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Event Data Recorders (EDRs) and high severity crashes: a summary of data collected by Victoria Police

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SD Doecke & ME Elsegood

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Title

Event Data Recorders (EDRs) and high severity crashes: a summary of data collected by Victoria Police

Authors

SD Doecke & ME Elsegood

Performing Organisation

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

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Abstract

The CASR-EDR database contains data from the Event Data Recorders (EDRs) of crashed vehicles, and matched police report and injury data. Data collection for the CASR-EDR database has been ongoing each year since its creation in 2017. This report details the addition to the CASR-EDR database of EDR data downloaded by the Victorian Police's Collision Reconstruction and Mechanical Investigation Unit (CRMIU). The Victorian data sample is summarised and its representativeness and utility is discussed. Out of 337 EDR files downloaded by the CRMIU between the beginning of 2017 and the end of March 2022, 256 unique crashes (271 EDR vehicles) with matched police report data were identified. Most of the EDR files were from crashes that were either fatal (45%) or resulted in 'major injury' (43%). Of the 'major injury' cases, 58% had a Maximum Abbreviated Injury Score (MAIS) of three or more (MAIS 3+). Almost half of the bullet vehicles involved in a fatal crash were speeding, with many speeding by more than 50 km/h, and 7.8% speeding by more than 100 km/h. In the total CRMIU EDR sample from Victoria, there were 7 bullet vehicles that were travelling above 200 km/h. There were also 17 drivers and 3 passengers who were recorded in the EDR as not wearing a seatbelt. It was concluded that the addition of EDR data downloaded by the CRMIU of Victoria Police to the CASR-EDR database, along with the matched police data, provides a useful standalone dataset and enhances the overall utility of the CASR-EDR database. The continuation of the collection of CRMIU EDR data, along with improvements to the sample, is recommended.

Keywords

Event Data Recorders, Fatal, Major injury, Speeding, Seatbelt, Victoria

Summary

Many modern vehicles contain Event Data Recorders (EDRs) which detect the occurrences of collisions and save the log of the last few seconds of driving data prior to each collision. Data downloaded from the EDR of a crash-involved vehicle can include many variables that are relevant to road safety. These include, but are not limited to, travel speed, impact speed, brake/accelerator pedal position, steering wheel angle, delta-*v* (crash impact severity), seatbelt usage and safety system deployment (for example, airbags and seatbelt pretensioners). In 2017, the Centre for Automotive Safety Research (CASR) initiated the development of a database of EDR data from crashed vehicles: the CASR-EDR database. Data collection for the CASR-EDR database has been ongoing each year since its creation.

This report details the addition of EDR data downloaded by the Victorian Police's Collision Reconstruction and Mechanical Investigation Unit (CRMIU) to the CASR-EDR database, summarises the data, and discusses representativeness and utility of this sample. The cases from the Victorian CRMIU were added to the CASR-EDR database because it was thought that they would represent a useful stand-alone dataset, would add more high severity crashes to the database, and would broaden the geographical coverage of the database.

The EDR data, downloaded by the CRMIU between the beginning 2017 and end of March 2022, were matched to data from police reports and injury data. Out of 337 EDR files provided, 31 had no recorded events, and 7 were duplicates. After matching with crash details, 256 unique crashes (271 EDR vehicles) were identified. Most of the EDR files were from crashes that were either fatal (45%) or resulted in 'major injury' (43%). Of the 'major injury' cases, 58% had a Maximum Abbreviated Injury Score (MAIS) of three or more (MAIS 3+).

The initial results presented in this summary report revealed some concerning statistics regarding driver behaviour in Victoria. Almost half of the bullet vehicles involved in a fatal crash were speeding, with many speeding by more than 50 km/h, and 7.8% speeding by more than 100 km/h. In the total CRMIU EDR sample from Victoria, there were 7 bullet vehicles that were travelling above 200 km/h. There were also 17 drivers and 3 passengers who were recorded in the EDR as not wearing a seatbelt.

It was concluded that the addition of EDR data downloaded by the CRMIU of Victoria Police to the CASR-EDR database, along with the matched Victorian Police Accident Reporting System (VPARS) data, provided a useful standalone dataset and enhanced the overall utility of the database. The 114 fatal cases from Victoria appeared to be reasonably representative of all fatal crashes in Victoria in terms of crash location, speed zone and crash type, and could be used to help address a broad range of road safety research topics. The utility of the 111 'major injury' cases from Victoria is reduced somewhat by apparent biases towards higher injury severity and speeding. The wide range of travel speeds, impact speeds, and delta-*v*s in the overall sample will have great utility for analyses such as speed-risk curves.

It is recommended that the collection of the matched EDR data be continued, and that further work be undertaken to understand and, if possible, improve the sample. It is also recommended that further use cases for CRMIU EDR sample be developed, and that the collection of EDR data from written-off vehicles in Victoria, and methods of increasing the percentage of the vehicle fleet with accessible EDRs, be explored.

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1. Introduction

Many modern vehicles contain Event Data Recorders (EDRs) which detect the occurrences of collisions and save the log of the last few seconds of driving data prior to each collision. Data downloaded from the EDR of a crash-involved vehicle can include many variables that are relevant to road safety. These include, but are not limited to, travel speed, impact speed, brake/accelerator pedal position, steering wheel angle, delta-*v* (crash impact severity), seatbelt usage and safety system deployment (for example, airbags and seatbelt pretensioners). Many of these data are either difficult or impossible to obtain through other means.

In 2017, the Centre for Automotive Safety Research (CASR) initiated the development of a database of EDR data from crashed vehicles, the CASR-EDR database. Data collection for the CASR-EDR database has been ongoing each year since its creation. EDR data were originally obtained from two sources: an auction yard for written off vehicles in South Australia, and the Major Crash Investigation Unit (MCIU) of the South Australian Police. The cases from the auction yard yielded a sample that is reasonably representative of police reported crashes in South Australia, though somewhat biased towards injury crashes (Elsegood, Doecke & Ponte, 2023). The cases from the South Australian MCIU are mostly fatal crashes. Data matching with police reports and hospital case notes provides information on the crash circumstances, vehicle details, occupant details, site features, and injury outcomes for the database. At the end of 2023, there were over 800 cases in the CASR-EDR database that had been matched to a police report.

The CASR-EDR database has been used to examine several important road safety topics. These include speeding (Doecke, Ponte & Elsegood, 2023), pre-impact braking (Elsegood, Doecke & Ponte, 2020), the benefits of Intelligent Speed Adaptation (Doecke, Raftery, Elsegood & Mackenzie, 2021), and speeds at intersections (Doecke, Elsegood and Ponte, in press).

The CASR-EDR database is largely representative in terms of injury severity and therefore contains only a small percentage of high severity crashes. The collection of cases from the South Australian MCIU was an attempt to collect more serious cases. However, only 34 of the more than 800 crashes in the database at the end of 2023 were fatal crashes, and only 29 were serious injury crashes (defined from police reported severity of hospital admission).

This report details the addition of cases from the Victorian Police's Collision Reconstruction and Mechanical Investigation Unit (CRMIU) to the CASR-EDR database, summarises the data, and discusses the samples representativeness and utility. The cases from the Victorian CRMIU were added to the CASR-EDR database because it was thought that they would represent a useful stand-alone dataset, would add more high severity crashes to the database, and would broaden the geographical coverage of the database.

2. Method

2.1. The CRMIU EDR data sample

EDR files were provided by the CRMIU of the Victorian Police. All EDR files downloaded from crashed vehicles by the CRMIU between the beginning of 2017 and March 2022 were provided to CASR for inclusion in the CASR-EDR database. The beginning of 2017 was chosen as the start date to match the existing data in the CASR-EDR database.

The sample was defined by the CRMIU's criteria for downloading from a vehicle involved in a crash. Before these criteria are explained, it is important to note that the CRMIU is a separate division to the Major Collision Investigation Unit (MCIU) and comes under a different department. This means that the criteria for the CRMIU to download EDR data is not the same as the MCIU's criteria for investigation, though they are related.

There are two main categories of crashes for which the CRMIU will attempt to download EDR data from the crash-involved vehicles. The first is crashes for which the MCIU are the primary investigating unit. In almost all instances, the CRMIU will attend the scene of a crash for which the MCIU are the primary investigating unit and will attempt to download EDR data from involved vehicles. MCIU are the primary investigating police unit for the following types of crashes:

- Crashes involving three or more fatalities
- Hit-run crashes involving fatal or life-threatening injuries
- Crashes involving fatal or life-threatening injuries for which there is evidence of criminal negligence by a surviving driver (e.g., failing to give way, distraction, excessive speed, drug or alcohol affected, fatigue)
- Crashes in which a Victoria Police employee (on or off duty) is involved as a driver, or the collision resulted from a police pursuit

MCIU may also attend other fatal or life-threatening collisions outside of the above criteria. This can include providing assistance and expertise where the involvement of police in the collision may cause reputational harm to Victoria Police, or when another emergency service is involved in the crash.

The CRMIU will also attempt to access EDR data from vehicles involved in crashes that the MCIU is not investigating when their involvement is requested to by the primary investigating unit. Typically, these requests are made by a Highway Patrol Unit, who investigate most collisions in Victoria. These crashes can be any severity; however, fatal and serious injury crashes, especially those for which criminal charges may be laid, are given priority.

In addition to these formal criteria, it is worth noting that CRMIU has advised the authors that it is their belief that they attend "most" fatal crashes and will attempt to download the data from an EDR where possible. It is outside the scope of the present report to quantify what precise percentage "most" represents.

The EDR files were provided with the notes section redacted for confidentiality purposes. The notes section is a text field that is entered by the person downloading the EDR file at the time of download and can be used to make notes about the case. It does not contain any data from the EDR itself.

2.2. Data matching

The EDR files were matched to data from TAC’s Victoria Police Accident Reporting System (VPARS) to provide crash, vehicle, and demographical information. The Vehicle Identification Numbers (VINs) recorded in the EDR files were used to match the two datasets. The fields exported from VPARS were selected to align to those already in the CASR-EDR database, which were primarily based on data available from South Australian Police reports and hospital data. Some additional fields were also added.

Injury data for each injured occupant was obtained from TAC’s Claims database. This included an indication of the duration of hospital stay and injuries categorised according to the Abbreviated Injury Scale (AIS). TAC specified that their AIS coded injuries were mapped from ICD-10-AM codes. This differs from the South Australian data in the CASR-EDR database, for which the individual injuries and corresponding AIS codes are coded from hospital notes.

In addition to establishing a protocol for converting TAC's provided data into a format compatible with CASR's established EDR database, several value-enhancing procedures were implemented prior to conducting summary analysis. These supplementary steps comprised:

- Verifying the consistency between the crash description and the EDR event record through the evaluation of an experienced EDR analyst
- Rectifying inconsistencies between the VPARS data and the EDR data (e.g., airbag deployment)
- Adjusting select Definitions for Coding Accidents (DCA) codes and vehicle positions to align with CASR's existing DCA code and position definitions
- Categorising the crashes into simple crash types
- Flagging crashes involving a Victoria Police employee as a driver, or a police pursuit

2.3. Speeding and the classification of bullet vehicles

The travel speed (maximum speed recorded in the EDR file) was compared to the post speed limit to determine if the vehicle was speeding, and to compare their speed relative to the speed limit. When considering the influence of speed and speeding on crash outcomes it is important to distinguish between the speeds of vehicles that will have a considerable influence on the outcome, and those for which the speed will have a comparatively minor influence on the outcome. A common vehicle classification that can be helpful in making this distinction in road crashes is the “bullet vehicle” and “target vehicle” nomenclature. The bullet vehicle, sometimes referred to as the striking vehicle, is the vehicle that was travelling in a forward direction to strike another vehicle (the target or struck vehicle) or an object.

The following method was used to classify vehicles as bullet vehicles in the CASR-EDR database. For crashes in which a vehicle was performing a turning manoeuvre across traffic, the bullet vehicle was the through vehicle. In right angle crashes, the bullet vehicle was classified as the vehicle that had right of way. In rear-end crashes, the rear-most vehicle was the bullet vehicle. For single vehicle and pedestrian crashes, the vehicle involved in the crash was always classified as the bullet vehicle. In head-on crashes and side-swipe crashes both vehicles were classified as bullet vehicles. Further information of the classification of vehicles as bullet vehicle for each DCA code is provided in Appendix A. A summary of the speeds of bullet vehicles is provided in this report.

3. Results

The CRMIU initially provided 337 EDR files. Upon entering these files into the CASR-EDR database, it was found that 31 EDR files had no events recorded, while 7 were duplicates of existing entries. Following crash-matching using the VINs from EDR files, 16 files had no corresponding crash details, and 12 cases were deemed to have implausible matches between crash details and EDR records. Despite these issues, 271 EDR files successfully matched with crash records. However, there were multiple sets of EDR files with the same crash details, indicating they were involved in the same crashes. This resulted in a total of 256 unique crashes (with 271 EDR vehicles) identified from the 337 EDR files provided.

In summary, of the initial 337 EDR files provided:

- 31 had no events recorded,
- 7 were duplicates,
- 16 had no matching crash details,
- 12 had implausible matches,
- 271 were successfully matched to crash records, but some of these were matched to duplicate crashes, resulting in 256 unique crashes.

Of the 256 crashes, 10 crashes involved a Victoria Police employee as a driver (7 EDRs from police vehicles, 2 from other vehicles, and one with EDR files from both a police vehicle and a civilian vehicle involved in a single crash). An additional 10 crashes were linked to a police pursuit in which the EDR vehicles were evading police and crashed.

3.1. Sample characteristics

The following section outlines the characteristics of the entire sample of EDR crashes obtained from the CRMIU that were matched successfully to crash records.

3.1.1. Crash dates

Table 3.1 shows the distribution of years when the crashes occurred. Most crashes in the sample occurred from 2017 to 2021, though some occurred in earlier years. Most of the crashes that occurred in 2016 occurred late in the year, and the download occurred in 2017 due to time lag between the crash and the actual download. It is unclear why two crashes that occurred in 2014 and 2015 had their EDR data downloaded in 2017. The number of cases was generally increasing from 2017 to 2019. The drop in cases in 2020 may have been related to the COVID-19 pandemic.

Table 3.1
Distribution of crash occurrence years in the CRMIU EDR sample

Crash occurrence year	Frequency	Percentage
2014	1	0.4%
2015	1	0.4%
2016	5	2.0%
2017	37	14.5%
2018	45	17.6%
2019	58	22.7%
2020	40	15.6%
2021	60	23.4%
2022	9	3.5%
Total	**256**	**100.0%**

3.1.2. Crash areas

The areas in which the crashes occurred is shown in Table 3.2. The majority occurred in Melbourne, with around 40% occurring in rural Victoria.

Table 3.2
The CRMIU EDR crash sample, by the area of Victoria in which they occurred

Area	Frequency	Percentage
Melbourne	153	59.8%
Rural Victoria	103	40.2%
Total	**256**	**100.0%**

3.1.3. Crash severities

Table 3.3 shows the severity of the crashes, as defined by the police. The category 'minor injury' typically involved situations in which ambulance personnel attended the crash scene but did not transport any occupants to a hospital, instead treating the minor injuries at the crash site. ‘Major injury’ typically involved a crash participant attending a hospital for any length of time. There were a similar number of crashes that were fatal (n=114) and that involved ‘major injury’ (n=111). These two categories made up around 88% of all the crashes in the sample. The presence in the sample of low severity crashes (minor injury and no injury) was usually the case due to one of the following circumstances:

- Suspicion of speeding or racing by investigating police, as noted in the crash description
- Instances in which the crash appears intentional or deliberate, sometimes involving domestic violence
- Suspicions of drug trafficking, drug use, or intoxication of the driver
- Drivers and occupants fleeing the crash scene, as noted in the crash description
- Direct involvement of a police vehicle in the crash; 9 out of 10 police vehicle crashes were in the low severity categories
- The crash being related to police activity, such as police pursuits; 2 out of 10 crashes involving police pursuits were in low severity categories.

Table 3.3
The CRMIU EDR crash sample, by police reported crash severity

Overall crash injury severity	Frequency	Percentage
No injury	16	6.3%
Minor injury	15	5.9%
Major injury	111	43.4%
Fatal	114	44.5%
Total	**256**	**100.0%**

3.1.4. Crash severity vs AIS coded injuries

The distribution of maximum AIS (MAIS) coded injury severities for each crash by the police reported severity for the associated crash is shown in Table 3.4. As the category 'minor injury' did not involve a crash participant attending a hospital AIS injury data was not coded. The scarcity of data for the 'fatal' category is likely attributable to many occupants who were fatally injured dying before they were transported to a hospital, and subsequent not having ICD-10-AM codes from which to map AIS codes. Of the ‘major injury’ cases with coded injuries, 42.0% had a MAIS score of less than 3, whereas 58.0% had a maximum AIS score of 3 or more, which is commonly classified as a ‘serious injury’.

Table 3.4
Maximum AIS code for each crash in the CRMIU EDR sample, by the police reported severity

Police reported severity	Maximum AIS coded injury severity								Total
	0	1	2	3	4	5	6	Unknown	
Non injury	-	-	-	-	-	-	-	16	**16**
Minor injury	-	-	-	-	-	-	-	15	**15**
Major injury	1	11	30	34	20	4	-	11	**111**
Fatal	-	-	-	-	-	-	-	114	**114**
Total	**1**	**11**	**30**	**34**	**20**	**4**	**-**	**156**	**256**

3.1.5. Crash speed zones

Table 3.5 shows the speed zones in which the crashes occurred. For crashes in which the involved vehicles were travelling on roads with different speeds zones, the speed zone of the crash was defined as the higher of the two speed zones. The highest number of cases occurred in 100 km/h zones, closely followed by 60 km/h zones. More than half (52.7%) of the crashes occurred in speed zones of 80 km/h or more. The crash in an area with an unknown speed zone occurred on a private road.

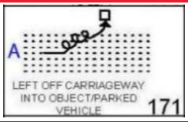
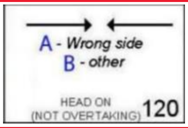
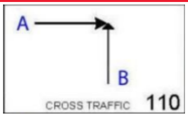
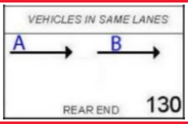
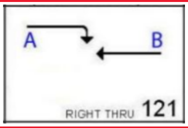
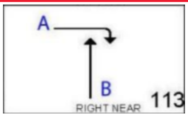
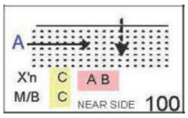
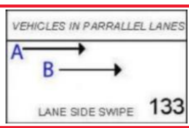
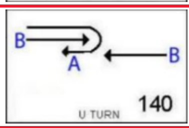
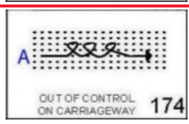
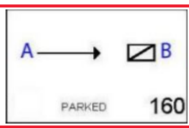
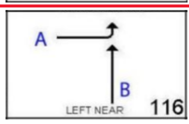
Table 3.5
Crashes with EDR data by speed zone

Speed zone (km/h)	Frequency	Percentage
40	9	3.5%
50	24	9.4%
60	72	28.1%
70	16	6.3%
80	45	17.6%
100	85	33.2%
110	4	1.6%
Unknown	1	0.4%
Total	**256**	**100.0%**

3.1.6. Crash DCA codes and positions

The crash types for all vehicles with EDR data, along with their position/action are shown in Table 3.6. Note that the total of 271 is greater than previous tables as there were 15 crashes for which two vehicles involved in the crash had EDR data downloaded, and this table is presenting all DCA codes and positions of all EDR vehicles in the CRMIU EDR sample. 'Single vehicle into object' crashes were the most numerous in the sample (n=71), followed by 'head-on' crashes (n=54). Crashes at intersections ('right angle', 'right turn – opposite directions', and 'right turn – adjacent directions') were also common, with 67 crashes in the sample across the three sub-types listed in Table 3.6. For collisions involving two or more vehicles, there was no significant bias observed in the retrieval of EDR data from the vehicle seemingly at fault, whether due to failing to give way, travelling onto the incorrect side of the road, or rear-ending another vehicle. There were 87 vehicles involved in crashes with at least two active vehicles who appeared to be at fault, and 75 from vehicles who appeared to not be at fault.

Table 3.6
Crash types and vehicle position/action of all EDR vehicles in the CRMIU EDR sample (all crash severities)

Crash type	Vehicle position/action	Frequency	Crash type total	Indicative DCA diagram
Single vehicle into object (DCA 141, 164, 171, 173, 174, 175, 181, 183)	A (vehicle)	71	71	
Head on (DCA 120, 150)	A (incorrect side) B (correct side) Other	27 24 3	54	
Right angle (DCA 110)	A (right of way) B (crossing right of way) Other	14 21 1	36	
Rear end (DCA 130, 131, 132)	A (rear/striking) B (first struck) C+ (following struck)	15 15 5	35	
Right turn – opposite directions (DCA 121)	A (turning) B (through)	12 5	17	
Right turn – adjacent directions (DCA 111, 113, 114)	A (turning) B (through) Other	6 7 1	14	
Pedestrian (DCA 100, 101, 102, 103, 104, 105, 106, 107, 108)	A (vehicle)	9	9	
Side swipe (DCA 133, 134, 135, 136, 137)	A (correct lane) B (changing lanes) Other	4 - 2	6	
U-turn in front (DCA 140)	A (turning) B (through)	5 1	6	
Rollover (DCA 170, 172, 174, 180, 182, 184)	A (vehicle) Other	4 1	5	
Hit parked vehicle (DCA 160, 161, 162, 163)	A (moving vehicle) B (parked vehicle)	5 -	5	
Left turn – adjacent directions (DCA 112, 116)	A (turning) B (through)	1 -	1	
Other (All other DCAs)		12	12	
Total			**271**	

3.2. Comparison to EDR sample to all Victorian crashes

The CRMIU EDR sample was compared to Victorian crashes over the same period, the 1st of January 2017 to the 31st of March 2022. Only 'major injury' and 'fatal' crashes were compared as there were insufficient numbers of 'minor injury' and 'no injury' cases in the EDR sample for comparison. The comparisons were made by injury severity so the representativeness of the sample in each injury category could be considered.

In order to accurately compare the CRMIU EDR sample to statewide data, it is essential to use vehicle-based comparisons. The CRMIU downloaded from all EDR-equipped vehicles at each crash scene they attended and so the likelihood of an EDR-equipped vehicle being involved was higher for crashes with multiple vehicles. Conducting the comparison at the vehicle level corrects for this sampling bias. The comparison was limited to light vehicles, as only light vehicles have accessible EDRs.

3.2.1. Crash area

Table 3.7 compares the CRMIU EDR sample and light vehicles involved in Victorian crashes by the area in which the crash occurred. The CRMIU EDR vehicles involved in 'major injury' crashes were under-represented in rural areas and CRMIU EDR vehicles involved in 'fatal' crashes were slightly under-represented in rural areas.

Table 3.7
Crash areas for the CRMIU EDR sample and Victorian state data (Jan '17 – Mar '22), separated by crash injury severity

Area	Vehicles involved in 'major injury' crashes				Vehicles involved in 'fatal' crashes			
	CRMIU EDR sample		Victorian state data		CRMIU EDR sample		Victorian state data	
	No.	%	No.	%	No.	%	No.	%
Melbourne	85	73.3%	25147	64.9%	53	43.4%	468	35.2%
Rural Victoria	31	26.7%	13559	35.0%	69	56.6%	862	64.8%
Unknown	-	-	27	0.1%	-	-	-	-
Total	**116**	**100.0%**	**38733**	**100.0%**	**122**	**100.0%**	**1330**	**100.0%**

3.2.2. Crash speed zones

A comparison of the CRMIU EDR sample and vehicles involved in all crashes in Victoria by speed zone is presented in Table 3.8. For the 'major injury' cases, the CRMIU EDR sample, to a small degree, over-represented crashes in 60 km/h zones and under-represented crashes in 50 km/h zones. In other speed zones, the CRMIU EDR sample of 'major injury' cases adequately reflected the proportion of 'major injury' crashes in those respective speed zones. The CRMIU EDR sample for 'fatal' crashes featured an under-representation of Victorian fatal crashes occurring in both 50 and 60 km/h zones, with this being particularly pronounced for 50 km/h zones. In contrast, fatal crashes in 100 km/h speed zones were over-represented in the CRMIU EDR sample.

Table 3.8
Speed zones for the CRMIU EDR sample and Victorian state data (Jan '17 – Mar '22), separated by crash injury severity

Speed zone (km/h)	Vehicles involved in 'major injury' crashes				Vehicles involved in 'fatal' crashes			
	CRMIU EDR sample		Victorian state data		CRMIU EDR sample		Victorian state data	
	No.	%	No.	%	No.	%	No.	%
≤ 40	5	4.3%	1874	4.8%	4	3.3%	33	2.5%
50	11	9.5%	5565	14.4%	5	4.1%	111	8.3%
60	43	37.1%	12821	33.1%	18	14.8%	268	20.2%
70	10	8.6%	3055	7.9%	5	4.1%	63	4.7%
75	-	-	5	0.0%	-	-	-	-
80	23	19.8%	7880	20.3%	21	17.2%	228	17.1%
90	-	-	105	0.3%	-	-	16	1.2%
100	24	20.7%	5896	15.2%	63	51.6%	558	42.0%
110	-	-	383	1.0%	5	4.1%	34	2.6%
Unknown	-	-	1149	3.0%	1	0.8%	19	1.4%
Total	**116**	**100.0%**	**38733**	**100.0%**	**122**	**100.0%**	**1856**	**100.0%**

3.2.3. Crash types

Table 3.9 compares the 'major injury' and 'fatal' cases in the CRMIU EDR sample to all vehicles involved in crashes of the same high injury severities that occurred in Victoria, by crash type. 'Head on' and 'right angle' cases were considerably over-represented in the CRMIU EDR sample, and 'pedestrian' cases were under-represented for both 'major injury' and 'fatal' cases. The over or under-representation of these three crash types was more pronounced in the 'major injury' CRMIU EDR cases than in the 'fatal' cases. 'Right turn – opposite direction' cases were under-represented in the 'major injury' CRMIU EDR cases but over-represented in the 'fatal' category. The proportion of the most common crash type for both 'major injury' and 'fatal' crashes, 'single vehicle into object', was represented reasonably well in the CRMIU EDR sample, especially for 'major injury' crashes.

Table 3.9
Crash types for CRMIU EDR sample and Victorian state data (Jan '17 – Mar '22), separated by crash injury severity

Crash type	**Vehicles involved in 'major injury' crashes**				**Vehicles involved in 'fatal' crashes**			
	CRMIU EDR sample		**Victorian state data**		**CRMIU EDR sample**		**Victorian state data**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Single vehicle into object	27	23.3%	5449	14.1%	32	26.2%	329	24.7%
Head on	21	18.1%	2516	6.5%	31	25.4%	264	19.8%
Right angle	19	16.4%	3688	9.5%	13	10.7%	113	8.5%
Rear end	18	15.5%	8605	22.2%	12	9.8%	158	11.9%
Right turn – opposite	6	5.2%	4233	10.9%	11	9.0%	58	4.4%
Right turn – adjacent	6	5.2%	2999	7.7%	7	5.7%	68	5.1%
Pedestrian	2	1.7%	2254	5.8%	7	5.7%	146	11.0%
Side swipe	5	4.3%	1808	4.7%	-	-	21	1.6%
U-turn in front	2	1.7%	767	2.0%	3	2.5%	17	1.3%
Rollover	2	1.7%	599	1.5%	2	1.6%	37	2.8%
Hit parked vehicle	3	2.6%	1909	4.9%	-	-	20	1.5%
Left turn – adjacent	1	0.9%	616	1.6%	-	-	3	0.2%
Other	4	3.4%	3290	8.5%	4	3.3%	96	7.2%
Total	**112**	**100.0%**	**38733**	**100.0%**	**117**	**100.0%**	**1330**	**100.0%**

3.3. Summary of data contained in the CRMIU EDR files

The information stored on EDRs differs between various vehicle makes and generations of EDRs. Table 3.10 shows the prevalence of selected variables recorded in the CRMIU EDR sample. In most of the vehicles, longitudinal and/or lateral delta-*v* (vehicle change in velocity due to impact) was recorded as part of the airbag deployment system. Only three cases in the sample did not have any delta-*v* recorded. Some EDRs only recorded a lateral delta-*v* when the crash event was classified as a side crash. Speed, brake pedal and accelerator pedal history were recorded by more than 80% of the EDRs. Driver seatbelt status was recorded in about half of the CRMIU EDR sample, but this reduced to only a third of the sample for passenger seatbelt status. Steering history was only recorded in around a quarter of the CRMIU EDR sample.

Table 3.10
Data fields recorded in files from the CRMIU EDR sample

Data field	**Recorded**	**Not recorded**	**Total**	**Percentage recorded**
Longitudinal delta-*v*	256	15	271	94.5%
Lateral delta-*v*	204	67	271	75.3%
Vehicle speed history	228	43	271	84.1%
Brake pedal history	228	43	271	84.1%
Accelerator pedal history	219	52	271	80.8%
Steering history	67	204	271	24.7%
Driver seatbelt status	136	135	271	50.2%
Passenger seatbelt status	91	180	271	33.6%

3.3.1. Bullet vehicle speeds and speeding

A total of 197 EDR vehicles were classified as bullet vehicles, and 165 of these had vehicle speed history recorded by the EDR. Figure 3.1 shows a summary of the travel speeds of these vehicles. The most common speed range was 91 to 100 km/h. There were 55 vehicles that were travelling above the maximum posted speed limit in Victoria of 110 km/h, with seven vehicles travelling above 200 km/h.

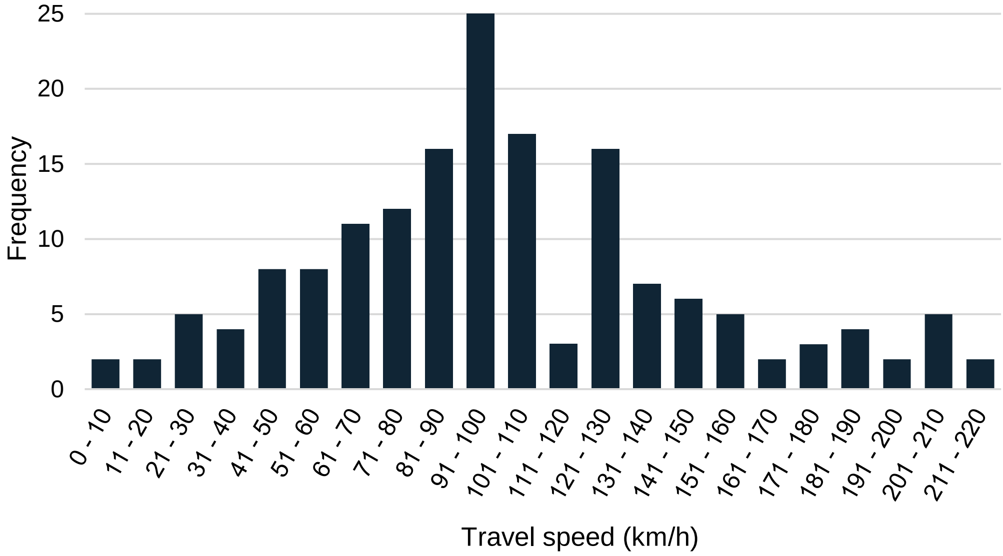


Figure 3.1
Travel speed categories of the CRMIU EDR sample bullet vehicles (n=165)

Figure 3.2 shows the impact speeds of the bullet vehicles in the CRMIU EDR sample. As with travel speed, an equally most common impact speed range was 91 to 100 km/h. When compared to the distrubution of travel speeds, the distrubtion of impact speeds is shifted to the left due to speed reduction prior to impact in some of the crashes. However, there was still a considerable number of crashes in which the impact speed of the bullet vehicle was above 110 km/h, and three in which the impact speed was above 200 km/h.

The travel speeds of the bullet vehicles relative to the posted speed limit are shown in Figure 3.3. The most common speed for a bullet vehicle was at, or less than 10 km/h below, the speed limit. However, the majority of vehicles (63.0%) were travelling above the posted speed limit. The most common range of speeding was between 1 and 10 km/h over the speed limit, though 13 vehicles were travelling more than 100 km/h over the speed limit.

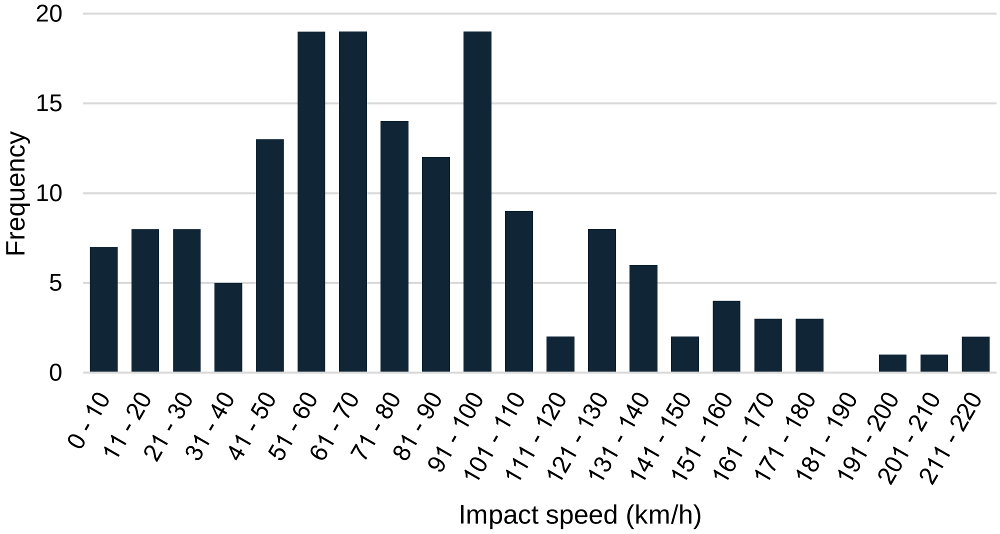


Figure 3.2
Impact speed categories of the CRMIU EDR sample bullet vehicles (n=165)

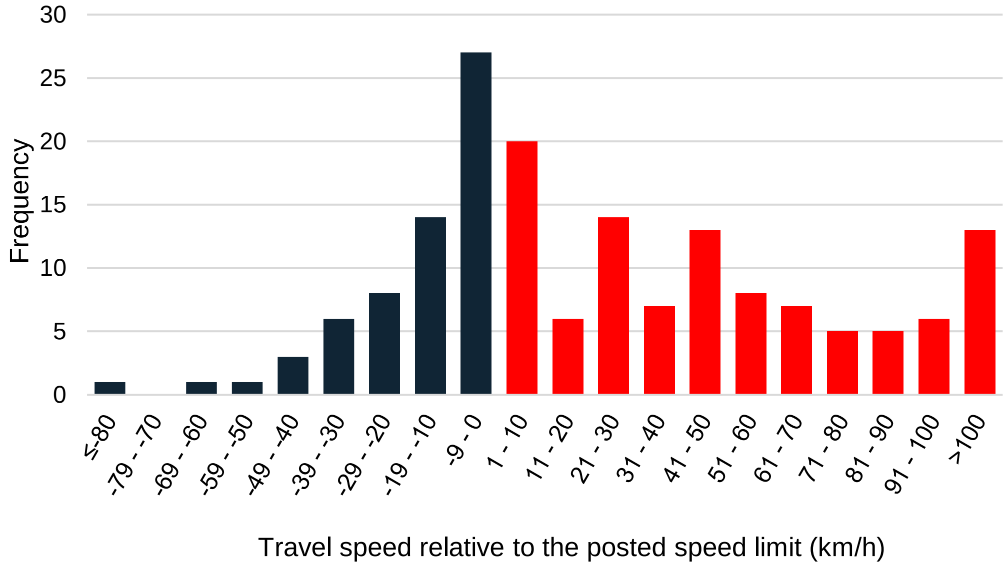


Figure 3.3
Travel speeds of the bullet vehicles in the CRMIU EDR sample, relative to the posted speed limit (n=165, speeding shown in red)

To investigate the speeding categories of crashes classified as 'major injury' and 'fatal', these incidents were isolated and expressed as a percentage of their respective samples, focusing solely on bullet vehicles. Figure 3.4 shows the distribution of travel speeds relative to the speed limit, by injury severity. The 'fatal' crashes involved 69 EDR bullet vehicles, while the 'major injury' crashes included 76 EDR bullet vehicles. Among the major injury crashes, 68.4% involved speeding, whereas 52.1% of the fatal crashes involved speeding. The most common range of travel speeds was between 0 and 9 km/h below the speed limit for both 'major injury' and fatal crashes. However, the difference in the proportion of each injury severity level that had a travel speed between 9 and 0 km/h below the speed limit was considerable (fatal, 24.6%; major injury, 13.2%).

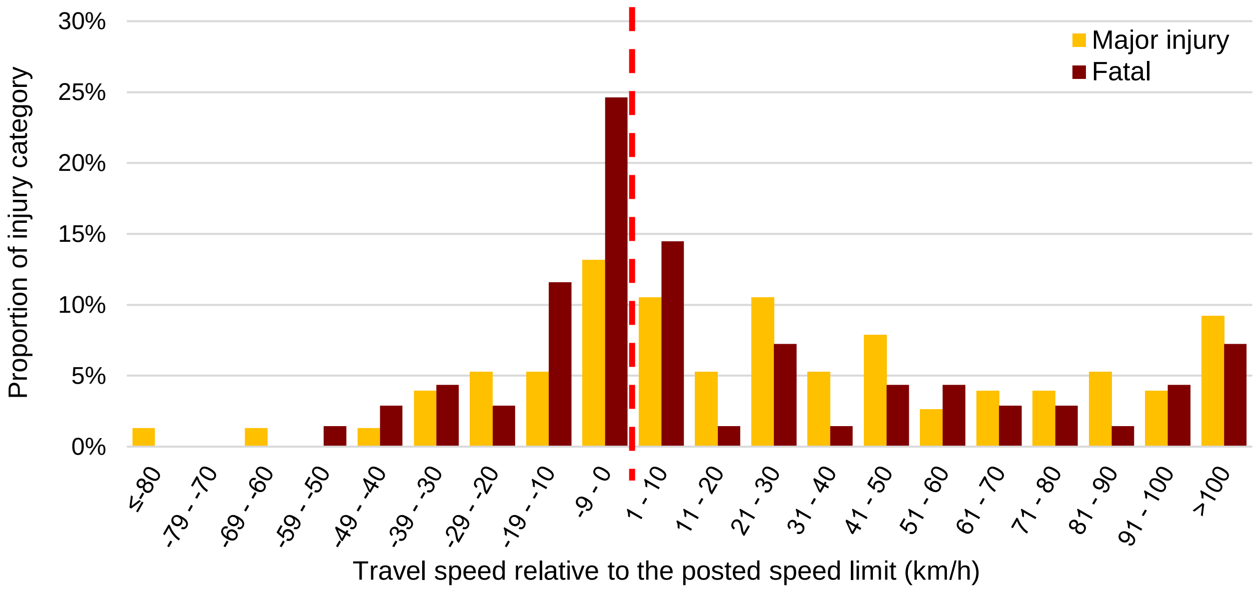


Figure 3.4
Travel speeds of the bullet vehicles in the CRMIU EDR sample relative to the posted speed limit, by injury severity (fatal n=69, 'major injury' n=76, red dash line represents speed limit)

3.4. Seatbelt use

Seatbelt usage by vehicle occupants is an important safety parameter recorded by EDRs. A summary of seatbelt use in the CRMIU EDR sample is shown in Table 3.11. Of the 91 EDR files with passenger seatbelt usage recorded, 40 had a person seated in the left-front seat at the time of the crash (according to the VPARS data). There was also a single case in which the vehicle was determined to have no driver at the time of the crash as they were in the process of alighting from the vehicle. Front seat passengers were more likely to have their seatbelt buckled than drivers, though this difference was not statistically significant according to a chi-square test of independence, X^2 (1, n=177) = 0.79, p = 0.37.

Table 3.11
Seatbelt statuses according to the CRMIU EDR records

Position	EDR seatbelt buckled	EDR seatbelt unbuckled	Percentage positive	Total
Driver	118	17	87.4%	135
Front seat passenger	37	3	92.5%	40
Total	**155**	**20**	**88.6%**	**175**

3.5. Impact severity (delta-*v*)

The change in velocity, or delta-*v*, that a vehicle experiences during an impact is a commonly used parameter that is indicative of impact severity. The distribution of delta-*v*s (in 5 km/h increments) recorded by the EDR vehicles is shown in Figure 3.5. The sample was found to include a wide range of delta-*v*s, with 10 or more cases in each 5 km/h increment spanning the range of 0 to 75 km/h.

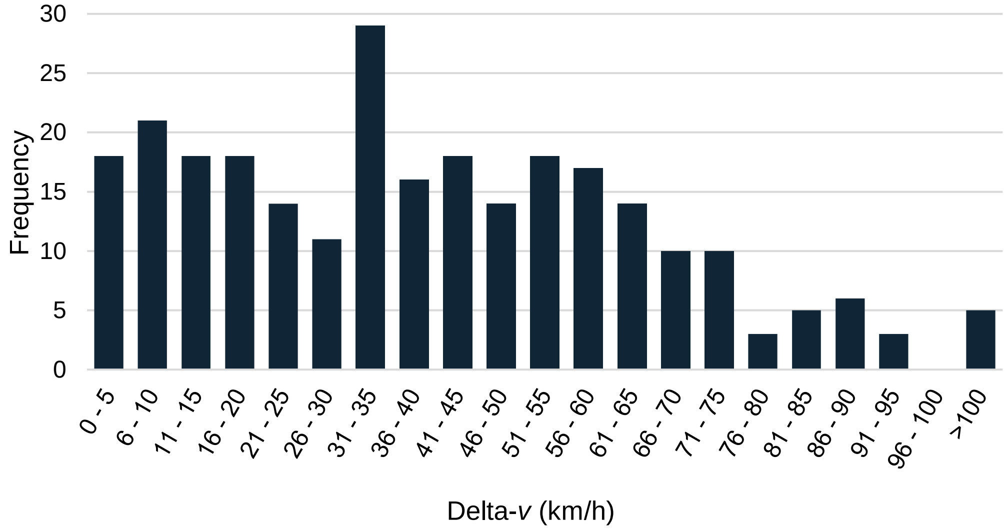


Figure 3.5
Frequency of delta-*v* recorded by EDR vehicles in 5 km/h increments (n=268)

4. Discussion

The CASR-EDR database has been used to examine a range of important road safety topics, providing many valuable insights into crashes and crash-related driver behaviours in South Australia. An agreement between the TAC, Victoria Police, and CASR enabled the addition of Victorian crashes investigated by the CRMIU to the existing CASR-EDR database.

A total of 256 crashes were successfully matched, although 16 VINs were not matched to a crash in TAC's VPARS. This discrepancy may be due to the VINs of the vehicles not being recorded in VPARS, and therefore not having a VIN to match to, or to the collision the EDR vehicle was involved in lacking an associated crash entry in VPARS altogether. Additionally, 12 matches were deemed implausible, where the EDR event did not align convincingly with the crash description in the VPARS dataset.

There were several differences in the data collection in relation to the CRMIU EDR cases, and that collected for other cases in the CASR-EDR database. In CASR's standard EDR data collection protocol, photographs are routinely captured of the EDR-equipped vehicle. This practice serves as an additional verification measure to ensure correspondence between the visible damage on the vehicle and the events recorded by the EDR. The CRMIU could not routinely supply photographs of the EDR vehicle as the CRMIU is not the custodians of such photographs within Victoria Police. This prevented using photographs as an additional verification check during data entry. Other elements that were lacking in the CRMIU cases in comparison to the other cases in the CASR-EDR database included damage measurements, results of physical analyses of the post-crash conditions of seatbelts, pretensioners and airbags. These variations highlight specific aspects of data collection that were omitted or modified in comparison to the typical procedures employed by CASR for EDR data collection.

4.1. Sample representativeness

The sample of vehicles from which CRMIU retrieved EDR data was not a random sample. It is therefore important to consider what biases exist due to the lack of random case selection. The sample selection was based on:

- MCIU's criteria for being the primary investigating unit for a crash
- Requests from Highway Patrol Units for which there is no defined criteria (though priority is given to fatal and serious injury crashes for which criminal charges may be laid)
- An involved vehicle having an EDR that has recorded data from the crash that can be downloaded.

The MCIU's criterion of "fatal or life-threatening injuries where there is evidence of criminal negligence by a surviving driver", and the priority given to the Highway Patrol requests of a similar type, appear to be the main sources of bias in the sample. There are two aspects of this criterion, the criminal negligence aspect, and the surviving driver aspect. The "surviving driver" aspect of this criterion could be expected to cause an under-representation of cases without a surviving driver and an over-representation of cases with a surviving driver. It is most likely that there is no surviving driver in fatal single vehicle crashes. However, vehicles involved in single-vehicle crashes (into object and rollover) were found to be well-represented in the 'fatal' category (29.1% in the CRMIU

EDR sample, 27.5% in Victoria) and over-represented in the ‘major injury’ category (25.9% in the CRMIU EDR sample, 15.6% in Victoria). This suggests there is no under-representation due to the “surviving driver” aspect of the criterion, but instead an over-representation of single-vehicle crashes with a surviving driver in the 'major injury' category.

The unexpected over-representation of single vehicle crashes in the sample of ‘major injury’ crashes raises a broader question of the representation of crash types in the sample. In general, with respect to crash type, the sample of EDR fatal crashes appears to be more representative of all fatal crashes in Victoria, than the sample of ‘major injury’ crashes is of all ‘major injury’ crashes in Victoria. This may be due to the CRMIU attempting to conduct an EDR download where possible for “most” fatal crashes. To consider the overall patterns and underlying factors, it is best to concentrate on the more common crash types, where the sample characteristics are more likely to be a product of underlying bias, and less likely to be the product of the limited sample size. If we consider the crash types for ‘major injury’ crashes for which the sample included more than 10 vehicles, the over-represented crash types were ‘single vehicle into object’, ‘head-on’, and ‘right angle’ crashes. ‘Rear end’ crashes were under-represented. A commonality between the over-represented crash types is that they involve impact types with a higher risk of serious injury at a given impact speed (Doecke, Baldock, Kloeden & Dutschke, 2020). This suggests the underlying bias in the ‘major injury’ crashes may be towards higher injury severities. The under-representation of ‘rear end’ crashes in the sample is consistent with this theory.

The theory that the underlying bias in the sample of ‘major injury’ crashes is towards higher injury severities is further supported by the distribution of MAIS of the ‘major injury’ crashes shown in Table 3.4. Fitzharris *et al.* (2020) states that between August 2014 and December 2016, only 18% of drivers with a TAC hospital admission claim had a MAIS of three or more (MAIS 3+). In contrast, 57% of the ‘major injury’ crashes in the CRMIU EDR sample were MAIS 3+ cases. As ‘major injury’ appears to represent both hospital admissions and injuries requiring only treatment in the emergency department, it would be expected that the percentage of these cases that are MAIS 3+ would be much smaller than a sample that is limited to hospital admission. The substantially higher percentage of ‘major injury’ crashes with MAIS 3+ in the CRMIU EDR sample, compared to the findings reported by Fitzharris *et al.* (2020), strongly suggests the CRMIU EDR sample of ‘major injury’ crashes is biased towards cases with a higher MAIS.

Other possible sources of biases in the sample were the “evidence of criminal negligence” component of MCIU’s criterion of “fatal or life-threatening injuries where there is evidence of criminal negligence by a surviving driver”, and the stated priority given to requests from Highway Patrol units where criminal charges may be laid. Examples of criminal negligence provided by CRMIU include, but are not limited to, failing to give way, distraction, excessive speed, drug or alcohol affected driving, and fatigue. This should not bias the fatal crashes in EDR sample towards any behaviour or type of criminal negligence if the CRMIU is correct in their claim that they download EDR data from “most” vehicles fatal crashes where EDR data is available. However, this criterion could bias the ‘major injury’ cases where the request came from a Highway Patrol unit, if the request is aimed at providing evidence for criminal charges, and the highway patrol units understand what evidence an EDR can provide. EDRs will provide evidence of speeding and failure to obey a stop sign. They may also provide some evidence related to failure to give way and failure to keep left, or inattention of some form. An EDR cannot provide direct evidence of drug or alcohol effected driving, or fatigue, though it may provide some supporting evidence.

An indication of a bias towards speeding in the ‘major injury’ cases may be inferred from the results of the speeding analysis. Studies of speeding in crashes in Australia have shown that speeding is more prevalent in fatal crashes than non-fatal crashes (Doecke, Elsegood & Ponte, 2021; Doecke & Kloeden, 2014). However, contrary to these prior studies, a higher prevalence of speeding in 'major injury' cases (68.4%) than fatal cases (52.1%) was found in the CRMIU EDR sample. This suggests speeding may be over-represented in the ‘major injury’ cases due to the requests from the Highway Patrol units being bias towards providing evidence for criminal charges, and EDRs providing reliable evidence of speeding.

Another potential source of bias is the MCIU’s criterion of crashes where a Victoria Police employee is involved as a driver, or the collision resulted from a police pursuit. There were 20 crashes identified in the sample that met this criterion (10 involving Victoria Police employees and 10 police pursuit related), though these crashes may have also met another criterion for the MCIU to be the primary investigating unit. Crashes involving Victorian Police employees were strongly biased towards the ‘no injury’ or ‘minor injury’ crash severities. Civilian vehicles involved in police pursuits are likely to have a higher prevalence of speeding than other crashes. However, crashes involving police pursuits represent part of the road safety problem, and simply excluding such cases may not always be desirable. Future analysis should take into consideration if these cases match with the sample being analysed.

The sample will invariably exhibit bias towards vehicles with accessible EDRs, as it relies on the CRMIU being able to download from the EDR of one of the involved vehicles. The main method of downloading from an EDR in Australia is using the Bosch CDR tool. The CRMIU may also request a vehicle manufacturer download and provide the EDR data using a propriety tool. In rare instances the CRMIU may be able to download data from vehicles not officially support by the Bosch CDR tool. In practice, almost all (99%) of the EDR downloads came from vehicles that were officially supported by the Bosch CDR tool. As a result, there will be a bias towards supported makes and newer models, though unsupported makes and models can still be present in the sample for crashes with more than one vehicle. In summary, supported makes that are common in Australia include:

- Toyota (including Lexus) from 2002 models onwards
- Holden from 2007 models onwards
- Subaru from 2012 models onwards
- Mitsubishi from 2011 models onwards
- Jeep from 2006 models onwards

The other bias inherent in a dataset based on EDR data is the exclusion of cases below the recording threshold of EDRs. Each EDR will have a threshold, often based on delta-*v*, that must be exceeded for the EDR to store the event data. While in most fatal and “major injury” crashes this threshold will be exceeded, high severity crashes with pedestrians or cyclists may still not reach this threshold due to the large difference in mass between the pedestrian or cyclist, and the EDR vehicle. This explains why pedestrian crashes were found to be under-represented for vehicles involved in fatal and ‘major injury’ crashes, and may also explain why vehicles involved in fatal crashes were under-represented in 50 and 60 km/h speed zones.

4.2. The utility of the sample

EDRs, in comparison to traditional crash investigation techniques and reconstruction practices, can provide data that are more accurate, more efficient to produce, or entirely unique. For example, consider the data that can be obtained from a forensic crash investigation and reconstruction, and that which can be obtained from an EDR. A forensic crash investigation and reconstruction can produce reliable data on the travel speed of a vehicle only if there is clear evidence of the duration and severity of pre-impact braking, or reliable witness accounts that no pre-impact braking occurred. A lack of any of these elements will lead to an inaccurate estimate of travel speed, despite the many days that must be spent to produce such an estimate. A further difficulty is that it is often unknown if braking occurred without leaving clear forensic evidence. In contrast, travel speed recorded on an EDR is highly accurate prior to braking (Bortles, Biever, Carter & Smith, 2016) and would only be inaccurate in rare cases where braking was occurring or the vehicle was undergoing considerable side-slip at the earliest data point of the EDR's pre-impact data, or the EDR's maximum recorded speed was reached. Furthermore, downloading data from an EDR generally takes a matter of minutes, with this only extended to hours if the module must be physically removed from the vehicle. Even allowing time for interpretation of the data, EDRs can provide data on travel speed far more efficiently than through forensic crash investigation and reconstruction. EDRs can also provide improvements in efficiency and accuracy for data on impact speed, delta-*v* and restraint wearing. Unique data provided by an EDR can include steering wheel angle, accelerator pedal percentage, brake use, brake oil pressure, longitudinal acceleration, lateral acceleration, roll angle, cruise control status, ABS status, ESC status, airbag deployment timings and pre-tensioner deployment timings.

The data that are contained in EDRs has already been used to help address many important road safety research topics, including:

- The prevalence and profile of speeding in crashes (Doecke, Ponte & Elsegood, 2023)
- The relationship between travel speed and risk of serious injury (Doecke, Dutschke, Baldock & Kloeden, 2021)
- The relationship between impact speed and risk of serious injury (Doecke *et al.* 2020)
- The relationship between delta-v and risk of serious injury (Brumbelow, 2019)
- The prevalence of seatbelt wearing in crashes (Elsegood, Doecke, & Ponte, 2023)
- How drivers react to emergency situations (Elsegood, Doecke, & Ponte, 2020)
- The speeds of vehicles in crashes at different intersection types (Doecke, Elsegood & Ponte, in press)
- The benefit of Intelligent Speed Adaptation (Doecke *et al.*, 2021)

The utility of the CRMIU EDR sample is influenced by its representativeness. In this respect, the fatal crashes in the sample have the greatest utility. As a reasonably representative sample of fatal crashes in Victoria, the data can be used to answer research questions that need only one level of crash severity, for example, "what is the prevalence of speeding in fatal crashes in Victoria?" The 'major injury' cases in the sample currently have less utility, as the biases within the sample are not fully understood. For example, the authors cannot be confident that the prevalence of speeding found in the 'major injury' crashes is representative of the prevalence of all 'major injury' crashes in Victoria. This does not mean there is no utility of the 'major injury' crashes, as analyses can be performed within a subset for which a bias may be present. For example, an analysis of the characteristics of speeding crashes is not negatively impacted by a bias towards speeding. In actuality, a bias towards a certain factor is useful for an analysis that will only consider cases with that factor, as it results in more cases within the sample for said factor. However, if the sub-sample of 'major injury' crashes, and its biases, can be better understood in the future, their utility may be increased.

A further benefit of the CRMIU EDR sample is the addition of many high severity crashes to the CASR-EDR database. The majority of the data in the CASR-EDR database prior to the addition of the CRMIU cases was from a sample of written off vehicles in South Australia. This sample was reasonably representative in terms of injury severity and, as a result, contained a limited number of high severity crashes (Elsegood, Doecke, & Ponte, 2023). The CASR-EDR database contains EDR data from South Australian fatal crashes investigated by the South Australian MCIU but, being a less populous state, this had yielded only 34 cases to the end of 2023. The addition of the fatal cases from Victoria represents a considerable increase in the number of fatal cases in the CASR-EDR database. While some care will need to be taken when combining data from different states, the addition of many more high severity crashes to the CASR-EDR database has the potential to greatly increase the utility of the whole database for analyses that require substantial numbers of crashes at all severity levels.

The wide range of values in the three speed variables, travel speed, impact speed, and delta-*v*, also increases the utility of the CRMIU EDR sample. When conducting certain analyses, such as examining the risk of injury relative to a speed variable, the robustness of the analysis can degrade considerably at low and high speeds due to a lack of data. This is often evidenced by the confidence intervals becoming much wider at these speeds, or the results being limited to a certain range of speeds. For example, Kloeden, McLean & Glonek (2002) stated their relative risk curve has a valid range of 26 to 80 km/h, Fitzharris *et al.* (2022) only displayed results for ±15 km/h of the speed limit, and there is clear evidence of the widening of the confidence intervals at high speeds in the Doecke *et al.*'s travel speed risk curves (Doecke *et al.* 2021). The wide range of the speed variables in the CRMIU EDR sample will have great utility for inclusion in analyses such as speed-risk curves.

5. Conclusions

The addition of EDR data downloaded by the CRMIU of Victoria Police to the CASR-EDR database, along with the matched VPARS data, provided a useful standalone dataset and enhanced the overall utility of the database. The 114 fatal cases from Victoria appeared to be reasonably representative of all fatal crashes in Victoria in terms of crash location, speed zone and crash type, and could be used to help address a broad range of road safety research topics. The utility of the 111 ‘major injury’ cases from Victoria is reduced somewhat by apparent biases towards higher injury severity and speeding. However, the wide range of travel speeds, impact speeds, and delta-*v*s in the sample will have great utility for analyses such as speed-risk curves.

The initial results presented in this summary report revealed some concerning statistics regarding driver behaviour in Victoria. Almost half of the bullet vehicles involved in a fatal crash were speeding, with many speeding by more than 50 km/h, and 7.9% speeding by more than 100 km/h. In the total EDR sample from Victoria, there were 7 bullet vehicles that were travelling above 200 km/h. There were also 17 drivers and 3 passengers who were recorded in the EDR file as not wearing a seatbelt.

6. Future enhancement of the database

The CASR-EDR database would be further enhanced by the addition of EDR data collected from written off vehicles in Victoria matched to VPARS and injury data. This would result in the database containing similar data from two Australian states, which would greatly increase the utility of the Victorian data and increase the validity of combining data from South Australia and Victoria in future analyses. The combination of data from South Australia and Victoria would also increase how representative the data is of all of Australia.

As noted in Section 2.1, the CRMIU advised the authors that they attend “most” fatal crashes and download from an EDR equipped vehicle, if possible, but it was outside the scope of this report to quantify what percentage “most” represented. This percentage could be quantified by comparing the number of vehicles involved in fatal crashes supported by the Bosch CDR tool to the number of EDRs downloaded by CRMIU. This would aid in further understanding the sample of fatal crashes and could lead to an increased level of confidence in the representativeness of the sample of fatal crashes. If this revealed that the CRMIU are not downloading data from all vehicles involved in fatal crashes with an accessible EDR, options should be explored to enable the CRMIU to do so.

The utility of the sample could be enhanced by recording why each case was sampled by the CRMIU. This is particularly relevant to the EDR downloads CRMIU conducts due to a request from a Highway Patrol unit, as these do not have any clear criteria. However, it may also be useful to understand which of MCIU’s criteria was met for each of the cases for which they were the primary investigating unit. For example, it would be of great benefit to know if a request came from a Highway Patrol unit because they suspected a certain type of criminal negligence, or if they simply noticed that an involved vehicle may have an accessible EDR. Collecting this information would require some additional effort by Victoria Police.

The continued updating of the CRMIU EDR sample would enhance the dataset of the Victorian cases, and the CASR-EDR database as a whole. The cases from the CRMIU that were added to the CASR-EDR database were downloaded from an EDR between the beginning of 2017 and the end of the first quarter of 2022. By the first quarter of 2025, an additional three years of cases could be added to the database. If the rate of case collection per year continues to trend upwards, this could mean that, by June 2025, the number of cases in the dataset could potentially be doubled.

7. Recommendations

Having completed the collection and initial analysis of EDR data from Victoria Police, the authors recommend that:

- The collection of EDR data from Victoria Police, matched to VPARS data and TAC AIS injury data, be continued.
- Work be undertaken to quantify the percentage of vehicles involved in fatal crashes with accessible EDRs (with a publicly available tool) that are downloaded by the CRMIU. If this percentage is found to be less than 100, the feasibility of methods of increasing this to 100 should be explored.
- Work be undertaken to further understand the selection criteria for the sample of non-fatal EDRs downloaded by the CRMIU, either in retrospect, or by the collection of data on why the EDR download was requested for future cases.
- The collection of EDR data from written-off vehicles in Victoria (and associated police report and injury data), to compliment the Victorian CRIMU sample and the EDR data from written of vehicles in South Australia already in the CASR-EDR database, be explored.
- Further use cases for the CRIMU sample of EDR data, and the CASR-EDR database in general, be developed, with a focus on answering research questions for which EDR data can provide unique (and uniquely accurate) insights.
- Methods of increasing the percentage of the Victorian and Australian vehicle fleets that have an accessible EDR be explored.

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Appendix A – Bullet vehicle classifications

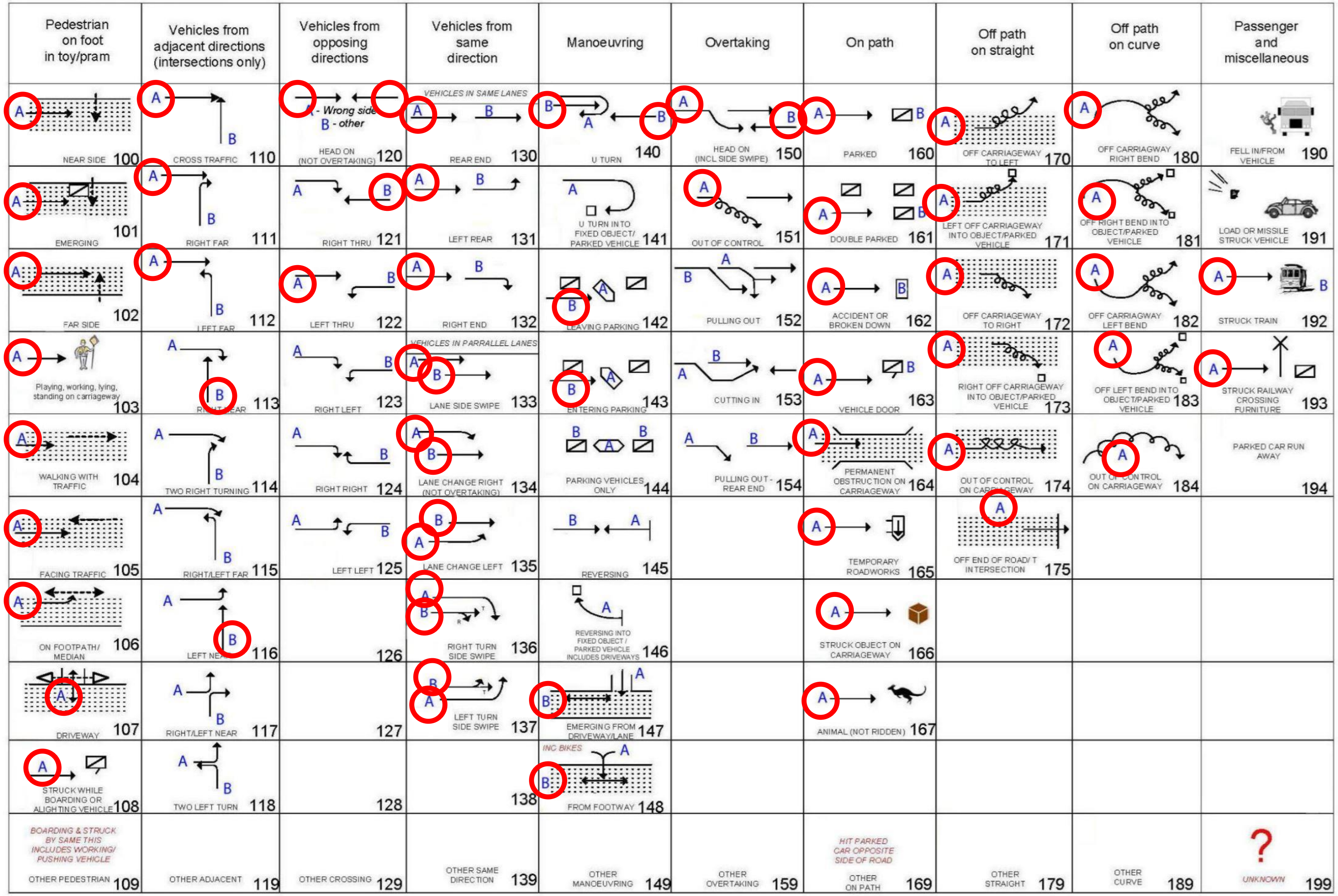

Figure A.1: Bullet vehicle classifications based on DCA position codes (Bullet vehicles circled in red)