# How do we prevent and mitigate crashes? Evidence from Australian at-scene in-depth crash investigations

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## Abstract

The Centre for Automotive Safety Research's conducts at-scene in-depth crash investigations in South Australia that allow detailed analysis of the crash in order to determine contributing factors to crashes and the interventions that could prevent or mitigate them. This initial analysis of such a dataset (n=116) showed that the most common contributing factors are human errors, but the interventions to prevent or mitigate the crashes are most commonly infrastructure treatments or vehicle technologies that eliminate the human error and/or reduce the vehicle's speed prior to impact in the event of a human error.

## Method

The Centre for Automotive Safety Research's (CASR's) at-scene in-depth crash investigators attend and investigate vehicle crashes (Figure 1) that occur on public roads within 100 km of Adelaide, and for which an ambulance has transported at least one person. All attended crashes are thoroughly investigated including photographs and video of the vehicle and scene; data collection on the characteristics of the vehicle, environment and people; injury information from treating hospitals; a survey of the crash scene; a reconstruction of the crash; and interviews with the crash participants. A more detailed description of the methodology can be found in Doecke, Baldock & Woolley (2016). This method of data collection results in a highly detailed and accurate database of injury crashes that compliments the larger, but far less detailed, datasets based on routine police reports.

***Figure 1. CASR crash investigation being conducted at a crash scene***

All cases are then reviewed by CASR's multidisciplinary team of experts to determine the factors that contributed to the crash occurring. In the current series of crash investigations, beginning in late 2014, interventions (or treatments) that could have prevented the crash or mitigated its severity are also nominated by the case review panel along with a confidence level (high, medium, low) that the intervention would have prevented or mitigated the crash. Future interventions, such as autonomous vehicles, were not considered. This paper details and discusses the contributing factors and interventions from the first 116 crashes occurring between 2014 and 2017 reviewed in this manner.

## Results

A brief summary of these 116 crashes is as follows:

- 5% Fatal, 36% Admitted to hospital, 58% Treated at hospital, 1% Unknown.
- 41% Rural, 59% Metropolitan
- 57% Speed zone 25-60 km/h, 19% Speed zone 70-90 km/h, 24% Speed zone 100-110 km/h
- 56% Mid-block, 44% Intersection
- 34% Single vehicle, 8% Pedestrian, 58% Multiple vehicles

The top ten contributing factors and interventions for prevention and mitigation with a medium or high confidence rating found from CASR's in-depth crash investigations are shown in Table 1. Most of the crashes involved at least one human factor (92%), and aalmost all the crashes (96%) were found to have applicable interventions.

***Table 1. Top ten contributing factors, prevention interventions, and mitigation interventions found from CASR's at-scene in-depth crash investigations***

| **Contributing factors** | **Number** | **Percentage** |
|---|---|---|
| Human: fail to give way | 43 | 37.1% |
| Human: speed too high for conditions | 20 | 17.2% |
| Road: visibility | 19 | 16.4% |
| Road: junction layout | 14 | 12.1% |
| Vehicle: conspicuity | 12 | 10.3% |
| Road: unsealed | 12 | 10.3% |
| Human: recognition failure | 12 | 10.3% |
| Human: exceed speed limit | 12 | 10.3% |
| Human: Alcohol | 10 | 8.6% |
| Human: Drugs | 10 | 8.6% |
| **Prevention interventions** | | |
| Roundabout | 34 | 29.3% |
| Prevent right turn | 29 | 25.0% |
| Traffic lights | 23 | 19.8% |
| Electronic Stability Control (ESC) | 20 | 17.2% |
| Apprehension for drink/drug driving offence | 15 | 12.9% |
| Grade separated junction | 15 | 12.9% |
| Autonomous Emergency Braking (AEB) | 14 | 12.1% |
| Speed limit reduction | 14 | 12.1% |
| Lane Keep Assist | 12 | 10.3% |
| Controlled right turn at signalised intersection | 8 | 6.9% |
| **Mitigation interventions** | | |
| Speed limit reduction | 21 | 18.1% |
| Autonomous Emergency Braking (AEB) | 13 | 11.2% |
| Centre barrier | 13 | 11.2% |
| Vertical deflection | 10 | 8.6% |
| Side barrier | 10 | 8.6% |
| Clear zone to guidelines | 7 | 6.0% |
| Emergency Braking Assist (EBA) | 5 | 4.3% |
| Intelligent Speed Assist - Limiting | 5 | 4.3% |
| **Total cases reviewed** | **116** | **100%** |

Note: Only 9 mitigation interventions are listed as several tied for 10th place

## Limitations

The number of crashes investigated and reviewed is relatively low compared to the total number of injury crashes that occur in South Australia (≈4,000 per year) and so the results should be treated with some caution. CASR's in-depth crash investigation activity is ongoing; therefore, this sample size will grow in time and this analysis can be updated with a larger sample.

It should be noted that only limited consideration was given to the cost or practicality of a given intervention and potential negative safety effects on other crash types.

## Conclusions

In-depth crash investigations allow detailed analysis of the contributing factors to crashes and the interventions that could prevent or mitigate them. This initial analysis of such a dataset showed that the most common contributing factors are human errors, but the interventions to prevent or mitigate the crashes are most commonly infrastructure treatments or vehicle technologies that are aimed at eliminating the human error and/or reducing the speed prior to impact in the event of a human error. Almost all the crashes could have been prevented or mitigated with currently available interventions.

## References

Doecke, S. D., Baldock, M. R. J., & Woolley, J. E. (2016). *In-depth crash investigation in South Australia and its use in roadside safety research*. Expert Symposium on Accident Research, Hannover, Germany, 9-10 June 2016.