans. The separate business case also includes an "exemplar" TDM package for Lincoln/Halswell PT corridor to support the various sections of PT improvements from Addington Village through to Waka Kotahi state highway NZUP section[62] and the two additional CCC sections.

The programme recommended through PT Futures will build on those initiatives and roll them out where services changes are proposed.

Key benefits

TDM measures will:

- Enhance customer's knowledge of the benefits of the system
- Attract more customers to the service; (and those that shift from cars to PT will contribute towards reduced congestion and pollution reduction)

This will be achieved by:

- Council/ECan representatives visiting tertiary campuses at stages in the programme where they achieve accessibility benefit due to frequency enhancements or network changes. The aim of the campaign will be to explain the changes to the network and work through with students how they can change their behaviour to make use of the newly created opportunity. It will also involve allowance for incentive packages with free MetroCard with two weeks' worth of travel loaded
- Council/ECan representatives will door knock at residential properties targeted along key routes that receive a service increase. The aim of the campaign will be to explain the changes to the network and work with households along the route to explain how they can change their behaviour to make use of the newly created opportunity. It also includes incentive packages with free MetroCard with two weeks' worth of travel loaded

For the short-term interventions these TDM packages will focus on the residents in the larger towns that will receive benefit through enhanced direct services, as well as residents living within the inner core of Christchurch City that will receive benefit through the short turn enhancements.

[62] The NZUP section of Halswell Road extends from the intersection with Curletts Road / Hoon Hay Road through tot the intersection with Dunbars Road.

Information campaigns

Rationale for intervention

The staging of the programme requires a regular change in the frequency/routing patterns across the network - on average every two years. There is therefore a need to inform the general public on a regular basis of these changes.

Construction work along key bus routes will also disrupt services (and general traffic) with a regular need to communicate these to the public.

Key benefits

- Shift in public perception of PT service in Christchurch
- Enhanced knowledge of the PT system and its benefits
- Less community/customer complaints

This will be achieved by:

Regular information campaigns aligned with changes to the network during the short-term programme roll out. This will involve, social media campaigns, flyers, radio ads and information in local newspapers

Bus lane enforcement

Rationale for intervention

The proposed bus lanes will only provide the predicted benefits if they are enforced to prevent people parking and driving cars in them. The customer insights work highlighted a perception that existing bus lanes are currently not well enforced and are not providing the full benefits that they should be.

Christchurch City Council suspended camera enforcement of bus lanes for several years following the earthquakes. They resumed in 2017 with a single mobile camera unit, which resulted in a marked increase in the number of offenders being issued fines. Since 2017 they have invested in three sets of permanent, semi-automatic cameras (two on Riccarton Road, one on Main North Road) which automatically make a recording of detected infringements, which an officer then reviews before issuing infringement notices.

These cameras are primarily used to police moving vehicle infringements (i.e. people driving their vehicles in the bus lane). Parking is enforced separately, primarily through officers on the street monitoring parking and either issuing drivers infringement notices and in some cases liaising with a tow-truck to shift vehicles. Parking offences are generally short-term in nature, e.g. people parking their cars for a few minutes while they access a shop. As such, officers will often have contact with the driver who will shift the vehicle before there is time for a tow truck to arrive.

Key benefits

The recommended option includes additional operating expenditure to provide for three additional enforcement officers, meaning the new sections of bus lane can be patrolled and offenders issued infringement notices.

5.2 DESCRIPTION OF MEDIUM-TERM INTERVENTIONS

5.2.1 Design philosophy for the medium-term interventions

The short-term interventions (Years one to six) focus on the core part of the PT network where there is the greatest density and demand, while the medium-term interventions (Years seven to ten) focus on substantial route changes to keep pace with the forecast growth in population and economic activity. The changes will create PT capacity across the region, improve coverage and reduce transfers.

These improvements will leverage capacity created through the short-term programme to enhance access to economic and social opportunities to residents in outer suburbs. It does this by introducing branching of services on key routes.

The medium-term interventions expand the frequent network and connect new greenfield areas to opportunities, whilst providing single seat journeys to the city centre (via a KAC) on frequent services from more locations in the city.

The network aims to provide mode choice to customers beyond pure commuting needs with enhanced weekend services, as well as more direct cross city connectivity opportunities (in the peak and off-peak periods).

5.2.2 Medium term service improvements

Branch out from core routes

Rationale for intervention

The UDS and Our Space development strategy for Greater Christchurch's seeks to not only intensify the inner core, but also significantly develop greenfield areas on the city fringe as well as in the towns of Waimakariri and Selwyn.

Over the next decade the Rolleston area is forecast to grow by 8,000 people (+31%); Lincoln by 6,000 people (41%) and Rangiora by 5,000 (+27%). Within Christchurch City, Halswell is forecast to grow by 5,000 (30%) and the north-eastern suburbs by approximately 4,200 (+7%).

Most new job opportunities are forecast to occur in the central city over the next decade as the city recovers from the earthquake's impact on business activity.

There is therefore an increasing need to connect the residents (existing and new) to the opportunities in the central city – this includes employment as well as social, cultural, retail and recreational. The medium-term programme will do this by leveraging the frequencies created in the short-term programme and branch them out into the outer suburbs (refer to Figure 93).

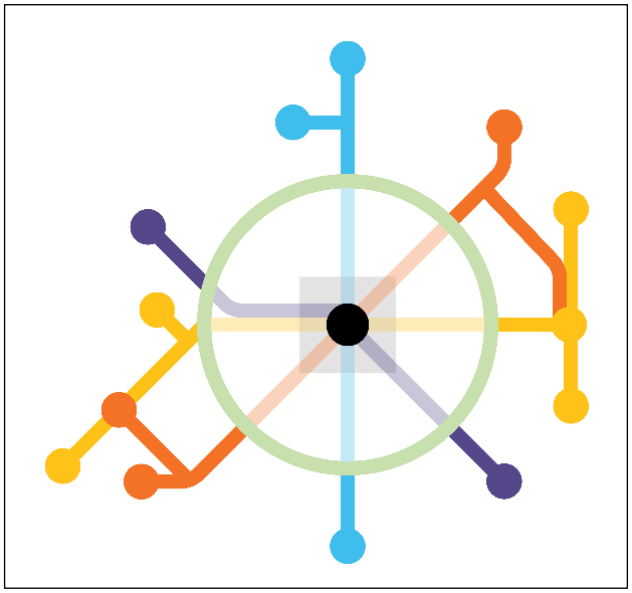


Figure 93: Medium term branching out from the core routes

Key benefits

- Enabling residents in more suburbs to have a single seat on a frequent service to the city centre
- Decreased journey time for residents in the outer suburbs through higher frequency as well as less journey time
- Provide capacity where the growth occurs
- New routes to connect key growth areas with KACs and the city centre
- Enhance the percentage of employees able to access the central city through PT

The average customer wait time on the branches would be 7.5 minutes all day, and the average wait times on the high frequency core routes inside the branches would be 3.25 minutes all day. Many of the inner core routes have other overlapping services too meaning average wait times are even lower.

This will be achieved by:

- Utilising the 7.5 min frequency on the inner core to branch out to access the outer suburbs (refer Figure 94) (note this is higher than the 5 minute headways used in the short-list assessment – headways were subsequently refined to reduce costs while still achieving most of the benefits)
- 15-minute peak on each branch
- 15 minute off-peak on each branch
- New routes to connect key growth areas with KACs and the city centre

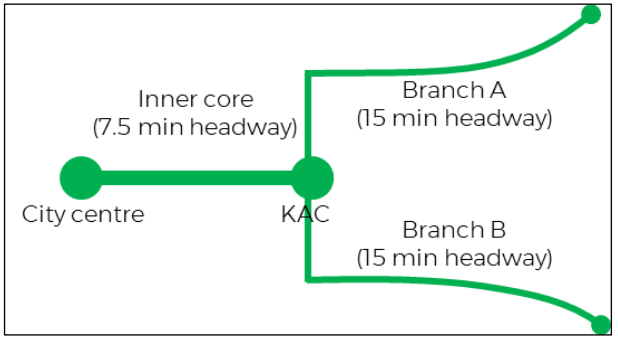


Figure 94: Medium term core and branched service frequencies

Expand frequent network coverage

Rationale for intervention

The expanded frequent network coverage will comprise routes that connect new growth areas with the city centre more directly. Specific growth areas in the south west include Halswell KAC and housing development, as well as enhanced connections between Lincoln/Prebbleton with the activity centre along Riccarton Road.

To the north east it connects growing areas in Prestons and Parklands more directly with the city centre.

Branching of the core routes also allows for these routes to be re-routed to enhance walk-up catchments to the frequent service network (refer Figure 95).

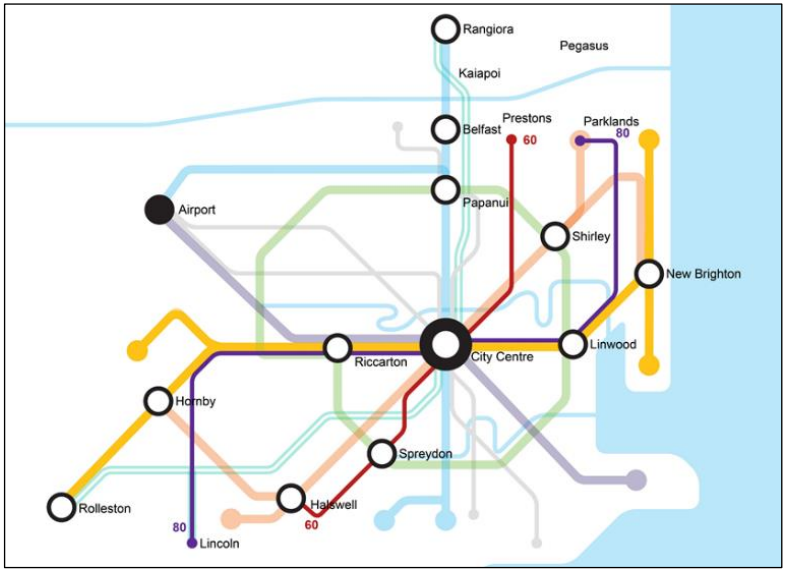


Figure 95: Medium term proposed expanded network coverage

Key benefits

- More households in Greater Christchurch with walk-up catchment to a frequent route
- Shorter journey times to more customers and greater access to employment areas and community facilities

This will be achieved by:

- Rerouting Route 60 to connect the new Halswell KAC, Barrington with the city centre in the south-western area
- Extending Route 60 to the north to connect The Palms and the new Prestons development area. This will connect the new greenfield development with a single seat to the city centre and remove need to transfer

Enhanced cross town connections

Rationale for intervention

The ability of the PT system to cater for the complex number of trips made daily requires a network of connected services that enable transfers to frequent radial routes without the need to divert the journey through the city centre (refer Figure 96).

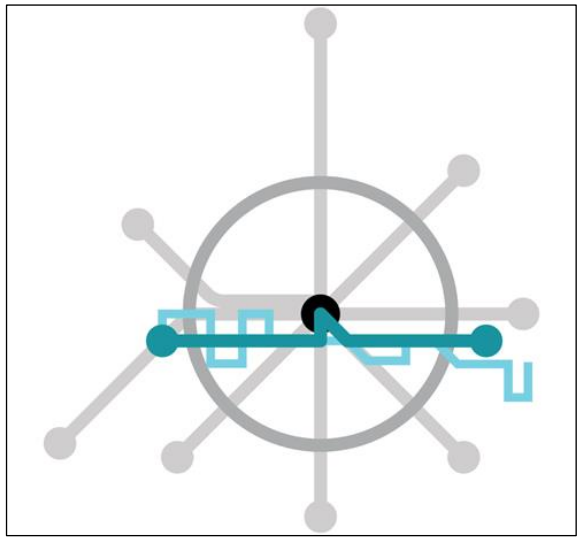


Figure 96: Enhanced, more direct cross town connections

Key benefits

- More direct (and shorter journeys for customers), reducing pressure on the city centre bus exchange
- Greater access to employment areas and community facilities
- Decreases journey times for customers making these trips

- Residents in outer areas can access the central city by PT though transfer to radial routes

This will be achieved by:

- Rerouting the connector services (100,120,125,130,140) to provide more direct connections, avoid city centre and connect in with high frequent routes at key stop locations
- Extending route 125 to provide an outer half-orbiter function to distribute trips across the outer parts of the city
- Straightening the route 140 to provide a spine through the industrial employment area and increase its frequency

Direct connections

Rationale for intervention

Direct connections are established from the large towns in Waimakariri and Selwyn in the short term. Land use forecast shows strong employment growth in the larger towns in Selwyn and Waimakariri with increased travel patterns between the city centre and the larger towns. The medium term allows for expansion to the frequency of these services to meet demand (refer Figure 97).

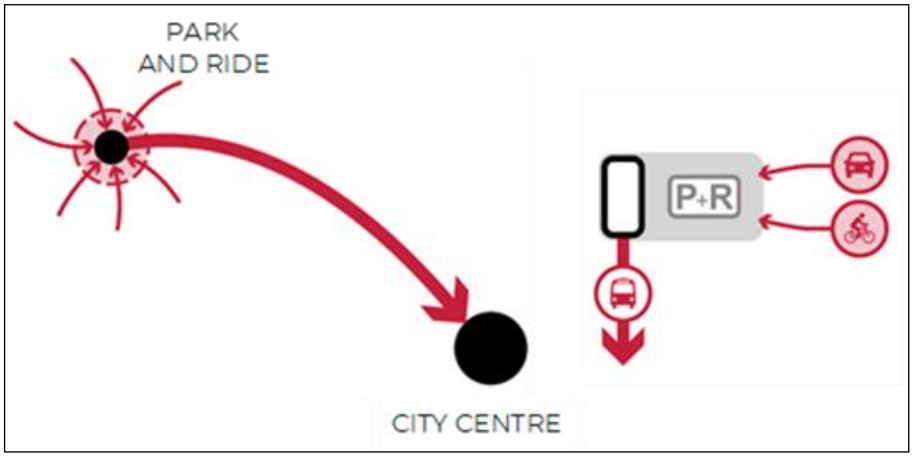


Figure 97: Direct connections in the medium term

Key benefits

- Direct services reduce journey time to be comparable with driving
- All-day services give flexibility for a more diverse range of commuters and users
- Enhanced access to the central city centre

This will be achieved by:

- All day 'direct' services to and from towns in Selwyn and Waimakariri (using motorways and with limited stops)
- 15-minute peak
- 30 minute off-peak

These services will use high-occupancy vehicle priority lanes already planned.

In Waimakariri the direct services will link to Park and Ride facilities already under development (refer to Section 5.1.3).

The programme allows for the relocation of the Rolleston park and Ride to a permanent location.

Summary of medium-term service improvements

These improvements will:

- Leverage capacity created in the short term to enhance access to economic and social opportunities to residents in outer suburbs
- Introduce branching on key routes
- Expand frequent network and connect new greenfield areas better to opportunities. Figure 98 and Figure 99 summarises the spatial changes proposed to the high frequency and city connector routes as a result of the medium-term interventions. **Appendix I** also summarises the proposed route changes
- Enhance weekend opportunities
- Enable more suburbs to have single seat ride to the central city (via a KAC)
- Enhance cross city connectivity opportunities (peak/off peak and weekends)
- Create capacity for growth across the region

A summary of the increased network frequency following the full programme (short and mid- term improvements) is outlined in Table 16.

There will be five new routes considered frequent routes. Routes 17, 28 and 29 will become frequent routes following the short-term improvements with Routes 60 and 80 becoming frequent routes following the mid-term improvements.

Table 16 Increased network frequency following medium-term improvements

Route	Existing frequency		Increased frequency	
	Peak	Inter peak	Peak	Inter peak
Blue (Route 1) / Yellow/ Purple/ Orange Lines	10min	15min	7.5min 15 min (branched section)	7.5 min 15 min (branched section)
Orbiter	10min	10min	7.5 min	7.5 min
Route 29	30min	30min	10 min	15 min
Route 17	30min	30min	10 min	15 min
Route 28	15min	30min	10 min	15 min
Route 60	15min	30min	10 min	15 min
Route 80	10min	30min	10 min	15 min
All direct services	N/A	N/A	15 min	30 min

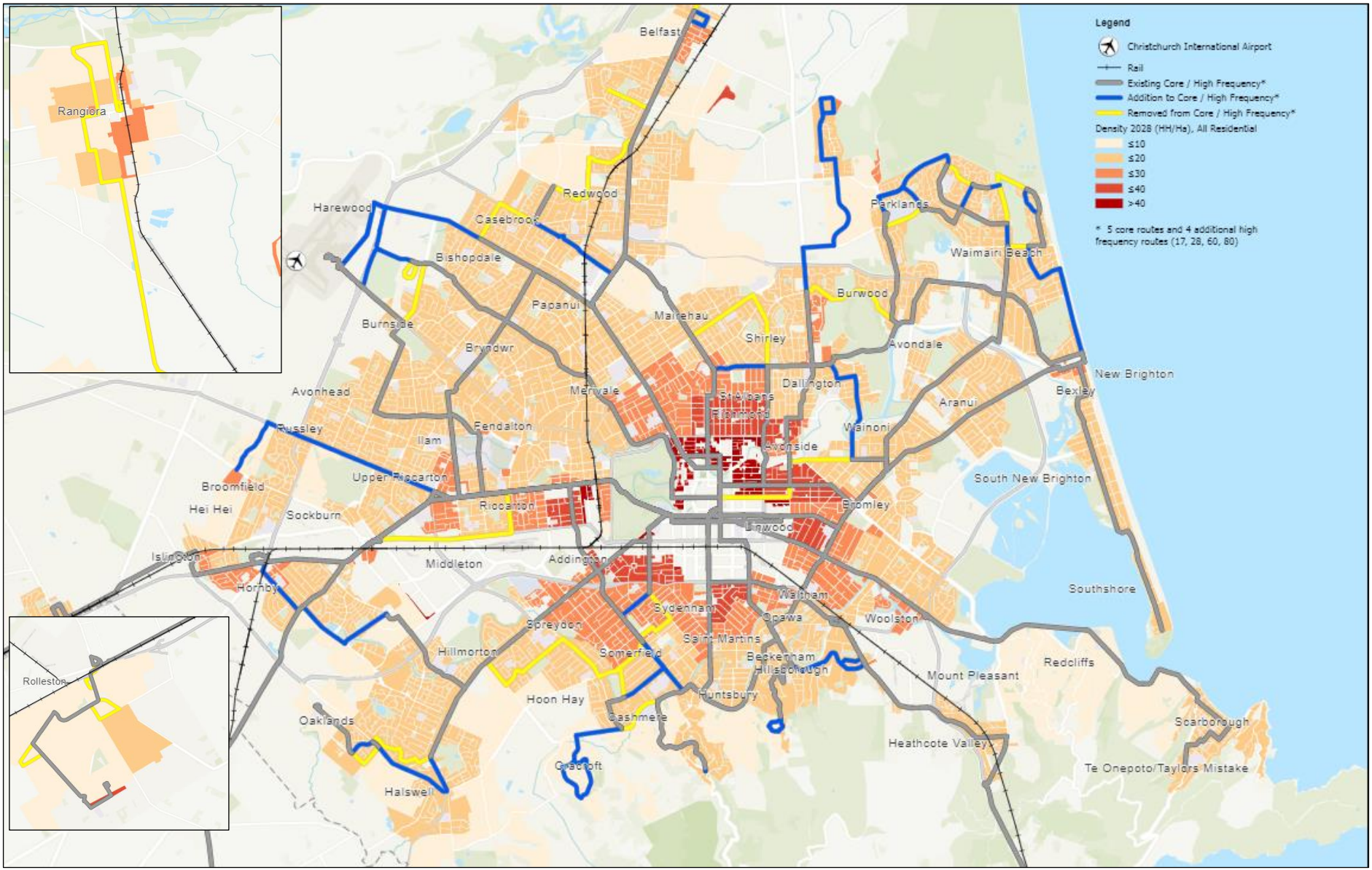


Figure 98: Medium term interventions - changes to existing high frequency (core) and additional high frequency routes

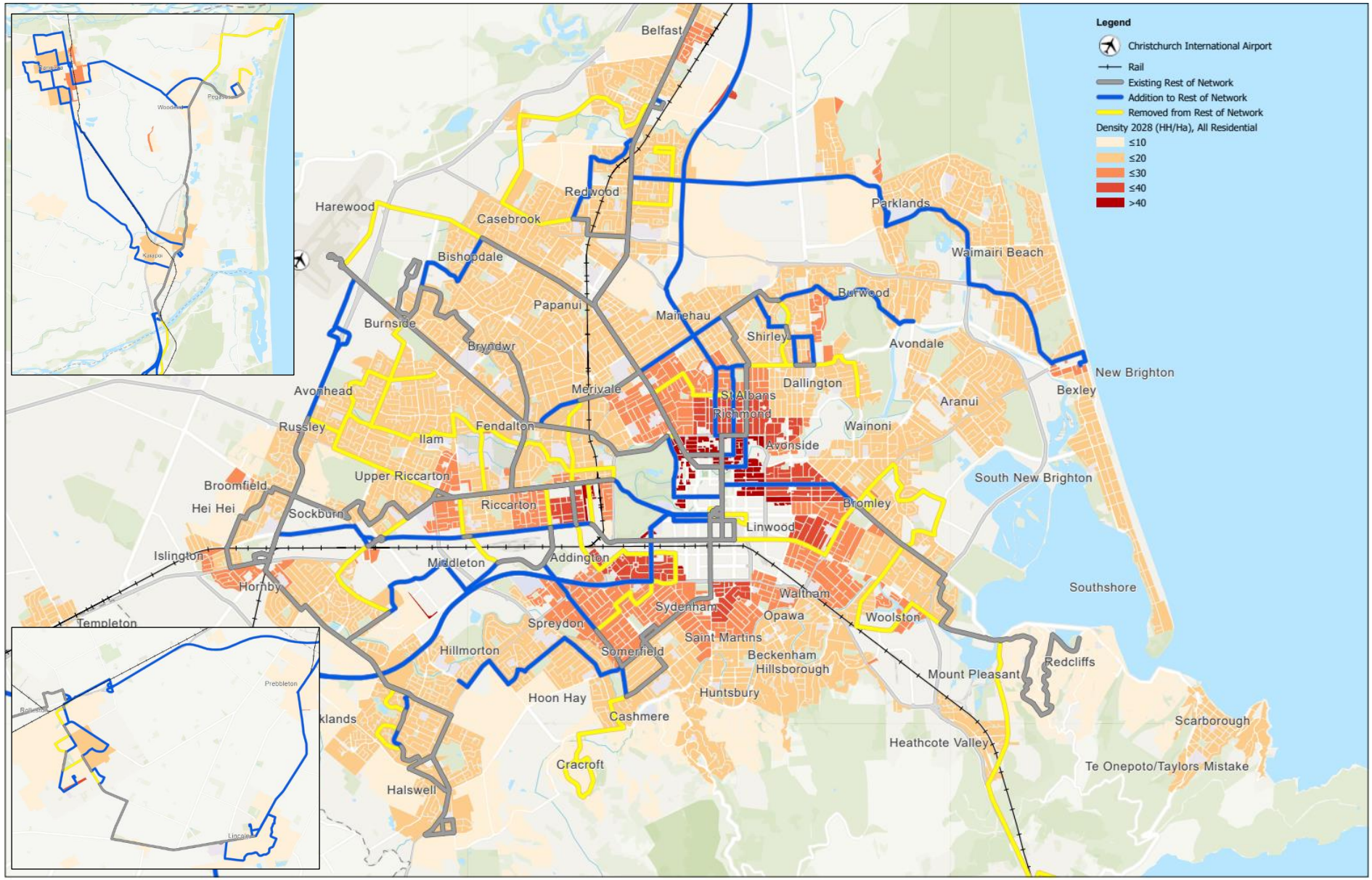


Figure 99: Medium term interventions - changes to existing city connector and suburban link route

5.2.3 Medium term infrastructure improvements

The programme proposes further expansion of the bus priority lane on the purple route (outside the inner core area).

The expansion to the frequent network (through frequency improvements to a reroutes route 60 and 80) will be supported by on board bus management system (to facilitate headway management and enhanced on board announcements).

Intersections along these routes will also be coordinated with the SCATS and real time bus system to enhance reliability at intersections.

Bus stop infrastructure provision is targeted at the changes to the frequent routes (as part of branching approach) as well as supporting the additional frequent route (route 80 and route 60) with bus stop infrastructure (shelters, timetable displays etc).

Access to the park and rides is further improved through the provision of secure cycle cages.

The additional frequency throughout the network will place pressure on the city centre bus exchange, increasing the bus volumes to approximately 130 buses per hour. This volume will exceed the operational capacity of approximately 116 buses per hour. The medium-term recommendations therefore include investment for alterations to the bus exchange to expand its capacity. A preferred option for this has not been identified, and several likely options are shown in **Appendix R**. The expansion will most likely require land purchase of the adjacent section (173 Tuam Street) with budget allocation for this reflected in the short-term programme.

A summary of the likely infrastructure programme to support the medium-term service improvements is shown in the table below.

Table 17 Medium term service improvements

Improvement	Comment
Bus lane priority	Approximately 2.0 km
Bus management system (on board units)	Bus fleet increases from ~250 to 315 buses
Intersection priority	12 further signal priority linked with real time system
Bus stop infrastructure	70 shelters 70 RTI displays, 44 Screens 8 Bike cages, 13 Bike racks
Park and Ride	Relocation of temporary Rolleston Park and Ride to a permanent site
Bus interchange	Enhancements to the central bus interchange

5.2.4 Supporting measures for the medium term

The medium-term interventions will be supported with similar measures included in the short-term interventions report.

The focus of the travel demand management envisaged as part of this medium-term programme will focus on the areas where the branching will be introduced, as well as a focus on the employment areas along route 140 and at Lincoln University which will benefit from frequency improvements along route 80.

The changes will also be supported with information campaigns aimed at the wider public to explain the branching operations, as well as the benefits associated with more frequent route coverage.

5.2.5 Demand responsive transit and micromobility opportunities

This business case report discusses opportunities for micro-mobility and demand responsive transit at a high level but does not provide detailed recommendations. Further explanation is included in the technical note in **Appendix U**.

Demand responsive transport (DRT) and micro mobility options are not a panacea but can bring many benefits to a city, for example by providing a first-last leg connection to PT, enabling more efficient use of transport assets by encouraging sharing and reducing emissions by enabling a mode shift away from solo car-driving.

'CB Insights' research shows a relationship between transport choice and how far a customer wants to travel on a trip, or on one leg of a trip.

Micromobility and Demand Responsive Transit (DRT) have the potential to increase the distances people can cover to get to and from the frequent network.

Figure 100 shows which trip distances the newer modes can support when they're readily available in the transport mix.

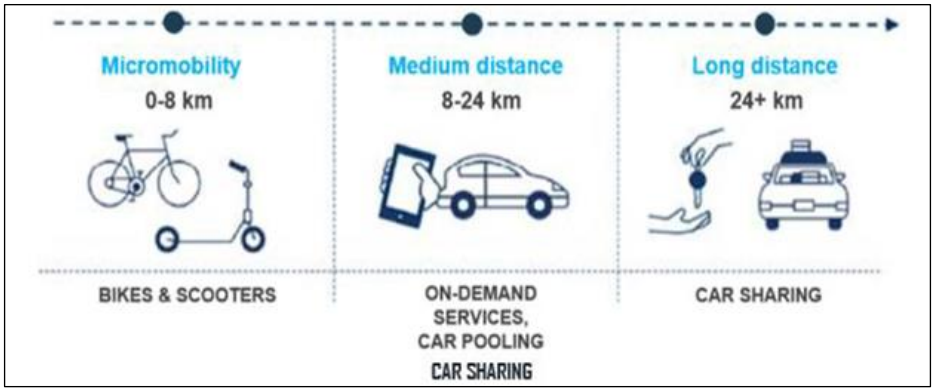


Figure 100: Trip distances

Micromobility

Micromobility is the use of small mobility devices, designed to carry one or two people. E-scooters, bikes and e-bikes are some of the existing and emerging examples of micromobility offerings (DfT, 2019). Key forms of micromobility recently observed in the New Zealand market include:

- Dockless shared e-scooters (e.g. Lime, Flamingo, Beam)
- Shared e-bikes (e.g. Jump/Lime, Big Street Bikers in Auckland, no trial in Christchurch)
- Dockless shared bikes (e.g. Onzo in Auckland, Lime)
- Docked shared bikes (e: Nextbike)
- Shared electric mopeds (Kwikli in Auckland, no trial in Christchurch)
- Personal mobility devices (user owned e-scooters and other micromobility devices)

There are active e-scooter trials and people using personal devices. Until there were no bike share and e-bike trials or schemes operating in Christchurch. In November 2020 Lime/Jump began a 12 month trial of dockless e-bikes.

By integrating micromobility with public offering in Christchurch, it is possible to encourage more people to use public transport (including current non-users and marginal users) through a connection to public transport deserts, provide improvement to the customer end-to-end journey and achieve better value for money without compromising accessibility. For the customer, interventions also have the potential to remove the need for private vehicle ownership and provide greater travel choice. Another key benefit of on-demand shared mobility intervention resulting from a reduction in solo car driving would be a reduction in emissions that could help Christchurch/ New Zealand meet its targets and commitments under COP21, C41 Cities and the Climate Change Action plan.

Demand responsive transit

Demand responsive transit is an alternative to fixed-route fixed-timetable PT that has been generating increased interest internationally. It can be categorised into two models:

Table 18 Models of operation for demand responsive transit

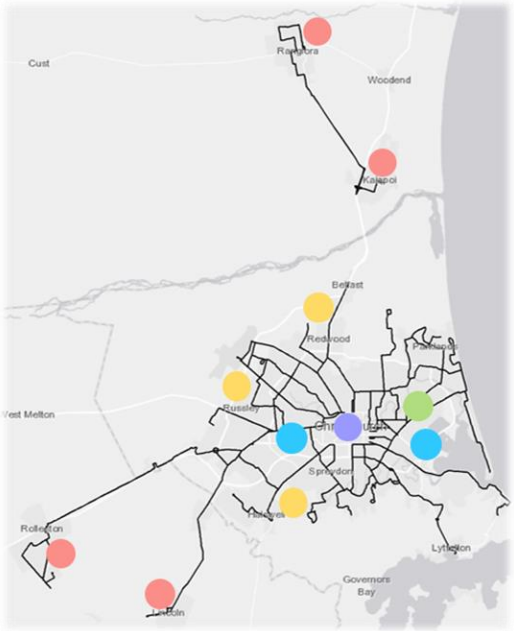
Point to hub	Point to point
Trips all start or end at one point, such as a key intersection, transport hub or activity centre.	Trips can start and end at any location within a defined catchment
Examples include AT Local, Auckland; TfNSW trials	Examples include My Way, Timaru; Regional trials undertaken by TfNSW

The relationship between demand responsive transit and traditional PT can take three forms:

- **Complement existing services:** by providing a first-last leg connection to scheduled, fixed route PT
- **Replace existing services:** where scheduled, fixed route PT services are inefficient to run, and access could be improved by providing on-demand/shared mobility solutions
- **Supplement existing services:** a low frequency bus route could be supplemented by an additional on-demand/shared mobility service where there is low demand outside of standard working hours e. g. early morning and late night

Table 19 below provides indicative locations in Christchurch that, subject to further investigation, could benefit from demand responsive transit. These were identified at a high level by analysing land use patterns, economic deprivation, reliance on private car, and access to the existing and planned frequent services. The table also makes comment on the potential for micro-mobility to work with DRT in these areas.

Table 19 Indicative locations in Christchurch

DRT – Christchurch context	Type of location	Rationale
 **Key** Larger Towns in Selwyn and Waimakariri Suburbia Socioeconomic Disparity Employment Zones Inner City	Larger Towns in Selwyn and Waimakariri	Larger towns in Selwyn and Waimakariri typically have poor PT coverage, and the expansion of the PT fixed network lags new greenfield development. This has resulted in poor PT uptake and mode share. The towns also have limited travel choices, with micromobility trials remaining within the Christchurch City limits, increasing the reliance on private vehicles. However, the forecast population growth, shifting travel patterns with workers returning to the central city and flexible working post Covid-19 present an opportunity to change travel habits. Example locations: Rangiora, Kaiapoi, Rolleston and Lincoln. Focus on first and last leg if it is possible to connect to the frequent network.
	Suburbia	Analytics undertaken in the long list and short list phase show poor PT patronage from the Northern Suburbs and the Outer West. DRT could replace coverage routes that offer uncompetitive journey times and have poor patronage. There is also an over reliance on the private car. The outer suburbs have some cycling infrastructure available. There is potential for micromobility to connect into FTN routes, subject to safe parking facilities and infrastructure. Example locations: Northwood, Hoon Hay or Avonhead. Focus on first and last leg if it is possible to connect to the frequent network.
	Socioeconomic disparity	Areas of Christchurch with socioeconomic disparity often have an over reliance on private vehicles. Eastern Christchurch faces a range of socioeconomic issues following the 2011 earthquake. There is an opportunity to improve access to jobs and services and ensure that those without access to a car are not socially isolated. Example locations: Wainoni. Focus on first and last-leg if it is possible to connect to the frequent network; cater to non-standard work hours; affordable on-demand services.
	Employment Zones	Employment zones will have many similar trips to one location that present an opportunity to reduce congestion. The PT Futures proposal has a high frequency bus route operating with ten-minute headways during the AM and PM peak, and limited to no service outside these hours. DRT could supplement this service outside of those peak hours to cater for non-standard hours of work. Other opportunity for DRT is employment zones that have limited parking and similar trips to one location. These could be tertiary education campuses or hospital precincts. Example locations: University of Canterbury, Bromley or Middleton. Focus on first and last leg to improve the reach of frequent services.
	Inner City	The new Christchurch District Plan has 'up zoned' areas to allow for medium and high-density housing redevelopments. These areas of medium and high-density present opportunities to trial car share, bike share, e-scooter share, carpooling. There are parts of the central city that are underserved by the PT network, such as the West-end. Micromobility schemes such as car share, bike share, e-scooter share could address first and last leg improvements within the central city.

Matters for consideration

The recommendations of this business case do not include any investment in micro-mobility or demand responsive transit. It assumed the network would be operated as fixed-route services, and that demand responsive transit would only be implemented if it required a comparable or lower level of investment.

There are several matters that would need to be carefully considered before implementing micromobility solutions as part of the medium-term solution for the recommended programme. These include:

- Funding: a wide range of private and public funding arrangements are possible. Legislation is still adapting to technological changes
- Pilots and Trials may be a suitable pathway for implementation
- Safety impacts are not as well understood as more traditional transport
- Privacy and Security needs to be addressed
- Competition with PT needs to be understood
- Competition with walking and cycling needs to be understood
- Digital and financial exclusion: The equity impacts on people who can't access the system through not having a smartphone, financial barriers or mobility barriers need to be understood
- Specific allocation of road space may be required for these modes (e.g. scooter parking and lanes, demand responsive transit stops)

More discussion on these is included in the technical note in **Appendix U**.

5.3 STAGING AND SEQUENCING OF THE RECOMMENDED OPTION

5.3.1 Recommended staging

This section sets out the recommended staging. There are however alternative staging options for implementing the programme, if the triggers outlined in the management case suggest the programme should be accelerated or deccelerated. One such alternative staging scenario includes slowing down the introduction of new routes to provide a more affordable programme in the short term, and is described in detail in Appendix W.

The short-term improvements entail several routes that receive service upgrades supported by infrastructure improvements (physical bus priority, signal pre-emption, bus stop shelters, RTI displays). These services provide additional capacity to the PT system that enable it to respond to the projected growth for the next decade. A staged introduction of these services was considered to ensure optimal value for money that allow for the timely provision of the capacity balancing the need to create room for growth with risk of providing too much capacity to early in the decade.

The sequencing has been determined by considering the following factors:

- The current commercial ratio of the service. This is the ratio between cost of operating the service and the farebox take from it. Routes with higher commercial ratio were considered likely candidates for earlier intervention
- The additional cost per new boarding. This considered the estimated incremental cost to provide the upgrade in relation the likely additional patronage it would attract based on 2028 forecast demand as determined from the project model. Improvements that require the lowest cost per additional boarding by 2028 were favoured for earlier intervention under this criterion
- The absolute number in additional boardings. This criterion considered the absolute increase in boardings between 2018 and 2028 as a result of the intervention and favoured the highest number of new boardings for early staging
- The percentage increase in new boardings over the existing ridership, with staging based on highest to lowest percentage
- The number of existing boardings on each route, which gives an indication of the benefits of investment to existing users (e.g. faster trips, reliability, shorter waits, better shelter)
- The staging considered the likely implementation timeframes of other committed projects and how these improvements will integrate with those. The staging sequence under these criteria aimed to align opening of improvements with those other projects
- Staging criteria also considered current land use activity and likely development areas over the next decade, favouring existing hotspots in development for early intervention

Customer surveys also provided insights into likely clusters of key destinations where participants felt car trips could be replaced with bus trips. This showed a strong preference for central city and south western areas of the city.

The table below summarise the key aspects of the staging. The purple line scored well against the staging criteria; however, it was delayed in the sequencing due to the proposed service upgrade it will receive under the Do-Minimum scenario as well as delays in ability to implement further improvements prior to the completion of the Ferry Road cycleway. The Orange

Line was slightly elevated in its sequencing largely to tie in with the Lincoln Road project staging programmed for delivery early in the decade and the Halswell Road Improvements Detailed Business Case being prepared to consider bus priority measures as part of the New Zealand Upgrade Programme for the section of Halswell Road between Dunbars Road and Curletts Road.

Table 20: Key aspects of staging

	Staging based on various criteria					Recommended staging for short term improvements (Years 1-6)	
Sequencing Order	**Additional boarding (number)**	**Additional boarding (percent)**	**Existing boardings**	**Additional cost per additional boarding**	**Existing commercial ratio**	**Integration with other projects**	
	Purple Short Turn	RNGX	Yellow	28	29	CSC – HOV lanes, PnRs and direct services Blue – Brougham St project Direct Services – Selwyn St bus lanes Orange – Lincoln Rd/ Halswell Rd projects Purple – Ferry Road cycleway	Yellow ST
	28	KAIX	Purple	Blue Short Turn	Yellow		28 ST
	Blue Short Turn	LINX	Orbiter	Yellow Short Turn	Purple		17
	Yellow Short Turn	ROLX	Blue	Purple Short Turn	17		LINX (start-up service)
	Orbiter	29	Orange	17	Orange		Blue ST
	17	Purple Short Turn	28	Orbiter	ROLX		Orange ST
	RNGX	17	17	29	Orbiter		Purple ST
	Orange Short Turn	28	29	Orange Short Turn	Blue		Orbiter
	29	Blue Short Turn	ROLX	RNGX	28		29
	KAIX	Yellow Short Turn		KAIX			RNGX (expanded)
	LINX	Orbiter		LINX			KAIX (expanded)
	ROLX	Orange Short Turn		ROLX			LINX (expanded)
							ROLX (expanded)

The table below shows the resulting staging of the service improvements. The timing of the associated infrastructure improvements generally lags these by 2-5 years due to the longer lead-in times for pre-implementation, consultation and procurement.

Table 21 Staging reason

Stage	Description		Staging reason
Implement in Years 1 - 2	1.1 Short Turn on Yellow Line	Short Turn overlay between Church Corner and Wainoni to increase frequency on the Yellow line to 7.5 minute during the peak and 10 minute in the inter-peak.	Will take advantage of the investment completed along Riccarton Road. The yellow line route has a high commercial ratio and is forecast to attract a high number of additional boardings with one of the lowest ratios of additional cost to boardings. The eastern section of the route (east of the city centre) is also well position to service the cluster of development occurring in the Gloucester Street location.
	1.2 Upgrade Route 28	Short Turn overlay between Papanui and Hillsborough to increase frequencies along that part to 15 minutes all day.	This section of Route 28 serves existing demand patterns in the St Albans area very well, and as a result is attracting high number of new boardings at the lowest cost per additional boarding of all the short-term routes. The entire route has a poor commercial ratio likely due to parts of the route outside the inner core (and not part of this upgrade) that present a very indirect route.
	1.3 Upgrade Route 17	Increase frequencies to 15 minutes all day. Extend route to connect with the airport.	This route has a very high commercial ratio, serves a reasonable demand pattern at a very effective cost per boarding ratio. It can also be implemented with very little infrastructure (bus lane) improvements and serve a portion of the city that has no access to frequent PT (but strong O-D pattern to the city centre).
	1.4 Direct Service	Introduce a direct service from Lincoln (3 services in morning, and 3 returning in the evening).	Lincoln is the only large town in Selwyn and Waimakariri that has no direct service (like what will now be implemented in Rangiora and Kaiapoi), despite having similar growth and population size. This stage will bring it up to similar level of service.
Implement in Years 3 - 4	2.1 Short Turn on Blue Line	Short Turn overlay between Cashmere and Papanui (to bring up to 7.5 minute in the peak, and 10 minute in the inter-peak)	The Blue line attracts a high number of new boardings, at a very cost-effective rate a s a result of the short turn. The route requires infrastructure upgrades which will take time to implement and the staging has been sequenced to align with likely improvements through other investment programmes already in the area - specifically, with the Brougham/Moorhouse project that will provide bus priority along Columbo Street.
	2.2 Short Turn on Orange Line	Short Turn overlay between Halswell and Burwood (to bring up to 7.5 minute in the peak, and 10 minute in the inter-peak).	The Orange line aligns well with new development activities in Halswell as well as the eastern parts of the central city. The route requires infrastructure upgrades which will take time to implement and the staging has been sequenced to align with likely improvements through the NZ Upgrade Programme (Halswell Junction) and CCC's Lincoln Road upgrade project that will also provide bus priority along this route.
	2.3 Short Turn on Purple Line	Short Turn overlay between Ilam and Woolston (to bring up to 7.5 minute in the peak, and 10 minute in the inter-peak).	The purple line scored the highest of all the short-term improvements against the criteria and was a good candidate to implement first. This implementation was delayed allowing for the new proposed frequency upgrades prior to this programme commencing (to 10 min in the peak) to be embedded first, as well as for disruption to operations due to the Ferry Road cycle lane construction to be completed.
	2.4 Orbiter	Increase frequencies on the Orbiter to 7.5 minute headway all day.	The staging of the Orbiter has been timed to align with the completion of the radial route upgrades to ensure maximum transfer benefit between radial and orbital services.
Implement in 5 - 6	3.1 Upgrade Route 29	Increase frequencies to 10 minutes in the peak and 15 minutes in the inter peak.	Lower hierarchy and patronage uptake than the core services. It has a very high commercial ratio due to the linkage with the airport. Can be implemented independently from other improvements.

	3.2 Direct services	Improve frequency on the Rolleston, Lincoln, Rangiora and Kaiapoi Direct services to 20 minutes in the peak, 60 minutes in the inter-peak. Expand park and ride capacity in Lincoln	Direct services show a 28% increase in ridership from Waimakariri to city centre. For Selwyn the increase is 21%. These services will also enhance benefits of investment programmes already underway by partner organisations and expected to be available by year 1 of the PTF programme. Staged later in the short-term programme to allow for monitoring of the uptake of the existing proposed expansions. The existing Rolleston express is performing well against commercial ratio criteria.
Implement in Year 7 and onwards	4.1 Branching extensions on core routes	Introduce branches (15-minute peak, 20 minute IP) on Orange, Blue, Yellow Lines	Leverage of the frequency improvements through the inner core. Allow for patronage monitoring through first stages to inform the need to expand. Allow for consultation with wider public on the route changes necessary to the wider network because of the branching.
	4.2 Network changes to accommodate branching	Adjust supporting network to accommodate branching Expand frequent network by improving frequency on route 60 and 80 to 15 minute in peak and 15 minutes in inter peak. Peak services could be further increased to 10 minutes based on monitoring uptake.	Allow for consultation with wider public on the route changes necessary to the wider network because of the branching.
	4.3 Improve direct service frequency	Improve direct service frequency to 15 minutes in the peak, and 30 minutes in the inter-peak. Also introduce weekend services. Relocate Rolleston park n Ride to permanent location	Allow for monitoring of uptake in the services. Align with growth forecasts in the larger towns in Selwyn and Waimakariri.
	4.4 Bus exchange upgrades	Expand capacity of bus interchange	Additional services will push the number of buses per hour beyond operational capacity of the bus exchange. A few options exist on ways to expand the capacity of the bus interchange which requires further analysis.

5.4 SUMMARY OF THE RECOMMENDED OPTION

A summary of the recommended network is outlined in Figure 101 and Figure 102The recommended option includes the following key elements:

- Approximately 100 more buses providing more seats to more locations more often
- 229 more bus shelters providing better waiting facilities
- 190 more real time display units providing accurate information on bus arrival times
- On-board audio-visual announcements providing information on upcoming stops and transfers
- Approximately 22 kilometres of bus lanes making buses more reliable and faster
- Priority measures for buses at key intersections across the city making journeys more reliable
- Park and ride facilities at larger towns making it easier to access the bus network
- Secure bike parking at key stops providing more options with a greater catchment to frequent bus routes

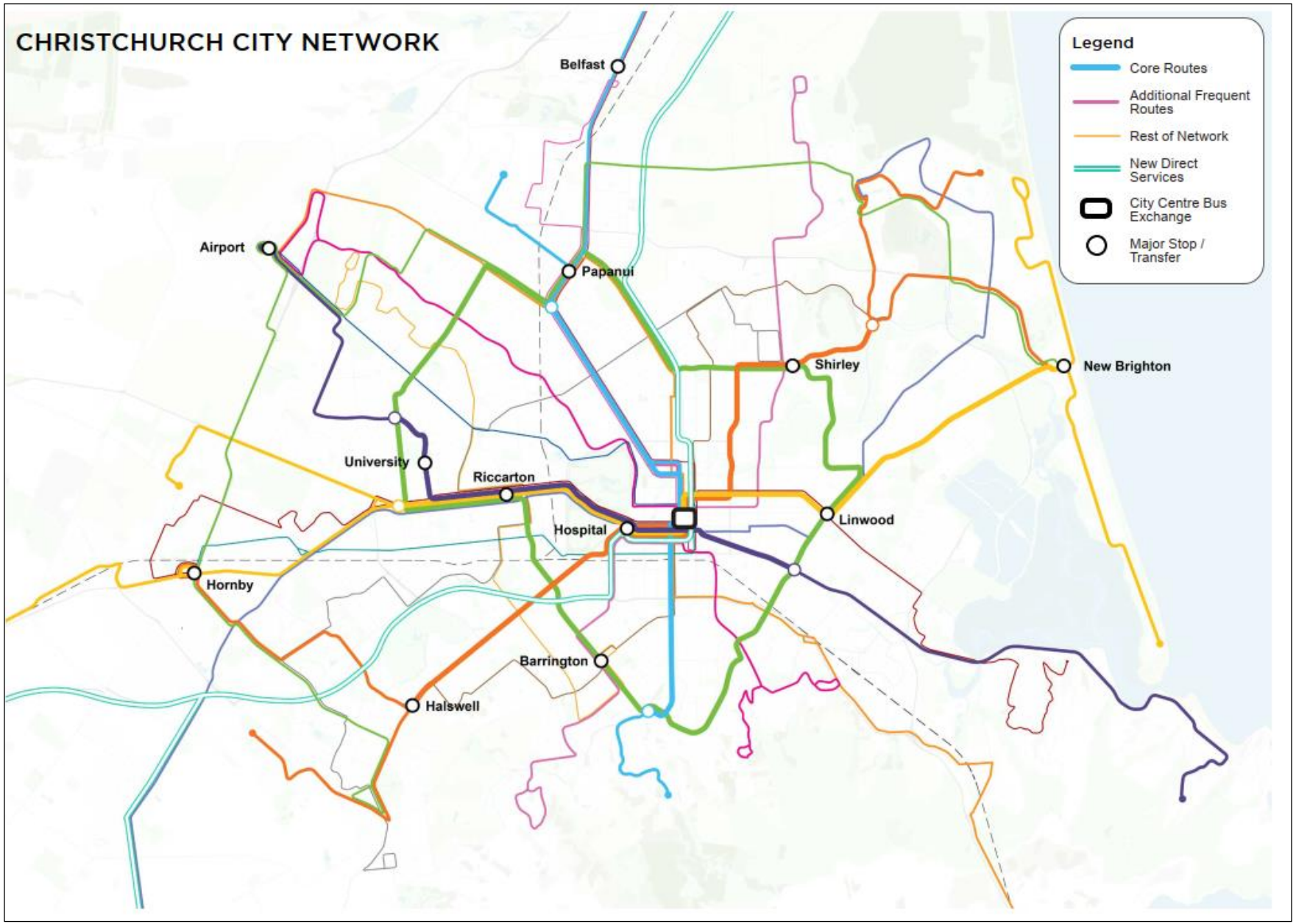


Figure 101: Summary of the recommended network

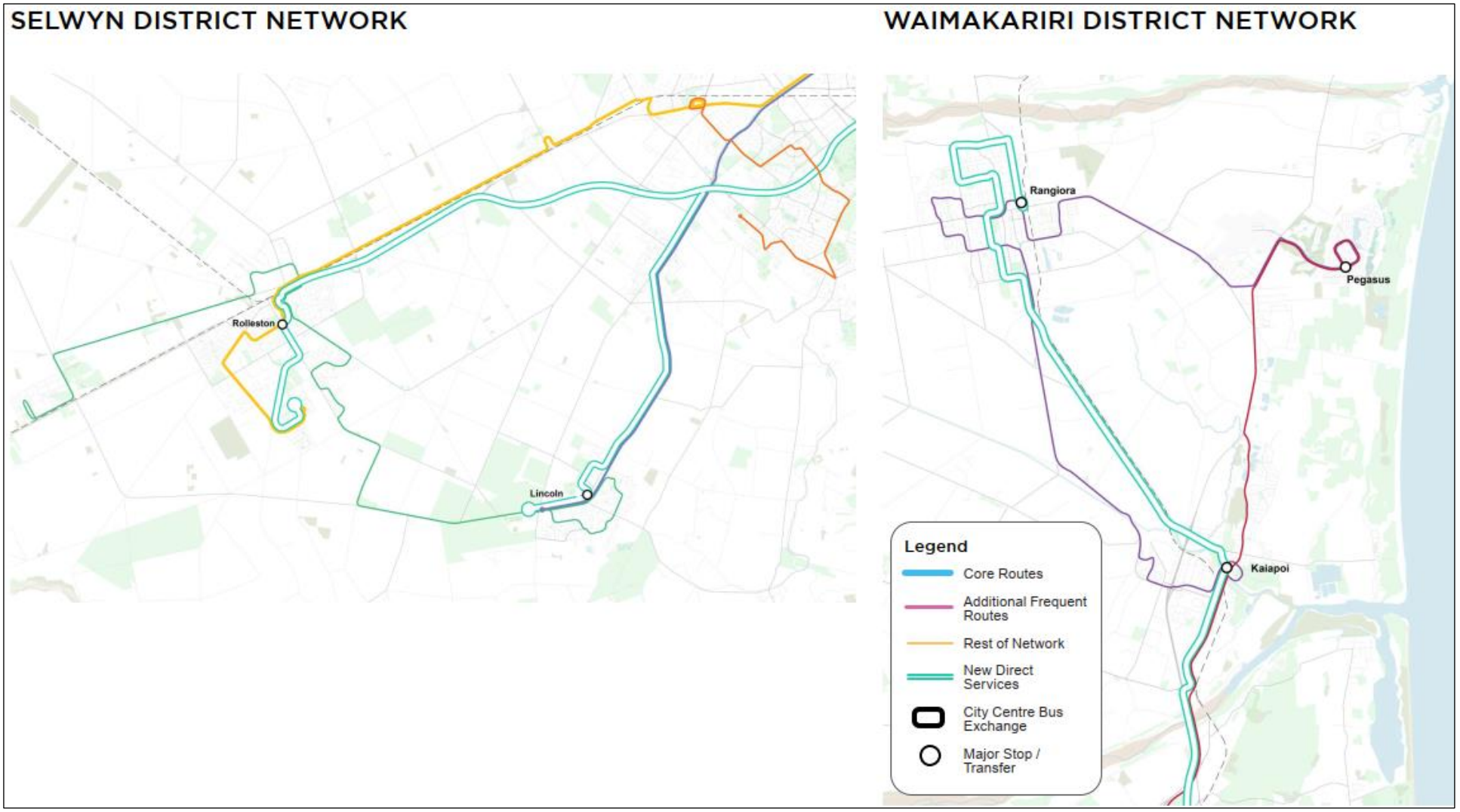


Figure 102: Summary of recommended option – Selwyn and Waimakariri

5.5 EFFECTIVENESS OF THE RECOMMENDED OPTION

This section assesses the effectiveness of the recommended improvements. Three external peer reviews have been completed on the methodology underlying this assessment of the recommended option:

i) Transport modelling methodology review, detailed in **Appendix X**
ii) Business Case Challenge Session, detailed in **Appendix Y**
iii) Economic Evaluation review, detailed in **Appendix Z**

The problem statements identified in the Strategic Case (Part A) are:

iv) The current PT system can be unreliable, and many journey times are not competitive with the private vehicle, resulting in poor PT mode share and longer and less reliable journey times (50%)
v) The current PT system is not effectively supporting highly populated/high growth areas and connections to key destinations, resulting in poor PT mode share within these areas (25%)
vi) There are a number of barriers to using PT in Greater Christchurch, resulting in a low uptake of new PT users and subsequent poor PT mode share (25%).

5.5.1 Key outcomes of the preferred solution

The Preferred Staged Option contributes to all the investment objectives, with the following headline outcomes:

- **End-to-end journey times** decrease as a result of improved wait times and in-vehicle journey times. This improves access to KACs and employment areas, including the Central City. The number of households that can access the Central City within 30 minutes on PT increases by 56% (from 168,000 households in the 2028 Do-Minimum to 262,000 households);
- **Population catchments** significantly increase within a frequent route (i.e. minimum PT frequency of 15minutes) with a 39% increase in the number of households within 400m (from 132,000 households in the 2028 Do-Minimum to 184,000 households); and
- **PT trips** increase by 3.4 million trips per year, a 21% increase from 2028 Do-Minimum, and a 43% increase from 2018. This equates to a 4.9% compound average annual growth from 2022 and 2028 (assuming an existing 1% per annum growth to 2022) (Figure 103). Note this compares favourably to Auckland's bus network which achieved approximately 3.7% per annum over the last decade (excluding Northern Busway and Rail Networks).

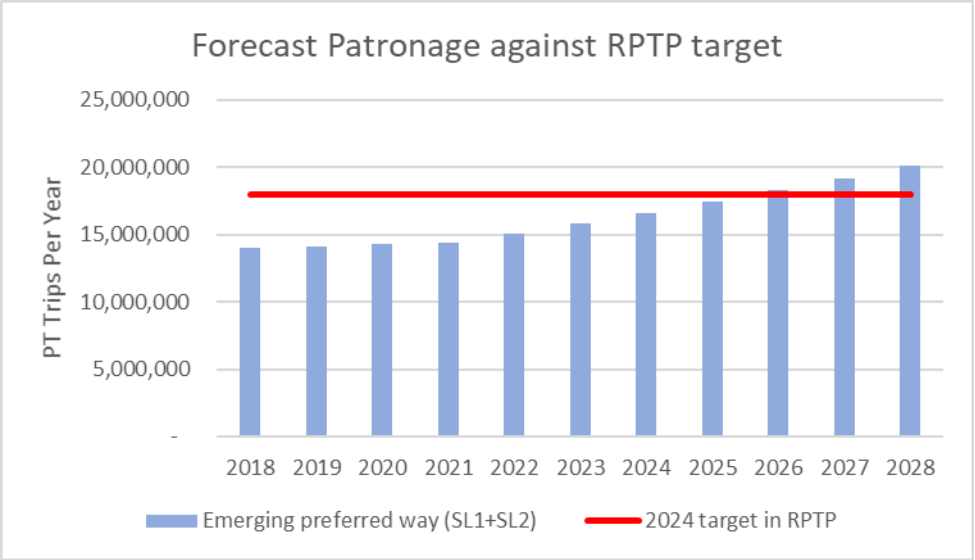


Figure 103: Patronage forecast

5.5.2 Alignment with investment objectives

Table 22 contains the Investment Objectives defined for this combined business case along with summary statements of how the objectives have been achieved for the full programme (i.e. the combined short and medium term). This is followed by a more detailed table outlining the key measure outputs separately for the short term and medium term, including shading in darker shades of green as more benefits are achieved.

Further detail around benefits achieved by corridor is presented in Table 23.

Table 22 Investment objectives – key achievements

Investment objective	Measure		Achievement of recommended improvements (short term and medium programme)
Improve journey time and reliability of PT services relative to private vehicles by 2028	In-vehicle journey time and congestion	Ratio of bus/car in-vehicle journey time along a specific route	The vehicle journey time gap between cars and PT has been reduced, to a range between 0.6 to 1.2 across the routes, compared to a ratio range between 0.9 to 1.4 in the 2028 Do-Minimum. The percentage of bus route exposed to congestion reduces to a range between 0 and 11% compared to a range between 8% and 26% in the 2028 Do-Minimum. The number of intersections with congestion reduces from 10 to 5.
		Percentage of the bus route exposed to vehicle congestion (V/C>0.5)	
		Number of intersections where PT experience a LOS worse than D	
Improve PT services to and from highly populated/high growth areas and key destinations across Greater Christchurch by 2028	End-to-end journey time and accessibility to and from key areas	Household accessibility* to **Christchurch City** (Christchurch Bus Interchange, West End, Ara Institute of Technology, Christchurch Hospital)	**Central City:** 262,000 households can access the Central City within 30minutes on PT, compared to 168,000 in the 2028 Do-Minimum, a 56% increase. **KACS:** Household accessibility to KACs increases across the region. 317,000 households can access their nearest KAC within 30minutes on PT, compared to 202,000 in the 2028 Do-Minimum. In addition, over 90% of households in the high-density residential areas can access more than one KAC within 30minutes PT. **Jobs**: 464,000 Jobs can be accessed within 30minutes on PT, an increase from 355,000 in the 2028 Do-Minimum. Accessibility to high employment zones (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington) has increased with 124,000 households able to access these locations within 30minutes PT, previously 79,000 **Selwyn and Waimakariri:** Accessibility within Rangiora and Rolleston improves with 12,500 households able to access the regions KAC within 30mins, previously 7,800 in 2028 Do-Minimum. Travel from Selwyn and Waimakariri to Christchurch with end to end journey times on PT reducing by 16%.
		Household accessibility* to **high employment zones** (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington)	
		Household accessibility* to **KACs** (Papanui, Riccarton, Hornby, Shirley and Linwood)	
		Household accessibility* to **more than one KAC** from key residential areas (North inner, Linwood, Sydenham, Barrington and Riccarton)	
		Job accessibility* from key residential areas (North inner, Linwood and Sydenham)	
		Household accessibility* to Rolleston and Rangiora centres	
		End to end journey time from Rangiora, Kaiapoi, Rolleston, and Lincoln to the Christchurch Bus Interchange using the PT system	
	Spatial coverage	Population that are located within 400m of a frequent route	39% more people live within 400m of a (15min) frequent PT route, increasing from 132,000 in 2028 Do-minimum to 184,000.

Investment objective	Measure		Achievement of recommended improvements (short term and medium programme)
Remove barriers to the uptake of PT by 2028	Environment	Private Vehicle Km travelled	Total Private Vehicle Km travelled per year decreases by 19.7M, which equates to a reduction of 37km per year per capita (less than a 1% reduction from 6806km/capita in 2028 Do-minimum to 6769km/capita). There is effectively no change to PM10 nor NO2 emissions. There is a minor increase in CO2 emissions (2700tn/yr, 4%), which will reduce to zero or less if electric buses increase from 10%, assumed in the Do-minimum, to 23%. Note that increases to electric fleet are being progressed a separate piece of work.
		Greenhouse gas emissions (CO2) from all transport sources	
		Air Pollution (PM10 and NO2) from all transport sources	
	PT ridership	Annual PT trips per capita	Annual PT trips increase by 3.5 million, from 16.5 million trips per year in the 2028 Do-Minimum to 20.1million per year (21% increase). This equates to 38 trips per capita per year, from 31trips per capita per year in the 2028 Do-Minimum.
		Proportion of trips made by PT	
	Perception in ease of use of PT system	Improve perceived ease of use of PT system	Use of technology, marketing, real-time information at stops and on-board announcements will improve the ease of use of the PT System. Travel Demand Management will help new users plan their trips. The National Ticketing scheme will make it payment easier through a unified payment system for the country, especially benefitting new users and visitors to Christchurch.

Table 23 Investment objectives and key performance indicators (KPIs)

Key:

Rating	Description
3	Significantly positive
2	Moderately positive
1	Minor positive
0	Neutral

Investment objective	Measure		Summary results compared to 2028 base (Do-Minimum)	
			Short term option years 1-6	Full option years 7-10
Improve journey time and reliability of PT services relative to private vehicles by 2028	In-vehicle journey time and congestion	Ratio of bus/car in-vehicle journey time along a specific route	Reduces (same across both options):	
			Blue Line NBnd remains at < 1	
			Blue Line SBnd remains at 1.1	
			Orange Line NBnd 1.1 to < 1	
			Orange Line SBnd 1.2 to 1.0	
			Purple Line EBnd remains at < 1	
			Purple Line WBnd 1.4 to 1.2	
			Yellow Line Ebnd 1.0 to < 1	
			Yellow Line WBnd 1.3 to 1.1	
		Percentage of the bus route exposed to vehicle congestion (v/c>0.5)	Reduces (same across both options)	
			Blue Line 8% to 6%	
			Orange Line 19% to 9%	
			Purple Line 26% to 11%	
			Yellow Line 16% to 0%	
		Number of intersections where PT experience a LOS worse than D	Reduces from 10 to 5 intersections	
Improve PT services to and from highly populated/high growth areas and key destinations across	End-to-end journey time and accessibility to and from key areas	Household accessibility* to **Christchurch City** (Christchurch Bus Interchange, West End, Ara Institute of Technology, Christchurch Hospital)	Increase by 29% (From 168,000 to 218,000)	Increase by 56% (From 168,000 to 262,000)
		Household accessibility* to **high employment zones** (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington)	Increase by 29% (From 79,000 to 102,000)	Increase by 57% (From 79,000 to 124,000)

Investment objective	Measure		Summary results compared to 2028 base (Do-Minimum)	
			Short term option years 1-6	Full option years 7-10
Greater Christchurch by 2028		Household accessibility* to **KACs** (Papanui, Riccarton, Hornby, Shirley and Linwood)	Increase by 30% (From 202,000 to 263,000)	Increase by 57% (From 202,000 to 317,000)
		Household accessibility* to **more than one KAC** from key residential areas (North inner, Linwood, Sydenham, Barrington and Riccarton)	92% HH have access	91% HH have access (From 83%)
		Job accessibility* from key residential areas (North inner, Linwood and Sydenham)	Increase by 16% (From 355,000 to 410,000)	Increase by 31% (From 355,000 to 464,000)
		Household accessibility* to Rolleston and Rangiora centres	No Change	Increase by 60% (From 7,800 to 12,500)
		End to end journey time from Rangiora, Kaiapoi, Rolleston, and Lincoln to the Christchurch Bus Interchange using the PT system - AM Peak	Average 15% faster	Average 16% faster
	Spatial coverage	Population within 400m of a frequent route	Increases by 24% (From 132,000 to 164,000)	Increases by 39% (From 132,000 to 184,000)
		Population within 800m of a frequent route	Increases by 27% (From 267,000 to 309,000)	Increases by 27% (From 267,000 to 338,000)
Remove barriers to the uptake of PT by 2028	Environment	Private vehicle kilometres travelled per capita	Decrease by 0.4% (From 6,806km to 6,781km)	Decrease by 0.6% (From 6,806km to 6,769km)
		Annual CO2 emissions from all transport sources	Decrease by 0.03%, 200 t/yr (From 677,800 to 677,600)	Increase by 0.4%, 2,700 t/yr (From 677,800 to 680,500)
		Annual PM10 emissions from all transport sources	No Change (70 t/yr)	No Change (70 t/yr)
		Annual NO2 emissions from all transport sources	No Change (120 t/yr)	No Change (120 t/yr)
	PT ridership	Annual PT trips	Increase by 13% (From 16.6M to 18.5M, or from 31 to 35 per capita)	Increase by 21% (From 16.6M to 20 M or from 31 to 38 per capita)
		Proportion of trips made by PT	Increase by 13% (2.4% to 2.7% PT mode share)	Increase by 21% (2.4% to 2.9% PT mode share)
	Perception in ease of use of PT system	Improve perceived ease of use of PT system	Programme across core routes, 17, 28 & 29 including: Marketing, TDM, bus stop shelters, RTI screens, integration with cycling and park-n-ride.	Programme extended to core route branches, 60 & 80 including: Marketing, TDM, bus stop shelters, RTI screens, integration with cycling and park-n-ride.

Benefits summarised by key corridor between 2018 and the 2028 medium term option are further outlined in the following table. This summarises PT boarding numbers and household catchment numbers by overall route. Travel time only focuses on the AM peak only, hence is reported for the inbound city direction only (for key sections of each corridor). It indicates that all corridors achieve an increase in boarding numbers, an increase in catchment area and a decrease in travel time difference.

Table 24 Improvements by corridor

Route	Measure	2018		2028 preferred options (medium term)	
Blue	Daily boarding	5,700		8,100 (+2,400)	
	Households within 800m	27,100		33,000 (+5,900)	
	PT Travel time difference with cars in AM	Northbound to City	Southbound to City	Northbound to City	Southbound to City
		1 min 40 sec slower	2 min slower	50 sec slower	40 sec faster
Orange	Daily boarding	4,100		7,900 (+3,800)	
	Households within 800m	21,000		25,200 (+4,200)	
	PT Travel time difference with cars in AM	Northbound to City	Southbound to City	Northbound to City	Southbound to City
		3 min slower	3 min 40 sec slower	3 min 20 sec faster	20 sec slower
Purple	Daily boarding	6,100		7,900 (+1,800)	
	Households within 800m	17,300		20,000 (+2,700)	
	PT Travel time difference with cars in AM	Eastbound to City	Westbound to City	Eastbound to City	Westbound to City
		3 min 50 sec slower	3 min 40 sec slower	4 min 40 sec faster	50 sec slower
Yellow	Daily boarding	6,100		10,100 (+4,000)	
	Households within 800m	23,800		27,900 (+4,100)	
	PT Travel time difference with cars in AM	Eastbound to City	Westbound to City	Eastbound to City	Westbound to City
		3 min 30 sec slower	4 min50 sec slower	4 min 20 sec faster	2 min 20 sec slower

5.6 PREFERRED OPTON INFRASTRUCTURE

5.6.1 Infrastructure improvements proposed for Christchurch City Council

Bus lane priority infrastructure

The recommended option includes bus lanes throughout the inner core as detailed in **Appendix M.**

The short-term improvement programme includes approximately 20 km of bus lane, with a further 2.0 km included in the medium-term programme.

Further explanation of how these were selected is described in a technical note contained in **Appendix L.** In summary, bus lanes are proposed in the locations shown on Figure 105.

Intersection improvement programme

The proposed option includes intersection upgrades aimed at bringing stops closer to the intersection to make transfers easier between orbital and radial routes, and providing bus priority through the intersection where possible, at the following locations:

1. Lincoln Road/ Barrington Street
2. Waimairi Road/ Maidstone Road
3. Buckleys Road/ Kerrs Road
4. Gloucester Street/ Barbadoes Street
5. Ferry Road/ Buckleys Road/ Aldwins Road
6. Colombo Street/ Cashmere Road/ Centaurus Road
7. Cashmere Road/ Hackthorne Road

Drawing showing the proposed intersection improvements are included in **Appendix O**.

In addition to these physical changes, the option includes installing real-time-information signal pre-emption at signalised intersections throughout the city to take advantage of the real-time-information upgrade project that ECan are rolling-out separate to PT Futures.

Bus stop improvement programme

The recommended option includes improving bus stops by installing shelters and real-time-information displays (additional to those for which funding has already been secured), cycle racks, and in some cases relocating and/or consolidating bus stops. It also includes installing new bus stops where route changes require them. This is distributed according to Table 25. Christchurch City Council bus stop improvement programme.

Table 25. Christchurch City Council bus stop improvement programme

CCC number and type of bus stop infrastructure improvements								
Year		**Shelters**	**New RTI Displays**	**Replacement RTI Displays**	**Screens at Key Locations**	**Caged Cycle Racks**	**Uncaged Cycle Racks**	**Toilet Facility**
Year 1/2	No improvements in year 1 and 2							
Year 3	Yellow Line	5	5	7				2
	17 Line	28	10	8				1
	28 Line	20	4	3				2
Year 4	Blue Line	11	14	17				2
Year 5	Orange Line	15	16	5				2
Year 6	Purple Line	10	6	15				2
	Orbiter	31	14	17				
Year 7	Other Bus Stops	13	6	10	9	2	5	
Year 8	29 Line	7	3	3				
	Other Bus Stops:	13	6	10	9	2	4	
Year 9	Other Bus Stops	13	6	10	8	2	4	

Year 10	Other Bus Stops	13	5	10	8	2	4	

Drawings showing the locations of these improvements are included in **Appendix M** for Christchurch City, **Appendix P** for Selwyn District Council and **Appendix Q** for Waimakariri District Council.

Investigations into bus stop spacing are detailed in a technical note in **Appendix H**. Many sections of the bus network have bus stops closer than 400m spacings and the recommended option allows for removal of stops as indicated, for comparatively little cost. This would rebalance the trade-off between minimising walk distances and maximising bus speeds.

Park and ride programme

No park and ride investments are proposed in Christchurch City.

Toilet facilities for drivers

The recommended option includes allowance to install twelve toilets at new bus terminus points for drivers to use on their breaks, in line with new employment requirements (refer to **Appendix J**). This is based on including toilets at all new terminus points that would be introduced as a result of the proposed changes. Alternatives have been investigated but these were discarded for the following reasons:

- Where existing municipal facilities exist, these can be used and have already been accounted for (e.g. New Brighton). However, in most terminus locations municipal toilets do not exist. It would therefore require a rerouting of the bus service or a lengthy detour at the end of the route, neither of which are desirable as they introduce ongoing operational expenditure
- Privately owned facilities were considered (e.g. toilets in shopping malls) but these typically are not open for the hours that the buses operate (early morning and late night). Drivers would require access outside of opening hours and therefore result in difficulty for the operators to meet their obligations
- The bus exchange could be expanded, and drivers use this for breaks. This would require both an expansion of driver facilities and bus parking space. This would involve bringing forward the bus exchange expenditure (currently programmed for 2028/29)
- Timetabling could potentially be developed to reduce the reliance on toilets. Some routes may be able to be timetabled so that a toilet is needed only at one end and not the other. Alternatively, the network could be timetabled so that drivers can use privately owned facilities (such as shopping mall toilets) during daytime hours, and the bus exchange toilets in the early morning and late night when the throughput of the bus exchange is not such a critical issue. This could be considered further during implementation stage through detailed route timetable analysis, but it carries the risk that it could likely change over time as timetables are continually adjusted
- If more detailed investigations throughout pre-implementation reveal these arrangements to be workable for some of the route termini, then this will represent a cost saving from the tables provided

Bus interchange upgrades

The option results in a significant increase in buses through the bus interchange such that in the medium term it will exceed its capacity. To address this, the option proposes purchasing adjacent land on Tuam Street early in the programme and developing this land into additional bus facilities later in the programme when the new network is rolled out.

The details of this bus exchange expansion would be developed at a later stage, but two high-level concepts for how this could be approached have been drawn and are included in **Appendix R** and summarised in Figure 104. The left-hand option shows how additional layover stops could be accommodated, while the right-hand option shows how the entrance could be relocated to allow a greater length of bus lane on Tuam Street and therefore a more reliable flow of buses into the exchange.

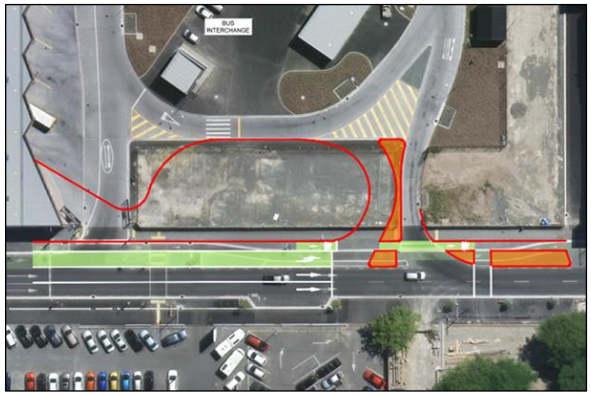


Figure 104: Potential bus interchange upgrade

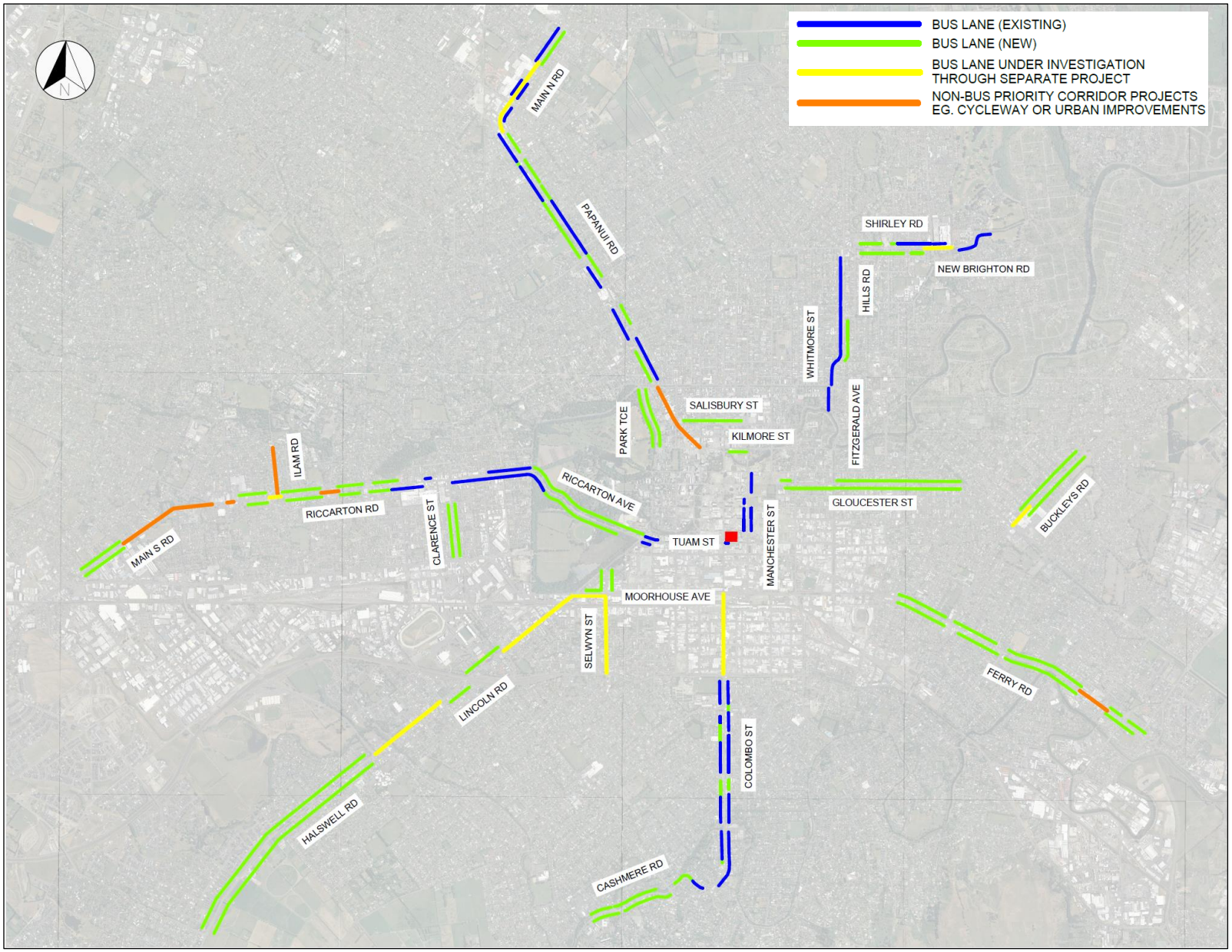


Figure 105: Christchurch city recommended bus priority lanes

5.6.2 Infrastructure improvements proposed for Selwyn District Council

Bus lane priority infrastructure

No bus priority is proposed in the Selwyn District.

Intersection improvement programme

No intersection upgrades are proposed in the Selwyn District.

Bus stop improvement programme

The recommended option includes improving bus stops by installing shelters and real-time-information displays, cycle racks, and in some cases relocating and/or consolidating bus stops. It also includes installing new bus stops where route changes require them. This is distributed according to Table 26 Selwyn District Council bus stop improvement programme.

Table 26 Selwyn District Council bus stop improvement programme

Selwyn number and type of bus stop infrastructure improvements							
YEAR	Shelters	New RTI Displays	Replacement RTI Displays	Screens at Key Locations	Caged Cycle Racks	Uncaged Cycle Racks	Toilet Facility
Year 1	3						
Year 2	3						
Year 3	3	5					
Year 4	3						
Year 5	3						
Year 6	3	5					
Year 7	2						
Year 8	2			6			

Drawings showing the locations of these improvements are included in **Appendix P.**

Park and ride programme

The proposed option includes the following allowance for park and ride facilities in the Selwyn District.

- Year 1 - 1 Shelter and 1 RTI Display at Lincoln Events Centre
- Year 3 - Foster Park P&R Formalisation
- Year 5 - Expanded P&R at Lincoln Events Centre (40%)
- Year 6 - Expanded P&R at Lincoln Events Centre (60%)
- Year 9 - Relocation of P&R from Rolleston Council to a permanent site (40%)
- Year 10 - Relocation of P&R from Rolleston Council to a permanent site (60%)

A concept plan showing the Lincoln P&R site is included in **Appendix P** and summarised in Figure 106.

Figure 106: Concept layout for park and ride in Lincoln at the Lincoln Events Centre

Bus interchange upgrades

No bus interchange upgrade is necessary in Selwyn District.

5.7 INFRASTRUCTURE IMPROVEMENTS PROPOSED FOR WAIMAKARIRI DISTRICT COUNCIL

5.7.1 Bus lane priority infrastructure

No bus priority is proposed in the Waimakariri District.

5.7.2 Intersection improvement programme

No intersection upgrades are proposed in the Waimakariri District.

5.7.3 Bus stop improvement programme

The recommended option includes improving bus stops by installing shelters and real-time-information displays, and in some cases relocating and/or consolidating bus stops. This is distributed according to Table 27Waimakariri District Council bus stop improvement programme.

Table 27 Waimakariri District Council bus stop improvement programme

Waimakariri number and type of bus stop infrastructure improvements							
YEAR	Shelters	New RTI Displays	Replacement RTI Displays	Screens at Key Locations	Caged Cycle Racks	Uncaged Cycle Racks	Toilet Facility
Year 1	4						
Year 2	4						
Year 3	4	5					
Year 4	4						
Year 5	4						
Year 6	4	5					
Year 7	4						
Year 8	2			4			
Years 9 / 10	No improvements proposed for Years 9 and10						

Drawings showing the locations of these improvements are included in **Appendix Q.**

Park and ride programme

No park and ride facilities are proposed in Waimakariri District beyond what is currently committed through other projects.

Bus interchange upgrades

No bus interchange upgrade is necessary in Waimakariri District.

5.7.4 Capital expenditure proposed for Environment Canterbury

Headway management system for the buses

The capital cost estimate allows for on board devices to be installed on each bus on the frequent network in the short term to allow for the information to be relayed to the bus driver regarding the bus's location relative to other buses on the same route and service.

The short-term option anticipated 144 devices to be installed and the medium-term a further 155, for a total of 299 buses (the entire fleet).

On board announcements

Allowance have also been made to install and enable on board audio and video devices to assist passengers with upcoming stops and transfer opportunities.

The short-term option anticipated 144 number of devices to be installed, covering 9 routes and the medium-term a further 155 devices covering a further 14 routes.

5.8 ECONOMIC EVALUATION

The Economic Evaluation at **Appendix T** and summarised below follows procedures specified in the Waka Kotahi Economic Evaluation Manual (EEM), effective July 2018 to August 2020. Because this project commenced in early 2020, the new Waka Kotahi 'Monetised benefits and costs manual' has not been used.

This economic evaluation has been externally peer reviewed, with review comments and responses detailed in **Appendix Z**.

For the purposes of the evaluation, Time Zero (assumed construction start date) is assumed to be 1 July 2020. The base date for costs and benefits is assumed to be 1 July 2018, in line with the latest available (1 December 2018) EEM A12.2 (cost) and A12.3 (benefit) update factors.

5.8.1 Existing and estimated PT, motor vehicle and cycle volumes

The adopted methodology involved utilising existing up-to date regional transport models (CTM and CAST) and supplementing these with a PT project model which is used to improve the estimation of changes to PT demand in response to the proposed interventions and provide detailed outputs relating to KPIs and economic assessment.

In particular, the following key strengths of the CTM transport model have been maintained:

- Estimation of travel demand by person (and PT), based on land use inputs for future years previously agreed by the various partners
- A reasonably detailed PT assignment that includes walk access, waiting at bus stops, interchanging between routes
- Mode split sub-model which is responsive to relative changes in generalised cost between modes (PT, private vehicle and cycle)
- Useful outputs that include skimmed travel times (walk, wait, in-vehicle), bus journey times, passenger on/off and in vehicle at each modelled stop
- Critical PT parameters have already been established (calibrated locally) and implemented

The PT project model supplements the CTM transport model as follows:

- The default CTM mode-split model is mostly influenced by vehicle availability (at the household level) and, to a lesser extent, the relative generalised cost of travel between modes. While this approach adequately replicates observed behaviour at 2006, it has been found that the resulting model is rather insensitive to interventions where a reasonable uptake in PT might be expected. Elasticities have been introduced to ensure more appropriate responses
- This is especially the case for interventions which are likely to result in significant change away from existing (2006) travel behaviour (i.e. 'step changes'), which will be required to achieve the proposed mode share targets
- More direct control over inputs and outputs is possible
- The CTM does not include crowding curves for buses, therefore bus capacity is unconstrained. Consideration was given to adding bus crowding curves to the model, but was rejected due to a lack of Christchurch-specific data

The project model 2018 base year scenario was adjusted to better match observed data (bus journey times, general traffic travel times, passengers on and off). These changes were carried forward to 2028 and 2038 base models to overcome known model resolution issues.

For option testing, the base year CTM PT demands (for each modelled year) has initially be applied to the option PT network (which includes option specific interventions) in order to extract updated travel time data (walk, wait, in vehicle etc.). This has then been used to establish the quantum of travel time savings achieved relative to the base for each Origin-Destination (OD) zone pair.

The default CTM mode split-model, which has limitations described earlier, was supplemented by elasticities (established from existing research) which have been applied to travel time and other savings associated with proposed intervention options in order to indicate the likely corresponding change in patronage.

The resulting adjusted PT demands (option) matrix were finally re-assigned to the option network and key model outputs updated. The modelled patronage change maps are attached at **Appendix V**.

5.8.2 Benefit and cost assessment

Due to the scale of the project, Full Procedures have been applied. Key benefits and costs included in the analysis include:

Benefits:

- PT travel time benefits, reflecting increased service frequency, wait time, in vehicle time and interchange time
- PT reliability improvement benefits
- Road traffic reduction benefits (decongestion for other road users)

- Travel behaviour change benefits
- Wider economic benefits (WEBs) have been excluded from the base evaluation. They are discussed in **Appendix T** as a sensitivity test.

Costs:

- Any additional capital expenditure (Capex) over what is expected to be spent on the Do-Minimum
- Any additional operational expenditure (Opex) over what is expected to be spent on the Do-Minimum
- Travel behaviour change costs

5.8.3 Short-term programme only: benefit cost ratio

The resulting present value (PV) of net benefits (with update factors applied) and costs are summarised below. The resulting National BCR_N is 2.2 with sensitivity in the range 2.1 to 3.5. The Government BCR_G is 2.6, with a sensitivity in the range of 2.4 to 3.4.

This BCR is between 1.0 and 3.0, therefore project is considered to have a 'low' rating for the Economic Efficiency component of the Waka Kotahi Investment and Revenue Strategy assessment profile.

Table 28 Short term benefit cost ratio

Present value of net benefits – short-term programme only	
Travel Time Cost Savings (62%):	$426m
Reliability Improvements (20%):	$137m
Road Traffic Reduction Benefits (11%):	$73m
Walk Benefits (5%)	$34m
TDM Benefits (3%):	$21m
TOTAL BENEFITS	$693m
Present Value of Costs	
TOTAL COSTS	$314m
Benefit Cost Ratio (n)	2.2

5.8.4 Full programme: benefit cost ratio

The present value for benefits and costs for the medium-term option are presented below, with the resulting National BCR_N of 1.6 with sensitivity in the range 1.5 to 2.3. The Government BCR_G is calculated as 1.9, with a sensitivity in the range of 1.8 to 2.4. This BCR is also considered to have a 'low' rating for the Economic Efficiency component of the Waka Kotahi Investment and Revenue Strategy assessment profile.

Table 29 Medium term benefit cost ratio

Present value of net benefits – full programme	
Travel Time Cost Savings (59%):	$615m
Reliability Improvements (21%):	$214m
Road Traffic Reduction Benefits (10%):	$105m
Walk Benefits (6%)	$64m
TDM Benefits (4%):	$37m
TOTAL BENEFITS	$1,037m
Present Value of Costs	
TOTAL COSTS	$647m
Benefit Cost Ratio (n)	1.6

The incremental $BCR_{(N)}$ to implement the medium-term option after the short-term option is 1.0. This meets the target incremental BCR of 1.0. The sensitivity test range for the incremental BCR is 0.9 to 1.6.

The EEM requires that economic assessments of PT projects report both the "national benefit-cost ratio" (BCRN) and "government benefit cost ratio" BCR(G).

The national benefit-cost ratio is as a measure of the economic efficiency from a national perspective. Payment of fares by PT users is simply a monetary transfer and therefore neither a benefit nor a cost from a national perspective.

The government benefit cost ratio considers any service provider and/or third-party funding is involved, to reflect the net costs to government which results in the 'funding gap'. This generally results in a higher BCR compared to the national benefit-cost ratio because revenue received from fares is subtracted from costs.

6 INVESTMENT PROFILE

6.1 STRATEGIC FIT AND EFFECTIVENESS

Development of the Business Case is under the overarching strategic direction of Our Space, with strong links to the GPS 2018 and GPS 2021. The investment in both the short term and medium term options are expected to contribute to three of the four GPS 2021 strategic priorities (Better travel options, climate change and safety) for investment in New Zealand's land transport system.

Overall, the Recommended Option has been given a High strategic fit in accordance with the IAF (2018-2021). This is based on the intent and potential scope of the Recommended Option to deliver against the range of effectiveness criteria set out in the current investment assessment framework and summarised in Table 30

6.2 ECONOMIC EFFICIENCY

The economic evaluation has been described earlier. The short-term programme has a BCR_N of 2.2 with sensitivity in the range 2.1 to 3.5. This BCR_N is between 1.0 and 3.0, therefore project is considered to have a 'low' rating for the Economic Efficiency component of the Waka Kotahi Investment and Revenue Strategy assessment profile.

The full programme has a BCR_N of 1.6 with sensitivity in the range 1.5 to 2.3. This BCR_N is also considered to have a 'low' rating for the Economic Efficiency component of Waka Kotahi Investment and Revenue Strategy assessment profile.

Table 30 Effectiveness rating

Strategic priority	Criteria for high rating	Assessment for recommended option	Rating
Safety – a safe transport system free of death and serious injury	▪ Enhances actual and perceived safe use of and access to PT	The Recommended Programme will contribute towards a mode shift from private vehicles to PT which is an inherently safer mode. Decreased congestion resulting from more efficient network use will also help to achieve safety outcomes. The provision of priority measures for PT will also reduce conflicts with general traffic and further improve safety. In addition, there is also a perceived improved safety element by reducing wait times at stops and improving stop facilities.	High
Access – to opportunities, enables transport choice and access, and is resilient – liveable cities	▪ Addresses a significant gap in level of service in accessing social or economic opportunities and makes a significant contribution ▪ Address significant gap in access to new housing in high growth urban areas ▪ Supports agreed integrated land use, multi-modal plans and mode shift in major metros ▪ Improves intermodal connectivity where this enhances the appropriate use of PT ▪ Makes best use of the PT service operations and connection to other services ▪ Supports technology to enhance PT user experience ▪ Address significant resilience risk to continued operation of the PT network ▪ Addresses an unplanned loss of an existing significant public funded transport connection	The Recommended Option will improve end-to-end journey times, improving access to KACs and employment. Access is improved across the region, with a focus on identified high density and growth areas. Improvements are also made to accessibility for the areas of high social deprivation. The priority afforded to PT will enable users to access a greater range of destinations within a reasonable journey time. Optimised bus routes also ensure better alignment with key areas, ensuring an integrated land use approach. The bus routes have been revised to ensure coordination with cycling and park and ride facilities and optimise transfer locations. Use of technology to support reliability and headway management and enhanced customer information through on board announcements. Technical innovations through RTI screens and bus GPS will support intersection prioritisation and headway management, providing for improved levels of service. The provision of additional direct services and park ride provides further resilience to the regular bus services.	High
Environment – reduce adverse effects on the climate, local environment and public health	▪ Enables significant reductions in harm to the environment and people, particularly arising from land transport-related air pollution and noise ▪ Enables long term reductions in greenhouse gas emissions from land transport	The proposed investment will contribute towards a mode shift from SOVs to PT, which will enable the movement of more people in fewer vehicles, reducing the overall vehicle kms travelled. This contributes to a reduction in emissions and air pollution.	High

PART D – READINESS AND ASSURANCE

7 COMMERCIAL CASE

7.1 INDUSTRY CAPABILITY

The recommended programme includes a progressive improvement of the bus services, supported by infrastructure provision to enhance its efficiency.

From a services perspective, Environment Canterbury recently awarded new contracts based on the Public Transport Operating Model (PTOM) that allow for expansion of the fleet over time. The new contracts retain a portion of the existing fleet and enable their gradual replacement with low emission and zero emission buses. The contracts also allow for a faster transition of the fleet. These contracts allow the recommended option to be staged either according to the recommended staging or alternative staging, one of which is detailed in Appendix W.

The procurement process has resulted in the award of approximately 80% of the Greater Christchurch urban bus market to Go Bus. Red Bus retain approximately 20% of the urban market and Ritchies Transport will operate the school services contracts. Additional bus services proposed in this business case would be made as variations to these existing contracts.

The recommended programme in this business case calls for incremental expansion to the urban bus fleet, staged every two years to allow existing contract owners to source additional vehicles and ensure / train required workforce.

The contractual mechanism and industry capability therefore exist to expand the fleet as envisaged in the programme.

Environment Canterbury also recently awarded contracts to implement RTI improvements to the existing bus system. The recommended programme allows for unlocking further capability from this system (already procured) and capability and capacity therefore already exists within the current environment to deliver these expansions.

Infrastructure improvements are classified under the following broad categories:

a) bus stop improvements which include shelters, information displays, cycle racks etc. and

b) main line upgrades which includes reallocation of road space to bus lanes with supporting changes to surrounding streetscape and

c) Park and ride expansion.

Several recently completed and ongoing contracts of a similar nature exist in the Greater Christchurch area, all demonstrating the local industry's capability to deliver improvements of this nature and scale.

The most significant risk to delivery is likely to be capacity within the industry rather than capability, given the forecast programme in the national transport sector.

The recommended programme included in this business case however allows for the staged delivery of the elements, and the ability of corridors to be implemented under separate contracts.

7.2 CERTAINTY AND FUNDING

The recommended programme allows for improvements to be phased in over time. The staging keeps pace with anticipated growth in demand as well as the ability and time needed to implement the recommended infrastructure changes.

The gross operational expenditure is estimated to increase from a base $65.5 million per annum (in 2020) to $118 million per annum by the end of the programme.

The current RLTP anticipates annual gross operating expenditure to increase to $89.5m by 2028. The RPTP estimates this would need to increase to $122m by 2028 to enable implementation of the plan. This additional operational expenditure will still need to go through formal LTP and RLTP approval processes.

The total physical works for the programme (the costs to construct the improvements) have been estimated at $115 million, with $87 million of that staged within the first six years.

The majority ($59 million) of this has not been allocated in the various Councils' LTPs and will be going through the formal consultation and budget allocation process for the 2022-32 LTP period. Capital budget has been allocated for the Halswell Road upgrades ($27.5 million) signalled in the recommended programme and included in the first 6 years of the programme.

There is significant risk to the ability of each organisation's LTP to accommodate the staging of the recommended programme. The recommended programme and staging have not taken account the impacts of covid-19.

Waka Kotahi Arataki Version 2 states that the expectation for Greater Christchurch will be an easing of growth in passenger transport demand over the short-term, because of slower population growth, and reduced employment and discretionary trips. No significant changes are expected in the nature, scale and location of transport demand over the medium to long-term, although work patterns for professional services may see a growth reduction in peak trips to the city centre, because of more people working remotely. Overall, the 10-year outlook remains largely unchanged.

However, it has become clear that the COVID-19 pandemic will have a significant impact on the partner councils' revenue and therefore their ability to service the recommended level of investment.

7.3 DELIVERY OPTIONS AND ISSUES

7.3.1 Responsibility

The implementation will adopt the "normal" split of responsibilities, with

- ECan responsible for planning and operating urban PT services in Greater Christchurch (Metro)
- CCC, WDC and SDC responsible for delivering the PT infrastructure within their respective districts
- Waka Kotahi responsible for delivery of PT infrastructure along State Highway portions of the network

These organisations have well established business processes to deliver the operational and physical works outcomes included in the recommended option. It is expected that procurement of outcomes will follow these processes.

7.3.2 Land acquisition

Most of the programme envisages improvements within the existing roading corridor through re-allocation of road space or bus stop improvements along existing footpaths / road berms.

Land acquisition is recommended as part of the short-term programme to future proof the ability to expand capacity at the central bus exchange. The capacity is not needed until the medium-term programme. The acquisition of this parcel of land (173 Tuam Street) is envisaged under a willing buyer / willing seller arrangement. Further option development will be required to satisfy PWA requirements if a willing buyer/seller arrangement is not possible. There is therefore a risk under these conditions of a up to 3-year delay in the land acquisition, noting that this will not impact the anticipated upgrade of the interchange.

The Park and Ride facilities at Lincoln will be constructed on Council owned land. The relocated Rolleston Park and Ride will require land acquisition. The acquisition of this site is needed in later stages of the programme (year 7+).

It is assumed that any terminus facilities (i.e. toilets) will be installed on Council owned land with no land acquisition required.

Consequently, the only land acquisition costs that have been included in the programme are those associated with the central bus exchange.

7.3.3 Consenting

The majority of the recommended option measures relate to network improvements (such as frequency improvements / non-infrastructure) or improvements such as the establishment of minor infrastructure upgrades (i.e. new bus stops within the existing transport zone/road reserve)) any associated environmental effects are anticipated to have minimal adverse environmental effects, occurring within existing urban transport corridors. Any earthworks associated with the construction of new infrastructure to support the proposed upgrades should be managed appropriately with site specific erosion and sediment control and dust control measures. In addition, any corridor upgrades to improve bus priority should consider integration with the streetscape and urban environment.

The measures with potential to result in a need to obtain resource consent are those that require land outside the transport zone (i.e. any new bus stops, park and rides, associated supporting infrastructure and an extension to the central city bus interchange). However, the intention is that any proposed infrastructure, such as bus lanes and bus shelters are provided within the existing road corridor (and within the Transport Zone where these would be a permitted activity under Rule 7.4.2.1 P14 of the Christchurch District Plan (CDP)).

Regarding the park and ride facilities, the Waimakariri park and ride facilities are those already under development at River Road; White Street; Southbrook Park; Wrights Road and Kaiapoi New World. It is assumed that any consenting requirements for these facilities have been captured in the respective planning documents for these.

The proposed Selwyn District park and ride facilities have also been captured in other business cases and planning considerations (i.e. the Rolleston Park and Ride is considered as part of the Rolleston Transport Improvements PBC).

Lincoln services will initially utilise the parking at the events centre, with expansion to provide additional parking in this location as demand grows to the other side of Meijer Drive. This expansion is likely to require consent under the Selwyn District Plan for a discretionary activity (given it is an activity not provided for within the Living Z zone). It is noted that this may alter following the Selwyn District Plan review, with the draft plan recently notified for public submissions. The nature of the works required (i.e. access arrangements, anticipated daily vehicle movements, earthworks, impervious service area, landscaping etc.) will impact on this.

An extension to the central city bus interchange (comprising the acquisition of 173 Tuam Street – Lot 2 DP 495013), is within the Ōtākaro Limited designation of the Bus Interchange. The purpose of this designation is 'bus interchange' which includes a concourse, bus platform, amenities, retail/food and beverage, staff facilities, cycle parking and ancillary activities. As the designation (and the Outline Plan of Works provisions of the RMA, which only apply to works undertaken by a requiring authority) is for Ōtākaro Limited it cannot be relied upon by CCC or any other party. However, s.180 of the RMA does enable a requiring authority the ability to transfer the designation to another requiring authority where the financial responsibility for a project has also been transferred. There are procedures that must be followed for this to occur but the provision the potential for the existing designation to be transferred from Ōtākaro to CCC. Without the designation, consent may be required under the underlying Commercial Central City Business Zone. Regardless, the ability to use the designation would aid the approval process (by helping to override the provisions of the district plan and recognising that an extension to the bus interchange is in accordance with the activity anticipated by the designation).

Lastly, earthworks within 5m, or the felling of, any street tree within the road corridor that is greater than 6m in height will require consent as a restricted discretionary under the CDP.

Overall, consent is likely to be required for the potential extension to the central city bus interchange and the creation of formalised park and ride sites.

7.3.4 Consultation

No consultation has been carried out beyond informative presentation to key stakeholders within the Greater Christchurch Partnership forum. The recommended option should be consulted on as part of general consultation to be undertaken with the RLTP and the council Long Term Plans. As projects are developed in more detail specific consultation will be required around the following components in particular:

- Changes to bus routes
- Bus lane and bus priority provision (including any temporary or permanent on-street parking removal)
- Bus stops and bus shelters

7.4 PRE-IMPLEMENTATION PHASE

7.4.1 Scope of the pre-implementation phase

The pre-implementation services are customarily associated with the consenting, property and design phases of a project.

The phase will focus on further developing the infrastructure design to support the statutory approvals process. Community and stakeholder engagement activities will help inform the location of bus shelters, removal of parking and setting of bus lane operational hours.

The design will be supported by geotechnical testing and assessment undertaken with results presented in a geotechnical assessment report (factual report) and interpreted in a geotechnical interpretative report. A pavement design report will evaluate and design any appropriate adjustments to the pavement structure.

The design will also be subjected to road safety audit procedures.

The specific scope of work will be developed as part of the procurement process. The professional services can be engaged on a corridor by corridor basis and not for the network.

7.4.2 Timeframes for pre-implementation

The programme anticipates scoping, procurement and award of professional services for each corridor over a 12-month period. This is then followed by a 24-month design, consultation, planning approval and physical works tender development phase. Construction is therefore anticipated to commence approximately 3 years after the commencement of procurement for pre implementation services.

Funding and governance approvals present a potential delay risk to the pre-implementation procurement and the delivery timeframes. Delays will have potential knock-on effects throughout the programme, with potential to delay the service delivery as far out as 2032 and loss of benefits to customers. Governance is addressed in the Management Case.

7.4.3 Procurement options for pre-implementation

Pre-implementation services may be procured via:

- Competitive tender - A market sounding, and communication exercise should be conducted early to gauge interest and capability, to generate interest in bidding to provide the services, to determine the best timing to bring the procurement to market, and to allow suppliers time to prepare and plan. Procurement should proceed through a short-listing and interactive process.
- Direct appoint – An existing consultant or a consultant could be appointed directly to reduce procurement timeframes and cost.

7.4.4 Council(s) internal staffing support

Council(s) and Waka Kotahi internal staffing requirements will be established as part of the approvals process for the programme, with a focus on expertise to manage the planning approval process through the pre-implementation stage.

7.5 INFRASTRUCTURE AND PROCUREMENT

Procurement strategies for the specific infrastructure stages and corridor sections will be developed at the time of each stage.

Selecting the most appropriate delivery model can reduce the costs associated with purchasing the required outputs. These costs include the identification and selection of suppliers and contract management costs.

Delivery models help drive best value for money by allocating risk and control to the most appropriate parties to manage and mitigate those risks.

The delivery models available in the Waka Kotahi Procurement manual are:

- Staged
- Design and build
- Shared risk (advanced)
- Supplier panel (advanced)

Note that the use of the advanced components listed above require Waka Kotahi written approval under s25 of the LTMA.

The following diagram illustrates the situations in which the staged, design and build, and shared risk delivery models may be used. Note that the supplier panel delivery model does not appear in the diagram because it gives each Council complete flexibility as to the type of contractual arrangement that is established with the supplier.

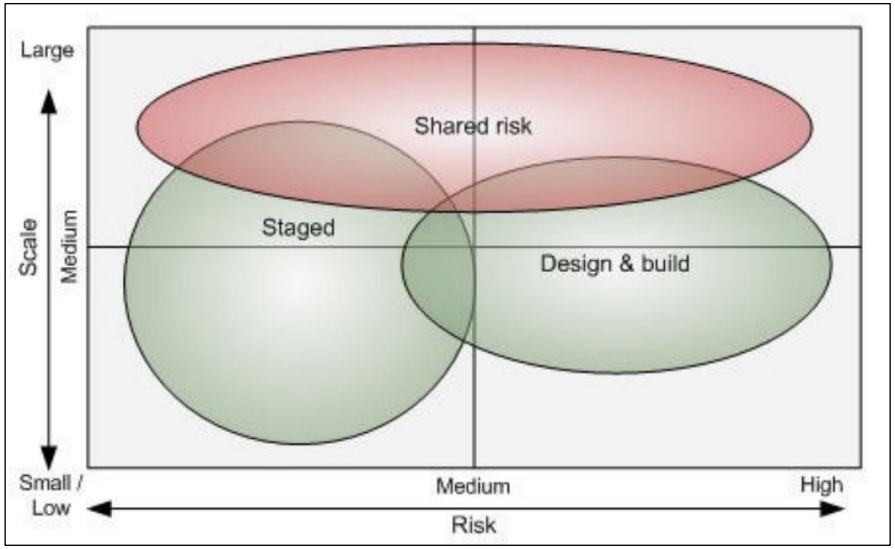


Figure 107: Different delivery models

The staged delivery model is recommended for each element in this programme due to the following factors:

- The scale of each corridor is small to medium
- Complexity, uncertainty and risk are low due to minimal land purchase and widening
- It allows each Council to maintain involvement and control over the activity, giving it the ability to respond to community and stakeholder concerns during construction
- The pre-implementation phase will develop a well-defined scope, that respond to community / stakeholder input and the opportunity for innovation is therefore low.

8 FINANCIAL CASE

8.1 OVERALL SUMMARY

Based on current estimates, the anticipated cash flows for the investment proposal over its intended life span are set out in the subsequent series of tables.

These tables are based on the recommended staging. There are however alternative staging options for implementing the programme, if the triggers outlined in the management case suggest the programme should be accelerated or deccelerated. One such alternative staging scenario includes slowing down the introduction of new routes to provide a more affordable programme in the short term, and is described in detail in Appendix W.

Based on the recommended staging, costs in the first three years comprise $22.4M additional capital expenditure and annual bus operational expenditure increasing from approximately $65.5M to $80.1M per annum by 2023/24. This should be viewed in the context of the NLTP which is guided by the GPS. The GPS 2021 provides annual ranges for PT services expenditure for the years 2021/22, 2022/2023, 2023/24, 2024/25, 2025/26, and 2026/27 of $390m-$600m, $410m-$630m, $420m-$700m, $430m-$820m, $440m-$900m, and $450m-$920m, respectively).

Table 31 Summary of estimated capital costs

Intervention	Years 1-3	Years 4-6	Years 7+
Capital expenditure			
Bus lane priority programme	$8.60M	$43.0M	$7.35M
Intersection improvement programme	$5.54M	$12.39M	$0.78M
Bus stop improvement programme	$5.98M	$6.49M	$4.80M
Park and ride programme	$0.55M	$2.0M	$3.2M
Bus interchange upgrades	$1.5M	-	$10.96M
Enhancement to bus management system	$0.26M	$0.63M	$0.98M
TOTAL	**$22.43M**	**$64.51M**	**$28.06**

Table 32 Summary of estimated operational costs

Intervention	Year 1-2	Year 3-4	Year 5-6	Year 7-8	Year 9-10
Operational expenditure (average per annum) (2020 dollars)					
Additional bus operational	$4.90M	$13.10	$17.30M	$38.20M	$50.70M
Travel demand measures	$0.45M	$0.60M	$0.38M	$0.51M	$0.82M
Information campaigns	$0.05M	$0.05M	$0.05M	$0.05M	$0.05M
Enforcement	$0.47M	$0.47M	$0.47M	$0.47M	$0.47M
Contract and network management	$0.37M	$0.37M	$0.37M	$0.37M	$0.37M
TOTAL	**$6.24M**	**$14.59M**	**$18.57M**	**$39.60M**	**$52.41**

8.2 BREAKDOWN OF ESTIMATED CAPEX COST BY COUNCIL OVER LTP PERIOD

The following tables summarise the estimated capital expenditure for the short-term and full programme option by financial year, broken down by headline intervention and roading authority.

Costs were developed in consultation with the relevant council officers. Bus lane and intersection costs were developed using rates from similar projects in other cities, then workshopped with Christchurch City council engineers on 3rd July and 26th July to agree methodology and rates. Bus stop shelter and display costs were agreed with Christchurch city council engineers. Park and ride costs were calculated based on standard rates from other work completed in Christchurch. Bus interchange improvements were not costed as the nature of the

improvements will not be decided until future phases of the project. Costs for enhancements to the bus management system were given by Ecan engineers.

It also assumes a 51% funding assistance rate from Waka Kotahi for all capital expenditure linked to the recommended option and provide cash flow summaries net of the funding assistance rate for the Councils, as well as an aggregate summary of the Waka Kotahi share to co-invest in the recommended option.

Table 33 Total capital expenditure for the full recommended programme

Total capital expenditure for the full recommended programme											
TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme	209,725	2,498,686	5,892,600	27,336,034	6,293,494	9,365,747	5,327,287	98,559	1,920,193	-	58,942,325
Intersection improvement programme	1,132,159	753,635	3,658,131	7,039,582	2,421,484	2,928,219	433,375	55,362	286,969	-	18,708,915
Bus stop improvement programme	745,728	1,132,286	4,097,459	1,939,628	1,897,074	2,657,624	1,305,754	1,376,355	1,190,131	928,449	17,270,487
Park and ride programme	53,000	-	500,000	-	800,000	1,200,000	-	-	1,280,000	1,920,000	5,753,000
Bus interchange upgrades	1,500,000	-	-	-	-	-	2,192,000	8,768,000	-	-	12,460,000
Bus management system		261,360		575,520		52,140		490,325	490,325		1,869,670
Sub Total	3,640,612	4,645,966	14,148,190	36,890,764	11,412,052	16,203,730	9,258,416	10,788,601	5,167,618	2,848,449	115,004,397
		Sub Total: Year 1-3	$22,434,768		Sub Total: Y4-6	$64,506,546			Sub Total: Y7+	$28,063,083	

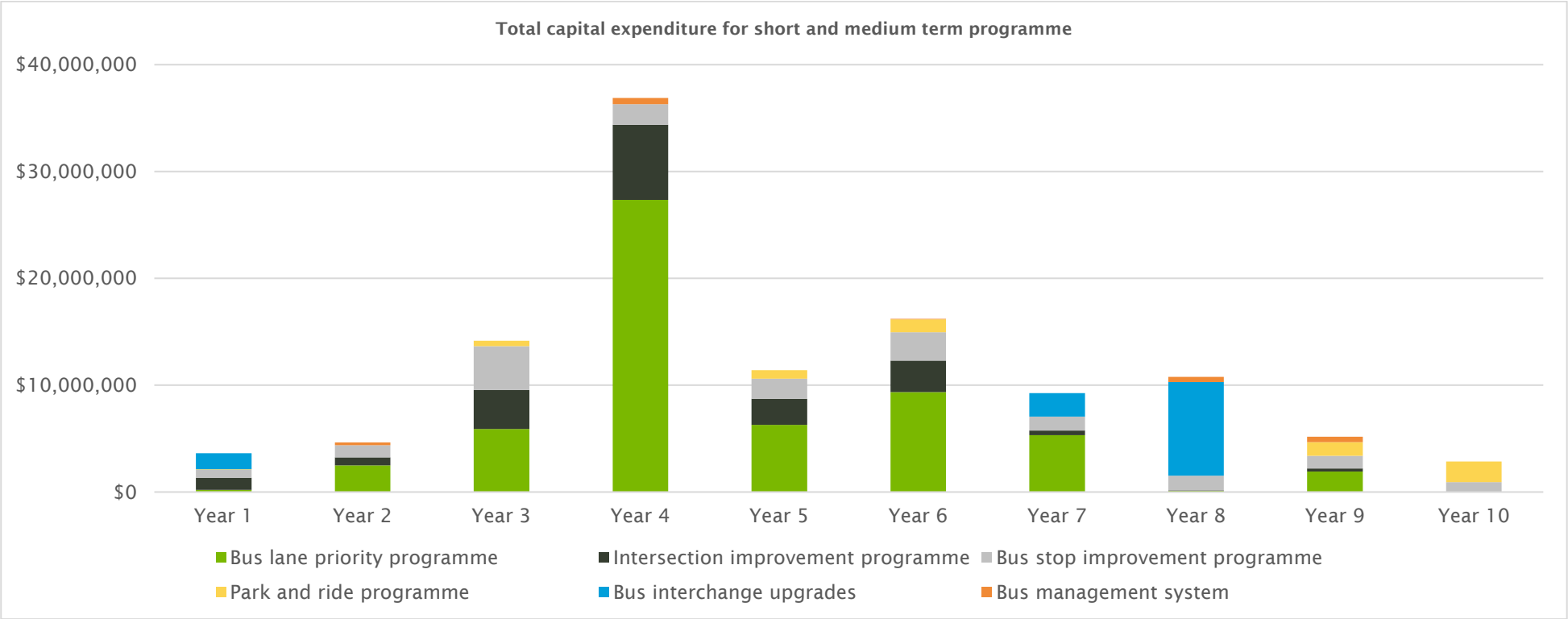


Figure 108: Total capital expenditure for the full recommended programme

8.2.1 Total capex costs

Christchurch City Council: Total capital expenditure for the full programme											
TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme	209,725	504,393	3,194,440	5,242,399	6,293,494	9,365,747	5,327,287	98,559	1,920,193		32,156,235
Intersection improvement programme	1,132,159	705,106	3,623,805	6,370,832	2,421,484	2,928,219	433,375	55,362	286,969		17,957,312
Bus stop improvement programme	339,696	726,254	3,484,031	1,533,596	1,491,042	2,044,196	956,701	978,933	1,190,131	928,449	13,673,031
Park and ride programme											
Bus interchange upgrades	1,500,000						2,192,000	8,768,000			12,460,000
Sub Total	3,181,580	1,935,753	10,302,276	13,146,827	10,206,021	14,338,162	8,909,364	9,900,853	3,397,293	928,449	**76,246,578**
	Sub Total: Year 1-3		15,419,610	Sub Total: Y4-6		37,691,010		Sub Total: Y7+		23,135,959	

CCC Share: Christchurch City Council: Total capital expenditure for the full programme											
CCC share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme	102,765	247,153	1,565,275	2,568,775	3,083,812	4,589,216	2,610,371	48,294	940,894		15,756,555
Intersection improvement programme	554,758	345,502	1,775,665	3,121,708	1,186,527	1,434,827	212,354	27,127	140,615		8,799,083
Bus stop improvement programme	166,451	355,865	1,707,175	751,462	730,611	1,001,656	468,784	479,677	583,164	454,940	6,699,785
Park and ride programme											
Bus interchange upgrades	735,000						1,074,080	4,296,320			6,105,400
Sub Total	1,558,974	948,519	5,048,115	6,441,945	5,000,950	7,025,699	4,365,588	4,851,418	1,664,673	454,940	**37,360,823**
	Sub Total: Year 1-3		7,555,609	Sub Total: Y4-6		18,468,595		Sub Total: Y7+		11,336,620	

Waka Kotahi Share: Christchurch City Council: Total capital expenditure for the full programme											
WK share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme	106,960	257,240	1,629,164	2,673,623	3,209,682	4,776,531	2,716,916	50,265	979,298		16,399,680
Intersection improvement programme	577,401	359,604	1,848,141	3,249,125	1,234,957	1,493,392	221,021	28,235	146,354		9,158,229
Bus stop improvement programme	173,245	370,390	1,776,856	782,134	760,432	1,042,540	487,918	499,256	606,967	473,509	6,973,246
Park and ride programme											
Bus interchange upgrades	765,000						1,117,920	4,471,680			6,354,600
Sub Total	1,622,606	987,234	5,254,161	6,704,882	5,205,070	7,312,462	4,543,775	5,049,435	1,732,619	473,509	**38,885,755**
	Sub Total: Year 1-3		7,864,001	Sub Total: Y4-6		19,222,415		Sub Total: Y7+		11,799,339	

Waimakariri District Council: Total capital expenditure for the full programme											
TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme											
Intersection improvement programme											
Bus stop improvement programme	235,094	235,094	338,793	235,094	235,094	338,793	235,094	183,914			2,036,971
Park and ride programme											
Bus interchange upgrades											
Sub Total	235,094	235,094	338,793	235,094	235,094	338,793	235,094	183,914			**2,036,971**
	Sub Total: Year 1-3		808,981	Sub Total: Y4-6		808,981		Sub Total: Y7+		419,008	

WDC Share: Waimakariri District Council: Total capital expenditure for the full programme											
WDC share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme											
Intersection improvement programme											
Bus stop improvement programme	115,196	115,196	166,008	115,196	115,196	166,008	115,196	90,118			998,116
Park and ride programme											
Bus interchange upgrades											
Sub Total	115,196	115,196	166,008	115,196	115,196	166,008	115,196	90,118			**998,116**
	Sub Total: Year 1-3		396,401	Sub Total: Y4-6		396,401		Sub Total: Y7+		205,314	

Waka Kotahi Share: Waimakariri District Council: Total capital expenditure for the full programme											
WK share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme											
Intersection improvement programme											
Bus stop improvement programme	119,898	119,898	172,784	119,898	119,898	172,784	119,898	93,796			1,038,855
Park and ride programme											
Bus interchange upgrades											
Sub Total	119,898	119,898	172,784	119,898	119,898	172,784	119,898	93,796			**1,038,855**
	Sub Total: Year 1-3		412,581	Sub Total: Y4-6		412,581		Sub Total: Y7+		213,694	

Selwyn District Council: Total capital expenditure for the full programme											
TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme											
Intersection improvement programme											
Bus stop improvement programme	170,937	170,937	274,635	170,937	170,937	274,635	113,958	213,508			1,560,485
Park and ride programme	53,000		500,000		800,000	1,200,000			1,280,000	1,920,000	5,753,000
Bus interchange upgrades											
Sub Total	223,937	170,937	774,635	170,937	970,937	1,474,635	113,958	213,508	1,280,000	1,920,000	**7,313,485**
	Sub Total: Year 1-3		1,169,509	Sub Total: Y4-6		2,616,509		Sub Total: Y7+		3,527,466	

SDC Share: Selwyn District Council: Total capital expenditure for the full programme											
SDC share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme											
Intersection improvement programme											
Bus stop improvement programme	83,759	83,759	134,571	83,759	83,759	134,571	55,839	104,619			764,637
Park and ride programme	25,970		245,000		392,000	588,000			627,200	940,800	2,818,970
Bus interchange upgrades											
Sub Total	109,729	83,759	379,571	83,759	475,759	722,571	55,839	104,619	627,200	940,800	**3,583,607**
	Sub Total: Year 1-3		573,059	Sub Total: Y4-6		1,282,089		Sub Total: Y7+		1,728,458	

Waka Kotahi Share: Selwyn District Council: Total capital expenditure for the full programme											
WK share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme											
Intersection improvement programme											
Bus stop improvement programme	87,178	87,178	140,064	87,178	87,178	140,064	58,119	108,889			795,847
Park and ride programme	27,030		255,000		408,000	612,000			652,800	979,200	2,934,030
Bus interchange upgrades											
Sub Total	114,208	87,178	395,064	87,178	495,178	752,064	58,119	108,889	652,800	979,200	**3,729,877**
	Sub Total: Year 1-3		596,450	Sub Total: Y4-6		1,334,420		Sub Total: Y7+		1,799,008	

Environment Canterbury: Total capital expenditure for the full programme											
TOTAL CAPEX	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Sum
Bus device and installation for headway management system		120,120		268,840		22,880		221,650	221,650		855,140
Bus device and installation for on-board announcements		141,240		306,680		29,260		268,675	268,675		1,014,530
Sub Total		261,360		575,520		52,140		490,325	490,325		**1,869,670**
	Sub Total: Year 1-3		261,360	Sub Total: Y4-6		627,660		Sub Total: Y7+		980,650	

ECan Share: Environment Canterbury: Total capital expenditure for the full programme											
ECan share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus device and installation for headway management system		58,859		131,732		11,211		108,609	108,609		419,019
Bus device and installation for on-board announcements		69,208		150,273		14,337		131,651	131,651		497,120
Sub Total		128,066		282,005		25,549		240,259	240,259		**916,138**
	Sub Total: Year 1-3		128,066	Sub Total: Y4-6		307,553		Sub Total: Y7+		480,519	

Waka Kotahi Share: Environment Canterbury: Total capital expenditure for the full programme											
WK share of the TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus device and installation for headway management system		61,261		137,108		11,669		113,042	113,042		436,121
Bus device and installation for on-board announcements		72,032		156,407		14,923		137,024	137,024		517,410
Sub Total		133,294		293,515		26,591		250,066	250,066		**953,532**
	Sub Total: Year 1-3		133,294	Sub Total: Y4-6		320,107		Sub Total: Y7+		500,132	

Waka Kotahi: Total capital expenditure for the full programme											
TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme	106,960	2,251,533	4,327,325	24,767,259	3,209,682	4,776,531	2,716,916	50,265	979,298		43,185,769
Intersection improvement programme	577,401	408,133	1,882,466	3,917,874	1,234,957	1,493,392	221,021	28,235	146,354		9,909,832
Bus stop improvement programme	380,321	577,466	2,089,704	989,210	967,508	1,355,388	665,934	701,941	606,967	473,509	8,807,948
Park and ride programme	27,030		255,000		408,000	612,000			652,800	979,200	2,934,030
Bus interchange upgrades	765,000						1,117,920	4,471,680			6,354,600
Bus management system		133,294		293,515		26,591		250,066	250,066		953,532
Sub Total	1,856,712	3,370,425	8,554,495	29,967,858	5,820,146	8,263,902	4,721,792	5,502,186	2,635,485	1,452,709	**72,145,712**
	Sub Total: Year 1-3		13,781,632	Sub Total: Y4-6		44,051,907		Sub Total: Y7+		14,312,172	

Waka Kotahi NZ Upgrade programme share: Total capital expenditure for the full programme											
NZUP share of TOTAL Capex	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme		1,994,293	2,698,161	22,093,636							26,786,089
Intersection improvement programme		48,529	34,325	668,750							751,604
Bus stop improvement programme											
Park and ride programme											
Bus interchange upgrades											
Sub Total		2,042,822	2,732,486	22,762,385							**27,537,693**
	Sub Total: Year 1-3		4,775,308	Sub Total: Y4-6		22,762,385		Sub Total: Y7+			

Waka Kotahi FAR: Total capital expenditure for the full programme											
Share of FAR to all councils included in TOTAL CAPEX	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Sum**
Bus lane priority programme	106,960	257,240	1,629,164	2,673,623	3,209,682	4,776,531	2,716,916	50,265	979,298		16,399,680
Intersection improvement programme	577,401	359,604	1,848,141	3,249,125	1,234,957	1,493,392	221,021	28,235	146,354		9,158,229
Bus stop improvement programme	380,321	577,466	2,089,704	989,210	967,508	1,355,388	665,934	701,941	606,967	473,509	8,807,948
Park and ride programme	27,030		255,000		408,000	612,000			652,800	979,200	2,934,030
Bus interchange upgrades	765,000						1,117,920	4,471,680			6,354,600
Bus management system		133,294		293,515		26,591		250,066	250,066		953,532
Sub Total	1,856,712	1,327,604	5,822,009	7,205,473	5,820,146	8,263,902	4,721,792	5,502,186	2,635,485	1,452,709	44,608,019
	Sub Total: Year 1-3		9,006,325	Sub Total: Y4-6		21,289,522		Sub Total: Y7+		14,312,172	

8.3 BREAKDOWN OF ESTIMATED OPEX COST BY COUNCIL OVER LTP PERIOD

Operational expenditure of the proposed option has been calculated in five categories:

- **Bus Operations**; Additional service-hours, service-kilometres and peak fleet size have been calculated for the proposed option. Costs have been estimated using rates of $2.19 per service-kilometre, $36 per service-hour and $83,839 per vehicle in the fleet, as agreed with Ecan officers based approximately on current PTOM contract rates. Additional costs were added to the base cost of approximately $65.5m.
- Bus operational costs are the responsibility of ECan but have been apportioned to the three council areas based on where services are located. Services which cross boundaries had their costs apportioned by the length of the route in each district, except for express services which were assigned wholly to the Waimakariri or Selwyn town they service. These local costs are net of the expected farebox take (as modelled), and a Waka Kotahi 51% funding assistance rate. Farebox take was calculated from modelled patronage numbers with an assumption that during the first year of operation only 60% of modelled farebox take would eventuate, with 100% from the second year of operation.
- **Travel Demand Management**; Each service and infrastructure improvements are accompanied by travel demand management measures, using a similar approach to that proposed for other locations in the Christchurch TDM business case. This includes three focus areas; schools, universities and residents. In all three cases the package would involve Council staff visiting potential riders to explain the bus system benefits and distribute metro cards with 2 weeks free travel pre-loaded. Costs were estimated using rates of $70 per school or university student, and $200 per household. The short-term improvements are supported solely by household focussed TDM, with allowance to visit 15% of households along each of the corridor sections being improved. The medium-term improvements include a broader range of TDM covering schools, universities, households and employers in the southern belt industrial zones that will be newly serviced under the option
- **Information campaigns**; Each improvement will be accompanied by a targeted marketing campaign, whose costs have been estimated at $100,000 for each 2-early intervention (equivalent to $50,000 annually)
- **Enforcement of Bus Lanes**; Additional enforcement of the proposed bus lanes will ensure they provide the maximum benefits. It is expected that the three additional full-time equivalent (FTE) staff would be required
- **Contract and Network Management**; The expanded size of the network would be expected to require a commensurate expansion in administration costs. This has been estimated as requiring an additional FTE's to manage bus contracts, bus exchange operations, and CTOC operations

The following tables summarise the estimated operational expenditure for the short-term and full programme by financial year, broken down by headline intervention and roading authority.

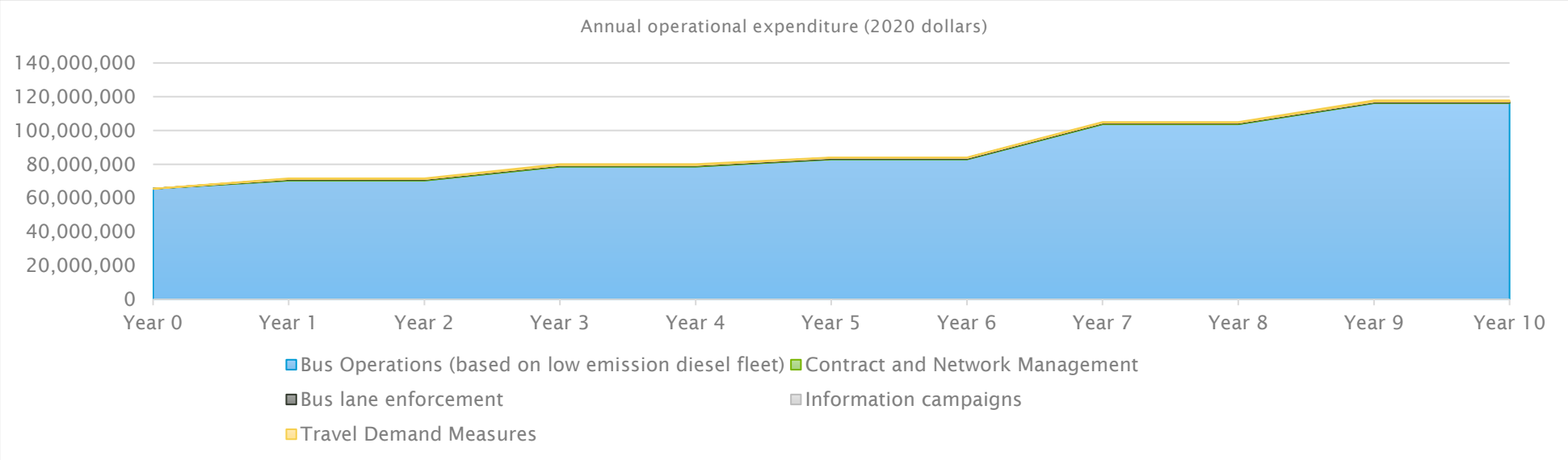
Costs were calculated based on methodology and rates given by Ecan engineers, then reviewed and agreed via workshops on 26 June (virtual) and 29 July.

A 51% funding assistance rate from Waka Kotahi applies to bus operations, travel demand management, information campaigns, and contract and network management categories.

Bus lane enforcement on local roads does not qualify for a funding assistance rate from Waka Kotahi. Bus lane enforcement on State Highways does apply, but is the responsibility of the NZ Police so funding is managed through the police enforcement channel.

Table 34 Total annual operational expenditure for the full recommended programme

Total annual operational expenditure for the short and medium term recommended programme (2020 dollars)											
TOTAL OPEX	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Contract and Network Management		370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000
Bus lane enforcement		465,000	465,000	465,000	465,000	465,000	465,000	465,000	465,000	465,000	465,000
Information campaigns		50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Travel Demand Measures		457,600	457,600	592,600	592,600	379,300	379,300	514,255	514,255	821,800	821,800
Bus Operations (based on low emission diesel fleet)	65,500,000	70,352,973	70,352,973	78,597,554	78,597,554	82,822,354	82,822,354	103,713,909	103,713,909	116,182,460	116,182,460
Total per annum	65,500,000	71,695,573	71,695,573	80,075,154	80,075,154	84,086,654	84,086,654	105,113,164	105,113,164	117,889,260	117,889,260



Total annual operational expenditure for the short and medium term recommended programme (2020 dollars)											
Gross Opex assigned to Council area	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
CCC	56,195,739	60,556,354	60,556,354	68,800,935	68,800,935	70,043,744	70,043,744	85,170,701	85,170,701	95,708,268	95,708,268
WDC	4,389,984	4,389,984	4,389,984	4,389,984	4,389,984	5,999,450	5,999,450	7,985,402	7,985,402	9,836,404	9,836,404
SDC	4,914,278	5,406,636	5,406,636	5,406,636	5,406,636	6,779,160	6,779,160	10,557,805	10,557,805	10,637,788	10,637,788

Proposed Opex in CCC Rating Area	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
CCC rating for Bus lane enforcement		465,000	465,000	465,000	465,000	465,000	465,000	465,000	465,000	465,000	465,000
CCC component of Travel Demand Measures		81,550	81,550	296,300	296,300	189,650	189,650	246,278	246,278	410,900	410,900
Ecan cost for Additional Bus Operation within CCC area		4,360,615	4,360,615	12,605,196	12,605,196	13,848,005	13,848,005	28,974,962	28,974,962	39,512,529	39,512,529
Ecan cost for Additional Bus Operation within CCC area (net farebox and WK share)		1,583,736	1,215,092	4,209,448	2,466,968	2,918,345	2,655,679	8,149,651	4,952,590	9,530,977	8,555,941
Total Opex for CCC LTP		546,550	546,550	761,300	761,300	654,650	654,650	711,278	711,278	875,900	875,900

Proposed Opex in SDC Rating Area	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
SDC component of Travel Demand Measures		63,400	63,400	0	0	0	0	10,850	10,850		0
Ecan cost for Additional Bus Operation within SDC area		492,358	492,358	492,358	492,358	1,864,882	1,864,882	5,643,527	5,643,527	5,723,510	5,723,510
Ecan cost for Additional Bus Operation within SDC area (net farebox and WK share)		178,820	137,196	137,196	137,196	635,684	345,603	1,717,973	919,362	954,113	946,712
Total Opex for SDC LTP		63,400	63,400	0	0	0	0	10,850	10,850	0	0

Proposed Opex in WDC Rating Area	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10

WDC component of Travel Demand Measures		83,850	83,850	0	0	0	0	10,850	10,850		0
Ecan cost for Additional Bus Operation within WDC area		0	0	0	0	1,609,466	1,609,466	3,595,418	3,595,418	5,446,420	5,446,420
Ecan cost for Additional Bus Operation within WDC area (net farebox and WK share)		0	0	0	0	584,543	244,385	965,665	545,937	1,350,164	1,178,892
Total Opex for WDC LTP		83,850	83,850	0	0	0	0	10,850	10,850	0	0

Proposed Opex for Ecan	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Ecan rating for Contract and Network Management		370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000
Ecan rating for Information campaigns		50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Ecan component of Travel Demand Measures		228,800	228,800	296,300	296,300	189,650	189,650	257,128	257,128	410,900	410,900
Ecan cost for Additional Bus Operation		4,852,973	4,852,973	13,097,554	13,097,554	17,322,353	17,322,353	38,213,907	38,213,907	50,682,459	50,682,459
Additional (incremental) Farebox (ramp up)		1,255,921	2,093,202	2,133,649	3,556,082	1,093,353	1,822,256	5,406,612	9,011,020	1,412,705	2,354,508
Additional Bus Operation Net Farebox		3,597,052	2,759,771	8,870,703	7,448,270	10,579,715	9,850,813	25,335,755	21,731,347	32,787,194	31,845,390
Additional Bus Operation Net Farebox and WK Share (51%)		1,762,555	1,352,288	4,346,644	3,649,652	5,184,061	4,826,898	12,414,520	10,648,360	16,065,725	15,604,241
Total Bus Operation	65,500,000	70,352,973	70,352,973	78,597,554	78,597,554	82,822,353	82,822,353	103,713,907	103,713,907	116,182,459	116,182,459

9 MANAGEMENT CASE

9.1 PROGRAMME MANAGEMENT PLANNING

9.1.1 Programme and business assurance arrangements

The Greater Christchurch Public Transport Joint Committee endorsed the co-ordinated investment programme and recommended, to their respective Councils, to make provision for the recommended investment programme in their respective draft Long-term plans.

The Greater Christchurch Public Transport Joint Committee (GCPTJC) also requested Environment Canterbury to include provision for the recommended investment programme in the draft 2021-2031 Regional Land Transport Plan.

The programme is recommended to be staged over a period of 10 years with key elements coming online approximately every two years. The programme therefore requires ongoing coordination between the 5 different project partners to ensure co-ordinated and integrated public transport response across the region.

The GCPTJC was dissolved at its meeting held on Friday 27 November 2020. It is therefore recommended that the Greater Christchurch Partnership Committee monitor the implementation of this programme on a regular basis to ensure an integrated approach be retained over future LTP cycles and that expected benefits are on track to realisation. The Greater Christchurch Partnership Committee has already been established with formal representation as shown in the diagram below.

The Transport Managers Group will have ownership of the recommended programme and monitor the wider programme drivers, costs, risks, contract management and expected benefits on a six-monthly basis.

Any changes to these aspects might require adjustments to the integrated programme. These will be agreed and discussed with the Chief Executive Advisory Group for presentation to the Greater Christchurch Partnership Committee. The Committee will make recommendations to the respective partner council's for consideration in future annual and long-term plans.

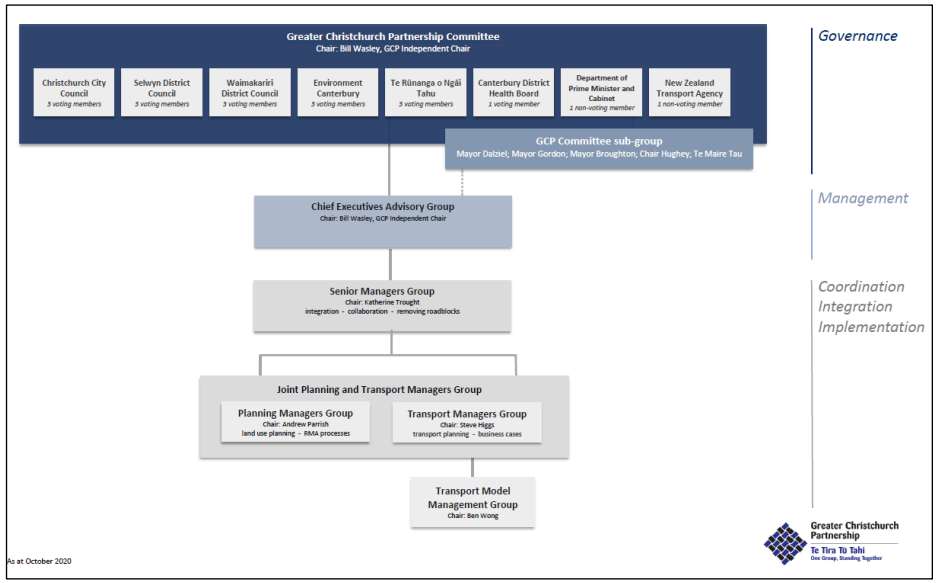


Figure 109. Greater Christchurch Partnership Committee

Formal post-project evaluation will take place within 12 months after each element of the programme is fully operational. The evaluation reviews will be prepared by the lead partner for that element and presented to the Transport Managers Group, with the focus on:

- The benefits and outcomes are achieved as planned
- Operational expectations and arrangements are functioning as planned
- Costs and risks were appropriately controlled

9.1.2 Project management arrangements

Each project within the programme will be managed using the project management methodology contained within the lead Council's Project Management Manual. The project will involve four stages:

- Project initiation (of which this Business Case process is part)
- Project planning
- Project execution
- Project completion and evaluation

For infrastructure projects, a Project Sponsor and Project Manager will oversee the project, in accordance with the lead Council's delivery methodology. A project team will be established with relevant staff from across the organisation responsible for project delivery. The Project Manager will be responsible for regular reporting updates to their nominated member on the Transport Managers Group where appropriate. For PT service changes, the PT Manager will have accountability for derlivery. In both cases, these staff will report to the Transport Managers Group.

9.1.3 Programme roles and responsibilities

Environment Canterbury: ECan is the lead agency responsible for contracting and operating the bus network within Greater Christchurch. Its role within this programme is to:

- Procure and manage the additional services required to ensure enhanced frequencies and more direct services
- Implement relevant travel demand measures alongside each service improvement in the programme (jointly with relevant Council)
- Introduce audio/visual on-board announcements for buses operating on frequent routes
- Install devices on the bus fleet and integrate them with the real time project to enable headway management
- Do ongoing information campaigns to ensure existing and potential new customers become aware of the benefit of the enhanced bus system
- Include allocation for this programme in the Regional Land Transport Plan and Regional Public Transport Plan.

Christchurch City Council: CCC is responsible for public transport infrastructure and for managing the local road network in Christchurch. Its role within this programme is to:

- Implement bus priority measures (bus lanes as well as priority at signalised intersections)
- Implement bus lane enforcement for the bus lane network on local roads. Enforcement on State highways is the responsibility of NZ Police but, for consistency, consideration should be given to CCC also enforcing the Halswell Road State Highway bus lanes. This will require an agreement with Waka Kotahi and NZ Police.
- Improve infrastructure at key stops (shelters, real time displays and cycle racks)
- Integrating the signal priority system (SCATS) with the bus real time information system to enable priority at key intersections
- Implement relevant travel demand measures alongside each service improvement in the programme (jointly with ECan)
- Land purchase to enable future expansion of the central bus exchange
- Include allocation for this programme in the City Council's long-term plan

Waimakariri District Council: WDC is the asset owner and responsible for managing the local transport system, including public transport facilities and infrastructure in the Waimakariri District. Its role within this programme is to:

- Improve infrastructure at key stops (shelters, real time displays and cycle racks)
- Improve infrastructure at the existing (currently under construction) park and ride sites (cycle cages, shelters, displays)
- Install information screens at library and council facilities
- Implement relevant travel demand measures alongside service improvements in the programme (jointly with ECan)
- Include allocation for this programme in the Council's long-term plan

Selwyn District Council: SDC is the asset owner and responsible for managing the local transport system, including public transport facilities and infrastructure in Selwyn District. Its role within this programme is to:

- Improve infrastructure at key stops (shelters, real time displays and cycle racks)
- Expand park and ride provision to support the new direct service from Lincoln as well as the ability extend and alter the direct service from Rolleston
- Provide supporting infrastructure at the park and ride sites (cycle cages, shelters, displays)
- Install information screens at library and council facilities
- Implement relevant travel demand measures alongside service improvements in the programme (jointly with ECan)
- Include allocation for this programme in the Council's long-term plan

Waka Kotahi: Waka Kotahi is responsible for managing, operating, planning for and improving the state highway network and delivery of public transport. It is a key investor in the transport system through co-investment in transport projects. Its role within this programme is to:

- Implement bus priority measures (bus lanes as well as priority at signalised intersections) along Halswell Road (SH75)
- Improve infrastructure at key stops (shelters, real time displays and cycle racks) along Halswell Road (SH75) in consultation with Christchurch City Council
- Include allocation for this programme in the National Land Transport Programme

9.1.4 Programme milestones

The programme will have at least five stages and implementation of the entire programme is estimated to take approximately ten years to implement (Table 35).

Table 35 Programme timetable

Stage / timing	Key Programme Milestones
Stage 1: Year 1 and 2	▪ Route 17 and route 28 operate at 15 minutes all day ▪ Yellow Line operates at 7.5 min headways through the inner core during the peak ▪ New direct service from Lincoln in place and operate with 3 services during the peak ▪ SCATS/RTI integrated ▪ Headway management implemented on core services ▪ Onboard announcements on core services in place
Stage 2: Year 3 and 4	▪ Blue and Orange, Purple Lines operate at 7.5 min headways through the inner core during the peak ▪ Orbiter operates at 7.5 min headways all day ▪ Bus lane measures for Yellow Line and Blue Line complete ▪ Bus lane measures for the Halswell section complete (SH75) ▪ Bus stop infrastructure upgrades for route 17 and 28 complete
Stage 3: Year 5 and 6	▪ Route 29 operates at 10-minute headways in the peak ▪ Direct services from satellite towns operate with six services during the peak, and with hourly service during the inter-peak ▪ New park and ride capacity in Lincoln ▪ Bus priority on remainder of Orange line completed ▪ Signal priority measures along Orbiter route completed
Stage 4: Year 7 and 8	▪ Frequent routes branched in outer suburbs and operate at 15-minute headways along each branch ▪ Route 60 and route 80 operate at 15 minutes all day ▪ Direct services from satellite towns operate with eight services during the peak, and with a 30-minute headway during the inter-peak ▪ New re-located park and ride in Rolleston ▪ Bus lane measures for Purple Line complete
Stage 5: Year 9 and 10	▪ Route 60, 80, 17 and 28 operate at 10 minutes headways during the peak ▪ Additional capacity created at the central bus exchange.

9.2 CHANGE MANAGEMENT PLANNING

It is proposed that approval of this combined business case will enable funding allocation to allow each responsible agency the ability to progress stages 1 – 3 in line with the programme timetable listed above. The next stage in the development of the programme elements will generally entail progression with detailed design, public engagement and procurement phases.

Stages 4 and 5 will require a further gateway review before funding is released to progress with the design, public engagement and procurement phases for

those elements. This review will occur through an update of the business case that specifically focus on:

- Benefits realisation review of stages 1-3
- Review of the policy and strategic environment to confirm organisational strategies and priorities;
- Forecast review to review if the demand has changes;
- Trends in the performance of the system;
- Changes in any dependencies and conditions; and
- The business case will also update the financial and economic cases for these aspects of the programme.

The recommended programme is informed through several key assumptions that could change over the duration of the programme. The stages and timing of the various elements within the programme will therefore be subject to regular confirmation and it is recommended that this be included in the remit of the Transport Managers Group as identified above.

The Transport Managers Group will consider the following 7 key aspects through an annual report and reconfirm or adjust the recommended programme accordingly:

Table 36 Recommended programme triggers for change

Aspect	Key assumption	Trigger for change
1.Population growth	Greater Christchurch's 2018 population of 470,000 is projected to grow to 533,000 by 2028. This represents an average annual population growth rate of 0.85% per annum over the next decade. The population is forecast to grow to over 641,000 by 2048.	Consider accelerating the recommended programme with higher population growth rates that result in 2028 forecast population to be achieved more than two years earlier. Consider slowing down the implementation of the recommended programme with lower population growth rates that result in 2028 forecast population to be achieved more than two years later.
2. Employment growth	Greater Christchurch's 2018 employment of 239,000 is forecast to grow by approximately 28% to 307,100 by 2048, with the majority of these (89%) in Christchurch's central city. The 2028 employment forecast is 264,700 for Greater Christchurch. This represents an average annual employment growth rate of 1% per annum over the next decade. Central city employment is forecast to increase from 38,800 in 2018 to approximately 69,500 by 2028. This represents an average annual employment growth rate of 6% per annum over the next decade.	Consider accelerating the recommended programme with higher employment growth rates that result in 2028 forecast employment to be achieved more than two years earlier (region wide or in the central city). Consider slowing down the implementation of the recommended programme with lower employment growth rates that result in 2028 forecast employment to be achieved more than two years later (region wide or in the central city).
3. Land use development	The priority development areas are documented in sections 1.4 and 1.5 of this business case.	Reconsider the staging of relevant programme items should any new areas not envisaged in this business case develop prior to 2028.
4. Integrating with other initiatives	Road network infrastructure improvements included within TLAs Long Term Plans (and the Waka Kotahi National Land Transport Programme) and other identified projects likely to achieve funding, as agreed for the CTM/CAST v18 model update (in 2018).	Consider changes to the recommended programme should any future initiatives not identified in the Do-Minimum be prioritised. These might include further expansion to the NZ Upgrade Programme, shovel ready projects or changes in policy direction that relates to central city parking or public transport fares.
5. Patronage numbers	The recommended option is expected to increase annual PT trips by 3.5 million trips per year by 2028 (growing at a 4.9% compound average rate from 2022 to 2028).	Accelerate recommended programme if bus network experience higher growth rates than forecast that result in 2028 forecast trips to be achieved two years earlier. Reconsider programme elements and timing with lower patronage growth rates that result in 2028 forecast trips to

Aspect	Key assumption	Trigger for change
		be achieved more than two years later. Accelerate improvements to any element in the programme where bus services experience crowding during the morning peak. For longer journeys (direct services) accelerate improvements in the programme where services experience full seat allocation during the morning peak.
6. Customer satisfaction	In 2019, 96% of passengers reported they were satisfied or better with the overall public transport service.	Reconsider programme elements and timing if less than 95% of passengers are "satisfied or better" with the public transport service two years running.
7. Council revenue	Each partner organisation will be able to set rates at a level that	Final adopted LTP that allocates less than required
	will support the inclusion of the programme within the next LTP.	funding to support the roll out of the programme as envisaged.

9.3 BENEFITS MANAGEMENT PLANNING

The ILM workshop developed a number of KPIs for the programme. The intention is that KPIs will be used, during and following the implementation of the programme, to assess whether the programme is achieving the desired benefits.

The KPIs developed at the workshop have been further refined as performance measures to make them more specific to the investment. These performance measures are set out in Figure 110 below.

Table 37 below provides details on the performance measures, including proposed methodology for capture, baseline data and expected results.

It is expected these measures will be collected through existing business processes and no specific allocation for their collection was allowed for in the business case. These measures will be reported on annually to the Transport Managers Group for their consideration.

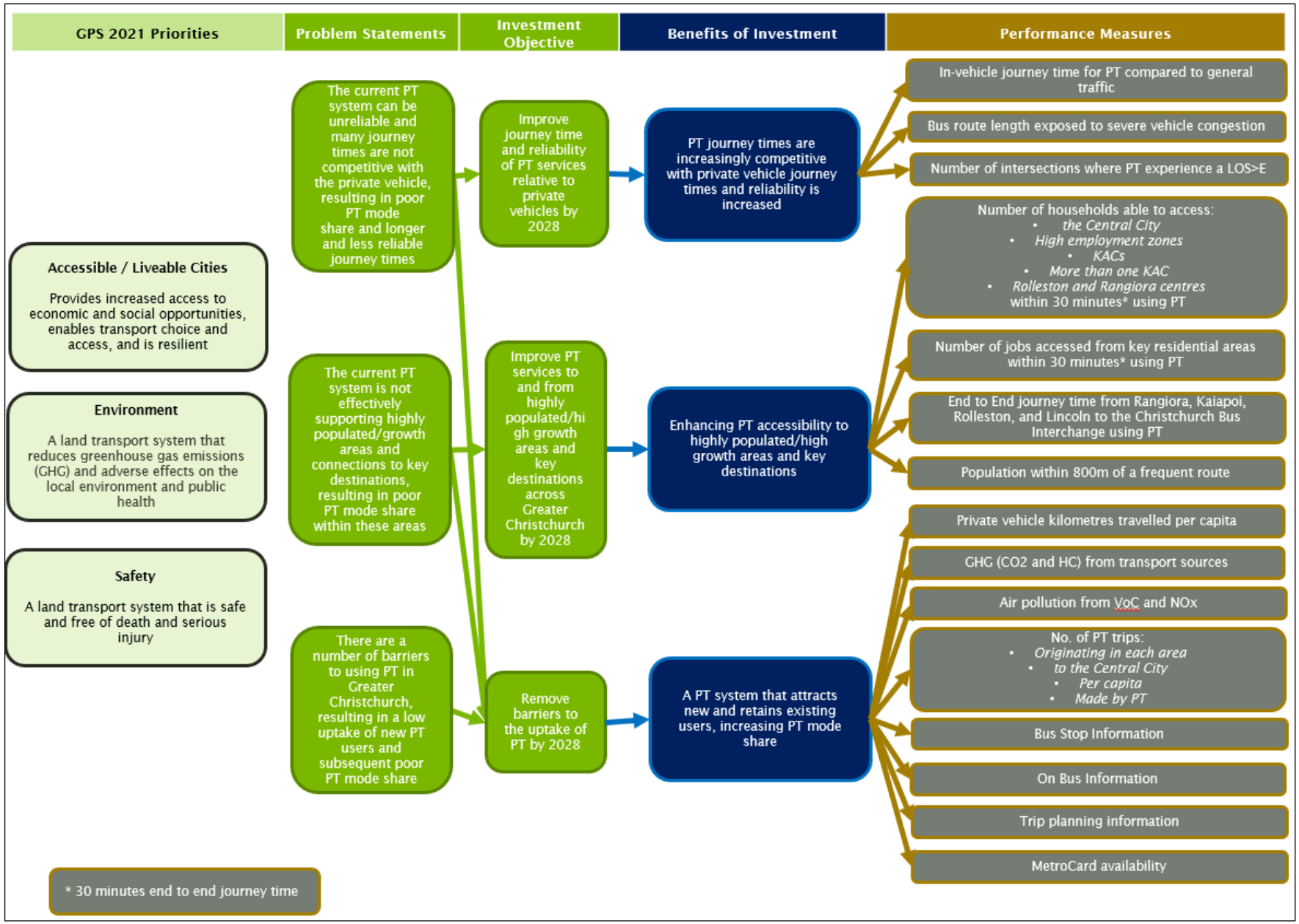


Figure 110: Investment logic map (ILM) summary, including link to performance measures

Table 37 Performance measures for the Greater Christchurch public transport project

Measure	Linked KPI*[63]	Method	Time of measurement	Baseline	Expected result
Change in the in-vehicle journey time along a specific route for PT compared to general traffic	1	Baseline existing in-vehicle journey time for PT (using ECan's Power BI GPS data) along specific core PT routes and compare to general traffic data (using Tom Tom or bluetooth CTOC data).	Should be measured following implementation of the short-term solutions (Years 1-6) and the medium-term solutions (Years 7-10).	2018 Census data / current network operation data from Power BI	The Bus/Car travel time ratio across the network is expected to reduce with implementation of the short-term recommendations, with the biggest reductions being on the Orange, Purple, and Yellow lines. The Bus/Car travel time for the Orange line travelling northbound is expected to reduce further with implementation of the medium-term recommendations.
Change in the percentage of the bus route exposed to severe vehicle congestion (v/c > 0.5)	1	Baseline the volume to capacity ratio traffic congestion on the five bus core routes using 2018 current network operation data from BI and general traffic data (using Tom Tom GIS and Bluetooth CTOC data). Measure: Traffic volume as per Power BI, Tom Tom GIS and Bluetooth CTOC data. Road Capacity: Constant – unless road upgrade changes proposed.	Minimum - Annual measurements.	2018 current network operation data from Power BI and general traffic data (using Tom Tom GIS and Bluetooth CTOC data).	The percentage of each bus route exposed to congestion is anticipated to drop from 30% to 0% for the Purple eastbound (Waimairi to Antigua) and Yellow eastbound (Waimairi to Antiqua) routes following implementation of the short-term recommendations. The percentage of the Orange northbound route exposed to severe congestion is expected to reduce from 15% to 0% following implementation of the medium-term recommendation.
Change in the number of intersections where PT experience a LOS>D	1	The first step will be to identify the best way to baseline the measurement of the intersection LoS. This may utilise Power BI (Bus journey time data), general traffic (data Tom Tom or Bluetooth data from CTOC) and average travel times (data set) live data.			There would be a reduction of seven intersections that experience a LOS>D.
Change in the number of households able to access the Christchurch City (Christchurch Bus Interchange, West End,	2	Baseline existing in-vehicle journey time for PT (using ECan's Power BI GPS data) and 2018 household census data to confirm the number	5 yearly (Census year)	2018 Census data / current network	Accessibility to the city centre improves across the locations with both the short- and medium-term improvements. The greatest improvements in access will be to

[63] These refer to the KPI's ID #'s identified in Table 3.

Measure	Linked KPI*[63]	Method	Time of measurement	Baseline	Expected result
Ara Institute of Technology, Christchurch Hospital) within 30 minutes end-to-end travel time using the PT system		of households located within a 30 min end to end travel time system. Measure: Average PT journey time over a week to determine the 30-minute travel catchment. Changes in households: Census data of the changes in population within the 30minute travel catchment area			the Hospital and Westend due to various frequency improvements near these locations.
Change in the number of households able to access high employment zones (Christchurch Airport, University of Canterbury, Blenheim Road Industry, Hornby, Addington) within 30 minutes end-to-end travel time using the PT system	2	Baseline existing in-vehicle journey time for PT (using ECan's Power BI GPS data) and 2018 household census data to confirm the number of households located within a 30 min end to end travel time system. Measure: Average PT journey time over a week to determine the 30-minute travel catchment. Changes in households: Census data of the changes in population within the 30minute travel catchment area	5 yearly (Census year)	2018 Census data / current network	Accessibility improvements are gained across the employment industries, through both short- and medium-term improvements. University and Addington get the biggest absolute increase, as they sit near the orbiter and get significant benefits from the increased frequency.
Change in the number of households able to access the Papanui, Riccarton, Hornby, Shirley and Linwood KACs within 30 minutes end-to-end travel time using the PT system	2	Baseline existing in-vehicle journey time for PT (using ECan's Power BI GPS data) and 2018 household census data to confirm the number of households located within a 30 min end to end travel time system. Measure: Average PT journey time over a week to determine the 30-minute travel catchment. Changes in households: Census data of the changes in population within the 30minute travel catchment area	5 yearly (Census year)	2018 Census data / current network data (Power BI)	Improvements to access to the KACs as a result of both the short term and medium-term improvements. The greatest changes to KACs in the inner core (Riccarton, Papanui, Linwood, Shirley, Barrington) are expected following the short term options which focus on the core with greater changes to Papanui and Halswell occurring after the medium term implementation with route and frequency changes beyond the core.
Change in the number of households that can access more than one KAC from key residential areas within 30 minutes	2	Baseline existing in-vehicle journey time for PT (using ECan's Power BI GPS data) and 2018 household census data to confirm the number	5 yearly (Census year)	2018 Census data / current network data (Power BI)	Increases to the number of households that can access the one KAC within 30 minutes following implementation of both options.

Measure	Linked KPI*[63]	Method	Time of measurement	Baseline	Expected result
end-to-end travel time using the PT system		of households located within a 30 min end to end travel time system. Measure: Average PT journey time over a week to determine the 30-minute travel catchment. Changes in households: Census data of the changes in population within the 30minute travel catchment area			Within key residential areas (North Inner, Linwood, Sydenham, Barrington, Riccarton), improvements from 83% of households in these key areas to 92%.
Change in the number of jobs that can be accessed from key residential areas within 30 minutes end-to-end travel time using the PT system	2	Baseline employment location numbers from census data. Measure: Average PT journey time over a week to determine the 30-minute travel catchment Number of jobs located within the 30-minute catchment taken from census data.	5 yearly (Census year)	2018 Census data / current network data (Power BI)	Accessibility to employment opportunities increase across Greater Christchurch. The short-term recommendations are anticipated to benefits to areas within the Orbiter (Incl St Albans, North West, Uni & Barr/South/Linwood), with the medium-term recommendations improving accessibility to areas beyond the inner core.
Change in the number of households able to access Rolleston and Rangiora centres within 30 minutes end-to-end travel time using the PT system	2	Baseline existing in-vehicle journey time for PT (using ECan's Power BI GPS data) and 2018 household census data to confirm the number of households located within a 30 min end to end travel time system. Measure: Average PT journey time over a week to determine the 30-minute travel catchment. Changes in households: Census data of the changes in population within the 30minute travel catchment area	5 yearly (Census year)	2018 Census data / current network data (Power BI)	No improvements are expected following the implementation of the short-term recommendations (which focus on the inner core). Improved numbers of households are expected after implementation of the medium-term recommendations.
Change in end-to-end journey time from Rangiora, Kaiapoi, Rolleston, and Lincoln to the Christchurch Bus Interchange using the PT system	2	Baseline existing in-vehicle journey time for PT (using ECan's Power BI GPS data) between the Bus interchange and the satellite towns. Measure: Average PT journey time over a week to determine the average in journey travel time.	5 yearly (Census year)	Current network data (Power BI)	Journey times improve from all regions to Christchurch City, by up to 35%. The medium-term recommendations provide particular benefits to Rolleston with the improvement of the direct services.

Measure	Linked KPI*[63]	Method	Time of measurement	Baseline	Expected result
Change in the population that are located within 800m of a frequent route	3	Use the Census data to determine the population location and the number of residents within households located within 800m of the route.	5 yearly (Census year)	2018 Census data and existing metro network information.	39% more people live within 400m of a (15min) frequent PT route, increasing from 132,000 in 2028 Do-minimum to 184,000.
Change in the private vehicle kilometres travelled per capita	4	Using General Traffic data from Tom Tom or Bluetooth data from CTOC, confirm the private vehicle kilometres travelled per capita. Use the Census data to determine the population.	5 yearly (Census year)	2018 Census data and existing private vehicle GIS information.	Reduction in total vehicle kilometres travelled per capita.
Change in the greenhouse gas emissions (CO2) from all transport sources	4	Baseline environmental measurements of greenhouse gas emissions from selected key locations along core routes. Once baseline quantitative data is gathered, implement monitoring plan to regularly measure changes in key indicators over the life of the project.	Bi-annual measurements following implementation of the short-term improvements.	Should be measured prior to construction start.	Very little reduction in emissions compared to the 2028 base (despite the reduction in total vehicle kilometres travelled per capita).
Change in the air pollution from PM10 and NO2	4	Baseline environmental measurements of air pollution (PM10 and NO2) gas emissions from selected key locations along core routes. Once baseline quantitative data is gathered, implement monitoring plan to regularly measure changes in key indicators over the life of the project.	Bi-annual measurements following implementation of the short-term improvements.	Should be measured prior to construction start.	No change anticipated.
Change in the number of PT trips originating in each area (aggregated zone)	5	Using boarding information from Environment Canterbury and provided on Power BI (created by ECan to analyse the bus network, see Figure 11. The data analysed originate from Real time Information based on GPS pings (approximately every 15 seconds)), confirm the number of PT trips originating within each zone.	Annually, or in-line with ECan regular operational data release.	Existing Power BI information from ECan.	Increases in the number of PT Trips within the orbiter, most significantly in North-Inner (St Albans), West Inner (Uni). Following implementation of the medium-term solution there are also increases in the number of PT Trips beyond the core and out to the branched routes (e.g. North-East into Parklands/Prestons).

Measure	Linked KPI*[63]	Method	Time of measurement	Baseline	Expected result
Change in the number of PT trips to the Christchurch Central City originating in each area (aggregated zone)	5	Using boarding information from Environment Canterbury and provided on Power BI (created by ECan to analyse the bus network, see Figure 11. The data analysed originate from Real time Information based on GPS pings (approximately every 15 seconds)).	Annually, or in-line with ECan regular operational data release.	Existing Power BI information from ECan.	Increased number of PT trips to the central city originating from the inner core. Once medium-term recommendations are implemented this increase to include increases from the north-west and north-east suburbs.
Change in the PT trips per capita	5	Using boarding information from ECan and population data as per the Census determine the number of PT trips made per capita.	5 yearly (Census year)	2018 Census data and existing ECan boarding information for 2018.	Approximately an additional 1.9million annual PT trips following implementation of the short-term option and a further 1.5million trips following the medium-term recommendation.
Change in the proportion of trips made by PT	5	Refer to the mode shift split for Greater Christchurch from the census data and taken from monitoring data for Waka Kotahi's Mode Shift Plan for Christchurch.	5 yearly (Census year)	2018 Census data	Increased proportion of trips in Greater Christchurch made by PT (up from 2.4% in the 2028 base to 2.7% - 2.9%).
Change in bus stop information	6	Baseline existing number of bus stops with shelters, seats and real-time service information and then assess the percentage increase of bus stops now providing these additional facilities. Drawing on annual Christchurch Metro User Surveys, satisfaction in areas relevant to bus stop information: ▪ The ease of getting information ▪ Real-time information quality ▪ Real-time information availability ▪ Information via a cell phone or tablet ▪ Quality of bus shelters	Should be measured following implementation of the short solutions (Years 1-6).	Survey existing number of stops with shelters, seats and real-time service information provided on the core routes. Metro User Surveys satisfaction in 2019: ▪ 93% ▪ 87% ▪ 86% ▪ 86% ▪ 78%	Increases number of bus stops that have shelters, seats and service information, which is expected to increase user satisfaction.
Change in on-bus information	6	Calculate the number of buses on the core and additional high	Should be measured following	Confirm with the bus operators the number	Use of technology, marketing, real-time information at stops and on-

Measure	Linked KPI*[63]	Method	Time of measurement	Baseline	Expected result
		frequency routes) with on-board announcements.	implementation of the short solutions (Years 1-6).	of existing buses on the high frequency routes (the Core) with on-board announcements.	board announcements will improve the ease of use of the PT System. Number of buses with bilingual on-board announcements for frequent routes to advise customers of upcoming stop and what connections can be made at the stop will increase.
Change in trip planning information (Metro website, phone apps)	6	Drawing on annual Christchurch Metro User Surveys, satisfaction in areas relevant to trip planning information: ▪ The ease of getting information ▪ Real-time information quality ▪ Real-time information availability ▪ Information via a cell phone or tablet	Annually	Metro User Survey Satisfaction levels in 2019: ▪ 93% ▪ 87% ▪ 86% ▪ 86%	Investment in travel demand management, better real-time information, and information campaigns, will all make it easier for people, especially new users, to plan their trips. Satisfaction is expected to therefore increase.
Change in availability of MetroCard (reduced cost, ease of signing up, locations where sold)	6	Drawing on annual Christchurch Metro User Surveys, satisfaction in areas relevant to trip planning information: ▪ How convenient it is to pay	Annually	Satisfaction levels in 2019: ▪ 93%	The National Ticketing Scheme (separate to this business case) will result in a whole new payment system for public transport in Christchurch, which is expected to increase satisfaction.

9.4 RISK MANAGEMENT PLANNING

The table below sets out an initial risk assessment for implementing the programme. Many of these risks could lead to the programme not being fully delivered or result in a delay to the implementation timeframe of the programme. However, with appropriate mitigation measures these should be able to be adequately managed.

None of these risks pose a threat that prevent the programme from proceeding to the next phase. However, ensuring these (and any other identified) risks remain sufficiently mitigated will be a key component of the Transport Management Group's oversight role.

Table 38 Risk management planning

Risk identifier	Risk description	Risk cause(s)	Risk consequence(s)	Controls	Current risk likelihood	Current risk consequence	Current controlled risk level
2052-14	There is a threat that long term assumptions on public transport attitudes/behaviours may change.	This is caused by impact of Covid-19 on behaviours; and working habits.	Consequences of this is lower than expected demand for the use of public transport, with a flow on impact on the ability to achieve the overall project objectives.	Monitor the situation annually and report key measures on population growth, employment growth, development activity and demand for PT use to the Transport Managers Group.	Unlikely	Moderate	Medium
2052-16	There is a threat that a partner may not deliver an individual project/ part of the recommended scope of works within their remit.	This is caused by: 1. Insufficient funding. 2. Partner does not support the recommended solution and therefore does not give it the priority in their LTP.	Consequences of this: 1. Overall project objectives and / or objectives of another part of the works are not achieved.	Presented the programme to the GCPTJC for endorsement and recommendation to each partner organisation's council. Future monitoring and agreement though the Greater Christchurch Partnership, with ongoing monitoring on an annual basis.	Unlikely	Moderate	Medium
2052-17	There is a threat that the recommended solution may require further enabling and / or supporting works outside the scope of this Project.	This is caused by: 1. Unforeseen projects or impacts of implementation during consultation phase.	Consequences of this: 1. Additional project costs. 2. Project objectives are not achieved.	Reporting through to the Transport Managers Group, for joint consideration of the impact on the programme timing and staging.	Possible	Moderate	Medium
2052-20	There is a threat that client organisations change their expenditure behaviour over the next 1-3 years.	This is caused by: 1. Covid-19 economic stimulus packages	Consequences of this: 1. Late benefit realisation of interventions. 2. Prioritisation of intervention are different to recommended programme	1 Sensitivity testing during Economic Case to test order of interventions and BCRs. 2 Ability to stage implementation to allow for acceleration / slowing down of elements in the	Likely	Moderate	High

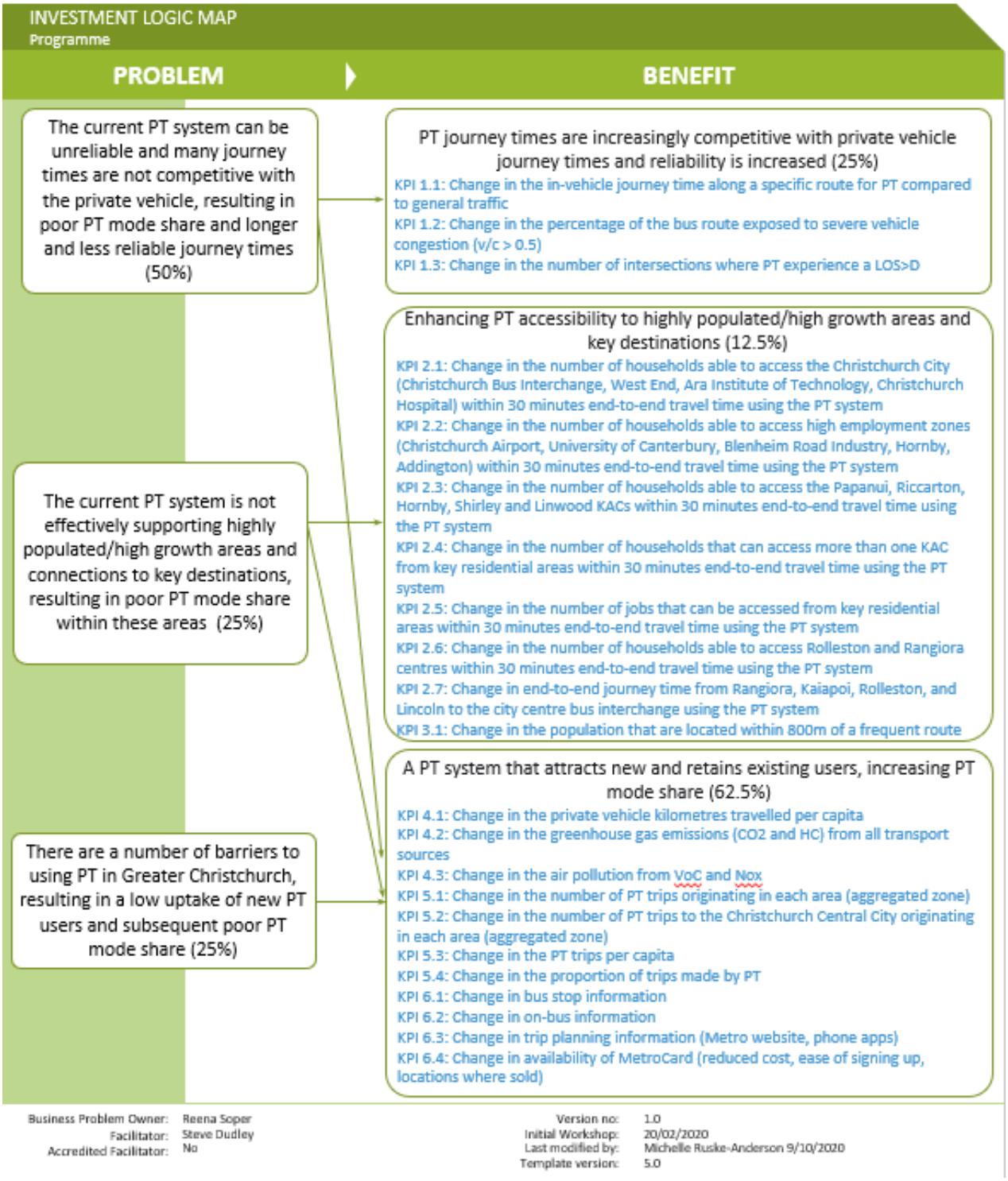
Risk identifier	Risk description	Risk cause(s)	Risk consequence(s)	Controls	Current risk likelihood	Current risk consequence	Current controlled risk level
				programme to respond to funding pressures.			

Appendix A
Investment Logic Map (ILM)

NZ TRANSPORT AGENCY
WAKA KOTAHI

Greater Christchurch Public Transport Combined Business Case

Addressing the public transport challenges in Greater Christchurch



Appendix B
Alignment with Existing Strategies and Organisational Goals

NATIONAL STRATEGIES AND ORGANISATIONAL GOALS

New Zealand Transport Agency Statement of Intent 2018-2022

The Statement of Intent (SOI) 2018-2022 outlines its primary objectives and functions outlined under the Land Transport Management Act 2003 (LTMA). The primary objective is to improve people's wellbeing, and the liveability of places. The SOI outlines the desired outcomes from transport solutions to work towards a transport system which is:

- **Inclusive access:** Enabling all people to participate in society through access to social and economic opportunities, such as work, education and health care
- **Economic prosperity:** Supporting economic activity through local, regional and international connections, with efficient movements of people and products
- **Resilience and security:** Minimising and managing the risks from natural and human-made hazards, anticipating and adapting to emerging threats, and recovering effectively from disruptive events
- **Environmental sustainability:** Transitioning to net zero carbon emissions and maintaining or improving biodiversity, water quality and air quality
- **Healthy and safe people:** Protecting people from transport-related injuries and harmful pollution and making active travel modes (such as walking and cycling) attractive options

Government Policy Statement on Land Transport 2021/2022-2030/2031

The Minister of Transport released the Government Policy Statement on land transport 2021/22–2030/31 in September 2020 following public feedback being received on the draft March to May 2020. The GPS 2021 takes effect 1 July 2021 and outlines the Government's priorities for the National Land Transport Fund (NLTF) and prioritises investment accordingly. The outcome of any activity supported by Waka Kotahi should align with three of the four strategic priorities of the GPS 2021. Key elements of the GPS 2021 priorities relevant to this project include:

Better travel options:

- Providing people with better transport options to access social and economic opportunities

Climate change:

- Developing a low carbon transport system that supports emission reductions while improving safety and inclusive access

Safety:

- Developing a transport system where no-one is killed or seriously injured

Government Policy Statement on Land Transport 2018/2019-2027/2028

The GPS 2018 was released on 28 June 2018 and took effect on 1 July 2018. The outcome of any activity supported by Waka Kotahi should align with the four strategic priorities of the GPS 2018. Key elements of the GPS 2018 priorities relevant to this project include:

Access:

- A land transport system that:
  - Provides increased access to economic and social opportunities
  - Enables transport choice and access
  - Is resilient

Safety:

- A land transport system that is a safe system, free from death and serious injury

Environment:

- A land transport system that reduces greenhouse gas emissions, as well as adverse effects on the local environment and public health

Value for money:

- A land transport system that delivers the right infrastructure and services to the right level at the best cost

Arataki Version 2

Arataki presents Waka Kotahi NZ Transport Agency's 10-year view of what is needed to deliver on the government's current priorities and long-term outcomes for the land transport system. It has been updated to reflect preliminary analysis and impacts from the COVID-19 pandemic on the land-transport system and the opportunities and challenges it presents over the next 10 years. Arataki seeks to ensure New Zealand's transport system is integrated and able to adapt to the evolving demands and changing needs of our customers. This is achieved by recognising the key drivers (demographic change, climate change, technology and data, customer desire, changing economic structure, funding and financing challenges) that are impacting on the land transport system. PT has been factored into some of these drivers, including how emerging technologies like apps can be used to improve the sustainable management of PT during demand peaks. The vision also considers that PT demand will increase as more people move into cities. Arataki recognises that these drivers will be subject to effects from COVID-19.

To respond to these drivers, Arataki proposes five step changes (improved urban form, transform urban mobility, significantly reduce harms, tackle climate change, support regional development) that are to spur on action to appropriately manage these drivers. PT is specifically captured in the transformation of urban mobility section, this in relation to improving urban form and addressing climate change. PT is a measurement of change regarding transforming urban mobility, improving built form and supporting regional development.

To implement the step changes there are six levers that can be pulled for varying degrees of pushing for change. This includes policy and regulation; education, engagement and awareness building; economic tools; investment; spatial and place-based planning; and network design, management and optimisation.

Waka Kotahi – Sustainability Plan April 2020

The Waka Kotahi Sustainability Plan April 2020 outlines a vision for a low carbon, safe and healthy land transport system. The plan outlines four key challenges:

1. Reduction in greenhouse gas emissions
2. Improvement in public health
3. Reduction in environmental harm
4. Reduction in corporate emissions

PT forms a key component of the plan, this includes:

- To use urban planning to promote and accelerating mode shift. There are several actions that are outlined which are to help achieve this in the plan such as to partner with local authorities to set emission reduction objectives for mode shift plans in our fastest growing cities
- Safe, clean and efficient vehicles which involves the decarbonisation of PT buses
- Investment in sustainable outcomes
- Deadline targets for June 2021 relating to PT include:
  - Support lead government agencies and the Climate Change Commission to understand the land use (avoid/reduce) and mode shift contribution to achieving net zero land transport emissions, relative to vehicle fleet transformation
  - Baseline the current and planned transport emissions profile of major urban areas targeted by Keeping Cities Moving
  - Identify the gap between baseline emissions and the scale of emission reductions required to deliver the land use/mode shift contribution to net zero carbon emissions 2050
  - Review and update the Environmental Social Responsibility Standard to ensure tools, guidance and requirements give effect to Environmental and Social Responsibility Policy, enabling consistent management and monitoring of environmental performance (especially biodiversity and water quality); social, cultural and heritage outcomes; and public health outcomes (related to air and noise emissions). Ensure application to all relevant infrastructure (e.g. rail, PT and active mode infrastructure as well as roads, bridges etc)
  - Establish and implement a Communications and Engagement Plan for Toitū Te Taiao to Embed Toitū Te Taiao into Waka Kotahi and support the culture change required to make sustainability part of our DNA
  - Establish and implement a change management plan for culture and capability

The plan itself is an implementation strategy for the Arataki long term vision/plan. PT forms a key staple in achieving that vision.

Climate Change Response (Zero Carbon) Amendment Act 2019

The purpose of the act is to limit the global temperature increase to 1.5 degrees Celsius above preindustrial levels and allow New Zealand to prepare for, and adapt to, the effects of climate change. It establishes a climate change commission that provides expert evidence on mitigation and adaptation measures for climate change. PT is anticipated to be way to reduce GHG emissions in New Zealand and the Act sets a target of reducing GHG emissions to net zero by 2050, with the exception of biogenic methane (separate targets and given for this).

An emission budget is required to be produced for each emissions budget period. There is a requirement for an emission reduction plan to be created that sets out the policies and strategies for meeting the budget. It is expected that increasing PT usage will factor into this plan as a strategy to help achieve the budget. A national climate change risk assessment must be also be undertaken to assess the risks to New Zealand's economy, society, environment, and ecology from the current and future effects of climate change; and identify the most significant risks to New Zealand, based on the nature of the risks, their severity, and the need for co-ordinated steps to respond to those risks in the next 6-year period. A national adaptation plan is required to be prepared in response to each national climate change risk assessment undertaken. It is anticipated that PT will feature in adaptation plans. This may be related to risks posed from climate change on PT infrastructure and services and identifying actions that can be taken to make them more resilient to those effects.

Overall, it is considered that despite PT not being specifically mentioned in the Act it is expected that it will feature in investigations and planning taken instigated under the Act.

Land Use Recovery Plan 2013 (LURP)

The Land Use Recovery Plan 2013 is a statutory document prepared under the Canterbury Earthquake Recovery Act 2011 in response to the 2010 and 2011 Canterbury earthquakes as a way forward for Greater Christchurch's recovery from the earthquakes. It set out immediate requirements for new development locations drawing on the Greater Christchurch Urban Development Strategy (UDS) 2007. The LURP identifies "Transform public and active transport" as an essential part of delivering infrastructure and services (Subsection 4.4).

Specifically, the LURP notes in subsection 4.4.2:

"Changing travel patterns since the earthquake have placed significant stress on Christchurch's transport infrastructure. While roading infrastructure is upgraded, use of other forms of transport lessens the impact on traffic. Making it easy for people to walk, cycle and use PT also supports a compact urban form. Creating safe, walkable communities also has positive health and social outcomes".

A new model for PT, comprised of core Metro Line services supplemented by connector/link routes, has been initiated to support the transition to recovery by:

- Maintaining accessibility to business and residential areas for members of the community
- Supporting economic recovery of the Central City, suburban and satellite centres

This model makes KACs an integral part of its network. The main PT routes will also support residential intensification.

REGIONAL-LEVEL STRATEGIES AND ORGANISATIONAL GOALS

Our Space 2018-2048: Greater Christchurch Settlement Pattern Update

Our Space is owned by the Greater Christchurch Partnership, a multi-agency group made up of members from councils in the Greater Christchurch area, Iwi and government organisations, such as Waka Kotahi, Regenerate Christchurch and the Canterbury District Health Board.

It represents a cohesive plan update to the Urban Development Strategy that charts Christchurch's future as it grows to a projected 640,000 people by 2048.

Section 5.5 of Our Space focuses on the direction and vision for transport and other infrastructure across Greater Christchurch, including PT. In highlighting the importance of integrated land use and transport planning, Our Space presents the case that with significant population growth within Christchurch City and in the surrounding districts, the current freedom and independence enjoyed by Cantabrians across the Greater Christchurch area in travelling around will in future become more difficult unless there is a significant shift in how we think about and approach transport[64].

Transport business cases underway (such as this one) will consider the multi-modal transport programme that will address such matters. These include specific investigations to determine the appropriate investment required to support an enhanced PT system and improvements along key transport corridors, including those that are part of the strategic transport network and support freight movements. This programme would be developed based on the strategic directions for the UDS 2007 and UDS Update 2016 and would contribute to the strategic goals related to an integrated and managed urban development.

It will help create a more efficient, reliable, safe and resilient transport system that promotes the use of active and PT and improves accessibility for all people in Greater Christchurch. Integrating land use and transport is particularly important for rapid transit and supporting an efficient PT network. Each can have a positive influence on the others by improving the accessibility of an area and supporting growth and housing density around rapid transit corridors and stations. This is essential to maximise the benefits from the large investment required to build and operate rapid transit.

Section 5.7 of Our Space further discusses that rationale of supporting future PT investment as part of the proposed approach. The future investment in Greater Christchurch's PT system will influence and be influenced by how the Christchurch City and surrounding towns accommodate future growth. For such investment to be sustainable it needs to foster significant increases in PT patronage. A settlement pattern approach that encourages greater urban densities, particularly along key PT corridors provides the greatest opportunity for people to live near proposed new rapid transit routes, increasing the likelihood and attractiveness for people to adopt these transport modes[65].

Canterbury Regional Land Transport Plan 2015-2025 (revised June 2018)

The CRLTP is prepared by the Regional Transport Committee[66] and outlines the current state of our regional transportation network and the challenges we face now and in the future.

The priority areas of investment contained in the CRLTP include safety, accessibility (condition and suitability of assets and travel time reliability), resilience, and environmental impact. These investment areas relate to several the transport issues and challenges in the Canterbury region.

The relevant issues, objectives and outcomes for the priority investment areas to this combined business case are outlined in Table 23.

Table 39 Relevant Canterbury Regional Land Transport Plan 2015–2025 issues, objectives and outcomes for the priority investment areas[67]

Issues	Objectives	Outcomes
1. Safety Safety is compromised by: ▪ Speed, roadsides, road user behaviour, and vehicle standards.	▪ Progressively reduce transport-related fatalities and serious injuries overtime	An accessible, affordable, integrated, safe, resilient and sustainable transport system that:

[64] Greater Christchurch Partnership (2019). Our Space 2018-2048: Greater Christchurch Settlement Pattern Update, p.31
[65] Greater Christchurch Partnership (2019). Our Space 2018-2048: Greater Christchurch Settlement Pattern Update, p.37
[66] The Canterbury Regional Transport Committee includes ECan, Ashburton District Council, CCC, Hurunui District Council, Kaikōura District Council, Mackenzie District Council, SDC, Timaru District Council, WDC, Waimate District Council and Waka Kotahi
[67] Environment Canterbury (2018). Canterbury Regional Land Transport Plan 2015-2025 (Revised June 2018), p.29-30

Issues	Objectives	Outcomes
2. Accessibility Accessibility is compromised by: ▪ A high reliance on single occupancy vehicles ▪ Earthquake damage/ post-earthquake recovery activities ▪ Population change, changing land use patterns ▪ Lack of transport choices ▪ Network design and land use planning and ▪ Difficulties accessing or crossing major routes in urban areas (severance)	▪ Improve levels of access in an environmentally sustainable way by increasing the attractiveness of PT, walking and cycling, so there is greater use of these modes: – For PT the focus is on timeliness, convenience, affordability, efficiency, connectedness and sustainability and – For walking and cycling the focus is on safety, amenity, convenience, connectivity and being able to take a direct route ▪ Improve connections between different transport modes	▪ Supports the safe, efficient and effective movement of people and goods by the most appropriate mode (including road, rail, sea, air) ▪ Is responsive and supports population change and economic development, including freight and tourism growth ▪ Minimises the consequences of disruptive events ▪ Supports convenient and connected transport options to support mobility and access ▪ Reduces the likelihood and extent of death and serious injury ▪ Is the result of co-ordinated transport and land use planning and infrastructure investment ▪ Fully incorporates sustainability issues, including environmental sustainability, into transport planning decisions ▪ Ensures transport makes a positive contribution to the health of Cantabrians and ▪ Represents good value-for-money
4. Travel time reliability Travel time reliability is compromised by: ▪ A high reliance on single occupancy vehicles ▪ An expanding range of road users mixing at different speeds, including an increasing number of freight vehicles and tourists ▪ A lack of supporting infrastructure, network management, and transport alternatives: – Earthquake damage/post-earthquake recovery activities and – Population change, changing land use patterns	▪ Improve journey time reliability on key corridors, with a focus on freight, PT and tourism ▪ Improve access to freight hubs	
6. Environmental impact The quality of the environment is compromised by the impact of: ▪ Emissions from a vehicle fleet predominantly powered by fossil fuel and the adverse effects these emissions have on the climate, local environment, and public health	Meeting the objectives outlined above under "accessibility" would also help to address environmental impact. In addition, the following objectives are also important: ▪ Increased uptake of energy efficient and environmentally sustainable vehicles ▪ Increased transport and land use integration ▪ Reduced air and water pollution	

Issues	Objectives	Outcomes
▪ The large number of vehicles on the road (both for freight transport and private travel) ▪ A lack of environmentally sustainable transport alternatives ▪ Dispersed settlement patterns making it difficult to service communities efficiently and sustainably ▪ Pollutants from vehicles and rainfall runoff from roads which degrade water and air quality and affect biodiversity ▪ Vehicle noise pollution and ▪ Increased roading and rainfall intensity contribute to greater runoff and risk of flooding	▪ Improved storm water management	

Statement of CRLTP priorities for 2015-2025

CRLTP Priority 1: Looking after what we have

For most trips in Canterbury, the existing transport network and services provide effective and efficient access. The priority for the region is keeping the existing network fit-for-purpose. Priority 1 programmes include existing PT services and low risk/low cost programmes and optimisation of the existing transport network and assets (note that low risk/low cost programmes replaced the category of minor improvements in 2017 under the National Land Transport Programme, and the threshold has been increased from $300,00 to $1,000,000)[68].

Priority 3: Improvements with high strategic alignment

Priority 3 includes programmes with a high alignment to the regional investment priorities of the CRLTP. Most of these programmes are in, or around, Christchurch due to the higher demand levels on this part of the network. Relevant Priority 3 projects include the National Ticketing Project.

High priority PT route and facility improvements, and planning for the future

The improvements for PT support a transition to a radial PT system. Alongside cycle routes, they also support access to the Christchurch Central City as part of earthquake recovery. The Greater Christchurch Future PT Business Cases will help shape land use and transport decisions. It was originally anticipated that the business case would be completed and incorporated in the revision of the Canterbury Regional Public Transport Plan (CRPTP) by mid-2018. Consultation with the public and interested groups on the proposed solutions coming out of this business case, and their delivery, will follow[69]. This combined business case will be incorporated in the CRLTP 2021-2031.

[68] ECan (2018). Canterbury Regional Land Transport Plan 2015-2025 (Revised June 2018), p.41
[69] ECan (2018). Canterbury Regional Land Transport Plan 2015-2025 (Revised June 2018), p.46

Greater Christchurch Mode Shift Plan 2020

Waka Kotahi have developed a plan to deliver on social, environmental and economic outcomes by growing the share of travel by PT, walking and cycling (mode shift).

For urban areas to thrive people need to be able to move around easily and have a range of choices about how they get to work, connect with family and friends and access services. We need to build a modern transport system with a mix of reliable transport options that help keep people and products safely moving.

The Waka Kotahi plan, *Keeping Cities Moving*, looks to do this through three main ways:

- Shaping urban form
- Making shared and active modes more attractive
- Influencing travel demand and transport choices

The plan outlines 35 interventions that seek to increase the pace of change in cities and ensure that investment is targeted to help provide more transport choice and ultimately reduce car dependency.

In addition to the Waka Kotahi plan, there are plans for place-based changes in the six high-growth urban areas with the highest potential to achieve mode shift: Auckland, Hamilton, Tauranga, Wellington, Christchurch and Queenstown.

A specific Mode Shift Plan has been developed for Christchurch and identifies three priority packages for implementation in the short term (3 to 6 years) and these are:

- Cycleways – connecting gaps in the existing cycleway network
- PT – Delivering short term improvements to PT as outlined in the PT Future business cases and
- Encouraging Behaviour Change: travel demand management activities to implement integrated behaviour change programmes alongside major capital investment

The mode shift plan acknowledges that within Greater Christchurch the key drivers for mode shift are environmental and safety concerns, with congestion a secondary consideration.

Greater Christchurch Transport Statement 2012

The Greater Christchurch Transport Statement (GCTS) 2012 provides an overarching framework to enable a consistent, integrated approach to planning, prioritising, implementing and managing the transport network and services in the Greater Christchurch area. The GCTS focuses on the strategic links between key places within the Greater Christchurch area. The agreed outcomes will be delivered through the transport activities of the various UDS partners[70]. Further and other localised activities for active transport and improvements will continue to be developed through the local area transport plans of the partners[71].

The GCTS recognises that people need to travel for business, work, education, shopping and social purposes. They want to do this safely and efficiently, with choices across a range of modes – walking, cycling, PT, private vehicles, trucks, trains and planes[72]. In planning and developing an effective 'one-network' transport system for a thriving Greater Christchurch, the UDS partners seek to achieve the best possible transport outcomes and objectives, using a strategic approach, those relevant to this combined business case are identified in Table 24.

[70] The partnership comprises of UDS partners - ECan, CCC, WDC, SDC, Waka Kotahi, Christchurch International Airport Limited (CIAL), KiwiRail, Lyttelton Port of Christchurch (LPC), Canterbury Earthquake Recovery Authority (CERA) and the Ministry of Transport (MoT)
[71] ECan, CCC, WDC, SDC, NZ Transport Agency, CIAL, KiwiRail, LPC, CERA and the MoT (2012). Greater Christchurch Partnership Transport Statement 2012, p.3
[72] ECan, CCC, WDC, SDC, NZ Transport Agency, CIAL, KiwiRail, LPC, CERA and the MoT (2012). Greater Christchurch Partnership Transport Statement 2012, p.3

Table 40 Greater Christchurch Transport Statement 2012 outcomes and objectives[73]

Transport outcomes		Objectives
Journey *Links between people and places*	Connectedness	Integrate land-use activities with transport solutions, enabling ease of movement between places
	Resilience, reliability and efficiency	Optimise the use of existing transport assets through managing travel demand and networks
		Provide safe, efficient and resilient links to connect people and places
		Ensure efficient and predictable travel time between key places
	Travel choice	Provide more options for people to walk, cycle and use PT
Safety	Safe journeys	Minimise the severity and social cost of crashes
		Improve personal security
Environment	Liveable communities	Support place-making, and 'active travel' and PT, reducing emissions and improving public and environmental health
	Low environmental impacts	

The GCTS identifies PT as being one of the five most pressing strategic transport issues needing partnership action in the short-term. The action plan for investing in PT outcomes includes:

- Investing in PT network operation and growth model to provide transport choice
- Developing PT interchanges
- Developing PT priority measures
- Investigating and protecting future PT options

Canterbury Regional Public Transport Plan 2018-2028

The vision of the CRPTP is to provide innovative and inclusive PT that sits at the heart of the transport network and supports a healthy, thriving, and liveable Greater Christchurch. It seeks to provide a PT system that is accessible and convenient, with high-quality, zero emission vehicles and facilities. The system would get people where they want to go and would be well used and valued by the people of Greater Christchurch.

The CRPTP aims to achieve the following:

- Grow patronage by progressively improving the attractiveness of PT, to achieve a threefold increase in patronage by 2048
- Improve journey times and the reliability of PT services to KACs, so that they are comparable to journeys by car
- More people can access KACs by PT, so that 90 per cent of households can access a KAC within 30 minutes by 2028
- Improve health and environmental outcomes by delivering:
  - A zero emissions fleet

[73] ECan, CCC, WDC, SDC, NZ Transport Agency, CIAL, KiwiRail, LPC, CERA and the MoT (2012). Greater Christchurch Partnership Transport Statement 2012, p.6

  - Supporting public health improvements through greater patronage
- Provide a catalyst for Central City regeneration, and regional housing and business development, by protecting and investing in rapid transit corridors

The relevant CRPTP policy areas, outcomes and targets are outlined in Table 25.

Table 41 Relevant Canterbury Regional Public Transport Plan 2018-2028 policy areas, outcomes and targets

Outcome	Measure	Target
Policy area 1: The network – services, infrastructure, and supporting measures		
The network-services, infrastructure and supporting measures	Proportion of Greater Christchurch urban households that can access one or more KAC by PT within 30 minutes.	90% of households can use PT to access one or more KAC within 30 minutes.
	Proportion of all peak-time trips to the Central City made by PT.	15% by 2021. 20% by 2030.
	Number of car trips replaced by PT trips per year.	More than 7 million per year.
	Number of communities who receive financial support from Environment Canterbury to establish Community Vehicle Trusts.	100% receive support.
Policy area 2: Customers		
The PT system provides a high-quality experience that retains existing customers, attracts new customers and achieves a high level of customer satisfaction.	Number of passenger trips per year in Greater Christchurch and Timaru.	36 trips per person per year by 2024 (this equates to approximately 18 million trips per year based on present population).
	Customer rating of service quality.	More than 95% of customers are satisfied.
	Proportion of Total Mobility customers satisfied with the system.	More than 90% of total mobility users are satisfied.
	A safe PT system.	More than 95% of customers are satisfied with personal safety.
	Passenger rating of value for money.	Decreasing every year (not yet measured).
	Greenhouse gas emissions per passenger trip.	Decreasing every year (not yet measured).
Policy area 3: Funding and fares		
PT funding is sustainable and supports system objectives while providing value to the community.	Overall ratepayer rating.	More than 95% of ratepayers are satisfied.
Policy area 4: Standards, procurement, monitoring and review		
PT services that meet customer needs, benefit the wider community, and minimise environmental impacts are procured at a price that provides excellent value for money for customers and ratepayers.	Proportion of PT fleet that is zero emission.	More than 40% of the vehicle fleet is low or zero emission by 2025.

Appendix C
Additional Evidence for Problem Statement 1 – Travel Time Data

Travel Time Data

Table 42 Travel time reliability measure for key PT routes - Inbound

Route	Direction	Period	Origin	Destination	Distance to Interchange (km)	Minimum (minutes)	Median (minutes)	95th Percentile (minutes)	Planning Time Index	Buffer time	Buffer Index (%)
17	Northbound	AM	Huntsbury	Bus Interchange (Platform D)	6.1	00:15:05	00:21:51	00:29:09	1.93	00:07:18	33%
17	Northbound	PM	Huntsbury	Bus Interchange (Platform D)	6.1	00:12:25	00:18:12	00:25:42	2.07	00:07:30	41%
17	Southbound	AM	Sheffield Cres	Bus Interchange (Platform B)	9.7	00:25:24	00:35:37	00:43:33	1.71	00:07:56	22%
17	Southbound	PM	Sheffield Cres	Bus Interchange (Platform B)	9.7	00:19:17	00:24:28	00:32:45	1.70	00:08:17	34%
28	Northbound	AM	Lyttelton Wharf	Bus Interchange (Platform D)	13.2	00:22:22	00:27:03	00:33:07	1.48	00:06:03	22%
28	Northbound	PM	Lyttelton Wharf	Bus Interchange (Platform D)	13.2	00:23:24	00:32:23	00:45:32	1.95	00:13:09	41%
28	Southbound	AM	Northwood	Bus Interchange (Platform B)	17	00:36:26	00:45:15	00:59:44	1.64	00:14:29	32%
28	Southbound	PM	Northwood	Bus Interchange (Platform B)	17	00:32:43	00:41:36	00:53:55	1.65	00:12:19	30%
60	Eastbound	AM	Corsair Dr - The Landing	Bus Interchange (Platform A)	11.8	00:25:40	00:32:44	00:44:20	1.73	00:11:36	35%
60	Eastbound	PM	Corsair Dr - The Landing	Bus Interchange (Platform A)	11.8	00:24:10	00:28:45	00:36:46	1.52	00:08:01	28%
60	Westbound	AM	Rocking Horse Rd near Petrel Ln	Bus Interchange (Platform C)	20.5	00:39:33	00:48:54	00:57:42	1.46	00:08:47	18%
60	Westbound	PM	Rocking Horse Rd near Petrel Ln	Bus Interchange (Platform C)	20.5	00:33:10	00:42:25	00:51:28	1.55	00:09:03	21%
80	Eastbound	AM	Lincoln University	Bus Interchange (Platform A)	22.9	00:39:33	00:53:11	01:07:31	1.71	00:14:21	27%
80	Eastbound	PM	Lincoln University	Bus Interchange (Platform A)	22.9	00:34:39	00:46:42	01:06:19	1.91	00:19:37	42%
80	Westbound	AM	Queenspark Dr near Inwoods Rd	Bus Interchange (Platform C)	15.1	00:29:26	00:38:34	00:50:04	1.70	00:11:30	30%
80	Westbound	PM	Queenspark Dr near Inwoods Rd	Bus Interchange (Platform C)	15.1	00:26:28	00:32:38	00:39:34	1.49	00:06:56	21%
Blue	Northbound	AM	Princess Margaret Hospital	Bus Interchange (Platform D)	5.2	00:11:16	00:17:10	00:23:52	2.12	00:06:42	39%
Blue	Northbound	PM	Princess Margaret Hospital	Bus Interchange (Platform D)	5.2	00:15:00	00:16:42	00:19:35	1.31	00:02:53	17%
Blue	Southbound	AM	Rangiora (Ashley St)	Bus Interchange (Platform B)	37.2	01:00:59	01:09:40	01:21:28	1.34	00:11:48	17%
Blue	Southbound	PM	Rangiora (Ashley St)	Bus Interchange (Platform B)	37.2	00:51:32	01:01:20	01:13:16	1.42	00:11:56	19%
Orange	Northbound	AM	Knights Stream Park	Bus Interchange (Platform D)	12.2	00:25:20	00:34:24	00:45:15	1.79	00:10:52	32%
Orange	Northbound	PM	Knights Stream Park	Bus Interchange (Platform D)	12.2	00:20:58	00:28:04	00:38:28	1.83	00:10:24	37%
Orange	Southbound	AM	Queenspark	Bus Interchange (Platform B)	14.1	00:25:57	00:36:21	00:45:24	1.75	00:09:03	25%
Orange	Southbound	PM	Queenspark	Bus Interchange (Platform B)	14.1	00:22:55	00:30:46	00:42:15	1.84	00:11:29	37%
Purple	Eastbound	AM	Christchurch International Airport	Bus Interchange (Platform A)	12.8	00:26:54	00:35:48	00:51:53	1.93	00:16:06	45%
Purple	Eastbound	PM	Christchurch International Airport	Bus Interchange (Platform A)	12.8	00:26:25	00:33:58	00:43:35	1.65	00:09:37	28%
Purple	Westbound	AM	Sumner	Bus Interchange (Platform C)	14.5	00:17:45	00:21:15	00:25:56	1.46	00:04:41	22%
Purple	Westbound	PM	Sumner	Bus Interchange (Platform C)	14.5	00:15:01	00:18:09	00:24:56	1.66	00:06:47	37%
Yellow	Eastbound	AM	Rolleston Terminus	Bus Interchange (Platform A)	30.6	00:49:51	00:59:37	01:10:43	1.42	00:11:05	19%
Yellow	Eastbound	PM	Rolleston Terminus	Bus Interchange (Platform A)	30.6	00:48:38	01:03:00	01:21:46	1.68	00:18:46	30%
Yellow	Westbound	AM	New Brighton (Oram Ave)	Bus Interchange (Platform C)	9.3	00:21:15	00:27:06	00:38:53	1.83	00:11:47	43%
Yellow	Westbound	PM	New Brighton (Oram Ave)	Bus Interchange (Platform C)	9.3	00:20:24	00:24:12	00:27:26	1.35	00:03:14	13%

Table 43 Travel time reliability measure for key PT routes - Outbound

Route	Direction	Period	Origin	Destination	Distance (km)	Minimum (minutes)	Median (minutes)	95th Percentile (minutes)	Planning Time Index	Buffer time	Buffer Index (%)
17	Northbound	AM	Bus Interchange (Platform D)	Sheffield Cres	10.1	00:22:52	00:27:37	00:38:17	1.67	00:10:41	39%
17	Northbound	PM	Bus Interchange (Platform D)	Sheffield Cres	10.1	00:22:04	00:33:22	00:47:42	2.16	00:14:20	43%
17	Southbound	AM	Bus Interchange (Platform B)	Huntsbury	5.9	00:13:34	00:18:16	00:23:47	1.75	00:05:31	30%
17	Southbound	PM	Bus Interchange (Platform B)	Huntsbury	5.9	00:14:53	00:19:56	00:26:51	1.80	00:06:55	35%
28	Northbound	AM	Bus Interchange (Platform D)	Northwood	17.4	00:31:58	00:38:44	00:47:18	1.48	00:08:33	22%
28	Northbound	PM	Bus Interchange (Platform D)	Northwood	17.4	00:32:25	00:42:30	01:02:18	1.92	00:19:48	47%
28	Southbound	AM	Bus Interchange (Platform B)	Lyttelton Wharf	13.9	00:28:11	00:33:41	00:49:00	1.74	00:15:19	45%
28	Southbound	PM	Bus Interchange (Platform B)	Lyttelton Wharf	13.9	00:29:28	00:38:03	00:54:21	1.84	00:16:18	43%
60	Eastbound	AM	Bus Interchange (Platform A)	Southshore	20.6	00:35:53	00:43:54	01:14:24	2.07	00:30:30	69%
60	Eastbound	PM	Bus Interchange (Platform A)	Southshore	20.6	00:37:10	00:46:13	01:08:43	1.85	00:22:30	49%
60	Westbound	AM	Bus Interchange (Platform C)	Corsair Drive	12.5	00:25:15	00:31:28	00:36:46	1.46	00:05:18	17%
60	Westbound	PM	Bus Interchange (Platform C)	Corsair Drive	12.5	00:28:14	00:35:03	00:43:00	1.52	00:07:57	23%
80	Eastbound	AM	Bus Interchange (Platform A)	Queenspark Dr near Inwoods Rd	14.6	00:23:59	00:44:06	01:00:02	2.50	00:15:57	36%
80	Eastbound	PM	Bus Interchange (Platform A)	Queenspark Dr near Inwoods Rd	14.6	00:25:23	00:47:25	01:05:59	2.60	00:18:34	39%
80	Westbound	AM	Bus Interchange (Platform C)	Lincoln University	23.4	00:37:36	00:43:21	00:53:40	1.43	00:10:19	24%
80	Westbound	PM	Bus Interchange (Platform C)	Lincoln University	23.4	00:36:08	00:45:54	01:18:11	2.16	00:32:16	70%
Blue	Northbound	AM	Bus Interchange (Platform D)	Rangiora (Ashley St)	36.5	00:58:00	01:07:11	01:31:44	1.58	00:24:32	37%
Blue	Northbound	PM	Bus Interchange (Platform D)	Rangiora (Ashley St)	36.5	00:51:46	00:56:52	01:01:54	1.20	00:05:02	9%
Blue	Southbound	AM	Bus Interchange (Platform B)	Princess Margaret Hospital	5.5	00:13:30	00:16:10	00:23:00	1.70	00:06:50	42%
Blue	Southbound	PM	Bus Interchange (Platform B)	Princess Margaret Hospital	5.5	00:12:55	00:17:39	00:37:11	2.88	00:19:33	111%
Orange	Northbound	AM	Bus Interchange (Platform D)	Queenspark	13.9	00:22:27	00:28:18	00:36:56	1.65	00:08:38	31%
Orange	Northbound	PM	Bus Interchange (Platform D)	Queenspark	13.9	00:24:03	00:32:20	00:41:26	1.72	00:09:06	28%
Orange	Southbound	AM	Bus Interchange (Platform B)	Knights Stream Park	12.6	00:21:55	00:27:59	00:42:44	1.95	00:14:45	53%
Orange	Southbound	PM	Bus Interchange (Platform B)	Knights Stream Park	12.6	00:20:31	00:33:10	00:44:14	2.16	00:11:03	33%
Purple	Eastbound	AM	Bus Interchange (Platform A)	Ferrymead Shops	6.1	00:14:18	00:18:11	00:25:51	1.81	00:07:39	42%
Purple	Eastbound	PM	Bus Interchange (Platform A)	Ferrymead Shops	6.1	00:14:44	00:19:10	00:24:33	1.67	00:05:22	28%
Purple	Westbound	AM	Bus Interchange (Platform C)	Christchurch International Airport	13.4	00:27:21	00:35:41	00:43:13	1.58	00:07:32	21%
Purple	Westbound	PM	Bus Interchange (Platform C)	Christchurch International Airport	13.4	00:29:43	00:40:37	00:48:20	1.63	00:07:42	19%
Yellow	Eastbound	AM	Bus Interchange (Platform A)	New Brighton (Oram Ave)	9.3	00:19:54	00:22:45	00:25:42	1.29	00:02:57	13%
Yellow	Eastbound	PM	Bus Interchange (Platform A)	New Brighton (Oram Ave)	9.3	00:17:16	00:23:38	00:29:26	1.70	00:05:48	25%
Yellow	Westbound	AM	Bus Interchange (Platform C)	Rolleston Terminus	31.1	00:49:32	01:01:32	01:30:48	1.83	00:29:16	48%
Yellow	Westbound	PM	Bus Interchange (Platform C)	Rolleston Terminus	31.1	00:53:48	01:01:40	01:09:57	1.30	00:08:17	13%

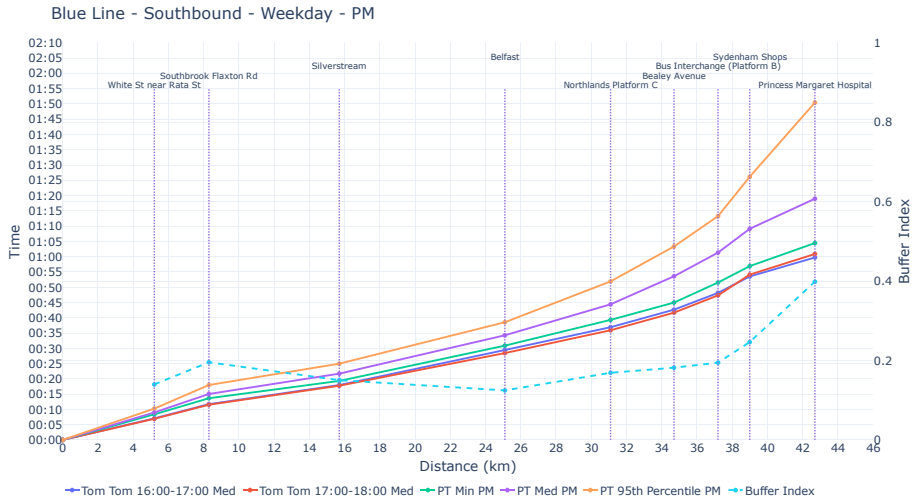
Table 44 Travel time reliability measure for Orbiter

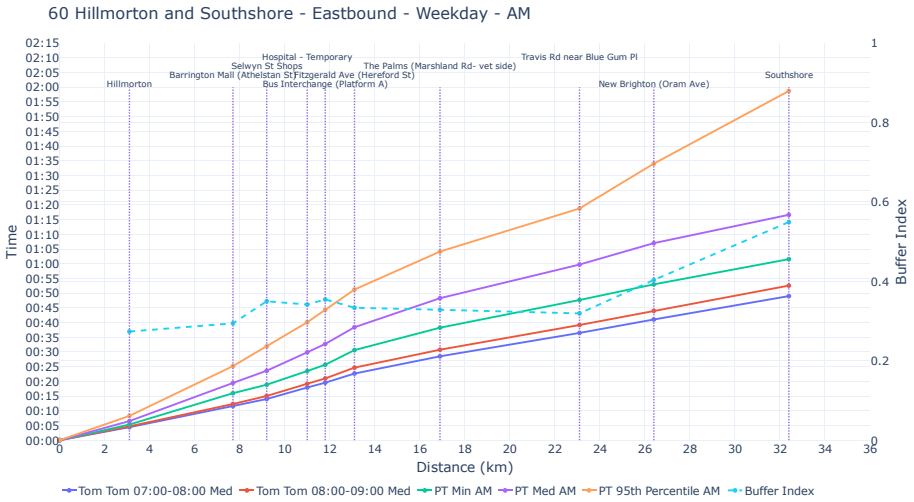
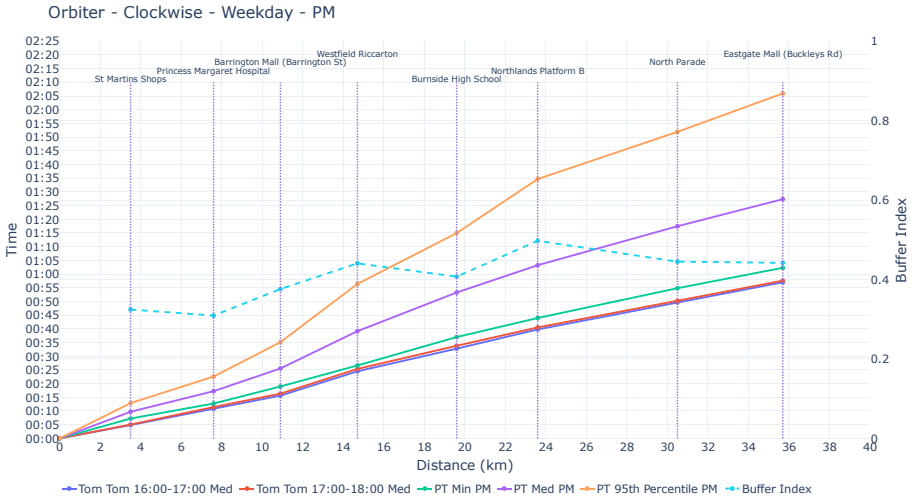
Route	Direction	Period	Origin	Destination	Distance to Interchange (km)	Minimum (minutes)	Median (minutes)	95th Percentile (minutes)	Planning Time Index	Buffer time	Buffer Index (%)
Orbiter	Anti-Clockwise	AM	Eastgate Mall (Buckleys Rd)	Northlands Platform D	12	00:20:36	00:28:45	00:37:10	1.80	00:08:26	29%
Orbiter	Anti-Clockwise	PM	Eastgate Mall (Buckleys Rd)	Northlands Platform D	12	00:19:47	00:30:19	00:37:45	1.91	00:07:26	25%
Orbiter	Clockwise	AM	Eastgate Mall (Buckleys Rd)	Northlands Platform B	23.6	00:42:40	01:00:24	01:31:31	2.14	00:31:07	52%
Orbiter	Clockwise	PM	Eastgate Mall (Buckleys Rd)	Northlands Platform B	23.6	00:43:57	01:03:14	01:34:42	2.15	00:31:28	50%
Orbiter	Anti-Clockwise	AM	Eastgate Mall (Buckleys Rd)	Westfield Riccarton	21.1	00:37:45	00:52:27	01:09:44	1.85	00:17:17	33%
Orbiter	Anti-Clockwise	PM	Eastgate Mall (Buckleys Rd)	Westfield Riccarton	21.1	00:35:46	00:53:17	01:07:39	1.89	00:14:22	27%
Orbiter	Clockwise	AM	Eastgate Mall (Buckleys Rd)	Westfield Riccarton	14.7	00:26:50	00:37:44	00:54:13	2.02	00:16:29	44%
Orbiter	Clockwise	PM	Eastgate Mall (Buckleys Rd)	Westfield Riccarton	14.7	00:26:37	00:39:09	00:56:24	2.12	00:17:15	44%

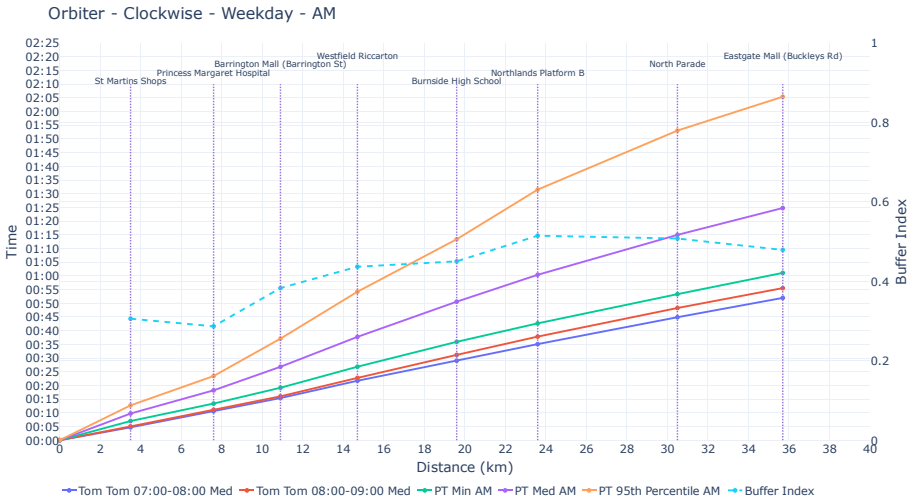
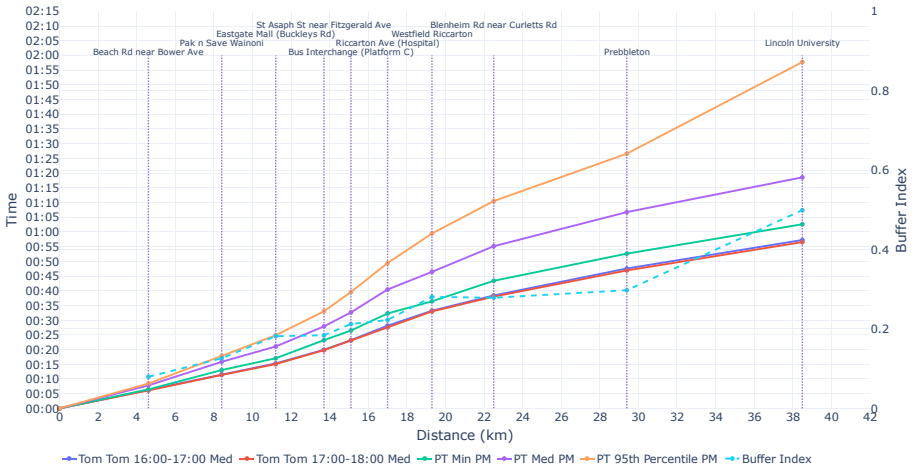
Appendix D
Additional Evidence for Problem Statement 1 – Segments to Improve

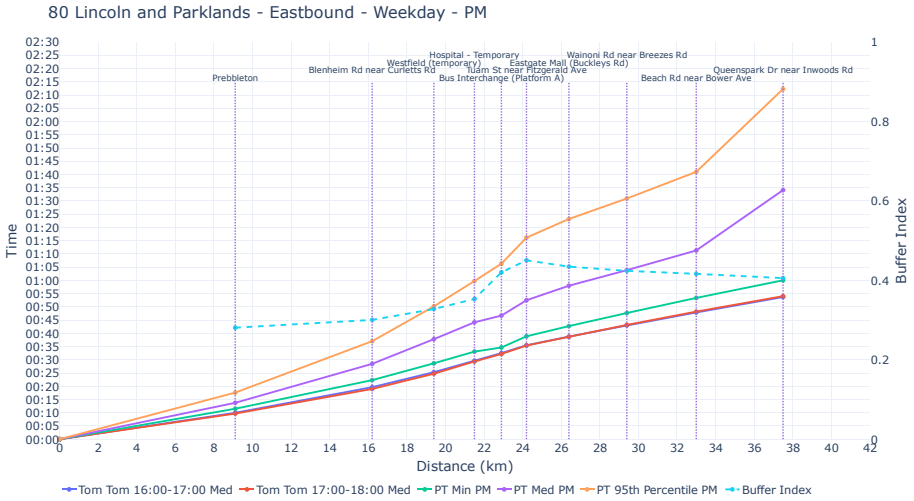
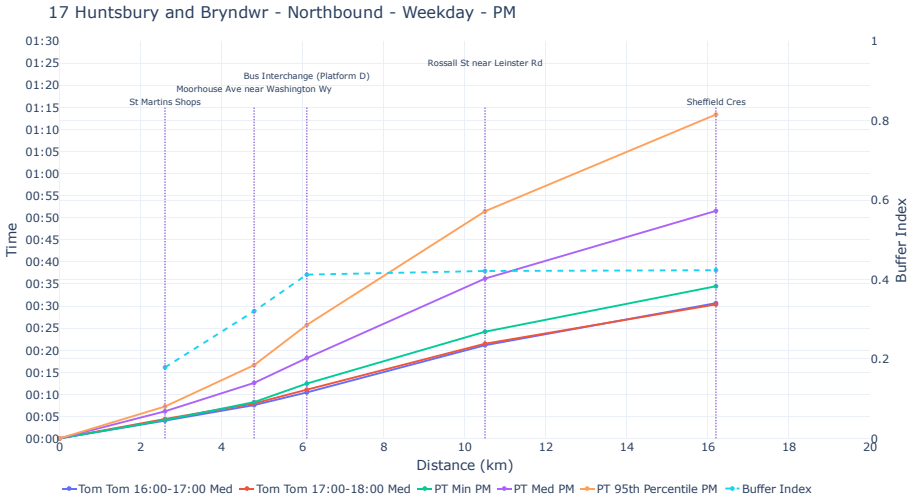
The segments that have issues are outlined, ordered by the relative ranking of the routes. The rank is based on a score calculated by multiplying the PTI by the Buffer Index. The score uses the minimum, median and the 95th percentile travel time, and allows a way to rank the routes relative to each other. The ranking is from 1 to 36, with 36 being relatively the worst route based on the scoring noted in Section 2.3.1.

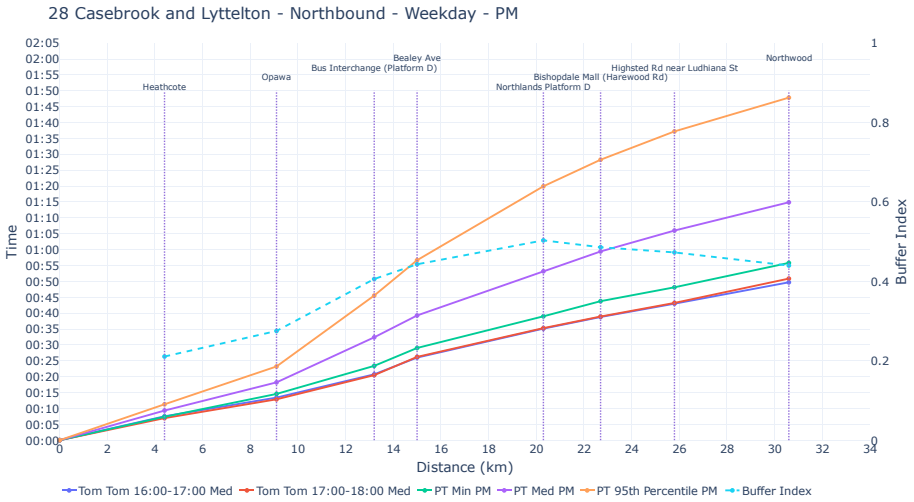
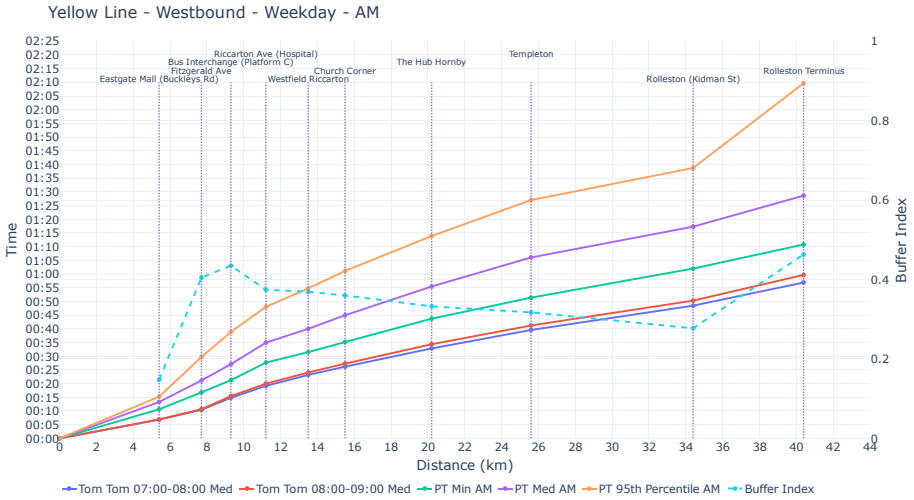
Table 45 Cumulative travel times of routes in ranked order

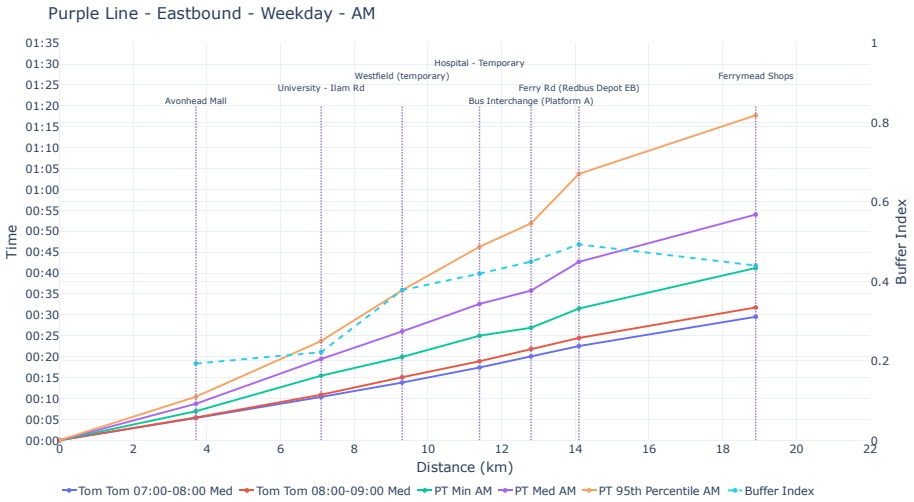
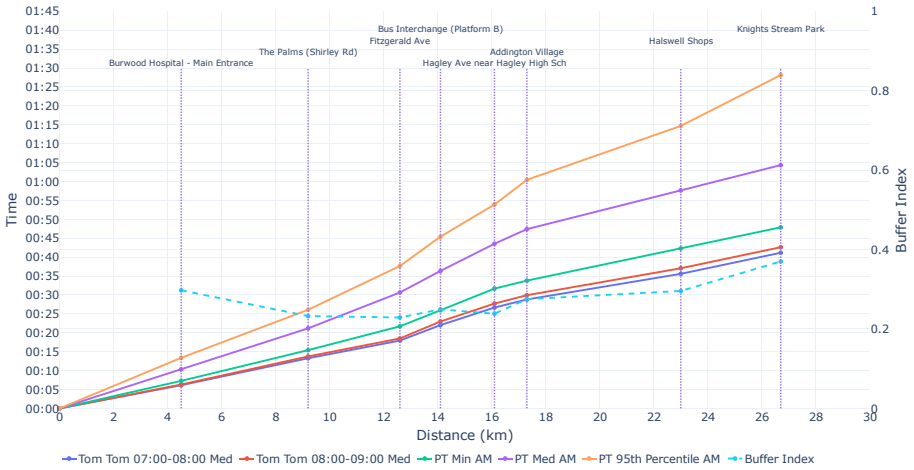
Route	Cumulative travel time	Potential segments for network improvement	Rank
Blue; PM Southbound		Christchurch Bus Interchange to the Princess Margaret Hospital	36

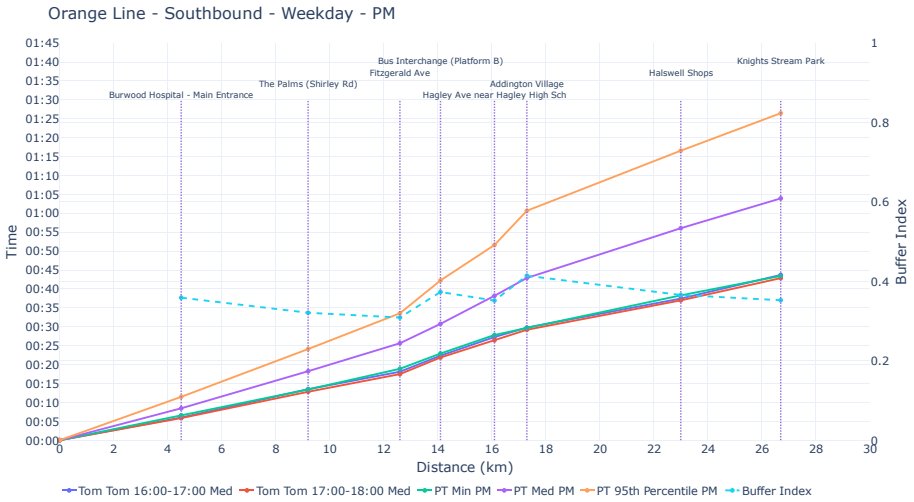
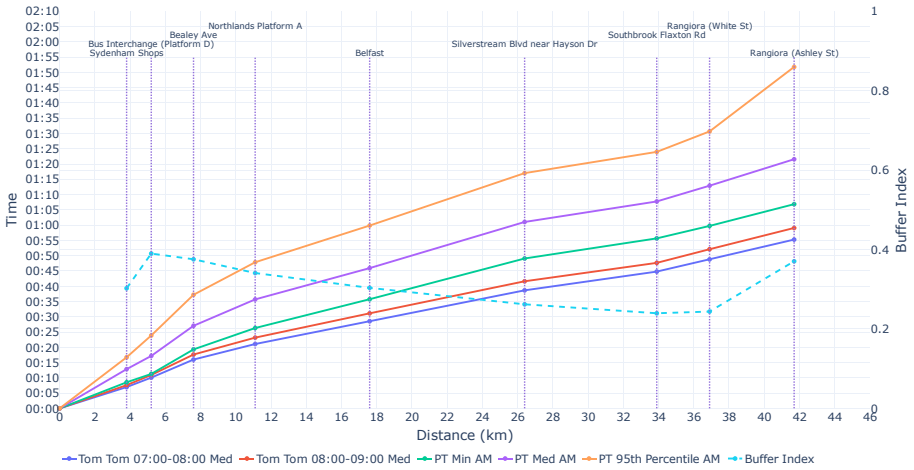
Route	Cumulative travel time	Potential segments for network improvement	Rank
60; AM Eastbound		Travis Road near Blue Gum Place to Southshore (end terminal of the route).	35
Orbiter; PM Clockwise		Princess Margaret Hospital to Westfield Riccarton. Second segment from Burnside High School to Northland Platform B.	34

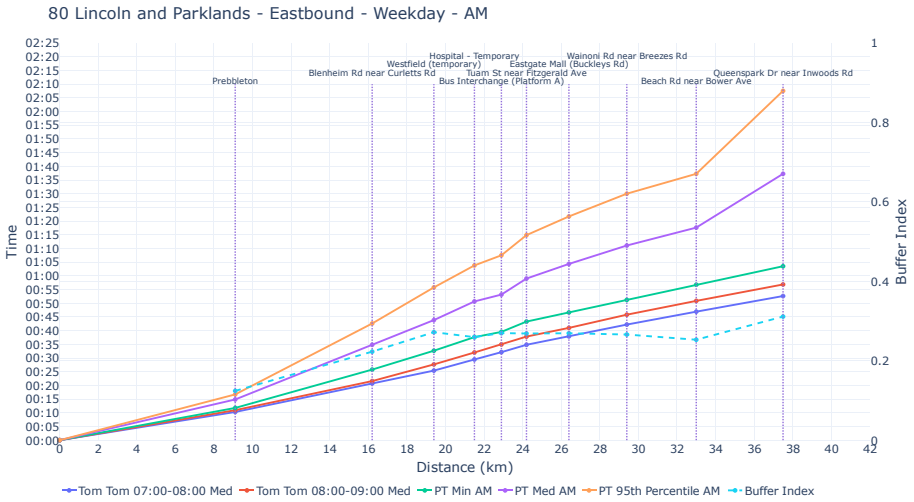
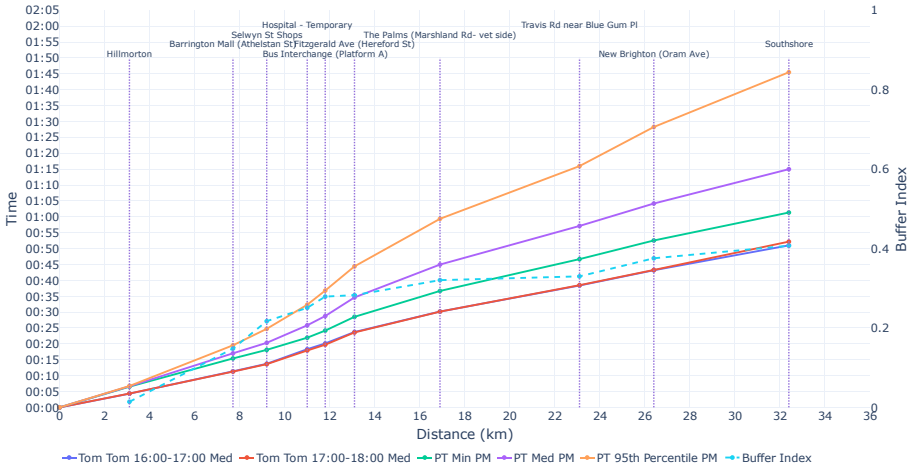
Route	Cumulative travel time	Potential segments for network improvement	Rank
Orbiter; AM Clockwise		Princess Margaret Hospital to Westfield Riccarton. Second segment from Burnside High School to Northland Platform B.	33
80; PM Westbound		Prebbleton to Lincoln University2	32

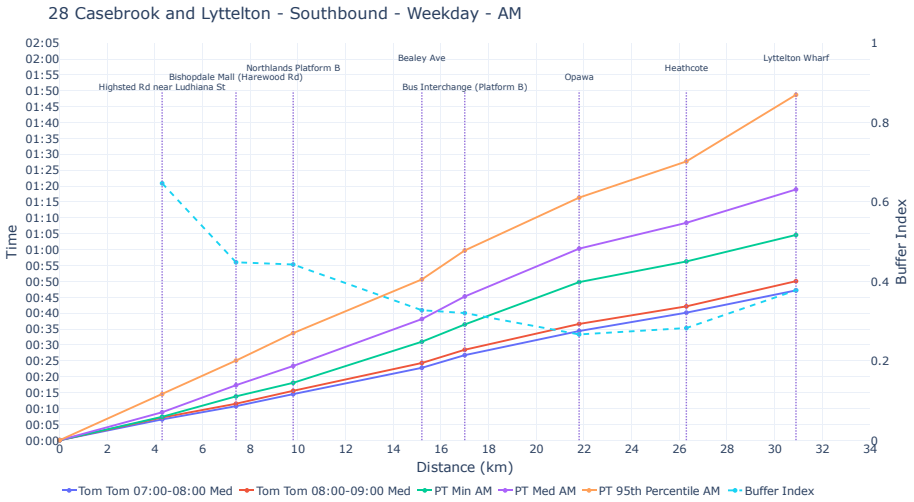
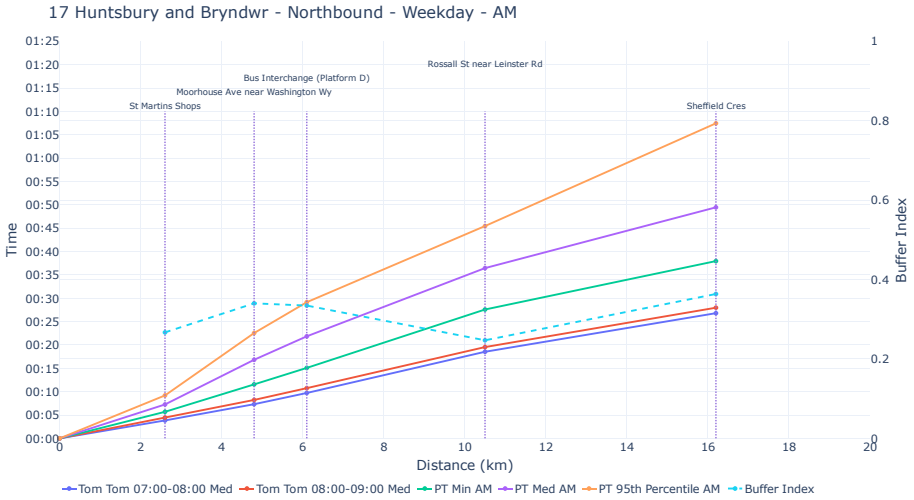
Route	Cumulative travel time	Potential segments for network improvement	Rank
80; PM Eastbound		Westfield Riccarton to Tuam Street/Fitzgerald, (travel through the Central City).	31
17; PM Northbound		St Martin Shops to Bus Interchange.	30

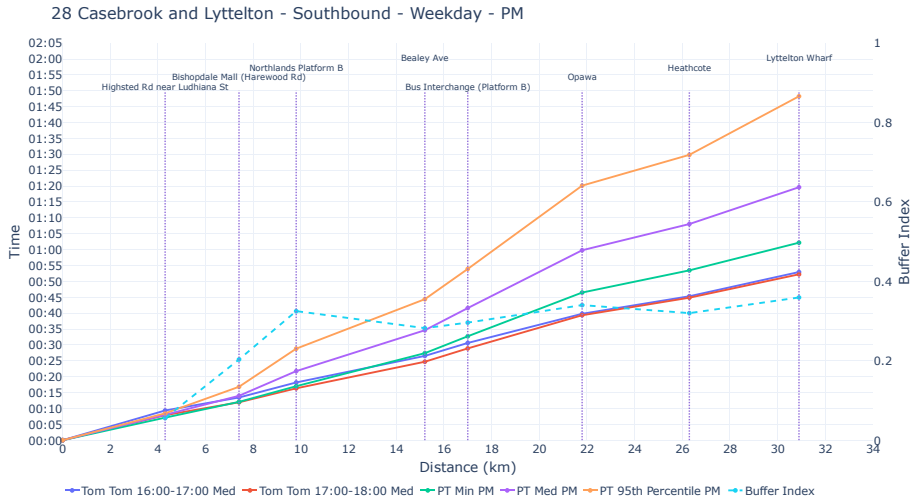
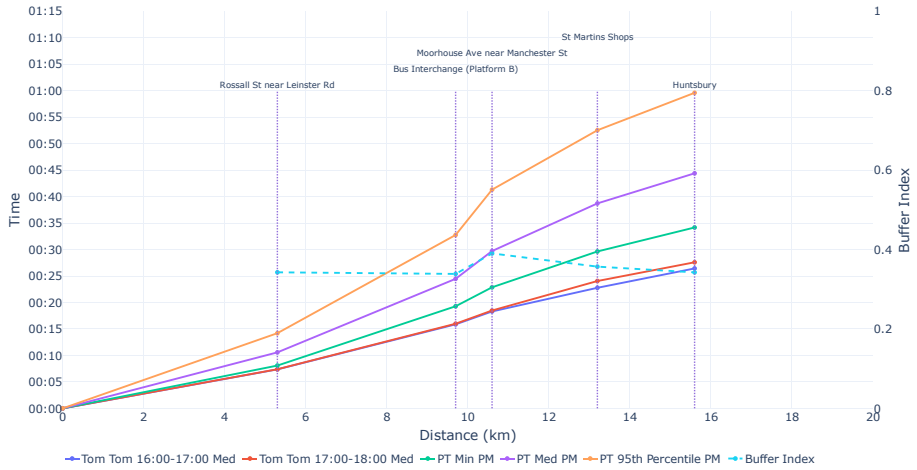
Route	Cumulative travel time	Potential segments for network improvement	Rank
28; PM Northbound		Opawa to Bealey, through the Central City (northbound).	29
Yellow; AM Westbound		Eastgate Mall to Bus Interchange and Rolleston (Kidman Street) to Rolleston Terminus.	28

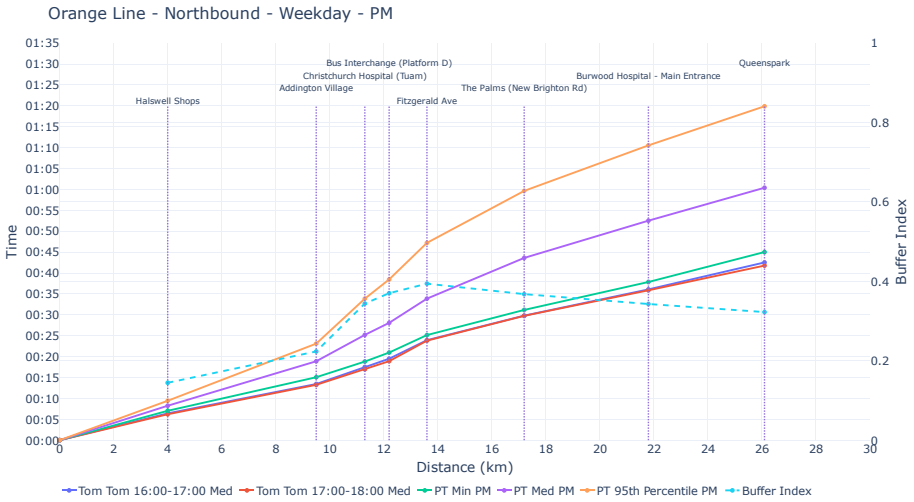
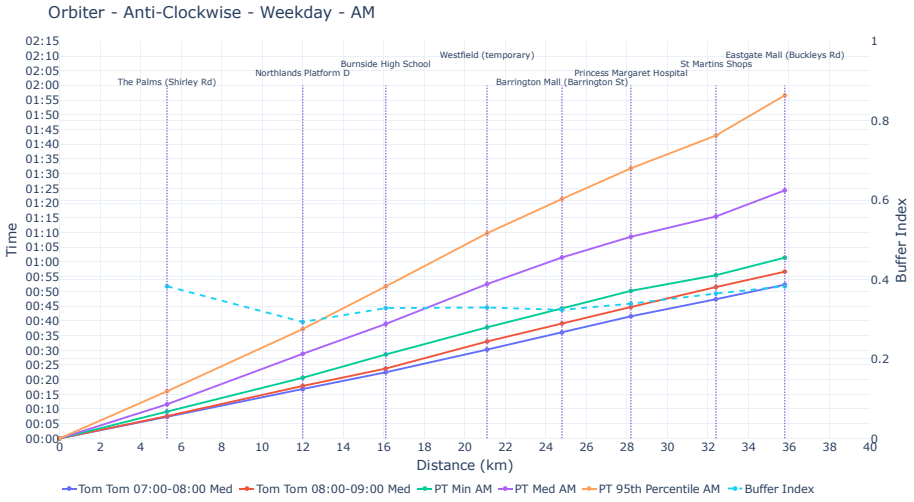
Route	Cumulative travel time	Potential segments for network improvement	Rank
Purple; AM Eastbound		University (Ilam Road) to Westfield Riccarton. Second section from Bus Interchange to Ferry Road RedBus Depot.	27
Orange; AM Southbound		Hagley Avenue (Hospital Corner) to Addington Village. Second section between Halswell Shops to Knights Stream Park.	26

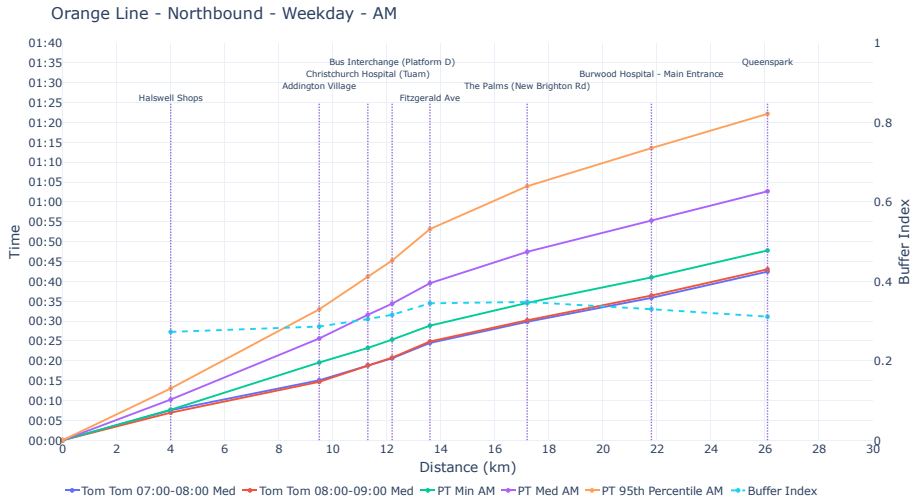
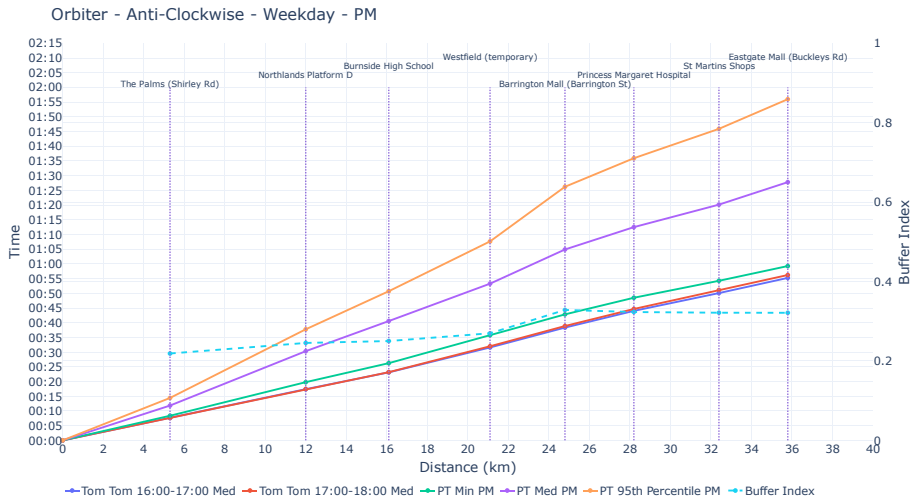
Route	Cumulative travel time	Potential segments for network improvement	Rank
Orange; PM Southbound		Fitzgerald Avenue to Bus Interchange. Hagley Avenue (Hospital Corner) to Addington Village.	25
Blue; AM Northbound		Sydenham Shops to Bus Interchange. Rangiora (White Street) to Rangiora (Ashley Street)	24

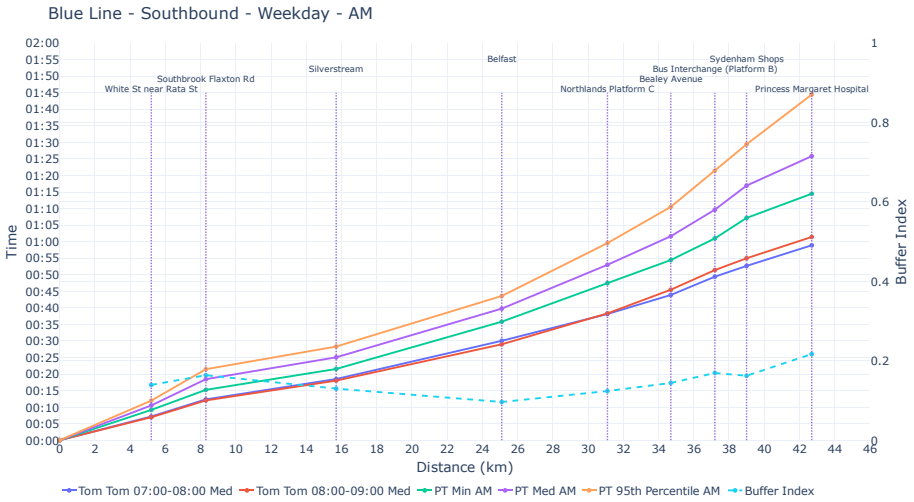
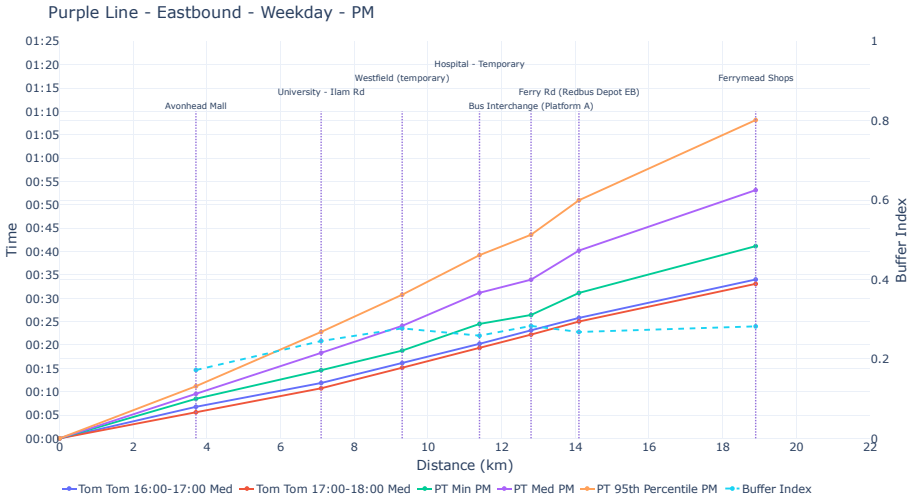
Route	Cumulative travel time	Potential segments for network improvement	Rank
80; AM Eastbound		Prebbleton to Westfield Shopping Centre in Riccarton. Second section from Beach Road (near Bower Avenue) to Queens Park Driver (near Inwoods Road)	23
60; PM Eastbound		Barrington Mall to Bus Interchange.	22

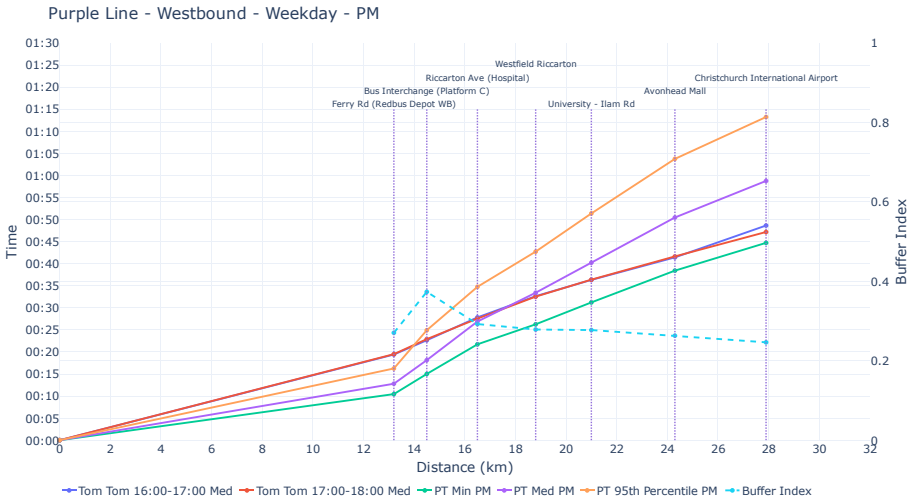
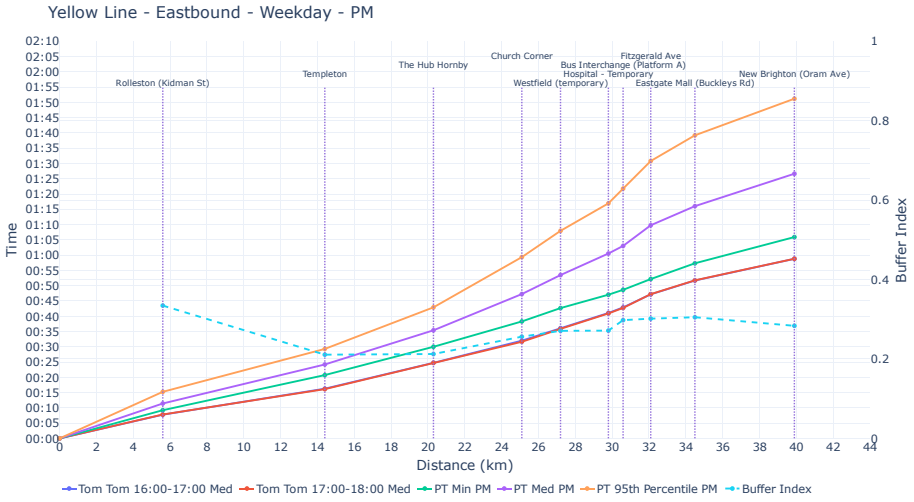
Route	Cumulative travel time	Potential segments for network improvement	Rank
28; AM Southbound		From Northwood to Highsted Road (near Ludhiana Street) the start of the route and the end of the route between Heathcote and Lyttelton Wharf.	21
17; AM Northbound		St Martins Shops to Moorhouse Avenue (near Washington Way).	20

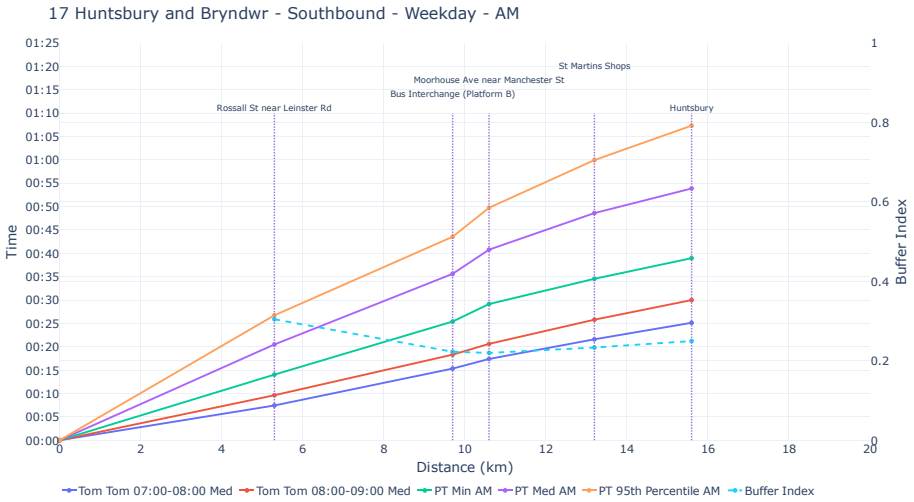
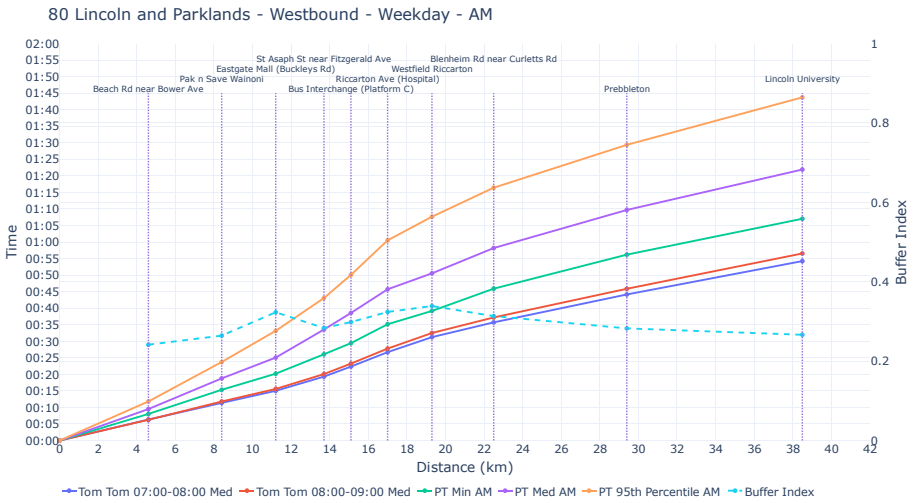
Route	Cumulative travel time	Potential segments for network improvement	Rank
28; PM Southbound		Highsted Road (near Ludhiana Street) to Northland Shopping Centre.	19
17; PM Southbound		Start of the route from Sheffield Cres to Rossall Street near Leinster Road.	18

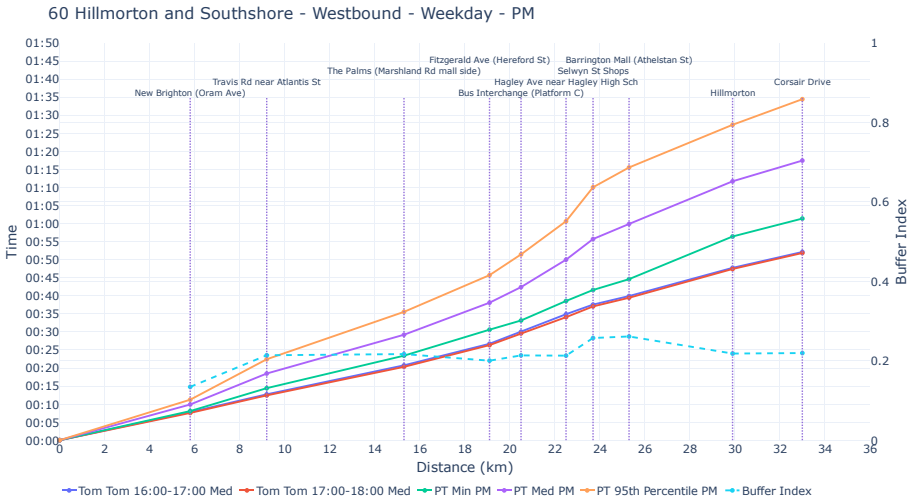
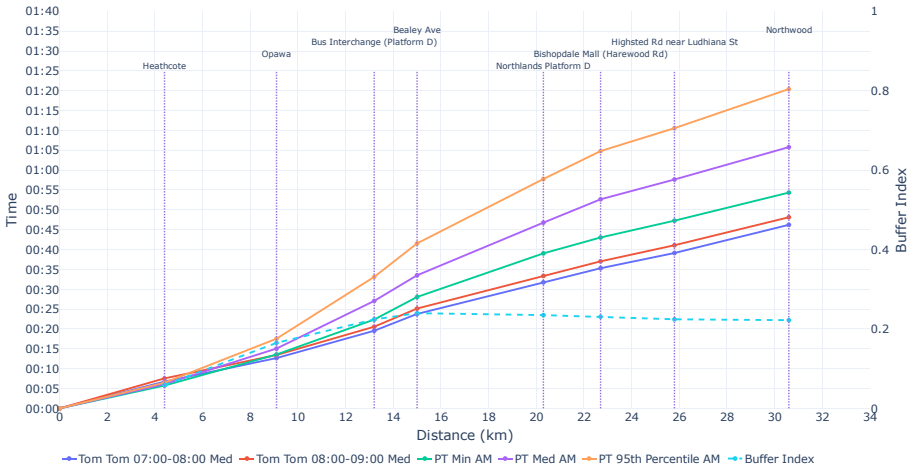
Route	Cumulative travel time	Potential segments for network improvement	Rank
Orange; PM Northbound		Addington Village to Bus interchange.	17
Orbiter; AM Anti-clockwise		Eastgate mall (Buckley Road) to The Palms.	16

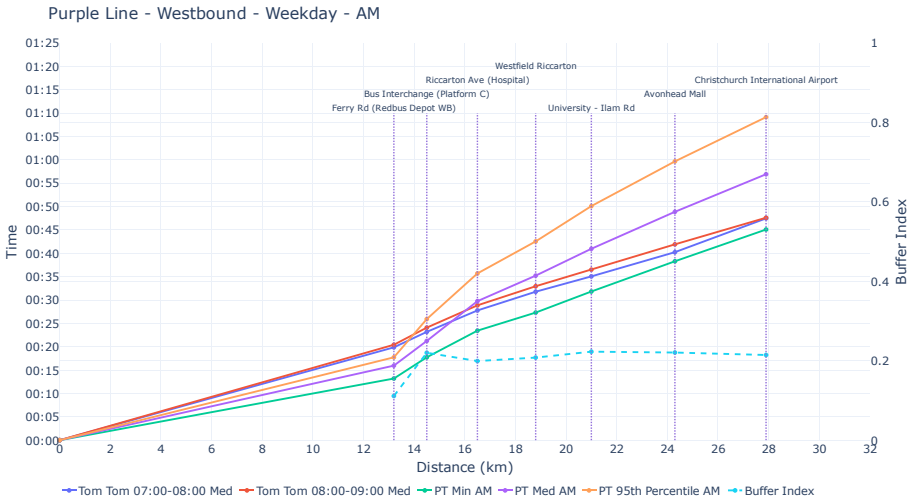
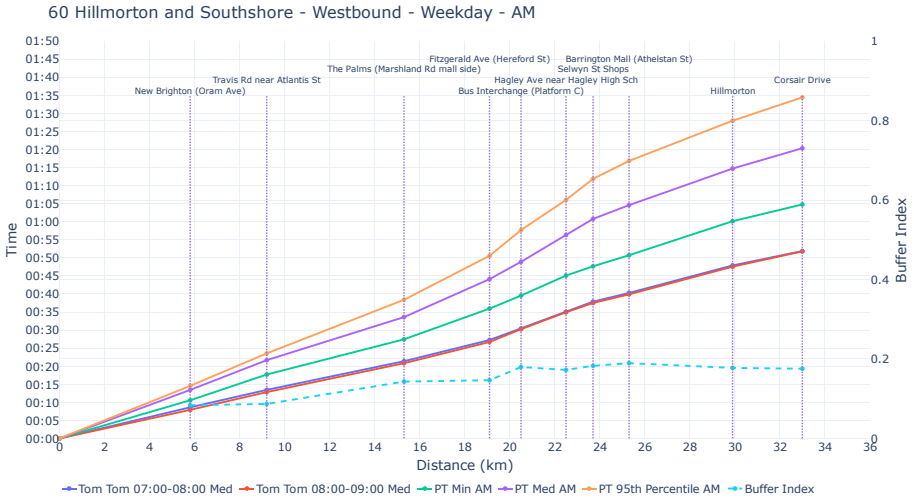
Route	Cumulative travel time	Potential segments for network improvement	Rank
Orange; AM Northbound		Knight Stream Park to Halswell Shops (the starting segment).	15
Orbiter; PM Anticlockwise		Westfield (Riccarton) shopping centre to Barrington Mall.	14

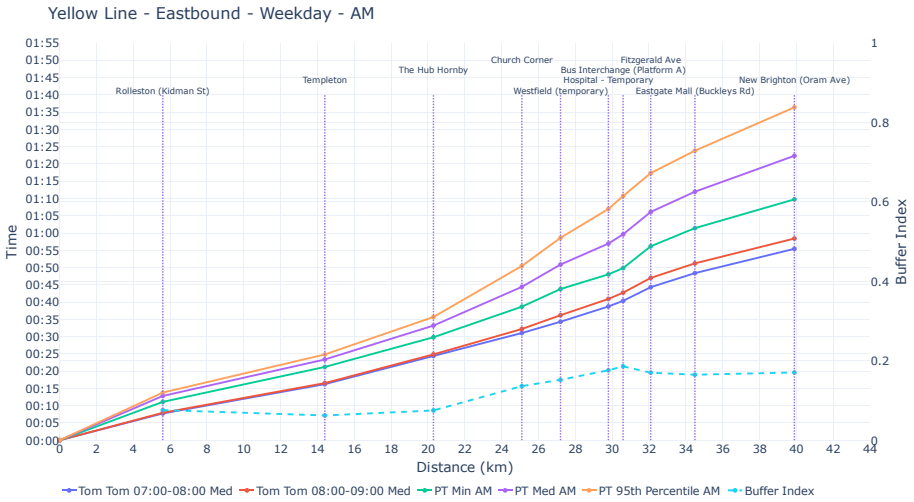
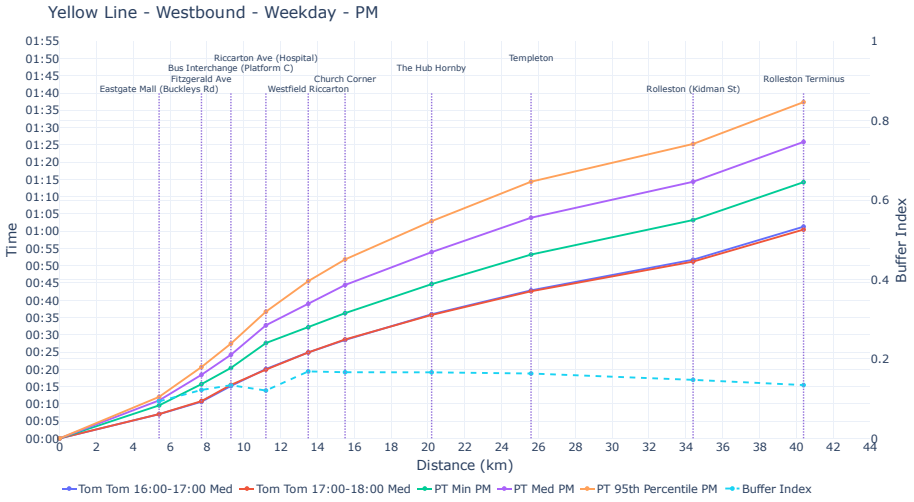
Route	Cumulative travel time	Potential segments for network improvement	Rank
Blue; AM Southbound		Sydenham Shops to Princess Margaret Hospital.	13
Purple; PM Eastbound		Christchurch Airport to Avonhead Mall. Second segment from Hospital to Bus Interchange.	12

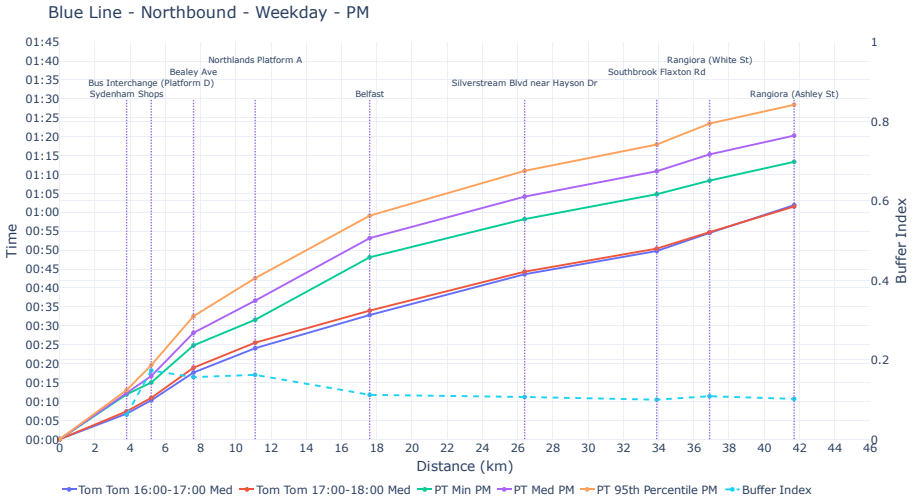
Route	Cumulative travel time	Potential segments for network improvement	Rank
Purple; PM Westbound		Ferry Road (RedBus Depot WB) to Bus Interchange.	11
Yellow; PM Eastbound		Rolleston Terminus to Rolleston (Kidman Street). Riccarton Avenue (Hospital) to Bus Interchange.	10

Route	Cumulative travel time	Potential segments for network improvement	Rank
17; AM Southbound		Start of the route from Sheffield Cres to Rossall Street near Leinster Road.	9
80; AM Westbound		Pak n Save (Wainoni) to Eastgate Mall (Buckleys Road).	8

Route	Cumulative travel time	Potential segments for network improvement	Rank
60; PM Westbound		Hagley Avenue (Hospital Corner) to Selwyn Street Shops.	7
28; AM Northbound		Opawa to Bealey, through the Central City northbound.	6

Route	Cumulative travel time	Potential segments for network improvement	Rank
Purple; AM Westbound		Ferry Road (RedBus Depot) to Bus Interchange.	5
60; AM Westbound		Bus Interchange to Riccarton Ave (hospital).	4

Route	Cumulative travel time	Potential segments for network improvement	Rank
Yellow; AM Eastbound			3
Yellow; PM Westbound			2

Route	Cumulative travel time	Potential segments for network improvement	Rank
Blue; PM Northbound		Sydenham Shops to Bus Interchange.	1

Appendix E
Customer Insights Report

Appendix F
Interim Draft Transport Analysis Report

Appendix G
Recommended Option Layout

Appendix H
Bus Stop Spacing Maps

Appendix I
Proposed Route Changes

Appendix J
Route Termini

Appendix K
Stop Capacities

Appendix L
Proposed Bus Priority Infrastructure in Christchurch City

Appendix M
Infrastructure Strip Maps

Appendix N
Typical Cross Sections

Appendix O
Intersection Upgrades

Appendix P
Selwyn Infrastructure Improvement Maps

Appendix Q
Waimakariri Bus Stop Improvement Maps

Appendix R
Bus Interchange Options

Appendix S
Detailed Cost Estimates

Appendix T
Economic Evaluation Technical Note

Appendix U
Demand Responsive Transit and Micromobility

Appendix V
Modelled Patronage Change Maps

Appendix W
Possible Alternative Staging

Appendix X
Modelling Methodology Review

Appendix Y
Challenge Session Review

Appendix Z
Economic Evaluation Review