Transport demand forecasts

Summary

NZIER report to Ministry of Transport

December 2013

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Authorship

This report was prepared at NZIER by John Stephenson.

The assistance of Nick Allison and Chris Parker is gratefully acknowledged.

1. Transport demand growth

This report summarises forecasts for land transport demand over the next 20 years. The forecasts are broken down by travel demand (Section 2) and freight demand (Section 3). Travel demand is further broken down into: light vehicle travel; public transport; and active modes (Sections 2.1, 2.2, and 2.3).

The measures of transport demand which are forecast include:

- total passenger travel demand (public transport passenger kilometres plus passenger kilometres travelled in light vehicles)
- light vehicle kilometres travelled (driver travel)
- light vehicle passenger kilometres travelled (driver plus passenger travel)
- public transport boardings
- public transport passenger kilometres (boardings plus average distance)
- combined walking and cycling kilometres travelled
- road freight tonne-kilometres
- freight value added for all surface modes (freight 'GDP').

1.1. Summary

The forecasts are for:

- passenger travel and freight demand to rebound in the next five years, (forecast growth of 1.3% and 2.0% p.a. respectively) as the economy continues to improve
- passenger travel demand to grow faster than population growth over the next 20 years (1.4% p.a. compared to 0.8% p.a.) but slower than average household income growth (2.1% p.a.)
- freight demand to grow by 2.1% p.a., slower than historical long term average growth as the industrial mix of the economy continues to shift into services and away from heavy commodities
- public transport demand to grow its share of passenger transport, especially in Auckland over the next 10 years where public transport boardings grow by 2.1% p.a.
- modest growth in light vehicle kilometres travelled per capita (0.5% p.a. over the next 10 years) with the level of travel per capita below its 2006 peak for at least the next decade
- considerable regional variations with, for example, low to negative growth over the next 10 years in light vehicle kilometres travelled per capita in Otago (-0.1% p.a.), Canterbury (0.1% p.a.), Auckland (0.3% p.a.) and Wellington (0.4% p.a.) and much higher growth in Northland (1.1%), Waikato (0.8%), Taranaki (0.9%) and Gisborne-Hawke's Bay (1.1%).

1.2. Interpreting the forecasts

The forecasts reflect underlying or structural drivers of (population and economic) demand rather than short term (1-3 year) drivers. They take account of key drivers including:

- demographics
- income growth
- prices
- industry mix
- regional differences[1]
- government investment.

Changes in these factors are explored through 4 scenarios.

The main scenario, a **Base** case, depicts transport demand growth given economic and demographic conditions projected by the Treasury and Statistics New Zealand.[2] This scenario is focussed on transport demand and assumes no change in government investment.

The Base case scenario is varied in 3 additional scenarios:

- **High price**, accounting for the possibility of higher fuel prices than in the base case where fuel prices reflect the IEA (2013) projections for oil prices
- **Growth acceleration**, where population and productivity grow more quickly than expected
  - productivity grows at 1.75% p.a., an acceleration compared to the past average of 1.0% p.a. and 0.25% higher than the 1.5% growth projected by the Treasury[3]
  - an increase in net migration of 5,000 p.a. on top of an assumed long run rate of 12,000 people p.a.
- **Investment-led** demand where government actions bolster demand for public transport and targets for public transport patronage in Auckland and Wellington are met.

We also provide an indication of the sensitivity of scenarios to random variation by charting our forecasts alongside the 25th to 75th percentiles of the Base Scenario.[4]

1.3. The demand dynamics

Population growth has the strongest single effect on travel demand. More people means higher travel demand.[5]

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1 Forecast demand growth reflects regional differences in economic growth, population growth, population densities and historical patterns of public transport use.

2 Treasury *Long Term Fiscal Model*, 11 July 2013, http://www.treasury.govt.nz/government/longterm/fiscalmodel. Statistics New Zealand Population projections, median projection, 19 July 2012, http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/NationalPopulationProjections_HOTP2011.aspx.

3 The Treasury assumption of 1.5% productivity growth is based on convergence to similar rates experienced by other countries.

4 The sensitivities are based on typical historical variations in net migration, exchange rates, oil prices and employment.

Uncertainty about future population growth is thus a risk for these transport demand forecasts. Statistics New Zealand projections, for example, include a range of plus or minus 80,000 for the projected population in 2021. This figure is from a fairly narrow range of uncertainty (25th to 75th percentile) and represents a 0.3% difference in population growth rates. This may appear small but it can have important implications for evaluating transport demand, including because population growth affects so many other drivers of transport demand such as incomes, average age of the population, and regional population growth.

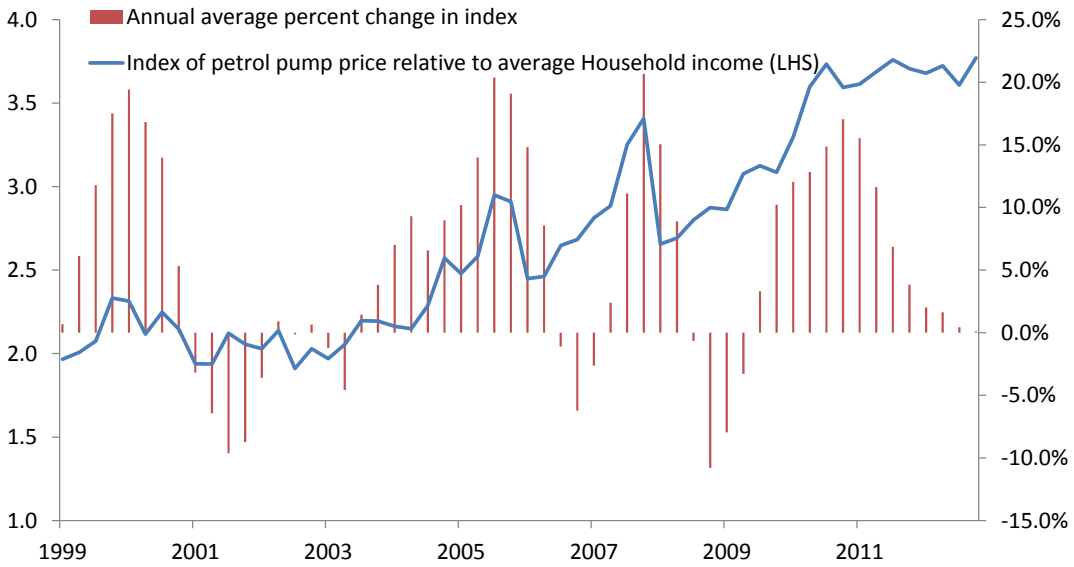
Prices, income, employment and the age composition of the population are the other key drivers of travel demand. Higher income growth raises per capita travel demand, while increases in fuel prices (inclusive of tax) reduce demand.

Prices can have a particularly profound effect on travel demand because they are subject to potentially large increases. This can be seen in Figure 1 which depicts growth in petrol prices relative to average household incomes. From March 2004 to March 2008 the pump price of petrol increased 56% while average household incomes grew by only 11%.

Incomes and economic activity are not subject to movements anywhere near the same magnitude as fuel prices, although in recent years economic activity has been extremely soft, following the global financial crisis. It took five years for GDP per capita to return to the 2008 levels (see Figure 2) and the unemployment rate remains more than 50% higher than 5 years ago.[6]

Figure 1 Fuel prices relative to average household incomes

Index of retail prices to average household income

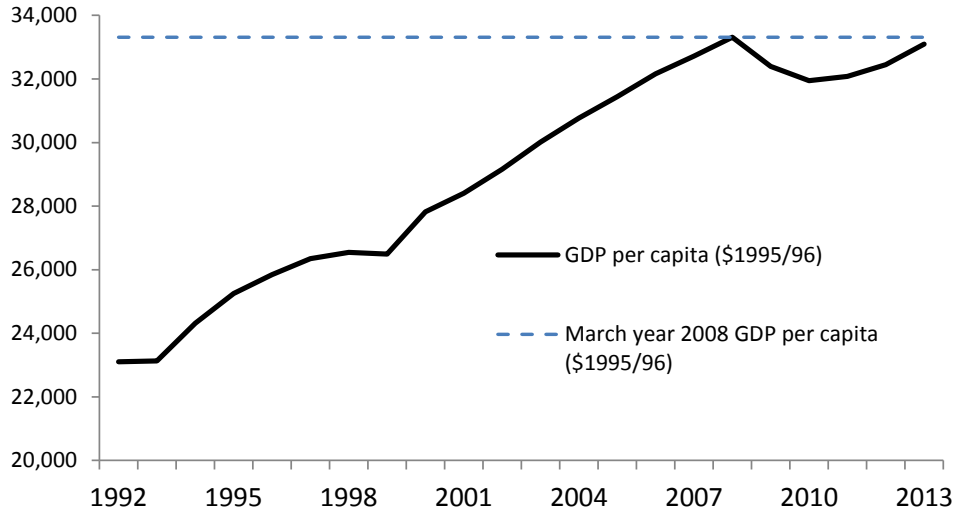


5 The key channels for increased population growth are migration and short lived increases in birth rates associated with larger population cohorts (groups of population of the same age) reaching ages at which they have children.

6 We say 'at least' because the recent census data suggests unemployment is higher than Statistics New Zealand's survey-based estimates.

Figure 2 Recent real GDP growth

Gross Domestic Product, chain volume, 1995/1996 dollars



The Treasury is forecasting strong growth in GDP and in employment over the next 7 years. An extra 200,000 people are expected to be employed by 2020 (1.4% growth p.a.).[7] This compares to an increase of only 15,000 (0.1% growth p.a.) between 2006 and 2013 (according to Census 2013). This should raise transport demand (on a per capita basis) due to increasing numbers of work trips.

The age composition of the population has three interacting effects.

- an older population boosts per capita travel demand if the ageing comes mostly from increases in the number of people of working age
- increased numbers of people in the over 65 age groups reduces per capita travel demand, compared to what it would otherwise be
- increased numbers of people in the under 20 age groups reduces per capita travel demand, compared to what it would otherwise be.

Travel mode choices are affected by similar dynamics to overall travel demand. Higher average household incomes reduce rates of growth in public transport patronage while higher vehicle travel costs increase patronage.[8]

Age composition has complex effects on aggregate public transport demand. Growth in the number of people aged under 20 will increase demand for public transport. At the same time, increasing numbers of younger people is associated with higher population growth. Higher population growth is associated with higher income growth. Higher income growth then moderates growth in public transport demand.

Aggregate vehicle kilometres travelled generally tracks total passenger travel demand, unless prices change or incomes fall. However, the aggregate is significantly affected by the region in which people live with more urbanised regions having slower per capita growth in vehicle travel than other regions, due to density effects.

7 This figure is for employed people, as opposed to full-time equivalents.

8 For a summary of typical directions and magnitudes of effects of income growth and prices on transport demand and modes of travel see e.g. Litman (2013) 'Understanding Transport Demands and Elasticities', Victoria Transport Policy Institute, 12 March 2013, http://www.vtpi.org/elasticities.pdf.

In addition, the more urbanised regions generally have younger populations and this means public transport takes up a greater share of travel demand growth in these regions.

Freight demand reflects the combined effects of economic growth and the changing industry composition of the economy. Higher growth implies higher freight demand while industry composition governs the strength of the relationship between economic growth and growth in freight demand.

2. Travel demand

Income and population growth boost travel demand short term

Total passenger travel demand (passenger kilometres travelled) will speed up in the next 5 years, driven by a rebound in population, employment and income growth compared to the past 5 years. Demand growth was slow in recent years as recessions abroad and at home has reduced migration flows and limited job and income growth.

Demand growth is highest under the Growth acceleration scenario, however the difference between the Base and Growth acceleration scenarios is small in the near term because it takes time for the effects of the growth acceleration to accumulate. Travel demand growth under the Base case is indistinguishable from the Investment-led demand case because it reflects a substitution of demand cross modes rather than a material change in travel demand.

Table 1 Passenger kilometres travelled

Public transport and light vehicle travel, compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	na	na	na	na
2001-08	0.7%	0.7%	0.7%	0.7%
2008-13	0.5%	0.6%	0.5%	0.5%
Next 10	**1.3%**	**1.1%**	**1.5%**	**1.3%**
Next 20	**1.4%**	**1.2%**	**1.6%**	**1.4%**

Figure 3 Total passenger kilometres travelled

Combined public transport and light vehicle passenger kilometres travelled, reflecting overall demand for passenger travel

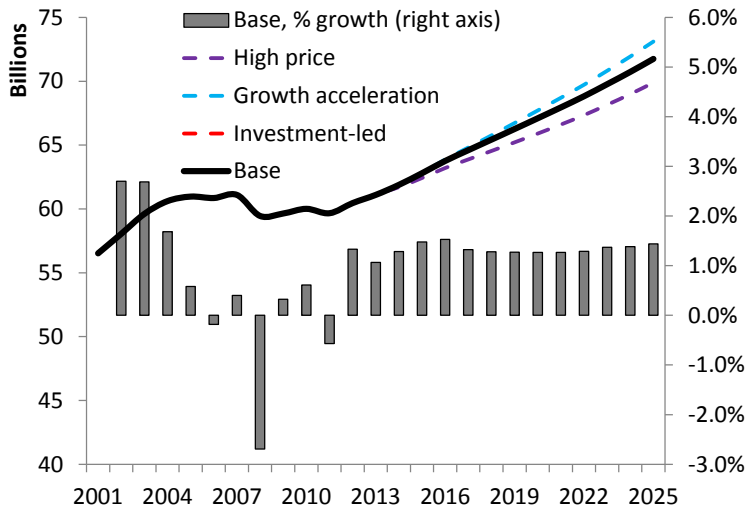


Figure 4 Resident population

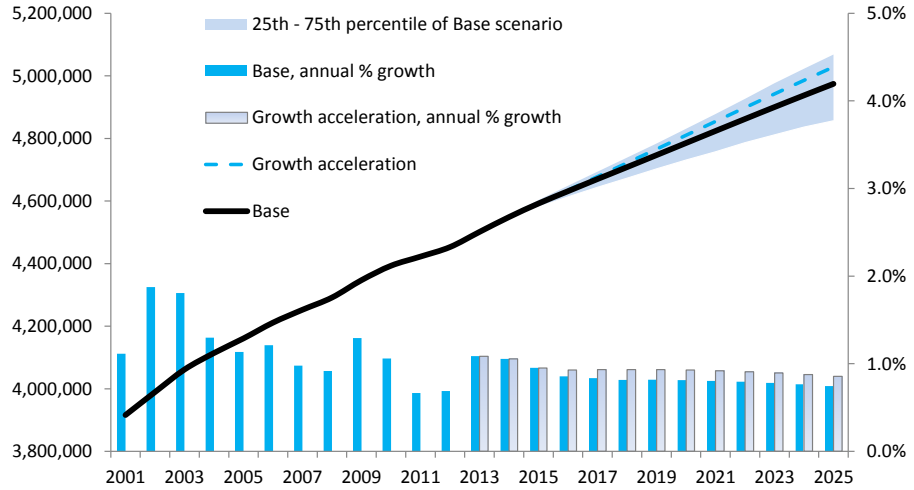


Table 2 Population

Compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	1.1%	1.1%	1.1%	1.1%
2001-08	1.3%	1.3%	1.3%	1.3%
2008-13	1.0%	1.0%	1.0%	1.0%
Next 10	**0.9%**	**0.9%**	**0.9%**	**0.9%**
Next 20	**0.8%**	**0.8%**	**0.9%**	**0.8%**

Fuel price increases expected to continue

High prices have had a dampening effect on travel demand in the past decade and will continue to do so. Prices are assumed to grow more slowly but not decline because:

- oil prices will rise gradually as global growth recovers
- fuel taxes will rise with inflation
- the New Zealand exchange rate will depreciate towards a long run average of 0.69 US dollars per NZ dollar.

Oil prices and exchange rates are notoriously unpredictable and higher prices are quite possible (see Figure 5, the 'high' price scenario is well within the range of possible outcomes).

A high price environment will reduce growth in passenger travel, although not as much as in recent years when the effects of large price increases were magnified by sluggish employment and income growth.

Figure 5 Petrol prices

Cents per litre at the pump (2007 dollars i.e. excluding general consumer price inflation)

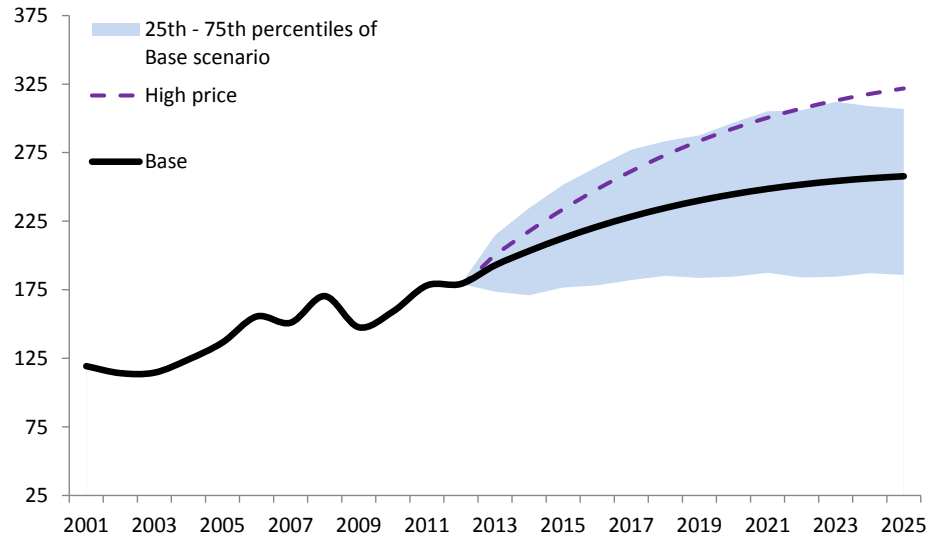


Table 3 Price of petrol at the pump

2007 dollars, compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	1.9%	1.9%	1.9%	1.9%
2001-08	5.2%	5.2%	5.2%	5.2%
2008-13	2.5%	2.5%	2.5%	2.5%
Next 10	**2.8%**	**4.6%**	**2.8%**	**2.8%**
Next 20	**1.4%**	**2.6%**	**1.4%**	**1.4%**

Longer term growth limited by population ageing

Ageing of the New Zealand population will limit population growth (0.9% p.a.) and limit economic growth (2.5% p.a.) by reducing growth in the labour force. Acceleration of labour force growth is possible if inward migration and productivity growth are higher than expected (Growth acceleration scenario). Even then, slowing labour force growth will keep economic growth to its average of the past 20 years (2.9% p.a.).

Figure 6 GDP

Millions of 1995/96 dollars

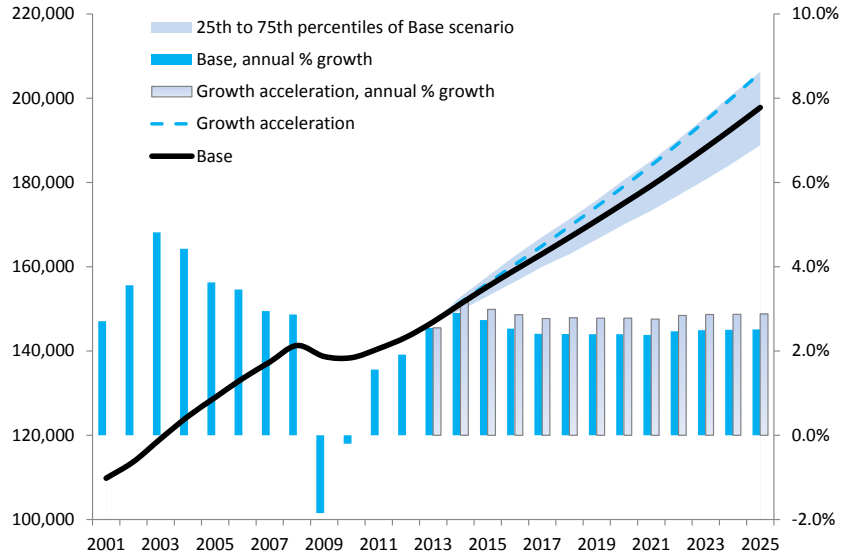


Table 4 GDP

Millions of 1995/96 dollars, compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	2.9%	2.9%	2.9%	2.9%
2001-08	3.7%	3.7%	3.7%	3.7%
2008-13	0.8%	0.8%	0.8%	0.8%
Next 10	**2.5%**	**2.5%**	**2.9%**	**2.5%**
Next 20	**2.5%**	**2.5%**	**2.9%**	**2.5%**

2.1. Light vehicle travel

In the next decade, falling unemployment and slower cost increases will cause a lift in growth in light vehicle travel demand. Vehicle passenger kilometres (drivers and passengers) will recover most strongly as recent declines in vehicle occupancy rates stabilise.

While light vehicle travel is expected to rebound light vehicle kilometres travelled per capita will not grow significantly (see Table 6).

Growth in light vehicle travel demand has been particularly subdued in recent years due to:

- rising travel costs
- increased investment in public transport
- slowing population growth
- a rise in unemployment (between 2007 and 2010)
- slow employment growth
- increased population density in major urban areas.

Under these conditions people have had less reason to travel and more reason to use public transport or other means when they do travel.

Some of these factors have long-lived effects on vehicle travel demand. This is particularly so where people have developed new habits or lifestyles such as changing where they choose to live. This persistence is captured in these forecasts to the extent that past events have lowered levels of vehicle use per capita.

This is because most growth will be in urban areas where fewer kilometres are travelled fewer vehicles are owned and public transport is more readily accessible. Urban and more rapidly growing regions are also where younger populations are concentrated and younger people are more likely to use public transport.

Growth in vehicle kilometres travelled in the Base case is virtually indistinguishable to vehicle kilometres travelled in the Investment-led scenario because public transport is a very small portion of aggregate travel demand. Reductions in light vehicle travel can be seen in vehicle kilometres travelled *per capita*.

Table 5 Vehicle kilometres travelled

Light vehicle travel, compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	0.9%	0.9%	0.9%	0.9%
2001-08	1.4%	1.4%	1.4%	1.4%
2008-13	0.6%	0.6%	0.6%	0.5%
Next 10	**1.3%**	**1.0%**	**1.5%**	**1.3%**
Next 20	**1.4%**	**1.2%**	**1.6%**	**1.4%**

The forecasts do not take account of potential changes in underlying preferences for vehicle use as the analytical evidence for the size of such changes is not yet well-developed.

It is unlikely that per capita light vehicle kilometres travelled will decline in the next decade. This is mainly because employment is forecast to grow more quickly than the population (1.4% vs. 0.9%).

That said, the likelihood of flat or declining per capita vehicle kilometres travelled is not trivial. Sensitivity analysis suggests there is a 1 in 10 chance that vehicle kilometres travelled per capita will be lower in 10 years than they are today and a 1 in 5 chance that vehicle kilometres travelled will be the same (or lower) in 10 years as they are today.

Table 6 Vehicle kilometres per capita

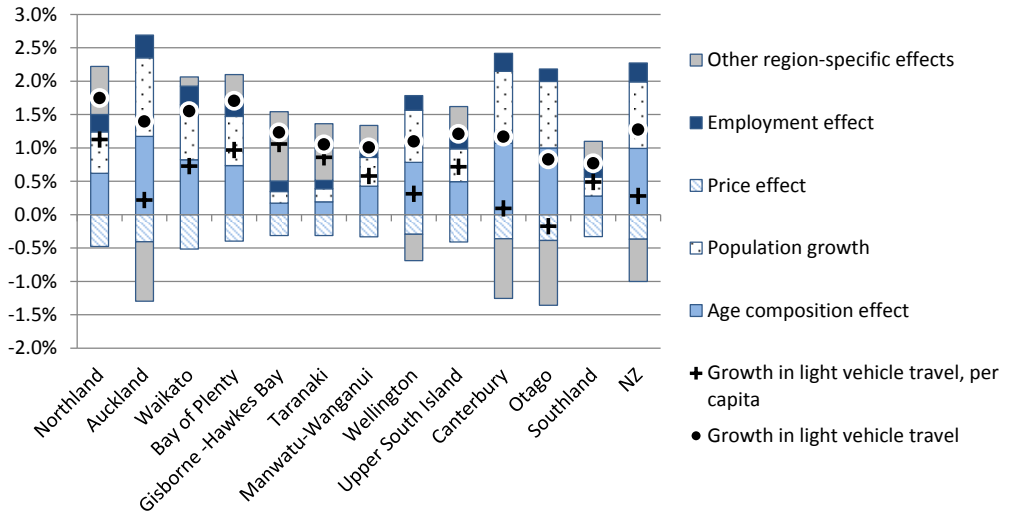
Light vehicle kilometres travelled per capita, compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	-0.3%	-0.3%	-0.3%	-0.3%
2001-08	0.0%	0.0%	0.0%	0.0%
2008-13	-0.4%	-0.4%	-0.4%	-0.4%
Next 10	**0.5%**	**0.2%**	**0.5%**	**0.4%**
Next 20	**0.7%**	**0.5%**	**0.7%**	**0.6%**

The drivers behind growth in vehicle kilometres travel over the next 10 years are summarised in Figure 7. The chart shows significant variation in growth across each of the regions. The black spots in the chart show average growth in VKT and the crosses show per capita growth rates. The bars show components of growth for each region.

Figure 7 Contributions to growth in vehicle travel, next 10 years

Components of annual average % growth in light vehicle passenger kilometres, Base case



The most significant source of VKT growth is population growth in urban areas. This is compounded by changes in the age composition of the population with increasing shares of the population at ages when people are most likely to drive.

The effect of increasing fuel prices can be seen in the striped 'price effect' bars.

The dark blue bars depict employment effects. Growth in employment raises vehicle passenger travel through higher incomes and greater need to travel to work.[9]

Grey bars depict a combination of other region-specific effects on light vehicle travel demand which vary across regions. This includes density effects, which tend to reduce vehicle travel demand. It also includes non-linear income effects associated with higher incomes in some regions reducing the likelihood of increased vehicle ownership(i.e. some regions are closer to saturation) and lower incremental distances travelled per driver per annum in urban areas.

In regions with major urban centres, density and other effects are large enough to offset other positive effects on vehicle travel. In other regions effects which increase vehicle use (including employment) will dominate.

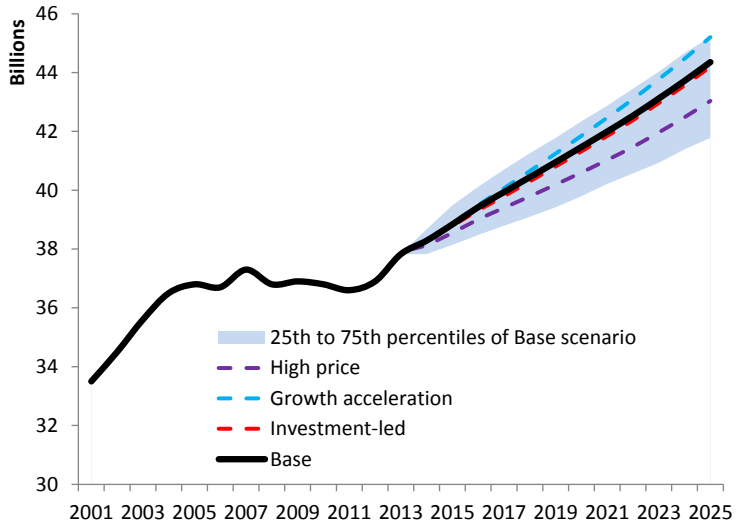
Region-specific effects depict the extent to which changes in the location of demand growth will lower aggregate national vehicle kilometres travelled. This can be seen in

[9] Note that the effect shown here is an approximation as employment effects cannot be entirely isolated from other effects (in these forecasts).

the combined result for New Zealand where the concentration of growth in urban areas lowers overall growth in light vehicle travel by 0.6% p.a. [10]

Note that these forecasts are quite sensitive to assumptions about petrol prices, incomes, and population growth (see Figure 8).

Figure 8 Vehicle kilometres travelled



2.2. Public transport

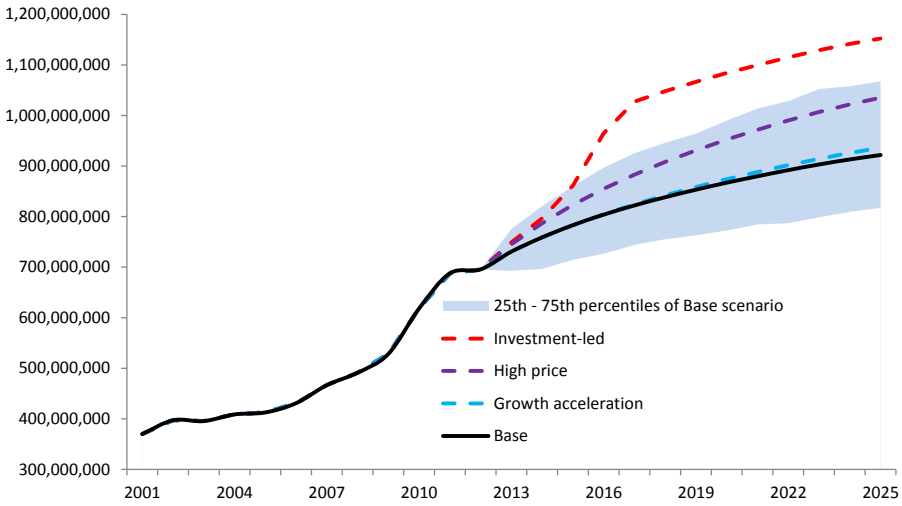
Public transport use has risen rapidly in recent years and boardings per capita will continue to rise, partly because fuel prices and therefore light vehicle travel costs are not expected to fall.

Growth has largely occurred in Auckland off a very small share of travel and in the context of rapidly rising prices and significant public transport investment.

[10] These 'other' effects also include a range of interacting effects such as region-specific changes in household composition and region-specific population cohort effects.

Figure 9 Auckland public transport passenger kilometres

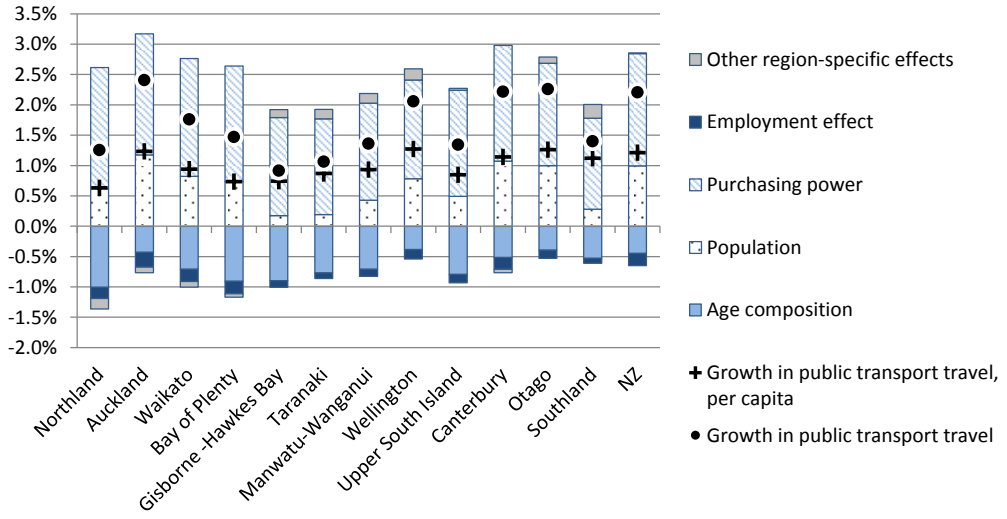
Bus, rail and ferry passenger kilometres. excludes active modes of travel.



Demand for public transport is dominated by the urban centres where per capita demand for public transport is expected to growth at around twice the rate of vehicle travel demand.

Figure 10 Contributions to growth in public transport, next 10 years

Components of annual average % growth in public transport passenger kilometres, Base case



The components of growth depicted Figure 10 show population and price effects driving overall growth in public transport passenger kilometres. These are partially offset by changes in the age composition of the population which reduce the probability of public transport patronage per capita.

The employment effect depicted in Figure 10 is not a 'pure' employment effect, as noted above. The employment effect combines both employment effects and income changes, with the latter dominating here. Note also that the employment effect only captures effects of employment that are not captured (de facto) in population growth.

Public transport's share of passenger kilometres will also continue to rise, although not as rapidly as in the past 5 years. Growth in patronage is expected to be broadly in line with historical growth trends. The reason it will not grow its share of travel at the same rates it has in the recent past is because growth in vehicle travel is expected to recover, as discussed in 2.1.

Table 7 National public transport boardings per capita

Bus, rail and ferry compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	na	na	na	na
2001-08	1.8%	1.8%	1.8%	1.8%
2008-13	2.8%	3.2%	2.8%	3.1%
Next 10	**1.1%**	**2.0%**	**1.1%**	**2.3%**
Next 20	**0.5%**	**1.1%**	**0.5%**	**1.1%**

Table 8 National public transport passenger kilometres

Bus, rail and ferry compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	na	na	na	na
2001-08	3.9%	3.9%	3.9%	3.9%
2008-13	4.7%	5.1%	4.7%	4.9%
Next 10	**2.0%**	**2.9%**	**2.1%**	**3.1%**
Next 20	**1.3%**	**1.8%**	**1.4%**	**1.8%**

A higher cost environment for vehicle travel would see an increase in the shift towards public transport as a share of travel but this, on its own, is unlikely to deliver the kinds of patronage increases envisaged by major regional transport plans such as the 103 million boardings targeted in the Auckland *Public Transport Plan.* This will require increased subsidies. Closing the gap may be feasible as the numbers involved are not large.[11]

2.3. Active modes

Walking and cycling typically track population growth, although a majority of kilometres travelled in these modes is at younger ages (according to the Household Travel survey). This means the ageing of the population will limit growth in kilometres travelled. If population growth accelerates through increased immigration this would increase the number of younger people in the population and boost walking.

[11] The cost effectiveness of closing the gap so is not something considered here as it is a supply-side issue.

Table 9 Walking and cycling kilometres travelled

Compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	na	na	na	na
2001-08	1.0%	1.0%	1.0%	1.0%
2008-13	-0.2%	-0.2%	-0.2%	-0.2%
Next 10	**0.8%**	**0.8%**	**0.9%**	**0.8%**
Next 20	**0.7%**	**0.7%**	**0.8%**	**0.7%**

Increased density and concentration of population growth in urban centres (in absolute terms) will increase growth in trips by active modes but this is expected to be offset, in terms of aggregate travel, by fewer kilometres travelled per trip.

3. Freight demand

Freight demand will continue to rebound as the economy recovers but with economic growth trending lower than in the past freight demand will growth at little more than half the rate of the past 20 years. The on-going shift in the economy towards services industries will limit the rate of growth in heavy freight demand relative to GDP (see Figure 12). In other words, economic growth is partially decoupling from growth in freight.

If growth accelerates, freight demand and road freight tonne-kilometres will rise while the share of freight in GDP will decline; reflecting that the source of growth is not in freight intensive sectors.

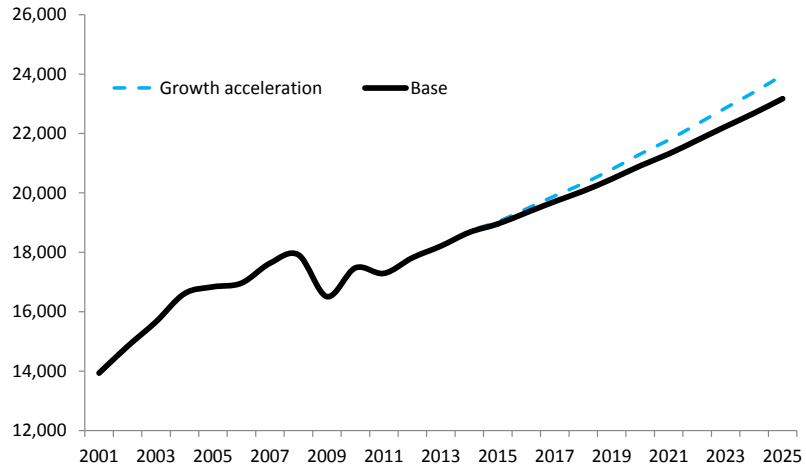
Table 10 Road freight

Tonne-kilometres, compound annual growth rates

	Base case	High price	Growth acceleration	Investment-led
1992-2013	3.8%	3.8%	3.8%	3.8%
2001-08	3.7%	3.7%	3.7%	3.7%
2008-13	0.3%	0.3%	0.3%	0.3%
Next 10	**2.0%**	**2.0%**	**2.3%**	**2.0%**
Next 20	**2.1%**	**2.1%**	**2.4%**	**2.1%**

Figure 11 Road freight

Millions of tonne-kilometres



The absolute size of the freight task will rise much faster than growth in passenger travel; much as it has done in the past.

The forecasts shown here are for lower freight demand growth than previous benchmark forecasts. The last National Freight Demand Study (2008) forecast the freight task to be around 70% larger in 2031 than in 2006/07. The forecasts here, while not entirely comparable in terms of measures of freight demand, are for a 57% increase in the (GDP) value of freight in 2031 over 2007 and a 49% in road freight

tonne kilometres. The Growth acceleration scenario sees the value of freight expand by 65% and the road freight tonne-kilometres expand by 57% over the period 2007 to 2031.

Table 11 Freight value added

Compound annual growth rates, all surface modes

	Base case	High price	Growth acceleration	Investment-led
1992-2013	4.1%	4.1%	4.1%	4.1%
2001-08	3.1%	3.1%	3.1%	3.1%
2008-13	1.0%	1.0%	1.0%	1.0%
Next 10	**2.3%**	**2.3%**	**2.6%**	**2.3%**
Next 20	**2.3%**	**2.3%**	**2.6%**	**2.3%**

Figure 12 Freight value-added per unit of GDP

Index for all modes, base year 2001