

RLTS Preferred Option: Passenger Transport

This attachment addresses passenger transport issues raised at the 02 July 2009 RTC workshop. All the elements are discussed separately but they are, however, integrated and changing any component results in changes to almost all other elements. For instance, adding a major road link will affect travel speeds, which will also change trip patterns, when during the day trips are made, and which mode of transport may be used. Changes thus support some outcomes but not others, which can make project assessment difficult.

Results presented in this attachment may differ slightly to previously presented results because the models are updated continuously to include changes and modifications to the preferred option.

The modelling report is considered sufficiently robust to support strategic decisions. In developing any of the projects considerable extension and refinement of the modelling would be required.

PB rail network

The Strategic Option 3 proposed rail / metro network was tested using the ART3 transport model. The initial results indicated that patronage gains were relatively low compared to the expected cost of providing the proposed infrastructure. Each line section was then assessed in isolation in order to see which lines attracted the most patronage. The patronage gains were then related to the number of stations along the line and the length of the line as a proxy for cost effectiveness. The results of the initial assessment are listed in the tables below. Note that there are no airport flight passenger related trips included in the tables. In the ARC modelling system these are estimated separately and added to the ART3 results.

A second set of tests were then carried out to refine the two lines that exhibited the "best value for money", the Avondale-Southdown and Airport lines, and the North Shore rail. There is some loss in patronage with the reduced rail system.

A third round of tests was carried out in July 2009 as some aspects of the ART3 model had been updates relative to the pervious tests. Results indicate reasonable consistency in ranking and scale except for the Airport rail lines. High levels of road congestion on the Airport approach roads in the first two rounds diverted trips to the PT system. Adding Airport road access capacity reduced the patronage on the Airport rail line (as evident in the drop in round 3 ranking). This test also includes the SH20 Waterview road link, which was not part of the first two rounds' tests. The Avondale – Southdown line consistently ranks high

Based on these results, and the high cost of implementing rail / metro in established areas, the focus in the Preferred Option was restricted to the Avondale-Southdown and Airport rail lines. The Airport line(s) patronage is forecast to double once the Airport flight –related PT trips are included, resulting in its performance becoming more viable.

Patronage forecasts per line for the Preferred Option are shown in the next section.

The service frequency assumptions are in line with ARTA's guidelines for RTN and QTN services.

In conclusion, the Avondale-Southdown and Airport railway lines have been included in the Preferred Option. The proposed North Shore rail line requires further consideration due to high patronage levels.

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Most Effective by Length of New Rail line

Effect of including line:	Regional patronage change per km				
	1st Round (May)	Ranking	2nd Round (June)	3rd Round (July) *	Ranking
Avondale Southdown Line	418	1	405	530	1
Airport Rail Lines	330	2	-104	50	5
Pt Chev Rail Line	219	3	-	382	2
Remuera Rail Line	122	4	-	115	4
Botany Rail Line	84	5	-	131	3
Pt Chev + Remuera + NS + Dominion	49	6	-	-	-
Dominion Road Rail	5	7	-	0	6
North Shore Rail Line	-178	8	60	-105	7

Most Effective by Number of New Stations

Effect of including line:	Regional patronage change per station				
	1st Round (May)	Ranking	2nd Round (June)	3rd Round (July) *	Ranking
Avondale Southdown Line	1372	1	1329	1740	1
Airport Rail Lines	972	2	-307	148	5
Pt Chev Rail Line	336	3	-	587	2
Remuera Rail Line	205	4	-	192	4
Botany Rail Line	189	5	-	294	3
Pt Chev + Remuera + NS + Dominion	81	6	-	-	-
Dominion Road Rail	6	7	-	6	0
North Shore Rail Line	-383	8	60	-226	7

Note: * Third round results relative to the Dominion Rd option
Units: additional patronage per km of additional rail way line, or additional patronage per station on the additional rail way line

Regional rail passenger forecasts: preferred option

The preferred option includes changes to the commuter rail network and services, as noted in Attachment 2. The tables below sets out the average passenger flows in the 2041 AM, IP and PM 2-hour peak periods on the main route sections.

The flows do not include potential airport flight related passengers that could access or egress the airport using public transport. The expected effect of the flight-related demand is an additional 2,500 passengers in the AM peak period. These demands can be added to the Airport, Onehunga and Southern lines, depending on the service pattern, as the majority are forecast to travel to the CBD.

In comparison, 2006 rail passenger flows in the AM peak period are:

- Britomart inbound 3,700
- Southern line northbound 1,800
- Western line eastbound 1,500

Table 1: Points of Maximum Patronage by Line (2-hour)

Line section (2041 AM peak period)	Inbound	Outbound
Western Line (West of Mt Eden station)	9,575	1,446
Southern Line (south of Newmarket)	9,678	2,047
Eastern Line (west of Orakei)	4,962	1,545
South West Rapid Transit (east of Dominion Rd)	4,128	1,180
Mangere Bridge	1,956	801
Puhinui Line (west of Southern Line)	1,232	399
Manukau Line	1,192	2,245

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Line section (2041 interpeak period)

Western Line (West of Mt Eden station)
 Southern Line (south of Newmarket)
 Eastern Line (west of Orakei)
 South West Rapid Transit (east of Dominion Rd)
 Mangere Bridge
 Puhinui Line (west of Southern Line)
 Manukau Line

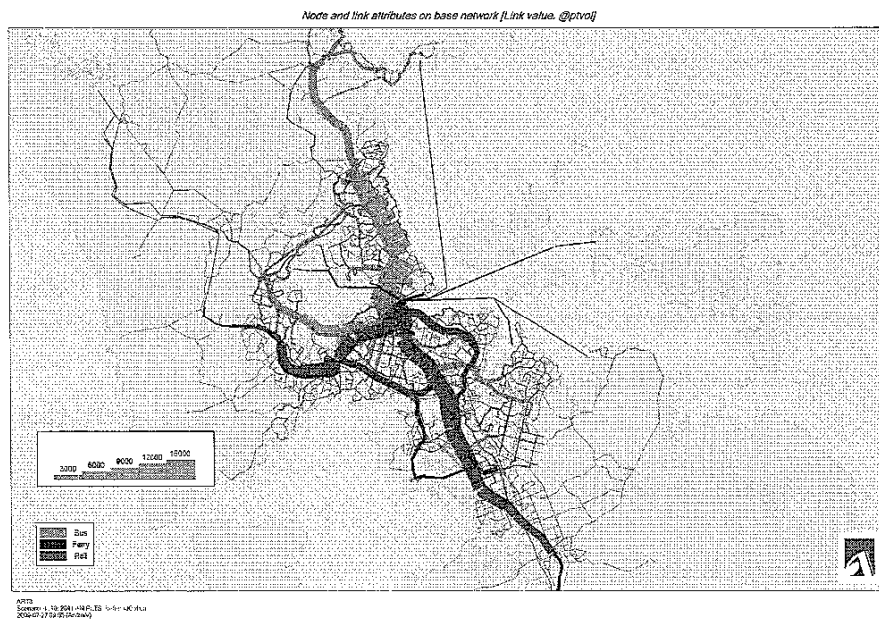
Inbound	Outbound
1,698	1,074
2,387	2,072
1,162	1,067
1,192	795
693	613
291	290
844	990

Line section (2041 PM peak period)

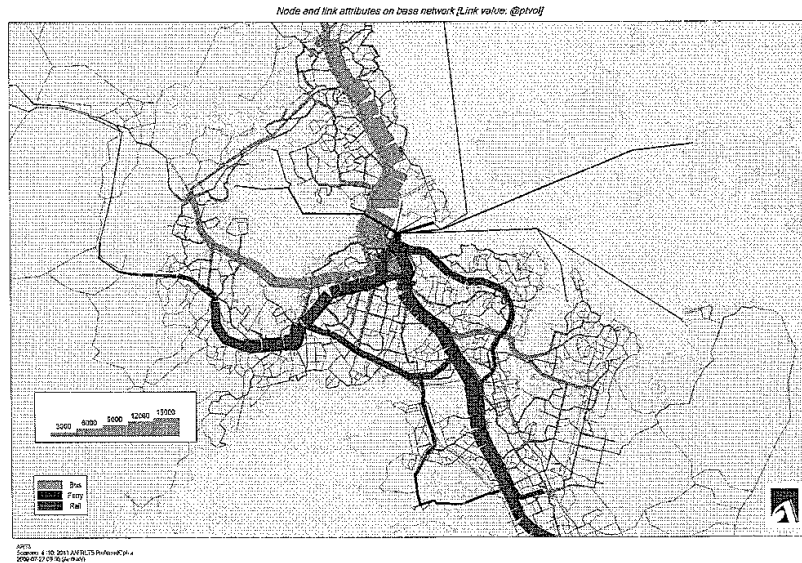
Western Line (West of Mt Eden station)
 Southern Line (south of Newmarket)
 Eastern Line (west of Orakei)
 South West Rapid Transit (east of Dominion Rd)
 Mangere Bridge
 Puhinui Line (west of Southern Line)
 Manukau Line

Inbound	Outbound
1,511	7,430
2,738	6,952
1,491	4,152
1,064	3,207
823	1,637
353	1,137
2,019	1,288

Figures 1 A, B: 2041 AM Peak Period PT Demands
A = Regional view
B = zoomed in



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The Airport rail connections are forecast to carry sufficient patronage once flight-related PT trips have been added. The Avondale-Southdown line patronage is marginal as it does not have the benefit of being radially orientated to the CBD (area of major regional rail demand). This line will reduce passenger flows via Newmarket as a direct connection from west to south will be available.

Rail CBD Loop

The impact of including the CBD rail loop has been a common assumption in all options and needs to be justified. The prime reason for implementing a rail loop in the CBD is to alleviate the limitations in service frequencies that are possible with the current dead-end configuration if the rail terminal at Britomart which requires trains to leave the station before others can arrive. A loop system allows trains to through run, enabling more services to be run through the CBD. The CBD rail loop also provides better penetration of the CBD and provides new CBD development opportunities. The aim of this test is to indicate that a loop system, with greater service options and frequencies, increases rail patronage. Note that the loop on its own will not maximise rail use but will tend to optimise rail access to the CBD.

Table 2: 2041 AM Peak Period Inbound Rail Passengers

		2016 rail system	CBD Loop added	Preferred Option
Western Line (West of Mt Eden station)	Patronage	7967	10791	9575
	Seated Capacity	6528	13056	13056
	% Seated	122%	83%	73%
Southern Line (south of Newmarket)	Patronage	8857	9950	9678
	Seated Capacity	9248	20672	20672
	% Seated	96%	48%	47%
Eastern Line (west of Orakei)	Patronage	4752	5024	4962
	Seated Capacity	5984	13600	13600
	% Seated	79%	37%	36%

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Volumes exceeding 80% of seated capacity over two hours are considered to be overcrowded during the peak with the peak period (Booz Allen Hamilton 2006, *Auckland Patronage Growth Targets – Comparative Analysis*, Ministry of Transport, Wellington)

The CBD loop increases patronage compared to the 2016 service pattern without the loop. Capacity increases significantly and this improves the percentage of passengers that can be seated.

The Preferred Option has slightly lower patronage around the CBD entry points inbound. This is because the addition of the Avondale-Southdown line allows passengers to travel from west to south without having to travel via Newmarket (for example).

Avondale to Southdown Rail Link

Figure 2: 2041 AM Peak Patronage, Preferred Option

Node and link attributes on base network [Node value: ca_board_i, ca_alight_i, Link value: @ptvol]



ART3
Scenario 4110_23x1_A14_RLTS_PreferecOption
2009-07-27 11:24 (4.1.0eV)

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Figure 3: 2041 Inter Peak Patronage, Preferred Option

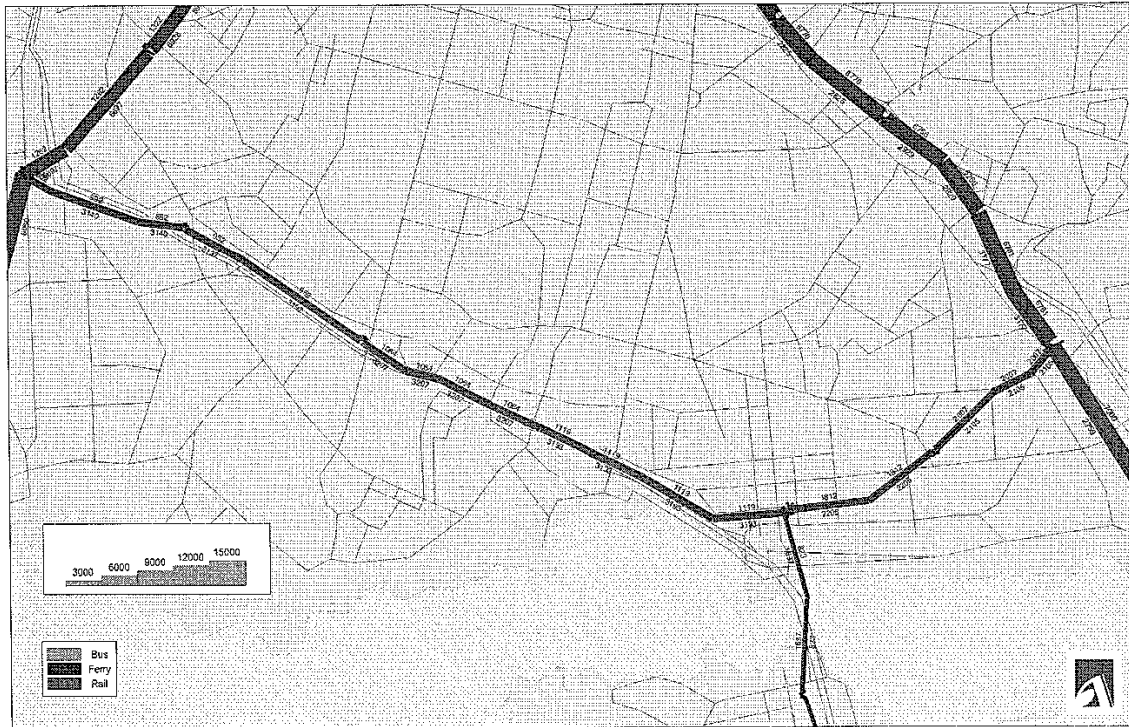
Node and link attributes on base network (Node value: ca_board_i, ca_alight_i, Link value: @ptvoif)



ART3
Scenario: 4120 2041 P RLTS PreferredOption
2009-07-27 11:24 (Ar&A)

Figure 4: 2041 PM Peak Patronage, Preferred Option

Node and link attributes on base network (Node value: ca_board_i, ca_alight_i, Link value: @ptvoif)



ART3
Scenario: 4130 2041 PM RLTS PreferredOption
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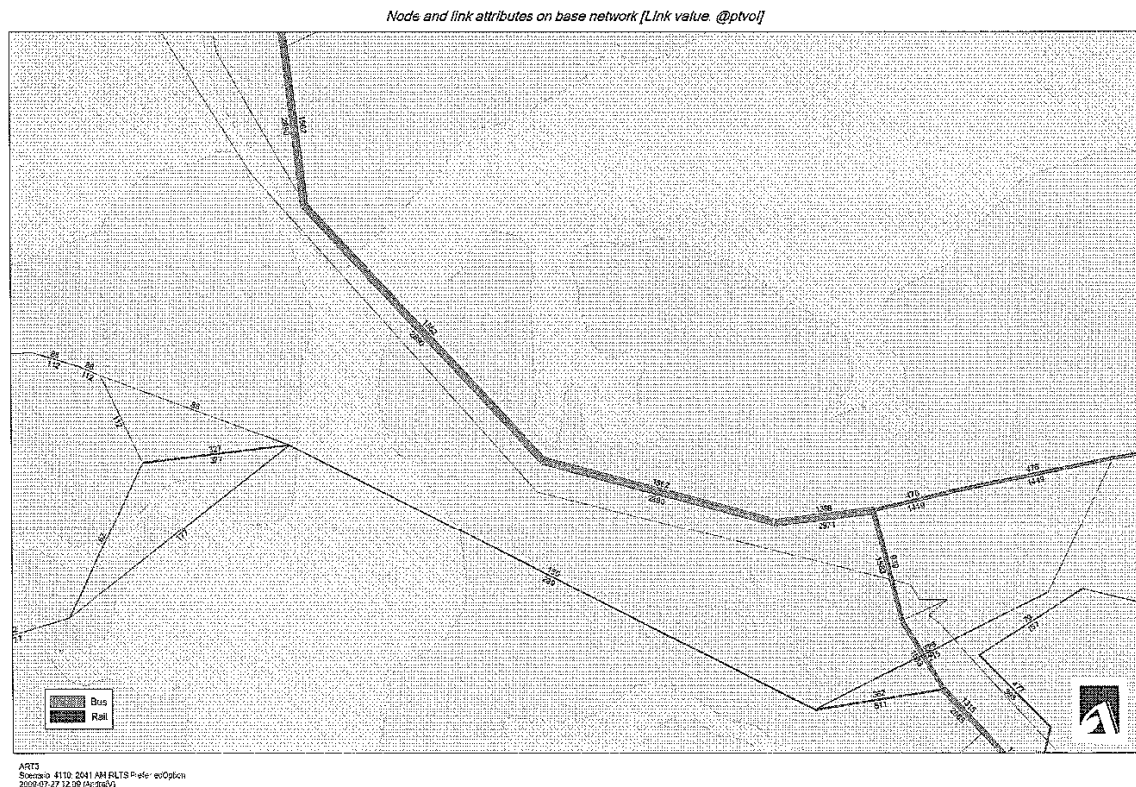
Patronage volumes along the Avondale to Onehunga section of the South West Rapid Transit rail corridor are relatively consistent in the AM and PM peak periods, with 3,000 to 4,000 users in the peak direction in two hours and 1,000 to 1,200 in the counter-peak direction. Interpeak volumes in both directions along the corridor are between 800 and 1,200 users in two hours.

These peak volumes are broadly comparable with the patronage at Britomart in the 2006 model (3,600 in, 400 out) in the AM peak. Consequently the Avondale to Onehunga section of the SWRT route is recommended as an appropriate candidate for a rail RTN service.

Panmure – Botany RTN/QTN

The point of peak demand on a rail line from Panmure to Manukau CBD via Botany Downs is found at the crossing over the Tamaki estuary. Demand over two hours in the 2041 AM peak is 2,400 inbound passengers and 2,100 outbound. Demand is significantly lower on other parts of the line however, dropping to 1,100/1,000 near Flat Bush. Due to the length of the rail line (approximately 15 kms) it is suggested this is too low a patronage level to support an RTN rail corridor. However, it is proposed that provision should be made for a bus RTN facility, with the ability to upgrade to rail at a later date if justified. Adjacent land use changes to support an RTN should be progressed.

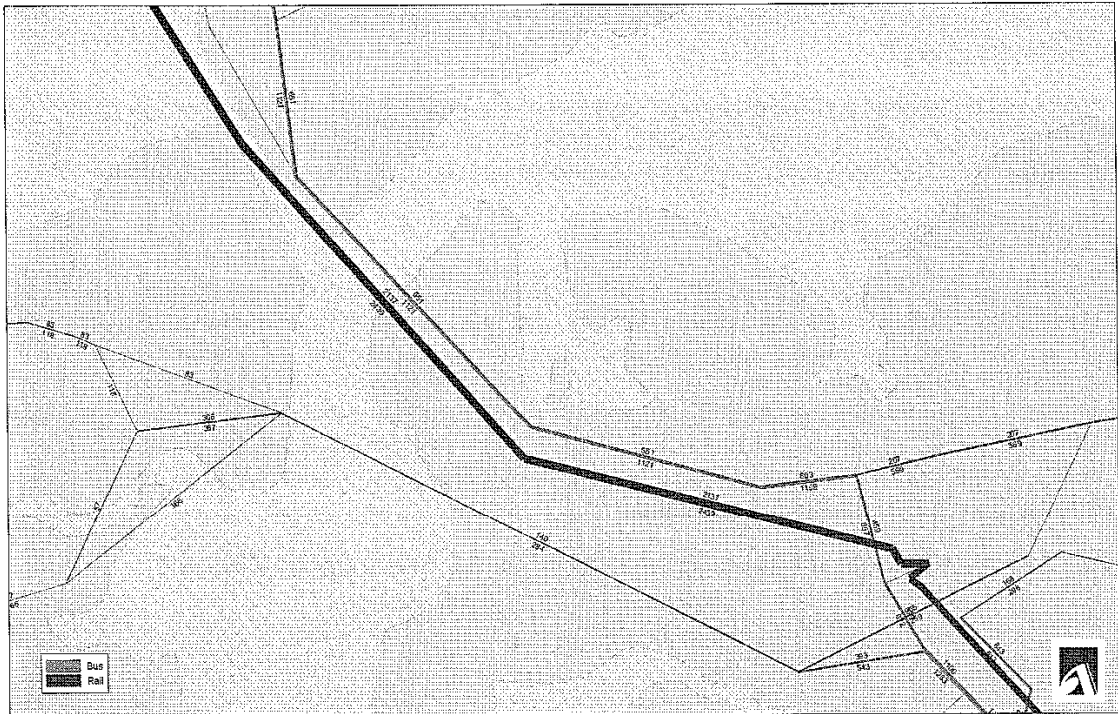
Figure 5: Bus (QTN) patronage Panmure Section, Preferred Option 2041 AM



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Figure 6: Rail (RTN) patronage Panmure Section, PB Network 2041 AM

Node and link attributes on base network [Link value. @ptvol]



AR13
Scenario 4115_2011_A14_RLTS_PO-PBRPart1
2009-07-27 12:09 (4c d16b)

Figure 7: Rail (RTN) patronage Ti Rakau Section, PB Network 2041 AM

Node and link attributes on base network [Link value. @ptvol]



AR13
Scenario 4115_2011_A14_RLTS_PO-PBRPart1
2009-07-27 12:10 (4c d16b)

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Figure 8: Bus (QTN) patronage Flat Bush Section, Preferred Option 2041 AM

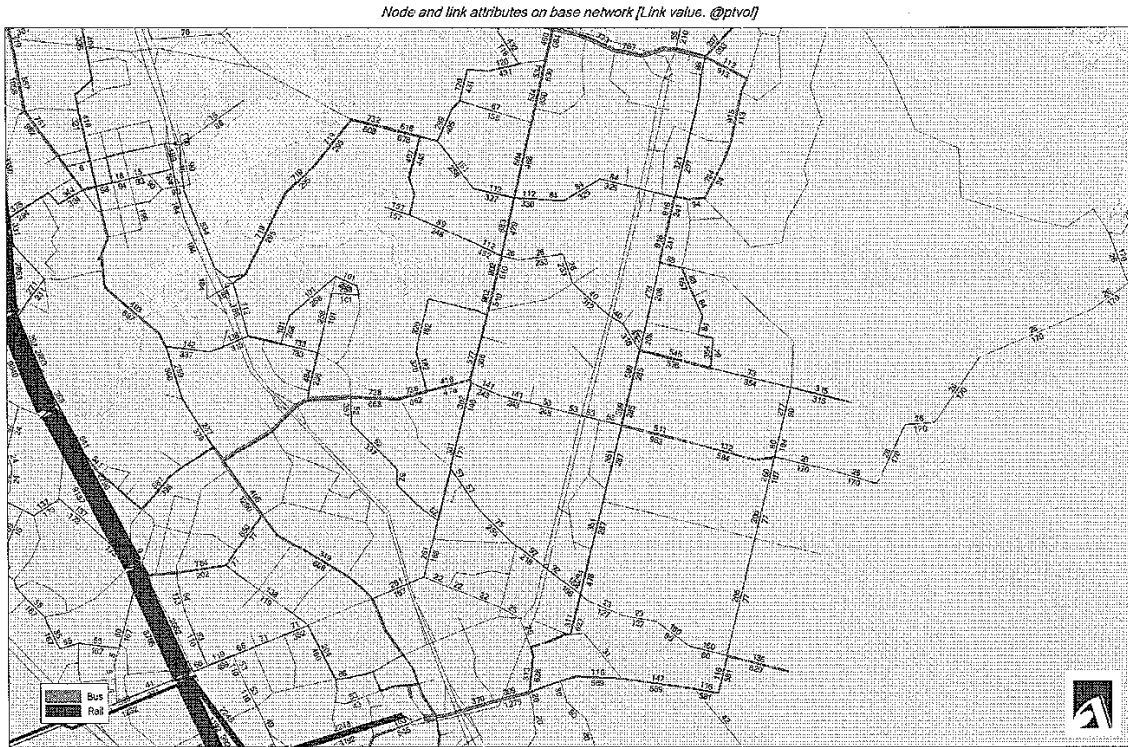
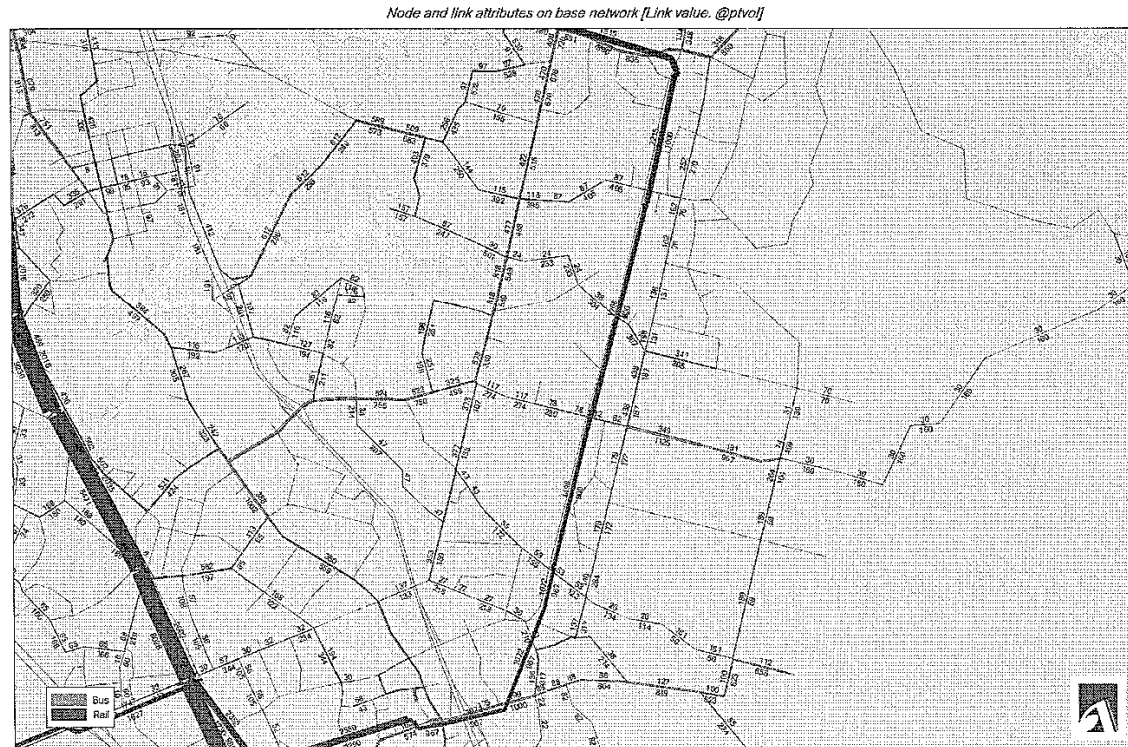


Figure 9: Rail (RTN) patronage Flat Bush Section, PB Network 2041 AM



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Henderson – Westgate – Albany RTN/QTN

Patronage on a North Western express bus service, running on bus shoulder lanes along the side of the motorway is approximately 500 users per direction over two hours in the AM peak. This is considered to be too low a patronage level to support any RTN service, though could justify a slight increase in service frequencies from the currently assumed 10 minute headway. PM peak patronage is slightly lower than AM peak (400-450 users per direction) and interpeak patronage is significantly lower (200 users per direction).

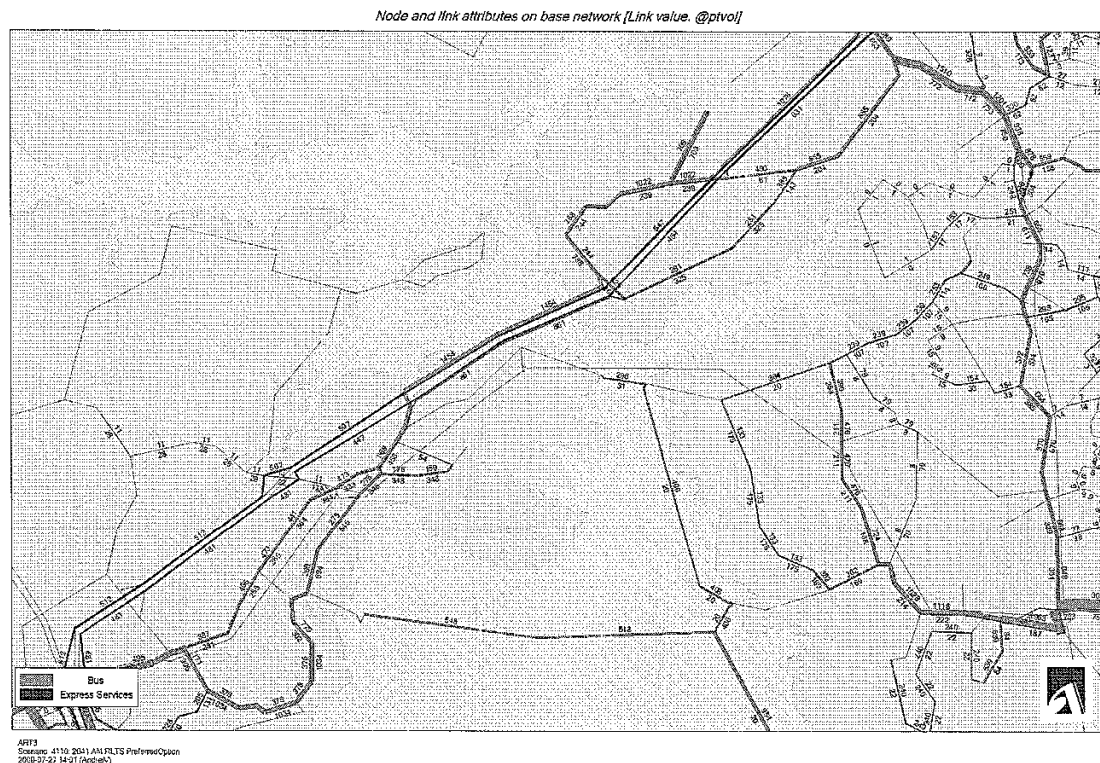
Figure 10: Bus Services per hour, Preferred Option 2041 AM Peak

Node and link attributes on base network [Link value: @ptvo]



ARK3
Scenario: #110: 2011 A31 RLTS Preferred Option
2009-07-27 13:56 (Andrew)

Figure 11: Patronage per two-hours, Preferred Option 2041 AM peak



North Shore Rail

Adding an additional harbour crossing for both road and PT (with the north shore busway converted into a rail line) to the preferred option results in a slight decrease in PT patronage. Demand drops from 22,000 inbound/4000 outbound to 21,000 inbound/4000 outbound. This is consistent with previous RLTS testing using the PB PT network. This decrease in PT is attributed to the transfer required for many PT users who did not previously, with a busway, need to transfer from their first bus to another mode. Further study is recommended to determine whether an optimised supporting bus network would eliminate this drop in patronage.

The change from a busway to a rail line on the north shore would therefore not be justified on patronage increase grounds but might due to issues of bus capacity. Assuming a capacity of 50 users per bus on average 440 buses in the peak two hours would be required to carry 22,000 users, raising issues of capacity particularly at busway stations and at the CBD terminal. Capacity issues require further study.

Demand on the rail link for the north shore rail option is 14,200 passengers in two hours. This compares to a seated capacity over two hours of 13,056 assuming a 5 minute service frequency and 8 car trains. This gives a loading of 109% of seated capacity. As per the ATSAP study and a previous study by Booz Allen Hamilton on behalf of MOT¹ loadings over 80% of seated capacity over two hours are representative of significant overcrowding in the peak within the peak period and therefore in reality loss of patronage. Consequently higher

¹ Booz Allen Hamilton 2006, Auckland Patronage Growth Targets – Comparative Analysis, Ministry of Transport, Wellington

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frequencies than the 5 minute headway currently modelled are appropriate for a north shore rail link.

Figure 12: 2041 AM peak PT Patronage with Busway (preferred option)

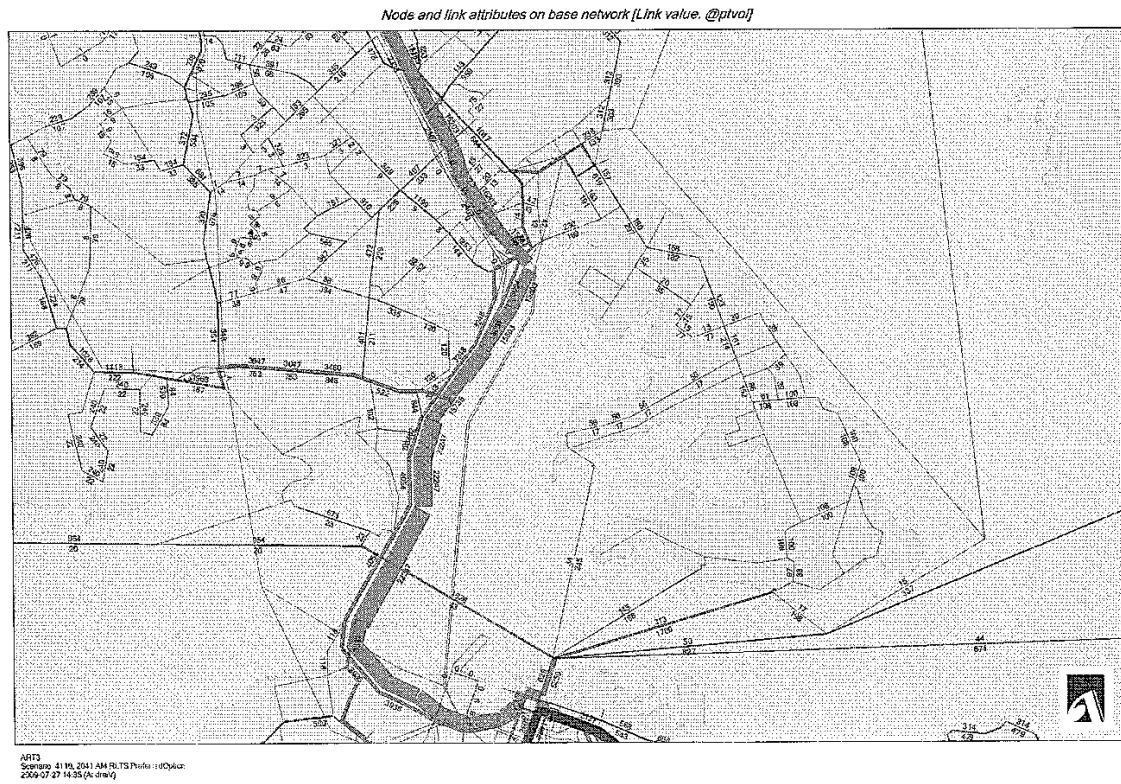
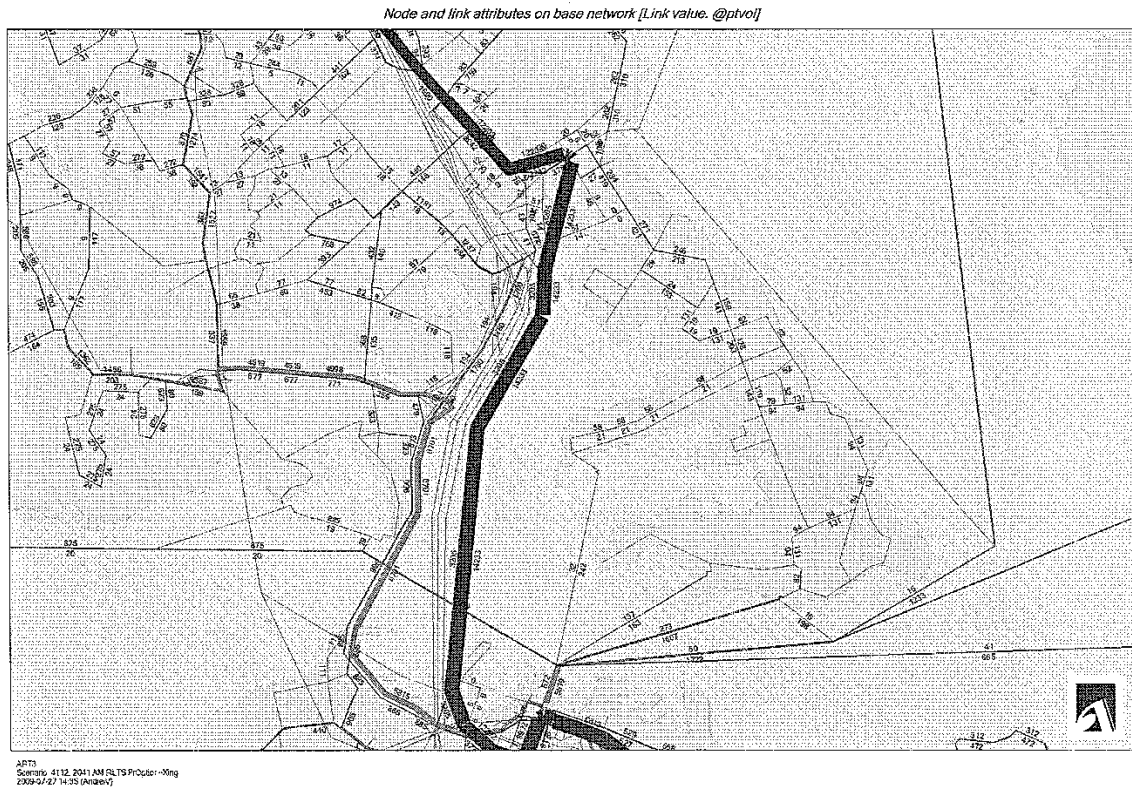


Figure 13: 2041 AM peak PT Patronage with North Shore Rail and additional road harbour crossing

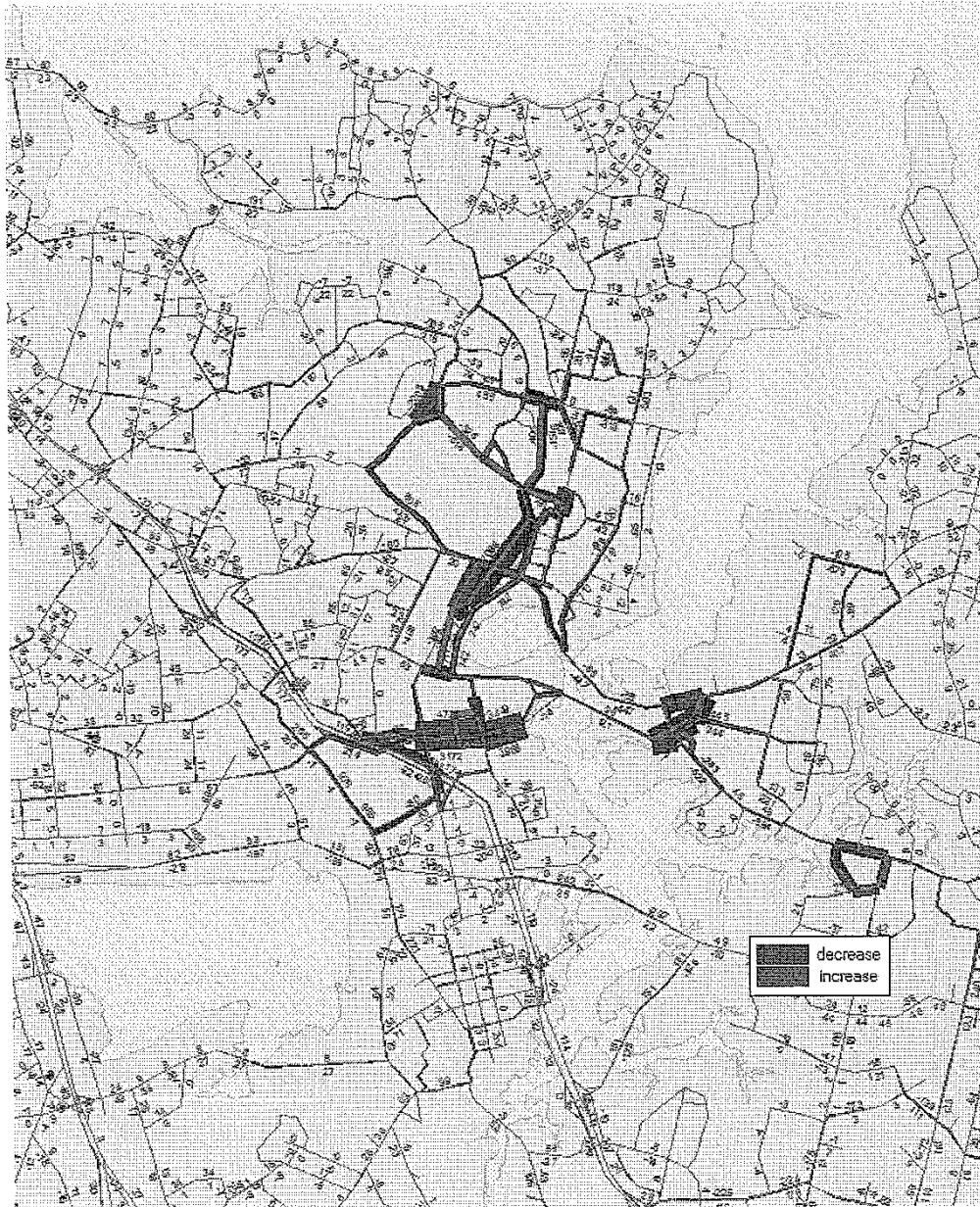


To be assessed further after the RLTS

AMETI

The effects of the AMETI scheme are reasonably localised, mainly because much of the proposed network already exists (except for the Stage 1 Auckland City section from Mt Wellington to Merton Rd). The vehicle flow differences with and without the AMETI scheme are shown in the figure below. Similar effects are reflected in the passenger transport flows.

Figure 14: 2041 AM peak period Vehicle Flow Differences, AMETI Scheme



The AMETI scheme is designed to enable significant land use changes in the Panmure, Glen Innes and Pakuranga areas, and should not be considered simply as a transport project.

RLTS Preferred Option: Roading

This attachment summarises roading issues raised at the 02 July 2009 RTC workshop. All the elements are discussed separately but they are, however, integrated and changing any component results in changes to almost all other elements. For instance, adding a major road link will affect travel speeds, which will also change trip patterns, when during the day trips are made, and which mode of transport may be used. Changes thus support some outcomes but not others, which can make project assessment difficult.

Results presented in this attachment may differ slightly to previously reported results because the models are updated continuously to include changes and modifications to the preferred option

The modelling report is considered sufficiently robust to support strategic decisions. In developing any of the projects considerable extension and refinement of the modelling would be required.

Bottlenecks

The locations of bottlenecks were assessed from a regional perspective – where bottlenecks were clustered or aligned along a route then improvement measures were investigated. Isolated bottlenecks have not been investigated in this stage of the RLTS. This form of analysis was in used in developing the projects listed in this report.

Regional Strategic Freight Network (ROAD) performance

The Regional Strategic Freight Network (RSFN) includes the state highways, and some major arterials in the vicinity of the main commercial and industrial areas (Henderson, Otahuhu, quarry accesses, Glenbrook, etc). The performance of the regional freight network has been measured by comparing the travel speed on the freight network with the rest of the region's roads. A further test was also run in which the Preferred Option PT network improvements were not included. The aim of this test was to see what the benefits of the proposed PT improvements would be to freight travel, measured via the expected road speed improvements as trips divert off roads onto an improved PT system.

The RSFN is described in a separate item on this Agenda.

The performance of the regional freight network has been measured by comparing the travel speed on the freight network with the rest of the region's roads

Table 1: Speeds on the Regional Freight Network (AM peak)

Road category	Average speed (kph)		
	2006	2041 PO	2041 Freight Test
Region: All Roads	41	42	41
Regional Arterials	35	34	34
Motorway Freight Network	55	61	60
Regional Arterial Freight Network	34	36	35
Rural Freight Network	74	69	69
% of RSFN congested	17.2%	15.7%	16.4%

2006 / 2041 filtered by tagfreight

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The speed changes in the freight test option indicate that enhancing the PT system does result in higher travel speeds on the regional freight network, although the change is small, about 2%. There is however, only a 10% reduction in PT trips if the enhanced PT system is omitted. This is because the PT system is not capacity constrained and is highly overloaded in the freight test option, indicating that in reality greater speed reductions should result as the "overloaded" portion of PT trips are forced onto other modes. If a 10% reduction in PT patronage results in a 2% decrease in speeds, then it can be inferred that a 50% reduction in PT patronage would result in a 10% decrease in speeds (this is not strictly correct as relationships are not linear).

Improving the PT network (by implementing the Preferred Option proposals) is forecast to reduce the proportion of the RSFN that operates under congested conditions from 16.4% to 15.7%, which is a 4% improvement.