

Comparing crashes: A Safe System analysis of serious injury and fatal crashes in New Zealand

Hamish Mackie^a, Richard Scott^a, Lily Hirsch^a, John de Pont^b, Simon Douglas^c, Dylan Thomsen^c

^aMackie Research, ^bTERNZ, ^cAA Research Foundation

Abstract

Serious injuries account for the greatest proportion of the social costs of New Zealand's road trauma, yet there is limited understanding of the differences in system failures between fatal crashes and those that result in serious injuries. Using a Safe System analysis framework, this research compared the circumstances of 200 serious injury crashes and 100 fatal crashes involving light vehicle occupants. This framework included criteria for 'triggering' each system pillar. The research shows that serious injury crashes are less likely than fatal crashes to involve complete system failure and that all pillars of the Safe System require attention if tangible road safety improvements are to be expected.

Background

Previous research suggests that there could be considerable differences in the nature of fatal and serious crashes (Stigson, Kullgren et al. 2011, Wundersitz and Baldock 2011). However, there is a limited understanding about the circumstantial differences between fatal crashes and those that result in serious injuries in New Zealand. This is of interest as serious injuries account for the greatest proportion of the social costs from New Zealand's road trauma. The aims for this paper are to establish 1) are there differences in the circumstances that lead to fatalities or serious injuries in New Zealand's light vehicle crashes? and 2) what proportion of crashes result predominantly from system failures as opposed to reckless behaviours?

Method

Data were obtained from the New Zealand Transport Agency's Crash Analysis System (CAS) in the form of Traffic Crash Reports (TCR), which are prepared by the Police Officer who attended the scene. Using random selection over the period 1/7/2015 – 30/6/2016, 100 fatal, and 200 serious injury crashes were selected for analysis. More serious injury crashes were analysed due to the higher proportion of cases that occur. It was established that this quantity of cases would capture a representative emerging pattern of factors associated with the broader crash cases.

Information from each crash report was categorized by one analyst into the four Safe System pillars - User, Vehicle, Speed, and Roads and Roadsides (Larsson and Tingvall 2013). By doing this, the involvement of each pillar in the crash could be 'triggered' so that the predominant factors implicated in fatal and serious injury crashes on New Zealand's roads could be better understood. In addition, the analysis applied an approach to understand the proportion of crashes which predominantly resulted from system failures (i.e. the condition of the road, the speed limit, drivers' errors or lapses, or the vehicle's safety system) as opposed to reckless behaviours (i.e. the actions of drivers who, either unusually or regularly, operate outside of the system that is deemed to be safe, such as a blood alcohol level above license conditions). Reckless behaviour also sat under the User Pillar, but was treated separately within the pillar. This approach was modified from similar work by Wundersitz and Baldock (2011).

Results

Across all 300 serious injury and fatal crashes, there was significant involvement by all four pillars of the Safe System (see Figure 1). However, serious injury crashes were less likely to involve all four pillars of the Safe System.

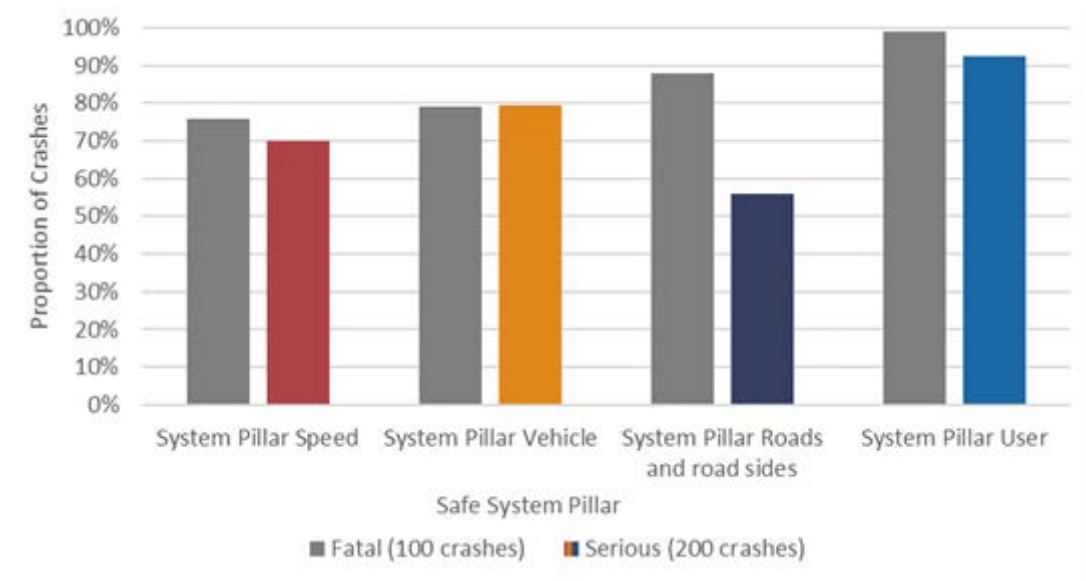


Figure 1. Involvement of Safe System pillars

Compared to serious injury crashes, fatal crashes had a higher proportion of roadside objects and other vehicles struck, more frequently involved narrow shoulders for run-off road crashes, were more often involved crashes where the centre line was crossed on 100 km/h roads, and typically happened in higher speed environments. In two-vehicle crashes, the occupants of the newer vehicle typically had less severe injuries than the older vehicle. Proportionally, SUV's, 4WD's and utes were involved in roll-over crashes 32% more than passenger cars due to the higher centre of gravity. Multiple user factors were more apparent in fatal crashes. Consistent with overseas literature, reckless behaviour was less common in serious injury crashes (30% in serious injury crashes and 47% in fatal crashes). Finally, across fatal and serious crashes, in 99% of the cases, the crash involved more than one Safe System pillar, rather than reckless behaviour being the only contributing factor.

Conclusions

A key finding from this analysis is that crashes often happen as a result of multiple system failures, further supporting the importance of the Safe System approach in road safety. Given that a large proportion of fatal crashes, more so than serious injury crashes exhibited failures by all pillars of the safe system, all pillars of the Safe System require attention if tangible road safety improvements are to be expected.

Acknowledgements

This research was commissioned by the AA Research Foundation with Steering Group support from The NZ Transport Agency, Accident Compensation Corporation, Ministry of Transport, and NZ Police. The AA Research Foundation acknowledges financial support from Exxon Mobil.

References

- Larsson, P. and C. Tingvall (2013). The Safe System Approach – A Road Safety Strategy Based on Human Factors Principles. *Engineering Psychology and Cognitive Ergonomics. Applications and Services*. D. Harris, Springer Berlin Heidelberg. 8020: 19-28.
- Stigson, H., A. Kullgren and M. Krafft (2011). Use of car crashes resulting in injuries to identify system weaknesses. 22nd International Conference on the Enhanced Safety Vehicles (ESV).
- Wundersitz, L. and M. R. J. Baldock (2011). The relative contribution of system failures and extreme behaviour in South Australian crashes. Adelaide, Australia, The University of Adelaide.