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HOW MANY TIMES? – A STUDY OF FREQUENCY AND RECENCY

It's often assumed that many tollway users travel the same road frequently, but is that really the case? In much the same way as traffic volume can be analysed across several dimensions it is also possible to understand more about the customer using the road. How often do they travel? How long has it been since they last travelled on this particular section of road? How does this vary along the length of the road? Understanding what percentage of toll road users are infrequent users of the road is relevant for traffic modelling and how roadside infrastructure (such as signage, both routine and following changes to the road / drivers experience) is best implemented.

1. Introduction

Transurban has 13 roads in its Australian portfolio. They include CityLink, which joins three of Melbourne's major motorways, as well as six roads in the Sydney network (M2, M5, M7, Lane Cove Tunnel, Eastern Distributor and Cross City Tunnel) and six roads in Brisbane (Gateway Motorway, Logan Motorway, Clem7, Airport Link, Go Between Bridge and Legacy Way).

In the United States, Transurban has interests in two roads in the state of Virginia, both in the Washington DC area.

All of Transurban's roads are tolled electronically with different tolling methods applied. These include:

- Fixed Point tolls
- Fixed Point tolls with cap
- Distance based tolls with cap
- Dynamic High Occupancy Toll Lanes

Tolling on Transurban's roads is electronic using transponders and toll gantries. In Australia there are a number of toll transponder providers:

- NSW Roads and Maritime Services (E-Toll)
- WestLinkM7 (Roam)
- Interlink Roads (E-Way)
- Transurban (Roam Express, CityLink, go via)
- Eastlink (Breeze)

While it is clear there are a number of toll providers, all toll transponders are inter-operable and work on all motorways across Australia.

Transurban monitors traffic on all of its roads. There are many ways of monitoring traffic on a road. Some of the systems used on Transurban's suite of assets include magnetic loops, weight-in-motion sensors, and automatic incident detection cameras.

The tolling gantries, however, provide one unique benefit that none of the other systems can – they not only count the traffic extremely accurately, but identify it too. Whilst the primary purpose of doing so is obvious – to enable accurate tolling – it provides a side benefit of being able to understand concepts of frequency and recency of use of the asset.

Transurban has recently started to consider this information and its practical application:

- How familiar is the driving traffic with a particular piece of infrastructure?
- To whom should you communicate to about upcoming roadwork?
- Is it possible to categorise customers based on their travel patterns?

The more that we can understand the customer travelling on the road, the better we can ensure that their needs are met and that they have a good travelling experience.

2. Frequency

2.1 Frequency of vehicles travelling on a road

To understand the frequency of vehicles making a motorway trip an analysis has been performed of all vehicles that travelled on one Transurban motorway in 2015. Over the course of the year a total of 3.8 million different vehicles travelled on the road, ranging from a single trip over the course of the year to close to 9,000 trips (unsurprisingly these were our maintenance and incident response vehicles).

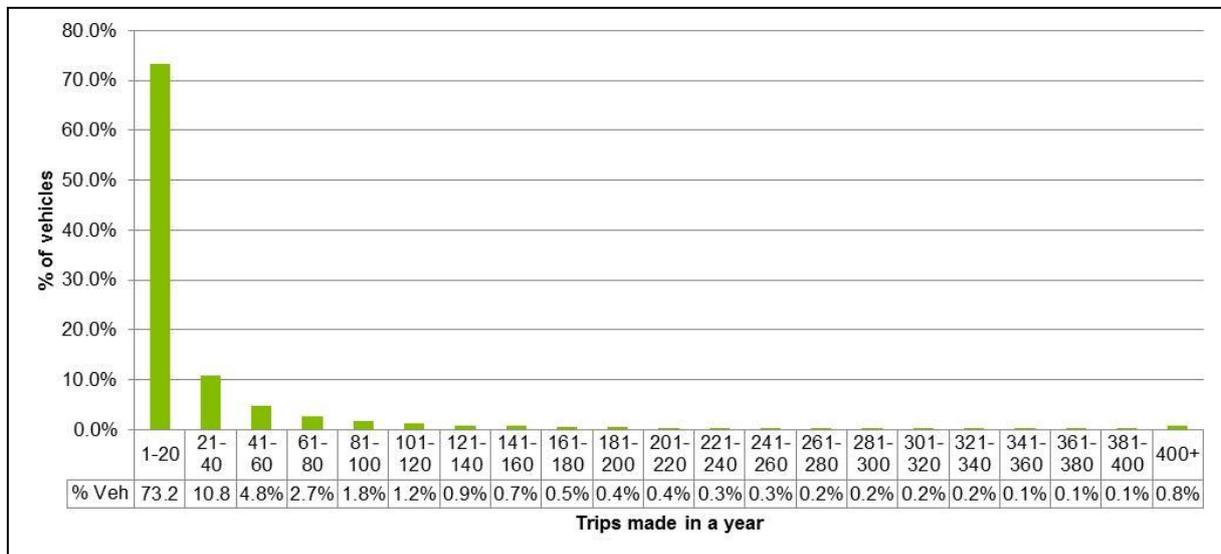


Figure 1 Trips Made per Year

The chart above draws out a few interesting numbers:

- 73.2% of vehicles made 20 or fewer trips in a year
- An extra 26% of vehicles made between 20 and 400 trips in a year
- A mere 0.8% of vehicles made more than 400 trips in a year. These are the population that could be considered daily commuters (i.e. equivalent to 2 trips per day, 5 days per week, 40+ weeks per year)

Exploring the very infrequently seen vehicles reveals further surprising statistics shown in the chart below.

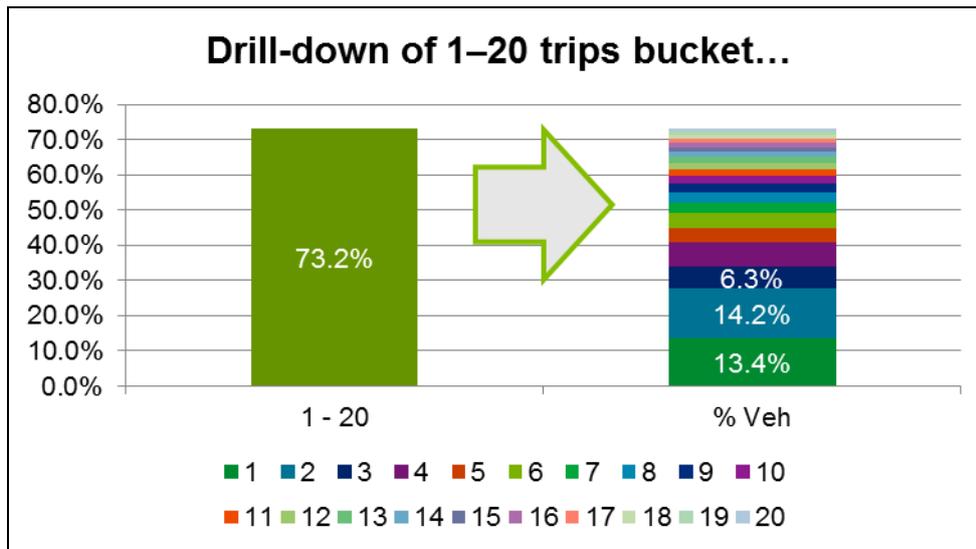


Figure 2 Trips Made per Year (<20)

From the chart it can be seen that of all the vehicles observed travelling the motorway in 2015:

- 13.4% made a single trip on the road
- 44.8% made 5 or fewer trips in the year
- 59.8% made 10 or fewer trips in the year
- 73.2% made 20 or fewer trips in the year

These statistics show the enormous number of vehicles for whom travelling on the motorway is an uncommon experience.

2.2 Motorway use across jurisdictions

While the above is for a single Transurban operated motorway, it is useful to know if the same pattern of usage applies across other motorways. Figure 3 summarises the usage trends across multiple Transurban motorways.

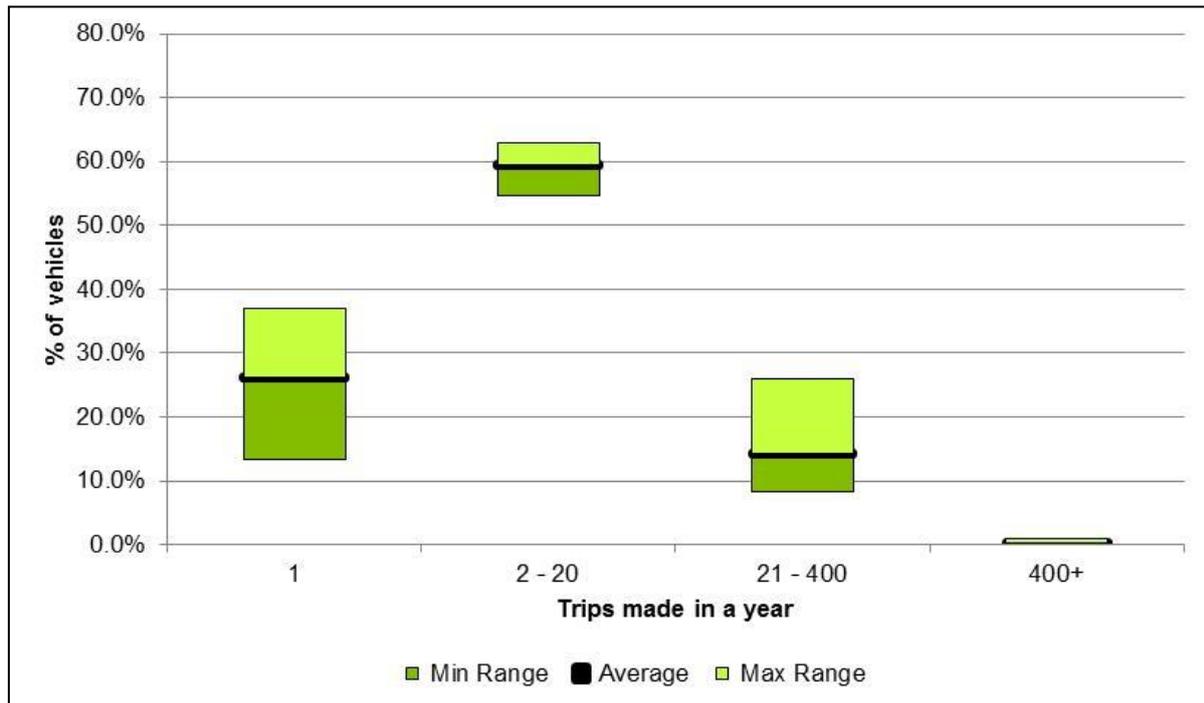


Figure 3 Frequency of Use Across Motorways

In the 2-20 trip range (which is the largest group of vehicles) there is little variation in the percentage of vehicles across the motorways. Similarly all motorways show little variation in the percentage of regular users (400+ trips).

Overall the chart shows there's little variation across the motorways.

2.3 Frequency of use by vehicle type

An analysis of usage by vehicle type has also been undertaken. Four vehicle classes have been examined and the results are shown at the charts below.

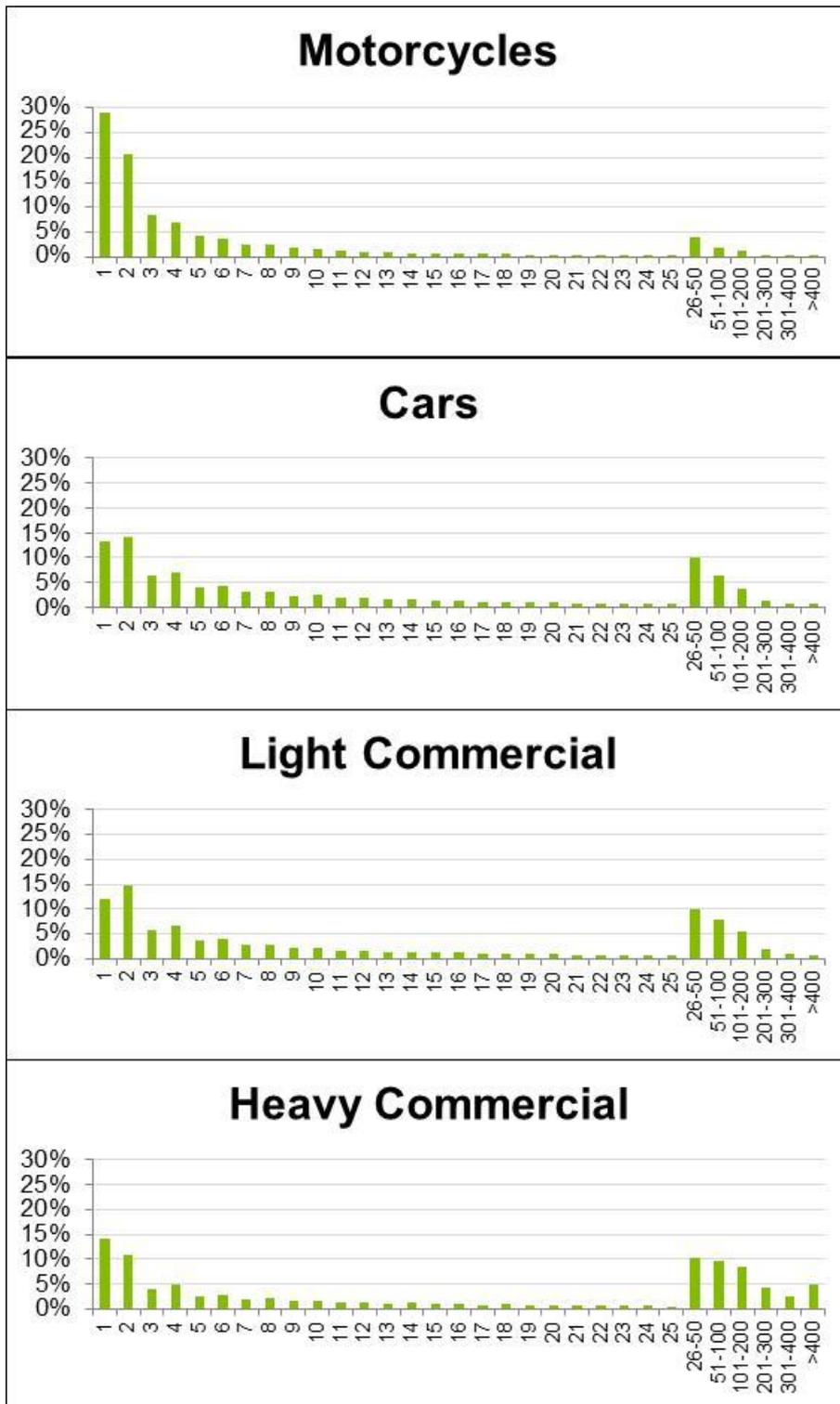


Figure 4 Frequency by Vehicle Type

Some interesting observations from the charts above include:

- The relatively high proportion of motorcycles that use the motorways 1 or 2 times a year (and the low percentage of “daily commuter” motorcyclists. Motorcycles are the least frequent users of the motorway, at an average of 0.2-0.25 trips per week.
- The similarity in the frequency of use for cars and light commercial vehicles with cars on average making 0.5-0.55 trips per week and light commercial vehicles making 0.65-0.7 trips per week.
- The relatively high proportion of heavy vehicles that frequently use the motorway (particularly in the 400+ category). The frequency of use for heavy vehicles is between 1.55-1.65 trips per week.

The following chart looks at frequency of travel broken down by vehicle class and whether or not the frequency of travel is changing year on year. Data on motorcycles is only available for 2014 and 2015.

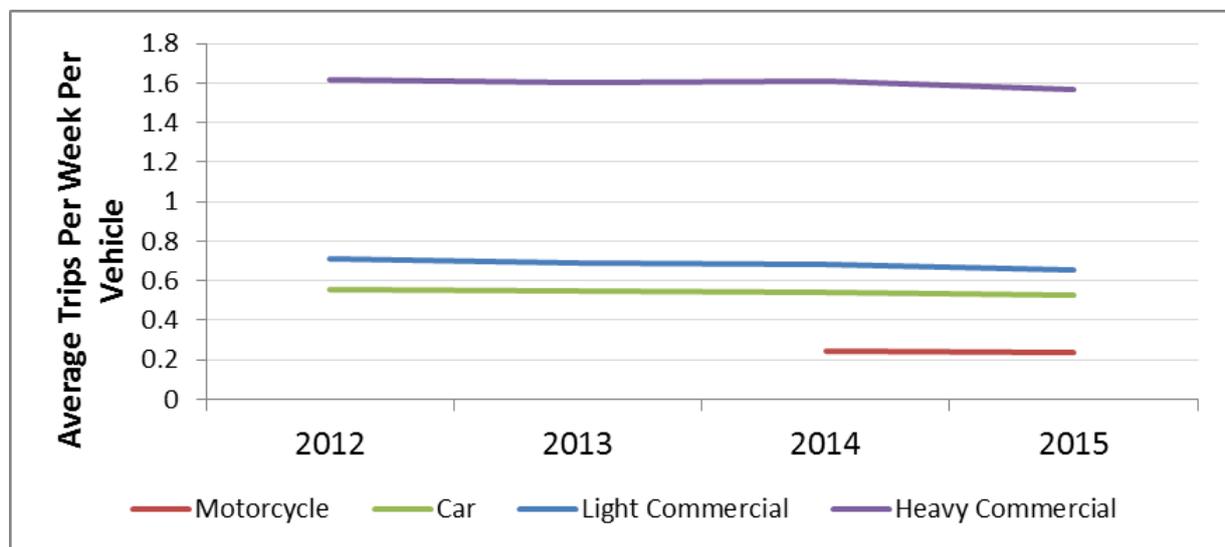


Figure 5 Frequency of Use Over Time

Looking over multiple years there is a very slight but consistent decline in the number of trips made by each type of vehicle. This suggests that every year there are a greater number of distinct vehicles on the road however the growth is strongest in the realm of infrequent users of the road, as opposed to people making more and more trips each year.

2.4 Does frequency of use change over time

Another question to consider is whether the average frequency for a particular user changes over time. We know from above there is a very slight reduction in the overall frequency of use over time, but is this due to less travel by individual users or simply new accounts having different usage profiles? The figure below shows how frequency of use changes for particular users over time.

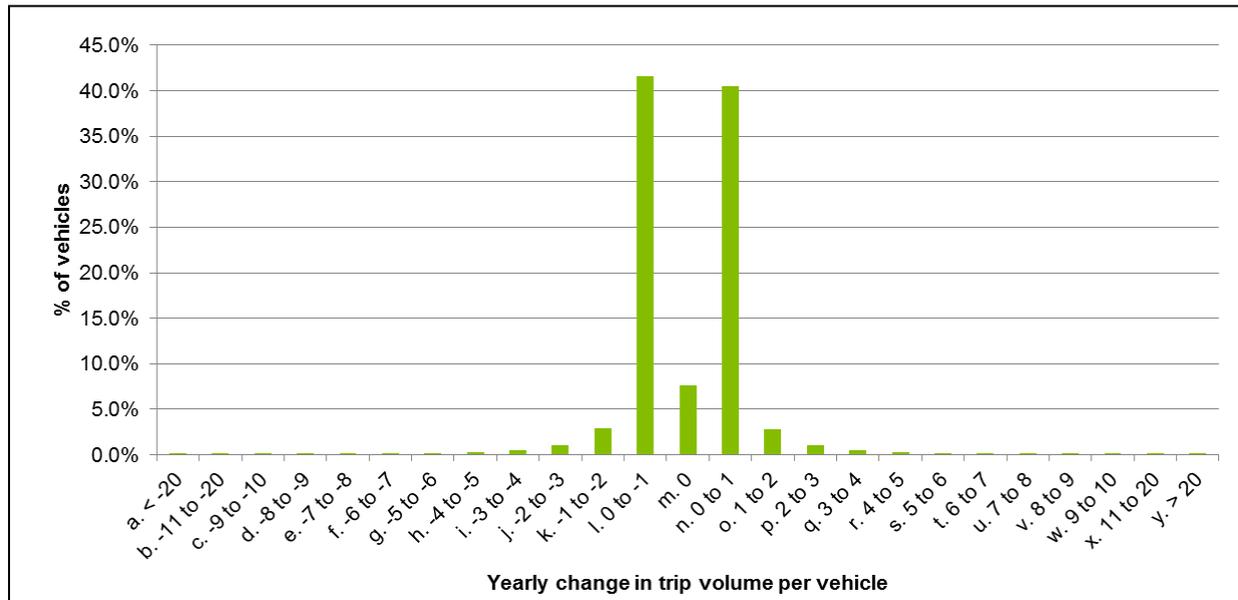


Figure 6 Yearly Change in Usage

The chart above shows that for the majority of vehicles (>80%) the number of trips from one year to the next is essentially unchanged; however there is a very slight bias towards reduction compared to increasing use. This chart also suggests that most people are quite consistent in their usage of the asset and only a small population of users change their usage pattern dramatically in any given year.

2.5 The relationship between frequency of use and traffic volumes

Whilst there is a very high number of vehicles that are identified travelling on motorways just once, or a few times, in the year those vehicles presumably don't contribute a great deal towards overall traffic on the road. The following table considers the contribution to traffic each group makes.

Table 2 Frequency of travel versus contribution to total traffic

Number of observations in 2015	% of all vehicles	% of all traffic
Single trip in year	13.40%	0.46%
2 to 10 trips in year	46.35%	7.22%
11 to 50 trips in a year	27.10%	21.93%
51 to 400 trips in a year	12.35%	53.76%
401 or more trips in a year	0.80%	16.64%

Inferences and observations that can be drawn from the above:

- Every sixth vehicle driving down the road can be considered a daily commuter
- About 60% of the traffic consists of people who use the road approximately weekly
- Fewer than 10% of traffic driving along the road will make 10 or fewer trips in the year

3. Recency

A slightly different perspective to place on the analysis is to consider all of the vehicles that might be travelling on any given day and determine how long it has been since they last travelled on the road. The chart below shows that 42.0% of the distinct vehicles making a journey have made another journey within the last 1 day, 72.9% have made another trip within the last week, 81.4% within the last fortnight and 88.0% within the last month. The remaining 12.0% have not used the asset for a month or longer.

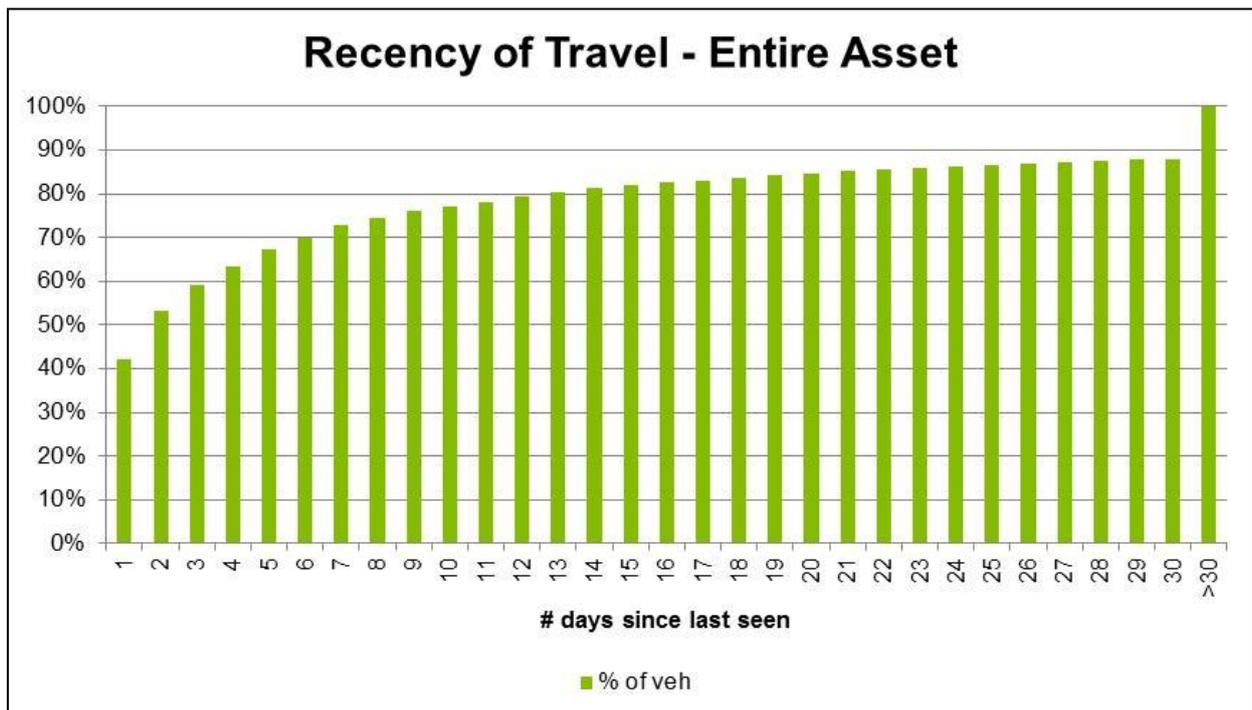


Figure 7 Number of Days Since Last Use

For many customers who use motorways, however, a journey in one direction might often lead to a return journey in the other direction. So when trying to understand familiarity with a particular portion of the road – such as following the introduction of roadwork – it is better to consider a single point on the road, rather than use of the entire asset.

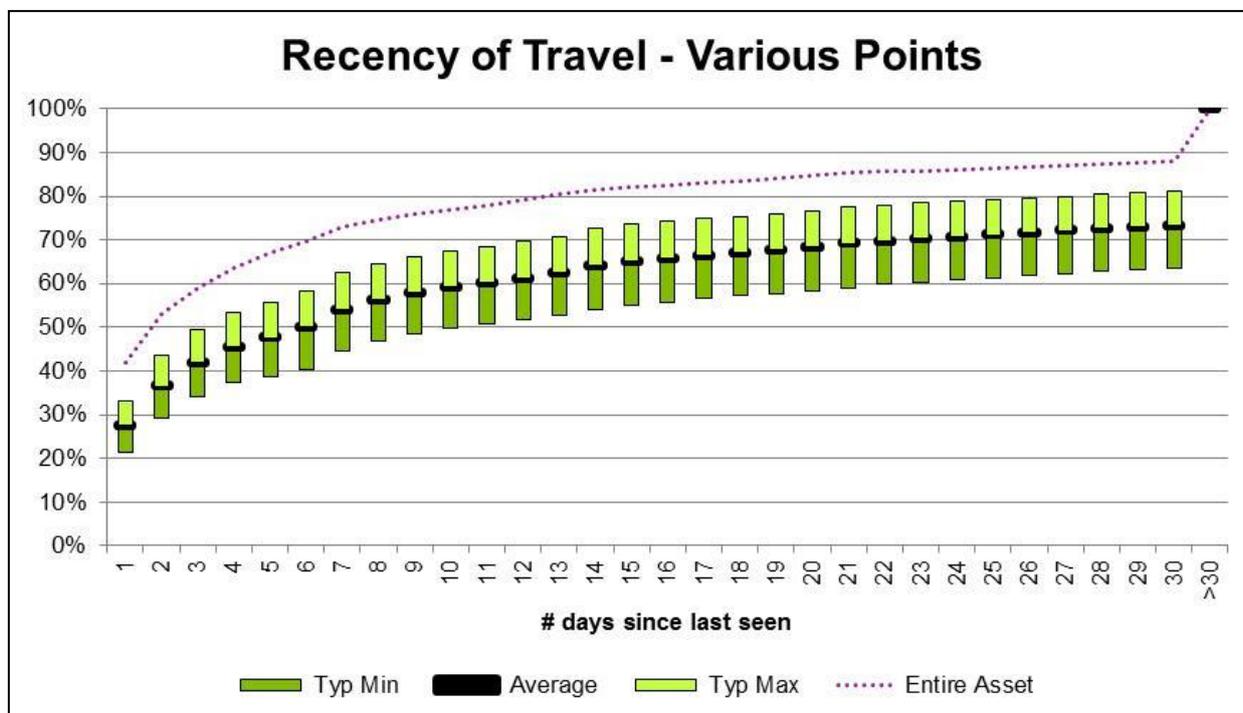


Figure 8 Number of Days Since Last Use (Single Point on Motorway)

The chart above shows how much familiarity can vary from point to point and is, expectedly, lower than the overall motorway. Now, the possibility that a vehicle has not travelled on a particular section of road for 30 days or longer jumps from 12% to somewhere between 19% and 36% depending on whether the section of road is subject to more commuter or casual use.

4. Practical Applications

Developing the tools and techniques to analyse traffic using the concepts of frequency and recency is not only “interesting” but also lends itself to practical application. Beyond the notion of growing our understanding of how customers tend to use the assets, be that confirming assumptions or dispelling misconceptions, there are some specific applications that can be considered. Two examples include:

4.1 Targeted communications

The ability to understand who travels on a particular section of road, how often they travel, and their likelihood of travelling on a particular section at a particular time can be used to target communications very specifically. A recent example involved an atypical road closure/diversion to be performed on a Saturday evening. Data analysis was used to identify customers that had a high probability of travelling in that area at the time for which the works were scheduled. These customers

then received targeted email communications about the works in advance of the event. The result is a communication that is much more efficient and relevant to the recipient. The email communication allows for a much richer communication than can be achieved with roadside messaging, and allows for customers to plan ahead.

4.2 Customer Classification / Segmentation

The ability to broadly group customers based on how often they travel, which routes they are most likely to travel, what time of day they are most likely to travel, etc. allows for more personalisation to ensure that they receive the right information and in the right format/language to suit their level of familiarity and experiences. Grouping customers under labels like “Weekday morning and evening commuter” or “Friday / Saturday evening commuter” translate millions, if not billions, of individual data points into convenient labels to ensure the customers’ needs are considered and met.

5. Conclusions

The analysis undertaken on Transurban’s motorways around Australia shows that there are a significant proportion of users on the motorways who would be considered infrequent users. This infrequent use of the motorway network means that driver familiarity with the road (and particularly if there are any changes or roadworks) may not be as high as expected.

In the future it is hoped that regulation will allow analysis of motorway to motorway journeys. This will allow greater understanding of trip and usage patterns on the most important parts of the road network.