



TN12 - WTSM 2013 Model Testing Report

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1. Introduction

The 2011 Wellington Transport Strategy Model (WTSM) was updated to a 2013 base year by GWRC and TDG. The re-calibration of WTSM, involving the incorporation of updated heavy commercial vehicle (HCV) module within the model, is documented in a series of technical notes.

In addition to the development of an updated 2013 WTSM base model, a series of future scenarios were developed for 2023, 2033 and 2043.

These scenarios were developed using assumptions relating to the following:

- land use – population, employment, households, school roll (TN11)
- input parameters such as the cost of parking, vehicle operating costs, PT fares and values of time, GDP and CPI (TN5)
- the nature and timing of proposed infrastructure improvements (this report)

The primary purpose of developing these future scenarios was to test the model to demonstrate that WTSM responds reasonably to a series of input assumptions, thus providing GWRC with a level of assurance that WTSM can be used with confidence as a tool to assess the impact of policy or infrastructure interventions.

These scenarios are based on one set of projections and assumptions regarding future events which, by their nature, cannot be independently substantiated. In reality, some assumptions may not eventuate or the transport network's response to certain interventions may be different to what is forecast. Therefore the actual results are likely to vary from the projections.

In the future, WTSM 2013 should be used on projects in a collaborative and intelligent manner, with appointed consultants involving GWRC at all stages of the project.

A critical stage of any project should be the liaison between GWRC and appointed consultants to determine whether the assumptions that form the basis of the tests highlighted in this report are valid for use in specific pieces of analysis. From these discussions, it is likely that a set of core assumptions would be agreed together with an agreed set of sensitivity tests to determine the extent to which project outcomes might vary depending upon the parameters in question.

2. Structure of Report

The report is structured as follows:

- Chapter 3 – summary of assumptions
- Chapter 4 – a high level summary of regional indicators, such as total car, PT and HCV trips, VKT, delays per km travelled and average network speed
- Chapter 5 – analysis of person trips at a regional level
- Chapter 6 – a summary of highway trips, public transport trips and PT mode share at a TA level
- Chapter 7 – AM peak trips to Wellington CBD
- Chapter 8 – a summary of highway trips and public transport trips to Wellington CBD, focussing on the peak periods
- Chapter 9 – a summary of PT boardings, alightings and passenger volumes at key points on the network
- Chapter 10 – a summary of traffic volumes at key locations on the network
- Chapter 11 – a summary of changes in VKT and VKT per capita
- Chapter 12 – change in travel times for key highway routes
- Chapter 13 – conclusions

3. Summary of Assumptions

This section outlines the input assumptions in WTSM relating to:

- land use – population, employment, households
- the nature and timing of proposed infrastructure improvements
- input parameters, such as parking costs, vehicle operating costs, PT fares and values of time

3.1 Land Use

Population, employment, households and school roll projections were developed for the 2023, 2033 and 2043 forecast versions of WTSM. These projections drew upon data from a number of sources, including Statistics NZ and .Id, together with discussions between GWRC and territorial authority stakeholders to obtain their feedback on initial projections prior to the finalisation of the projections.

The development of the projections is fully documented in ‘TN11 – WTSM Demographic Projections’. The final projections were reviewed by Russell Jones of Prism Consulting, with the report also reviewed by the project peer reviewer, John Bolland Consulting.

Table 1 below summarises the projected absolute increase in population and employment by 10 year period. Household projections are not tabulated as they are largely a function of the population projections, with growth in households exceeding corresponding growth in population due to declining household size through time.

Table 1: Population and employment projections, 2013 to 2043

	Population				Employment			
	Base	Growth			Base	Growth		
	2013	2023	2033	2043	2013	2023	2033	2043
Wellington City	199,951	214,991	230,012	241,040	136,965	146,562	155,204	159,873
Lower Hutt	101,102	102,155	102,661	103,167	40,464	40,872	41,271	41,681
Upper Hutt	41,375	43,862	44,685	45,513	11,345	11,570	11,689	11,806
Porirua	54,027	57,537	58,885	59,983	15,410	16,104	16,404	16,557
Kapiti	50,651	54,190	56,981	59,002	14,037	14,672	14,947	15,086
Wairarapa	42,374	43,491	44,241	44,727	17,540	17,637	17,459	17,349
Total	489,481	516,226	537,464	553,431	235,760	247,417	256,972	262,351

It shows that the population of Wellington City is forecast to increase by around 42,000 between 2013 and 2043, accounting for over half of the region’s forecast increase in population during that period.

Kapiti, Porirua and Upper Hutt are forecast to experience moderate growth, whilst Lower Hutt is forecast to experience low growth.

Just under 60% of existing employment (jobs) in the Wellington region are located in Wellington City. The projections suggest that over 85% of the region's growth in employment is forecast to be located in Wellington City.

Table 2 below summarises the projected percentage increase in population and employment by each 10 year block and for the whole 2013 to 2043 period.

Table 2: Forecast percentage increase in population and employment projections, 2013 to 2043

	Population			Employment		
	Growth			Growth		
	2023	2033	2043	2023	2033	2043
Wellington City	7.5%	15.0%	20.5%	7.0%	13.3%	16.7%
Lower Hutt	1.0%	1.5%	2.0%	1.0%	2.0%	3.0%
Upper Hutt	6.0%	8.0%	10.0%	2.0%	3.0%	4.1%
Porirua	6.5%	9.0%	11.0%	4.5%	6.4%	7.4%
Kapiti	7.0%	12.5%	16.5%	4.5%	6.5%	7.5%
Wairarapa	2.6%	4.4%	5.6%	0.6%	-0.5%	-1.1%
Total	5.5%	9.8%	13.1%	4.9%	9.0%	11.3%

It shows that Wellington City is forecast to see the biggest percentage increase in both population and employment throughout the period 2013 to 2043.

3.2 Infrastructure

Along with population and employment, changes to transport infrastructure are another key input into forecast versions of WTSM.

As WTSM is a strategic model, it only exhibits a significant response to larger scale infrastructure projects as opposed to smaller projects such as minor safety improvements; as a result, only significant infrastructure projects are included in forecast WTSM scenarios.

Table 3 below shows the infrastructure assumptions for the various forecast year versions of WTSM. This list has been developed from the Regional Land Transport Plan list of committed activities, whilst also taking into account recent developments regarding progress and variations to the programme.

Specifically, the list takes into account recent uncertainty regarding Wellington inner city improvements following the decision by the Basin Bridge Board of Inquiry to decline resource consent for the Basin Bridge.

A conservative stance has been taken for the testing outlined in this report, with none of the inner-city improvements included in the list of committed / assumed activities.

Table 3: WTSM 2013 Model Testing Infrastructure Assumptions

	Category	2023	2033	2043
M2PP Expressway	RoNS	Yes	Yes	Yes
PP20 Expressway	RoNS	Yes	Yes	Yes
Transmission Gully	RoNS	Yes	Yes	Yes
Petone to Grenada	Expressway	No	Yes	Yes
Ngauranga to Aotea Quay	RoNS	NB only ¹	Yes	Yes
Terrace Tunnel Duplication	RoNS	No	No	No
Inner City Bypass Improvements	Part of RoNS	No	No	No
Basin Bridge	RoNS	No	No	No
Mt Victoria Tunnel Duplication	RoNS	No	No	No
Bus Rapid Transit	RoNS	No	No	No
RRP	PT	Yes	Yes	Yes
Wellington City Bus Networks	PT	Yes	Yes	Yes
IFT	PT	Yes	Yes	Yes

The assumptions relating to the nature of each scheme and the proposed completion date are the best estimates made at the time.

¹ Current timing has northbound opening in 2018, with southbound opening sometime between 2023 and 2033

3.3 Working Assumptions

In previous versions of WTSM there has been criticism that the model does not realistically account for the ‘expected future’ in terms of the following:

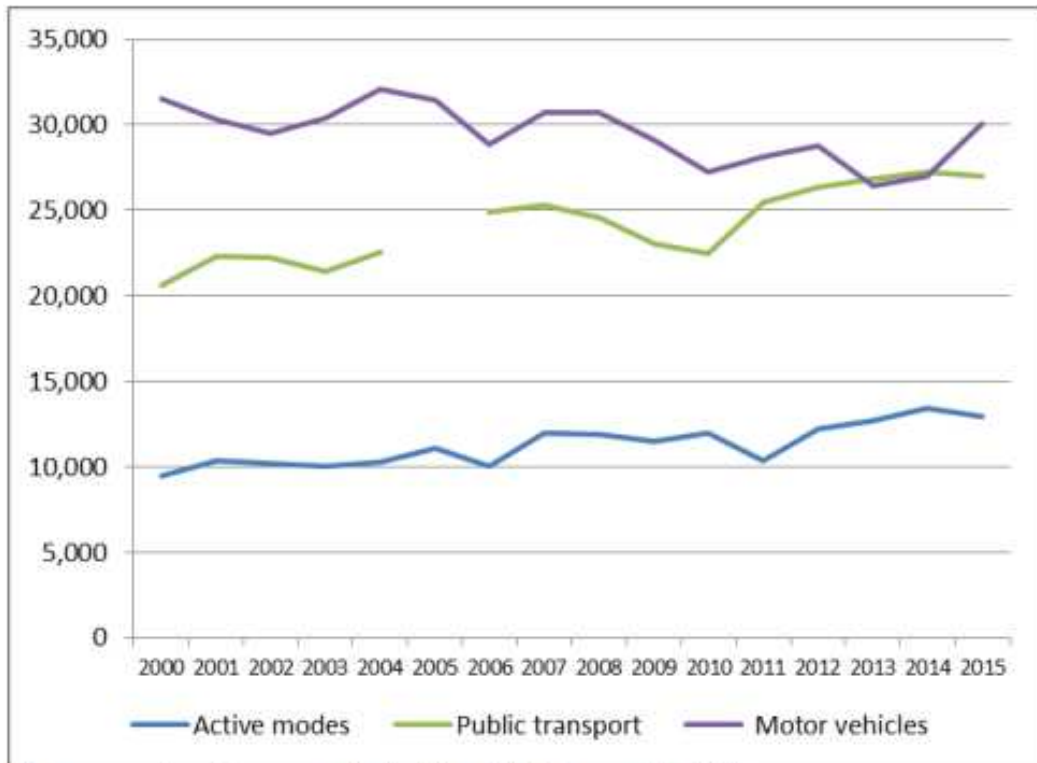
- parking supply and demand in Wellington CBD
- vehicle kilometres travelled per capita

Regarding parking supply, whilst a lack of observed data means that we can’t draw conclusions with great certainty, anecdotal evidence and limited observed evidence suggests that there has not been a net increase in parking spaces in the CBD over the last 5 to 10 years (if anything there may have been a slight decrease).

In terms of car demand to the CBD, recent annual monitoring data presented in **Figure 1** looking at AM peak inbound car trips crossing the Wellington CBD shows that car numbers have actually declined between 2000 and 2015, with a corresponding increase in PT, pedestrian and cycle cordon crossings.

Whilst we cannot directly equate a reduction in motor vehicles crossing the CBD cordon to a reduction in car trips to the CBD, it does further support the view that there has not been an increase in peak period motor vehicle demand to Wellington CBD during the last 10 to 15 years.

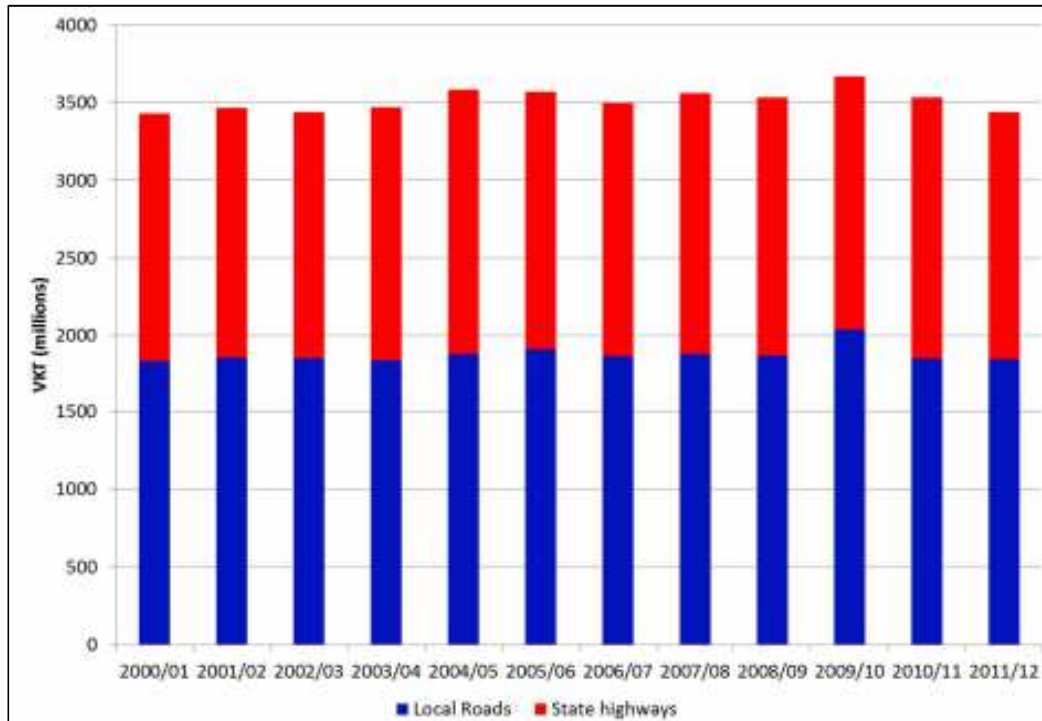
Figure 1: Wellington CBD Cordon crossing data, AM peak inbound, 2000 to 2015



Note: no cordon data were collected for public transport in 2005.

In terms of vehicle kilometres travelled, Ministry of Transport data shows that VKT has remained relatively flat between 2004 and 2014. As the region's population has grown by around 10% over this same period, this implies a decrease in vehicle kilometres travelled per capita.

Figure 2: Regional road VKT, Wellington region, 2000/01 to 2011/12 (millions)



There are a number of possible explanations for these recent trends, including:

- young people driving less
- lower rates of car ownership
- the GFC (though this can only partly explain some of the trends)
- development focussed in and around Wellington CBD, resulting in less need to own / drive a car
- an increase in environmental consciousness, with an accompanying increase in the popularity of cycling
- congestion and parking supply limiting car trips to the CBD at peak times
- the 'peak car' phenomenon

Many of these factors are summarised in a discussion document commissioned by the New Zealand Ministry of Transport in 2014.

<http://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/fd-outlook-for-car-travel.pdf>

The question of most relevant for WTSM is the extent to which these trends might continue into the future. Whilst there is an inherent level of uncertainty attached to forecasting what might happen in the future, our best estimates which form the working assumptions for the WTSM tests presented in this report are as follows:

- there will be no increase in peak time commuter parking supply (HBW parking) in Wellington CBD between 2013 and 2043
- there will be no increase in VKT per capita across the region between 2013 and 2043

The rationale behind the parking supply assumption is that whilst new commercial development is forecast to occur, the number of parking spaces associated with such development is likely to be limited. Furthermore, continued commercial and residential development in the CBD is likely to see a continuation of recent trends, whereby land currently used for parking is developed for other purposes, with the parking spaces not replaced.

This assumption will be applied in the model by calibrating the CBD HBW parking charge to identify a charge that results in HBW trip ends to Wellington CBD remaining at 2013 levels.

The rationale for assuming no significant change in VKT per capita into the future (if not a slight decrease) is threefold:

- a considerable amount of population growth is forecast to occur in and around Wellington CBD, with such growth likely to favour an increase in PT, cycle and walking trips rather than car trips
- with employment growth focussed on Wellington CBD, new trips to the CBD will be generated. Given the likely future parking constraints, PT is likely to play a major role in accommodating these new trips on the network
- based on recent evidence, it is unlikely that increasing affluence (and the increasing affordability of owning and operating a car) will continue to result in substantial increases in car VKT by the average person

Changes in VKT per capita, at both a TA and regional level, will be monitored when running WTSM, with parameters modified if required to ensure that VKT per capita remains largely unchanged between 2013 and 2043.

3.4 Economic Parameters

Base year and estimated future year costs for the following input parameters were developed for WTSM:

- public transport fares
- vehicle operating costs – a function of fuel price, maintenance and vehicle fleet efficiency
- values of time
- Wellington CBD parking charges (commuter and other)

These costs are input into WTSM, to be used in the PT and highway generalised cost calculations.

The development of future year costs draws upon information such as GDP projections, CPI projections, fuel price projections, vehicle efficiency forecasts and long term relationships between PT fares and GDP.

The whole process is documented in TN5 – WTSM Economic Parameters.

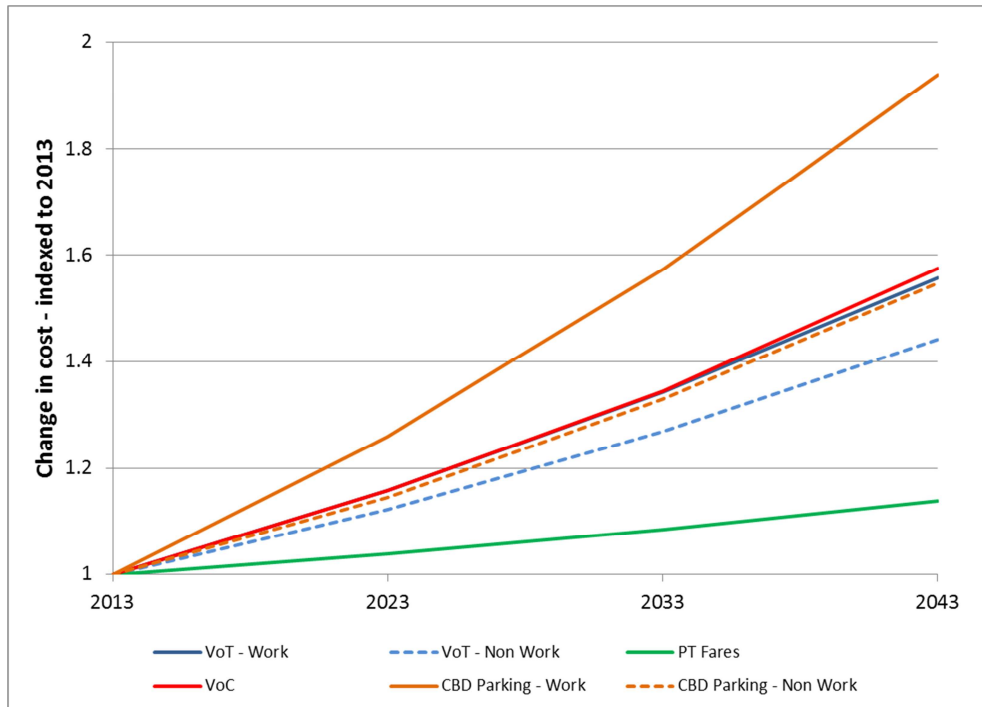
Table 4 below summarises the indexed (to the base year 2013) growth rates, by year, for the key economic parameters.

Table 4: Indexed growth rates for economic parameters

	2013	2023	2033	2043
VoT – Work	1.00	1.16	1.34	1.56
VoT – Non-work	1.00	1.12	1.27	1.44
PT fares	1.00	1.04	1.08	1.14
VoC	1.00	1.16	1.34	1.57
CBD Parking – Work	1.00	1.26	1.57	1.94
CBD Parking – Non-work	1.00	1.14	1.33	1.55
GDP / CPI	1.00	1.15	1.34	1.55

Figure 3 below shows the assumed change in the cost of each parameter through time, indexed to the base year (2013) values.

Figure 3: WTSM forecast parameters, indexed growth to 2013



It shows the following:

- public transport fares increase at a relatively low rate, the result of a working assumption that PT fares will increase by a rate equal to GDP / CPI and an elasticity of 0.25 (i.e. if CPI increases by 10%, PT fares would only increase by 2.5%)
- values of time, CBD parking (non-work) and VoC (combination of fuel price and improved vehicle efficiency) are all forecast to increase at a similar rate
- CBD parking (HBW) is forecast to increase at the fastest rate, a direct result of the cost of HBW CBD parking being used as a calibration tool to maintain HBW car trip ends to the CBD at 2013 levels, the working assumption that has been adopted for these forecasts

3.5 HCV Growth

Growth in car and PT trips is a function of changes in land use (population, employment), economic parameters (GDP, CPI, cost of parking, fuel cost, PT fares) and infrastructure enhancements (that improve travel times and reduce travel costs).

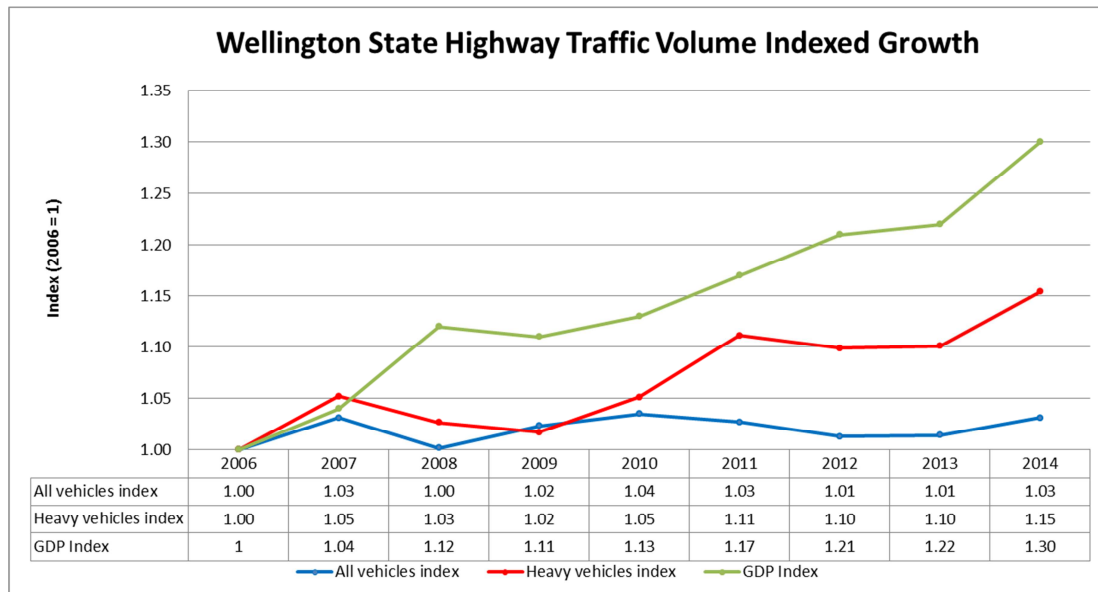
WTSM responds by generating trip matrices and modelling travel patterns that are reflective of these changes.

HCV growth, however, is not directly linked to changes in land use, economic parameters nor new infrastructure. Whilst car trip growth rates are outputs from WTSM, HCV growth rates are inputs into WTSM, derived from a formula that uses assumed GDP growth rates (1.8% per annum) and an elasticity (sensitivity) factor.

This approach is based upon the historic correlation between GDP growth rates and growth in freight volumes.

Figure 4 below shows indexed growth in state highway HCV volumes between 2006 and 2014.

Figure 4: Wellington State Highway Traffic Volume Indexed Growth, 2006 to 2014



It shows that HCV growth has been around 15% over the 8 year period, compared with regional GDP per capita growth of around 30%² over the same period (regional GDP growth was 32%).

This recent relationship suggests that freight volumes have grown by a rate equal to GDP growth and a multiplier of around 0.6 between 2006 and 2014.

² Statistics NZ Regional GDP Growth

The National Freight Demand Study (NFDS), produced by the Ministry of Transport, forecasts freight demand at a regional level for the period 2012 to 2042.

Table 5 below shows total freight movements in the Wellington Region for 2012 and 2042 (forecast from NFDS), split by origin / destination.

Table 5: Total freight movements in Wellington Region, 2012 to 2042 (billion tonne-kms)

Origin	Destination	2012	2042	% change
Wellington	Other regions	0.9	1.2	38%
Other regions	Wellington	1.7	2.6	52%
Wellington	Wellington	0.2	0.3	40%
All	All	2.8	4.1	47%

It shows that, when looking at all trips, the NFDS forecasts a 47% increase in freight volumes transported within the Wellington region between 2012 and 2042.

The data in **Table 5** relates to freight by volume (and not trips) and does not differentiate by mode, although data presented elsewhere in the NFDS shows that currently 95% of freight transported in the Wellington region gets transported by road. Even if the popularity of rail freight were to increase, it is still likely that in 2042, the majority of freight will be transported within the Wellington region by road.

Whilst it is possible that the size and axle weights of the future road transport fleet might increase in the future, thus reducing the number of lorries on the network, limited information is available regarding the extent to which such a change might eventuate in the future.

Therefore based on the information presented in the NFDS, it is assumed that the forecast 47% increase in total freight movements within the Wellington Region between 2012 and 2042 would equate to a 47% increase in road freight trips within the Wellington region over the same period.

For a growth in HCV trips of 47% between 2012 and 2042 to be applied to WTSM, a multiplier of around 0.65 would need to be applied to the assumed long-term GDP growth rate (1.8% pa). This forecast relationship is very similar to the recent relationship between GDP and HCV growth rates as derived from **Figure 4** – GDP per capita growth and a multiplier of 0.6.

Based upon recent trends and the NFDS, it was decided that HCV growth in WTSM, for the purpose of the tests documented in this report, should be applied by using the long-term GDP per capita growth forecast of 1.8% per annum and a multiplier of approximately 0.65.

Whilst this approach is conservative compared to HCV growth assumptions in WTSM 2011 (70% growth between 2011 and 2041), it is considered appropriate for these demonstration tests.

When WTSM is being used for project specific testing, consultants should liaise with GWRC regarding the appropriate HCV growth assumptions and as a matter of course undertake sensitivity tests to see how dependent the scheme in question might be upon the chosen HCV growth assumptions.

4. High Level Indicators

This chapter presents an initial summary of some of the key high level, regional indicators that are output from the 2023, 2033 and 2043 tests, namely:

- car trips by time period
- HCV trips by time period
- PT trips by time period
- Vehicle kilometres travelled (car only) by time period
- Delays per kilometre travelled by time period
- Average network speed by time period

These indicators are designed to provide a broad indication of the change in travel patterns and network characteristics that are generated by WTSM in response to changes in land use, infrastructure and economic parameters.

4.1 Car, HCV and PT trips

Table 6 below shows the change in regional car, HCV and PT trips between 2013 and each of the forecast years, providing an indication of the relative change in popularity of travelling by car and PT throughout the 30 year period.

Table 6: Regional car, HCV and PT trips by time period

	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Car Trips							
AM	162,789	171,412	5.3%	177,227	8.9%	181,505	11.5%
IP	150,602	160,580	6.6%	167,339	11.1%	172,571	14.6%
PM	192,972	205,059	6.3%	213,611	10.7%	219,749	13.9%
Daily	394,028	419,432	6.4%	436,726	10.8%	449,937	14.2%
HCV Trips							
AM	8,503	9,543	12.2%	10,719	26.1%	12,038	41.6%
IP	9,446	10,601	12.2%	11,906	26.0%	13,371	41.5%
PM	6,767	7,594	12.2%	8,532	26.1%	9,584	41.6%
Daily	16,245	18,231	12.2%	20,476	26.0%	22,996	41.6%
PT Trips							
AM	31,960	35,469	11.0%	37,498	17.3%	39,709	24.2%
IP	9,390	10,330	10.0%	11,138	18.6%	11,744	25.1%
PM	25,465	28,407	11.6%	30,470	19.7%	32,497	27.6%
Daily	29,211	32,307	10.6%	34,612	18.5%	36,628	25.4%

The table shows that for each 10 year period, PT growth rates are higher than car growth rates. Between 2013 and 2043, growth in daily PT trips (25%) is forecast to be greater than growth in daily car trips (14%).

Growth rates over each 10 year period are forecast to slow, a result of input population and employment projections that assume declining growth rates through time.

A greater increase in the cost of travelling by car (VoC and parking, particularly in peak periods) compared with public transport (PT fares), together with the fact that the majority of the growth in employment is forecast to occur in Wellington CBD (with associated good transport links) explains why PT growth rates are forecast to be higher than car growth rates.

HCV trips are forecast to increase by 42% over the 30 year period, a slightly lower rate of growth than comparable forecast GDP growth over the same period and slightly lower than the ‘target’ growth rates that are provided by the NFDS and recent trends.

As stated in the previous section, it is suggested that when WTSM is used in the future by GWRC and appointed consultants, the resulting growth rates from using the 1.8% GDP / 0.65 multiplier scenario presented in this report (~42% growth between 2013 and 2043) and a 1.8% GDP / 1.0 multiplier (70% growth between 2013 and 2043) be used as benchmarks, with the consultant / GWRC liaising and agreeing upon a suitable assumption.

4.2 Mode Share

Table 7 shows the change in private vehicle (car) and public transport mode share by time period across the region.

Table 7: Private vehicle (car) and public transport mode share

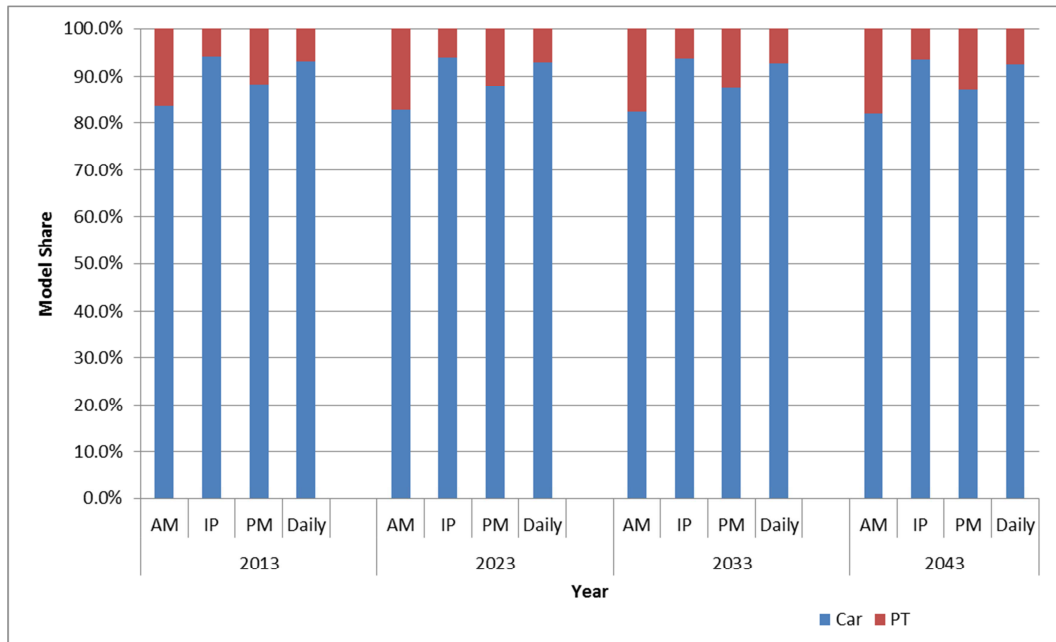
	2013	2023	2033	2043
Car Trips				
AM	83.6%	82.8%	82.5%	82.0%
IP	94.1%	94.0%	93.8%	93.6%
PM	88.3%	87.8%	87.5%	87.1%
Daily	93.1%	92.8%	92.6%	92.5%
PT Trips				
AM	16.4%	17.2%	17.5%	18.0%
IP	5.9%	6.0%	6.2%	6.4%
PM	11.7%	12.2%	12.5%	12.9%
Daily	6.9%	7.2%	7.4%	7.5%

The information shows that PT mode share is forecast to increase slowly but steadily across all time periods, with the daily PT mode share increasing from 6.9% in 2013 to 7.5% in 2043.

The percentage increase in regional PT mode share is more significant in peak periods than in the inter-peak, due to the dominance of Wellington CBD as a destination for commuters coupled with good public transport links to the CBD and continued peak time parking constraint.

The forecast increase in PT mode share, as shown in graphical format in **Figure 5**, is due to future changes in the relative costs of travelling by car and PT, further explained in section 11.3, together with the location of future population and employment growth.

Figure 5: Private vehicle (car) and PT mode share, 2013 to 2043



4.3 VKT, Delays, Average Network Speed

Table 8 below shows the forecast change in VKT, average delay per vehicle kilometre travelled and average network speed between 2013 and 2043 by time period – AM, Inter-peak, PM – and expressed as an average across the whole day.

Table 8: VKT, average delay per vehicle kilometre travelled and average network speed by time period

	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
VKT (1000s)							
AM	1,337	1,382	3.3%	1,407	5.2%	1,411	5.5%
IP	948	997	5.1%	1,020	7.6%	1,031	8.7%
PM	1,420	1,500	5.7%	1,542	8.6%	1,559	9.8%
Daily	2,607	2,737	5.0%	2,800	7.4%	2,827	8.5%
Average seconds delay per km travelled							
AM	18.7	17.9	-4.3%	16.1	-13.6%	16.9	-9.6%
IP	7.4	7.5	1.5%	8.3	11.3%	8.7	17.6%
PM	16.7	16.6	-0.6%	16.3	-2.6%	17.8	6.5%
Daily	10.1	10.0	-0.5%	10.3	2.3%	10.9	8.7%
Average network speed							
AM	43.6	44.4	1.8%	45.0	3.1%	44.4	1.7%
IP	49.6	49.6	0.0%	48.8	-1.7%	48.2	-2.9%
PM	43.6	43.7	0.3%	43.4	-0.4%	42.3	-2.9%
Daily	47.8	48.0	0.3%	47.4	-0.8%	46.8	-2.3%

The table shows the following:

- Daily VKT is forecast to increase by 9% between 2013 and 2043, slightly lower than the rate of population growth (13%) over the same period, implying a slight decrease in per capita VKT
- VKT increases at a slower rate in the AM peak, a reflection of parking constraint and the fact that the AM peak period is generally more concentrated and consequently more congested than the PM peak
- At a daily level, average delay per kilometre travelled increases in proportion to the increase in VKT, with the impact of increased VKT (increased congestion and delays) balanced to a certain extent by infrastructure investment – M2PP, PP2N, TG, P2G - that improves travel times and reduces delays on certain parts of the network
- In the inter-peak, average delay per km travelled increases by 18%, although this is from a very low base, with the 2043 figure (9s delay per km travelled) still around half the corresponding value in the peak periods
- Across all periods, average delays per kilometre travelled remain largely unchanged between 2013 and 2043, the result of an increase in car trips being

balanced by capacity improvements designed to accommodate increased traffic volumes on the region's roads

- Average network speed follows a similar trend to average delay per km travelled, with little change between 2013 and 2033 followed by a slight deterioration between 2033 and 2043

4.4 Commuter Trips

Table 9 below shows daily commuting trips (definition of commuting trips: combined AM, Inter-peak and PM peak home-based work trips) by mode.

Table 9: Daily commuting trips by mode

	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Daily Trips							
Car	215,384	220,806	2.5%	225,006	4.5%	228,604	6.1%
PT	52,663	58,794	11.6%	62,588	18.8%	67,113	27.4%
Active	28,348	28,724	1.3%	28,921	2.0%	29,711	4.8%
Total	296,395	308,324	4.0%	316,515	6.8%	325,428	9.8%

The information shows that, overall, daily HBW commuting trips are forecast to increase by 9.8% between 2013 and 2043, broadly in line with the corresponding projected increase in employment of around 11% over the same period.

At a modal level, PT is forecast to see the highest percentage growth rate (27%) followed by car (~6%). Active mode commute trips are forecast to increase by around 5%.

Similar trends can be seen for each 10 year forecast period.

5. Person Trips

Table 10 below shows regional weekday person trips by purpose and time period. The purposes are as follows:

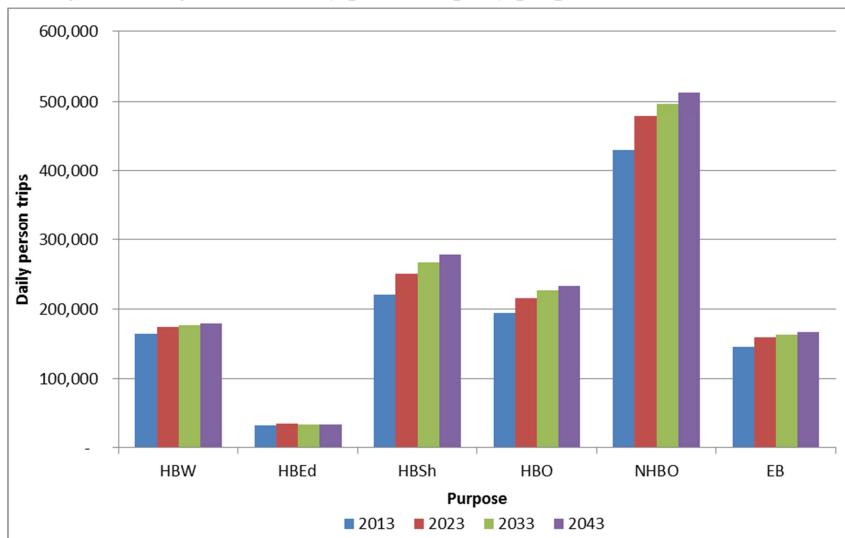
- Home based work
- Home based education
- Home based shopping
- Home based other
- Non-home based other
- Employer's business

Table 10: Regional weekday person trips by time period and purpose

	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Daily Trips							
HBW	164,019	174,451	6.4%	177,862	8.4%	180,640	10.1%
HBEd	32,971	35,473	7.6%	34,664	5.1%	34,420	4.4%
HBSH	221,447	251,471	13.6%	267,167	20.6%	278,996	26.0%
HBO	195,160	216,751	11.1%	226,813	16.2%	234,192	20.0%
NHBO	428,921	477,332	11.3%	497,145	15.9%	512,830	19.6%
EB	145,275	158,528	9.1%	162,361	11.8%	165,780	14.1%
Total	1,187,793	1,314,006	10.6%	1,366,012	15.0%	1,406,858	18.4%

Figure 6 below shows the regional weekday person trips by purpose

Figure 6: Regional weekday person trips by purpose



The results show that daily person trips are forecast to increase by around 18% between 2013 and 2043, and the following more detailed observations can be made:

- Home-based work trips are forecast to increase by around 10%, similar to the forecast employment growth rates during the same period
- Home-based education trips increase by around 4%, the result of low growth in children of school age but higher growth rates for tertiary students, driven by growth in University roll numbers in Wellington
- Employer's business trips are forecast to increase by 14%
- 'other' trips – home-based other, non-homes based other and shopping trips – are forecast to increase by between 20% and 26%
- As 'other' trips account for over 2/3rd of daily trips in the base year, the forecast growth in 'other' trips is the main driver of the 18% growth in overall person trips

When compared against population projections showing 11% growth between 2013 and 2043, growth in person trips implies that the average person will make more trips in 2043 compared with 2013, with 'other' trips accounting for the majority of this growth.

6. Highway and Public Transport Trips

This section summarises highway trips, public transport trips and PT mode share by TA as follows:

- AM peak trips by originating TA
- PM peak trips by destination TA

6.1 AM Peak Trips by Origin TA

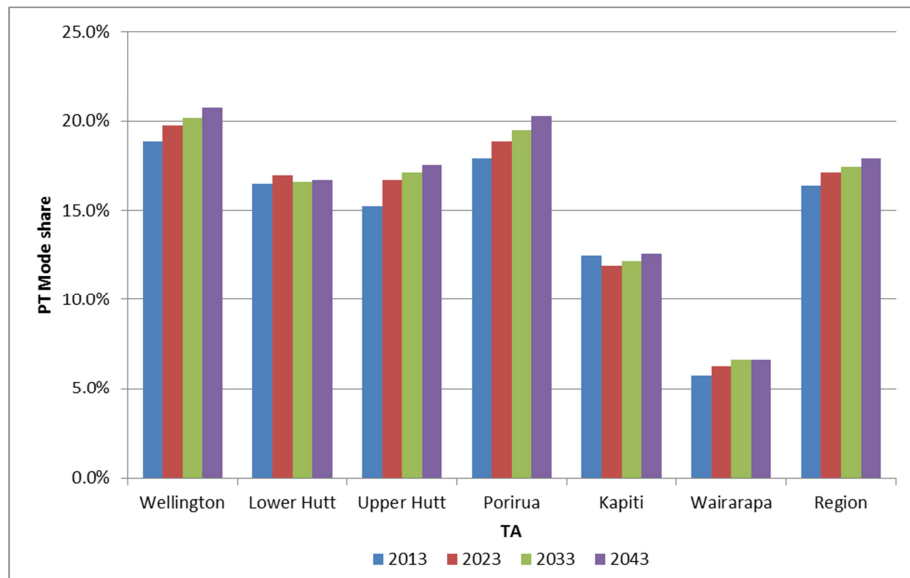
Table 11 below shows AM peak highway trips, PT trips and PT mode share by origin TA

Table 11: AM peak highway trips, PT trips and PT mode share by origin TA

	2013 Base	Mode	2023		2033		2043	
			Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Highway trips								
Wellington	70,642	Car	75,348	7%	79,212	12%	82,048	16%
	16,423	PT	18,549	13%	20,018	22%	21,502	31%
	18.9%	MS	19.8%		20.2%		20.8%	
Lower Hutt	33,203	Car	34,599	4%	36,089	9%	36,890	11%
	6,574	PT	7,076	8%	7,202	10%	7,431	13%
	16.5%	MS	17.0%		16.6%		16.8%	
Upper Hutt	13,330	Car	13,659	2%	13,603	2%	13,722	3%
	2,397	PT	2,747	15%	2,818	18%	2,926	22%
	15.2%	MS	16.7%		17.2%		17.6%	
Porirua	16,040	Car	16,743	4%	16,816	5%	16,968	6%
	3,504	PT	3,896	11%	4,073	16%	4,318	23%
	17.9%	MS	18.9%		19.5%		20.3%	
Kapiti	15,330	Car	16,500	8%	16,963	11%	17,343	13%
	2,192	PT	2,229	2%	2,354	7%	2,501	14%
	12.5%	MS	11.9%		12.2%		12.5%	
Wairarapa	14,244	Car	14,563	2%	14,543	2%	14,533	2%
	869	PT	972	12%	1,033	19%	1,031	19%
	5.8%	MS	6.3%		6.6%		6.6%	
Region	162,789	Car	171,412	5%	177,227	9%	181,505	11%
	31,960	PT	35,469	11%	37,498	17%	39,709	24%
	16.4%	MS	17.1%		17.5%		18.0%	

Figure 7 shows PT mode share by originating TA in the AM peak.

Figure 7: AM peak highway trips, PT trips and PT mode share by origin TA



The forecasts shows that AM peak car and public transport trips by origin TA are expected to increase by 11% and 24% respectively between 2013 and 2043, with most of that growth occurring between 2013 and 2023.

We can also summarise that:

- Wellington City is expected to see the largest percentage growth in both AM peak car and PT trips, a result of most growth in population occurring within Wellington City.
- Wairarapa is expected to see the smallest growth in AM peak car trips of only 2% between 2013 and 2043, while Lower Hutt is expected to see the smallest growth in PT trips of 13%.
- In 2043 it is expected that Wellington City will be the TA with the highest mode share for AM peak public transport trips of 21% (up from 19% in 2013), whilst only 7% of trips in the Wairarapa will be made by PT (up from 6% in 2013).
- Porirua and Upper Hutt show the biggest increases in PT mode share between 2013 and 2043, driven by congestion downstream on SH1 (from Porirua) and SH2 (from Upper Hutt) making PT an attractive option for trips to Wellington CBD
- Kapiti and Lower Hutt show little change in PT mode share between 2013 and 2043, largely driven by infrastructure projects (Kapiti = M2PP, TG; Lower Hutt = P2G) that improve levels of service for cars

6.2 PM Peak Trips by Destination TA

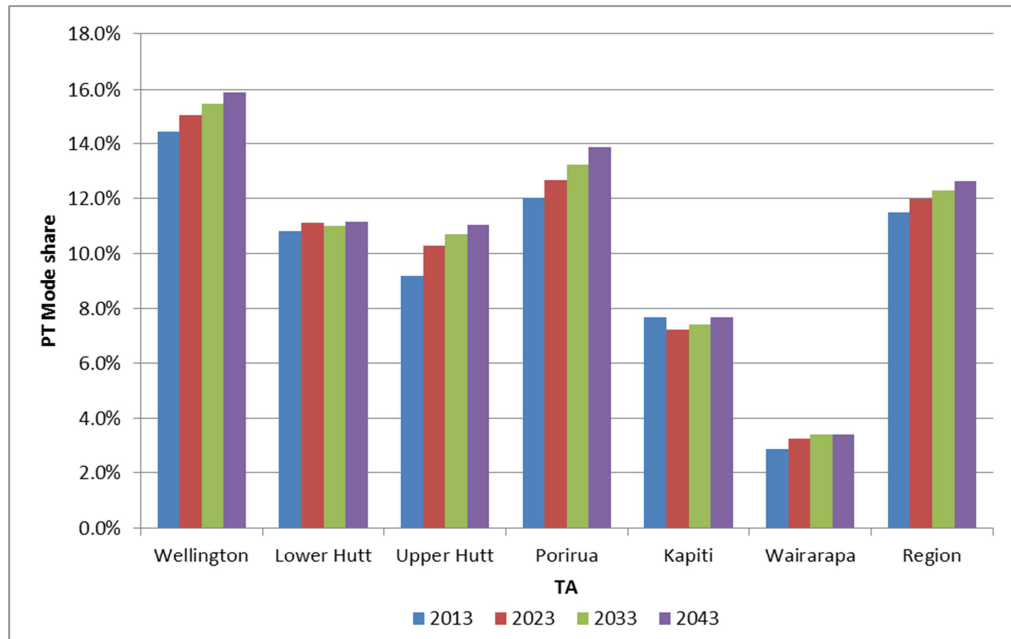
Table 12 below shows PM peak private vehicle (car) and PT trips by destination TA, together with the PT mode share.

Table 12: PM peak highway trips, PT trips and PT mode share by destination TA

	2013 Base	Mode	2023		2033		2043	
			Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Highway trips								
Wellington	83,720	Car	89,582	7%	94,415	13%	98,100	17%
	14,146	PT	15,863	12%	17,240	22%	18,575	31%
	14.5%	MS	15.0%		15.4%		15.9%	
Lower Hutt	40,122	Car	42,565	6%	45,216	13%	46,611	16%
	4,864	PT	5,328	10%	5,601	15%	5,856	20%
	10.8%	MS	11.1%		11.0%		11.2%	
Upper Hutt	16,197	Car	16,949	5%	16,881	4%	17,058	5%
	1,647	PT	1,946	18%	2,026	23%	2,117	29%
	9.2%	MS	10.3%		10.7%		11.0%	
Porirua	19,446	Car	20,628	6%	20,761	7%	21,015	8%
	2,658	PT	3,000	13%	3,175	19%	3,384	27%
	12.0%	MS	12.7%		13.3%		13.9%	
Kapiti	19,206	Car	20,935	9%	21,886	14%	22,636	18%
	1,598	PT	1,636	2%	1,752	10%	1,882	18%
	7.7%	MS	7.2%		7.4%		7.7%	
Wairarapa	17,437	Car	18,110	4%	18,321	5%	18,491	6%
	518	PT	609	18%	652	26%	655	27%
	2.9%	MS	3.3%		3.4%		3.4%	
Region	196,127	Car	208,767	6%	217,480	11%	223,911	14%
	25,432	PT	28,383	12%	30,445	20%	32,470	28%
	11.5%	MS	12.0%		12.3%		12.7%	

Figure 8 graphs the total PM peak highway trips aggregated by destination TA as presented in **Table 12**.

Figure 8: PM peak highway trips, PT trips and PT mode share by destination TA



The results shows that PM peak car and public transport trips by origin are expected to increase by 14% and 28%, respectively between 2013 and 2043, with most of that growth occurring between 2013 and 2023.

We can also summarise that:

- Kapiti is forecast to see the largest growth in terminating PM peak car trips (18%), while Wellington City is forecast to see the largest percentage growth in terminating PM peak PT trips (31%).
- Wairarapa and Upper Hutt are forecast to see the lowest growth in terminating PM peak car trips of around 5% to 6% between 2013 and 2043
- Similar to when looking at AM peak trips by origin, Kapiti and Lower Hutt are forecast to see little change in PT mode share whilst Porirua and Upper Hutt are forecast to see the biggest increase in PT mode share
- In 2043 it is forecast that Wellington City will be the TA with the highest PT mode share for PM peak terminating trips of 15.9% (up from 14.5% in 2013)

6.3 Comparison between AM and PM peak results

When comparing AM peak trips by origin TA in **Table 11** and PM peak trips by destination TA in **Table 12**, we would expect to see similar patterns in terms of growth in car / PT trips and PT mode share, given that persons commuting to work in the AM peak will generally commute back home in the PM peak.

In broad terms, the growth rates are similar when corresponding AM peak and PM peak results are compared.

For example, AM peak car / PT trips from Wellington City are forecast to increase by 16% and 31% respectively between 2013 and 2043, whilst PM peak car / PT trips to Wellington City are forecast to increase by 17% and 31% respectively over the same period.

A similar pattern is evident at a regional level, with AM peak car / PT growth rates similar to PM peak car / PT growth rates.

In terms of PT mode share, however, the current (2013) AM peak PT mode share across the region (16.4%) is significantly greater than the current PM peak PT mode share across the region (11.5%).

Whilst both the AM peak and PM peak PT mode share is forecast to increase between 2013 and 2043, the differential between the AM peak and PM peak figures is forecast to remain.

This differential is largely due to the characteristics of trips in both periods.

In the AM peak, most trips are commuter / education trips, many destined for Wellington CBD. Constrained capacity on the highway network into Wellington results in public transport being an attractive option for many of these trips.

In the PM peak, there are more non-commuter trips on the network, with people heading to activities after work (e.g sporting activities, shopping). The characteristics of these trips mean that the origin and destination are often outside of the CBD, resulting in car travel often being favoured over PT. Combined with the fact that the commuter peak in the afternoon / evening is generally much more spread out than in the morning, this results in the PT mode share being lower in the PM peak compared with the AM peak.

7. Highway and Public Transport Trips to Wellington CBD

This section summarises highway trips, public transport trips and PT mode share to Wellington CBD in the AM peak. Note that this analysis does not include active mode trips.

For this analysis, the region is split up into the following distinct sectors:

- Wellington CBD
- Wellington eastern suburbs
- Wellington southern suburbs
- Wellington western suburbs
- Wellington northern suburbs (excluding Tawa)
- Tawa Basin
- Porirua
- Kapiti
- Lower Hutt
- Upper Hutt
- Wairarapa

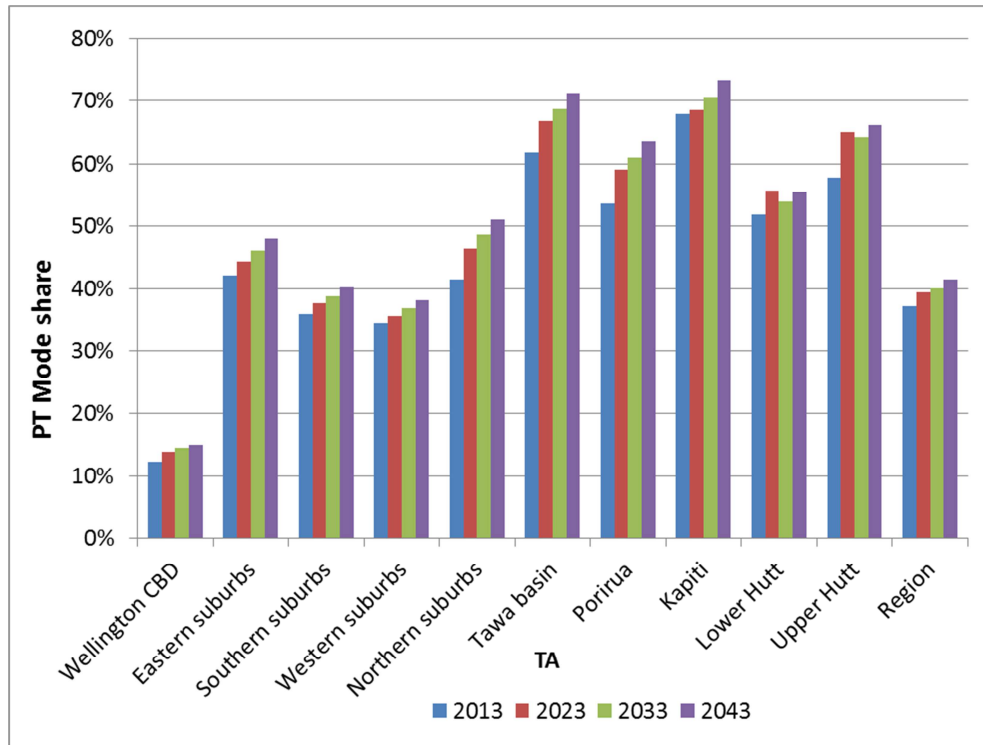
Table 13 shows AM peak private vehicle (car) and PT trips to Wellington CBD, together with the PT mode share, aggregated by origin sector.

Table 13: AM peak highway trips, PT trips and PT mode share to Wellington CBD, by origin sector

	2013 Base	Mode	2023		2033		2043	
			Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Highway trips								
Wellington CBD	12,715	Car	14,846	16.8%	16,003	25.9%	16,727	31.6%
	1,785	PT	2,386	33.7%	2,715	52.1%	2,948	65.1%
	12.3%	MS	13.8%		14.5%		15.0%	
Eastern suburbs	3,187	Car	3,232	1.4%	3,188	0.0%	3,126	-1.9%
	2,319	PT	2,572	10.9%	2,731	17.8%	2,889	24.6%
	42.1%	MS	44.3%		46.1%		48.0%	
Southern suburbs	4,229	Car	4,539	7.3%	4,592	8.6%	4,596	8.7%
	2,367	PT	2,748	16.1%	2,919	23.3%	3,099	30.9%
	35.9%	MS	37.7%		38.9%		40.3%	
Western suburbs	4,288	Car	4,449	3.8%	4,401	2.6%	4,373	2.0%
	2,251	PT	2,458	9.2%	2,571	14.2%	2,706	20.2%
	34.4%	MS	35.6%		36.9%		38.2%	
Northern suburbs	3,828	Car	3,870	1.1%	3,944	3.0%	3,951	3.2%
	2,720	PT	3,362	23.6%	3,754	38.0%	4,117	51.4%
	41.5%	MS	46.5%		48.8%		51.0%	
Tawa basin	552	Car	527	-4.6%	509	-7.7%	519	-6.0%
	893	PT	1,059	18.6%	1,119	25.3%	1,283	43.6%
	61.8%	MS	66.8%		68.7%		71.2%	
Porirua	1,786	Car	1,776	-0.6%	1,759	-1.5%	1,705	-4.5%
	2,064	PT	2,561	24.1%	2,744	33.0%	2,966	43.7%
	53.6%	MS	59.1%		60.9%		63.5%	
Kapiti	607	Car	626	3.2%	612	0.9%	583	-3.9%
	1,280	PT	1,361	6.3%	1,469	14.7%	1,603	25.2%
	67.8%	MS	68.5%		70.6%		73.3%	
Lower Hutt	3,767	Car	3,726	-1.1%	4,001	6.2%	3,936	4.5%
	4,064	PT	4,685	15.3%	4,699	15.6%	4,923	21.1%
	51.9%	MS	55.7%		54.0%		55.6%	
Upper Hutt	930	Car	891	-4.3%	973	4.6%	946	1.6%
	1,278	PT	1,659	29.8%	1,748	36.7%	1,852	44.9%
	57.9%	MS	65.1%		64.2%		66.2%	
Wairarapa	80	Car	63	-21.5%	70	-12.4%	63	-21.7%
	259	PT	309	19.0%	329	27.0%	322	24.1%
	76.4%	MS	83.1%		82.5%		83.7%	
Region	35,968	Car	38,545	7.2%	40,052	11.4%	40,525	12.7%
	21,280	PT	25,160	18.2%	26,797	25.9%	28,708	34.9%
	37.2%	MS	39.5%		40.1%		41.5%	

Figure 9 shows the PT mode share to Wellington CBD in the AM peak, by origin sector.

Figure 9: PT Mode share to Wellington CBD, AM peak



The results show the following regarding AM peak trips to the CBD:

- Kapiti and the Tawa Basin have PT mode share figures of over 60% in the 2013 AM peak, with Porirua, Upper Hutt and Lower Hutt having figures between 50% and 60%
- Between 2013 and 2043, PT mode share to Wellington CBD increases significantly in Porirua and Upper Hutt, the result of congestion on SH1 (Ngauranga Gorge) and SH2 (north of Petone) together with increased parking charges in Wellington CBD improving the attractiveness of travelling by PT
- PT mode share increases at a more moderate rate for Lower Hutt and Kapiti, the result of specific highway infrastructure projects (M2PP, TG and P2G) improving highway levels of services and travel times for trips between Kapiti /Lower Hutt and Wellington CBD respectively
- PT mode share to Wellington CBD from Wellington's northern suburbs is forecast to increase at a significant rate between 2013 and 2043, the result of population growth generating a substantial increase in the overall number of trips between the northern suburbs and the CBD and highway congestion / parking charges resulting in many of these new trips being made by bus or train

- Whilst PT mode share from Wellington's southern, eastern and western suburbs to the CBD is forecast to increase, the forecast rate of increase is relatively modest compared to the northern suburbs
- Looking at the region as a whole, PT mode share to Wellington CBD in the AM peak is forecast to increase from 37% to 41%, the result of employment growth in the CBD generating many new commuter trips and congestion / parking charges resulting in PT being the most attractive option for many of these new trips

The PT mode share of trips to Wellington CBD from Wellington CBD (internal trips) is very low (~12% to 15%). This is discussed in more detail in the next section.

8. AM Peak Trips to Wellington CBD

8.1 Car Trips

Table 14 below summarises AM peak car trips to Wellington CBD, categorised as follows:

- External origin – trips from zone outside of the CBD to zones within the CBD
- Internal origin – trips from zones within the CBD to zones within the CBD

For the purpose of this analysis, the CBD is defined as the set of zones in WTSM for which HBW commuter parking charges are applied. This area comprises the core CBD including Lambton Quay, the Terrace, mid-town (Willis Street / Victoria street) and Courtenay Place area.

It is a slightly tighter (smaller) definition of the CBD compared to what was used for the analysis presented in section 7.

The car trips themselves are further categorised as follows:

- HBW – home-based work (commuter) trips that pay the higher parking charge
- Other car trips (inc EB) that pay the lower parking charge

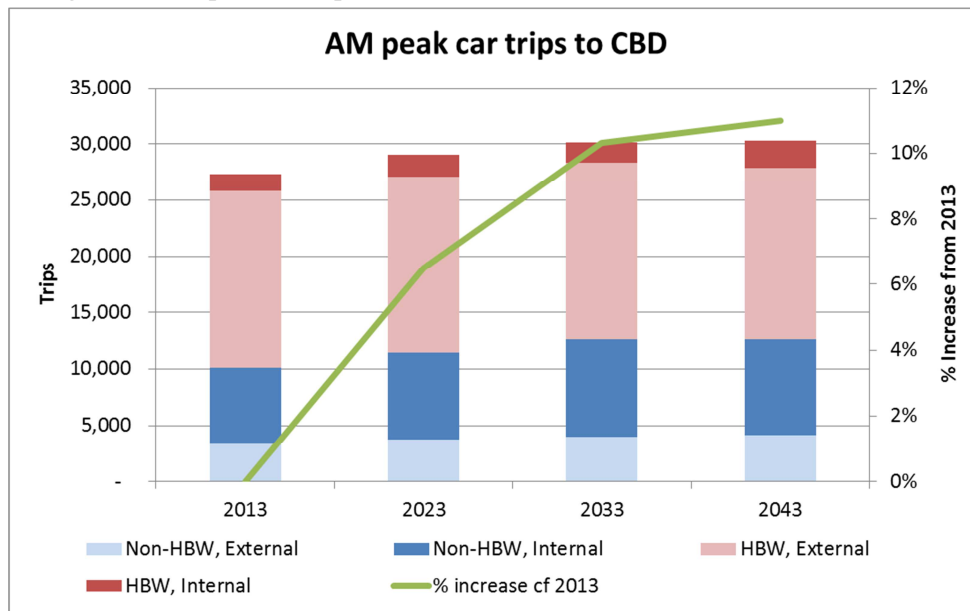
As mentioned previously in this report, the parking charge in Wellington CBD for HBW car trips has been calibrated to reflect a future scenario where AM peak HBW car trips to the CBD remain largely fixed at 2013 levels. This analysis therefore excludes HCV trips and solely focusses on car trips.

Table 14 below shows modelled car trips into the Wellington CBD during the AM peak period over the base and forecast years categorised by HBW and other trips. **Figure 10** graphs this same information whilst also providing an additional breakdown of internal and external trips to the Wellington CBD in the AM peak period.

Table 14: AM peak car trips to Wellington CBD

Purpose	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
External Origin							
HBW	15,718	15,655	-0.4%	15,698	-0.1%	15,272	-2.8%
Other	3,359	3,777	12.5%	3,993	18.9%	4,143	23.3%
All trips	19,077	19,432	1.9%	19,692	3.2%	19,415	1.8%
Internal Origin							
HBW	1,490	1,965	31.9%	1,794	20.4%	2,417	62.2%
Other	6,736	7,678	14.0%	8,638	28.2%	8,474	25.8%
All trips	8,226	9,643	17.2%	10,432	26.8%	10,891	32.4%
Total							
HBW	17,208	17,620	2.4%	17,492	1.7%	17,689	2.8%
Other	10,095	11,455	13.5%	12,631	25.1%	12,617	25.0%
All trips	27,302	29,075	6.5%	30,123	10.3%	30,306	11.0%

Figure 10: AM peak car trips to CBD



From **Table 14** and **Figure 10** it can be seen that:

- total car trips to the CBD are expected to increase by around 11% between 2013 and 2043,
- HBW car trips, that account for around 2/3rd of AM peak car trips to the CBD, are only expected to increase 2.8% from 2013 to 2043, a result of the HBW commuter parking charge being calibrated to reflect a future scenario where AM peak HBW car trip ends to the CBD remain broadly fixed at existing 2013 levels

- non-HBW car trips to the CBD, by comparison, are forecast to increase by 25% between 2013 and 2043
- external trips to the CBD are only forecast to increase by 1.8%, accounted for by a small decline in HBW trips (which still account for over 80% of external to CBD car trips) balanced by a 23% increase in ‘other’ car trips to Wellington CBD from external zones
- whilst internal trips only account for 30% of trips to zones within Wellington CBD, there is forecast to be significant growth in internal HBW trips (62%, from a small base), and a 25% increase in ‘other’ internal trips between 2013 and 2043, largely driven by population growth,

The forecasts show that all growth in car trips to Wellington CBD is expected to be generated by ‘other’ trips as opposed to HBW trips, with a significant increase in internal to internal trips forecast.

This analysis raises a number of questions that need to be considered by GWRC and consultants when using WTSM for project specific analysis:

- whilst small in absolute terms, is it realistic to expect that growth in population within Wellington CBD would result in a 62% increase in HBW car trips to places of employment that are also situated within Wellington CBD
- is it realistic to expect that a 20% increase in persons employed within Wellington CBD (according to the employment projections) would be accompanied by a 25% increase in ‘other’ trips to the CBD
- is it realistic that around 1/3rd of trips to Wellington CBD in the AM peak are actually internal trips

8.2 PT Trips

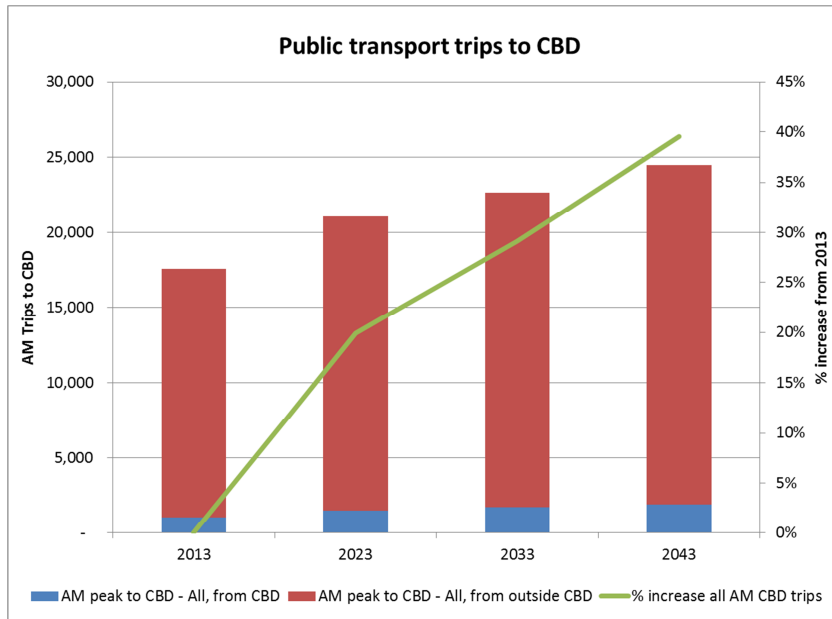
Table 15 below shows the growth in PT trips to Wellington CBD in the AM peak, disaggregated by trip origin – external (origin outside of CBD) or internal (origin within CBD).

Figure 11 presents the results in a graphical format

Table 15: Public transport trips to Wellington CBD, AM peak

Purpose	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
External Origin							
All trips	16,500	19,563	18.6%	20,933	26.9%	22,603	37.0%
Internal Origin							
All trips	1,055	1,491	41.3%	1,732	64.2%	1,889	79.1%
Total							
All trips	17,554	21,054	19.9%	22,665	29.1%	24,493	39.5%

Figure 11: Public transport trips to Wellington CBD



The results show that:

- AM peak PT trips to the CBD are expected to increase by about 40% between 2013 and 2043
- whilst internal PT trips are forecast to 80% increase from 2013 to 2043, they only make up a very small proportion of total PT trips to Wellington CBD in the AM peak
- external PT trips are forecast to increase by 37% between 2013 to 2043.

9. Public Transport Boardings and Transit Volumes

This section focusses on key public transport indicators – boardings and alighting by mode / time period / station, together with bus passenger volumes crossing the CBD cordon.

9.1 Boardings, pax km, Total Trips

Table 16 below shows annual PT boardings and pax km (by mode) and total trips.

Table 16: Annual public transport boardings, pax km and total trips (000s)

Indicator	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Rail board / pax km							
Rail boardings	10,906	13,153	21%	13,427	23%	14,351	32%
Rail pax km	243,082	285,545	17%	298,804	23%	318,271	31%
Bus board / pax km							
Bus boardings	17,586	23,390	33%	25,673	46%	27,084	54%
Bus pax km	117,904	132,139	12%	150,375	28%	158,469	34%
Total board / pax km							
Total boardings	28,492	36,543	28%	39,100	37%	41,435	45%
Total pax km	360,986	417,684	16%	449,180	24%	476,740	32%
Total trips							
Total trips	29,185	32,286	11%	34,589	19%	36,602	25%

The results show the following:

- The increase in total boardings (45%) is largely driven by increases in bus boardings (54%), with rail boardings forecast to increase by 32%
- the forecast growth in annual rail boardings and pax km are similar (32% vs 31%)
- a reduced rate of growth in rail boardings is seen between 2023 and 2033. This is caused by various RoNS projects coming online throughout the region in 2033, resulting in travelling by car becoming more attractive (relative to travelling by PT)
- the forecast growth in annual bus boardings (54%) between 2013 and 2043 is forecast to be greater than the forecast growth in annual bus pax km (34%), implying a significant decrease in average bus trip length
- annual PT trips (total trips includes both boardings and transfers as one journey) are forecast to increase by 25% between 2013 and 2043, considerably lower than noted forecast growth rates for bus and rail boardings

The main reason why the growth in boardings (bus in particular) is forecast to be greater than growth in PT trips is that integrated ticketing scheme, which effectively allows for ‘free’ transfers between modes, generates a significant increase in multi-modal trips.

The nature of this increase in multi-modal trips is discussed in more detail later in this section.

9.2 Boardings and Alightings by Mode and Time Period

Table 17 below shows bus boardings across the whole network, rail boardings by line and rail alightings at Wellington station.

Table 17: Public transport boardings and alightings

Indicator	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Bus Boardings							
AM peak	17,903	25,536	42.6%	27,377	52.9%	28,779	60.7%
Inter-peak	6,150	7,813	27.0%	8,724	41.9%	9,209	49.7%
PM peak	13,496	18,600	37.8%	20,074	48.7%	21,248	57.4%
Rail boardings							
AM peak							
Johnsonville	1,584	2,926	84.7%	2,783	75.7%	3,019	90.6%
Hutt Valley	5,921	7,090	19.7%	7,202	21.6%	7,587	28.1%
Kapiti	5,618	6,833	21.6%	7,097	26.3%	7,712	37.3%
Total	13,123	16,849	28.4%	17,082	30.2%	18,318	39.6%
Inter-peak							
Johnsonville	342	447	30.7%	466	36.3%	494	44.4%
Hutt Valley	831	1,026	23.5%	1,012	21.8%	1,064	28.0%
Kapiti	1,100	1,345	22.3%	1,344	22.2%	1,454	32.2%
Total	2,273	2,818	24.0%	2,822	24.2%	3,012	32.5%
PM peak							
Johnsonville	1,255	1,860	48.2%	1,971	57.1%	2,158	72.0%
Hutt Valley	4,350	5,202	19.6%	5,318	22.3%	5,691	30.8%
Kapiti	4,559	5,522	21.1%	5,833	27.9%	6,353	39.4%
Total	10,164	12,584	23.8%	13,122	29.1%	14,202	39.7%
Rail peak direction trips at Wellington Station							
AM peak alightings	11,347	14,984	32.1%	15,219	34.1%	15,716	38.5%
Inter-peak boardings + alightings	1,701	2,243	31.9%	2,184	28.4%	2,339	37.5%
PM peak boardings	8,299	10,573	27.4%	11,006	32.6%	11,898	43.4%

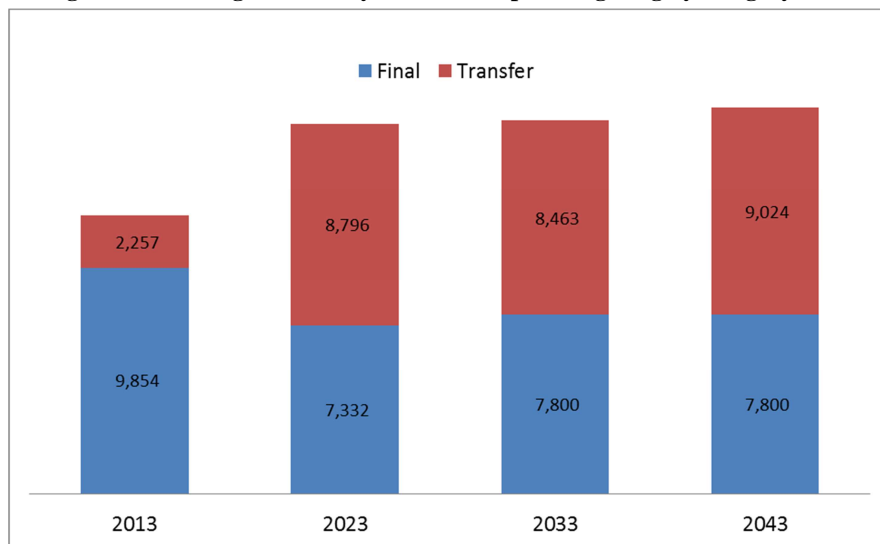
The results table above shows:

- a big jump in bus boardings between 2013 and 2023 (27% in Inter-peak to ~40% in peak periods), the result of integrated ticketing, with smaller increases in subsequent 10 year periods
- Johnsonville line rail boardings are forecast to increase by around 80% between 2013 and 2023, due to integrated ticketing resulting in modal shift from bus to rail/bus, together with population growth in Wellington's northern suburbs generating additional demand to Wellington CBD at peak times that is accommodated via rail services and park and ride in particular
- peak and off-peak period boardings / alightings at Wellington Station are forecast to increase by around 30% between 2013 and 2023, largely due to increases in Johnsonville line patronage outlined above, with growth rates more subdued in the remaining 10 year periods
- Inter-peak growth rates are lower than peak period growth rates, due to lower level of congestion in the Inter-peak resulting in faster car travel times (compared with during peak times) and lower PT service frequencies

9.3 Transfer Trips at Wellington Rail Station

Figure 12 below shows AM peak alightings at Wellington station, split into two categories – final alighting (i.e. continue journey to final destination on foot) or transfer alighting (continue journey to final destination by bus).

Figure 12: Wellington Railway Station AM peak alighting by category – final and transfer



The results clearly highlight the impact of integrated ticketing:

- in 2013, around 20% of persons alighting at Wellington Station in the AM peak use PT to reach their final destination in the CBD, with the majority (80%) walking to their final destination

- in 2023, integrated ticketing results in between 55% and 60% of persons alighting from rail services at Wellington station in the AM peak transferring onto bus services for their onward journey towards Wellington CBD

The questions relating to integrated ticketing that need to be discussed when GWRC and appointed consultants use WTSM 2013 are as follows:

- is it realistic to expect that the percentage of rail transfer trips would increase from 20% to 60% as a result of integrated ticketing?
- is it realistic to expect that patronage on the Johnsonville line would increase by around 80% as a result of modal shift to rail / bus from bus generated by integrated ticketing

Table 18 shows Wellington CBD bus screenline crossing volumes in the AM peak (inbound).

Table 18: Wellington CBD bus screenline crossing volumes – AM peak (inbound)

Location	2013 Base	2023		2033		2043	
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)
Oriental Parade	272	532	95.6%	554	103.7%	582	114.2%
Elizabeth Street	1,879	2,041	8.6%	2,176	15.8%	2,314	23.2%
Kent / Cambridge Terrace	1,403	1,146	-18.3%	1,231	-12.3%	1,433	2.1%
Combined	3,282	3,187	-2.9%	3,406	3.8%	3,747	14.2%
Taranaki Street	382	622	63.1%	571	49.7%	487	27.5%
Willis Street	588	1,036	76.2%	1,087	84.9%	1,145	94.7%
Kelburn Parade	397	64	-83.8%	68	-82.8%	72	-81.8%
Tinakori Road	1,060	1,595	50.5%	1,653	56.0%	1,749	65.1%
Murphy Street	663	551	-16.8%	620	-6.5%	667	0.6%
Thorndon Quay	1,886	1,366	-27.6%	1,863	-1.2%	1,971	4.5%
Total	8,529	8,954	5.0%	9,822	15.2%	10,419	22.2%

It shows the following:

- volumes at Oriental Parade are forecast to increase by 114%, admittedly from a low base, the result of service changes from the Wellington City Bus Review
- volumes are forecast to decrease at Kelburn Parade, the result of some Karori to Wellington trips re-routing via services that run along Tinakori Road
- between 2013 and 2043, combined Elizabeth Street / Kent / Cambridge Terrace volumes, representing the majority of bus trips from Wellington's eastern and southern suburbs to the CBD, are forecast to increase by around

14%, the result of population growth and congestion meaning that new trips to the CBD at peak times are catered for by PT

- volumes are forecast to decrease by around 500 along Thorndon Quay in 2023, the result of modal shift from bus to bus / rail along the Johnsonville Line corridor
- in 2033 and 2043, volumes along Thorndon Quay increase, a result of modal shift from bus to bus / rail being balanced by an increase in bus trips associated with new residential developments in Wellington's northern suburbs

The main considerations for GWRC and appointed consultants when using WTSM 2013 that arise from the bus analysis are as follows:

- Is modelled re-routing associated with the Wellington City Bus Review networks deemed reasonable?
- Focussing on Wellington's northern suburbs, is the modelled modal shift from bus to bus / rail considered reasonable?

10. Car and HCV Traffic Volumes

This section looks out how car and HCV traffic volumes crossing several screenlines in the study area change between scenarios.

Table 19 below shows daily screenline crossing volumes covering all vehicles, expressed in terms of ADT, together with the % heavies.

Table 19: Daily screenline crossing volumes (two-way)

Indicator	2013 Base	2023		2033		2043		Percentage heavies			
		Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	Trips	% Diff (cf 2013)	2013	2023	2033	2043
South CBD	43,987	48,676	10.7%	49,748	13.1%	50,270	14.3%	3.6%	3.6%	3.9%	4.3%
North CBD	114,121	121,397	6.4%	125,415	9.9%	126,905	11.2%	5.0%	5.2%	5.5%	6.0%
West CBD	13,952	15,145	8.6%	15,726	12.7%	16,112	15.5%	3.3%	3.4%	3.8%	4.2%
East CBD	39,902	42,052	5.4%	43,131	8.1%	43,419	8.8%	5.4%	5.7%	6.1%	6.7%
Miramar	35,736	39,301	10.0%	41,773	16.9%	42,189	18.1%	4.4%	4.5%	4.6%	5.1%
Karori	16,966	17,935	5.7%	18,211	7.3%	18,192	7.2%	3.7%	4.0%	4.5%	5.1%
Thorndon	96,128	101,444	5.5%	105,429	9.7%	106,489	10.8%	5.9%	6.2%	6.5%	7.1%
Churton Park	42,801	46,548	8.8%	45,247	5.7%	46,486	8.6%	6.0%	6.1%	6.3%	7.0%
Island Bay	33,426	37,057	10.9%	38,936	16.5%	39,613	18.5%	3.3%	3.2%	3.4%	3.7%
Nga to Pet	61,849	65,271	5.5%	53,559	-13.4%	54,289	-12.2%	7.0%	7.0%	7.0%	7.6%
Lowert to Upper Hutt	39,543	44,656	12.9%	44,372	12.2%	45,754	15.7%	5.7%	6.0%	6.1%	6.6%
Lower Hutt	80,160	87,692	9.4%	96,894	20.9%	99,623	24.3%	5.8%	5.8%	5.9%	6.3%
Wainui-Stokes	40,720	43,195	6.1%	44,498	9.3%	44,565	9.4%	4.2%	4.3%	4.5%	5.0%
Upper Hutt North	18,191	19,302	6.1%	19,439	6.9%	20,030	10.1%	4.2%	4.7%	5.3%	5.9%
Upper Hutt South	37,633	42,482	12.9%	43,394	15.3%	44,165	17.4%	5.4%	5.7%	6.2%	6.9%
Porirua South in	21,708	14,295	-34.1%	15,274	-29.6%	15,764	-27.4%	4.8%	4.5%	5.3%	5.9%
SH58 West	13,332	7,767	-41.7%	6,741	-49.4%	7,299	-45.2%	5.9%	6.5%	7.6%	8.2%
Porirua South	36,714							6.2%			
Kapiti	17,877	11,862	-33.6%	12,603	-29.5%	13,198	-26.2%	8.1%	7.0%	7.8%	8.6%

The results show the following:

- Between 2013 and 2043 the largest percentage increase in vehicle traffic (24%) is forecast to be crossing the Lower Hutt, largely a result of re-assignment associated with Petone to Grenada link road, with SH58 (the current route) showing a corresponding 45% decline in vehicle traffic
- The HCV share of trips, whilst small, is forecast to increase between 2013 and 2043, the result of HCV growth rates (42% between 2013 and 2043) being greater than car trip growth rates over the same period

11. VKT, Average Trip Length, Average Trip Cost

This section looks at how vehicle kilometres travelled per capita, average trip length and average trip costs is forecast to change through time.

11.1 VKT per Capita

Table 20 below shows the forecast change in annual VKT per capita calculated using both a matrix and link based method.

Table 20: Change in annual VKT per capita, by TA – matrix and link-based method

Origin TA	2013	2023		2033		2043	
	VKT per capita	VKT per capita	% diff (cf 2013)	VKT per capita	% diff (cf 2013)	VKT per capita	% diff (cf 2013)
	Link based						
Wellington	4.75	4.60	-3%	4.46	-6%	4.32	-9%
Lower Hutt	5.38	5.26	-2%	5.24	-3%	5.20	-3%
Upper Hutt	4.87	5.10	5%	4.93	1%	4.74	-3%
Porirua	5.39	5.68	5%	5.96	11%	6.09	13%
Kapiti	6.46	6.37	-1%	6.17	-4%	6.10	-6%
Wairarapa	7.28	7.12	-2%	6.78	-7%	6.61	-9%
Region	5.33	5.30	0%	5.22	-2%	5.12	-4%
	Matrix based						
Wellington	4.74	4.56	-4%	4.49	-5%	4.34	-8%
Lower Hutt	4.74	5.30	12%	5.17	9%	5.06	7%
Upper Hutt	5.06	4.89	-3%	4.76	-6%	4.66	-8%
Porirua	4.50	4.74	5%	5.07	13%	5.15	14%
Kapiti	4.55	4.36	-4%	4.19	-8%	4.17	-8%
Wairarapa	7.28	7.08	-3%	6.68	-8%	6.50	-11%
Region	4.93	4.91	0%	4.86	-1%	4.76	-3%

The results show the following:

- VKT per capita is expected to fall in every TA except Porirua and Lower Hutt (the later under a matrix-based method).
- Wellington is forecast to experience a 9% reduction in VKT per capita between 2013 and 2043, the result of population growth being concentrated around the CBD (favouring walking / cycling) and in areas with existing good public transport services, combined with HBW parking charges and congestion limiting the extent to which commuter car trips to the CBD might increase
- Porirua is forecast to see an increase in VKT per capita, a result of Transmission Gully
- Across the region as a whole, VKT per capita is forecast to decrease by around 3% to 4% between 2013 and 2043

11.2 Average Daily Trip Length

Table 21 shows the change in average daily trip length by mode between 2013 and 2043.

Table 21: Change in average daily trip length

Origin TA	2013 Average trip length	2023		2033		2043	
		Trip length	% diff (cf 2013)	Trip length	% diff (cf 2013)	Trip length	% diff (cf 2013)
Car							
Wellington	5.42	5.29	-3%	5.21	-4%	5.09	-6%
Lower Hutt	8.08	7.98	-1%	8.19	1%	8.22	2%
Upper Hutt	6.94	7.13	3%	6.90	-1%	6.64	-4%
Porirua	7.04	7.00	-1%	6.92	-2%	6.82	-3%
Kapiti	8.78	8.87	1%	8.90	1%	8.89	1%
Wairarapa	8.63	8.36	-3%	8.04	-7%	7.84	-9%
Region	6.68	6.59	-1%	6.48	-3%	6.36	-5%
HCV							
Wellington	6.46	6.48	0%	6.46	0%	6.48	0%
Lower Hutt	9.23	9.00	-2%	9.00	-2%	8.90	-4%
Upper Hutt	7.19	7.62	6%	7.64	6%	7.66	6%
Porirua	7.24	7.43	3%	7.65	6%	7.71	6%
Kapiti	9.58	9.59	0%	9.52	-1%	9.50	-1%
Wairarapa	7.51	7.53	0%	7.59	1%	7.64	2%
Region	7.25	7.35	1%	7.42	2%	7.45	3%
PT							
Wellington	11.03	11.31	3%	11.28	2%	11.33	3%
Lower Hutt	14.15	14.92	5%	16.08	14%	16.50	17%
Upper Hutt	25.90	25.71	-1%	25.99	0%	26.55	3%
Porirua	13.00	13.32	3%	13.10	1%	13.06	1%
Kapiti	16.72	18.39	10%	18.92	13%	19.34	16%
Wairarapa	51.57	54.25	5%	56.58	10%	56.98	10%
Region	13.59	13.93	3%	14.00	3%	14.04	3%

The results show the following:

- average car trip length is forecast to decrease by 5% across the region between 2013 and 2043
- only Kapiti and Lower Hutt see small increases in average car trip length, with Wellington seeing a 6% decrease
- HCV average trip length is forecast to increase by 3%, driven by increases in Upper Hutt and Porirua of 6%
- PT average trip length is forecast to increase by 3%

11.3 Travel Cost per Kilometre

Table 22 below shows the change in travel cost per kilometre (generalised minutes / km)

Table 22: Change in travel cost per kilometre (generalised minutes / km)

Mode	Period	2013 Base	2023		2033		2043	
			Travel cost / km	% diff (cf 2013)	Travel cost / km	% diff (cf 2013)	Travel cost / km	% diff (cf 2013)
Car	AM	2.65	2.81	6%	3.03	14%	3.31	25%
	IP	2.46	2.64	7%	2.89	17%	3.16	28%
	PM	2.63	2.81	7%	3.04	16%	3.33	27%
PT	AM	4.36	4.16	-5%	4.11	-6%	4.11	-6%
	IP	5.85	5.72	-2%	5.65	-3%	5.65	-3%
	PM	5.09	4.90	-4%	4.90	-4%	4.92	-3%
HCV	AM	2.77	2.93	6%	3.13	13%	3.40	23%
	IP	2.63	2.80	7%	3.06	16%	3.34	27%
	PM	2.84	3.02	6%	3.25	14%	3.55	25%

The results show the following:

- Car and HCV travel costs are forecast to increase by around 25% between 2013 and 2043 (in real terms) whilst PT costs are forecast to decrease slightly
- these differences in the relative cost of travelling by car and PT explain to a certain extent why PT mode share is forecast to increase through time

11.4 Ratio of PT to Car Travel Costs

Table 23 below shows the ratio of PT to car travel costs per kilometre.

Table 23: Ratio of PT to car travel costs per kilometre

Period	Origin TA	2023 Base	2023		2033		2043	
			Travel cost / km	% diff (cf 2013)	Travel cost / km	% diff (cf 2013)	Travel cost / km	% diff (cf 2013)
AM (by origin)	Wellington	2.76	2.53	-8%	2.32	-16%	2.15	-22%
	Porirua	2.14	1.95	-9%	1.79	-16%	1.61	-25%
	Kapiti	2.12	2.07	-2%	1.90	-10%	1.72	-19%
	Lower Hutt	2.23	2.07	-7%	2.03	-9%	1.88	-16%
	Upper Hutt	2.33	2.06	-12%	1.93	-17%	1.77	-24%
	Wairarapa	3.10	2.77	-11%	2.52	-19%	2.31	-25%
	Region	2.52	2.32	-8%	2.16	-15%	1.99	-21%
IP (average of origin and destination)	Wellington	3.35	3.09	-8%	2.80	-17%	2.59	-23%
	Porirua	3.28	3.08	-6%	2.73	-17%	2.49	-24%
	Kapiti	4.29	4.03	-6%	3.72	-13%	3.43	-20%
	Lower Hutt	3.34	3.10	-7%	2.82	-16%	2.59	-22%
	Upper Hutt	3.48	3.23	-7%	2.94	-15%	2.70	-22%
	Wairarapa	4.23	3.97	-6%	3.70	-13%	3.40	-20%
	Region	3.50	3.25	-7%	2.96	-15%	2.72	-22%
PM (by destination)	Wellington	2.43	2.19	-10%	2.05	-16%	1.89	-22%
	Porirua	2.67	2.51	-6%	2.28	-15%	2.08	-22%
	Kapiti	3.30	3.14	-5%	2.90	-12%	2.69	-18%
	Lower Hutt	3.01	2.73	-9%	2.47	-18%	2.26	-25%
	Upper Hutt	3.28	2.97	-9%	2.72	-17%	2.49	-24%
	Wairarapa	4.25	3.89	-8%	3.66	-14%	3.34	-21%
	Region	2.84	2.59	-9%	2.39	-16%	2.19	-23%

The results clearly shows that the ratio of PT to car costs is forecast to decrease through time at a fairly uniform rate for all TAs and time periods, further explaining why PT mode share is forecast to increase in the future.

11.5 Proportion of Hours Travelled by LOS

Table 24 shows the proportion of hours travelled at LoS E or F, by TA and time period.

Table 24: Proportion of hours travelled at LoS E and F

Period	TA	2013 Base	2023		2033		2043	
			Prop of hrs at LoS E/F	% diff (cf 2013)	Prop of hrs at LoS E/F	% diff (cf 2013)	Prop of hrs at LoS E/F	% diff (cf 2013)
AM peak	Wellington	38%	39%	1%	35%	-3%	36%	-2%
	Porirua	17%	1%	-16%	1%	-16%	1%	-16%
	Kapiti	9%	0%	-9%	0%	-9%	0%	-9%
	Lower Hutt	5%	6%	1%	17%	13%	17%	12%
	Upper Hutt	14%	15%	1%	16%	2%	15%	1%
	Wairarapa	0%	0%	0%	0%	0%	0%	0%
	Region	23%	22%	-1%	22%	-1%	22%	-1%
Inter-peak	Wellington	7%	9%	2%	11%	4%	12%	5%
	Porirua	0%	0%	0%	0%	0%	0%	0%
	Kapiti	0%	0%	0%	0%	0%	0%	0%
	Lower Hutt	0%	0%	0%	1%	1%	2%	1%
	Upper Hutt	1%	1%	0%	2%	1%	2%	1%
	Wairarapa	0%	0%	0%	0%	0%	0%	0%
	Region	3%	4%	1%	5%	2%	6%	3%
PM peak	Wellington	33%	37%	3%	35%	2%	36%	3%
	Porirua	19%	5%	-14%	7%	-12%	8%	-11%
	Kapiti	9%	1%	-7%	2%	-7%	2%	-7%
	Lower Hutt	10%	12%	2%	21%	11%	23%	13%
	Upper Hutt	8%	9%	1%	14%	6%	15%	7%
	Wairarapa	1%	1%	0%	1%	0%	1%	0%
	Region	21%	22%	0%	23%	2%	24%	3%

The results show the following:

- The proportion of time travelling at LoS E/F is expected to decrease across the region in the AM peak by 1% and increase in the Inter-peak and PM peak by 3%.
- Porirua in the AM peak is expected to see the proportion of hours at LOS E/F reduce from 17% to 1% in 2023 and remain at this level in subsequent years, the result of Transmission Gully and, to a lesser extent, P2G
- Kapiti is also forecast to see a reduction in vehicles hours at LOS E/F, the result of the M2PP Expressway
- Lower Hutt is forecast to see a 10 to 12 percentage point increase in vehicle hrs at LOS E/F in 2033 and 2043, due to increasing congestion levels on SH2

- Wellington City is forecast to see little change in vehicles hours travelled at LOS E/F, the result of limited increase in vehicles trips balanced against limited highway capacity improvements

12. Change in Travel Times

Changes in highway and PT travel times (in minutes) between the base and future year scenarios can arise from the following:

- changes in traffic volumes leading to increased congestion due to modal shift, new infrastructure, changes to relative cost of travelling by car or PT
- changes in land use, resulting in different travel patterns, PT patronage and traffic volumes
- travel demand management measures, leading to changes in traffic volumes

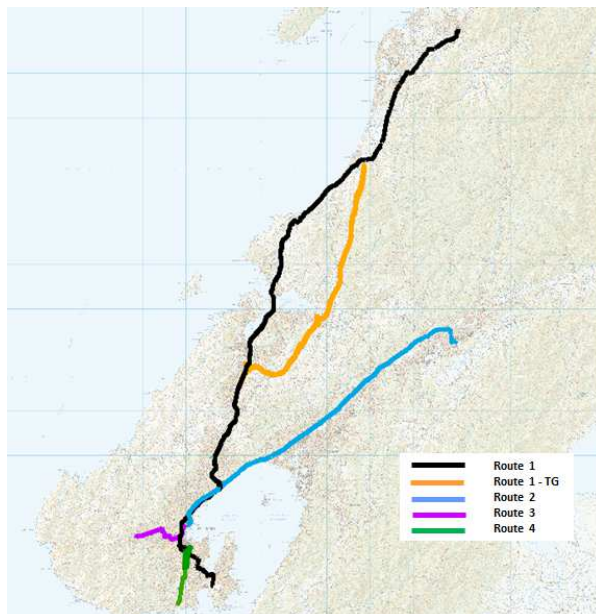
12.1 Highway Travel Times

Changes in highway travel times have been assessed for following routes, focussing on the AM peak (inbound) and PM peak (outbound):

- Route 1: Waikanae to Wellington Airport via SH1
- Route 2: Upper Hutt to Wellington Station via SH2 and old Hutt Road
- Route 3: Island Bay to Courtenay Place via Rintoul St.
- Route 4: Karori to Bowen Street via Kelburn

The map in **Figure 13** below displays the routes used for this travel time analysis (colour coded by route), with orange route showing the TG alignment used in 2023, 2033 and 2043 for Route 1.

Figure 13: Map of highway travel time routes



These routes align with routes for which modelled base year and forecast travel time information has been collected.

The travel times for each route as well as the change from 2013 are shown in **Table 25** below for both the AM and PM time periods.

Table 25: Modelled highway travel times by route and time period

Period	Route	Highway travel time						
		2013 Base Time (min)	2023		2033		2043	
			Time (min)	Abs diff	Time (min)	Abs diff	Time (min)	Abs diff
AM Peak	1 (via TG from 2023 onwards)	70.1	66.7	-3.4	67.4	-2.6	68.3	-1.7
	2	46.4	47.0	0.7	42.1	-4.2	41.4	-5.0
	3	12.5	13.4	0.9	14.0	1.5	14.7	2.2
	4	16.4	17.0	0.6	17.5	1.1	17.8	1.4
PM Peak	1 (via TG from 2023 onwards)	59.0	60.3	1.3	61.9	2.9	62.3	3.3
	2	30.6	29.8	-0.8	30.7	0.1	31.1	0.5
	3	15.0	16.9	1.9	17.5	2.6	17.9	2.9
	4	29.2	32.1	2.9	24.8	-4.4	26.1	-3.1

Table 25 shows the following:

- The AM peak travel time between Waikanae and Wellington Airport is forecast to decrease by about 3 minutes in 2023, partly the result of TG and M2PP, before increasing slightly between 2023 and 2033 / 2043 as a result of increases in traffic volumes
- AM peak travel times on the SH2 corridor are forecast to increase slightly between 2013 and 2023 before decreasing between 2023 and 2033 / 2043, a direct result of capacity improvements delivered by the re-routing of some trips from SH2 to P2G
- PM peak travel times on Route 1 (Airport and Waikanae) and Route 2 (Wellington and Upper Hutt) are forecast to remain relatively unchanged through time, with any infrastructure improvements being balanced by increased traffic volumes
- Travel times on local routes 3 and 4 increase slightly through time (with the exception of Route 4 in the PM peak)

12.2 PT Travel Times

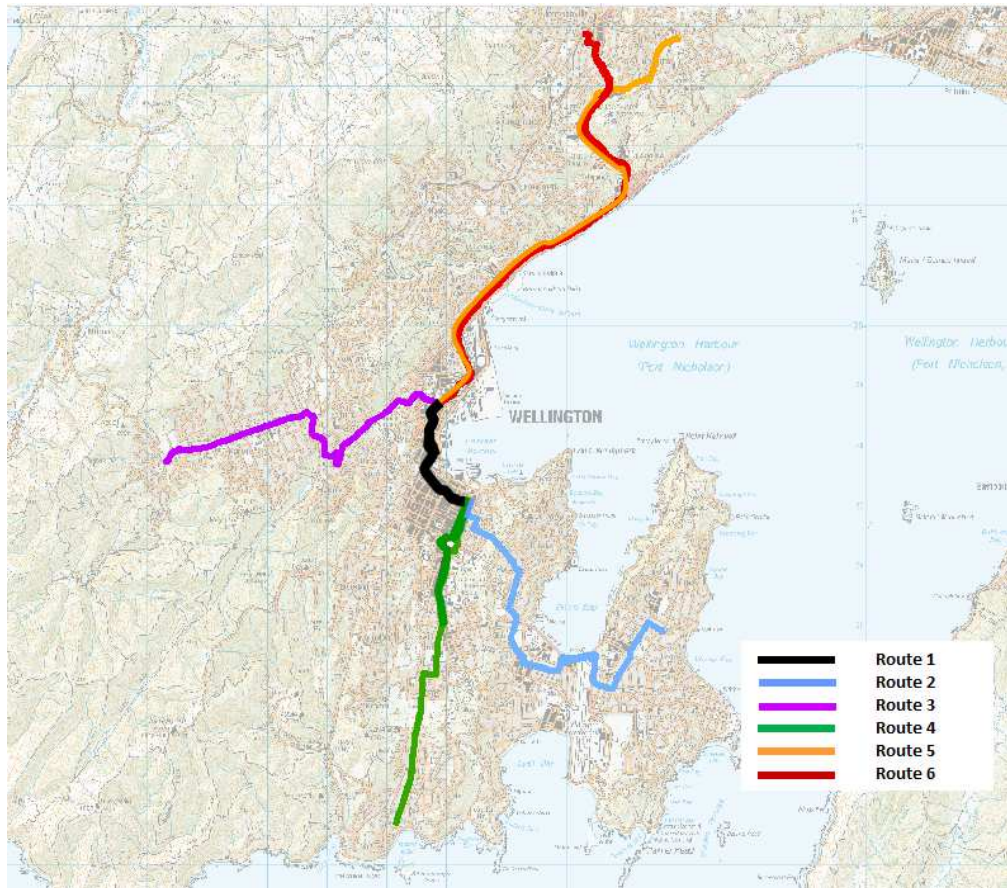
Changes in public transport travel times have been assessed for the following routes, also focussing on the AM peak (inbound from CBD) and PM peak (outbound from CBD):

- Route 1: Golden Mile (both directions per peak)
- Route 2: Miramar to CBD

- Route 3: Island Bay to Courtenay Place
- Route 4: Karori to Bowen Street
- Route 5: Newlands to Wellington Station
- Route 6: Johnsonville to Wellington Station

The map shown in **Figure 14** below displays the public transport routes used for this travel time analysis (colour coded by route).

Figure 14: Map of public transport travel time routes



These routes align with routes for which real time passenger information (RTPI) data is available.

The travel times for each route as well as the change from 2013 are shown in **Table 26** below for both the AM and PM time periods.

Table 26: Modelled PT travel times by route and time period

Period	Route	2013 Base Time (min)	PT travel times (in-vehicle time)					
			2023		2033		2043	
			Time (min)	Abs diff	Time (min)	Abs diff	Time (min)	Abs diff
AM Peak	1 NB	11.7	11.5	-0.2	11.9	0.2	12.1	0.4
	1 SB	10.6	9.9	-0.7	10.0	-0.6	10.1	-0.5
	2 IB	22.6	21.8	-0.8	22.4	-0.1	22.6	0.0
	3 IB	19.9	20.2	0.3	20.8	0.9	21.1	1.2
	4 IB	19.2	19.2	0.0	19.4	0.2	19.7	0.5
	5 IB	22.8	23.2	0.4	19.9	-2.9	20.0	-2.8
PM Peak	1 NB	13.9	12.4	-1.5	12.8	-1.1	13.0	-0.9
	1 SB	11.1	10.4	-0.7	10.5	-0.6	10.6	-0.5
	2 OB	21.8	22.8	1.0	23.7	1.9	24.2	2.4
	3 OB	23.4	25.1	1.8	25.5	2.2	26.0	2.6
	4 OB	18.9	20.2	1.3	20.6	1.8	21.3	2.4
	5 OB	22.8	22.3	-0.5	20.5	-2.3	20.6	-2.2
	6 OB	19.4	20.5	1.1	19.6	0.2	19.9	0.6

Table 26 shows the following insights:

- Golden Mile travel times are not forecast to change significantly through time
- Routes 2, 3 and 4 in Wellington City show that travel times increase slightly between 2013 and 2043, with the increase more pronounced in the PM peak
- Travel times between Wellington CBD and Johnsonville and Newlands (Routes 5 and 6) decrease between 2023 and 2033 / 2043 in both directions, due the 4-laning of Aotea Quay between Ngauranga and Aotea Quay and the consequent addition of bus lanes along the Hutt Road improving bus travel speeds and times

13. Summary and Conclusion

This report has summarised the assumptions and resulting from a series of model tests run in WTSM 2013 to demonstrate that the modelling system is responding reasonably to a set of input assumptions.

The assumptions upon which this work has been based are as follows:

- Population and employment projections, with Wellington City having the greatest population growth (21%) and employment growth (17%) between 2013 and 2043 of all the TAs within the region
- All the RoNS projects north of the CBD are assumed to be completed in either 2023 or 2033, in addition to integrated fares and ticketing, the Wellington City new bus network and Regional Rail Plan (RS1)
- The Wellington inner-city RoNS and BRT schemes have not been included in any future years due to current uncertainty relating to the status and nature of such schemes
- Parking charges in Wellington CBD have been calibrated to keep HBW trip ends to the CBD constant between 2013 and 2043, with an assumption that no increase in parking supply (nor demand) will occur between 2013 and 2043
- Assumptions were made, based upon trends and forecasts, relating to growth in PT fares, the value of time, CBD parking costs and vehicle operating costs
- Based on recent trends and the MoT National Freight Demand Study 2014, an HCV growth was applied using the long term GDP per capita growth forecast of 1.8% per annum with a multiplier of 0.65

In summary, the results of the tests show the following:

- Between 2013 and 2043, daily car trips are forecast to increase by 14%, with PT trips forecast to increase by 25% and HCVs 42%
- Peak and off-peak period PT mode share (of total car and PT trips) is forecast to increase through time from 2013 to 2043
 - AM peak – 16.4% to 18.0%
 - Inter-peak – 5.9% to 6.4%
 - PM peak – 11.7% to 12.9%
 - Daily – 6.9% to 7.5%
- Looking at daily commuting trips, PT is forecast to see the highest percentage growth rate (27%) followed by car (6%) and active modes (5%)
- AM peak and PM peak PT mode share is forecast to increase for all TAs, with Lower Hutt, Porirua and Wellington seeing the greatest increases

- AM peak PT mode share to Wellington CBD is forecast to increase, with Wellington's northern suburbs, Porirua and Upper Hutt seeing the greatest increases
- Kapiti and the Tawa Basin will still have the highest PT mode share to Wellington CBD in the AM peak, at between 71% and 74% in 2043
- Total PT boardings are forecast to increase by 45%, with PT pax km forecast to increase by 32% and PT trips by 25%; the implied increase in multi-modal trips is driven by integrated ticketing which essentially makes it 'free' to transfer between modes
- Increased rail alightings at Wellington station are the result of population growth and modal shift from bus to rail/bus on the Johnsonville line, again driven by integrated ticketing
- Bus volumes from Wellington's eastern and southern suburbs to the CBD are forecast to increase, the result of population growth, highway congestion and the cost of parking
- The cost of travelling by PT is forecast to decrease relative to travelling by car, in part explaining the modelled increase in PT mode share
- Highway travel times for key routes largely remain unchanged in the future, with the exception of Upper Hutt to Wellington (inbound) where decongestion on SH2 resulting from P2G improves highway travel times in 2033 and 2043
- PT travel times on arterials within Wellington City increase slightly, the exception being between Newlands / Johnsonville and Wellington CBD where the bus lanes on Hutt Road in 2033, enabled by increased highway capacity between Ngauranga and Aotea Quay, improve AM peak bus travel times

The purpose of this report has been to document and explain results from several tests to demonstrate how WTSM 2013 responds to a given set of input assumptions.

Whilst the broad conclusion from this work is that WTSM does respond reasonably to the input assumptions, a number of areas have been highlighted for discussion when GWRC and appointed consultants are producing forecasts using WTSM 2013.

These areas can be summarised as follows:

- land use forecasts and their relevance
- HCV growth assumptions and their appropriateness, given uncertainty surrounding input assumptions and future growth
- forecast assumptions relating to PT fares, fuel prices and parking charges

- changes in travel behaviour resulting from integrated ticketing
- growth in car trips within Wellington CBD

In summary, the tests presented in this report reflect scenarios developed using a set of assumptions at one point in time.

When WTSM 2013 is used for project specific analysis, a collaborative process between GWRC and any appointed consultant should be followed to ensure that WTSM and its inputs are understood and used intelligently.