Toward Automated Enforcement at Active Level Crossings in Australia

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Abstract

Collisions at active level crossings are a growing concern and largely arise from violations. The rail industry is exploring automated enforcement to target these violations. The aim of the study was to obtain a baseline measurement of violations at level crossings. A level crossing was selected for a two-day observation and the installation of monitoring equipment for 1.5 months. Over 1,000 violations were recorded. The monitoring system was installed unobtrusively, but in spite of this, the frequency of violations was disproportionally lower than during the in-situ observations, suggesting the need to consider Australian specificities during the configuration of such equipment to obtain accurate measurements of these violations.

Introduction

In Australia, most railway level crossings in high-traffic road environments are actively protected. Despite this, collisions at these crossings account for two thirds of the costs of collisions at all level crossings. Many of these collisions arise from deliberate violations at level crossings with full protection, and are favoured by congested road conditions. Violations are committed by all road users at level crossings, and include entering the level crossing while active, and stopping on the crossing due to road congestion; all leading to risk of collision with approaching trains.

Australia has trialled and researched many initiatives to increase drivers' awareness of level crossings, and reduce chances of inadvertently ignoring warning infrastructure. However, these approaches do not target deliberate violations and are unlikely to engender lasting change in substantive driver behaviour, and new interventions are necessary. The current road safety strategy is to use the Safe System approach with the aim to build a road transport system that is tolerant to human errors. In this paradigm, road users still have a responsibility to obey road rules. Enforcement is therefore a constitutive part of this strategy to reduce unsafe road behaviours as well as highlight their social unacceptability.

The rail industry is therefore exploring the use of automated enforcement at level crossings to target deliberate violations, largely because it has been shown to be very effective for other road user violations such as speeding. However, very little research has evaluated the potential benefits of such an approach for rail level crossings or provided a sound scientific evidence-base for its utility within Australia.

Method

The aim of the study was to obtain a baseline measurement of violations at level crossings and the purpose of this study is to create a scientific evidence-base to reflect the size of the problem and describe some of the pertinent issues associated with obtaining this. A level crossing close to Melbourne was selected as a study site based on reported congestion issues and reported high violations incidence (see Figure 1). Monitoring equipment (cameras and radar) was installed in an unobtrusive manner for 1.5 months to obtain a baseline dataset of driver violations. A two-day observation study was conducted at the site prior to the installation in order to evaluate the reliability of these data.

Figure 1. Pictures of the level crossing at Aviation road, Laverton, and bird's eye view with researchers' (yellow circle) and equipment (white cross) positions highlighted

Results

The monitoring equipment showed that the level crossing was closed for 75% of the time during peak hours, leading to chronic road congestion issues, long waiting times and high likelihood of transgressions by all types of road users. Over a month and a half the monitoring equipment recorded a total of 626 flashing light violations; 331 of these all occurred within 2s of the activation of the lights at the crossing, and 295 occurred later than 2s after the activation of the crossing. This was an average of 13.3 flashing light violations per day. A further 241 drivers left the crossing before the flashing lights were fully turned off, and 148 drivers encroached over the Stop line while the lights were flashing. The violations observed over the two-day in-situ observations are the following: 16 flashing light violations were observed within 2s of crossing activation, and 29 occurred later than 2s after crossing activation. One cyclist was observed going around the lowered boom gates; 34 drivers left the crossing before it was completely re-opened; 170 vehicles stopped on the crossing, and 145 vehicles stopped on yellow box marking. After normalisation (per hour) of the violations recorded, we found that the number of violations recorded by the monitoring equipment was consistently smaller than the number recorded during the in-situ observations.

Discussion and conclusions

The chosen level crossing was very challenging for testing a monitoring technology, with high level of road, rail and pedestrian traffic, multiple road lanes in each direction, three rail tracks and roundabout on either side of the crossing. The design of the crossing environment led to a large range of violations from all road users. A disproportionately higher number of violations were captured during the observation study. Further observations at the site suggest that this is due to limitations from the monitoring equipment configuration rather than driver behavioural change. Level crossings are a very dynamic intersection between the road and rail networks, with numerous and complex interactions between trains, road vehicles and pedestrians during peak hours. This research shows the need to have a broader understanding of the complex situations at level crossings in order to obtain accurate baseline behaviour measurements with automated monitoring systems, and that technical solutions need to take into account these specificities. Having obtained data in an non-obtrusive manner, the next phase of this project was to install similar equipment in a more conspicuous mode to evaluate the propensity to reduce violations with visible driver behaviour monitoring at that level crossing. The overall research provides an insight into how effective is the use of automated enforcement for reducing level crossing crashes.