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6(b)	as release would be likely to prejudice the entrusting of information to the Government of New Zealand on a basis of confidence by <ul style="list-style-type: none"> (i) the Government of any other country or any agency of such a Government; or (ii) any international organisation
6(c)	prejudice the maintenance of the law, including the prevention, investigation, and detection of offences, and the right to a fair trial
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9(2)(ba)(i)	to protect information which is subject to an obligation of confidence or which any person has been or could be compelled to provide under the authority of any enactment, where the making available of the information would be likely to prejudice the supply of similar information, or information from the same source, and it is in the public
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9(2)(j)	to enable a Minister of the Crown or any public service agency or organisation holding the information to carry on, without prejudice or disadvantage, negotiations (including commercial and industrial negotiations)



Demand forecasting

Technical note

17 September 2021

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			Signature			

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Concept design report

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1. Executive Summary

This report documents the results of the demand modelling done for various options within the CC2M corridor. The initial short list consists of five options, 2 light rail, 2 light metro and a hybrid light rail option. These options were narrowed down to the following three options:

- Option 1B: Light rail running at a 4 min headway between the airport and the City centre with street running sections through Mangere Town centre, Dominion Road and Queen Street;
- Option 2A: Light metro running at a 3 min headway between the airport and the City centre with tunnel sections through Mangere Town centre, underneath Sandringham Road and Wellesley Street.
- Option 3: Hybrid light rail running at 4 min headway between the airport and the city centre, with a overlay service (also at 4 min headway) between Mt Roskill and the city centre. It has street running sections through Mangere Town centre, and with tunnel sections through underneath Sandringham Road and Wellesley Street

The options all have different travel time and stop configurations responding to the alignment and environment in which they operate. Light metro provides the fastest end to end travel time (36 mins), followed by the Hybrid option (43 mins) with light rail providing a 57-minute travel time.

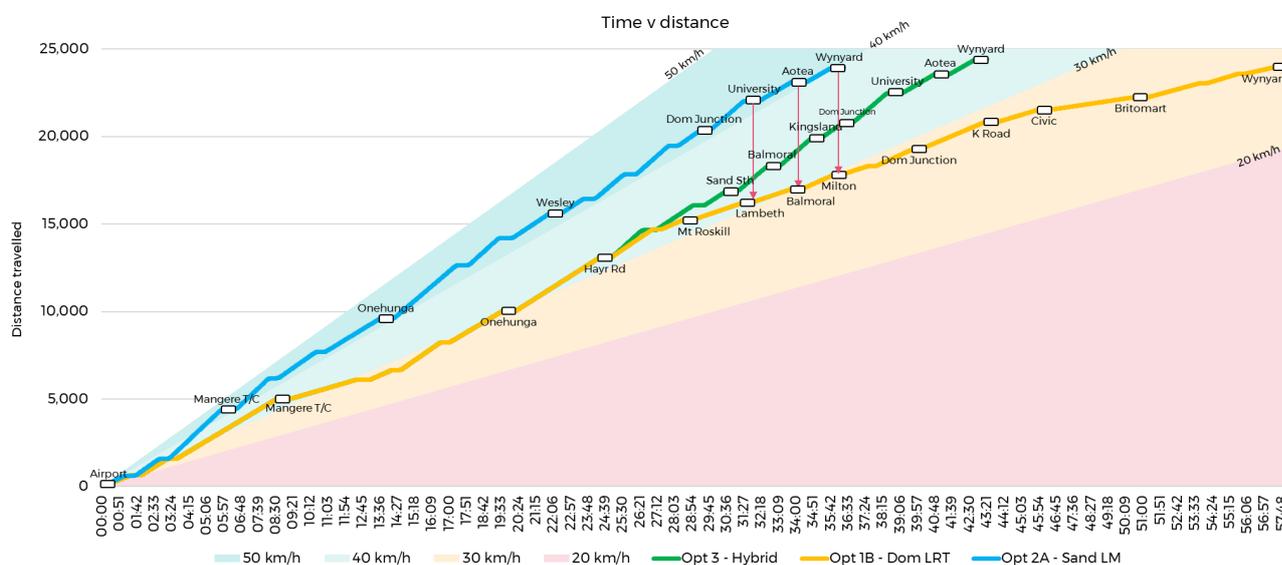


Figure 1: travel time comparison

All options enable faster public transport travel times from Mangere and Onehunga to the city centre when compared to the most viable alternative (car travel). Car travel remains slightly more competitive to the central city from Mt Roskill.

The option alignments, speed and headways result in expanded labour pool with 45 minutes access to the central city. The initial short list analyses showed Wynyard and the city universities to be key destinations for trips from the CC2M corridor.

The geographical analyses of the change in 45-minute catchment to these zones show clear differences for the light metro and hybrid over the light rail option, with the latter having limited reach into Mangere.

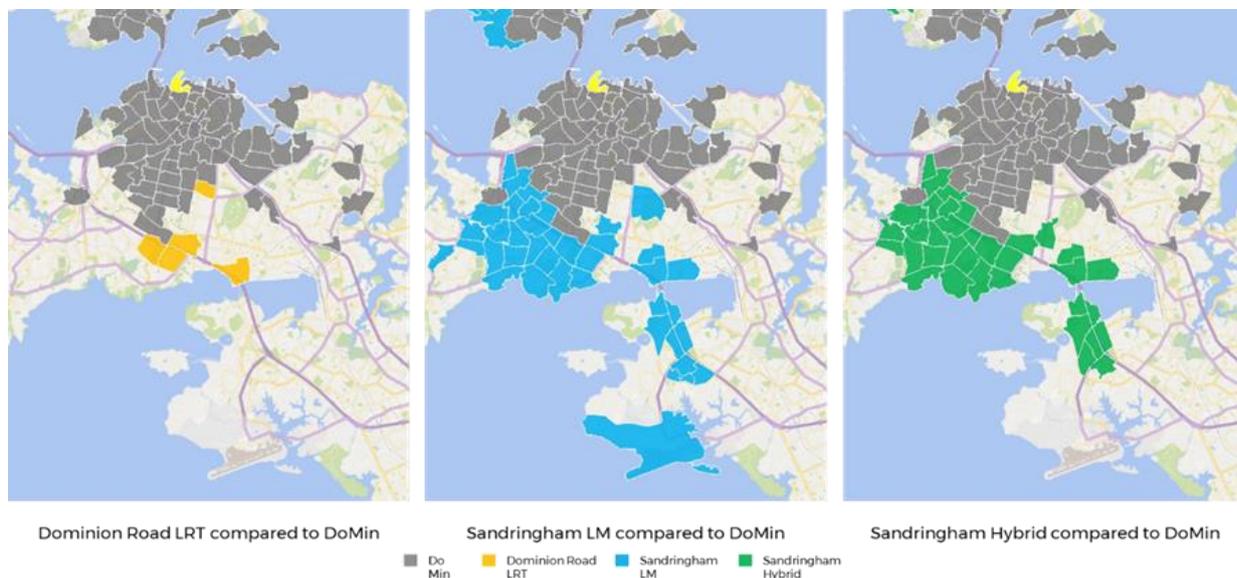


Figure 2: Zones within 45 min catchment from Wynyard (by 2051)

The demand profile along the corridor shows light metro and the hybrid attracts significantly higher demands than the light rail option, with the peak load point approximately 86% higher than light rail.

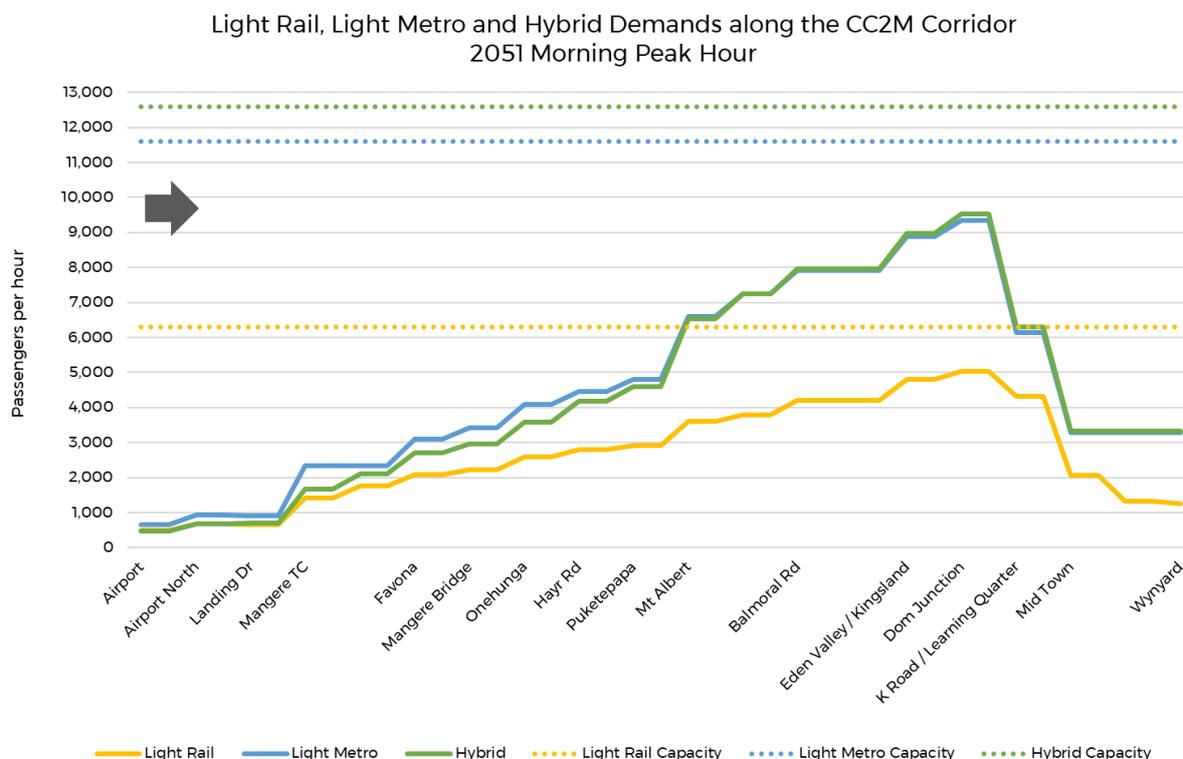


Figure 3: Demand profile along CC2M corridor (2051 AM 1hr)



The vehicle capacity, demand and travel time associated with each option result in nearly a quarter (26%) of all passengers standing for longer than 20 minutes on the light rail system during the morning peak. This compares to 8% and 7% of passengers standing on the light metro and hybrid options respectively.

The demand profile shows the light rail option is expected to reach 81% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops) by 2051. The ridership at the peak loading point is forecast to be 5,100 over the busiest 1hr period. Extrapolating demand (using the average annual growth rate between 2031 and 2051) signal the higher intensification land use scenario could generate peak hour demand on the light rail system that exceeds the modelled capacity by 2059.

Light metro demands are forecast to reach 82% of its modelled capacity by 2051. The ridership on the peak loading point is forecast to be 9,500 over the busiest 1hr period. This is 86% higher than the light rail option along Dominion Road. The option generates (extrapolated) demand that exceed its capacity by 2058.

The hybrid option is expected to reach 76% of its modelled capacity at the peak load point. The ridership at the peak loading point is forecast to be 9,500 over the busiest hour. This is similar to the Light Metro option. It is also 86% higher than light rail along Dominion Road.

The public transport share of all trip purposes within the CC2M corridor is forecast to increase from 12% (2018) to 26% by 2051 for all options. A summary of the key indicators is provided in the table below, with more detailed included within the report.

Table 1: Summary of key indicators

Key indicators	2051 results (higher intensification land use scenario)		
	Option 1B (LRT)	Option 2A (Light metro)	Option 3 (Hybrid)
Accessibility			
Number of jobs within 45 mins by PT from Mangere Town centre	247,207	452,773	344,317
Number of jobs within 45 mins by PT from Onehunga	405,544	463,881	
Number of jobs within 45 mins by PT from Mt Roskill centre	414,691	423,047	401,431
Number of households within 45 min by PT from city centre	378,545	405,418	400,133
Number of households within 45 min by PT from airport	97,008	164,245	113,954
CC2M boardings			
AM peak (2hr)	16,505	28,822	27,706
Daily	72,605	125,252	114,174
Annual	20,256,851	34,945,169	31,854,462
PT Mode share within CC2M Corridor	26%	26%	26%
Regional PT boardings			
Total PT network	240,883,615	248,801,954	246,606,277
Total bus network	154,983,514	151,727,720	151,695,945
Total heavy rail network	61,669,356	59,905,763	60,498,231
CC2M modelled capacity and demands			
Modelled Maximum Capacity of CC2M (pax/hour/direction)	6,300	11,600	12,600
CC2M Demand at Peak Load Point (pax/hour/direction)	5,036	9,345	9,521



Sensitivity tests were done to test the impact on road pricing and the network expansion on the demand for the respective CC2M option. The purpose of these tests was to confirm adequate capacity in the system to accommodate future changes.

It shows road pricing will have a minimal impact on the CC2M demand, increasing demand on the options between 1% and 2%. This low shift to PT associated with pricing in the ALR scenario is most likely down to the inability of the wider PT system to accommodate extra passengers given capacity constraints (as a result of limited investment outside light rail in the do minimum approach).

Road pricing combined with an expanded CC2M network to the north shore and north west will increase demands on the options by between 5% and 9%.

The results from the demand modelling were also benchmarked against global examples of major public transport infrastructure in similar cities to compare patronage characteristics with CC2M patronage forecasts. The report suggests the forecasts for CC2M are likely in the right range.



2. Demand modelling approach

2.1 MSM model

2.1.1 Description

The Auckland Forecasting Centre (AFC) Macro Strategic Model (MSM) was used to assess the likely impact various light rail alignments, station configuration and changes to the bus network would have on demand for travel and the outcomes sought in the business case.

The MSM Regional Transport Demand Model has 596 zones that contain projections about population, education and employment into the future.

Travel demands were forecast in MSM based on the population and employment forecasts provided in the Land Use Model. Council supplied data for 2018, 2031 and 2051 (for the medium growth Scenario - generally referred to as Scenario I-11.6).

2.1.2 Model constraints

The following constraints were identified and considered in the development of the short-listed options:

- Only two land use horizons were used; 2031 and 2051.
- The 2051 land use horizon is an extrapolation of the Stats NZ 2048 forecast for Auckland (based on growth leading up to 2048).
- No demands were modelled beyond 2051, and any analyses or interpretation in this report for periods beyond the 2051 horizon were derived through extrapolating the growth curve (either straight line or average annual compound growth) between the 2031 and 2051 forecast horizons.
- As a strategic, all modes model, MSM is ideal for providing information on the system wide assessment criteria set out in the business case. However, for public transport passenger demand forecasting, there are other, more robust modelling tools and these should be used in the detailed business case stage of the project to refine and confirm the passenger forecasts for the recommended option and the public transport networks that support it. Given the compressed time constraint, it was not possible to use these passenger demand forecasting tools.
- The strategic model does not have the ability to simulate detailed bus operations associated with high volumes of buses stopping for boarding and alighting at kerbside stops - especially in the city centre. The Do Minimum allows for 117 buses per hour (eastbound) and 123 buses per hour (westbound) along sections of Customs Street during the morning peak. The upper section of Symonds Street (where it crosses the motorway) will have 97 buses per hour (northbound). Wellesley Street will experience 113 buses per hour (westbound) in the PM peak. These volumes of buses in and around the City Centre are unlikely to operate efficiently at the speeds assumed in the Do Minimum model.

- The bus speed curves were adjusted for these sections; however, in the next phase of the project, the Do Minimum would have to be reviewed and assessed to ensure that it realistically represents the likely bus network operation.
- The MSM model has no specific function estimating access to the light rail options (or other RTN stations) by demand responsive services or personal mobility modes (e.g. Lime or Flamingo scooters).
- Adjustments were made to station¹ access (in 2051 only) consistent with NZTA research project 674 Mode Shift to Micro Mobility; in particular the section on “first mile/last mile”.

2.2 Approach

2.2.1 Process followed

The investment objectives, outcomes and supporting measures were defined through investment logic map workshops as part of the strategic case development workstream.

Several outputs and reports from the MSM model were identified² to provide quantitative data against the relative measures that informed the Multi Criteria Assessment (MCA) workshop for the short list options.

Do minimum land use and transport models were agreed with the urban development and economic case workstreams (for both the 2031 and 2051) and documented in the memorandum titled Do Minimum Assumptions – 5 July 2021.

Option specifications were developed for each of the five short listed options. The initial outcomes were used to inform the change (when compared to the do minimum scenario) in accessibility and effective job densities.

This information (amongst others) were used by the urban development workstream to model the likely change in the spatial distribution of the growth over time. The adjusted spatial distribution was then applied to the 2051 model horizon and remodelled to determine the results against the agreed KPIs and measures. The process is illustrated in Figure 4.

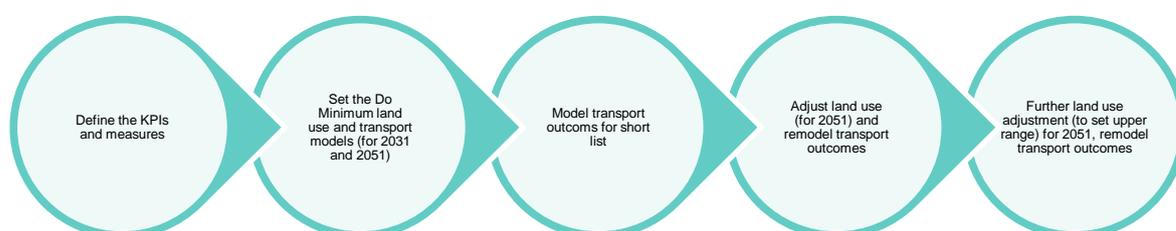


Figure 4: Process followed

¹ Only stations that represent Mt Roskill, Onehunga and Mangere Town Centre

² Documented in “SR 1 - AFC_DataModelRequest_CC2M21 - 2021-07-21 - r5 - additional info”



A total of 5 short listed options were tested. Several reference cases were also developed to help inform sensitivity of the alignment to wider policy changes (road pricing) as well as future expansion of the light rail network to the North Shore and Auckland's North-west.

Public Transport fares and other costs inputs such as parking are in real 2016 dollars in the MSM model. All PT fares were increased at 0.37% per annum for future year horizons based on GDP/capita growth of 1.5%

Auckland Transport's ticketing data (HOP) were analysed for the period between 2018 and 2019 to determine the peak hour factor for public transport demands on the entire PT network (excluding school buses) and the existing RTN network. The existing RTN included rail and NEX boardings only.

The data indicated the following peak hour factors to convert 2hr peak period demands to 1 hr demands in Auckland:

Table 2: PT boardings phf

Period	RTN boardings	All PT boardings
AM	0.61	0.60
IP	0.51	0.50
PM	0.55	0.54

2.2.2 Defining the KPIs

Table 3: Agreed KPIs and measures below illustrates the measures obtained from the demand modelling to support the agreed investment objectives and KPIs.

Table 3: Agreed KPIs and measures

Investment Objectives	KPIs	Measures supported by MSM demand modelling
<p>A rapid transit service that:</p> <ul style="list-style-type: none"> Is attractive, reliable, frequent, safe and equitable Is integrated with the current and future active and public transport network Improves access to employment, education and other opportunities. 	<p>Improved access to major and growing employment areas, especially the city centre and Auckland Airport precinct;</p>	<p>No of employment opportunities accessible with 45 mins PT travel time from communities within the corridor (especially Mangere, Onehunga and Mt Roskill) and regionally.</p> <p>Effective Job Density</p>
		<p>No. of households within 45 mins travel time from City Centre and Airport</p>
		<p>PT mode share within the corridor</p> <p>Private VKT within the corridor.</p>
	<p>Improved access to education from communities along the corridor;</p>	<p>Number of education opportunities (tertiary education) within 45 mins travel time from communities within the corridor (especially Mangere, Onehunga and Mt Roskill) and regionally.</p> <p>Effective Job Density (adapted to education)</p>
	<p>Improved access to cultural, social, health, recreational and cultural facilities (including marae) from communities along the corridor</p>	<p>MSM model not used to inform this measure.</p>

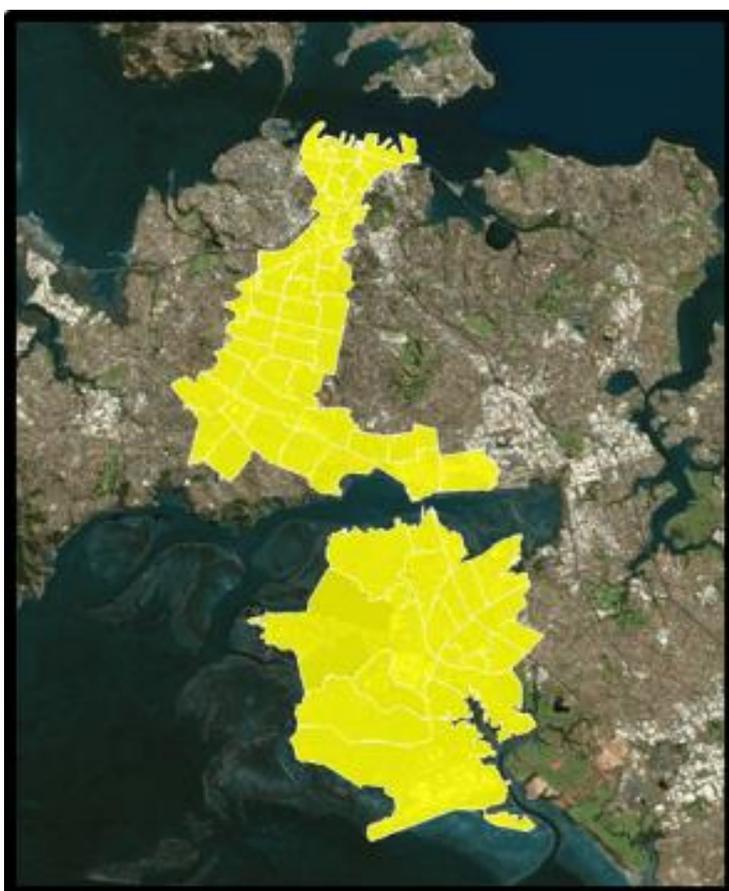


Investment Objectives	KPIs	Measures supported by MSM demand modelling
	Improved travel times for key journeys along the corridor	PT travel times between key centres along the route (including the City Centre, Airport, Mt Roskill, Onehunga and Mangere).
		PT travel times compared to car travel times between key centres along the corridor (including the City Centre, Airport, Mt Roskill, Onehunga and Mangere).
		Freight efficiency impact
	An attractive service that increases public transport mode share in the corridor and across Auckland.	Number of PT journeys within the corridor and regionally Corridor PT mode share. Mode share for education trips Maximum length of time standing (level of crowding)
	Increased walking and cycling mode share in the corridor.	MSM model not used to support this measure.
	Effective and efficient integration between the proposed service and the broader PT network.	Passenger km / service km Regional PT journeys Access measures (as above for access to employment, education and other opportunities)
	Effective and efficient integration between the proposed service and anticipated future rapid transit network.	Regional rapid transit boardings.
	Alleviation of current and forecast bus capacity constraints in the city centre;	Number of buses entering city Centre in AM peak
Increased corridor capacity and utilisation of capacity;	Rapid Transit carrying capacity - AM peak and all day Rapid Transit pax capacity kms / RT pax kms	
A transport intervention that embeds sustainable practice and that reduces Auckland's carbon footprint	Reduced CO2 emissions Reduced air pollution within the corridor Enabled Kaitiakitanga outcomes in the management of natural resources. Sustainable practice embedded in project design	CO2 emissions, total vehicle kilometres travelled, embedded carbon SOX, NOX, VOC emissions
Unlocking significant urban development potential, supporting a quality compact urban form and enabling integrated and healthy communities.	Additional feasible urban development capacity enabled within 1km of stations.	Effective job density (and other density measures)

Investment Objectives	KPIs	Measures supported by MSM demand modelling
	Redevelopment of major public landholdings enabled along the corridor within 1km of stations.	MSM model not used to support this measure.
	Facilitation of quality transformation of areas around stations, improving community connectivity and delivering attractive, active and safe spaces.	MSM model not used to support this measure.

2.2.3 Defining the Corridor

For reporting purposes, the MSM model uses the zones shown in Figure 5: MSM zones that represent 'the Corridor' below to represent the 'Corridor' between the city centre and Mangere:



The following specific zones represent key locations used within the reporting:

- Wynyard = zone 243;
- Downtown = zone 245;
- Mid-town = zone 248;
- Auckland universities = zone 249;
- Dominion Junction = zone 266
- Mt Roskill = zone 327;
- Onehunga = zone 347;
- Mangere = zone 472; and
- The airport = zone 478

Figure 5: MSM zones that represent 'the Corridor'



3. The do minimum

3.1 The do minimum approach

Auckland Transport (AT) and the AFC provided the base 2018 model as well as the transport model for 2031 that reflect the approved Regional Land Transport programme (RLTP).

Only two planning horizons was developed for the analyses – 2031 and 2051. This allowed assessment of outcomes against a Do Minimum ‘at opening’ as well as an outcomes assessment 3-decades from 2021.

The approved and funded 2031 RLTP was adopted as the Do Minimum for the 2031 scenario. Key assumptions for the 2051 scenario are documented in a separate report, attached to Economic Case section of the business case.

The Do Minimum approach was agreed to by the peer reviewer. Refer to Appendix A for the Peer review note.

3.1.1 The do minimum land use

The DM land used assumed for 2031 reflects the totals and distribution contained within Scenario I-11.6 without any adjustments. For 2051: The DM Land Use was based on Scenario I-11.6 but with the following adjustments:

- Households: households were reduced by 20,649 within the corridor zones and re-distributed to other zones in the region – in line with the original Scenario I-11.3 forecast.
- Education roll was adjusted to match the revised household totals per zone.
- Employment: 4,000 jobs were redistributed away from the corridor (excluding city centre zones).

Table 4 shows population and employment forecasts for the 2031 and 2051 Do Minimum model horizons:

Table 4: Do Minimum population and employment assumptions

Totals	Auckland Region			CC2M Corridor		
	2021	2031	2051	2021	2031	2051
Households	562,833	671,227	845,955	62,488	71,159	91,083
Population	1,666,599	1,930,490	2,331,170	185,224	212,517	259,688
Employment	705,461	809,803	960,521	169,973	203,612	251,144
Percentage increase from previous planning horizon						
Households		19%	26%		14%	28%
Population		16%	21%		15%	22%
Employment		15%	19%		20%	23%

3.1.2 The do minimum transport patterns

The travel patterns within the do minimum scenario illustrates 55% of trips from the CC2M corridor are to destinations outside model. It also shows the vast majority (90%) of short distance trips are by car.

The Figures below illustrate the trip patterns from Mangere, Onehunga and Mt Roskill to the wider network.

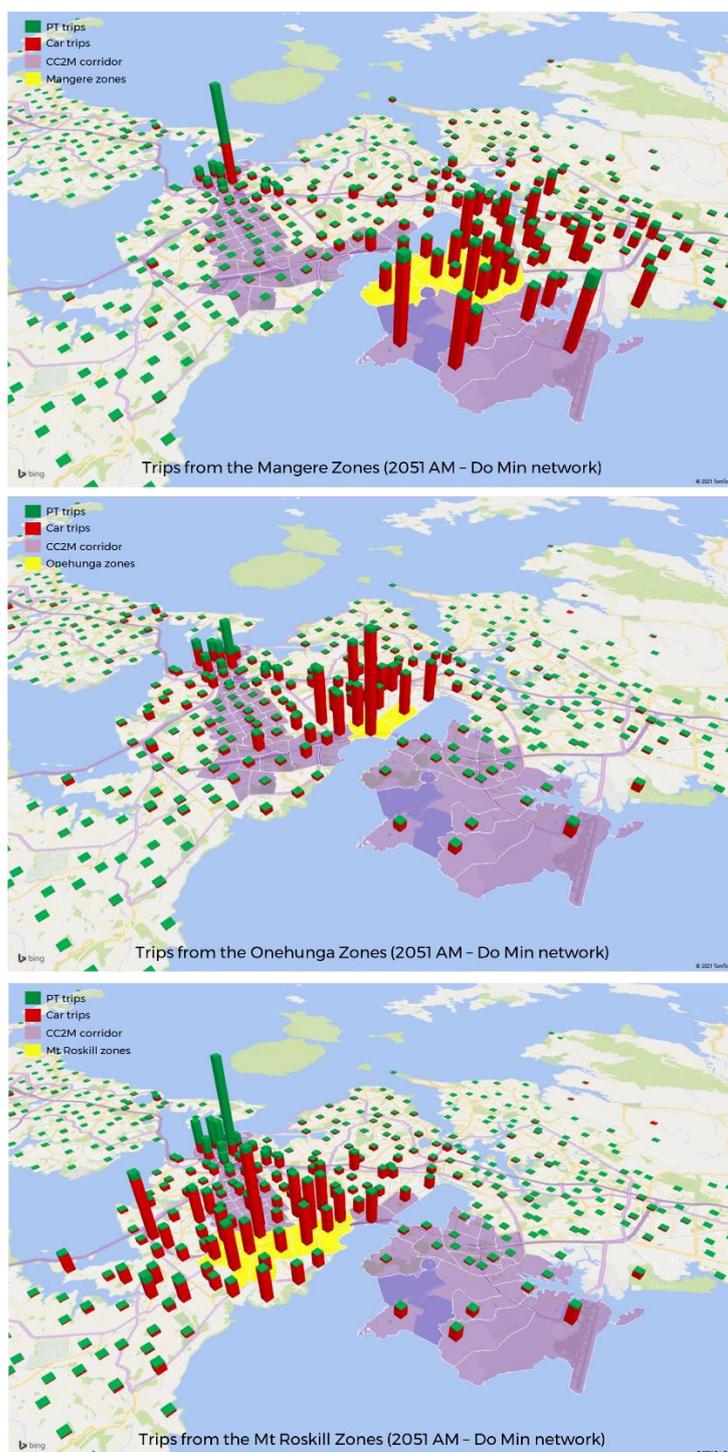


Figure 6: Trip patterns from Mangere, Onehunga and Mt Roskill

4. Initial short list – demand modelling

4.1 Description of the options

4.1.1 Option 1A

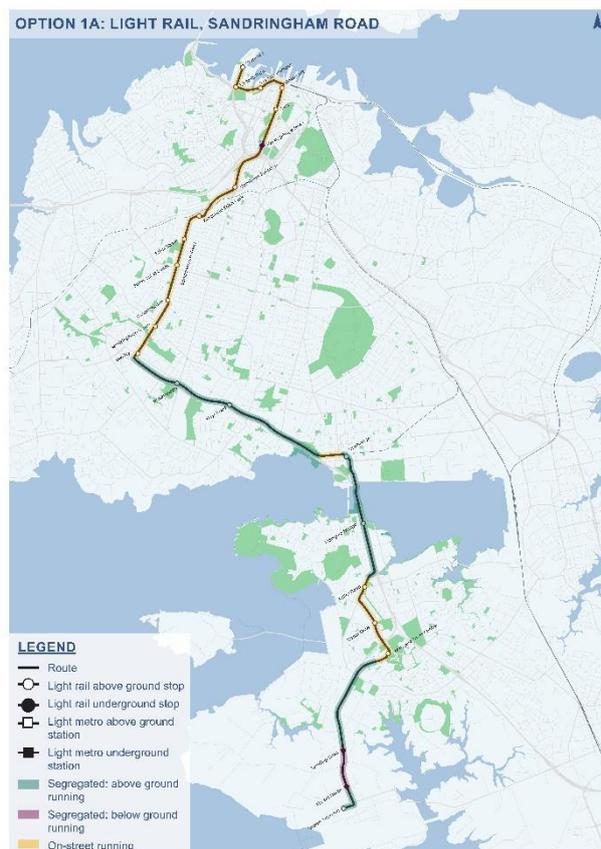


Figure 7: Option 1A LRT Sandringham Road

Option 1A connects the city centre and Mangere through a new surface running light rail alignment that traverses the isthmus along the Sandringham Road corridor. See Figure 7.

It includes 23 new stations and integrates with heavy rail at five key locations, Britomart; Aotea Station, Karangahape Road; Kingsland and Onehunga.

The model assumes the light rail vehicles run at a 4 min headway (15 trains per hour) between Wynyard and the Airport terminal for the AM and PM peaks. During the inter-peak the model reflects an 8 min headway (7.5 tph). Light rail was modelled with a total capacity of 420 people per train (including 128 seats), for both the peak and inter-peak.

The journey time along the route allows for acceleration / deceleration, dwell times at stations and is estimated at 58 minute "in-vehicle" run time between Wynyard station to the airport.

The number of stations; journey time between them; dwell time and station quality assumed in the model is shown in

Table 5: Input assumptions for Option 1A: LRT on Sandringham Road below. New walking connectors from zone centroids to the certain stations were also implemented (25% shorter than existing) to reflect intensification within walking distance of the stations.

Table 5: Input assumptions for Option 1A: LRT on Sandringham Road

Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Wynyard	1	Terminus	5		8			0:00
Victoria Park	2	Interchange	8		8	1:36	18 sec	1:54
Viaduct Harbour	3	Coverage	8		8	3:36	18 sec	3:54
Britomart	4	High future demand	8		8	6:24	36 sec	7:00
Civic	5	High future demand	8		8	11:06	36 sec	11:42



Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Karangahape Road	6	Interchange	8		8	13:36	30 sec	14:06
Dominion Junction	7	High future demand	8	Yes	8	16:42	18 sec	17:00
Kingsland / Eden Park	8	Interchange	8		8	19:36	18 sec	19:54
Ethel Street	9	Coverage	8		8	21:42	18 sec	22:00
Balmoral/St Lukes	10	Interchange	8	Yes	8	23:06	18 sec	23:24
Sandringham	11	Coverage	8		8	25:18	30 sec	25:48
Sandringham South	12	Interchange	8		8	27:54	18 sec	28:12
Wesley	13	Coverage	5	Yes	8	29:18	18 sec	29:36
Puketapapa	14	Interchange	8		8	31:30	24 sec	31:54
Hayr Road	15	Coverage	8		8	33:42	24 sec	34:06
Onehunga	16	Interchange	5	Yes	5	38:00	30 sec	38:30
Mangere Bridge	17	Coverage	8		8	41:18	18 sec	41:36
Miller Road	18	Coverage	8		8	43:36	18 sec	43:54
Bader Drive	19	Coverage	8		8	45:12	36 sec	45:48
Mangere Town Centre	20	Interchange	5	Yes	8	49:24	30 sec	49:54
Landing Drive	21	Coverage	8		8	55:12	18 sec	55:30
Airport North	22	Coverage	8		8	56:54	24 sec	57:18
Airport Terminal	23	Terminus	5		8	58:48	60 sec	-

4.1.2 Option 1B

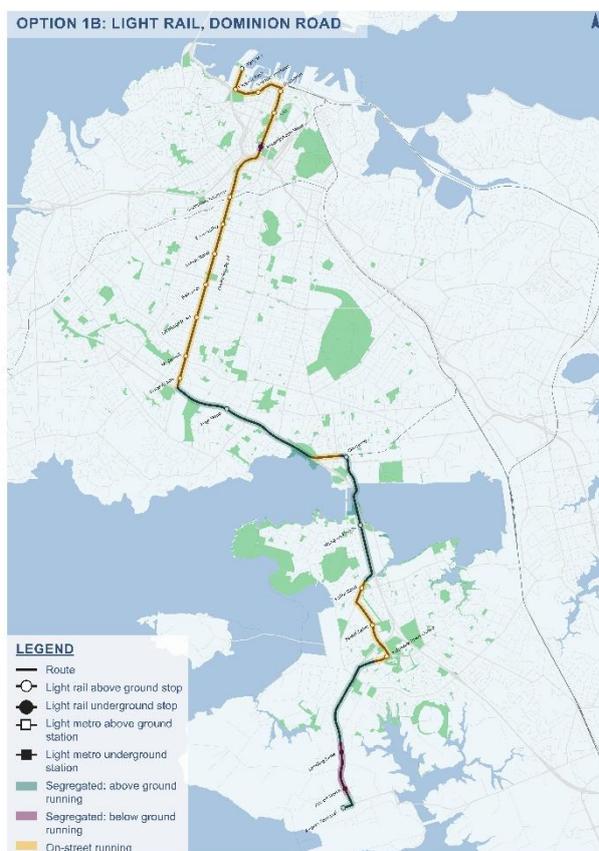


Figure 8: Option 1B LRT Dominion Road

Option 1B connects the city centre and Mangere through a new surface running light rail alignment that traverses the isthmus along the Dominion Road corridor. See Figure 8.

It includes 22 new stations and integrates with heavy rail at four key locations, Britomart; Aotea Station, Karangahape Road and Onehunga.

The model assumes the light rail vehicles run at a 4 min headway (15 trains per hour) between Wynyard and the Airport terminal for the AM and PM peaks. During the inter-peak the model reflects an 8 min headway (7.5 tph). The light rail was modelled with a total capacity of 420 people per train (including 128 seats), for both the peak and inter-peak.

The journey time along the route allows for acceleration / deceleration, dwell times at stations and is estimated at 57 minute "in-vehicle" run time between Wynyard station to the airport.

The number of stations; journey time between them; dwell time and station quality assumed in the model is shown in

Table 6: Input assumptions for Option 1B: LRT on Dominion Road below. New walking connectors from zone centroids to the certain stations were also implemented (25% shorter than existing) to reflect intensification within walking distance of the stations.

Table 6: Input assumptions for Option 1B: LRT on Dominion Road

Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Wynyard	1	Terminus	5		8	--	24 sec	0
Victoria Park	2	Interchange	8		8	1:36	18 sec	1:54
Viaduct Harbour	3	Coverage	8		8	3:36	18 sec	3:54
Britomart	4	High future demand	8		8	6:24	36 sec	7:00
Civic	5	High future demand	8		8	11:06	36 sec	11:42
Karangahape Road	6	Interchange	8		8	13:54	30 sec	14:24
Dominion Junction	7	High future demand	8	Yes	8	17:30	18 sec	17:48
Eden Valley	8	Interchange	8		8	19:54	18 sec	20:12
Milton Rd	9	Coverage	8		8	21:24	18 sec	21:42
Balmoral Rd	10	Interchange	8	Yes	8	23:24	24 sec	23:48
Lambeth Road	11	Coverage	8		8	25:54	18 sec	26:12



Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Mt Roskill	12	Interchange	5	Yes	8	28:42	24 sec	29:06
Puketepapa	13	Interchange	8		8	30:18	18 sec	30:36
Hayr Road	14	Interchange	8		8	32:36	24 sec	33:00
Onehunga	15	Interchange	5	Yes	5	36:54	30 sec	37:24
Mangere Bridge	16	Interchange	8		8	40:06	18 sec	40:24
Miller Road	17	Interchange	8		8	42:30	18 sec	42:48
Bader Drive	18	Coverage	8		8	44:00	36 sec	44:36
Mangere Town Centre	19	Interchange	5	Yes	8	48:18	30 sec	48:48
Landing Drive	20	Coverage	8		8	54:06	18 sec	54:24
Airport North	21	Coverage	8		8	55:42	24 sec	56:06
Airport Terminal	22	Terminus	5		8	57:36	60 sec	--

4.1.3 Option 2A

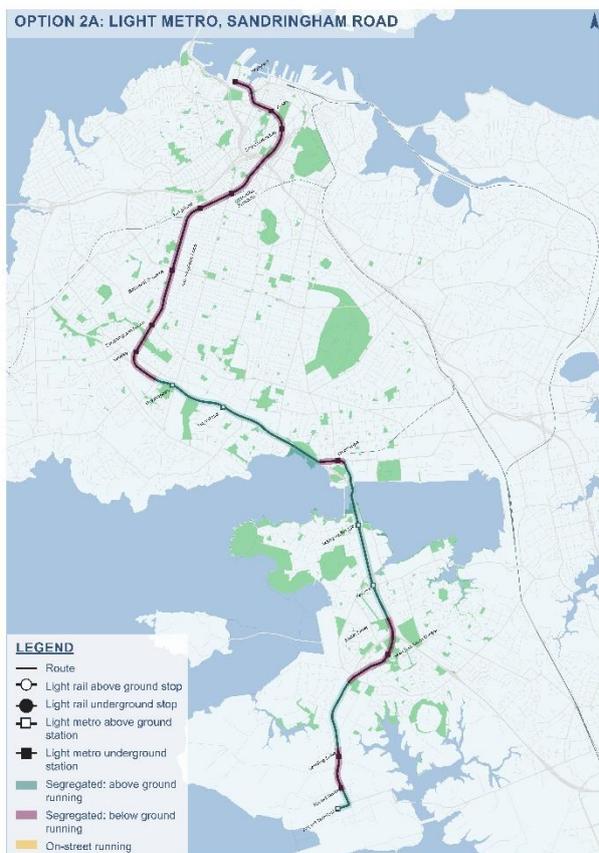


Figure 9: Option 2A LM on Sandringham Road

Option 2A connects the city centre and Mangere through a new fully segregated light metro alignment that traverses the city centre in a tunnel and the isthmus in a tunnel along the Sandringham Road corridor. See Figure 9.

It includes 17 new stations and integrates with heavy rail at three key locations, Aotea Station, Kingsland and Onehunga.

The model assumes the light metro vehicles run at a 3 min headway (20 trains per hour) between Wynyard and the Airport terminal for the AM and PM peaks. During the inter-peak the model reflects an 8 min headway (7.5 tph). The light metro was modelled with a total capacity of 580 people per train (including 150 seats), for both the peak and inter-peak.

The journey time along the route allows for acceleration / deceleration, dwell times at stations and is estimated at 36 minute "in-vehicle" run time between Wynyard station to the airport.

The number of stations; journey time between them; dwell time and station quality assumed in the model is shown in

Table 7: Input assumptions for Option 2A: LM on Sandringham Road below. New walking connectors from zone centroids to the certain stations were also implemented (25% shorter than existing) to reflect intensification within walking distance of the stations.

Table 7: Input assumptions for Option 2A: LM on Sandringham Road

Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Wynyard	1	Terminus	5		8			0:00
Aotea	2	Interchange	3		5	1:18	36 sec	1:54
City Universities	3	High future demand	5		5	3:36	36 sec	4:12
Dominion Junction	4	High future demand and TOD	3	Yes	5	6:18	18 sec	6:36
Kingsland	5	Interchange	5		8	8:06	18 sec	8:24
Balmoral / St Lukes	6	Interchange	5	Yes	8	10:12	24 sec	10:36
Sandringham South	7	Interchange	5		8	12:12	24 sec	12:36
Wesley	8	Interchange	5	Yes	8	13:42	24 sec	14:06
Puketapapa	9	Interchange	5		8	16:00	30 sec	16:30
Hayr Rd	10	Interchange	5		8	18:12	24 sec	18:36



Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Onehunga	11	Interchange	5	Yes	5	21:36	30 sec	22:06
Mangere Bridge	12	Interchange	5		8	24:42	18 sec	25:00
Favona	13	Coverage	5		8	26:48	18 sec	27:06
Mangere Town Centre	14	Interchange	5	Yes	8	29:12	30 sec	29:42
Landing Drive	15	Coverage	5		8	32:36	18 sec	32:54
Airport North	16	Coverage	5		8	34:12	24 sec	34:36
Airport terminal	17	Terminus	3		5	36:06	60 sec	

4.1.4 Option 2B

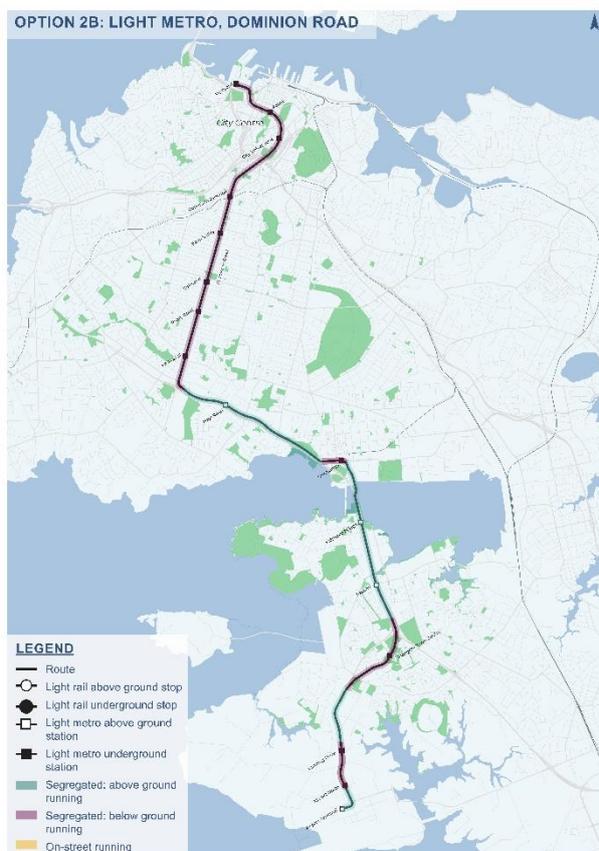


Figure 10: Option 2B LM on Dominion Road

Option 2B connects the city centre and Mangere through a new fully segregated light metro alignment that traverses the city centre in a tunnel and the isthmus in a tunnel along the Dominion Road corridor. See Figure 10.

It includes 16 new stations and integrates with heavy rail at two key locations, Aotea Station and Onehunga.

The model assumes the light metro vehicles run at a 3 min headway (20 trains per hour) between Wynyard and the Airport terminal for the AM and PM peaks. During the inter-peak the model reflects an 8 min headway (7.5 tph). The light metro was modelled with a total capacity of 580 people per train (including 150 seats), for both the peak and inter-peak.

The journey time along the route allows for acceleration / deceleration, dwell times at stations and is estimated at 34 minute "in-vehicle" run time between Wynyard station to the airport.

The number of stations; journey time between them; dwell time and station quality assumed in the model is shown in

Table 8: Option 2B LM on Dominion Road below. New walking connectors from zone centroids to the certain stations were also implemented (25% shorter than existing) to reflect intensification within walking distance of the stations.

Table 8: Option 2B LM on Dominion Road

Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Wynyard	1	Terminus	5		8			0:00
Aotea	2	Interchange	3		5	1:18	36 sec	1:54
City Universities	3	High future demand	5		5	3:36	36 sec	4:12
Dominion Junction	4	High future demand and TOD	3	Yes	5	6:18	18 sec	6:36
Eden Valley	5	Interchange	5		8	7:48	18 sec	8:06
Balmoral	6	Interchange	5	Yes	8	9:36	24 sec	10:00
Peary Rd	7	Interchange	5		8	11:18	24 sec	11:42
Mt Roskill	8	Interchange	5	Yes	8	13:12	24 sec	13:36
Hayr Rd	9	Interchange	5		8	16:06	24 sec	16:30
Onehunga	10	Interchange	5	Yes	5	19:30	30 sec	20:00
Mangere Bridge	11	Interchange	5		8	22:36	18 sec	22:54



Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Favona	12	Coverage	5		8	24:42	18 sec	25:00
Mangere Town Centre	13	Interchange	5	Yes	8	27:12	30 sec	27:42
Landing Drive	14	Coverage	5		8	30:36	18 sec	30:54
Airport North	15	Coverage	5		8	32:06	24 sec	32:30
Airport terminal	16	Terminus	3		5	34:00	60 sec	

4.1.5 Option 3

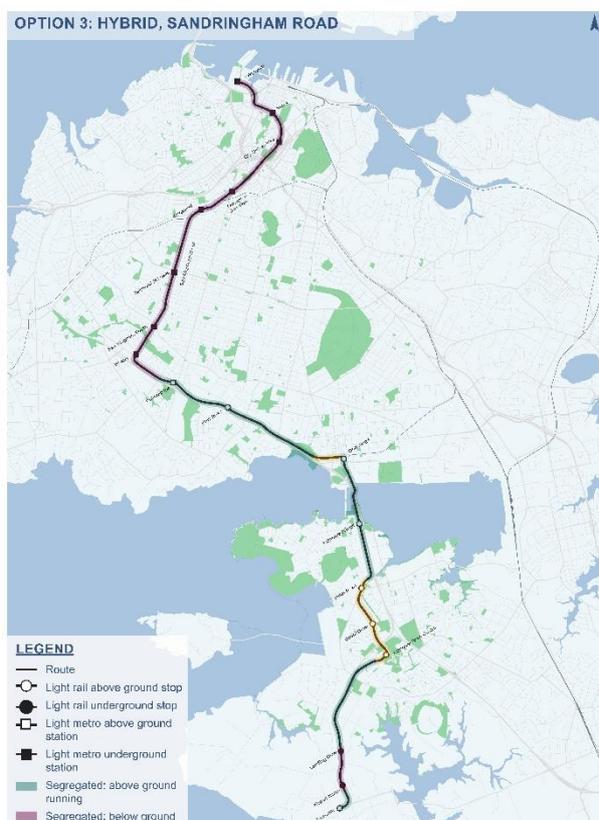


Figure 11: Option 3 Hybrid on Sandringham Road

Option 3 connects the city centre and Mangere through a new segregated alignment that traverses the city centre in a tunnel and the isthmus in a tunnel along the Sandringham Road corridor. The alignment south of Onehunga follows Coronation Road and Bader Drive as street running with at-grade stops along it and in the Mangere Town Centre. See Figure 11.

It includes 18 new stations and integrates with heavy rail at three key locations, Aotea Station, Kingsland and Onehunga.

The model assumes the light rail vehicles run at a 3 min headway (20 trains per hour) between Wynyard and the Airport terminal for the AM and PM peaks. During the inter-peak the model reflects an 8 min headway (7.5 tph). The hybrid light rail was modelled with a total capacity of 420 people per train (including 128 seats), for both the peak and inter-peak.

The journey time along the route allows for acceleration / deceleration, dwell times at stations and is estimated at 43 minute "in-

vehicle" run time between Wynyard station to the airport.

The number of stations; journey time between them; dwell time and station quality assumed in the model is shown in Table 9: Option 3: Hybrid on Sandringham Road below. New walking connectors from zone centroids to the certain stations were also implemented (25% shorter than existing) to reflect intensification within walking distance of the stations.

Table 9: Option 3: Hybrid on Sandringham Road

Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Wynyard	1	Terminus	5		8			0:00
Aotea	2	Interchange	3		5	1:18	36 sec	1:54
City Universities	3	High future demand	5		5	3:36	36 sec	4:12
Dominion Junction	4	High future demand and TOD	3	Yes	5	6:18	18 sec	6:36
Kingsland	5	Interchange	5		8	8:06	18 sec	8:24
Balmoral / St Lukes	6	Interchange	5	Yes	8	10:12	24 sec	10:36
Sandringham South	7	Interchange	5		8	12:12	24 sec	12:36
Wesley	8	Interchange	5	Yes	8	13:42	24 sec	14:06
Puketapapa	9	Interchange	5		8	16:00	30 sec	16:30



Station	No.	Function	Quality	New walking connector	Bus stop quality	Arrival	Dwell	Departure
Hayr Rd	10	Interchange	5		8	18:12	24 sec	18:36
Onehunga	11	Interchange	5	Yes	5	22:30	30 sec	23:00
Mangere Bridge	12	Coverage	8		8	25:48	18 sec	26:06
Miller Road	13	Coverage	8		8	28:06	18 sec	28:24
Bader Drive	14	Coverage	8		8	29:42	36 sec	30:18
Mangere Town Centre	15	Interchange	5	Yes	8	33:54	30 sec	34:24
Landing Drive	16	Coverage	8		8	39:42	18 sec	40:00
Airport North	17	Coverage	8		8	41:24	24 sec	41:48
Airport Terminal	18	Terminus	5		8	43:18	60 sec	-



4.2 Outcomes against KPIs and measures

4.2.1 Initial run and land use adjustments

The five shortlisted options were modelled using MSM for both the 2031 and 2051 horizons.

The options were initially run on the Do Minimum land use, and accessibility and effective job density outputs were used to inform hedonic land use modelling (external to MSM) for the 2051 modelling horizon.

The hedonic modelling resulted in adjustments to the land use distribution in 2051 that reflect a slightly higher growth within the corridor. This adjusted growth pattern is referred to as the 'accessibility-based land use scenario'. Growth outside the corridor forecast to slow down to keep Auckland's 2051 regional forecast constant. The 2051 population in the CC2M Corridor was forecast to increase by between 5% and 6% and employment totals by between 1.2% and 1.7% as shown in Table 10: Adjustments to the 2051 land use forecast below.

Table 10: Adjustments to the 2051 land use forecast (accessibility-based land use scenario)

	Population in CC2M Corridor by 2051	Increase over Do Minimum in CC2M Corridor	Percentage change in the C2M Corridor
DM 2051	259,688		
Opt 1A 2051	272,969	13,281	5.1%
Opt 1B 2051	272,608	12,920	5.0%
Opt 2A 2051	275,408	15,720	6.1%
Opt 2B 2051	275,769	16,081	6.2%
Opt 3 2051	274,992	15,304	5.9%
	Employment in CC2M Corridor by 2051	Increase over Do Minimum in CC2M Corridor	Percentage change in the C2M Corridor
DM 2051	251,144		
Opt 1A 2051	254,253	3,109	1.2%
Opt 1B 2051	254,142	2,998	1.2%
Opt 2A 2051	255,341	4,197	1.7%
Opt 2B 2051	255,248	4,104	1.6%
Opt 3 2051	255,135	3,991	1.6%

4.2.2 Comparing the outcomes

The five shortlisted options were re-modelled in 2051 using MSM the adjusted land use distribution discussed above.

A summary version of the results for the 2051 model horizon is shown in Table 11: Key outcomes for the 5 shortlisted option at 2051 model horizon below, with a full set of results included in Appendix B.



Table 11: Key outcomes for the 5 shortlisted option at 2051 model horizon

Indicators	2018	2051 DM	1A	1B	2A	2B	3
	Existing land use	Do minimum land use scenario	Accessibility based land use scenario				
Number of Jobs within 45min by PT from origins in the AM Peak from:							
Mangere Town Centre	79,780	82,065	250,013	241,967	440,725	421,323	336,932
Onehunga	165,136	194,045	401,109	397,745	456,074	435,807	444,666
Mt Roskill	208,209	297,096	359,671	412,067	419,743	469,689	401,412
Number of Households within 45min by PT to destinations in the AM Peak from:							
City Centre	202,704	354,075	364,488	365,663	381,059	384,833	376,112
Airport	3,840	19,838	86,547	90,179	136,616	143,071	94,963
Number of Tertiary Education Opportunities within 45min by PT from origins in the AM Peak							
Mangere Town Centre	9,081	4,828	22,495	22,494	131,676	115,737	114,336
Onehunga	4,323	5,787	111,800	111,789	115,975	115,972	111,831
Mount Roskill	77,097	111,005	111,800	111,791	111,873	120,513	111,831
CC2M Travel times to Airport business from:							
Mangere			7.0	6.9	4.5	4.4	7.0
Onehunga			18.4	18.3	12.1	12.1	18.4
Mount Roskill			27.3	26.6	20.1	18.5	29.9
CC2M Travel times to Mid Town from:							
Mangere			37.7	36.6	27.3	25.3	32.0
Onehunga			26.3	25.2	19.7	17.6	20.6
Mount Roskill			17.6	17.0	11.8	11.3	11.8
CC2M Travel times to Universities Station from:							
Mangere					25.0	23.0	29.7
Onehunga					17.4	15.3	18.3
Mount Roskill					9.5	9.0	9.5
CC2M Travel times to Wynyard from:							
Mangere			49.4	48.3	29.2	27.2	33.9
Onehunga			38.0	36.9	21.6	19.5	22.5
Mount Roskill			29.3	28.7	13.7	13.2	13.7
CC2M Boardings							
AM Peak			14,816	14,665	24,157	23,184	22,328
Daily			64,589	64,760	106,379	102,987	95,664
Annual			18,020,359	18,067,901	29,679,713	28,733,401	26,690,117
Percentage of Corridor separated from general traffic and pedestrianised areas			45%	42%	100%	100%	82%
Regional Rapid Transit (AM peak 2 hours):							
Boardings	22,735	84,669	96,789	96,298	105,338	103,755	103,637
CC2M Spare Capacity at Peak Load Point (maximum capacity - Peak Load Demand)							
Modelled Maximum Capacity of CC2M (pax/hour/direction)			6,300	6,300	11,600	11,600	8,400
Maximum Potential Capacity (pphpd)			8,400	8,400	23,200	23,200	12,600
CC2M Demand at Peak Load Point (pax/hour/direction)			4,412	4,528	7,799	7,121	7,337
% Utilisation (modelled capacity)			70%	72%	67%	61%	87%
Available capacity - modelled (pax/hour/direction)			1,888	1,772	3,801	4,479	1,063
Available Capacity Maximum (pphpd)			3,988	3,872	15,401	16,079	5,263

4.2.3 Travel time comparison

The travel time comparisons of public transport and private vehicles at the 2051 model horizon show that:

- For Mangere all options will result in public transport options being competitive to the central city (midtown zone) when compared to private cars (refer to Figure 12: Travel times from zone 472 to zone 248) below);

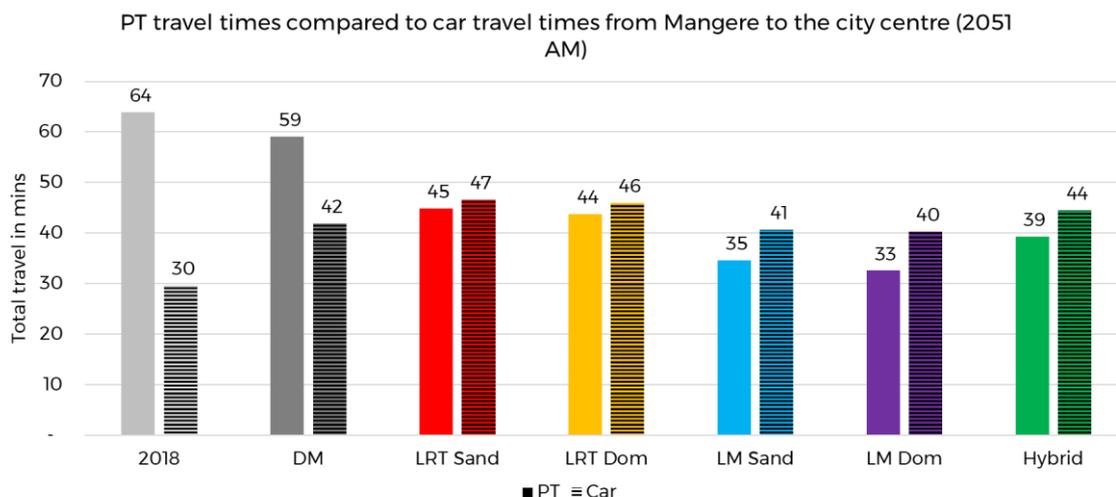


Figure 12: Travel times from zone 472 to zone 248)

- For Onehunga the light metro and hybrid options provide competitive travel times to the central city with the light rail options achieving parity with private cars (refer to Figure 13: Travel times from zone 347 to zone 248) below;

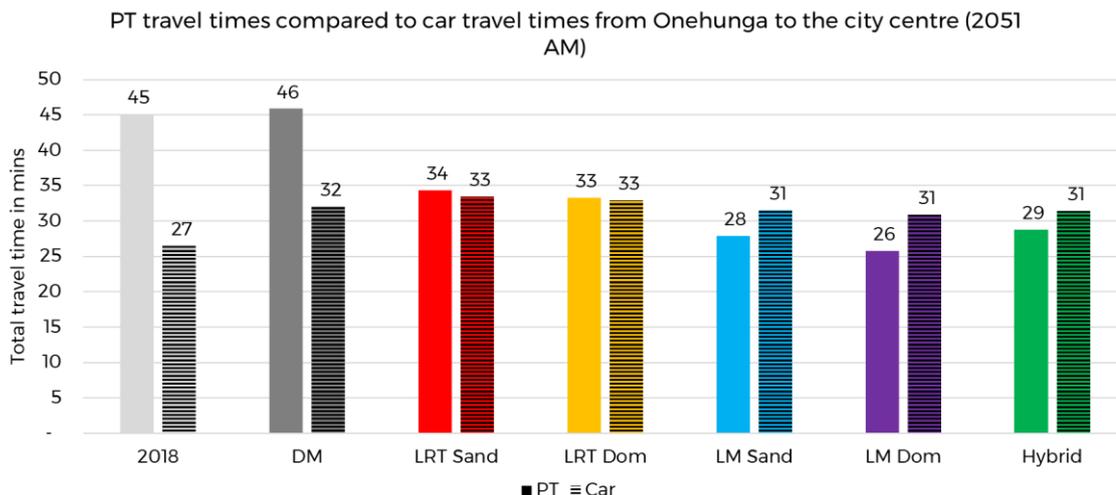


Figure 13: Travel times from zone 347 to zone 248)

- For Mt Roskill (zone 327) private cars will still be more competitive from a vehicle travel time perspective. Refer to Figure 14: Travel times from zone 327 to zone 248)

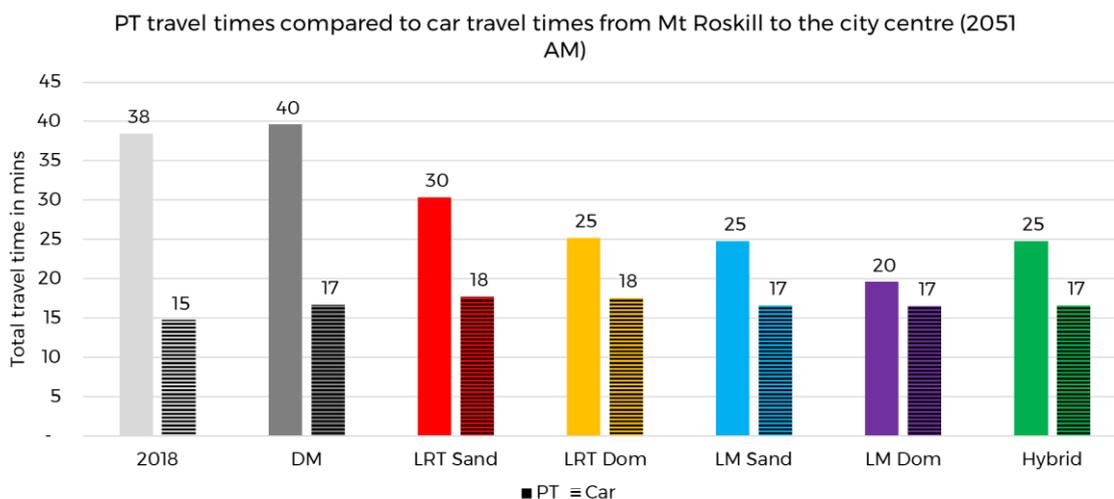


Figure 14: Travel times from zone 327 to zone 248)

4.2.4 Number of households within 45 minutes from city centre and airport

MSM analyses of the number of households that can access the midtown central city (represented by zone 248) within 45 minutes using public transport show that:

- Light metro increases the number of households that can access the central city in 45 minutes by 2051 between 8% and 9% when compared to the Do Minimum;
- The hybrid option increases the number of households that can access the central city in 45 minutes by 2051 by 6% when compared to the Do Minimum;
- Light rail increases the number of households that can access the central city in 45 minutes by 2051 by 3% when compared to the Do Minimum;

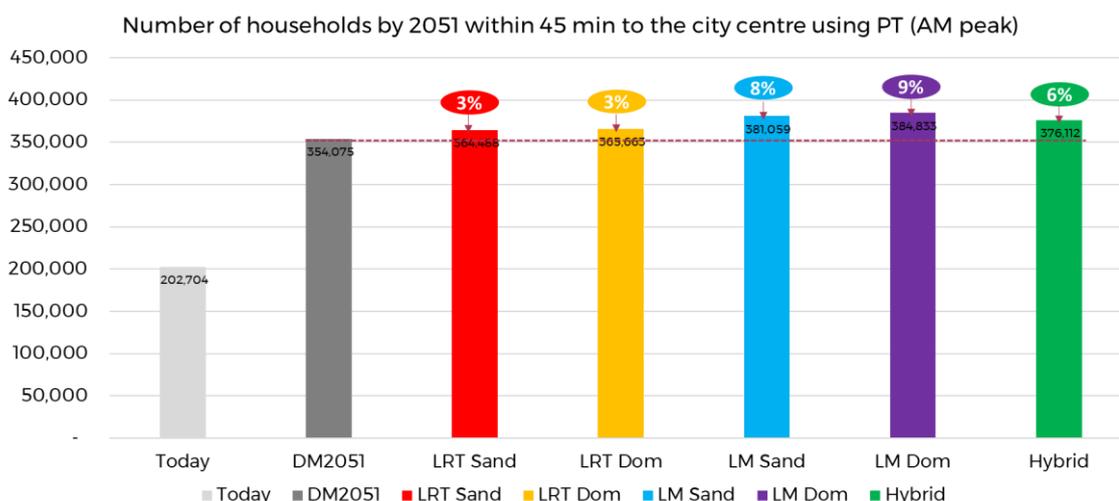


Figure 15: Households within 45 mins of central city (zone 248)

The options have a significant impact on the airport employment zone. MSM analyses shows that of the number of households that can access the airport employment area (represented by zone 478) within 45 minutes using public transport show that:



- Light metro increases the number of households that can access airport employment in 45 minutes by 2051 between 589% and 621% when compared to the Do Minimum;
- The hybrid option increases the number of households that can access airport employment in 45 minutes by 2051 by 379% when compared to the Do Minimum;
- Light rail increases the number of households that can access airport employment in 45 minutes by 2051 by between 336% and 355% when compared to the Do Minimum

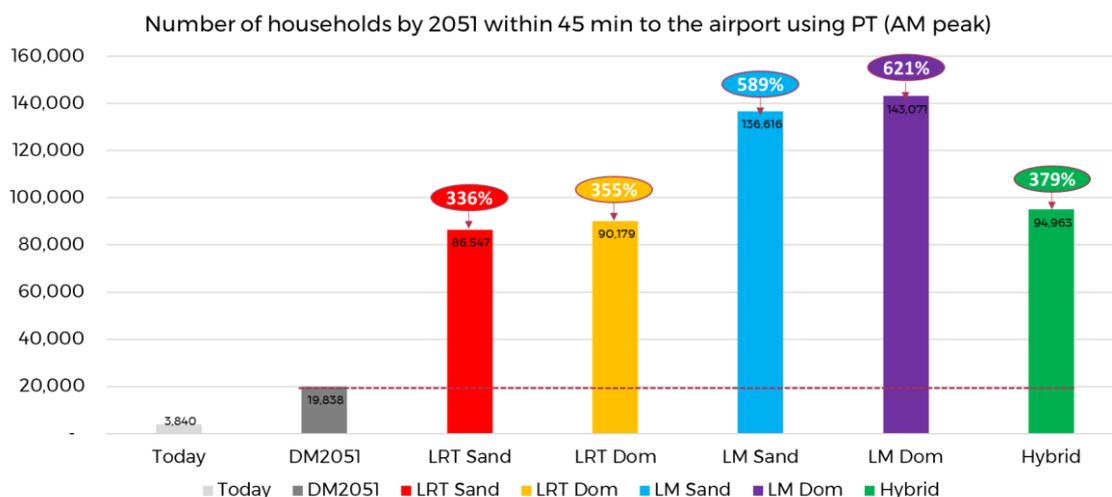


Figure 16: Households within 45 mins of airport employment (zone 478)

4.2.5 Number of jobs from key areas

MSM analyses on the number of opportunities (jobs) available to residents from key areas of interest within 45 minutes using public transport show that:

- For Mangere residents (represented by zone 472) all options improve the number of jobs residents can access within 45 mins, with light metro options providing the highest improvement – a fivefold increase.

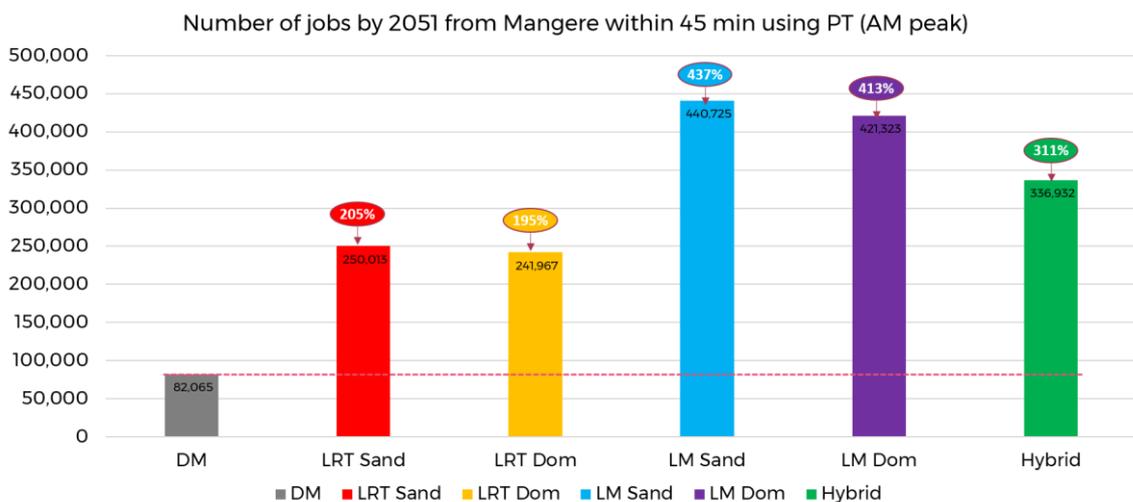


Figure 17: Improvement in job accessibility from Mangere (zone 472)

- For Onehunga residents (represented by zone 347) all options improve the number of jobs residents can access within 45 mins, with light metro option on Sandringham and the Hybrid options providing the highest improvement, doubling the number of jobs accessible – a 135% and 129% uplift respectively;

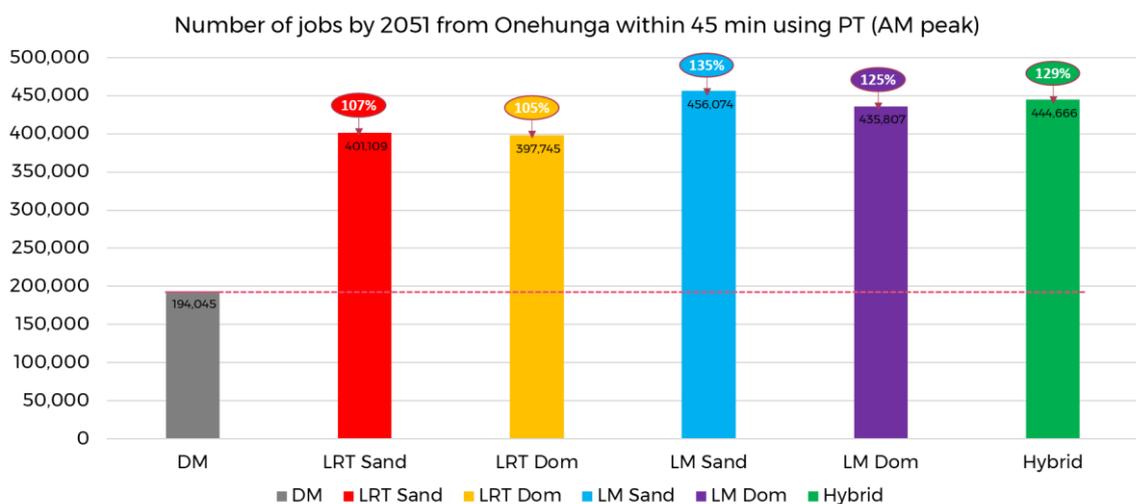


Figure 18: Improvement in job accessibility from Onehunga (zone 347)

- Mt Roskill (represented by zone 327) receive the lowest uplift of the three areas of interest – improving job accessibility between 21% and 58%, with light metro along Dominion Road providing the highest improvement over the Do Minimum (+58%).

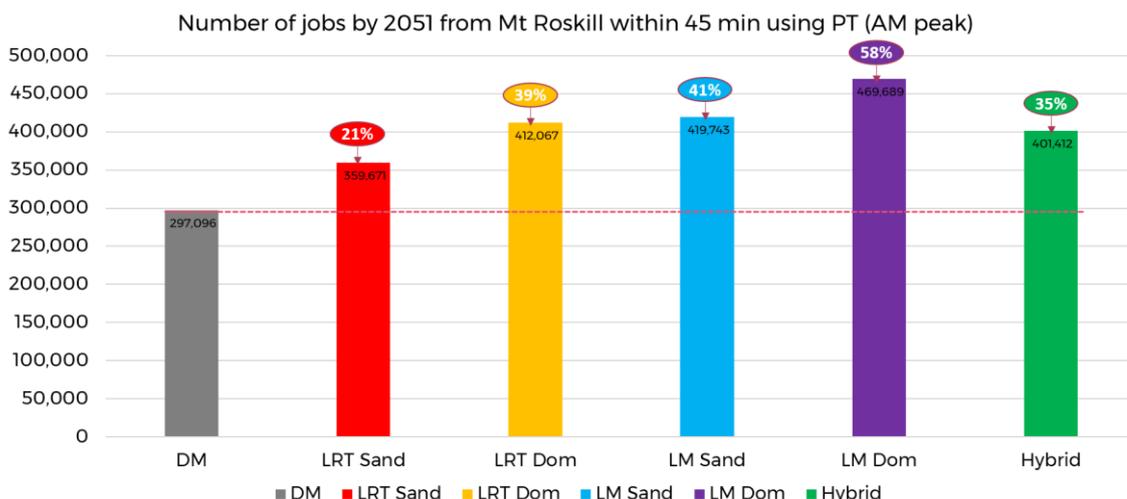


Figure 19: Improvement in job accessibility from Mt Roskill (zone 327)

4.2.6 Number of tertiary education opportunities from key areas

The number of tertiary education opportunities available to residents from key areas of interest within a 45 minutes public transport journey estimated by the MSM model show that:

- For Mangere residents (represented by zone 472) all options improve access to education, with light metro and the hybrid options improving access significantly more than light rail options.
- For Onehunga all options improve access to similar level of improvement;
- Mt Roskill is forecast to achieve similar levels of access to education when compared to the Do Minimum - with light metro along Dominion Road the only option that provides notable improvements (+9%).

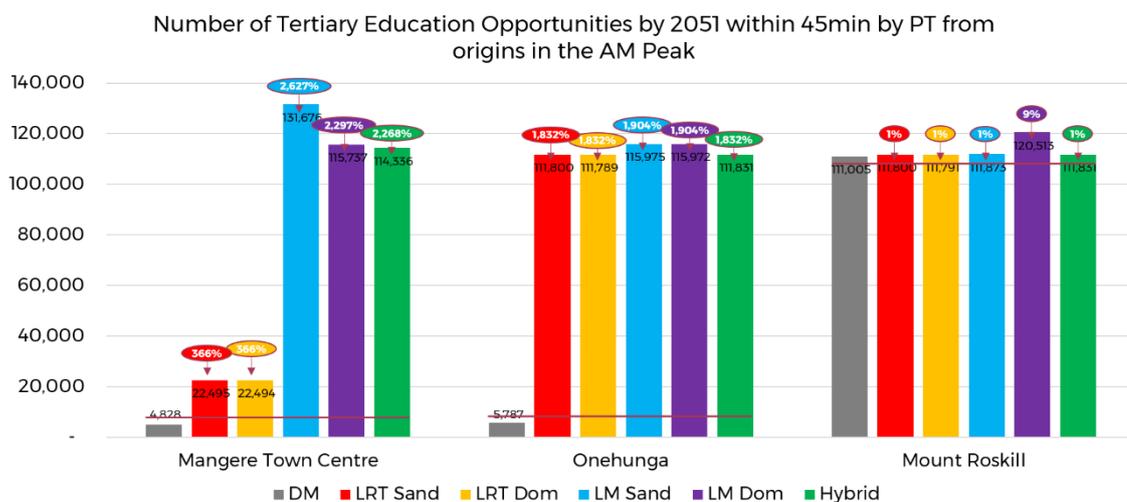


Figure 20: Improvements in tertiary education from all areas



4.2.7 Light rail/light metro demands

The system and network configurations as discussed above are forecast to increase annual ridership on the entire public transport network by between 3% and 6%. The light metro solutions are forecast to contribute the highest - between 25.8M and 26.7M of the annual boardings. Light rail options forecast to attract approximately 16.2M annual boardings. Refer to Figure 21: Boardings – Region wide PT network below.

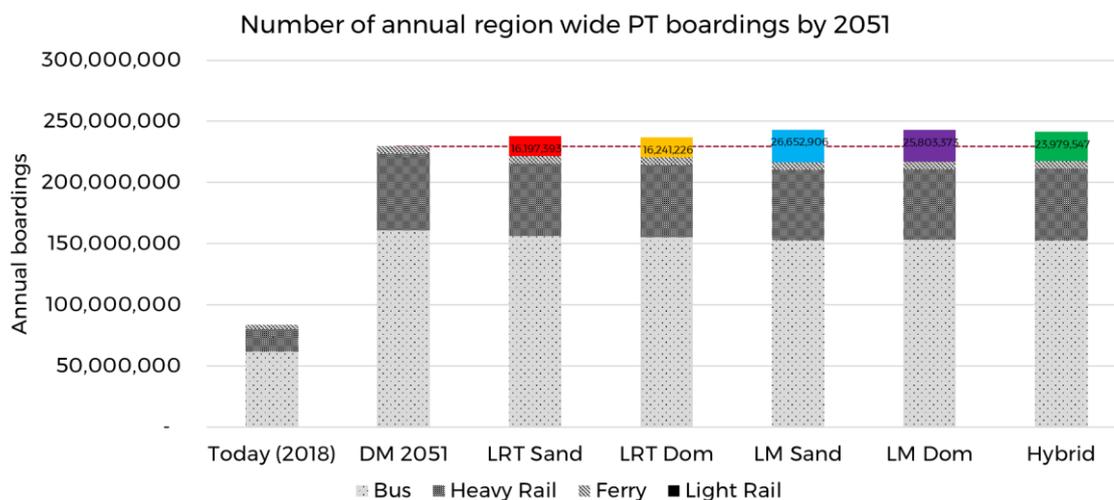


Figure 21: Boardings – Region wide PT network

4.2.8 Boarding and alighting at each station

Total boarding and alighting during the 2-hour morning peak vary along the route, with Mangere, Onehunga and Mt Roskill stations attracting the highest boardings during the morning peak. The highest alighting stops are serving employment areas in the central city and the airport. Specific observations for each option are reported below:

4.2.8.1 Option1A: Sandringham LRT

Boarding and alighting distribution for the morning 2hr peak along the Sandringham Light rail option is shown in Figure 22: Station use: Sandringham Road LRT.

- A total of approximately 14,800 boardings are forecast during the 2hr period
- It shows the Wesley stop as the busiest with approximately 3,400 boardings over that period. This is also a significant transfer stop, with just over a third of all boardings coming from transfers.
- The Civic stop is the busiest destination in the morning peak, with approximately 3,500 alightings over the 2hr period. Wynyard and the Airport North stops are the second busiest with approximately 1,800 alightings.
- The six city centre stops combined are forecast to have approximately 7,400 alightings over the 2hr period.

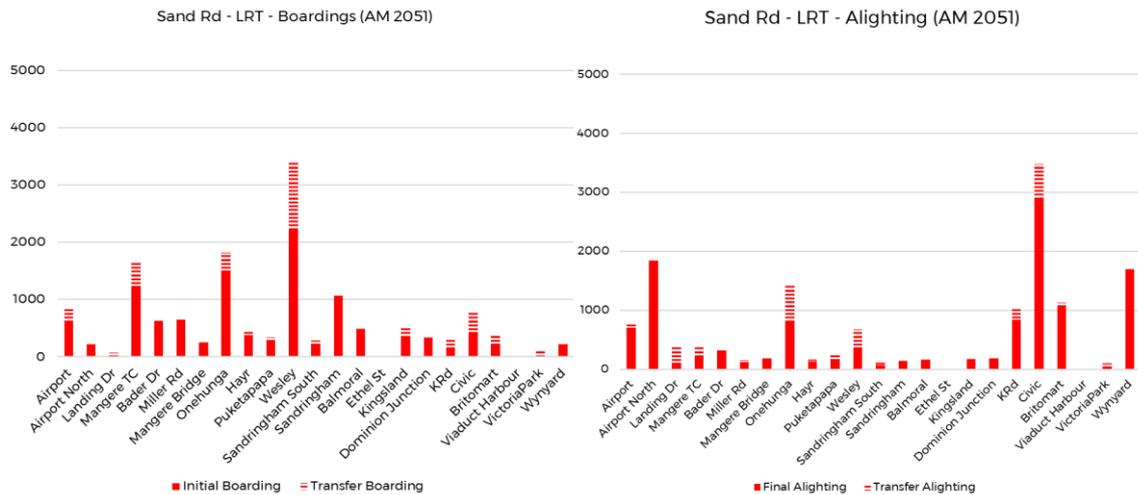


Figure 22: Station use: Sandringham Road LRT (2hr)

4.2.8.2 Option 1B: Dominion Road LRT

Total boarding and alighting distribution for the morning 2hr peak along the option is shown in Figure 23: Station use: Dominion Road LRT.

- A total of approximately 14,700 boardings are forecast during the 2hr period. It shows a very similar pattern compared to the Sandringham Rd option, with the Mt Roskill stop as the busiest. It is lower than the Sandringham Road option in this location, at approximately 2,600 boardings over the 2hr morning peak period. It is also a significant transfer stop, with approximately 40% of all boardings coming from transfers.
- The Civic stop is the busiest destination in the morning peak, with approximately 3,500 alightings over the 2hr period. Wynyard and the Airport North stops are the second busiest with approximately 1,800 alightings.
- The six city centre stops combined are forecast to have approximately 7,600 alightings over the 2hr period.

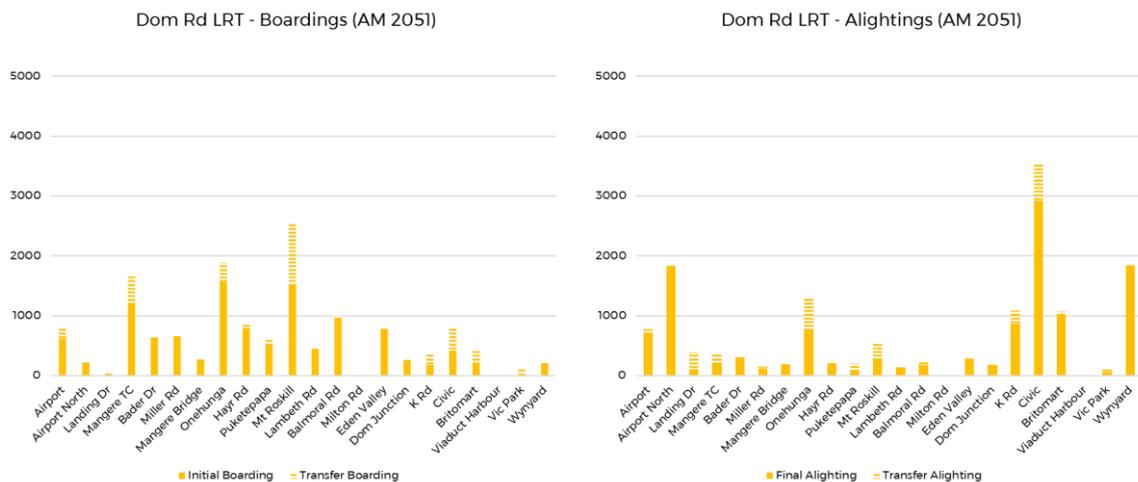


Figure 23: Station use: Dominion Road LRT (2hr)



4.2.8.3 Option 2A: Sandringham Road Light Metro

Total boarding and alighting distribution for the morning 2hr peak along the option is shown in Figure 24: Station use: Sandringham Road LM.

- A total of approximately 24,200 boardings are forecast during the 2hr period, 63% more than light rail along the same corridor. It shows Wesley, Onehunga and Mangere Town Centre as busiest boarding stations together with Aotea and Kingsland. Significant transfers are forecast at Wesley (39%), Kingsland (66%) and Aotea (75%).
- Wesley is the busiest stop at 4,100 boardings over the 2hr morning peak period. This is approximately 20% more boardings than the light rail option in the same location.
- The three city centre stops are the busiest destinations in the morning peak. A total of 14,500 alightings occur in the central city during the morning 2hr peak. This is 96% more alightings in the central city than light rail from Sandringham Road.
- The Airport North stop also experience an increase in alighting over the compared to light rail options with approximately 2,300 alightings.

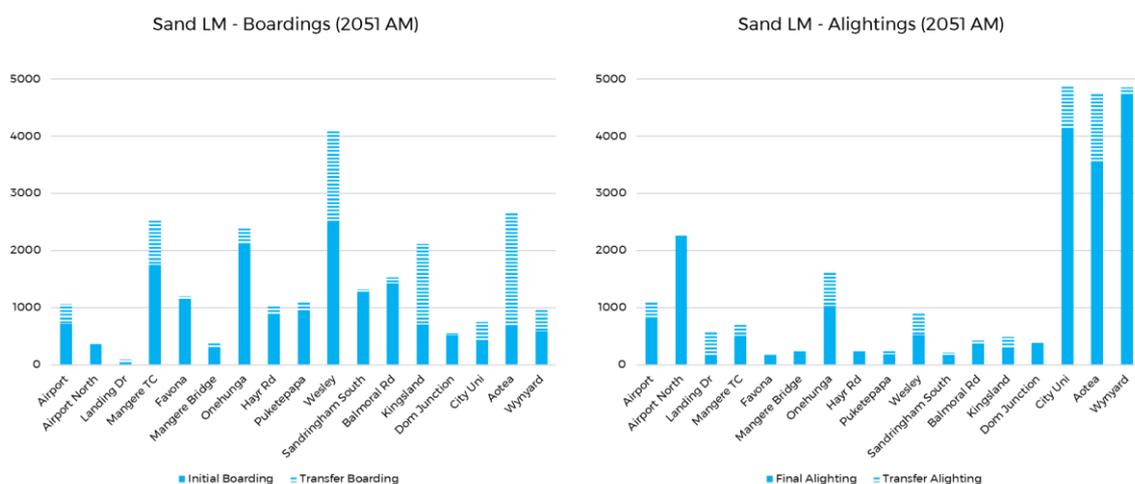


Figure 24: Station use: Sandringham Road LM (2hr)

4.2.8.4 Option 2B: Dominion Road Light Metro

Total boarding and alighting distribution for the morning 2hr peak along the option is shown in Figure 25: Station use: Dominion Road LM.

- A total of approximately 23,200 boardings are forecast during the 2hr period, 58% more than light rail along the same corridor. It shows Aotea as the busiest boarding station, with Mt Roskill, Onehunga and Mangere Town Centre the busiest outside the city centre. Aotea is a significant transfer station with almost 80% of all boardings coming from transfers.
- The Hayr Road station attracts almost twice the boardings when compared to the Sandringham Light Metro option. At 2,100 boardings it is the fifth busiest boarding station on the system and play a more significant role in this option compared to the other options.

- Mt Roskill remains a busy station and at 3,600 boardings over the 2hr morning peak period. This is approximately 38% more boardings than the light rail option in the same location.
- The three city centre stops are the busiest destinations in the morning peak. A total of 14,200 alightings occur in the central city during the morning 2hr peak. This is 87% more than light rail along Dominion Road).
- The Airport North stop also experience an increase in alighting over the compared to light rail options with approximately 2,300 alightings.

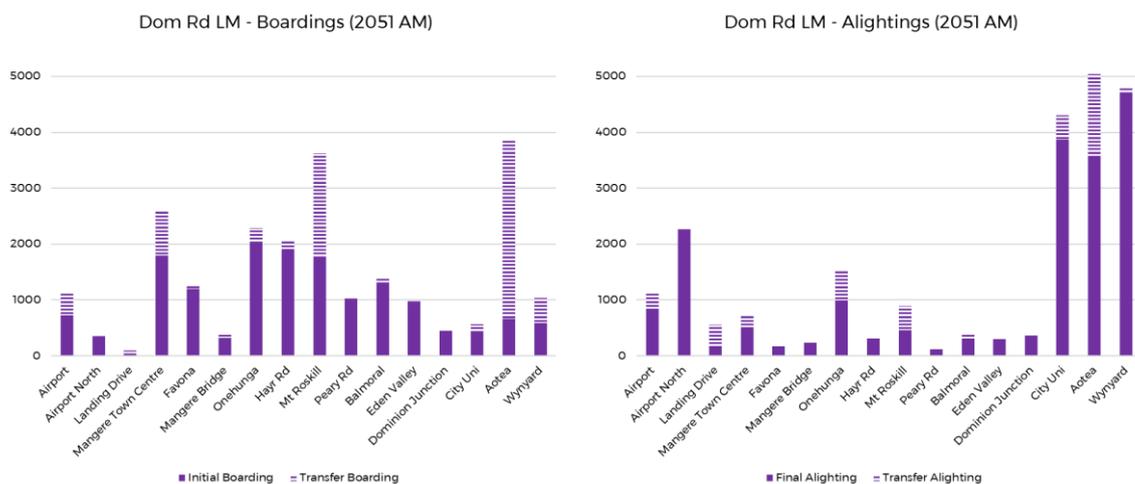


Figure 25: Station use: Dominion Road LM (2hr)

4.2.8.5 Option 3: Sandringham Road Hybrid

Total boarding and alighting distribution for the morning 2hr peak along the option is shown in Figure 26: Station use: Sandringham Road Hybrid. Figure 24: Station use: Sandringham Road LM.

- A total of approximately 22,300 boardings are forecast during the 2hr period, 8% less than light metro along the same route, but more than light rail. It shows Wesley, Onehunga and Mangere Town Centre as busiest boarding stations together with Aotea and Kingsland. Significant transfers are forecast at Wesley (39%), Kingsland (66%) and Aotea (75%).
- Wesley remains the busiest stop on the system with 3,900 boardings over the 2hr morning peak period. Approximately 38% of these boardings are from transfers.
- The three city centre stops are the busiest destinations in the morning peak. A total of 13,700 alightings occur in the central city during the morning 2hr peak. This is a 5.5% reduction in alightings in the central city when compared to the light metro along Sandringham Road.

The Airport North remains a busy alighting stops during the morning peak with approximately 1,900 alightings.

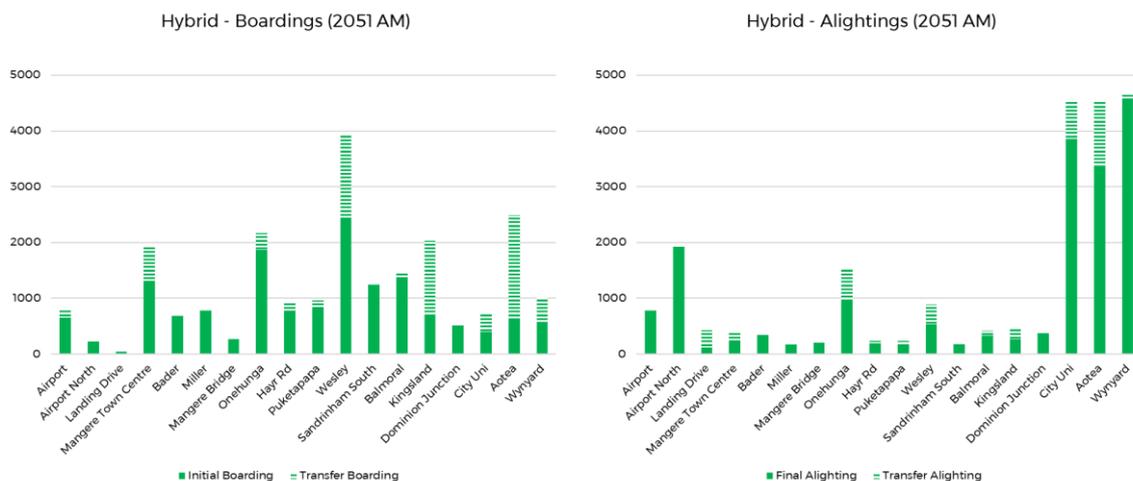


Figure 26: Station use: Sandringham Road Hybrid (2hr)

4.2.9 Demand along the route

The MSM model was used to generate demand profiles along the corridor for the 2hr morning and evening peak, as well as the 2hr midday interpeak.

4.2.9.1 Option 1A: Sandringham Road LRT

- Option 1A's 2051 demand profile is shown below in Figure 27: CC2M ridership – LRT Sandringham Road.
- The demand profile shows the option is expected to reach 58% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops). The ridership at the peak loading point is forecast to be 7,400 over 2hrs.

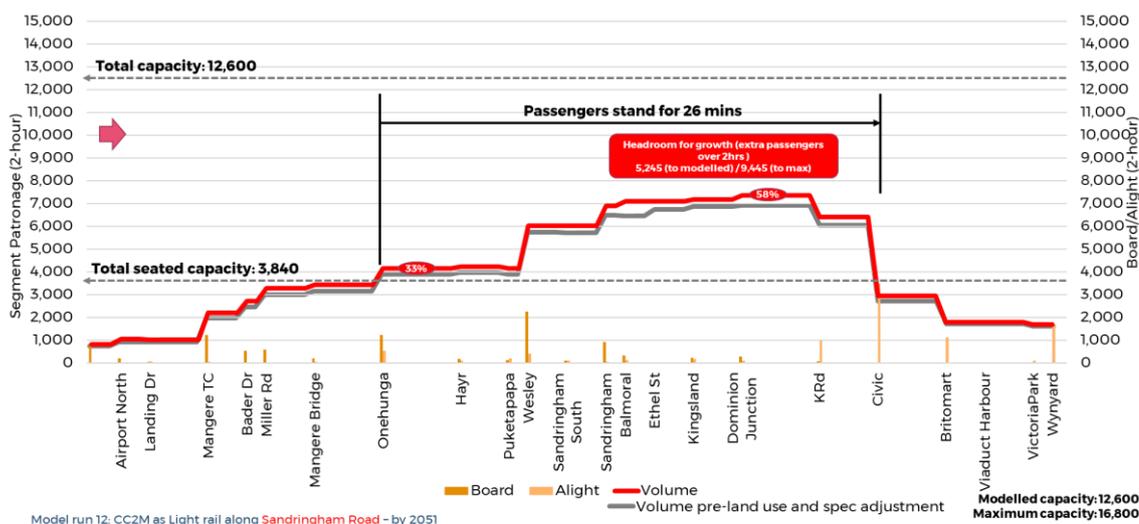


Figure 27: CC2M ridership – LRT Sandringham Road (2hr)

- Inbound patronage is forecast to exceed the total seated capacity from the Onehunga stop up to the Civic stop. This implies some passengers boarding at this location, and all passengers boarding north of this location will stand during their



inbound journey to the city. The maximum standing time on this system is approximately 26 minutes (for passengers boarding at Onehunga and travelling all the way to the Civic stop).

- Most of the passengers get off at the Civic stop.

4.2.9.2 Option1B: Dominion Road LRT

- Option 1B's 2051 demand profile is shown below in Figure 28: CC2M ridership: LRT Dominion Road.
- The demand profile shows the option is expected to reach 60% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops). The ridership at the peak loading point is forecast to be 7,500 over 2hrs.
- Inbound patronage is forecast to exceed the total seated capacity from the Onehunga stop up to the Civic stop. The maximum standing time on this system is slightly less when compared to Sandringham Road LRT at approximately 25 minutes (for passengers boarding at Onehunga and travelling all the way to the Civic stop).
- Most of the passengers get off at the Civic stop.

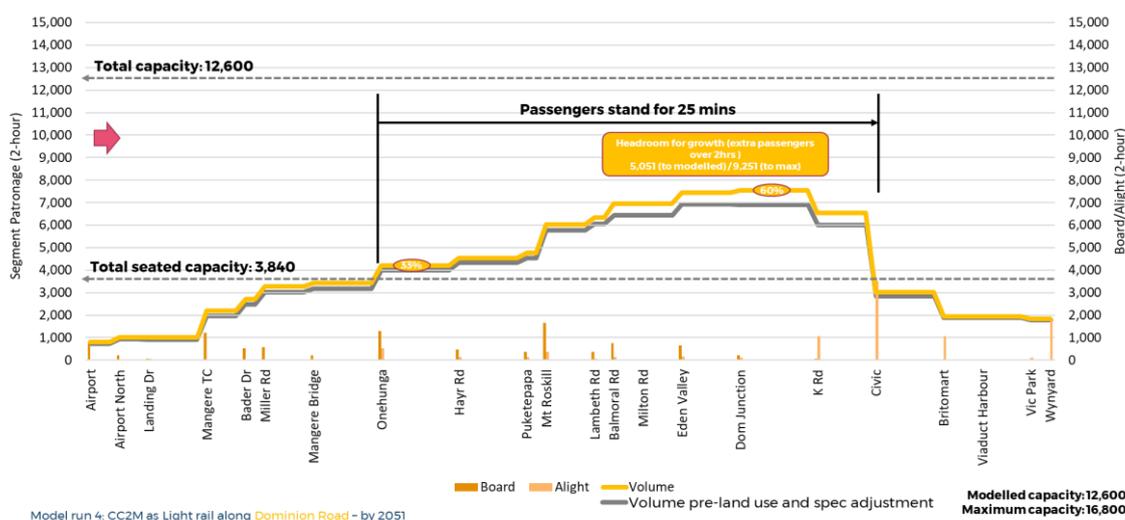


Figure 28: CC2M ridership: LRT Dominion Road

4.2.9.3 Option2A: Sandringham Road LM

- Option 2A's 2051 demand profile is shown below in Figure 29: CC2M ridership: LM Sandringham Road.
- The demand profile shows the option is expected to reach 56% of the modelled capacity at its peak load point (between Dominion Junction and University stops). The ridership at the peak loading point is forecast to be 13,000 over 2hrs. This is 76% higher than the light rail option along Sandringham Road.

- Inbound patronage is forecast to exceed the total seated capacity from the Hayr Road station up to the Aotea Station. The maximum standing time on this system is less when compared to Sandringham Road LRT at approximately 18 minutes (for passengers boarding at Hayr Road and travelling all the way to the central city). The shorter standing time is attributable to the faster journey times associated with light metro.
- The three central city stations (University, Aotea and Wynyard) have all very similar demands.

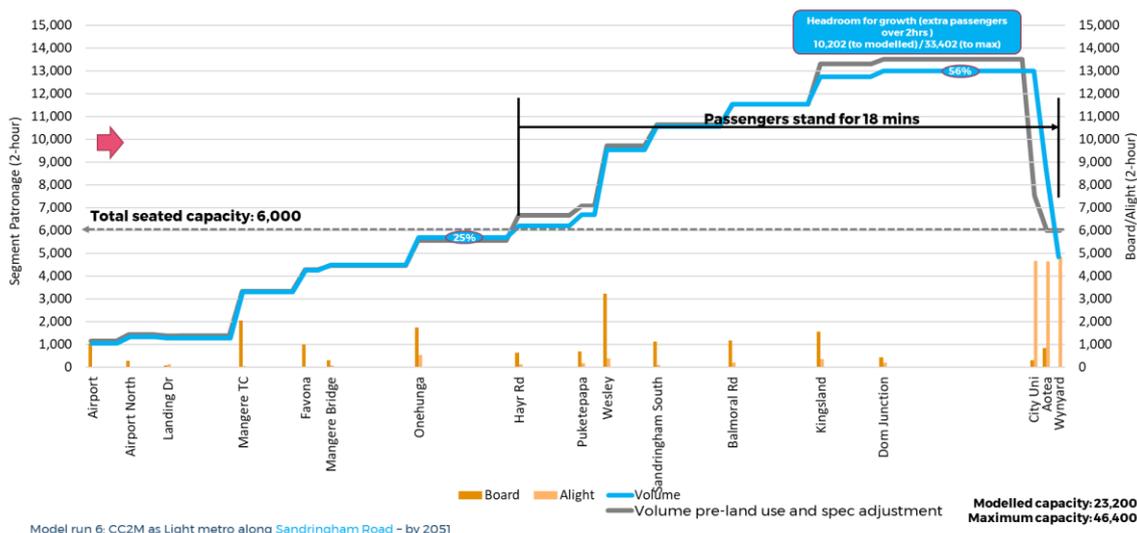


Figure 29: CC2M ridership: LM Sandringham Road

4.2.9.4 Option2B: Dominion Road LM

- Option 2B's 2051 demand profile is shown below in Figure 30: CC2M ridership: LM Dominion Road.

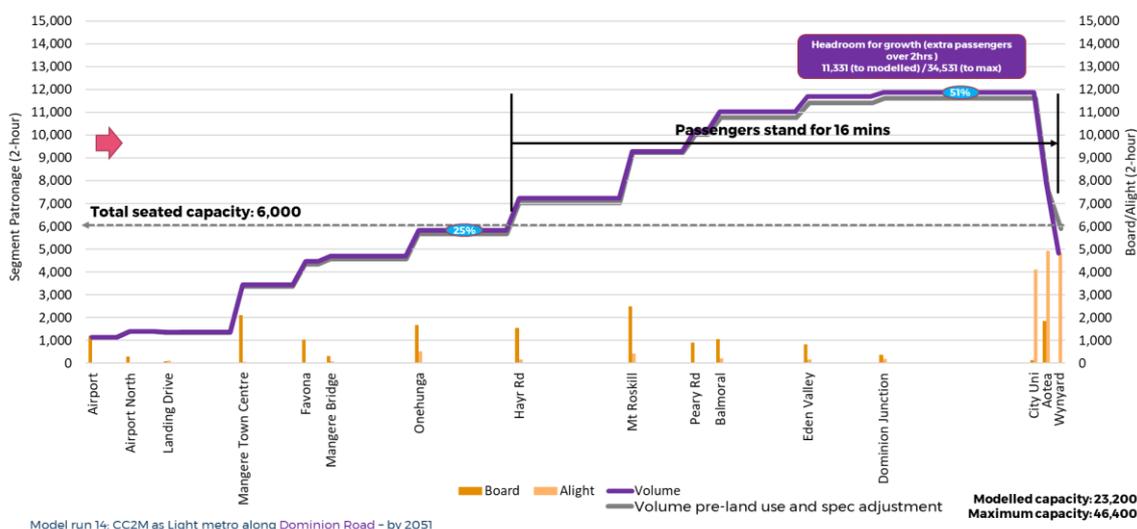


Figure 30: CC2M ridership: LM Dominion Road



- The demand profile shows the option is expected to reach 51% of the modelled capacity at its peak load point (between Dominion Junction and University stops). The ridership at the peak loading point is forecast to be 11,900 over 2hrs. This is 59% higher than the light rail option along Dominion Road.
- Inbound patronage is forecast to exceed the total seated capacity from the Hayr Road station up to the Aotea Station. The maximum standing time on this system is less when compared to Dominion Road LRT at approximately 16 minutes (for passengers boarding at Hayr Road and travelling all the way to the central city). The shorter standing time is attributable to the faster journey times associated with light metro.
- The Aotea and Wynyard stations have very similar alighting forecasts during the morning peak, with the university station approximately 15% lower.

4.2.9.5 Option 3: Sandringham Road Hybrid

- Option 3's 2051 demand profile is shown below in Figure 31: CC2M ridership: Hybrid on Sandringham Rd.

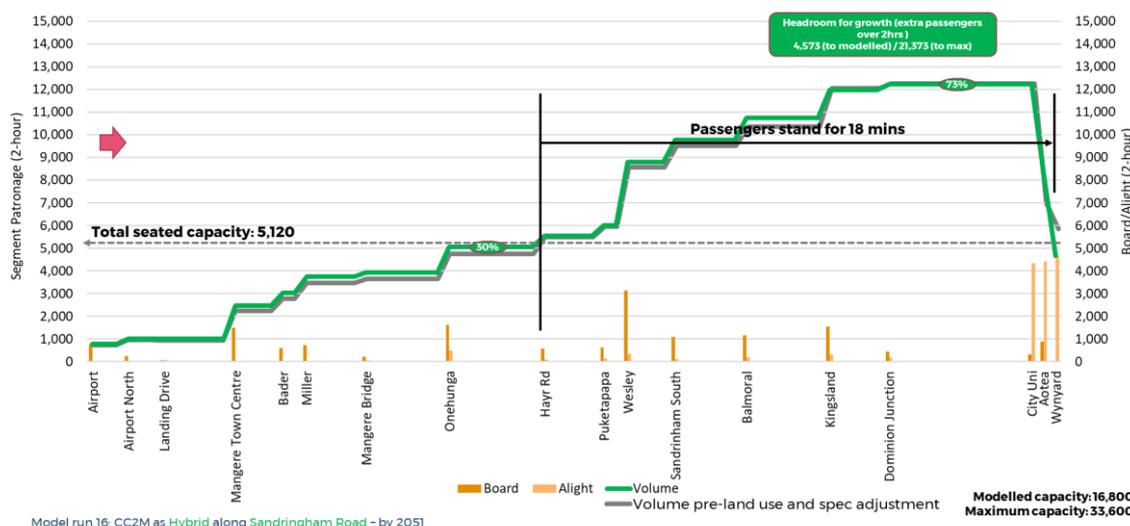


Figure 31: CC2M ridership: Hybrid on Sandringham Rd

- The demand profile shows the option is expected to reach 73% of the modelled capacity at its peak load point (between Dominion Junction and University stops). The ridership at the peak loading point is forecast to be 12,200 over 2hrs. This is 6% lower than the light metro option on Sandringham Road, but still 65% higher than light rail along Sandringham Road.
- Inbound patronage is forecast to exceed the total seated capacity from the Hayr Road station up to the Aotea Station. The maximum standing time on this system is less when compared to Sandringham Road LRT at approximately 18 minutes (for passengers boarding at Hayr Road and travelling all the way to the central city). The shorter standing time is attributable to the faster journey times associated with light metro.
- Wynyard Station in the city centre has the highest number of alightings during the morning 2hr period. The University and Aotea stations have all very similar alightings, approximately 7% lower than Wynyard alightings.

5. Final short list – demand modelling

5.1 Description of options and their land use

5.1.1 Introduction

The 5 shortlisted options were evaluated through an multi criteria assessment process and reduced to three options for further development and analyses.

The three options were

- Option 1B – Light Rail on Dominion Road
- Option 2A – Light metro on Sandringham Road
- Option 3 – Hybrid on Sandringham Road

5.1.2 Higher intensification land use scenario

The three final shortlisted options were further analysed from a development capacity perspective resulting in further adjustments to the land use distribution in 2051 that reflect higher growth within the corridor.

The 2051 population in the CC2M Corridor under the higher intensification scenario was forecast to increase population in the corridor by between 18% and 31% This compares to a population of 5% to 6% under the accessibility-based land use scenario used during the initial short list phase, described earlier in the report. Employment totals were increased (over the do minimum) by between 5% and 6% under the higher intensification scenario, compared to an increase of between 1.2% and 1.7% for the accessibility-based scenario.

The changes are summarised in Table 12: Further adjustments to the 2051 land use forecast below.

Table 12: Further adjustments to the 2051 land use forecast (higher intensification scenario)

	Population in CC2M Corridor by 2051	Increase over Do Minimum in CC2M Corridor	Percentage change in the C2M Corridor
DM 2051	259,688		
Opt 1B 2051	306,227	46,539	17.9%
Opt 2A 2051	341,132	81,444	31.4%
Opt 3 2051	341,132	81,444	31.4%
	Employment in CC2M Corridor by 2051	Increase over Do Minimum in CC2M Corridor	Percentage change in the C2M Corridor
DM 2051	251,144		
Opt 1B 2051	263,144	12,000	4.8%
Opt 2A 2051	267,144	16,000	6.4%
Opt 3 2051	267,144	16,000	6.4%

Growth outside the corridor was forecast to slow down to keep Auckland's 2051 regional forecast constant. Growth in the greenfields areas of Silverdale, Kumeu and Drury were all reduced and re-allocated to the project corridor.

Figure ... provides a visual illustration on how the growth was distributed for each final short-listed option. Population or employment were redistributed from red zones to green zones. Note: the figure only illustrates zones with redistribution of more than 100 people or jobs by 2051.

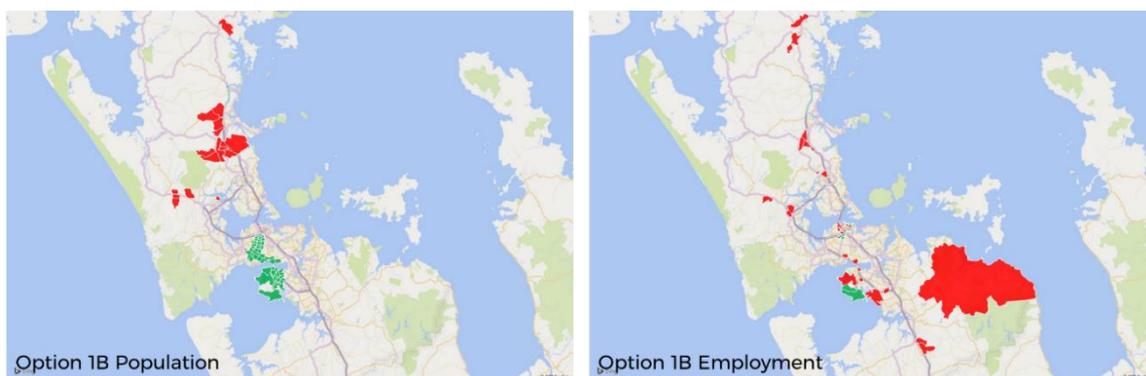


Figure 32: Option 1B population and employment redistribution over Do Min

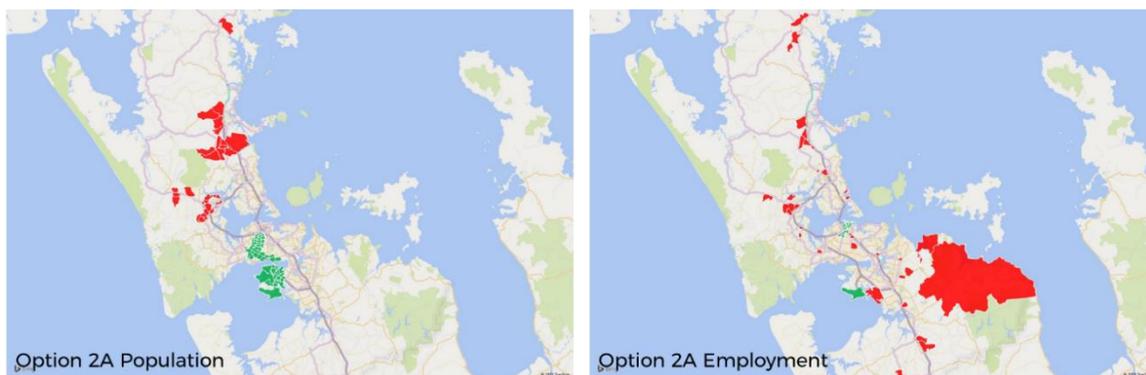


Figure 33: Option 2A population and employment redistribution over Do Min

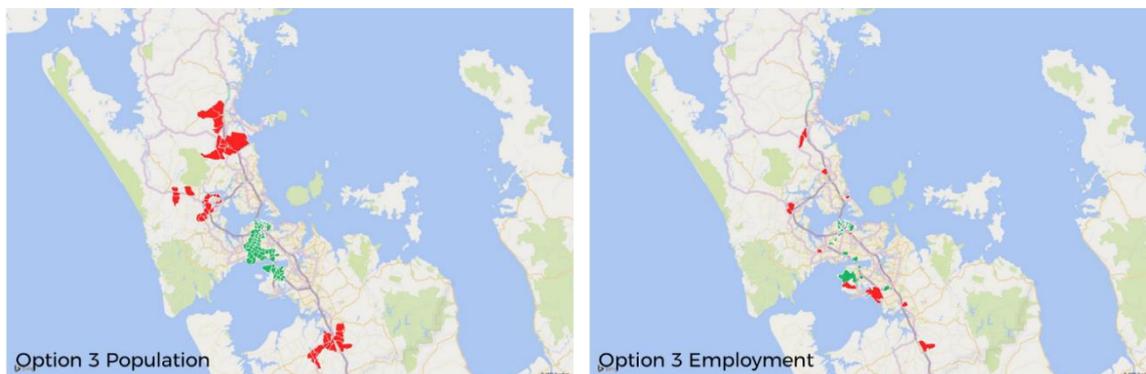


Figure 34: Option 3 population and employment redistribution over Do Min



5.2 Outcomes against KPIs and measures

5.2.1 Comparing the outcomes

The three final shortlisted options were re-modelled in 2051 using MSM with the higher intensification land use scenario discussed above.

A summary version of the results for the 2051 model horizon is shown in Table 13: Key outcomes for the 3 final shortlisted option at 2051 model horizon below, with a full set of results included in Appendix C.

Table 13: Key outcomes for the 3 final shortlisted option at 2051 model horizon

Indicators	2018	2051 DM	1B (light rail)	2A (light metro)	3 (hybrid)
Number of Jobs within 45min by PT from origins in the AM Peak from:					
Mangere Town Centre	79,780	82,065	247,207	452,773	346,183
Onehunga	165,136	194,045	405,544	463,881	437,561
Mt Roskill	208,209	297,096	414,691	423,047	403,296
Number of Households within 45min by PT to destinations in the AM Peak from:					
City Centre	202,704	354,075	378,545	405,418	399,246
Airport	3,840	19,838	97,008	164,245	116,737
Number of Tertiary Education Opportunities within 45min by PT from origins in the AM Peak					
Mangere Town Centre	9,081	4,828	22,541	131,990	114,614
Onehunga	4,323	5,787	112,025	116,251	111,702
Mount Roskill	77,097	111,005	112,027	112,139	112,103
CC2M Travel times to Airport business from:					
Mangere			6.9	4.5	7.0
Onehunga			18.3	12.1	18.4
Mount Roskill			26.6	20.1	29.9
CC2M Travel times to Mid Town from:					
Mangere			36.6	27.3	32.0
Onehunga			25.2	19.7	20.6
Mount Roskill			17.0	11.8	11.8
CC2M Travel times to Universities Station from:					
Mangere				25.0	29.7
Onehunga				17.4	18.3
Mount Roskill				9.5	9.5
CC2M Travel times to Wynyard from:					
Mangere			48.3	29.2	33.9
Onehunga			36.9	21.6	22.5
Mount Roskill			28.7	13.7	13.7
CC2M Boardings					
AM Peak			16,505	28,822	26,411
Daily			72,605	125,252	111,724
Annual			20,256,851	34,945,169	31,170,996
PT Mode share					
CC2M corridor	12%	21%	26%	26%	26%

Indicators	2018	2051 DM	1B (light rail)	2A (light metro)	3 (hybrid)
Percentage of Corridor Separated from General Traffic and Pedestrianised Areas			42%	100%	82%
CC2M Spare Capacity at Peak Load Point (maximum capacity - Peak Load Demand)					
Modelled Maximum Capacity of CC2M (pax/hour/direction)			6,300	11,600	8,400
Maximum Potential Capacity (pphpd)			8,400	23,200	12,600
CC2M Demand at Peak Load Point (pax/hour/direction)			5,036	9,345	8,193
% Utilisation (modelled capacity)			80%	81%	98%
Available capacity - modelled (pax/hour/direction)			1,264	2,255	207
Available Capacity Maximum (pphpd)			3,364	13,855	4,407

5.2.2 Travel time comparison

5.2.2.1 Short list options compared to car alternative

The travel time comparisons of public transport and private vehicles at the 2051 model horizon show that:

- For Mangere all 3 options will result in public transport options being competitive to the central city (midtown zone) when compared to private cars (refer to Figure 35: Travel times from zone 472 to zone 248 below);

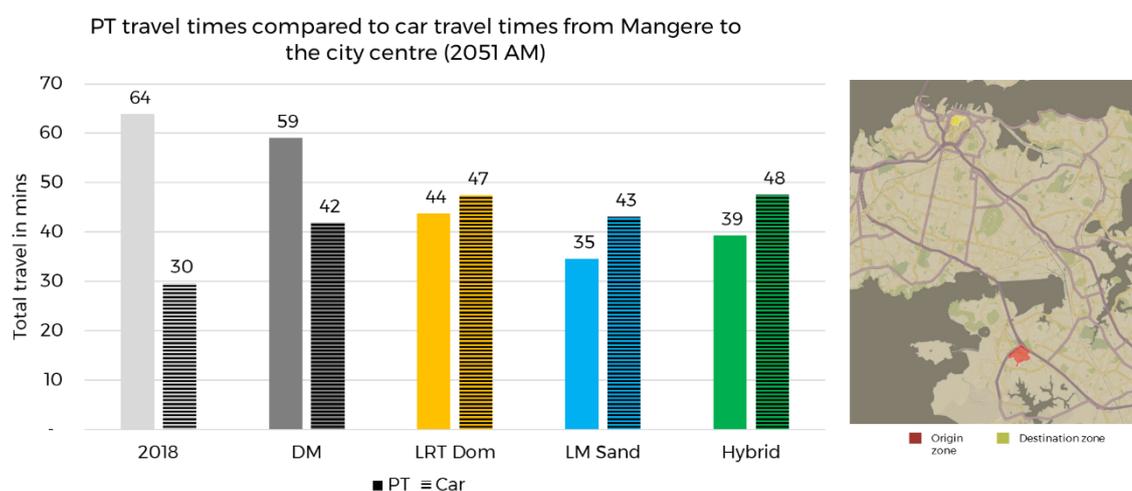


Figure 35: Travel times from zone 472 to zone 248

- For Onehunga all 3 options will result in public transport options being competitive to the central city (midtown zone) when compared to private cars (refer to Figure 36: Travel times from zone 347 to zone 248 Figure 13: Travel times from zone 347 to zone 248) below;

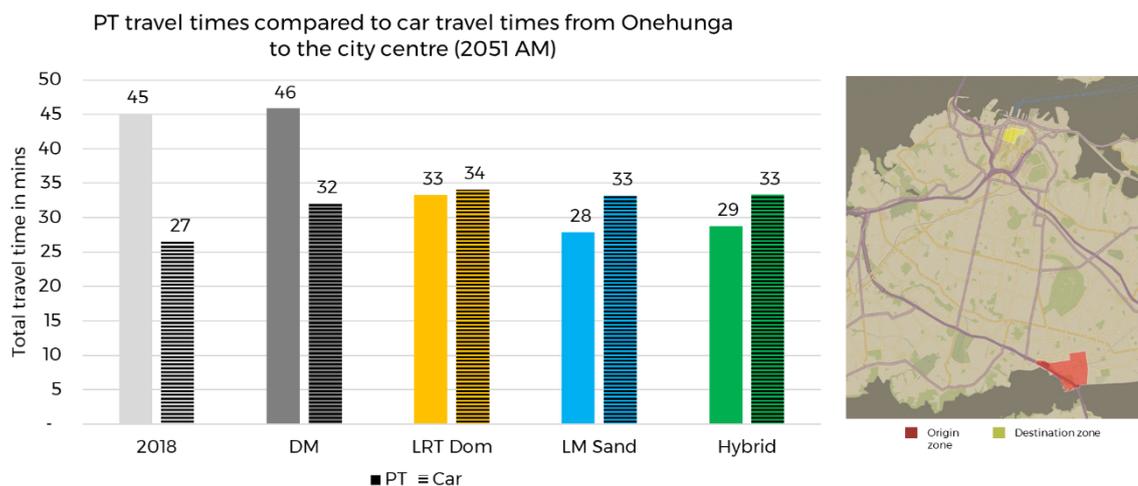


Figure 36: Travel times from zone 347 to zone 248

- For Mt Roskill (zone 327) private cars will still be more competitive from a vehicle travel time perspective for options along Sandringham Road. Refer to Figure 37: Travel times from zone 327 to zone 248

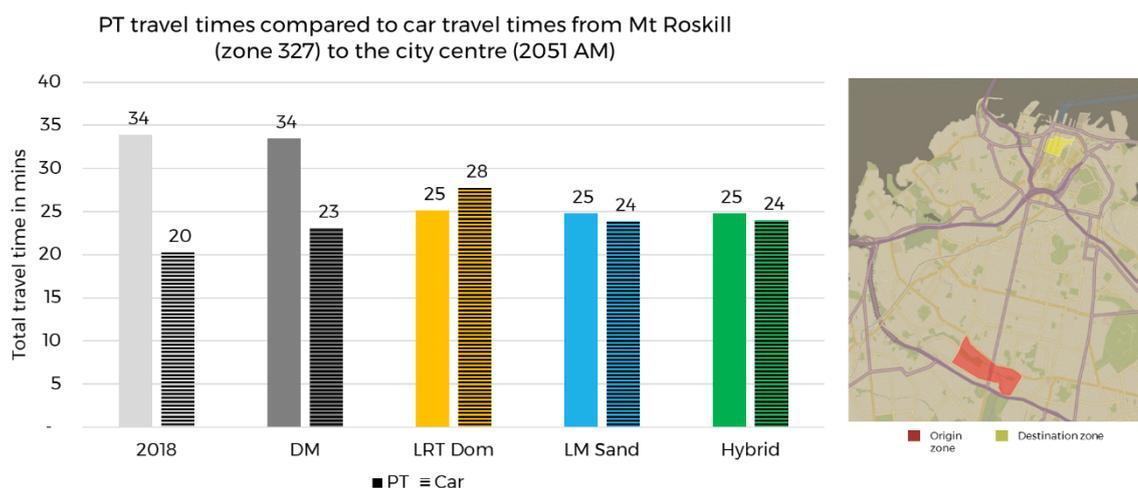


Figure 37: Travel times from zone 327 to zone 248

- A large part of the Kainga Ora development is located to the west of the Mt Roskill zone adopted for the analyses, zone 327. Further travel time comparisons were therefore made from this zone (zone 320) to the central city.
- This show that the two options along Sandringham Road will result in public transport being competitive to private cars from the development area within zone

320. The Dominion Road LRT option will not impact this area significantly, and hence no significant improvement over the do minimum is forecast.

- Refer to Figure 38: Travel times from zone 320 to zone 248

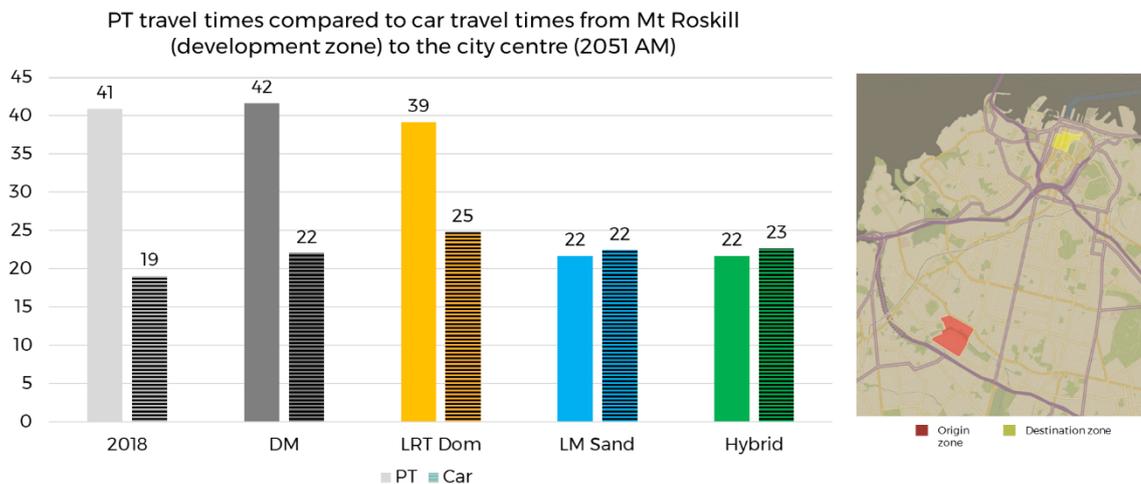


Figure 38: Travel times from zone 320 to zone 248

5.2.2.2 Short list options compared to each other

Time – distance analysis in of the options in Figure 39 below illustrates that (for services that hypothetically start at the same time from the airport):

- light metro services will arrive at the Aotea Station, while the hybrid will be approaching Kingsland station, and the light rail services will still be at Balmoral Road stop;
- light metro services will arrive at the Wynyard Station, while the hybrid will be at Dominion Junction station and the light rail services will still not have entered the city centre and be at Milton Road stop. (See Attachment X for enlarged version).

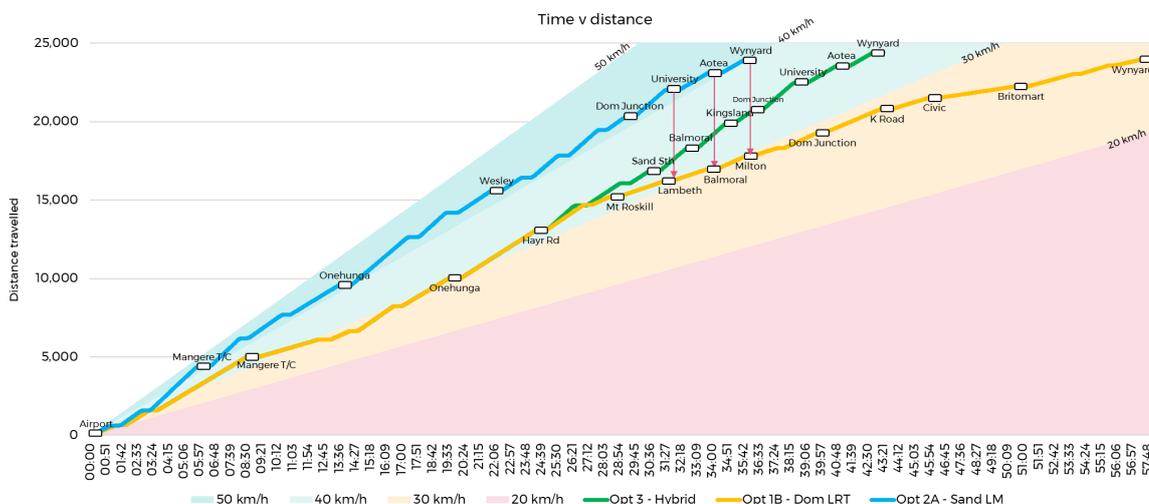


Figure 39: Time vs distance comparison for 3 short list options

5.2.3 Number of households within 45 minutes from city centre and airport

5.2.3.1 Changes in accessibility to the central city

MSM analyses of the number of households that can access the midtown central city (represented by zone 248) within 45 minutes using public transport show that:

- Light metro increases the number of households that can access the central city in 45 minutes by 2051 by 15% compared to the Do Minimum;
- The hybrid option increases the number of households within the catchment by 13% and the light rail option increases it by 7%.

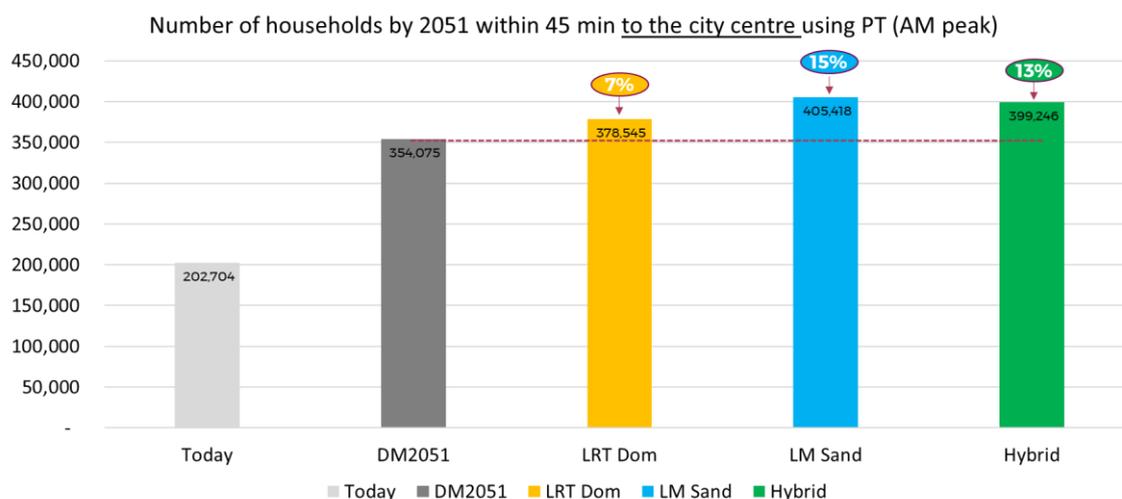


Figure 40: Households within 45 mins of central city (zone 248)

- The options largely enhance the 45-minute catchment in various degrees to include the areas of Mt Roskill south of SH20 as well as more of Onehunga and Mangere. Figure 41 below shows the geographical extend of a 45-minute catchment to midtown associated with each option.

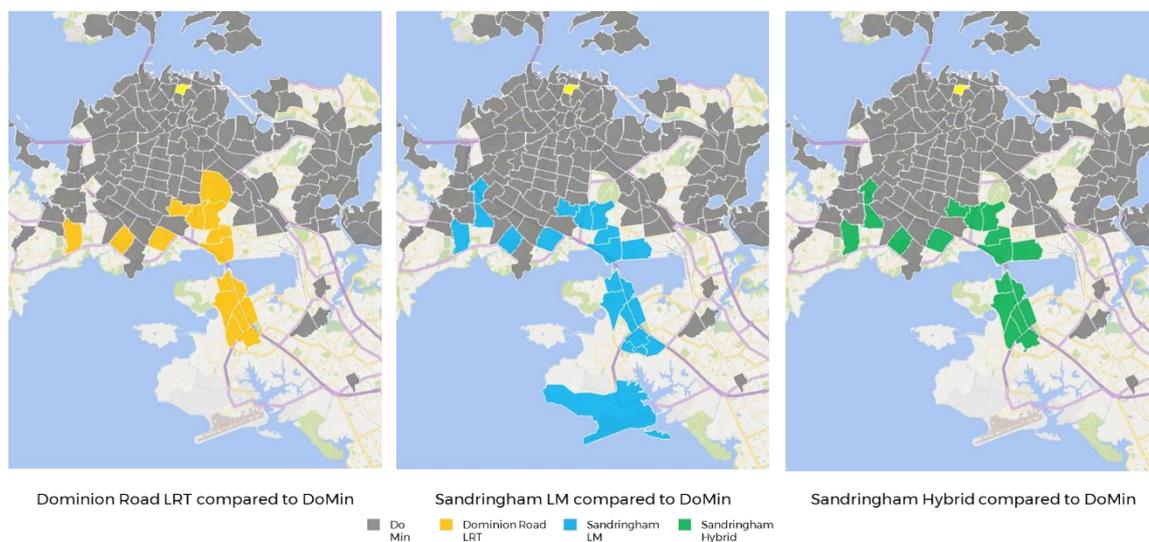


Figure 41: Zones that reach city centre (midtown zone 248) within 45 min on PT - 2051 AM

- The initial short list analyses showed Wynyard to be a key destination for trips from the CC2M corridor. The geographical analyses of the change in 45-minute catchment to Wynyard shows clear differences for the light metro and hybrid over the light rail option, with the latter having limited reach into Mangere. Refer to Figure 42 below.

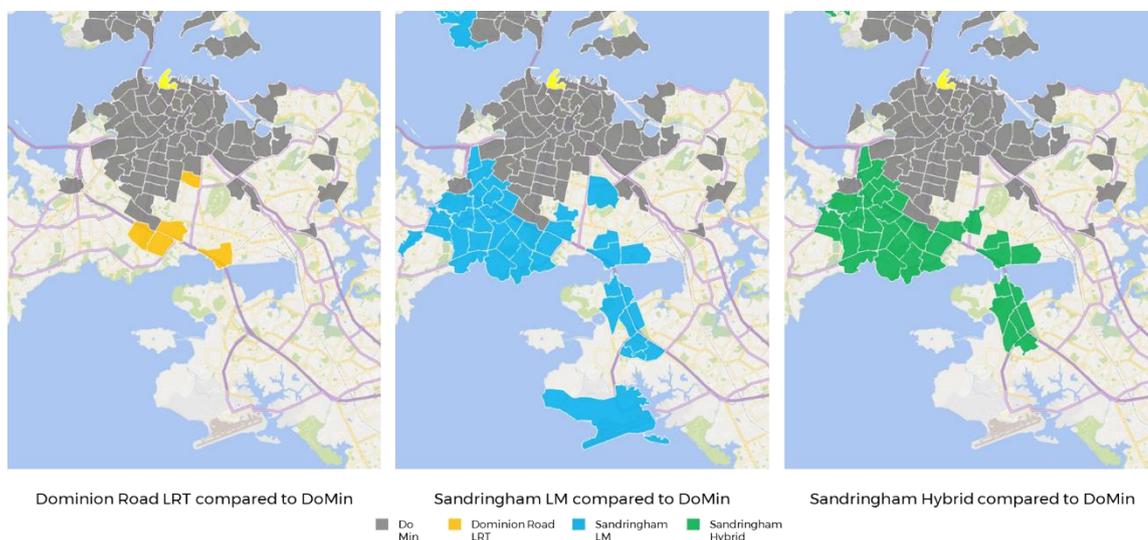


Figure 42: Zones that reach city centre (Wynyard zone 243) within 45 mins on PT - 2051 AM

- The city universities are also an important destination from all areas within the corridor. The geographical analysis of the change in 45-minute catchment to the university zone shows the catchment expands further into Mangere for the faster options (light metro and hybrid) when compared to light rail.

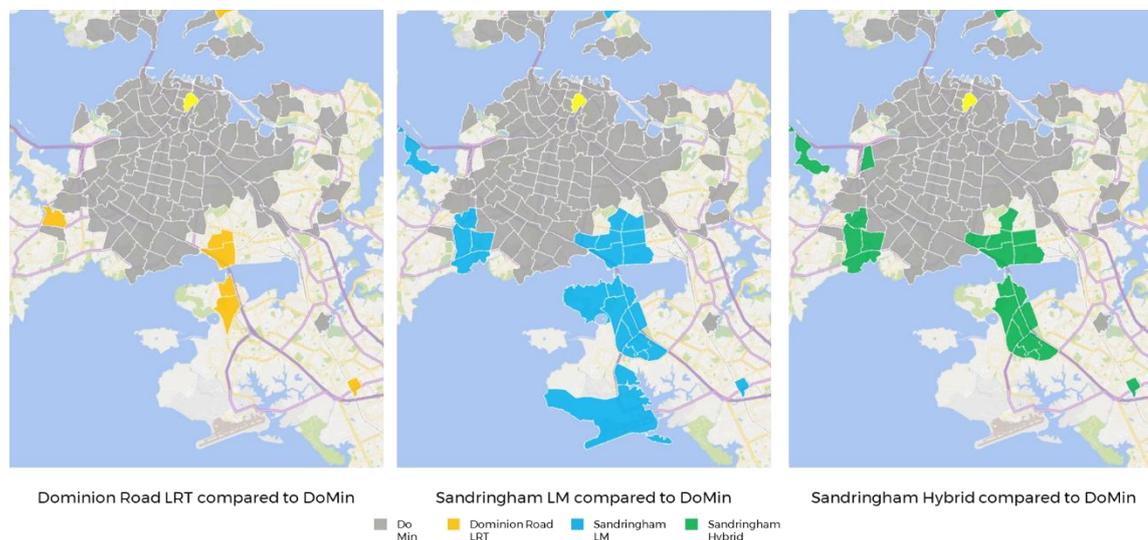


Figure 43: Zones that reach city centre (university zone 249) within 45 mins on PT - 2051 AM

5.2.3.2 Changes in accessibility to the airport

The three options have a significant impact on the airport employment zone. MSM analyses shows that of the number of households that can access the airport employment area (represented by zone 478) within 45 minutes using public transport show that:

- Light metro increases the number of households that can access airport employment in 45 minutes by 2051 between 728% when compared to the Do Minimum; the hybrid option increases the number of households by 488% and light rail increases it by 389%. Refer to Figure 44: Households within 45 mins of airport employment (zone 478) below.

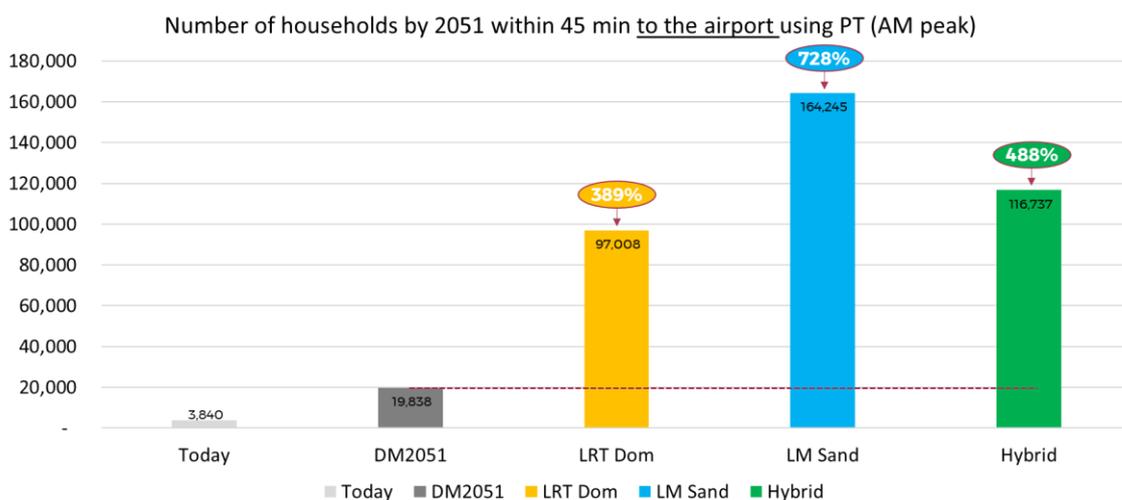


Figure 44: Households within 45 mins of airport employment (zone 478)

- All options extend the 45 minute PT catchment into the isthmus when compared to the do minimum. The light metro option extends the 45 minute catchment as far north as the centre city, with hybrid and light rail options extending the catchment to the Dominion Junction area. Refer to Figure 45 below.

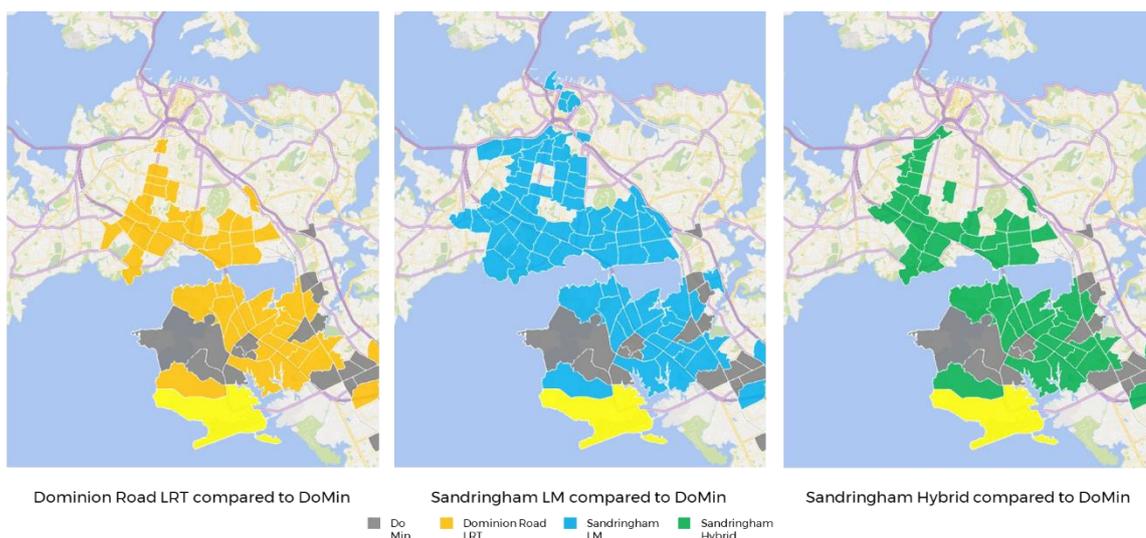


Figure 45: Zones that reach the airport (zone 478) within 45 mins on PT - 2051 AM

5.2.4 Number of jobs from key areas

MSM analyses on the number of opportunities (jobs) available to residents from key areas of interest within 45 minutes using public transport show the following for each area.

5.2.4.1 Opportunities accessible to Mangere residents

- For Mangere (represented by zone 472) all three options improve the number of jobs residents can access within 45 mins, with light metro providing the highest improvement – a 452% increase.

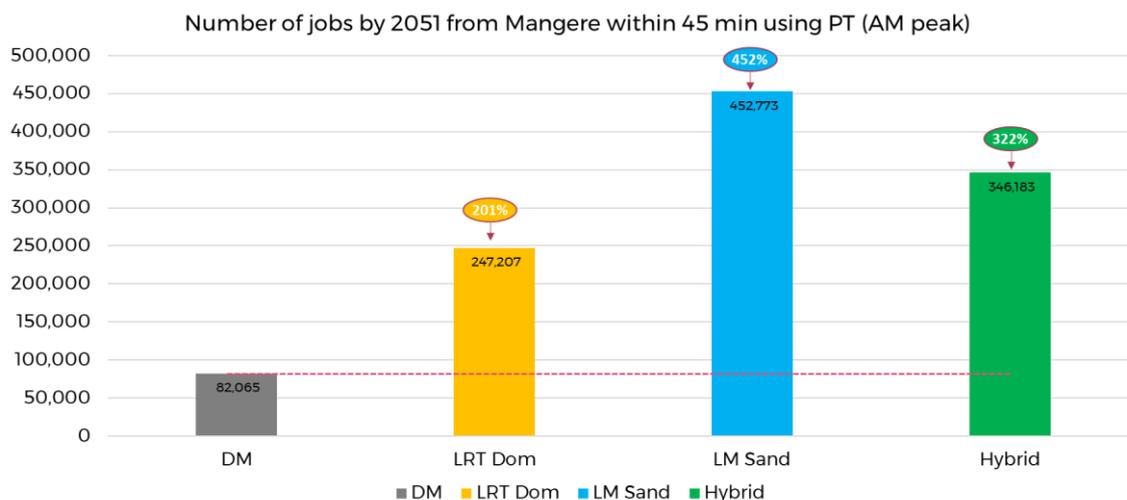


Figure 46: Improvement in job accessibility from Mangere (zone 472)

- The spatial expansion of the 45-minute catchment for each option is shown in Figure 47 below.
- It shows both light metro and hybrid options include significant parts of the central city within its 45-minute catchment area.

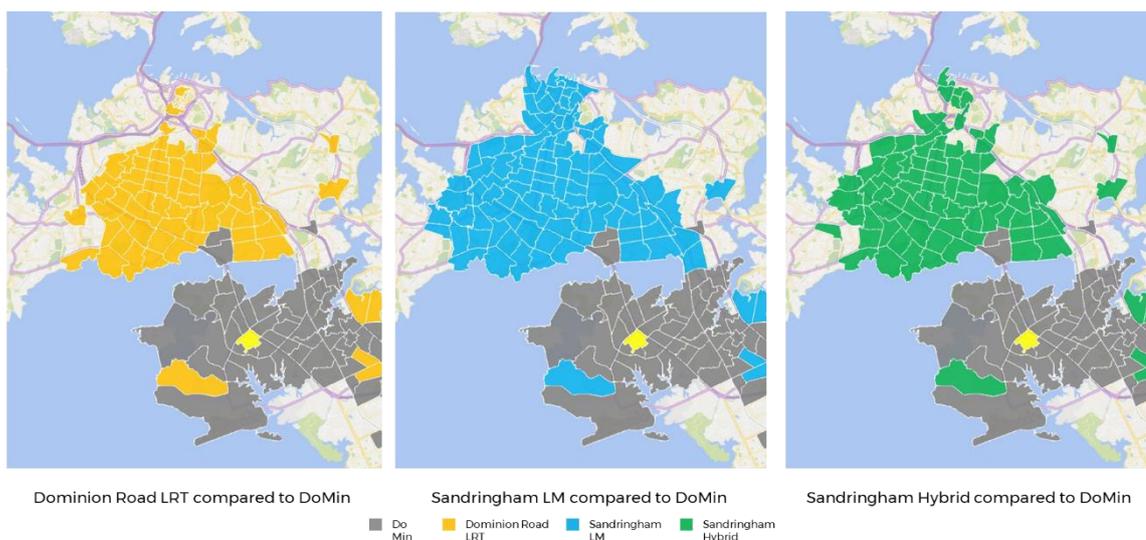


Figure 47: Zones within 45 min PT trip from Mangere Town Centre (zone 472) - 2051 AM

- Further analyses were done to test the sensitivity of the 45-minute catchment on accessibility to employment opportunities to Mangere residents. The analyses show that light metro will provide more job opportunities than light rail within a range of catchment isochrones, from 30 minutes to 60 minutes. The largest differences occur within the 38 – 48 minute range.
- The hybrid option will achieve accessibility parity with light metro for accessibility analyses of more than 55 minutes.

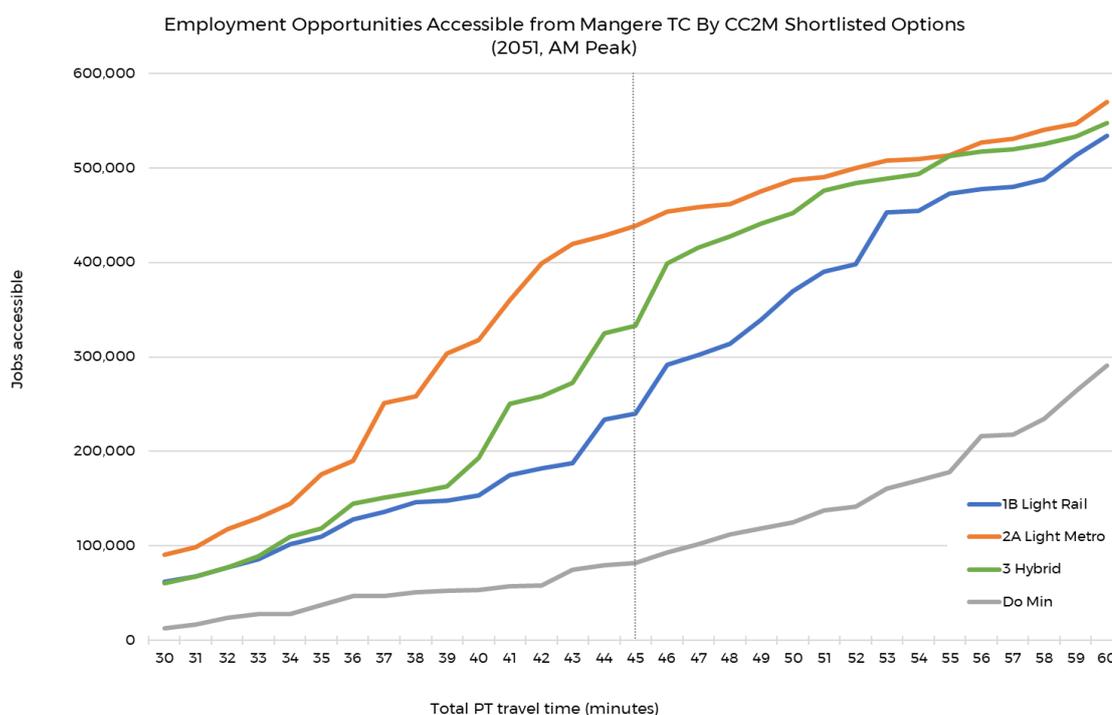


Figure 48: Sensitivity analysis of employment accessibility from Mangere for various travel time isochrones

- Origin-destination analyses for trips on the CC2M line during the AM peak show a significant number of people use the CC2M system to go to the City Centre, including Wynyard for work and Education purposes from Mangere, Favona and Mangere Bridge. Refer to Figure 49. More detailed breakdown is provided in Appendix E.
- Education related trips are an important component for Mangere trips to the central city, with light rail using the Civic stop as the main alighting station. Light metro and the hybrid have a more direct connection to the education precinct through the university station.
- Midtown, Wynyard and the airport are the top three alighting destinations for work related trips.

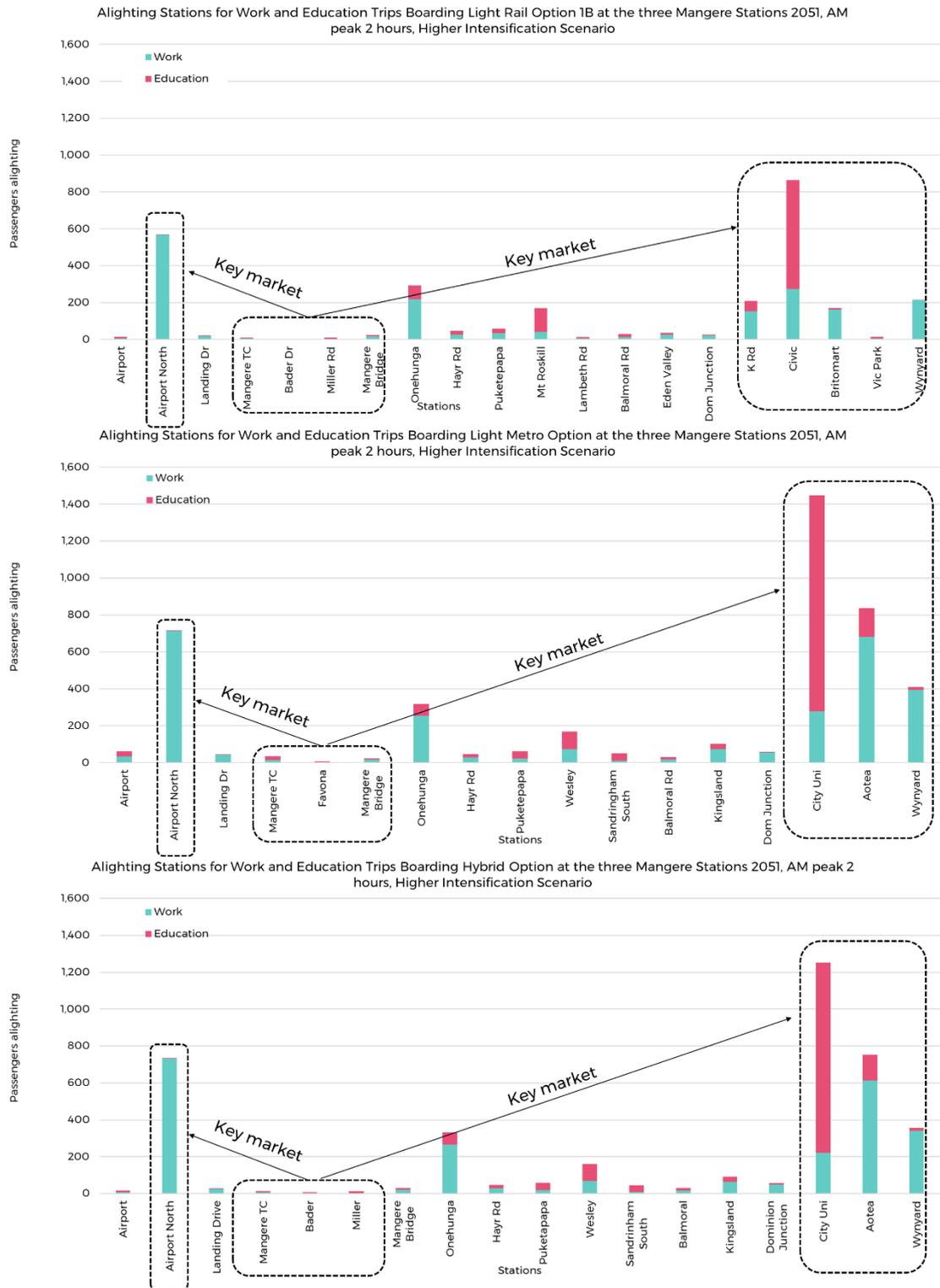


Figure 49: Destination stations for Mangere residents

5.2.4.2 Opportunities accessible to Onehunga residents

- For Onehunga (represented by zone 347) all options improve the number of jobs residents can access within 45 mins.

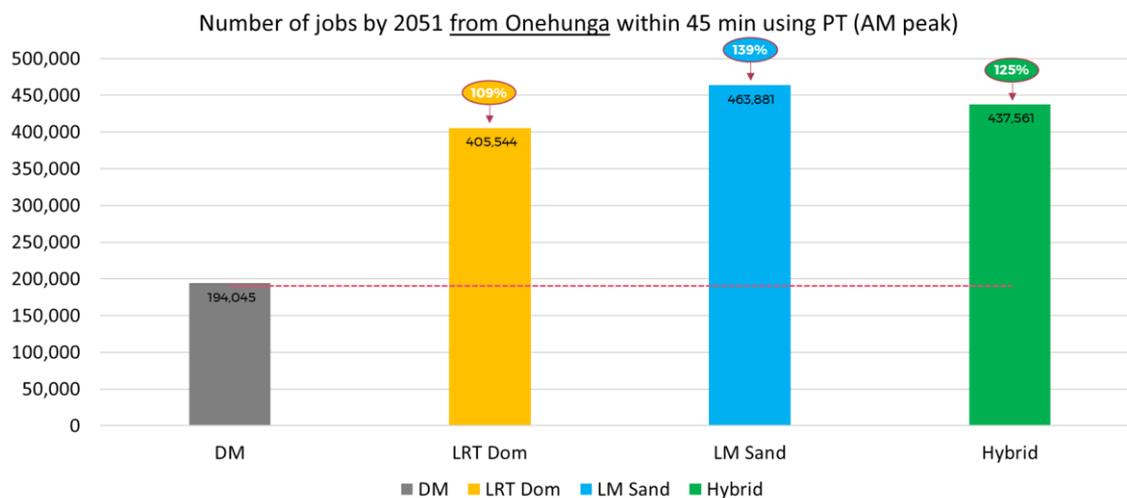


Figure 50: Improvement in job accessibility from Onehunga (zone 347)

- The light metro option increases accessibility by 139% over the do minimum, the hybrid option increases it by 125% and the light rail by 109%.
- The spatial analysis below (Figure 51) shows very similar coverage provided by each option within a 45 minute catchment of the two key employment areas, the central city and the airport employment zone.

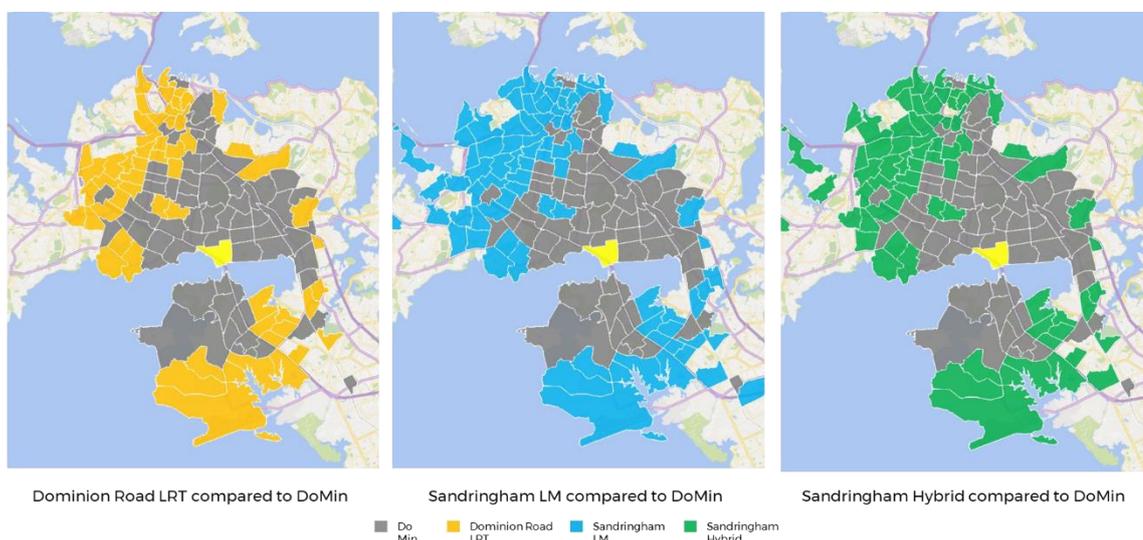


Figure 51: Zones within 45 min PT trip from Onehunga (zone 347) - 2051 AM

- The travel time sensitivity analyses (Figure 52) on accessibility to employment opportunities show the difference between the options are not sensitive to the value of the travel time isochrone.
- Light metro will provide more job opportunities than hybrid and light rail within a range of catchment isochrones.

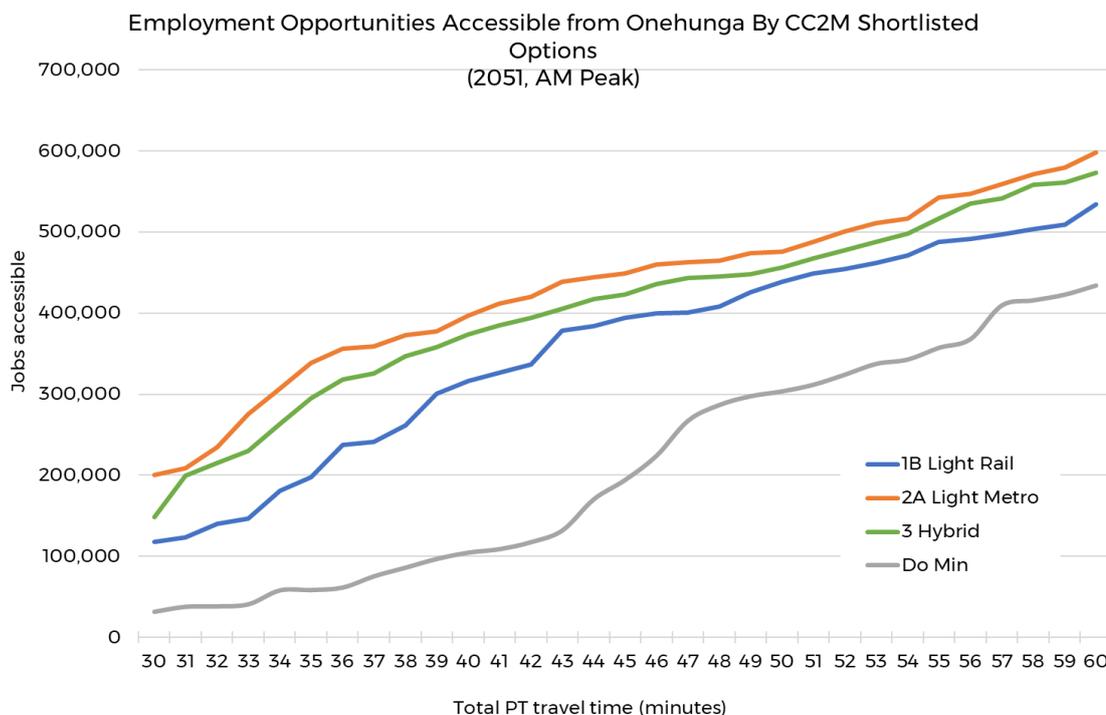


Figure 52: Sensitivity analysis of employment accessibility from Onehunga for various travel time isochrones

- Origin-destination analyses for trips on the CC2M line during the AM peak show Onehunga residents (people boarding the CC2M system at the Onehunga station) predominately use the CC2M to access work and education opportunities in the city centre and the airport. Refer to Figure 53. A more detailed breakdown is provided in Appendix E.
- Education related trips are an important component for Onehunga trips to the central city, with light rail using the Civic stop as the main alighting station. Light metro and the hybrid have a more direct connection to the education precinct through the university station.
- Midtown, Wynyard and the airport are the top three alighting destinations for work related trips.

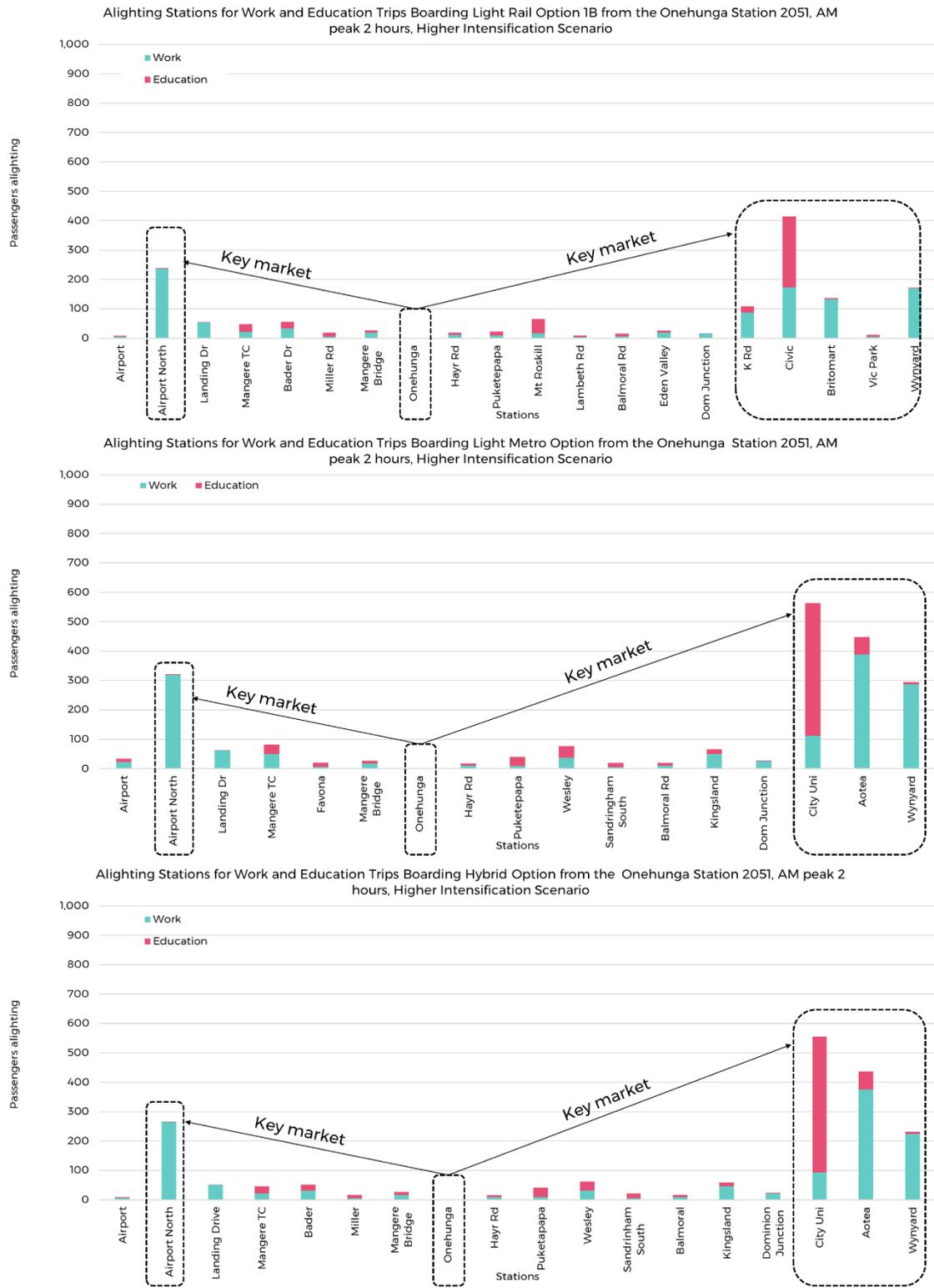


Figure 53: Destination stations for Onehunga residents

5.2.4.3 Opportunities accessible to Mt Roskill residents

- Mt Roskill (represented by zone 327) receive a similar magnitude of improvement in accessibility from the all 3 short list option options, with the lowest uplift (36%) provided by the hybrid option. Light metro provided the highest improvement at 42%. Refer to Figure 54 below.

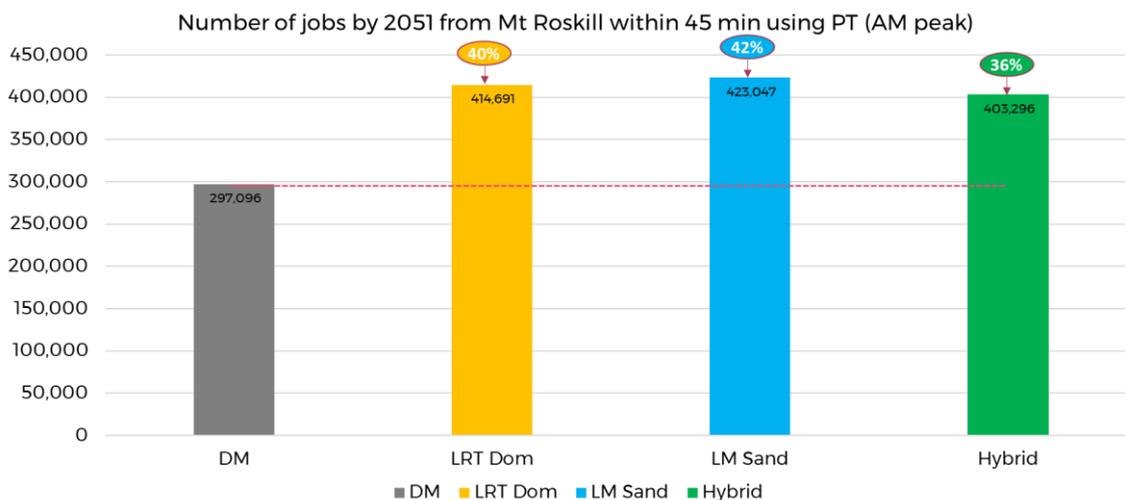


Figure 54: Improvement in job accessibility from Mt Roskill (zone 327)

- The spatial analysis below (Figure 55) shows the do minimum already provide coverage of large parts of the central city within 45-minute isochrone. The options impact accessibility more significantly towards the airport over the do minimum.

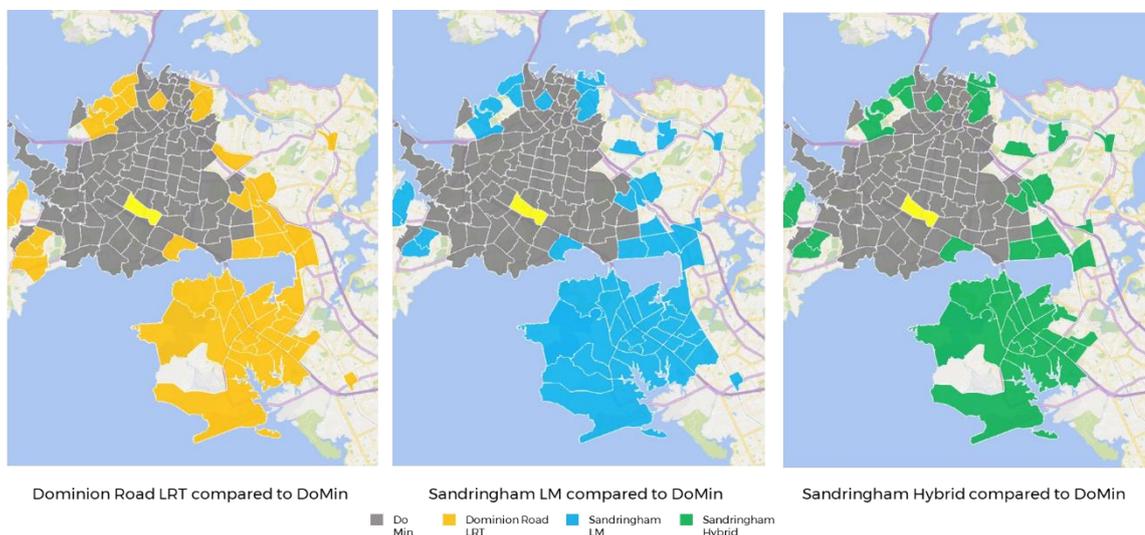


Figure 55: Zones within 45 min PT trip from Mt Roskill development area (zone 327) - 2051 AM

- The travel time sensitivity analyses (Figure 56) on accessibility to employment opportunities show the difference between the options are not sensitive to the value of the travel time isochrone.
- It also shows very little difference in accessibility when comparing the options with each other, with all providing an incremental improvement over the do minimum.

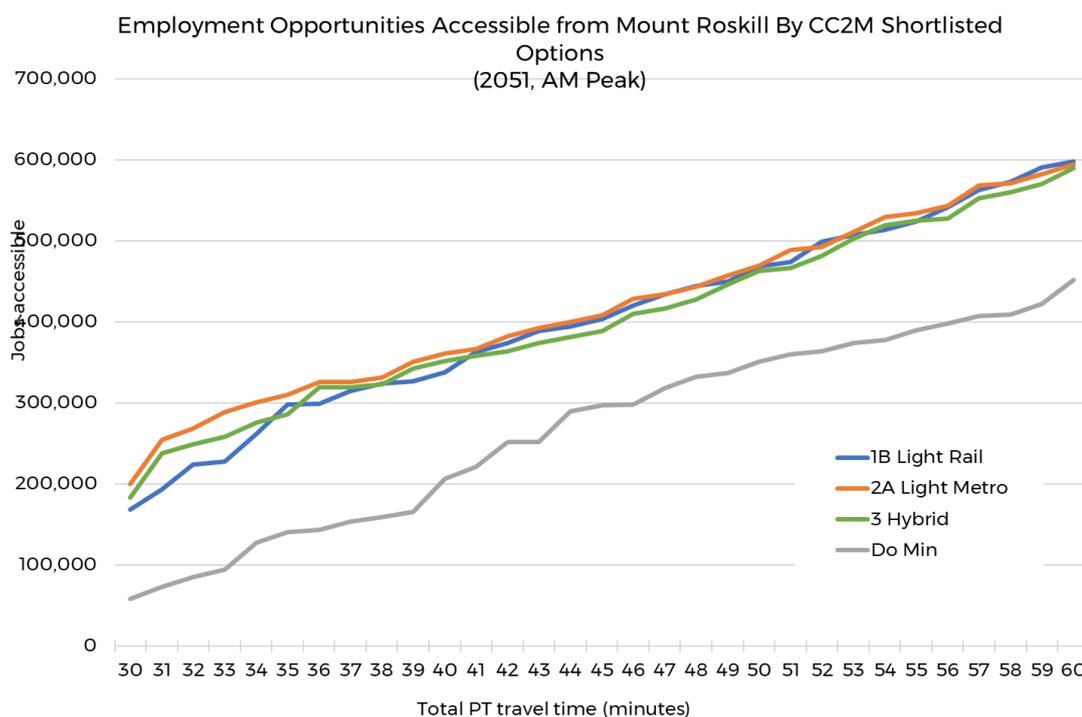


Figure 56: Sensitivity analysis of employment accessibility from Mt Roskill for various travel time isochrones

- Origin-destination analyses for trips on the CC2M line during the AM peak show Mt Roskill residents (people boarding the CC2M system in the Mt Roskill area) predominately use the CC2M to access work and education opportunities in the city centre. The airport is of lesser relative importance for this area compared to Onehunga and Mangere boardings. It is still the largest destination station outside the city centre. Refer to Figure 57. Refer to Appendix E. for more detailed breakdown.
- Education related trips are an important component for Mt Roskill trips to the central city, with light rail used to a lesser extent compared to light metro and the hybrid. Light metro and the hybrid have a more direct connection to the education precinct through the university station.
- Midtown and Wynyard are large alighting destinations for work related trips.

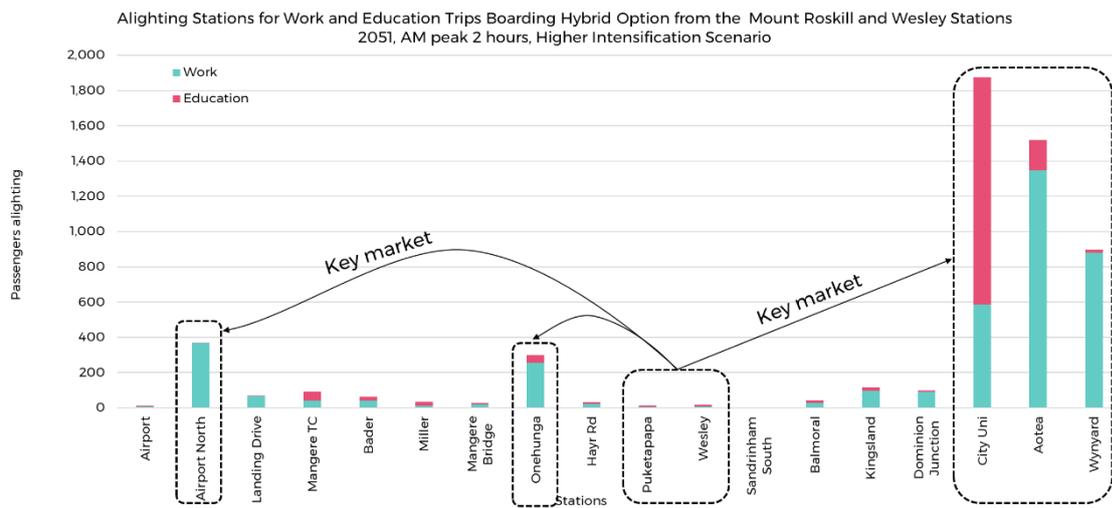
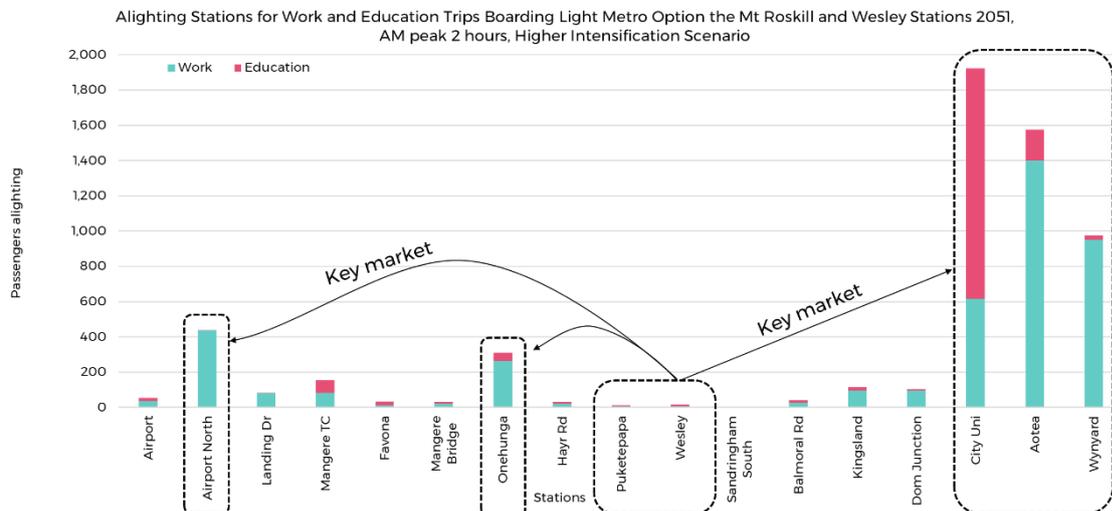
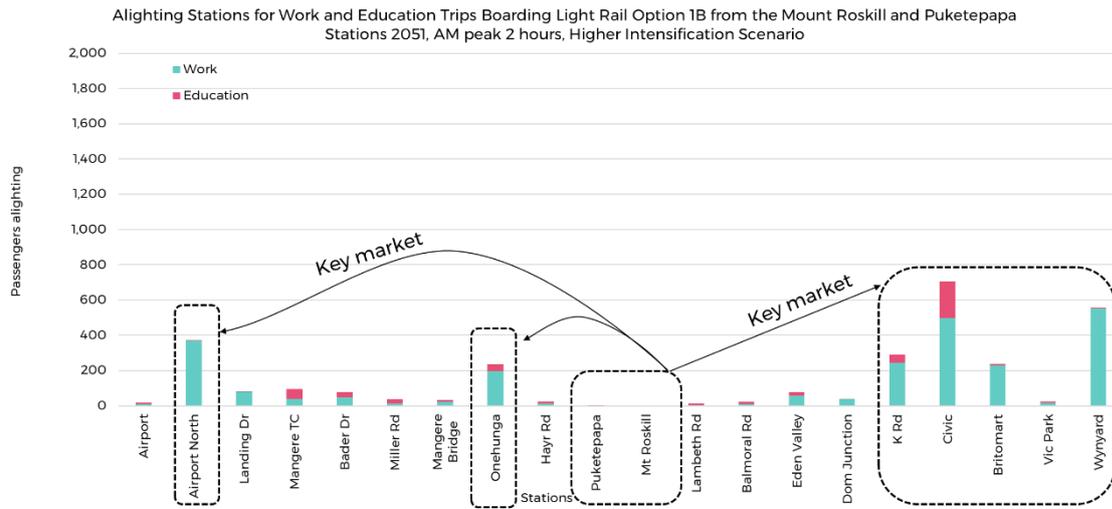


Figure 57: Destination stations for Mt Roskill residents

5.2.5 Number of tertiary education opportunities from key areas

The MSM analyses on the number of opportunities (tertiary education) available to residents from key areas of interest within 45 minutes using public transport are shown in Figure 58 below:

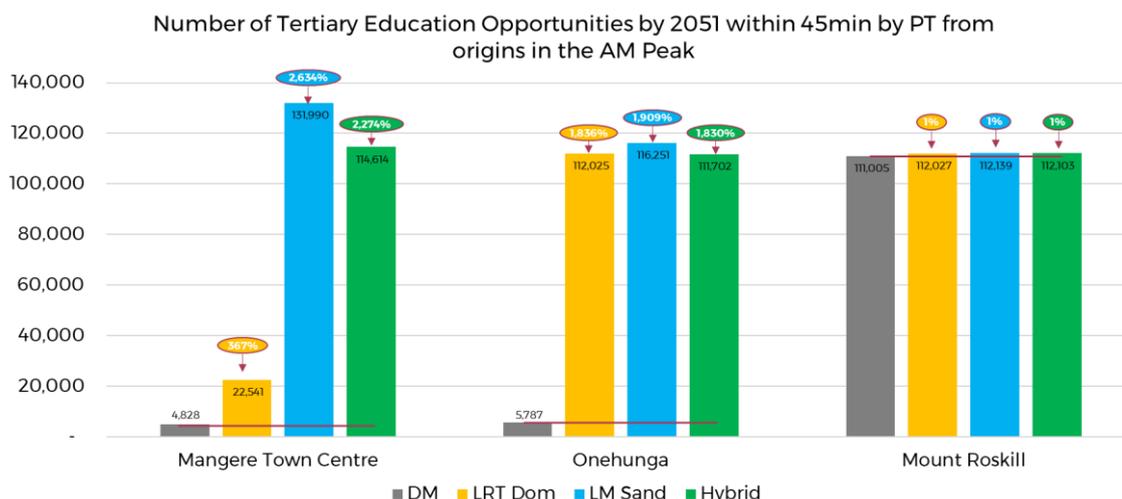


Figure 58: Improvements in tertiary education from all areas

- Mangere residents (represented by zone 472) will receive significantly more benefit under the light metro and hybrid options when compared to light rail. All options provide significant improvement over the do minimum.
- Onehunga residents receive a similar magnitude of benefit from all options, with light metro providing slightly more benefit than the other options. All options provide significant improvement over the do minimum.
- Mt Roskill residents will not receive any significant benefit over the do minimum under all options.



5.2.6 Light rail/light metro demands

The three short listed options are all forecast to increase annual ridership on the entire public transport network by between 5% and 8%. Refer to Figure 59 below.

The light rail option will represent 8% (20.3M) of all boarding on the public transport network by 2051; light metro 14% (35.0M) and the hybrid option 13% (31.2M).

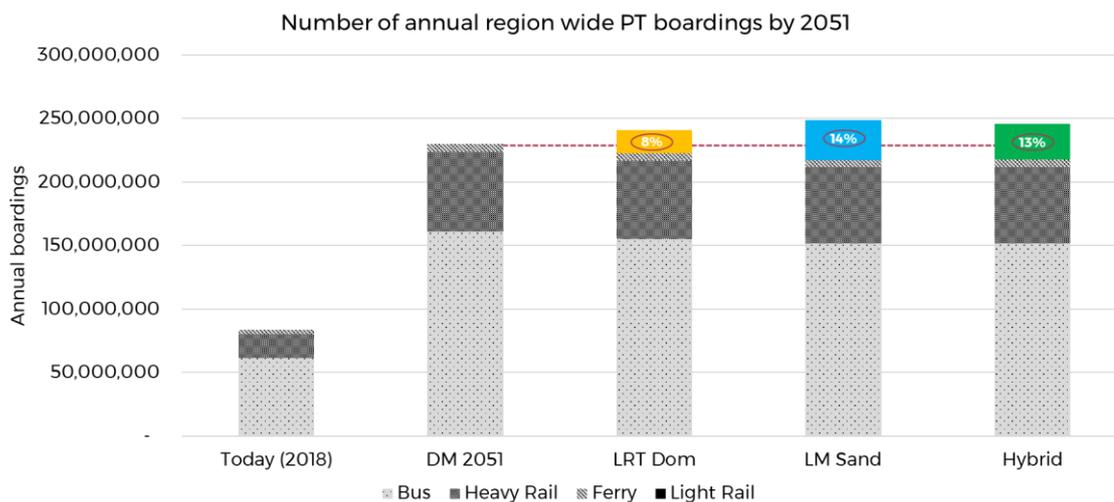


Figure 59: Annual boardings – Region wide PT network by 2051

Light metro and the hybrid option will also represent almost a quarter of all boardings on the rapid transit network included within the MSM for the 2051 model horizon.

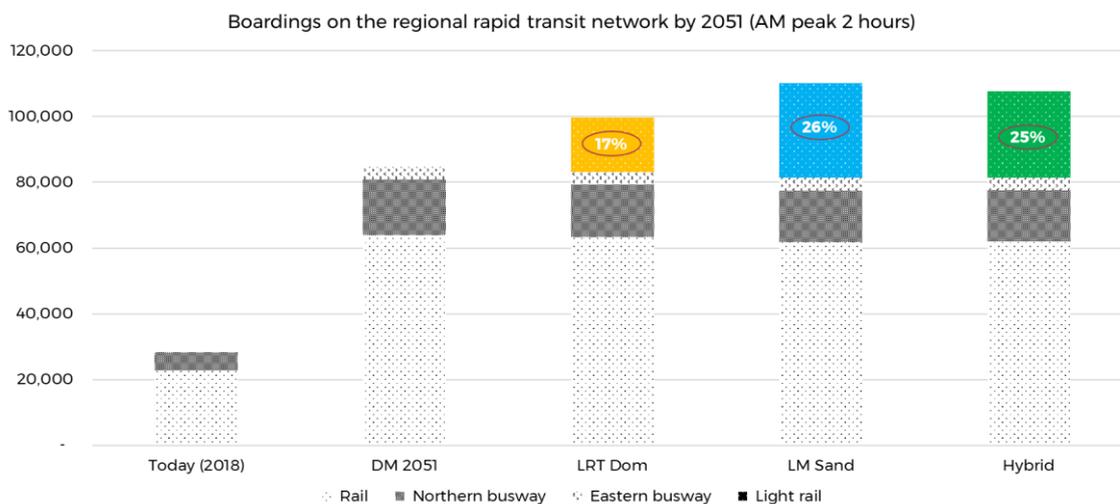


Figure 60: AM peak period (2hr) boardings on the regional rapid transit network - 2051

The regional rapid transit network consists of:

- the heavy rail network, inclusive of CRL and Papakura to Drury electrification,
- the northern busway including its expansion to Albany; and
- the eastern busway between Panmure and Botany.



A summary of the annual, daily and peak period boardings are provided in the table below.

The data shows light metro will generate 72% more demand, based on annual boardings by 2051, when compared to light rail. The hybrid will attract 10% less than the light metro option.

Table 14: CC2M boardings by 2051

Option	2051 Boardings by option		
	AM 2hr peak	Daily	Annual
Opt 1B 2051	16,505	72,605	20,256,851
Opt 2A 2051	28,822	125,252	34,945,169
Opt 3 2051	26,411	111,724	31,170,966

5.2.7 Boarding and alighting at each station

Boarding and alightings for the final short listed options are reported on the peak 1 hour, by applying the peak hour factors listed in Table 2: PT boardings phf.

Total boarding and alighting during the 1-hour morning peak vary along the route, with Mangere, Onehunga and Mt Roskill stations attracting the highest boardings during the morning peak. The highest alighting stops are serving employment areas in the central city and the airport. Specific observations for each option are reported below:

5.2.7.1 Option 1B: Dominion Road LRT

- Boarding and alighting distribution for the morning 1hr peak along the Dominion Road Light rail option is shown in Figure 61: Station use: Final short list - Dominion Road LRT.
- A total of approximately 10,100 boardings are forecast during the busiest 1hr period
- It shows the Mt Roskill stop as the busiest with approximately 1,500 boardings over that period. This is also a significant transfer stop, with approximately 43% of all boardings coming from transfers.
- The Civic stop is the busiest destination in the morning peak, with approximately 2,300 alightings over the 1hr period. Wynyard and the Airport North stops are the second busiest with approximately 1,300 alightings.
- The six city centre stops combined are forecast to have approximately 5,200 alightings over the 1hr period.

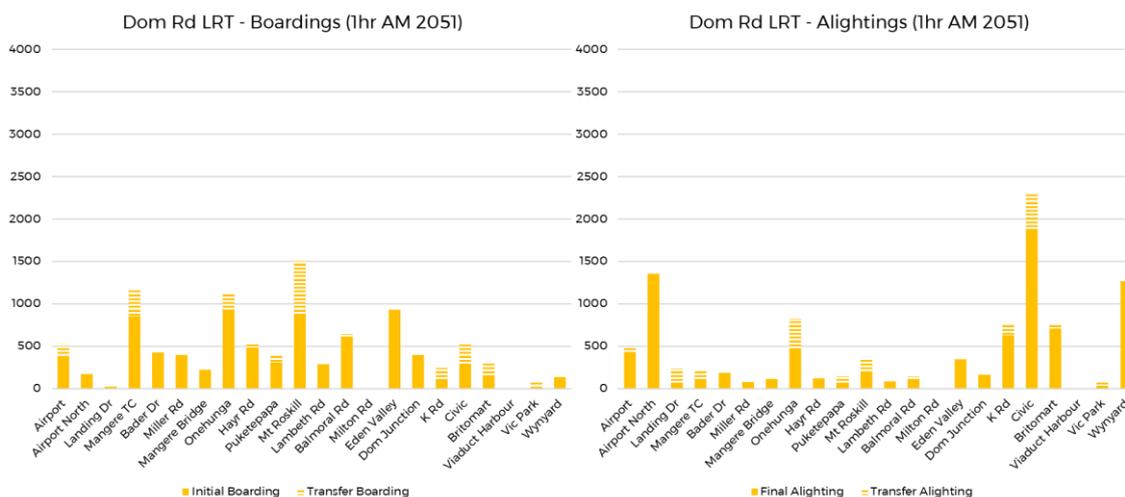


Figure 61: Station use: Final short list - Dominion Road LRT (1hr)

5.2.7.2 Option 2A: Sandringham Road Light Metro

- Total boarding and alighting distribution for the morning 1hr peak along the option is shown in Figure 62: Station use: Final short list - Sandringham Road LM.
- A total of approximately 17,600 boardings are forecast during the busiest 1hr period, 74% more than the light rail short listed option along Dominion Road. It shows Wesley, Onehunga and Mangere Town Centre as busiest boarding stations



together with Aotea and Kingsland. Significant transfers are forecast at Wesley (34%), Kingsland (48%) and Aotea (74%).

- Wesley is the busiest stop at 2,600 boardings over the 1hr morning peak period. This is approximately 73% more boardings than the light rail option at Mt Roskill.
- The three city centre stops are the busiest destinations in the morning peak. A total of 10,400 alightings occur in the central city during the morning 1hr peak. This is doubling (100%) the alightings delivered by light rail to the central city.
- The Airport North stop also experience an increase in alighting over the compared to the light rail option with approximately 1,900 alightings (46% more).

1

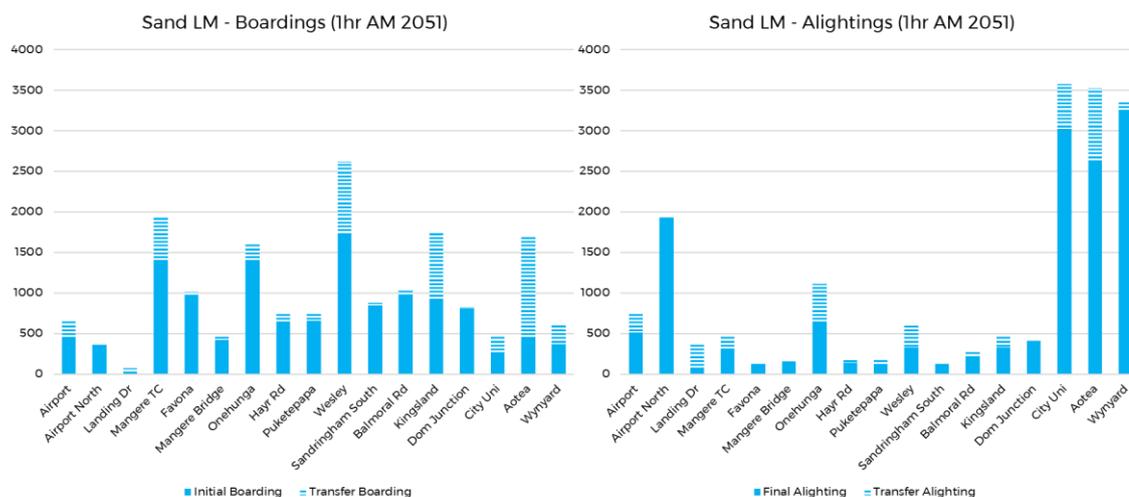


Figure 62: Station use: Final short list - Sandringham Road LM (1hr)

5.2.7.3 Option 3: Sandringham Road Hybrid

- Total boarding and alighting distribution for the morning 1hr peak along the option is shown in Figure 63: Station use: Sandringham Road Hybrid. Figure 24: Station use: Sandringham Road LM.

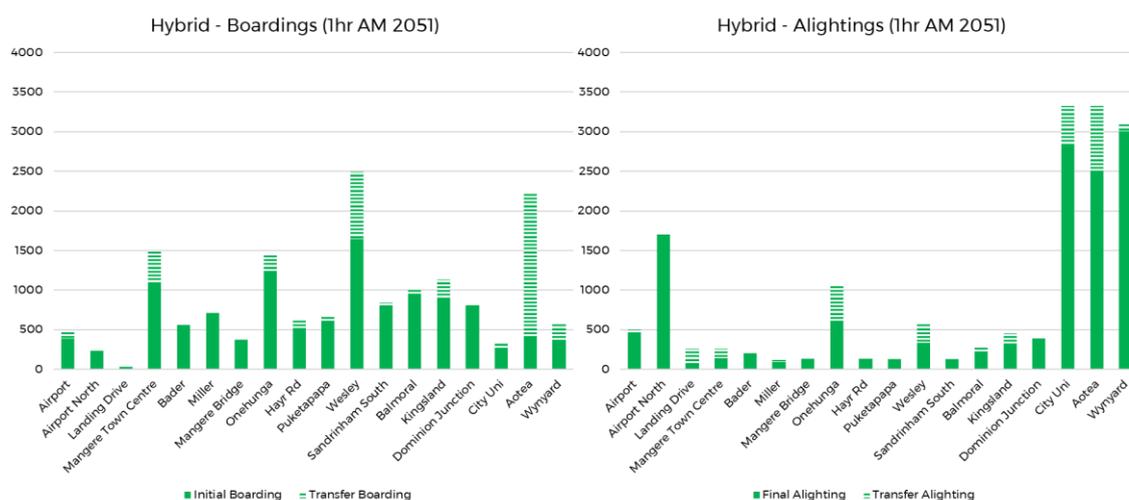


Figure 63: Station use: Sandringham Road Hybrid (1hr)



- A total of approximately 16,100 boardings are forecast during the busiest 1hr period, 8.5% less than light metro along the same route, but more than light rail. It shows Wesley, Onehunga and Mangere Town Centre as busiest boarding stations together with Aotea. Significant transfers are forecast at Wesley (34%), Mangere Town Centre (28%) and Aotea (82%).
- Wesley remains the busiest station on the system with 2,500 boardings over the 1hr morning peak period. This station attracts approximately 3.8% less boardings when compared to light metro at the same station.
- The three city centre stops are the busiest destinations in the morning peak. A total of 9,700 alightings occur in the central city during the morning 1hr peak. This is a 6.7% reduction in alightings in the central city when compared to the light metro along Sandringham Road.

The Airport North remains a busy alighting stops during the morning peak with approximately 1,700 alightings (10.5% less than light metro).



5.2.8 Demands along the route

The MSM model was used to generate demand profiles along the corridor for the 2hr morning and evening peak, as well as the 2hr midday interpeak. These two hour peaks were then converted to 1 hr peak flows by using the peak hour factors listed in Table 2: PT boardings phf.

5.2.8.1 Option 1B: Dominion Road LRT

- Option 1B's 2051 AM peak period demand profile is shown below in Figure 64: .
- The demand profile shows the option is expected to reach 81% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops). The ridership at the peak loading point is forecast to be 5,100 over the busiest 1hr period.
- Inbound patronage is forecast to exceed the total seated capacity from the Miller Road stop up to the Britomart stop. The maximum standing time on this system is approximately 36 minutes (for passengers boarding at Miller Road and travelling all the way to the Britomart stop).
- Most of the passengers get off at the Civic stop.

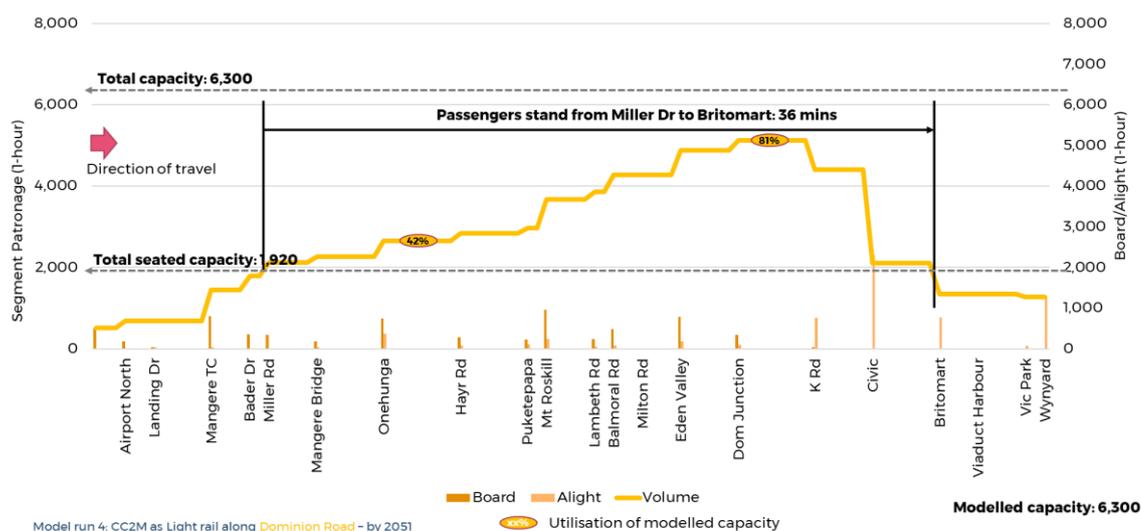


Figure 64: CC2M ridership (AM1hr): LRT Dominion Road (phf 0.61)

- Option 1B's 2051 IP peak period demand profile is shown below in Figure 65: .
- The demand profile shows the option is expected to reach 52% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops). The ridership at the peak loading point is forecast to be 1,600 over the busiest hour in the inter-peak.
- Inbound patronage is forecast to exceed the total seated capacity from the Bader Drive stop up to the Civic stop. The maximum standing time on this system is approximately 32 minutes (for passengers boarding at Bader Drive and travelling all the way to the Civic stop).
- Most of the passengers get off at the Civic stop.

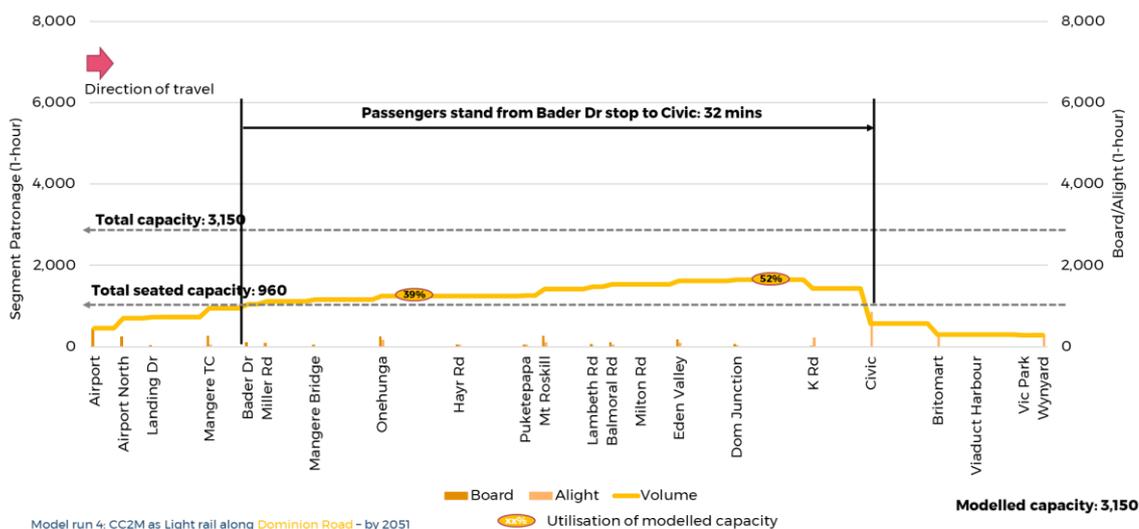


Figure 65: CC2M ridership (IP1hr): LRT Dominion Road (phf 0.51)

- Extrapolating demand generated by the two land use scenarios (using the average annual growth rate between 2031 and 2051) signal the higher land use scenario could generate peak hour demand (using a 0.61 phf) on the light rail system that exceeds the modelled capacity by 2059 under the higher land use scenario.
- The lower growth land use scenario is forecast to generate demand that could exceed capacity 7 years later, at 2066. See Figure 66 below.

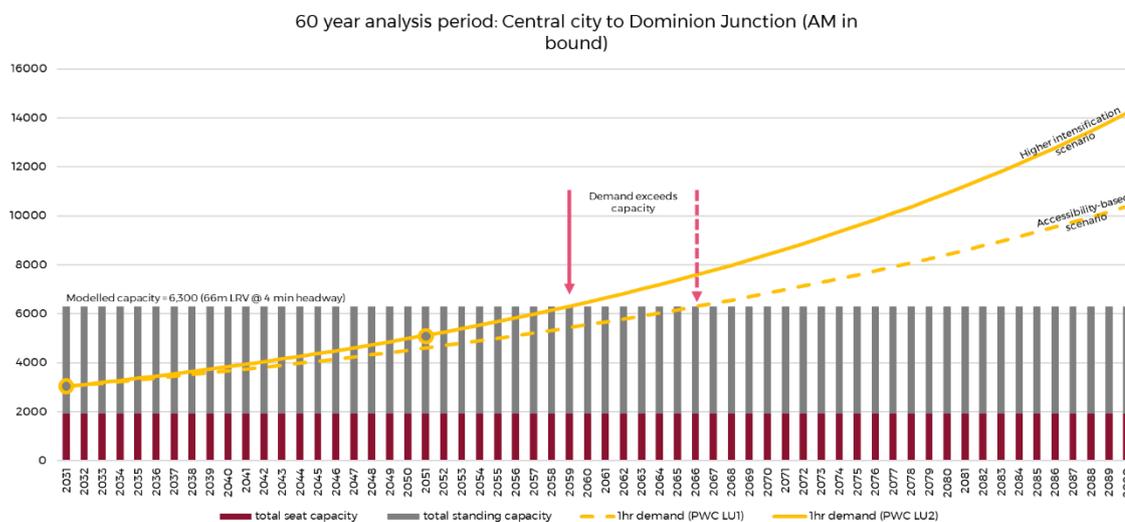


Figure 66: Dom Rd LRT - inbound AM peak 1hr demand vs capacity



5.2.8.2 Option2A: Sandringham Road LM

- Option 2A's 2051 AM peak demand profile is shown below in Figure 67.
- The demand profile shows the option is expected to reach 82% of the modelled capacity at its peak load point (between Dominion Junction and University stops). The ridership at the peak loading point is forecast to be 9,500 over the busiest 1hr. This is 86% higher than the light rail option along Dominion Road.
- Inbound patronage is forecast to exceed the total seated capacity from the Favona Station up to the Wynyard Station. The maximum standing time on this system is approximately 27 minutes (for passengers boarding at Favona and travelling all the way to Wynyard).
- The three central city stations (University, Aotea and Wynyard) have all very similar demands.

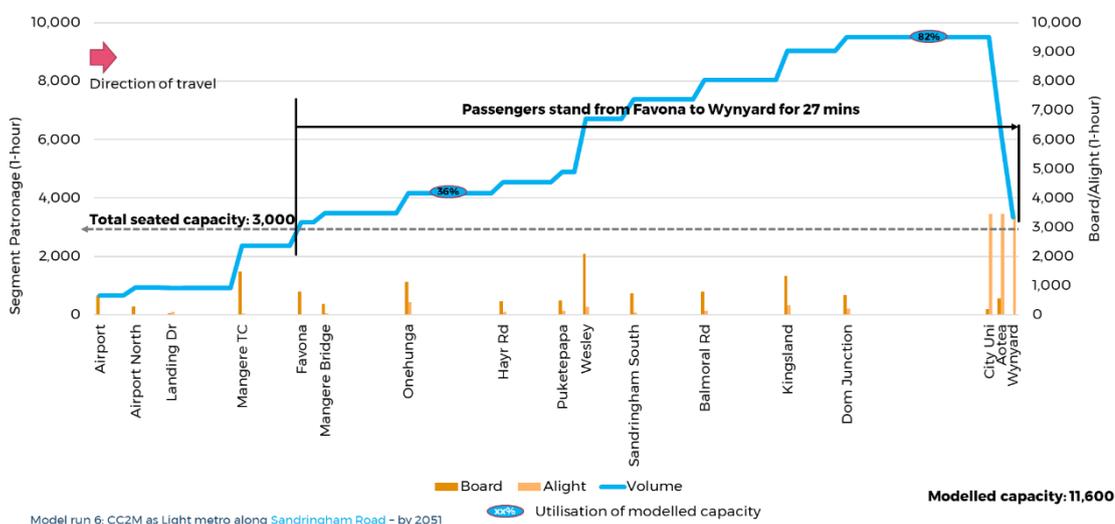


Figure 67: CC2M ridership (AM1hr): LM Sandringham Road (phf 0.61)

- Option 2A's 2051 IP peak period demand profile is shown below in Figure 68 below.
- The demand profile shows the option is expected to reach 61% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops). The ridership at the peak loading point is forecast to be 2,600 over the busiest hour in the inter-peak.
- Inbound patronage is forecast to exceed the total seated capacity from the Mangere Town Centre stop up to the Civic stop. The maximum standing time on this system is approximately 27 minutes (for passengers boarding at Mangere Town Centre and travelling all the way to the Aotea Station).
- Most of the passengers get off at the University station.

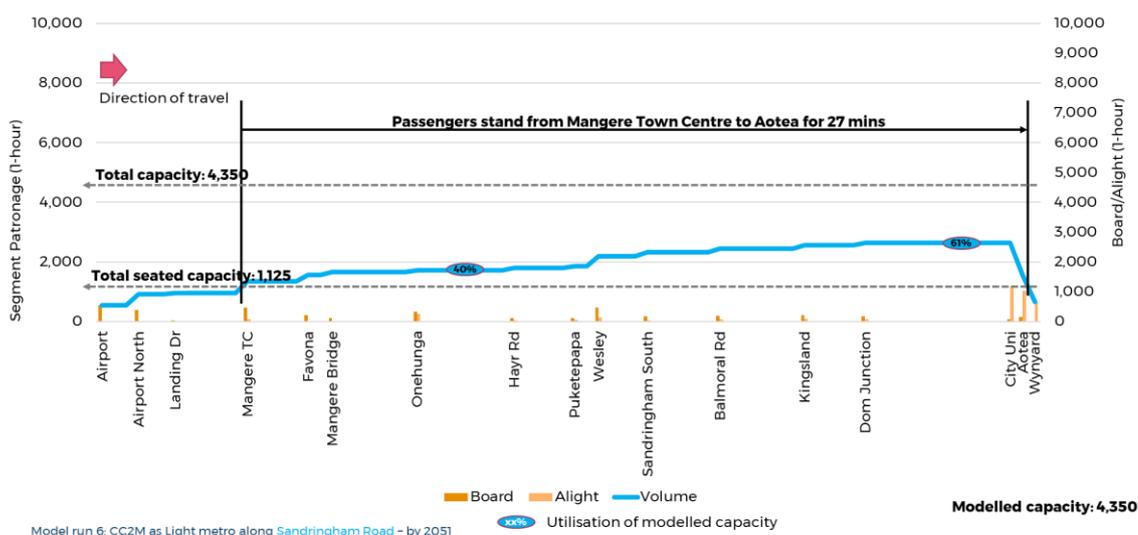


Figure 68: CC2M ridership (IP1hr): LM Sandringham Road (phf 0.51)

- Extrapolating demand generated by the two land use scenarios (using the average annual growth rate between 2031 and 2051) signal the higher land use scenario could generate peak hour demand (using a 0.61 phf) on the light metro system that exceeds the modelled capacity by 2058 under the higher land use scenario. Note this higher land use reflects a total Corridor population of approximately 11% more than the light rail option.
- The lower growth land use scenario is forecast to generate demand that could exceed capacity 13 years later, at 2071. See Figure 69 below.

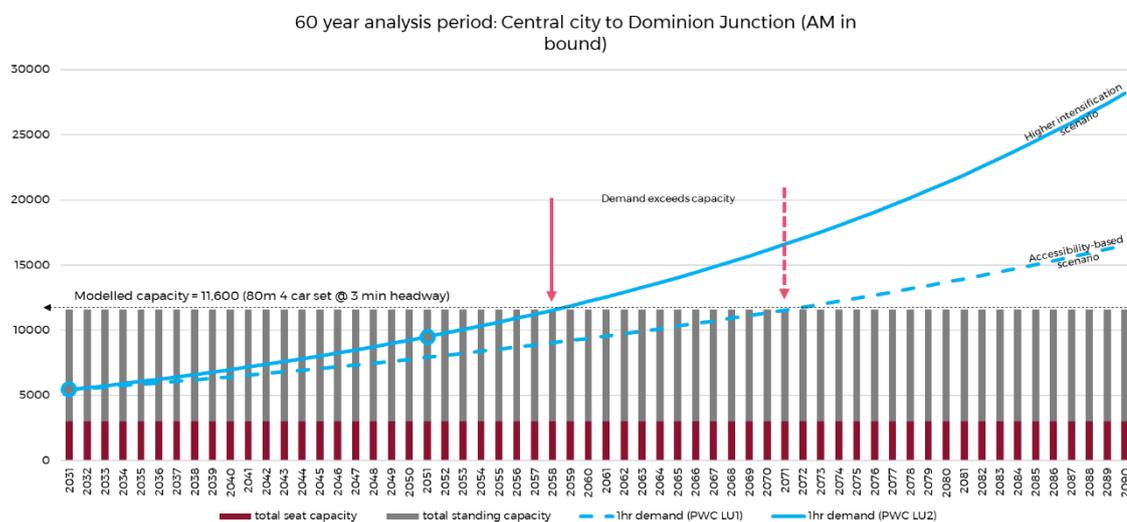


Figure 69: Sand Rd LM - inbound AM peak 1hr demand vs capacity



5.2.8.3 Option 3: Sandringham Road Hybrid

- Option 3's 2051 AM peak demand profile is shown below in Figure 70 below.
- The demand profile shows the option is expected to reach modelled capacity at its peak load point (between Dominion Junction and University stops). The ridership at the peak loading point is forecast to be 8,300 over the busiest hour. This is 12% lower than the light metro option on Sandringham Road, but still 63% higher than light rail along Dominion Road.
- Inbound patronage is forecast to exceed the total seated capacity from the Miller Drive stop up to the Wynyard Station. The maximum standing time on this system is approximately 28 minutes (for passengers boarding at Miller drive and travelling all the way to Wynyard).
- The three central city stations (University, Aotea and Wynyard) all have very similar demands.

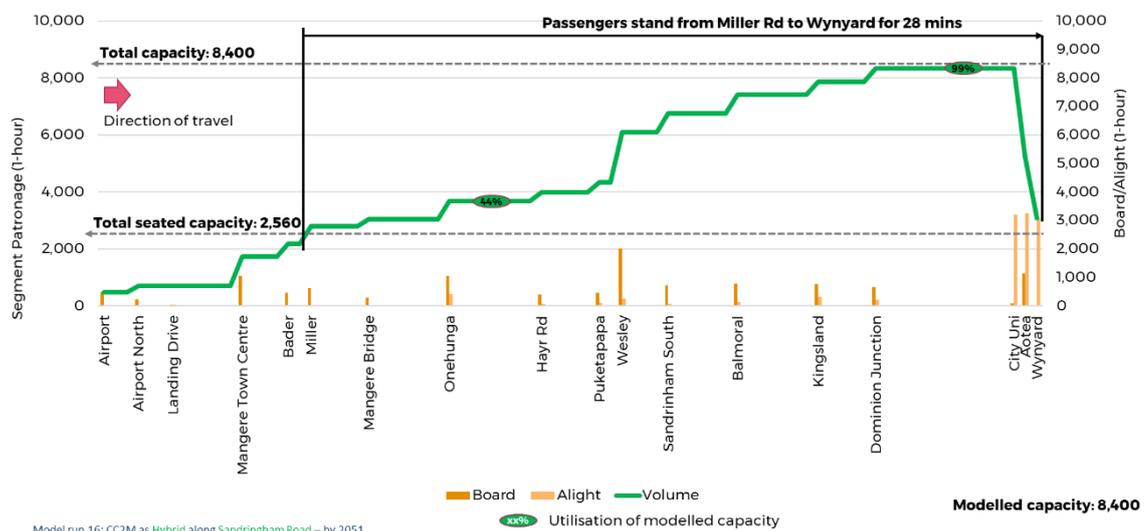


Figure 70: CC2M ridership (AM1hr): Hybrid on Sandringham Rd (phf 0.61)

- Option 3's 2051 Inter peak period demand profile is shown below in Figure 71 below.
- The demand profile shows the option is expected to reach 76% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops). The ridership at the peak loading point is forecast to be 2,405 over the busiest hour in the inter-peak.
- Inbound patronage is forecast to exceed the total seated capacity from the Mangere Town Centre stop up to the Civic stop. The maximum standing time on this system is approximately 32 minutes (for passengers boarding at Mangere Town Centre and travelling all the way to the Aotea Station).
- Most of the passengers get off at the University station.

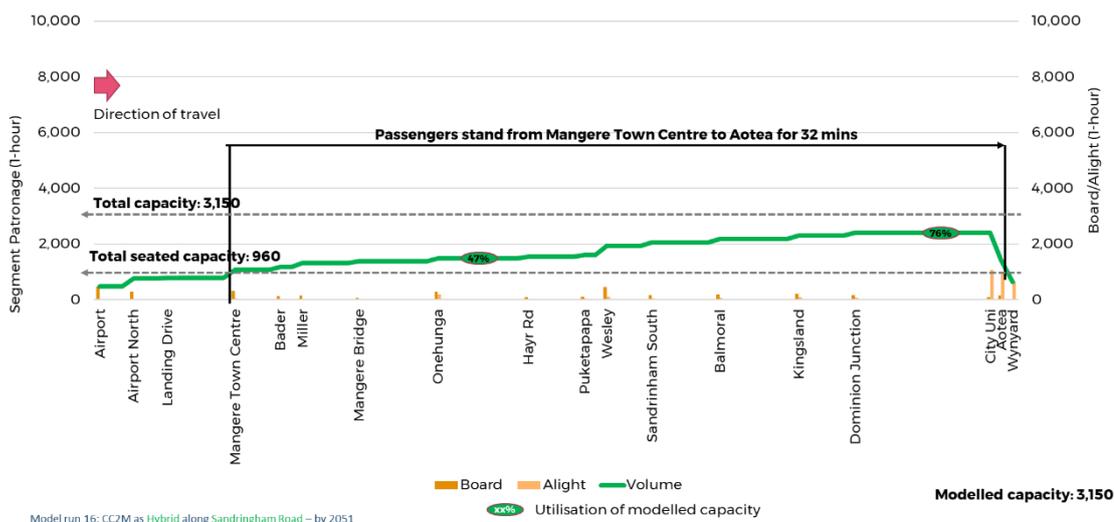


Figure 71: CC2M ridership (IP1hr): Hybrid on Sandringham Rd (phf 0.51)

- Extrapolating demand generated by the two land use scenarios (using the average annual growth rate between 2031 and 2051) signal the higher land use scenario could generate peak hour demand (using a 0.61 phf) on the hybrid system that exceeds the modelled capacity by 2051 under the higher land use scenario. Note this higher land use reflects a total Corridor population of approximately 11% more than the light rail option.
- The lower growth land use scenario is forecast to generate demand that could exceed capacity 6 years later, at 2057. See Figure 72 below.

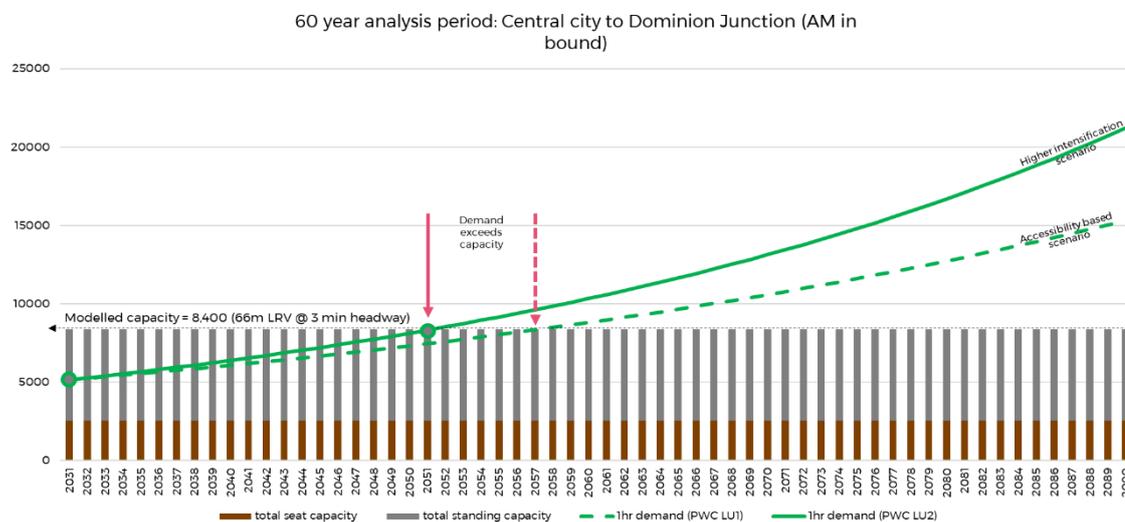


Figure 72: Hybrid- inbound AM peak 1hr demand vs capacity

5.2.8.4 Overview of short list demand

A visual representation of the 2-hour morning peak demand flows from the MSM model - including the wider public transport network - is illustrated in Figure 73 below for on each of the short listed options:

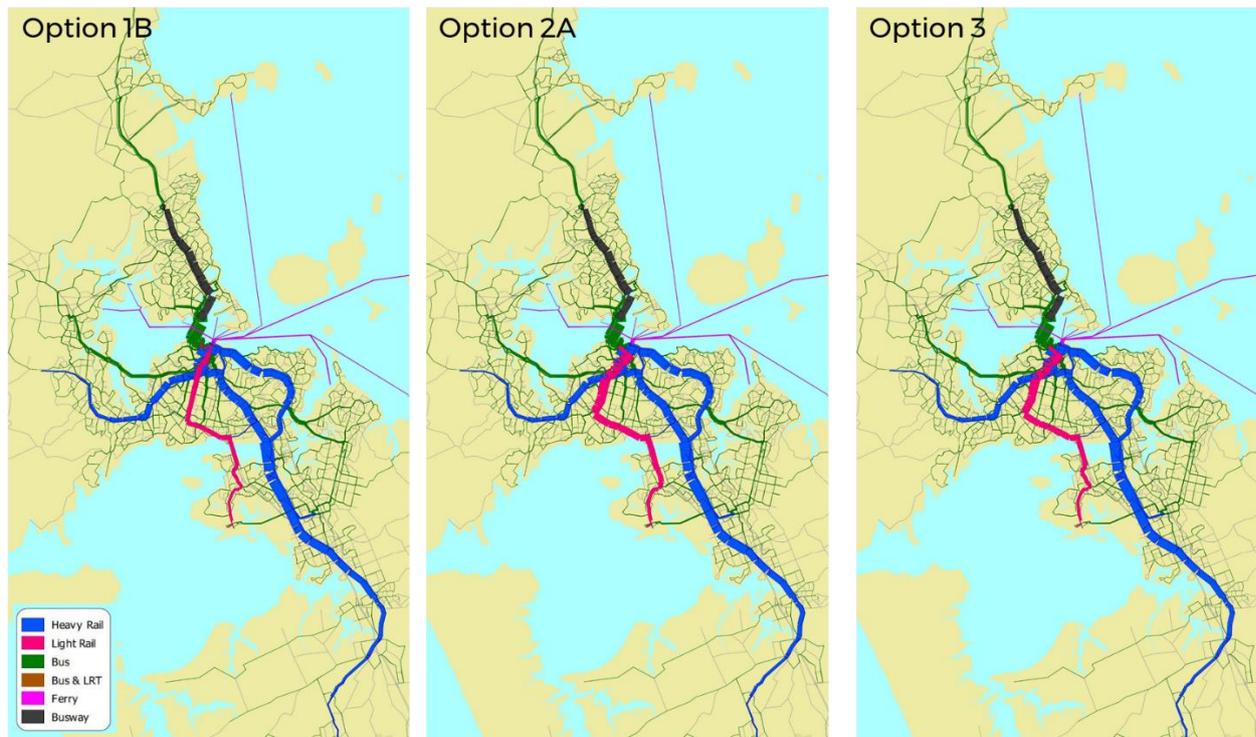


Figure 73: Visual representation of the 2hr AM peak demand along the CC2M corridor

A comparison of the 2051 1hr morning peak demand is illustrated for the three short listed option in Figure 74 below.

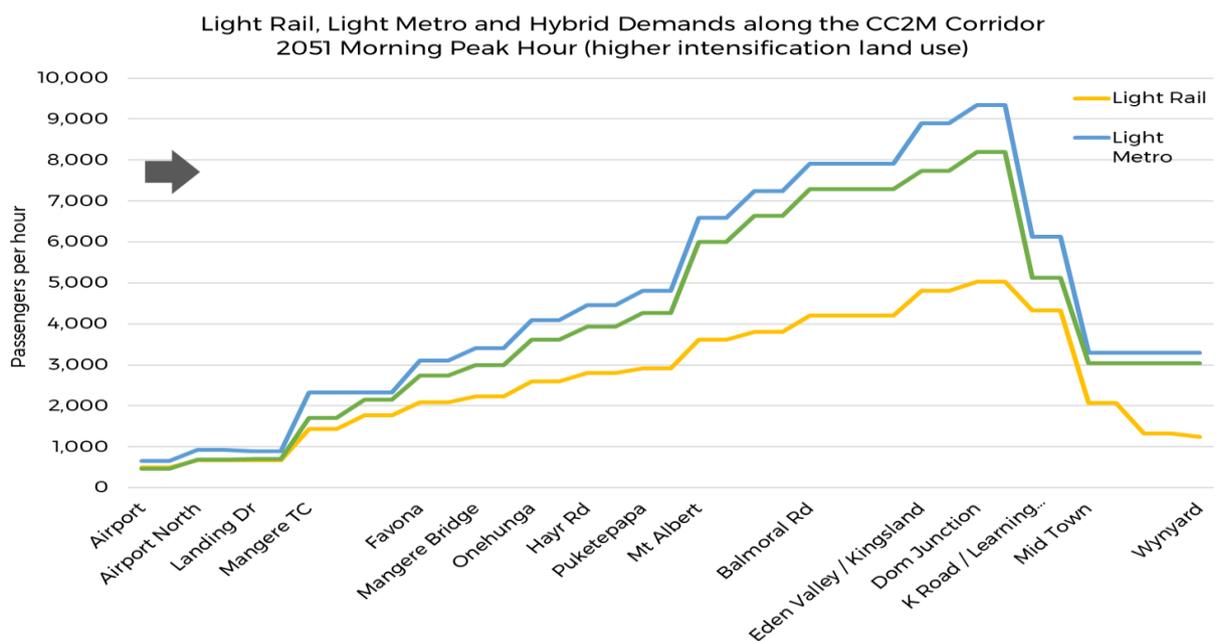


Figure 74: CC2M ridership (2051 AM 1hr):3 shortlisted options

5.3 Refinement of Option 3

The demand modelling shows Option 3 would reach its modelling capacity (within the peak 1 hour) by 2051, limiting its ability to accommodate growth (at the key load point) beyond this date.

The hybrid option envisages a tunnel through the city centre and isthmus, allowing for mode capacity to be allocated through this section compared to the modelled capacity.

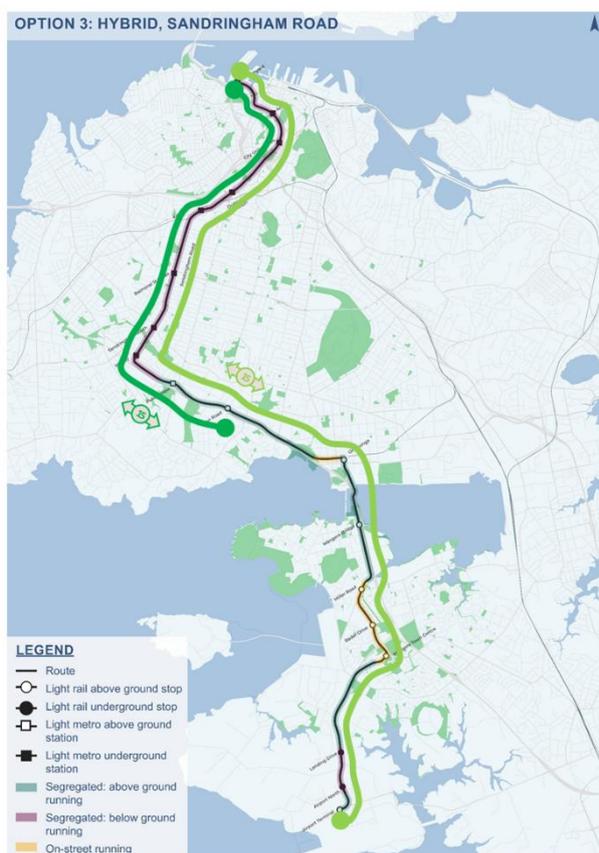


Figure 75: Option 3B: additional capacity

A further model test was therefore performed to test the impact on demand by introducing a short run service at a 4 min headway (15 trains per hr) between Hayr Road and the city centre. The headways for services from the city centre to the airport were increased to 4 minutes, effectively lowering the level of service for Mangere residents. (from 3 mins to 4 mins). This test still assumes the same vehicle configuration (66m LRVs), with the same seating and standing capacity per vehicle.

This operating plan results in 30 trains per hour (2 min headways) through the isthmus and increases the capacity at the peak load point (from 8,400 to 12,600 per hour per direction).

The refined Option 3 test assumes the same land use growth and distribution used for Option 3.

The key changes to CC2M demands when comparing Option 3 with its refinement are shown in Table 15 below. It shows capacity will have the following impacts:

- Access to employment: The Mangere and Mt Roskill areas will experience a slight decrease (-0.5%) in accessibility (Mangere decreasing from 346 thousand to 344 thousand).
- PT Boarding's: The regional total PT boardings experience a marginal increase of 0.4%.
- CC2M Boarding: Boardings on the hybrid system increase by 4.9% in AM and 2.2% annually from 31.2 million to 31.9 million.
- The largest increase in demand is forecast at the Peak Load Point (between Dominion Junction and University stops). This section of the route experienced capacity pressure under option 3. The additional capacity increases demand by



16.2% from 8,200 to 9,500 persons per hour per direction. This demand is now higher than light metro along the comparative section.

Table 15: Impact of additional capacity on Option 3 demands

Key Indicators by 2051	Results based on higher intensification scenario by 2051		Percentage change as a result of additional capacity	
	Option 3	Option 3 (refined)		Option 3 (refined)
Accessibility				
Number of jobs within 45 mins by PT from Mangere Town centre	346,183	344,317		-0.5%
Number of jobs within 45 mins by PT from Mt Roskill centre	403,296	401,431		-0.5%
Number of households within 45 min by PT from city centre	399,246	400,133		+0.2%
Number of households within 45 min by PT from airport	116,737	113,954		-2.4%
CC2M Boardings				
AM peak (2hr)	26,411	27,706		+4.9%
Daily	111,724	114,174		+2.2%
Annual	31,170,996	31,854,462		+2.2%
Regional PT Boardings (annual)				
Total PT network	245,711,233	246,606,277		+0.4%
Total bus network	151,519,602	151,695,945		+0.1%
Total heavy rail network	60,369,499	60,498,231		+0.2%
CC2M capacity and demands				
Modelled Maximum Capacity of CC2M (pax/hour/direction)	8,400	12,600		+50%
CC2M Demand at Peak Load Point (pax/hour/direction)	8,193	9,521		+16.2%

The refined Option 3's 2051 AM peak demand profile is shown below in Figure 76 below.

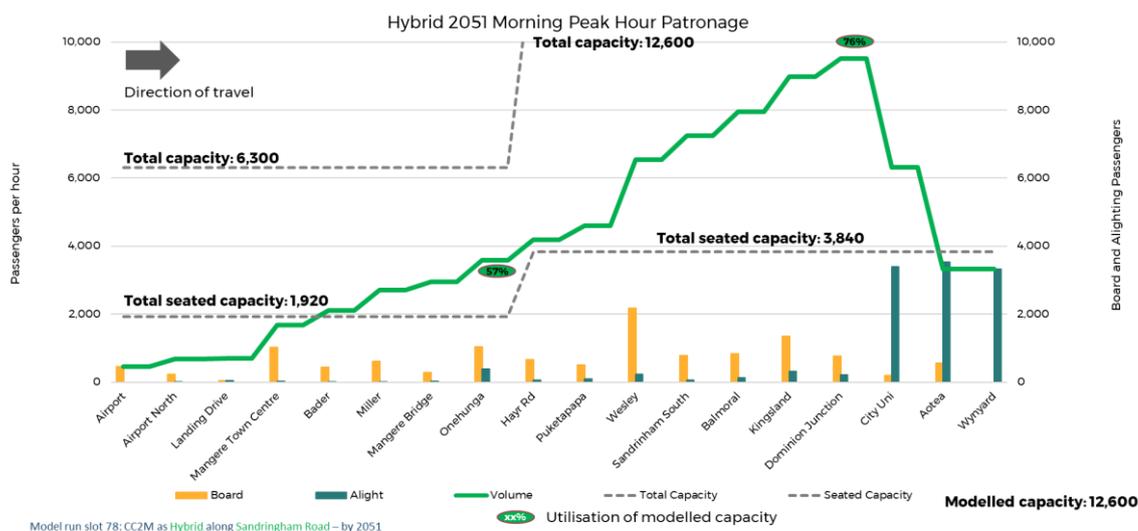


Figure 76: CC2M ridership (AM1hr): Refined Hybrid option on Sandringham Road (phf 0.61)

- The demand profile shows the refined option is expected to reach 76% of its modelled capacity at the peak load point (between Dominion Junction and University stops). The ridership at the peak loading point is forecast to be 9,500



over the busiest hour. This is 16% higher than the previous hybrid option (option 3), and similar when compared to the Light Metro option. It is also 86% higher than light rail along Dominion Road.

- For the short run service (Hayr Rd to Wynyard): Inbound patronage is forecast to exceed the total seated capacity from the Wesley Station up to the Aotea Station. The maximum standing time on this system is approximately 12 minutes (for passengers boarding at Wesley Station and travelling all the way to Aotea Station).
- For the entire service (Airport to Wynyard): Inbound patronage is forecast to exceed the total seated capacity from the Miller Road stop up to the Aotea Station. The maximum standing time on this system is approximately 26 minutes (for passengers boarding at Miller Road and travelling all the way to Aotea Station).
- The three central city stations (University, Aotea and Wynyard) all have very similar demands.

Comparing the refined Option 3's 2051 AM peak 1hr (inbound) demand with light metro and light rail shows the following (refer to Figure 77):

- Light metro and the hybrid attract approximately 86% higher demand at the peak load point (prior to entering the city centre).
- Light metro and the hybrid have very similar peak hour demands north of the Mt Albert Road station;
- Light metro attracts the highest boardings at Mangere Town Centre

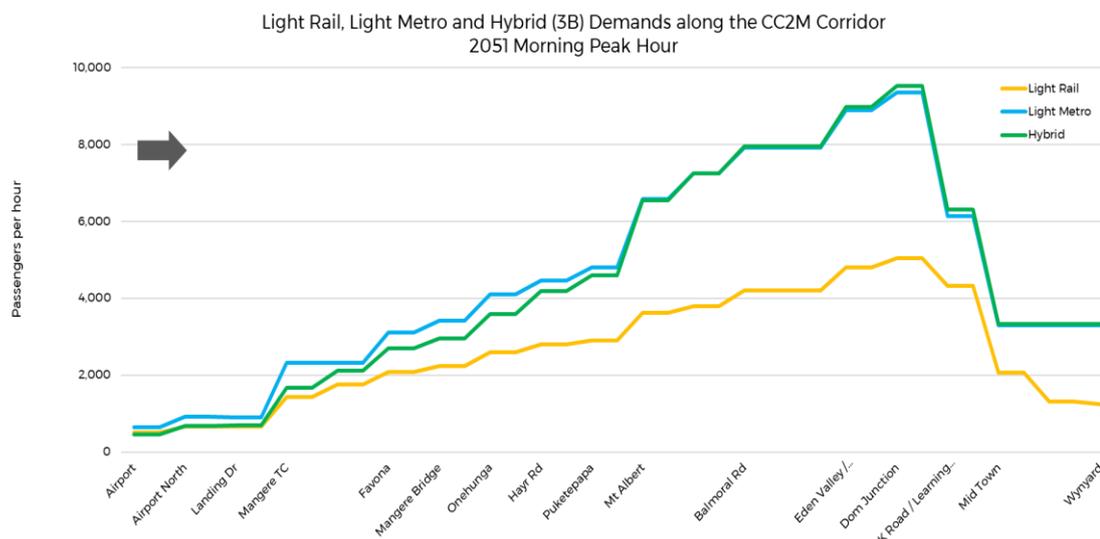


Figure 77: CC2M ridership (2051 AM 1hr): 3 options



Extending demand profile to 2090

- Extrapolating demand generated by the higher intensification land use scenario (using the average annual growth rate between 2031 and 2051) signal the extra capacity will extend the date where the hybrid system exceeds its modelled capacity by a decade – from 2051 to 2061. Refer to Figure 78 below.

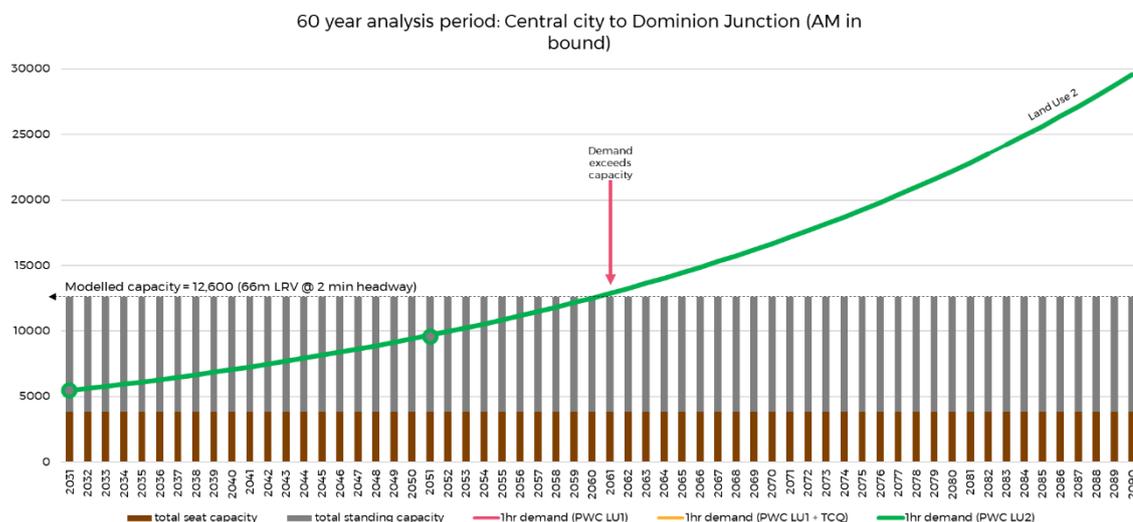


Figure 78: Refined Hybrid- inbound AM peak 1hr demand vs capacity

5.4 Customer level of service

Analyses³ of the station to station matrix within MSM (for the 2051 AM 2hr peak) shows:

- 4% of the light metro passengers travel longer than 30 mins
- 7% of the hybrid passengers travel longer than 30 mins
- 23% of light rail passengers travel longer than 30 mins

The seat capacity, journey time and trips patterns result in the following passenger level of service, as it relates to standing time (refer to Table 16: Level of service by option):

Table 16: Level of service by option

Passenger LoS (2051 AM inbound)	Option 1B (LRT)	Option 2A (Light metro)	Option 3 (Refined Hybrid)
Portion of passengers that stand 20 minutes or more	26%	8%	7%
Portion of passengers that will have a seat	29%	21%	23%

For annotated matrices refer to Appendix E.

³ Note the station to station matrix excludes rail to rail transfers.



6. Conclusion

6.1 Summary

The final short-listed options (light rail, light metro, and hybrid) all deliver enhanced outcomes against the agreed measures for the CC2M project when compared to both the current conditions (represented by 2018 data) and the do minimums for 2031 and 2051.

The light rail was modelled with a land use that stimulates growth that results in approximately 46,000 additional residents along the corridor by 2051 when compared to the do minimum land use. The light metro and hybrid options were modelled with a growth patterns that result in an additional 81,000 residents along the corridor (when compared to the do minimum).

Light metro services are significantly faster than light rail, and travel time comparison shows light metro will arrive at the Wynyard Station, while the hybrid will be at Dominion Junction station and the light rail services will not have entered the city centre and be at Milton Road stop. This is especially important to Mangere Residents for whom the City Centre is an important destination for work, education and other purposes, and the Wynyard station is the 4th highest destination station.

All options enable faster public transport travel times from Mangere and Onehunga to the city centre when compared to the most viable alternative (car travel). Car travel remains slightly more competitive to the central city from Mt Roskill.

The option alignments, speed and headways result in expanded labour pool with 45 minutes access to the central city. The initial short list analyses showed Wynyard and the city universities to be key destinations for trips from the CC2M corridor. The geographical analyses of the change in 45-minute catchment to these zones show clear differences for the light metro and hybrid over the light rail option, with the latter having limited reach into Mangere.

The three options deliver very similar accessibility outcomes for the isthmus residents, with no significant differences between the options. The accessibility differences for the options become more pronounced for areas within the corridor located further away from the central city. For Mangere (represented by zone 472) all three options improve the number of jobs residents can access within 45 mins over the do minimum. Light metro does however provide significant more opportunities than both the hybrid and light rail. Sensitivity tests were done with shorter and longer travel isochrones, ranging from 30 mins to 1 hr. The tests show the light rail option will always delivers lowest of the three short listed options, with the hybrid achieving parity with light metro for travel times between 55 mins and 1 hr.

The demand modelling shows light metro will generate 72% more demand, based on annual boardings by 2051, when compared to light rail. The hybrid will attract 10% less than the light metro option.

The demand profile shows the light rail option is expected to reach 81% of the modelled capacity at its peak load point (between Dominion Junction and K-Road stops) by 2051. The ridership at the peak loading point is forecast to be 5,100 over the busiest 1hr period. Extrapolating demand (using the average annual growth rate between 2031 and 2051)



signal the higher land use scenario could generate peak hour demand on the light rail system that exceeds the modelled capacity by 2059 under the higher land use scenario.

Light metro demands are forecast to reach 82% of its modelled capacity by 2051. The ridership on the peak loading point is forecast to be 9,500 over the busiest 1hr period. This is 86% higher than the light rail option along Dominion Road. The option generates (extrapolated) demand that exceed its capacity by 2058.

The hybrid option generates demands that reach its modelled capacity by 2051. The ridership on the peak loading point is forecast to be 8,300 over the busiest 1hr period. This is 12% lower than the light metro option on Sandringham Road, but still 63% higher than light rail along Dominion Road.

A further modelling test was done on the hybrid option that introduces an overlay service through the isthmus. The service plan for this option increases that capacity of the hybrid system through the high demand section of the corridor (the isthmus) with a minor decrease in capacity through Mangere.

The demand profile for this option (referred to as Hybrid 3B) is expected to reach 76% of its modelled capacity at the peak load point. The ridership at the peak loading point is forecast to be 9,500 over the busiest hour. This is 16% higher than the previous hybrid option (option 3), and similar when compared to the Light Metro option. It is also 86% higher than light rail along Dominion Road.

Further sensitivity tests were done to test the impact on road pricing and the network expansion on the demand for the respective CC2M option. The purpose of these tests was to confirm adequate capacity in the system to accommodate future changes.

It shows road pricing will have a minimal impact on the CC2M demand, increasing demand on the options between 1% and 2%. Road pricing combined with an expanded CC2M network to the north shore and north west will increase demands on the options by between 5% and 9%. Appendix F summarises these tests and their results.

The results from the demand modelling were also benchmarked against global examples of major public transport infrastructure in similar cities to compare patronage characteristics with CC2M patronage forecasts. Refer to Appendix H for more detail. The report suggests the forecasts for CC2M are likely in the right range.



7. Glossary of Terms

7.1 Table 2: Terms and Description

Term	Description
AFC	Auckland Forecasting Centre
AM Peak	Morning peak period (7-9)
CC2M	City Centre to Mangere
Corridor	The CC2M zones that define the corridor from the city centre to the airport
CRL	City Rail Link
KPI	Key Performance Measure
K Road	Karangahape Road
LM	Light Metro
LRT	Light Rail Transit
MSM	Macro Strategic Model
NEX	Northern Express Bus Service
pax	passengers
phf	Peak Hour Factor
PM Peak	Afternoon peak period (4 to 6)
pphpd	Passengers per hour per direction
PT	Public Transport
tph	Trains per Hour



Appendix A: Peer review note – Do Minimum



MEMO

25 June 2021

To: Pete Clark, Waka Kotahi
From: John Williamson, Ascari
Subject: Peer Review - ALR Do Minimum

Background

This memo summarises the findings from my review of the ALR Do Minimum (ALR Memo from Theunis van Schalkwyk 22 June 2021).

Approach to the Peer Review:

It is standard practice (as per Waka Kotahi's guidelines) to test the credibility of the choice of the Do Minimum within a peer review.

Usually, the peer review of the Do Minimum would be undertaken within the overall peer review of the Business Case. However, given the tight timeframes associated with this stage of the ALR project this review has been undertaken once the Do Minimum has been developed, to help provide confidence and minimise risk around any potential re-work.

This review considers:

- The approach used to develop the do minimum
- The guidelines provided by Waka Kotahi and Treasury around appropriate Do Minimums
- The composition of the chosen do minimum.

Development of the Do Minimum

The do minimum has been developed by technical experts with significant previous experience in the definition of the do minimum for a major passenger transport assessment in Auckland, including the City Rail Link (CRL) and Additional Waitemata Harbour Crossing (AWHC)

The process has also been collaborative and transparent. This has included a meeting of technical experts and Treasury representative (which I also attended). The meeting canvassed a significant range of issues and ultimately confirmed the specification of the do minimum.

I note that all of the points agreed at the meeting are captured in the memo of 22 June and reflected in the do minimum

Overall, the approach taken has involved a high level of technical expertise and collaboration.

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Waka Kotahi and Treasury Guidelines

A particular point to raise here is the need to be aware of both the project and the network. The guidelines from Waka Kotahi note this, with the do minimum needing to:

- *Provide a minimum level of expenditure required to maintain a minimum level of service, and,*
- *account for committed and funded transport activities.*

The final do minimum adequately reflects these requirements.

Composition of the Do Minimum

The 'lean' approach with 2 planning horizons (2031 & 2051) is supported given the available timeframe and need to economise on model outputs/runs.

The use of the 2031 RLTP as the network do minimum is consistent with the network do minimums developed for similar major PT project assessments e.g. the CRL and AWHC.

Exclusion of road pricing as this is not a committed or funded project is consistent with usual practice.

The land use assumptions are important. The adjustments to forecast I-11.6 for 2051 are necessary to remove the effect of anticipation of growth related to CC2M and ensure a fair comparison between the Mt Eden and Sandringham Road options.

The approach to bus service levels, using uncrowded demand in 2051 is supported.

Conclusion

The do minimum has been developed in a way which is consistent with previous do minimums for similar major PT project assessments, by technical experts who have been involved with these projects. The do minimum has then been workshopped with other technical specialists and officials and is consistent with the outcome of this process.

The proposed do minimum is consistent with the guidelines provided by Waka Kotahi and Treasury and is well aligned with the specification of previous do minimums, whilst ensuring a fair comparison between options.

Therefore, in my view the ALR do minimum is appropriate for the task.



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Appendix B: Summary of model results for the 5 initial short list options with accessibility-based land use scenario



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
<i>KPI</i>													
<i>Improved access to major and growing employment areas, especially the city centre and Auckland Airport precinct</i>													
Number of Jobs within 45min by PT from origins in the AM Peak from:													
Mangere Town Centre	79,780	88,483	190,241	206,379	367,323	351,877	284,606	82,065	250,013	241,967	440,725	421,323	336,932
Onehunga	165,136	183,188	341,015	331,227	379,108	370,255	371,809	194,045	401,109	397,745	456,074	435,807	444,666
Mt Roskill	208,209	264,750	272,604	300,741	342,981	327,994	314,532	297,096	359,671	412,067	419,743	469,689	401,412
Number of Households within 45min by PT to destinations in the AM Peak from:													
City Centre	202,704	293,210	299,868	299,868	307,813	308,057	305,084	354,075	364,488	365,663	381,059	384,833	376,112
Airport	3,840	24,387	69,703	72,916	118,189	115,226	74,228	19,838	86,547	90,179	136,616	143,071	94,963
PT Mode Share in the Corridor (No. and %)													
Mangere / Favona / Mangere Bridge AM (no.)													
Car	19,463.2	22,132.1	21,296	21,281	21,305	21,285	21,178	21,594	21,243	21,211	21,250	21,201	21,180
PT	1,756.1	2,845.6	3,946	3,951	3,933	3,949	4,071	3,693	5,617	5,629	5,757	5,809	5,805
Active	3,620.5	4,197.7	4,192	4,193	4,197	4,196	4,197	4,863	5,060	5,060	5,068	5,074	5,080
Mangere / Favona / Mangere Bridge AM (%)													
Car	78.4	75.9	72.3	72.3	72.4	72.3	71.9	71.6	66.5	66.5	66.3	66.1	66.1
PT	7.1	9.8	13.4	13.4	13.4	13.4	13.8	12.2	17.6	17.6	17.9	18.1	18.1
Active	14.6	14.4	14.2	14.2	14.3	14.3	14.3	16.1	15.9	15.9	15.8	15.8	15.8
Mangere / Favona / Mangere Bridge All Day (No.)													
Car	112,410.9	134,607.2	129,529	129,504	129,244	129,174	128,926	140,722	137,440	137,443	137,297	137,178	137,092
PT	5,299.6	8,993.8	12,659	12,681	12,680	12,743	13,131	11,806	18,442	18,466	18,844	18,992	19,018
Active	15,374.7	19,967.2	19,878	19,886	19,860	19,859	19,871	26,400	27,191	27,222	27,130	27,197	27,221
Mangere / Favona / Mangere Bridge All Day (%)													
Car	84.5	82.3	79.9	79.9	79.9	79.8	79.6	78.6	75.1	75.1	74.9	74.8	74.8
PT	4.0	5.5	7.8	7.8	7.8	7.9	8.1	6.6	10.1	10.1	10.3	10.4	10.4
Active	11.6	12.2	12.3	12.3	12.3	12.3	12.3	14.8	14.9	14.9	14.8	14.8	14.8



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
Onehunga AM (No.)													
Car	10,341.0	11,659.1	11,169	11,153	11,102	11,100	11,125	13,315	12,824	12,807	12,768	12,752	12,800
PT	616.2	1,230.8	1,642	1,630	1,709	1,698	1,683	1,938	2,980	2,977	3,166	3,181	3,088
Active	511.2	771.0	770	770	770	769	770	1,461	1,480	1,480	1,481	1,483	1,482
Onehunga AM (%)													
Car	90.2	85.3	82.2	82.3	81.8	81.8	81.9	79.7	74.2	74.2	73.3	73.2	73.7
PT	5.4	9.0	12.1	12.0	12.6	12.5	12.4	11.6	17.2	17.2	18.2	18.3	17.8
Active	4.5	5.6	5.7	5.7	5.7	5.7	5.7	8.7	8.6	8.6	8.5	8.5	8.5
Onehunga All Day (No.)													
Car	62,509	71,882	68,660	68,656	68,169	68,222	68,359	83,217	80,339	80,252	79,957	79,897	80,150
PT	2,133	4,324	5,942	5,914	6,202	6,171	6,106	6,741	10,783	10,782	11,398	11,450	11,132
Active	2,457	4,414	4,387	4,390	4,375	4,374	4,382	9,927	9,845	9,851	9,794	9,818	9,824
Onehunga All Day (%)													
Car	93.2	89.2	86.9	87.0	86.6	86.6	86.7	83.3	79.6	79.5	79.0	79.0	79.3
PT	3.2	5.4	7.5	7.5	7.9	7.8	7.7	6.7	10.7	10.7	11.3	11.3	11.0
Active	3.7	5.5	5.6	5.6	5.6	5.6	5.6	9.9	9.8	9.8	9.7	9.7	9.7
Mt. Roskill / Hillsborough AM (No.)													
Car	26,350	29,320	28,959	28,820	28,794	28,766	28,859	31,497	32,049	31,548	32,128	31,641	32,149
PT	2,565	4,290	4,670	4,712	4,875	4,885	4,809	6,043	7,590	7,530	8,111	7,979	7,956
Active	3,397	4,215	4,215	4,214	4,219	4,218	4,219	5,562	6,007	5,926	6,082	5,973	6,075
Mt. Roskill / Hillsborough AM (%)													
Car	81.6	77.5	76.5	76.4	76.0	76.0	76.2	73.1	70.2	70.1	69.4	69.4	69.6
PT	7.9	11.3	12.3	12.5	12.9	12.9	12.7	14.0	16.6	16.7	17.5	17.5	17.2
Active	10.5	11.1	11.1	11.2	11.1	11.1	11.1	12.9	13.2	13.2	13.1	13.1	13.2
Mt. Roskill / Hillsborough All Day (No.)													
Car	158,002	180,178	178,080	177,621	176,896	176,887	177,318	199,654	202,908	200,352	203,518	200,469	203,660
PT	7,910	13,412	14,490	14,632	15,158	15,148	14,968	18,873	24,003	23,756	25,495	25,021	25,033



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
Active	15,677	21,570	21,518	21,513	21,497	21,502	21,505	33,024	35,322	34,902	35,570	35,018	35,582
Mt. Roskill / Hillsborough All Day (%)													
Car	87.0	83.7	83.2	83.1	82.8	82.8	82.9	79.4	77.4	77.4	76.9	77.0	77.1
PT	4.4	6.2	6.8	6.8	7.1	7.1	7.0	7.5	9.2	9.2	9.6	9.6	9.5
Active	8.6	10.0	10.1	10.1	10.1	10.1	10.1	13.1	13.5	13.5	13.4	13.4	13.5
<i>KPI</i> Improved access to education from communities along the corridor													
Number of Education Opportunities within 45min by PT from origins in the AM Peak													
Mangere Town Centre													
Primary	18,941	18,649	37,327	34,626	42,217	39,902	38,558	18,382	41,063	38,654	47,280	44,409	42,389
Secondary	13,749	12,190	25,452	25,060	31,121	32,886	26,636	11,335	28,488	27,799	35,659	36,468	30,003
Tertiary	9,081	14,100	14,438	15,788	111,066	97,623	93,252	4,828	22,495	22,494	131,676	115,737	114,336
TOTAL	41,771	44,940	77,217	75,473	184,404	170,411	158,446	34,545	92,047	88,946	214,615	196,613	186,727
Onehunga													
Primary	24,489	23,665	38,185	37,366	40,233	39,437	39,450	23,506	40,993	39,713	47,147	45,601	45,042
Secondary	14,601	14,836	32,371	28,055	37,347	34,617	37,112	16,122	34,854	30,677	39,937	36,570	39,598
Tertiary	4,323	4,889	94,332	94,331	97,822	97,821	94,332	5,787	111,800	111,789	115,975	115,972	111,831
TOTAL	43,413	43,390	164,888	159,752	175,402	171,875	170,893	45,416	187,646	182,179	203,058	198,142	196,471
Mount Roskill													
Primary	19,644	21,740	25,733	33,476	32,316	32,490	27,968	24,850	32,485	44,421	45,625	53,696	42,292
Secondary	23,588	27,599	27,647	25,556	33,250	33,635	32,500	28,447	35,265	39,088	43,013	48,643	40,345
Tertiary	77,097	93,774	93,774	93,772	94,332	94,331	93,774	111,005	111,800	111,791	111,873	120,513	111,831
TOTAL	120,329	143,112	147,153	152,805	159,898	160,456	154,241	164,301	179,550	195,299	200,512	222,852	194,467
<i>KPI</i> Improved travel times for key journeys along the corridor													
PT travel times compared to car travel times between key centres along the corridor (including the City Centre, Airport, Mt Roskill, Onehunga and Mangere).													
CC2M Travel times to Airport business from:													
Mangere			7.0	6.9	4.5	4.4	7.0		7.0	6.9	4.5	4.4	7.0



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
Onehunga			18.4	18.3	12.1	12.1	18.4		18.4	18.3	12.1	12.1	18.4
Mount Roskill			27.3	26.6	20.1	18.5	29.9		27.3	26.6	20.1	18.5	29.9
CC2M Travel times to Mid Town from:													
Mangere			37.7	36.6	27.3	25.3	32.0		37.7	36.6	27.3	25.3	32.0
Onehunga			26.3	25.2	19.7	17.6	20.6		26.3	25.2	19.7	17.6	20.6
Mount Roskill			17.6	17.0	11.8	11.3	11.8		17.6	17.0	11.8	11.3	11.8
CC2M Travel times to Universities Station from:													
Mangere					25.0	23.0	29.7				25.0	23.0	29.7
Onehunga					17.4	15.3	18.3				17.4	15.3	18.3
Mount Roskill					9.5	9.0	9.5				9.5	9.0	9.5
CC2M Travel times to Wynyard from:													
Mangere			49.4	48.3	29.2	27.2	33.9		49.4	48.3	29.2	27.2	33.9
Onehunga			38.0	36.9	21.6	19.5	22.5		38.0	36.9	21.6	19.5	22.5
Mount Roskill			29.3	28.7	13.7	13.2	13.7		29.3	28.7	13.7	13.2	13.7
Car Travel times to Airport business from:													
Mangere	7.6	9.9	10.9	10.9	8.9	8.9	10.8	15.8	17.0	17.0	13.1	13.1	16.7
Onehunga	11.6	16.6	16.0	16.0	15.3	15.3	15.9	29.1	26.6	26.5	25.6	25.5	26.3
Mount Roskill	16.1	20.5	19.8	20.0	19.0	19.0	19.5	36.2	33.3	33.5	32.1	32.0	32.8
Car Travel times to City Centre University from:													
Mangere	29.7	33.7	35.9	36.4	32.5	32.4	35.2	40.1	44.4	44.1	39.1	38.7	42.5
Onehunga	24.4	26.4	26.7	26.9	26.0	25.9	25.9	29.7	30.3	29.8	29.0	28.8	29.1
Mount Roskill	20.2	21.3	21.9	23.2	20.6	20.5	20.6	23.8	24.7	26.7	22.9	22.9	23.0
Car Travel times to City Centre Mid Town from:													
Mangere	29.7	34.4	37.1	37.0	33.2	33.1	36.0	41.9	46.6	45.9	40.6	40.3	44.5
Onehunga	26.5	28.1	28.9	29.4	27.6	27.6	27.6	32.0	33.5	33.0	31.5	30.9	31.4
Mount Roskill	14.7	15.7	16.5	16.1	15.7	15.6	15.7	16.7	17.7	17.5	16.6	16.5	16.6
Car Travel times to City Centre Down Town from:													



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
Mangere	32.4	35.7	38.5	38.3	34.4	34.3	37.1	43.6	47.6	47.1	42.2	41.9	46.1
Onehunga	27.4	30.2	30.5	30.9	29.7	29.9	29.6	34.0	34.7	34.0	33.7	32.8	33.4
Mount Roskill	22.9	23.0	25.3	25.3	22.4	22.3	22.4	25.8	29.0	28.4	25.0	24.9	25.1
Car Travel times to City Centre Wynyard from:													
Mangere	30.3	35.6	38.3	38.1	34.1	34.0	36.8	45.2	48.8	48.2	43.1	42.8	47.0
Onehunga	27.3	30.3	30.5	30.7	29.7	29.6	29.5	36.0	36.1	35.8	34.5	34.5	34.7
Mount Roskill	22.8	24.2	25.5	25.0	23.4	23.4	23.4	28.4	30.2	29.6	27.4	27.3	27.5
PT Travel times to City Centre University from:													
Mangere	70.0	63.2	50.5	49.4	32.2	30.2	36.9	65.7	49.5	48.4	31.3	29.3	36.0
Onehunga	52.8	57.9	40.0	38.9	25.6	23.5	26.5	46.7	39.0	37.9	24.6	22.5	25.5
Mount Roskill	33.0	31.4	27.9	29.8	26.4	24.1	26.4	31.7	26.4	29.8	21.5	16.3	21.5
PT Travel times to City Centre Mid Town from:													
Mangere	63.8	56.6	45.8	44.7	35.6	33.6	40.3	59.0	44.9	43.8	34.6	32.6	39.3
Onehunga	45.1	55.9	35.4	34.3	28.9	26.8	29.8	45.9	34.4	33.3	27.9	25.8	28.8
Mount Roskill	38.4	39.1	35.2	31.0	29.7	27.4	29.7	39.6	30.4	25.2	24.8	19.6	24.8
PT Travel times to City Centre Down Town from:													
Mangere	55.6	52.8	47.8	46.7	41.4	39.4	46.1	55.2	46.8	45.7	40.4	38.4	45.1
Onehunga	39.9	43.6	37.3	36.2	34.7	32.6	35.6	43.6	36.3	35.2	33.7	31.6	34.6
Mount Roskill	35.8	41.0	36.0	33.0	35.5	35.5	35.5	41.7	32.3	27.1	30.6	25.4	30.6
PT Travel times to City Centre Wynyard from:													
Mangere	69.9	65.4	54.8	53.7	37.2	35.2	41.9	67.8	53.8	52.7	36.2	34.2	40.9
Onehunga	54.2	55.2	44.3	43.2	30.6	28.5	31.5	56.5	43.3	42.2	29.5	27.4	30.4
Mount Roskill	41.6	42.2	43.0	40.0	31.3	29.1	31.3	43.6	39.3	34.1	26.4	21.2	26.4
PT Travel times to Airport business from:													
Mangere	39.1	32.1	13.4	13.3	10.7	10.6	13.2	42.3	12.4	12.3	9.7	9.6	12.2
Onehunga	60.2	56.6	25.7	25.6	19.2	19.2	25.5	69.9	24.7	24.6	18.2	18.2	24.5
Mount Roskill	56.7	84.1	42.2	36.0	31.2	32.6	38.4	83.5	38.5	33.1	27.9	24.8	35.1



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
Freight Efficiency Impact													
% of VKT spent in severe congestion (LOS EF) on the Strategic Freight Network													
AM	28.2	31.3	31.5	31.4	31.3	31.1	31.3	47.2	46.8	46.8	46.7	47.0	46.7
IP	9.8	13.0	12.6	12.6	12.5	12.5	12.5	41.2	40.4	40.2	40.1	39.8	40.3
PM	30.8	38.7	38.8	38.6	38.3	38.3	38.4	52.3	51.5	51.8	51.5	51.4	51.8
<i>KPI</i> An attractive service that increases public transport mode share in the corridor and across Auckland.													
<i>KPI</i> Increased walking and cycling mode share in the corridor.													
<i>KPI</i> Effective and efficient integration between the proposed service and the broader PT network.													
Number of PT journeys within the corridor Corridor PT mode share. Mode share for education trips Active mode share in the corridor.													
CC2M Boardings													
AM Peak			9,325	8,906	15,340	14,233	14,412		14,816	14,665	24,157	23,184	22,328
Daily			39,139	39,107	67,227	63,060	62,167		64,589	64,760	106,379	102,987	95,664
Annual			10,919,837	10,910,769	18,756,445	17,593,601	17,344,481		18,020,359	18,067,901	29,679,713	28,733,401	26,690,117
Percentage of Corridor Separated from General Traffic and Pedestrianised Areas			45%	42%	100%	100%	82%		45%	42%	100%	100%	82%
Number of PT Boardings Regionally													
All PT													
Total Boardings All (annual)	83,799,239	162,892,562	167,955,052	167,861,148	171,929,498	171,874,995	170,548,584	230,038,705	237,819,791	236,779,154	243,191,799	242,866,875	241,364,939
Total Boardings/Capita All (annual)	52.8	84.4	87.0	87.0	89.1	89.0	88.3	98.7	102.0	101.6	104.3	104.2	103.5
Bus													
Total Boardings Bus (annual)	61,701,619	113,903,867	111,518,441	111,060,080	109,614,248	110,390,017	109,169,011	161,109,422	156,055,885	155,046,140	152,567,581	153,472,711	152,810,845



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
Total Boardings/Capita Bus (annual)	38.9	59.0	57.8	57.5	56.8	57.2	56.6	69.1	66.9	66.5	65.5	65.8	65.6
Heavy Rail													
Total Boardings Heavy Rail (annual)	18,505,847	44,427,440	42,082,770	42,484,785	41,026,359	41,218,172	41,346,706	62,703,530	59,390,118	59,377,447	57,934,990	57,570,829	58,493,726
Total Boardings/Capita Heavy Rail (annual)	11.7	23.0	21.8	22.0	21.3	21.4	21.4	26.9	25.5	25.5	24.9	24.7	25.1
Light Rail													
Total Boardings Light Rail (annual)	0	0	9,803,737	9,789,829	16,817,629	15,773,920	15,560,602	0	16,197,393	16,241,226	26,652,906	25,803,373	23,979,547
Total Boardings/Capita Light Rail (annual)	0.0	0.0	5.1	5.1	8.7	8.2	8.1	0.0	7.0	7.0	11.4	11.1	10.3
Ferry													
Total Boardings Ferry (annual)	3,591,776	4,561,201	4,550,104	4,526,440	4,471,322	4,492,959	4,472,192	6,225,803	6,176,343	6,114,296	6,036,320	6,019,901	6,080,904
Total Boardings/Capita Ferry (annual)	2.3	2.4	2.4	2.3	2.3	2.3	2.3	2.7	2.7	2.6	2.6	2.6	2.6
Passenger Kilometres													
Bus	482,489	809,686	776,743	778,259	767,554	775,123	764,788	1,097,366	1,049,298	1,049,048	1,037,651	1,047,465	1,035,276
Train	348,333	781,761	860,933	853,279	901,033	886,420	894,303	1,036,502	1,157,813	1,136,511	1,212,107	1,194,919	1,204,442
Ferry	57,113	69,048	69,202	69,109	68,557	68,492	68,527	97,971	97,590	96,320	94,678	94,667	96,444
<i>KPI</i> Effective and efficient integration between the proposed service and anticipated future rapid transit network.													
Regional Rapid Transit (AM peak 2 hours):													
Boardings	22,735	61,368	69,284	69,218	74,659	73,675	73,950	84,669	96,789	96,298	105,338	103,755	103,637
Pass. Kms	414,312	933,199	1,012,781	1,005,411	1,053,166	1,038,967	1,046,854	1,245,053	1,364,426	1,342,607	1,419,610	1,401,675	1,411,665
Capacity Kms.		2,489,170	3,150,724	3,117,823	3,649,204	3,588,626	3,337,921	2,765,990	3,430,413	3,398,386	3,931,428	3,870,205	3,618,378
% Utilisation		37%	32%	32%	29%	29%	31%	45%	40%	40%	36%	36%	39%
<i>KPI</i> Alleviation of current and forecast bus capacity constraints in the city centre													
Number of buses entering city Centre in AM peak													
AM													



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
Inbound	770	813	737	737	739	761	739	952	858	862	853	881	851
Outbound	339	520	492	484	492	496	492	586	560	551	562	567	561
IP													
Inbound	322	397	356	348	356	360	356	431	390	382	390	394	390
Outbound	317	398	358	350	358	362	358	421	384	376	385	387	385
PM													
Inbound	340	536	490	482	490	494	490	587	535	528	542	548	541
Outbound	729	769	715	715	717	739	717	854	778	783	783	810	782
<i>KPI</i> Increased corridor capacity and utilisation of capacity													
CC2M Spare Capacity at Peak Load Point (maximum capacity - Peak Load Demand)													
Modelled Maximum Capacity of CC2M (pax/hour/direction)			6,300	6,300	11,600	11,600	8,400		6,300	6,300	11,600	11,600	8,400
Maximum Potential Capacity (pphpd)			8,400	8,400	23,200	23,200	12,600		8,400	8,400	23,200	23,200	12,600
CC2M Demand at Peak Load Point (pax/hour/direction)			3,113	2,986	5,350	4,722	5,071		4,412	4,528	7,799	7,121	7,337
% Utilisation (modelled capacity)			49%	47%	46%	41%	60%		70%	72%	67%	61%	87%
Available capacity - modelled (pax/hour/direction)			3,187	3,314	6,250	6,878	3,329		1,888	1,772	3,801	4,479	1,063
Available Capacity Maximum (pphpd)			5,287	5,414	17,850	18,478	7,529		3,988	3,872	15,401	16,079	5,263
CC2M pax capacity kms / RT pax kms													
CC2M AM Boardings			9,324	8,903	15,338	14,232	14,409		14,817	14,668	24,158	23,184	22,328
CC2M AM Pax Kms			105,790	97,347	157,760	140,315	144,542		165,816	155,091	243,039	225,092	220,044
CC2M AM Capacity Kms			665,294	632,393	1,163,774	1,103,196	852,491		665,294	632,393	1,163,774	1,103,196	852,491
% Utilisation			16%	15%	14%	13%	17%		25%	25%	21%	20%	26%
<i>KPI</i> Reduced CO2 emissions													



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
CO Emissions - kg/24hr													
CO Total	86,265	29,614	29,514	29,542	29,458	29,460	29,482	6,513	6,455	6,460	6,432	6,432	6,441
CO Total/capita	0.054	0.015	0.015	0.015	0.015	0.015	0.015	0.003	0.003	0.003	0.003	0.003	0.003
CO2 Emissions - kg/24hr													
CO2 Total	9,153,355	9,731,787	9,702,635	9,709,690	9,685,668	9,686,447	9,693,377	4,674,653	4,642,267	4,644,284	4,625,308	4,624,954	4,631,823
CO2 Total/capita	5.769	5.041	5.026	5.030	5.017	5.018	5.021	2.005	1.991	1.992	1.984	1.984	1.987
VKT / 24hr													
VKT Total	35,598,592	42,600,212	42,455,316	42,476,836	42,393,208	42,393,296	42,422,976	52,789,652	52,375,112	52,404,864	52,278,968	52,279,892	52,319,216
VKT Total/capita	22	22	22	22	22	22	22	23	22	22	22	22	22
VKT Total less than 8.5t	32,937,948	39,291,012	39,143,992	39,165,872	39,083,528	39,082,548	39,112,316	48,694,436	48,279,648	48,309,232	48,189,228	48,188,028	48,228,356
VKT Total more than 8.5t	2,549,280	3,179,604	3,182,414	3,182,514	3,180,175	3,180,063	3,181,047	3,933,874	3,936,034	3,936,142	3,929,491	3,930,170	3,930,757
VKT Buses	111,073	129,562	128,824	128,511	129,442	130,722	129,442	161,245	159,564	159,361	160,285	161,693	160,178
<i>KPI</i> Reduced air pollution within the corridor													
NOX Emissions - kg/24hr													
NOX Total	86,265	29,614	29,514	29,542	29,458	29,460	29,482	6,513	6,455	6,460	6,432	6,432	6,441
NOX Total/capita	0.054	0.015	0.015	0.015	0.015	0.015	0.015	0.003	0.003	0.003	0.003	0.003	0.003
NO2 Emissions - kg/24hr													
NO2 Total	9,153,355	9,731,787	9,702,635	9,709,690	9,685,668	9,686,447	9,693,377	4,674,653	4,642,267	4,644,284	4,625,308	4,624,954	4,631,823
NO2 Total/capita	5.769	5.041	5.026	5.030	5.017	5.018	5.021	2.005	1.991	1.992	1.984	1.984	1.987
PM10E Emissions - kg/24hr													
PM10E Total	1,309	478	477	477	476	476	477	61	61	61	61	61	61
PM10E Total/capita	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Car Person Trips AM													
Home to Work	215,764	225,745	224,299	224,329	224,299	224,311	224,399	250,297	247,493	247,600	247,378	247,428	247,432
Home to Education	104,316	108,611	108,388	108,354	108,457	108,425	108,449	116,615	116,484	116,461	116,656	116,512	116,649



Indicators	2018	2031						2051 (Accessibility based land use scenario)					
		DM	1A	1B	2A	2B	3	DM	1A	1B	2A	2B	3
All Other Purposes	375,843	424,047	422,267	422,320	422,551	422,520	422,533	468,467	465,308	465,463	465,565	465,661	465,575
Total Car Person Trips	695,923	758,403	754,954	755,003	755,307	755,256	755,381	835,379	829,285	829,524	829,599	829,601	829,656
PT Person Trips AM													
Home to Work	30,520	60,455	62,267	62,150	62,842	62,756	62,615	84,710	88,266	88,012	89,279	89,172	88,934
Home to Education	26,177	36,367	36,635	36,648	36,679	36,660	36,684	49,238	49,815	49,748	50,234	50,235	50,238
All Other Purposes	11,833	22,357	23,500	23,468	23,594	23,551	23,538	31,116	33,508	33,379	33,741	33,658	33,622
Total PT Person Trips	68,530	119,179	122,402	122,266	123,115	122,967	122,837	165,064	171,589	171,139	173,254	173,065	172,794
Car Vehicle Trips AM													
Veh kilometres	5,787,375	6,594,431	6,570,928	6,573,058	6,572,829	6,572,049	6,572,539	7,667,284	7,616,746	7,618,804	7,619,955	7,616,116	7,616,957
Veh minutes	9,421,133	11,111,594	11,046,550	11,057,844	10,988,836	10,993,086	11,015,023	14,690,522	14,469,486	14,489,486	14,367,864	14,351,184	14,381,428
Vehicle trips	560,661	627,809	624,758	624,825	624,861	624,764	624,970	711,886	706,081	706,180	706,082	705,915	706,159
Av trip length (km)	11	11	11	11	11	11	11	12	12	12	12	12	12
Av trip time (min)	18	19	19	19	19	19	19	22	22	22	22	22	22
Av trip speed (kph)	37	36	36	36	36	36	36	31	32	32	32	32	32
Daily Person Trips													
Car	4,480,883	5,033,291	5,010,598	5,011,192	5,006,308	5,006,292	5,008,469	5,722,885	5,672,704	5,675,987	5,665,697	5,667,026	5,668,167
PT	275,827	498,476	512,469	512,086	514,071	513,962	513,075	704,265	734,089	732,674	737,554	736,947	735,815
Active	934,899	895,953	895,436	895,382	895,348	895,361	895,381	1,367,400	1,368,907	1,368,825	1,370,172	1,370,277	1,370,083
Total	5,691,609	6,427,720	6,418,503	6,418,660	6,415,727	6,415,615	6,416,925	7,794,550	7,775,700	7,777,486	7,773,423	7,774,250	7,774,065

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Appendix C: Summary of model results for the final 3 short listed options with higher intensification land use scenario



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
KPI									
Improved access to major and growing employment areas, especially the city centre and Auckland Airport precinct;									
Number of Jobs within 45min by PT from origins in the AM Peak from:									
Mangere Town Centre	79,780	88,483	206,379	367,323	284,606	82,065	247,207	452,773	346,183
Onehunga	165,136	183,188	331,227	379,108	371,809	194,045	405,544	463,881	437,561
Mt Roskill	208,209	264,750	300,741	342,981	314,532	297,096	414,691	423,047	403,296
Number of Households within 45min by PT to destinations in the AM Peak from:									
City Centre	202,704	293,210	299,868	307,813	305,084	354,075	378,545	405,418	399,246
Airport	3,840	24,387	72,916	118,189	74,228	19,838	97,008	164,245	116,737
PT Mode Share in the Corridor (No. and %)									
Mangere / Favona / Mangere Bridge AM (no.)									
Car	19,463.2	22,132.1	21,281	21,305	21,178	21,594	22,401	24,912	24,850
PT	1,756.1	2,845.6	3,951	3,933	4,071	3,693	6,135	7,372	7,433
Active	3,620.5	4,197.7	4,193	4,197	4,197	4,863	5,551	6,519	6,559
Mangere / Favona / Mangere Bridge AM (%)									
Car	78.4	75.9	72.3	72.4	71.9	71.6	65.7	64.2	64.0
PT	7.1	9.8	13.4	13.4	13.8	12.2	18.0	19.0	19.1
Active	14.6	14.4	14.2	14.3	14.3	16.1	16.3	16.8	16.9
Mangere / Favona / Mangere Bridge All Day (No.)									
Car	112,410.9	134,607.2	129,504	129,244	128,926	140,722	145,549	162,515	162,587
PT	5,299.6	8,993.8	12,681	12,680	13,131	11,806	20,148	24,050	24,292
Active	15,374.7	19,967.2	19,886	19,860	19,871	26,400	29,746	34,721	35,009
Mangere / Favona / Mangere Bridge All Day (%)									
Car	84.5	82.3	79.9	79.9	79.6	78.6	74.5	73.4	73.3
PT	4.0	5.5	7.8	7.8	8.1	6.6	10.3	10.9	10.9
Active	11.6	12.2	12.3	12.3	12.3	14.8	15.2	15.7	15.8
Onehunga AM (No.)									
Car	10,341.0	11,659.1	11,153	11,102	11,125	13,315	12,629	13,127	13,189



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
PT	616.2	1,230.8	1,630	1,709	1,683	1,938	3,008	3,412	3,318
Active	511.2	771.0	770	770	770	1,461	1,529	1,685	1,683
Onehunga AM (%)									
Car	90.2	85.3	82.3	81.8	81.9	79.7	73.6	72.0	72.5
PT	5.4	9.0	12.0	12.6	12.4	11.6	17.5	18.7	18.2
Active	4.5	5.6	5.7	5.7	5.7	8.7	8.9	9.2	9.3
Onehunga All Day (No.)									
Car	62,509	71,882	68,656	68,169	68,359	83,217	78,705	81,387	81,736
PT	2,133	4,324	5,914	6,202	6,106	6,741	10,844	12,149	11,842
Active	2,457	4,414	4,390	4,375	4,382	9,927	10,088	10,997	11,020
Onehunga All Day (%)									
Car	93.2	89.2	87.0	86.6	86.7	83.3	79.0	77.9	78.1
PT	3.2	5.4	7.5	7.9	7.7	6.7	10.9	11.6	11.3
Active	3.7	5.5	5.6	5.6	5.6	9.9	10.1	10.5	10.5
Mt. Roskill / Hillsborough AM (No.)									
Car	26,350	29,320	28,820	28,794	28,859	31,497	31,975	35,342	35,445
PT	2,565	4,290	4,712	4,875	4,809	6,043	7,663	9,163	8,971
Active	3,397	4,215	4,214	4,219	4,219	5,562	6,018	7,030	7,019
Mt. Roskill / Hillsborough AM (%)									
Car	81.6	77.5	76.4	76.0	76.2	73.1	70.0	68.6	68.9
PT	7.9	11.3	12.5	12.9	12.7	14.0	16.8	17.8	17.4
Active	10.5	11.1	11.2	11.1	11.1	12.9	13.2	13.6	13.6
Mt. Roskill / Hillsborough All Day (No.)									
Car	158,002	180,178	177,621	176,896	177,318	199,654	202,790	223,241	223,770
PT	7,910	13,412	14,632	15,158	14,968	18,873	24,181	28,761	28,204
Active	15,677	21,570	21,513	21,497	21,505	33,024	35,231	40,861	40,853
Mt. Roskill / Hillsborough All Day (%)									



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Car	87.0	83.7	83.1	82.8	82.9	79.4	77.3	76.2	76.4
PT	4.4	6.2	6.8	7.1	7.0	7.5	9.2	9.8	9.6
Active	8.6	10.0	10.1	10.1	10.1	13.1	13.4	14.0	14.0
CC2M Home to Work									
Car	20,661	23,350	22,463	22,429	22,470	25,398	27,385	30,058	30,226
PT	3,923	8,390	9,490	9,620	9,587	11,524	16,882	19,364	19,085
%PT	16%	26%	30%	30%	30%	31%	38%	39%	39%
CC2M Home to Education									
Car	4,319	4,990	5,126	5,094	5,099	6,443	7,925	8,834	8,818
PT	13,224	16,086	16,032	15,945	15,943	17,872	21,144	23,629	23,619
%PT	75%	76%	76%	76%	76%	74%	73%	73%	73%
CC2M All Trip Purposes									
Car	77,756	88,282	86,019	85,933	86,026	93,914	101,622	109,771	110,152
PT	10,587	19,084	21,071	21,259	21,182	25,557	35,013	39,360	38,867
%PT	12%	18%	20%	20%	20%	21%	26%	26%	26%
Mangere Home to Work									
Car	3,816	4,771	4,446	4,450	4,419	4,811	4,876	5,523	5,524
PT	364	799	1,280	1,277	1,337	1,087	2,151	2,797	2,804
%PT	9%	14%	22%	22%	23%	18%	31%	34%	34%
Mangere Home to Education									
Car	2,958	3,084	2,966	2,925	2,908	2,917	3,163	3,584	3,590
PT	800	1,076	1,125	1,113	1,121	1,335	1,575	1,840	1,852
%PT	21%	26%	28%	28%	28%	31%	33%	34%	34%
Mangere All Trip Purposes									
Car	12,658	14,957	14,262	14,255	14,164	14,754	15,425	17,463	17,405
PT	1,361	2,217	3,023	2,995	3,101	2,863	4,802	5,975	6,021
%PT	10%	13%	17%	17%	18%	16%	24%	25%	26%



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Onehunga Home to Work									
Car	1,231	1,715	1,582	1,564	1,579	2,378	2,171	2,314	2,354
PT	140	323	424	449	436	574	901	1,092	1,042
%PT	10%	16%	21%	22%	22%	19%	29%	32%	31%
Onehunga Home to Education									
Car	347	521	498	489	491	763	783	836	838
PT	121	222	228	223	223	401	451	489	485
%PT	26%	30%	31%	31%	31%	34%	37%	37%	37%
Onehunga All Trip Purposes									
Car	4,656	5,888	5,571	5,544	5,565	7,368	6,988	7,374	7,433
PT	326	684	856	888	869	1,202	1,779	2,081	2,004
%PT	7%	10%	13%	14%	14%	14%	20%	22%	21%
Mt Roskill Home to Work									
Car	5,102	5,402	5,252	5,186	5,218	5,757	5,766	6,475	6,536
PT	836	1,671	1,844	1,950	1,915	2,397	3,091	3,941	3,835
%PT	14%	24%	26%	27%	27%	29%	35%	38%	37%
Mt. Roskill Home to Education									
Car	2,668	2,832	2,821	2,803	2,809	3,039	3,250	3,771	3,771
PT	914	1,186	1,227	1,224	1,221	1,589	1,802	2,104	2,090
%PT	26%	30%	30%	30%	30%	34%	36%	36%	36%
Mt. Roskill All Trip Purposes									
Car	16,327	18,008	17,694	17,637	17,688	19,010	19,481	22,023	22,103
PT	2,027	3,343	3,643	3,775	3,726	4,656	5,918	7,328	7,162
%PT	11%	16%	17%	18%	17%	20%	23%	25%	24%
Sandringham / Dominion Home to Work									
Car	7,255	7,648	7,457	7,493	7,513	7,803	9,898	10,850	10,900
PT	1,862	3,743	3,990	3,989	3,960	4,699	7,632	8,267	8,174



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
%PT	20%	33%	35%	35%	35%	38%	44%	43%	43%
Sandringham / Dominion Home to Education									
Car	4,180	5,571	5,726	5,727	5,756	5,898	7,028	8,320	8,328
PT	1,062	1,583	1,617	1,605	1,604	2,027	2,965	3,215	3,207
%PT	20%	22%	22%	22%	22%	26%	30%	28%	28%
Sandringham / Dominion All Trip Purposes									
Car	23,115	25,600	25,234	25,363	25,395	25,608	32,982	35,686	35,770
PT	3,358	6,187	6,552	6,533	6,496	7,811	12,513	13,488	13,351
%PT	13%	19%	21%	20%	20%	23%	28%	27%	27%
City Centre - CC2M Home to Work									
Car	1,938	1,797	1,694	1,721	1,730	1,929	2,067	2,309	2,333
PT	2,439	4,481	5,071	5,102	5,101	6,006	8,872	10,230	10,082
%PT	56%	71%	75%	75%	75%	76%	81%	82%	81%
City Centre CC2M Home to Education									
Car	1,259	1,606	1,575	1,576	1,575	1,375	1,525	1,596	1,603
PT	1,856	2,614	2,677	2,829	2,831	3,163	3,919	4,685	4,645
%PT	60%	62%	63%	64%	64%	70%	72%	75%	74%
City Centre CC2M All Trip Purposes									
Car	8,430	8,648	8,337	8,407	8,418	8,782	9,065	9,572	9,643
PT	5,695	9,224	10,029	10,208	10,209	11,956	16,123	18,468	18,241
%PT	40%	52%	55%	55%	55%	58%	64%	66%	65%
Airport Terminal and Business Home to Work									
Car	677	738	674	657	666	666	690	790	804
PT	20	99	287	312	287	155	902	1,241	1,163
%PT	3%	12%	30%	32%	30%	19%	57%	61%	59%
Airport Terminal All Purposes									
Car	1,571	1,836	1,683	1,641	1,668	2,047	2,062	2,266	2,348



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
PT	30	160	422	458	425	283	1,366	1,862	1,762
%PT	2%	8%	20%	22%	20%	12%	40%	45%	43%
Airport Commercial CC2M Home to Work									
Car	1,010	1,521	1,427	1,421	1,413	1,745	1,743	1,954	1,935
PT	50	90	150	163	151	160	361	423	403
%PT	5%	6%	10%	10%	10%	8%	17%	18%	17%
Airport Commercial CC2M All Purposes									
Car	2,524	3,797	3,619	3,600	3,595	4,639	4,593	5,003	4,960
PT	86	147	247	263	247	265	599	683	662
%PT	3%	4%	6%	7%	6%	5%	12%	12%	12%
KPI									
Improved access to education from communities along the corridor;									
Number of Education Opportunities within 45min by PT from origins in the AM Peak									
Mangere Town Centre									
Primary	18,941	18,649	34,626	42,217	38,558	18,382	39,640	51,625	44,781
Secondary	13,749	12,190	25,060	31,121	26,636	11,335	28,586	37,565	31,914
Tertiary	9,081	14,100	15,788	111,066	93,252	4,828	22,541	131,990	114,614
TOTAL	41,771	44,940	75,473	184,404	158,446	34,545	90,767	221,179	191,309
Onehunga									
Primary	24,489	23,665	37,366	40,233	39,450	23,506	40,935	48,938	46,208
Secondary	14,601	14,836	28,055	37,347	37,112	16,122	31,652	42,742	39,664
Tertiary	4,323	4,889	94,331	97,822	94,332	5,787	112,025	116,251	111,702
TOTAL	43,413	43,390	159,752	175,402	170,893	45,416	184,612	207,931	197,573
Mount Roskill									
Primary	19,644	21,740	33,476	32,316	27,968	24,850	45,216	47,251	43,927
Secondary	23,588	27,599	25,556	33,250	32,500	28,447	39,939	41,343	38,682
Tertiary	77,097	93,774	93,772	94,332	93,774	111,005	112,027	112,139	112,103
TOTAL	120,329	143,112	152,805	159,898	154,241	164,301	197,181	200,733	194,711



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
KPI <i>Improved travel times for key journeys along the corridor</i>									
PT travel times compared to car travel times between key centres along the corridor (including the City Centre, Airport, Mt Roskill, Onehunga and Mangere).									
CC2M Travel times to Airport business from:									
Mangere			6.9	4.5	7.0		6.9	4.5	7.0
Onehunga			18.3	12.1	18.4		18.3	12.1	18.4
Mount Roskill			26.6	20.1	29.9		26.6	20.1	29.9
CC2M Travel times to Mid Town from:									
Mangere			36.6	27.3	32.0		36.6	27.3	32.0
Onehunga			25.2	19.7	20.6		25.2	19.7	20.6
Mount Roskill			17.0	11.8	11.8		17.0	11.8	11.8
CC2M Travel times to Universities Station from:									
Mangere				25.0	29.7			25.0	29.7
Onehunga				17.4	18.3			17.4	18.3
Mount Roskill				9.5	9.5			9.5	9.5
CC2M Travel times to Wynyard from:									
Mangere			48.3	29.2	33.9		48.3	29.2	33.9
Onehunga			36.9	21.6	22.5		36.9	21.6	22.5
Mount Roskill			28.7	13.7	13.7		28.7	13.7	13.7
Car Travel times to Airport business from:									
Mangere	7.6	9.9	10.9	8.9	10.8	15.8	18.4	15.9	19.7
Onehunga	11.6	16.6	16.0	15.3	15.9	29.1	27.6	27.8	28.5
Mount Roskill	16.1	20.5	20.0	19.0	19.5	36.2	34.8	34.3	35.0
Car Travel times to City Centre University from:									
Mangere	29.7	33.7	36.4	32.5	35.2	40.1	45.4	42.3	46.5
Onehunga	24.4	26.4	26.9	26.0	25.9	29.7	31.1	30.7	30.9
Mount Roskill	20.2	21.3	23.2	20.6	20.6	23.8	27.7	24.5	24.6



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Car Travel times to City Centre Mid Town from:									
Mangere	29.7	34.4	37.0	33.2	36.0	41.9	47.4	43.1	47.6
Onehunga	26.5	28.1	29.4	27.6	27.6	32.0	34.1	33.2	33.3
Mount Roskill	20.3	20.6	23.2	20.0	20.0	23.1	27.8	23.9	24.0
Car Travel times to City Centre Down Town from:									
Mangere	32.4	35.7	38.3	34.4	37.1	43.6	48.7	44.5	49.0
Onehunga	27.4	30.2	30.9	29.7	29.6	34.0	35.2	34.9	35.3
Mount Roskill	22.9	23.0	25.3	22.4	22.4	25.8	30.1	26.5	26.7
Car Travel times to City Centre Wynyard from:									
Mangere	30.3	35.6	38.1	34.1	36.8	45.2	49.7	45.2	49.9
Onehunga	27.3	30.3	30.7	29.7	29.5	36.0	36.6	36.1	36.6
Mount Roskill	22.8	24.2	25.0	23.4	23.4	28.4	31.0	28.5	28.7
PT Travel times to City Centre University from:									
Mangere	70.0	63.2	49.4	32.2	36.9	65.7	48.4	31.3	36.0
Onehunga	52.8	57.9	38.9	25.6	26.5	46.7	37.9	24.6	25.5
Mount Roskill	33.0	31.4	29.8	26.4	26.4	31.7	29.8	21.5	21.5
PT Travel times to City Centre Mid Town from:									
Mangere	63.8	56.6	44.7	35.6	40.3	59.0	43.8	34.6	39.3
Onehunga	45.1	55.9	34.3	28.9	29.8	45.9	33.3	27.9	28.8
Mount Roskill	33.9	33.1	31.0	29.7	29.7	33.5	25.2	24.8	24.8
PT Travel times to City Centre Down Town from:									
Mangere	55.6	52.8	46.7	41.4	46.1	55.2	45.7	40.4	45.1
Onehunga	39.9	43.6	36.2	34.7	35.6	43.6	35.2	33.7	34.6
Mount Roskill	35.8	41.0	33.0	35.5	35.5	41.7	27.1	30.6	30.6
PT Travel times to City Centre Wynyard from:									
Mangere	69.9	65.4	53.7	37.2	41.9	67.8	52.7	36.2	40.9
Onehunga	54.2	55.2	43.2	30.6	31.5	56.5	42.2	29.5	30.4



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Mount Roskill	41.6	42.2	40.0	31.3	31.3	43.6	34.1	26.4	26.4
PT Travel times to Airport business from:									
Mangere	39.1	32.1	13.3	10.7	13.2	42.3	12.3	9.7	12.2
Onehunga	60.2	56.6	25.6	19.2	25.5	69.9	24.6	18.2	24.5
Mount Roskill	56.7	84.1	36.0	31.2	38.4	83.5	33.1	27.9	35.1
Freight Efficiency Impact									
% of VKT spent in severe congestion (LOS EF) on the Strategic Freight Network									
AM	28.2	31.3	31.4	31.3	31.3	47.2	46.6	47.2	47.2
IP	9.8	13.0	12.6	12.5	12.5	41.2	41.3	39.7	39.9
PM	30.8	38.7	38.6	38.3	38.4	52.3	51.7	51.0	50.7
KPI									
An attractive service that increases public transport mode share in the corridor and across Auckland									
KPI									
Increased walking and cycling mode share in the corridor									
KPI									
Effective and efficient integration between the proposed service and the broader PT network.									
CC2M Boardings									
AM Peak			8,906	15,340	14,412		16,505	28,822	26,411
Daily			39,107	67,227	62,167		72,605	125,252	111,724
Annual			10,910,769	18,756,445	17,344,481		20,256,851	34,945,169	31,170,996
Percentage of Corridor Separated from General Traffic and Pedestrianised Areas			42%	100%	82%		42%	100%	82%
Number of PT Boardings Regionally									
All PT									
Total Boardings All (annual)	83,799,239	162,892,562	167,861,148	171,929,498	170,548,584	230,038,705	240,883,615	248,801,954	245,711,233
Total Boardings/Capita All (annual)	52.8	84.4	87.0	89.1	88.3	98.7	103.3	106.7	105.4
Bus									
Total Boardings Bus (annual)	61,701,619	113,903,867	111,060,080	109,614,248	109,169,011	161,109,422	154,983,514	151,727,720	151,519,602
Total Boardings/Capita Bus (annual)	38.9	59.0	57.5	56.8	56.6	69.1	66.5	65.1	65.0



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Heavy Rail									
Total Boardings Heavy Rail (annual)	18,505,847	44,427,440	42,484,785	41,026,359	41,346,706	62,703,530	61,669,356	59,905,763	60,369,499
Total Boardings/Capita Heavy Rail (annual)	11.7	23.0	22.0	21.3	21.4	26.9	26.5	25.7	25.9
Light Rail									
Total Boardings Light Rail (annual)	0	0	9,789,829	16,817,629	15,560,602	0	18,199,409	31,356,950	27,988,733
Total Boardings/Capita Light Rail (annual)	0.0	0.0	5.1	8.7	8.1	0.0	7.8	13.5	12.0
Ferry									
Total Boardings Ferry (annual)	3,591,776	4,561,201	4,526,440	4,471,322	4,472,192	6,225,803	6,031,156	5,811,448	5,833,484
Total Boardings/Capita Ferry (annual)	2.3	2.4	2.3	2.3	2.3	2.7	2.6	2.5	2.5
Passenger Kilometres									
Bus	482,489	809,686	778,259	767,554	764,788	1,097,366	1,032,577	1,006,895	1,001,724
Train	348,333	781,761	853,279	901,033	894,303	1,036,502	1,173,409	1,276,139	1,256,192
Ferry	57,113	69,048	69,109	68,557	68,527	97,971	92,166	88,891	89,671
KPI <i>Effective and efficient integration between the proposed service and anticipated future rapid transit network.</i>									
Regional Rapid Transit (AM peak 2 hours):									
Boardings	28,371	61,368	69,218	74,659	73,950	84,669	99,626	110,144	107,737
Pass. Kms	414,312	933,199	1,005,411	1,053,166	1,046,854	1,245,053	1,369,334	1,470,198	1,449,685
Capacity Kms.	1,486,288	2,489,170	3,117,823	3,649,204	3,337,921	2,765,990	3,398,386	3,931,428	3,618,378
% Utilisation	28%	37%	32%	29%	31%	45%	40%	37%	40%
KPI <i>Alleviation of current and forecast bus capacity constraints in the city centre;</i>									
Number of buses entering city Centre in AM peak									
AM									
Inbound	770	813	737	739	739	952	862	853	851
Outbound	339	520	484	492	492	586	551	562	561
IP									
Inbound	322	397	348	356	356	431	382	390	390



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Outbound	317	398	350	358	358	421	376	385	385
PM									
Inbound	340	536	482	490	490	587	528	542	541
Outbound	729	769	715	717	717	854	783	783	782
KPI <i>Increased corridor capacity and utilisation of capacity;</i>									
CC2M Spare Capacity at Peak Load Point (maximum capacity - Peak Load Demand)									
Modelled Maximum Capacity of CC2M (pax/hour/direction)			6,300	11,600	8,400		6,300	11,600	8,400
Maximum Potential Capacity (pphpd)			8,400	23,200	12,600		8,400	23,200	12,600
CC2M Demand at Peak Load Point (pax/hour/direction)			2,986	5,350	5,071		5,036	9,345	8,193
% Utilisation (modelled capacity)			47%	46%	60%		80%	81%	98%
Available capacity - modelled (pax/hour/direction)			3,314	6,250	3,329		1,264	2,255	207
Available Capacity Maximum (pphpd)			5,414	17,850	7,529		3,364	13,855	4,407
CC2M pax capacity kms / RT pax kms									
CC2M AM Boardings			8,903	15,338	14,409		16,503	28,824	26,409
CC2M AM Pax Kms			97,347	157,760	144,542		165,583	281,896	249,694
CC2M AM Capacity Kms			632,393	1,163,774	852,491		632,393	1,163,774	852,491
% Utilisation			15%	14%	17%		26%	24%	29%
INVESTMENT OBJECTIVE 2 <i>A transport intervention that embeds sustainable practice and that reduces Auckland's carbon footprint</i>									
KPI <i>Reduced CO2 emissions</i>									
CO Emissions - kg/24hr									
CO Total	86,265	29,614	29,542	29,458	29,482	6,513	6,417	6,387	6,392
CO Total/capita	0.054	0.015	0.015	0.015	0.015	0.003	0.003	0.003	0.003
CO2 Emissions - kg/24hr									
CO2 Total	9,153,355	9,731,787	9,709,690	9,685,668	9,693,377	4,674,653	4,613,445	4,594,175	4,597,813



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
CO2 Total/capita	5.769	5.041	5.030	5.017	5.021	2.005	1.979	1.971	1.972
VKT /24hr									
VKT Total	35,598,592	42,600,212	42,476,836	42,393,208	42,422,976	52,789,652	52,046,380	51,869,072	51,892,752
VKT Total/capita	22	22	22	22	22	23	22	22	22
VKT Total less than 8.5t	32,937,948	39,291,012	39,165,872	39,083,528	39,112,316	48,694,436	47,980,424	47,808,448	47,834,016
VKT Total more than 8.5t	2,549,280	3,179,604	3,182,514	3,180,175	3,181,047	3,933,874	3,906,728	3,900,368	3,898,666
VKT Buses	111,073	129,562	128,511	129,442	129,442	161,245	159,361	160,285	160,178
KPI Reduced air pollution within the corridor									
NOX Emissions - kg/24hr									
NOX Total	86,265	29,614	29,542	29,458	29,482	6,513	6,417	6,387	6,392
NOX Total/capita	0.054	0.015	0.015	0.015	0.015	0.003	0.003	0.003	0.003
NO2 Emissions - kg/24hr									
NO2 Total	9,153,355	9,731,787	9,709,690	9,685,668	9,693,377	4,674,653	4,613,445	4,594,175	4,597,813
NO2 Total/capita	5.769	5.041	5.030	5.017	5.021	2.005	1.979	1.971	1.972
PM10E Emissions - kg/24hr									
PM10E Total	1,309	478	477	476	477	61	60	60	60
PM10E Total/capita	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Car Person Trips AM									
Home to Work	215,764	225,745	224,329	224,299	224,399	250,297	245,899	245,194	245,455
Home to Education	104,316	108,611	108,354	108,457	108,449	116,615	116,620	116,976	116,985
All Other Purposes	375,843	424,047	422,320	422,551	422,533	468,467	464,798	464,614	465,001
Total Car Person Trips	695,923	758,403	755,003	755,307	755,381	835,379	827,317	826,784	827,441
PT Person Trips AM									
Home to Work	30,520	60,455	62,150	62,842	62,615	84,710	89,555	91,818	91,232
Home to Education	26,177	36,367	36,648	36,679	36,684	49,238	50,314	50,778	50,695
All Other Purposes	11,833	22,357	23,468	23,594	23,538	31,116	34,067	34,864	34,623



Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Total PT Person Trips	68,530	119,179	122,266	123,115	122,837	165,064	173,936	177,460	176,550
Car Vehicle Trips AM									
Veh kilometres	5,787,375	6,594,431	6,573,058	6,572,829	6,572,539	7,667,284	7,574,398	7,572,370	7,568,687
Veh minutes	9,421,133	11,111,594	11,057,844	10,988,836	11,015,023	14,690,522	14,366,748	14,197,646	14,245,276
Vehicle trips	560,661	627,809	624,825	624,861	624,970	711,886	703,031	702,124	702,335
Av trip length (km)	11	11	11	11	11	12	12	12	12
Av trip time (min)	18	19	19	19	19	22	22	22	22
Av trip speed (kph)	37	36	36	36	36	31	32	32	32
Daily Person Trips									
Car	4,480,883	5,033,291	5,011,192	5,006,308	5,008,469	5,722,885	5,646,232	5,628,859	5,636,050
PT	275,827	498,476	512,086	514,071	513,075	704,265	745,267	757,219	754,023
Active	934,899	895,953	895,382	895,348	895,381	1,367,400	1,373,996	1,376,265	1,376,538
Total	5,691,609	6,427,720	6,418,660	6,415,727	6,416,925	7,794,550	7,765,495	7,762,343	7,766,611
PT Service Characteristics (Morning Peak 2 hours)									
Bus Service kilometres	28,337	33,258	33,182	33,316	33,316	42,795	42,244	42,315	#REF!
Rail Service kilometres	2,386	3,416	4,922	5,423	5,446	3,161	4,666	5,167	5,190
Ferry Service kilometres	902	1,268	1,268	1,268	1,268	1,574	1,574	1,574	1,574
Bus pas kilometres	482,489	809,686	778,259	767,554	764,788	1,097,366	1,032,577	1,006,895	1,001,724
Rail pas kilometres	348,333	781,761	853,279	901,033	894,303	1,036,502	1,173,409	1,276,139	1,256,192
Ferry pas kilometres	57,113	69,048	69,109	68,557	68,527	97,971	92,166	88,891	89,671
Households, Population, Employment									
Households									
City Centre		18,818	18,818	18,818	18,818	25,748	25,748	25,748	25,748
Sandringham / Dominion		20,971	20,971	20,971	20,971	24,900	38,291	42,617	42,619
Mt. Roskill / Hillsborough		13,769	13,769	13,769	13,769	17,024	19,075	23,403	23,351
Onehunga		3,477	3,477	3,477	3,477	5,266	5,729	6,446	6,412
Mangere Bridge / Mangere / Favona		12,310	12,310	12,310	12,310	15,775	19,229	23,955	24,068



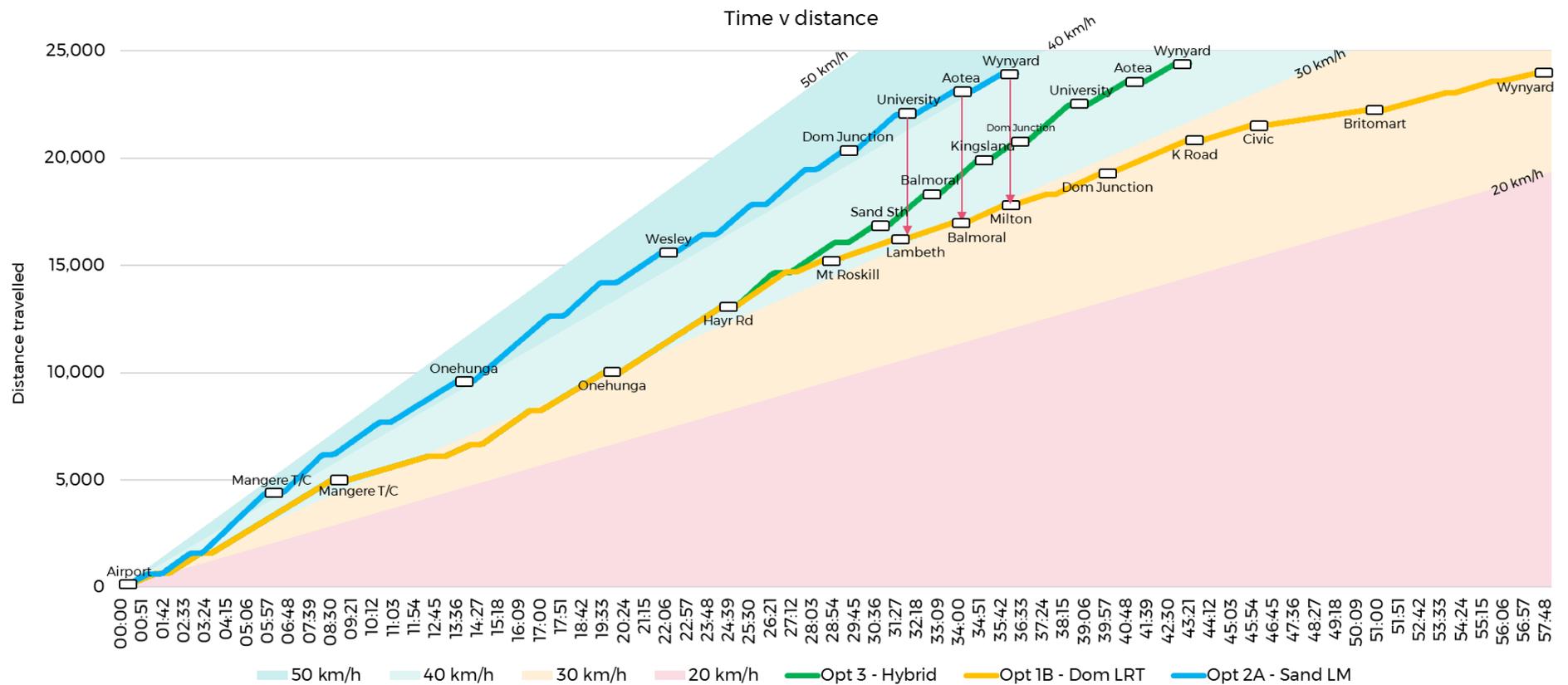
Indicators	2018	2031 with DM land use				2051 (higher intensification land use scenario)			
		DM	1B	2A	3	DM	1B	2A	3
Airport Terminal and Business		17	17	17	17	33	220	456	464
Airport Business Precinct		1,799	1,799	1,799	1,799	2,336	2,791	3,458	3,422
Total CC2M		71,159	71,159	71,159	71,159	91,083	111,083	126,083	126,083
Rest of Auckland		600,068	600,068	600,068	600,068	754,871	734,871	719,871	719,871
Population									
City Centre		44,471	44,471	44,471	44,471	57,130	57,130	57,130	57,130
Sandringham / Dominion		59,655	59,655	59,655	59,655	71,772	102,933	112,999	113,003
Mt. Roskill / Hillsborough		45,195	45,195	45,195	45,195	54,096	58,870	68,939	68,820
Onehunga		9,143	9,143	9,143	9,143	14,200	15,277	16,946	16,866
Mangere Bridge / Mangere / Favona		47,125	47,125	47,125	47,125	54,678	62,714	73,711	73,973
Airport Terminal and Business		49	49	49	49	92	526	1,077	1,094
Airport Business Precinct		6,880	6,880	6,880	6,880	7,720	8,777	10,330	10,246
Total CC2M		212,517	212,517	212,517	212,517	259,688	306,227	341,132	341,132
Rest of Auckland		1,717,973	1,717,973	1,717,973	1,717,973	2,071,482	2,024,943	1,990,038	1,990,038
Employment									
City Centre		129,300	129,300	129,300	129,300	163,589	165,839	167,839	167,839
Sandringham / Dominion		21,360	21,360	21,360	21,360	22,757	30,257	30,257	30,257
Mt. Roskill / Hillsborough		9,981	9,981	9,981	9,981	11,749	11,749	11,749	11,749
Onehunga		7,547	7,547	7,547	7,547	7,765	7,765	7,765	7,765
Mangere Bridge / Mangere / Favona		7,477	7,477	7,477	7,477	7,810	7,810	7,810	7,810
Airport Terminal and Business		12,413	12,413	12,413	12,413	16,451	18,701	20,701	20,701
Airport Business Precinct		15,533	15,533	15,533	15,533	21,024	21,024	21,024	21,024
Total CC2M		203,612	203,612	203,612	203,612	251,144	263,144	267,144	267,144
Rest of Auckland		606,191	606,191	606,191	606,191	709,377	697,377	693,377	693,377



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Appendix D: Time distance chart – 3 shortlist options





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Appendix E: Origin – destination matrices

Option 1B Destination Stations for People boarding at origin stations

ALL PURPOSES

Origin Stations	Destination Stations																			Total	
	Airport	Airport North	Landing Dr	Mangere TC	Bader Dr	Miller Rd	Mangere Bridge	Onehunga	Hayr Rd	Puketepapa	Mt Roskill	Lambeth Rd	Balmoral Rd	Eden Valley	Dom Junction	K Rd	Civic	Britomart	Vic Park		Wynyard
Mangere Bridge	5	59	11	9	6	2		62	6	8	16	1	4	6	3	29	95	28	2	28	380
Miller Rd	4	91	14	7			4	102	14	19	48	4	9	13	8	58	170	43	4	68	678
Bader Dr	8	111	5				9	103	10	14	35	3	7	10	6	53	222	49	4	49	696
Mangere TC	16	569				12	23	212	42	46	108	13	23	34	15	109	480	92	9	98	1,901
Sub-Total	32	830	30	16	6	14	35	477	71	88	208	21	43	63	32	248	967	212	19	242	3,655
Onehunga	31	316	70	64	71	24	36		29	30	85	15	24	44	22	129	476	161	13	190	1,830
Lambeth Rd	2	27	5	8	5	3	2	32	6	4				14	13	80	131	62	4	79	477
Mt Roskill	37	342	75	80	71	35	32	226	20			17	26	103	30	192	566	164	19	442	2,475
Puketepapa	11	92	19	30	18	10	8	93	6			4	5	16	8	64	128	50	5	77	645
Sub-Total	51	461	99	118	94	47	42	351	31	4	0	21	30	133	51	336	826	275	29	598	3,597

Work

Origin Stations	Destination Stations																			Total	
	Airport	Airport North	Landing Dr	Mangere TC	Bader Dr	Miller Rd	Mangere Bridge	Onehunga	Hayr Rd	Puketepapa	Mt Roskill	Lambeth Rd	Balmoral Rd	Eden Valley	Dom Junction	K Rd	Civic	Britomart	Vic Park		Wynyard
Mangere Bridge	1	38	7	3	2	0		28	2	3	4	0	1	2	2	19	36	21	1	24	196
Miller Rd	1	61	9	2			2	49	5	8	9	1	3	5	5	38	57	33	2	61	352
Bader Dr	2	71	3				4	46	3	5	6	1	2	4	4	32	62	37	1	43	325
Mangere TC	2	398				2	12	96	17	17	20	3	6	15	11	64	119	69	3	85	938
Sub-total	6	567	20	5	2	3	17	219	27	33	39	5	12	26	23	153	274	161	7	213	1,811
Onehunga	5	237	53	21	33	5	18		11	9	17	4	6	18	15	88	173	132	6	170	1,021
Lambeth Rd	1	22	4	3	3	1	1	20	3	2				7	10	62	98	53	2	74	366
Mt Roskill	6	273	61	27	38	9	17	126	9			4	8	46	21	136	308	135	11	409	1,645
Puketepapa	4	74	16	11	10	3	5	52	3			1	2	6	6	46	91	42	3	70	442
Sub-total	11	369	81	41	50	13	23	198	14	2	0	5	10	59	37	245	497	230	16	552	2,453

Education

Origin Stations	Destination Stations																			Total	
	Airport	Airport North	Landing Dr	Mangere TC	Bader Dr	Miller Rd	Mangere Bridge	Onehunga	Hayr Rd	Puketepapa	Mt Roskill	Lambeth Rd	Balmoral Rd	Eden Valley	Dom Junction	K Rd	Civic	Britomart	Vic Park		Wynyard
16 Mangere Bridge	1	0	0	3	2	1		6	1	1	8	0	1	0	0	4	44	1	1	0	74
17 Miller Rd	1	0	0	2			1	14	3	5	31	1	3	2	1	11	94	2	2	0	173
18 Bader Dr	4	0	0				2	18	2	4	22	1	2	1	1	12	135	2	2	0	209
19 Mangere TC	3	1				7	5	36	13	16	69	6	10	6	2	28	317	4	5	0	526
Sub-Total	9	1	0	4	2	7	8	73	20	26	130	8	16	10	3	55	590	9	9	1	982
15 Onehunga	3	1	1	26	23	13	9		8	15	48	6	9	7	2	21	243	4	5	0	443
11 Lambeth Rd	0	0	0	3	1	1	0	3	2	1				2	1	8	13	1	1	0	38
12 Mt Roskill	4	1	1	35	22	18	8	23	6			8	10	15	2	29	180	4	6	1	375
13 Puketepapa	3	0	0	14	5	4	2	11	2			2	1	2	1	10	14	1	2	0	75
Sub-Total	8	1	1	53	29	23	10	37	10	1	0	10	12	18	4	47	207	7	10	1	488



Row Labels	01 Wynyard	02 Vic Park	04 Britomart	05 Civic	06 K Rd	07 Dom Junction	08 Eden Valley	10 Balmoral Rd	11 Lambeth Rd	12 Mt Roskill	13 Puketepapa	14 Hayr Rd	15 Onehunga	16 Mangere Bridge	17 Miller Rd	18 Bader Dr	19 Mangere TC	20 Landing Dr	21 Airport North	22 Airport	Grand Total		
01 Wynyard					18	12	17	5	3	10	5	5	14	1	2	3	3	2	12	112	225		
02 Vic Park						21	19	7	3	9	4	1	13	2	3	6	3	5	25	14	135		
04 Britomart						19	71	21	14	31	6	2	33	8	7	16	7	14	63	170	483		
05 Civic						50	118	33	23	38	16	10	71	13	15	29	19	26	156	286	884		
06 K Rd	64					9	69	25	14	11	6	8	34	6	7	15	8	15	65	49	404		
07 Dom Junction	163	10	118	169	84		5	10	4	6	2	4	12	3	3	6	4	7	33	7	650		
08 Eden Valley	344	16	208	520	198	7		13	8	34	11	11	51	4	5	9	13	11	54	5	1523		
10 Balmoral Rd	199	9	114	334	113	16	10			29	10	13	63	7	7	14	19	16	76	6	1055		
11 Lambeth Rd	79	4	62	131	80	13	14				4	6	32	2	3	5	8	5	27	2	477		
12 Mt Roskill	442	19	164	566	192	30	103	26	17			20	226	32	35	71	80	75	342	37	2475		
13 Puketepapa	77	5	50	128	64	8	16	5	4			6	93	8	10	18	30	19	92	11	645		
14 Hayr Rd	161	6	1	187	23	19	28	17	10	7	3		114	12	15	26	49	31	144	20	871		
15 Onehunga	190	13	161	476	129	22	44	24	15	85	30	29		36	24	71	64	70	316	31	1830		
16 Mangere Bridge	28	2	28	95	29	3	6	4	1	16	8	6	62		2	6	9	11	59	5	380		
17 Miller Rd	68	4	43	170	58	8	13	9	4	48	19	14	102	4		7	14	91	4	678			
18 Bader Dr	49	4	49	222	53	6	10	7	3	35	14	10	103	9			5	111	8	696			
19 Mangere TC	98	9	2	480	109	15	34	23	13	108	46	42	212	23	12				569	16	1901		
20 Landing Dr	4	1	4	24	5	1	1	0	6	2	1	1	12	1	1	1				9	75		
21 Airport North	16	2	20	59	2	3	6	5	2	21	12	7	62	5	5	5	36				284		
22 Airport	96	12	140	209	83	6	6	6	4	62	30	26	47	8	4	8	13	69	4		832		
Grand Total	2076	118	1253	3769	1260	267	591	240	142	556	230	219	1357	185	158	307	373	394	2218	792	16503		
Total inbound	2078	116	1254	3770	1243	157	291	127	73	388	164	135	600	50	22	14	49	69	4	0	10604		
Total inbound in red zone	710	53	376	994	220	10	13	11	4													2391	22.5%
Total inbound in orange zone	797	37	376	741	269	32	57	24	15	89	44	34										2515	23.7%
Total inbound in light green zone	507	16	176	811	87	22	50	20	7	108	46	18	121	8								2067	19.5%
Total inbound in green zone	64	10	326	1154	667	9	171	72	47	191	74	101	479	42	22	14	49	69	4	0		3649	34.4%
Total in orange zone with no seat	797	37	376	741	216	11	13															2191	20.7%
Total in red zone with no seat	447	25	71																			543	5.1%

- more than 30 minute journey time
- 20-30 minute journey time
- 15-20 minute journey time
- 15 minute journey time

Passengers in this zone have no seat.
They represent 543, or 5.1% of all inbound passengers
They will stand more than 30 minutes

Passengers in this zone have no seat.
They represent 2,191, or 20.7% of all inbound passengers
They will stand between 20 and 30 minutes

Passengers in this zone will have a seat
They represent 3,077, or 29% of all inbound passengers

Option 1B: Dominion Road light rail

2051 AM 2hr boardings
(exclude rail to rail transfers)



Option 2A Destination Stations for People boarding at origin stations

ALL PURPOSES

Origin Stations	Destination Stations																	Total
	Airport	Airport North	Landing Dr	Mangere TC	Favona	Mangere Bridge	Onehunga	Hayr Rd	Puketepapa	Wesley	Sandringham South	Balmoral Rd	Kingsland	Dom Junction	City Uni	Aotea	Wynyard	
Mangere Bridge	30	111	23	31			89	9	10	30	8	8	21	12	158	179	74	793
Favona	31	244	39	21			152	19	22	69	19	16	48	24	467	346	145	1,662
Mangere TC	38	703			10	34	290	44	57	128	40	36	76	42	910	525	252	3,184
Sub-total	98	1,058	62	52	10	34	531	72	88	228	66	60	146	78	1,535	1,050	471	5,639
Onehunga	77	428	80	110	30	36		28	54	103	28	35	93	37	599	548	331	2,618
Sandringham South	13	87	16	29	6	6	58	9	2			7	48	32	411	467	245	1,437
Wesley	48	313	57	107	27	23	259	27	16			56	76	84	1,418	1,155	636	4,302
Puketepapa	31	156	29	60	13	11	150	7		21	2	16	40	11	248	261	190	1,244
Sub-total	92	555	102	196	46	39	467	43	19	21	2	79	164	126	2,078	1,883	1,072	6,983

Work

Origin Stations	Destination Stations																	Total
	Airport	Airport North	Landing Dr	Mangere TC	Favona	Mangere Bridge	Onehunga	Hayr Rd	Puketepapa	Wesley	Sandringham South	Balmoral Rd	Kingsland	Dom Junction	City Uni	Aotea	Wynyard	
Mangere Bridge	12	71	15	11			42	4	3	11	2	2	11	8	44	120	61	418
Favona	12	164	28	4			75	8	5	22	3	5	24	17	93	225	122	807
Mangere TC	9	478			1	16	136	18	13	41	6	11	37	29	140	336	210	1,485
Mangere / Favona	33	713	43	16	1	16	255	29	21	74	11	18	72	55	277	682	393	2,710
Onehunga	23	319	61	50	7	17		10	9	37	5	11	50	25	111	388	287	1,409
Sandringham South	6	70	13	13	2	3	34	5	1			2	29	25	142	362	222	929
Wesley	15	243	45	45	7	12	150	14	5			20	43	62	405	850	561	2,477
Puketepapa	14	122	23	25	4	6	80	3		7	0	6	22	7	70	188	170	748
Mt Roskill / Wesley	35	435	81	83	13	20	264	22	6	7	0	28	95	95	617	1,400	952	4,154

Education

Origin Stations	Destination Stations																	Total
	Airport	Airport North	Landing Dr	Mangere TC	Favona	Mangere Bridge	Onehunga	Hayr Rd	Puketepapa	Wesley	Sandringham South	Balmoral Rd	Kingsland	Dom Junction	City Uni	Aotea	Wynyard	
Mangere Bridge	7	0	0	9			6	2	3	9	3	1	3	0	99	17	2	162
Favona	9	0	0	11			17	5	9	30	11	4	11	2	351	54	6	520
Mangere TC	11	2			5	8	38	12	29	56	24	9	17	3	720	84	9	1,029
Sub-total	28	2	1	20	5	8	61	19	41	95	38	14	31	5	1,170	154	17	1,710
Onehunga	11	1	1	32	14	9		8	31	39	15	8	15	3	451	60	8	708
Sandringham South	2	0	0	10	3	1	5	3	1			1	7	2	242	39	3	319
Wesley	8	1	1	40	13	6	25	5	6			10	8	5	902	109	16	1,155
Puketepapa	8	0	0	23	5	2	17	2		10	0	2	5	1	160	26	4	266
Sub-total	18	2	1	73	21	9	47	9	7	10	0	13	20	7	1,304	174	23	1,740



Row Labels	01 Wynyard	02 Aotea	03 City Uni	04 Dom Junction	05 Kingsland	06 Balmoral Rd	07 Sandringham South	08 Wesley	09 Puketepapa	10 Hayr Rd	11 Onehunga	12 Mangere Bridge	13 Favona	14 Mangere TC	15 Landing Dr	16 Airport North	17 Airport	Grand Total	
01 Wynyard		110	186	92	60	40	17	63	11	13	70	10	12	34	21	123	168	1031	
02 Aotea	932			190	103	118	61	235	26	36	163	34	25	74	57	294	438	2788	
03 City Uni	327			28	44	8	13	65	8		45	7	11	32	15	82	107	791	
04 Dom Junction	444	373	296		19	26	6	28	2	7	39	4	4	18	11	61	16	1356	
05 Kingsland	1188	499	471	30		40	19	54	11	16	123	18	20	63	45	251	22	2871	
06 Balmoral Rd	320	506	404	36	61		5	77	6	10	89	8	9	39	21	117	13	1721	
07 Sandringham South	245	467	411	32	48	7			2	9	58	6	6	29	16	87	13	1437	
08 Wesley	636	1155	1418	84	76	56			16	27	259	23	27	107	57	313	48	4302	
09 Puketepapa	190	261	248	11	40	16	2	21		7	150	11	13	60	29	156	31	1244	
10 Hayr Rd	225	304	85	25	47	24	12	35	9		115	13	15	70	35	182	42	1237	
11 Onehunga	331	548	599	37	93	35	28	103	54	28		36	30	110	80	428	77	2618	
12 Mangere Bridge	74	179	158	12	21	8	8	30	10	9	89			31	23	111	30	793	
13 Favona	145	346	467	24	48	16	19	69	22	19	152			21	39	244	31	1662	
14 Mangere TC	252	525	910	42	76	36	40	128	57	44	290	34	10			703	38	3184	
15 Landing Dr	8	23	32	2	4	1	2	6	2	2	15	1	1	2			14	115	
16 Airport North	38	104	82	8	21	7	9	31	10	9	82	7	10	48			123	589	
17 Airport	129	380	98	4	14	9	7	34	49	46	87	45	6	14	145	7		1084	
Grand Total	5484	5780	5865	665	777	447	248	980	295	283	1826	257	199	752	595	3159	1211	28824	
Total inbound	5484	5670	5679	355	551	216	125	458	211	157	715	88	27	65	145	7	0	19954	
Total inbound in red zone	176	484	98															759	3.8%
Total inbound in orange zone	801	1073	1491	65	115	17	15	34	1491									3613	18.1%
Total inbound in light green zone	415	1112	757	36	70	51	41	37	60	55								2634	13.2%
Total inbound in green zone	4092	3001	3334	254	366	147	69	388	151	102	715	88	27	65	145	7	0	12950	64.9%
Total in orange zone with no seat	550	525	467															1542	7.7%
Total in red zone with no seat																			0.0%

- more than 30 minute journey time
- 20-30 minute journey time
- 15-20 minute journey time
- 15 minute journey time

Passengers in this zone have no seat.
They represent 1,542, or 7.7% of all inbound passengers
They will stand between 20 and 30 minutes

Passengers in this zone will have a seat
They represent 4,095, or 21% of all inbound passengers

Option 2A: Sandringham light metro

2051 AM 2hr boardings
(exclude rail to rail transfers)



Option 3 Destination Stations for People boarding at origin stations

ALL PURPOSES

Origin Stations	Destination Stations																		Total	
	Airport	Airport North	Landing Drive	Mangere TC	Bader	Miller	Mangere Bridge	Onehunga	Hayr Rd	Puketapapa	Wesley	Sandrinham South	Balmoral	Kingsland	Dominion Junction	City Uni	Aotea	Wynyard		
Mangere Bridge	6	96	15	14	9	3		86	7	8	24	6	6	18	9	115	138	56	615	
Miller	4	134	19	9			5	122	15	17	54	15	13	30	18	344	277	111	1,186	
Bader	9	152	6				11	114	10	12	36	10	9	25	13	238	196	77	918	
Mangere TC	17	690					14	28	252	37	48	102	30	27	56	31	626	335	164	2,437
Sub-total	37	1,072	40	23	9	17	44	555	69	84	216	61	55	128	71	1,323	945	409	5,157	
Onehunga	35	353	66	63	67	24	36		25	55	83	30	33	84	32	588	532	260	2,366	
Sandrinham South	5	73	13	17	11	7	5	55	9	2			8	50	27	397	458	236	1,375	
Wesley	22	265	48	63	46	26	22	255	28	16			57	76	83	1,388	1,097	596	4,089	
Puketapapa	11	125	23	37	21	12	10	141	6		22	2	16	39	10	258	253	155	1,120	
Sub-total	38	463	83	118	78	45	37	451	44	19	22	2	82	165	120	2,023	1,809	987	6,585	

Work

Origin Stations	Destination Stations																		Total
	Airport	Airport North	Landing Drive	Mangere TC	Bader	Miller	Mangere Bridge	Onehunga	Hayr Rd	Puketapapa	Wesley	Sandrinham South	Balmoral	Kingsland	Dominion Junction	City Uni	Aotea	Wynyard	
Mangere Bridge	2	62	11	4	3	1		42	3	2	8	1	2	9	7	34	95	46	331
Miller	1	91	12	3			2	62	6	4	17	3	4	16	13	54	184	94	566
Bader	2	98	4				4	54	4	3	11	2	2	12	9	45	126	64	438
Mangere TC	2	482					14	110	15	10	32	5	8	27	22	88	210	137	1,165
Sub-total	7	732	27	7	3	3	20	267	28	20	68	10	17	64	50	222	612	341	2,500
Onehunga	6	265	51	21	32	5	17		9	9	31	5	10	46	21	93	376	223	1,222
Sandrinham South	1	59	11	7	7	2	3	33	5	1			3	31	22	131	355	213	883
Wesley	3	209	39	22	24	7	11	150	15	5			21	43	62	391	810	531	2,341
Puketapapa	4	99	18	13	11	4	5	74	2		7	0	6	22	7	64	183	158	660
Sub-total	8	368	67	41	42	13	20	257	22	6	7	0	30	96	91	586	1,348	881	3,884

Education

Origin Stations	Destination Stations																		Total
	Airport	Airport North	Landing Drive	Mangere TC	Bader	Miller	Mangere Bridge	Onehunga	Hayr Rd	Puketapapa	Wesley	Sandrinham South	Balmoral	Kingsland	Dominion Junction	City Uni	Aotea	Wynyard	
Mangere Bridge	2	0	0	4	3	1		6	1	2	7	2	1	2	0	71	13	1	116
Miller	1	0	0	2			1	12	4	7	24	9	3	5	1	274	41	5	389
Bader	4	0	0				3	14	2	5	15	6	2	5	1	178	27	3	265
Mangere TC	3	2					7	32	11	26	46	18	8	13	3	508	60	7	749
Sub-total	9	2	0	6	3	8	11	65	18	39	93	35	13	26	5	1,031	140	15	1,520
Onehunga	4	1	1	24	21	13	9		7	32	31	16	7	13	3	463	61	7	713
Sandrinham South	1	0	0	7	3	3	1	4	3	1			1	7	1	240	39	3	315
Wesley	2	1	1	28	14	13	6	23	5	7			10	8	5	892	104	11	1,127
Puketapapa	2	0	0	16	5	5	2	17	2		10	0	2	5	1	157	27	3	256
Sub-total	5	2	1	51	22	21	9	44	9	7	10	0	13	20	7	1,289	170	17	1,698



Row Labels	01 Wynyard	02 Aotea	03 City Uni	04 Dominion Junction	05 Kingsland	06 Balmoral	07 Sandringham South	08 Wesley	09 Puketapapa	10 Hayr Rd	11 Onehunga	12 Mangere Bridge	13 Miller	14 Bader	15 Mangere TC	16 Landing Drive	17 Airport North	18 Airport	Grand Total	
01 Wynyard		117	188	91	59	40	20	68	13	13	60	9	11	19	15	16	91	152	982	
02 Aotea	933			200	109	125	65	274	35	55	141	32	23	51	30	43	221	397	2734	
03 City Uni	319			29	46	18	15	66	8		38	6	10	13	17	11	62	94	754	
04 Dominion Junction	451	514	298		22	26	7	28	2	7	35	4	4	8	8	9	48	12	1485	
05 Kingsland	1224	513	478	30		39	21	55	11	21	106	16	17	34	25	35	197	19	2841	
06 Balmoral	329	533	421	36	57		7	79	6	10	75	7	8	15	21	17	92	6	1719	
07 Sandringham South	281	492	429	33	51	9			2	9	54	5	6	11	16	13	69	5	1486	
08 Wesley	666	1264	1458	88	80	62			17	28	235	21	25	44	58	45	247	21	4358	
09 Puketapapa	203	282	259	11	43	17	5	21		7	131	10	12	21	37	23	124	8	1213	
10 Hayr Rd	319	365	240	29	65	27	12	40	9		101	12	14	25	43	29	147	13	1490	
11 Onehunga	265	545	593	34	84	31	24	74	4	24		36	24	67	60	65	342	31	2346	
12 Mangere Bridge	56	139	115	9	18	6	6	22	7	7	84		3	9	12	14	92	6	607	
13 Miller	111	279	343	18	29	12	15	51	16	14	116	5		9	19	129	4	1170		
14 Bader	77	198	237	12	25	9	10	34	11	10	108	11			6	145	9	902		
15 Mangere TC	164	338	625	30	56	25	28	94	45	36	216	25	14				669	16	2382	
16 Landing Drive	6	18	27	1	3	1	1	5	2	1	12	1	1	1				10	91	
17 Airport North	30	78	64	6	17	5	7	24	8	7	71	6	6	6	44				380	
18 Airport	118	344	85	10	13	5	4	21	9	9	46	8	5	8	13	67	4		767	
Grand Total	5551	6017	5672	669	777	458	246	957	248	109	1630	215	183	332	408	412	2681	803	27706	
Total inbound	5551	5900	5672	349	540	209	111	387	154	109	654	56	26	15	57	67	4	0	19861	
Total inbound in red zone	318	777	176	18	32	11	4												1336	6.7%
Total inbound in orange zone	509	616	1320	61	80	26	37	50	18	17	129								2864	14.4%
Total inbound in light green zone	521	909	593	44	47	20	24	128	45	36		8							2375	12.0%
Total inbound in green zone	4203	3597	3583	228	381	152	46	209	90	55	525	48	26	15	57	67	4		13286	66.9%
Total in orange zone with no seat	432	418	458	8															1326	6.7%
Total in red zone with no seat																			0	0.0%

- more than 30 minute journey time
- 20-30 minute journey time
- 15-20 minute journey time
- 15 minute journey time

Passengers in this zone have no seat.
They represent 1,326, or 7.7% of all inbound passengers
They will stand between 20 and 30 minutes

Passengers in this zone will have a seat
They represent 3,666, or 18.5% of all inbound passengers

Approx 50% of passengers in this zone will have a seat from overlay service.
They represent 974, or 4.9% of all inbound passengers

Option 3 (refined): Sandringham hybrid

2051 AM 2hr boardings
(exclude rail to rail transfers)



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Appendix F: Sensitivity tests on short list

Network pricing:

Sensitivity tests were done on the three final shortlisted options, using the lower bound 2051 land use distribution, to understand the impact of road pricing on CC2M demand.

Road pricing specifications were based on The Congestion Question road pricing scenario. It reflects a \$0.20/km charge only on arterials in the urban area for the AM and PM peaks.

This was intended to be a proxy for an approximate \$2 access charge to the arterial network / roads experiencing congestion (with an average trip length ~10km).

The key changes to CC2M demands are shown in the Table 17 below. It shows road pricing will have a minimal impact on the CC2M demand, increasing demand on the options between 1% and 2%.

Table 17: Impact of road pricing on CC2M demands

Indicators	2051 results based on accessibility based land use scenario			Percentage change as a result of road pricing		
	1B	2A	3	1B	2A	3
CC2M Boardings						
AM Peak	14,665	24,157	22,328	1.1%	1.9%	2.0%
Daily	64,760	106,379	95,664	1.7%	1.6%	1.3%
Annual	18,067,901	29,679,713	26,690,117	1.7%	1.6%	1.3%

Wider network expansion

Sensitivity tests were also done on the three final shortlisted options, using the lower bound 2051 land use distribution, to understand the impact on CC2M demand by extending the CC2M network to the north shore and north-west, together with the introduction of road pricing.

Road pricing specifications were as discussed above.

A network expansion scenario was developed for each of the three short listed options.

The network expansion scenarios were based the wider network assumptions for the Northwest and North Shore corridors on the Auckland Rapid Transit Plan (ARTP).

All corridors used vehicle capacity assumptions used by the ALR project (i.e. the seating to standing ratios and train lengths).

Network expansion applied to Option 1B: Light Rail on Dominion Road:

For the North Shore and North-western lines

- Light metro will run on these lines.
- Alignments and station locations generally in line with the ARTP Option 8 alignment, amended to use the city centre alignment to Dominion Junction developed by the ALR project

- Kumeu to Milldale service pattern, at 3 minutes in the peak, and 8 minutes in the inter-peak.
- Light Metro vehicle capacity applied: 80 m long (580 total capacity with 150 seats)

Network expansion applied to Option 2A: Light Metro on Sandringham Road:

For the North Shore and North-western lines

- Light metro will run on these lines.
- The network provides a service pattern with a single seat service between Milldale and the airport, and between Milldale and Kumeu.
- The Milldale to airport was modelled as an extension of the CC2M service (i.e. it had a 3min headway in the peak, and 8 min in the inter-peak).
- The Milldale to Kumeu was also modelled with a 3min headway in the peak and 8 min in the inter-peak.
- This provides a 90 second headway through city centre and to North Shore.
- The light metro vehicle capacity applied: 80m long (580 total capacity with 150 seats)

Network expansion applied to Option 3: Hybrid on Sandringham Road:

For the North Shore and North-western lines

- Light rail will run on these lines.
- Note the network provides a service pattern with a single seat service between Milldale and the airport, and between Milldale and Kumeu.
- The Milldale to airport was modelled as an extension of the CC2M service (i.e. with a 3min headway in the peak, and 8 min in the inter-peak).
- The Milldale to Kumeu was also modelled with a 3min headway in the peak and 8 min in the inter-peak.
- This provides a 90 second headway through city centre and to North Shore.
- The LRT vehicle capacity applied: 66m long (420 total capacity with 128 seats)

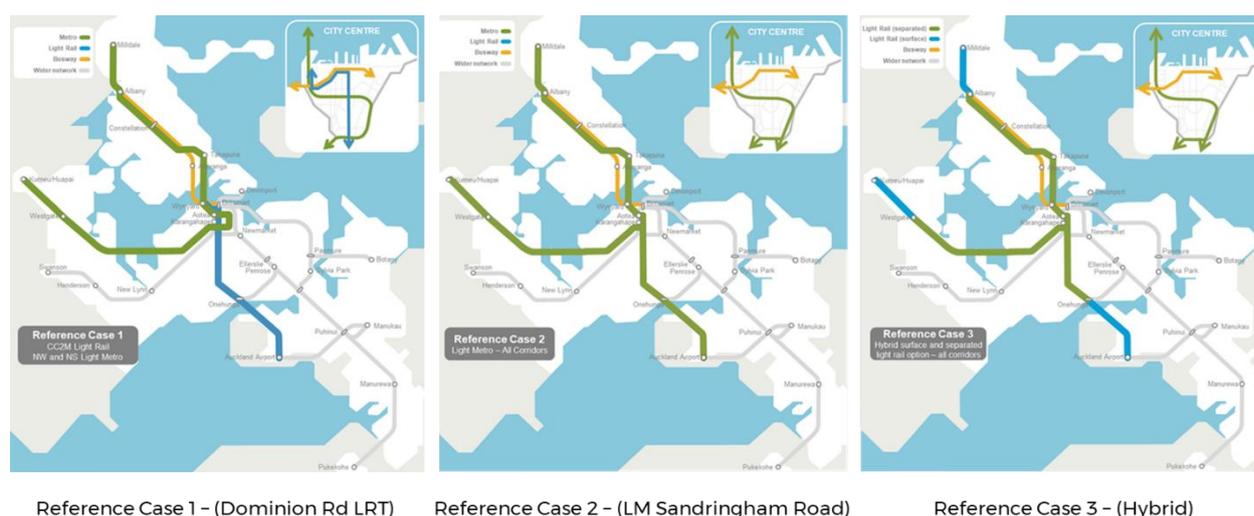


Figure 79: Illustration of the three network scenarios

The key changes to CC2M demands are shown in the Table 18 below.

It shows expanding the CC2M network to the north shore and north west, together with road pricing will increase demands on the options by between 5% and 9%.

By 2051 the various options will experience similar increases during the morning peak, approximately an additional 6%. Light metro and hybrid options will experience approximately 10% increase in its daily and annual boardings, suggesting the higher inter-peak use for these options.

Table 18: Impact of network expansion and road pricing on CC2M demands

Indicators	2051 results based on accessibility based land use scenario			Percentage change as a result of road pricing		
	1B	2A	3	1B	2A	3
CC2M Boardings						
AM Peak	14,665	24,157	22,328	5.7%	5.9%	5.6%
Daily	64,760	106,379	95,664	4.7%	8.9%	8.3%
Annual	18,067,901	29,679,713	26,690,117	4.7%	8.9%	8.3%

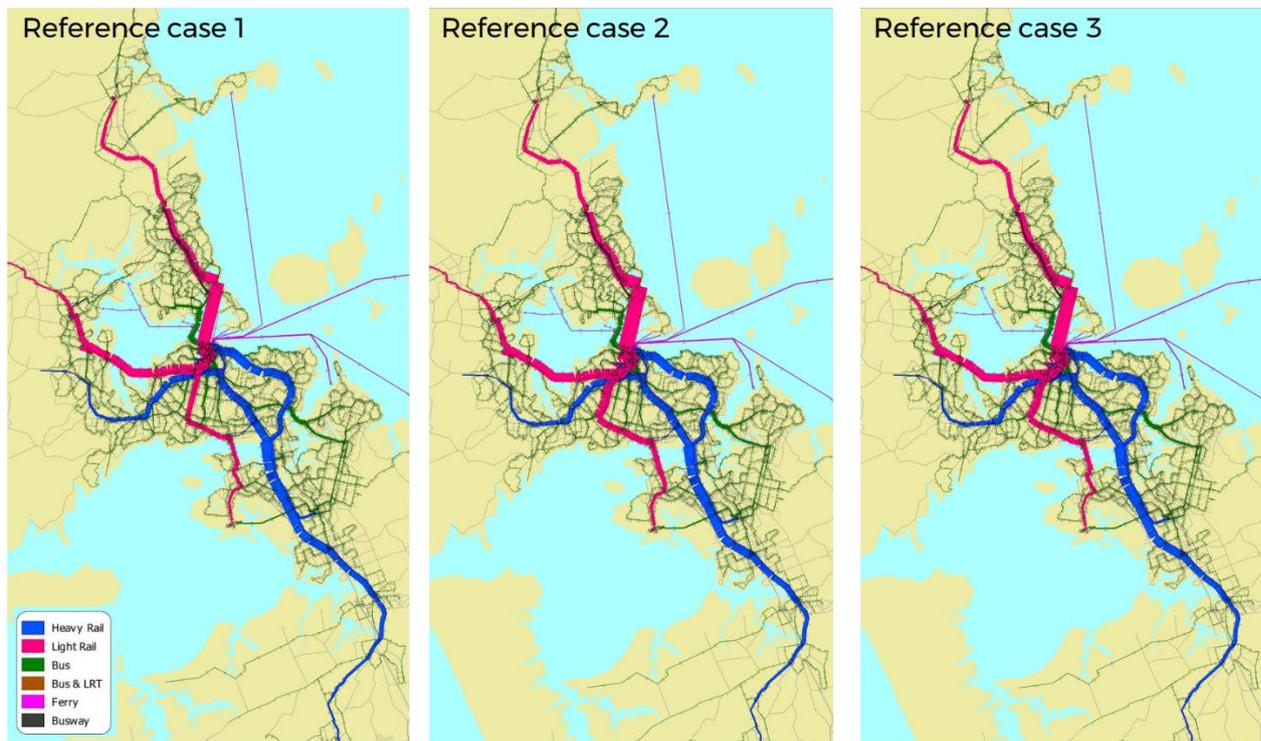


Figure 80: MSM network plot. AM 2hr PT volumes



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Appendix G: Heavy rail test

Heavy rail:

Sensitivity test was also done on a heavy rail option to confirm the justification for ruling it out at the long list stage.

The option introduces a new heavy rail service pattern between the Airport and Britomart (see Figure 81 below). The route starts at Britomart and follows the western line up to Mt Albert Station. From here it deviates south-east along the old Avondale-Southdown designation towards Onehunga and on to the Airport – via Mangere Town centre.

The south-eastern extension will add 9 stations to the heavy rail network. The entire route will have 18 stations from Britomart to Airport

The option also allows for extension of the Onehunga Branch line services to the airport.

For modelling purposes, the test assumes the following service pattern:

- 8 tph (7.5 minute headways) from Britomart to the airport (via western line and new extension) during the AM and PM peaks (using 6 car EMUs) – and vice versa. This service drops to 4tph (15 min headway) during the inter-peak
- 2 tph (30 min headways) from Mt Eden via Onehunga Branch line to the airport during the AM and PM peaks (using 3 car EMUs) – and vice versa. This service stay the same for the inter-peak.

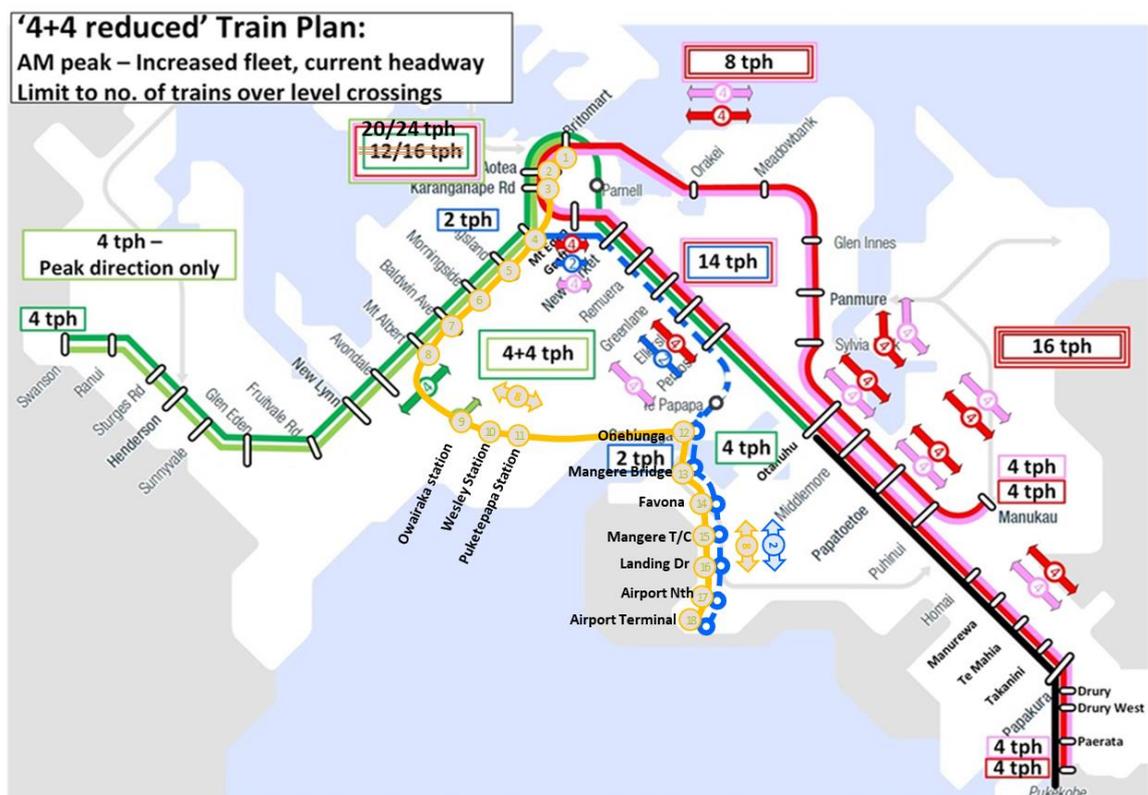


Figure 81: Heavy rail option



The comparative results are shown in Table 19 below:

Table 19: HR compared to CC2M final short list

Key Indicators by 2051	Results based on higher intensification land use scenario by 2051			
	Option 1B (Light rail)	Option 2A (light metro)	Option 3 (Hybrid refined)	Heavy Rail Option
Accessibility				
Number of jobs within 45 mins by PT from Mangere Town centre	247,207	452,773	344,317	287,254
Number of jobs within 45 mins by PT from Mt Roskill centre	414,691	423,047	401,431	335,437
Number of households within 45 min by PT from city centre	378,545	405,418	400,133	375,765
Number of households within 45 min by PT from airport	97,008	164,245	113,954	129,329
CC2M Boardings (heavy rail option show extra boardings on HR)				
AM peak (2hr)	16,505	28,822	27,706	19,223
Daily	72,605	125,252	114,174	82,835
Annual	20,256,851	34,945,169	31,854,462	23,110,939
Regional PT Boardings (annual)				
Total PT network	240,883,615	248,801,954	246,606,277	240,186,462
Total bus network	154,983,514	151,727,720	151,695,945	155,754,105
Total heavy rail network	61,669,356	59,905,763	60,498,231	78,368,991
CC2M capacity and demands				
Modelled Maximum Capacity of CC2M (pax/hour/direction)	6,300	11,600	12,600	6,000
CC2M Demand at Peak Load Point (pax/hour/direction)	5,036	9,345	9,521	4,728

Key observations from the results:

- Access to employment opportunities from Mangere – Heavy Rail option performs better than option 1B in terms of access to employment opportunities from Mangere, but worse than the light metro and hybrid options.
- HR performs worse than all options for access to employment opportunities from Onehunga and Mount Roskill – but only marginally worse than light rail.
- HR performs better than light metro and hybrid for access to employment to the airport.
- Annual PT boardings – HR performs worse than all short listed options - only marginally worse than surface light rail (240.9m p.a. for 1B, 240.2m p.a. for HR).

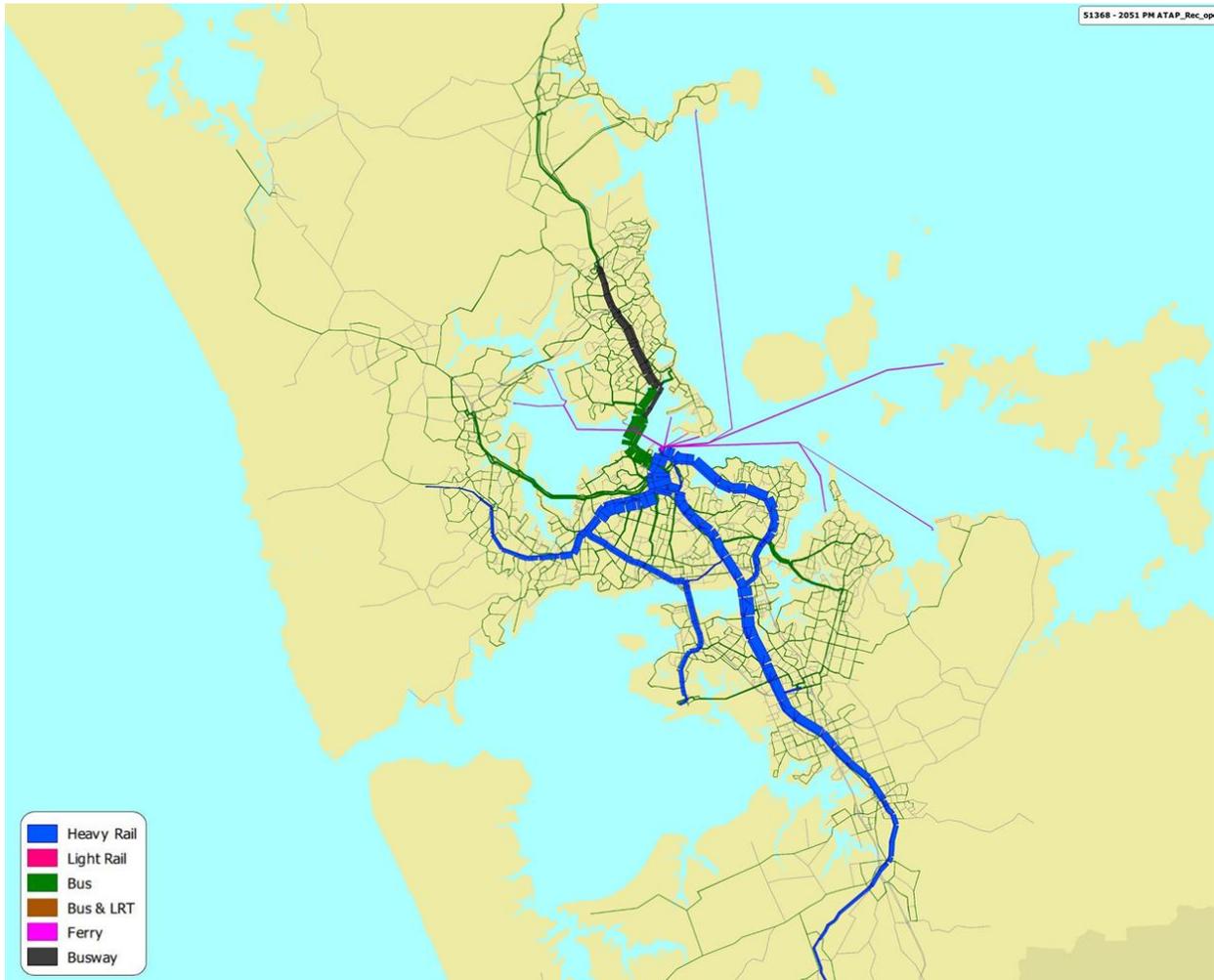


Figure 82: MSM demand flows- 2051 AM peak



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Appendix H: Benchmarking against other cities

Arup (Peter Dunn) prepared a paper titled: Exploring the benefits of Rapid Transit, dated 2 September 2021.

The purpose of this paper is to benchmark the City Centre to Mangere (CC2M) rapid transit corridor against global examples of major public transport infrastructure in similar cities to:

- Compare patronage characteristics with CC2M patronage forecasts
- Identify opportunities to obtain the best value from the investment
- Identify lessons learned from these case studies

This report draws on a set of ten case studies from Australasia, North America, United Kingdom and Europe. The recent history of transport investment in Auckland is also considered.

The report noted the following:

“It is difficult to compare the performance of public transport systems in different cities given their unique settings. However, the cases studies we have examined broadly suggest the forecasts for CC2M are likely in the right range. The European examples experience much higher patronage than those forecast for CC2M, but the context is very different given the compact and dense nature of their cities and an established public transport culture. The patronage levels observed for Australian light rail and metro examples, where population densities are similar to Auckland are broadly comparable based on the length of the facility.

Other factors to consider are:

- *Historical forecasts in Auckland for major rail improvements have proved reasonably accurate over the past 20 years*
- *There is always a degree of uncertainty associated with patronage forecasting, particularly now with various health and environmental disruptors*
- *Where the actual patronage differed from the forecast patronage there were clearly identified reasons for that associated with the assumptions”*



Patronage compared to population density

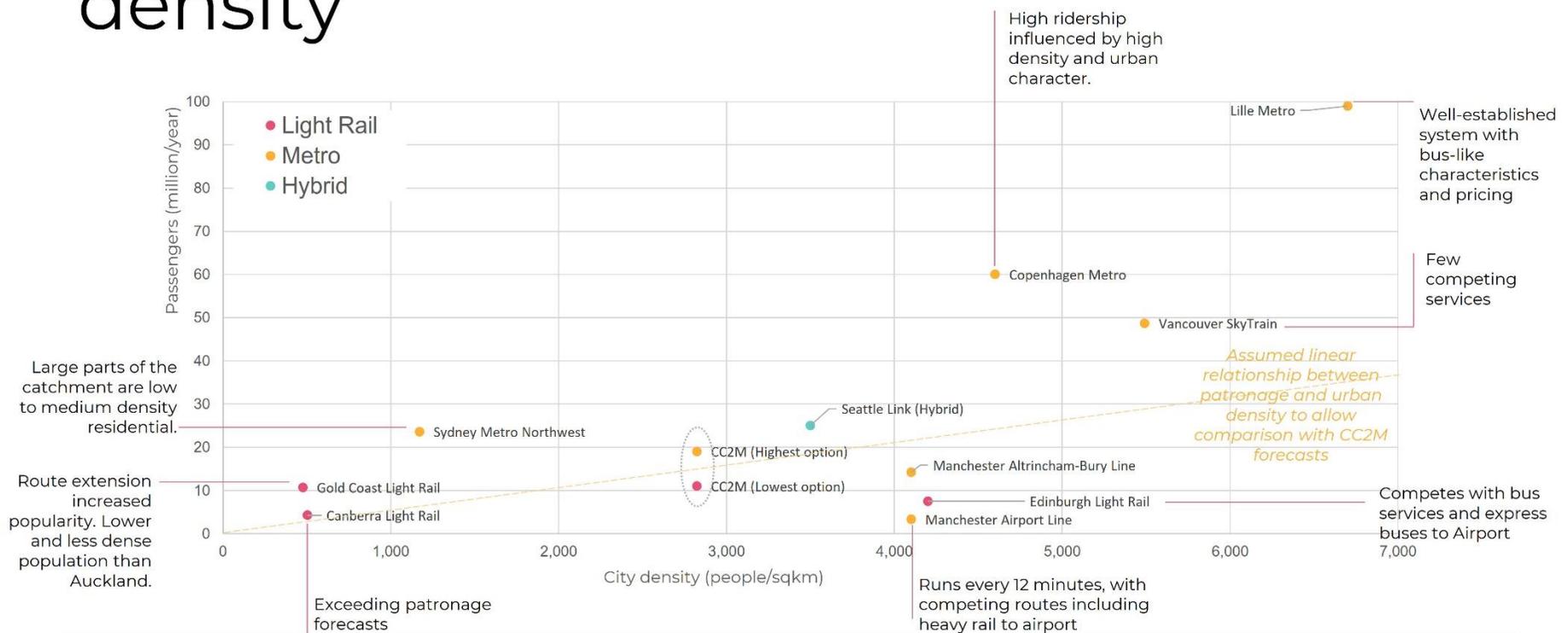


Figure 83: Patronage compared to population. Source Exploring the benefits of rapid transit, 2 Sept 2021, Arup



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