

## **Hold the Red: innovative technology reducing the risk of crashes at signalized intersections**

Connor Broe <sup>a</sup>, Warren Anderson <sup>a</sup>, Peter Kolesnik <sup>a</sup>, Allan Hales <sup>b</sup>

<sup>a</sup>Department of Transport and Main Roads, <sup>b</sup> Queensland Police Service

### **Abstract**

Crashes at signalised intersections caused by motorists disobeying red light signals carry elevated risks of serious injury or fatalities. In an Australian first, the Department of Transport and Main Roads and the Queensland Police Service are conducting a trial of innovative crash-avoidance radar-based technology at several intersections across Queensland which monitors vehicle speeds approaching an intersection, predicts when a vehicle will run a red light and then extends the opposing red lights to prevent vehicles and pedestrians from entering the intersection, lowering the chance of a crash while still issuing infringement notices to the offender.

### **Background**

In Queensland, there are approximately 1,700 signalised intersections. Crashes at signalised intersections caused by motorists disobeying red light signals are especially dangerous as they frequently lead to adjacent direction or T-bone crashes at high speeds with high severity outcomes. From 1 January 2013 to 31 December 2017, crashes at intersections with operating traffic lights were responsible for 11.5% of all serious casualties in Queensland (n=3,887).<sup>1</sup> These casualties were estimated to have cost Queensland approximately \$2.35 billion over the five-year period.<sup>2</sup>

The majority of red-light running occurs in the first few seconds after the light has switched to red as drivers are either inattentive or erroneously believe they have enough time to cross before the red. To allow for late entrants to clear the intersection, signalised intersections are programmed with an 'all- red' phase during which all the lights are red, which typically lasts for 2-3 seconds.

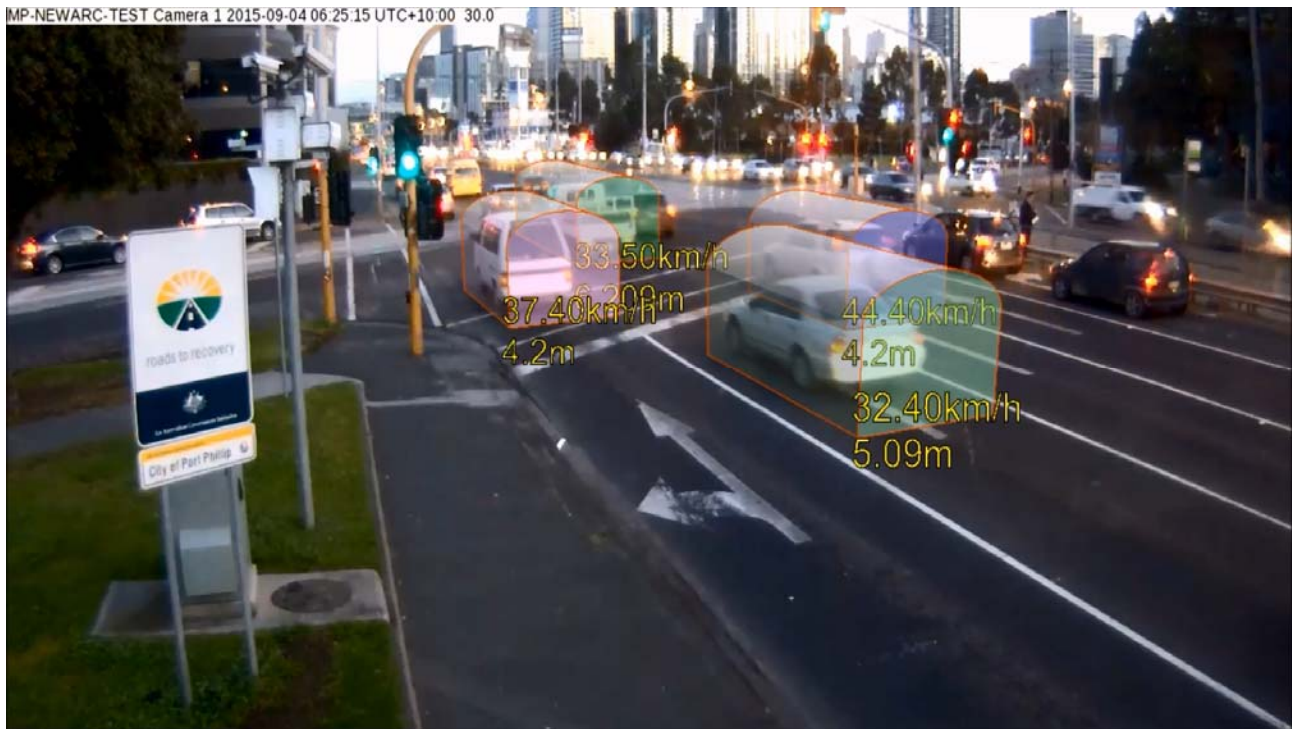
### **Hold the Red technology**

Hold the Red (HTR) is an intelligent crash avoidance system that is installed into the Traffic Controller Cabinet at signalised intersections using a virtual loop card. The system uses radar to track each vehicle approaching an intersection up to 150m from the stop bar. This range provides the advantage of using radar over other alternatives such as existing induction loops as the radar system can dynamically track the speed of vehicles and predict when a vehicle approaching an intersection will not be able to stop in time. When such a vehicle is detected, HTR instructs the signal controls to extend the all-red phase by an extra 2 seconds. Law-abiding drivers in cross traffic lanes do not enter the intersection, reducing the chances they'll enter into a potentially hazardous situation. When Speed or Red Light Cameras are operating at the intersection an infringement notice can also be issued to offenders, reinforcing behaviour change while minimising the risk of serious casualties.

---

<sup>1</sup> Serious casualties = fatalities or hospitalisations as a result of a crash.

<sup>2</sup> Calculated using Transport and Infrastructure Council Willingness To Pay values in 2017 dollars value.



*Figure 1. Hold the Red camera view with speed overlay*

## Queensland Trial

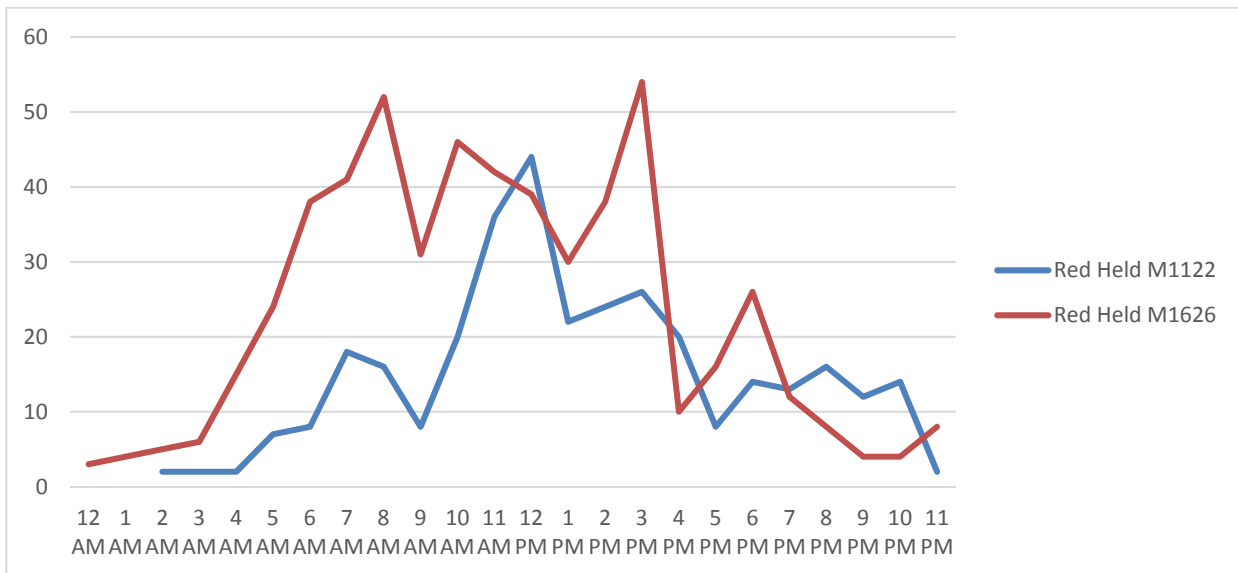
TMR and QPS officers created the HTR project as a joint submission for the TMR Director-General's Innovation Challenge, known as the 'TMR Hack'. In Queensland, HTR is currently being trialled at four intersections. The four sites were chosen from the list of intersections selected for installation of Combined Red Light/Speed (CRLS) cameras in 2018. This list comprised sites with the most significant crash history related to red light running over the preceding five years. Combining the installation of Hold The Red with the CRLS cameras allowed for minimisation of roadworks disruption at the sites. Site assessments were carried out to ensure that HTR technology would be suitable for the configuration of each site. Installation at the four trial sites was carried out between August and October 2018.



**Figure 2. Labelled diagram of Hold the Red system in Ashmore, Queensland**

The system had activated (extended the all-red phase) 6325 times across the four sites as at 26 May 2019. The highest number of activations on one day at one site was 37 on 21 November 2018.

Detailed trigger information was available and analysed for one month (October 2018). Two sites were excluded due to data irregularities and technical issues. Initial evaluation of this data showed that the system was activated most often between 11AM and 1PM. There are also noticeable decreases around 9AM and 5AM. This behaviour is closely linked to vehicle volume on the road. The proportion of activated cycles to all cycles varied from 1:101 to 1:140. This demonstrates that red light running continues to be a problem at these intersections.



**Figure 3. Number of Hold the Red activations by hour of day during October**

While these initial numbers are promising and demonstrate the potential of HTR, it is still a work in progress. Not every activation is necessarily accompanied by an event of red light running as the prediction algorithms are fine-tuned. However, the aim of HTR is to prevent crashes at intersections, not to reduce or punish instances of red light running.

To analyse the performance of HTR, CARRS-Q was selected via a procurement process to conduct the independent evaluation of HTR performance. The objectives of the evaluation are to determine if HTR is performing as intended, and to determine the impact HTR has had on safety and traffic flow at the trial intersections. The evaluation is intended to produce an initial report in June 2019, followed by a final report in December 2019. The report will be comprised of:

- Review of the performance of the HTR system, including analysis of the trigger point of the system, in particular any failures to trigger (vehicle continues through red light without opposite red being extended) as well as any false triggers (HTR triggered without any vehicle continuing through the red light).
- Review of road safety benefits of HTR during the trial period.
- Analysis of potential unintended consequences of HTR, for example, disrupted/increased traffic at sites or potential increase in red light running.
- Development of recommendations for future HTR implementation.
- Review of scientific and grey literature regarding HTR systems worldwide.

Results of the initial report will be included in the presentation at Adelaide.

Future plans for Hold the Red include installation at intersections of different types, including at sites without a CRLS Camera, and at sites with existing CRLS cameras (instead of concurrent installation of CRLS and HTR).