

The impact of specific crash characteristics on the risk of road trauma

January 2025



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Looking back over the last couple of decades, progress in road safety in WA has been inexcusably slow and an unforgivably high number of people continue to be killed and seriously injured (KSI) every day on WA's roads.

The WA Government has set a target to reduce KSIs by 50-70 per cent by 2030 compared with a 2015-2019 baseline. RAC has set more ambitious targets to halve the rate of KSIs on our roads by 2025, from a 2020 base. We have been exploring which road safety countermeasures should be prioritised in order to meet these targets, and this bulletin explores which crash characteristics have the biggest impact on the risk of a fatal or serious injury.

Modelling road safety countermeasures in WA

In 2022, RAC commissioned the Centre for Accident Research and Road Safety - Queensland (CARRS-Q) to identify and analyse the road safety countermeasures that would reduce the number of KSIs on WA roads within the next 5-10 years. To inform the modelling, CARRS-Q analysed WA crash data from 2016 to 2021 and calculated the impact of different crash characteristics on the risk of a fatal or serious injury.

Analysing the WA crash data

Crashes from three road user groups (motor vehicle occupants, motorcyclists and bicyclists/pedestrians) were analysed to understand which crash characteristics were associated more strongly with fatal or serious injury and which were associated more strongly with minor injury or no injury. Crash characteristics could only be included in the analysis where they are recorded in WA crash data for the vast majority of crashes.



What were the findings?

Road user type	Top 5 crash types associated with an <i>increased</i> risk of a fatal or serious injury	Top 5 crash types associated with a <i>decreased</i> risk of a fatal or serious injury
Motor vehicle occupants	<ul style="list-style-type: none"> » Head on » 110km/h road » Hit something (e.g. a person, animal or object) » Right turn » Single vehicle 	<ul style="list-style-type: none"> » Sideswipe » Male occupant » Occupant under 25 years old » Driveway » Heavy vehicle
Motorcyclists	<ul style="list-style-type: none"> » Head on » Right turn » Right angle » Hit something (e.g. a person, animal or object) » Single vehicle 	<ul style="list-style-type: none"> » Traffic lights or signage present » Rainy weather » Driveway » Rider under 25 years old » Motorcycle under 5 years old
Bicyclists and pedestrians	<ul style="list-style-type: none"> » Bicyclist or pedestrian under 16 years old » Bicyclist or pedestrian over 60 years old » Between 7pm and midnight » Outer regional and remote areas » Overcast weather 	<ul style="list-style-type: none"> » T-intersection/3-way intersection » Traffic lights or signage present » Curved road » Roundabout present » Driveway



Interpreting the results

While the results provide us with some interesting data about road crashes in WA, some of the findings have more than one possible explanation, and so must be considered carefully. For example, the finding that older drivers are more likely to suffer a fatal or serious injury does not necessarily mean that they are a risky group of drivers – we must consider alternative explanations, some of which are presented below.

Head-on crashes

For motor vehicle occupants, head-on crashes were associated with an increased risk of fatal or serious injury by 382 per cent and 323 per cent respectively, compared with non-collision and rear end crashes. For motorcyclists, it was 385 per cent and 72 per cent, respectively. The speed differential between two vehicles travelling in opposite directions is much greater than when vehicles are travelling in the same direction, meaning more energy is released in a crash and results in worse outcomes for the occupants. According to research, the chances of a vehicle occupant being killed in a head-on crash rapidly increases from about 70km/h. Audible or wide centre lines, dual carriageways and median barriers can reduce the risk of a serious head-on crash.

Single vehicle crashes

For motor vehicle occupants, single vehicle crashes were associated with an increased risk of fatal or serious injury by 54 per cent and 51 per cent respectively, compared with multiple vehicle crashes. For motorcyclists, it was 120 per cent and 53 per cent, respectively. Single vehicle crashes most commonly involve a vehicle leaving the road and hitting an object such as a tree. They are more common on high-speed rural roads and the outcome is often serious – for example, trees are rigid and do not absorb much energy in a crash. Sealed shoulders, audible line marking and safety barriers can reduce the risk of a serious single vehicle crash.

Right-turn crashes

For motor vehicle occupants, right-turn crashes were associated with an increased risk of fatal or serious injury by 56 per cent and 52 per cent respectively, compared with non-collision and rear end crashes. For motorcyclists, it was 244 per cent and 69 per cent, respectively. According to research, the probability of a fatality sharply increases for motor vehicle occupants in side-impact crashes at over 50km/h. In Perth, between 2019-2023, over half of the crashes where someone is fatally or is seriously injured happened at one of its more than 51,000 intersections. Roundabouts and traffic signals both reduce the risk of a serious crash when turning right at an intersection.

Older adults and children

For motor vehicle occupants, being over the age of 60 years old was associated with an increased risk of fatal or serious injury by 35 per cent and 33 per cent respectively, compared with a 25 to 44 year old. For motorcyclists, it was 48 per cent and 23 per cent respectively, compared with a 25 to 60 year old. For bicyclists and pedestrians, it was 144 per cent and 63 per cent respectively, compared with a 25 to 44 year old. For bicyclists and pedestrians, being 16 years or younger was also associated with an increased risk of fatal or serious injury - 66 per cent and 33 per cent, respectively. Older adults and children are considered more vulnerable road users because they are generally less able than a young adult to withstand the forces involved in a crash. For example, children have softer heads than adults and their bones and muscles are still developing, while older adults often have weaker bones, muscles and other tissues. Lower speed limits, bicycle helmets and modern vehicle safety features can reduce the risk of serious injury, including for older adults and children.

Driveway crashes

For motor vehicle occupants, driveway crashes were associated with a decreased risk of fatal or serious injury by 43 per cent and 41 per cent respectively, compared with a midblock section of road. For motorcyclists, it was 27 per cent and 16 per cent respectively, compared with a midblock section of road, a cross intersection, T-intersection and other features. For bicyclists and pedestrians, it was 14 per cent and 8 per cent respectively, compared with a midblock section of road or cross intersection. Driveway crashes typically occur at low speed, which results in less severe outcomes in the event of a crash. These crashes can be reduced by paying particular attention when turning into, or out of, driveways, and by driving vehicles with a high ANCAP safety rating (5-stars). These vehicles tend to have technologies to help prevent these types of crashes, such as reversing autonomous emergency braking, vulnerable road user detection and rear cross traffic alert.

Intersections with traffic lights or signs restricting turns

Traffic light-controlled intersections and intersections with signs restricting turns were associated with a decreased risk of fatal or serious injury by 14 per cent and 13 per cent for motor vehicle occupants respectively, compared with intersections with no traffic control measures. For motorcyclists, it was 37 per cent and 22 per cent respectively, compared with intersections with no traffic control measures. For bicyclists and pedestrians, it was 59 per cent and 43 per cent respectively, compared with intersections with no traffic control measures. Signalised intersections are typically safer than unsignalised intersections, as they reduce the risk of road users failing to see another road users or misjudging a gap, due to conflicting movements mostly occurring at different times within the traffic light cycle.

Counterintuitive results

You may be wondering why certain crash characteristics decrease the risk of a fatal or serious injury when you would expect them to increase the risk (or vice versa). Here are some possible explanations.

Why does being male result in a *decreased* risk of a fatal or serious injury to a motor vehicle occupant?

You may think that being male would increase the risk of a fatal or serious injury to a motor vehicle occupant, as males are generally involved in more crashes than females due to a higher prevalence of risk-taking behaviours and most road fatalities in WA are male. While this result doesn't mean that men are less likely to be involved in a crash, it tells us that if they are, they may be 61 per cent and 59 per cent less likely than females to suffer a fatal or serious injury, respectively. This may have something to do with the way the average male body is able to absorb the impact of crash forces compared with the average female body. Historically crash test dummies have only been based on the average male body, which means that car safety features are typically designed with the average male body in mind, leaving females at higher risk of injury in the event of a crash.

Why do heavy vehicle crashes result in a *decreased* risk of a fatal or serious injury to a heavy vehicle occupant?

You may think that heavy vehicle crashes would increase the likelihood of a fatal or serious injury for all involved. However, occupants of heavy vehicle cabs are more protected in a crash due to the sheer size and weight of their vehicle compared to other road users and roadside objects. For example, if a heavy vehicle collides with a light vehicle, then the heavy vehicle and its occupants will experience less deceleration than the light vehicle and its occupants, resulting in a 33 per cent and 32 per cent decreased risk of fatal or serious injury, respectively. However, while heavy vehicle occupants may be safer in the event of a crash, it is highly likely that any other road users involved in a heavy vehicle crash would not fare so well.

Why do crashes in rainy weather result in a *decreased* risk of a fatal or serious injury to a motorcyclist?

You may think that rainy weather should result in higher severity crashes, due to factors such as reduced visibility, losing control of your vehicle and aquaplaning (when your car's tyres begin skimming across the water), and an increased stopping distance. However, this result doesn't mean that fewer motorcycle crashes occur in rainy weather; it means that if a crash does happen, motorcyclists have a decreased risk of 32 per cent and 20 per cent of a fatal or serious injury respectively, compared with in clear conditions. This might be because people tend to slow down in wet weather - the slower you ride, the better your outcome if you do crash.

Why do crashes on curved roads result in a *decreased* risk of a fatal or serious injury to a bicyclist or pedestrian?

You may think that crashes would be more serious when they occur on a bend in the road. Curves not only result in reduced visibility of the road in front, but also make it easier for a motor vehicle or bicyclist to lose control, particularly if they are travelling at a high speed. While this result says nothing about the risk of a crash on curved roads, it's possible the risk of a fatal or serious injury decreases by 33 per cent and 22 per cent respectively, compared with straight roads, because road users tend to be more cautious when navigating curves. Most road users slow down as they approach a curve in the road, so this deceleration is likely to result in a better outcome for bicyclists and pedestrians in the event of a crash.

Why do roundabouts result in a *decreased* risk of a fatal or serious injury to a bicyclist or pedestrian?

You may think that bicyclists or pedestrians are at an increased risk of a fatal or serious injury when navigating a roundabout, as some advocacy groups have expressed concern about bicyclist safety at roundabouts and also there is a lack of pedestrian priority in the WA road rules compared with other intersection types. However, when compared with a 4-way intersection or midblock, roundabouts actually decrease the risk of a fatal or serious injury to these road users by 27 per cent and 17 per cent, respectively. This is most likely because typically vehicles approach and travel through roundabouts at lower speeds, meaning that if a bicyclist or pedestrian is hit, the impact force is also lower. The slower the speed, the higher the chance of minimising a fatal or serious injury - impact speed is arguably the most influential factor determining the outcome of a crash.



Where we stand

To reduce the unacceptable impact of road trauma in WA, RAC advocates and supports the Safe System approach, which seeks safe road users, safe speeds, safe vehicles, safe roads, and post-crash care.

RAC's Vision 2030 sets ambitious targets for reducing the rate of fatalities and serious injuries on WA roads and looks to a future where all parts of the Safe System approach have been strengthened.

This project has improved our understanding of the crash characteristics most strongly associated with fatal and serious injury. Our other publications explore further the potential for speed limit reductions, infrastructure upgrades and safer vehicles to prevent these risky crash characteristics.

To learn more about how we are already **advocating change**, head to our website to read our most recent Public Policy document, Social & Community Impact Report and State and Federal Budget Submissions. RAC's public policy positions reflect where we stand on issues that support our Vision and help achieve our targets. Our policies are developed based primarily on the best available evidence, including the findings from projects like this.



For more information or to contact RAC
E advocacy@rac.com.au rac.com.au/advocacy