Safety benefits of connected and automated driving technologies in Australia and New Zealand

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Abstract

Two rapidly developing technology areas, Cooperative Intelligent Transport Systems (C-ITS) and Automated Driving (AD) applications, are likely to have a substantial impact on road trauma through assisting drivers with the driving task and providing enhanced crash avoidance capabilities. This study aimed to identify emerging C-ITS and AD applications and assess their potential safety benefits for Australia and New Zealand.

Using an analysis of a sample of Australian serious injury real-world crashes, expert estimates were made of the potential effectiveness of several light passenger vehicle applications in preventing each crash. Following this, the outcomes from the crash sample were scaled using aggregate serious injury crash data to project annual savings across Australia and New Zealand.

Study Aims and Method

This study aimed to identify emerging C-ITS and AD applications and assess the safety benefits of a selection of those judged to have the greatest potential for Australia and New Zealand. A review of the literature was conducted and a range of C-ITS and AD research and policy experts contacted for information about recent research activities, their thoughts on the likely deployment timelines and the key challenges to widespread adoption. Based on the literature review, four C-ITS and two AD applications were selected, with the potential to address major road trauma problems including carriageway departure crashes and intersection crashes, as well as being feasible for deployment in the Australasian vehicle market.

A sample of real-world crashes from the ANCIS database (Logan et al, 2006) was extracted and the relevant technology retrospectively applied to each. Based on comprehensive information from a driver interview, vehicle and crash site inspections, expert judgement was used to assign a combined likelihood of successful technology triggering, driver intervention and avoidance of the crash, as appropriate. It was assumed that all participating vehicles were equipped with the necessary in-vehicle and supporting technology.

The final stage of the project was to extrapolate the individual crash benefits to the current Australian and New Zealand serious injury pool, to estimate the annual benefits of each application if fitted to all light passenger vehicles.

Findings – Cooperative ITS applications

The analysis of Australian real-world crash types demonstrated the following reductions in targeted crash types, and serious injuries based on four C-ITS applications:

C-ITS Application	Type	Crash types	Reduction in targeted crash type	Projected annual savings in FSI crashes (Australia)	Projected annual savings in FSI crashes (NZ)
Cooperative Forward Collision Warning	V2V	Same direction	20-30%	515-805	15-25
Curve Speed Warning	V2I	Run-off-road, head-on	20-30%	75-115	10-20
Intersection Movement Assist	V2V	Adjacent direction	35-50%	940-1470	70-110
Right Turn Assist	V2V	Right turn against	25-40%	525-825	25-55

A range of limitations for C-ITS were identified, primarily related to the level of digital infrastructure required for them to operate as predicted, along with potential security and privacy concerns. It was also noted that C-ITS applications only provide driver alerts or warnings at this stage, requiring a driver to intervene.

Findings – Automated driving applications

Automated driving applications perform one or more aspects of vehicle control without driver intervention and are expected to confer significant safety benefits (Kockelman et al, 2016).

The analysis of Australian real-world crash types demonstrated the following reductions in targeted crash types, and serious injuries based on two key automated driving applications:

Automated Driving Application	Crash types	Reduction in targeted crash type	Projected annual savings in FSI crashes (Australia)	Projected annual savings in FSI crashes (NZ)
Lane Keeping Assist	Run-off-road, head-on	25-40%	1415-2210	160-245
Auto Emergency Braking	Same direction	35-50%	1195-1865	35-55

Discussion/conclusions

This study undertook a detailed analysis of several key C-ITS and automated driving technologies, using an expert analysis of real-world crash outcomes to estimate the benefits at a per-crash level, then extrapolating these results to the entire light vehicle fleet.

For the warning-only connected vehicle technologies, Intersection Movement Assist was estimated to be the most effective, preventing up to half the serious injuries among its targeted crash type of adjacent direction crashes at intersections. Right Turn Assist was estimated to prevent between 25% and 40% of serious crashes, while Cooperative Forward Collision Warning could allow drivers to avoid 20-30% of same direction crashes.

Of the AD applications, Automated Emergency Braking (AEB) was estimated to eliminate approximately 45-70% of same direction serious injuries and active Lane Keep Assist (LKA) around 25-40%.

Among the whole light vehicle fleet, LKA was predicted to reduce annual fatal and serious injury crashes by 1560-2450 annually throughout Australia and New Zealand, with AEB following with 1240-1900 same direction FSI crashes annually. Of the connected vehicle warning technologies, IMA showed the potential to eliminate 1020-1560 FSI crashes.

References

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