CENTRE FOR
AUTOMOTIVE
SAFETY RESEARCH

THE UNIVERSITY of ADELAIDE

Collection and analysis of EDR data from crash-involved vehicles: 2021 summary report

ME Elsegood, SD Doecke, G Ponte

CASR REPORT SERIES
CASR194
August 2023

Report documentation

REPORT NO.	DATE	PAGES	ISBN	ISSN
CASR194	August 2023	18	978-1-925971-28-6	1449-2237

TITLE

Collection and analysis of EDR data from crash-involved vehicles: 2021 summary report

AUTHORS

ME Elsegood, SD Doecke, G Ponte

PERFORMING ORGANISATION

Centre for Automotive Safety Research
The University of Adelaide
South Australia 5005
AUSTRALIA

FUNDING

This research was partly funded via a deed with the South Australian Government and by the Victorian Transport Accident Commission (TAC)

AVAILABLE FROM

Centre for Automotive Safety Research
http://casr.adelaide.edu.au/publications/list

ABSTRACT

Modern vehicles are fitted with Event Data Recorders (EDRs) that constantly record variables such as speed, seatbelt usage, accelerator/brake pedal position, and steering wheel angle. When a crash occurs, a snapshot of the final few seconds of these variables are saved on the EDR in addition to crash related variables such as change in velocity (delta-*v*) and safety system deployments. In 2017, CASR established a data collection process whereby a large number of crash-involved vehicles could be accessed regularly from a single location (an auction yard) and the EDR data downloaded. Additionally, the South Australian Police Major Crash unit provided EDR data to CASR, downloaded from vehicles involved in investigated serious crashes. In 2021, CASR successfully retrieved EDR data from 171 crashed vehicles, of which 143 (83.6%) had associated police vehicle collision reports. This collection has contributed to a current total of 827 EDR records with 639 matched to police reports and 171 injured occupants matched to hospital injury data. In the sample of cases collected by CASR from the auction yard, 27.1% of bullet (striking) vehicles, and 40.3% of free-speed vehicles were found to be speeding. The rate of seatbelt wearing for front seat occupants in the sample was 96.9%.

KEYWORDS

Event data recorder (EDR), Speed, Speeding, Restraint use, Crash data

Summary

Modern vehicles are fitted with Event Data Recorders (EDRs) that constantly record variables such as speed, seatbelt usage, accelerator/brake pedal position, and steering wheel angle. When a crash occurs, a snapshot of the final few seconds of these variables are saved on the EDR in addition to crash related variables such as change in velocity (delta-*v*) and safety system deployments.

In 2017, CASR established a data collection process whereby a large number of crash-involved vehicles could be accessed regularly from a single location (a vehicle auction yard). Additionally, the South Australian Police Major Crash unit provided EDR data to CASR, downloaded from vehicles involved in investigated serious crashes. The Department for Infrastructure and Transport (DIT) funded the collection of 100 EDR downloads per year starting mid-2017, and additional funding was provided by the Transport Accident Commission to collect an additional 200 cases from July 2019 to June 2021. In 2021, CASR successfully retrieved EDR data from 171 crashed vehicles, of which 143 (83.6%) had associated police vehicle collision reports. This collection contributed to a current total of 827 EDR records with 639 matched to police reports over the four and a half years of data collection; 610 from the auction yard and 29 from Major Crash.

The police reports supplemented the EDR data with crash location, site features, crash descriptions, and driver and occupant information. Information pertaining to other vehicles and occupants involved in the crashes, in addition to the EDR vehicle, were obtained. The matched cases yielded details from a total of 1375 crash involved vehicles and 1909 crash participants. Of the 1909 crash participants, 433 were transported to a hospital, of which 171 had hospital records collected and injuries AIS coded.

The sample of EDR cases collected was found to be reasonably representative of all passenger vehicles involved in police reported crashes in South Australia (according to injury severity and speed zones).

In the sample of cases collected by CASR from the auction yard, some key statistics are listed below:

- Of the 610 EDR vehicles matched to police reports, 358 EDR vehicles were classified as bullet vehicles,
- 317 bullet vehicles had speed data recorded with 27.1% travelling above the posted speed limit by any amount,
- 159 EDR vehicles were classified as travelling at a driver-selected free-speed prior to a crash with 40.3% travelling above the posted speed limit by any amount,
- 17.0% of the free-speed vehicles were travelling 10 km/h or more above the posted speed limit,
- 96.9% of 344 frontal occupants with seatbelt usage recorded had their seatbelt buckled at the time of the crash.

Contents

1 Introduction

A significant number of modern vehicles contain Event Data Recorders (EDRs) that detect when a collision has occurred and save the last few seconds of driving data prior to the crash. Data downloaded from the EDR of a crash-involved vehicle can reveal key information which are relevant in a road safety context, such as travel speed, impact speed, brake/accelerator pedal position, steering wheel angle, delta-*v* (crash impact severity), seatbelt usage and safety system deployment (e.g. airbags and seatbelt pretensioners). Travel speed, pedal position and seatbelt usage are particularly valuable for road safety research as they are not easily attainable objectively through other means.

In 2017, CASR established a data collection process whereby a large number of crash-involved vehicles were accessed regularly from a single location (a vehicle auction yard) and from the South Australian Police Major Crash unit. The EDR data collected was matched to a police report (whenever possible) to provide crash location, a description of the crash circumstances, vehicle details, occupant details, site features and police-reported injury severity for relevant crash participants. Detailed hospital case notes were also collected for individuals involved in the crashes that were listed on the police report as having attended a major metropolitan hospital, and the injuries were coded according to the Abbreviated Injury Scale (AIS 2005). The EDR collection project was continued through to 2021 to expand the sample of crashes.

Funding for the project was provided initially by the South Australian Department for Infrastructure and Transport for the collection of 100 EDR downloads per financial year starting mid-2017. Additional funding was provided by the Transport Accident Commission to collect an additional 200 cases from July 2019 to June 2021.

2 Method

EDR data from crashed vehicles was accessed by attending a holding yard of a vehicle auction company on the day before their weekly auction (when the vehicle yard was open for public inspection). Around 80-90% of the insured, written off vehicles in South Australia reportedly come through this single holding yard.

Figure 2.1 shows a section of the vehicle holding yard and a CASR researcher undertaking a download. To download the data from a crashed vehicle, a Bosch Crash Data Retrieval (CDR) tool was used to access and decode the data contained in the crashed vehicle's EDR via the OBD-II port. Photographs were taken around the exterior of the vehicle as well as the interior of the vehicle, and basic measurements of the deformation were recorded. On the rare occasions that the OBD-II was not accessible, the airbag control module (ACM) that contains the EDR data was requested from the purchaser of the vehicle for a monetary value to directly download from. Three modules were obtained by this method.

Typically, 200 to 400 vehicles were auctioned every week, but only around 10-15% of the vehicles had an EDR that was supported by the Bosch CDR tool. The majority of vehicles that capture EDR data in the CASR dataset were vehicles manufactured by Toyota and Holden. EDR data can be obtained from these vehicles manufactured from as early as 2002 and 2007, respectively. Other vehicle manufacturers that had EDR data that is accessible via the Bosch CDR tool include Audi (from 2018), Bentley (from 2019), BMW (from 2019), Chevrolet (from 2020), Chrysler (from 2006), Dodge (from 2005), Fiat (from 2012), select Fords (from 2015-2016), Jeep (from 2006), Lancia (from 2012-2015), Lexus (from 2000), Mitsubishi (from 2007), Opel (from 2013), Porsche (from 2019), RAM (from 2010), Scion (from 2003), Subaru (from 2012), Volkswagen (from 2018), and Volvo (from 2014). Bosch has been actively increasing the number of supported vehicles and manufacturers over the years.

The South Australian Police Major Crash unit provided EDR files from vehicles that were supported by the Bosch CDR tool and were involved in fatal or high severity crashes. The data collected from Major Crash was coded separate from the data collected from the auction yard as it was sampled from a different crashed vehicle population, though it may be acceptable to combine both data sources for selected analyses.

Figure 2.1
Crashed vehicles at the holding yard (left) and a CASR researcher performing an EDR download via the OBD-II port (right)

Vehicle collision reports were obtained directly from the South Australian Police by supplying a registration plate number, vehicle identification number, vehicle make, and vehicle model. This ensured prompt EDR and police report data matching. The police vehicle collision reports listed crash locations, a crash narrative, basic vehicle details, occupant details, site features and police-reported injury severities for relevant crash participants.

Detailed injury information was obtained from the six major metropolitan hospitals in South Australia. This process involved matching patient records by name and date of birth and physically attending the hospitals to copy the ambulance and hospitals' case notes related to the crash participant. These case notes were then transferred to CASR's EDR database and the injuries were coded according to the Abbreviated Injury Scale (AIS 2005). Hospitals were attended for data collection approximately once every six months.

The information from the EDR files and police reports were entered into a searchable database to enable later analyses. Each database record included all data from the EDR files, the police report, a photo of the main area of vehicle damage and a basic collision diagram of the crash based on information derived from the police report.

3 Results

3.1 Data collected and matched

During the 2021 calendar year, EDR data was retrieved from 171 crashed vehicles, with 143 (83.6%) vehicles having both a genuine crash event record and a matching police report. The 28 cases that were not matched included cases where there was no police report corresponding to the vehicle damage observed or there was no EDR data that corresponded to the observed damage. There were a few cases where the EDR could not be accessed through the OBDII port and the module was not able to be obtained from the vehicle purchaser.

Since June 2017, EDR data was retrieved from a total of 827 vehicles, with 639 vehicle downloads (77.3%) containing EDR information that could be matched to a police report. This includes 610 written off vehicles from the auction yard and 29 from Major Crash. From the 639 matched police reports, there were a total of 1375 active vehicles (in motion or stationary in traffic at time of the crash) with 1909 occupants distributed within these vehicles. The number of cases collected and matched to police reports for each collection year is shown in Table 3.1.

Table 3.1
EDR cases collected and matched to police reports by years

Year	EDR files downloaded	EDR file matched to police report	Percent matched
2017	91	69	75.8%
2018	128	98	76.6%
2019	217	169	77.9%
2020	220	160	72.7%
2021	171	143	83.6%
Total	827	639	77.3%

Table 3.2 shows the hospitalised participants by crash-year, the type of hospital they attended and the percentage that had hospital notes collected. During the collection year of 2020, hospital data collection was suspended due to the pandemic, resulting in a drop of cases.

Half of the participants listed on the police report as being hospitalised and transported to a major metropolitan hospital had their hospital case notes collected, and their injuries coded according to the AIS. Hospital and injury data could not be collected when the hospital they attended was not a major metropolitan hospital, or the hospital they attended was not specified on the police report.

The lack of data collected for cases who were treated at major metropolitan hospitals may be due to: an error on the police report, a lack of or mis-recording by an emergency department staff worker (possibly due to nil injuries being reported), or an early departure from the emergency department.

Table 3.2
Hospital attendance, hospital type and data collection/rates for injured participants in EDR crashes, by crash-year (including Major Crash cases)

Crash-year	Attended hospital (Police report)	Major metropolitan hospital	Other hospital	Hospital not specified	Hospital data collected	Collection rate
2017	46	37	6	3	20	43.5%
2018	62	49	9	4	38	61.3%
2019	110	88	18	4	53	48.2%
2020	104	70	31	3	20	19.2%
2021	92	77	10	5	40	43.5%
Total	414	321	74	19	171	41.3%

3.2 Representativeness of sample obtained through the auction yard

To determine the representativeness of the crashes collected in the EDR database, the EDR sample was compared to passenger vehicles in police reported crashes in South Australia, retrieved through the Traffic Accident Reporting System (TARS). The comparison was made at the vehicle level rather than the crash level to align better with the EDR data collection process, which was vehicle based, not crash based. As 2021 TARS data was not complete, 2017-2020 TARS data was used for comparison.

Location

The locations of the matched 610 cases (excluding Major Crash cases) are shown in Figure 3.1. A total of 496 (81.3%) crashes occurred in the metropolitan area of Adelaide, distributed across various suburbs. The remaining 114 (18.7%) crashes occurred in rural and outer rural areas of South Australia. This compares to 15.0% of all passenger vehicles in police reported crashes in South Australia that crashed in rural and outer rural areas.

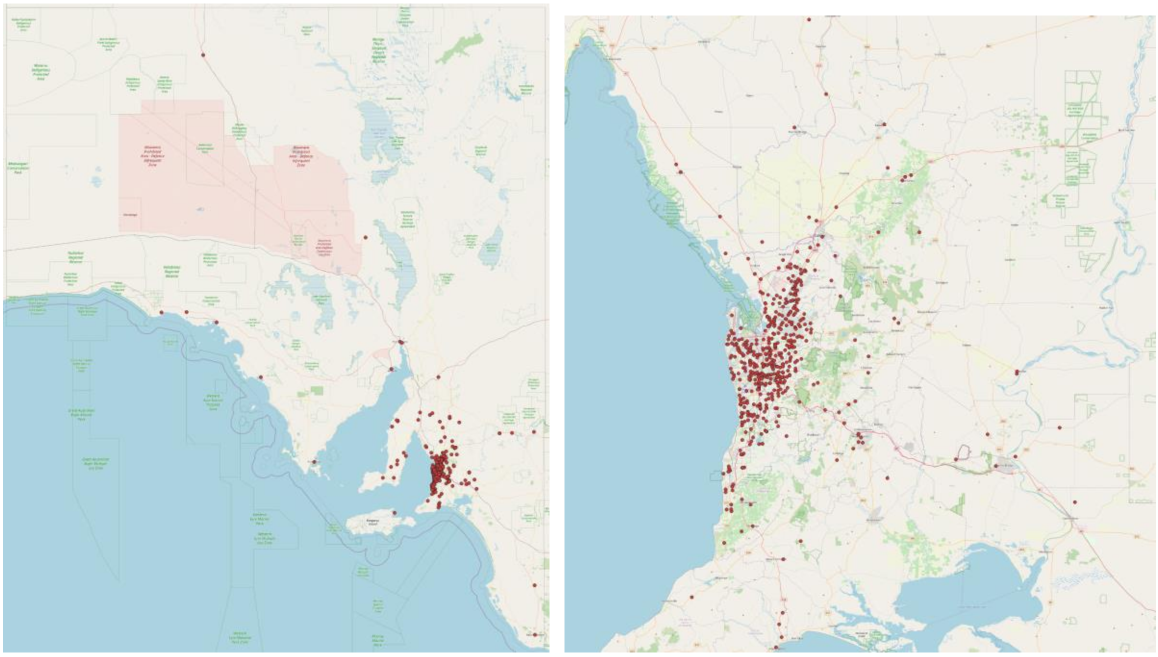


Figure 3.1
Locations of EDR crashes (left: South Australia, right: zoomed into metropolitan area)

Speed zones

The EDR vehicle sample and passenger vehicle sample in police reported crashes in South Australia are shown in Table 3.3 by speed zone. The EDR vehicle sample has a similar distribution of crash involvement by speed limit compared to the passenger vehicle data from TARS.

Table 3.3
Comparison of matched EDR vehicles to all passenger vehicle units in police reported crashes in South Australia from the TARS database by speed limit (excluding Major Crash cases)

Speed Zone	EDR vehicles 2017-2021		TARS 2017-2020 passenger vehicles	
	Count	Percentage	Count	Percentage
≤ 40	19	3.1%	1467	1.9%
50	141	23.1%	18632	24.0%
60	305	50.0%	40621	52.3%
70	16	2.6%	2533	3.3%
80	63	10.3%	6788	8.7%
90	15	2.5%	1709	2.2%
100	31	5.1%	3559	4.6%
110	20	3.3%	2316	3.0%
Total	610	100.0%	77625	100.0%

Injury severity

The injury severity of the crash, by vehicle, in the EDR injury cases was obtained from the matched police reports. These are shown in Table 3.4 and are compared to TARS crash severity for all passenger vehicles in crashes from 2017 to 2020. The EDR sample had a higher proportion of vehicles involved in hospital treated crashes and a lower proportion of non-injury crashes compared to the TARS sample.

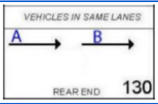
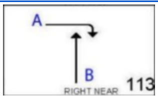
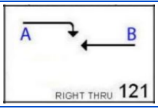
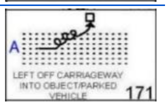
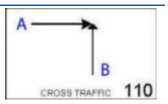
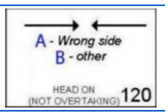
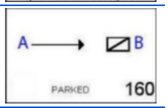
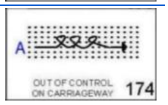
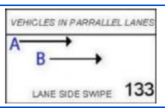
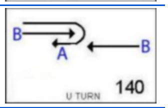
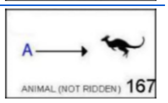
Table 3.4
Comparison of matched EDR vehicles to all passenger vehicles in police reported crashes in South Australia from the TARS database by injury severity (excluding Major Crash cases)

Injury severity	Matched EDR vehicles 2017-2021		TARS 2017-2020 passenger vehicles	
	Count	Percentage	Count	Percentage
Non injury	319	52.3%	49669	64.0%
Doctor / Minor Injury	58	9.5%	7466	9.6%
Hospital treated	208	34.1%	17557	22.6%
Hospital admitted	19	3.1%	2571	3.3%
Fatal	1	0.2%	362	0.5%
Unknown	5	0.8%	-	-
Total	610	100.0%	77625	100.0%

3.3 Crash types of EDR matched cases

The crash types of all the EDR vehicles (including Major Crash cases) have been aggregated into simple crash type categories as shown in Table 3.5. Over a third (35.1%) of the crashed vehicles were involved in rear-end crashes and almost a quarter (23%) were involved in right-turn crashes. The right-turn crashes have been disaggregated into two categories, where the initial travel directions of the two vehicles involved in the crash were either opposite directions or adjacent directions. The complete South Australian Definition for Coding Accidents (DCA) is included in Appendix A.

Table 3.5
Crash types of EDR vehicles (including Major Crash cases)

Crash type	Vehicle position/ action	Frequency	Crash type total	Indicative DCA code diagram
Rear end	A (rear/striking)	97	216	
(DCA 130,131,132)	Middle	54		
	B (front)	65		
Right-turn – adjacent directions	A (turning)	42	84	
(DCA 113)	B (through)	41		
	Other	1		
Right-turn – opposite directions	A (turning)	39	81	
(DCA 121)	B (through)	39		
	Other	3		
Single vehicle into object	A (vehicle)	65	66	
(DCA 171, 173, 181, 183)	Other	1		
Right angle	A (crossing right of way)	32	64	
(DCA 110)	B (right of way)	32		
Head on	B (correct side)	11	23	
(DCA 120, 150)	A (incorrect side)	12		
Hit parked vehicle	A (moving vehicle)	21	23	
(DCA 160, 161, 162, 163)	B (parked vehicle)	2		
Rollover	A (vehicle)	18	18	
(DCA 170, 172, 174, 180, 182, 184)				
Side swipe	A (correct lane)	8	18	
(DCA 133, 134, 135, 136, 137)	B (changing lanes)	9		
	Other	1		
U-turn in front	B (through)	10	17	
(DCA 140)	A (turning)	7		
Hit animal	A (vehicle)	8	8	
(DCA 167)				
Other			21	
(All other DCAs)				
Total			639	

3.4 Data contained in the EDR files

The information stored on an EDR differs for various vehicle makes and generations of EDRs. Table 3.6 shows the rates of some data variables recorded by the EDR devices in the sample collected from the auction yard. In most crashed vehicles, longitudinal or lateral delta-*v* was recorded as part of the airbag deployment system. Only two cases in the sample did not have any delta-*v* recorded. Some EDRs only record lateral delta-*v* when a crash event is classified as a side crash.

Table 3.6
Number of cases by data available (excluding Major Crash cases)

Data field	Recorded	Not recorded	Total	Percentage recorded
Longitudinal delta-*v*	580	30	610	95.1%
Lateral delta-*v*	384	226	610	63.0%
Speed history	553	57	610	90.7%
Steering wheel angle	182	428	610	29.8%
Driver seatbelt status	330	280	610	54.1%
Passenger seatbelt status	183	427	610	30.0%

3.5 Impact speeds and speeding

Vehicle speed-time history was recorded in 553 of 610 (90.7%) of crashed vehicles (not including Major Crash cases). This allowed objective determination of two very important safety parameters: the crashed vehicle travel speed and impact speed. The maximum travel speeds of the vehicles (derived from EDRs) were used to determine the speeding rates of vehicles compared to the posted speed limit for the road they were travelling on.

When comparing travel speed to the posted speed limit in crashes, it was important to classify the category of vehicle involvement in a crash. A common vehicle classification useful in describing vehicle impact interactions in road crashes was the “bullet” (or striking) vehicle. These were vehicles that were travelling in a forward direction to strike another vehicle (the target or struck vehicle). Bullet vehicles were vehicles that generally had right of way (if travelling through an intersection) and were usually travelling at a speed greater than the other vehicle involved. For crashes where a vehicle was performing a turning manoeuvre across traffic, the bullet vehicle was the through vehicle. In rear-end crashes, the rear-most vehicle was the bullet vehicle. For single vehicle crashes, the crashed vehicle was always classified as the bullet vehicle. In head-on crashes, both vehicles were classified as bullet vehicles. For side-swipe crashes, both vehicles were classified as bullet vehicles. For pedestrian crashes, the vehicle was classified as a bullet vehicle.

Figure 3.2 shows the frequency of the various impact speed ranges of the bullet vehicles in the EDR sample and Figure 3.3 shows the frequency of travel speed variation relative to the posted speed limit (i.e., the maximum recorded travel speed above posted speed limit) of bullet vehicles. A total of 358 EDR vehicles (317 with speed data recorded) of the 610 matched EDR vehicles were classified as bullet vehicles with 27.1% travelling above the speed limit in the seconds before a crash.

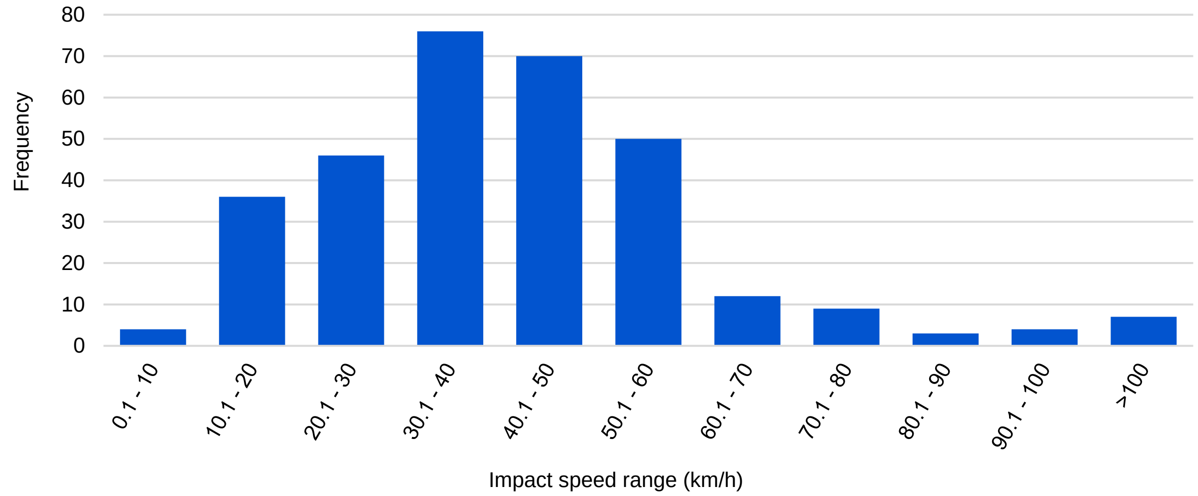


Figure 3.2
EDR bullet vehicle impact speeds (excluding Major Crash cases)

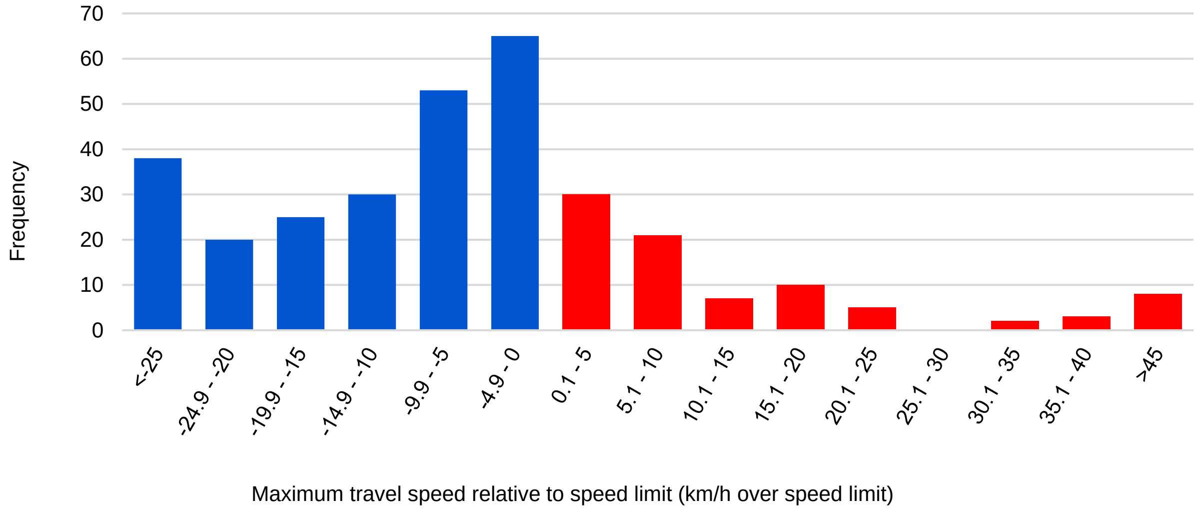


Figure 3.3
EDR bullet vehicle maximum travel speed relative to speed limit (excluding Major Crash cases)

A vehicle travelling at a free-speed was also an important classification in road safety analyses. Free-speed vehicles were those that were assumed to be travelling at a driver-selected, non-restricted speed. A common quantifiable definition includes vehicles who had at least four seconds of no traffic ahead of them. Therefore, vehicles involved in rear-end crashes were not included in this classification, as there was insufficient information to determine if these vehicles were travelling at a self-selected free-speed. Vehicles that are performing manoeuvres, accelerating from stationary positions, performing illegal manoeuvres, travelling through work zones, or with drivers suffering from illness or fatigue were not included as free-speed vehicles. A total of 159 EDR vehicles were categorised as free-speed vehicles, with their speeding rates shown in Table 3.7. Figure 3.4 displays the distribution of speeding levels of the 159 free-speed EDR vehicles, with 64 crashed vehicles (40.3%) having travelled above the speed limit by any amount.

Table 3.7
Maximum travel speed of free-speed EDR vehicles relative to speed limit (excluding Major Crash cases)

Maximum vehicle speed relative to posted speed limit (PSL)	Count	Percentage
At least 10 km/h under PSL	19	11.9%
Between 0 and 9.9 km/h under PSL	76	47.8%
Between 0.1 and 5 km/h over PSL	22	13.8%
Between 5.1 and 10 km/h over PSL	15	9.4%
Greater than 10 km/h over PSL	27	17.0%
Total	159	100.0%

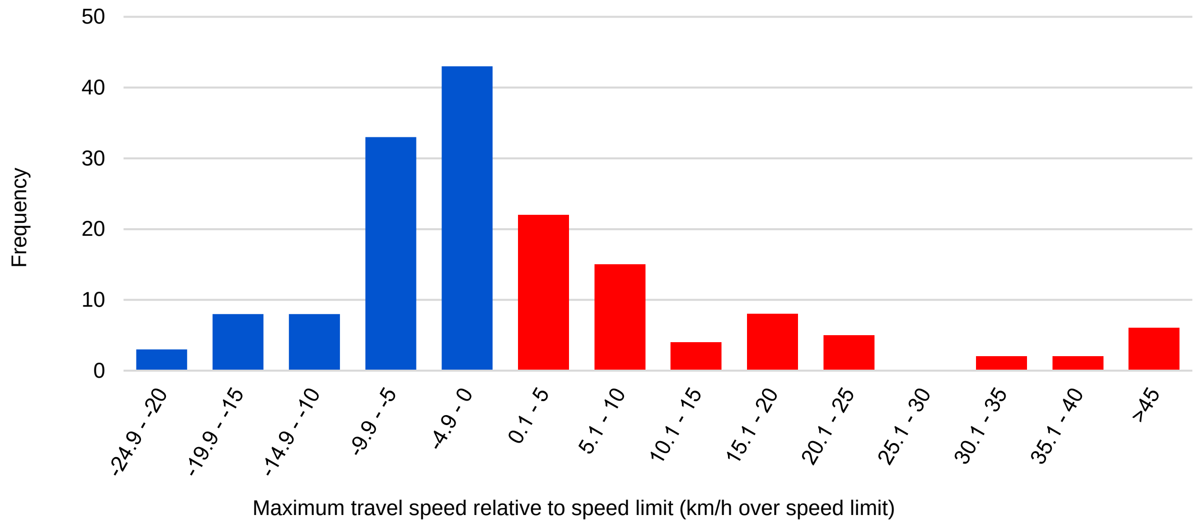


Figure 3.4
EDR free-speed vehicle's maximum travel speed relative to speed limit (excluding Major Crash cases)

3.6 Seatbelt use

Seatbelt usage by vehicle occupant is an important safety parameter recorded by EDRs. A summary of seatbelt use in the EDR sample is shown in Table 3.8. Of the 329 EDRs (not including Major Crash cases) that recorded driver seatbelt usage, 321 (97.6%) of the drivers had their seatbelt buckled at the time of the crash. Of the 183 EDR reports (not including Major Crash cases) with passenger seatbelt usage recorded, only 26 of the vehicles had a person seated in the left-front seat at the time of the crash (according to the matched police report) and 23 (88.5%) were recorded as having their seatbelt buckled at the time of the crash.

Table 3.8
Seatbelt use by occupants in EDR vehicles (excluding Major Crash cases)

Position	EDR seatbelt buckled	EDR seatbelt unbuckled	Percentage positive	Total
Driver	321	8	97.6%	329
Front seat passenger	23	3	88.5%	26
Total	344	11	96.9%	355

3.7 Impact severity (delta-*v*)

Delta-*v* is a measurement of the change in velocity that occurs for a vehicle during an impact. It is a commonly used parameter that is indicative of the impact severity and has been correlated with injury: a higher delta-*v* is associated with higher probability of injury. The distribution of maximum delta-*v*s (in 5 km/h increments) recorded by the EDR vehicles for all cases is shown in Figure 3.5.

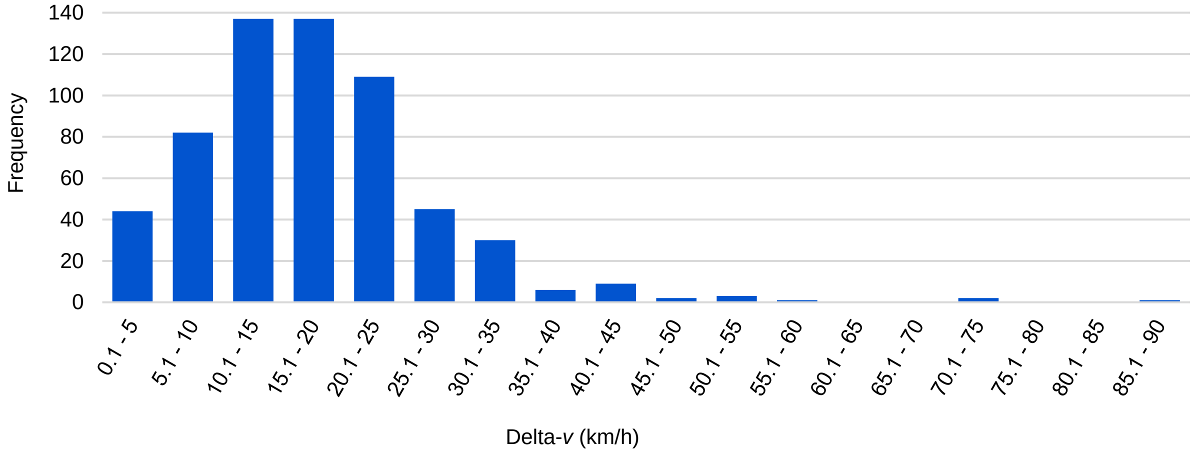


Figure 3.5
Frequency of delta-*v* of EDR vehicles in 5 km/h increments (excluding Major Crash cases)

3.8 Police-reported injury severity and maximum AIS level

There were 171 participants of all crashes involving EDR vehicles (including Major Crash cases) whose injuries were AIS coded for based on hospital records. The AIS injury scoring system ranks injuries by severity and performs well as a measure of mortality, though it also takes other factors such as ongoing disability into account. Each injury receives an individual AIS code, and from all injuries attributed to a single person, the maximum AIS severity can be determined. An AIS score of 0 indicates no injury was detected, whereas a score of 6 indicates a very high probability of the injury being fatal.

Table 3.9 shows the distribution of maximum AIS coded injury severities for each level of police reported severity. Four cases reported as non-injury and minor injury may have self-reported to a hospital rather than be transported via ambulance from the scene. Only three fatalities were coded (even though Major Crash cases were included) as the remainder may have died at scene and were transported directly for an autopsy rather than to a hospital for their injuries to be assessed. Half the participants (50%) that were coded in the police report as 'hospital treated' commonly had no injuries noted in the hospital records. This may be partly due to emergency doctors not noting very minor injuries, such as abrasions (AIS 1), rather than these participants being completely uninjured. Six cases that were reported by police as being 'hospital treated' had an AIS 3 injury, which is commonly used as a threshold for a 'serious injury'. Conversely, when AIS injury data is unavailable, 'hospital admission' is commonly used as a threshold of 'serious injury' based on police reported injury severity, but less than half (43.8%) would be considered as seriously injured according to the AIS coded injuries.

Table 3.9
Police-reported severities of all occupants in EDR crashes, by maximum severity of AIS coded injuries

Police reported severity	Maximum AIS coded injury severity							Total
	0	1	2	3	4	5	6	
Non injury	1	1	-	-	-	-	-	2
Doctor / Minor Injury	1	1	-	-	-	-	-	2
Hospital treated	66	50	10	6	-	-	-	132
Hospital admitted	4	7	7	10	3	1	-	32
Fatal	-	-	-	-	1	2	-	3
Total	72	59	17	16	4	3	-	171

4 Discussion

This project achieved its primary aim of expanding the number of EDR cases matched to police reports and hospital data, with this summary report showing that the data collected is broadly representative of the crashes that occur in the South Australian passenger vehicle crash population. The matching rates of EDR downloads to police records was 77%, and the matching rate of injury data from hospitals for police reported hospital-attendees was 41%. The data from the project was used to determine the percentage and extent of speeding in crashes by bullet vehicles and by vehicles travelling at a free-speed, something that can only generally be undertaken with detailed crash investigations and reconstructions. Over a quarter of bullet vehicles (27.1%) were found to be speeding before a crash, and 40.3% of free-speed vehicles were found to have been speeding, with nearly half of those (17.0%) travelling 10 km/h or more above the speed limit. The seatbelt usage reported by the EDR files indicated that 96.9% of frontal occupants were buckled at the time of the crash.

The speed data from EDRs is not only useful for determining speeding, but has the potential to be useful for many other applications. To date it has been used to:

- Explore driver reactions and avoidance strategies from crash-involved vehicles (Elsegood, Ponte & Doecke, 2020; Elsegood, Ponte & Doecke, in press)
- Examining the timing of pre-impact braking in different crash scenarios (Elsegood, Ponte & Doecke, 2020)
- Determining the effects of Intelligent Speed Adaptation (Doecke *et al.*, 2021)
- Investigate the relationship between delta-*v* and injury risk (Ponte, Elsegood and Doecke, 2021)

Other applications yet to be realised include:

- Determining characteristics of drivers that choose to travel above the speed limit (paper currently under development)
- Examining the speeds of vehicles navigating different infrastructure
- Investigating the level and effectiveness of pre-impact braking
- Determining the effects of different vehicle technologies and how/if they would avoid or reduce the severity of a crash

It is important to note that this project has allowed for the efficient collection of data from non-injury crashes. Non-injury crashes are important for use as the denominator when calculating risk. They are also important for comparison and contrast between the desired outcome should a crash occur (no injury), and an undesirable outcome (injury). Current methods of detailed data collection are typically resource intensive and focus their finite resources on injury crashes.

Acknowledgements

This research was partly funded via a deed with the South Australian Government and by the Victorian Transport Accident Commission. The TAC project manager was Paulette Ziekemijjer.

The authors would like to acknowledge: Pickles Auctions for allowing CASR researchers to access crashed vehicles; Christine Basso from SAPOL for providing police reports matching the EDR vehicles; and Tori Lindsay and Siobhan O'Donovan from the Centre for Automotive Safety Research for accessing hospital records and AIS coding the injuries.

The views expressed in this report are those of the authors and do not necessarily represent those of the University of Adelaide or the funding organisations.

References

Doecke, S. D., Raftery, S. J., Elsegood, M. E., & Mackenzie, J. R. R. (2021). *Intelligent Speed Adaptation (ISA): benefit analysis using EDR data from real world crashes* (CASR176). Adelaide: Centre for Automotive Safety Research.

Elsegood, M. E., Doecke, S. D., & Ponte, G. (2020). Pre-impact braking in crashes: insights from event data recorders (EDRs) (CASR171). Adelaide: Centre for Automotive Safety Research.

Elsegood, M. E., Ponte, G., & Doecke, S. D. (in press). Event data recorder (EDR) preliminary insights - 2020 analysis. Adelaide: Centre for Automotive Safety Research.

Ponte, G., Elsegood, M. E., & Doecke, S. D. (2021). Injury risk and delta-*v* - insights from event data recorder information and reported injury outcomes. 2021 Australasian Road Safety Conference, Melbourne, Australia, 28-30 September 2021.

Appendix A – DCA Codes