

An examination of run-off-road crashes in Western Australia.

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Abstract

Run off road-non collision type crashes form a very significant subset of fatal and serious injury road traffic crashes in WA. Typically, this crash type includes driving off the road and rolling the vehicle or driving off the road and hitting vegetation or built object. In the five years from 2006 to 2010, this crash type accounted for 55% of fatalities and 50% of serious injuries. Understanding the key characteristics of this crash type has the potential to provide pathways for impacting on the road toll in a significant way.

This research utilises a number of WA Police datasets and sources to analyse the characteristics of the crash and driver. Data studied includes characteristics of the crash and driver such as; crash cause, location, road topography, time of day and day of week, gender, age, licence status, traffic history, and criminal history.

Run-off-road crashes are of particular interest to enforcement authorities as typically they are considered problematic from a traffic enforcement perspective. This research identifies a number of driver and crash characteristics that do respond to traffic enforcement and hence enforcement has a key role to play in decreasing run-off-road crashes.

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Introduction

Run off road-non collision type crashes form a very significant subset of fatal and serious injury road traffic crashes in WA. This aggregated crash type typically includes driving off the road and rolling the vehicle or driving off the road and hitting vegetation or a built object. In WA Police crash datasets these crash types are described as “hit object” and “non-collision” crashes. The key common elements are the involvement of a single vehicle and the leaving the road at speed. Within this paper crashes of both run off road and non-collision type will be referred to as run-off-road crashes (ROR).

In the five years from 2006 to 2010, this crash type accounted for 55% of fatalities and 50% of serious injuries. The Road Toll has varied significantly in this period from a peak of 235 to a minimum of 190. However, the proportion resulting from run-off-road crashes has been consistently in the range of 54.2% to 56.2%. As a comparison, vehicle on vehicle crashes accounted for an average of 32.6% of fatalities over this period.

Run-off-road crashes are of particular interest to traffic enforcement authorities due to both their significant count and due to the perception that they are a difficult target for traffic enforcement. Understanding the characteristics of the driver and crash has the potential to change this perception, especially if there are high risk and enforceable behaviours such as speed and alcohol involved, as opposed to the more difficult enforcement targets, such as inexperience, fatigue and carelessness.

Data sources and data issues

The data analysed in this study includes all fatal and serious injury crashes in Western Australia that occurred in the 2010 calendar year. The dataset integrates data from five sources:

- Casualty database¹ provides the basic data on crash details, time, date, location, road conditions, persons involved and individual roles within the crash. Casualty is based upon the Form 1-18 as completed by the Attending Officer, and may be updated by the Investigating Officer, Major Crash Section, and or the Coroner.
- FrontlineIMS² provides ethnicity, “risk factors”- drink driving outcomes, driving without a licence outcomes and criminal outcomes, IMS also provides more detailed information about the licensing status of drivers as sourced from DPI’s Trellis system
- Form1-18’s³ provide the person believed responsible for the crash.
- Coronial blood sample results analysed by ChemCentreWA.
- Blood alcohol results analysed by ChemCentre WA and recorded in the WA Police Breath system.

All fatal crashes in this dataset were classified as ‘Statistical’ crashes. This incorporates satisfying the criteria to be included in the Road Toll⁴.

¹ Casualty database, WA Police database of fatal and serious injury traffic crashes

² FrontlineIMS, WA Police Incident Management System

³ Form 1-18, WA Police document completed by the attending officer at scene of traffic crash

⁴ ATSB Guidelines for determining events as road crashes, 2000

The reasons for excluding crashes can include:

- occurred off a road or road related area,
- premeditated act of injury or damage,
- didn't involve at least one vehicle,
- didn't involve significant contribution from vehicle movement,
- death occurred more than 30 days after the crash,
- death occurred prior to a crash.

All serious injury crashes in this dataset also satisfy the 'Statistical' crash criteria when *Grievous Bodily Harm* is substituted for death. The source of blood alcohol data varies from fatalities to seriously injured persons. Fatally injured persons blood alcohol data is recorded as a result of Coronial blood testing, whereas serious injured persons or uninjured drivers in fatal and serious injury crashes are subject to testing in either hospital or Police facilities. This imposes a number of restrictions including a four hour sampling time limit and the capacity of medical staff to refuse to take a sample. Typically, where the taking of a sample is not in the injured driver's medical best interests.

The datasets were combined to create a single dataset of 753 records, including; 193 fatally injured persons, 291 serious injured persons, 263 drivers who were not seriously injured and 6 unknown persons. Unknown persons are typically unidentified drivers in hit and run incidents.

This research is focused on the characteristics of the driver and crash and hence the majority of tables will be counts of drivers as opposed to counts of injuries which could include injured passengers.

Where crashes are referred to in this paper it should be interpreted as fatal and serious injury crashes, as determined by WA Police. It should be noted that the serious injury definition is significantly different to other definitions of serious injuries employed by other agencies in Western Australia.

Where the terms licensed driver and unlicensed driver are utilised in this paper it should be interpreted as having two elements, the first being the driver's licensing status, the second being their status as the driver or one of the drivers in a fatal traffic crash. Hence being a licensed driver or unlicensed driver who was in a passenger, pedestrian or cyclist role in a traffic crash is excluded.

Within IMS and the DPI datasets the classification of unlicensed status was identified as problematic. There appears some variation in classification into categories such as suspended, disqualified and or cancelled. To overcome these inconsistencies drivers have been reclassified into licensed, or unlicensed. Licensed driver includes; full licence, extraordinary licence, provisional/probationary, and learner. Unlicensed driver includes; no licence, expired/inappropriate, disqualified, and suspended/cancelled licence. In some instances, the status of the driver's licence could not be ascertained as they were licensed overseas or in another state. These cases have been assigned licensed status on the basis that an externally licensed driver is permitted to drive in Western Australia for a three month period.

Analysis

Table 1: Gender & injury of all drivers in fatal and serious injury crashes, 2010

Gender	Fatal injury	Serious injury	Uninjured driver	Total	Fatal injury %	Serious injury %	Uninjured driver %
Female	34	40	57	131	26.8%	26.3%	22.3%
Male	93	112	199	404	73.2%	73.7%	77.7%
Total	127	152	256	535	100.0%	100.0%	100.0%

The drivers in this dataset fall into three classes fatally injured, seriously injured and uninjured. Fatally injured drivers form 23.7% of drivers, seriously injured drivers 28.4% and uninjured drivers 47.8%. The gender balance between the three categories is remarkably consistent, 75.5% of drivers are male and each sub-category falls within 2.5 percentage points.

This is consistent with patterns in the previous four years, males typically form 73%-82% of drivers in fatal and serious injury crashes. The explanation for why males appear to be over-represented is likely to relate to their propensity to engage in high risk behaviours and exposure factors linked to relative distances travelled.

Table 2: Crash nature of fatal and serious injury crashes, 2010

Crash Nature	Fatal injury	Serious injury	Uninjured driver	Total	Fatal injury %	Serious injury %	Uninjured driver %
Hit object	52	55	22	129	39.1%	36.2%	8.6%
Right angled	13	26	51	90	9.8%	17.1%	19.9%
Non collision	28	33	19	80	21.1%	21.7%	7.4%
Head on	17	15	32	64	12.8%	9.9%	12.5%
Hit pedestrian	0	1	50	51	0.0%	0.7%	19.5%
Rear end	5	8	34	47	3.8%	5.3%	13.3%
Indirect right angled	3	8	23	34	2.3%	5.3%	9.0%
Sideswipe- same direction	3	3	8	14	2.3%	2.0%	3.1%
Sideswipe- opposite direction	5	1	8	14	3.8%	0.7%	3.1%
Unk	2	1	6	9	1.5%	0.7%	2.3%
Passenger fell	3	1	3	7	2.3%	0.7%	1.2%
Hit animal	2	0	0	2	1.5%	0.0%	0.0%
Total	133	152	256	541	100.0%	100.0%	100.0%

The relative proportions of the most significant “crash natures” tends to be relatively stable. In the previous four years, the proportion of run-off-road crashes has ranged from 57% to 64%. In comparison to other aggregated crash types, run-off-road crashes tend to involve a higher proportion of injured drivers. In run-off-road crashes in 2010, 80.3% of drivers were injured, whereas 54.2% of drivers in vehicle-on-vehicle crashes were injured. This is consistent with the four year trend where the proportion of run-off-road crashes with injured drivers ranged from 74% to 81%.

Table 3: Drivers in run-off-road crashes by Injury, 2010

Crash Nature	Fatal injury	Serious injury	Uninjured driver	Total	Fatal injury %	Serious injury %	Uninjured driver %
Hit object	52	55	22	129	65.0%	62.5%	53.7%
Non collision	28	33	19	80	35.0%	37.5%	46.3%
Total	80	88	41	209	100.0%	100.0%	100.0%

This table (3) displays the two crash natures that form run-off-road type crashes, subsequent tables show a comparison between run-off-road crashes and all other crashes to illustrate the contrast between these two aggregations.

Table 4: Gender of drivers in run-off-road crashes, 2010

Gender	ROR	Other	Total	ROR %	Other %
Female	54	78	132	25.8%	23.5%
Male	155	254	409	74.2%	76.5%
Total	209	332	541	100.0%	100.0%

The gender profile of both crash types is relatively stable.

Table 5: Indigenous status of drivers in run-off-road crashes, 2010

	ROR	Other	Total	ROR %	Other %
Non ABTSI	184	319	503	88.0%	96.1%
ABTSI	25	13	38	12.0%	3.9%
Total	208	332	541	100.0%	100.0%

Indigenous status in the dataset was recorded where IMS or the Form 1-18 prepared by Attending Officer explicitly identified the driver as Indigenous. Where there was uncertainty over the Indigenous status of the driver, non-Indigenous status was recorded. Indigenous drivers accounted for 7.1% of drivers and 12.0% of run-off-road crashes. Almost two thirds of the crashes involving Indigenous drivers were run-off-road crashes as opposed to one third of non-Indigenous drivers being involved in this crash type.

The gender profile of Indigenous drivers was consistent with the greater dataset. Indigenous drivers were more likely to have a history of alcohol offences, but were less likely to have extreme range alcohol levels recorded following their crash. Indigenous drivers were more likely to be in the sub thirty years age ranges.

Table 5: Age ranges of drivers in run-off-road crashes, 2010

Age range	ROR	Other	Total	ROR %	Other %
0-16	6	3	9	66.7%	33.3%
17-19	20	24	44	45.5%	54.5%
20-24	40	51	91	44.0%	56.0%
25-29	31	35	66	47.0%	53.0%
30-39	36	70	106	34.0%	66.0%
40-49	31	56	87	35.6%	64.4%
50-59	26	43	69	37.7%	62.3%
60-69	14	22	36	38.9%	61.1%
70+	5	25	30	16.7%	83.3%
Total	209	329	538	38.8%	61.2%

Run-off-road crashes are typically higher in the younger age ranges. Excluding the 0-16 age group due to its small sample size, the highest proportions occur in the 17-19, 20-24 and 25-29 year age ranges.

Table 6: Crash causes in run-off-road crashes, 2010

Age range	ROR	ROR %
Alcohol/speed	45	28.1%
Speed	23	14.4%
Inattention	19	11.9%
Alcohol	13	8.1%
Fatigue	11	6.9%
Inexperience	10	6.3%
Careless	6	3.8%
Reckless	6	3.8%
Other medical	5	3.1%
Fallen load	4	2.5%
Alcohol/drugs	4	2.5%

Determining the cause of run-off-road crashes is often difficult in the absence of information from the driver and limited evidence at the scene. One in four crashes are recorded as 'unknown' cause by the Attending Officer. Of the run-off-road crashes with a determined cause, combined alcohol/speed (28.1%) and speed (14.4%) are the most common. Simplifying causes by aggregating causes into like types produces a clearer description of the driver behaviours underlying run-off-road crashes. Over half (56.9%) of crashes can be attributed to wilful high risk road user behaviours (alcohol/speed/drugs/reckless driving) whilst 25.1% are attributed to less deliberate risky behaviours such as inattention, fatigue and inexperience. The separation is of importance to enforcement agencies as at least half of run-off-road crashes fall within their common enforcement targets and strategies.

Table 7: Licence Status of drivers in run off-road-crashes, 2010

Abbreviated License Status	ROR	Other	Total	ROR %	Other %
Licensed	130	259	389	62.2%	78.0%
No WA MDL	24	11	35	11.5%	3.3%
Unknown	38	43	81	18.2%	13.0%
Unlicensed	17	19	36	8.1%	5.7%
Total	209	332	541	100.0%	100.0%

Drivers in run-off-road crashes are less likely to have regular licensed status, they are more likely to be unknown to the WA licensing system or be unlicensed. This is likely to be influenced by drivers who are WA resident and have never held a licence, intrastate licensed drivers who a relatively transient across state borders and student and tourists drivers utilising overseas issued licences. The driver's traffic court history has been summarised into two risk factors, alcohol outcomes and driving without a licence outcomes. A count of each outcome type was recorded as an indicator of driver's propensity to offend, and the driver's propensity to engage in these high risk behaviours. Court outcomes as a result of the fatal crash were excluded.

Table 8: Prior alcohol court outcomes of drivers in run-off-road crashes, 2010

Alcohol	ROR	Other	Total	ROR %	Other %
0	117	236	353	68.4%	81.4%
1	21	28	49	12.3%	9.7%
2	12	15	27	7.0%	5.2%
3	9	6	15	5.3%	2.1%
4	4	4	8	2.3%	1.4%
5	1	0	1	0.6%	0.0%
6	1	0	1	0.6%	0.0%
7	1	0	1	0.6%	0.0%
8	3	0	3	1.8%	0.0%
11	2	0	2	1.2%	0.0%
12	0	1	1	0.0%	0.3%
Total	171	290	461	100.0%	100.0%

Excluding drivers whose driving history is unknown, the number of alcohol outcomes recorded ranged from 0 to 12, 68.4% of run off road drivers had no alcohol outcome. In comparison, 81.4% of other drivers had no alcohol outcome. A higher proportion of run-off-road drivers had alcohol outcomes and the number of outcomes was higher. 54 run off road drivers had an average of 2.8 alcohol outcomes whereas 54 other crash type drivers had an average of 1.9 alcohol outcomes.

Alcohol outcomes ranged in severity from probationary driver driving with 0.02% blood alcohol content to driving under the influence of alcohol, each outcome was treated equally for the purposes of this analysis.

The count of offences and proportion of drivers with DWOL outcomes varied little between run-off-road and other drivers. Similarly, the count of criminal offences and

proportion of drivers with criminal records varied little between the run-off-road drivers and other drivers.

Table 9: Alcohol involvement suspected in run-off-road crashes, 2010

Alcohol suspected	ROR	Other	Total	ROR %	Other %
Not suspected	133	203	437	64.1%	91.3%
Suspected	75	29	104	35.9%	8.7%
Total	208	332	541	100.0%	100.0%

The Attending Officer records whether alcohol consumption is suspected based on the information available at the initial attendance. Alcohol is much more likely to be suspected in run-off-road crashes (35.9%) than other crashes (8.7%).

Table 10: Alcohol levels recorded in run-off-road crashes, 2010

Alcohol recorded	ROR	Other	Total	ROR %	Other %
No alcohol	47	47	94	49.5%	64.4%
0 to 0.049	4	6	10	4.2%	8.2%
0.05 to 0.079	4	4	8	4.2%	5.5%
0.08 to 0.149	15	7	22	15.8%	9.6%
DUI	25	9	34	26.3%	12.3%
Total	95	73	168	100.0%	100.0%

Alcohol levels are recorded via two mechanisms, fatally injured drivers are recorded via sampling at the mortuary, testing at ChemCentre WA and the Coroner Court system. Whilst surviving drivers are recorded via hospital based blood sampling or via Police conducted breath analysis. These different approaches allow for some ambiguity in the results, especially in relation to no alcohol recorded. Drivers with no alcohol recorded could either be tested and found to have no alcohol present or untested and hence assumed to have no alcohol present. This is likely to lead to an undercount of alcohol involvement.

There is a very significant difference in the count and distribution of drivers with alcohol recorded proportion for run-off-road and other crashes. Run-off-road drivers are more likely to have alcohol present (50.5%) than other drivers (35.6%), and the level of alcohol is liable to be much higher. Ignoring offences below 0.05 BAC, one in five (46.3%) run-off-road drivers had illegal blood alcohol concentrations. The extreme case being Driving under the Influence (>0.15 BAC), where one in four run-off-road drivers was exceed 0.15 BAC. The run-off-road drivers rate was double for than other drivers.

The highest alcohol concentrations were found in run-off-road drivers, 18 of the 20 drivers with blood alcohol concentrations above 0.2 were run-off-road drivers.

Table 11: Person believed responsible in run-off-road crashes, 2010

PBR	ROR	Other	Total	ROR %	Other %
Not responsible	12	175	187	5.8%	53.5%
Responsible	195	152	347	94.2%	46.5%
Total	207	327	534	100.0%	100.0%

The Person Believed Responsible (PBR) is assessed by the Attending Officer at the time of initial attendance based on the information that is available at that time. Unsurprisingly, run-off-road crashes are attributed to the driver in 94.2% of crashes, in comparison 46.5% of other drivers are considered responsible.

Table 12: Metropolitan v Regional WA of drivers in run-off-road crashes, 2010

Location	ROR	Other	Total	ROR %	Other %
Metro	72	221	293	34.45%	66.57%
Regional WA	137	111	248	65.55%	33.43%
Total	209	332	541	100.00%	100.00%

The concentration of run-off-road crashes in Regional WA is not unexpected, two thirds of the run-off-road crashes occur in Regional WA. Run-off-road crashes account for over half of the driver injuries in Regional WA. However, run-off-road crashes remain a significant issue in the metropolitan area, accounting for one third of run-off-road crashes and 24.6% of metropolitan's driver injuries.

The metropolitan and Regional WA split is reinforced when considering speed zones, over half the drivers were in higher speed, 110 km/hr zones. The relatively high proportion of drivers in urban speed zones (50, 60 kph) is unexpected, however the speed zone may not be reflected in the speed of the vehicle at the time of the crash.

Table 13: Speed zone in run-off-road crashes, 2010

Speed Zone	ROR	Other	Total	ROR %	Other %
40	0	1	1	0.0%	0.3%
50	18	41	59	9.1%	13.0%
60	23	73	96	11.6%	23.2%
70	11	60	71	5.6%	19.0%
80	20	31	51	10.1%	9.8%
90	6	16	22	3.0%	5.1%
100	17	23	40	8.6%	7.3%
110	103	70	173	52.0%	22.2%
Total	198	315	513	100.0%	100.0%

Table 14: Restraint use by drivers in run-off-road crashes, 2010

Restraint Use	ROR	Other	Total	ROR %	Other %
Not Worn	34	9	43	24.5%	9.3%
Worn	105	88	193	75.5%	90.7%
Total	139	97	236	100.0%	100.0%

Excluding where restraint use is unknown, drivers in run-off-road crashes (24.5%) are less likely to utilise restraints than other drivers (9.3%). This is consistent with other high risk behaviours such as alcohol consumption and excessive speed.

Impact on road safety and traffic enforcement strategy and practice

Clearly, run-off-road crashes represent a significant feature in the West Australian fatal and serious injury road toll. Run-off-road crashes are often interpreted as a difficult enforcement target because of the widely held perception that crashes of this type are driven by the “difficult” enforcement issues. Issues such as fatigue and inattention that do not have a simple enforcement remedy that is defined, measured and valued. Fatigue and inattention are significant drivers of run-off-road crashes, however they account for less than one in five crashes.

The crash causes that are linked to the standard suite of enforcement targets (alcohol and speed) account for over 50% of crashes. Not only are dominant run-off-road causes strongly related to the standard enforcement targets but in the case of alcohol they are relatively extreme examples. The enforcement response to run-off-road crashes must therefore be a both mainstream response of more enforcement and targeted response to high end alcohol consumption.

Western Australia currently has a fatality per 100,000 persons rate above most other Australian jurisdictions. One of the key drivers is the non-metropolitan fatality rate which is four times the metropolitan fatality rate. This coincides with a run off road crash rate significantly higher in Regional WA than metropolitan WA. Impacting on regional and remote run-off-road crashes is a mechanism to shift the WA fatality rate closer to other Australian jurisdictions and lower the national fatality rate. This may necessitate both increasing enforcement resources in rural and remote WA and accepting what may appear to be a decrease in per unit enforcement output. The lower rural and remote road traffic volumes and resulting lower contact rates may lead to an apparent decline in per unit enforcement outputs but could potentially lead to improved road safety outcomes.

Summary

The drivers at higher risk of run-off-road crashes are:

- indigenous drivers,
- drivers aged under 30,
- drivers with a history of alcohol related offences, and
- drivers in Regional WA.

These drivers tend to display high risk driver behaviours including:

- non use of restraints,
- speed, and
- alcohol consumption.

The drivers are:

- more likely to be unlicensed, and
- more likely to be unknown to the WA licensing system.

Sources:

IMS

Briefcase

Casualty database

ABS population data