

B Evaluation Results

The following sections detail the evaluation results for each of the key evaluation criteria and discussed under section 3 of the AMETI PT Plan.

B.1 Sustainable Movement of People Goods and Services

The evaluation factors from the APT model supporting the evaluation of the sustainability criterion are:

- **decongestion** effect - reducing the requirement for road space;
- peak **car trips diverted** to public transport - insofar as this will lead to a change in vehicle purchasing behaviour over time, with savings in the size of the car fleet, although offset by resource consumption in the public transport fleet;
- reduction in fuel consumption from the **diverted car-kilometres**, offset by additional fuel consumption by the public transport services leading to improved energy efficiency and less CO2 emission.

Each of these is estimated as physical quantities and as dollar values. The comparative results are shown in Table B.1.

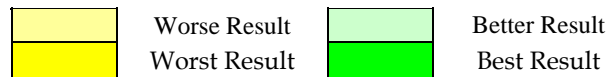
QTN Options - QTN6 is clearly the best performing option on sustainability measures, with QTN5 much less effective but still slightly better than the unmodified PTNP, whereas QTN4 is significantly worse than the PTNP.

RTN1 to RTN3 - RTN1 is the most effective in use of road space and reducing the size of the private car fleet, with RTN2 a close second and RTN3 third. For energy use and greenhouse gas emissions the rail option RTN2 is clearly the best. When the four factors are assigned economic values, RTN2 is the best, with RTN1 second and RTN3 third. All are improvements on the PTNP with the CDB loop.

RTN3A & B alternatives - in this group RTN3B is the best option on all measures of sustainability, followed by RTN3B-A and then the two RTN3A options.

Table B.1- Evaluation against Sustainability Factors

Sustainability Evaluation Factors	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A- A	RTN3B	RTN3B- A
<i>Road Space</i>										
reduction, m2	-1,170	538	1,134	6,910	6,675	6,076	6,803	8,309	10,416	9,875
value \$m NPV	-0.41	0.19	0.40	2.42	2.34	2.13	2.38	2.91	3.65	3.46
<i>Private Vehicle Fleet</i>										
reduction, units	-15	7	15	89	86	79	89	108	136	130
value \$m NPV	-0.23	0.11	0.22	1.34	1.29	1.18	1.34	1.62	2.04	1.95
<i>Fuel consumption</i>										
reduction, Mlitres/y	-4	-3	1	1	8	-2	20	18	26	16
value \$m NPV	-0.14	-0.09	0.02	0.03	0.27	-0.08	0.66	0.60	0.83	0.52
<i>CO2 emissions</i>										
reduction, tonnes/y	-343	-220	48	81	671	-188	1,640	1,488	2,085	1,309
value \$m NPV	-0.39	-0.25	0.05	0.09	0.77	-0.21	1.87	1.70	2.38	1.49
<i>Combined</i>										
value \$m NPV	-1.17	-0.05	0.69	3.88	4.66	3.01	6.25	6.82	8.89	7.42



B.2 Connectivity between Communities and Businesses

Connectivity between communities and businesses is shown in Table B.2 and is evaluated from (i) the percentage of trips made by public transport to key economic nodes - centres of employment, tertiary education and main hospitals and (ii) the trip-weighted total journey times by bus and rail, both in the AM peak period, to the same nodes, in each case compared against the base option. The focus is on existing developed zones; with growth zones similarly rated in Section 0. The ART zone numbers are shown in brackets in the Table after the location names. Locations in bold are those within the AMETI corridor.

Mode Share of Public Transport:

QTN Options – PT mode share to the centres of employment is similar over all options with none clearly better or worse than the unmodified PTNP. QTN4 and QTN5 are slightly worse than the PTNP for PT use to Panmure but better for the Waiouru Peninsular/East Tamaki area. QTN6 is a marginal improvement on the PTNP over most employment destinations, to tertiary education and the hospitals with no significant negatives.

RTN1 to RTN3 – PT mode share to the centres of employment is generally better for RTN3, followed by RTN2 and then RTN1. RTN1 is slightly less effective in improving PT use to the East Tamaki and surrounding area of employment concentration compared with the PTNP. RTN3 provides slightly better capture of trips by PT to the educational and hospital destinations. RTN3B is slightly ahead overall, followed by RTN3B-A and RTN3A-A with RTN3A last.

RTN3A & 3B Alternatives – there are only small differences between these options in PT mode share to the employment centres.

Public Transport Journey Times:

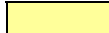
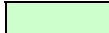


QTN Options – differences between the options are only small. QTN4 provides slightly shorter journey times than QTN5 with QTN6 last.

RTN1 to RTN3 – with the exception of travel to Howick, for which RTN1 gives the lowest travel time, RTN3 is better at reducing public transport journey times to key employment nodes than either RTN1 or RTN2

RTN3A & 3B Alternatives – the variant RTN3A-A performs better than all other options particularly to the suburban centres in the main AMETI corridor. RTN3A is noticeably worse than other alternatives in this group.

Table B.2 – Connectivity between Communities and Businesses
 (% of AM peak trips by PT to employment centres, tertiary education and hospitals)

Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>High Employment Areas</i>										
Pakuranga (156)	0.06%	0.17%	0.15%	0.36%	-0.24%	0.03%	-0.11%	0.23%	0.09%	0.05%
Howick (151)	0.02%	0.02%	0.06%	1.01%	0.10%	0.69%	0.45%	0.42%	0.84%	0.46%
Lunn Ave (134)	-0.13%	-0.03%	0.01%	0.26%	-0.08%	0.19%	0.24%	-0.37%	0.16%	0.08%
Panmure (135)	-0.27%	-0.24%	-0.10%	-0.16%	0.00%	0.02%	0.04%	0.25%	0.18%	0.08%
Mt Wellington (136)	-0.02%	0.00%	0.00%	-0.41%	0.00%	0.01%	0.04%	0.02%	0.07%	0.03%
E Tamaki (E) (164)	0.25%	0.26%	0.16%	-0.13%	0.17%	0.20%	0.15%	0.16%	0.16%	0.18%
Greenmount (166)	-0.14%	-0.11%	0.07%	-0.32%	0.09%	0.29%	0.19%	0.35%	0.25%	0.29%
Ormiston (169)	0.20%	0.21%	0.16%	-0.47%	0.14%	0.20%	0.19%	0.25%	0.24%	0.25%
Otara N. (170)	0.03%	0.06%	0.02%	0.09%	0.19%	0.23%	-0.03%	0.08%	0.10%	0.14%
Penrose (122)	0.04%	0.00%	0.02%	0.05%	0.09%	0.07%	0.08%	0.09%	0.12%	0.07%
Onehunga (124)	-0.09%	-0.07%	-0.05%	0.11%	0.02%	0.06%	0.19%	0.08%	0.19%	0.19%
<i>Tertiary Education</i>										
Auckland Uni (75)	-0.66%	-0.08%	0.03%	0.62%	0.45%	0.73%	0.16%	0.56%	0.10%	0.01%
AU Tamaki (132)	-0.02%	-0.01%	0.00%	-0.27%	0.08%	0.05%	0.14%	0.13%	0.55%	0.49%
Manukau Tech (170)	0.03%	0.06%	0.02%	0.09%	0.19%	0.23%	-0.03%	0.08%	0.10%	0.14%
<i>Hospitals:</i>										
Auckland City (106)	-0.22%	-0.02%	0.02%	0.07%	0.00%	0.14%	0.35%	0.61%	0.20%	0.18%
Middlemore (171)	0.06%	0.09%	0.09%	0.17%	0.14%	0.13%	0.23%	0.23%	0.31%	0.28%

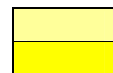
	Worse Result		Better Result
	Worst Result		Best Result

Note: in bold are within AMETI corridor

Connectivity between Communities and Businesses

(Weighted PT journey times to employment centres, tertiary education and hospitals)

Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>High Employment Areas</i>										
Pakuranga (156)	-0.50	-0.47	-0.32	-1.54	0.67	-2.26	-1.74	-7.21	-4.60	-4.43
Howick (151)	-2.06	-2.02	-1.48	-7.42	0.48	-1.27	0.84	-6.10	-8.02	-2.55
Lunn Ave (134)	-0.31	-0.12	-0.19	-0.29	1.22	-0.82	0.32	-1.66	-0.27	-0.22
Panmure (135)	0.60	0.52	0.15	1.09	0.70	-0.55	1.28	-3.96	-1.42	-1.36
Mt Wellington (136)	-0.06	0.18	0.03	2.10	0.89	-0.35	0.93	-0.50	-0.04	0.08
E Tamaki (E) (164)	-3.04	-2.90	-1.36	-1.05	0.71	-3.45	-1.79	-6.93	-5.01	-5.18
Greenmount (166)	1.67	1.88	-0.06	-2.40	3.69	-6.75	-6.37	-13.33	-9.12	-10.08
Ormiston (169)	-1.68	-1.40	-0.67	-2.13	3.02	-6.44	-5.94	-11.71	-9.19	-9.43
Otara N. (170)	0.83	1.04	1.71	1.75	2.62	1.29	3.26	-1.06	0.32	0.14
Penrose (122)	0.06	0.03	-0.08	-0.28	0.36	-0.41	0.80	0.50	0.66	0.81
Onehunga (124)	-0.17	-0.05	-0.10	-0.37	-0.19	-0.21	1.94	0.77	1.46	1.55
<i>Tertiary Education</i>										
Auckland Uni (75)	-0.38	0.04	0.04	-0.37	0.02	-1.24	0.22	-2.57	-1.68	-1.39
AU Tamaki (132)	0.11	0.21	0.08	0.98	-0.49	-0.70	1.04	0.21	-3.64	-3.63
Manukau Tech (170)	0.83	1.04	1.71	1.75	2.62	1.29	3.26	-1.06	0.32	0.14
<i>Hospitals:</i>										
Auckland City (106)	-0.17	-0.09	0.04	-0.08	0.36	-1.13	-0.68	-3.80	-0.08	-0.11
Middlemore (171)	-0.33	-0.34	-0.47	-0.20	0.26	0.05	1.51	-0.26	0.12	0.36



Worse Result
Worst Result



Better Result
Best Result

Note: in bold are within AMETI corridor

B.3 Promotion of Economic Development/Reduction of Congestion

Two ratings are grouped into the criterion of promoting economic development and congestion relief.

Congestion is the main hindrance to economic activity and contributor to excessive transport cost in the region. Decongestion benefit is the selected main indicator of effect for this economic development criterion. By diverting cars to PT, improved travel conditions are provided for modes that do not have the same diversion opportunities, such as freight deliveries.

Table B.3 – Decongestion Benefits

Option	Compared to	Decongestion benefit \$ (2hr AM peak)
QTN4	PTNP	-1,564
QTN5	PTNP	191
QTN6	PTNP	957
RTN1	PTNP + CBD Loop	5,170
RTN2	PTNP + CBD Loop	5,499
RTN3	PTNP + CBD Loop	3,777
RTN3A	PTNP	4,391
RTN3A_A	PTNP	6,843
RTN3B	PTNP	8,812
RTN3B_A	PTNP	7,418

Decongestion Benefits

QTN Networks – QTN6 is the best performing, providing substantial decongestion benefits compared with other QTN options; QTN5 is similar to the PTNP so is neutral; and QTN4 is substantially less effective than the PTNP.

RTN1 to RTN3 Networks – RTN1 and RTN2 produce high and approximately the same level of decongestion benefit compared to the base option; RTN3 still produces good decongestion benefits but less than the other options in this group.

RTN3A and 3B Alternatives – RTN3B followed by RTNB_A provide higher decongestions benefits than RTN3A_A and lowest RTN3A.

The second factor under the economic development criterion is PT connectivity measured again as percentage of mode share and PT journey times, for trips to the Auckland CBD, Manukau City Centre and other main suburban retail centres such as Newmarket, Botany and Highland Park.

Mode Share of Public Transport:

QTN Options – Connectivity with the CBD and Manukau City Centre is noticeably better for QTN5 than for other QTN options. There is little difference for PT connectivity to suburban retail centres.

RTN1 to RTN3 – PT mode share to the CBD and suburban retail centres is generally better for RTN2 and RTN3. RTN1 is slightly less effective in improving PT use to Botany and Highland Park compared with the PTNP.

RTN3A & 3B Alternatives – RTN3B-A is noticeably better in PT mode share to Manukau City and to the Auckland CBD than other options. RTN3A and RTN3A-A are similar and rank second with RTN3B third. All perform better than the PTNP network.

Public Transport Journey Times:





QTN Options – differences between the options are only small. QTN4 and QTN5 have increased journey times to Botany. QTN4 gives slightly better reduction in PT journey times to the CBD. On balance QTN6 is marginally favoured because of slightly reduced journey times overall without the increase in time to Botany.

RTN1 to RTN3 – RTN3 is best at reducing public transport journey times to the CBD and suburban centres, followed by RTN1 and then RTN2. RTN2 gives increased travel times to Botany.

RTN3A & 3B Alternatives – the variant RTN3A-A performs better than all other options particularly to the suburban centres in the main AMETI corridor, with RTN3B and 3B-A second. RTN3A performs less well but still better than the PTNP.

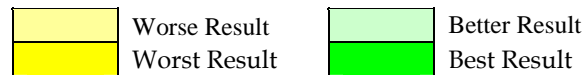
Table B.4 – Promotion of Economic Development
 (% of AM peak trips by PT to CBD and main suburban retail centres)

Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>Main Centres</i>										
Manukau City	0.11%	3.55%	0.65%	0.77%	0.04%	0.64%	1.01%	0.70%	0.11%	3.55%
CBD - Downtown	0.02%	0.41%	0.12%	0.11%	-0.03%	0.05%	0.08%	0.06%	0.02%	0.41%
CBD - West	0.03%	4.60%	0.27%	0.34%	0.15%	0.70%	0.14%	0.11%	0.03%	4.60%
CBD - Town Hall	0.04%	2.99%	-0.64%	0.39%	1.27%	1.35%	3.76%	3.12%	0.04%	2.99%
CBD - Quay Park	0.11%	3.55%	0.65%	0.77%	0.04%	0.64%	1.01%	0.70%	0.11%	3.55%
<i>Suburban Retail Centres</i>										
Highland Park (158)	0.05%	0.10%	0.09%	-0.52%	0.07%	0.09%	0.02%	0.02%	0.11%	0.03%
Botany (160)	-0.03%	0.00%	-0.03%	-0.69%	0.27%	0.17%	0.09%	0.24%	0.21%	0.23%
Newmarket (108)	-0.09%	-0.06%	0.01%	0.47%	0.09%	0.40%	2.05%	3.03%	1.89%	1.80%

	Worse Result		Better Result
	Worst Result		Best Result

Promotion of Economic Development
(Weighted PT journey times to the CBD and main suburban retail centres)

Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>Main Centres</i>										
Manukau City	-0.07	0.00	-0.07	-3.24	-0.63	-5.39	-4.37	-8.95	-6.91	-7.19
CBD - Downtown	-0.28	0.03	-0.04	-0.40	-0.28	-1.27	-0.69	-3.55	-3.28	-3.14
CBD - West	-0.16	0.05	-0.02	-0.42	-0.18	-1.42	-0.71	-3.09	-3.13	-3.00
CBD - Town Hall	-0.18	0.07	0.05	-0.47	-0.28	-1.23	-0.76	-2.98	-2.63	-2.59
CBD - Quay Park	-0.64	0.19	0.15	1.07	-0.31	-1.03	-0.66	-4.19	-5.55	-5.38
<i>Retail Centres</i>										
Highland Park (158)	-2.42	-2.25	-2.06	-2.25	0.26	-3.23	-2.41	-9.33	-6.77	-5.30
Botany (160)	3.46	3.54	-0.09	-1.17	2.37	-5.10	-4.74	-12.67	-6.91	-7.68
Newmarket (108)	0.92	0.26	0.31	-0.36	-0.05	-1.02	0.48	-2.32	1.62	1.42



B.4 Providing for Future Growth Needs (Regional Growth Strategy)

This is evaluated from PT journey times and the percentage of trips served by public transport (i) to the growth areas for employment and retail development, and (ii) trips originating from residential growth areas.

Mode Share of Public Transport:

QTN Options – there is very little difference between QTN options. Overall QTN5 captures a slightly higher proportion of PT trips than QTN4 or QTN5.

RTN1 to RTN3 – RTN3 captures the largest share of PT, followed by RTN2 and then RTN1.

RTN3A & 3B Alternatives – the options are all very similar. Overall the RTN3B and 3B-A options capture slightly more trips to PT than the 3A and 3A-A options, and more evenly across the employment and population growth nodes.

Public Transport Journey Times:

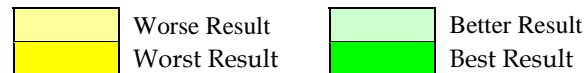
QTN Options – QTN4 gives slightly lower PT journey times than QTN5 followed by QTN6. However differences are slight

RTN1 to RTN3 – RTN3 is clearly the best option followed by RTN1 and then RTN2.

RTN3A & 3B Alternatives – RTN3A-A is the best, followed by RTN3B and 3B-A, with RTN3A last. The first three all provide significantly lower PT journey times than the PTNP

Table B.5 – Providing for Future Growth Needs
 (% of AM peak trips by PT to growth employment areas and from growth residential areas)

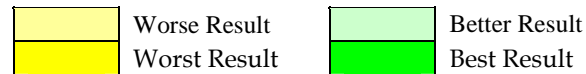
Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>Trips to Employment Growth Areas</i>										
East Tamaki (W) (163)	0.92%	0.96%	0.67%	0.59%	1.12%	1.11%	0.67%	0.75%	0.74%	0.77%
East Tamkai (E) (164)	0.25%	0.26%	0.16%	-0.13%	0.17%	0.20%	0.15%	0.16%	0.16%	0.18%
<i>Trips to New Suburban Retail Centres</i>										
Sylvia Park (137)	-0.01%	0.01%	0.04%	0.19%	0.04%	0.12%	0.06%	0.08%	0.17%	0.12%
Flat Bush TC (178)	0.00%	0.00%	0.00%	-1.03%	0.02%	0.07%	0.01%	0.04%	0.02%	0.04%
<i>Trips from Residential Growth Centres</i>										
Flat Bush (168)	-0.05%	0.00%	0.04%	-0.01%	0.24%	0.42%	-0.02%	0.17%	-0.04%	-0.03%
Donegal Park (178)	-0.12%	-0.07%	0.05%	-0.54%	0.08%	0.98%	0.92%	1.82%	0.90%	0.94%
Tuscany Estates (179)	-0.12%	-0.07%	0.04%	-0.31%	-0.09%	0.20%	0.10%	0.47%	0.10%	0.11%
Lunn Ave (N) (132)	-0.04%	0.01%	0.01%	-0.07%	0.65%	0.55%	0.39%	0.45%	0.97%	0.90%
Lunn Ave (S) (134)	-0.42%	-0.02%	-0.03%	0.82%	0.69%	0.78%	0.36%	-0.67%	0.39%	0.20%
Mt Wellington (136)	-0.18%	0.01%	-0.01%	0.55%	0.56%	0.57%	0.04%	-0.05%	0.10%	0.02%



Providing for Future Growth Needs

(weighted PT journey times to growth employment areas and from growth residential areas)

Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>Trips to Employment Growth Areas</i>										
East Tamaki (W) (163)	-3.81	-3.70	-2.64	-5.72	-3.02	-6.51	-1.75	-7.11	-4.92	-5.19
East Tamaki (E) (164)	-3.04	-2.90	-1.36	-1.05	0.71	-3.45	-1.79	-6.93	-5.01	-5.18
<i>Trips to New Suburban Retail Centres</i>										
Sylvia Park (137)	0.29	0.31	0.28	-0.59	-0.11	-0.39	1.68	0.88	0.76	0.93
Flat Bush TC (178)	-0.17	-0.08	-0.17	-3.15	3.39	-9.70	-9.67	-15.84	-12.90	-13.57
<i>Trips from Residential Growth Centres</i>										
Flat Bush (168)	0.00	0.55	0.11	-2.42	0.15	-7.91	-7.31	-13.71	-11.10	-11.51
Donegal Park (178)	-0.25	0.11	-0.13	-1.78	1.49	-4.39	-3.88	-8.72	-6.72	-7.02
Tuscany Estates (179)	-0.75	-0.28	0.08	-1.23	1.50	-5.12	-4.56	-10.48	-7.89	-8.31
Lunn Ave (N) (132)	0.13	0.25	0.12	0.76	0.96	-0.22	-0.72	-0.87	-6.66	-6.58
Lunn Ave (S) (134)	-0.58	0.17	0.14	0.07	1.07	-0.97	-1.06	-2.45	-2.37	-1.97
Mt Wellington (1360)	-0.52	0.24	0.24	1.10	1.54	0.43	0.11	-1.01	-1.25	-1.11



B.5 Efficiency

Efficiency is measured as transport user benefits generated by each option. If the costs of the options vary significantly then efficiency can be expressed as the ratio of transport user benefits to costs. Efficiency features as a criterion in the wider regional/national objectives.

Table B.6 – Transport User Benefits

Option	Compared to	Transport User Benefits \$ (2hr AM peak)
QTN4	PTNP	-2,926
QTN5	PTNP	286
QTN6	PTNP	1,975
RTN1	PTNP + CBD Loop	10,590
RTN2	PTNP + CBD Loop	10,973
RTN3	PTNP + CBD Loop	9,166
RTN3A	PTNP	9,864
RTN3A_A	PTNP	13,567
RTN3B	PTNP	17,271
RTN3B_A	PTNP	16,186

QTN Networks – QTN6 is the best performing, providing substantial transport user benefits compared with other QTN options; QTN5 is similar to the PTNP so is neutral; and QTN4 is substantially less effective than the PTNP.

RTN1 to RTN3 Networks – RTN1 and RTN2 produce high and approximately the same level of benefit compared to the base option; RTN3 still produces good decongestion benefits but slightly less than the other options in this group.

RTN3A and 3B Alternatives - RTN3B followed by RTNB_A provide higher benefits than RTN3A_A and lowest RTN3A although all are substantially better than the base.

B.5.1 Improves Journey Time Reliability

The proportion of public transport trips and passenger-kms served by the RTN are taken as indicators of increased reliability on the grounds that the separated right-of-way provided by these services, coupled with the high frequency is inherently less prone to punctuality and journey time variability than is bus-on-road.

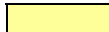
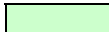


The performance of each option is shown in Table B.7 below:

QTN Networks – QTN5 has the highest proportion of RTN boardings followed by QTN6 and QTN4, although the differences are very minor and determined by the way that the new QTN services integrate with the baseline RTN network.

RTN1 to RTN3 Networks – RTN1 has the highest percentage of RTN boardings, with RTN2 and RTN3 similar in effect and lower, but still better than the base PTNP + CBD Loop comparator. In terms of passenger-kms on the PT network, RTN1 and RTN2 are similar with RTN3 lower, but again better than the base.

Table B.7 – Reliability Measured as RTN Boardings and Passenger-kms

	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>Change in % of Passenger Boardings</i>										
RTN	0.0%	0.8%	0.3%	3.9%	2.7%	2.4%	2.4%	3.1%	5.3%	3.3%
QTN				-4.0%	-2.7%	-2.7%	-2.7%	-3.7%	-5.9%	-3.4%
LCN				0.1%	0.0%	0.3%	0.3%	0.6%	0.6%	0.0%
<i>Change in % of Passenger-kms</i>										
RTN				3.1%	3.2%	1.1%	1.2%	3.6%	7.0%	5.0%
QTN				-3.0%	-3.0%	-1.3%	-1.4%	-4.1%	-6.7%	-4.4%
LCN				-0.2%	-0.2%	0.2%	0.2%	0.5%	-0.3%	-0.7%
<i>Change in Capacity-kms ('000s in AM peak)</i>										
RTN				60.4	477.5	42.1	42.1	67.0	171.1	183.1
QTN				-28.0	-24.9	9.8	9.8	-23.9	-28.2	-27.8
LCN				8.4	35.8	36.6	36.6	40.2	38.0	13.9

	Worse Result		Better Result
	Worst Result		Best Result

RTN3A and 3B Alternatives - RTN3B stands out as capturing a larger proportion of boardings and passenger-kilometres on the RTN network, with the RTN3B-A options second. All these options are again better than the base.

Also it can be noted that additional RTN boardings and p-km are at the expense of QTN boardings, with the LCN little affected.

A comparison with capacity-kms provided is also relevant. The higher passenger boardings on the RTN are to some extent correlated with the capacity provided. However RTN3B achieves a greater increase in RTN boarding and p-km in comparison to capacity provided than does RTN2. So there are probably some implications in cost-effectiveness of the various PT solutions emerging in the evaluation.

B.5.2 Improves Interchange Quality and Facilities

As there is no differentiation between the quality of interchanges at this level of analysis, preference is given to options that require fewer interchanges per trip. The options compare as follows:

Table B.8 – Interchanges per Trip

Option	Compared to	Change in average number of interchanges per Trip
QTN4	PTNP	0.025
QTN5	PTNP	0.001
QTN6	PTNP	0.004
RTN1	PTNP + CBD Loop	0.008
RTN2	PTNP + CBD Loop	-0.013
RTN3	PTNP + CBD Loop	0.009
RTN3A	PTNP	-0.117
RTN3A_A	PTNP	-0.107
RTN3B	PTNP	-0.101
RTN3B_A	PTNP	-0.089

QTN Networks - QTN4 has a slightly increased number of interchanges per trip with QTN5 and QTN6 similar to the PTNP base case.

RTN1 to RTN3 Networks - There are only very small differences among the RTN options. RTN2 is marginally the better option.

RTN3A and 3B Alternatives - All four alternatives are slightly better than the PTNP base, with RTN3A the best, followed by RTN3A_A and RTN3B and the RTN3B_A.

B.5.3 Reduces Travel Times/Increases Opportunities for Areas of Deprivation

Areas of social deprivation are based on Statistics NZ/Ministry of Health index of social deprivation (SDI) with census area units aggregated to ART zones forming weighted averages of the 1-10 point scale of the SDI. The zones shown are all the poorest in terms of this index which incorporates a basket of factors including income, housing, health, employment status and opportunity. Where the same suburb is shown twice, this indicates that it covers more than one ART zone and the result for each zone is shown. The ART zone is shown in parenthesis against each area name.

Percentage of Trips made by Public Transport in AM Peak

QTN Networks – none of the QTN options stand out as being better than the others or the original PTNP.

RTN1 to RTN3 Networks – RTN3 attracts slightly more PT trips than other options, with RTN2 second and RTN3 third and, on balance, inferior to the base option - the PTNP with the CBD loop.

RTN3A and 3B Alternatives – the RTN3B alternatives are slightly better than RTN3A, with little to choose between RTN3A and RTN3A-A.

Weighted Journey Time for Public Transport Trips in AM Peak

QTN Networks – there is little difference between the options, and between the options and the PTNP.

RTN1 to RTN3 Networks – RTN3 is the best of the three options, followed by RTN1 and then RTN2. RTN2 is, on balance, poorer on this measurement than the base option – the PTNP with the CBD Loop.

RTN3A and 3B Alternatives – RTN3A-A is the best of this group of options, followed by RTN3B and RTN3b-A, with RTN3A last.

Table B.9 – Reduces Travel Times/Increases Opportunities to Areas of Social Deprivation
 (% of AM peak trips by PT to/from areas with a poor social deprivation index)

Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A-A	RTN3B	RTN3B-A
<i>Trips to Zones with low SDI</i>										
Glenn Innes/Pt England (130)	-0.02%	-0.02%	-0.01%	-0.06%	0.19%	0.13%	0.30%	0.28%	0.84%	0.73%
Panmure/Tamaki (135)	-0.27%	-0.24%	-0.10%	-0.16%	0.00%	0.02%	0.04%	0.25%	0.18%	0.08%
Otara North (170)	0.03%	0.06%	0.02%	0.09%	0.19%	0.23%	-0.03%	0.08%	0.10%	0.14%
Otara South (175)	0.38%	0.39%	0.38%	-0.36%	0.21%	0.24%	0.25%	0.30%	0.32%	0.35%
Flat Bush (W) (176)	0.06%	0.06%	0.04%	-0.55%	0.25%	0.29%	0.25%	0.39%	0.29%	0.32%
Chapel Downs (177)	0.00%	0.00%	0.01%	-0.33%	0.10%	0.18%	0.00%	0.11%	0.07%	0.07%
<i>Trips from Zones with low SDI</i>										
Glenn Innes/Pt England (130)	0.01%	0.01%	0.00%	-0.05%	0.22%	0.02%	0.61%	0.67%	1.44%	1.35%
Panmure/Tamaki (135)	-0.53%	-0.28%	-0.06%	0.50%	0.76%	0.73%	0.21%	0.34%	0.37%	0.19%
Otara North (170)	-0.29%	-0.22%	-0.29%	-0.56%	-0.19%	-0.24%	-0.34%	-0.04%	-0.27%	-0.24%
Otara South (175)	0.11%	0.15%	0.09%	-0.21%	0.18%	0.14%	-0.01%	0.18%	0.00%	0.02%
Flat Bush (W) (176)	0.07%	0.13%	0.10%	-0.18%	0.48%	1.29%	1.23%	1.77%	1.16%	1.24%
Chapel Downs (177)	-0.01%	0.01%	0.03%	-0.48%	0.41%	0.77%	0.62%	1.25%	0.63%	0.70%

Worse Result
 Worst Result
 Better Result
 Best Result

(Weighted PT journey times to/from areas with a poor social deprivation index)

Economic Node	Compared with PTNP			Compared with PTNP + CBD Loop			Compared with PTNP			
	QTN4	QTN5	QTN6	RTN1	RTN2	RTN3	RTN3A	RTN3A- A	RTN3B	RTN3B- A
<i>Trips to Zones with low SDI</i>										
Glenn Innes/Pt England (130)	0.05	0.11	0.00	0.09	-0.61	-0.74	0.90	-0.66	-4.47	-4.48
Panmure/Tamaki (135)	0.60	0.52	0.15	1.09	0.70	-0.55	1.28	-3.96	-1.42	-1.36
Otara North (170)	0.83	1.04	1.71	1.75	2.62	1.29	3.26	-1.06	0.32	0.14
Otara South (175)	-1.62	-1.45	-0.95	1.74	1.69	-1.75	-0.78	-5.50	-3.60	-3.72
Flat Bush (W) (176)	-0.47	-0.35	0.32	-5.08	0.63	-9.75	-9.35	-15.50	-12.61	-13.19
Chapel Downs (177)	-0.24	-0.15	0.30	-2.91	2.01	-7.55	-6.34	-11.96	-9.30	-9.84
<i>Trips from Zones with low SDI</i>										
Glenn Innes/Pt England (130)	0.30	0.39	0.17	-0.33	-0.13	-1.16	-0.54	-1.03	-5.85	-5.74
Panmure/Tamaki (135)	0.14	0.74	0.37	0.84	1.57	-0.24	-0.21	-4.17	-2.85	-2.56
Otara North (170)	1.66	2.34	2.40	2.17	1.19	2.50	3.96	-0.30	0.56	0.47
Otara South (175)	-1.10	-0.51	0.01	-0.02	-0.45	-1.60	0.93	-3.79	-2.17	-2.28
Flat Bush (W) (176)	-0.14	0.28	0.45	-3.63	0.31	-7.23	-6.06	-11.84	-9.62	-9.90
Chapel Downs (177)	-0.41	-0.01	0.22	-1.77	1.11	-4.49	-2.56	-7.26	-5.38	-5.66

Worse Result
 Worst Result
 Better Result
 Best Result

B.5.4 Reduces Crash Rates

Changes in vehicle-kilometres travelled is used as the indicator for crash reduction, the vehicle-kms of car travel diverted to PT being the APT output. This is then converted to an annual basis (assuming 300 days and 2 peaks per day) and a value assigned using the social cost per reported crash from the LTNZ Economic Evaluation Manual. The resulting comparison is shown in Table B.10 below.

Table B.10 – Road Crash Reduction

Option	Compared to	vehicle-kms diverted to PT	NPV of Savings \$m		
			Crashes	Air Quality	Noise Reduction
QTN4	PTNP	-1,416	-1.0	0.0	0.0
QTN5	PTNP	165	0.1	-0.5	-0.1
QTN6	PTNP	859	0.6	-0.3	0.0
RTN1	PTNP + CBD Loop	4,668	3.2	-2.0	-0.1
RTN2	PTNP + CBD Loop	4,963	3.4	-0.2	0.1
RTN3	PTNP + CBD Loop	3,410	2.3	-1.9	-0.1
RTN3A	PTNP	3,942	2.7	1.4	0.2
RTN3A_A	PTNP	6,669	4.6	0.0	0.2
RTN3B	PTNP	7,925	5.4	0.5	0.2
RTN3B_A	PTNP	6,155	4.2	-0.4	0.1

QTN Networks – QTN6 performs best, with QTN5 similar to the PTNP and QTN4 inferior to the PTNP

RTN1 to RTN3 Networks – RTN1 and RTN2 perform similarly and slightly better than RTN3

RTN3A and 3B Alternatives – RTN3B performs best, with RTN3A-A and RTN3B-A similar and RTN3A last

B.5.5 Environment

Environmental effects are also based on changes in vehicle-kilometres of travel by car and bus.

Inhalable Particulate Emissions (PM₁₀)

In this case the savings in particulate matter (PM) emissions by cars diverted to PT is offset by PM emissions from buses. As relatively uncontrolled heavy diesel engines emit particulates at a rate of about 20 times that of a light petrol engine, the effect of increasing bus transport on regional air quality by this measurement is not necessarily positive.

Noise Emissions

The main effects are assumed to be from cars and buses. Change in noise impact from trains has not been included and is assumed to be relatively small compared with road traffic. Noise emission impacts depend very much on local circumstances, so some broad assumptions are made – that receptors are on average 15m from the traffic stream, and that frontage residential dwellings affected by noise has a density of 50 properties per km. This allows a broad estimate of marginal changes in noise exposure to be made, and a rough estimate of social cost changes based on \$250/year per dB change in noise exposure per property. When the higher noise generation effects of buses are offset against the reduction in cars diverted, the overall effects on traffic noise generation are relatively small and it would require more specific site data to more clearly identify.

For both noise emissions and air quality effects, the net change will be sensitive to the emission characteristics of the bus fleet. Substituting car-kms with fewer but relatively noisier and dirtier buses will not necessarily result in an improvement in environmental quality. A low emission and low noise bus fleet would give quite a different result.

Because of the uncertainty and relatively small differences between options, we have not rated any one option better than another in the final assessment for environmental quality effects.