Centre for Automotive Safety Research

THE UNIVERSITY of ADELAIDE

Speeding prevalence and profile in high severity crashes: data from Event Data Recorders (EDRs) obtained by Victoria Police

CASR238

ME Elsegood, SD Doecke

make history.

Report documentation

REPORT NO.	DATE	PAGES	ISBN	ISSN
CASR238	August 2024	46	978-1-925971-71-2	1449-2237

Title

Speeding prevalence and profile in high severity crashes: data from Event Data Recorders (EDRs) obtained by Victoria Police

Authors

ME Elsegood, SD Doecke

Performing Organisation

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

Funding

This research was funded under a project agreement with the Transport Accident Commission (TAC)

Available From

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

Abstract

This report analyses the speeding behaviours and characteristics of vehicles involved in crashes in Victoria, Australia, between 2017 and 2022. The study utilises data from Event Data Recorders (EDRs) obtained from the Victoria Police's Collision Reconstruction and Mechanical Investigation Unit (CRMIU). The primary focus is on understanding the speeding profiles of the 165 bullet vehicles and 147 free-speed vehicles within the 271 EDR-equipped vehicle dataset. The analysis includes eighteen driver, vehicle, and crash characteristics, and employs chi-square tests to identify statistically significant associations with speeding. While the findings highlight the prevalence of speeding in both bullet vehicles (63%) and free-speed vehicles (71%), caution is advised when generalising this result due to a potential sample bias towards speeding. Statistically significant associations with speeding were found for driver age, driver alcohol, driver drug results, crash time and day, crash area, crash intersection type, crash speed zone, and crash type. A comparison was also undertaken with four other studies: two focused on crashed vehicles, one focused on self-reported speeding, and another on vehicle travel speeds throughout Victoria. The report concludes by emphasising the need for targeted interventions focused on younger drivers, those under the influence of alcohol or illicit drugs, drivers travelling at nighttime or in metropolitan Melbourne, T-junction intersections, and traffic within 40 to 80 km/h speed zones.

Keywords

Speeding behaviour, crashes, Event Data Recorders (EDRs), Victoria, driver demographics, vehicle demographics, crash characteristics

Summary

Vehicle speed is a crucial component of the Safe System approach to road safety, as speeding increases the likelihood and severity of crashes. Despite speed limits being set based on road characteristics, safety risks, and mobility needs, speeding remains a prevalent behaviour among drivers. This report examines 271 Event Data Recorder (EDR) files from crashes investigated by Victoria Police's Collision Reconstruction and Mechanical Investigation Unit (CRMIU) between 2017 and 2022. These files were matched to crash data from the Victorian Police Accident Reporting System (VPARS), allowing for detailed analyses of driver, vehicle, and crash characteristics.

The study focuses on two categories of vehicles: bullet vehicles, which generally have the greatest influence on the injury outcome of a crash, and free-speed vehicles, which are those travelling at voluntary speeds not influenced by external factors. Key findings indicate that 63% of bullet vehicles (sample of 165 vehicles) and 71% of free-speed vehicles (sample of 147 vehicles) were speeding in the seconds leading up to the crash. However, caution is advised when generalising this result due to a potential sample bias towards speeding.

Eighteen driver, vehicle, and crash characteristics were analysed, with chi-square tests employed to identify any statistically significant associations with speeding. The characteristics tested include driver age, sex, alcohol, drug tests, licence type and status, vehicle body type, transmission type, colour, number of occupants, age category, crash weekday and time, area, intersection type, road class, road curvature, surface wetness, speed zone, and crash type.

Statistically significant associations with speeding ($p < 0.05$) for bullet vehicles were found for driver age, alcohol level, drug test results, crash time and weekday, intersection type, speed zone and crash type. For free-speed vehicles, significant associations with speeding included driver alcohol level, crash time and weekday, crash area, intersection type, and speed zone.

The report underscores the noteworthy prevalence of speeding within the CRMIU sample. Results from this study were compared to two other studies involving crashed vehicles: a similar study based on lower-severity crashes in South Australia by CASR using EDR data, and Monash University's Enhanced Crash Investigation Study which primarily used reconstruction software to determine impact and travel speeds. The results were also compared to an Australia-wide self-reported speeding survey and an analysis of measured vehicle travel speeds throughout Victoria. The report concludes by highlighting significant demographic and situational factors associated with speeding behaviour. Given the high prevalence of speeding among crash-involved vehicles, the findings emphasise the necessity for targeted interventions. Specifically, efforts should focus on younger drivers, those under the influence of alcohol or illicit drugs, drivers travelling at nighttime or in metropolitan Melbourne, T-junction intersections, and traffic within 40 to 80 km/h speed zones.

Table of Contents

1. Introduction 5
2. Method 7
    2.1. Vehicle categorisations 8
    2.2. Chi-square tests for statistical significance 9
3. Results 11
    3.1. Speeding prevalence 12
    3.2. Driver demographics 14
    3.3. Vehicle characteristics 20
    3.4. Crash characteristics 25
    3.5. Summary of significant results 33
4. Discussion 35
    4.1. Sample selection and study limitations 35
    4.2. Comparisons to other studies 36
5. Conclusions 41
6. Future studies 42
Acknowledgements 43
References 44
Appendix A – Bullet vehicle classification from DCA code and position 46

1. Introduction

Speed is a crucial component of the Safe System approach to road safety, which emphasises the need for safe interactions among people, roads, vehicles and speed (International Transport Forum, 2016). As the travel speed of a vehicle increases, so does the likelihood of being involved in an injury crash (Kloeden, McLean, Moore & Ponte, 1997; Kloeden, Ponte & McLean, 2001; Fitzharris et al., 2020), and the risk of a crash resulting in serious or fatal injuries (Doecke et al., 2021). The setting of speed limits is therefore necessary to balance this heightened risk against the necessity for mobility.

Authorities consider various factors when setting speed limits. In Australia, speed limits are determined based on the functional hierarchy and physical characteristics of the road, accounting for the safety risks to individual and collective road users, as well as considerations of amenity and mobility (Austroads, 2021; Department of Planning, Transport and Infrastructure, 2017). However, factors such as local politics may also influence these decisions (e.g., McCarthy & Martin, 2017).

Although it is illegal, speeding (exceeding the speed limit) remains relatively common. Kloeden & Woolley (2023) conducted measurements of vehicle speeds in South Australia in 2020 on various road classifications and speed limits. They showed that 13-39% of vehicles were speeding. This percentage increased to 19-40% when only free-speed vehicles (those presumably free to choose their travel speed) were considered.

Determining the role of speeding in vehicle crashes is more difficult than in non-crash situations. Historically, speeding related to a crash could only be identified through crash reconstructions, which require specialist knowledge, are labour-intensive, and are limited in their ability to identify speeding due to pre-impact braking often leaving no forensic evidence, especially since the advent of Anti-lock Braking Systems (ABS). For these reasons, the prevalence of speeding in crashes in some Australian jurisdictions has been determined by a method developed by the NSW Centre for Road Safety (Centre for Road Safety, 2020). In this method, a vehicle is considered to have been speeding if police suspect it was travelling at excessive speed or performing a manoeuvre indicative of speeding, such as losing control on a curve, regardless of whether the crash report directly notes speeding. However, this method does not distinguish between speeding and inappropriate speed, and has been found to lack both sensitivity and specificity when used to identify only speeding (Doecke & Kloeden, 2014).

Event Data Recorders (EDRs) in vehicles present a new opportunity for identifying speeding. EDRs are devices installed in many modern vehicles which detect occurrences of crashes and save a log of the last few seconds of driving data prior to each collision, including the speeds of the vehicle. Studies have found EDRs to be highly accurate, generally under-reporting speed by only around 1 km/h (Bortles, *et al.*, 2016).

Two studies have examined the prevalence of speeding in crashes in Australia using, at least in part, EDR data. A third study examined self-reported speeding of drivers in Australia, and a fourth study examined the traveling speeds of vehicles in Victoria across different speed zones.

Doecke, Ponte & Elsegood (2023) is the only study to date that has profiled speeding in crashes in Australia using EDR data. This study examined a reasonably representative sample of 319 crashes between 2017 and 2021 in South Australia and found that 27% of bullet (generally striking) vehicles and 39% of free-speed vehicles were speeding in the seconds preceding a crash. Speeding was more prevalent in crashes involving bullet vehicles driven by younger drivers, drivers with provisional licences, and when the bullet vehicle was black, red, or grey in colour. Speeding was also most common in crashes that occurred on a curve, at a mid-block location, on a local road, during weekend nights, in regional areas, on wet roads, in low-speed zones, and in single-vehicle crashes.

Fitzharris *et al.* (ECIS report 1, 2020, pg. 87) reported the prevalence of speeding in a sample of 393 crashes involving hospital admission in Victoria between August 2014 and December 2016. Most of the speed data in Fitzharris *et al.* were based on crash reconstructions, as EDR data were only obtained from 9% of the case vehicles. They found that 26% of the crashes involved a vehicle exceeding the speed limit, which increased to 37% for crashes with a maximum abbreviated injury score of three or more (MAIS3+).

Stephens *et al.* (2017) conducted an examination of the self-reported prevalence of speeding in Australia. This study surveyed a representative sample of 5,179 drivers from all states and territories except South Australia. The drivers were asked to report the speeds at which they usually drove in different speed zones, indicating whether they drove below, at, or above the speed limit, with four distinct ranges for speeds above the limit. The findings were analysed according to speed limit, as well as driver age, sex, and licence type. They found that 56% of surveyed Australian drivers (n=5,179) self-reported driving above the speed limit as part of normal driving in at least one of four speeds zones (40, 50, 60 or 100 km/h zones).

Alavi *et al.* (2014) examined travel speed data from approximately 350,000 vehicles collected by covert mobile speed cameras throughout metropolitan Melbourne and rural Victoria during 2013. The analysis highlighted the overall proportions of speeding vehicles and the prevalence of low-level speeding in each speed zone, aiming to quantify the contribution of low-level speeding to trauma in Victoria. Their results showed that 9.5% of Victorian drivers passing covert speed cameras violated the speed limit, and among these speeders, 94.9% were speeding by 10 km/h or less.

The data analysed in Doecke, Ponte & Elsegood (2023), from a random sample of written-off vehicles, contained only a limited number of high-severity crashes. In late 2023 and early 2024, EDR files downloaded by the Victorian Police's Collision Reconstruction and Mechanical Investigation Unit (CRMIU) between 2017 and March 2022 were added to the CASR-EDR database. These EDR files were matched to crashes in the Traffic Accident Commission's (TAC's) Victorian Police Accident Reporting System (VPARS), with the process described in detail in Doecke & Elsegood (in press). The aim of the study described in the present report is to analyse the prevalence and profile of speeding in this new sample of high-severity crashes from Victoria.

2. Method

As of May 2024, the CASR-EDR database contained 275 EDR files from Victoria Police's CRMIU that were successfully matched with TAC records. These files were from 260 crashes, with 15 crashes involving two vehicles each with EDR data. The TAC crash data included demographic information of the occupants (e.g., age, sex, licence type), driver behaviour (e.g., alcohol and drug test results), vehicle details (e.g. vehicle type, colour), and crash scenario characteristics (e.g., crash type, road type, speed limit). For a more detailed description of this dataset, see the companion report by Doecke & Elsegood (in press).

Two variables from the CRMIU dataset were used to identify speeding: the travel speed of the vehicle and the speed limit. The travel speed was defined as the highest speed shown in the 2.5 to 5 seconds of pre-crash data on the EDR, while the speed limit was obtained from the matched TAC data. By comparing these two variables, speeding in a sample of high-severity crashes was identified.

Speeding was further categorised based on how much the travel speed exceeded the speed limit, aligning with the categories used in Victorian law for speeding offence penalties. The categories and associated penalties are shown in Table 2.1. For the analysis, multiple speeding offences categories were combined primarily based on the amount by which the speed limit was exceeded, and the corresponding penalties.

Table 2.1
Speeding offence categories (and associated penalties) in
Victorian law, and the speeding categories used in the analysis

Exceeding the speed limit	Penalty (as at 1 July 2023)	Demerit points	Automatic licence suspension	Categories in analysis
By less than 10 km/h	$240	1	-	1 - 9 km/h
10 km/h - 24 km/h	$385	3	-	10 - 24 km/h
20 km/h - 24 km/h (110 km/h zone)	$385	-	3 months	
25 km/h - 29 km/h	$529	-	3 months	25 - 34 km/h
30 km/h - 34 km/h	$625	-	3 months	
35 km/h - 39 km/h	$721	-	6 months	35 - 44 km/h
40 km/h - 44 km/h	$817	-	6 months	
By 45 km/h or more	$962	-	12 months	45+ km/h

Obtained in May 2024 from: https://online.fines.vic.gov.au/Your-options/Fine-amounts-and-demerit- points.

The profile of speeding was investigated by examining the prevalence of speeding across various driver, vehicle, and crash variables. The variables included in the analysis were selected based on those examined in Doecke, Ponte & Elsegood (2023), that were influenced by prior studies and data availability. However, unlike the South Australian data used in Doecke, Ponte & Elsegood (2023), the Victorian data in the present study had not been matched to driving offence data. Consequently, the impact of the number of speeding or traffic offences could not be investigated in this study.

2.1. Vehicle categorisations

Separate analyses were conducted for two sub-samples of the CRIMU EDR data: bullet vehicles, and free-speed vehicles. These sub-samples are not mutually exclusive and have a substantial overlap. The following section describes these vehicle categorisations.

2.1.1. Bullet vehicle categorisation

The classification of bullet vehicles was created to isolate the vehicle whose speed would likely have the greatest influence on the injury outcome of a crash. Bullet vehicles were generally the vehicles with higher impact speeds.

For crashes in which a vehicle was performing a turning manoeuvre across traffic, the through vehicle was classified as the bullet 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.

Bullet vehicles were identified using a calculation based on the DCA code and position combination. This method is particularly useful when dealing with large datasets, such as statewide data, where manually classifying each vehicle would be resource intensive. However, it is acknowledged that this approach might exclude certain cases where a vehicle, for example, travels through an intersection with considerable speed where it is required to give way, yet is not classified as a bullet vehicle. These exclusions represent false negatives, which in this context, are preferable to false positives to ensure the analysis errs on the side of producing a conservative result. Appendix A provides a diagram indicating the bullet vehicles on the DCA code chart.

2.1.2. Free-speed vehicle categorisation

To isolate vehicles traveling at free-speed, defined as a voluntary, self-selected speed, it was necessary to classify all cases into specific movement categories. This classification process was essential to accurately identify vehicles operating independently of external influences such as traffic conditions or road configurations. The categories used for classification are as follows:

- ‘No speed data’: Cases where speed data was not recorded in the EDR file.
- ‘Parked/stationary’: Vehicles that were not in motion, either parked or stopped.
- ‘Already braking’: Vehicles that were travelling at a speed lower than the speed limit and were in the process of decelerating at the initial timestep of the EDR pre-crash data.
- ‘Accelerating’: Vehicles that were accelerating for the majority of the EDR pre-crash data and had not reached a steady speed.
- ‘Restricted by traffic’: Vehicles evidently restricted by other traffic, such as vehicles involved in rear-end crashes travelling at a speed less than half of the speed limit.
- ‘Performing manoeuvre’: Vehicles engaged in specific driving actions, such as turning or navigating around a bend with an advisory speed significantly lower than the posted speed limit.
- ‘Work zone’: Vehicles operating within a road works area, with a significantly reduced speed limit.

- ‘Illegal manoeuvre’: Vehicles involved in unlawful actions, such as deliberately running a red light after slowing to check for traffic or driving on a footpath to avoid police.
- ‘Sleep/medical’: Vehicles with a driver suffering a sleep-related incident or medical episode.
- ‘Other’: Scenarios including evading police through traffic, runaway vehicles with no driver, deliberate ramming of another vehicle or pedestrian due to domestic violence, or stolen vehicles.
- ‘Free-speed’: Vehicles traveling at a self-selected speed, not influenced by external factors. Rear-end striking vehicles were classified as free-speed if they were deemed to have been traveling a considerable distance behind the vehicle in front and seemed unaffected by its speed.

2.2. Chi-square tests for statistical significance

The chi-square test for independence is a statistical method used to determine whether there is a significant association between two categorical variables. In this report, chi-square tests are performed on various driver, vehicle and crash characteristics to determine if there is an association between these characteristics and the prevalence of speeding. The chi-square test compares the observed frequencies in a contingency table to the expected frequencies, which are calculated under the assumption that the variables are independent and not associated.

By performing chi-square tests on contingency tables that show the number of vehicles speeding and not speeding by a specific variable, the statistical significance of differences in the prevalence of speeding across the categories of that variable can be assessed. For example, the variable could be driver age, with the contingency table including rows for age categories such as 16 to 24 years, 25 to 39 years, 40 to 64 years, and 65 years and older. The chi-square test would determine if the differences in the prevalence of speeding among these age categories are statistically significant.

The process begins by setting up two hypotheses: the null hypothesis (H_0) suggests that the variables are independent (no association), while the alternative hypothesis (H_1) suggests that the variables are not independent (there is an association).

To perform the chi-square test, a contingency table is constructed displaying the observed frequencies for each combination of the categories of the selected variables. Next, the expected frequencies are calculated for each cell in the table using the formula:

$$E_{ij} = \frac{(a_{i+} \times a_{+j})}{N}$$

where a_{i+} is the row total, a_{+j} is the column total, and N is the grand total of all observations. The chi-square statistic (χ^2) is then computed by summing the squared differences between observed (O_{ij}) and expected (E_{ij}) frequencies, divided by the expected frequencies:

$$\chi^2 = \sum \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}}$$

The degrees of freedom (df) for the test are determined by the formula:

$$df = (r-1) \times (c-1),$$

where r is the number of rows and c is the number of columns. Using the chi-square distribution table, the critical value for the calculated degrees of freedom and p-value can be calculated using statistical software. If the chi-square statistic is greater than the critical value, or if the p-value is less than the significance level (commonly 0.05), the null hypothesis is rejected. Otherwise, the null hypothesis is not rejected.

The tables in the results section include the χ^2 (chi-square) values and p-values. In general, a higher χ^2 value indicates that there is a larger discrepancy between the observed sample and expected frequencies, providing stronger evidence against the null hypothesis of independence (no association). In statistical terms, a higher χ^2 value means there is a lower probability that the observed data would occur by chance if the variables were independent. For a test with the same number of degrees of freedom, a higher χ^2 value also corresponds to a lower p-value. The p-value in a chi-square test helps determine whether the observed data deviate significantly from what would be expected if the variables were independent. It provides a quantitative measure of the strength of evidence against the null hypothesis. A low p-value indicates that the observed relationship is unlikely to be due to chance alone, suggesting a significant association between the categorical variables.

The other factor that influences the p-value is the degrees of freedom. Variables with more than two categories increase the degrees of freedom for the chi-square test, and tests with more degrees of freedom require stronger associations to reach statistical significance. For example, a chi-square test with two rows (categories) has one degree of freedom. To achieve statistical significance at a p-value of 0.05, the chi-square result needs to be approximately 3.84. In contrast, a chi-square test with five rows has four degrees of freedom, and to reach statistical significance at a p-value of 0.05, the chi-square result must be approximately 9.49. There were many variables in the analysis that had multiple categories (e.g., age).

Variables with unknown values, such as unknown driver ages and unknown driver sexes, were not included in the chi-square tests. Rows of variables with low total frequencies should be interpreted with caution, accounting for the potential impact of the low frequencies on the reliability of the results. Although there is no universal threshold for including a row with a low frequency, the ideal expected cell frequency (E_{ij}) should be 5 or more for the chi-square test to be valid. If several expected frequencies are below 5, the results are more likely to be inaccurate and the chi-square test may not be the appropriate test for statistical significance.

3. Results

A total of 197 vehicles in the sample were classified as bullet vehicles. Table 3.1 shows the counts for each of the bullet vehicle categorisations. Of these bullet vehicles,165 had speed data recorded and could be included in the analysis. There were 147 free-speed vehicles identified in the sample. Table 3.2 shows the counts for each of the movement categories. 'Free-speed' accounts for the largest percentage of cases across all injury severity categories, and more than half of the entire sample.

Table 3.1
Counts of bullet-vehicle categorisations of EDR vehicles in CRMIU sample

Bullet vehicle categorisation	No.	%
Single vehicle bullet	80	30%
Head-on bullet	54	20%
Right-angle bullet	26	10%
Rear-end bullet	15	6%
Pedestrian bullet	9	3%
Side swipe bullet	6	2%
U-turn in front bullet	5	2%
Roundabout bullet	2	1%
All bullet vehicles	***197***	***73%***
Not a bullet vehicle	74	27%
Total	**271**	**100%**

Table 3.2
Counts of movement categorisations of EDR vehicles in CRMIU sample

Movement categorisation	No.	%
No speed data	43	16%
Parked/ stationary	5	2%
Already braking	6	2%
Accelerating	10	4%
Restricted by traffic	8	3%
Performing manoeuvre	30	11%
Illegal manoeuvre	2	1%
Other	20	7%
Free-speed	147	54%
Total	**271**	**100%**

A substantial overlap existed between bullet vehicles and free-speed vehicles, indicating that these categories were not mutually exclusive. Nevertheless, distinct differences existed between the categorisations. A total of 131 vehicles were classified as both free-speed vehicles and bullet vehicles. In contrast, 16 vehicles were identified as free-speed vehicles but not bullet vehicles, and 66 vehicles were categorised as bullet vehicles but not free-speed vehicles.

The 16 vehicles classified as free-speed but not bullet vehicles often included those that proceeded through intersections at speed without having the right of way or were traveling at a free-speed and were subsequently struck by another vehicle traveling in the same direction, such as in rear-end collisions. Conversely, the 66 vehicles classified as bullet but not free-speed typically encompassed those with no available speed data, those that were accelerating or decelerating, or those influenced by other factors rendering them unsuitable for classification as free-speed vehicles. Table 3.3 presents the crosstabulation of the counts of bullet and free-speed vehicles.

Table 3.3
Crosstabulation of bullet vehicle counts, and free-speed vehicle counts of EDR vehicles in CRMIU sample

	Bullet vehicle	Not a bullet vehicle	Total
Free-speed vehicle	131	16	**147**
Not a free-speed vehicle	66	58	**124**
Total	**197**	**74**	**271**

3.1. Speeding prevalence

3.1.1. Bullet vehicles

Figure 3.1 shows the distribution of the travel speeds of bullet vehicles relative to the speed limit, in increments of 5 km/h above or below the limit. A total of 104 of 165 (63%) bullet vehicles in the sample were speeding, and 49 of 165 (30%) were travelling at least 45 km/h over the road speed limit.

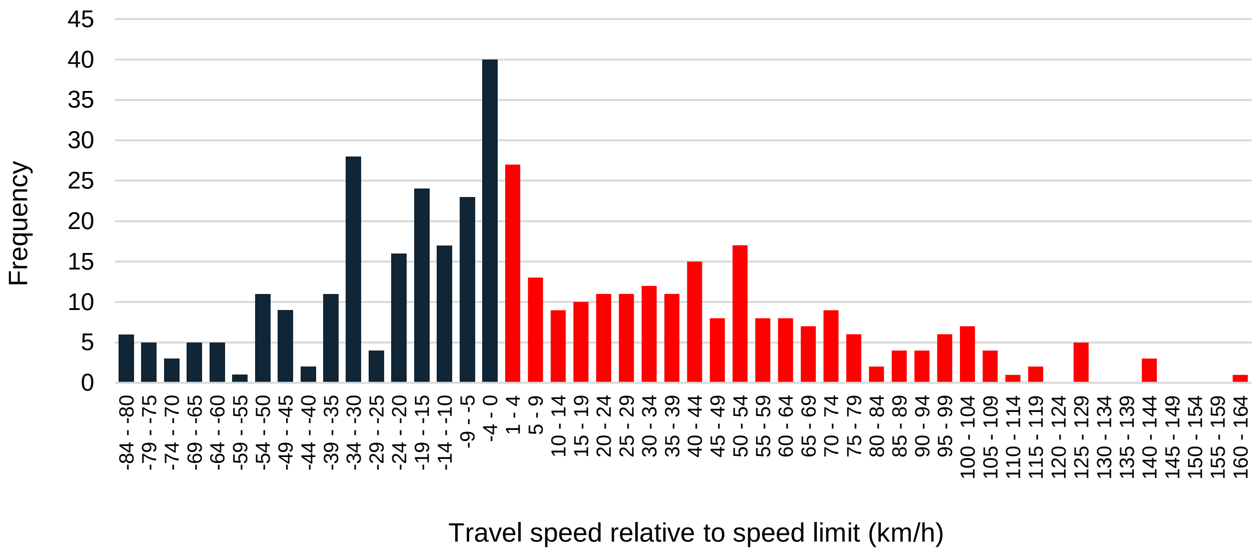

Figure 3.1
Travel speed relative to the speed limit for EDR bullet vehicles (n=165, red indicates speeding)

3.1.2. Free-speed vehicles

Figure 3.2 shows the distribution of travel speeds of free-speed vehicles relative to the speed limit, in 5 km/h increments. A total of 105 of 147 (71%) free-speed vehicles in the sample were speeding, and 51 of 147 (35%) were travelling at least 45 km/h over the road speed limit.

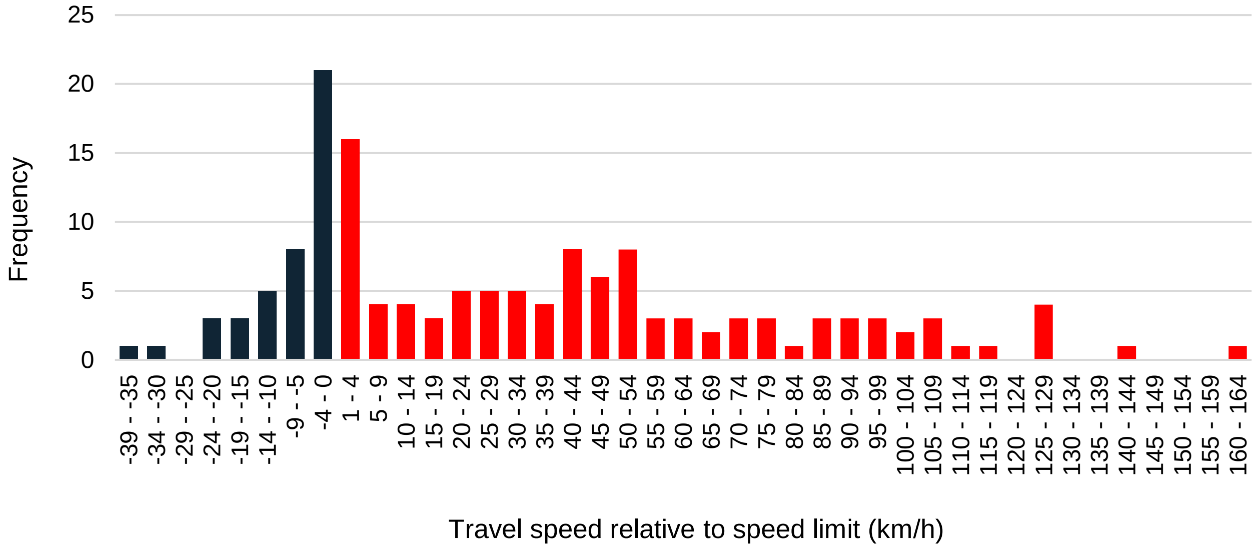

Figure 3.2
Travel speed relative to the speed limit for EDR free-speed vehicles (n=147, red indicates speeding)

3.2. Driver demographics

3.2.1. Age of driver

The prevalence of speeding in bullet vehicles by driver age, both overall and in the individual speeding categories, is shown in Table 3.4. In the sample, drivers in the youngest age category (16- to 24-year-olds) were most likely to be speeding, and the likelihood of speeding appeared to decrease with driver age. Extreme speeding (45+ km/h over the posted speed limit) was also most commonly seen in the youngest age group of 16 to 24-year-olds. Seven of the drivers had an unknown age, due to some drivers absconding the crash scene, and some driver ages were simply not recorded. A chi-square test (*n* =158) indicated a significant association between driver age and speeding behaviour ($\chi^2_{(3)}$ = 15.12, $p < .01$), with the prevalence of speeding appearing to be higher in younger drivers.

Table 3.5 shows the speeding prevalence of free-speed vehicles by driver age, both overall and in the individual speeding categories. In the sample, younger drivers (16 years old to 39 years old) appeared to be more likely to be speeding compared to drivers in the older age categories (40 years old and older). However, the age categories were not shown to have a statistically significant association to speeding. Even when the 65+ years old age category was omitted due to low frequencies from the chi-square test (*n* = 140), the association was only approaching significance ($\chi^2_{(2)}$ = 5.23, $p = .07$).

Table 3.4
Speeding prevalence by driver age category and speeding category, for bullet vehicles

Driver age (years old)	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
16 - 24 †	43	34	79%	4	9%	5	12%	4	9%	5	12%	16	37%
25 - 39 †	71	48	68%	11	15%	5	7%	3	4%	6	8%	23	32%
40 - 64 †	37	16	43%	2	5%	2	5%	2	5%	1	3%	9	24%
65+ †	7	2	28%	1	14%	-	-	1	14%	-	-	-	-
Unknown	7	4	57%	-	-	1	14%	-	-	2	29%	1	14%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (*n* = 158) for association to speeding: $\chi^2_{(3)}$ = 15.12, $p < .01$

Table 3.5
Speeding prevalence by driver age category and speeding category, for free-speed vehicles

Driver age (years old)	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
16 - 24 †	40	31	78%	3	8%	4	10%	4	10%	5	13%	15	38%
25 - 39 †	65	50	77%	12	18%	4	6%	3	5%	5	8%	26	40%
40 - 64 †	35	20	57%	3	9%	4	11%	2	6%	1	3%	10	29%
65+ †	6	3	50%	2	33%	-	-	1	17%	-	-	-	-
Unknown	1	1	100%	-	-	-	-	-	-	1	100%	-	-
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 146) for association to speeding: $\chi^2_{(3)}$ = 6.50, p = .09

3.2.2. Sex of driver

The prevalence of speeding of bullet vehicles by driver sex, both overall and in the individual speeding categories is shown in Table 3.6. Overall, 67% of males were speeding compared to 50% of females. Male drivers in the sample were almost six times more likely to be engaged in extreme speeding (45+ km/h over the posted speed limit) when they were involved in a crash compared to females in the sample. Drivers with an unknown sex were either drivers who absconded from the crash scene, or their sex was simply not recorded. The difference between males and females in the likelihood of speeding was only approaching significance (p = .06).

Table 3.7 shows the speeding prevalence of free-speed vehicles by driver sex, both overall and in the individual speeding categories. Again, males appeared to be more likely to be speeding in the sample and were more than three times more likely to be engaged in extreme speeding compared to females in the sample. However, the association been sex of driver and speeding was not significant.

Table 3.6
Speeding prevalence by driver sex and speeding category, for bullet vehicles

Driver sex	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Female †	36	18	50%	6	17%	5	14%	2	6%	3	8%	2	6%
Male †	123	83	67%	11	9%	8	7%	8	7%	10	8%	46	37%
Unknown	6	3	50%	1	17%	-	-	-	-	1	17%	1	17%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 159) for association to speeding: $\chi^2_{(1)}$ = 3.67, p = .06

Table 3.7
Speeding prevalence by driver sex and speeding category, for free-speed vehicles

Driver sex	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Female †	31	20	65%	7	23%	4	13%	2	6%	3	10%	4	13%
Male †	115	84	73%	12	10%	8	7%	8	7%	9	8%	47	41%
Unknown	1	1	100%	1	100%	-	-	-	-	-	-	-	-
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 146) for association to speeding: $\chi^2_{(1)} = 0.87$, $p = .35$

3.2.3. Blood alcohol content (BAC) of driver

Blood alcohol content (BAC) was recorded for 97 drivers of bullet vehicles, with 26 (27%) testing positive. The top section of Table 3.8 shows the speeding prevalences, both overall and in individual speeding categories, for positive tests, negative tests and an 'unknown' category. The bottom section of the table shows the disaggregation of the positive BAC values. Drivers with a positive BAC were significantly more likely to be speeding ($\chi^2_{(1)} = 6.60$, $p = .01$). A large proportion of drivers with a positive BAC were travelling in the extreme speed category (45+ km/h over the speed limit) and they were three times more likely to be speeding than drivers with a negative BAC reading in the sample. The disaggregation of positive BAC values did not have a large enough sample in each category to conduct a chi-square test.

For free-speed drivers, 89 had their BAC recorded, with 23 (26%) testing positive. Table 3.9 shows the speeding prevalence, both overall and in individual speeding categories, for free-speed vehicles by BAC levels. Drivers with a positive BAC were significantly more likely to be speeding ($\chi^2_{(1)} = 5.78$, $p = .02$). Drivers with a positive BAC in the sample were also more likely to be engaged in extreme speeding (45+ km/h over the speed limit) compared to drivers with a negative BAC.

Table 3.8
Speeding prevalence by driver blood alcohol content (BAC) and speeding category, for bullet vehicles

Driver blood alcohol content (BAC) (g/mL)	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Negative †	71	40	56%	7	10%	6	8 %	4	6%	7	10%	16	23%
Positive †	26	22	85%	-	-	2	8%	1	4%	1	4%	18	69%
Unknown	68	42	62%	11	16%	5	7%	5	7%	6	9%	15	22%
0	71	40	56%	7	10%	6	8%	4	6%	7	10%	16	23%
0.01 - 0.049	2	2	100%	-	-	-	-	-	-	-	-	2	100%
0.05 - 0.099	5	3	60%	-	-	1	20%	-	-	1	20%	1	20%
0.1 - 0.199	11	10	91%	-	-	-	-	-	-	-	-	10	91%
0.2 - 0.299	7	6	86%	-	-	1	14%	1	14%	-	-	4	57%
0.3 - 0.399	1	1	100%	-	-	-	-	-	-	-	-	1	100%
Unknown	68	42	62%	11	16%	5	7%	5	7%	6	9%	15	22%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 97) for association to speeding: $\chi^2_{(1)} = 6.60$, $p = .01$

Table 3.9
Speeding prevalence by driver blood alcohol content (BAC) and speeding category, for free-speed vehicles

Driver blood alcohol content (BAC) (g/mL)	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Negative †	66	43	65%	9	14%	5	8%	4	6%	6	9%	19	29%
Positive †	23	21	91%	-	-	2	9%	1	4%	1	4%	17	74%
Unknown	58	41	71%	11	19%	5	9%	5	9%	5	9%	15	26%
0	66	43	65%	9	14%	5	8%	4	6%	6	9%	19	29%
0.01 - 0.049	2	2	100%	-	-	-	-	-	-	-	-	2	100%
0.05 - 0.099	3	2	67%	-	-	1	33%	-	-	1	33%	-	-
0.1 - 0.199	11	10	91%	-	-	-	-	-	-	-	-	10	91%
0.2 - 0.299	6	6	100%	-	-	1	17%	1	17%	-	-	4	67%
0.3 - 0.399	1	1	100%	-	-	-	-	-	-	-	-	1	100%
Unknown	58	41	71%	11	19%	5	9%	5	9%	5	9%	15	26%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 89) for statistically significant association to speeding: $\chi^2_{(1)} = 5.78$, $p = .02$

3.2.4. Drug test results of driver

Drug tests were conducted for 90 bullet vehicle drivers, with 21 (23%) testing positive to at least one illicit substance. The substances of focus in Table 3.10 include the illicit drugs: methylenedioxy methamphetamine (MDMA), methamphetamine, and tetrahydrocannabinol (THC). In the top section of the table, these three illicit drugs were combined, and the association between illicit drug use and speeding was shown to be statistically significant ($\chi^2_{(2)} = 7.07$, $p = .03$). Although police officers conduct roadside saliva-based drug tests for the illicit drugs listed above, occupants of vehicles attending a hospital or drivers undergoing a blood test may be subjected to additional drug screenings that detect a broader range of substances. These additional substances include a variety of drugs such as opioids, benzodiazepines, stimulants, amphetamines, antidepressants, antipsychotics, cannabinoids, and others. For the purpose of this report, drivers who only tested positive for drugs other than the three illicit substances were grouped in the 'other drug(s) detected' category. If a driver tested positive for both an illicit substance and a non-illicit substance, they were categorised in the illicit substance group. No drivers of bullet vehicles in the sample tested positive for MDMA. All eight drivers who tested positive for THC were speeding and travelling at a speed at least 35 km/h above the speed limit. Drivers who only tested positive to non-illicit drugs had a speeding rate similar to the drivers who tested negative to all tested drugs.

Drug tests were conducted for 87 free-speed vehicle drivers, with 23 (26.4%) testing positive to at least one illicit substance. Table 3.11 shows the speeding prevalence, of both the overall and individual speeding categories, for each drug grouping for free-speed vehicle drivers. A significant association between speeding and drug use was not found for free-speed vehicles.

Table 3.10
Speeding prevalence by driver drug test result and speeding category, for bullet vehicles

Driver drug test results	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
None †	44	23	52%	4	9%	3	7%	3	7%	2	5%	11	25%
Positive for methamphetamine and/or THC †	21	18	86%	4	19%	-	-	2	10%	3	14%	9	43%
Other drug(s) detected †	25	14	56%	2	8%	3	12%	1	4%	2	8%	6	24%
Unknown	75	49	65%	8	11%	7	9%	4	5%	7	9%	23	31%
None	44	23	52%	4	9%	3	7%	3	7%	2	5%	11	25%
MDMA	-	-	-	-	-	-	-	-	-	-	-	-	-
Methamphetamine	13	10	77%	4	31%	-	-	2	15%	-	-	4	31%
THC	6	6	100%	-	-	-	-	-	-	2	33%	4	67%
THC & methamphetamine	2	2	100%	-	-	-	-	-	-	1	50%	1	50%
Other drug(s) detected	25	14	56%	2	8%	3	12%	1	4%	2	8%	6	24%
Unknown	75	49	65%	8	11%	7	9%	4	5%	7	9%	23	31%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 90) for association to speeding: $\chi^2_{(2)} = 7.07$, $p = .03$

Table 3.11
Speeding prevalence by driver drug test result and speeding category, for free-speed vehicles

Driver drug test results	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
None †	39	26	67%	5	13%	4	10%	3	8%	2	5%	12	31%
Positive for methamphetamine and/or THC †	23	20	87%	4	17%	1	4%	2	9%	3	13%	10	43%
Other drug(s) detected †	25	16	64%	2	8%	3	12%	1	4%	2	8%	8	32%
Unknown	60	43	72%	9	15%	4	7%	4	7%	5	8%	21	35%
None	39	26	67%	5	13%	4	10%	3	8%	2	5%	12	31%
MDMA	-	-	-	-	-	-	-	-	-	-	-	-	-
Methamphetamine	15	12	80%	4	27%	1	7%	2	13%	-	-	5	33%
THC	6	6	100%	-	-	-	-	-	-	2	33%	4	67%
THC & methamphetamine	2	2	100%	-	-	-	-	-	-	1	50%	1	50%
Other drug(s) detected	25	16	64%	2	8%	3	12%	1	4%	2	8%	8	32%
Unknown	60	43	72%	9	15%	4	7%	4	7%	5	8%	21	35%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 87) for statistically significant association to speeding: $\chi^2_{(2)} = 3.81$, $p = .15$

3.2.5. Licence type and status of driver

The prevalence of speeding in bullet vehicles by driver licence and status, both overall and in the individual speeding categories, is shown in Table 3.12. Drivers holding a current Learners licence exhibited the highest proportion of speeding incidents, with 4 out of 5 drivers found to be speeding. However, none of these speeding instances were accompanied by an appropriate supervising passenger as required by Victorian law. According to regulations, a supervising driver with a full licence must always be present with learners. Additionally, the minimum age for obtaining a full licence in Victoria is 22 years old (or 21 years old if obtained interstate). Among the speeding incidents involving Learner drivers, the eldest ages of other occupants in the vehicles were 18, 18, 18, and 20 years old, indicating that none of them could have legally acted as a supervising passenger. Drivers with a Probationary licence in the sample were most likely to be engaged in extreme speeding (45+ km/h over the road speed limit). Drivers with a standard current licence in the sample were the least likely to be speeding. Drivers with 'unknown' licences included cases in which the driver absconded the crash scene, or in which they were simply not recorded. A chi-square test did not find a statistically significant difference in speeding between different licence categories, but the test result should be interpreted with caution as the expected frequency in multiple cells was not above the recommended minimum. Excluding the Learners category from the chi-square test also failed to return a significant result ($\chi^2_{(2)} = 4.54$, $p = .10$].

Table 3.13 presents the speeding prevalence of free-speed vehicles by driver licence and status, both overall and in the individual speeding categories. In the sample, drivers with a standard current licence appeared to be least likely to be engaged in speeding and drivers without a valid licence appeared to be most likely to be speeding. However, a chi-square test was conducted, and the result was not statistically significant.

Table 3.12
Speeding prevalence by driver licence type and status, and speeding category, for bullet vehicles

Driver licence status	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Learners - current †	5	4	80%	1	20%	-	-	-	-	2	40%	1	20%
Probationary - current †	23	17	74%	2	9%	2	9%	2	9%	1	4%	10	43%
Standard - current †	107	61	57%	12	11%	5	5%	6	6%	6	6%	32	30%
Unlicensed* †	13	10	77%	2	15%	2	15%	1	8%	2	15%	3	23%
Unknown	17	12	71%	1	6%	4	24%	1	6%	3	18%	3	18%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 148) for association to speeding: $\chi^2_{(3)} = 4.44$, $p = .22$

Note: Unlicensed* includes those with disqualified, expired and suspended licences.

Table 3.13
Speeding prevalence by driver licence type and status, and speeding category, for free-speed vehicles

Driver licence type and status	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Learners - current †	5	4	80%	1	20%	-	-	-	-	2	40%	1	20%
Probationary - current †	22	16	73%	1	5%	2	9%	2	9%	1	5%	10	45%
Standard - current †	94	66	70%	15	16%	6	6%	6	6%	5	5%	34	36%
Unlicenced* †	13	11	85%	2	15%	2	15%	1	8%	1	8%	5	38%
Unknown	13	8	62%	1	8%	2	15%	1	8%	3	23%	1	8%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 134) for association to speeding: $\chi^2_{(3)} = 1.62$, $p = .66$

Note: Unlicenced* includes those with disqualified, expired and suspended licences.

3.3. Vehicle characteristics

3.3.1. Body type of vehicle

The prevalence of speeding in bullet vehicles by vehicle body type, both overall and in the individual speeding categories, is shown in Table 3.14. In the sample, the majority of vehicles were sedans, hatchbacks and station wagons. Utilities appeared to be most likely to be engaged in speeding but a chi-square test showed no significant association between vehicle body type and speeding prevalence.

Table 3.15 shows the prevalence of speeding for free-speed vehicles, for both overall and individual speeding categories. No significant association was found between vehicle body type and speeding prevalence.

Table 3.14
Speeding prevalence by body type of vehicle and speeding category, for bullet vehicles

Body type of vehicle	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Sedan, hatchback, station wagon †	117	74	63%	12	10%	8	7%	8	7%	9	8%	37	32%
Utility †	26	19	73%	1	4%	2	8%	2	8%	4	15%	10	38%
4WD, SUV †	20	10	50%	5	25%	2	10%	-	-	1	5%	2	10%
Van	2	1	50%	-	-	1	50%	-	-	-	-	-	-
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 163) for statistically significant association to speeding: $\chi^2_{(2)} = 2.59$, $p = .27$

Table 3.15
Speeding prevalence by body type of vehicle and speeding category, for free-speed vehicles

Body type of vehicle	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Sedan, hatchback, station wagon †	106	75	71%	14	13%	6	6%	8	8%	8	8%	39	37%
Utility †	22	18	82%	1	5%	2	9%	2	9%	3	14%	10	45%
4WD, SUV †	18	11	61%	5	28%	3	17%	-	-	1	6%	2	11%
Van	1	1	100%	-	-	1	100%	-	-	-	-	-	-
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 146) for association to speeding: $\chi^2_{(2)} = 2.11$, $p = .35$

3.3.2. Transmission type of vehicle

The prevalence of speeding in bullet vehicles by vehicle transmission type, both overall and in the individual speeding categories, is shown in Table 3.16. Most vehicles had an automatic transmission, while the vehicles in the sample with a manual transmission appeared to be more likely to be speeding, and also more likely to be involved in extreme speeding (45+ km/h over speed limit). A chi-square test, however, showed no association between the transmission type of the sample and speeding prevalence.

The sample of free-speed vehicles, showing the prevalence of speeding both overall and within individual speeding categories, is presented in Table 3.17. The prevalence of speeding was similar for vehicles with automatic transmissions and those with manual transmissions, as confirmed by a chi-square test.

Table 3.16
Speeding prevalence by transmission type of vehicle and speeding category, for bullet vehicles

Transmission type of vehicle	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Automatic †	147	92	63%	15	10%	13	9%	8	5%	14	10%	42	29%
Manual †	17	12	71%	3	18%	-	-	2	12%	-	-	7	41%
Unknown	1	-	-	-	-	-	-	-	-	-	-	-	-
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 164) for association to speeding: $\chi^2_{(1)} = 0.42$, $p = .52$

Table 3.17
Speeding prevalence by transmission type of vehicle and speeding category, for free-speed vehicles

Transmission type of vehicle	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Automatic †	129	93	72%	18	14%	12	9%	8	6%	12	9%	43	33%
Manual †	16	12	75%	2	13%	-	-	2	13%	-	-	8	50%
Unknown	2	-	-	-	-	-	-	-	-	-	-	-	-
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 145) for association to speeding: $\chi^2_{(1)} = 0.06$, $p = .81$

3.3.3. Colour of vehicle

The prevalence of speeding in bullet vehicles by vehicle colour, both overall and in the individual speeding categories, is shown in Table 3.18. In the sample, black vehicles appeared to be most likely to be speeding but a chi-square test found no association between speeding prevalence and vehicle colour for the sample, when categorised into white, black, silver, grey, and other colours. Even after combining vehicle colours into the categories white, black/silver/grey, and other colours, no statistical significance was found ($\chi^2_{(2)} = 3.51$, $p = 0.17$].

Table 3.19 shows the prevalence of speeding for free-speed vehicles by colour, for both the overall speeding and individual speeding categories. Again, black vehicles appeared to be most likely to be speeding in the sample, but a chi-square test found no association between speeding prevalence and vehicle colour for the sample when categorised into white, black, silver, grey, and other colours.

Table 3.18
Speeding prevalence by vehicle colour and speeding category, for bullet vehicles

Vehicle colour	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
White †	49	28	57%	4	8%	5	10%	-	-	3	6%	16	33%
Black †	25	19	76%	3	12%	1	4%	3	12%	3	12%	9	36%
Silver †	20	14	70%	4	20%	2	10%	1	5%	3	15%	4	20%
Grey †	19	13	68%	4	21%	2	11%	3	16%	1	5%	3	16%
Other colour †	52	30	58%	3	6%	3	6%	3	6%	4	8%	17	33%
White	49	28	57%	4	8%	5	10%	-	-	3	6%	16	33%
Black	25	19	76%	3	12%	1	4%	3	12%	3	12%	9	36%
Blue	21	13	62%	2	10%	2	10%	2	10%	3	14%	4	19%
Silver	20	14	70%	4	20%	2	10%	1	5%	3	15%	4	20%
Grey	19	13	68%	4	21%	2	11%	3	16%	1	5%	3	16%
Red	12	7	58%	1	8%	-	-	1	8%	-	-	5	42%
Green	7	3	43%	-	-	-	-	-	-	-	-	3	43%
Gold	6	3	50%	-	-	1	17%	-	-	-	-	2	33%
Other	6	4	67%	-	-	-	-	-	-	1	17%	3	50%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test ($n = 165$) for association to speeding: $\chi^2_{(4)} = 3.82$, $p = .43$

Table 3.19
Speeding prevalence by vehicle colour and speeding category, for free-speed vehicles

Vehicle colour	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
White †	40	28	70%	5	13%	5	13%	-	-	2	5%	16	40%
Black †	20	17	85%	4	20%	-	-	3	15%	2	10%	8	40%
Silver †	18	14	78%	3	17%	2	11%	1	6%	3	17%	5	28%
Grey †	20	13	65%	4	20%	1	5%	3	15%	1	5%	4	20%
Other colour †	49	33	67%	4	8%	4	8%	3	6%	4	8%	18	37%
White	40	28	70%	5	13%	5	13%	-	-	2	5%	16	40%
Black	20	17	85%	4	20%	-	-	3	15%	2	10%	8	40%
Grey	20	13	65%	4	20%	1	5%	3	15%	1	5%	4	20%
Blue	20	13	65%	2	10%	2	10%	2	10%	3	15%	4	20%
Silver	18	14	78%	3	17%	2	11%	1	6%	3	17%	5	28%
Red	11	8	73%	1	9%	1	9%	1	9%	-	-	5	45%
Gold	7	4	57%	-	-	1	14%	-	-	-	-	3	43%
Green	6	4	67%	1	17%	-	-	-	-	-	-	3	50%
Other	5	4	80%	-	-	-	-	-	-	1	20%	3	60%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(4)} = 3.01$, $p = .56$

3.3.4. Number of occupants in vehicle

Table 3.20 shows speeding prevalence, both overall and in individual speeding categories, of bullet vehicles by the number of occupants in the vehicle. The proportions of speeding were similar across most of the speeding categories. A chi-square test showed no association between speeding prevalence and the number of occupants for bullet vehicles in the sample.

Speeding prevalence for free-speed vehicles, by the number of occupants in the vehicle, is shown in Table 3.21. Again, speeding proportions were similar across most of the speeding categories and a chi-square test showed no association between speeding and the number of occupants in the vehicles.

Table 3.20
Speeding prevalence by number of occupants in vehicle and speeding category, for bullet vehicles

Number of occupants in vehicle	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Single occupant †	89	55	62%	11	12%	8	9%	3	3%	6	7%	27	30%
Multiple occupants †	76	49	64%	7	9%	5	7%	7	9%	8	11%	22	29%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 165) for association to speeding: $\chi^2_{(1)} = 0.13$, $p = .72$

Table 3.21
Speeding prevalence by number of occupants in vehicle and speeding category, for free-speed vehicles

Number of occupants in vehicle	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Single occupant †	73	54	74%	12	16%	7	10%	3	4%	6	8%	26	36%
Multiple occupants †	74	51	69%	8	11%	5	7%	7	9%	6	8%	25	34%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(1)} = 0.46$, $p = .50$

3.3.5. Age category of vehicle

The prevalence of speeding across bullet vehicle age categories (i.e., how old the vehicle was when the crash occurred) is shown in Table 3.22. Newer vehicles (0 - 4 years old) appeared to have a lesser likelihood of being engaged in speeding compared to older vehicles in the sample. They also appeared to be less likely to be engaged in extreme speeding (45+ km/h over the speed limit) compared to older vehicles in the sample. However, there was no significance found between speeding and bullet vehicle age.

Table 3.23 shows the speeding prevalence of free-speed vehicles by vehicle age category, both overall and in the individual speeding categories. Again, newer vehicles (0 - 4 years old) appeared to show a lesser likelihood of being involved in speeding, both overall and in extreme speeding cases. However, no statistically significant association was found between the free-speed vehicle age and speeding.

Table 3.22
Speeding prevalence by vehicle age category and speeding category, for bullet vehicles

Vehicle age category	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 - 4 years old †	48	27	56%	7	15%	4	8%	2	4%	4	8%	10	21%
5 - 9 years old †	67	45	67%	7	10%	5	7%	4	6%	6	9%	23	34%
10+ years old †	48	31	65%	4	8%	4	8%	4	8%	4	8%	15	31%
Unknown	2	1	50%	-	-	-	-	-	-	-	-	1	50%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 163) for association to speeding: $\chi^2_{(2)} = 1.49$, $p = .47$

Table 3.23
Speeding prevalence by vehicle age category and speeding category, for free-speed vehicles

Vehicle age category	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 - 4 years old †	42	27	64%	7	17%	5	12%	2	5%	3	7%	10	24%
5 - 9 years old †	63	48	76%	10	16%	3	5%	4	6%	6	10%	25	40%
10+ years old †	41	29	71%	3	7%	4	10%	4	10%	3	7%	15	37%
Unknown	1	1	100%	-	-	-	-	-	-	-	-	1	100%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 146) for association to speeding: $\chi^2_{(2)} = 1.75$, $p = .42$

3.4. Crash characteristics

3.4.1. Weekday and time category of crash

Table 3.24 shows the prevalence of speeding, both overall and in individual speeding categories, for bullet vehicles in the sample, by crash weekday and time categories (weekday day, weekday night, weekend day, weekend night). Weekday days consisted of Mondays to Fridays, 6am to 7:59pm, weekday nights consisted of Monday to Thursday nights, 8pm to 5:59am the following day, weekend days consisted of Saturday and Sundays, 6am to 7:59pm, and weekend nights consisted of Friday, Saturday and Sunday nights 8pm to 5:59am the following day. The chi-square test indicated a significant association between the weekday and time categories and speeding prevalence ($\chi^2_{(3)}$ = 13.16, p < .01). Notably, bullet vehicles travelling on weekday nights appeared most likely to be speeding and appeared most likely to be engaged in extreme speeding (45+ km/h over the speed limit). Weekday day crashes appeared least likely to involve speeding.

The free-speed vehicle prevalence of speeding by crash weekday and time categories is shown in Table 3.25. A chi-square test indicated a significant association between the time of the crash and speeding prevalence ($\chi^2_{(3)}$ = 7.87, p = .049). Notably, crashes occurring at nighttime appeared most likely to involve speeding of the free-speed vehicles and weekday night crashes appeared most likely to involve extreme speeding compared to the other categories in the sample.

Table 3.24
Speeding prevalence by weekday and time category, and speeding category, for bullet vehicles

Weekday and time category of crash	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Weekday day †	73	37	51%	9	12%	4	5%	4	5%	5	7%	15	21%
Weekday night †	32	28	88%	7	22%	1	3%	2	6%	2	6%	16	50%
Weekend day †	33	21	64%	2	6%	4	12%	2	6%	5	15%	8	24%
Weekend night †	27	18	67%	-	-	4	15%	2	7%	2	7%	10	37%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 165) for association to speeding: $\chi^2_{(3)}$ = 13.16, p < .01

Table 3.25
Speeding prevalence by weekday and time category, and speeding category, for free-speed vehicles

Weekday and time category of crash	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Weekday day †	61	37	61%	11	18%	2	3%	4	7%	4	7%	16	26%
Weekday night †	34	29	85%	7	21%	1	3%	2	6%	2	6%	17	50%
Weekend day †	30	21	70%	2	7%	5	17%	2	7%	4	13%	8	27%
Weekend night †	22	18	82%	-	-	4	18%	2	9%	2	9%	10	45%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(3)}$ = 7.87, p = .049

3.4.2. Area in which the crash occurred

Dividing the locations of crashes into the Melbourne metropolitan areas and rural areas, Table 3.26 shows the prevalence of speeding, both overall and in individual speeding categories. Bullet vehicles that crashed in the Melbourne metropolitan area appeared to be more likely to be speeding than bullet vehicles that crashed in rural Victoria. However, no statistical significance was found between the two categories for the bullet vehicle sample.

Table 3.27 shows the prevalence for speeding for free-speed vehicles, by the area the crash occurred in. Free-speed vehicles that crashed in Melbourne metropolitan were significantly more likely to be engaged in speeding than those that crashed in rural Victoria ($\chi^2_{(1)} = 8.71$, $p < .01$).

Table 3.26
Speeding prevalence by area and speeding category, for bullet vehicles

Area in which the crash occurred	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Melbourne †	101	68	67%	9	9%	8	8%	7	7%	10	10%	34	34%
Rural Victoria †	64	36	56%	9	14%	5	8%	3	5%	4	6%	15	23%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 165) for association to speeding: $\chi^2_{(1)} = 2.06$, $p = .15$

Table 3.27
Speeding prevalence by area and speeding category, for free-speed vehicles

Area in which the crash occurred	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Melbourne †	84	68	81%	10	12%	7	8%	7	8%	9	11%	35	42%
Rural Victoria †	63	37	59%	10	16%	5	8%	3	5%	3	5%	16	25%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(1)} = 8.71$, $p < .01$

3.4.3. Intersection type

Table 3.28 presents the speeding prevalence, both overall and in individual speeding categories, for bullet vehicles by the intersection type where the crash occurred. Bullet vehicles in the sample involved in crashes at T-junctions had the highest likelihood of speeding, while those involved in crashes at cross roads had the lowest likelihood of speeding. A statistically significant association was found between intersection type and speeding when comparing mid-block, cross road, and T-junction intersections ($\chi^2_{(2)} = 8.52$, $p = .01$). Bullet vehicle involved in crashes at roundabouts and other intersections were excluded from the chi-square test due to low frequency counts.

Free-speed vehicles in the sample also showed a significant association with speeding when comparing mid-block, cross road, and T-junction intersection types ($\chi^2_{(2)} = 10.28$, $p < .01$). Table 3.29 shows the speeding prevalence, both overall and in individual speeding categories, of free-speed vehicles for each intersection type. Free-speed vehicles travelling through T-junction intersections appeared most likely to be speeding in the sample, and crashes at cross-road intersections appeared least likely to involve speeding of the free-speed vehicle.

Table 3.28
Speeding prevalence by intersection type and speeding category, for bullet vehicles

Crash intersection type	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Mid-block †	114	72	63%	10	9%	9	8%	7	6%	9	8%	37	32%
Cross road †	23	10	43%	5	22%	1	4%	-	-	-	-	4	17%
T-junction †	25	21	84%	3	12%	3	12%	2	8%	5	20%	8	32%
Roundabout	2	1	50%	-	-	-	-	1	50%	-	-	-	-
Other	1	-	-	-	-	-	-	-	-	-	-	-	-
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 162) for association to speeding: $\chi^2_{(2)} = 8.52$, $p = .01$

Table 3.29
Speeding prevalence by intersection type and speeding category, for free-speed vehicles

Crash intersection type	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Mid-block †	97	70	72%	12	12%	7	7%	7	7%	7	7%	37	38%
Cross road †	26	13	50%	5	19%	2	8%	-	-	-	-	6	23%
T-junction †	23	21	91%	3	13%	3	13%	2	9%	5	22%	8	35%
Roundabout	1	1	100%	-	-	-	-	1	100%	-	-	-	-
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 146) for association to speeding: $\chi^2_{(2)} = 10.28$, $p < .01$

3.4.4. Road class

Victoria's Statewide Route Numbering Scheme classifies the road types throughout Victoria. Table 3.30 depicts the speeding prevalence, both overall and in individual speeding categories, for each of the road classes in the scheme. 'M' roads are generally freeways with divided carriageways, at least two lanes in each direction, sealed shoulders and line markings easily visible in all weather conditions. 'A' and 'B' roads are arterial-type roads with a single carriageway and at least one lane in each direction. In the top section of Table 3.30, these have been aggregated with other arterial roads for ease of comparison. 'C' roads are generally two-lane sealed roads with shoulders, similar to collector roads. A chi-square test did not provide evidence for a statistically significant association with speeding between the grouped road types.

Table 3.31 depicts the prevalence of speeding for the free-speed vehicles in the sample, for each of the road classes in the scheme. Not considering the unknown road classes, local roads appeared to be associated most commonly with speeding cases, both overall and in the extreme speed (45+ km/h over the speed limit) category. However, no significant associations with speeding were found.

Table 3.30
Speeding prevalence by road class and speeding category, for bullet vehicles

Road class	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
M †	12	8	67%	1	8%	2	17%	1	8%	-	-	4	33%
A, B, Arterials †	65	37	57%	8	12%	3	5%	2	3%	4	6%	20	31%
C †	36	19	53%	5	14%	2	6%	2	6%	2	6%	8	22%
Local †	38	29	76%	2	5%	4	11%	4	11%	5	13%	14	37%
Unknown	14	11	79%	2	14%	2	14%	1	7%	3	21%	3	21%
M	12	8	67%	1	8%	2	17%	1	8%	-	-	4	33%
A	10	5	50%	1	10%	1	10%	-	-	-	-	3	30%
B	18	10	56%	4	22%	1	6%	-	-	1	6%	4	22%
Arterial Highway	13	8	62%	1	8%	1	8%	-	-	1	8%	5	38%
Arterial Others	24	14	58%	2	8%	-	-	2	8%	2	8%	8	33%
C	36	19	53%	5	14%	2	6%	2	6%	2	6%	8	22%
Local	38	29	76%	2	5%	4	11%	4	11%	5	13%	14	37%
Unknown	14	11	79%	2	14%	2	14%	1	7%	3	21%	3	21%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 151) for association to speeding: $\chi^2_{(3)} = 5.39$, $p = .15$

Table 3.31
Speeding prevalence by road class and speeding category, for free-speed vehicles

Road class	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
M †	11	8	73%	1	9%	2	18%	1	9%	-	-	4	36%
A, B, Arterials †	60	41	68%	10	17%	3	5%	2	3%	4	7%	22	37%
C †	35	20	57%	5	14%	4	11%	2	6%	2	6%	7	20%
Local †	32	27	84%	2	6%	2	6%	4	13%	4	13%	15	47%
Unknown	9	9	100%	2	22%	1	11%	1	11%	2	22%	3	33%
M	11	8	73%	1	9%	2	18%	1	9%	-	-	4	36%
A	11	8	73%	2	18%	1	9%	-	-	-	-	5	45%
B	19	10	53%	4	21%	1	5%	-	-	1	5%	4	21%
Arterial Highway	11	8	73%	2	18%	1	9%	-	-	1	9%	4	36%
Arterial Others	19	15	79%	2	11%	-	-	2	11%	2	11%	9	47%
C	35	20	57%	5	14%	4	11%	2	6%	2	6%	7	20%
Local	32	27	84%	2	6%	2	6%	4	13%	4	13%	15	47%
Unknown	9	9	100%	2	22%	1	11%	1	11%	2	22%	3	33%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 138) for association to speeding: $\chi^2_{(3)} = 3.08$, $p = .38$

3.4.5. Road curvature

Table 3.32 presents the speeding proportions, both overall and in individual speeding categories, of bullet vehicles by the road curvature. Bullet vehicles travelling on straight roads were shown to have similar proportions of speeding to bullet vehicles travelling on curved roads. There was no significant association found between speeding and road curvature in the sample of bullet vehicles.

Free-speed vehicles were also shown to have similar proportions of speeding, both overall and in individual speeding categories, as shown in Table 3.33. There was no significant association found between road curvature and speeding in the sample of free-speed vehicles.

Table 3.32
Speeding prevalence by road curvature and speeding category, for bullet vehicles

Road curvature	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Straight †	113	68	60%	10	9%	9	8%	7	6%	9	8%	33	29%
Curved †	52	36	69%	8	15%	4	8%	3	6%	5	10%	16	31%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 165) for association to speeding: $\chi^2_{(1)} = 1.25$, $p = .26$

Table 3.33
Speeding prevalence by road curvature and speeding category, for free-speed vehicles

Road curvature	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Straight †	97	69	71%	13	13%	7	7%	7	7%	7	7%	35	36%
Curved †	50	36	72%	7	14%	5	10%	3	6%	5	10%	16	32%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(1)} = 0.01$, $p = .91$

3.4.6. Surface wetness

Table 3.34 shows the prevalence of speeding, both overall and in individual speeding categories, of bullet vehicles, by the surface wetness. Bullet vehicles travelling on roads with a dry or wet surface were shown to have similar speeding proportions. There was no significant difference between the overall speeding proportions for dry and wet surfaces found in the sample.

Table 3.35 shows the speeding prevalence of free-speed vehicles for the two categories of surface wetness. The results were similar for dry and wet roads, with no significant association found for speeding and surface wetness for free-speed vehicles in the sample.

Table 3.34
Speeding prevalence by surface wetness and speeding category, for bullet vehicles

Crash surface wetness	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Dry †	149	93	62%	17	11%	12	8%	8	5%	12	8%	44	30%
Wet †	16	11	69%	1	6%	1	6%	2	13%	2	13%	5	31%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 165) for association to speeding: $\chi^2_{(1)} = 0.25$, $p = .62$

Table 3.35
Speeding prevalence by surface wetness and speeding category, for free-speed vehicles

Crash surface wetness	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Dry †	131	93	71%	19	15%	11	8%	8	6%	10	8%	45	34%
Wet †	16	12	75%	1	6%	1	6%	2	13%	2	13%	6	38%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(1)} = 0.54$, $p = .46$

3.4.7. Speed zones

The speeding prevalence of bullet vehicles across different speed zones, ranging from 40 km/h to 110 km/h, are presented in Table 3.36. The top section of the table shows the speed zone groups of 40 to 60 km/h, 70 to 80 km/h, and 100 to 110 km/h, groupings that produced a significant association with speeding ($\chi^2_{(2)} = 10.95$, $p < .01$). Speeding appeared less likely in the 100 and 110 km/h zones compared to the lower speed zones. It is important to note that these speed zones are related directly to the speed limit of the road that the EDR vehicle was travelling on, rather than the maximum speed limit for all vehicles involved in the crash, although it was common that these were the same. In the sample, extreme speeding of 45 km/h or more over the speed limit was two to three times more likely in lower speed zones than in 100 and 110 km/h speed zones.

The speeding prevalence of free-speed vehicles, both overall and in individual speeding categories, by speed zones is presented in Table 3.37. Again, speeding appeared significantly least likely to occur in 100 and 110 km/h speed zones ($\chi^2_{(2)} = 25.25$, p < .01). In the free-speed vehicle sample, extreme speeding was at least three times more prevalent in lower speed zones compared to 100 and 110 km/h speed zones.

Table 3.36
Speeding prevalence by speed zone and speeding category, for bullet vehicles

Speed zone (km/h)	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
40 - 60 †	72	52	72%	6	8%	6	8%	6	8%	9	13%	25	35%
70 - 80 †	38	27	71%	4	11%	2	5%	2	5%	2	5%	17	45%
100 - 110 †	55	25	45%	8	15%	5	9%	2	4%	3	5%	7	13%
40	5	4	80%	-	-	1	20%	-	-	-	-	3	60%
50	18	14	78%	1	6%	2	11%	2	11%	3	17%	6	33%
60	49	34	69%	5	10%	3	6%	4	8%	6	12%	16	33%
70	10	9	90%	2	20%	-	-	1	10%	1	10%	5	50%
80	28	18	64%	2	7%	2	7%	1	4%	1	4%	12	43%
100	53	24	45%	8	15%	4	8%	2	4%	3	6%	7	13%
110	2	1	50%	-	-	1	50%	-	-	-	-	-	-
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 165) for association to speeding: $\chi^2_{(2)} = 10.95$, $p < .01$

Table 3.37
Speeding prevalence by speed zone and speeding category, for free-speed vehicles

Speed zone (km/h)	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
40 - 60 †	58	50	86%	6	10%	4	7%	6	10%	7	12%	27	47%
70 - 80 †	37	31	84%	6	16%	4	11%	2	5%	2	5%	17	46%
100 - 110 †	52	24	46%	8	15%	4	8%	2	4%	3	6%	7	13%
40	4	4	100%	-	-	1	25%	-	-	-	-	3	75%
50	15	13	87%	1	7%	1	7%	2	13%	2	13%	7	47%
60	39	33	85%	5	13%	2	5%	4	10%	5	13%	17	44%
70	10	9	90%	2	20%	-	-	1	10%	1	10%	5	50%
80	27	22	81%	4	15%	4	15%	1	4%	1	4%	12	44%
100	50	23	46%	8	16%	3	6%	2	4%	3	6%	7	14%
110	2	1	50%	-	-	1	50%	-	-	-	-	-	-
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(2)} = 25.25$, $p < .01$

3.4.8. Crash types

The speeding prevalence, both overall and in individual speeding categories, of bullet vehicles by crash type is shown in Table 3.38. Crash types were combined into broad categories, with the acronyms LD (lane departure), AP (across path), RI (rear impact), and O (other) representing these groupings. Among the broad crash types, lane departure crashes in the sample were most likely to involve speeding, while across path crashes were least likely to involve speeding. Across path crashes were also least likely to be engaged in extreme speeding (45+ km/h over the speed limit). A chi-square test showed a significant association between broad crash type and the prevalence of speeding ($\chi^2_{(3)} = 9.34$, $p = .03$). Examining the individual crash types, single-vehicle crashes into objects appeared to have the highest prevalence of speeding, with a notable proportion (44%) exceeding speed limits by 45 km/h or more. In contrast, right-angle collisions showed a much lower overall speeding incidence at 21%.

Table 3.39 shows the speeding prevalence of free-speed vehicles by vehicle crash type. Among the broad crash types, rear impact crashes appeared most likely to involve speeding by the free-speed vehicle, while across path crashes appeared to be least likely to involve speeding. Across path crashes also appeared least likely to involve extreme speeding (45+ km/h over the speed limit). A significant association between crash type and speeding was not found, however, and was also not found when the category ‘Other’ was omitted from the test ($\chi^2_{(2)} = 3.90$, $p = .14$). Examining the individual crash types with larger counts, single-vehicle crashes into objects had a high level of involvement of speeding (98%), with a notable proportion (49%) exceeding speed limits by 45 km/h or more. In contrast, head-on and right-angle collisions showed a lower speeding likelihood at 38% and 39% respectively.

Table 3.38
Speeding prevalence by crash type and speeding category, for bullet vehicles

Crash type	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Lane departure (LD) †	106	74	70%	13	12%	9	8%	8	8%	13	12%	31	29%
Across path (AP) †	26	10	38%	5	19%	1	4%	-	-	1	4%	3	12%
Rear impact (RI) †	18	10	56%	-	-	1	6%	2	11%	-	-	7	39%
Other (O) †	15	10	67%	-	-	2	13%	-	-	-	-	8	53%
Single vehicle into object (LD)	59	54	92%	6	10%	6	10%	6	10%	10	17%	26	44%
Head on (LD)	44	17	39%	6	14%	3	7%	2	5%	3	7%	3	7%
Right angle (AP)	14	3	21%	3	21%	-	-	-	-	-	-	-	-
Rear end (RI)	13	9	69%	-	-	1	8%	2	15%	-	-	6	46%
Pedestrian (O)	7	3	43%	-	-	1	14%	-	-	-	-	2	29%
Hit parked vehicle (LD)	5	1	20%	-	-	-	-	-	-	-	-	1	20%
Side swipe (O)	5	4	80%	-	-	-	-	-	-	-	-	4	80%
U-turn in front (AP)	5	2	40%	-	-	-	-	-	-	-	-	2	40%
Right turn - adjacent (AP)	3	2	67%	1	33%	-	-	-	-	1	33%	-	-
Right turn - opposite (AP)	3	3	100%	1	33%	1	33%	-	-	-	-	1	33%
Rollover (LD)	3	3	100%	1	33%	-	-	-	-	-	-	2	67%
Left turn - adjacent (AP)	1	-	-	-	-	-	-	-	-	-	-	-	-
Other* (O)	3	3	100%	-	-	1	33%	-	-	-	-	2	67%
Total	**165**	**104**	**63%**	**18**	**11%**	**13**	**8%**	**10**	**6%**	**14**	**9%**	**49**	**30%**

†Chi-square test (n = 165) for association to speeding: $\chi^2_{(3)} = 9.34$, p = .03

Note: Other and Other* are not the same.

Table 3.39
Speeding prevalence by crash type and speeding category, for free-speed vehicles

Crash type	Total count	Speeding		Speeding category (km/h over speed limit)									
				1 - 9 km/h		10 - 24 km/h		25 - 34 km/h		35 - 44 km/h		45+ km/h	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Lane departure (LD) †	94	68	72%	12	13%	7	7%	8	9%	11	12%	30	32%
Across path (AP) †	27	15	56%	5	19%	2	7%	-	-	1	4%	7	26%
Rear impact (RI) †	16	13	81%	3	19%	1	6%	2	13%	-	-	7	44%
Other (O) †	10	9	90%	-	-	2	20%	-	-	-	-	7	70%
Single vehicle into object (LD)	51	50	98%	5	10%	5	10	6	12%	9	18%	25	49%
Head on (LD)	40	15	38%	6	15%	2	5%	2	5%	2	5%	3	8%
Right angle (AP)	18	7	39%	3	17%	1	6%	-	-	-	-	3	17%
Rear end (RI)	13	12	92%	3	23%	1	8%	2	15%	-	-	6	46%
Pedestrian (O)	3	2	67%	-	-	-	-	-	-	-	-	2	67%
Hit parked vehicle (LD)	3	1	33%	-	-	-	-	-	-	-	-	1	33%
Side swipe (O)	3	3	100%	-	-	-	-	-	-	-	-	3	100%
U-turn in front (AP)	2	2	100%	-	-	-	-	-	-	-	-	2	100%
Right turn - adjacent (AP)	3	3	100%	1	33%	-	-	-	-	1	33%	1	33%
Right turn - opposite (AP)	4	3	75%	1	25%	1	25%	-	-	-	-	1	25%
Rollover (LD)	3	3	100%	1	33%	-	-	-	-	-	-	2	67%
Left turn - adjacent (AP)	-	-	-	-	-	-	-	-	-	-	-	-	-
Other* (O)	4	4	100%	-	-	2	50%	-	-	-	-	2	50%
Total	**147**	**105**	**71%**	**20**	**14%**	**12**	**8%**	**10**	**7%**	**12**	**8%**	**51**	**35%**

†Chi-square test (n = 147) for association to speeding: $\chi^2_{(3)} = 5.82$, $p = .12$
Note: Other and Other* are not the same.

3.5. Summary of significant results

The analysis identified significant ($p < .05$) associations for bullet vehicles across several characteristics:

- Age of driver: Younger drivers appeared to exhibit a higher likelihood of speeding ($\chi^2_{(3)} = 15.12$, $p < .01$)
- BAC of driver: Drivers testing positive for alcohol were more likely to be speeding ($\chi^2_{(1)} = 6.60$, $p = .01$)
- Drug test results: Drivers testing positive to methamphetamine or THC showed a significant association with speeding ($\chi^2_{(2)} = 7.07$, $p = .03$)
- Time and weekday of crash: Incidents during weekday nights were notably associated with speeding ($\chi^2_{(3)} = 13.16$, $p < .01$)
- Intersection type: Crashes at T-junctions appeared more likely to involve speeding of the bullet vehicle ($\chi^2_{(2)} = 8.52$, $p = .01$)

- Speed zones: Bullet vehicles travelling in 40 to 80 km/h speed zones demonstrated a significant propensity for speeding ($\chi^2_{(2)} = 10.95$, $p < .01$)
- Crash type: Bullet vehicles involved in lane departure crashes were associated with a higher proportion of speeding ($\chi^2_{(3)} = 9.34$, $p = .03$)

Statistically significant associations ($p < .05$) were observed among free-speed vehicles, highlighting the following characteristics:

- BAC of driver: Drivers with a positive BAC were more prone to speeding ($\chi^2_{(1)} = 5.78$, $p = .02$)
- Time and weekday of crash: Speeding was more prevalent during weekday nights and weekend nights ($\chi^2_{(3)} = 7.87$, $p = .049$)
- Crash area: Free-speed vehicles involved in crashes in Melbourne metropolitan areas showed increased speeding behaviour ($\chi^2_{(1)} = 8.71$, $p < .01$)
- Intersection type: Crashes at T-junctions appeared more likely to involve speeding of the free-speed vehicle ($\chi^2_{(2)} = 10.28$, $p < .01$)
- Speed zones: Free-speed vehicles travelling in 40 to 80 km/h speed zones appeared more likely to be speeding ($\chi^2_{(2)} = 25.25$, $p < .01$)

4. Discussion

The analysis of the CRMIU sample revealed a notable prevalence of speeding of vehicles involved in crashes with 63% of bullet vehicles and 71% of free-speed vehicles travelling above the speed limit. More specifically, the data also highlight a concerning prevalence of extreme speeding, with 30% of bullet vehicles and 35% of free-speed vehicles travelling above the speed limit by 45 km/h or more. This higher rate of extreme speeding underscores the severity of the speeding behaviour within the sample, reflecting not only a general tendency towards speeding but also a dangerous level of excessive speed that contributes to the high severity of the crashes observed.

From the sample of 165 crashed bullet vehicles, speeding appeared most likely to be engaged in by younger drivers, drivers with a positive BAC, and drivers who tested positive to methamphetamine or THC. The bullet vehicles were more likely to be speeding during weekday nights, appeared more likely to be travelling through T-junction intersections, to be travelling in a 40 to 80 km/h speed zone, and to be involved in a lane departure crash.

Drivers in the sample of 147 crashed free-speed vehicles appeared more likely to be engaged in speeding when they had a positive BAC. Free-speed vehicles appeared more likely to be engaged in speeding during the nighttime, when they were in Melbourne metropolitan areas, if they were travelling through a T-junction intersection, or if they were travelling in a speed zone of 40 to 80 km/h.

The characteristics which were found to have significant associations with speeding in the sample were all driver and crash characteristics, and not vehicle characteristics.

Before comparing the outcomes of this study with those previously reported in the literature, the limitations of the study need to be acknowledged.

4.1. Sample selection and study limitations

To consider the limitations of this study it is important to understand the sample of EDR data that was analysed. The sample is made up predominately of two crash severities: fatal and 'major injury', with 'major injury' indicating that an occupant attended hospital (Doecke & Elsegood, in press). Doecke & Elsegood (in press) stated that, while the fatal cases in the CRMIU EDR sample appeared to be reasonably representative of fatal crashes in Victoria, the 'major injury' cases had an apparent bias towards higher injury severity and speeding. While the magnitude of the bias towards speeding could not be determined, the prevalence of speeding for high severity crashes found in this study is likely to be an overestimate of the prevalence of speeding in all high severity crashes in Victoria. The prevalence of speeding for each individual variable category (e.g., drivers aged 16 to 25 years) is also likely to be an overestimate. However, the differences in the prevalence of speeding identified between certain variable categories remain meaningful, as there are no identified biases in the sample selection towards certain driver, vehicle, or road and crash characteristics, as inferred in Doecke & Elsegood (in press).

It is also important to recognise that the results presented in this report are derived from data on crashed vehicles and may not necessarily reflect the behaviours of vehicles that are not involved in crashes. This distinction is important because the driving patterns, risk factors, and characteristics observed in crash-involved vehicles may differ significantly from those of the general driving population. Consequently, while the findings provide valuable insights into the characteristics associated with crashes, they should be interpreted with caution when generalising to the broader context of driver behaviour.

The bullet vehicle sample consisted of 63% speeding vehicles and 37% non-speeding vehicles, whereas the free-speed vehicle sample consisted of 71% speeding vehicles and 29% non-speeding vehicles. For an optimal chi-square test, achieving a balanced distribution in the sample, with approximately equal numbers in each category being compared, tends to maximise statistical power. Statistical power refers to the probability of detecting a true effect when it exists (i.e., rejecting the null hypothesis correctly). When categories are balanced, the chi-square test is more sensitive to detecting differences or associations between the categories because each category contributes equally to the analysis. In cases where one category is much smaller, the test may lack the necessary power to detect significant differences, leading to conclusions that no significant association exists. Imbalanced tests may also overstate associations in the larger category, potentially biasing the interpretation of results. What this implies is that, while the statistically significant associations identified remain valid, there are additional categories currently lacking a sufficient sample size to demonstrate statistical significance. With a larger or more balanced sample, these categories may reveal more statistically significant associations or differences.

4.2. Comparisons to other studies

The following section compares the results to selected Australian studies that examined the profile or prevalence of speeding. Prior studies were selected for comparison if they used EDR data, or included data from Victoria.

4.2.1. CASR's South Australian sample of EDR data

Elsegood, Doecke, & Ponte (2023) provided a summary report of the EDR data collected by CASR, which was used in Doecke, Ponte, & Elsegood (2023) to examine the prevalence and profile of speeding. The sample consisted of 315 bullet vehicles and 160 free-speed vehicles involved in crashes in South Australia between 2017 and 2021. Both studies noted that the sample was skewed towards higher injury severity, with non-injury cases being underrepresented and hospital-treated cases being overrepresented. However, the proportions for hospital treated (participants of crashes attended a hospital for less than an overnight stay), hospital admission (participants of crashes admitted to a hospital for a minimum period of an overnight stay) and fatal cases were much closer to being representative, accounting for 34.1%, 3.1% and 0.2%, respectively, of the sample. In contrast, the current study showed proportions of 43.4% with 'major injury' (participants of crashes attended a hospital for any length of time) and 44.5% with 'fatal' outcomes.

The prevalence of speeding in the present study was considerably higher than in Doecke, Ponte & Elsegood (2023), for both bullet vehicles (63% vs. 27%) and free-speed vehicles (71% vs. 40%). High level speeding was also far more prevalent in the present study than in Doecke, Ponte & Elsegood (2023). Extreme speeding (by 45+ km/h) was the most common form of speeding in the present study, whereas low-level speeding (by 1-5 km/h) was most common in Doecke, Ponte & Elsegood (2023). These discrepancies are likely due to differences in crash severity between the samples and a bias towards speeding in the present study, as discussed in Section 4.1. Consequently, the results cannot be used to compare speeding behaviour between South Australia and Victoria.

Despite the considerable differences in crash severity between the samples analysed in Doecke, Ponte & Elsegood (2023) and the present study, many findings regarding the profile of speeding were consistent. Statistically significant associations with speeding that were consistent between the two studies included driver age (for bullet vehicles only), time of crash (for both bullet and free-speed vehicles), intersection type (for both bullet and free-speed vehicles), speed zone (for both bullet and free-speed vehicles), and crash type (for bullet vehicles only).

Both studies found younger drivers of bullet vehicles appeared more likely to be speeding when they crashed. However, Doecke, Ponte & Elsegood (2023) reported that speeding prevalence was similar between drivers aged 16 to 24 years and 25 to 39 years for bullet vehicles. In contrast, drivers aged 16 to 24 years in free-speed vehicles had a higher prevalence of speeding compared to those aged 25 to 39 years. The present study, however, showed similar prevalence rates of speeding for these two younger age groups in free-speed vehicles.

The time of the crash was associated with speeding prevalence in both studies, though the specifics differed. The present study found that speeding appeared most prevalent on weekday nights, while Doecke, Ponte & Elsegood (2023) found it appeared most prevalent on weekend nights. This discrepancy might be due to the differences in crash severity between the two studies or variations in speed enforcement, demographics, or culture between South Australia and Victoria.

Intersection types associated with a higher prevalence of speeding in crashes also differed. Doecke, Ponte & Elsegood (2023) found crashes at mid-block locations appeared to have the highest prevalence of speeding, while the present study identified T-junctions as appearing to have the highest prevalence, though the prevalence of extreme speeding (45+ km/h above the speed limit) was similar for both mid-block locations and T-junctions. This difference might be related to variations in crash severity or road network differences between South Australia and Victoria.

Both studies found a significant association between speed limit and speeding prevalence. While both found speeding to appear more likely in lower speed zones, the groupings used for significance testing differed. Doecke, Ponte & Elsegood (2023) used 50 km/h or less as their lowest speed zone, whereas the present study used 40 to 60 km/h. Doecke, Ponte & Elsegood (2023) found the lowest speeding rates in 60 km/h zones, while the present study found them in 100 and 110 km/h zones. This difference may be explained by the severity of crashes in each sample. The present study primarily involved high-severity crashes. In such cases, speeding is often a contributing factor to the severity of the outcome, especially in lower speed zones. For a crash in a low-speed zone to result in high severity outcome, speeding might be necessary, which could lead to a higher observed prevalence of speeding in these zones than in samples that include many non-injury crashes, as in Doecke, Ponte & Elsegood (2023).

An association between the area in which the crash occurred and the prevalence of speeding was found in both studies, though the results differed. Doecke, Ponte & Elsegood (2023) found speeding appeared more likely in rural areas (significant only for bullet vehicles), while the present study found it appeared more likely in Melbourne metropolitan areas (significant only for free-speed vehicles). This discrepancy may be due to differences in crash severity between the two studies, in a similar manner to the results for speed zones. In Melbourne metropolitan areas, speeding might be necessary for a crash to be included in the CRMIU EDR sample, more so than in rural areas.

Both studies found a significant association between crash type and speeding prevalence, though different crash type groupings were used, and the association was significant only for bullet vehicles in the present study. Single vehicle crashes had the highest rates of speeding in both studies, though the present study grouped single-vehicle crashes with other lane departure crashes for significance testing. Across path crashes, referred to as “R. turn/angle” in Doecke, Ponte & Elsegood (2023), had the lowest speeding rates in both studies.

The present study identified significant associations between speeding and driver alcohol and drug test results, whereas Doecke, Ponte & Elsegood (2023) found higher rates of speeding among drivers with positive alcohol tests compared to negative alcohol tests, but the small sample sizes (n=7 for bullet vehicles, n=6 for free-speed vehicles) precluded statistical testing. The present study had higher numbers of drivers with positive BAC (n=26 for bullet vehicles, n=23 for free-speed vehicles) and found a significant association between positive BAC and higher speeding prevalence. While Doecke, Ponte, & Elsegood (2023) did not report on illicit drugs, the present study found that bullet vehicle drivers who tested positive for methamphetamine and/or THC appeared more likely to be speeding than those without drugs or with other drugs in their system.

Unlike the present study, Doecke, Ponte & Elsegood (2023) found an association between vehicle colour and speeding. They reported that vehicles that were black, grey and red appeared more likely to be speeding compared to silver, white, or other colours, though this was only significant for bullet vehicles. The present study was unable to achieve significant associations for vehicle colour, likely due to the smaller sample size of 165 bullet vehicles and 147 free-speed vehicles, whereas Doecke, Ponte & Elsegood (2023) achieved significance with their larger sample size of 319 bullet vehicles, but not their smaller sample size of 160 free-speed vehicles.

The present study did not find an association between speeding and road curvature, unlike Doecke, Ponte, & Elsegood (2023), which found speeding prevalence to be significantly more likely on curved roads for bullet vehicles and free-speed vehicles. Both studies categorised road curvature as either “straight” or “curved.” The present study found marginally higher speeding prevalence on curves compared to straight roads, but the difference was not significant. The reasons for this difference are unclear.

Doecke, Ponte & Elsegood (2023) found an association between speeding prevalence and road class, unlike the present study. Both studies found speeding was most prevalent in crashes on local roads, but Doecke, Ponte & Elsegood (2023) found it least prevalent on arterial roads, whereas the present study found it least prevalent on C-class roads (similar to collector roads). South Australia and Victoria classify their roads similarly, but not identically. South Australia also has a much smaller network of freeways, or M roads. The differences in the road classifications and networks, and the differences in severity between the two samples, may contribute to the differing results between the two studies.

The present study found that, while speeding appeared to be more prevalent on wet roads, this result was not significant. Doecke, Ponte & Elsegood (2023) also found speeding more prevalent on wet roads, with the result significant for free-speed vehicles. This likely reflects the increased sensitivity of speeding to wet road conditions, as discussed in Doecke, Ponte & Elsegood (2023), where speeding is more likely to contribute to a crash on a wet road compared to a dry road.

Neither study found significant associations between speeding and driver sex, vehicle body type, vehicle transmission, number of occupants, or vehicle age. The present study found a trend towards high speeding prevalence among males, however, with a p-value of 0.06 for bullet vehicles, suggesting a larger sample might yield a significant result.

4.2.2. The Enhanced Crash Investigation Study (ECIS)

Fitzharris *et al.* (2020) reported on the Enhanced Crash Investigation Study (ECIS), conducted in Victoria from August 2014 to December 2016, that collected data on 393 crashes involving drivers admitted to hospital for at least a day. They found that 26% of these crashes involved speeding, with this prevalence increasing to 37% among serious injury crashes (MAIS3+). To compare to the current study, the assumption that all crashes have a bullet vehicle, which is generally the vehicle speeding in a crash, must be made. Therefore, these proportions provide an indication of the speeding prevalence of bullet vehicles in their sample. This is notably lower than the 63% of bullet vehicles found to be speeding in the present study. Fitzharris *et al.* (2020) did not identify free-speed vehicles and hence did not report their prevalence of speeding.

Several factors may contribute to the difference in speeding prevalence between Fitzharris *et al.* (2020) and the present study. One key factor is that the CRMIU EDR sample might be biased towards speeding (Doecke & Elsegood, in press), suggesting that the prevalence of speeding in the present study could be an overestimate of actual speeding rates in high-severity crashes in Victoria. Conversely, Fitzharris *et al.* (2020) likely underestimated speeding prevalence since EDR data were only available for 36 (9%) of their cases. Travel speeds in the remaining cases were determined using simulation-based reconstruction techniques, which may underestimate speeds due to the lack of forensic evidence from pre-impact braking. Additionally, as investigators attended crash scenes up to two weeks after the crash (pg. 23), critical evidence that could assist in determining pre-crash travel speeds may have been removed or faded away. Although Fitzharris *et al.* (2020) mentioned two categories of reconstruction, only “Type-A” reconstructions (n=170) were used to analyse the relationship between travel speed and risk. Notably, Table 6.6A (pg. 87) cites a sample size of 393 for speeding prevalence, while the total number of reconstructed cases (Type-A and Type-B) is 347. This discrepancy suggests that the reported prevalence of speeding might be an underestimate due to the limited EDR data and inclusion of non-reconstructed cases.

Differences in crash severity between the samples may also partly explain the variation in speeding prevalence. Fitzharris *et al.* (2020) reported driver injury severity, while the present study, described in Doecke and Elsegood (in press), uses crash severity. Fitzharris *et al.* (2020) indicated that 4% of their crashes were fatal, whereas 45% of crashes in the CRMIU EDR sample were fatal (Doecke & Elsegood, in press). The higher proportion of fatal crashes in the present study could contribute to the observed differences in speeding prevalence.

The only characteristic profiled for speeding in Fitzharris *et al.* (2020) was crash type. Both the present study and Fitzharris *et al.* (2020) found that lane departure crashes had the highest prevalence of speeding. However, the present study found that across path crashes had the lowest prevalence of speeding, whereas Fitzharris *et al.* (2020) identified rear impact crashes as having the lowest prevalence of speeding. This discrepancy may be due to the difficulties in determining speeding using crash reconstructions for rear impact crashes, where forensic evidence may be less apparent and can quickly disappear after emergency personnel clear the scene.

4.2.3. Self-reported speed compliance in Australia

A study conducted by Stephens *et al.* (2017) examined the self-reported prevalence and profiles of speeding in Australia amongst a sample of 5,179 drivers from all states and territories, representative for all except South Australia. Participants were asked to report their usual driving speeds in various speed zones, either below or at the speed limit, or within four different ranges above it. The results were analysed based on speed limit, driver age, sex, and licence type. Although the methodologies differ, it is useful to compare general findings to identify areas of agreement and discrepancy with the present study.

Stephens *et al.* (2017) found that self-reported speeding was more common in high-speed zones, whereas the findings of the present study indicated speeding was more prevalent in low-speed zones. This discrepancy may be partly explained by the crash severities in the present study, and the bias this may cause towards higher prevalence of speeding in low-speed zones, it may also be partly related to the difference in methodology. Similar discrepancies were noted in Doecke, Ponte & Elsegood (2023), where it was suggested that self-reported speed behaviour may reflect lower awareness of or less social acceptance of speeding in low-speed zones.

Both studies suggest that males are more likely to speed than females. However, despite a larger difference between the sexes in the present study, this difference was not statistically significant, unlike in Stephens *et al.* (2017). This suggests that further analysis of a larger CRMIU dataset might reveal a significant association between speeding prevalence and sex.

Stephens *et al.* (2017) also found that young drivers were more likely to speed, particularly those under 25 years old, who were over-represented in both mid-level (6-10 km/h above the limit) and excessive speeding (11+ km/h above the limit) categories. The present study supported this finding, showing that, for bullet vehicles, drivers aged 16 to 24 years exhibited the highest prevalence of speeding, including extreme speeding (45+ km/h above the limit). Despite differences in age categories, both studies align in their observations regarding driver age and speeding.

Regarding licence status, both studies found that probationary licence holders were more likely to speed than those with standard or unrestricted licences. However, Stephens *et al.* (2017) reported that learners permit holders were generally compliant, unlike in the present study, where learners permit holders were found not only speeding but also seemingly disregarding the supervising requirements of their permit. However, caution is advised due to the low number of learners permit holders in the sample (n=5). Stephens *et al.* (2017) did not capture speeding behaviour of individuals who were unlicensed, disqualified, suspended, or had expired licences.

4.2.4. Measured speed compliance in Victoria

Alavi *et al.* (2014) recorded the travel speeds of nearly 350,000 vehicles using covert mobile speed cameras across Melbourne metropolitan and regional Victoria, within 40, 50, 60, 70, 80, 90, 100, and 110 km/h zones. They found the prevalence of speeding in each metropolitan speed zone to be 47%, 21%, 10%, 6%, 3%, 6%, 5%, and 6%, respectively. For rural Victoria, where data on 40 km/h zones were unavailable, speeding prevalences were 23%, 12%, 8%, 8%, 5%, 10%, and 10%, respectively. The study did not identify vehicles travelling at a free-speed.

A fundamental difference to note between the present study and Alavi *et al.* (2014) is that Alavi *et al.* focused on vehicles that were not involved in crashes, whereas the present study analysed vehicles that had crashed. Consequently, the present study reported much higher speeding proportions, often more than triple, among crashed bullet vehicles and free-speed vehicles.

Both studies observed higher speeding proportions in 40-60 km/h zones. However, the present study found similar speeding proportions in 70-80 km/h zones compared to 40-60 km/h zones, with a notable decrease in speeding in 100-110 km/h zones. In contrast, Alavi *et al.* (2014) reported generally lower speeding rates in 70-110 km/h zones compared to 40-60 km/h zones.

5. Conclusions

The analysis found that speeding, including high-level speeding, is common in high-severity crashes. Specifically, 63% of bullet vehicles and 71% of free-speed vehicles in the CRMIU sample of high-severity crashes were speeding. Furthermore, 30% of bullet vehicles, and 35% of free-speed vehicles in this sample were travelling at 45 km/h or more above the speed limit. However, it must be acknowledged that the prevalence of speeding found in this study is likely an overestimate of speeding in all high-severity crashes in Victoria.

The analysis indicated that specific demographics, conditions, and locations are associated with a higher likelihood of speeding. To reduce speeding in high-severity crashes, and therefore increase road safety, consideration should be given to the implementation of interventions aimed at reducing speeding, targeted towards:

- Younger drivers
- Drivers who drive while under the influence of alcohol or illicit drugs
- Drivers who are driving at nighttime
- People driving in metropolitan Melbourne
- T-junctions
- Traffic in 40 to 80 km/h speed zones

These interventions may include vehicle technology, such as Intelligent Speed Adaptation (ISA), enforcement activities, or advertising campaigns. The interventions may also include infrastructure designed to encourage speed compliance, such as roundabouts or vertical deflection.

6. Future studies

Increasing the sample size can help improve the reliability and validity of the findings. A larger dataset allows for more robust analyses, particularly when examining characteristics with numerous categories, where achieving statistically significant associations becomes more difficult. Increasing the sample size typically mitigates biases that may have arisen by chance. However, it does not eliminate biases introduced by the data collection method. In this report, the sample was skewed towards higher severity crashes and vehicles involved in incidents where a vehicle was suspected of committing a driving offence, such as speeding. To create a more representative dataset of high-severity crashes in Victoria, it would be beneficial to include cases where crashes were not investigated due to the suspicion of a driving offence, provided resources are available for such investigations.

Additionally, incorporating variables such as driver offence histories, including both speeding-related and general traffic offences, could provide further insights into associations with speeding prevalence in crashes.

As the CASR-EDR database expands, particularly with the possible ongoing inclusion of CRMIU cases, there will be an opportunity to explore associations between characteristics and extreme speeding events. This would involve statistically testing cases where speeding exceeds a certain threshold (e.g., 45+ km/h over the speed limit) to determine the significance of these associations. Additionally, isolating fatal cases could provide deeper insights into how speeding contributes to crash severity and fatality, and help profile characteristics in fatal crashes that are associated with speeding.

Acknowledgements

The authors would like to acknowledge Paulette Ziekemijjer, Renee Schuster, and David Young as the project managers from TAC. Thanks to Mishra Suryaprakash from TAC for providing the VIN data matching services.

The authors would also like to acknowledge the efforts of David Ballek (Victoria Police), Paulette Ziekemijjer (TAC) and Renee Schuster (TAC) in assisting with the development and finalisation of Memorandum of Understanding between Victoria Police, The University of Adelaide, and TAC, that enabled this project to take place.

This project would not have been possible without the significant contribution of Michael Hardiman from the Victorian Police Major Collision Investigation Unit and Yuxing Zhao from the Victorian Police Collision Reconstruction and Mechanical Investigation Unit who redacted and uploaded hundreds of EDR files and provided detailed explanations of the processes of their investigations.

Finally, the authors would like to acknowledge Associate Professor Matthew Baldock for his contribution to the quality control of this report.

References

Alavi, H., Keleher, S. & Nieuwesteeg, M., (2014). *Quantifying the contribution of low-level speeding to trauma in Victoria.* 2014 Australasian Road Safety Research, Policing & Education Conference, Melbourne, Australia, 12-14 November.

Austroads (2021). *Guide to Road Safety Part 3: Safe Speed*. https://austroads.com.au/publications/road-safety/agrs03

Bortles, W., Biever, W., Carter, N., and Smith, C., (2016) *A Compendium of Passenger Vehicle Event Data Recorder Literature and Analysis of Validation Studies.* SAE Technical Paper 2016-01-1497, doi:10.4271/2016-01-1497.

Centre for Road Safety, Transport for NSW (2020). *Road traffic crashes in New South Wales: Statistical Statement for the year ended 31 December 2019*. https://roadsafety.transport.nsw.gov.au/downloads/crashstats2019.pdf

Department of Planning, Transport and Infrastructure (2017). *Speed Limit Guideline for South Australia*. https://www.dpti.sa.gov.au/?a=338713

Doecke, S. D., & Elsegood, M. E. (in press). *Event Data Recorders (EDRs) and high severity crashes: a summary of data collected by Victoria Police.* (CASR237) Centre for Automotive Safety Research, Adelaide.

Doecke, S. D., & Kloeden, C. N. (2014). *The accuracy of determining speeding directly from mass crash data and using the NSW Centre for Road Safety method.* Journal of the Australasian College of Road Safety, 25(1), 35-41.

Doecke, S. D., Dutschke, J. K., Baldock, M. R. J., & Kloeden, C. N. (2021). *Travel speed and the risk of serious injury in vehicle crashes.* Accident Analysis and Prevention, 161 (2021), 106359.

Doecke, S. D., Ponte, G., & Elsegood, M. E. (2023). *Determining the prevalence and profile of speeding in vehicle crashes using Event Data Recorders (EDRs)*. 27th International Technical Conference on The Enhanced Safety of Vehicles, Yokohama, Japan, 3-6 April.

Elsegood, M. E., Doecke, S. D., & Ponte, G. (2023). *Collection and analysis of EDR data from crash-involved vehicles: 2021 summary report.* (CASR194). Adelaide: Centre for Automotive Safety Research.

Fitzharris, M., Lenne´, M. G., Corben, B., Pok Arundell, T., Peiris., S., Liu. S., Stephens., A., Fitzgerald, M., Judson, R., Bowman., D., Gabler, C., Morris, A., Tingvall., C. (2020). *ECIS Report 1: Overview and Analysis of Crash Types, Injury Outcomes and Contributing Factors.* Melbourne: Monash University Accident Research Centre.

ITF (2016). *Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System.* OECD Publishing, Paris. http://dx.doi.org/10.1787/9789282108055-en

Kloeden, C. N., & Woolley, J. E. (2023). *Vehicle speeds in South Australia 2020 (CASR183).* Adelaide: Centre for Automotive Safety Research.

Kloeden, C. N., McLean, A. J., Moore, V. M., & Ponte, G. (1997). *Travelling speed and the risk of crash involvement. Volumes 1 and 2* (CR172). Canberra: Federal Office of Road Safety, Transport and Communications.

Kloeden, C. N., Ponte, G., & McLean, A. J. (2001). *Travelling speed and the risk of crash involvement on rural roads* (CR204). Canberra: Australian Transport Safety Bureau.

McCarthy, M., Martin, P. (2017). *Speed limit cut: SA minister breaks ranks, Opposition promises reverse*. Accessed on 22/2/2022. https://www.abc.net.au/news/2017-10-05/sa-cabinet-minister-breaks-ranks-over-speed-limit-policy/9017580

Stephens, A.N., Nieuwesteeg, M., Page-Smith. J., Fitzharris, M. (2017). *Self-reported speed compliance and attitudes towards speeding in a representative sample of drivers in Australia*. Accident Analysis and Prevention 103 (2017) 56–64.

Appendix A – Bullet vehicle classifications from DCA codes and positions