

Establishment of effective travel time data measures for network performance

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ABSTRACT

An optimised and resilient transport network is critical for Auckland's economic productivity. Auckland Transport has worked in partnership with the New Zealand Transport Agency to develop a "one system" approach, which is designed to improve the connectivity and integration of the Auckland transport system.

Monitoring and understanding the performance of the network enables us to optimise existing infrastructure and improve the performance of different modes by time of the day. We recently have done a review on our transport indicators based on international and New Zealand case studies. We have found the following measures to be the key indicators for Auckland network

- Travel Speed
- Travel Time - On key origin-destination by time of day via different modes
- Congestion/Level of Service
- Delay relative to free flow
- Reliability relative to peak travel time
- People movement on key corridors

INTRODUCTION

There are many key performance indicators for measuring network performance. For Auckland Transport our key measures have the following characteristics:

- Track over time to establish a trend
- Easy to explain and be understood by the public
- Technically sound
- One network approach (i.e. State Highway and arterials)
- Focus on key issues on the network
- Consistent with international measures

This paper outlines our journey on the development of meaningful key performance indicators.

LITERATURE REVIEW

Auckland Transport has been reporting on network performance since 2010. Over the years, we constantly improve the way we report on network performance so that we can have a consistent methodology for

- Different modes (bus, freight, general traffic)
- Different time periods
- Different network (arterial, State Highways, freight and One Network)

In 2016, we undertook a literature review to investigate whether there are any better measures that we can adopt, and to have the consistency with AUSTROADS and three New Zealand regional Traffic Operations Centres (TOCs).

What we found was that different organisations tend to name their key indicators differently and use slightly different statistical definitions, but the fundamental themes are the same and consistent with what Auckland Transport has been using. Essentially, there are five key measures commonly used. These are:

- Traffic Speed
- Travel Time on key routes
- Congestion
- Delay (relative to free flow)
- Reliability (relative to peak travel)

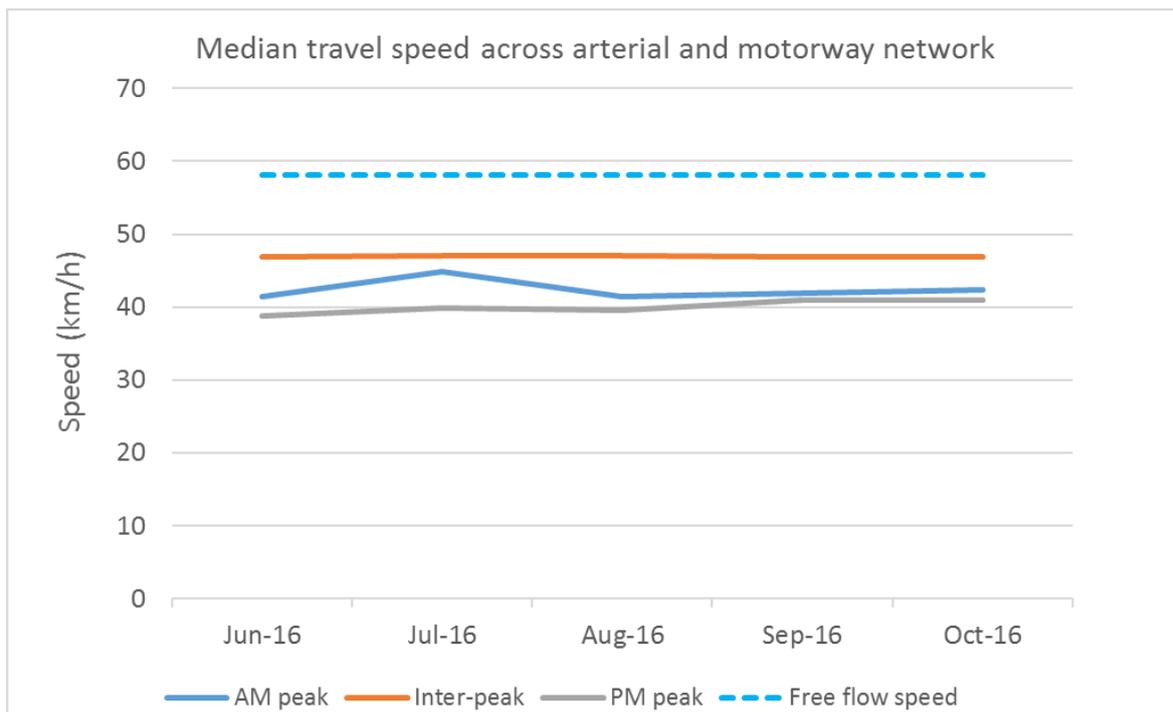
The Auckland Transport believes that the People Productivity indicator is important as it reflects on how efficient we move people through corridors and therefore remains as a sixth key performance indicator for Auckland (more detail come later)

KEY TRANSPORT INDICATORS

The following 6 key transport indicators provide different information on the performance and operation of the routes and network.

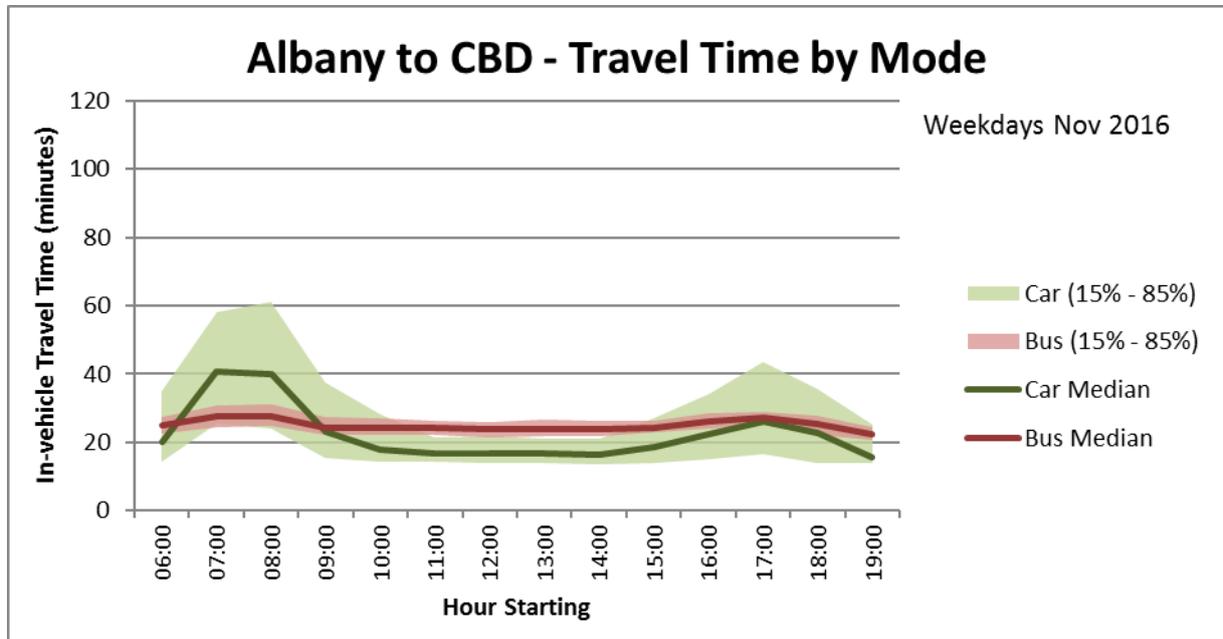
Travel Speed

This indicator shows median travel speed across the network. The free flow speed has also been provided as a comparative.



Travel Time on key routes

The variability of travel time by time of the day is important to the public. It is easier for people to relate their travel experience by providing key origin-destinations travel time information by different modes. This information becomes useful for travel demand management and travel behaviour initiatives.

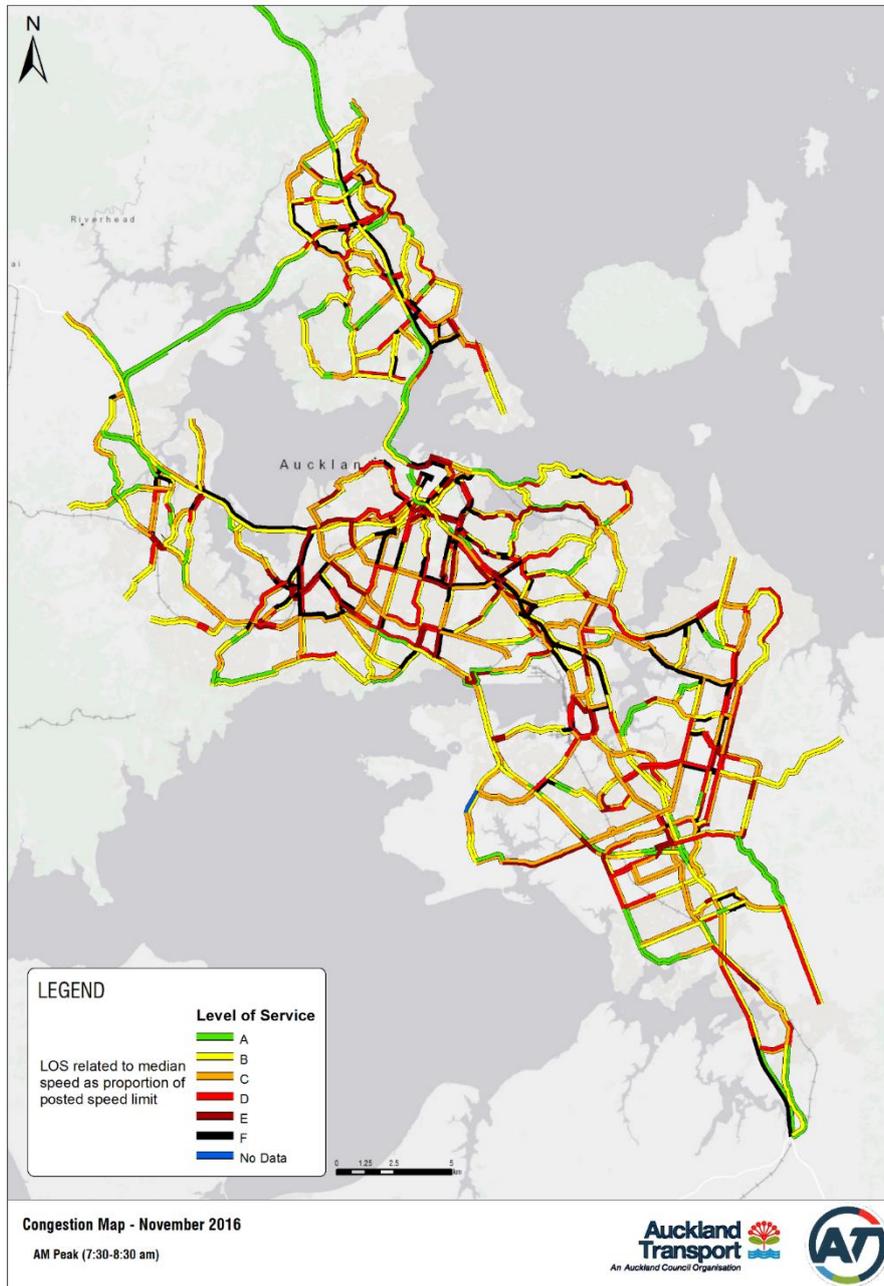
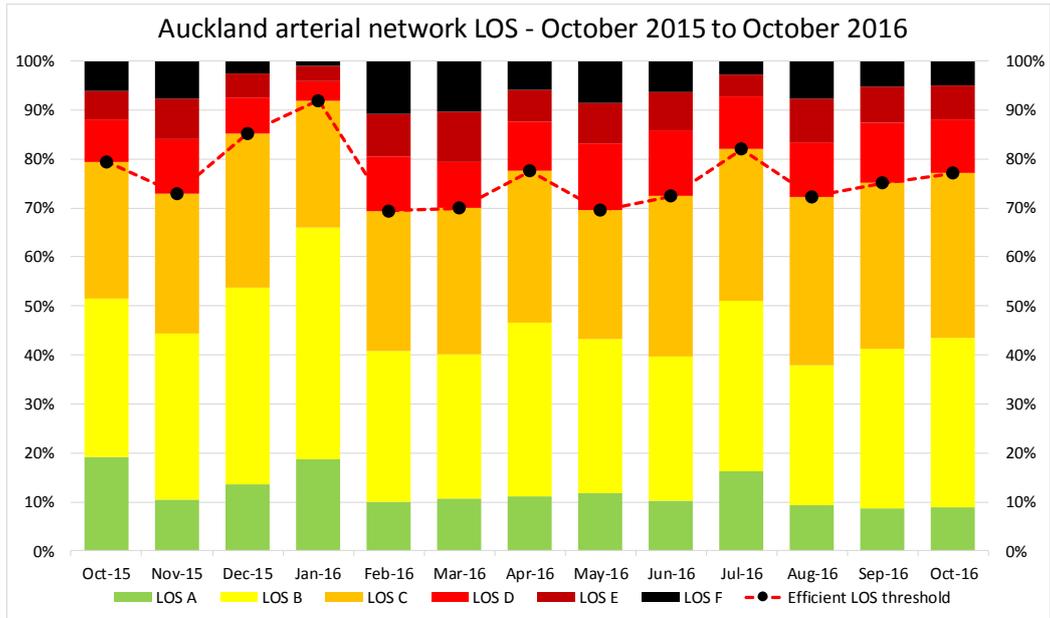


Congestion/Level of Service

Level of Service is measured by median speed as a percentage of the posted speed and categorised as follows:

- A: 90% and greater
- B: 70 – 90%
- C: 50 – 70%
- D: 40 – 50%
- E: 30 – 40%
- F: Less than 30%

Auckland Transport have defined congestion as when the median speed is less than 50% of the posted speed (LOS D-F). We can then monitor the percentage of the network that is congested as a single indicator and map the network segment by segment geospatially.



Delay (relative to free flow)

This indicator is measured as how much additional time is needed relative to free flow condition.

The formula is

$$Delay (\%) = \frac{TT_{median} - TT_{free\ flow}}{TT_{free\ flow}}$$

For example, if Delay is 100% for the morning peak, a trip that takes 20 minutes during free flow condition would be expected to take on additional 20 minutes during the morning peak i.e. 40 minutes

Reliability (relative to peak travel)

This indicator is similar to Delay but refers to the additional time needed relative to typical peak trip. Different organisations use slightly different statistics/percentile based on the nature of travel time information collected. In Auckland Transport, we interrogated our GPS data source and we are comfortable to use 85th percentile travel time (TT) to represent the “extreme” travel time. Thus, our reliability formula is

$$Reliability (\%) = \frac{TT_{85th} - TT_{median}}{TT_{median}}$$

For example, if Reliability is 50% during the morning peak, it means that for a typical morning peak journey of 40 minutes, a motorist would need to allow an additional 20 minutes, for a total of 60 minutes to be 85% certain of arriving on time.

People Productivity

Corridor productivity for peak periods is a measure of the efficiency of the corridor. Whilst the AUSTROADS definition relates to vehicle movement efficiency, Auckland Transport have extended this definition to relate to people movement efficiency. This is therefore an important measure of the efficiency of the corridor in moving people during the commuting peaks. It is measured as the product of the number of people and journey speed compared to the AUSTROADS corridor people movement capacity.

$$People\ Productivity (\%) = \frac{Speed \times People}{Corridor\ Capacity\ in\ People\ Movement}$$

A high people productivity is achieved if we can move more people at higher speed. These people can be in private cars or on bus or transit lanes. Typically, bus and transit lanes move more people at higher speed and therefore provide higher People Productivity. T2, T3 transit lane and bus lane are examples how we can maximise the people movement without widening the exist corridor infrastructure.

OPERATIONAL DEFICIENCY ANALYSIS

Through our business as usual network performance reporting, we are able to identify projects through deficiency assessments such as

- Identify bus and transit lane locations
- Route optimisation programme
- Network improvement programme

CONCLUSIONS

The Auckland Transport has reviewed the key transport indicators and continue tracking those indicators to build network optimisation and resilience.