Driver Behaviour at Level Crossings: Too Fast Approach Speeds and Too Fast Decisions?

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Abstract

Collisions at level crossings are a concern worldwide, but the contributing factors for such collisions are not well understood. The aim of the study was to further investigate driver behaviour at level crossings, during day and night-time driving. A 50-minute rural route was driven by 27 participants; GPS position and speed of the vehicle were recorded. Drivers approached level crossings without boom gates significantly faster than road intersections, resulting in more abrupt braking. Drivers spent a lot less time assessing the situation as compared to road intersections without traffic. Drivers slightly reduced their travelling speed under night-time conditions.

Background

There are 22 collisions per year between trains and motor vehicles on public railway crossings in New Zealand (Ministry of Transport, 2017; trackSAFE Foundation NZ, 2017). These collisions can occur at crossings with all types of protection. While most collisions occur during the daytime in good conditions, many occur at night, with the motorist driving into the side of the train (trackSAFE Foundation NZ, 2017). No studies have investigated the effect of night-time on driver behaviour at a variety of level crossings.

Method

Twenty-seven participants (M_{age}=42.7±13 years; 14 females) were recruited to drive a 50-minute rural route around Marton, New Zealand. Eleven of the participants also drove the same route at night in a counterbalanced order.

The position and speed of the vehicle was recorded every second by the GPS of a smartphone. The measures considered for analysis were the approach speed profile, the stopping rate and the amount of time stopped to make the decision regarding whether to enter the crossing/intersection. These measures were extracted for a passive level crossing with a stop sign, two active crossings with flashing lights (one with boom barriers), and a cross-roads intersection with a stop sign.

Statistical analyses were conducted with Generalised Linear/Additive Mixed Models to consider the repeated measures design of this study.

Results

Drivers slowed down for all crossings and intersections. However, drivers prepared to stop for the road intersection earlier than for the passive crossing (75m/30m to the intersection/crossing). Drivers also slowed down quite abruptly before the active crossings with flashing lights only, before deciding to proceed through (Figure 1).

Drivers almost always completely stopped at the passive crossing (Table 1). The stopping behaviour was not statistically different to the intersection with a stop sign (97.4% vs 93.5%; t=0.84, DF=160, p=.402), but was (as expected) for the active crossings (8.0% vs 93.5%; t=-5.11, DF=160, p<.001). Further, there was a difference between the active crossing with boom barriers and the one with

flashing lights only (2.8% vs 12.8%; t=-2.52, DF=46, p<.001). When stopping, the amount of time stopped at the passive crossing was 0.8s shorter (t=2.44, DF=71, p=.017) when compared to the road intersection with a stop sign.

There were no differences between day and night driving behaviour for the stopping rate and amount of time stopped. Drivers drove at slightly slower speed at night. As in day conditions, braking for the intersection tended to occur earlier than for the two non-boom-gate controlled level crossings (Figure 1).

Table 1. Mean stopping behaviour at the different level crossings and the road intersection

			Day (N=27)		Night (N=11)	
			Stopping rate (%)	**Time stopped (s)**	**Stopping rate (%)**	**Time stopped (s)**
Level crossings	Passive protection	Stop sign only	96.1	1.9	90.9	2.2
	Active protection	Flashing lights only	11.5	-	18.2	-
		Flashing lights and boom barriers	0	-	10	-
Road intersection	Stop sign		100	3.2	90.9	3.2

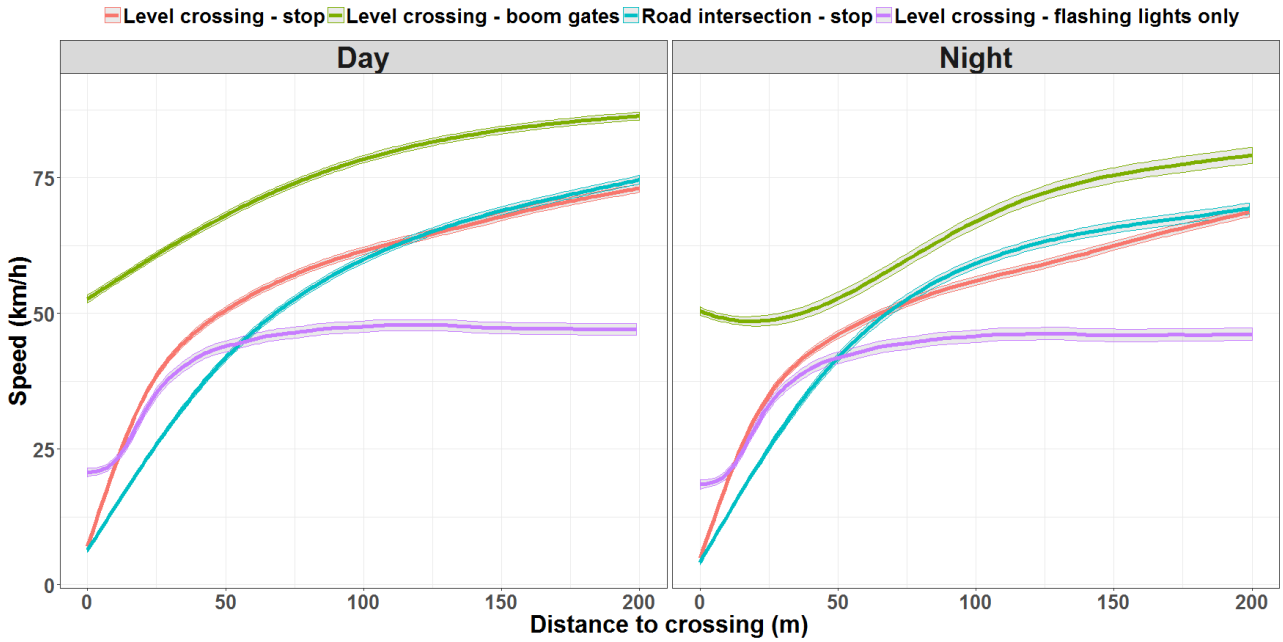

Figure 1. Mean approach speed of the different railway crossings and the road intersection (with standard error) during day and night-time driving

Conclusions

Drivers complied with the road rules, stopping for the passive crossing and the road intersection. However, drivers decelerated for level crossings late and abruptly when compared to the road intersection, sometimes at level crossings where they did not need to. They also spent less time assessing the situation when stopped at the crossing. Further, drivers did not appropriately adapt their driving behaviour to the reduced visibility conditions of night-time driving. This suggests that drivers may experience some difficulties in recognising the presence of the level crossing, or identifying the actions required for the type of level crossing they are approaching. These findings

have implications for the development of effective road safety initiatives targeted at level crossings, and development of active advanced warnings could be considered for passive level crossings.

References

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