



Auckland
Regional Council
TE RAUHITANGA TAIAO

Auckland RLTS Update: Development of Regional Targets – Final Report

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This document supports the development of the Auckland Regional Land Transport Strategy 2010. It is the culmination of work developed by the Technical Advisory Committee (TAC) to support the Auckland Regional Transport Committee. The TAC includes representatives from all local territorial authorities, Auckland Regional Transport Authority, Auckland District Public Health Board and other technical experts.

Reviewed by:

A handwritten signature in black ink, appearing to read 'Don Houghton', written in a cursive style.

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Date: May 2009

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Development of Regional Targets

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1 Purpose

This report has been prepared to assist the Auckland Regional Transport Committee with preparation of the Auckland Regional Land Transport Strategy 2010.

2 Introduction

2.1 This report

This report develops potential targets for incorporation in the forthcoming Auckland Regional Land Transport Strategy (ARLTS). It has been prepared for Auckland Regional Council (ARC) by Ian Wallis Associates Ltd (IWA), including inputs by Ian Wallis, Don Wignall and Carolyn O'Fallon.

2.2 Background

RLTSs are required to identify regional outcomes¹ and associated measurable targets are also required by legislation².

The RLTS has to take the 2015 government policy statement (GPS) into account³ but the New Zealand Transport Strategy (NZTS) (MoT, 2008) targets are principally for 2040, are non-statutory and more work is underway by the MoT to further develop and define a number of aspects of these targets.

The national targets for 2015 are contained in the GPS (MoT, 2008) and are expected to be achieved within specified national ranges.

To assist the implementation of the GPS targets, the New Zealand Transport Authority (NZTA) commissioned research (IWA, 2008) that proposed the regionalisation of three targets, namely: walking and cycling, public transport, and single occupancy vehicle travel, for 2015. The NZTA subsequently adopted these regionalised targets for monitoring and funding approval purposes (NZTA, 2008)⁴.

Regional allocation of the GPS funding ranges has also been undertaken (NZTA, 2008).

The ARLTS currently in preparation will cover a period of at least 30 years⁵.

¹ LTMA 2008 Schedule 7, 5 (1) (a).

² LTMA Schedule 7, 5 (1) (j).

³ LTMA 2008, Schedule 7, 3 (b) (i).

⁴ Since the work reported here was undertaken, the new Government has released (March 2009) a document on "Amending the Government Policy Statement on Land Transport Funding 2009/10-20018/19". This proposes to replace the GPS outcome targets with "a list of impacts that the Government wishes to achieve". It is not clear at this stage whether these impacts will be given a regional dimension.

⁵ LTMA, 2008, Schedule 7, 2 (1) (a).

2.3 Project scope and required outputs

The project brief is set out in Annex A. The advice required on regional targets is to relate to and to be consistent with:

- national indicators and targets set out in the NZTS, for year 2040 and (as an intermediate year) 2025,
- national indicators and targets set out in the GPS, for year 2015, together with any draft regional level targets (consistent with these national targets) where these have been formulated.

A top down approach⁶ to the review of regional targets has been taken, based partly on identifying appropriate per capita contributions to the achievement of national targets.

⁶ A top-down approach can be described as a strategic or high level policy based approach and is the opposite to a bottom-up approach which is often based on detailed network analysis and traditional (4 stage) transport modelling, although, in practice, both approaches are needed.

3 Methodology Overview

3.1 Treatment of targets

Table 2.1 sets out the national targets as specified in the GPS (for 2015) and the NZTS (mainly for 2040).

In discussion with ARC at the project inception stage, it was agreed that the various indicators/targets should be considered in three groups in terms of their treatment in the project:

- Three targets should be appraised in the most detail (walking and cycling, public transport, single occupancy vehicles) - see section 3.
- Other specified targets should be appraised more broadly, based largely on previous work of others (safety, coastal shipping, rail freight and CO2) - see section 4.
- Four targets were largely outside the scope of the work, but brief comments on these have been made (reliability, travel time, noise and air pollution) - see section 5.

3.2 Approach

As required by the brief, a top-down approach to identifying Auckland regional targets has been adopted.

This approach essentially addresses the question: "Given the national targets set out in the NZTS and GPS documents, what sub-targets should be set for the Auckland region (for years 2015, 2025 and 2040) that are consistent with these national targets, such that the region makes a fair and reasonable contribution, appropriate in all the circumstances, to the national targets?"

For the targets that were required to be appraised in the most detail (as above), a two-pronged approach was adopted:

- What would be the resulting targets for the Auckland region if the changes required achieving the national targets, expressed on a per capita (or equivalent) basis, were to be set for Auckland?
- How should this per capita approach be varied to take account of the different scope in the different regions for modifying travel behaviour through the range of potential policy measures?

For other targets not suitable for a per capita based approach (for example, coastal shipping, rail freight, noise and air pollution), a peer review approach was taken, involving a

top-down reality-check. This was undertaken on the basis of team experience and drawing on previous studies where possible.

Only secondarily did the project compare the Auckland targets resulting from addressing the above question with the outcomes predicted by ARC's forecasting and modelling processes. Comments are made on such comparisons throughout the report.

Table 2.1: NZTS/GPS Targets			
NZTS targets	Category (N = National, R = Regional)	GPS targets (2015)	Notes
<p>A. Improving travel times and reliability</p> <p>For identified critical routes:</p> <ul style="list-style-type: none"> improve reliability of journey times by 2040 compared with 2007, reduce average journey times by 2040 compared with 2007. 	<p>N/R</p> <p>N/R</p>	<ul style="list-style-type: none"> No overall deterioration in travel times and reliability on critical routes by 2015. 	<ul style="list-style-type: none"> The critical routes are yet to be defined (likely to be 2009). Will comprise both inter- and intra-urban routes. This section not addressed by RTT project.
<p>B. Health and Safety</p> <ul style="list-style-type: none"> Reduce road deaths to no more than 200 per annum by 2040. Reduce serious injuries on roads to no more than 1,500 per annum by 2040. Reduce the number of people exposed to health-endangering noise levels from transport. Reduce number of people exposed to health-endangering concentrations of air pollution in locations where the impact of transport emissions is significant. 	<p>N/R</p> <p>N/R</p> <p>N/R?</p> <p>N/R?</p>	<ul style="list-style-type: none"> Reduce fatalities and hospitalisations from road crashes by 2015. 	<ul style="list-style-type: none"> GPS targets not quantified, pending work on 2020 safety strategy. This section not addressed by RTT project.
<p>C. Moving people</p> <ul style="list-style-type: none"> Increase public transport mode share to 7per cent of all trips by 2040 (from 111 million boardings in 2006/07 to more than 525 million boardings in 2040). Increase walking, cycling and other active modes to 30 per cent of total trips in urban areas by 2040. 	<p>R</p> <p>R</p>	<ul style="list-style-type: none"> Increase PT patronage by 3 per cent per annum up to 2015. Increase number of walking and cycling trips by 1 per cent per annum up to 2015. 	<ul style="list-style-type: none"> This section was the major focus of RTT (GPS) project.

NZTS targets	Category (N = National, R = Regional)	GPS targets (2015)	Notes
<ul style="list-style-type: none"> Reduce SOV kilometres in major urban areas on weekdays by 10 per cent per capita by 2015 compared to 2007. 	R	<ul style="list-style-type: none"> As NZTS 	<ul style="list-style-type: none"> SOV target under reconsideration by government.
<p>D. Moving freight</p> <ul style="list-style-type: none"> Increase coastal shipping's share of inter-regional freight to 30 per cent of tonne kilometres by 2040. Increase rail's share of freight to 25 per cent of tonne kilometres by 2040. 	<p>N/R</p> <p>N/R</p>	<ul style="list-style-type: none"> Increase the mode share of transporting freight by coastal shipping and rail by 2015. 	<ul style="list-style-type: none"> This section not addressed by RTT project.
<p>E. Reducing greenhouse gas emissions</p> <ul style="list-style-type: none"> Halve per capita greenhouse gas emissions from domestic transport by 2040 (relative to 2007). Become one of the first countries in the world to widely use electric vehicles. Reduce the rated CO₂ emissions per kilometre of combined average new and used vehicles entering the light vehicle fleet to 170 grams CO₂ per kilometre by 2015, with a corresponding reduction in average fuel used per kilometre. 	<p>N/R</p> <p>N</p> <p>N</p>		<ul style="list-style-type: none"> This section not (directly) addressed by RTT project.
<p>F. Local environmental effects and resource use</p> <ul style="list-style-type: none"> Reduce the consumption of fossil fuels used in vehicles per annum. Increase the area of Crown transport land covered with indigenous vegetation. 	<p>N</p> <p>N</p>		<ul style="list-style-type: none"> This section not addressed by RTT project.

Notes: RTT = Regional Transport Targets project (Ian Wallis Associates for NZ Transport Agency).

It should be noted throughout that:

- For a large proportion of the NZTS and GPS indicators, responsibility for the achievement of the associated targets is shared jointly between central and regional/local government (these indicators are marked national or regional in Table 2.1).

- For those other indicators that are primarily a regional/local responsibility (marked R), the target achievement is usually dependent on funding contributions from both central and regional/local levels of government.

3.3 Modelling aspects

Strategic modelling outputs have also been reviewed to provide a context for the work. This has been used to consider what business as usual⁷ (BAU), might contribute towards target achievement.

Some outputs were available from the new Auckland region strategic model, which has been used by the ARC for initial testing of three strategic scenarios in 2040. However, as only limited information is currently available from the new model, supplementary analysis has been undertaken incorporating outputs from the previous strategic model. This is further discussed in Annex B.

Additional sensitivity testing on the potential effects of a substantial increase in oil price has been undertaken using a policy-based model⁸.

⁷ The continuation of current policies and strategies into the future (see also Annex D).

⁸ Strategy Review Model (SRM), an elasticity based policy testing model: further information available from www.transportfutures.net

4 Targets for Detailed Appraisal

4.1 Walking and cycling

4.1.1 Context

The NZTS national target (2040) for walking and cycling in main urban areas is to achieve a 30 per cent mode share, measured in trip legs, as compared with the current estimated national mode share of 18.6 per cent (derived from NZ HTS 2003-07 data). The corresponding 2007 Auckland urban area mode share was 17.2 per cent, slightly below the national average (Annex D).

The GPS national target (2015) for walking and cycling was expressed on a trip (leg) basis, with a target to increase walking and cycling (W/C) trip legs by 1 per cent per annum average in the period up to 2015. This implies an almost constant rate of trips and capita over the period. To a good approximation, there is a constant ratio between trips and capita and mode share.

At the national level, the NZTS target requires a 61 per cent increase in W/C trip leg mode share in urban areas from 2007 to 2040 (ie 30/18.6). This, together with an estimated population increase of 31 per cent, would require an increase in total W/C legs of approximately 110 per cent from 2007 to 2040.

Further model-based estimates and targets for W/C travel are given in Appendix C, for years 2007, 2015, 2025 and 2040: Table C1 gives national estimates and Table C2 Auckland region estimates. (These estimates are broadly similar to, but not fully consistent with, the figures used in our analyses presented here.)

4.1.2 Regional appraisal

Our approach to estimating a fair and reasonable 2040 W/C target for Auckland metropolitan urban areas (MUAs) has been as follows:

- a. Estimate the increase in W/C mode share (2007) for Auckland, likely to be achievable by travel demand management (TDM) and other measures applied in the region.
- b. Estimate the increase in W/C mode share (2007) nationally likely to be achievable by TDM and other measures applied in all MUAs nationally (allowing for different impacts in different centres, according to population size, transport services and facilities available, congestion issues, etc).
- c. From (b), calculate the further per cent increase in national MUA W/C mode share required to meet the NZTS national target.

- d. Assume this per cent increase also applies to Auckland; and hence derive the 2040 W/C target for the Auckland MUA.

Item (a)

Annexure E provides estimates of the impacts of a wide range of TDM-related measures (including PT enhancements and increased development densities⁹) on travel by different modes, both for the Auckland region and on a national (urban area) basis. For W/C, it is seen that the per cent increase in mode share in Auckland, for all measures combined, is 40.6 per cent, excluding land use intensification effects or 69.6 per cent including these effects. For current analyses, we take the mid-point, ie a 55.1 per cent increase. This equates to an increase in Auckland W/C mode share from the 2007 base figure of 17.2 per cent to 26.7 per cent.

Item (b)

At a national level (including Auckland), the corresponding increase in W/C mode share resulting from TDM-related measures is estimated at 38.1 per cent. This equates to a national W/C mode share increase from the 2007 base figure of 18.6 per cent to 25.7 per cent.

Item (c)

Hence the further per cent increase in national W/C mode share required to meet the NZTS 2040 national target is a factor $(30/25.7-1) = 16.7$ per cent.

Item (d)

Applying this factor to the Auckland region gives a 2040 Auckland target of 17.2 per cent * 1.551 * 1.167 = 31.1 per cent.

Hence the Auckland 2040 W/C target, consistent with the NZTS target, is for a mode share (in terms of trip legs) of 31.1 per cent. This is marginally higher than the corresponding national (urban area) target figure of 30.0 per cent.

This 2040 AKL target is some 80 per cent greater than the 2007 W/C mode share. Combined with a 55 per cent regional population increase by 2040¹⁰, the total W/C task (trip legs) would need to increase from 2007 to 2040 by a factor of about 2.8 (ie approaching three times).

4.1.3 Comments

The following points are worthy of mention:

⁹ Our review of the impacts of increased development densities made use of the best estimates available internationally on relationships between average development densities and modal shares for car driver travel and walking/cycling. These international studies typically use "density" as a proxy for various urban form effects, including "intensification" around transport nodes and spines (as proposed for Auckland). Our analyses of the maximum densification/intensification effects assumes that all future development (in the period up to 2040) will occur within the present Auckland metropolitan urban limits.

¹⁰ Refer Annex F for Auckland regional population estimates 2006-2051.

- The Auckland (urban area) target for W/C mode share by 2040 is approximately 31 per cent (measured in terms of trip legs).
- This figure is marginally greater than the corresponding 2040 national (NZTS) target of 30 per cent.
- The Auckland target would involve an increase in Auckland W/C trip leg mode share by some 80 per cent by 2040, which appears very ambitious.
- This is perhaps particularly so given that W/C mode shares have been declining for many years, although with some signs that this trend has bottomed out more recently.
- Substantial contributors to achieving this target include:
 - The target increases in PT patronage (most PT trip legs are accompanied by two W/C trip legs).
 - The impacts of land use intensification.
 - Travel planning (personalised, school-based and work-based).
 - Improvements to walking and cycling facilities, including construction of cycle lanes and paths; traffic calming and travel demand management¹¹.
- Our analyses have not included any impacts of increasing fuel prices by 2040 (but have included increased parking charges and direct road-use pricing). Any increases in fuel prices may help to bridge the 16.7 per cent gap identified under item C above.
- The required increase in W/C mode share to meet the target is significantly greater than that assumed in the ARLTS modelling work (Table B1) or that estimated using the consultants' Strategic Review Model (Table C2).

4.2 Public transport

4.2.1 Context

The NZTS national target (2040) for PT is to achieve a seven per cent mode share, measured in trip legs, as compared with the current estimated national share of some 2.2 per cent¹². The corresponding Auckland mode share was 3.4 per cent for 2007 (refer Table C2).

The GPS national target (2015) for PT was expressed on a trip leg (or boardings) basis, similar to that for W/C. The target involved an average three per cent per annum

¹¹ Our appraisal (which included an extensive review published in late 2008), found that there is insufficient work done internationally to confidently say that lower speed increases walking and cycling mode share. There is no evidence (yet) to indicate the extent of any effect. Similarly, safety improvements lead to perceptions of better safety, but little has been done to assess the actual behavioural effect. Hence most of the increase in W/C mode share is expected to result from improvements in walking and cycling facilities as there is greater evidence to support this supposition.

¹² These figures relate to the whole country, not just main urban areas.

increase in boardings in the period 2006/07 - 2015/16, giving a 30.5 per cent increase in total or an increase per capita of some 18.8 per cent.

At the national level, the NZTS target requires a 220 per cent increase in the PT boardings mode share from 2007 to 2040. This together with the estimated population increase of 27 per cent over the period will require an increase in total PT boardings from some 111 million in 2006/07 to some 500 million boardings in 2040, ie by a factor of 4.5.

On a boardings and capita basis, the required increase nationally is from approximately 37 in 2007 to 125 in 2040 (further details are given in Table C1).

4.2.2 Regional appraisal

Our approach to estimating a fair and reasonable 2040 PT target for Auckland has been generally similar to that outlined earlier for W/C (Section 3.1.2).

Item (a)

From Annex E, it is estimated that the full range of TDM-related measures (but excluding PT enhancements for now) applied in Auckland, would increase base PT boardings (per capita) by approximately 69 per cent.

It has also been noted in previous studies Auckland Transport Strategic Alliance Project (ATSAP et al) that Auckland's current level of PT patronage is well below what might be expected for an Australasian city of its population. This under performance is now being addressed, at least in part, by current catch-up efforts to improve Auckland's PT system. These are reflected in the Auckland GPS target, based on the ATSAP work, for 85 million boardings by 2015/16: this represents an increase of 56 per cent in total from the 2007 base level.

It is noted in the ATSAP work that approximately five per cent of this patronage increase is the result of TDM etc measures assumed implemented by 2015/16. Deducting this component, to avoid double-counting, leaves an increase of 51 per cent in total, or 30 per cent on a per capita basis, from the 2007 base level.

Item (b)

Table 3.1 includes estimates at both national and regional levels of the impacts on PT boardings and capita of: (i) GPS/ATSAP targets, for 2015; and (ii) TDM measures assumed applied in AKL and other centres (having regard to their potential level of application and likely impacts in different centres).

Item (c)

The bottom row of Table 3.1 indicates that additional to the above effects, a further 52 per cent increase in PT boardings/capita would be required nationally by 2040 to meet the NZTS target.

Item (d)

Assuming this factor is also applied to Auckland, this gives a 2040 Auckland target of 144 boardings and capita (as compared with 125 boardings and capita nationally). The Auckland figure equates to a PT mode share of around 12 per cent.

This 2040 Auckland target is some 3.4 times the 2007 level, expressed in terms of boardings and capita and mode share. Combined with an expected regional population increase of 55 per cent by 2040, the total AKL PT task (boardings) would need to increase from 2007 to 2040 by a factor of about 5.3, broadly from 52.5 million boardings (2006/07) to 270-280 million boardings pa (55 per cent of the total national target).

4.2.3 Comments

The following points are worthy of mention:

- The Auckland (urban area) target for PT has been expressed in terms of trip legs (boardings) per capita, but could alternatively be expressed in mode share terms (as in NZTS).
- The Auckland target is for 144 trip legs and capita pa by 2040, somewhat above the national average target of about 125 trip legs and capita.
- This Auckland target involves an increase in PT trip legs per capita (or mode share) by a factor of 3.4 times by 2040, which appears very ambitious.
- The first step towards achieving this 2040 target is achievement of the proposed 2015 GPS target: this involves an increase in 2007 PT trips/capita of some 34 per cent.
- After 2015, progress towards the 2040 target will require ongoing TDM-related measures and further PT system improvements.
- Even then, a further 52 per cent increase in PT trips and capita will be required in Auckland (and throughout New Zealand) to meet the NZTS target. Part of this further increase may be achieved through (real) increases in fuel prices up to 2040 (other car pricing measures are already included in the assumed TDM-related package).
- The required increase in Auckland PT trips and capita and mode share to meet the target is substantially greater than that estimated in the ARLTS modelling work (Table B1).

Item	AKL	National	Notes
PT trips/capita 2007 base	41.7	36.8	GPS papers
2015 GPS/ATSAP	57.8	49.9	GPS Papers
Adjustment for TDM measures	<u>-1.8</u>	<u>-0.8</u>	
Adjusted 2015 trips/capita	56.0	49.1	
TDM-related measures:			
Factor	+69%	+30%	Annex E details
Trips/capita 2015 adjusted	94.6	82.5	
Target trips/capita 2040:	(144)	125	
Increase factor to meet target	+52%	+52%	

4.3 Single occupancy vehicles

4.3.1 Context

The national targets for single occupancy vehicles (SOV) use in both GPS and NZTS are identical, ie to reduce weekday SOV KT/capita in major urban areas by 10 per cent by year 2015 relative to the 2007 level. The NZTS has no SOV targets for years after 2015.

The GPS RTT work developed a SOV KT/capita target for Auckland for 2015. This was for an eight per cent reduction from the 2007 level as a result of TDM-related non-price measures. In addition, if fuel prices increase substantially over the 2007-2015 period, this would be likely to reduce the “underlying” growth in vehicle kilometres travelled (VKT)/capita and maybe result in a net decline over the period. This would help to meet both the Auckland SOV target and the national target for 2015. The national and regional SOV KT targets for 2015 are given in Tables C1, C2.

4.3.2 Regional appraisal

We have made no attempt to set SOV KT targets for Auckland for the post 2015 period, for several reasons:

- No post-2015 targets are given in NZTS.
- It was understood that the GPS SOV target is under active review and may be deleted and replaced shortly (this has now happened).
- The SOV KT target is very difficult to monitor in an effective and timely manner, and is arguably not a good indicator of progress in improving the sustainability of the transport system.

We suggest (pending any decision from government on the SOV KT target) that future efforts would be better focused on monitoring total VKT (on a per capita basis).

5 Targets for Broad Appraisal

5.1 Road safety (deaths and serious injuries)

5.1.1 Context

From MoT monitoring data up to and including December 2008, it seems unlikely that the 2010 safety targets will be fully achieved.

Auckland's future targets need to be consistent with the forthcoming national safety strategy for 2020 (MoT, 2009) although it is not yet clear what this will consist of and precisely when it will emerge.

In the longer term, any regional targets for 2040 need to be consistent with the NZTS safety targets, ie no more than 200 pa deaths and 1,500 pa serious injuries by 2040.

National input will be needed to achieve future safety targets and not all required measures (for example, regulation and penalties) can be achieved by regional authorities, although important regional contributions can be made.

The recent report on regional road safety (ARC, 2008) provides a good context based on proxy forecasts and sensitivity testing. The report used three alternative methods to derive potential regional targets for 2040: this produced a range of target estimates from 401 to 431 combined deaths and serious injuries in 2040. The report concluded that a reasonable target would therefore be at the lower end of this range, namely 40 deaths and 360 serious injuries. Using a per capita approach based on the base year figures used by the report gives a regional figure of 422 combined deaths and serious injuries in 2040 (44 deaths and 378 serious injuries) However, the base year figures in the report for national and regional serious injuries appear to be low and have therefore not been used for the regional target analysis below.

5.1.2 Regional appraisal

For comparison purposes, a per capita based approach has been used as part of this review, resulting in the indicative targets given in Table 4.1. It should be noted that this table contains estimates that differ from those used in the ARC report (ARC, 2008) due to the different base figures and methodologies employed.

5.2 Rail freight

5.2.1 Context

The NZTS rail freight target is to “Increase rail’s share of freight to 25 per cent of tonne kilometres by 2040”. The current rail share is 18 per cent.

This section reviews earlier work, namely:

- a report prepared for the ARC, current and future freight movements in the Auckland region and GPS targets (Paling, 2008),
- the National Freight Development Study (MoT, 2008),
- some subsequent analysis and projections based on the national freight demand study (NFDS) work (Hyder, 2008).

Key points from these reviews are as follows:

- The ARC report debates whether the NZTS rail freight target relates to total freight or inter-regional freight only, although it seems clear from the NZTS and supporting documents that the target relates to total freight.

Table 4.1 Road Safety Targets				
National	2007 Base	2015 Target	2025 Target	2040 Target
Road deaths	407	357	294	200
Index	100	88	72	49
Deaths per (000) capita	0.096	0.078	0.060	0.038
Road serious injuries	3050	2,674	2,205	1500
Index	100	88	72	49
Injuries per (000) capita	0.721	0.588	0.449	0.283
<i>Population⁽¹⁾</i>	<i>4,228,000</i>	<i>4,549,800</i>	<i>4,905,400</i>	<i>5,303,600</i>
Index	100	108	116	125
REGIONAL	2007 base	2015 Target	2025 Target	2040 Target
Road deaths	70	64	56	42
Index	100	92	80	60
Deaths per (000) capita	0.050	0.041	0.031	0.020
Road serious injuries	860	792	692	516
Index	100	92	81	60
Injuries per (000) capita	0.617	0.503	0.384	0.242
<i>Population⁽¹⁾</i>	<i>1,393,460</i>	<i>1,574,740</i>	<i>1,800,980</i>	<i>2,134,368</i>
Index	100	113	129	153

Note: (1): The population figures used differ slightly from those given in Annex F.

- Nationally, the freight task is expected to approximately double over the period 2006-2040 (MoT, 2008): in order to maintain the current rail mode share an increase

in the current rail tonne-km carried of 100 per cent will be required, and in order to achieve the NZTS target an increase in current rail tonne km of around 270 per cent will be needed.

- Regionally a similar level of increase in tonne km might be targeted (Paling, 2008). It should be noted that “through freight” is not included in Paling’s assessment¹³ and some commodities have been excluded (the NFDS looked at 17 principal commodities). This raises issues of compatibility with the modelled forecast of a quadrupling of road freight over the same period (see Annex C).
- A simple pro-rata approach to the need for regional mode share to increase in the same proportion as the required national mode share change has been adopted. This is regarded as a reasonable “first pass” working assumption in the absence of other evidence¹⁴.
- “Business as usual” will not achieve the national rail freight target either nationally (MoT, 2008) or regionally (Paling, 2008).
- The Table 4.2 summary indicates the likely scale of expected growth in freight to 2031 (from Paling, 2008), plus our projections to 2040.

To achieve the rail freight target it seems clear that major interventions in favour of rail will be required (Paling, 2008).

It will also be important not to take actions to achieve rail targets that may undermine the achievement of shipping targets, especially for long distance movements.

	2006/7	2015	2015 targets	2025	2025 targets	2031	2040	Indexed increase 2006-2040	2040 Regional Targets
	b tonne km	b tonne km		b tonne km		b tonne km	b tonne km		
Northland	0.81	1.30		1.84		2.16	2.65	327	
Auckland (internal)	0.77	0.86		0.96		1.02	1.11	144	
Waikato	1.41	2.12		2.90		3.37	4.08	289	
BOP/Gisborne	0.68	0.78		0.89		0.95	1.05	154	
Hawkes Bay	0.20	0.24		0.28		0.3	0.34	168	
Taranaki	0.12	0.12		0.13		0.13	0.13	111	
South	3.25	3.58		3.95		4.17	4.50	138	
Total inter-regional freight	6.47	8.13		9.97		11.08	12.74	197	
Total (all freight)	7.24	8.99		10.93		12.1	13.85	191	
Rail mode share (of total)	1.49	1.78		2.11		2.31	2.61	175	
Rail mode share (%)	20.6%	19.8%	22.7%	19.3%	25.0%	19.1%	18.8%		29%

¹³ In establishing regional targets for freight transport, it is not clear how movements that pass through or round the region should be treated.

¹⁴ An alternative approach would be to consider current and future forecasts of industrial production, primary resources and port related activity within the region and compare this with equivalent national figures, but this was outside the scope of the current study.

	2006/7	2015	2015 targets	2025	2025 targets	2031	2040	Indexed increase 2006-2040	2040 Regional Targets
	b tonne km	b tonne km		b tonne km		b tonne km	b tonne km		
Coastal shipping modal share (of inter-regional)	0.97	1.32		1.71		1.94	2.29	236	
<i>Coastal shipping mode share (%)</i>	<i>15.0%</i>	<i>16.2%</i>	19.0%	<i>17.1%</i>	23.4%	<i>17.5%</i>	<i>18.0%</i>		30%

The actions needed to achieve the rail freight target are mainly national responsibilities, although there are specific regional actions that can be taken (Paling, 2008).

5.2.2 Regional appraisal

The regional rail target of 29 per cent of all tonne kilometres suggested in the report appears likely to be achievable, given sufficient investment and policy interventions.

The rail target could be bettered if major changes took place and identified actions to transfer aggregates (from road to rail) and oil (from pipeline to rail) were implemented.

5.3 Coastal shipping

5.3.1 Context

The NZTS coastal shipping freight target is to “Increase coastal shipping’s share of inter-regional freight to 30 per cent of tonne kilometres by 2040”. The current coastal shipping share is 15 per cent.

Refer to Table 4.2 and the above discussion for rail freight:

- Business as usual will not achieve the national shipping target either nationally (MoT, 2008) or regionally (Paling, 2008).
- The coastal shipping target is difficult and national input will be needed, as many of the required actions cannot be taken at the regional level.
- A simple pro-rata approach to the need for regional mode share to increase in the same proportion as the required national mode share change has been adopted.
- To achieve the coastal shipping target it seems clear that major interventions in favour of shipping will be required.

It will also be important not to take actions to achieve coastal shipping targets that may undermine the achievement of rail freight targets, especially for long distance movements.

The actions needed to achieve the coastal shipping target are mainly national responsibilities, although there are specific regional actions that can be taken (Paling, 2008).

5.3.2 Regional appraisal

The report (Paling, 2008) highlights the difficulty of setting regional targets for coastal shipping and the inter-relationships of this issue with the requirements of international shipping lines and any national port planning policy.

It may have to be accepted that the shipping target cannot simply be calculated on a pro-rata basis and that there is a maximum achievable mode shift, depending on specific regional circumstances.

In setting regional targets, various definitional issues arise, including:

- how regional tonne kms are to be calculated for coastal shipping movements,
- how through freight, which is trans-shipped in the region (or may remain on the same ship while it calls at a regional port), is to be treated.

5.4 Greenhouse gas emissions

5.4.1 Context

The NZTS target is for greenhouse gas (GHG) emissions per capita from domestic transport to be reduced by 50 per cent by 2040 relative to their base (2007) level: this equates to a 59 per cent per capita reduction from predicted (BAU) levels. NZTS also includes an interim milestone for a 23 per cent per capita reduction (from predicted levels) by 2020.

The NZTS document also provides indicative estimates of the expected contributions to the overall GHG reductions. For those types of policy measures most within regional/local influence, it estimates:

- 2020: two per cent reduction relating to TDM/mode shift for light vehicles, additional 2 per cent reduction relating to mode shift for heavy vehicles (relative to predicted/BAU levels).
- 2040: six per cent reduction relating to TDM/mode shift for light vehicles, additional 6 per cent relating to mode shift for heavy vehicles (relative to predicted and BAU levels).

The GPS does not include any GHG targets.

As is evident from the NZTS assessment, national level actions (involving regulation etc.) are expected to provide the majority contributions towards the GHG target. At the national level, some likely trends (eg in traffic volumes and levels of congestion) are

expected to increase GHG/capita but NZTS anticipates that these will be more than off-set by vehicle efficiency improvements, changes in vehicle fuels (electric and hybrid vehicles) etc.

5.4.2 Regional findings

Two approaches have been used to assess the likely impact of regionally-based policy measures on GHG per capita emissions.

The first approach uses our TDM etc analyses (Annex E) to derive estimates of VKT reductions associated with TDM and other policy measures. Assuming 50 per cent of the maximum intensification effect, these analyses suggest a reduction in BAU car VKT in the order of 15 per cent as a result of all the measures assessed. In the absence of vehicle technology, efficiency etc changes, it could be expected that this would translate to a reduction in the order of 15 per cent in car GHG, most likely equating to around 10 per cent reduction in total road transport GHG (relative to BAU). The analyses do not provide estimates of the change in VKT or GHG from current levels.

The second approach uses the new ARC strategic modeling results: these results reflect only the effects of traffic factors on GHG emissions, and excluded any technology/efficiency factors. The strategic options modelled all indicate substantial increases in CO₂ emissions/capita from 2006 to 2040, of around 30 per cent (Table B.2). The BAU scenario SO2 produces an increase in CO₂ per capita of 32 per cent over the 2006 level. The alternative scenarios, namely SO1 (push factors) and SO3 (pull factors), both reduce the CO₂ per capita by 2 per cent relative to the BAU scenario, which is less than the NZTS indicative management contributions referred to above. This suggests that further consideration of additional positive regional actions may be needed, for example, in terms of demand management, transport avoidance and prevention of induced traffic effects. Alternatively, it may indicate that the strategic modelling is not sufficiently sensitive to the impacts of TDM and related measures.

5.4.3 Comments

Given the limited regional influence on GHG emissions it is suggested that ARC give further consideration to any GHG targets in the ARLTS. Options to consider include:

- a total target (per capita), consistent with the overall NZTS target,
- a target expressed in terms of the %age reductions (relative to BAU) to be achieved by regional and local actions,
- no target, but recognition that regional/local actions that influence other targets (eg PT, walking and cycling) will help to reduce GHG emissions.

6 Other targets for comment

6.1 Noise

6.1.1 Context

The NZTS target is “Reduce the number of people exposed to health-endangering noise levels from transport”.

In many ways this can be regarded as a localised issue, although some general policies (for example, with respect to vehicles, road surfacing and environmental standards) can affect overall system performance in noise terms.

Strategic assessment techniques for noise are limited, but possible approaches could be either through:

- Using proxy measures, for example, using network traffic volumes by road type.
- Predicting noise emissions by taking into account vehicle delays, speeds, distances and the number of vehicles on a network wide basis.
- Applying either of the above techniques to more specific population and frontage sub-network classification, using GIS based techniques.

In terms of noise, some future trends can be expected to be negative, particularly the growth in traffic volumes. However, improvements in engine performance will to some extent counter-balance this.

There is a NZ Standard (non mandatory) being developed to manage noise from new or altered roads, but this does not currently apply to existing roads. There is no NZ current definition of what constitutes “health-endangering noise levels” in regard to the impacts of transport-related noise.

In the absence of national noise standards, the MoT transport monitoring indicator framework (TMIF) provides measures and noise category bands that should be used to assess progress against the NZTS target.

6.1.2 Regional comments

Further actions are possible at the regional scale to meet or better this target, for example, through better:

- road surfacing and speed management to reduce transport noise at source,
- land use planning, mitigation and attenuation to reduce the community impact of transport related noise.

6.2 Improving travel times and reliability

6.2.1 Context

The NZTS targets are, for identified critical routes, to (i) improve the reliability of journey times, and (ii) reduce average journey times, by 2040.

Although neither the critical routes nor the extent of improvement required have been defined as yet, some observations can be made as follows.

The future scenarios SO1 (push factors) and S03 (pull factors) appear to have the potential to improve reliability and travel time on critical parts of the road network. This is because they (respectively) reduce and stabilise congested conditions on the overall network (Table B2); this indicates that improvements in conditions might be achievable on selected critical parts of the network or system, such as critical routes.

Typical reductions in road network speeds of between 10 and 20 per cent are anticipated over the period 2006 to 2040 with larger reductions anticipated of over 30 per cent for inter-peak conditions for SO1 (push factors) and S03 (pull factors).

It should be noted that there can be some undesirable side-effects of increases in general road traffic speeds in terms of noise, emissions and safety.

It should also be noted that unreliability is a significant issue for bus services, rail passenger services and rail freight.

6.2.2 Regional comments

All three future scenarios are projected to worsen reliability using the proxy measure (speed divided by free-flow speed) compared with base year conditions (Annex 2). However, the change between base and future assessment years is marginal.

There is a reasonable correlation between congested VKT and road network reliability (Annex B).

It should also be noted that improved reliability has virtually no undesirable side-effects (apart from maybe some marginal induced traffic volumes).

6.3 Air pollution

6.3.1 Context

The NZTS target is to “reduce the number of people exposed to health-endangering concentrations of air pollution in locations where the impact of transport emissions is significant”.

In many ways this can be regarded as a localised issue, although some general policies do affect overall system performance in air pollution terms (for example, vehicle, fuel and environmental standards).

Strategic assessment techniques for air quality are limited, but possible approaches could involve:

- using proxy measures, for example, using network traffic volumes by road type,
- predicting pollutants by taking into account vehicle delays, speeds, distances and the number of vehicles on a network wide basis,
- applying either of the above techniques to more specific population and frontage sub-network classification, using GIS based techniques.

For air quality standards the Ministry of Transport (MoT) transport monitoring indicator framework (TMIF), the national environmental standards (NES) for air quality, Ministry for the Environment (MfE) ambient air quality guidelines and regional air quality targets (where they exist) should be used as the basis for assessing progress against the NZTS target.

The additional challenge is to identify where transport emissions are significant because compliance with the various standards listed here will be affected by emissions from all sources, eg home heating, vehicles, industry, natural sources, etc.

In terms of air pollution, some future trends (from transport sources) are expected to be negative, particularly the growth in traffic volumes; however, these are likely to be more than counter-balanced by improvements in vehicle standards and engine performance. One qualification is that some pollutants, for example particulate matter (PM) 2.5, are a particular source of health-related concern and may continue to represent a significant issue even if overall air pollution is substantially reduced.

6.3.2 Findings

Overall air quality targets are likely to be achieved, both nationally and regionally, as a result of improvements in vehicle quality. Most of this is expected to be achieved through national initiatives.

Further actions are also likely to be required at the regional scale to meet or better this target, for example, through traffic management and queue relocation to reduce air pollution in sensitive locations, better land use planning, mitigation and attenuation to reduce the community impact of air borne pollutants.

7 Appendix 1: Consultancy Brief

Auckland RLTS Update: Development of regional targets

7.1 Introduction

This (draft) proposal is to assist the Auckland Regional Council (ARC) in the development of regional targets as an input to its new Regional Land Transport Strategy (RLTS), currently being prepared. This draft was prepared by Ian Wallis Associates (IWA) in response to an invitation from Don Houghton (ARC Group Manager Transport).

7.2 Context

ARC is preparing a new RLTS for the region, in parallel with its review of the Regional Policy Statement (RPS). It is aiming to complete a consultation draft of this new RLTS by end March 2009.

The (central) government recently published The NZ Transport Strategy 2008 (NZTS) and a government policy statement on land transport funding 2009/10-2018/19 (GPS). Both these documents contain (for the first time) sets of transport -related targets at a national level, which are targeted for achievement by 2015 (in the case of the GPS) or 2040 (most of the NZTS targets).

Recent work by IWA for NZTA (the regional transport targets project, RTT) has developed draft targets on a region-by-region basis relating to some of the GPS national targets (those targets directly related to the quantity and mode shares of person travel). That work also involved some initial thinking on which of the NZTS and GPS targets have a regional dimension (ie are significantly within the influence of local authorities) and on the regionalisation of some of the NZTS targets.

In developing the new RLTS, the recent LTMA Amendment legislation requires any RLTS to (inter alia):

- contain measurable targets,
- take into account the relevant GPS,
- be consistent with any national land transport strategy.

7.3 Project requirements

ARC's requirements for this consultancy project may be summarised as follows:

- To advise ARC on appropriate regional targets for incorporation into the draft new RLTS currently under preparation.
- Such regional targets are to relate to and to be consistent with:
 - national indicators and targets set out in the NZTS, for year 2040 and (as an intermediate year) 2021, and
 - national indicators and targets set out in the GPS, for year 2015, together with any draft regional -level targets (consistent with these national targets) where these have been formulated.
- A top down approach to developing the regional targets is envisaged, based primarily on what are the appropriate Auckland regional contributions to the national targets, having regard to a range of relevant factors (similar to the approach adopted in the RTT project).

7.4 Proposed approach

The current NZTS and GPS targets are summarised in Table A attached. This table indicates a first pass categorisation of the targets into those that are solely a national responsibility (N) and those that are solely or partially within the influence of regional and local authorities (R). It is evident that the last two of the six target groups are seen solely as a national responsibility.

The main tasks proposed are as follows.

(A) Agreement on the indicators and targets to be addressed

Agreement with ARC on those indicators/targets requiring regionalisation in this project:

- Some indicators are solely a national responsibility.
- For other indicators, there is no specific national target to be regionalised, so ARC can address these directly (eg A: improving travel time and reliability).
- Some indicators currently have no quantitative targets, at the national (or regional) level (eg those expressed solely in terms of “improve” or “reduce”). It needs to be decided whether ARC wishes to develop quantified targets for these items, and if so on what basis.
- Need to clarify relationships between the required indicators to be developed in this project and indicators already adopted by ARC.
- Need to clarify the various target years to be adopted:
 - GPS targets relate to 2015.
 - NZTS uses 2040 as the primary target year, with 2020 as an intermediate year and some targets for 2015.
 - RLTSs need to have a time horizon of at least 30 years.
 - Long range planning exercises in AKL have timescales of up to 50 years.

- It may be worthwhile to prioritise the indicators/targets (including target years) to be addressed within the project.

(B) Assessment principles and considerations

Formulation and agreement on a set of principles and considerations to be taken into account in regionalising those indicators/targets for which regionalisation is required in this project:

- We envisage these principles and considerations would build on those developed in the RTT project.
- We propose to discuss and agree these with ARC before proceeding further.

(C) Central government perspectives

Discussions with MoT and NZTA staff in regard to the further development and regionalisation of the national targets. Inter alia, these would cover:

- confirmation of which targets are seen as solely a national responsibility, and therefore do not need to be considered further in this project,
- current work (in both agencies) relating to the further definition and regionalisation of the national targets (eg MoT NZTS implementation plan),
- any likely changes to the currently specified indicators and/or targets (we are aware that the NZTS and GPS SOV target is currently under review, at the request of the new government),
- any work on intermediate phasing of NZTS targets (eg for year 2020/21).

(D) Development of Auckland regional targets

This will be the core analytical task of the project. For the selected national indicators and targets, it would involve the “top down” assessment of an appropriate package of regional targets, for the relevant target years (2015/21/40). The assessment would be based on the principles and considerations drawn up in task B, and undertaken in the light of the outputs of tasks A and C. As appropriate, use may be made of the Strategy Review Model (developed by Don Wignall and already validated for Auckland) as one tool to assist in the assessment process.

(E) Draft findings and ARC review

Following task D, this task would:

- document the findings from task D, through a draft report and presentation,
- hold a workshop with ARC staff, to present the draft findings and their rationale, to debate these as appropriate, and to discuss any needs for modification.

(F) Final reporting

Following task E this task would involve modification and refinement as appropriate of the draft findings, and preparation of the final report. The reporting format would be agreed with ARC in advance.

7.5 Timetable

ARC has requested that the required advice on targets should be provided by end January 2009. We consider that this timing should be achievable.

We propose that:

- An initial workshop is held with ARC staff covering tasks A and B. We tentatively propose that this be held in the week 15-19 December. Following that workshop, a refined timetable for the remainder of the project would be prepared (having regard to leave commitments etc.).
- Task C would also be completed before the Christmas and New Year holiday break.
- Task D would then take place in the early to mid January period.
- The task E workshop would take place in late January (maybe week 26 to 30 January).
- The final report (task F) would then be completed in early February.

7.6 Staffing

Our project manager would be Ian Wallis. He would be assisted by the same team that undertook the recent RTT project for NZTA, ie Carolyn O'Fallon, Don Wignall, David Kennedy and Pete Furnish.

8 Appendix 2: ARC 's Strategic Modelling

8.1 Background

The ARC maintains a strategic four stage transport model which has recently been improved and extended to cover the period 2006-2041. This model is currently being used by the ARC for preliminary RLTS development purposes.

Three strategic options have been considered to date by the ARC in this work. All three scenarios assume an increase in fuel pump price of 240 per cent in real terms over the period 2006 to 2041, and each of these scenarios contains the following common elements:

- committed road projects (of which there are several),
- integrated PT ticketing,
- soft TDM measures,
- road safety and maintenance.

Reference: ARC, Components of Strategic Options, 10 December 2008.

Noteworthy individual features of each scenario are summarised below:

Strategic Option 1 (SO1) The purpose of this option is to test push factors, including road pricing (this option assumes the most recent MoT road pricing study area congestion scheme (with \$6 charge) and parking regulation (assuming a \$5 charge applies in Auckland CBD, Newmarket, Takapuna, Henderson and Manukau City Centre) This option includes the provision of additional PT capacity (including the CBD rail tunnel) to deal with higher demand and also where specifically required (frequencies and priority measures) due to road pricing and other push factors.

Strategic Option 2 (SO2) This is a mixed scenario, which effectively represents a slightly enhanced "business as usual" type approach. This scenario assumes that responses will be made to road capacity constraints on the regional arterial road network including the provision of additional capacity for general traffic. More bus and rail services on the rapid transit and quality transit networks are also assumed.

Strategic Option 3 (SO3) The purpose of this is to test pull factors, this scenario also assumes that responses will be made to road capacity constraints on the regional arterial road network, including the provision of additional capacity for general traffic. Further development and optimisation of the rapid transit and quality transit networks is assumed.

Some initial model results based on the three strategic options described above have been undertaken; see for example projected changes in daily mode share in Table B1 below.

Some other selected modelling results are indexed in Table B2 below.

The results for all three scenarios indicate a reduction in car-based mode share and significant increases in PT and active (walking and cycling) modal shares. The underlying fuel price effect is likely to be largely responsible for these effects.

However, the increases in mode share for non-car modes are not sufficient to meet the 2040 NZTS targets (on a national basis).

<i>Mode</i>	2006 <i>mode share</i>	2041 <i>mode share</i>		
	Base	SO1	SO2	SO3
Car	85.3%	74.8%	76.1%	75.2%
PT	4.5%	8.6%	7.4%	8.2%
Active	10.2%	16.6%	16.5%	16.6%
<i>Total</i>	<i>100.0%</i>	<i>100.0%</i>	<i>100.0%</i>	<i>100.0%</i>

	2006	2041		
	Base	SO1	SO2	SO3
<i>VKT (all vehicles)</i>	<i>100</i>	<i>128</i>	<i>132</i>	<i>128</i>
VKT per capita	100	84	86	84
<i>Trips (all modes)</i>	<i>100</i>	<i>203</i>	<i>205</i>	<i>203</i>
Trip rate per capita	100	132	134	133
<i>Car trips (driver and px)</i>	<i>100</i>	<i>178</i>	<i>183</i>	<i>179</i>
Car trip rate per capita	100	116	119	117
CO₂ per capita	100	129	132	130
<i>Injury crashes</i>	<i>100</i>	<i>39</i>	<i>40</i>	<i>40</i>
Injury crashes per capita (not pm)	100	26	26	26
Speed	100	81	87	83
Speed / free flow speed (not pm)	100	98	97	96
Congested VKT	100	89	123	104
Car VKT	100	116	121	117
HCV VKT	100	426	426	424

indicate substantial reductions in VKT per capita over the same period as a large (and surprising) change in trip rate per capita.

The reductions in crashes and crash rates per capita over the period are also surprising.

8.2 Oil prices

The EEM uses a base retail price of \$1.80 per litre of petrol as at July 2008, which roughly equates to an oil price of approximately US \$95 per barrel of oil. The oil price tends to be more volatile than the pump price in NZ. However, taking the above relationship as a proxy for the time being, this would mean that the ARC modelled base year 2006 fuel price of \$1.55 approximates to an oil price of \$82 a barrel and the assumed 2041 fuel price equates to around \$196 a barrel.

The NZTS assumed a constant price of \$100 a barrel over the period 2007-2040, so to undertake a comparison with the NZTS targets the pump price for 2040 would need to be set at \$1.90.

To date, the ARC testing has been based on the petrol prices in a recently commissioned report (McCormick Rankin Cagney, Transport Fuels and Other Energy Forms: Price Forecasts to 2060, 26th November 2008): this assumes \$3.71 (in 2006 NZ\$) in 2041 which is 240 per cent higher than the 2006 base year value of \$1.55.

Testing undertaken by the ARC in August 2008 (Increasing fuel cost by 50 per cent, 100 per cent, 200 per cent) indicates that for a similar level of fuel price increase (+250 per cent over the period 2006-2016) a change from business as usual (selected RLTS Scenario 5) the impacts shown in Table B3 could be expected¹⁵.

Auckland Region Statistics	2016 BAU	Fuel +250%	Indexed Change (compared to BAU)
VKT	4,639,371	4,096,091	88
Speed	37	41	111
<i>Driver trips</i>	<i>438,177</i>	<i>418,086</i>	<i>95</i>
<i>Car passengers</i>	<i>101,408</i>	<i>121,054</i>	<i>119</i>
<i>PT (mode split)</i>	<i>65,031 (9%)</i>	<i>75,484 (10%)</i>	<i>116</i>
<i>Walk & cycle (mode split)</i>	<i>114,427 (16%)</i>	<i>118,043 (16%)</i>	<i>103</i>
Total trips	719,043	732,667	102
% Congested VKT	24%	16%	67
Injury crashes	2,984	2,639	88
Access to employment	322,047	394,963	123

Note that the implied elasticity from this (-.05) looks on the low side even allowing for the fact that it relates to the peak period only and also that “arcing” effects can be expected which will dampen the effect of large price increases.

Sensitivity testing using strategy review model (SRM) using the same base data over the same period for annualised forecasts more in keeping with target analysis, using

¹⁵ In looking at these results – it has to be remembered that the ARC assumption is that fuel prices will increase by 240 per cent over the period to 2040 (rather than to 2016).

conservative elasticities and testing for +240 per cent increase in fuel price, forecasts the changes shown in Table B4.

The results from the policy model sensitivity testing are very broadly similar to the ARC model tests, with the following exceptions: slightly more responsiveness in terms of influencing public transport and walking and cycling mode share, an overall trip suppression effect is predicted, and a greater impact on VKT and congested VKT.

Auckland region statistics	2015 BAU	Fuel +240%	Indexed change (compared to BAU)
VKT	9,498,721,580	7,821,202,371	82
Speed	41	47	116
<i>Driver trips</i>	<i>911,783,468</i>	<i>768,858,831</i>	<i>84</i>
<i>Car passengers</i>	<i>358,628,952</i>	<i>337,430,142</i>	<i>94</i>
<i>PT (mode split)</i>	<i>74,235,117 (5%)</i>	<i>86,149,669 (6%)</i>	<i>116</i>
<i>Walk & cycle (mode split)</i>	<i>279,650,403 (17%)</i>	<i>303,740,881 (20%)</i>	<i>109</i>
Total trips	1,624,297,940	1,496,179,523	92
Congested VKT	1,119,711,013	650,473,662	58
% Congested VKT	12%	8%	71
SOV VKT	6,506,624,282	5,075,200,825	78
CO2 per capita	1,738	1,438	83

8.3 Forecasting aspects

Road freight growth assumed in the ARC model is based on a 1.8 per cent per annum GDP growth (reference: ARC, Commercial Vehicle Model Report, August 2008) over the modelled period and a factor for heavy commercial value (HCV) VKT growth has been used at more than double this rate, ie four per cent+ per annum over the period 2006 to 2040. This results in a more than quadrupling of HCV VKT under all scenarios and in both peak and inter-peak conditions and is in contrast to other VKT that increases very modestly (5-25 per cent increase over a 34 year period, which appears on the low side

The HCV forecast is also in contrast to other sources, for example, the MoT vehicle, fuel and environmental monitoring (VFEM) and the NFDS, which both forecast an approximate doubling of the total freight task over the same period. If the very high rates of HCV growth predicted under the ARC modelling were to materialise, this would have major implications for the achievement of both the costal shipping and the rail freight targets. It would be useful to further clarify these related points and the associated data sources, definitions and conclusions from this commercial vehicle

model (CVM) report. For example, it is not obvious where the justification for the high rate of HCV growth has been derived from.

Significant improvements in vehicle efficiencies over the modelled period (in terms of fuel, emissions and pollution) have been assumed in the modelling work. Comparison between the approach taken in Auckland and the national approach taken to the preparation of the NZTS has not been possible within the constraints of this review.

The modelling shows large projected increase in active modes in contrast to past trend data over many years. This raises the question, on the basis of the strategic options being considered, as to whether this is substantially due to the underlying oil price assumptions or is whether there is also an optimism bias occurring. Active mode trends are currently treated as inputs to the models. Based on the targets in the NZ Digital Strategy, it was also assumed that 16.9 per cent of work trips will be work at home trips in 2041, although currently the level is only 6.9 per cent.

The modelled reduction in injury crashes to 2041 also appears to be optimistic, possibly due to assumed accident rates, which result in a more than halving of crash totals over the modelled period in absolute terms. It is appreciated that it is not possible to use the strategic model as a detailed safety evaluation tool; however, the incorporation of some additional parameters (changes in speed and the rate of engineering improvements / safety retrofitting / management treatments on the network) may assist in refining future injury crash estimation. Injury crash severity is another useful indicator that could be considered for modelling development.

8.4 Clarification of the term business as usual or BAU

Regional and local models are primarily established to replicate current conditions and to forecast “business as usual” (BAU) conditions. These “platforms” allow future transport system and network improvement options to be tested in operational performance and economic appraisal terms.

BAU forecasts, on the basis of planned expenditure, that anticipated funding and a continuation of current practice and policy settings can be regarded as relatively reliable outputs from regional and local models. It should also be remembered that BAU often represents significant improvement when compared with base year and/or future do-minimum conditions.

The BAU to 2015 can be taken to consist of: the current Regional Land Transport Strategy (RLTS), the Long Term Council Community Plan (LTCCP) and the Land Transport Programme (LTP). The BAU has been modelled in all four of the locations used in the SRM model.

The Auckland RLTS (Scenario 5) consists of: medium TDM (\$420m), high PT (\$3,750m), medium roading (\$6,540m). A “base” roading figure is quoted in the 2005 ARLTS of \$5,800m, around half of which is for maintenance, traffic management and

safety, with the remainder allocated to selected new projects. The total funding expected to be available at the time was \$10,990m.

Since 2005, additional funding has been allocated to the Auckland Region for transport purposes, through the JOG and ATSAP initiatives. The net result of this is likely to improve BAU outcomes (compared with those predicted from the 2005 RLTS modelling) particularly in terms of public transport patronage by 2015.

8.5 Findings

The findings of the modelling review can be summarised as follows:

- 2040 BAU (SO1) will make progress towards targets but will not fully achieve them – even on the basis of the high oil price assumption used in the new ARC modelling work.
- If the high oil price assumption were not to materialise, then the progress towards the 2040 targets would be lessened.
- The strategic options considered for 2040 (SO1 and SO3) provide some additional potential.
- Some targets are still out of reach in terms of the foreseeable scenarios.
- Not all of the 2040 targets need to be fully achieved by regional actions alone – for example, the NZTS is explicit about the contribution of demand management to the GHG target.

Further development and testing of the new ARC strategic model would be needed to further explore the above issues.

9 Appendix 3: Supplementary modelling analysis and results

9.1 Background

The new ARC strategic model does not yet produce the following:

- annualised data (required for NZTS targets),
- results for intermediate years (for example, 2015 and 2025),
- outputs using the NZTS assumption of \$100 per barrel of oil (similar to the EEM requirements for detailed evaluation),
- a full range of NZTS target measures (for example, SOVs, fatalities, serious injuries).

It is difficult for model results to fully replicate all aspects of the NZTS target definitions, including: the requirement to work in trip leg units rather than number of main mode trips; and the nature of the modelled area, which does not coincide precisely with the boundaries of “major urban areas”. It is important to interpret model and associated forecasting results within the context of broad strategic assessment and decision-making rather than expecting modelling results to be precise and detailed.

9.2 Further analysis

For the above reasons further analysis was necessary, as follows:

- Examination of previous strategic model outputs prepared for the development of the current RLTS (consisting of annualised data from the previous version of the Auckland Strategic Model). This, together with a conservative assumption of linking further growth to population increases, allowed “business as usual” (BAU) scenarios for the years 2015, 2025 and 2040 to be compared with potential targets.
- Sensitivity testing using a policy model (SRM) to review the potential effect of variations in future oil price to be compared with the ARC strategic model results.
- Incorporation of RTT 2007 base data to re-calibrate model results.

Further modification of results was considered to allow for expected mode share for PT and active modes, on the basis of the new Auckland model results for the “mixed” scenario SO2: however this was felt to potentially compromise the consistency and integrity of the earlier model results and so this was not undertaken.

9.3 Target setting

Targets have been calculated as follows:

National: GPS and NZTS targets are taken as givens at the national scale – with interpolation for the 2025 intermediate year.

Regional: RTT 2015 targets (for walking and cycling, public transport, SOVs) have been taken as givens.

For several targets, ie walking and cycling, public transport, safety and CO2, the per-capita pro-rata change required at the national scale has been applied to Auckland for 2040 - with interpolation for the 2025 intermediate year.

Other regional targets have been addressed on an individually reasoned basis, as described elsewhere in this report.

9.4 Modelling results

Table C1 below has been derived from base year and future business as usual modelled forecasts for Auckland Region, Greater Christchurch, Wellington Region and Dunedin, which have then been aggregated and factored to produce estimated national totals.

Table C2 below has been derived from base year and future business as usual (2005 RLTS scenario 5) modelled forecasts for Auckland Region. Results from the new Auckland Strategic Model are not included in this table for the reasons outlined in Annex B.

Modelled data has been annualised and adjusted to be broadly consistent with NHTS mode share estimates (although some of the adjusted figures differ in detail from those derived from NHTS – refer Annex D).

Beyond the range of available model forecasts (ie after 2016/2021), growth has been applied at the rate of projected population increase (Statistics NZ medium estimates).

National	2007 Base	2015 GPS		2025 Intermediate Year		2040/41 NZTS	
		BAU	Target	BAU	Target	BAU	Target
Walking and cycling (trip legs)	1,115,000,500	1,225,629,633	1,231,700,000	1,347,535,026	1,791,514,881	1,505,698,602	2,631,237,202
Index	100	110	110	121	161	135	236
W&C trips per capita	282	288	290	294	389	304	531
W&C mode share (%)	17.15	17.01	16.95	17.03	22.57	17.17	30
Public Transport (trip legs)	116,350,000	138,629,266	171,130,000	153,730,630	303,088,886	174,950,783	501,027,216
Index	100	119	147	132	260	150	431
PT trips per capita	37	40	50	42	79	44	125
PT mode share (%)	2.19	2.36	2.58	2.38	4.52	2.44	7.00

National	2007 Base	2015 GPS		2025 Intermediate Year		2040/41 NZTS	
		BAU	Target	BAU	Target	BAU	Target
SOV VKT per capita	3,039	3,276	2,735	3,670	2,735	3,947	2,735
Index	100	108	90	121	90	130	90
Road deaths	407		357		294		200
Index	100	0	88	0	72	0	49
Deaths per capita	0.096		0.078		0.060		0.038
Road serious injuries	3050		2,674		2,205		1500
Index	100	0	88	0	72	0	49
Injuries per (000) capita	0.721		0.588		0.449		0.283
Road travel time (km/h)	47.91	43.76	47.91	37.16	47.91	30.35	47.91
Index	100	91	100	78	100	63	100
Road reliability (VKT LOE E&F)	1,340,757,855	1,785,041,353	1,340,757,855	2,824,443,753	1,340,757,855	3,297,353,283	1,340,757,855
Index	100	133	100	211	100	246	100
Coastal shipping (inter-reg b'tonne km)	4.2					8.8	12.2
Index	100	0	0	0	0	210	290
Total inter-reg b'tonne km	19.9					39.9	
Rail freight (b'tonne km)	3.8					7.8	13.4
Index	100	0	0	0	0	205	353
Total freight b'tonne km	26.7					53.4	
Index	100	0	0	0	0	200	0
CO2 per capita	2,028	2,138	1,741	2,390	1,476	2,502	1,014
Index	100	105	86	118	73	123	50
<i>Population</i>	<i>4,228,000</i>	<i>4,549,800</i>	<i>4,549,800</i>	<i>4,905,400</i>	<i>4,905,400</i>	<i>5,303,600</i>	<i>5,303,600</i>
Index	100	108	108	116	116	125	125

Table C2: Summary of Auckland region forecasts and targets							
Regional	2007 base	2015 GPS		2025 Intermediate year		2040/41 NZTS	
		BAU	Target	BAU	Target	BAU	Target
Walking and cycling (trip legs)	361,300,000	417,340,376	427,200,000	477,171,700	672,759,487	566,918,685	1,041,098,717
Index	100	116	118	132	186	157	288
W&C trips per capita	292	298	307	298	421	299	549
W&C mode share	16.84	17.22	17.62	17.44	24.59	17.85	32.78
Public Transport (trip legs)	54,340,000	70,176,902	85,000,000	80,666,120	165,291,404	96,399,948	285,728,509
Index	100	129	156	148	304	177	526
PT trips per capita	42	48	58	48	98	48	143
PT mode share	4.00	4.57	5.54	4.69	9.54	4.79	14.20
SOV VKT per capita	3,310	3,441	3,045	3,782	2,979	3,920	2,979
Index	100	104	92	114	90	118	90
Road deaths	70		64		56		42
Index	100	0	92	0	80	0	60
Deaths per capita	0.050		0.041		0.031		0.020
Road serious injuries	860		792		692		516
Index	100	0	92	0	81	0	60
Injuries per capita	0.617		0.503		0.384		0.242
Road travel time (km/h)	45.00	41.00	45.00	33.40	45.00	25.30	45.00
Index	100	91	100	74	100	56	100
Road reliability (VKT LOE E&F)	824,783,456	1,119,711,013	824,783,456	1,922,228,340	824,783,456	2,278,061,199	824,783,456
Index	100	136	100	233	100	276	100
Coastal shipping (inter-reg tonne km)							
Index	100	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
total inter-reg b'tonne km							
Rail freight (inter-reg tonne km)							
Index	100	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Total freight b'tonne km)							
Index	100	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
CO2 per capita	1,710	1,738	1,468	1,915	1,244	1,915	855
Index	100	102	86	112	73	112	50
<i>Population</i>	<i>1,393,460</i>	<i>1,574,740</i>	<i>1,574,740</i>	<i>1,800,980</i>	<i>1,800,980</i>	<i>2,134,368</i>	<i>2,134,368</i>
Index	100	113	113	129	129	153	153

10 Appendix 4: NZ household travel survey summary statistics

The following table provides summary statistics on mode shares (by trip legs) for main urban areas (MUAs) derived from the NZ HTS data for the 4-year period July 2003-June 2007. MUAs have been grouped together, by geographical location, in some cases where the individual sample sizes are too small.

Regional_MUA MUAs (clustered by geographical location where sample size is too small) * trmodeWC Crosstabulation

% within Regional_MUA MUAs (clustered by geographical location where sample size is too small)

		trmodeWC					Total
		1.00 vehicle driver	2.00 vehicle passenger	3.50 walking or cycling	5.50 PT (bus, train or ferry)	9.00 other	
Regional_MUA MUAs (clustered by geographical location where sample size is too small)	1.00 Auckland	51.2%	26.9%	17.2%	3.4%	1.3%	100.0%
	2.00 Hamilton zone (including Cambridge and Te Awamutu zones)	56.7%	27.2%	13.6%	1.4%	1.0%	100.0%
	3.00 North of NI MUAs (Whangarei, Tauranga, Rotorua)	58.0%	23.8%	16.1%	1.5%	.6%	100.0%
	4.00 South of NI MUAs (Gisborne, Napier, Hastings, New Plymouth, Wanganui, Palmerston North)	53.9%	27.1%	16.6%	.9%	1.6%	100.0%
	5.00 Wellington, 4 cities plus Kapiti zone	47.7%	24.4%	23.0%	4.3%	.6%	100.0%
	6.00 Christchurch	48.5%	24.8%	22.9%	2.8%	1.1%	100.0%
	7.00 Dunedin	50.2%	27.3%	19.6%	2.1%	.8%	100.0%
	8.00 Rest of SI MUAs (Nelson, Invercargill)	52.9%	27.1%	17.8%	1.1%	1.0%	100.0%
Total		51.3%	26.1%	18.6%	2.9%	1.1%	100.0%

11 Appendix 5: Analysis of potential impacts of TDM measures in NZ main urban areas and urban areas

TDM etc MEASURES--ESTIMATED NATIONAL IMPACTS

2040 effect		Change is relative to 2004/07 base (ONZTS):			
Measure	Description	% VKT removed	Driver trip decrease	PT trip increase	W/C trip increase
Non-Pricing					
STP	All schools in NZ develop and implement STPs - 3.4% reduction in car psgr trips; 2.4% mode share to walk/cycle; 1.0% to PT - (a) remove 30% of driver trips from network	0.04%	negligible	1.70%	0.60%
WPTP	by 2040, either 80% of businesses with 20+ employees have high quality WPTP (includes on-going review & revitalisation); or 70% of businesses with 20+ employees and 50% of those with 10-19 employees in larger MUAs (Auckland, Wellington, Canterbury, Otago, Waikato, BOP) and those with a commitment to WPTP (Nelson, Horizons Manawatu)	1.8%	1.5%	15.6%	0.7%
Teleworking	by 2040, all employees telework 1 day per month or 25% of employees telework 1 day per week in MUAs throughout NZ	1.3%	1.2%	0.0%	0.0%
Guaranteed Ride Home	"Emergency ride home," provides non-SOV commuters with a guaranteed 'ride' in the event of a personal or family emergency, illness, or unexpected employment-related delay - estimated impact, one-half of WPTP - in all MUAs throughout NZ	0.9%	0.8%	7.8%	0.4%
Personalised Travel Planning	by 2040, 60% of population participates in a 'standard' programme (EEM2) in larger MUAs / 30% in lesser MUAs - on-going support/maintenance provided to all	3.3%	2.9%	23.0%	5.7%
Intensification (maximum)	by 2040, density increase in bigger MUAs, with some areas experiencing sufficient increases to impact on driver & w/c mode shares. Assumed that overall national impact, given that the AKL and WLG MUAs have the greatest densities at present and form one-half the total NZ MUA population, is one-half the projected maximum impact in Auckland.	not calculated	6.5%	not calculated	14.5%
Intensification (minimum)	by 2040, density increases in bigger MUAs, much of it in the form of brownfield and greenfield development with little or no impact on driver and w/c mode shares		0.00%		0.00%
Pedestrian and cycling network improvements	by 2040, further integration (e.g. traffic calming & traffic management in conjunction with infrastructure) and lengthening of cycling network in all MUA-regions - assumes 1% increase in mode share (e.g. from 2-3%) for cycling, one-half coming from drivers & one-half from vehicle passengers; potential increases in pedestrian trips as a result of increased safety.	not calculated	1.0%	not calculated	6.0%
Mediated walking interventions	could be re-branded 'push-play' programme or refocus of PTP, prescribing walking & supported through internet/telephone contact - RCT indicate there is an effect, not able to be quantified at present.		not calculated	0.0%	not calculated
HOV	definite increases in vehicle occupancy recorded, though often at the expense of PT - HOV lanes implemented in Auckland, Wellington, and Canterbury MUA-regions.	1.1%	1.1%	not calculated	0.0%
Pricing					
Parking levy	based on ARPES \$5 parking charge - widely applied in congested areas & major destinations - covering all car parks within reasonable walking distance - in all MUA-regions, although mode shift between PT and walking/cycling varies to account for differing levels of PT services	0.9%	0.8%	10.0%	0.5%
Cordon toll	Using results from ARPES - could reduce vehicle traffic by 5-6% (≈4% SOV); increase PT from 7 to 12 or 9 %; increase w/c from 15 to 17; 6 am to 10 am (affecting JTW and return trip - approx 42% of all car driver trips) - applied to 6 largest MUA-regions (Auckland, Wellington, Canterbury, Otago, Waikato, BOP)	1.1%	1.3%	10.0%	1.8%
Public Transport					
	PT service enhancements - assumes that PT service enhancements cause an absolute mode share increase of 2.1% in larger MUAs. Walking trips increase 1.35% per 1% point increase in PT mode share; driver trips decrease by 0.4%.		1.6%	75%	15%
Total impacts					
	Total change by 2040 (with intensification effects):		18.7%	143.1%	45.4%
	Total change by 2040 (without intensification effects):		12.2%	143.1%	30.9%
	Total change by 2040 (50% intensification effects):		15.4%	143.1%	38.1%
	New mode share (using ONZHTS 2004/07 as base mode share)		43.4	7.0	25.7

TDM etc MEASURES--ESTIMATED AUCKLAND REGIONAL IMPACTS						
	2040 effect					
				Change is relative to 2004/07 base (ONZHTS):		
	Measure	Description	% VKT removed	Driver trip decrease	PT trip increase	W/C trip increase
Non-Pricing						
	STP	All schools in NZ develop and implement STPs - 3.4% reduction in car psgr trips; 2.4% mode share to walk/cycle; 1.0% to PT - (a) remove 30% of driver trips from network and (b) remove 40% of driver trips from network	0.04%	negligible	1.70%	0.60%
	WPTP	by 2040, either 80% of businesses with 20+ employees have high quality WPTP (includes on-going review & revitalisation); or 70% of businesses with	1.9%	1.9%	16.1%	0.9%
	Teleworking	by 2040, all employees telework 1 day per month or 25% of employees telework 1 day per week	1.8%	1.7%	0.0%	0.0%
	Guaranteed Ride Home	"Emergency ride home," provides non-SOV commuters with a guaranteed 'ride' in the event of a personal or family emergency, illness, or unexpected employment-related delay - estimated impact, one-half of WPTP	1.0%		8.0%	0.5%
	Personalised Travel Planning	by 2040, 60% of population participates in a 'standard' programme (EEM2) in Auckland MUA region - on-going support/maintenance provided to all	3.7%	3.6%	24.7%	7.7%
	Intensification (maximum)	by 2040, density increase across Auckland Region of 60%, with MUA areas experiencing sufficient increases to impact on driver & w/c mode shares.	not calculated	13.0%	not calculated	29.0%
	Intensification (minimum)	by 2040, density increases across Auckland Region of 60%, much of it in the form of brownfield and greenfield development with little or no impact on driver and w/c mode shares	0.0%		0.0%	0.0%
	Pedestrian and cycling network improvements	by 2040, further integration (e.g. traffic calming & traffic management in conjunction with infrastructure) and lengthening of cycling network (up to 75 km new lanes) - assumes a further 50% increase in mode share (e.g. from 2-3%), one-half coming from drivers & one-half from vehicle passengers.	not calculated	2.0%	not calculated	12.0%
	Mediated walking interventions	could be re-branded 'push-play' programme or refocus of PTP, prescribing walking & supported through internet/telephone contact - RCT indicate there is an effect, not able to be quantified at present.		not calculated	0.0%	not calculated
	HOV	definite increases in vehicle occupancy recorded, though often at the expense of PT	1.6%	1.4%	not calculated	0.0%
Pricing						
	Parking levy	based on ARPES \$5 parking charge - widely applied in congested areas & major destinations - covering all car parks within reasonable walking distance	0.9%	0.8%	8.8%	0.4%
	Cordon toll	Using results from ARPES - could reduce vehicle traffic by 5-6% (=4% SOV); increase PT from 7 to 12 or 9%; increase w/c from 15 to 17; 6 am to 10 am (affecting JTW and return trip - approx 42% of all car driver trips)	1.0%	1.3%	10.0%	2.0%
Public Transport						
		PT service enhancements - assumes that PT service enhancements cause an absolute mode share increase of 2.1%. Walking trips increase 1.35% per 1% point increase in PT mode share; driver trips decrease by 0.4%.		1.6%	62%	16%
Total impacts		Total change by 2040 (with intensification effects):		27.3%	131.1%	69.6%
		Total change by 2040 (without intensification effects):		14.3%	131.1%	40.6%
		Total change by 2040 (50% of intensification effects):		20.8%	131.1%	55.1%
		New mode share (using ONZHTS 2004/07 as base mode share)		40.5	7.9	26.7

12 Appendix 6: Auckland regional population projections, 2006-2051

Table F1: Auckland region population projections 2006-2051 (Source: ARC)

Year	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051	2006-2051 Additional Growth	% Growth 2006-2051
Auckland region	1,371,000	1,482,950	1,596,817	1,709,679	1,820,565	1,928,117	2,028,530	2,122,169	2,209,898	2,290,877	919,877	67.10%
Rodney	92,470	101,481	110,182	118,888	127,716	136,437	144,532	151,971	158,906	165,451	72,981	78.92%
North Shore	216,900	231,338	246,339	261,003	275,140	288,569	300,786	311,814	321,834	330,732	113,832	52.48%
Waitakere	195,340	211,490	226,987	242,181	257,258	272,088	286,015	299,027	311,230	322,485	127,145	65.09%
Auckland	428,310	458,336	490,366	522,475	553,429	582,591	609,156	633,331	655,434	675,210	246,900	57.65%
Manukau	347,080	381,911	417,682	453,724	490,119	526,656	562,314	597,098	631,115	664,195	317,115	91.37%
Papakura	46,860	50,236	53,480	56,677	59,900	63,116	66,170	69,109	71,990	74,781	27,921	59.58%
Franklin	43,800	47,991	51,992	55,915	59,818	63,618	67,125	70,370	73,397	76,242	32,442	74.07%
NZ	4,184,500	4,392,908	4,587,473	4,768,443	4,936,104	5,086,422	5,206,419	5,299,642	5,372,369	5,425,408	1,240,908	29.65%

13 Appendix 7: References

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