Implications of Traffic Sign Recognition Systems for Road Operators

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Abstract

Achieving a zero fatality vision will require innovative new approaches such as adoption of vehicle systems that warn, aid and ultimately replace the driver. Vehicles are now available with machine-vision based systems which can read and interpret traffic signs. However, machine-vision systems require 'readable' infrastructure. Austroads engaged ARUP to consider the implications of traffic sign recognition systems on road operations, including their design, maintenance and configuration at the road side. Based on literature reviews, on-road and off-road evaluations and stakeholder interviews, we have determined that road side infrastructure changes will be required to make Australia's signs more readable.

Background

Global research from has shown that speed assistance can significantly reduce travel speeds and therefore crashes. Research undertaken in the United Kingdom (Carsten and Tate, 2005) shows that speed assistance systems can reduce fatal and serious injury crashes by between 10 and 36 per cent depending on the level of control exerted on the vehicle and driver.

Early deployments of traffic sign recognition systems in Australia caused the vehicle industry to report issues with readability with LED variable speed limit signs, vehicle mounted signs, location of signs at the road-side, maintenance of signs and text qualification on speed signs. In some cases, vehicle manufacturers have chosen to disable traffic sign recognition systems when imported into the Australian market. This project seeks to validate and understand those issues in order to provide advice for changes to Australia's traffic signing regimes.

Method

To better understand readability of signage, the project undertook evaluations of traffic signage, through on-road and off-road testing of a range of modern traffic sign recognition equipped vehicles and a range of road environments (*Table 1).*

Table 1. On-road and off-road trial evaluations

Trial	**Vehicles involved**
Australian Automotive Research Centre test track	Holden (prototype vehicle) Ford (prototype vehicle) BMW (5-Series) Volvo (XC60) Mazda (6)
Melbourne on-road	BMW (5-Series)

	Volvo (XC90 and XC60) Mazda (6)
Sydney on-road	BMW (X3) Volvo (V40)
Auckland on-road	BMW (X3) Volvo (XC60) Mazda (CX-5)

Recording data from the trials utilised vehicle cameras and in vehicle observations which was both quantitative and qualitative. As a part of each test use case a video camera was placed on the front windscreen to provide a view of the roadway. A second synchronised video camera was positioned so that it focused on the instrument panel where TSR responses are displayed. (*Figure 1)*. The role of the observer was to note down discrepancies as a cross reference to the video or any additional observations that enhanced the findings of the study, such as commentary from the driver.

Figure 1: Example data capture system for traffic sign recognition systems

Results

Analysis of data capture was performed to record differences between vehicle traffic sign recognition expected responses and the actual response of the systems. Responses were aggregated across the traffic sign use-cases, and vehicles involved in the study. Sign readability issues identified included:

- Text variations such as time of day, vehicle base, weather or notes to end a speed zone were not readable

- LED variable speed limit signs could not be consistently read depending on their design
- Traffic signing locations on side-roads and off-ramps were often placed within a camera system's viewing range
- Vehicle mounted signs were inadvertently read by camera systems when they had not been activated.

Conclusion

This study has validated concerns with traffic sign recognition readability of Australia's speed signing approach through on-road and off-road testing of current vehicle technology. The study, once finalized (August 2018), will produce recommendations for consideration for changes to be considered in future drafting of AS1742 – Traffic Signs, and Austroads Guide to Traffic Management.

References

Carsten, O.M.J. & Tate F.N. (2005). Intelligent speed adaptation: accident savings and cost–benefit analysis. In: Accident Analysis & Prevention, vol. 37, nr. 3, p. 407-416.