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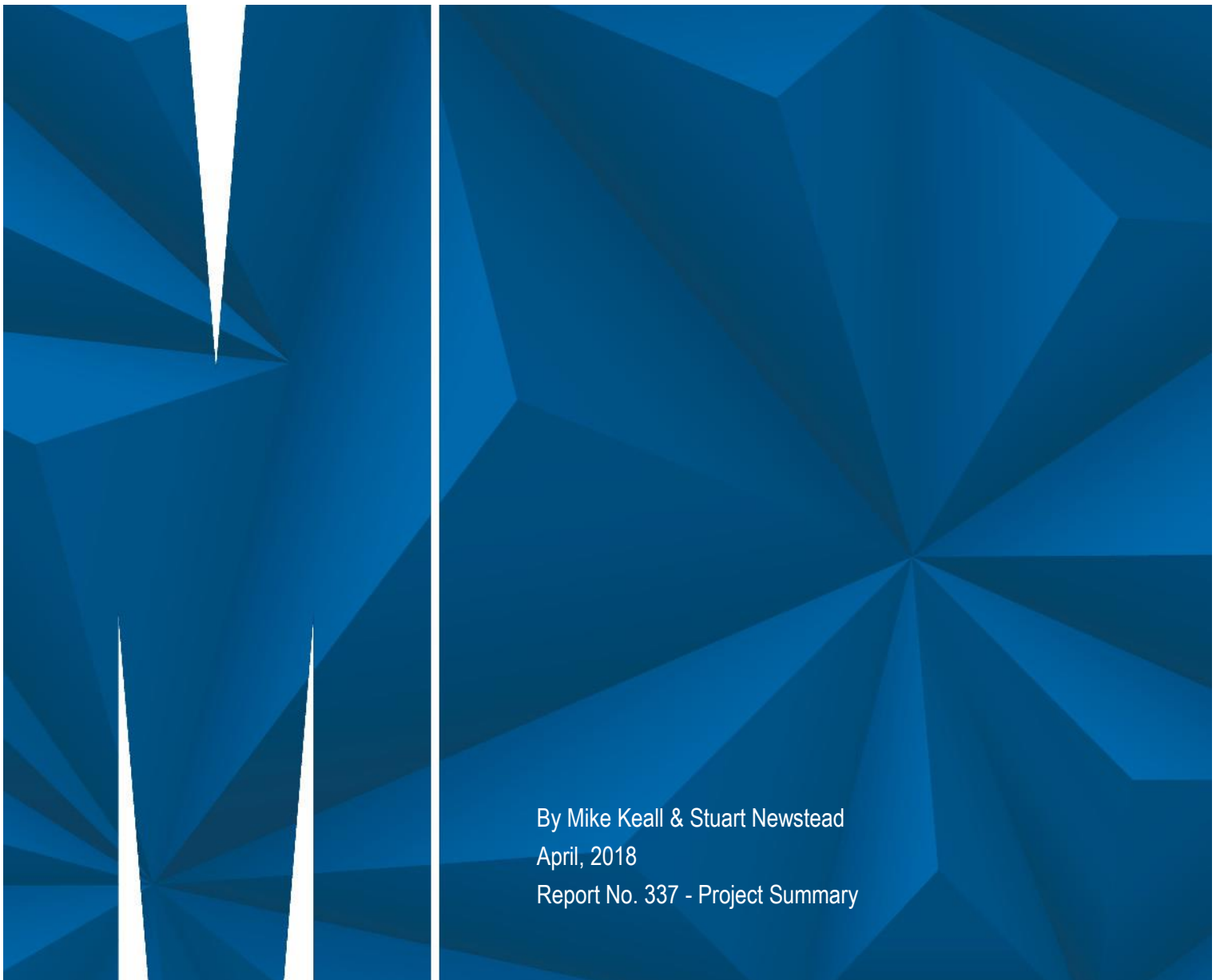
RELATIVE VEHICLE SAFETY, ROAD ENVIRONMENT AND CRASH TYPE: PROJECT SUMMARY



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BACKGROUND

The Used Car Safety Ratings (UCSRs) measure relative vehicle safety performance averaged over a standard set of crash circumstances and occupant characteristics. As such they reflect the average serious injury risk to which vehicle occupants are exposed across the full range of crash circumstances and occupant characteristics. An important question is whether relative vehicle safety as measured by crashworthiness can identify combinations of road types and crash types where the ability of the vehicle to protect its occupants is inadequate. Under a Safe System approach, it is these circumstances where other elements of the system need to play a greater role. Identifying such gaps in the Safe System framework will assist in setting priorities for road infrastructure improvements that will assist in allowing vehicle safety improvements to produce maximum benefits as part of a wider framework.

ANALYSIS AND DATA

Analysis was conducted of data on injuries sustained by drivers of almost one million crashed vehicles from New Zealand and the Australian States Victoria, Queensland, Western Australia, South Australia and New South Wales. To obtain separate vehicle market group estimates of crashworthiness (risk of fatal and serious injury per tow-away crash of the particular type studied) for each of the crash types and crash circumstances of interest, logistic regression models were constructed using relevant data for the crash type or road classification studied.

Crash outcomes were analysed according to the following types of crashes for roads of different speed limits and roads that were divided or undivided:

- front impact, where the vehicle in question hit another vehicle's side or rear;
- head-on, where the vehicle collided head-on with another vehicle;
- rear, where the vehicle was impacted from the rear;
- rollover, where the vehicle rolled over;
- side, where the vehicle was impacted from the side (either driver's or passenger's side);
- single vehicle crash into a fixed object (a tree, wall, post or building);
- other, all other crash types, excluding collisions with heavy vehicles or unprotected road users (pedestrians, cyclists or motorcyclists).

RESULTS

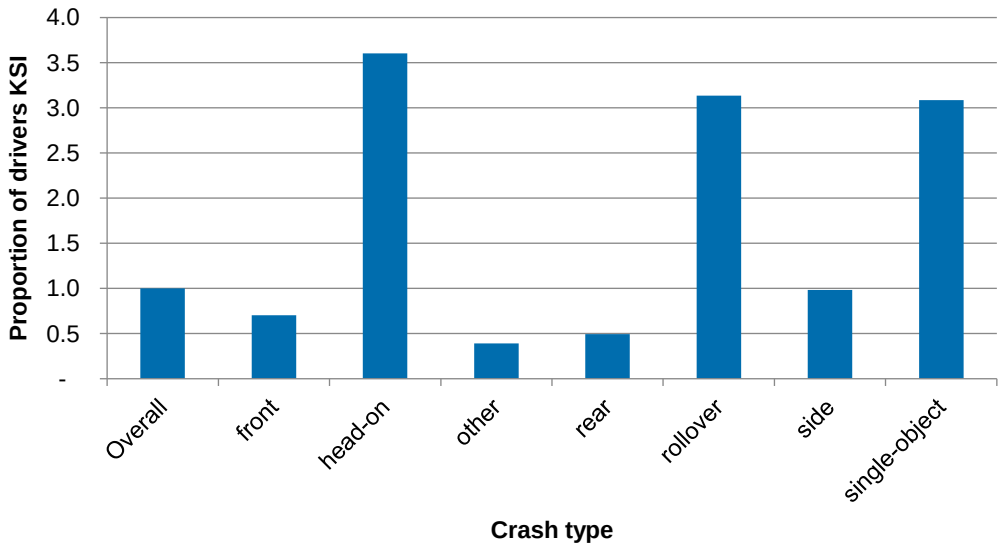

Figure 1: Crude relative measures of crashworthiness by crash type

Error! Reference source not found. shows the proportion of drivers who were killed or seriously injured (KSI) when involved in the crash types specified. Clearly the most injurious types of crashes are head-ons, rollovers, and collisions with a fixed object. These crash types were much more common, and had much more severe consequences, in higher speed limit areas.

When crash outcomes were analysed for divided roads compared to undivided roads, some key safety benefits included:

- a reduction in the rate of fatal or serious injuries to drivers of 35% (95% CI 33%-38%) averaged across the various crash circumstances studied;
- an even greater improvement in the outcomes for head-on crashes and rollovers;
- although this aspect could not be examined here, other studies have shown that the overall crash rate for such roads is considerably lower.

DISCUSSION

Different market groups show quite different patterns of injury outcome for different crash types. The most marked differences are between head-on crashes and single vehicle into object crashes. For the former, the mass of the vehicle plays a very important role. Drivers of smaller vehicles generally suffer more severe injuries as (on average) they collide with larger vehicles, which impose higher levels of deceleration on the smaller vehicle. Conversely, drivers of larger vehicles generally fare better.

Divided roads have been shown in this study to have an important benefit in terms of reduced injury severity. Quite apart from the reduced rate of crashes on divided roads compared to undivided roads found in other studies, divided roads also constrain the mix of crashes, generally reducing the rate of more injurious crashes. We estimated that they reduce the risk of fatal or serious injuries for drivers by around 35% (95% CI 33%-38%), averaged across the various crash circumstances studied and controlling for the other influential factors. This is a similar safety benefit that could be obtained by upgrading from a three-star UCSR vehicle (30% worse than benchmark) to a five-star vehicle (equivalent to benchmark). Some of this safety benefit also arises from better outcomes from all the crash types studied, although particularly for two of the more injurious crash types, rollovers and head-on crashes.

CONCLUSIONS

Circumstances that impose very higher risk of fatal and serious injuries are clearly worth addressing, particularly under a Vision Zero framework. Three crash types, head-ons, rollovers and single vehicle-fixed object, all impose at least three times the risk of fatal and serious injury as the other crash types, indicating clear limitations to the capacity of secondary safety systems in vehicles to modulate injury risks adequately. The current research has shown that divided roads successfully reduce these risks by approaching a half for rollovers and head-ons, and by around 30% for single vehicle into fixed object crashes. Divided roads have the additional benefit of reducing the rate of all injury crashes. In higher speed limit areas, the benefits of reduced injury severity will also be much higher.

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