greater WELLINGTON
REGIONAL COUNCIL

RLTS Review

Strategic Options Analysis

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1. Purpose

This report is a technical background document for the regional land transport strategy (RLTS) review. It sets out an analysis of strategic options that have been developed for the purpose of consultation.

2. Background

The Land Transport Act 1998, as amended by the Land Transport Management Act 2003, requires us to:

- identify land transport outcomes sought by the region and strategic options for achieving those outcomes (s175(2)(l)); and

- provide early and full opportunities for persons and organisations, prescribed by s179(1), to contribute to the development of the strategy (s175(2)(i)).

Outcomes are set out in section 4 of this report. Many have been defined as part of the development of the Regional Land Transport Strategy (RLTS) sub strategies. Others have been developed to ensure an appropriate balance for all modes of travel.

The consideration of strategic options is a statutory requirement for the RLTS review. This part of the RLTS review has been waiting for the WRS to be sufficiently developed to allow it to be integrated with the WRS Growth Framework consultation planned for August 2005.

3. Vision

During 2004, the Regional Land Transport Committee (RLTC) developed a draft vision, draft objectives and policies as part of the RLTS review. The draft vision of the new RLTS is:

To deliver an integrated land transport system that supports the region's prosperity in a way that is economically, environmentally and socially sustainable.

4. Objectives

The six draft objectives of the new RLTS are:

4.1 Objective 1 Assist economic and regional development

Aid the development of national and regional economic prosperity; and foster the housing, employment, education, health and recreation aspirations of the regional community.

4.2 Objective 2 Assist safety and personal security

Achieving a safer community through a land transport system that improves or achieves regional road casualty targets and contributes to a sense of individual and community security when using the transport system.

4.3 Objective 3 Improve access, mobility and reliability

Transport should provide for the access and mobility needs of our regional community. Improving them is the primary purpose of a Regional Land Transport Strategy.

Improving access enables social participation, inclusion and independence and improving mobility ensures the availability of realistic transport choices for the individual or community, including affordability and equity of cost considerations.

4.4 Objective 4 Protect and promote public health

Provide a transport system that allows for social participation and interaction, and healthy communities via reduced transport impact on natural resources, and increased uptake of active mode use, particularly for short trips.

4.5 Objective 5 Ensure environmental sustainability

Avoid, remedy or mitigate the negative impacts of transport on the environment, including encouragement of energy efficiency, reduced CO_2 emissions, and high quality project and new development design.

4.6 Objective 6 Consider economic efficiency and affordability

Economic efficiency and funding availability for new transport packages.

5. Land transport outcomes

No single outcome can be seen in isolation. All outcomes must be considered as part of an integrated strategic view of the region's transport system.

Roading and passenger transport (PT) outcomes are identified first because they are the region's most used transport networks. The draft regional passenger transport plan, being developed separately by Greater Wellington's Passenger Transport Committee, has as its main outcome the retention of PT mode share. Its objectives and outcomes have been developed taking account of the draft RLTS objectives (as set out in section 4 of this report).

The proposed land transport outcomes are as follows:

Roading (draft)

- Maintained vehicle travel times between communities and regional destinations
- Reduced road congestion
- Improved reliability of the strategic roading network

Passenger Transport (draft)

- Maintained peak period mode share
- Enhanced off peak mode share and community connectedness
- Improved accessibility
- Improved customer satisfaction

Travel Demand Management (draft)

- Reduced traffic demand
- Reduced greenhouse gas emissions
- Reduced fuel consumption
- Reduced road congestion
- Improved journey to work mode share
- Increased vehicle occupancy
- Increased resident satisfaction
- More efficient land use (to be defined by the WRS process)
- No adverse impact on economic development (to be defined by the WRS process)

Pedestrian (May 2004)

- Increased level of service for pedestrian facilities
- Increased mode share for pedestrians, especially for short trips
- Increased safety for pedestrians
- Improved perception of pedestrian safety for children

Cycling (May 2004)

- Improved level of service for cycling
- Increased proportion of all trips cycled
- A perception of cycling safety, convenience and ease
- Reduced relative risk of cycling as a transport mode

Road Safety (September 2004)

- Improved regional road safety
- Improved perceptions of road safety
- A safer roading environment.

6. Affordability envelope

Background work undertaken for the Wellington Transport Project, Greater Wellington's LTCCP and the Western Corridor Transportation Study has enabled the following estimate of Wellington's ten year total strategic transport investment envelope[1]. There are five basic components: roading maintenance, roading improvements, passenger rail, bus services and travel demand management.

Highway maintenance provides for the operation and maintenance of the region's state highway network. Local roading provides for operation and maintenance ($350M) plus usual replacements and improvements ($450M). Costs are funded in current territorial authority LTCCPs and are largely fixed. Roading improvements provides for safety and efficiency improvements to the strategic roading network, largely the region's state highways, but does allow for strategic local roading investments like Kapiti's Western Link Road.

[1] All private costs are excluded e.g. motor vehicle purchase.

Passenger rail maintains the current rail service and allows for additional rolling stock capacity to accommodate the current 1.7% annual patronage growth rate. Allowances have also been made for improvements to park and ride facilities, stations and track on the Western Corridor and for the purchase of additional units to enable the provision of more frequent train services to the Kapiti Coast. Bus services maintains current mode share and improves customer service with enhanced marketing and innovations such as integrated ticketing and real time information. It also provides for harbour ferry subsidies and the total mobility scheme.

Travel demand management (TDM) has yet to be fully defined but is likely to include enhancements to walking and cycling infrastructure, improved traffic management and travel planning initiatives. An investment of $30M over the next 10 years was signalled in the Government's announcement of increased funding for Wellington region's transport needs on 27 January 2005.

The following table identifies the expected ten year strategic transport investment of $3432M.

Table 1: Investment by component ($M)

Component	Planned investment
Highway maintenance	220
Local roading	800
Roading improvements	1060
Passenger rail	889
Bus services	453
Travel demand management	30
10 year total	**3432**

7. Strategic options

Three strategic scenarios have been developed within this affordability envelope, they are planned investment, advanced passenger transport, and advanced roading.

The planned investment scenario is set out in the previous section.

Advanced passenger transport would involve increasing passenger transport service frequency, coverage and service; and the introduction of a light rail service between Johnsonville and Courtenay Place. It would see a greater investment in travel demand management, including walking and cycling facilities. Such a change would be paid for by reducing road improvements.

Without a step change in the affordability envelope, advanced roading would accelerate identified roading improvements, delivering safety and efficiency improvements sooner. This approach would be paid for by reducing passenger transport and TDM investments. The reduced passenger transport investment would accommodate current patronage levels but mode share would decline. It is assumed that no significant changes to the highway network maintenance regime are required as changes to the network are likely to be marginal over the next decade.

Table 2: Strategic Options: Investment by component ($M)

Component	Advanced passenger transport	Planned investment	Advanced roading
Highway maintenance	200 (6%)	200 (6%)	200 (6%)
Local roading	800 (23%)	800 (23%)	800 (23%)
Roading improvements	860 (25%)	1060 (31%)	1260 (37%)
Passenger rail	1019 (30%)	889 (26%)	770 (22%)
Bus services	503 (15%)	453 (13%)	392 (11%)
Travel demand management	50 (1.5%)	30 (0.9%)	10 (0.3%)
10 year total	**3432**	**3432**	**3432**

Table 3: Strategic Options: Investment by mode ($M)

Mode	Advanced passenger transport	Planned investment	Advanced roading
Roading	1860 (54%)	2060 (60%)	2260 (66%)
PT & TDM	1572 (46%)	1372 (40%)	1172 (34%)
10 year total	**3432**	**3432**	**3432**

Tables 2 and 3 highlight a number of points:

- Local roading is 23% of total cost
- State highway road maintenance is 6% of total cost
- TDM investment is less than 2% of the total in any scenario.

What the investment analysis over looks is that the 'advanced passenger transport' scenario would be more expensive for the regional community. This is because state highway investments are 100% crown funded, whereas passenger transport investments normally require 40% to 50% local contribution. Therefore, increasing PT investment by some $200M would require $80M to $100M more funding, most likely from regional transport rate and/or fare increases.

8. Outcome analysis

The three scenarios have been analysed using the region's strategic transport model and assessed against the draft regional land transport strategy objectives and outcomes. Each objective and outcome has been assessed individually. Indicators have been repeated under different objective/outcome viewpoints. This is not double counting because the ticks and crosses are not added.

We have generally used a five point scale to rate the performance of the scenario against each indicator, comparing the expected/forecast outcome in 2016 to our base network in 2001. Two ticks (✓✓) shows the outcome to be strongly positive, in other words significantly improved. A dash (-) indicates a neutral outcome and two crosses (××) shows strongly negative performance. Most indicators do not show very large variances

from the base network. However, an exception to this is the forecast rise in fuel use and consequential 21% increase in carbon dioxide (CO_2) emissions. We have taken the unusual step of rating these outcomes with three crosses (×××) to highlight the fact that these are very strongly negative outcomes.

Table 4: Analysis against RLTS objectives

RLTS objective	Indicator AM peak compared to 2001 unless stated otherwise	Advanced passenger transport	Planned investment	Advanced roading
Assist economic and regional development	• Reduced congestion	××	–	–
	• Reduced HCV costs	×	–	–
Assist safety and personal security	• Reduced road traffic injuries	✓✓	✓	–
	• Qualitative assessment of personal security improvements	✓	✓	✓
Improve access, mobility and reliability	• Increased PT network coverage	✓✓	–	–
	• Improved PT services	✓✓	✓	××
	• Increased road network coverage	✓	✓✓	✓✓
	• Reduced congestion	××	–	–
	• Increased car ownership	✓	✓	✓
	• Improved active mode facilities	✓	✓	✓
Protect and promote public health	• Increased opportunities for physical activity	✓✓	–	×
	• Reduced road traffic injuries	✓✓	✓	–
	• Reduced air pollution	✓	✓	✓
	• Reduced traffic noise	–	–	–
	• Enhanced social cohesion	✓✓	–	×
	• Decreased CO_2 emissions	××	×××	×××
Ensure environmental sustainability	• Decreased CO_2 emissions	××	×××	×××
Consider economic efficiency and affordability	• Package BCR >1	✓	✓	✓
	• Package cost in line with affordability envelope	✓	✓✓	✓✓

✓✓strongly positive – neutral ×× strongly negative (××× very strongly negative)

Table 5: Analysis against RLTS outcomes

RLTS outcome	Indicator AM peak compared to 2001 unless stated otherwise	Advanced passenger transport	Planned investment	Advanced roading
Roading				
• Maintained vehicle travel times between communities and regional destinations	• Strategic road network average speed	–	–	–
• Reduced road congestion	• Strategic road network % at LoS E & F	××	–	–
• Improved reliability of the strategic roading network	• Subjective considering LoS and availability of alternative routes	×	✓	✓
Passenger Transport				
• Maintained peak period mode share	• Peak PT mode share	✓✓	–	×
• Enhanced off peak mode share and community connectedness	• Inter peak PT mode share	–	–	–
• Improved accessibility and customer satisfaction	• Subjective considering new services, frequency & standard	✓✓	✓	××
Travel Demand Management				
• Reduced traffic demand	• Total car trips	××	××	××
• Reduced greenhouse gas emissions	• Total CO_2	××	×××	×××
• Reduced fuel consumption	• Total fuel	××	×××	×××
• Reduced road congestion	• Strategic road network % at LoS E & F	××	–	–
• Improved journey to work mode share	• PT JTW mode share to Wellington CBD	✓✓	✓	–
• Increased vehicle occupancy	• Subjective considering likely TDM measures	✓✓	✓	–
• Increased resident satisfaction	• Subjective considering congestion and PT LoS	–	✓	×
• More efficient land use (to be defined by the WRS process)	• Subjective considering land use changes	–	–	–
• No adverse impact on economic development (to be defined by the WRS process)	• Subjective considering the transport investment programme	✓	✓✓	✓✓

RLTS outcome	Indicator AM peak compared to 2001 unless stated otherwise	Advanced passenger transport	Planned investment	Advanced roading
Pedestrian				
• Increased level of service for pedestrian facilities	• Subjective considering LTCCP ped investment	✓	✓	✓
• Increased mode share for pedestrians, especially for short trips	• Subjective considering ped investment and PT accessibility	✓	✓	–
• Increased safety for pedestrians	• Subjective considering general safety investment	✓	✓	✓
• Improved perception of pedestrian safety for children	• Subjective considering school journey programmes	✓	✓	✓
Cycling				
• Improved level of service for cycling	• Subjective considering LTCCP cycle investment	×	×	×
• Increased proportion of all trips cycled and perception of cycling safety, convenience and ease	• Subjective considering increase in car trips	××	××	××
• Reduced relative risk of cycling as a transport mode	• Subjective considering cycle LoS	×	×	×
Road Safety				
• Improved regional road safety and safer roading environment	• Reduced road traffic injuries	✓✓	✓	–
• Improved perceptions of road safety	• Subjective considering road safety improvements	✓	✓	✓

✓✓strongly positive – neutral ×× strongly negative (××× very strongly negative)

9. Conclusions

The main trade off is between roading investment which reduces congestion; and PT enhancement which provides an alternative to car use.

All three scenarios fail to reduce greenhouse gas emissions compared to the 2001 level due to increasing population and vehicle usage. Even the best performing 'Advanced Passenger Transport' scenario produces 21% more CO_2.

Pedestrian and road safety outcomes are expected to improve under all scenarios. Cycling is expected to decline in all scenarios.

The advanced PT scenario improves PT mode share which has significant public health and safety benefits but significantly worsens congestion because PT improvements do not fully overcome the community's preference for private vehicle travel. It is also likely to be more expensive for the regional community.

The planned investment scenario reduces congestion and retains PT mode share. It improves most indicators with the exception of increased fuel use and consequential CO_2 emissions.

The advanced roading scenario does not perform as well as the planned investment scenario. It results in a significant degradation of PT services and mode share without making any overall decongestion improvement.

Appendix 1: Modelling summary

Three scenarios, reflecting different investment priorities between passenger transport, roading and travel demand management, have been identified and modelled to understand the transport consequences of each option. The three options are:

- Advanced Passenger Transport [APT]
- Planned Investment [PI]
- Advanced Roading [AR].

This appendix provides a summary of the schemes and projects included in the modelling for each scenario, as well as how they are modelled in the Wellington Transport Strategic Model (WTSM).

Modelled schemes and projects

Each of the three scenarios has the same total expenditure, but the amounts allocated to roading improvements, passenger transport (rail and bus) and travel demand management varies. Details of these differences are given in below.

Passenger transport (rail and bus)

The Advanced Passenger Transport scenario includes light rail from Johnsonville to Courtenay Place, along with heavy rail electrification extensions to Waikanae and Timberlea (along with associated stations). The Advanced Roading scenario will result in a reduction in the frequency of bus services and reduced attractiveness for all rail journeys and peak period bus services.

Table A1 provides a complete list of the passenger transport projects modelled.

Table A1: Modelled projects – Passenger transport

	Project Type	APT	PI	AR
Bus Frequency Change (Regionwide)	Level of Service	-	-	-10%
CBD Bus Lanes	Level of Service	✓	-	-
Cruickshank Station	Coverage	✓	-	-
Featherston Peak Period Express	Level of Service	✓	-	-
Light Rail – Johnsonville to Courtenay Place	Level of Service	✓	-	-
Lindale Station	Coverage	✓	-	-
Petone-Grenada PT Service	Coverage	-	✓	✓
Porirua Interchange	Level of Service	✓	✓	✓
Raumati Station	Coverage	✓	-	-
Revised Wellington City Bus Routes	Level of Service	✓	-	-
Timberlea Electrification	Coverage	✓	-	-
Timberlea Station	Coverage	✓	-	-
Waikanae Electrification	Coverage	✓	-	-

Roading network improvements

The Advanced Passenger Transport scenario has had the Petone-Grenada link and Ngauranga-Aotea 8-laning removed. The current capacity constraints around Ngauranga (on both SH1 and 2) remain in place, acting as a deterrent to car travel through this area. The Advanced Roading scenario has the Basin Reserve to Evans Bay four-laning being brought forward into the ten year programme. This will improve road access between Wellington's eastern suburbs and the Wellington CBD.

Table A2 provides a complete list of the roading projects modelled.

Table A2: Modelled projects – Roading network

	Project Type	APT	PI	AR
Basin Reserve	Capacity/Safety	Option H	Option H	Option H
Basin Reserve to Evans Bay 4-laning	Capacity	-	-	✓
Centennial Highway 4-laning	Capacity/Safety	✓	✓	✓
Dowse-Petone Upgrade	Capacity/Safety	✓	✓	✓
ICBP Stage II	Capacity	✓	✓	✓
MacKays Crossing	Capacity/Safety	✓	✓	✓
Paekakariki Grade Separation	Safety	✓	✓	✓
Petone-Grenada Link	New Route	-	✓	✓
Plimmerton to Mana	Capacity	✓	✓	✓
Pukerua Bay Bypass	Capacity/Safety	✓	✓	✓
Pukerua Bay to Plimmerton 4-laning	Capacity/Safety	✓	✓	✓
SH1 Ngauranga-Aotea	Capacity	6 Lanes	8 Lanes	8 Lanes
SH1/Whitford Brown Grade Separation	Capacity/Safety	✓	✓	✓
SH2/SH58 Grade Separation	Capacity/Safety	✓	✓	✓
Terrace Tunnel (capacity)	Capacity	Tidal	Tidal	Tidal
Western Link Road Stage I	New Route	✓	✓	✓
Western Link Road Stage II	New Route	✓	✓	✓
Western Link Road Stage III	New Route	✓	✓	✓

Travel Demand Management

Travel demand management (TDM) programmes are expected to result in a reduction in the number of peak period car trips. It is expected that these programmes will be focussed on workers in the Wellington CBD (as per the TDM Strategy currently under development).

The varying levels of expenditure on TDM under each of the three scenarios will produce different net reductions in these trips. For the purposes of modelling the strategic options, the following reductions in peak period commuting vehicles to the Wellington CBD are expected:

- Advanced passenger transport 10% reduction
- Planned investment 5% reduction
- Advanced roading 1% reduction

This section includes the WTSM results and rationale from which the scores for the scenarios were determined against the RLTS objectives and outcomes.

Table A3: Analysis against RLTS objectives

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	Comments and WTSM Measure
Assist economic and regional development	• Reduced congestion	41%	47% [××]	41% [–]	41% [–]	[Percentage of strategic road network vehicle hours at LoS E & F]
	• Reduced HCV costs	$14.65	$14.95 [×]	$14.70 [–]	$14.70 [–]	[Average HCV cost per trip]
Assist safety and personal security	• Reduced road traffic injuries as evidenced by PT trips; and private car use	28,100 121,900	34,400 134,900 [✓✓]	32,000 137,800 [✓]	30,600 139,100 [–]	• General trend of road and vehicle safety improvements • All strategic options include roading projects which will be built to modern safety standards • Advanced PT scores better due to higher usage of PT, an inherently safer mode and smaller increased usage of cars; and • Advanced Roading scores worse due to higher private car usage and lower growth of PT use. [Total PT trips in AM peak period] [Total private car trips in AM peak period]
	• Qualitative assessment of personal security improvements		[✓]	[✓]	[✓]	• All options have investments in PT security eg park and ride carpark security patrols, CCTV on new rolling stock and at stations, etc; and • Increased PT and active mode usage will increase people's feelings of security due to "safety in numbers".

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	Comments and WTSM Measure
Improve access, mobility and reliability	• Increased PT network coverage		[✓✓]	[–]	[–]	• PT Service Design are continually refining bus routes • Coverage will not be significantly increased under the PI and AR scenarios; and • The APT scenario has a range of coverage improvements including rail extension, additional stations and bus improvements (refer Table A1).
	• Improved PT services		[✓✓]	[✓]	[××]	• APT significantly improves service levels eg light rail • The improvement of rolling stock and timely replacement of buses in PI provides improved service levels compared with 2001; and • AR, by definition, reduces PT level of service.
	• Increased road network coverage		[✓]	[✓✓]	[✓✓]	Western Link Road, included in all options, and Petone-Grenada link significantly increases road network coverage in PI and AR.
	• Reduced congestion	41.3%	46.8% [××]	40.9% [–]	41.4% [–]	[Percentage of strategic road network vehicle hours at LoS E & F]
	• Increased car ownership	0.53 cars/ person 224,050	0.60 cars per person 281,600 [✓]	0.60 cars per person 281,600 [✓]	0.60 cars per person 281,600 [✓]	Car ownership is expected to increase under all scenarios, both in terms of average number of cars per person and total number of cars. [Cars per person/ total cars]
	• Improved active mode facilities		[✓]	[✓]	[✓]	Expecting moderate improvements to walking and cycling facilities in line with national and regional strategies and LTCCPs.
Protect and promote public health	• Increased opportunities for physical activity	15.3%	16.8% [✓✓]	15.5% [–]	14.8% [×]	Increased PT usage necessitates additional walking for access. This is more prevalent in the APT scenario, as indicated by PT mode share. [PT mode share]
	• Reduced road traffic injuries as evidenced by PT trips; and private car use	28,100 121,900	34,400 134,900 [✓✓]	32,000 137,800 [✓]	30,600 139,100 [–]	• General trend of road and vehicle safety improvements • All strategic options include roading projects which will be built to modern safety standards • Advanced PT scores better due to higher usage of PT, an inherently safer mode and smaller increased usage of cars; and

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	Comments and WTSM Measure
						• Advanced Roading scores worse due to higher private car usage and lower growth of PT use. [Total PT trips in AM peak period] [Total private car trips in AM peak period]
	• Reduced air pollution	15,600 3,200 330 2,000	7,600 3,000 430 1,300 [✓]	8,200 3,000 430 1,400 [✓]	8,300 3,000 430 1,400 [✓]	Most emissions are forecast to reduce: • Carbon Monoxide (CO) by 50%; • Volatile organic compounds (VOC) by 30%; and • Nitrous Oxide (NOx) by 5%. Particulate matter (PM10) emissions are forecast to increase by 30%, due to increasing diesel consumption. On balance, air quality is forecast to improve under all scenarios. [CO(kg), NOx(kg), PM10 (kg), VOC (kg)]
	• Reduced traffic noise		[–]	[–]	[–]	Not anticipating any significant changes. Vehicle volumes need to double to cause a perceptible increase in noise levels.
	• Enhanced social cohesion	15.3%	16.8% [✓✓]	15.5% [–]	14.8% [×]	Increased walking and PT provide opportunities for social interaction. [PT mode share]
	• Decreased CO_2 emissions	234	284 [××]	295 [×××]	296 [×××]	All scenarios result in significantly increased CO_2 emissions compared with 2001. The best result is achieved by APT, but there is still 21% more CO_2 than in 2001. The PI and AR produce 26% more CO_2 than in 2001. Due to the significant magnitude of this increase, we have scored APT as being strongly negative, and taken the unusual step of scoring the other scenarios with three crosses to indicate that these are significantly worse. [Carbon dioxide (T)]
Ensure environmental sustainability	• Decreased CO_2 emissions	234	284 [××]	295 [×××]	296 [×××]	As above. [Carbon dioxide (T)]

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	Comments and WTSM Measure
Consider economic efficiency and affordability	• Package BCR >1		1 [✓]	1 [✓]	1 [✓]	Analysis of tangible benefits calculated by WTSM indicate that each scenario has a BCR of at least one. These tangible benefits do not include: • Trip reliability; • Site specific safety benefits; • National strategic factors; and • Other intangibles.
	• Package cost in line with affordability envelope		$3,432M [✓]	$3,432M [✓✓]	$3,432M [✓✓]	All indicative strategic scenarios have been developed within the affordability envelope. However, the increased local share cost of the advanced PT makes it less affordable. [Package Cost]

✓✓strongly positive – neutral ×× strongly negative (××× very strongly negative)

Table A4: Analysis against RLTS outcomes

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	
Roading						
• Maintained vehicle travel times between communities and regional destinations	• Strategic road network average speed	71 kmh	72 kmh [–]	72 kmh [–]	72 kmh [–]	
• Reduced road congestion	• Strategic road network % at LoS E & F	41.3%	46.8% [××]	40.9% [–]	41.4% [–]	
• Improved reliability of the strategic roading network	• Subjective considering LoS and availability of alternative routes		[×]	[✓]	[✓]	• PI and AR both provide a bypass (Petone-Grenada) to the most heavily congested part of the strategic road network (in the vicinity of Ngauranga), as well as an increase in road capacity south of Ngauranga. • The Western Link Road provides an alternative route through the Kapiti area, which will improve SH1 reliability. • Western Corridor highway improvements will also improve reliability on this route.
Passenger transport						
• Maintained peak period mode share	• Peak PT mode share	15.3%	16.8% [✓✓]	15.5% [–]	14.8% [×]	
• Enhanced off peak mode share and community connectedness	• Inter peak PT mode share	6.3%	6.5% [–]	6.3% [–]	6.1% [–]	
• Improved accessibility and customer satisfaction	• Subjective considering new services, frequency & standard		[✓✓]	[✓]	[××]	• APT significantly improves service levels eg light rail • The improvement of rolling stock and timely replacement of buses in PI provides improved service levels compared with 2001; and • AR, by definition, reduces PT level of service.
Travel Demand Management						
• Reduced traffic demand	• Total car trips	121,900	134,900 [××]	137,800 [××]	139,100 [××]	
• Reduced greenhouse gas emissions	• Total CO2 (T)	234	284 [××]	295 [×××]	296 [×××]	

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	
• Reduced fuel consumption	• Total fuel (L)	97,200	115,800 [××]	120,500 [×××]	121,100 [×××]	
• Reduced road congestion	• Strategic road network % at LoS E & F	41%	47% [××]	41% [–]	41% [–]	Desire this as outcome of TDM measures.
• Improved journey to work mode share	• PT JTW mode share to Wellington CBD	45%	55% [✓✓]	49% [✓]	46% [–]	TDM measures expected to be focussed on journey to work car trips to this geographical area.
• Increased vehicle occupancy	• Subjective considering likely TDM measures		✓✓	✓	–	This correlates with our TDM assumptions, which seek reductions of 10%/5%/2% under each respective scenario in JTW car trips to Wellington CBD.
• Increased resident satisfaction	• Subjective considering congestion and PT LoS		[–]	[✓]	[×]	Surveys consistently show road congestion to be a significant issue for the community, along with PT LoS and reliability. Results for this outcome are based on results for reduced road congestion and improved PT services.
• More efficient land use (to be defined by the WRS process)	• Subjective considering land use changes		[–]	[–]	[–]	No significant change in land use patterns expected within 10 year time frame of RLTS.
• No adverse impact on economic development (to be defined by the WRS process)	• Subjective considering the transport investment programme		[✓]	[✓✓]	[✓✓]	All scenarios will increase the transport investment program, which is significantly larger than that undertaken over the last 20 years. However, this benefit is offset in APT due to unfavourable congestion outcomes.
Pedestrian						
• Increased level of service for pedestrian facilities	• Subjective considering LTCCP pedestrian investment		[✓]	[✓]	[✓]	• The local roading investment includes $66M for walking infrastructure improvements over the next 10 years (mainly for footpath renewal); and • It is expected that all major (non-motorway) roading improvements will include upgraded provision for pedestrians.
• Increased mode share for pedestrians, especially for short trips	• Subjective considering pedestrian investment and PT accessibility		[✓]	[✓]	[–]	Based on results for increasing level of service for pedestrian facilities and improved PT services, with greater weighting given to pedestrian LoS.

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	
• Increased safety for pedestrians	• Subjective considering general safety investment		[✓]	[✓]	[✓]	Expect continuing improvements to pedestrian safety, coming out of local road improvements eg WCC's Safer Roads project, and National and Regional pedestrian and road safety strategies.
• Improved perception of pedestrian safety for children	• Subjective considering school journey programmes		[✓]	[✓]	[✓]	Expect continuing improvements to pedestrian safety, coming out of local road improvements e.g. WCC's Safer Roads project, and National and Regional pedestrian and road safety strategies, along with increasing emphasis on Safer Routes to School and Walking School Bus programmes.
Cycling						
• Improved level of service for cycling	• Subjective considering LTCCP cycle investment		[×]	[×]	[×]	• The local roading investment includes $8M for cycling infrastructure improvements over the next 10 years • It is expected that all major (non-motorway) roading improvements will include upgraded provision for cycling • People cycle for different purposes, which require different facilities. Achieving service improvements for the diverse needs of cyclists is expected to remain difficult; and • The modest investment in cycling improvements is not expected to maintain the current LoS in the face of increasing motorised traffic.
• Increased proportion of all trips cycled and perception of cycling safety, convenience and ease	• Subjective considering increase in car trips		[××]	[××]	[××]	• Surveys show cyclists desire improved facilities, indicating a desire for segregated road space. The current very low cycling numbers are a reflection of this poor LoS. • Increasing vehicle numbers will deter cycling without the provision of suitable cycling facilities; and • Due to the difficulty and cost of providing high quality segregated facilities, and the concurrent increase in motorised traffic, we anticipate a decline in cycling.
• Reduced relative risk of cycling as a transport mode	• Subjective considering cycle LoS		[×]	[×]	[×]	Same as Cycling LoS

RLTS objective	Indicator	2001	Advanced Passenger Transport	Planned Investment	Advanced Roading	
Road safety						
• Improved regional road safety and safer roading environment	• Reduced road traffic injuries as evidenced by PT trips; and private car use	28,100 121,900	34,400 134,900 [✓✓]	32,000 137,800 [✓]	30,600 139,100 [–]	• General trend of road and vehicle safety improvements • All strategic options include roading projects which will be built to modern safety standards • Advanced PT scores better due to higher usage of PT, an inherently safer mode and smaller increased usage of cars; and • Advanced Roading scores worse due to higher private car usage and lower growth of PT use. [Total PT trips in AM peak period] [Total private car trips in AM peak period]
• Improved perceptions of road safety	• Subjective considering road safety improvements		[✓]	[✓]	[✓]	Perceptions derive from when people feel vulnerable, which will normally be when in a car or walking, rather than using PT. Consequently, road safety improvements have been used an indicator, with road safety improvements featuring in all scenarios.

✓✓strongly positive – neutral ×× strongly negative (××× very strongly negative)

Modelling methodology

The methodology used to model the three scenarios is described in this section.

Wellington Transport Strategy Model

Greater Wellington Regional Council operates a multimodal transport model to evaluate integrated transport packages within the Wellington region. The Wellington Transport Strategy Model (WTSM) is based on Emme/2, a transportation modelling package used by over 645 government and private organisations worldwide. WTSM is a four-stage model (trip generation, trip distribution, mode choice and assignment) so is well suited to evaluating roading and public transport options.

WTSM models three time periods on an 'average' weekday, the AM (7-9am) and PM (4-6pm) peak periods, along with the inter-peak period (9am-4pm). The model splits the Wellington region into 225 internal and 3 external transport zones for the generation, distribution and assignment of trips. The modelled network includes all major roads in the region, with greater detail within regional CBD's, and all public transport (rail, bus, cable car and ferry) services.

The evaluation of the three strategic option scenarios has been undertaken using demographic projections for 2016 under Statistics NZ medium growth assumptions.

Scenario Benefits

Quantification of some the direct economic benefits is undertaken using the results from WTSM. The benefits which are calculated include:

- Travel time benefits (PT and road)
- Congested travel time benefits (road)
- Vehicle operating cost and congested vehicle operating cost benefits (road)
- Carbon dioxide benefits (all road vehicles); and
- Generic accident benefits.

The benefits for each scenario have been calculated against the outcomes achieved by a 'Do Minimum' scenario. No new PT services or infrastructure are included in the Do Minimum, although it does include the new rolling stock and track improvements which allow for increased frequency of rail services by 2016. The roading projects included are Dowse-Petone upgrade, ICBP Stage II, MacKays Crossing, Plimmerton to Mana upgrade and Western Link Road Stages I to III. The Do Minimum does not include any TDM effects.

TDM Effects

Modelling the effects of TDM measures is difficult in the absence of information on the specific approaches used, and the expected effect of each component of any TDM scheme. To enable an approximation of the effects on the road network and PT services, the combined outcome of all TDM measures in a TDM package was represented by the removal of a certain percentage of all peak period car commuting

trips to/from[2] the Wellington CBD. This percentage varied according to the expected level of TDM expenditure and the outcomes anticipated.

The percentage reduction in CBD bound commuting car trips was modelled as the net effect, not allowing for a mode shift to car to take advantage of the reduction in congestion brought about by the TDM measures[3]. Consequently, any target percentage for TDM will actually have to affect a larger number of commuters, resulting in both a shift away from car for current car users whilst keeping PT users on PT.

Heavy rail (Advanced Roading)

The reduction in expenditure on heavy rail in the Advanced Roading case would not be expected to result in a decrease in rail services. Rather, the condition of the rolling stock and general infrastructure would be expected to deteriorate, resulting in a less favourable perception of its comfort and reliability by the public.

This has been modelled by removing the reduction for perceived in-vehicle time (IVT) which currently applies to all rail travel. This reduction, set at 10%, reflects the observed preference of travellers to using trains over buses, and makes travel by rail more attractive. Consequently, under the reduced rail spending in Advanced Roading, travellers perceive the full cost of the time that they are on rail services when WTSM assigns trips to the PT network.

Light rail (Advanced Passenger Transport)

The Light Rail service modelled is based closely on that reported in *Light Rail Transit Feasibility Study*, produced by Works Consultancy Services Ltd and MVA Consultancy for Wellington City Council and Wellington Regional Council in 1995. It operates on the current Johnsonville rail line, serving all stations between Johnsonville and Crofton Downs, and then (mostly) following the Golden Mile bus route from the Wellington rail yards, through Lambton Interchange to Courtenay Place. The headways used are 15 minutes in the peak periods and half-hourly inter-peak. In addition, a supplementary service between Lambton Interchange and Courtenay Place is run with the same headways, resulting in headways of 7½ and 15 minutes in the peak periods and inter-peak respectively.

It is generally accepted that travellers perceive light rail as providing a superior level of comfort and service to that of heavy rail and buses. To reflect this preference towards light rail, the perceived cost for travelling on a light rail vehicle has been reduced by 15% of the actual in-vehicle time when WTSM assigns trips to the PT network.

Bus services (Advanced Passenger Transport)

The increased expenditure on bus services under the Advanced Passenger Transport scenario will be likely to result in an enhanced bus service, both in terms of routes and frequency of services. It is likely that this effect will be most prominent in Wellington City, as both the Hutt Valley and Porirua have recently had their services revamped. This improvement in Wellington City services has been modelled with new services and frequencies suggested by Anthony Cross (Manager, Transport Service Design).

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[2] In the AM peak period, the reduction was in trips to the Wellington CBD, whilst in the PM peak period, it was in trips leaving the CBD.
[3] This mode shift is likely to apply to all trip makers, not just commuters.

Bus services (Advanced Roading)

The reduction in spending on bus services under the Advanced Roading scenario has been modelled as reducing the frequency of all bus services by 10%, resulting in longer waiting times for all services. It is also expected that this decrease in service frequency would also result in overcrowding occurring on peak period services. This has been reflected in the in-vehicle time on buses during the AM and PM peak periods being increased by an additional 10% to 110% of the actual travel time.

Effects of TDM

Travel demand management (TDM) measures seek to change travel behaviour and either collectively or individually change the need, time or form of travel. It is anticipated that the use of TDM can forestall the need for infrastructure investment, which may be only fully utilised during the morning and afternoon peak periods.

To test the effects on the regional transport network, the Planned Investment scenario was modelled with reductions in car commuting trips to the Wellington CBD in the AM peak period of 0%, 1%, 2%, 5%, 10%, 15% and 20%. Similar reductions in car commuting trips from the Wellington CBD were modelled in the PM peak period. Key network statistics were then extracted from the modelled results under these TDM reductions.

The total number of car trips removed from the road network is only a small proportion of all car trips in the AM peak period:

	Net TDM Effect						
	0%	1%	2%	5%	10%	15%	20%
Total Car Trips	138,600	138,400	138,300	137,800	137,000	136,300	135,500
TDM Reduction in Car Trips		150	310	780	1,550	2,330	3,100
Percentage Reduction		0.1%	0.2%	0.6%	1.1%	1.7%	2.2%

Conversely, due to the smaller number of PT trips, the expected mode shift to PT results in a significant increase in PT trips. This has significant cost implications for the provision of sufficient peak period PT capacity to meet this increased demand as a prerequisite for TDM to work in the region.

	Net TDM Effect						
	0%	1%	2%	5%	10%	15%	20%
Total PT Trips	31,200	31,400	31,500	32,000	32,900	33,700	34,500
TDM Increase in PT Trips		170	330	830	1,660	2,490	3,320
Percentage Increase		0.5%	1.1%	2.7%	5.3%	8.0%	10.7%

This requirement is especially pronounced when looking just at PT trips that terminate in the Wellington CBD:

	Net TDM Effect						
	0%	1%	2%	5%	10%	15%	20%
Total PT Trips to CBD	16,200	16,400	16,500	17,000	17,900	18,700	19,500
TDM Increase in PT Trips to CBD		170	330	830	1,660	2,490	3,320
Percentage Increase to CBD		1.0%	2.1%	5.1%	10.3%	15.4%	20.5%

The effects of TDM on network performance can far exceed the relatively small change in vehicular trips. This is due to the heavily congested nature of the major routes leading to the Wellington CBD:

	Net TDM Effect						
	0%	1%	2%	5%	10%	15%	20%
Strategic Road Network Vehicle Hours at LoS E & F (%)	43.2%	43.0%	42.3%	40.9%	39.7%	37.3%	35.7%
Percentage Reduction		-0.4%	-2.1%	-5.4%	-8.1%	-13.7%	-17.3%

The use of TDM measures to significantly reduce the total output of CO_2 without severe restrictions on personal mobility will not be effective, as the reduction is closely correlated with the reduction in total motorised travel:

	Net TDM Effect						
	0%	1%	2%	5%	10%	15%	20%
CO_2 Emissions (T)	296.7	296.5	296.1	295.0	292.3	289.9	288.3
Percentage CO_2 Reduction		-0.1%	-0.2%	-0.6%	-1.5%	-2.3%	-2.8%
Network VKT (1,000 km)	1,977	1,975	1,973	1,966	1,954	1,943	1,931
Percentage Reduction		-0.1%	-0.2%	-0.6%	-1.2%	-1.8%	-2.3%

The annual benefits[4] of each TDM level were calculated relative to the Planned Investment scenario with no TDM effects (the 'Base' case):

	Net TDM Effect						
	0%	1%	2%	5%	10%	15%	20%
Annual Benefit ($M)	$0	$1.1	$1.7	$4.6	$8.5	$12.1	$15.1

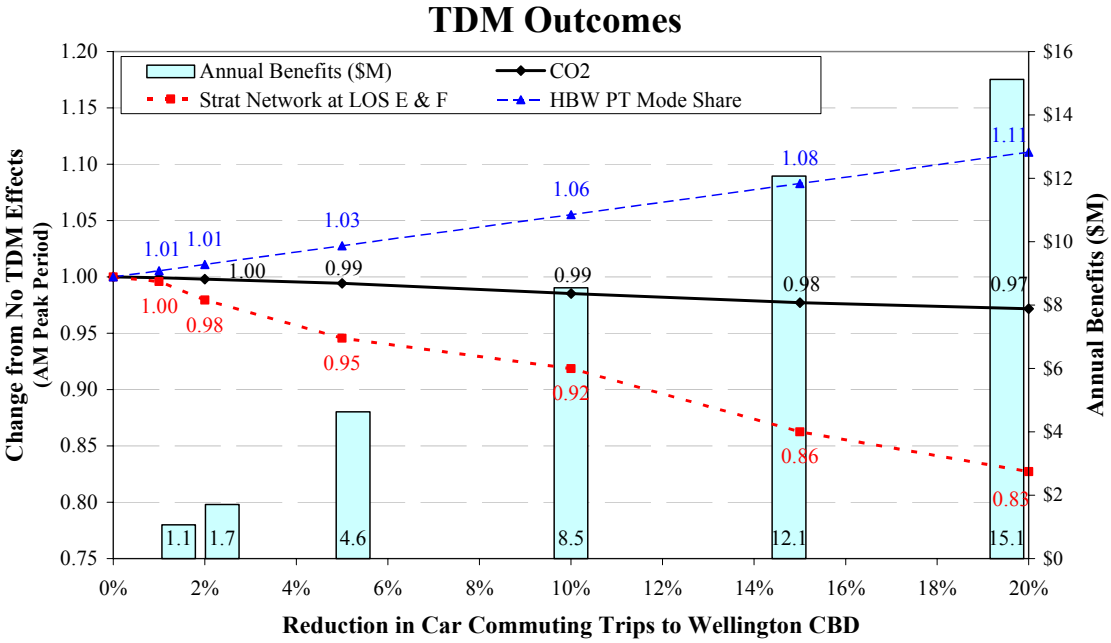
These benefits are the direct result of the reduction in peak period car commuting trips to/from the Wellington CBD.

It is expected that the Planned Investment scenario will achieve a 5% reduction in peak period car commuting trips to/from the Wellington CBD at an annual cost of $3M. The annual benefit from such an investment is in the order of $4.6M, producing a Benefit

[4] Benefits have been calculated using Variable Trip Matrix methods to account for the change in trip numbers by each mode. The benefits include travel time and congested travel time savings, vehicle operating cost and congested vehicle operating cost savings, PT travel and waiting time benefits, accident benefits and carbon dioxide benefits.

Cost Ratio of 1.5 i.e. a return of $1.50 for every $1.00 invested. This BCR satisfies the RLTS requirement for any project to be economically efficient.

The effects of the various TDM levels are shown in the following graph:



This shows that TDM measures aimed at reducing car travel to the CBD can potentially reduce congestion significantly but this requires an increase in PT service capacity. CO_2 output is not significantly reduced as it is dominated by the wider regional travel patterns.