UTILISATION OF THE KERBSIDE THROUGH-LANE AT SIGNALISED INTERSECTIONS

Randhir Karma, GHD

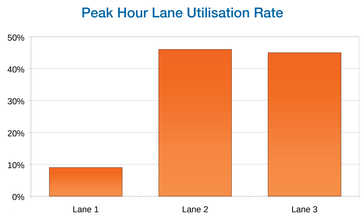
Rob Douglas-Jones, GHD

Marisha Jaglal, GHD

What is lane under-utilisation?

Lane under-utilisation is the unequal distribution of traffic travelling in the same direction within available traffic lanes of a particular intersection approach.

It is common in the urban environment where many intersections have short lanes, resulting in significant effects on intersection capacity.



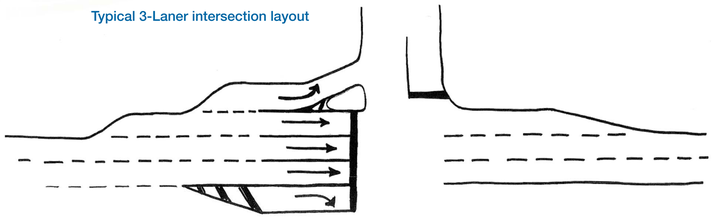
Under-utilisation reduces efficiency

Lane under-utilisation has significant effects on intersection capacity, which has consequences for congestion. Little research has been undertaken in New Zealand and Australia on this topic. In ideal circumstances the rate of use of each lane would be equal, therefore being 50% in the 2-Laner scenario and 33% for 3-Laners.

Many practitioners may not be fully aware of the causes and effects of lane under-utilisation. Improving lane utilisation at intersections would contribute to reducing overall levels of congestion and vehicle emissions into the environment.

The type of lane configuration used at signalised intersections is possibly the main reason why lanes are utilised differently by drivers. This study focuses on the implications of providing short auxiliary lanes at signalised intersections.

Typical 3-Laner intersection layout

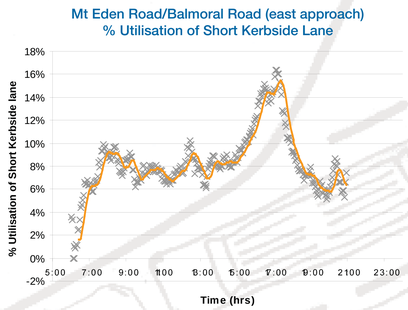


Many factors influence lane utilisation

The four main factors are:

- Auxiliary Lane length
- Lane Blockage
- Shared Lanes
- Side Friction

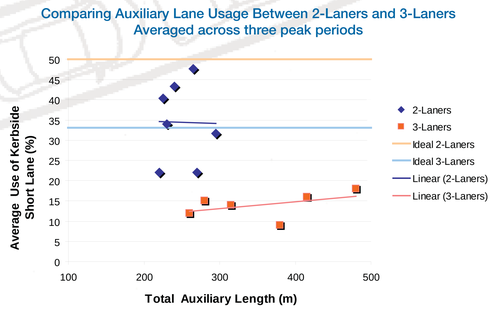
Lane utilisation varies with demand



To gain a better understanding of the influence of traffic demand on usage of the auxiliary lane, the variation of lane utilisation throughout the day was investigated.

Lane utilisation of the auxiliary lane increased during the tidal peak period, i.e. when traffic demand is higher.

3-Laners are utilised less than 2-Laners



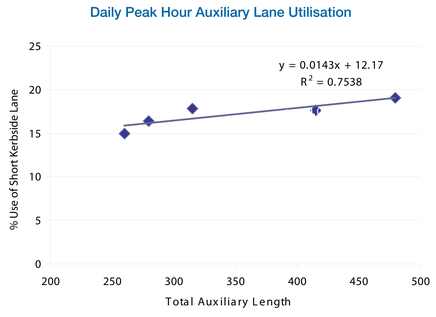
2-Laners and 3-Laners display different operational characteristics with differing lane utilisation effects.

The results showed that for 2-Laners lane under-utilisation is less of a problem, but they tend to display more variable rates of use. Therefore there is greater value in researching the high volume 3-Laner intersections.

For 3-Laners, a positive relationship between utilisation and total length of the auxiliary lane is typical.

For a true like-for-like comparison between the performance of various approaches the peak hour rates were compared.

This scatter plot shows the utilisation of the auxiliary lane against the total auxiliary length for the tidal peak period only. A positive relationship resulted from this small sample, but it is not a strong one.



References

AKCELIK, R. (1995), Traffic Signals: capacity and timing analysis, Australian Roads Research Board, Research Report ARR123, 6th Report.

ROYCE, B., JURISICH, I. and DUNN, R.C.M. (2006), Through-lane use at traffic signals, Land Transport New Zealand Research Report No. 297.

SIDRA INTERSECTION 4.0 (2009), Akcelik & Associates Pty Ltd. and the user manual.

Conclusions

- We found each approach had differing peaks (because of tidal flow) and therefore we compared the busiest time of the day for each
- Lane utilisation rates are not strongly related to lane length
- SIDRA Intersection significantly over-estimates utilisation rates for auxiliary lanes

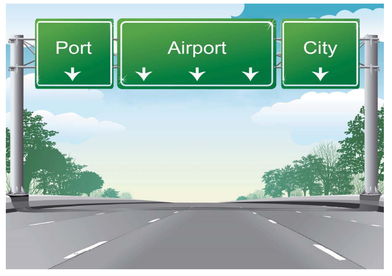
Recommendations

Four low cost alternative / improvement treatments have been suggested as part of this Study and are closely aligned with the NZTA's principles of employing cost effective measures to improve network operation. The four treatments are as follows:

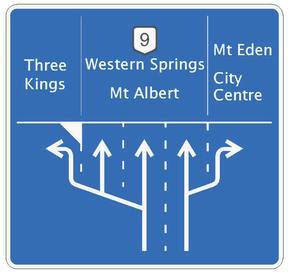
- Auxiliary lane on the right
- Advanced lane designation signage and road marking
- Converting auxiliary lanes into bus or HOV lanes
- Phasing and cycle time changes

Alternative treatments should be trialed to determine how effective they are in improving the use of auxiliary lanes. The objective of the trial would be to identify measures that result in a more even distribution of lane utilisation, and therefore more efficient intersection operation.

Example Overhead Lane Designation Signage



Example Advanced Lane Designation Sign



The number of sites with short though-lanes in NZ is limited, and the sample size used in studies to date is less than satisfactory. It is therefore recommended to include sites from Australia and work towards developing a prediction model that can be used for assessing the operation of proposed intersection improvements.

Acknowledgements

Auckland City Council

Associate Professor Roger C.M. Dunn of the Department of Civil and Environmental Engineering, University of Auckland

Ivan Jurisich, Traffic Engineering Solutions Ltd.

Ian Constable, Traffic Solutions Ltd.