Transport Modelling for Western Distributor

Review of Travel Forecasting Methodologies – DRAFT INTERNAL WORKING DOCUMENT

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PREPARED FOR
Department of Economic Development, Jobs, Transport and Resources

www.velitchlister.com.au
Transport Modelling for Western Distributor

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Project 15-010

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DEDJTR has engaged VLC to use the Zenith model of Melbourne to provide initial, non-reliance travel demand forecasts for the Western Distributor project.

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1 Introduction

The State of Victoria is fortunate to have access to two four-step travel models:

- the Zenith model, developed and used by Veitch Lister Consulting (VLC) since the mid-1990s, and
- the VITM model, developed and used by the State Government since the early 2000s.

Much of the value of having two models stems from their differences. Travel forecasting is an uncertain science, and having different approaches to modelling tends to bring about greater transparency regarding key assumptions and methodologies, by providing a point of comparison.

Where the models produce similar results, it provides reassurance; where the models produce different results, it leads to investigation of the key underlying causes of difference, often highlighting assumptions and uncertainties that would otherwise be ignored. In both cases, having two models helps to identify and minimise traffic forecasting risk.

It is also worth noting that there can be differences in the approach taken by different modellers. Even with the same model, different modellers may apply different assumptions and methodologies that can lead to different outcomes. Again, this diversity can add value.

One important source of difference between forecasts produced by VLC using the Zenith model, and forecasts produced by VITM, is the way in which the models are used to forecast the future distribution of travel.

This paper explains the two alternative modelling approaches, explains the rationale behind each, and compares the outputs produced using each approach. These outputs are then put in context by considering historical data and trends.
2 The Two Forecasting Approaches

2.1 Overview

The conventional four-step model has four main steps:

- **Trip Generation**, which predicts the number of trips produced by each origin, and attracted to each destination travel zone (but not the linkage between origins and destinations),
- **Trip Distribution**, which predicts the number of trips made between each origin and destination pair,
- **Mode Choice**, which predicts the usage of each travel mode for travel between each origin and destination pair,
- **Trip Assignment**, which predicts the route(s) chosen for each trip.

The first three steps (Trip Generation, Trip Distribution and Mode Choice) are often collectively referred to as the “Demand Model”. These steps are concerned with predicting the demand for travel – i.e. predicting why, where, when, how and how often people will travel. The demand model takes account of the distribution of land uses, population and demographics, and the cost and time taken to travel between all possible origin / destination pairs, at different times of the day, by each possible mode of travel (i.e. car, walking, cycling, public transport). All of these factors influence people’s choices about where, when and how to travel.

The final step, Trip Assignment, is responsible for predicting the route taken by each vehicle or person through the transportation network. The Trip Assignment model takes account of traffic congestion, by considering how road travel times / speeds respond to changes in traffic volumes, based on road capacities. The Trip Assignment models used in Zenith and VITM are “user equilibrium” models, which produce as their output an equilibrium situation where each driver is seeking to minimise their perceived travel cost (considering travel time and tolls), and no driver can reduce their perceived travel cost by choosing an alternative route.

One of the outputs produced by the Trip Assignment step is an estimate of travel times and costs for all possible origin / destination pairs, by time of day and mode. This output is then fed back to the demand model, resulting in an iterative process which is repeated until an equilibrium between demand and supply is reached. This process is illustrated in Figure 1 below.

1 Note that the order of the steps in the Demand Model is not always fixed. For example, in VITM, mode choice comes before, or is done at the same time as trip distribution for some types of trip.
Figure 1: Structure of a four step model with feedback to trip distribution and mode choice

Because travel times and costs are an input to, and an output of, the model, an important practical consideration is what travel times and costs to use in the first iteration. We will return to this point later.

When VITM is used to forecast travel into the future, it is typical for the whole model to be run for several iterations – i.e. looping through Trip Distribution, Mode Choice and Assignment several times. This means that future congestion levels feed back to affect choices of destination and mode. This approach will be referred to as the “loop through distribution” approach.

When VLC uses the Zenith model to forecast travel, it generally only iterates through Mode Choice and Trip Assignment, as illustrated in Figure 2 below. This means that Trip Distribution is only run once, using the skims that are input to the model in the first iteration. Because of this approach, the travel times and costs used as input to the process are very important. We will refer to this as the “single distribution” approach.
Figure 2: Structure of a four step model with feedback to mode choice only
Input Travel Times and Costs

In the VITM modelling process, the travel times and costs used as input to seed the model run are not so important, provided that the model is iterated enough times to ensure satisfactory levels of convergence.

In the Zenith process, however, the seed travel times and costs are very important, because they fully determine the trip distribution. That is because the Zenith modelling process does not loop back through trip distribution in subsequent iterations.

The process used to derive input travel times and costs for the Zenith model involves assigning base year trip matrices to the input network. So, for a 2031 base case scenario, the base year matrix is assigned to the 2031 base case network. The assignment process outputs OD level travel times and costs which are then used as input to the trip distribution and mode choice in the first iteration of the full model.

This process takes account of the new accessibility provided by improvements to road and public transport infrastructure, and therefore, the Zenith process does consider the induced demand caused by a new infrastructure project.
2.2 The Rationale and Limitations of each Approach

The rationale behind the “loop through distribution” approach used in VITM is that changes in travel times and costs are likely to affect people’s future choices of destination – in other words, if the travel time to a destination increases, then it is reasonable to expect that (in the long run) people will be less likely to choose that destination.

Under this approach, increases in traffic congestion and travel times lead to a reduction in trip lengths – i.e. people are predicted to choose new destinations that involve less travel – destinations that are “closer to home”.

A limitation of this approach, and four step models generally, is that people have other ways to avoid increases in traffic congestion and travel times, other than changing destination and mode. In particular, people can change their departure time (i.e. travel earlier or later) to avoid “peak congestion”.

When people change their trip departure time to avoid peak congestion, it results in a smoothing of traffic over a longer period. This effect is commonly known as “peak spreading”. Peak spreading is an observable effect; for example, it is estimated that in Victoria the AM peak has increased in duration from 2.25 hours to 2.7 hours between 2002/03 and 2012/13 (VicRoads, 2014). ²

Four step models do not directly model changes in departure time in response to increasing traffic congestion, and are therefore unable to model peak spreading. Because of this fundamental limitation, we consider it likely that four step models over-state the sensitivity of destination and mode choices to future changes in traffic congestion. In their model validation guidance, VicRoads provide advice relating to out-of-model adjustments to address model peak spreading, however few specific details are provided and VLC believes that this process has not been used in either the VITM or Zenith models.

Furthermore, for many trips, changing mode is not a realistic option, as there are many trips for which public transport and walking are not competitive options. Therefore, for many trips, the primary modelled response to increasing congestion is to change destination, resulting in trip shortening.

An argument can be made that in reality, many of these trips would change their departure time, rather than changing their destination, thus alleviating peak period congestion through peak spreading.

With four step models unable to directly model peak spreading, and changing destination the only (realistic) option for many trips, it is reasonable to assume that

² VicRoads define the peak period as the period where traffic volumes exceed 85% of peak volumes
the degree of destination switching (and trip shortening) predicted by four step models may be overstated when using the "loop through distribution" approach.

The alternative, the "single distribution", essentially assumes that trip makers respond to increasing congestion by changing their departure time, instead of changing destination.

Clearly, neither approach is correct, and a much better approach would be to extend the four step model to include departure time choice (essentially making it a five step model). No such models have been successfully implemented in Australia, though it is likely that some will emerge over the coming years.

With neither approach being correct, owing to limitations of the four-step model, it is important to review and compare the forecasts produced by each approach.
2.3 Forecasts Using the Two Approaches

The table below contains some aggregate outputs for a 2031 base case scenario, using each modelling approach, together with 2011 (base year) outputs. Both approaches have been tested using the Zenith model.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Zenith 2011</th>
<th>Zenith 2031 – “single distribution”</th>
<th>Zenith 2031 – “loop through distribution”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>4.89 million</td>
<td>6.96 million</td>
<td>+42% or 2.11% p.a.</td>
</tr>
<tr>
<td>Car trips</td>
<td>8.9 million</td>
<td>12.1 million</td>
<td>+37% or 1.84% p.a.</td>
</tr>
<tr>
<td>Average car trip length</td>
<td>14.4 km</td>
<td>15.4 km</td>
<td>+7% or 0.35% p.a.</td>
</tr>
<tr>
<td>Car kilometres travelled</td>
<td>128 million</td>
<td>188 million</td>
<td>+46% or 2.32% p.a.</td>
</tr>
<tr>
<td>Weekday car kilometres travelled per capita</td>
<td>26.2 km</td>
<td>26.95 km</td>
<td>+2.9% or 0.14% p.a.</td>
</tr>
<tr>
<td>Mode share – Car</td>
<td>78.7%</td>
<td>74.4%</td>
<td>73.6%</td>
</tr>
<tr>
<td>Mode share – PT</td>
<td>8.3%</td>
<td>12.5%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Mode share – Walk / Cycle</td>
<td>13.1%</td>
<td>13.1%</td>
<td>14.0%</td>
</tr>
</tbody>
</table>

Table 1: Estimated weekday car usage in 2011, compared with predictions for 2031 using two alternative methodologies (based on the Zenith model, excludes intrazonal trips)

Both 2031 scenarios assume a population of 6.96 million, a growth of 42%, or 2.11% per annum (linear), over 2011 levels. This population is for the Zenith modelled area, which includes Melbourne, Geelong, Bendigo, Ballarat and Traralgon.

Under both approaches, car trips are predicted to increase at a rate slower than population growth. In the case of the “single distribution” approach, car trips are predicted to increase by 37% (1.84% p.a.), compared with 34% (1.7% p.a.) using the “loop through distribution” approach. These results imply a slight reduction in car trips per capita under both approaches.
This reduction in car trips per capita is caused by a shift to other modes. Under both approaches public transport usage is predicted to increase, from around 8% to 12% of trips by 2031.

The two approaches are less consistent in their prediction of average car trip lengths. In the “single distribution” approach, car trip lengths are predicted to increase by around 7% (0.35% p.a.), while in the in the “loop through distribution” approach, car trip lengths are predicted to decrease slightly by 0.7% (0.03% p.a.).

The above differences in car trips and in average trip lengths lead to a difference in car kilometres travelled (CKT). In the base year, weekday CKT per capita is estimated to be 26.2 km / person. Using the “single distribution” approach, 2031 CKT per capita is predicted to increase to 26.95 km / person, an increase of 2.9% over 2011 levels. Using the “loop through distribution” approach, 2031 CKT is predicted to decline to 24.5 km / person, a reduction of 6.4% compared with 2011.

Clearly, the two methodologies make different predictions about whether CKT per capita will increase or decrease by 2031, with an overall 9.3% difference in CKT between the two approaches (i.e. +2.9% versus -6.4%).

The different levels of CKT forecast by the two approaches can be easily understood by considering their methodological difference. Under the “loop through distribution” methodology, predicted increases in traffic congestion are fed back to the trip distribution step, causing average trip lengths to shorten, while in the “single distribution” methodology they are not. Given this, it makes sense that the “loop through distribution” approach would produce a lower estimate of future trip lengths and future CKT.

In order to assess the reasonableness of these alternate forecasts, we will now review past, present and possible future trends in car use in Australia. Given the differences elaborated above, particular focus will be given to trends in VKT / CKT per capita.
3 Long Term Trends in Motor Vehicle Use in Australia

The Australian Bureau of Infrastructure, Transport and Regional Economics (BITRE) regularly publishes estimates of total vehicle kilometres travelled in each capital city and state (BITRE, 2012a). These estimates, which are based on fuel sales, and assumptions about fuel efficiency, go back to 1965. Based on these estimates, Figure 3 compares growth in population against growth in total vehicle kilometres summed over all of Australia’s capital cities. It can be seen that over the 48 year period (1965 to 2012), total vehicle kilometres travelled (VKT) increased by a factor of around 4.5, while population grew by a factor of around 2.

![Figure 3: Comparison of population and total vehicle kilometres travelled in Australia’s capital cities](image)

It follows that VKT per capita grew significantly over the period. This is illustrated in Figure 4, which shows that annual VKT per capita increased from around 4000km in 1965, to around 9000km in 2012. It can also be seen from this graph that:

- the rate of growth in VKT per capita was most rapid in the early part of this period (i.e. 1965 to 1978);
- Post 1978, the rate of growth in VKT per capita progressively slowed, and then levelled off post 2000.
In 2012, the BITRE published a report analysing the above trends in VKT per capita, and cited a number of factors that have influenced VKT per capita over the period, including (BITRE, 2012b):

- The price of fuel;
- Unemployment;
- The Global Financial Crisis (GFC).

While these factors do explain some of the “bumps” in the curve, they do not explain its fundamental shape. That is, the above factors do not explain why VKT per capita has increased substantially over the period, nor why the rate of growth has progressively slowed down over time.

Two key factors not analysed by BITRE, which would go a long way to explaining the above macro-trends, are:

- The spatial pattern of population and employment growth (i.e. expansion versus densification); and
- Changes in vehicle ownership and licence holding.
The Spatial Pattern of Population and Employment Growth

The spatial distribution of population and employment growth has played an important role in causing VKT per capita to increase in Australia’s cities.

In the following series of plots, the distribution of Melbourne’s population growth is illustrated going back to the year 1900 (SGS, 2014). At each year, existing populations are represented by grey dots, while population growth is represented by red. It can be clearly seen that Melbourne’s urban footprint has gradually increased, with population growth occurring most intensely at the city perimeter.
Figure 5: Changes in Melbourne Population Since 1900 (Source: SGS)
This pattern of growth is expected to continue, as illustrated in Figure 6 below. Between 2014 and 2021, well over half of all population growth is expected to occur in the “outer” and “outer-growth” areas.

Figure 6: Estimated actual and projected future annual population growth by Melbourne region. Source: www.chartingtransport.com
Outer lying areas are also the areas that contribute most to total VKT. Figure 7 below shows daily average car kilometres travelled per capita, for people living in different SA3s. It is clear car usage is higher among people living in the outer suburbs.

![Map of Melbourne showing car kilometres travelled per capita by home SA3](image)

*Figure 7: Car kilometres travelled per capita, by home SA3. Source: VISTA*

The gradual expansion of Melbourne’s urban footprint has caused people and jobs to become increasingly separated. In Melbourne, for example, the average distance between people and jobs increased from 23.2 km in 1981, to 26.4 km in 2011 (SGS, 2014).

This trend is expected to continue. Figure 8 below shows how the average distance between people and jobs has changed between 1981 and 2011, and how it is forecast to change based on Victoria in Future 2014 (VIF2014). It is clear that past trends are expected to continue, with the average distance between people and jobs expected to increase to 27.9 km by 2031, an increase of 6% over 2011 levels.
A particular feature of Melbourne’s recent growth has been the imbalance between population and employment growth in the west. SGS (2014) report that between 1981 and 2011, the population in Melbourne’s west increased by 330,000, while employment grew by only 70,000 – that is, 2 jobs per 10 people, compared to the metropolitan average of 7 jobs per 10 people. In contrast, in Melbourne’s east, population grew by 190,000 while employment grew by 150,000 – that is, 8 jobs per 10 people.

This imbalance between population and employment growth in the west creates a demand for west-to-east travel, which contributes to increasing average trip lengths, and increasing VKT per capita.

This imbalance is expected to continue, with VIF2014 forecasting that by 2031, the population of Melbourne’s west will grow by an additional 680,000 people, while employment will only grow by 160,000 jobs, continuing the trend of 2 jobs per 10 people (SGS, 2014).

All other things being equal, the trends reflected in VIF2014 – a continued imbalance between people and jobs in Melbourne’s west, and further increases in the average distance between people and jobs – are likely to cause further increases in VKT per capita in Melbourne.

In summary, the spatial pattern of population and growth observed in Melbourne helps to explain why VKT per capita has increased over time. Furthermore, it is reasonable to expect that this effect would reduce over time, leading to a slow down in the rate at which VKT per capita increases (as has been observed).
To understand why, assume for a moment that cities are circular. Using the well
known relationship between a circle’s radius and its area \( A = \pi r^2 \), and assuming
that a city’s population is proportional to its area (i.e. constant density), we see that a
city’s population is proportional to its radius squared (i.e. \( \text{Population} \propto \text{cityradius}^2 \)).
Therefore, a city’s radius is proportional to the square root of its population (i.e.
\( \text{cityradius} \propto \sqrt{\text{population}} \)), implying that the radius of a city will grow progressively
more slowly than its population.

Assuming that CKT per capita is related in some way to the radius of the city, it is
reasonable to expect that CKT per capita would increase as a city expands, but that
this growth would slow over time. This fits very nicely with the fundamental shape of
VKT per capita presented in Figure 4.
Changes in Vehicle Ownership and Licence Holding

Increases in vehicle ownership and driver’s licence holding have been key drivers of growth in VKT per capita over a long period. For example, Figure 9 below presents historical licence holding rates in Sydney for the period 1971 to 2007. It can be seen that licence holding rates have increased substantially over time, particularly among females.


For males aged 30 to 60, licence-holding appears to have reached saturation at around 95%. Among young people, licence-holding rates have actually dropped in recent times, while among older people licence holding rates continue to increase. We will return to these trends shortly.

Female licence-holding rates were significantly lower than male rates in 1971. Since then, female licence-holding rates have approximately doubled, and are continuing to increase, albeit at a declining rate. Female licence-holding rates are still lower than for men, and there is scope for continued increase, particularly among older age groups.

These trends are consistent with the trends in VKT per capita presented earlier. Licence-holding has increased substantially over the past 40 years, which coupled with increased vehicle ownership have resulted in substantial increases in VKT per capita. Of course, there is an upper limit to licence-holding (i.e. saturation) which is likely to have contributed to the progressive slow down of growth in VKT per capita over time.

Looking forward, there are important contemporary trends to consider.
Lower car use among young people

As mentioned earlier, there has been a notable reduction in licence-holding rates among young people since the early 2000s. This generation is often referred to as the “millenials”, and nominally includes those born after 1980. This trend is not unique to Australia, with similar trends observed in the US, Canada, UK, Japan and much of Europe (Delbosc, 2015). In Victoria, licence-holding rates for under-30s have dropped by around 12% since 2001, but have largely stabilised since 2010. This is illustrated in Figure 10, which shows the decline in licence-holding rates for individual year ages.

This reduction in licence holding is very likely to have resulted in a reduction in car use among young people. This is supported by evidence from the Sydney Household Travel Survey (Bureau of Transport Statistics, NSW, 2014), which reports that for people aged 21-30, the proportion of trips made as a vehicle driver dropped from 53% in 2002/03 to 47% in 2012/13.

![Figure 10: Drivers licence ownership by age and year, Victoria. Source: www.chartingtransport.com](image-url)
Alexa Delbosc of Monash University has led research into possible explanations of this downward trend in licence holding and car use among young people. Possible explanations include:

- Changes to driver’s licence regulations that require learners to log many hours of supervised driving time prior to receiving their licence (up to 120 hours, depending on the jurisdiction). While this may have been a factor, it cannot explain the entire trend given similar trends overseas;
- Changes in the life course of young people compared with previous generations. In the words of Alexa Delbosc:

  "In the past, many young Australians quickly transitioned from secondary school to full-time work, marriage, mortgage and children. Today’s young Australians are more likely to attend tertiary studies, work part-time, live with parents and delay marriage, mortgage and children. All of these changes mean that young adults have less need for a car in their teens, but also have less money to pay for one."

This raises the question of whether young people will eventually follow the same car-use path as their parents, just a few years later. It is too early to say.

- Changes in cultural attitudes toward the car. Research by Alexa Delbosc and Graham Curry (2014) suggests that for young people, the car is not a symbol of status and luxury, but instead a symbol of adulthood and maturity. It is suggested that gadgets and mobile phones are the new status symbols.
- Changes in technology such as mobile communications. One possibility is that technology may reduce the need for travel. However, according to Delbosc, preliminary research suggests that young people who keep in regular contact with their friends via technology are actually more likely to see their friends in person (not reducing the need for a car). Another possibility is that technology has increased the utility of passive transportation (e.g. trains) where travel time can be used productively to socialise, read, study or work.

Overall, it is too early to say how this trend in licence holding and car use among young people will play out.
Increasing car use among older people

While fewer young people are obtaining a driver’s licence, the opposite applies to older people. This is clearly illustrated in Figure 11 below, which shows the proportion of NSW population who hold a driver’s licence, by single year age groups. For people aged 55+ there has been a significant increase in licence holding over the period 1998 to 2009. For example, for 65 year olds, licence-holding rates increased from 76% to 87% during the period.

In the words of Raimond and Milthorpe (2010):

>This is a large shift, with potentially significant implications for the travel choices of this group in retirement. This cohort will be more mobile as it ages than the previous generation, but will also potentially add to the externalities associated with road use, including congestion and emissions

![Figure 11: Proportion of NSW population who hold a driver's licence, by single year of age. Source: Raimond and Milthorpe, 2010.](image-url)
The increased mobility of older drivers was also observed in a Victorian Department of Transport report, "Maintaining Mobility: The Transition from Driver to Non-Driver" (Victorian Department of Transport, 2007), which predicted that licence-holding rates among people aged 60+ would increase from 73% in 2001 to 96% in 2031. An upwardly mobile older generation has the potential to further increase the demand for car travel, and further increase VKT per capita.
4 Recent Trends in Motor Vehicle Usage in Australia

In this section we review recent trends in car use reported by the *Sydney Household Travel Survey* (HTS), and trends in vehicle use reported by the *VicRoads Traffic Monitor 2012/13*.

**The Sydney Household Travel Survey**

We have chosen to analyse the Sydney HTS, rather than the Victorian Integrated Survey of Travel and Activity (VISTA), because the Sydney HTS has been running continuously since the late 90s, and thus provides an unrivalled source of *time series disaggregate travel information*.

During the period 1999/00 to 2012/13 (the full range of available published data), car trips per capita decreased by 5.4%, while average car trip lengths increased by 6.3%. The net effect was a very small increase in CKT per capita, suggesting that CKT per capita is approximately stable in Sydney.

The trend toward fewer, but longer, car trips, is consistent with the forecasts made by the Zenith model using the “*single distribution*” approach.

Because the Sydney HTS has been running continuously since 1999, we can examine how CKT has changed each year compared with changes in population.

Referring to Figure 12 below, it can be seen that CKT grew faster than population during the early 2000s, but then plateaued between 2003 and 2010, before recovering strongly between 2010 and 2013. By the end of 2013, CKT had grown at an almost identical rate to population, implying no change in CKT per capita.
By contrast, PT passenger kilometres followed a similar but opposite pattern, reducing between 2000 and 2005, increasing rapidly between 2005 and 2008, and then plateauing until 2013. By the end of 2013, PT passenger kilometres per capita had increased by approximately the same amount as population, implying no change in PT passenger kilometres per capita.

The above fluctuations in car and public transport usage may have been caused by a number of factors, some of which we will now explore.
Fuel Price

Figure 14 below presents real Australian petrol prices during the period 1970 to 2010. It can be seen that real petrol prices increased substantially from the late 1990s and through the 2000s. In total, prices increased by around 55%. Much of this increase (about 36%) occurred between 2003 and 2008. Prices peaked in 2008, and subsequently fell by around 15% in 2009 and stabilised in 2010 (more recent data has not yet been sourced).

This pattern is consistent with the above fluctuations in car and public transport use, and thus may be at least partly responsible.

*Figure 14 – Australian real petrol price and real import equivalent oil price. Source: BITRE, 2012*
Reduced licence holding among young people

As in Victoria, licence-holding rates among young people declined in NSW during the 2000s. Figure 15 shows independent (non-learner) driver’s licence rates by 5 year age groups over the period 2005 and 2014. It can be seen that licensing rates for the 20-24 and 25-29 age groups dropped by around 5 percentage points between 2005 and 2009. However, in a pattern consistent with that seen in Victoria, licence-holding rates stabilised between 2009 and 2014.

Again, this pattern is consistent with the fluctuations in car and public transport use reported in the Sydney HTS.

This data may also provide some early evidence that the 2003 to 2008 period (where traffic growth slowed) may not have been the beginning of a long-term trend, but instead an “adjustment” caused by a sharp increase in fuel prices coinciding with a step change reduction in licence holding rates among young people.

It is too early to say whether this is actually the case, but it is notable that the rate of traffic growth observed in the Sydney HTS between 2009 and 2013 is similar to that observed between 1999 and 2003, and in both cases, CKT per capita is continuing to increase. Predictions of “peak car” may be premature, at least in Australia.

![Figure 15: Independent driver’s licence ownership by age group, NSW. Source: www.chartingtransport.com](image-url)
It is also interesting to use the Sydney HTS to compare changes in total distance travelled (summed across all modes) to changes in population (see Figure 16 below). It can be seen that increases in total distance travelled have tracked population growth very closely. The main exception, albeit a temporary exception, was the period 2009-2010, when distance travelled fell behind population growth. This period coincided with the Global Financial Crisis, suggesting that the economic slowdown may have temporarily affected travel demand. This would be an interesting finding, if correct.

![Figure 16: Growth in total person distance travelled and population, Sydney. Source: data sourced from Bureau of Transport Statistics, 2012 and 2014.](image)

There are at least two main mechanisms by which the GFC may have affected travel:

- **Unemployment** increased in NSW from 4.6% in September 2008, to 6.6% in March 2009; that is, an increase of 2% in only 6 months (BITRE, 2012b). The increase was relatively short-lived, however, with unemployment returning to 4.9% by September 2010; and

- The Australian **Savings Rate** increased sharply during the GFC, as illustrated in Figure 17 below. This may have led to a reduction in discretionary spending, and hence a reduction in the need to travel. However, the savings rate has not since reduced, suggesting that the savings rate may not explain the observed temporary reduction in travel, and subsequent recovery.
Figure 17: Australian Household Savings Rate. Source: http://www.tradingeconomics.com/australia/personal-savings (as at the 2nd of September 2015)
VicRoads Traffic Monitor

Combining VKT data from the 2010/11 and 2012/13 editions of the VicRoads Traffic Monitor with estimated resident population data sourced the ABS, we have compared VicRoads’ estimates of total VKT in metropolitan Melbourne with estimates of population over the period 2000 to 2012. The result is presented in Figure 18 below.

It can be seen that with the exception of the period 2004 to 2006, VKT has grown in-line with population. For example:

- between 2000 and 2004, VKT grew by 6%, while population grew by 5.6%;
- and
- between 2006 and 2012, population and VKT both grew by 13.1%.

Figure 18: Growth in VKT and population in Melbourne. Sources: ABS, VicRoads 2012 and VicRoads 2014
5 Future Motor Vehicle Use in Australia

Australia’s cities continue to expand. In Victoria, VIF2014 forecasts continued expansion in Melbourne’s outer suburbs and growth areas, coupled with higher growth of inner city populations. It also forecasts a continued imbalance between population and employment in the west, which will further increase the need for east-west travel. Given these factors, it is reasonable to expect that VKT in Melbourne will continue to increase, and VKT per capita may also increase.

We have explored trends in car licence holding and car use among young people. Recent data suggests that the trend toward reduced licence holding among young people may have now stabilised, though it remains unclear how this cohort (and the cohorts that follow) will behave as they move into their 30s and 40s. Will they settle in the outer suburbs and drive as much as their parents? Or will they build their lives around a car free existence, perhaps leading to a paradigm shift in transport and land use planning? Can Governments influence this outcome, rather than simply react to it? These are difficult questions, and it is arguably too early to say.

At the same time, licence holding and car use among older people is increasing, with licence-holding rates among people aged 60+ predicted to increase from 73% in 2001 to 96% in 2031 (Victorian Department of Transport, 2007).

Technology will also undoubtedly play a role, though there is no evidence (yet) to suggest that technology will reduce travel. Indeed, new motor vehicle technology (i.e. self-driving cars) may ultimately remove the need for a driver’s licence, and increase the mobility of the young, old and disadvantaged. At the same time, there will be opportunities to increase traffic flow rates via connected vehicle technologies.

In summary, VKT per capita has held steady over the past 10-15 years, despite a significant reduction in car use among young people. Many of the factors that previously caused VKT per capita to increase still persist today; licence holding is not fully saturated (especially among older generations), and population growth continues in the outer suburbs. If the trend toward young people driving less has now stabilised (as preliminary evidence suggests), then there is a reasonable likelihood that VKT per capita will remain steady or begin to increase once again.
6 Conclusions

This report has presented two alternative travel forecasting methodologies, considered the strengths and limitations of each approach, presented the results produced by each approach using the Zenith model, and examined these results within the context of past, present and possible future trends in traffic growth.

We have examined these forecasting methods both on their theoretical grounds (including their limitations), and the reasonableness of their forecasts.

From a theoretical perspective, both approaches have their strengths and limitations. The “loop through distribution” approach is more “theoretically natural” of the two approaches, in that it considers the impact of future congestion levels on people’s choice of destination. In contrast, the “single distribution” approach is intended as a more “pragmatic” approach, based on managing the limitations of the model, in particular, the inability of the model to predict “peak spreading”. We have reasoned that models that loop through distribution may over-state destination switching and trip length shortening, because they do not consider peak spreading.

We have also presented the results of each forecasting method, and placed these forecasts in context by considering past and present trends. Overall, both approaches produce plausible results. The “single distribution” approach predicts a 2.9% increase in VKT per capita by 2031, while the “loop through distribution” approach predicts a 6.4% reduction in VKT per capita.

The slight increase in VKT per capita predicted by the “single distribution” approach is plausible given that Melbourne’s population growth is still largely predicted to occur in the outer suburbs and growth areas, and the expectation that older people will be more active and more mobile in the future.

The reduction in VKT per capita predicted by the “loop through distribution” is also plausible, especially if the current younger generation continue to drive less than their parents during their 30s and 40s. A reduction in VKT per capita is also plausible should increases in congestion bring about a reduction in mobility and travel.

It is notable that much of this discussion centres on demographic change - i.e. changes in licence holding and car use among older and younger generations. Aggregate four step models (such as VITM and Zenith) are currently limited in their ability to reflect demographic changes; we believe this should be taken into account when using forecasts produced by the models.

Based on the evidence reviewed, there is not enough evidence to conclusively favour one approach over the other, and we suggest that both should be considered legitimate approaches until new evidence suggests otherwise, or until better methods emerge.
7 References


SGS,. 2014. 'East West Link - West, Business Case Development'. Presentation.


