Data exploration and visualisation of crash risk at Perth Metropolitan Intersections

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Abstract

An issue facing all road agencies is ensuring lives saved per dollars invested are maximised. This is particularly challenging at metropolitan intersections, where strategic investment choices range between a small number of targeted high-cost treatments and a large number low-cost treatments applied across all metropolitan intersections that share similar characteristics.

In order to investigate the above, data exploration and analytics were used to provide insights into the viability of alternative treatment programs. Data visualisation was used to help communicate the data story, which improved understanding and acceptance by our stakeholders and decision makers.

Background

Over 16,500 people were injured as a result of crashes at Perth metropolitan intersections over the past 5 years (2013-2017), resulting in almost $3 billion dollars in associated injury costs. Nearly 50% of all casualty crashes in Western Australia occurred at metropolitan intersections. Main Roads Western Australia receives on average $5million per annum to invest at high-risk intersections in the Perth metropolitan region. Heretofore this has been focused on intersections with the highest numbers of killed or serious injury crashes. This has generally resulted in treating one or two intersections per year as the only viable treatment for these intersections is often major capital works (e.g. grade separation). However, is this the best approach to maximise lives saved? Could we treat more intersections with lower cost treatments and save more lives per dollars invested?

Method

A common issue that faces all agencies is ensuring data is clean and formatted in such a way to enable exploration and analytics which can result in meaningful insights. Main Roads stores data on all crashes that occur on the WA road network and inventory data on all state assets and some information on local government assets. Through extensive consultation with subject matter experts, information held by these individuals was transformed into usable data. System data (i.e. crash and inventory) and information obtained from subject matter experts was combined to result in a comprehensive set of data tables that was ready for exploration and analysis.

Our approach to developing a low cost treatment program had to be data driven due to the complexity of assessing and applying treatments to intersections on a large scale. We developed a data model that mapped the relationship between crashes at intersections, treatment eligibility at specific intersections and the estimated crash reduction effect of these treatments. We used a data visualisation tool, namely Power BI, to enable the presentation of the data model to stakeholders.

We presented this data visualisation at stakeholder workshops with a focus on demonstrating 1) crash problems at intersections, 2) the performance of the existing funding program and 3) the cost and safety benefits of different low cost treatments options across the Metropolitan network. In this way, we were able to enhance understanding and acceptance from important stakeholders early on, and throughout the process.

Conclusion

Maximising lives saved for dollars spent is an important issue that faces all road agencies, which is becoming increasingly more important with limited funds and competing priorities. Therefore, ensuring that available data is prepared in a suitable manner to allow for data exploration and the teasing out of insights is an important yet often overlooked step in using data for decision making. Furthermore, being able to visualise and present data to stakeholders and decision makers is an important step to ensuring their understanding and ultimately their approval of any new targeted programming.