Ipswich Connected Vehicle Pilot

The Ipswich Connected Vehicle Pilot (ICVP), testing Cooperative Intelligent Transport System (C-ITS) technologies, produced positive safety results, positive user experience and positive perceptions of the technology.

C-ITS technology, also known as connected vehicle technology, allows vehicles to 'talk' with other vehicles, roadside infrastructure, and transport management systems in real-time. On a dedicated in-vehicle display, drivers would receive visual and audible warnings relevant to their current on-road situation.

The *Queensland Road Safety Strategy 2022–31* includes leveraging new technologies and data, such as C-ITS road infrastructure, to set Queensland on the path to achieving a vision zero serious road trauma by 2050.

Between September 2020 and September 2021, 355 public participants drove their own vehicles retrofitted with connected vehicle technology that could display relevant warnings (see Figure 1). Their driving data was then used to estimate the crash reduction benefit of implementing C-ITS.

A simulator was also used to capture driving data for vehicle-to-vehicle (V2V) warnings, where the interaction of two connected vehicles could be guaranteed.

Subjective evaluation

The user perceptions study was led by research partner, Centre for Accident Research and Road Safety – Queensland (CARRS-Q), a part of the Queensland University of Technology (QUT). Participant user perceptions were captured using questionnaires, interviews and focus groups.

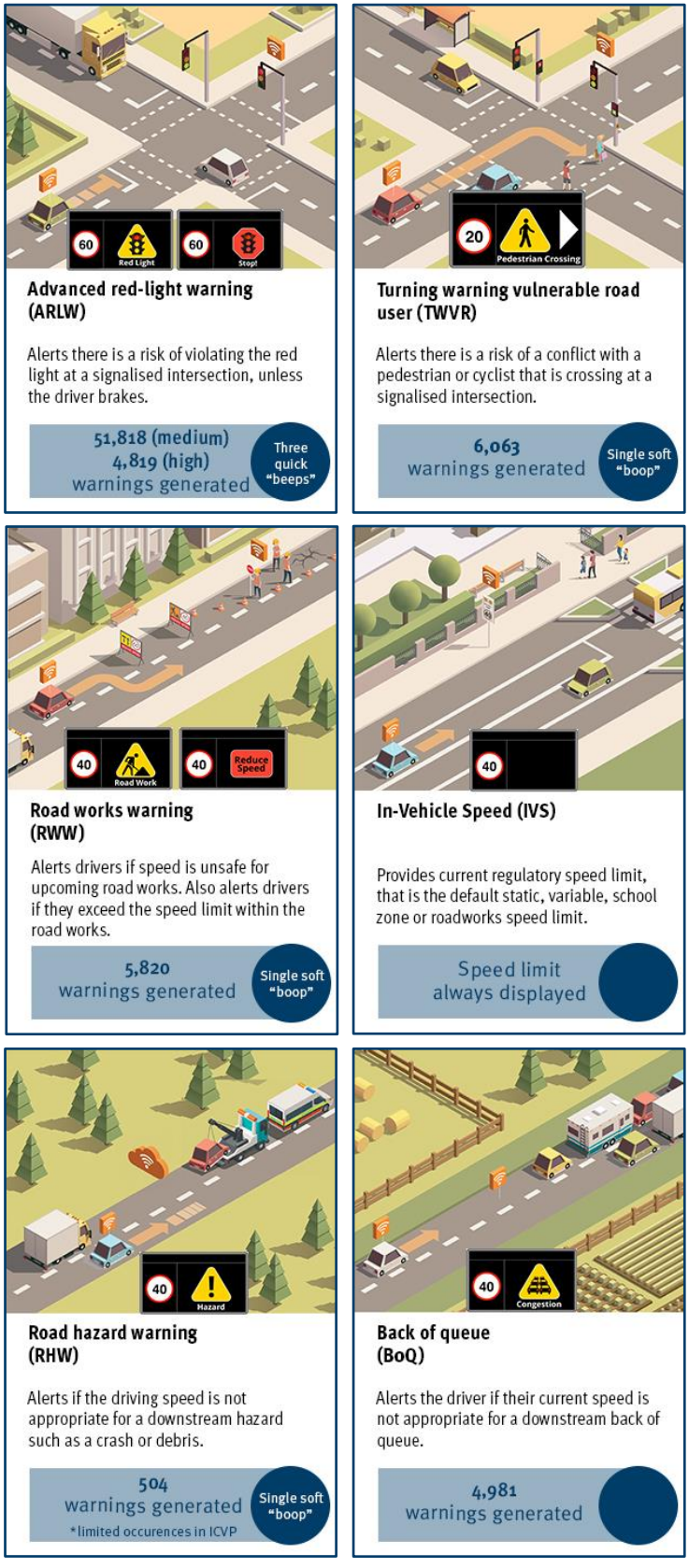
Overall, the user perceptions study found that participants believed the system helped make them more aware of the outside driving environment and that the system prompted them to drive more safely.

> One participant reported that the red-light warning, and particularly the alert tone, had prevented them from running a red light while driving fatigued.

Participants rated in-vehicle speed (IVS) as the most useful. Also rated road works warning and back of queue warnings useful for greater awareness.

The participants had positive expectations of connected vehicle technology prior to the equipment being installed in their vehicle and their expectations remained positive throughout participation.

Figure 1: Use cases



Noting that the evaluation needed to keep the pilot experience consistent across the pilot period and between users, suggestions from participants included - improved warning timing and accuracy, customising warnings, personalised driving feedback, and integrating the functionality into the vehicle.

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Simulator study

As the likelihood of V2V interactions within the ICVP was unlikely to generate sufficient on-road events to meet the requirements for the safety evaluation, the V2V scenarios, Slow/ Stopped Vehicle (SSV) and Emergency Electronic Brake Light (EEBL), were evaluated in a controlled simulator at CARRS-Q involving new participants outside of the on-road ICVP. These participants experienced the six on-road ICVP scenarios and the two V2V scenarios within the simulator via which both subjective data, through questionnaires, and objective driving data were captured.

Slow/stopped Vehicle (SSV)

Alerts the driver there is a risk of a rear-end collision with a slow/ stopped vehicle ahead.

A total of 43 participants completed the driving simulation.

Emergency Electrotonic Brake Light (EEBL)

Alerts the driver there is a risk of a rear-end collision with a vehicle braking hard ahead.

A total of 47 participants completed the driving simulation.

Overall, findings across the two simulator studies suggested that participants reduced their speed when presented with a warning in an emergency and were positive towards connected vehicle technology.

Usefulness ratings

Participants' rating of the usefulness of each use case also remained high throughout the ICVP and simulator studies. The mean-rated usefulness of the warnings (on a scale of 0–100) from the final questionnaire for each scenario, including the simulator scenarios, are shown below.

Advanced red-light warning	Turning warning vulnerable road user	Road works warning	In-vehicle speed information
72	68	77	90

Road hazard warning	Back of Queue warning	Slow/ stopped vehicle (simulator)	Emergency electronic brake light (simulator)
77	77	81	82

Safety evaluation

The driving data were analysed with and without warnings presented to the drivers, to determine the impacts of receiving these warnings on the driver's behaviour. The safety evaluation confirmed connected vehicle technology has the potential to improve driver behaviour, positively impacting road safety. Overall, the participants driving behaviour improved – with slower speeds and smoother driving observed after a warning was issued.

49,000 hours of driving, covering 2.7 million kilometres. Over 90,000 warnings were issued to participants, with red-light warnings being the most frequently displayed.

Speed reduction was consistent when the road works warnings were presented, meaning participants were more compliant with posted speed limits in road works zones.

Participants were less likely to run a red traffic light after receiving the red-light warning. The occurrences of red-light running were compared amongst the participants with and without the warnings being available pointing to a 22 per cent reduction when the warning was enabled.

The observed improvement in driving behaviour is expected to reduce the number of road crashes when the system becomes more readily available in future.

From the pilot and simulator study, these use-cases collectively have the **potential to reduce crashes by up to 20 per cent** when cooperative intelligent transport systems cover 100% of the road network.

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