21 February 2018

Attention: Advisory Board Co-Chairs
Dr John Crozier and Dr Jeremy Woolley
Lodged via email: road safetystrategy@infrastructure.gov.au

Dear Dr Crozier and Dr Woolley,

Re: Inquiry into progress under the National Road Safety Strategy 2011-2020

This is a joint submission by the Amy Gillett Foundation, Cycling Australia, Bicycle New South Wales, Pedal Power (ACT) and WestCycle to the Inquiry into progress under the National Road Safety Strategy 2011-2020. The submission was compiled by the Amy Gillett Foundation, the national cycling safety organisation and incorporates perspectives from road safety experts and cycling groups. Collectively we reviewed the progress of the Strategy with one question in mind:

How well is the strategy working to maintain and improve safety when we ride our bicycles?

In preparing for this submission we were both encouraged and dismayed at the review of the national road safety strategy by Prof Mary Lydon, Co-Chair Dr Jeremy Woolley and colleagues in 2015. Encouraged that the authors recognised the failings of the NRSS to maximise the safety of vulnerable road users and dismayed for the same reason.

The concerns raised by Lydon et al were all identified by this collective in our 2011 submission – Joint Reponses to the Draft National Road Safety Strategy 2011-2020 (Appendix A). The submission made then by leading cycling organisations, preeminent road safety experts and industry representatives clearly identified that greater action was needed to prevent continued death and serious injury of vulnerable road users.

Once again in this submission we clearly state our collective concerns in response to the Terms of Reference and provide practical recommendations to reduce vulnerable road user death and trauma. We would welcome the opportunity to engage in this Inquiry either in person or in writing to further discuss safety from the perspective of vulnerable road users, particularly cyclists, and discuss how the recommendations can be implemented to maximise vulnerable road user safety for the remainder of the current period and beyond.

Please do not hesitate to contact me directly if you have any questions or require any additional information.

Yours sincerely,

Phoebe Dunn
Chief Executive Officer, Amy Gillett Foundation
On behalf of the Joint Contributors

Joint contributors

This submission incorporates the views and concerns from the following organisations and individuals.

Amy Gillett Foundation

Cycling Australia

Bicycle New South Wales

Pedal Power ACT

WestCycle

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Matt Fulton, WestCycle

Ian Ross, Pedal Power ACT

Introduction

We welcome the opportunity to contribute to the National Road Safety Strategy (NRSS), to highlight the specific safety issues of vulnerable road users, particularly cyclists. In preparing this submission, we reviewed our previous submission to the then draft NRSS in 2011, only to find that many of the actions identified then are still needed today. We have reproduced the key actions we recommended in that submission here and we have included the full submission in Appendix A for your reference. These key actions, in addition to the further actions and issues identified in this submission, require concerted attention if we are to move towards a safer road environment for all road users.

Summary page from Joint Submission to the draft 2011 NRSS

The safe use of the Australian road network and the reduction in trauma for the transport of people and goods requires a cultural shift away from competition for space and shared use. Designing for shared use requires the prioritisation of vulnerable road users. This will improve the safety for all road users.

The Australian Transport Council (ATC) needs to adopt bold strategies to support the ambitious targets or we will continue to lag behind in the management of safe road networks.

In revisiting the Draft NRSS the ATC would be well advised to incorporate actions to:

- *Acknowledge the increased value of shared modality and increased priority of vulnerable road users e.g. bicyclists and pedestrians, in infrastructure design*
- *Introduce research protocols to identify participation and exposure rates, and crash typologies for vulnerable road users including on road, shared paths and off-road paths*
- *Introduce criteria such that all road infrastructure funding incorporates inclusion of bicycle infrastructure at the time of design and of new and upgraded infrastructure*
- *Work towards removal of FBT tax incentives for new cars and generally seek to reduce demand for private motorised transport, especially in urban areas*
- *Adopt three yearly roadworthiness checks for all registered vehicles*
- *Adopt a nationally agreed Benefit Cost Ratio for the development of bicycling Infrastructure*
- *Work in partnership with community groups to deliver behaviours change programs and other campaigns to educate drivers on sharing the road with all road users - the success of "a Metre Matters" exemplifies the type of cross sector collaboration that is possible*
- *Modify learner driver education and testing to promote a culture of shared road usage rather than identifying bicycle riders and pedestrians as hazards - the RoadRight program is such an example*
- *Increase financial and institutional support of Austcycle (nationally accredited bicycle education and safety program) to increase reach to all Australian school-aged children and a significant proportion of the adult population.*
- *Review road rules and legislation to place greater emphasis on the safety of vulnerable road users. Such opportunities may include zoned speed limits, legislating the passing distance by motorists around bicyclists, legislating that left turning motorists give way to bicyclists also turning left*

Terms of Reference

1. **Identify the key factors involved in the road crash death and serious injury trends including recent increases in 2015 and 2016.**

Cycling is an emerging mode of transport in Australia. Despite the ambitious targets of the most recent national cycling strategy to double the number of people cycling, we are yet to see a substantial increase in participation. In direct relation to cyclist crashes, the key missing element is exposure data. We know very little about cycling in Australia in term of the number of people who ride, where they ride and the number of hours they are on the road and exposed to risk. Without a meaningful denominator it is virtually impossible to calculate rates that can be tracked over time. As part of developing useful metrics to track cyclist crashes, federal government investment in relevant data collection is required.

In the period of this Term of Reference, 2015 and 2016, there were 31 and 29 cyclist deaths respectively. This increased to 38 deaths in 2017 and as at the end of January 2018, there have been 2 cyclist fatalities in Australia (BITRE, 2018). There has not been a significant change in the number of cyclist fatality crashes in the last decade, averaging 36 people killed while riding their bicycle each year. However, without exposure data, it is impossible to determine whether this represents an increase or decrease in safety for cyclists.

As a proportion of all road trauma crashes, cyclists are 3 percent of all fatalities, yet 15 percent of all hospitalisations. Injury crashes are increasingly the majority of reported crashes involving a motor vehicle (85%) (BITRE, 2015).

We direct the Committee to three reports that have reviewed cyclist crash data to provide insights into the key factors involved in cyclist crashes. These reports are also included in this submission as Appendices B, C and D.

- Australian cycling safety: casualties, crash types and participation levels (link)
- Road crashes involving bike riders in Victoria, 2002-2012 (link)
- Bicycling crash characteristics: an in-depth crash investigation study (link)

However, we caution the Committee with regard to the data on crashes. Factors that are anecdotally critical in crash events are underreported, or not reported at all. For example, driver distraction is a known road safety issue, yet it is not routinely reported (e.g. drivers' use of mobile phones to talk or text, or distraction within the vehicle due to passengers etc.). In addition, the social determinants are largely absent from the data, so we do not know the impact of situational distress (e.g. driver is upset or angry) or life factors (e.g. recent job loss, family issues) on driver behaviour.

Increasing road safety is an intractable, difficult problem and it is artificial to reduce the actions needed to a bullet point list. Such a list implies that there are simple solutions. However, that is not the case. For meaningful change in road user safety, and a reduction in the death and trauma of vulnerable road users, the broader, conceptual issues that underlie the current road safety approach in Australia need to be considered and a shift is needed. Specifically, vulnerable road users must be included in the demonstrable actions, performance indicators, and metrics of the next action plan and the post-2020 NRSS.

Importantly, we encourage the Committee to consider the entire NRSS and action plan from the perspective of the most vulnerable road users. In the main we are referring to cyclists, but this also extends to include pedestrians, motorcyclists, children, older adults and people with physical or intellectual disabilities.

The remainder of this submission addresses the Terms of Reference from the perspective of vulnerable road users with a focus on the conceptual framework of the Safe System approach and how it has been applied in the current NRSS and the changes needed for the next strategy.

Terms of Reference

2. **Review the effectiveness of the National Road Safety Strategy (NRSS) 2011-2020 and supporting 2015-17 Action Plan, with particular reference to the increase in deaths and serious injuries from road crashes over the last two years.**

The National Road Safety Strategy (NRSS) 2011-2020 and the supporting 2015-17 Action Plan, from their commencement, including the last two years, are failing to improve safety for vulnerable road users.

Historically, road safety in Australia has focused on our safety when we are inside a motor vehicle. This motor vehicle-centric priority is evidenced by the absence of reference to cyclists in the National Road Safety Strategy and as a consequence, the lack of priority for cyclist safety in the action plan and improvements required to create a safe cycling environment in Australia.

Our 2011 submission to the draft NRSS (attached) raised these issues and our concerns were repeated in 2015 in the Austroads review of the NRSS.

> "…the NRSS (2011) provides **little more than passing references to cyclists**
>
> … while the NRSS sees the Safe System approach as underpinning the entire NRSS, it is essentially applied to motorists rather than vulnerable road users
>
> … [major documents relevant to cyclists] focus on the cyclist and **offer few suggestions as to how to apply Safe System principles to promote cycling safety** in the broader context of the transport system"
>
> (Lydon et al, 2015, p5)

Despite this lack of priority and action to maximise our safety when we ride our bicycles, the government has a concurrent goal to double cycling participation as part of the National Cycling Strategy, 2011-2016 (2010) (yet to be updated).

However, doubling participation is unlikely as the underlying **Safe System principle of 'shared responsibility' is not true for cyclists.** The responsibility for cyclist safety has been mainly borne by individual cyclists. There is a lack of responsibility by government and even less accountability, particularly in relation to road design, that increases cyclists' crash risk (e.g. bike lanes alongside parallel parking bays) and vehicle design, manufacture and registration.

> Safe System – shared responsibility…the 'system managers'—have a primary responsibility to provide a safe operating environment for road users. They include the **government** and industry organisations that **design, build, maintain and regulate roads and vehicles**…that caters for **all groups** on the road.
>
> (The Safe System approach, NRSS)

The current Safe System framework is misleading. It is incorrect to state that 'Human tolerance to crash impact' is at the centre of the approach. The current Safe System approach has motor vehicle occupants at the centre. Tolerances to crash impact are calculated for speeds, road design and vehicle safety based primarily on our safety when we are inside a motor vehicle.

Vulnerable road users are largely excluded from the Safe System approach. When vulnerable road users are referred to in terms of safety, the focus is on their behaviour. That is, the individual is responsible for their own safety – not the system.

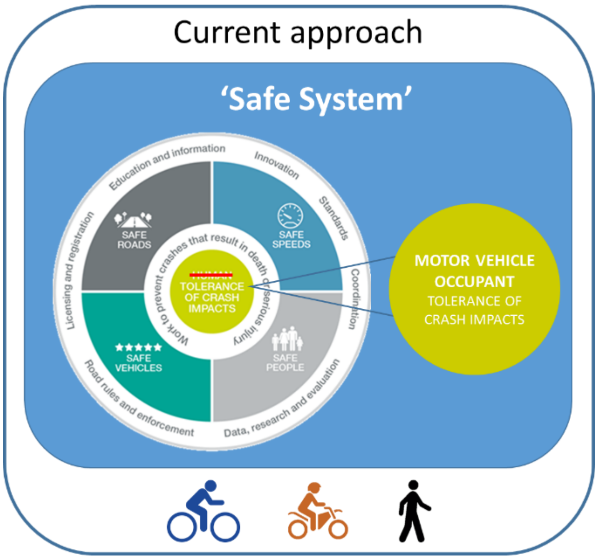


Figure 1. Safe System – current approach excludes vulnerable road users

In terms of the effectiveness of the NRSS and the current action plan, the main concern is the **poor representation of non-motorised vulnerable road users in the Performance Indicators**. There are over 60 agreed performance indicators that monitor the progress of the NRSS identified in the Review of the National Road Safety Strategy. Yet of the 60, only 2 identify outcomes for non-motorised Vulnerable Road Users: Number of bicyclist deaths; Number of pedestrian deaths. This is highly problematic for numerous reasons, including:

- **Measurement informs action, no measurement = no action**
  These Performance Indicators are the agreed measurements of the progress, or the success, of the NRSS. Lack of focus on cyclists and pedestrians demotes the importance of their safety and makes it less likely that action to improve cyclist and pedestrian safety will be taken, as it is clearly not a high priority – as indicated by the lack of Performance Indicators.

- **Failure to meet the central Safe System principle: Human Tolerance of Crash Impacts**
  Central to the Safe System approach is Human Tolerance of Crash Impacts. Again these Performance Indicators focus on the outcome of people involved in motor vehicle crashes (being the occupants of the vehicles) who are protected by the body of the motor vehicle as well as the protective technology (i.e. airbags, ESC, ABS etc.).
  In simple terms, roads that are safe for humans who are inside motor vehicles are not safe for the same human when they are not inside a motor vehicle. By creating a road

network that is safe for us only when we are inside a motor vehicle, the NRSS is not protecting our safety when we cycle or walk.

- **Positioning of Vulnerable only under Safe People**
  In addition to the absence of cyclists and pedestrians in the High Level Outcome Measures, the inclusion of cyclists and pedestrians under Safe People creates the impression that the safety of vulnerable road users is a behavioural issue; ergo vulnerable road users are responsible for their own safety. This approach fails to recognise that the entire system is responsible for the safety of vulnerable road users. Safe Roads, Safe Speeds and Safe Vehicles all have a role to play to improve our safety when we are physically unprotected as we travel each day.

Terms of Reference

3. **Identify issues and priorities for consideration in development of a post-2020 national road safety strategy and 2018-2020 action plan, focusing on how Australia can recognise and move towards a safe road transport system which minimises harm to all users.**

For specific action in 2018-2020, we return the Committee's attention to the underlying, guiding principles of the Safe System approach. We ask that the Committee considers how these principles can be applied for vulnerable road users. While some of the Committee may or may not ride a bicycle, everyone is a pedestrian. We invite the Committee to consider a vie w of road safety that protects us when we are outside our motor vehicles.

Safe System Principle 1 **People make mistakes. Humans will continue to make mistakes, and the transport system must accommodate these. The transport system should not result in death or serious injury as a consequence of errors on the roads.**

Mistakes in the road network by vulnerable road users rarely result in serious injury or death to others. While there are examples where the actions of the vulnerable road users led to trauma, in the vast majority of cases, when a mistake is made on the road, the vulnerable road users is more likely to be killed or injured. This is particularly the case in terms of children and older adults whose physical fragility means they are less resilient to the violent impact of a crash.

Explicit inclusion of all road users in both the broad strategy and with specific targets in the action plan are required for real safety outcomes for vulnerable road users. This will require a real shift in the application of the Safe System approach from a motor vehicle-centric approach which largely ignores vulnerable road users, to a true safety philosophy that is inclusive of all road users.

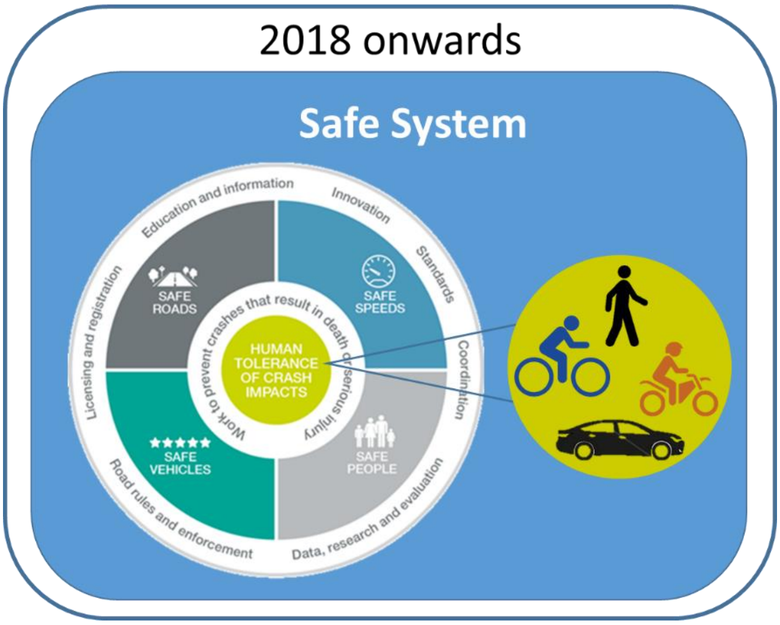


Figure 2. Safe System – approach from 2018 onwards needs to include vulnerable road users

Safe roads and roadsides

Extensive documentation is available from Austroads, and supplemented in most jurisdictions, that details how cycling infrastructure should be constructed. While these guidelines are technically comprehensive, the approach to creating spaces for cycling on the road is not best practice and often fails in the implementation.

A recent study comparing the Australian and Dutch approaches to cycling infrastructure reported that the Australian approach does not accord with the Safe System principles (Docker and Johnson, 2017). The Dutch approach is grounded in five main requirements: safety, cohesion, directness, comfort and attractiveness. When represented in a Maslow style hierarchy, each stage must be fulfilled to achieve the requirements of Dutch cycling amenity.

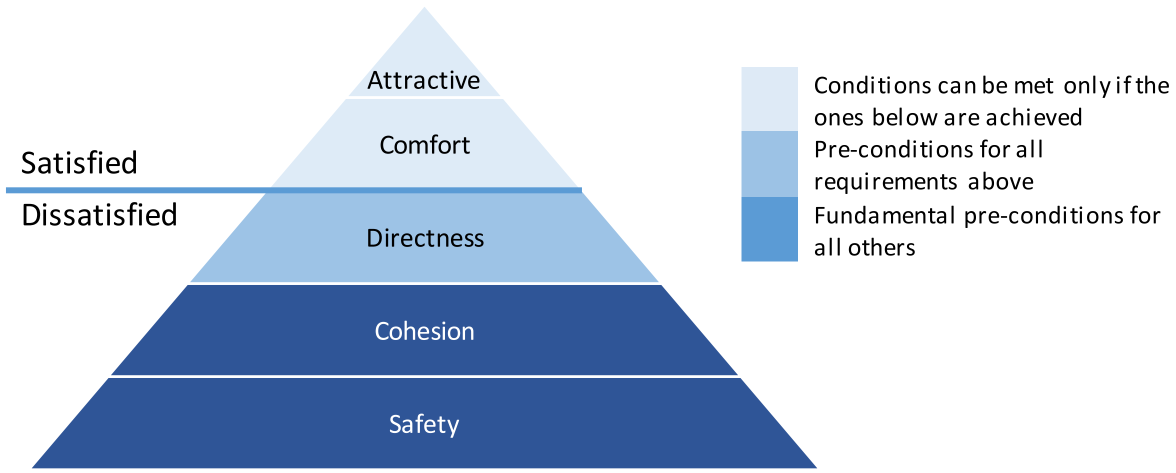
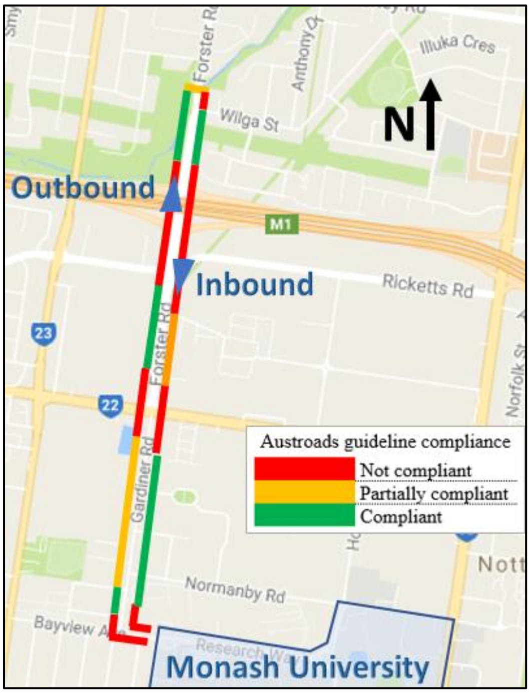


Figure 3. Dutch requirements for cycling amenity

Adapted from: Scheltema, N (2012)

Comparatively, in Australia, cyclist safety was found to be overly reliant on 'Safe People' through education programs. The study included an assessment of cycling infrastructure, including routes considered 'strategic cycling corridors' by the Victorian government. Half the routes assessed were found to be non-compliant with the Austroads guidelines (Figure 4).



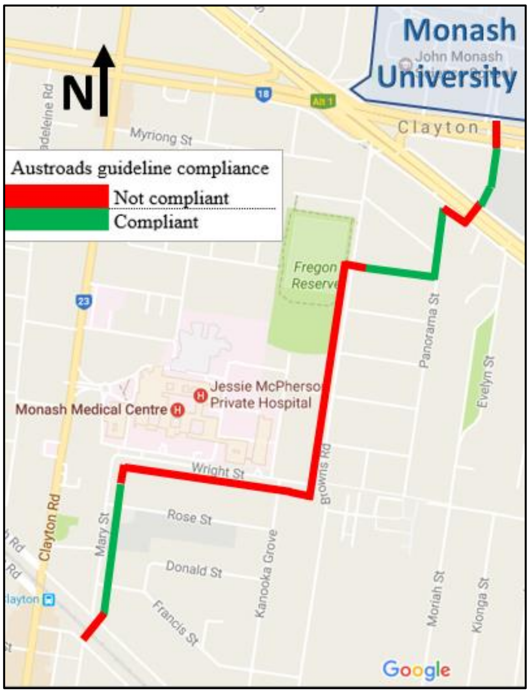


Figure 4. Assessment of cycling infrastructure by Austroads guidelines in Victoria (Docker and Johnson, 2017)

One component of the Dutch approach that is missing in the Australian context is the linking of people to their local trip destinations from their homes. In Australia, the emphasis has been on linking long 'strategic corridors', or providing scenic routes for leisure rides. The Dutch approach focuses on short trips, from home to the local shops, train station, schools, and ensuring the neighbourhood environment is conducive to people choosing their bicycle for these local trips. One example of how this can be implemented in Australia is to review and upgrade active transport routes within a 5km radius of primary and secondary schools. Concerns about safety is the key barrier cited by parents and carers about why they will not allow their children to walk and cycle to school. Provision of safe access to schools will help increase active transport and achieve all the associated social benefits (e.g. reduce childhood obesity, traffic congestion around schools etc.).

In Australia, engineers, road authorities and the people involved in the implementation of the cycling infrastructure are heavily reliant on government approved guidelines. However, when these guidelines are not best practice, action to improve the standards is required. In terms of cycling infrastructure design, the Dutch are 40 years ahead of Australia. The Dutch approach has contributed to the Netherlands leading the world in cycling participation. There is an obvious need for a close association between the Dutch and the Australians to enable us to leapfrog their mistakes and achieve a safe cycling environment nationally.

This requires leadership from the national government in strategies, including the NRSS, to ensure action and investment in Australia meets known international best practice.

Performance Indicators for Vulnerable Road Users

Targeted, measurable metric are fundamental to change to improve the safety of vulnerable road users. Specifically, the post-2020 NRSS must include Performance Indicators for Vulnerable Road Users. This is essential to create the much needed paradigm shift within the government agencies charged with road safety. In terms of organisational culture, Australian government agencies prioritise the efficient flow of motorised vehicles as the primary purpose of the roads, neglecting walking and cycling safety. Performance Indicators for Vulnerable Road Users will help to ensure our safety when we are walking and cycling.

Safe speeds

Lower speed and corresponding lower speed limits are vital for meaningful action on vulnerable road user safety.

Safe System Principle 2	**Human physical frailty. There are known physical limits to the amount of force our bodies can take before we are injured.**
Safe System Principle 3	**A 'forgiving' road transport system. A Safe System ensures that the forces in collisions do not exceed the limits of human tolerance. Speeds must be managed so that humans are not exposed to impact forces beyond their physical tolerance. System designers and operators need to take into account the limits of the human body in designing and maintaining roads, vehicles and speeds.**

The Safe System has human tolerance to crash forces at its centre. For this to be true for vulnerable road users, then the second principle of human physical frailty is a matter of simple physics. Higher speeds will result in greater injury and potentially death. The correlation between speed and survivability is already known in terms of the national strategy and was explicitly included in the NRSS 2011 (Figure 5).

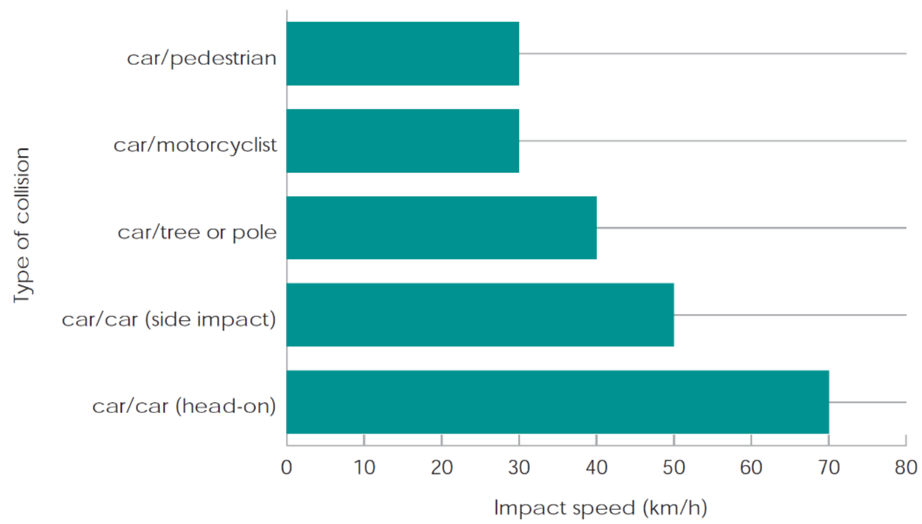


Figure 5. Survivable impact speeds for different crash scenarios (NRSS, 2011)

The corollary is also simple. Lower posted speeds will lead to lower impact speed and when we inevitably make a mistake, there is a lower likelihood of death or injury. The science is irrefutable. Lower impact speeds will result in a reduction in death and injury for pedestrians and cyclists. This is widely recognised at the jurisdictional level, for example Figure 6 is taken from the Transport Accident Commission in Victoria and recognises that impact speeds above 30km/h will cause a vulnerable road user harm.

Impact forces of 30km/h or more cause our fragile bodies to break. This fragility makes us vulnerable in a crash where these forces are often much greater. Vehicles give some protection from the full brunt of a crash thanks to safety features like airbags. But there are still some of us who are more vulnerable than others.

Figure 6. Speed information from the Transport Accident Commission (TAC, Victoria)

At a strategic, theoretical level, the relationship between vulnerable road users and speed is clearly recognised – vulnerable road users are more likely to survive crashes that occur at lower speeds. Yet this is not the reality on our roads – specifically in local, neighbourhood streets where the default urban speed limit is 50km/h.

Figure 7 is from a recent Swedish study of data from 8,166 pedestrian crashes and shows the relationship between speed and injury outcome (Kröyer, 2015). The data clearly shows the risk to pedestrians for injury increases from as low as 20km/h with the likelihood of death increasing exponentially at speeds above 40km/h. However, the current default urban speed limit in Australia, the speed that we can legally drive on our local neighbourhood streets is 50km/h. At 50km/h, there is an 80% or greater risk of injury or death. The risk curves are even steeper for young children, seniors and older seniors, who are more likely to be seriously injured or killed at lower speeds.

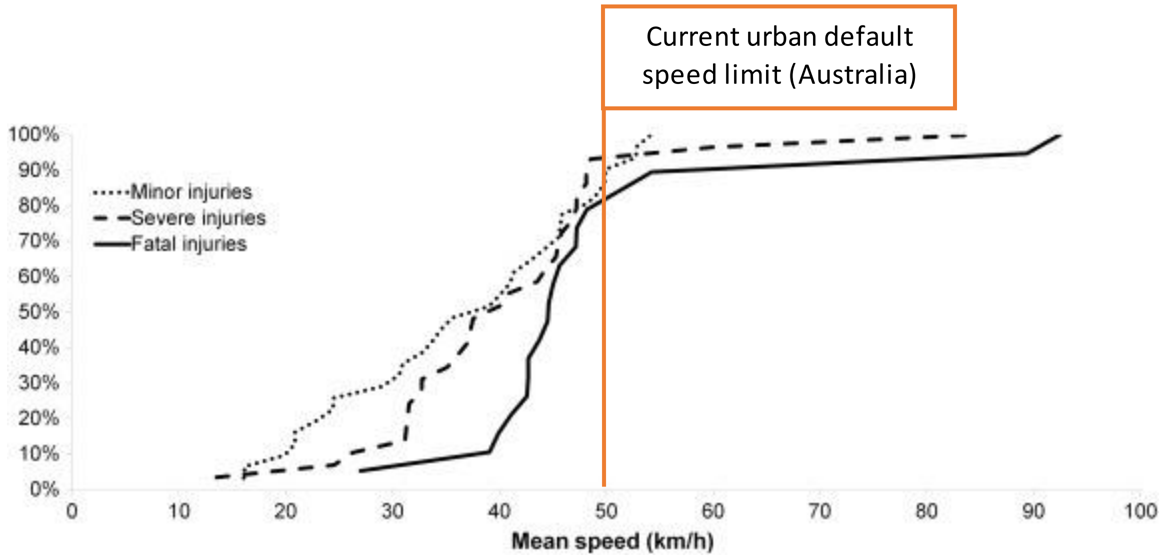


Figure 7. Mean speed by injury severity (pedestrian-motor vehicle crashes) (Kröyer, 2015)

The national urban default speed limit of 50 km/h is too high to be considered safe under the Safe System principles. Lowering the default speed limit in residential areas is an important next step. Lower speed limits in inner city and local streets will lead to lower travel speed and importantly, lower impact speeds when a crash does occur. Lower severity of injury outcomes and increased amenity of our streets will assist with making it more likely that people will walk and cycle.

We already have lower speed zones in Australia. Around schools and in urban shopping strips, the speed limit has been reduced to 40km/h. Speed reduction needs to be considered across all our neighbourhood streets to increase the level of safe, active movement in and around our homes.

Internationally, neighbourhood-scale speeds are being introduced with 30km/h or 20 mph (32km/h). In Europe, 30km/h are an important component to 'liveable' streets where the safety priority is on the vulnerable road users, pedestrians and cyclists, as well as children and seniors. Cities and municipalities in 15 European countries have implemented 30km/h zones including: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxemburg, Netherlands, Poland, Slovenia, Spain, Sweden, Switzerland and United Kingdom. Click on each country for additional details on action on implementation of 30 km/h. In the United State of America, 11 states have implemented lower speed zones (20mph), with extensive action in New York City to improve safety and amenity for people when they walk and cycle.

> Lower speed zones should be implemented in areas with high cyclist and pedestrian activities, particularly in residential areas.

Mixed messaging

As part of this submission, we conducted a brief review of the major government agency websites in relation to the messaging about speed. Among some parts of the community, the prevailing attitude is speed enforcement is revenue raising, with a tolerance of low level speeding. Behaviour change is required to change societal attitudes towards speeding, along the lines of what has been achieved in relation to drink driving.

We visited the website for each jurisdiction (search: *jurisdiction name* and *road safety*) and entered the term 'speed' into the search engine (Appendix E). Table 1 provides details on the information returned for each state and territory for speed for the top three responses and the current speed related communication campaign.

Speed cameras was a dominant search response. Of the 21 search returns, 40 percent directly related to speed cameras. In one jurisdiction, 8 of the first 10 responses to the search term 'speed' related directly to speed cameras. Overemphasis on enforcement and the justification of speed cameras including detailed information on the calibration, certification, operation and effectiveness of speed cameras reinforces speed as an enforcement issue. The emphasis is on the importance of the punitive measures, rather than the broader social context and the attitudes that driving at slow speeds is safer for everyone.

Across the video clips for current speed, jurisdictions are taking different approaches, including science (Victoria), emotion (Queensland) and humour (South Australia, Western Australia). The other jurisdictions do not have a current speed campaign.

We have not conducted a detailed analysis of the video clips, but we did note the ambiguity of the Rethink Speed campaign produced by the TAC (Figure 8). The clip has a great tagline, 'You decide the speed, speed decides the outcome'. It succinctly incorporates the responsibility of the driver and the danger of higher speeds. However, the locations of the crash suggest placement around an analogue speedometer, indicating the higher the speed the more severe the outcome. Yet without any reference to the actual speeds, it could be interpreted that there is a low injury risk to cyclists at high speed (i.e. the 12 o'clock typically indicating 100kph, and the crash at that location not injuring the cyclist).

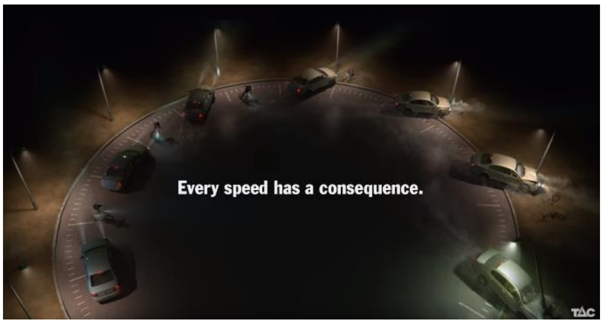


Figure 8. Rethink Speed (TAC, Victoria)

Safe Speeds are critical for a safe system and supporting activity that nudges the public conversation and attitudes needs to be elevated to a national priority. The focus on this issue cannot be reliant on the message cycle or budget of individual jurisdictions.

Table 1. Findings from the review of state and territory government websites about 'speed'

Jurisdiction	Agency	Top 3 search returns	Current speed messaging	Link
Australian Capital Territory	Justice and Community Safety Directorate	• Speeding, ACT Policing • Fix my street • Operation Safe Speeds	No current speed campaign	
New South Wales	Centre for Road Safety	• Speed cameras, how do they work? • Speed cameras, calibration and certification • Speed cameras, current locations	No current speed campaign Link to New Zealand campaign. 'Other people make mistakes'	
Northern Territory	Department of Infrastructure, Planning and Logistics	• Default speed limits • Speed cameras • Speed limits	No current speed campaign	
Queensland	Department of Transport and Main Roads	• Speed camera locations • Living on speed • Speed compliance and average speed results	• Dedicated campaign • 'Control your speed'.	
South Australia	Motor Accident Commission	No response from search for 'speed' Speed – campaign on home page 	• Dedicated campaign • 'Slow down before things get hairy'.	
Tasmania	Department of State Growth	• Novice: new changes L2 & P1 car drivers • Variable speed limit system – Tasman Highway – Transport • Appendix V Inspection of Tyre Load and Speed Rating	No current speed campaign	
Victoria	Transport Accident Commission (TAC)	• Speed • Safer speeds • Speed statistics	• Dedicated campaign • Impacts of crashes at increasing speeds.	
Western Australia	Road Safety Commission	• Speed quiz • Average speed safety camera zone • Average speed safety cameras	• Dedicated campaign • Low level speeding	

Road rules to protect vulnerable road users

There are gaps in the legislation in Australia that leave vulnerable road user exposed to risk.

The need for regulatory reform in relation to vulnerable road users has been explored by Margaret Grant (2015) and identifies some of the gaps and possibilities in relation to the NRSS:

> Although the NRSS is a comprehensive strategy, it does not translate into a comprehensive national regulatory framework. As highlighted by the civil court case provided earlier, the NRSS has limited regulatory impact because there is a disconnect between the policy framework and the legal system. In that case, although the judge identified infrastructure issues that contributed to the accident — the parked cars near the driveway, and the design and structure of the shared pedestrian/bicycle path — he was not able to recommend infrastructure improvements to reduce the risk of injury or death of another cyclist in a similar incident. The approach to work health and safety reform supports the proposition that a reform of the road safety regulatory framework might assist in making space for cycling…It is possible that reforming the regulatory framework could contribute to establishing a Safe System, in particular by integrating regulation of the interactions considered by the Safe System.
>
> …If a framework that reflected some of the principles of work health and safety regulation applied in the context of road safety, local governments might then have a statutory responsibility based on reasonableness in any given situation.
>
> In addition to more clearly identifying obligations and rights, the regulatory framework may establish a system of penalties. The work health and safety laws offer a model for offences and penalties that apply to anyone who fails to comply with a health and safety duty. Importantly, the penalties are proportional to the risk of injury or death and to the level of control a person has for work health and safety. The legislation provides for on-the-spot fines, and details action to be taken if a fine is not paid. The work health and safety laws also offer a model that reduces the time, cost and stress of personal injury claims.
>
> The road safety regulatory framework needs to be responsive, as well as effective. Many of the regulatory frameworks in Australia are underpinned by regulatory philosophies that draw upon the basic principles of 'responsive regulation' (Wood, Ivec, Job, & Braithwaite, 2010). Existing policy frameworks such as the NRSS and its associated action plan align with the principles of responsive regulation. It is acknowledged that the current regulation of activities such as driving cars and cycling has some of the hallmarks of responsive regulation, insofar as it encourages individuals to behave in a way that minimises the risk of harm and reserves punitive measures for serious offences such as the criminal case outlined earlier in this chapter. Many of the underlying principles of responsive regulation discussed by Braithwaite (2011) are relevant to implementing a regulatory framework to support establishment of a Safe System for vulnerable road users.
>
> …Imagine a regulatory framework for road safety based on learnings from frameworks such as those outlined above. Such a framework could only operate if it was part of a strategy that covered the entire scope of stakeholders with obligations and rights related to road safety. Given the complexity and enormity of that scope across eight states and territories, the development of such a framework may prove to be too challenging. A staged approach may reduce the complexity and enormity sufficiently to at least start a conversation about drawing on the principles. It may be that the co-ordinated commitment of key stakeholders, including all levels of government, to implement initiatives such as the *National Road Safety Strategy 2011-2020* (Australian Transport Council, 2011), the *National Road Safety Action Plan 2015-2017* (Transport and Infrastructure Council, 2014) and the *National Cycling Strategy 2011-2016* (Austroads, 2010) provides a useful opportunity for dialogue about the potential to develop a more effective and responsive regulatory framework.

> …Law has a part to play in making space for cycling by providing a regulatory framework with shared responsibilities across a range of people including cyclists, drivers and infrastructure agencies. The framework must provide for regulation of a range of factors including, but not limited to, cycling behaviour, driver behaviour, infrastructure laws and planning laws. A sound regulatory framework requires the law and policy makers in these areas to interact with each other.

Regulatory reform, together with sustained effort on behaviour change measures, is needed to ensure that vulnerable road users are protected in the event of crash. As Grant discussed above, there is a potential to achieve this reform through leveraging the NRSS.

It is important that there is leadership from the NRSS in relation to regulatory reform. With the federated jurisdictions, the task of improving the protection of vulnerable road users is a complicated and lengthy process that requires sustained effort and investment. One example is the efforts to amend road rules to include minimum distances when drivers pass cyclists.

For decades the national guideline has required drivers to leave a minimum lateral distance when passing cyclists. The Amy Gillett Foundation started an education campaign to raise awareness about this guideline in November 2009. Then in 2012, when a Brisbane court found not guilty the driver of a heavy vehicle that hit and killed cyclist Richard Pollett, the AGF moved for minimum distances to be specified in the road rules.

At the time of writing, six jurisdictions in Australia have amended or are trialling the amendment of road rules related to minimum passing distances for cyclists. From the beginning of the parliamentary process, providing minimum passing distances for cyclists in the road rules has been considered and recommended by four Parliamentary committees and other policy fora, and road rules have been amended permanently in three jurisdictions and/or trialled for a total of eight years across four jurisdictions. The timeline of action from the first parliamentary committee is included in Table 2.

All four parliamentary committees recommended that the law be amended and this amendment has been made in all jurisdictions with the exception of Victoria where the Andrews Government has implemented an education campaign. This action in Victoria is despite the trial in Queensland and the positive evaluation presented by Prof Narelle Haworth, a leading Australian road safety expert and Fellow of the Australasian College of Road Safety, the recommendation of a Senate Inquiry, road rule amendments in South Australia, Queensland and Tasmania, the current trials in the ACT, New South Wales and Western Australia and the recommendation of the bipartisan parliamentary committee in Victoria.

The example of the sustained effort required to achieve legislative change to include minimum passing distance amendments in all Australian jurisdictions is included to provide a concrete example of how difficult it is to achieve uniform legislative protection for vulnerable road users.

The main arguments raised against specified minimum passing distances focused on the perceived impact on drivers, including slower travel times (caused by slowing down), the efficiencies for drivers in built up environments (e.g. 'narrow' streets) and increased risk of head-on collisions with another vehicle. The argument relating to collisions is framed as though passing a cyclist is the same as passing a motor vehicle and ignores the relatively small envelope of the cyclist, and that it takes less time to pass a person on a bicycle than a motor vehicle, as well as ignoring the alternative option, which is to slow down and wait until it is safe to pass.

More importantly, these argument highlight that the convenience of the driver is more important than the safety of the person on the bicycle. After five years of sustained action by the Amy Gillett

Foundation, partners, supporters and collaborators, the road rules have been changed in six jurisdictions. While this is a successful progress for cyclists, it has been achieved through sustained effort and investment. We are strongly of the view that the broader reforms needed to protect vulnerable road users require action and leadership from government.

Under the Safe System principle 3, governments are responsible for the safety of all road users, including vulnerable road users. We encourage the Committee in developing the next action plan and NRSS to consider the role that legislation can have in road safety and in particular, to improve the safety for vulnerable road users. This intersection between road safety and legislation needs national leadership as part of governments' action to take responsibility for road safety.

Table 2. National timeline of action for minimum passing distance

	2013			2014				2015				2016				2017				2018			
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Federal													Senate Steering Committee Recommends						Final report tabled	Govt response due, 26 Jan 2018			
SA										Citizens Jury	Road Rules amended to specify minimum passing distances												
QLD	Parliamentary Inquiry				April - Two Year Trial Commences								Amended Road Rules continue beyond trial										
TAS				Steering Committee				February - Selected Road Rules Amended							Road Rules amended to specify minimum passing distances								
ACT	Parliamentary Inquiry										November - Two Year Trial Commences								Amended Road Rules continue beyond trial				
WA																			November - Regulation Changed				
NSW									Roundtable Meetings			March - Two Year Trial Commences											
NT																AMM being considered in development of new Road Safety Action Plan							
VIC												Parliamentary Inquiry							Nov - One Year Education Campaign Commences				

Political Action

Trial of amended road rules

Selected road rules amended

Road rules amended

Safe vehicles – current ANCAP ratings hide dangers to Vulnerable Road Users

Safe motor vehicles are fundamental to a safe road network. The extensive testing undertaken as part of the ANCAP tests provides an important tool for consumers with the easy to follow '5-star rating' system through the howsafeisyourcar.com.au website.

However, the current **ANCAP** system **does not require excellence in vulnerable road user safety** for a motor vehicle to earn a 5-star rating. In total, there are eight test stages, of which seven relate to the safety of the occupant.

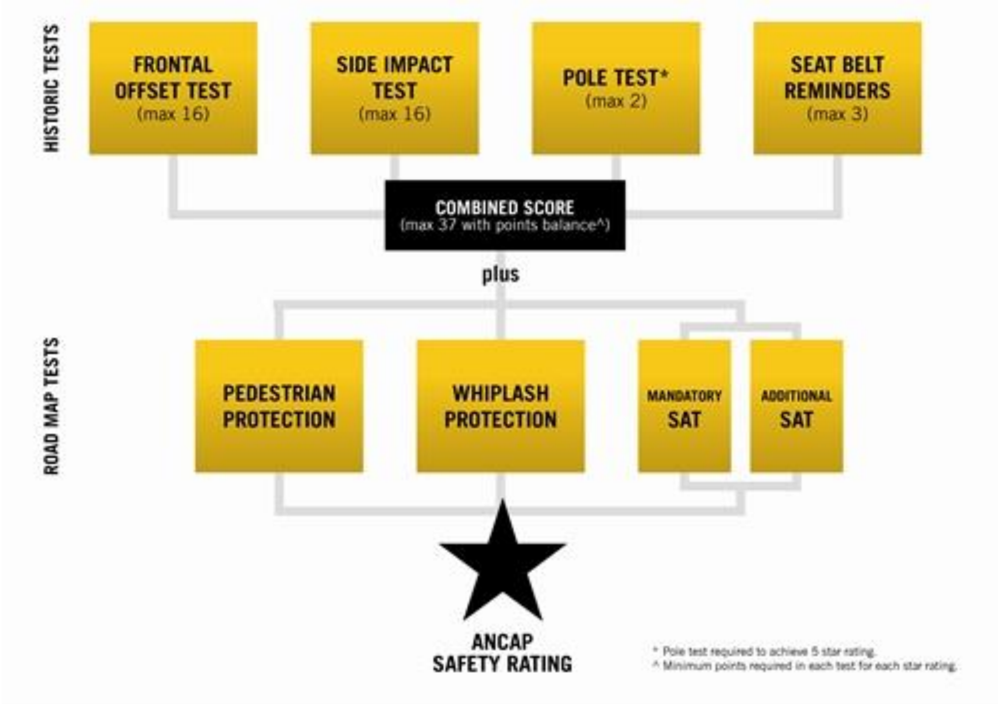


Figure 9. ANCAP tests

Mandatory tests and scores for a motor vehicle to earn a 5-star rating include:

- Frontal offset test, 12.5/16
- Side impact test, 12.5/16
- Pole test 1/2

Mandatory equipment for a 5-star rating include:

- Electronic Stability Control
- 3-point seat belts for all forward facing seats
- Head protecting technology (side airbags) front seat
- Seat belt reminders, front seats
- Electronic brakeforce distribution (EBD)
- Plus 3 additional Safety Assist Technology e.g. Autonomous Emergency Braking (AEB), Adaptive Cruise Control (ACC), Blind Spot Monitoring (BSM)
- 'Intelligent seat belt reminders can earn up to 3 bonus points to help improve star rating'

The pedestrian test, the only active crash test for vulnerable road users to test the potential for harm to others, is not a mandatory test for 5-star rated motor vehicles in Australia. Further, the actual ANCAP rating system is problematic. The Amy Gillett Foundation undertook a review of the publicly available ANCAP tests for 48 motor vehicles rated 5-star from 2015 to 2017. There is not one consistent measurement of the crash test result. Some tests are reported as a percentage, while others are presented with a label, however we were not able to find a public definition of these labels (Marginal, Acceptable, Good). Revision of the reporting of the ANCAP pedestrian protection test is needed for greater transparency. Figure 10 illustrates the concerns about how ANCAP tests can hide dangers to Vulnerable Road Users.

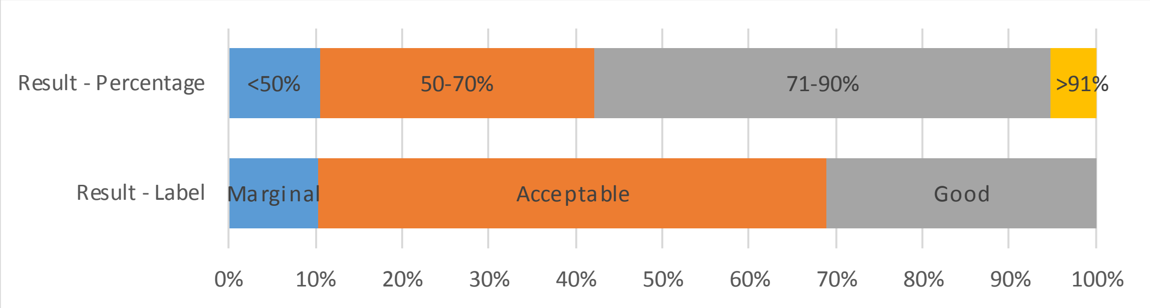


Figure 10. Pedestrian protection scores of ANCAP 5-star rated motor vehicles[1]
Analysis included vehicles from the following: ***Manufacturers:*** Audi, BMW, Fiat, Ford, Haval, Holden, Hyundai, Infiniti, Jaguar, Jeep, Kia, Lexus, Mazda, Mercedes-Benz, MG, Mitsubishi, Skoda, Subaru, Suzuki, Toyota, VW. ***Vehicle types:*** Small Car, Sports Car, Medium Car, Large Car, Compact SUV, Medium SUV, Large SUV, People Mover, Utility/Van

Further, this cannot be disregarded as a relic that is being addressed by newer model motor vehicles. The new Holden Commodore was introduced in Australia this year and the press release of 1 February 2018 headline reads 'First imported Holden Commodore to land in Australia with 5 stars'. Yet for the pedestrian protection test, this car was rated 32.8 out of 42, or 78%, which cannot be considered 5 stars for vulnerable road users. Link to detailed results.

The pedestrian test itself is conducted at an impact speed of 40km/h as these crashes represent "**as high as 30% [of fatal crashes] in some urban areas**" (Figure 11). This returns us to speed and the need for urban default speed limits to be reduced to 30km/h.

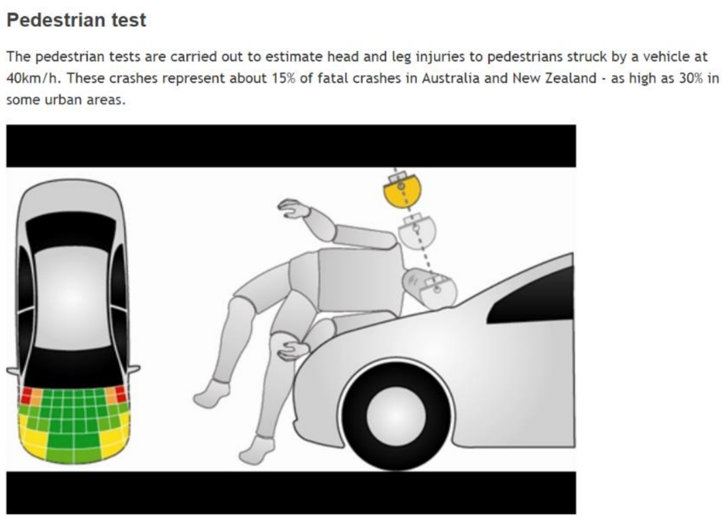


Figure 11. ANCAP pedestrian test details[2]

[1] Source: howsafeisyourcar.com.au Accessed April 2017, http://www.howsafeisyourcar.com.au/Find-My-Car
[2] Source: howsafeisyourcar.com.au website. Accessed 15 January 2018 at http://www.howsafeisyourcar.com.au/Rating-Process/What-is-ANCAP/

In the Safe Vehicle space, we urge caution against complacency, particularly in reliance that technology will solve the road safety problem. Key considerations to keep in mind in relation to motor vehicle technology 'solutions':

1. That the motor vehicle fleet has a fairly long turnover
2. That the developers of technology are focusing on the purchasers of the technology rather than the system safety
3. That technology such as Autonomous Emergency Braking and Lane Keep Assist has the potential to be beneficial to safety of VRUs but needs to be tested with them to ensure they do not lead to risk compensation or unintended consequences
4. That vehicle manufacturers should be encouraged to develop Driver Vulnerable Road User Assist (DVA) packages that detect VRUs, warn the driver, take appropriate action where necessary including braking, door locking, steering to ensure safe passing distances.
5. That ADRs be updated to reflect safety expectations with respect to technology

There are additional Safe Vehicle issues that relate to vulnerable road users. We have addressed these issues in the recent Amy Gillett Foundation submission to the New South Wales Inquiry into heavy vehicle safety and use of technology to improve road safety. We have included this submission as Appendix F as many of the issues raised in that submission in relation to vulnerable road user safety and heavy vehicles is applicable across the entire motor vehicle fleet.

Terms of Reference

4. **Advise on arrangements for the management of road safety and the NRSS, looking at best coordination and use of the capacity and contributions of all partners.**

A true Safe System

The Safe System approach in Australia has been successful in shifting the focus of crash events away from the individual road users involved to recognise the need for broader, system wide responsibility and action. However, this application of the Safe System approach is largely mechanistic and does not explicitly include the broader social context and the conversations and attitudes about road safety. It's not just about what happens on the road, road design or enforcement – it's about the Australian attitude to road safety.

The current version of the Safe System does not provide adequate guidance to address the broader social factors. Two theoretical models that clearly address these broader factors need to be considered for integration into the Australian approach.

The first comes from the Netherlands and is an approach developed as part of the Bike Friendly Cities initiative.

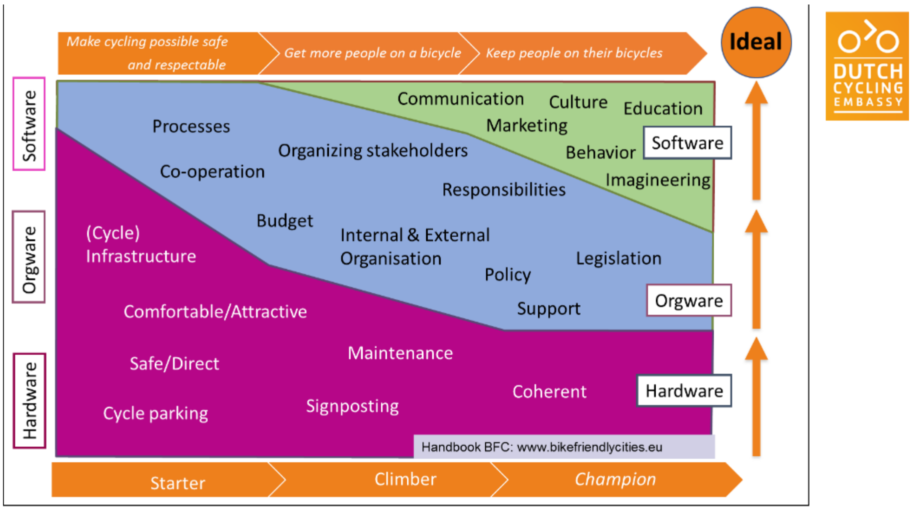


Figure 12. THINK: how to make cycling possible - theoretical model that incorporates broader social factors

The model was developed to identify the levels of action needed across three key elements:

Hardware	Hardware is the easiest component to identify, it relates to the physical environment including the roads and roadsides. While this is simple to identify, action for cycling infrastructure in Australia is not best practice. Action is needed to improve the safety of the infrastructure being implemented for cyclists to ensure it is safe for cyclists of all ages and abilities.

Orgware

Orgware relates to a less tangible, but equally important element, the culture of the organisations involved in cycling. This includes the policy documents (e.g. NRSS) but also the attitudes and actions of the individuals who work at the lead agencies tasked with road safety (e.g. road authorities, road safety agencies). This also includes legislation to ensure legal protection of cyclists and budget so infrastructure and cycling related programs are adequately funded.

Software

Software relates to what we might consider communications and marketing but extends to a broader inclusion of culture and 'Imagineering'. Imagineering encourages innovation in the cycling space, including Living Labs and support to redesign public spaces.

While this model was primarily developed to provide a structure to increase cycling participation, it identifies important broader factors than those currently focused on in the NRSS. This model provides a clear framework that could be used to inform the next NRSS to ensure the broad social and cultural factors, including organisational culture, are included.

The second theoretical model is Haddon's Matrix. Haddon's Matrix is fundamental in injury prevention and presents a simple yet comprehensive approach to understanding the range of risk and protective factors in a crash event. Importantly, like the Dutch model above, Haddon's Matrix also includes the broader social environment and the role it plays in incidents.

		Person	Vehicle	Environment	
				Physical	Social
Time ↓	Pre-crash: prevention				
	Crash: minimise injury				
	Post-crash: minimise affect				

Figure 13. Haddon's Matrix

In addition, Haddon's Matrix provides the element of time. This ensures that action is not simply focused on minimising injury but also on pre-crash prevention and post-crash care. Explicit pre- and post-crash inclusion in Haddon's Matrix ensures that all elements of a crash are considered. This clear model for considering the elements of a crash across risk factors and time would be a valuable addition to the structure and approach in the next NRSS.

National priority

Road safety needs to be elevated to the national conversation and given the same high profile as other major priority areas. Leadership in the public conversation about critical road safety messaging is an urgent action. This includes the next NRSS and associated plans. Highlighting this as an action in the NRSS is in response to the lack of consideration for the role of social and cultural factors in the current NRSS.

For action to be effective, a change in approach, including the messaging of road safety and the mechanics of broadcasting (mass communication) and investment in experiential based behaviour change which requires greater investment and time but has been shown to have greater impact on ongoing behaviour change than mass communication alone.

Road safety is an issue of national significance and this needs to be negotiated with broadcasters to maximise coverage including a reduced or subsidised rate for broadcasting on traditional and online media platforms. Governments need to be more collaborative with broadcasts to find ways to include exemplar road safety messages to help to shift the culture around road safety.

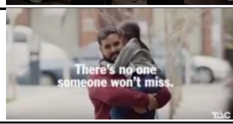
In our media and content saturated world with constant distraction and competition for attention, it is understandable that government agencies have engaged creative agencies to develop campaigns that have the greatest potential to cut through, or 'go viral'. However, the push for return on investment in dissemination, increasingly measured in social media metrics (e.g. shares, likes) must be balanced with critically reviewed content. The fragmented approach to the communication of critical road safety messaging highlights the underlying delegation of the implementation of road safety action to the states/territories.

Campaigns that raise awareness of road safety issues are an important component of improving road safety. Two recommendations are made to further improve the outcome of this investment:

- Federal government support to ensure national dissemination of excellent road safety campaigns
- Critical review of content in the development stage by road safety experts external to the government agencies and free to critique without fear or favour

Our review of road safety as part of this submission has been brief. However, we bring to the Committee's attention a selection of excellent road safety campaigns, both national and international content, as examples of the type of messaging that needs to be supported by the federal government to disseminate nationally.

Table 3. Examples of excellent road safety campaigns

	Targeted road user	Road user safety	Topic	Link to clip
Tasmania	Drivers	Cyclists	Safe passing distance	
New Zealand	Drivers	Drivers, passengers	Speed	
United Kingdom	Drivers, passengers	Drivers, passengers	Seat belts	
Victoria	Parents/drivers	Drivers, passengers	Modelling to children	
Victoria	Drivers	All road users	Challenging acceptance of road deaths ('toll')	

The importance of language

Throughout the NRSS, the Action Plan and the government campaigns and websites we have reviewed in preparing this submission, we have noted that use of language in the main still promotes a driver-centric narrative. For example, the ANCAP safety rating provides a valuable resource for consumers but there does need to be a shift in the terminology to help to reframe road safety as a social responsibility. Currently the ANCAP safety website focuses on the actions needed to keep an individual safe.

> Make safety a priority when choosing your next car. Look for a vehicle which has a maximum 5 star ANCAP safety rating… it could save **your** life.
>
> ANCAP website
> (emphasis added)

In the example above, replacing 'save your life' to 'save a life' is a subtle nudge that shifts the emphasis of road safety from the individual purchasing the motor vehicle, to everyone on the road. As we have recommended in this submission, inclusion of vulnerable road user experts to provide critical review and advice is required in relation to the ANCAP rating scheme and communications.

This example is one of many observed in preparing this document and we do not include it here to single out ANCAP. Instead, this is one of many examples of wording that is driver-focused and with minor revisions could be more inclusive.

Our review was brief and not intended to be comprehensive. What it did highlight was the need for a broader review of the language used in public documentation in relation to road safety. We support this type of review for the next version of the NRSS and Action Plan and road safety messaging more broadly.

Recent research

Finally, we draw the Committee's attention to recent research that has been undertaken related to how drivers are taught to share the road with cyclists. With support from the NRMA-ACT Road Safety Trust, Bonham and Johnson undertook a review of the driver licensing documentation, compulsory pre-learner *Road Ready* program including in-class observations, learner driver lessons and an online survey of fully licensed drivers. They reported that throughout the driver training process to licensure, that the representation of cyclists was either absent or problematic.

Findings from that study were used to inform a new driver training competency designed to increase awareness of vulnerable road users. This study also highlighted that fully licensed drivers would welcome training about sharing the road with cyclists before supervising a learner driver. The paper from that study was published in 2018 and the abstract is included as Appendix G.

This study formed the basis for a national study Cycle Aware, which is currently underway with support from the federal government through the Australian Research Council Linkage scheme.

Cycle Aware

Cycle Aware is a collaborative research project that is critically examining how drivers learn to interact with cyclists. The project is being led by Dr Jennifer Bonham (University of Adelaide) with chief investigators Dr Marilyn Johnson (Monash University and AGF) and Professor Narelle Haworth (Queensland University of Technology, CARRS-Q). Partner organisations include the Motor Accident Commission (SA), Amy Gillett Foundation, Royal Automobile Association (RAA, SA), Adelaide City Council, Government of South Australia (Department of Planning, Transport and Infrastructure) and the Northern Territory Government.

From the study website (link):

> As it currently stands, existing driver education and training research in Australia does not focus on including cyclists in driver training curriculums. Within the broader driver education and training field globally, researchers make a strong case for developing curricula to include 'anticipatory' education – that is, inexperienced drivers being taught to interpret and prepare for different road environments and road user behaviours. This research implies that learner drivers will benefit from better understanding the behaviours of the full range of road users, not simply other motorists. Cycle Aware focuses on all Australian states and territories to determine whether, how and to what effect drivers learn to interact with cyclists.

This major project will led to increased inclusion of cyclists in the driver training, education and licensing process, beginning with trials with project partners in South Australia and the Northern Territory. This project is an important step in an inclusive approach to road safety that takes a broader, system view to consider how we construct the narrative around different road user groups.

This project is an example of the type of critical review needed across the next NRSS to ensure that vulnerable road users are included and that their representation is equitable with motorised road users. Examples of practical advice are explanations of why cyclists sometimes ride two abreast, why sometimes cyclists will move out of the bike lane (e.g. to avoid debris, pothole) and why sometimes cyclists might be wobbly and need a bit more space (e.g. starting off from an intersection or in crosswinds).

Concluding remarks

Road safety is a shared responsibility and efforts to improve the safety of Australia roads should focus on all road users. To date the focus has largely been on the occupants of vehicles, with little attention to vulnerable road users external to vehicles. The review of the National Road Safety Strategy provides an opportunity to recalibrate that focus, and provide a critical path to achieving a shared goal of safer roads for all road users, through regulation, infrastructure, education and awareness.

In this submission we have focused on action required across the following critical areas:

- Recognising vulnerable road users at the centre of the Safe System approach
- Ensuring that vulnerable road users are included in the NRSS with specific targets and measurable outcomes
- Implementing best practice guidelines for infrastructure design for vulnerable road users
- Implementing lower speed zones in areas with high cyclist and pedestrian activities, particularly in residential areas
- Recognising vulnerable road users in the development and testing of vehicles
- Ensuring road safety is given national priority
- Support for road safety education in schools, including cycling safety skills training (Austcyle)
- Regulation change required to support cycling safety through the inclusion of cycle awareness modules in the driver training, education and licensing process
- National support for ongoing vulnerable road user awareness campaigns such as the Amy Gillett Foundation's **a metre matters** campaign
- Supporting measures to shift the conversation and language around road safety to include vulnerable road users, reflecting a shared environment

We would welcome the opportunity to engage in this Inquiry further to discuss the perspective of cyclists and cycling safety.

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Appendix A – 2011 Joint Response to the Draft NRSS

Joint Response to the

Draft National Road Safety Strategy 2011-2020

Contributing Organisations

Amy Gillett Foundation

Bicycle NSW

Bicycle Transport Alliance, WA

Cycling Australia

Cycling Promotion Fund

Retail Cycle Traders Association

18 February 2011

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Background

This document incorporates views on the Draft National Road Safety Strategy (NRSS) (Standing Committee on Transport 2010). It has been compiled from responses received by experts in road safety as well as bicycling groups.

The Cycling Promotion Fund and the Amy Gillett Foundation have coordinated the administrative and writing task.

Significant input has been received from many areas including the following groups and individuals:

- Amy Gillett Foundation (AGF)
- Bicycle NSW
- Bicycle Transportation Alliance of WA (Inc) (BTA)
- Cycling Australia
- Cycling Promotion Fund
- Pedal Power ACT
- Retail Cycle Traders Association
- Dr Jan Garrard
- Dr Leigh Glover
- Prof Narelle Haworth
- David Healy
- Marilyn Johnston
- Alton Twine

The process has included reviewing the Draft NRSS and seeking comment from known experts and groups, reviewing relevant publications (including other submissions and proceedings of parliamentary committees such as the NSW Staysafe Committee report (Parliament of NSW 2010) and attempting to synthesise the main comments.

These tasks have been completed in a very time constrained manner. The authors would welcome the opportunity to further discuss the development of the NRSS and maintain a dialogue both in the development and implementation of the Strategy.

Summary of Submission

The safe use of the Australian road network and the reduction in trauma for the transport of people and goods requires a cultural shift away from competition for space to shared use. Designing for shared use requires the prioritisation of vulnerable road users. This will improve the safety for all road users.

The Australian Transport Council (ATC) needs to adopt bold strategies to support the ambitious targets or we will continue to lag behind in the management of safe road networks.

In revisiting the Draft NRSS the ATC would be well advised to incorporate actions to:

- Acknowledge the increased value of shared modality and increased priority of vulnerable road users e.g. bicyclists and pedestrians, in infrastructure design
- Introduce research protocols to identify participation and exposure rates, and crash typologies for vulnerable road users including on road, shared paths and off-road paths
- Introduce criteria such that all road infrastructure funding incorporates inclusion of bicycle infrastructure at the time of design and of new and upgraded infrastructure.
- Work towards removal of FBT tax incentives for new cars and generally seek to reduce demand for private motorised transport, especially in urban areas
- Adopt three yearly road-worthiness checks for all registered vehicles
- Adopt a nationally agreed Benefit Cost Ratio for the development of bicycling infrastructure
- Work in partnership with community groups to deliver behaviour change programs and other campaigns to educate drivers on sharing the road with all road users – the success of “a Metre Matters” exemplifies the type of cross sector collaboration that is possible
- Modify learner driver education and testing to promote a culture of shared road usage rather than identifying bicycle riders and pedestrians as hazards – the RoadRight program is such an example
- Increase financial and institutional support of AustCycle (nationally accredited bicycle education and safety program) to increase reach to all Australian school-aged children and a significant proportion of the adult population.
- Review road rules and legislation to place greater emphasis on the safety of vulnerable road users. Such opportunities may include zoned speed limits, legislating the passing distance by motorists around bicyclists, legislating that left turning motorists give way to bicyclists also turning left.

Principle concern

Our principle concern is that the Draft NRSS proposes only marginal changes to the existing system, which will only result in achieving marginal changes to safety outcomes. The ambitious goals that were rightly set in this area will not be achieved if this Draft is adopted without significant changes.

We believe that one of the key improvements needed is a strategic focus on the most vulnerable road users.

By vulnerable road users we mean; the young and the old, people with disabilities and people using modes of transport such as bicycling, walking and motor cycling who are particularly susceptible to impacts from large-mass, fast-moving vehicles as well as crashes caused by road design, engineering, individual skill and decision making issues. A fuller definition and exposition of the position of vulnerable road users is set out by Haworth (Haworth 2006).

Vulnerable road users make up a significant percentage of road use. In 2009, over 1.92 million people over the age of 15 years rode a bicycle regularly (at least three times a week).

By adopting the viewpoint of the most vulnerable users, there will be a consequent increase in safety for all users. This approach is consistent with the approach being taken in the countries that lead the league tables in road safety and is arguably why Australia is falling off the pace and has failed to achieve previous road safety targets.

We endorse a 'safe system' approach that as a starting point is the perspective of the most vulnerable users in assessing each element of the system in any context. The 'safe system' approach is otherwise open to misinterpretation as an excuse to eliminate vulnerable users from the system.

While an economic estimation of the cost of road crashes is valuable, all lives have an unquantifiable value - all deaths and serious injuries are tragedies and are a significant cost to the nation. This is true irrespective of the mode employed for transport or other characteristics of the individual. The Safe System and Vision Zero objectives are consistent with this moral premise and we support it as a philosophical approach. It is important that this moral position is not lost as the Safe System concept is implemented.

Ultimately, a Safe System should see a significant change in the ways that we organise our transport system. This is likely to see a much greater use of active travel modes such as walking, bicycling and public transport. The NRSS should be working, in cohesion with other strategic initiatives in health and the environment, to achieve this outcome in a way that does not create adverse safety outcomes.

We recommend that:

1. Vulnerable road users be specifically prioritised - If the NRSS adopts the perspective of the vulnerable, all will be safer

2. A moral approach to road safety be adopted and advocated through the NRSS to stress the value of all lives

3. This approach be used in discussions across, and with all levels of Government to garner support for the NRSS goals.

General

The Draft NRSS developed by the ATC, has a central aim to reduce the trauma created by the transportation or movement of people and goods by road across Australia. To achieve this, it has attempted to embody the concepts of Safe Roads, Safe Speeds, Safe Vehicles, Safe People. The strategy identifies a number of opportunities to increase the level of safety for all road users throughout metropolitan, regional and rural Australia to the year 2020.

In developing the strategy, the ATC has used a number of measures to identify critical areas of focus and future funding priorities.

The measures outlined in the document appear to define priorities which are heavily weighted towards motor vehicles and in particular, car drivers. This emphasis appears not to embrace 'shared' road use and increased shared modality road use. It also does not acknowledge the broad support for increases in bicycling, walking and use of public transport that link to substantial benefits for all Australians.

The Draft NRSS has made the separation of bicycle riders from high speed traffic a future priority not a primary outcome. We suggest that, given the expected increases in bicycling and other non-motorised modes (discussed below), and given existing targets for increased participation as embodied in key government policies such as the National Cycling Strategy 2011 -2016 (Austroads 2010) as agreed by Federal and State governments, **the prioritisation of non-motorised modes such as bicycling deserves to be much higher if the key outcomes and objectives of the Draft NRSS are to be achieved.**

The focus of the Draft NRSS also needs to be clarified. It is our view that the strategy needs to address the safety of both the overall transport task as well as the road system – whether the use of the road is for transport or some other purpose such as recreation or fitness.

We recommend that:

1. Vulnerable road users e.g. bicyclists, be specifically prioritised in the final NRSS
2. Specific actions be enumerated for vulnerable road users in each of the categories, Safe Roads, Safe Speeds, Safe Vehicles, Safe People
3. Specific targets for casualty reduction be identified for people walking and bicycling on an exposure and absolute basis, consistent with an increase in travel by these modes

Vulnerability and risk

The risk of injury on our roads is borne most heavily by those groups who impose the least danger on others: walkers and bicycle riders, children and those with impaired mobility (vulnerable road users). The Draft NRSS identifies that vulnerable road user's account for 35% of deaths and almost 50% of serious injuries (Table 3 of the Draft NRSS).

We argue that the budgets provided to support improvements in safety for those groups who are at relatively greater risk than car drivers and passengers should be increased accordingly. Increasing the safety of vulnerable road users is likely to have a significant impact in increasing the numbers choosing non-motorised modes - safety and perceived safety is a major barrier to uptake of non-motorised modes (Noland 1992).

While Australia has been successful in reducing overall rates of road traffic fatalities and serious injuries, the benefits have not been equitably distributed across all road user groups. In the six years between 2003 and 2008, traffic-related fatalities for cyclists in Australia ranged between 26 and 43. On average there were 36 deaths per year, representing 2.3% of all road deaths for this time period. Passenger, pedestrian and driver deaths showed reductions (5.2%, 3.2% and 0.9% respectively), but there was no comparable trend in cyclist deaths (Department of Infrastructure Transport Regional Development and Local Government 2009).

Over the period 2000 to 2007, serious injury rates for cyclists (per 100,000 population) increased by 47 percent, while for all other modes (motorcycles aside), rates either remained steady or declined (Henley and Harrison 2009). This clearly needs to be seen in the context of uncertain participation rates.

The draft strategy employs the measure of casualties to assess the safety of road infrastructure. The parties to this submission suggest that a highly appropriate additional indicator would be a measure of the rates of walking and bicycling across participation, incidents and deaths (not exhaustive). Not only would this create a more complete indicator for the level of safety of our transport network for vulnerable road users, it would allow identification of the specific impacts of improvement in safety for different user groups within the transport spectrum.

We recommend that:

1. The Department of Infrastructure Transport Regional Development and Local Government carry out a 'root and branch' review of how its activities and that of State and Local Government departments identify the impact on the safety of vulnerable road user groups

2. Improved baseline and longitudinal data be shared on participation/volume of all road user types, as well as crash/injury/death statistics (see next section).

Collection of data and modelling

In order to formulate a sound strategy, the ATC needs a solid understanding of crash types, causes and contributing factors, vehicle involved and location. For strategic development it also needs good estimates of exposure. Much of the strategic development in the Draft NRSS is influenced by the information assembled at Chapter 3 of the Draft .

One issue about the information (as identified by Haworth 2006) is the propensity for significant and rapid change in the size and composition of groups participating in bicycling and motorcycling. There are policy, economic and behavioural reasons why these groups are likely to increase rapidly in forthcoming years and a failure to anticipate these changes will render the NRSS modelling misleading and targets unachievable.

The data relied on inevitably have a number of biases. Two biases that particularly affect strategy development for bicycling are a significant focus on fatalities and a reliance on police data. These data have a number of problems especially from the point of view of bicycling and other vulnerable road-user groups. For instance, police data are unlikely to capture many of the serious crashes that occur on separated facilities. For the NRSS to use this data as a performance measure is thus likely to misrepresent actual performance in transport safety.

The use of population based data has the potential to be particularly misleading when it comes to evaluating the safety performance for vulnerable modes. Thus a population based analysis (for example, Henley and Harrison 2009 pp. 27-34) suggests a poor performance by Victoria and the ACT for bicycle serious injuries. However, on a travel time, or kilometres travelled, measure these jurisdictions are likely to perform better than others.

The measure of casualties per vehicle kilometres travelled (VKT) is used extensively in assessing safety for other modes. For example the Draft NRSS uses VKT to demonstrate the over–representation of heavy vehicles in death numbers. Heavy trucks and buses make up only 3% of registered vehicles but they account for 8% of VKT and are involved in 17% of total deaths and 3% of total serious injuries. There is a question as to whether VKT is an appropriate metric – arguably it conflicts with the Vision Zero philosophy in that it implies that more casualties are tolerable if there is more travel.

Whilst noting this difficulty with VKT as a measure, it is also worth noting that the ATC would be unable, at this time, to reliably determine any comparable rate of travel for bicycles. We submit that, with the National Cycling Strategy's objective to double the rate of bicycling by 2016, the draft NRSS must employ or indicate a viable means of assembling the data necessary to understand the current safety status of non-motorised modes.

In Australia, bicycle usage and travel is determined using basic data including:

- The number of people who cycle in a particular year through ERASS data,
- Annual bike counts in major metro areas
- State and local government traffic counters on principal thoroughfares in major metro areas
- The distance people cycle for the journey to work through the census (every five years)
- Bicycle mode share of daily travel (and related information) from some capital-city household travel surveys.

Despite access to the data mentioned above, we would argue that without equivalent data sets such as robust VKT data for vulnerable road users such as bicycle riders, the ATC is unable to adequately determine ratios between injury/death and actual traffic either on the road, on bicycle lanes, on maintained shared paths or on off road paths.

We recommend that:

1. The Australian Bicycle Council (ABC) be funded to support exposure studies and crash typology studies for bicycling
2. The reinstatement of ABS surveys of bicycle ownership and use as previously carried out in the 1980s (Australian Bureau of Statistics 1982; Australian Bureau of Statistics 1989) which were sampled off the census and had high reliability
3. The Bureau of Infrastructure, Transport and Regional Economics (BITRE) be commissioned to analyse vulnerable road user traffic
4. The ABC implement a common data collection policy relating to bicycling across all jurisdictions.

Future rates of bicycling

While rates of bicycle use are not well understood, the small but increasing amount of data available does indicate a substantial rate of increase.

The information available creates a remarkable picture:

- Cities continue to experience significant rider numbers; for example from 2007 to 2008 the City of Melbourne bike count highlighted a 47% increase in morning bike commuters.
- Participation in bicycling has increased by 32% in the same period (ERASS)
- Over 1.92 million people over the age of 15 years are riding a bicycle regularly (at least three times a week).

This data demonstrates that the numbers of people riding is increasing rapidly. With the populations of cities such as Melbourne expected to rise dramatically in coming years, bicycling participation is expected to continue to grow substantially.

The Australian Government has supported the development and implementation of several strategies which impact on the Draft NRSS which will either contribute to an improvement of road safety for bicycle riders or benefit from such an improvement. These include the National Cycling Strategy, the National Greenhouse Strategy, land use planning, taxation and finance strategies as well as social policy.

The promotion of bicycling for transport, urban amenity and environmental benefits; bicycle educational programs; bicycle infrastructure development and travel behaviour change programs all either promote greater rates of bicycle riding or benefit from increased bicycling to achieve their objectives.

The Draft NRSS makes references to support the outcomes of the National Cycling Strategy 2011-2016. This strategy has identified a target of doubling the rate of bicycling by 2016.

There are a number of recognised barriers to increasing the rate of bicycling, including the level of real and perceived safety (Bauman A. 2008).

In a recently released study (Lamont in press 2010), surveying the impediments to the development of bicycle tourism in Australia, respondents clearly identified the fear of road trauma due to driver attitudes and lack of appropriate infrastructure as major reasons preventing bicycling tourism as a mainstream activity rather than simply a niche activity.

Australia needs to improve infrastructure for bicycling, but as importantly, driver education and behaviour change campaigns need to support greater safety for those currently choosing not to use vulnerable modes based on a fear of the road environment.

A strong focus on improving the road safety for vulnerable road users such as bicycle riders will not only achieve the objectives of the Draft NRSS, but also have significant flow-on benefits for a range of related and complementary government policies and programs.

We recommend that:

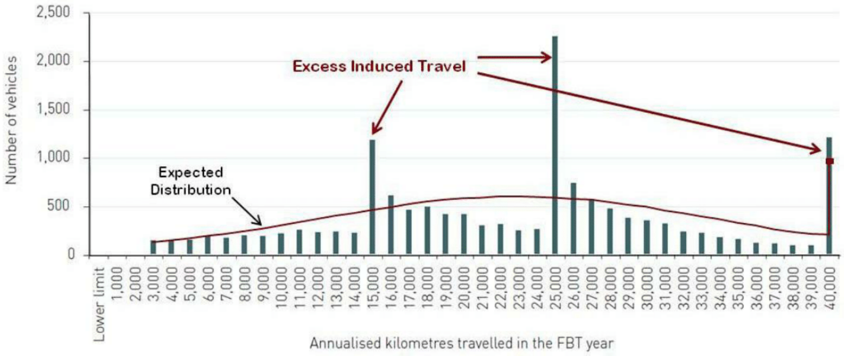
1. The Government should establish a long-term, strategic program for walking and bicycling, supported by significant and reliable recurrent funding and located within one central department or agency. A key aim of such a program should be to make bicycling an accepted alternative to cars and buses as a transport choice for shorter trips. This would go well beyond the existing National Cycling Strategy in that the program would have a significant budget and a clear mission.

2. The NRSS include a performance measure that identifies the extent to which 'fear of the road environment' is deterring participation in walking, bicycling and motor-cycling. This measure would provide a powerful indicator of progress in creating a culture of safety on our roads. Questions can be included in the national Community Attitudes to Road Safety survey to gather this information.

Negative safety outcomes of funding incentives

The Draft NRSS has proposed improvements to the safety of car drivers through subsidising the price of purchasing new cars through tax concessions. These concessions would be designed to make the purchase price of new cars cheaper, reducing the age of the car fleet in Australia.

We submit that road safety would be better improved by taking old and unsafe cars 'off' the road. This should be done without tax incentives that make new cars cheaper. This could be achieved by a mandatory road worthiness check every three years for vehicles over 10 years of age, with increasing requirements for safety features (especially active safety features) in second hand cars.



Research presented by Hughes (Hughes 2010) identifies that tax incentives for the purchase of driving cars induces greater driving distances and greater numbers of cars on the road for longer periods of time. The above graph demonstrates the impact of the 15,000km, 25,000km and the 40,000km FBT tax thresholds and the extra possible 'induced' distances which cars travel to meet those thresholds at certain times of the year.

Tax incentives for the purchase and operation of motorised vehicles have the strong likelihood of promoting greater use of motor-vehicles and therefore greater exposure to the risk of road transport crashes. Whilst the adverse safety impacts may not be well recognised, it is important that the NRSS identifies how government policy in other areas should be adapted to reduce dangers associated with use of motorised transport.

The utilisation of tax concessions to affect road use would be far more effective through the withdrawal of FBT concessions, which would have the effect of reducing the actual kilometres travelled. The withdrawal or restructure of the FBT rules to encourage drivers to travel greater distances would improve road safety.

There are other areas where high-cost low-benefit government subsidies are provided to the motor vehicle industry. These should be evaluated and rationalised with the dividends being applied to enhancing the safety and amenity of vulnerable users. For example, it has been suggested in submissions by the Bicycle Transport Alliance of WA that parking levies in the CBD of all major Australian cities be imposed to finance infrastructure that allows the separation of cars and bicycles where necessary.

We recommend that:

1. the NRSS address subsidies to the use of motor vehicles
2. the NRSS seek to have any dividends from reduced subsidies to the motor vehicle industry applied to improving road safety for all road users.

Safer road environment

Physical Infrastructure

Physical infrastructure is critical to the safety of both experienced and inexperienced vulnerable road users including bicycle riders.

The Draft NRSS has identified targeting infrastructure treatments and supporting measures that address safety issues for vulnerable road users. This step needs to be extended to include the development of infrastructure which promotes greater use of road networks for bicycles.

The benefit-to-cost ratio for developing bicycle infrastructure has been accepted as a positive return. In the past two years, there has been a number of Demand Assessments and Economic Appraisals completed which identify a positive Benefit Cost Ratio (BCR) for bicycling infrastructure. These reports have included; Inner Sydney Regional Bicycle Network 2010, Economic Feasibility Assessment of the Active Transport Queensland 2009, and Evaluation of the costs and benefits to the community of financial investment in the Naremburn to Harbour Bridge Active Transport Corridor 2010. Each report has utilised a range of values for a variety of influencing factors providing positive ratios.

To support greater development of the required infrastructure in support of safer bicycling, an agreed BCR framework should be identified and promoted.

The formal adoption of an agreed BCR framework would further promote increased/improved infrastructure for greater safety, and increased numbers of bicycle riders willing to utilise bicycles to travel to work.

Page 24 of the Draft NRSS identifies common treatments for improved safety. This box highlights the undervaluing of bicyclists and pedestrians in the road hierarchy. There are no specific safety improvements for vulnerable road users.

For e.g., at point three of the interventions - there is a strong focus on the separation of vehicles, and as an apparent 'add on', separation of vulnerable road users 'where possible'. The language reinforces the hierarchy of 'do whatever possible' to improve safety of motorised vehicle occupants, but vulnerable road users, especially bicycle riders are an 'afterthought', when they should be equally considered.

Speed

As noted in the Draft NRSS, one of the most beneficial measures for improving the bicycling and walking environment is lowering vehicle speeds.

The current implementation of the general urban speed limit of 50 km/h is supported as the first stage in speed limit reduction. The introduction of a consistent application of lower speeds in metropolitan areas is necessary e.g. Brisbane CBD has recently implemented 40km/hr speed limit. High activity areas require lower speeds - even the 40 km/h for schools and high pedestrian activity areas is still too high – it is at least 10 - 20 km/h above the speed where children will survive a collision with a motor vehicle.

Grundy indicates that the introduction of 20 mph (32 kmh) zones in London has resulted in a casualty reduction of 41.9% - "the percentage reduction was greatest in younger children and greater for the category of killed or seriously injured casualties than for minor injuries" (Grundy 2009).

Route treatments and rights of way

Increasing numbers of off-road shared paths and new separated cycleways create an urgent need to revise the current rules e.g.:

- Recognised and consistent types of crossings for both shared paths and bicycle-only paths: Currently there is no crossing type which offers an equitable level of service and safety. The lack of a dedicated shared path crossing type creates ambiguity and an unnecessary severance of off-road facilities (e.g. bicyclists are not permitted to use pedestrian crossings on a shared path road crossing).
- Priority crossings of intermediate low-volume side streets for paths paralleling major roads: A bicyclist travelling in on-road bicycle lanes fitted to a through-road has right of way over exiting and entering traffic, as do other vehicles using the through-road lanes. If the bicycle facility is instead located off-road, the bicyclist currently loses their travel priority at each intervening side street intersection. This deficiency in the road rules makes it very difficult for transport facility designers to provide off-road bicycle facilities of a sufficient level of service to meet community expectations. It also places naive users of off-road bike lanes in considerable danger of misinterpreting their right of way.
- Recognised, consistent and safe "bollards" at the entry and exit of shared paths to slow bicycle traffic and obstruct vehicle entry.

Professional knowledge and training

Bicycle groups regularly report instances of local traffic committee members who display a lack of knowledge on the use and design of quality bicycle facilities. There are training

cycling promotion fund | Cycling Australia | bicycle NSW | Bicycle Transportation Alliance | RCTA Retail Cycle Traders Australia | Amy Gillett FOUNDATION Safe together courses available (e.g. NSW RTA courses developed in 2003 to accompany its Bicycle Design Guidelines) for professional practitioners regarding road treatments that are beneficial to the safety and amenity of vulnerable users. Incentives need to be provided such that members of local traffic committees and others are encouraged to participate in these courses.

We recommend that:

1. BITRE adapt existing BCR models to establish a national BCR framework

2. The Department of Infrastructure Transport Regional Development and Local Government continue successful bicycle infrastructure funds to ensure key bicycle projects are completed

3. Implement national compliance regulations for minimum standards of bicycle infrastructure in road designs

4. The Australian Road Rules be reviewed and updated to permit the safe design and operation of separated cycleways and bicycle lanes within the road corridor and to explicitly require vehicles travelling along a through road to give way when attempting to turn across the path of bicyclists using bicycle facilities (either on- or off-road) along the same road

5. Members of traffic committees (local road authority representatives, council staff and Police) to complete training courses on design for vulnerable road users as part of their regular in-service training requirement. Places could also be offered to Road Safety Officers and Sustainable Transport/Access Officers of local Councils for skill development

6. Introduction of permanent 30km/hr speed restrictions in school zones and some residential areas.

7. Introduction of permanent 40km/hr speed restrictions in CBD zones.

Behaviour and education of road users

The education of both drivers and bicycle riders is critical to the safety of all road users.

We submit that there are serious inequalities in the way different road user groups are represented in key educational and official settings that have a direct negative impact on the safety of vulnerable road users such as bicycle riders.

Driver licensing and education

The Victorian drivers test is one 'example' that can be used to highlight the issue. In each of the example tests online (http://webapps.vicroads.vic.gov.au/vrne/vrlpq.nsf/30e17e0161c950e6ca256f39001c1724?OpenForm)
there are questions involving bicycle riders in which the 'cyclist' is identified or portrayed as a 'hazard'. The language and type of question immediately develops or reinforces the thinking that people who choose to ride a bicycle do not belong on the road and are in fact in the way of cars travelling on the road. Licence testing should reflect the rights of all road users and use questions which develop a shared road culture and not imply road ownership by one type of vehicle.

The behaviour of motorists towards bicycle riders has a critical impact on the safety of all bicycle riders, as well as a person's willingness to ride a bike. In recently released research from the Monash University Accident Research Centre (Johnson 2010), it was found that in 87% of incidents between cars and bicycles, cars drivers were at fault and most did not know they acted in a reckless manner. The study found that the most prevalent incidents occurred as a result of the motorist "side swiping" the bicyclist or turning left in front of rider.

The introduction of programs to educate and develop respect towards vulnerable road users would be expected to reduce the incidence of bicycle injuries.

Program campaigns such as the AGF Road Right and 'A Metre Matters', promotes an awareness and changed culture for the safe sharing of roads for all users.

Changes in behaviour can also be brought about by incentives. Changing the onus for insurance purposes such that, in the event of a motor-vehicle vulnerable user collision, the driver of the motor vehicle is assumed to be at fault and their insurance responsible for all injuries is likely to bring about pressure for behaviour change. This will be promoted by insurance companies who are likely to encourage drivers to respect the interests of vulnerable users if their payouts are likely to be affected.

Review of road rules to address common situations where drivers place bicyclists at risk would also bring about improved awareness and culture change.

We recommend that:

1. the licensing system be reviewed such that motor vehicle license holders are assessed on their awareness of vulnerable users

2. the onus of proof be reexamined such that vulnerable users (who may not be in a position to give evidence on their own behalf) are treated equitably and incentives offered for particular care on the part of motor vehicle operators

3. regular ongoing license testing be introduced rather than lifetime licensing

4. the NRSS should support behaviour change and information programs such as the 'Metre Matters' campaign and the Road Right Program

5. Road rules be reviewd to introduce legistation that maximises the safe sharing of roads and protects vulnerable road users, such as; legislating that motorists provide one metre when passing bicyclists, permanently reduced speed limits in the CBD and school zones, legislating that motorists, when turning left must give way to bicyclists also turning left.

Bicyclist education

The ability to ride a bike safely and with sufficient base-level skills has significant benefits for road safety in addition to the other individual and environmental benefits.

There has been some resistance to the provision of skills training for road users in the past. There is evidence that advanced driver training may contribute to increased crash risk, particularly for young males (Mills, Hall et al. 1999) This problem is recognised in the Australian driver training industry (Hill and Fickling 2006) and it is suggested that attitudinal and cognitive factors play a greater role in crash involvement than operational skills. Training in advanced vehicle handling skills may create a false sense of confidence leading to increased risk taking behaviour.

However, there is increasing evidence that crash involvement among motor cyclists is associated with a relative lack of skills (Liz de Rome, Stanford et al. 2004) and that participation in post licence training actually reduces crash involvement among motor cyclists. There is a strong case that the same applies to bicyclists. Observations of bicycling skills and behaviours in the community suggest that there are a wide range of unsafe behaviours in common usage. Increasing the recognition that bicycling training is required is likely to improve rider behaviours.

Despite the old saying ‘it’s like riding a bike’, bicycling is actually a learned skill which can deteriorate with lack of use. There is a significant need for bicycling education and training in the Australian community to allow more people to ride bikes, keep bike riders safe and engaged as well as realising the benefits of increased levels of participation in bicycling.

Balancing, pedalling, manoeuvring and stopping a bicycle are just the beginning of the skills needed to be proficient. Each of these skills can be improved through training along with hazard recognition and the acquisition of cognitive skills regarding road riding risks. There is an increasing body of research supporting the effectiveness of bicycling proficiency training across a range of domains (The Royal Society for the Prevention of Accidents 2001; Telfer B, Rissel C et al. 2005).

The recently developed national bicycle training program, AustCycle, is the only truly national grass roots bicycle educational safety and skills program in Australia. It provides an accredited curriculum endorsed by the National Coaching Accreditation Scheme for the acquisition of bicycle riding skills. It runs under a licensing model that is designed to allow an extensive rollout via accredited Providers across the country. The model ensures that incentives are in place for Providers to offer quality training services to a wide range of people across all types of riding environments.

AustCycle requires the collaboration of government departments responsible for education, health, recreation, transport and the environment to support this rollout while commercial sponsorship is emerging.

The NSW Department of Environment Climate Change and Water has supported AustCycle Providers via a pilot voucher scheme. This has been successful in delivering training to a significant number of inexperienced bicycle users. AustCycle has also been funded by the Department of Health and Ageing (DOHA) as a three year approved program under the Federal Healthy Communities Initiative. This is important program-based funding but is not sufficient for AustCycle to achieve completely inclusive engagement as a national safety program. For this it requires funding to support promotion and training for its Providers and Teachers.

The funding of AustCycle is critical to ensure that future generations have the skills required to be safe on the road while bicycling.

We recommend that:

1. Resources devoted to driver training and education be increased alongside an ongoing license testing regime

2. Training of vulnerable road users in the area of safe bicycling, motorcycling etc. be addressed as a priority

3. The NRSS commit to supporting AustCycle to deliver bicycle training and educational opportunities to all Australians, with a focus on school-age children.

Adapting the NRSS key areas to create a Safe System for vulnerable users

The discussion above has drawn out some major concerns about the approach of the Draft NRSS. Below we have attempted to show some examples of how the Draft should be specifically ameliorated using the existing framework of cornerstone areas.

Safe roads

As highlighted earlier the improvement of infrastructure for the most vulnerable road user will improve the safety for all road users.

Some key elements that require further attention under this area are:

- Prioritisation of infrastructure with an established benefit for vulnerable road users to ensure safety for all road users
- Review of the equity of Black Spot funding allocations in light of underreporting of bicyclist serious injury crashes
- Intersection design treatments, particularly in view of increased use of separated bicycle and shared use paths
- Review safety barrier and shared path “bollard” designs from a bicyclist perspective incorporating learnings from motorcyclist studies (Grzebieta R.H., Jama H. et al. 2009). Location of safety barriers and the use of un-shrouded W form beams may be implicated in prevention and severity of bicyclist crashes.
- Address professional and practitioner knowledge gaps through provision of design courses specifically addressing the perspective of the vulnerable road user.

Safe speeds

The Draft correctly identifies speed as a factor that is strongly associated with crash involvement and severity.

One of the most effective injury prevention strategies for cyclists and pedestrians is lower vehicle speed. For road users who lack vehicle crash protection, human tolerance to injury by a car is exceeded if the vehicle is travelling at more than 30 km/h. While most unprotected road users survive if hit by a car travelling at 30 km/h, the majority are killed if hit by a car travelling at 50 km/h (World Health Organisation 2008).

The draft strategy recommendation for speed reduction in 'high pedestrian/cyclist areas' takes the first step to the creation of a safe travel environment, but does not provide adequate safety for all pedestrians and cyclists. Creating environments which are determined to be 'high pedestrian/cyclist areas'could support a culture that cyclists or motorists do not belong on any other section of the road network. This will mean that the road system remains unsafe for the many pedestrians and cyclists who are not necessarily in high pedestrian/cyclist locations. It also creates a perverse incentive to design out vulnerable users where it is inconvenient from a road capacity viewpoint. An emphasis on road capacity has historically been the key performance indicator for road authorities - the vestigial impact of this emphasis needs to be repeatedly addressed.

The implementation of a uniform 30km/hr speed limit in residential streets is a key element of bicyclist and pedestrian safety in countries with relatively low injury rates for cyclists and pedestrians (Pucher and Dijkstra 2000; Pucher J, Dill J et al. 2010).

The implementation of a 40km/hr speed limit in CBD zones (recently introduced in Brisbane) is another key element.

This submission supports working with community organisations to develop support for speed control initiatives. This is something Government needs to do with the community not to the community.

Safe vehicles

As noted in our opening comments, the primary focus of the road safety strategy should be towards the more vulnerable users sharing the road with large mass vehicles rather than towards the occupants of vehicles who are already relatively well protected.

Thus, this submission supports active safety measures over passive measures. Introducing intelligent speed adaptation devices together with ABS braking services, heads-up displays and other technologies that assist in reducing crash involvement are clearly desirable if they can reduce crash involvement. These need to be introduced in a way that does not result in risk homeostatic responses from drivers.

Car design that emphasises pedestrian protection in the event of a crash needs to be promoted and unsafe designs should be regulated and penalised. There is a case for introducing absolute liability provisions for unsafe pedestrian-impact vehicle designs and allowing the insurance industry to assist in driving design in a safer direction. The popularity of SUVs and light commercial vehicles that fail to provide for pedestrian or bicyclist safety in the event of an impact are particularly troubling.

We support the introduction of Global Technical Regulation (GTR) 9, an international vehicle standard developed by the United Nations, which requires vehicle manufacturers to design the front of vehicles to absorb the energy of a collision with a pedestrian or other "vulnerable" road user.

The introduction of GTR 9 needs to be supported with modifications to laws supporting 'bull bars'. These, and similar modifications, make survivable impact speeds much lower than they need to be and possibly reinforce a feeling of invulnerability in drivers of vehicles equipped with them.

Bicycles and bicycle equipment also need to comply with safety standards. For example, the street use of un-braked fixed-wheel bicycles needs to be addressed.

The past emphasis on promoting conspicuity for pedestrians and bicyclists can be maintained. However, there is likely to be an increasing prevalence of utility bicycling in 'normal' clothes. The system needs to be sufficiently safe to allow for this type of riding and avoid the approach of 'blaming the victim'. Similarly, safety measures which promote the use of reflective clothing among pedestrians could be considered as virtually an admission of failure on the part of the safety authorities.

Safe people

The Draft NRSS strongly identifies driver responsibility as a key element in meeting the short term road safety targets. The question of driver liability for collisions with cyclists and pedestrians needs to be reconsidered.

Placing the onus of proof on drivers involved in collisions with pedestrians and cyclists has been adopted in several countries, including some of those identified in the NRSS as leading the world in road safety. This change increases the burden of responsibility for drivers to be accountable for their actions to a level which is commensurate with the level of vulnerability in the event of collision.

Road user education and testing also needs to be reflective of the requirements of improved shared modality. A reflexive treatment of pedestrians or bicyclists as 'hazards' needs to be addressed, together with the promotion of road-sharing, rather than an 'owning the road', as a thinking style.

Review of road rules to introduce legislation that maximizes the safety of vulnerable road users will also increase the emphasis on "sharing" versus "owning" the road.

Specific education of bicyclists is also important for improved safety on shared roads. Support for the AustCycle program is crucial. AustCycle, with the appropriate institutional and financial support from government agencies, can help to establish norms of responsible, respectful, efficient and safe bicycling in the community. It should be assisted to expand into schools and workplaces through voucher support and education systems.

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Appendix B – Bureau of Infrastructure and Regional Development (BITRE) Cyclists at a Glance Report

Information sheet 71

Australian Government

Department of Infrastructure and Regional Development

Bureau of Infrastructure, Transport and Regional Economics

Australian cycling safety: casualties, crash types and participation levels

At a glance

This paper presents an analysis of cycling safety in Australia. Topics included are

- analysis of casualties by demographics
- types of crash that result in cyclist injuries
- recent trends in cycling participation.

Cyclists comprise 3 per cent of all road fatalities and 15 per cent of all road hospitalisations. These proportions are higher today than five or ten years ago.

Children (0–16 years) have the highest population-standardised rate of cycling hospitalisations. This is in contrast to vehicle occupant hospitalisations, which peak in both the young adulthood ages and in the older (65+) ages.

Males are approximately four times more likely than females to be hospitalised following a cycling crash. For hospitalisations following any road crash, the male/female ratio is approximately 2:1.

Around 85 per cent of reported cyclist casualty crashes involve another vehicle (mostly a light vehicle).

Around 25 per cent of cyclist casualty crashes occur when two vehicles (including the cyclist) approach an intersection from perpendicular directions or from opposing directions. Other frequent crash types are side-swipes (14 per cent), collisions with vehicle doors (7 per cent) and rear-ends (6 per cent).

Cyclist casualty crashes are heavily skewed towards the lower posted speed zones (50km/h and 60 km/h).

Participation in cycling is increasing across many capital city commuting routes. However for overall cycling participation (transport and recreation), latest measures show flat or negative growth.

1

Introduction

Cycling is a popular and efficient mode of transport and a healthy recreation activity. The benefits of participation in cycling are promoted in Australia by strong community based associations and by policies and programs developed at all government levels through local to national. Infrastructure designed to meet the needs of cycling is being progressively built across Australia.

Cycling has associated safety risks, many of which are specific to the mode. Cyclists are considered vulnerable road users, whereby an error that might trigger a minor incident for a vehicle occupant could have major consequences for a cyclist. In this paper, several sources of bicycle crash data and exposure data are used to provide an overview of cycling safety and data sources in Australia. Recent trends are identified. The paper has three main sections. Section 1 presents latest casualty and fatality statistics, including tabulations by jurisdiction and age group. Section 2 presents analyses of crash type, vehicles-involved and location characteristics for crashes involving a cyclist casualty, and Section 3 explores recent Australian cycling exposure data.

Recent Australian research into cycling safety covers a wide field of topics—including exposure data and risk modelling, visibility, helmets, vehicle conflicts, injury, education and health. Many of the recent published papers provide much greater detail than is provided in the present broad study. See the References section.

Cycling is developing as a transport mode, and future studies to update safety statistics and model risk should be considered.

Definitions and data sources

The scope of the paper is traffic crash casualties (fatalities and injuries) of cyclists. 'Traffic' includes locations such as roads, road-related areas, bicycle paths and footpaths. Excluded are locations such as private land and roads not open to the public. A cyclist is a person riding or being carried as a passenger on a bicycle (also called a pedal cycle) — a vehicle with two or more wheels built to be propelled by human power (National Transport Commission 2012).

A fatality is a person who dies within 30 days from injuries in a traffic crash.

Two sources of injury data are used in this paper. A 'reported injury' is an injury that is recorded by police in a crash report. The road safety authorities in each state or territory validate and code this data into their individual databases, which contain all levels of crash severity. In this paper, national tabulations based on reported injury data do not separate minor injuries from serious or severe injuries.

The second source of injury data is 'hospitalised injury', or 'hospitalisation'. This is a hospital admission of an injured person, excluding those fatally injured. This data is sourced at hospitals and collated into the National Hospital Morbidity Database, which is managed by the Australian Institute of Health and Welfare (AIHW). BITRE receives annual extracts of this data.

The tables and figures are prefaced with the source/type of data used. The different sources of data necessitate that the tables show different years. Generally the latest available data are used.

1. Annual casualties

1.1 Australia

The first set of tables focus on counts of fatalities and injuries (hospitalised and police-reported), and on the proportions cyclists comprise of total road crash casualties.

Table 1: Cyclist casualties in traffic crashes — Australia

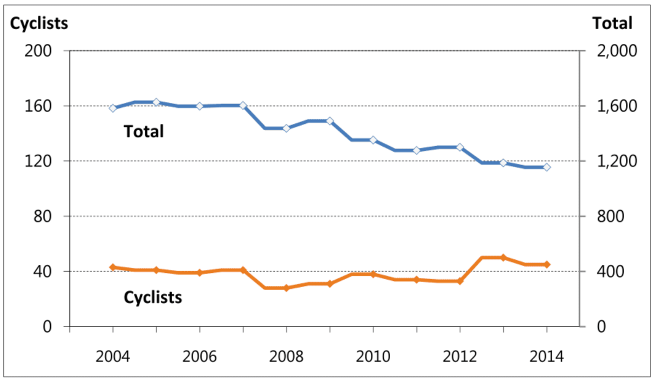
Year	Cyclists killed	Cyclists as % of all road fatalities	Year	Cyclists hospitalised	Cyclists as % of all road hospitalisations
2005	41	2.5%	2003-04	3,676	12.8%
2006	39	2.4%	2004-05	-	-
2007	41	2.6%	2005-06	4,370	14.0%
2008	28	1.9%	2006-07	4,789	14.6%
2009	31	2.1%	2007-08	4,814	14.8%
2010	38	2.8%	2008-09	5,264	15.4%
2011	34	2.7%	2009-10	5,330	16.2%
2012	33	2.5%	2010-11	5,168	15.5%
2013	50	4.2%	2011-12	5,527	16.0%
2014	45	3.9%	2012-13	-	-

- Data not available.

The two series of proportions in Table 1 have statistically significant increasing trends[1]. The annual series of hospitalised cyclists also has a significant trend of around 4 per cent increase per year[2]. There is no significant increase in the series of the annual fatality counts.

Figures 1 and 2 display the data in Table 1, adding lines for total road crash fatalities and total hospitalisations.

Figure 1: Fatalities: annual counts of killed cyclists and all road users



[1] Using a test for a linear trend in the log-odds (*prop.trend.test* in R).
[2] A *linear* model was fit and thus the annual per cent change varies — between 3% and 5%. Statistical significance was found at the size α <0.05.

Figure 2: Hospitalisations: annual counts of hospitalised cyclists and all road users

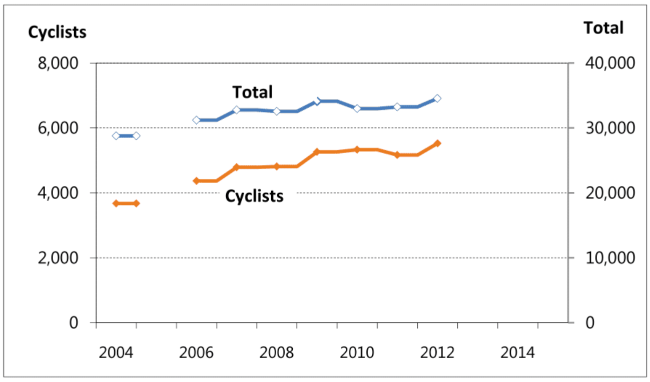


Table 2 compares cyclist fatalities as a proportion of all road fatalities, across jurisdictions and over time.

Table 2: Fatalities: cyclists as proportion of all traffic fatalities, by jurisdiction

5-year period	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
2005-2009	2.4%	2.6%	2.3%	2.5%	1.5%	3.6%	1.1%	2.5%	2.3%
2010-2014	3.0%	2.9%	3.7%	3.8%	2.8%	4.5%	1.8%	7.4%	3.2%

For all jurisdictions, the proportion of cyclists' fatalities out of total fatalities was higher during the latter half of the decade than that during the first half. Small numbers preclude significant statistical findings for these differences — with the exceptions of Queensland, Western Australia and whole of Australia, all of which did record significantly increased proportions.

Table 3 gives counts of cyclist hospitalisations by jurisdiction. Hospitalised injuries by jurisdiction are available for a restricted number of years.

Table 3: Hospitalisations: cyclists hospitalised in traffic crashes, by jurisdiction

Year	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
2005-06	1,362	1,212	824	323	328	111	61	101	4,370
2006-07	1,428	1,446	1,000	290	331	100	51	102	4,789
2007-08	1,297	1,402	999	353	410	115	70	119	4,814
Cyclists as % of all traffic hospitalisations	13.7%	15.8%	14.7%	13.4%	13.3%	14.9%	12.9%	20.1%	14.5%
2008-09	1,450	1,486	1,093	336	465	110	76	175	5,264
2009-10	-	-	-	-	-	-	-	-	5,330
2011*	1,487	1,688	955	379	531	73	np	np	5,393
Cyclists as % of all traffic hospitalisations	14.2%	17.5%	15.2%	14.7%	15.3%	14.4%	14.8%	28.5%	15.6%

* Calendar
\- not available
np not published

For all jurisdictions except Tasmania, the proportion of total hospitalisations comprised by cyclists has increased over time. Significant differences in the proportions over the two time periods occurred for Victoria, South Australia, Western Australia, Australian Capital Territory and Australia.

Police reported crashes (national only) are an alternative data source, shown in Table 4. These counts are of any reported injury, including minor injury.

Table 4: Reported injuries: cyclists injured in traffic crashes

Year	Australia[a]
2008	4,269
2009	4,510
2010	4,404
2011	4,363
2012	4,300
2013	4,400
Cyclists as % of all traffic injuries	4.4%

[a] Australia's totals in 2012 and 2013 includes estimates for Queensland.

Comparing Table 4 with Table 3, the counts of injured cyclists are similar in both, but the proportion is much lower in Table 4. The denominator (all reported road crash injuries) used for the proportion in Table 4 must be much higher. Around 80 per cent of reported injuries are of a vehicle driver or passenger. A significant number of these would have a minor injury rather than one requiring admission to hospital. Thus they will be included in the police reported injury data, but will likely be excluded from the hospital admission data. Johnson et al (2015) discuss crash reporting issues and data sources in a recent paper on Australian Capital Territory cycling.

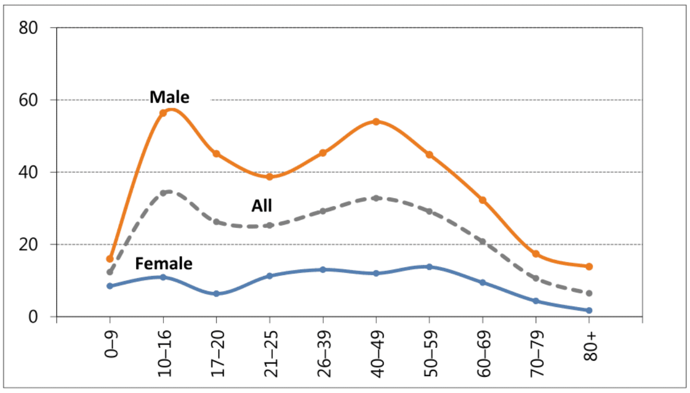
Table 5 gives cyclist hospitalisations by age groups. For children, approximately one third of all road crash hospitalisations are from cycling crashes.

Table 5: Hospitalisations: cyclists hospitalised in traffic crashes by age group

2012	Age group:	0-9	10-16	17-25	26-39	40-59	60-69	≥ 70	Total
	Gender								
	Male	239	567	603	1,025	1,488	360	158	4,440
	Female	120	104	128	292	393	107	39	1,183
	Ratio M/F	2.0	5.5	4.7	3.5	3.8	3.4	4.1	3.8

The overall number of annual hospitalisations of male cyclists is approximately four times higher than that of females. This is not explained solely by participation rates. For most ages, males have approximately twice the participation of females (see Section 3). Hospitalisation data by age group is standardised by population in Figure 3.

Figure 3: Cyclist hospitalisations per 100,000 population — age and sex distributions, Australia, 2012



The peak in the under 16 years group is not evident in hospitalisation rates for other road users (which are dominated by vehicle occupants). This highlights both higher exposure rates for younger people, and the vulnerability of cyclists. There is an increase in the male 40-49 demographic, which is also not seen in other road user groups, nor in female cyclists.

The next table presents greater-capital-city cyclist injuries standardised by population over six years. There is evidence that cyclist trips are increasing in capital cities (Section 3).

Table 6: Reported injuries: cyclists injured in traffic crashes per 100,000 population, for capital cities

	2008	2009	2010	2011	2012	2013
Sydney	16.4	17.3	16.9	15.1	14.5	14.7
Melbourne	28.7	30.3	30.8	32.0	27.6	29.6
Brisbane	19.0	19.5	19.0	17.6	-	-
Adelaide	35.8	33.6	37.0	38.0	38.9	39.0
Perth	16.2	17.8	16.7	17.1	15.3	14.6
Hobart	17.2	25.9	12.6	14.8	18.9	17.9
Darwin	29.7	30.3	25.8	19.4	16.6	24.0
Canberra	17.8	16.9	20.5	21.5	29.3	20.7
Australia – capital city[a]	22.1	23.0	23.0	22.7	21.9	22.2
Australia – outside capital city[a]	15.7	16.0	13.8	12.9	13.4	12.7

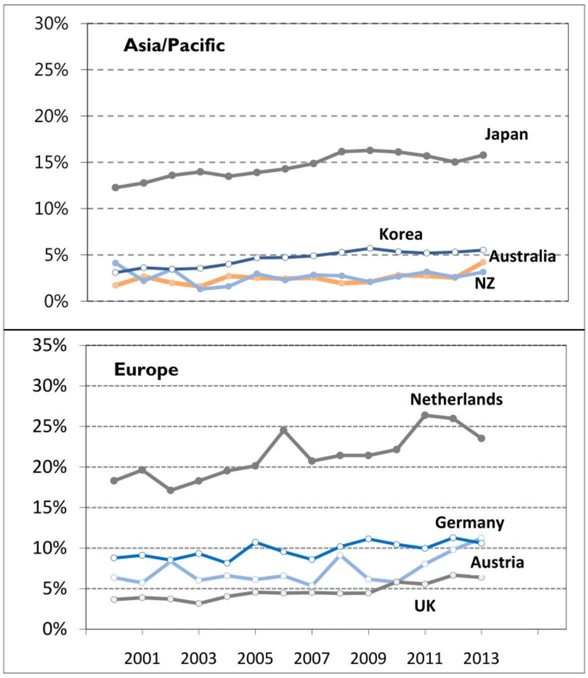
[a] Australia's rates for 2012 and 2013 use estimates for Queensland

Not shown in Table 6 is the corresponding rest-of-state rate. In all jurisdictions except Queensland and Tasmania, the capital city rate is higher than that rate. In Section 3, cycling participation levels are classified by Capital city and rest of state. Of note in the data above are the differences between the capital cities: the rates for Sydney and Perth are half of the rates for Melbourne and less still compared to Adelaide.

1.2 International

As a proportion of all road traffic crash casualties, cyclist casualties are increasing in Australia. Whilst this is also true for most OECD countries, the proportion varies significantly across countries. For the eight countries shown below, it varies between 3 per cent to 5 per cent for Australia and New Zealand to 25 per cent for the Netherlands.

Figure 4: Fatalities: cyclist fatalities as proportion of all road deaths — selected countries, 2000 to 2013



Source: International Road Traffic and Accident Database (IRTAD)

It is difficult to compare cycling participation rates across countries: surveys differ on size, date and other parameters. Pucher et al (2012) provides some data and analysis which shows that the Netherlands, Germany and Austria have much higher rates of cycling than either Australia or the United Kingdom. Similarly, in The European Commission's (2012) urban mobility survey, rates of recent bicycle use are reported to be approximately double that of Australia. Data for Japan was not available.

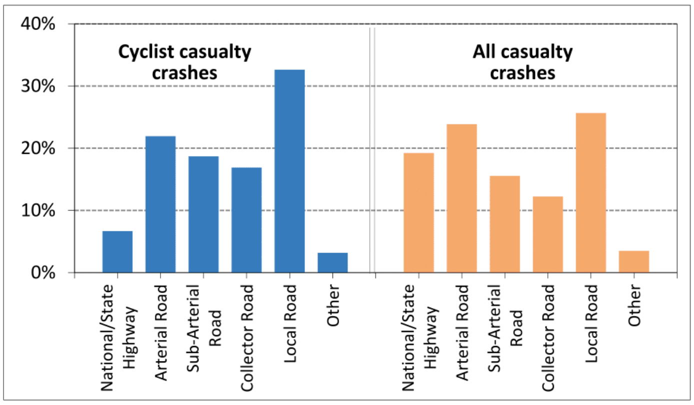
2. Casualty crash details

This section provides analysis of cyclist casualty crashes. Mostly, the data used is reported injury crashes. Three main areas are examined: the location and time-of-day characteristics of crashes; involvement of other vehicles by vehicle type for cyclist crashes; and analysis of crash type using the *Definitions for Classifying Accidents* (DCA) and *Road User Movements* (RUM) codes (Austroads 2009).

2.1 Location and Time-of Day

Part of the risk for cyclists is related to the number and speed of the other vehicles on the road. Larger roads offer more direct routes for longer trips, but necessarily involve greater interaction with other vehicles. Smaller local roads are less direct routes but have lower posted speed limits. Fatal cyclist crashes occur on all types of road. Highways and arterial roads account for around 29 per cent of all reported cyclist casualty crashes. For all fatal road crashes, (not just cyclists) highways and arterial roads account for around 43 per cent.

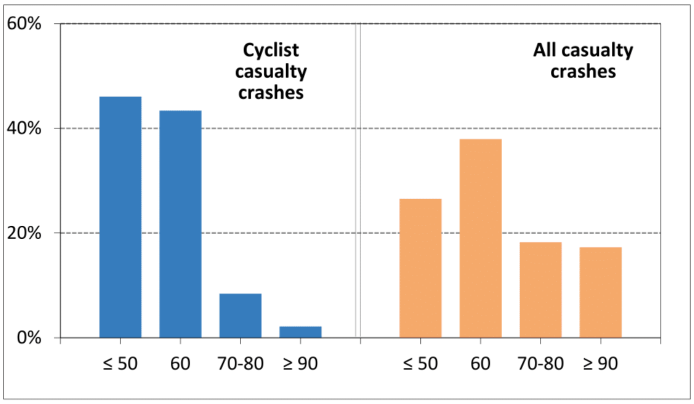
Figure 5: Reported casualty crashes by Road type — 2008-2013



Note: 'Other' includes Access roads, Busways, Paths and Unknown.

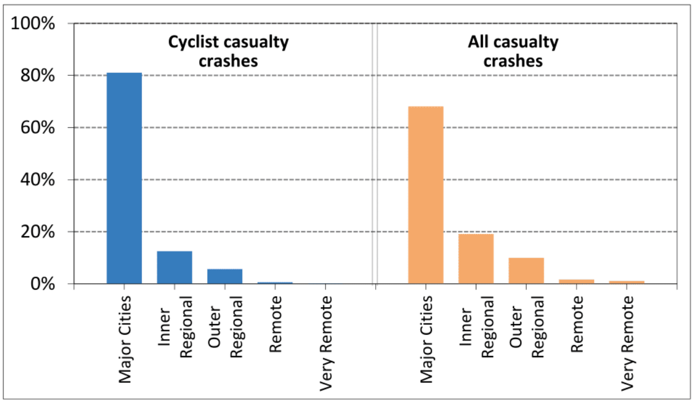
Related to the above is the posted speed limit on these roads. A significant proportion of all reported casualty crashes occur in zones of 70 km/h and above, whereas casualty cyclist crashes occur predominantly in lower speed zones (Figure 6).

Figure 6: Reported casualty crashes by posted speed limit (km/h) — 2008-2013



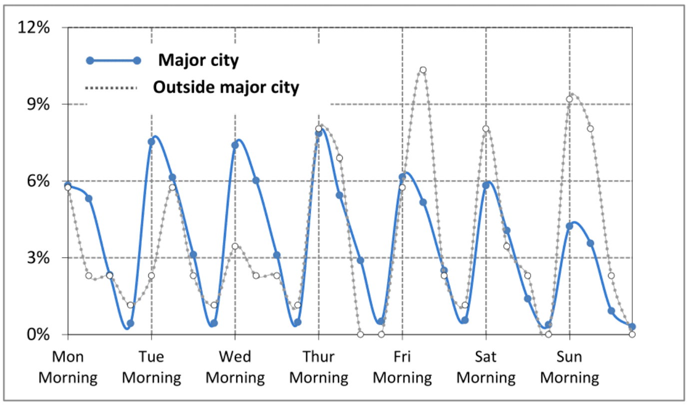
The risk implications of interactions between cyclists and other road users is highlighted in an analysis by Remoteness Region. Compared to all casualty crashes, those involving a cyclist injury/fatality are skewed towards a major city (81 per cent).

Figure 7: Reported casualty crashes by remoteness region — 2008-2013



The next analysis (Figure 8) classifies reported crashes involving a cyclist injury by time-of-day and by day-of-week. In the figure, the horizontal axis is divided into twenty eight 6-hour periods, where for ease of reading, only the morning period (6am to noon) is marked on the horizontal axis. As seen, the main peaks occur during this six-hour morning period. The data is also divided into Major city[3] regions and other regions. The former especially shows a regular daily cycle in crash times, peaking in the morning, falling in the afternoon and evening. The lowest points correspond to the period midnight to 6 am.

Figure 8: Reported cyclist casualty crashes by time[a] of crash — 2008 to 2013



[a] Morning (6am to noon), Afternoon (noon to 6pm), Evening (6pm to Midnight), Night/early (Midnight to 6am).

[3] 'Major city' refers to a category in the Australian Bureau of Statistics Remoteness Structure, ABS (2011)

2.2 *Vehicles involved –fatal and injury traffic cyclist crashes*

This section analyses the number and type of vehicles involved in cyclist casualty crashes. Two data sources are used: casualty crashes reported to police (both fatal and injury); and hospital admissions. Tables 7 and 8 utilise reported injury data.

Table 7: Reported casualty crashes: numbers of vehicles involved in crashes involving a cyclist casualty

	Fatal crashes			Injury crashes		
Year	One (cyclist only)	Two or more	Total crash count	One (cyclist only)	Two or more	Total crash count
2008-2010	21%	79%	99	10%	90%	12,915
2011-2013	24%	76%	120	10%	90%	12,005

The probability of non-reporting would probably be higher for single vehicle (cyclist only) crashes than for multiple vehicle crashes. If this was true, the figures of 10 per cent in the injury table would be under-estimates of the true proportions. Overall the proportions have not changed between the two time periods.

Crashes with three or more vehicles comprise approximately 3 per cent of all multi-vehicle crashes involving a cyclist casualty. The next table includes only two-vehicle crashes. It shows the type of vehicle with which the cyclist is colliding.

Table 8: Reported casualty crashes: type of other vehicle in reported two-vehicle crashes involving a cyclist casualty

	Fatal crashes				Injury crashes			
Year	Light vehicle	Heavy truck/Bus	Pedal cycle	Other	Light vehicle	Heavy truck/Bus	Pedal cycle	Other
2008-2010	63%	26%	3%	7%	86%	3%	4%	7%
2011-2013	66%	22%	5%	7%	84%	3%	4%	7%

Also not shown in Table 8 are approximately 60 casualty crashes per year (1.5 per cent) involving a cyclist and pedestrian. Of these, 45 per cent involve an injury to the pedestrian only, 13 per cent involve an injury to the cyclist only, and 40 per cent involve injuries to both. See de Rome et al (2011) for data analysis and discussion on cyclist crashes in the Australian Capital Territory.

Table 9 gives a a similar analysis to that shown in Table 8 but uses hospitalisation data. Counts of cyclists hospitalised with an injury are classified by type of other vehicle involved.

Table 9: Hospitalised injuries: counterpart[a] involved in crashes where a cyclist was hospitalised

	Colliding with another vehicle		
Year	Light vehicle	Heavy truck/Bus	Pedal cycle
2008-2010	80%	5%	16%
2011-2013	81%	3%	16%

[a] In collisions between a person's mode of transport and another vehicle or some other object, the other vehicle or object is called the 'counterpart'. (Henley 2012).

10

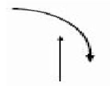
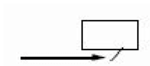
Table 9 is a summary of published and unpublished hospitalisation data. Approximately 25 per cent of cases record the counterpart as unknown, and there are another 25 per cent where the cyclist does not collide with any other vehicle. These categories are excluded from Table 9 to enable better comparison with Table 8. As such, the proportions shown are indicative only.

2.3 Analysis of crash types

'Crash type' as used here refers to a coding used by states and territories to summarise vehicle movements at the time of a crash. The coding is categorised into ten main groups and approximately 80 sub groups. A pictorial representation of the most common crash types for cyclist crashes is provided in Figure 9. See Austroads (2009) for more detail. The main groups are:

- Adjacent Directions (intersection only)
- Same Directions
- Overtaking
- Non-collision (straight)
- Non-collision (curve)
- Opposing Directions
- Manoeuvring
- On Path
- Miscellaneous
- Pedestrian

Figure 9: Common crash sub-groups for cyclist-involved casualty crashes

Main Crash Type	Sub-group		
Adjacent Directions [a] (Intersection only)	 Adjacent directions Cross traffic	 Adjacent directions Left Near	 Adjacent directions Right Near
Same Direction [a]	 Same direction Turning side swipe	Same direction Rear end	 Same direction Lane side swipe
Opposing Directions [a]	 Opposing directions Right thru		
Manoeuvring	 Manoeuvring From Footpath	 Manoeuvring From Driveway	
On Path	 On path Vehicle door		
Non-Collision(Straight)	 Non-collision (Straight) – Out of Control		

[a] Available data is crash-level and does not indicate which vehicle is the bicycle.

Tabulations of casualty crashes by main group and by sub-group are given in Tables 10 and 11 respectively. Single vehicle (cyclist only) and multi-vehicle casualty crashes are separately listed.

Table 10: Reported casualty crashes: crashtype (main groups) for crashes involving a cyclist casualty 2008-2013

Single-vehicle (cyclist only)		Multi-vehicle	
Main Crash type		Main Crash type	
Non-collision (Straight)	61%	Adjacent Directions	29%
Non-collision (Curve)	13%	Same Directions	22%
On Path	11%	Manoeuvring	22%
Pedestrian	5%	Opposing Directions	14%
Manoeuvring	5%	On Path	8%
Other	6%	Other	5%
Total	100%	Total	100%

Table 11: Reported casualty crashes: crashtype (sub-groups) for cyclist casualty crashes, 2008-2013

Single-vehicle (one cyclist only)		Multi-vehicle	
Crash type – Sub group		Crash type –Sub group	
Non-collision (Straight) – Out of Control	47%	Adjacent Directions – Cross Traffic	14%
Non-collision (Straight) – Off Left	10%	Opposing Directions – Right Thru	12%
Non-collision (Curve) – Out of control	8%	Manoeuvring – From Footway	10%
On Path – Object/Animal	5%	Same Directions – Side-Swipe	8%
Miscellaneous – Fell from vehicle	3%	On Path – Vehicle door	7%
Non-collision (Curve) – Off Carr/way at right bend	2%	Manoeuvring – Emerge from Driveway	6%
Pedestrian – Nearside	2%	Same Direction – Rear-end	6%
Other	20%	Same Direction – Turning Side-Swipe	6%
	100%	Adjacent Directions – Right Near	6%
Total case count	1,765	Adjacent Directions – Left Near	5%
		Other	20%
			100%
		Total case count	19,420

In their paper on risk factors in the ACT, Johnson et al (2015) found *Same Direction* interactions to be most frequent, followed by *Adjacent Directions*. See also Orsi et al (2013) for detail on some European cyclist crash configurations. Some of the behaviours of all the road users involved in cyclist crashes are analysed in Goode et al (2014).

The crash types for multi-vehicle crashes can be further analysed depending on the type of other vehicle involved.

Table 12: Reported casualty crashes: crashtype (sub-groups) for reported cyclist casualty crashes by vehicles involved (2008-2013)

Crash type (sub-groups)	Light vehicle	Heavy truck	Bus
Adjacent Direction – Cross Traffic	**15%**	7%	6%
Adjacent Direction – Right Near	6%	5%	1%
Adjacent Direction – Left Near	6%	4%	3%
Opposing Direction – Right Thru	**13%**	6%	4%
Manoeuvring – From Footway	**10%**	**11%**	**15%**
Manoeuvring – From Driveway	7%	**26%**	**32%**
Same Direction – Side-Swipe	7%	**26%**	**32%**
Same Direction – Turning Side-Swipe	7%	10%	7%
Same Direction – Read-end	5%	9%	10%
On Path – Vehicle door	7%	3%	1%
Other	17%	18%	19%
	100%	100%	100%
Total case count	16,329	354	242

The most common crashtype sub-groups in each column are in bold. Where a heavy vehicle is involved, side-swipes and Manoeuvring (from driveway or footway) are prevalent. When a light vehicle is involved, Adjacent direction and Opposing direction crashes are more common.

The final table in this section analyses crash type by the age of the injured cyclist.

Table 13: Reported casualties: crash types by age of the injured cyclist

Main crash type	Age 0-16	Age 25-60
Adjacent Direction – Cross Traffic	**13%**	**12%**
Adjacent Direction – Right Near	4%	6%
Adjacent Direction – Left Near	2%	6%
Opposing Direction – Right Thru	3%	**13%**
Manoeuvring – From Footway	**27%**	4%
Manoeuvring – From Driveway	**13%**	5%
Same Direction – Side-Swipe	4%	9%
Same Direction – Turning Side-Swipe	3%	8%
Same Direction – Rear-end	3%	6%
On Path – Vehicle door	2%	8%
Other		
	100%	100%
Total case count	3,242	14,344

For injured child cyclists, crashes involving manoeuvring vehicles are common. For older injured cyclists, cross traffic, opposing direction and side-swipe collisions are more prevalent. See Hutchinson et al (2010) for a longer term analysis of child cyclist casualties.

3 Exposure / Participation

3.1 Introduction

This section presents summaries of several diverse collections of recent data on cycling in Australia. Included are the National Cycling Participation Survey (Austroads 2013), ABS census data on Journey to work, and selected State/Territory cyclist count data. It is not a complete collection of relevant data, however it is sufficient to identify some common trends.

3.2 Australian Cycling Participation 2013

The Australian National Cycling Strategy 2011-2016 (Austroads 2010) has a goal of doubling cycling participation between 2011 and 2016. From the Strategy:

> *The overarching vision for this strategy is to realise a step-change in attitudes to cycling and in the numbers of riders in this country. In the short term, the goal is to double the number of people cycling over the next five years.* (page 5)
>
> ... ...
>
> *This target should be structured as a composite indicator, reflecting cycling for the purpose of travelling to work/study, recreational cycling and bicycle ownership.* (page 25)

The biennial *National Cycling Participation Survey* (Austroads 2013) is the main tool used to monitor progress towards the Strategy's goals. Two surveys have been carried out to date, with the latest in 2013. The tables below summarise key results.

Table 14: Cycling participation as a proportion of resident population — Australia, 2011 and 2013

	Rode in last 7 days	Rode in last month	Road in last year
2013	16.6%	24.6%	37.4%
2011	17.8%	26.5%	39.6%

Nationally, reported participation fell marginally in 2013 over the 2011 survey. Of the eight jurisdictions, only the Australian Capital Territory and New South Wales reported increased participation. The ACT had the highest participation in 2013 (47 per cent) and SA had the lowest (32 per cent).

The following table reports on participation by capital city and rest of state/territory.

Table 15: Cycling participation — Region of State/Territory, 2011 and 2013

	NSW		Vic		Qld		SA		WA		Tas		NT		ACT	
	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013
Capital city	34%	39%	40%	37%	40%	37%	37%	31%	44%	40%	38%	39%	49%	47%	46%	47%
Other	40%	36%	46%	40%	35%	34%	43%	34%	47%	45%	42%	31%	55%	46%	-	-

Of the capital cities, only Sydney and the ACT reported increased participation.

Age groups and gender at the national level are shown in the next table.

Table 16: Cycling participation — Age groups and gender, 2011 and 2013

2011			2013		
Age (years)	Male	Female	Age (years)	Male	Female
0-9	51%	47%	2-9	48%	41%
10-17	42%	25%	10-17	41%	25%
18-19	17%	10%	18-29	14%	7%
40+	12%	5%	30-49	16%	8%
			50+	9%	3%

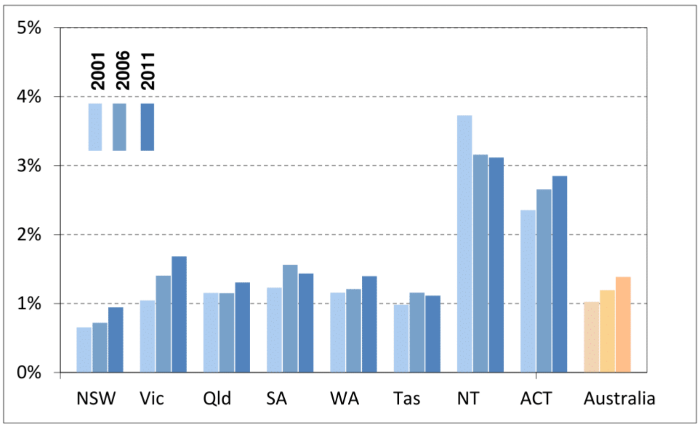
The reported age groups are not consistent across surveys, but in the 10-17 years group, participation is constant. Male participation is significantly higher in all age groups except the youngest (2 to 9 years).

It is clear from Tables 14, 15 and 16 above that reported participation is not generally increasing in Australia. Any changes between 2011 and 2013 are mostly non-significant in a statistical sense, although there are some exceptions to this. See the full reports for more details.

3.3 Australian Bureau of Statistics — Journey to Work

The data presented here is sourced from the censuses carried out in 2001, 2006 and 2011. The proportions shown are those undertaken by bicycle out of all single mode trips by persons aged over 15 years travelling to work. Capital city rates (Figure 10) increased over the three collections to around 1.4 per cent in 2011. Rest-of-state rates (not shown) fell over the three collections.

Figure 10: Journey to Work — proportion of single-mode trips made by bicycle, Capital cities



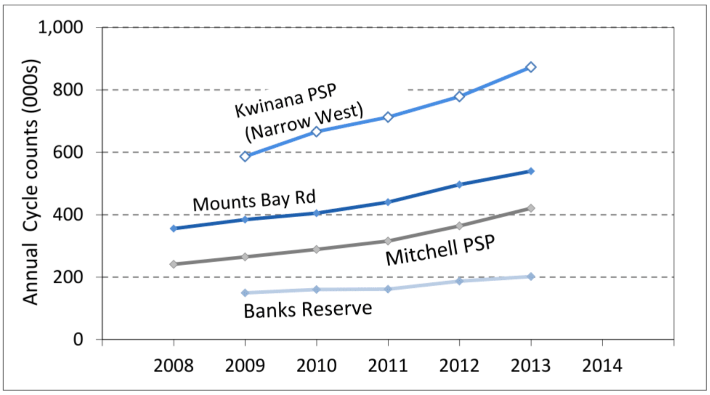
3.4 *City traffic (bicycle) counts*

A number of State and Territory transport agencies publish capital city vehicle traffic counts in map and chart form. The following cycling data is from Western Australia, Victoria and New South Wales.

3.4.1 *Perth*

The Western Australia Department of Transport publishes annual monitoring reports for its Bicycle network, and tabulated counts at each of its many traffic counter locations. Many of these have data for the last five years. A selection of annual counts for several widely separated locations are shown in Figure 11 below.

Figure 11: Annual cyclist counts — selected locations in Perth

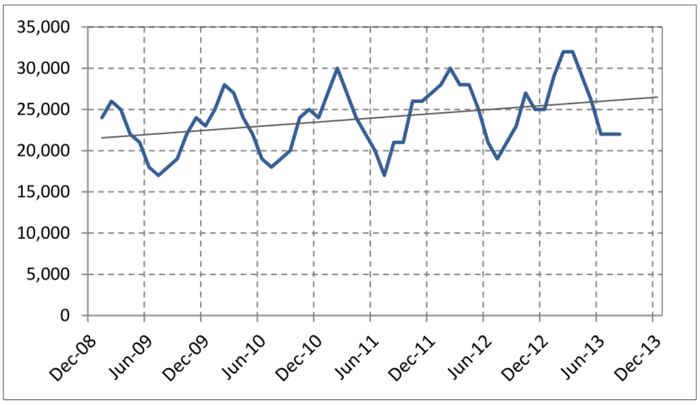


More detail is available at Transport's website:
http://www.transport.wa.gov.au/activetransport/25725.asp

3.4.2 *Melbourne*

Vicroads publishes summaries of bicycle count data, and has available more detailed datasets. The data presented here shows average daily bicycle counts across the total network of VicRoads' Group I sites.

Figure 12: Average Daily Bicycle counts — Total for Group I Sites in Melbourne



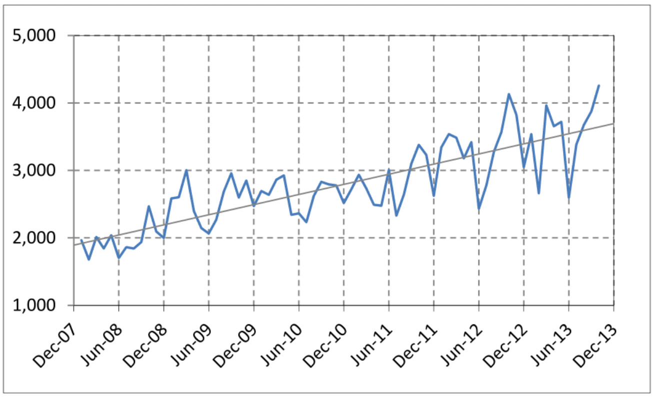
There is a strong seasonality (peaks in late summer and troughs in winter) and an increasing trend of approximately 4.5 per cent per year. More detail on the cycle volume data is available at the following VicRoads website:

https://www.vicroads.vic.gov.au/traffic-and-road-use/road-network-and-performance/road-use-and-performance.

3.4.3 Sydney

Roads and Maritime Services (RMS) publishes site-specific average annual daily traffic (AADT) counts for cyclists at a number of diverse locations throughout Sydney. Some data is also available on an hourly and daily basis enabling analysis of counts during morning and afternoon peak as well as for day of week. The following chart shows the total for five geographically diverse locations over the most recent five years.

Figure 13: Average Daily Bicycle counts — Total for five selected sites in Sydney



Note: The names of the five sites are (briefly) Bicycle path–The Rocks: Cycleway–Anzac Pde: Cycleway–Olympic Park; Cycleway–Baulkham Hills; and Cycleway–Captain Cook Bridge.

A linear fitted trend shows an increase of approximately 10 per cent per year. No analysis of seasonality was performed. Of the 20 site locations shown in the RMS Web tool — http://www.rms.nsw.gov.au/roads/using-roads/bicycles/statistics/index.html, eight show increasing trends, one is clearly decreasing, and for 11 sites, the time period is too short for a trend to be identified.

The increasing trends in cycle counts for the three cities above coincides with recent analysis published by BITRE (2014). See also Pucher et al (2010) for discussion and data on cycling exposure.

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Use of the Coat of Arms

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Appendix C

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Bicycling crash characteristics: An in-depth crash investigation study

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ABSTRACT

The aim of this study was to describe the crash characteristics and patient outcomes of a sample of patients admitted to hospital following bicycle crashes. Injured cyclists were recruited from the two major trauma services for the state of Victoria, Australia. Enrolled cyclists completed a structured interview, and injury details and patient outcomes were extracted from the Victorian State Trauma Registry (VSTR) and the Victorian Orthopaedic Trauma Outcomes Registry (VOTOR). 186 cyclists consented to participate in the study. Crashes commonly occurred during daylight hours and in clear weather conditions. Two-thirds of crashes occurred on-road (69%) and were a combination of single cyclist-only events (56%) and multi-vehicle crashes (44%). Of the multi-vehicle crashes, a motor vehicle was the most common impact partner (72%) and distinct pre-crash directional interactions were observed between the cyclist and motor vehicle. Nearly a quarter of on-road crashes occurred when the cyclist was in a marked bicycle lane. Of the 31% of crashes that were not on-road, 28 (15%) occurred on bicycle paths and 29 (16%) occurred in other locations. Crashes on bicycle paths commonly occurred on shared bicycle and pedestrian paths (83%) and did not involve another person or vehicle. Other crash locations included mountain bike trails (39%), BMX parks (21%) and footpaths (18%). While differences in impact partners and crash characteristics were observed between crashes occurring on-road, on bicycle paths and in other locations, injury patterns and severity were similar. Most cyclists had returned to work at 6 months post-injury, however only a third of participants reported a complete functional recovery. Further research is required to develop targeted countermeasures to address the risk factors identified in this study.

Amy Gillett FOUNDATION *Safe together*

Road crashes involving bike riders in Victoria, 2002–2012: an Amy Gillett Foundation report

By Megan Garratt, Marilyn Johnson and Jacinta Cubis
July 2015

Report Documentation Page

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Keywords: bike rider crashes, fatality, serious injury, Victoria

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1 Executive Summary

There are many benefits to bicycle riding and an increasing number of people in Victoria are choosing to travel by bike to work, for sport and for fun. However, the number of bike rider crashes is also increasing.

This study is a multi-year analysis of bicycle rider crash statistics undertaken using Victorian CrashStats. It clearly shows that there are distinct differences in the crash profiles of fatal bike rider crashes compared to non-fatal crashes. Across all bike rider crashes, the highest proportion occurred in urban areas, mainly metropolitan Melbourne. However, almost half of all bike rider fatality crashes in Victoria occurred in regional areas. Rear-end crashes with the vehicles travelling in the same direction were the crash type which resulted in the greatest proportion of bike rider fatality crashes. Of all bike rider crashes, more were likely to occur at intersections and heavy vehicles were involved in over a third of fatality crashes. While it is important to take action to improve the safety of the circumstances that result in fatality crashes, it is also important to recognise the enormous and increasing number of people who are injured in non-fatal crashes. Given the differences in bike rider crash profiles, countermeasures that reduce fatal crashes may not achieve similar crash reductions in non-fatal crash types. These differences need to be taken into account when considering investment in action to improve bike rider safety.

Bike rider crash analysis is an important component to understanding how to create a safe cycling environment. However, the insight offered by crash data analysis alone is limited and comprehensive data about cycling trip, or exposure data, is required to understand how changes in participation affect crash rates. Further, it is important to acknowledge that while police data provides one of the most comprehensive data sources about road user crashes, there are limitations that need to be considered.

Bike riders are vulnerable road users who, like motorbike riders, often share the road with motor vehicles. In the discussion of the findings, some of the contributing factors to the crash types are identified and solutions to address such factors are highlighted. This discussion of the findings in this report aims to improve the safety of all bike riders in Victoria, and most of the findings are likely to be applicable to bike riders in other Australian states and territories. The findings could also contribute to a safe road environment for motorbike riders, as many of the same issues affect the safety of all two-wheeled vehicles.

Note: It is important to note that this report contains **analysis of crashes reported to Victoria Police**. While Victorian law requires that injury road crashes must be reported to police, research shows that not all bike rider crashes are reported to police. Reasons for non-reporting include: little or no property damage; perception of wasting scarce police resources; fear that a report may result in prosecution; crashes where the bike rider is the only injured party; misconception that crashes involving bike riders are not road traffic crashes; and misclassification of injury severity.

As a result, police-reported crashes are highly likely to involve a motor vehicle, often considered the trigger for reporting the crash to police. This trigger for reporting crashes to police is an important context when analysing bike rider crashes in this dataset.

1.1 Summary of police-reported bike rider crashes

- Period analysed: 1 January 2002 to 31 December 2012
- Bike rider crashes have increased annually since 2003 (police and hospital reported crashes)
- Total number of bike rider crashes: 14,270 100%
  - Fatality 86 0.6%
  - Serious injury 4582 32.1%
  - Other injury 9602 67.3%

Bike rider crashes – all

- Gender: 77% male
- Age: 85% adult
- Location: 81% metropolitan Melbourne
- Crash type: 23% vehicles from same direction
- Geometry: 60% at intersections
- Motor vehicle: 90% involved a motor vehicle – 4.3% involved a heavy vehicle
- Speed zone: 77% in 50kph or 60kph zones
- Helmet: 75% yes
- 9% of all non-fatal crashes were the result of a driver or passenger opening a vehicle door

Fatal bike rider crashes

- Gender: 82% male
- Age: 49% aged 30-59 years
- Location: 52% metropolitan Melbourne, 48% regional Victoria
- Crash type: 49% vehicles from same direction (including 26% rear end)
- Geometry: 65% **not** at intersections (e.g. mid-block)
- Motor vehicle: 87% involved a motor vehicle – 35% involved a heavy vehicle
- Speed zone: 36% in 50kph or 60kph zones – 59% in speed zones of 70kph or higher

Serious injury bike rider crashes

- Gender: 78% male
- Age: 48% aged 18-39 years
- Location: 80% metropolitan Melbourne
- Crash type: 20% vehicles from the same direction
- Geometry: 58% at intersections
- Motor vehicle: 86% involved a motor vehicle – 6% involved a heavy vehicle
- Speed zone: 75% in 50kph or 60kph zones

Other injury bike rider crashes

- Gender: 76% male
- Age: 50% aged 30-59 years
- Location: 82% metropolitan Melbourne
- Crash type: 23% vehicles from the same direction
- Geometry: 61% at intersections
- Motor vehicle: 91% involved a motor vehicle – 3% involved a heavy vehicle
- Speed zone: 78% in 50kph or 60kph zones

- While police-reported crashes provide the most comprehensive publicly available data, these data must be used with caution, as:
  - not all crash types are reported to police (e.g. crashes that did not involve a motor vehicle)
  - bicycle rider crashes are less likely to be reported to police
  - police reports do not include all crash types (e.g. bicycle rider-only crashes).
- 2.41 times more bike rider crashes were reported to hospital compared to all police-reported bike rider crashes.
- A category that clearly differentiates electric bikes needs to be added to the reported bike rider crash data. Electric bike uptake is rapidly increasing and Australian research shows their crash profiles differ compared to those of pedal bicycles. Electric bikes need to be clearly identified in the crash data to ensure accurate monitoring compared to pedal bikes over time.

2 Introduction

Each week in Victoria, 1.08 million people ride their bikes (Victorian Government 2012). However, bike riders have a significantly higher crash risk compared to vehicle occupants. Research shows that when bike riders and drivers travel the same distance, bike riders have a fatality risk 4.5 times that of vehicle occupants and the relative risk of injury is 13 (police data) or 34 (hospital data) compared to driving (Garrard et al. 2010).

This study has been undertaken with support from the TAC Community Road Safety Grant (Round 11) with funding awarded for the Road Right – Drive Rules Program project application to provide an update of bicycle rider crashes in Victoria from 2002 to 2012. The purpose of the study is to improve our understanding of the characteristics of the bicycle rider crashes that were reported to police over that period. The study includes a Background which provides an overview of cycling in Victoria including participation and crashes, followed by the Study Design, Results and Discussion.

The publicly available CrashStats database of road trauma crashes was analysed for crashes involving bike riders. The following analyses were conducted:

- Overview of bike rider crashes
- Characteristics of bike riders who crashed, including analysis by injury outcome
- Characteristics of bike rider crashes, including crash type, motor vehicle involvement
- Mapping crashes: identifying locations with high volume of bicycle rider fatality crashes

2.1 Background and context

Bicycle riders are one of the most physically vulnerable road user groups that travel on our roads. They are recognised by law as legitimate road users, but the space for bike riders on Victorian roads varies from fully separated (e.g. fully separated cycle lanes in Melbourne) to symbolically or notionally separated (e.g. bike lanes, wide kerbside lanes) to completely intermingled travel with motorised vehicles, ideally in slow-speed streets (Levasseur 2014). Australia's cycling environment contrasts with extensive networks of physically separated facilities for cycling that exist in European countries with high cycling participation (Pucher et al. 2010). In Australia, the interaction with vehicles on the road contributes to a higher rate of bike rider fatality and serious injury crashes compared to Europe (Garrard et al. 2010).

2.2 Cycling participation in Victoria

In Victoria, an increasing number of people are riding their bike for transport and recreation. The Victorian Government's Cycling Strategy (Victorian Government 2012) reported strong growth in cycling from 2001 to 2011, with 1.08 million Victorians riding a bike each week and, among commuters, that increase was 5 per cent each year.

At a public policy level, there is widespread support for cycling. State and local governments consistently promote cycling as a viable active transport option, acknowledging that a small increase in active transport can lead to positive outcomes for the transport system. These outcomes include increased capacity, reduced vehicle congestion and environmental impacts, improved public health and reduced healthcare costs, and improved community wellbeing and social cohesion (Victorian Government 2012).

The intentions of the state government bode well for bike riders and bike rider safety (Victorian State Government 2013), with short-term goals of speed reduction to 40kph in areas with high volumes of bike riders, greater separated crossings at major roads, working with local councils to develop strategic cycling corridors and a focus on creating '20 minute neighbourhoods' with every suburb within a short commute to everyday services and jobs.

The Victorian Government, along with many Victorian regional and metropolitan local governments, has incorporated bike riding into its transportation and sustainability strategies. Regional centres such as Geelong, Ballarat, Bendigo, Wodonga, Shepparton and Horsham have included plans to increase regional bike riding facilities, improve cycling safety and incorporate bike networks in town planning (Hennessy Services 2007, Ratio Consultants 2007, City of Greater Geelong 2008, Victorian State Government 2013, Greater Shepparton City Council 2014).

Cycling-inclusive public policies are an important and positive step to creating a safer cycling environment; however, in Victoria, while we wait for these aims to be realised, there has been a concurrent increase in the number of bike rider crashes.

2.3 Literature review of Victorian bicycle rider crashes

The scientific literature has been reviewed for recent publications (2010 to 2014) that analysed bicycle rider crashes in Victoria and are discussed below.

Garrard and colleagues (2010) compared risk of injury outcomes crashes between bike riders and vehicle occupants (drivers and passengers) in metropolitan Melbourne. When bike riders and drivers travelled the same distance, bike riders had a fatality risk 4.5 times that of vehicle occupants and the relative risk of injury was 13 (police data) or 34 (hospital data) compared to driving. While the authors caution the use of fatality figures due to the low and highly variable number, they concluded that the car-centric nature of many road safety measures in Australia means they have done little to improve bike rider safety.

Andrew and colleagues (2012) reviewed sports and recreation trauma in Victoria from 2001 to 2007. They reported that cycling-related trauma increased by 16 per cent per year. Of note were crashes with motor vehicles travelling at speeds greater than 24kph (>15mph). The authors reported that it is difficult to determine the extent to which increased cycling participation has contributed to the increase in cycling related trauma, a data limitation that has been repeatedly identified in the literature (Sikic et al. 2009, Garrard et al. 2010).

> 'SmartRoads focuses on the most efficient ways to move people and goods, rather than vehicles. It promotes safety outcomes by being particularly responsive to pedestrian activity and separation for cyclists, and it has an inbuilt bias towards sustainable modes, recognising that they have the greatest potential to accommodate future growth in demand, as well as the improved amenity and environmental outcomes they deliver.'
>
> Plan Melbourne, May 2014, p87

A review of police-reported crashes in Victoria between 2004 and 2008 by Boufous and colleagues (2012) identified the following risk factors that increased the risk of severe injury in bike rider–motor vehicle crashes:

- Age – riders aged 50 years or older were twice as likely to be severely injured as younger bike riders
- Not wearing a helmet – 56% increased risk of severe injury
- Speed limits – risk increased proportionally with road speed limits
- Riding at night – especially in areas that were unlit or had poor lighting
- Curved sections of road – 86% increased risk compared to straight roads
- Crashes in rural Victoria had a higher risk of severe injury (and fatality) because of higher

speeds in rural areas, involvement of alcohol, lack of cycling infrastructure and delays of medical care post-crash.

Boufous and colleagues (2013) analysed police and hospital bike rider crash data for the same period to compare single- versus multiple-vehicle bike rider crashes in Victoria. The total reported number of crashes reveals a significant disparity, with twice the number of bike rider crashes reported in hospitals records (n=6432) compared to police (n=3937) bike rider crashes. Of the crash types, multiple-vehicle crashes were the majority of police-reported crashes (95.1%), yet multiple-vehicle crashes were less than half (45.1%) of hospital records. The authors conclude that police reports include valuable crash data; however, single-vehicle crashes are significantly underreported. Yet, while hospital records better capture incident prevalence, there is a lack of crash-related data. Of the single-vehicle crashes, the bike riders' loss of control was reported as the main cause of the crash (82.6% police; 86.7% hospital). However, as the authors noted, these data may be affected by subjective opinion at the time of the crash, rather than extensive investigation. Further, it is possible that a single vehicle crash is the result of a bike rider losing control after taking evasive action to avoid a crash with a vehicle but this is not reported.

Recognising the limitations of the two data sources (police and hospital), Biegler and colleagues (2012) conducted an in-depth crash investigation with 158 bike riders who had crashed and presented to either the Sandringham or Alfred hospitals in Melbourne. Major findings related to bike rider crashes included:

- Majority of bike riders who crashed were regular bike riders; 81% cycled 2–3 times per week, including 62% who cycled more than 3 times per week
- 93% of riders wore a helmet, of whom 45% sustained helmet damage due to a head strike during the crash
- Crash type: 39% multiple-vehicle; 60% single vehicle
- Loss of control was the main cause of single-vehicle crashes, coded from the rider's description of the crash
- Factors affecting the risk of a head injury:
    - Bike rider speed before the crash; estimated odds of sustaining a head injury compared to a bike rider travelling below 20kph:
        - 20–29kph: 2.7 times the risk of head injury
        - 30kph and over: 4.9 times the risk of head injury
    - Helmet use: 1.8 times higher risk of head injury if not wearing a helmet compared to wearing a helmet.

In their analysis of police and hospital reported data, Boufous and colleagues (2013) reported that loss of control was the main cause of bike rider crashes, particularly in single-vehicle crashes (police 82.6%; hospital 86.7%). However, there is little causal data available to determine the contributing factors in a crash, especially in the hospital-reported data. Indeed, in their study involving in-depth interviews with bike riders who had crashed, Biegler and colleagues (2012) reported that loss of control was the main contributing factor in only seven of the total of all crashes (4.4%). In more detailed analysis of crash events, there is a preceding event that causes the loss of control: four riders lost their balance (e.g. while attempting to throw a banana peel onto the roadside, travelling over a speed hump), one rider's shoe slipped in the rain, one rider's sunglasses fell off causing sudden braking and loss of control, and one rider lost control when the exercise mat they were carrying was caught in the wheel.

It is important to deconstruct the events preceding a crash to fully understand the factors that contribute to the crash event. ‘Loss of control’ is a vague and overarching classification that does not offer meaningful insight into the factors that contributed to the crash and cannot be effectively used to develop countermeasures to improve bike rider safety.

A review of Transport Accident Commission (TAC) claim data provides additional crash type context. Ruseckaite and colleagues (2012) reviewed a total of 204,315 adult claims for injury and death compensation made to the TAC from 1995 to 2008, of which road user type was available for 199,002. The authors’ focus was on healthcare following transport injury for all road user types and they reported that bike riders were 3.5 per cent of all analysed adult claims where road user type was available (n=7004). Of the bike rider claims, the majority (61.5%) were for transport injuries that did not require hospitalisation, with 38.5 per cent resulting in hospital admissions (38.5%). This proportion of non-hospitalised compared to hospital admissions was comparable to the claims made by drivers (67.8%) and passengers (65.5%), but was higher than the proportions reported for motorcycle riders (42.2%) and pedestrians (44.9%).

Of note is a recent collaborative study by researchers from Victoria and the Netherlands that analysed trauma outcomes for bike rider crashes in Victoria and the south-west Netherlands (Yilmaz et al. 2013). They reported that head injury is a leading cause of death and long-term disability from bicycle crash injuries and it may be prevented by wearing a helmet. Bike riders who presented to hospital in the Netherlands suffered from more serious head injuries than patients in Victoria. The authors concluded that there was a higher mortality rate associated with a higher percentage of serious head injuries in the Netherlands compared to Victoria and that the head injuries may have been preventable with the use of a bicycle helmet (Yilmaz et al. 2013).

Recent reviews of bike rider crashes have provided insight into the types of crashes that occur. The reviews also highlight the gaps in the data that are available and the limitations in using police and hospital data to understand bike rider trauma crashes. Despite these limitations, it is important to maintain regular reviews of the data to monitor changes over time and to investigate those factors that are reported. Such evidence is essential to informing action to improve safety for all bike riders.

3 Study Design

The purpose of this study is to increase our understanding of police-reported bike rider crashes for the period 1 January 2002 to 31 December 2012 using the publicly available internet edition of CrashStats, the Victorian crash statistics and mapping program delivered by the state road authority, VicRoads. Data were not available for the entire year for 2013; therefore, this report includes data up until 31 December 2012, the most recent full-year data that were available at the time of preparing this report.

The following analyses were conducted:

- Overview of bike rider crashes
- Characteristics of bike riders who had crashed, including analysis by injury outcome
- Characteristics of bike rider crashes, including crash type, motor vehicle involvement
- Mapping crashes: identifying locations with high volumes of bicycle rider crashes.

To provide context for the changes in bike rider crashes in Victoria, a brief overview of data from 1 January 1987 is also included. All figures included in the main body of the report are those generated by the query “Location is Region(s): TOTAL VICTORIA; Road User Type is Bicyclist; Date range is 01/01/2002 to 31/12/2012”.

3.1 Definitions

3.1.1 Injury outcome

Definitions for injury outcomes used in this report were taken from the VicRoads CrashStats User Guide (VicRoads 2008) and are as below:

Fatality injury:	killed or died within 30 days of the crash
Serious injury:	sent to hospital, possibly admitted
Other injury:	typically required medical treatment (e.g. bruising, pain, soreness)

3.1.2 Locations

In this report, location data is presented in two classifications. The first is a distinction between metropolitan Melbourne and regional Victoria. The CrashStats data categorise Victoria into nine categories from Melbourne CAD (Central Activity District) to Rural (VicRoads 2008). The list below shows how these VicRoads location descriptors were classified in this study.

Location	Study classification
Melbourne CAD	Metro Melbourne
Urban Melbourne excluding CAD e.g. suburbs	Metro Melbourne
Other Urban Areas in MSD <Melbourne Statistical Divisions) e.g. small outlying towns	Metro Melbourne
Large provincial cities	Regional Victoria
Small provincial cities	Regional Victoria
Other cities/towns	Regional Victoria
Small towns	Regional Victoria
Hamlets	Regional Victoria
Rural i.e. ‘open road’	Regional Victoria

8

Second, municipal or local government areas were also used in the analysis of crash trends over the period (2002–2012). In total, there are 79 separate municipalities in Victoria and 7 unincorporated areas. The maps below show the metropolitan Melbourne and regional Victorian municipalities.

Figure 1 Map of metropolitan Melbourne Local Government Areas (LGAs)
Source: File:Australia Victoria location map.svg

Figure 2 Map of Victorian (non-metro) Local Government Areas (LGAs)
Source: File: Australia Victoria location map.svg

3.1.3 Definitions for Classifying Accidents (DCAs)

All crashes reported to police in Victoria are coded using the Definitions for Classifying Accidents or DCA codes, which are included in the CrashStats database. In these codes, vehicles in a crash, up to two vehicles, are positioned relative to each other, then travel direction and point of conflict are identified. Crashes are coded under ten classifications:

- Pedestrian on foot, in toy/pram
- Vehicles from adjacent directions (intersections only)
- Vehicles from opposing direction
- Vehicles from same direction
- Manoeuvring
- Overtaking
- On path
- Off path on straight
- Off path on curve
- Passenger and miscellaneous

Each category consists of up to nine scenarios that depict the movements of the road users immediately preceding the crash. Bicycle rider crashes have been analysed by DCA code in this report. A full list of DCA codes and their illustrative diagrams is included as an appendix.

3.2 Limitations

There are two major limitations to using police-reported data to understand how crashes involving bike riders occurred. The first limitation is the CrashStats dataset itself and the second is that not all cycling-related crashes are reported to police. While many bicycle rider crashes may not require reporting to police (e.g. a child falls on a footpath), there is also a gap in reporting of serious bicycle rider crashes to police (Sikic et al. 2009). A report by Victoria Police suggested that as few as 1 in 30 bicycle rider crashes are reported to police (Harman 2007).

3.2.1 CrashStats data

CrashStats is a repository of police reports from traffic crashes that have been logged in Victoria since 1987. Over this time there have been changes made to the reporting methods and technology used to manage the data, and for this reason a number of limitations exist and have been identified by VicRoads (2008):

- In 1989 there was a change to injury classification and definitions
- In 1990 a change was made to the collection of road surface type data; prior to this time, only one road surface type was recorded, but since 1990 the road surface type for each vehicle involved the crash has been recorded
- Real times of crashes are rarely known and it is common for police to round to the nearest five-minute interval or hour when estimating the time of a crash
- There are occasional discrepancies in the number of reported persons in crash events depending on the type of query run through CrashStats; this is significant in the Age/Sex Summary queries
- In 2005 the method of recording crash information was changed from a paper-based form to electronic coding; this particularly affects data relating to non-fatal crashes

3.2.2 Gaps in reporting of crashes

It is widely recognised that not all bike rider crashes are reported, both in Australia and internationally, and this is a significant limitation of many cycling studies (Agran et al. 1990, Harris 1990, Schlep and Ekman 1990, Ameratunga et al. 2006, Veisten et al. 2007, Sikic et al. 2009). Unlike bike rider fatality crashes, there is no legal requirement to report non-fatal bike rider crashes to police, especially if there is no property (vehicle) damage, despite some crashes resulting in serious injuries to cyclists. As a result of this lack of reporting, analysis of bicycle rider crashes using solely police data is likely to underrepresent the magnitude of cycling crashes. In a report by Victoria Police, Harman conservatively estimated that only 1 in 30 non-fatal bike rider crashes is reported (Harman 2007). Further, studies that examined police and hospital reported crashes for all road users show that not all non-fatal injuries are reported to police. A study of underreporting of NZ road trauma reported that less than two thirds of all hospitalised road crash victims were reported to police (Alsop and Langley 2001).

Researchers have cautioned against using official crash records to quantify or investigate bike rider crashes, due to the extensive underreporting (Bull 1975, Lindqvist 1991, Welander et al. 1999, Stone and Broughton 2003, de Lapparent 2005, Gavin et al. 2005, Lujic et al. 2008, Sikic et al. 2009). With this caution in mind, in this study we obtained the numbers of hospital-reported bike rider crashes to determine the level of difference. We also recognised that there are likely to be a high number of injury crashes that are also not reported to hospital: riders may not seek medical attention or may be treated by other healthcare professionals who do not need to report these crashes centrally.

It is important to note that the criterion for a crash to be reported on CrashStats is that the police recorded the event, either at the scene or post-event with a physical report at a police station. Typically this means that there has been physical or property damage in the crash (i.e. usually motor vehicle damage) that requires formal reporting, often as part of the insurance cost-recovery process. This is an important distinction, as this 'vehicle damage' trigger is likely to lead to a greater proportion of vehicle-involved crashes being reported and is likely to overrepresent the proportion of vehicle-involved cycling crashes. This is particularly important in bike rider crashes, as a crash with minor/no property damage may still result in serious personal injury.

3.3 Hospital data

Given that not all bike rider crashes are reported to police, hospital data on bike rider crashes in Victoria for the same period was obtained from the Victorian Injury Surveillance Unit (VISU) to provide a broader context for bike rider crashes. These data were extracted from the Victorian Admitted Episodes Dataset (VAED) and the Victorian Emergency Minimum Dataset (VEMD). The VAED is collected from all Victorian public and private acute hospitals including rehabilitation centres, extended-care facilities and day-procedure centres. The VEMD is collected from 39 Victorian hospital emergency departments. The data presented below are a summary of both the VAED (admitted to hospital) and the VEMD (non-admissions) datasets.

In Victoria, over the period from 2002 to 2012, a total of 34,417 bike rider crashes were reported in the hospital datasets, compared to 14,270 reported to police. However, it is important to clarify that the majority of all police-reported crashes occurred on-road (97%) whereas of the bike riders who presented to hospital, the majority were in a traffic environment (i.e. public road space) (61.7%) and almost a third (38.3%) occurred in a non-traffic environment.

In total, over the period from 2002 to 2012, 2.41 times more bike rider crashes were reported to hospital compared to all police-reported bike rider crashes. Table 1 shows the number of police-reported and hospital reported bike rider crashes. Figure 3 shows the number of police-reported bike rider crashes compared to hospital-reported crashes for both traffic related crashes and all bike rider crashes by year from 2002 to 2012.

Table 1 All police and hospital (in-traffic) reported bike rider crashes in Victoria, 2002-2012

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Police	1,144	1,034	1,204	1,256	1,210	1,272	1,338	1,441	1,449	1,527	1,395	14,270
Hospital	2,372	2,579	3,046	3,316	3,528	3,766	3,544	3,511	3,149	2,858	2,748	34,417

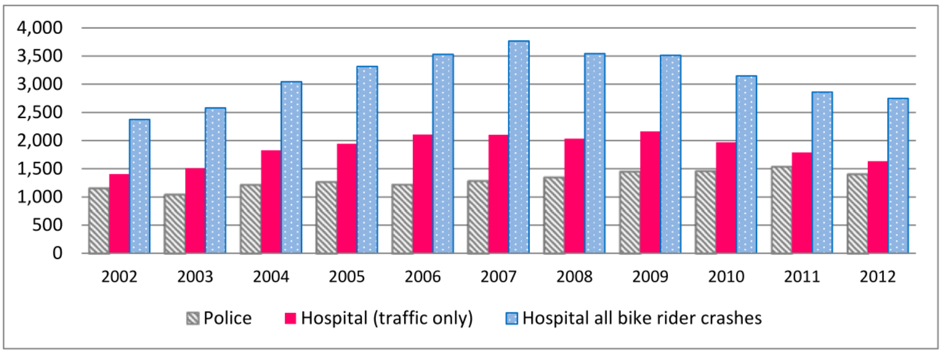


Figure 3 All police and hospital (traffic and all bike rider crashes) reported bike rider crashes in Victoria, 2002-2012

3.3.1 Bike rider crashes as a proportion of all road crashes

Nationally in Australia, bike rider crashes account for 18 per cent of all serious injury land transport crashes (Henley and Harrison 2009). Given the difference between police and hospital reported bike rider crashes in Victoria, the percentages of all bike rider crashes as a proportion of all road crashes were calculated for each dataset.

The annual number of reported crashes for each road user group was calculated using the denominator for that dataset. That is, the numbers of police-reported bike rider crashes were standardised using total numbers of police-reported crashes for all road users and the numbers of hospital-reported bike rider crashes were standardised using the total numbers of hospital-reported crashes for all road users.

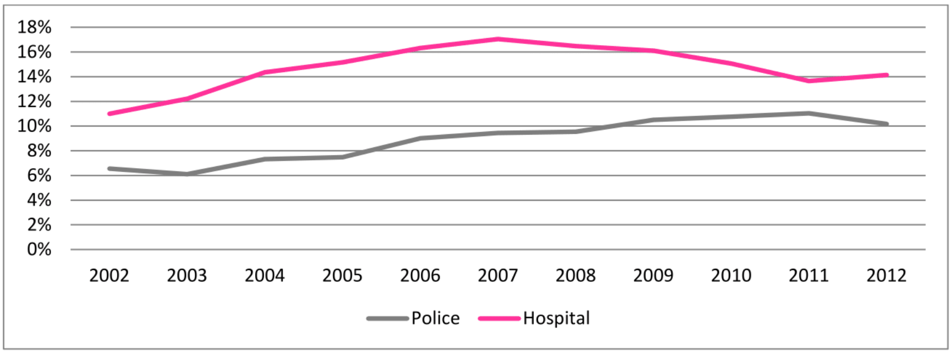


Figure 4 Percentage of all bike rider crashes as a proportion of all road crashes in Victoria, 2002-2012

Across the 11-year period, as a proportion of all road crashes, the number of police-reported bike rider crashes averaged 8.9 per cent, whereas hospital-reported bike rider crashes comprised 14.7 per cent of all road crashes. The hospital data are comparable to the nationally reported data that bike riders comprise 18 per cent of all road trauma crashes.

On average, bike rider crashes account for:

- *8.9% (police data)*
- *14.7% (hospital data) of all road crashes in Victoria (2002–2012)*

Clearly, identifying that fewer bike rider serious injury and minor injury crashes are reported to police compared to those recorded in hospital data provides important context.

However, hospital data do not provide any data on the crash circumstances and therefore cannot be used to understand how crashes occurred, and more importantly, identify action that may prevent future crashes. Despite its limitations, CrashStats provides the singular most comprehensive data source of road user crashes. No other publicly available and routinely published data provide the same level of detail about crash circumstances.

4 Results

Results are presented in three sections:

1. An overview of all bike rider crashes from the CrashStats database (1987–2012)
2. Analysis of all bike rider crashes from 2002–2012
3. Area analysis of bike rider crashes, including mapped crashes

4.1 Overview of police-reported crashes

Figure 5 is a graph of all police-reported bicycle rider crashes from 1987 to 2012. This graph is included to provide context for the changes in bike rider crashes (fatality, serious injury, other injury) over that period. The primary Y axis (columns) shows the total number of bike rider crashes, including fatality, serious injury and other injury crashes. The line on the secondary Y axis (line) shows bike rider crashes as a proportion of all road crashes.

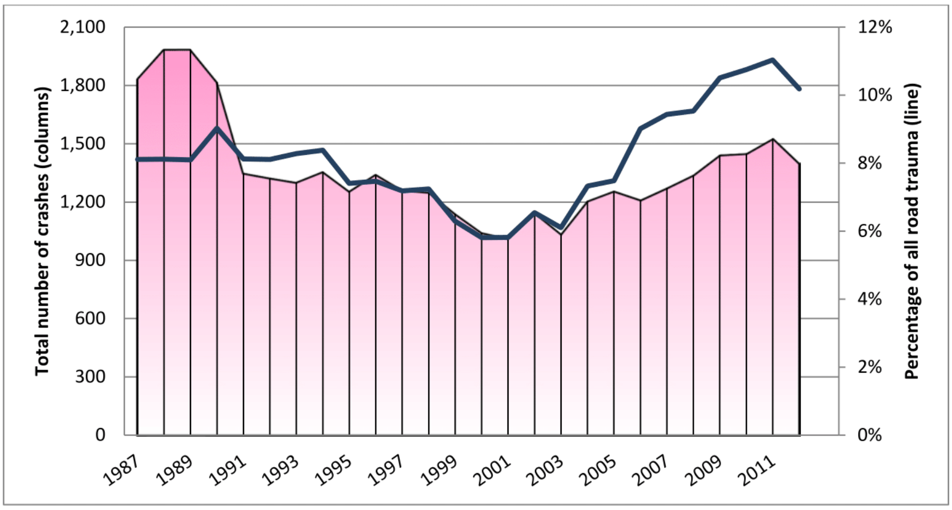


Figure 5 All bike rider crashes (fatalities, serious injuries and other injuries) in Victoria: total number of reported events and percentage of total road toll, 1987-2012

Over the past 25 years, 35,515 bike riders have been involved in crashes, equating to over 1,000 riders every year. Since 2002, the proportion that bike rider crashes account for in the total road toll has increased from a low of 5.8% (2001) to 11.0% (2011).

Figure 6 presents all crashes by injury severity for all bicycle rider road trauma crashes over the 25 year period from 1987 to 2012. The majority of all crashes were other injury crashes (68.8%), with almost a third of crashes resulting in serious injuries (30.4%) and 1 percent of police reported bicycle rider crashes were fatalities (0.9%; n: 314).

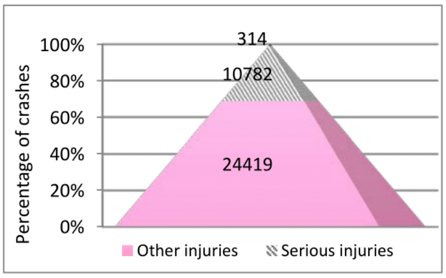


Figure 6 All bike rider crashes in Victoria by injury outcome, 1987-2012

The focus of this report is the period from 2002 to 2012. The remainder of the results included in this report is for this period.

4.2 Analysis of police reported bike rider crashes (2002–2012)

4.2.1 Injury outcomes

From 2002 to 2012, 14,270 bicycle riders were involved in road trauma crashes. While the broader historical context shows that the total number of bicycle rider road trauma crashes has decreased since the late 1980s, there has been a steady annual increase in both the number of bike rider crashes and the proportion of all road trauma crashes (Figure 7) since 2003 (1034 crashes).

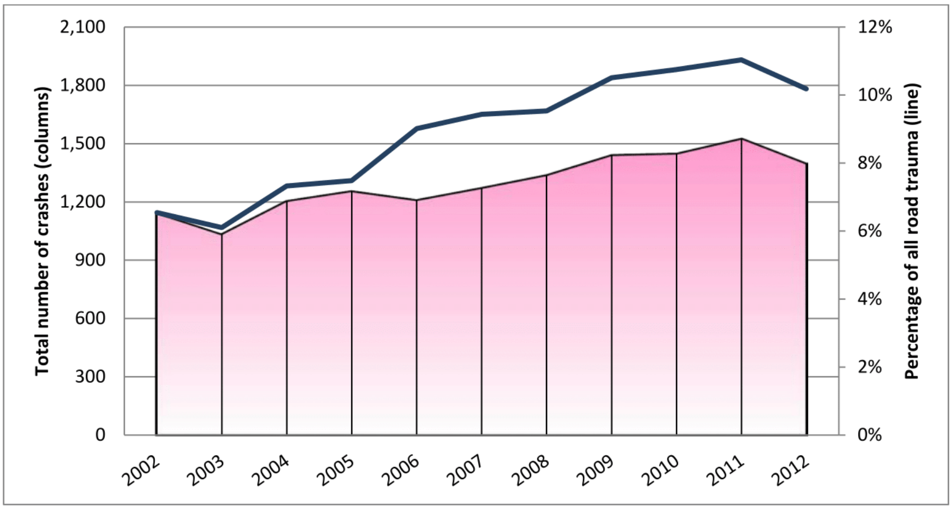


Figure 7 All bike rider crashes (fatalities, serious injuries and other injuries) in Victoria: total number of reported events and percentage of total road toll, 2002-2012

The charts below show the annual number of bike rider crashes by injury outcome for the period 2002-2012. The serious injury category includes people whose crash resulted in an outcome of total and permanent disability.

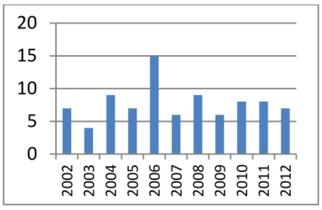


Figure 8 All fatal bike rider crashes in Victoria, 2002-2012

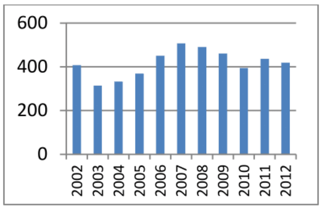


Figure 9 All serious injury bike rider crashes in Victoria, 2002-2012

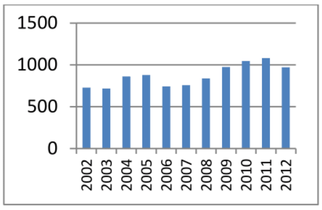


Figure 10 All other injury bike rider crashes in Victoria, 2002-2012

4.2.2 Bicycle rider characteristics

Gender

More males were involved in bicycle rider crashes than females (Figure 11). While there is a perception of higher risk-taking behaviour among males than females, this cannot be determined from these data. The overrepresentation of males may be a function of exposure, as a larger proportion of the known cycling population in Victoria, and Australia, is male (in Victoria, rode in past 7 days: males: 20.9%, females: 12.4%; rode in past month: males: 29.9%, females: 19.3%; rode in past year: males: 43.9%, females: 31.1%) (Australian Bicycle Council and Austroads 2013).

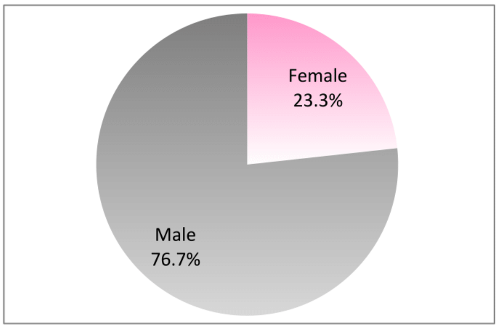


Figure 11 All bike rider crashes in Victoria by gender, 2002–2012

The following three charts show the proportion of bike riders by gender by crash injury outcome.

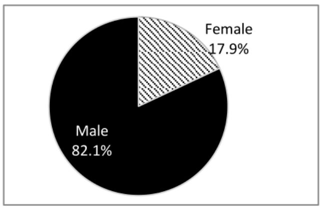


Figure 12 All fatal bike rider crashes in Victoria by gender, 2002-2012

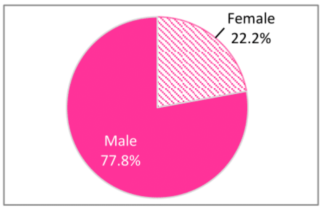


Figure 13 All serious injury bike rider crashes in Victoria by gender, 2002-2012

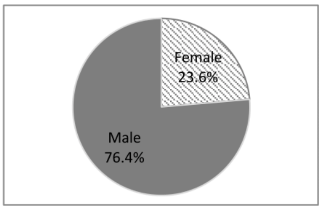


Figure 14 All other injury bike rider crashes in Victoria by gender, 2002-2012

16

Age

The age distribution is presented by gender in Figure 15. Adult riders (aged over 18 years) were involved in the majority of bicycle rider crashes that were reported to police (84.2%) with a third of all crashes involving bicycle riders aged 30-49 years (34.5%). As discussed in Gender above, this crash distribution is likely to be a function of exposure, as opposed to inherent differences in risk-taking behaviour among particular age groups.

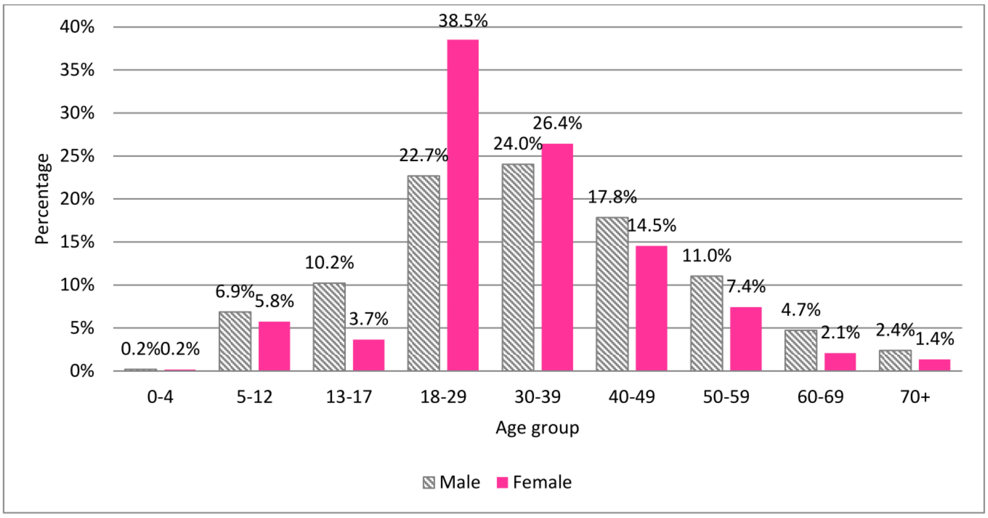


Figure 15 All bike rider crashes in Victoria by age and gender, 2002-2012

The following three charts show the proportion of bike riders by age by crash injury outcome.

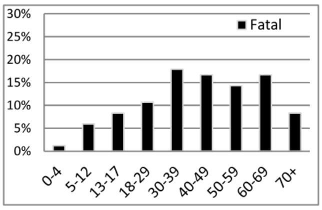


Figure 16 All fatal bike rider crashes in Victoria by age, 2002-2012

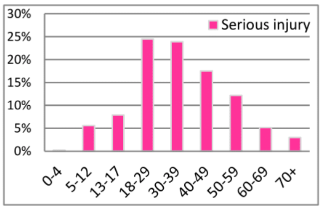


Figure 17 All serious injury bike rider crashes in Victoria by age, 2002-2012

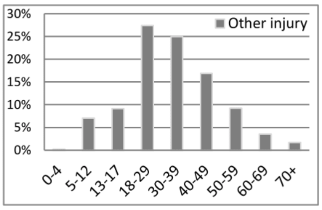


Figure 18 All other injury bike rider crashes in Victoria by age, 2002-2012

Helmet use

Across the study period, three quarters of bike riders (74.6%) were reported to have been wearing a bicycle helmet at the time of the crash. Helmet use is presented per year in Figure 19.

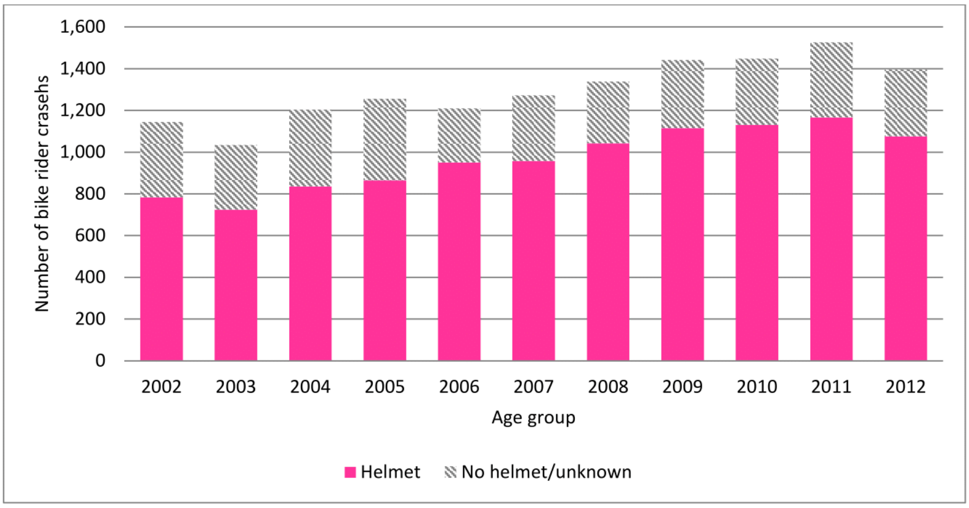


Figure 19 Helmet wearing and non-helmet wearing/unknown by all bike riders for all injury outcome crashes in Victoria, 2002-2012

The following three graphs display the reported percentage of helmet wearing and non-helmet wearing of bike riders who have crashed by injury outcome.

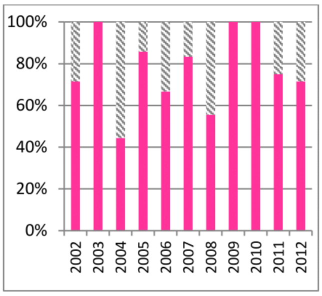


Figure 20 All fatal bike rider crashes in Victoria by helmet wearing and non-wearing/unknown, 2002-2012

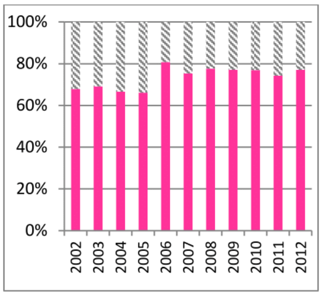


Figure 21 All serious injury bike rider crashes in Victoria by helmet wearing and non-wearing/unknown, 2002-2012

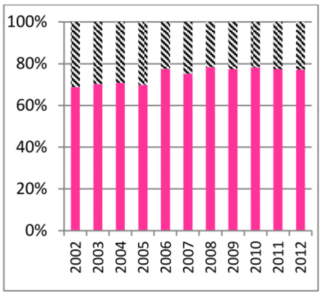


Figure 22 All other injury bike ride crashes in Victoria by helmet wearing and non-wearing/unknown, 2002-2012

4.2.3 Crash characteristics

Time of day

The bike rider crashes were distributed across the day (Table 2, Figure 23). Most crashes occurred during peak travel times, 8am to 10am (19.3%) and 4pm to 6pm (18.6%). The fewest crashes occurred from midnight to 6am (2.2%). Crashes by time of day by injury outcomes are also graphed to illustrate the variation across the three injury categories.

Table 2 All bike rider crashes in Victoria by time of day and injury outcome, 2002–2012

Time of day	Fatal	Serious injury	Other injury	Total	Per cent
Midnight to 6am	3	124	185	312	2.2
6am to 8am	10	525	1035	1570	11.0
8am to 10am	15	830	1908	2753	19.3
10am to midday	11	404	906	1321	9.3
Midday to 2pm	7	424	897	1328	9.3
2pm to 4pm	10	487	1197	1694	11.9
4pm to 6pm	13	847	1794	2654	18.6
6pm to 8pm	11	617	1221	1849	13.0
8pm to midnight	6	319	456	781	5.5
Total	**86**	**4577**	**9599**	**14,254**	**100**

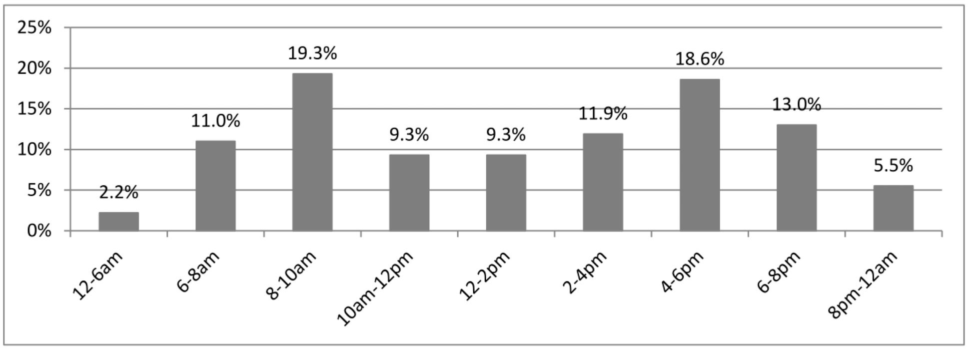


Figure 23 All police-reported bike rider crashes in Victoria by time of day, 2002–2012

The following three charts show the proportion of crashes by time of day by crash injury outcome.

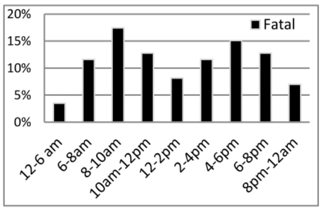


Figure 24 All fatal bike rider crashes in Victoria by time of day, 2002-2012

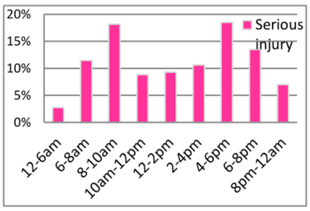


Figure 25 All serious injury bike rider crashes in Victoria by time of day, 2002-2012

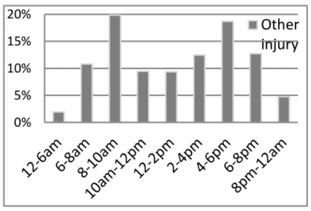


Figure 26 All other injury bike rider crashes in Victoria by time of day, 2002-2012

Light conditions

The majority of all bike rider crashes occurred during the day (76.4%) with 12.5 per cent occurring at night and 10.1 per cent at dusk/dawn (Figure 27). The time the crash occurred was reported for almost all bike rider crashes (99.1%). Crashes by light condition are also included by injury outcome to illustrate the variation in light conditions across the three categories. Again, the high proportion of daytime crashes is likely to be a function of exposure.

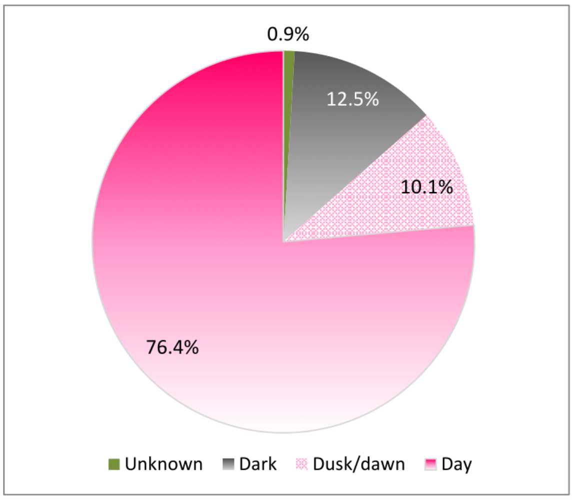


Figure 27 All bike rider crashes in Victoria by light conditions, 2002-2012

The following three charts show the proportion of bike riders by light conditions by crash injury outcome.

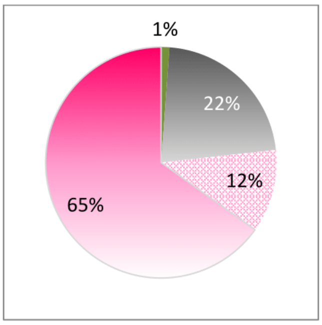


Figure 28 All fatal bike rider crashes in Victoria by light condition, 2002-2012

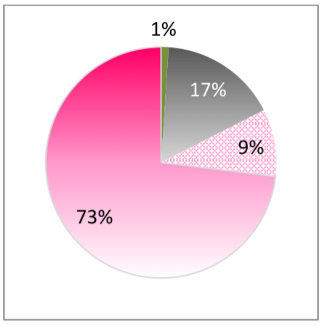


Figure 29 All serious injury bike rider crashes in Victoria by light condition, 2002-2012

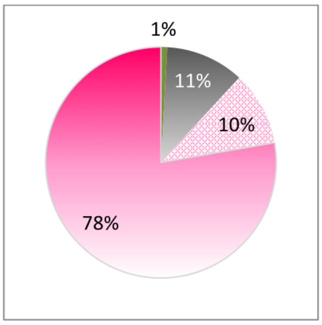


Figure 30 All other injury bike rider crashes in Victoria by light condition, 2002-2012

Day of week

The bike rider crashes were distributed across all days of the week. Most crashes occurred on Tuesday (17.4%) followed by Thursday (16.8%). The least crashes occurred on Sunday (9.1%) (Table 3, Figure 31).

Table 3 All bike rider crashes in Victoria by day of week and injury outcome, 2002-2012

Day of week	Fatal	Serious injury	Other injury	Total	%
Monday	12	658	828	2047	14.3
Tuesday	20	743	1377	2485	17.4
Wednesday	13	721	1722	2313	16.2
Thursday	11	776	1579	2397	16.8
Friday	14	693	1610	2128	14.9
Saturday	7	536	1421	1608	11.3
Sunday	9	455	1065	1292	9.1

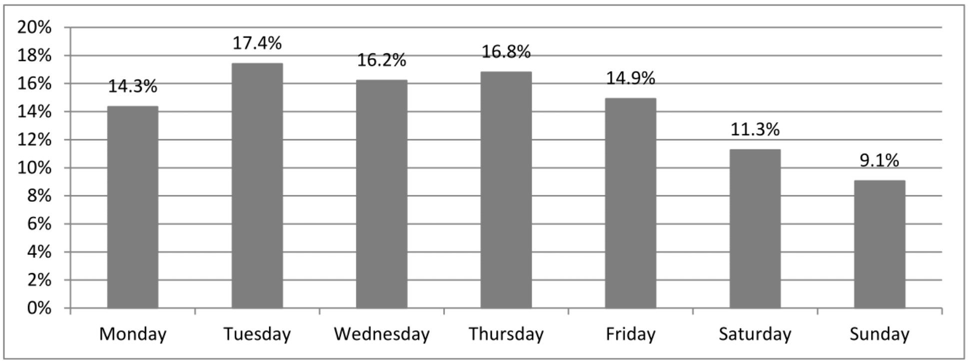


Figure 31 All bike rider crashes in Victoria by day of week, 2002-2012

The following three charts show the proportion of bike riders by day of the week by crash injury outcome.

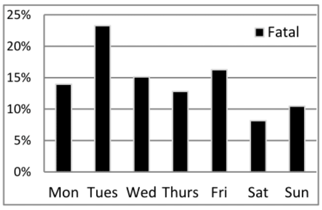


Figure 32 All fatal bike rider crashes in Victoria by day of week, 2002-2012

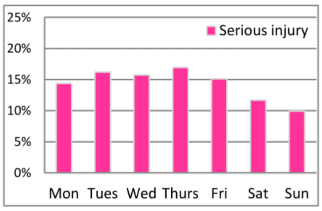


Figure 33 All serious injury bike rider crashes in Victoria by day of week, 2002-2012

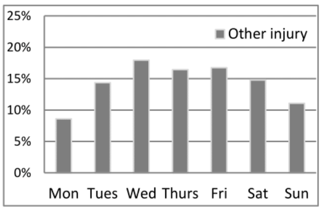


Figure 34 All other injury bike rider crashes in Victoria by day of week, 2002-2012

Month

The bike rider crashes were distributed across all months of the year. The most crashes occurred in March (10.2%), followed by February (9.7%). The fewest crashes occurred in July (7.1%) and June (7.2%) (Table 4, Figure 35).

Table 4 All bike rider crashes in Victoria by month of year and injury outcome, 2002-2012

Month	Fatal	Serious injury	Other injury	Total	%
January	13	371	741	1125	7.9
February	5	434	948	1387	9.7
March	10	507	942	1459	10.2
April	7	391	801	1199	8.4
May	5	361	890	1256	8.8
June	2	331	699	1032	7.2
July	6	311	699	1016	7.1
August	7	374	742	1123	7.9
September	8	309	747	1064	7.5
October	6	424	817	1247	8.7
November	4	394	829	1227	8.6
December	13	375	747	1135	8.0

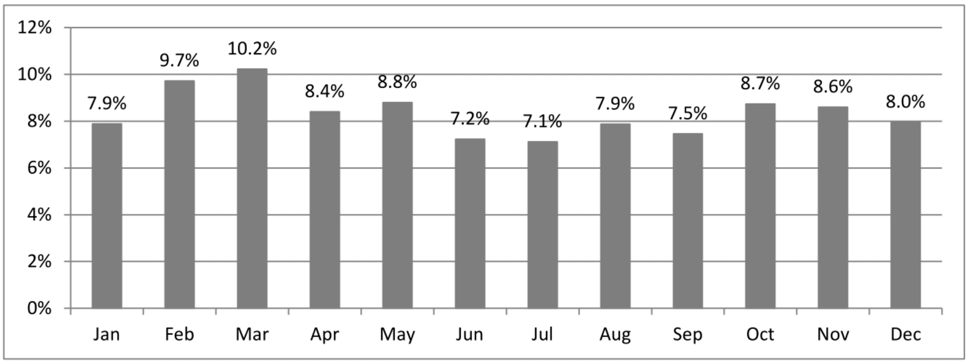


Figure 35 All bike rider crashes in Victoria by month of year, 2002-2012

The following three charts show the proportion of bike riders by month by crash injury outcome.

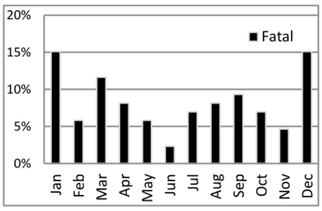


Figure 36 All fatal bike rider crashes in Victoria by month, 2002-2012

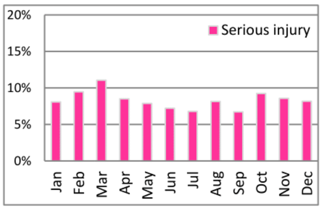


Figure 37 All serious injury bike rider crashes in Victoria by day of week, 2002-2012

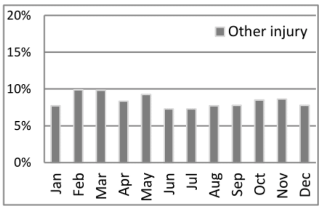


Figure 38 All other injury bike rider crashes in Victoria by day of week, 2002-2012

Location

The majority of bike rider crashes occurred in metropolitan Melbourne. While over 80 per cent of all non-fatal crashes occurred in metropolitan Melbourne, almost half of all fatalities (48%) occurred in regional Victoria.

Table 5 All bike rider crashes in Victoria by location and injury outcome, 2002-2012

Location	Fatal	Serious injury	Other injury	Total	Percent
Metro Melbourne	45	3675	7837	11559	81.1
Regional Victoria	41	912	1746	2699	18.9

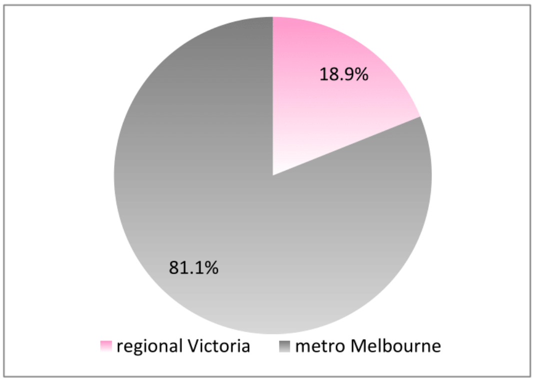


Figure 39 All bike rider crashes in Victoria by location, 2002-2012

The following three charts show the proportion of bike riders by location (metropolitan Melbourne and regional Victoria) by crash injury outcome.

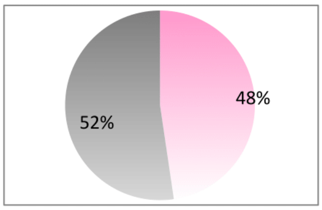


Figure 40 All fatal bike rider crashes in Victoria by location, 2002-2012

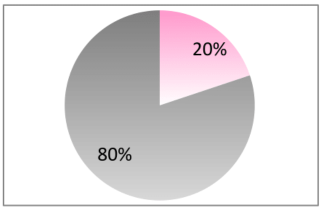


Figure 41 All serious injury bike rider crashes in Victoria by location, 2002-2012

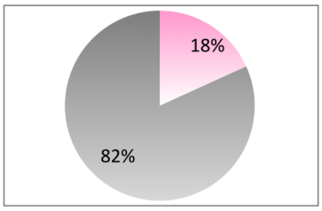


Figure 42 All other injury bike rider crashes in Victoria by location, 2002-2012

Location – geometry

The majority of bike rider crashes occurred at an intersection (60%). Intersections include cross intersections, T intersections, Y intersections and multiple intersections. Sections of road defined as not an intersection include midblock, dead end, road closure and private property. Crashes where the road geometry was unknown were excluded. Fatality crashes differ from non-fatal crashes, with two thirds occurring at non-intersection locations.

Table 6 All bike rider crashes in Victoria by location and injury outcome, 2002-2012

Geometry	Fatal	Serious injury	Other injury	Total	Percent
Cross intersection	14	1205	2818	4038	28.4
Other intersection	15	1467	3029	4511	31.7
Not at intersection	56	1904	3729	5689	40.0

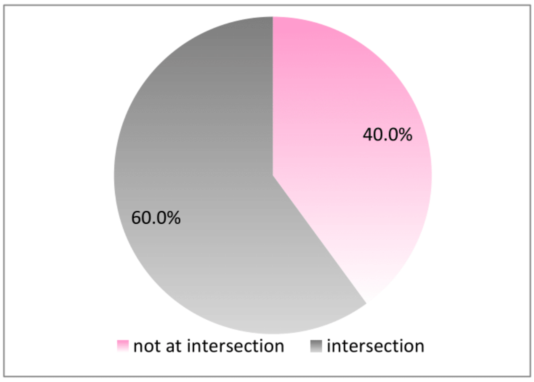


Figure 43 All bike rider crashes in Victoria by geometry, 2002-2012

The following three charts show the proportion of bike riders crashes by geometry pink: not at intersection, grey: at intersection) by crash injury outcome.

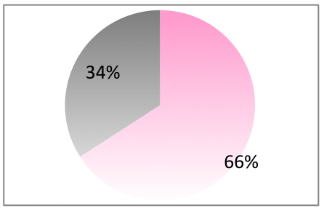


Figure 44 All fatal bike rider crashes in Victoria by geometry, 2002-2012

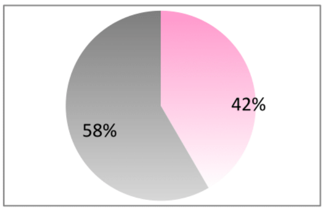


Figure 45 All serious injury bike rider crashes in Victoria by geometry, 2002-2012

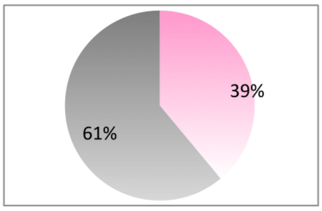


Figure 46 All other injury bike rider crashes in Victoria by geometry, 2002-2012

Crash type

The majority of crashes reported involved a crash with a vehicle (90%). A summary of crash types is included below. 'No crash and no object struck' refers to single-vehicle crashes, that is, when the bike rider fell from or crashed their bike and no counterpart or object was involved in causing the crash.

Note: caution is needed when using the data below, as these crash numbers are based on police-reported crashes and are not likely to include either crashes that did not involve a motor vehicle or bicycle-rider only crashes. For further details, see Section 2.1 above.

Table 7 All bike rider crash types in Victoria, 2002-2012

Crash type	n	Percent
Collision with vehicle	12,792	89.6
Struck pedestrian	195	1.4
Struck animal	36	0.3
Collision with fixed object	101	0.7
Collision with some other object	55	0.4
Vehicle overturned (no collision)	70	0.5
Fall from or in moving vehicle (bicycle)	69	0.5
No collision and no object struck	946	6.6
Other crash	6	0.0
Total	14,270	100

The majority of all bike rider crashes reported in CrashStats involved a crash with a vehicle, across all injury outcome categories as follows:

- Cyclists involved in a crash with a vehicle
  - 87% fatality crashes
  - 86% serious injury crashes
  - 91% other injury crashes

Vehicles involved

Cars were the most commonly reported partner vehicle of crashes (Table 8). The list of vehicles involved in bike rider crashes generated by CrashStats includes the bicycle of the bike rider; however, it does not show where multiple bicycles may have been involved in a crash. Further, the number of bike riders involved in crashes in the period (14,270) is fewer than the number of bicycles involved in reported crashes (14,635). It is assumed that the additional bicycles include crashes where the counterpart was a bike rider and crashes that involved multiple bike riders, some of whom were not injured.

All vehicles involved in bike rider crashes, including bicycles, are included in Table 8; however, bicycles have been excluded from the following analysis.

Table 8 Vehicles involved in bike rider crashes, Victoria, 2002-2012

Vehicle type	n	Percent
Car	8466	30.0
Station wagon	2112	7.5
Taxi	409	1.4
Utility	849	3.0
Panel van	399	1.4
Prime mover (no of trailers unknown)	50	0.2
Rigid truck (weight unknown)	138	0.5
Prime mover only	5	0.0
Prime mover- single trailer	31	0.1
Prime mover B-Double	13	0.0
Prime mover B-Triple	0	0.0
Light commercial vehicle (rigid) <= 4.5 tonnes	111	0.4
Heavy vehicle (rigid) > 4.5 tonnes	119	0.4
Bus/coach	103	0.4
Mini bus	14	0.0
Motor cycle	79	0.3
Moped	0	0.0
Motor scooter	7	0.0
Bicycle	14636	51.8
Horse	0	0.0
Tram	40	0.1
Train	4	0.0
Other vehicle	62	0.2
Not applicable	3	0.0
Not known	615	2.2
Total	28265	100.0

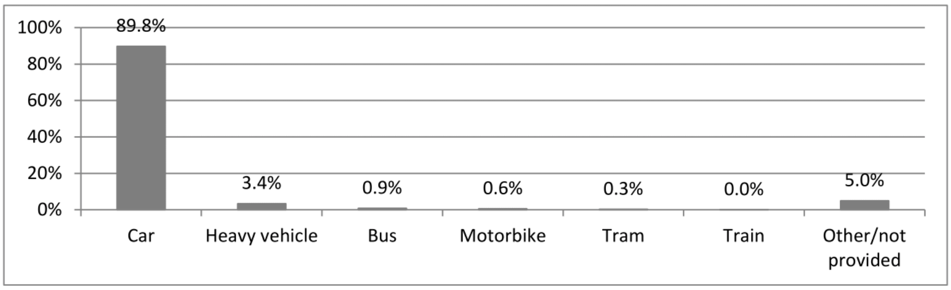


Figure 47 All bike rider crashes in Victoria by vehicle involved (grouped, excluding bicycles), 2002-2012

All counterpart road users were grouped by type and analysed by bike rider injury outcome; see list below.

Vehicle type	Study classification
Car Station wagon Taxi Utility Panel van	Car
Prime mover (no of trailers unknown) Rigid truck (weight unknown) Prime mover only, single trailer, B double, B triple Light commercial vehicle (rigid) <=4.5 tonnes Heavy vehicle (rigid) > 4.5 tonnes	Heavy vehicle
Bus/coach Mini bus	Bus
Motorcycle Moped Motorscooter	Motorbike
Tram	Tram
Train	Train
Other Not known	Other

Table 9 Bike rider crashes involving a vehicle (excluding bicycles): grouped vehicles by injury outcome

	Fatality		Serious injury		Other injury		Total	
Car	43	55.1	3749	88.0	8443	90.9	12235	89.8
Heavy vehicle	27	34.6	206	4.8	234	2.5	467	3.4
Bus	3	3.8	38	0.9	76	0.8	117	0.9
Motorbike	2	2.6	39	0.9	45	0.5	86	0.6
Tram	1	1.3	21	0.5	18	0.2	40	0.3
Train	1	1.3	3	0.1	0	0.0	4	0.0
Other/not provided	1	1.3	205	4.8	471	5.1	677	5.0
	78	100.0	4261	100.0	9287	100.0	13626	100.0

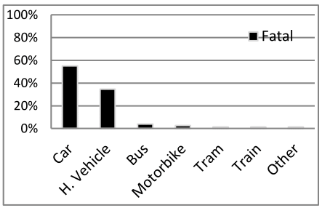


Figure 48 All fatal bike rider crashes in Victoria by counterpart, 2002-2012

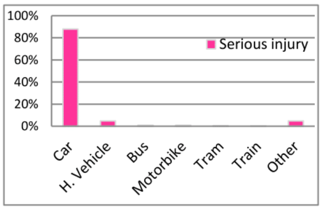


Figure 49 All serious injury bike rider crashes in Victoria by counterpart, 2002-2012

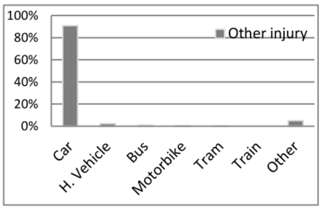


Figure 50 All other injury bike rider crashes in Victoria by counterpart, 2002-2012

Crash mechanism – grouped

The crash types are first discussed in their grouped categories, followed by an analysis that highlights the most common crash type for each injury outcome.

Table 10 Grouped crash mechanism for all bike rider crashes in Victoria (2002-2012)

Grouped DCA		**n**	**Percent**
130-139	Vehicles from same direction	3221	22.6
140-149	Manoeuvring	2822	19.8
120-129	Vehicles from opposing directions	1823	12.8
110-119	Vehicles from adjacent directions (intersections only)	1762	12.3
160-169	On path (including dooring)	1711	12.0
100-109	Pedestrian on foot	1604	11.2
170-179	Off path on straight	1118	7.8
150-159	Overtaking	90	0.6
190-199	Passenger and miscellaneous	62	0.4
180-189	Off path on curve	57	0.4
Total		**14270**	100

The five most frequent bike rider crashes grouped by DCA type by injury outcome are shown below.

Fatality crashes

- 49% Vehicles from the same direction (DCA 130–139)
- 14% Vehicles from opposing directions (DCA 120–129)
- 13% Manoeuvring (DCA 140–149)
- 9% Off path on straight (DCA 170–179)
- 6% Vehicles from adjacent directions (intersections only) (DCA 100-109)

Serious injury

- 20% Vehicles from the same direction (DCA 130–139)
- 18% Manoeuvring (DCA 140–149)
- 14% Vehicles from opposing directions (DCA 120–129)
- 13% On path (including dooring) (DCA 160–169)
- 11% Vehicles from adjacent directions (intersections only) (DCA 100-109)

Other injury

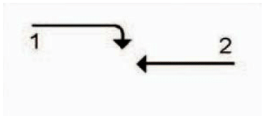
- 23% Vehicles from the same direction (DCA 130–139)
- 21% Manoeuvring (DCA 140–149)
- 13% Vehicles from adjacent directions (intersections only) (DCA 110–119)
- 12% Vehicles from opposing directions (DCA 120–129)
- 12% On path (including dooring) (DCA 160–169)

Crash mechanism – individual

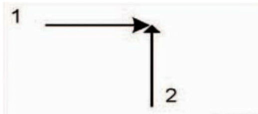
Six crash classifications were used by Victoria Police to describe half (52.3%) of the 14,270 crashes (Table 11). Diagrams that illustrate these most common crash types are included below (Figure 51).

Table 11 Most frequent bike rider crashes (all) by DCA type, Victoria, 2002–2012

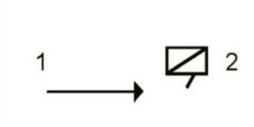
Crash classification (DCA)	n	Per cent
Right through (DCA 121)	1601	11.2
Cross traffic (intersection only) (DCA 110)	1408	9.9
Vehicle strikes door of parked/stationary vehicle (DCA 163)	1247	8.7
Vehicle off footpath strikes vehicle on carriageway (DCA 148)	1180	8.3
Vehicle strikes another vehicle while emerging from driveway-lane (DCA 147)	1159	8.1
Out of control on carriageway (DCA 174)	868	6.1
Total	7463	52.3



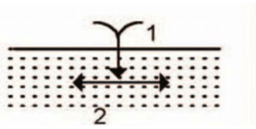
Right through (DCA 121)



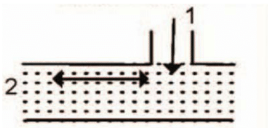
Cross through (DCA 110)



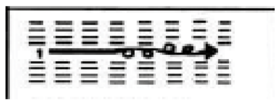
Vehicle door (DCA 163)



From footway (DCA148)



Emerging from driveway/lane (DCA147)



Out of control on carriageway (DCA174)

Figure 51 DCA codes and graphic representation of 6 most frequent bike rider crash types in Victoria, 2002-2012

Table 12 Most frequent bike rider crashes by DCA type by injury outcome, Victoria, 2002–2012

Fatal	%	Serious injury	%	Other injury	%
Rear end (DCA 130)	25.6	Right through (DCA 121)	12.5	Right through (DCA 121)	10.7
Off footpath (DCA 148)	11.6	Cross traffic (DCA 110)	9.8	Cross traffic (DCA 110)	9.9
Head on, not overtaking (DCA 120)	8.1	Off footpath (DCA 148)	8.9	Vehicle door (DCA 163)	9.4
Lane side swipe, vehicles in parallel lanes (DCA 133)	7.0	Out of control on carriageway, on straight (DCA 174)	7.8	Emerging from driveway/ lane (DCA 147)	9.1
Right through (DCA 121)	5.8	Vehicle door (DCA 163)	7.5	Off footpath (DCA 148)	7.9
Left turn sideswipe (DCA 137)	5.8	Emerging from driveway/ lane (DCA 147)	6.3	Left turn sideswipe (DCA 137)	6.6

Speed zones

The majority of all bike rider crashes (76.6%) occurred in 50kph and 60kph speed zones. This is likely to reflect the high proportion of Victorian roads that have a speed limit of 50kph or 60kph and the likelihood that a high proportion of bike riders ride on these roads on each bike trip.

Note: speed was listed as 'unknown' for a proportion of bike rider crashes, across all injury outcome types. This is included in the figures below to accurately represent the available data and highlight that this was a gap across fatality, serious injury and other injury crashes.

Table 13 All police reported bike rider crashes by speed zone, Victoria, 2002–2012

Speed zone	n	%
40kph	707	5.0%
50kph	4280	30.1%
60kph	6635	46.6%
70kph	749	5.3%
75kph	4	0.0%
80kph	708	5.0%
90kph	18	0.1%
100kph	327	2.3%
110kph	5	0.0%
Other	20	0.1%
Off road	35	0.2%
Not known	753	5.3%
	14241	100.0%

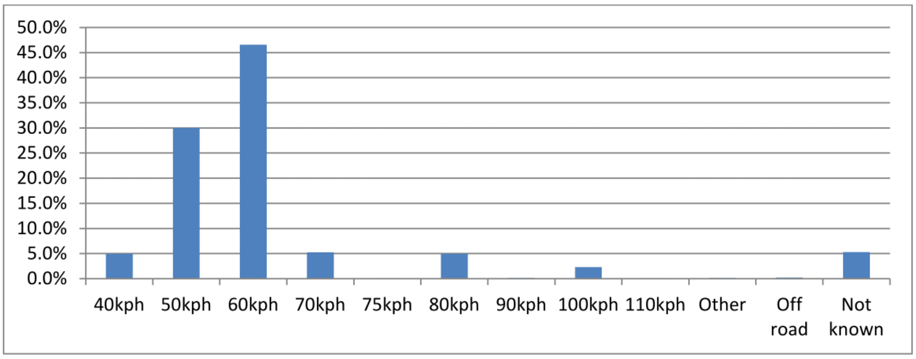


Figure 52 All bike rider crashes in Victoria by speed zones, 2002-2012

The following three charts show the proportion of bike riders crashes by speed zone by crash injury outcome. Other locations and off road have been excluded in these breakdowns.

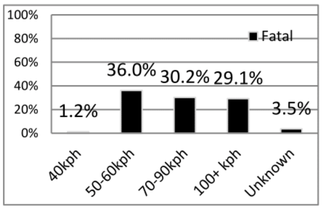


Figure 53 All fatal bike rider crashes in Victoria by speed zone, 2002-2012

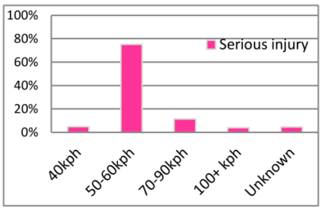


Figure 54 All serious injury bike rider crashes in Victoria by speed zone, 2002-2012

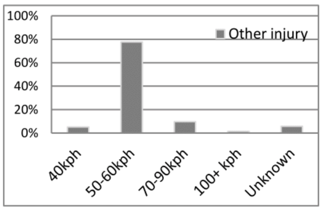


Figure 55 All other injury bike rider crashes in Victoria by speed zone, 2002-2012

Crashes in 50kph and 60kph speed zones

The majority of bike rider crashes, 10,915 (76.6%), occurred in 50kph and 60kph speed zones, that is, local streets and neighbourhoods. These crashes included:

- 31 fatality crashes (36.0% of all bike rider fatality crashes 2002–2012)
- 3436 serious injury crashes (75.2% of all bike rider serious injury crashes 2002–2012)
- 7448 other injury crashes (77.7% of all bike rider other injury crashes 2002–2012)

For the serious injury and other injury bike rider crashes, the profile of the crashes has already been discussed above, as for each of these injury classifications, the majority of crashes occurred in these low-speed locations.

The crash circumstances for all 31 people killed following a bicycle crash were analysed and there was considerable variation between the crash events. Some of the key factors that were identified for the crashes that occurred in 50kph and 60kph speed zones included:

- 13 (41.9%) involved a heavy vehicle
- 12 occurred in the daytime
- 12 occurred in the metropolitan Melbourne area
- 7 occurred at intersections
- 5 involved a left-turn sideswipe
- 4 involved the bike rider leaving the footpath and being struck by a heavy vehicle on the carriageway
- All crashes occurred in clear, dry conditions.

4.3 Area analysis of bike rider crashes (2002–2012)

All bike rider crashes

Crash clusters are seen in regions with high population density, such as Melbourne's metropolitan and urban regions, and areas popular with bike riding (e.g. along scenic routes).

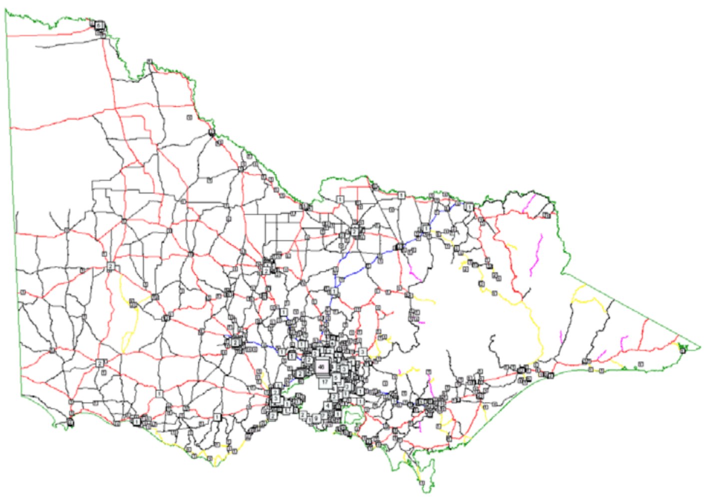


Figure 56 All police-reported bike rider road crashes in Victoria, 2002–2012

Fatality crashes

All police-reported bicycle rider fatality crashes that occurred in Victoria from 2002 to 2012 are mapped below. Figure 57 shows all fatality crash locations for the state. Figure 58 shows the fatality bike rider crashes in the Melbourne metropolitan area.

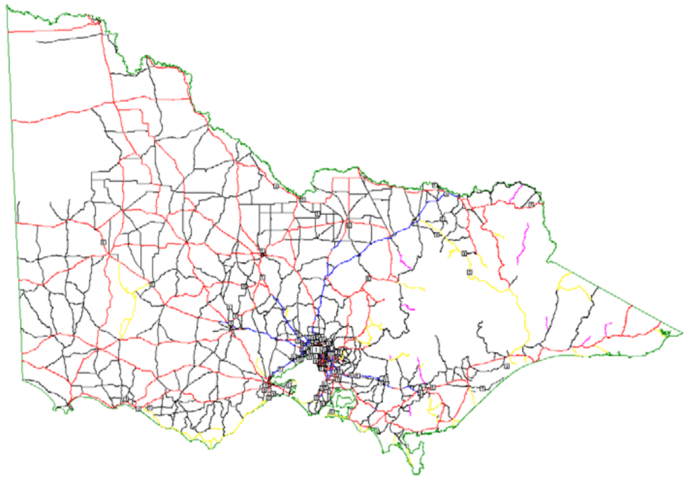


Figure 57 Map of fatal bike rider crashes in Victoria, 2002–2012

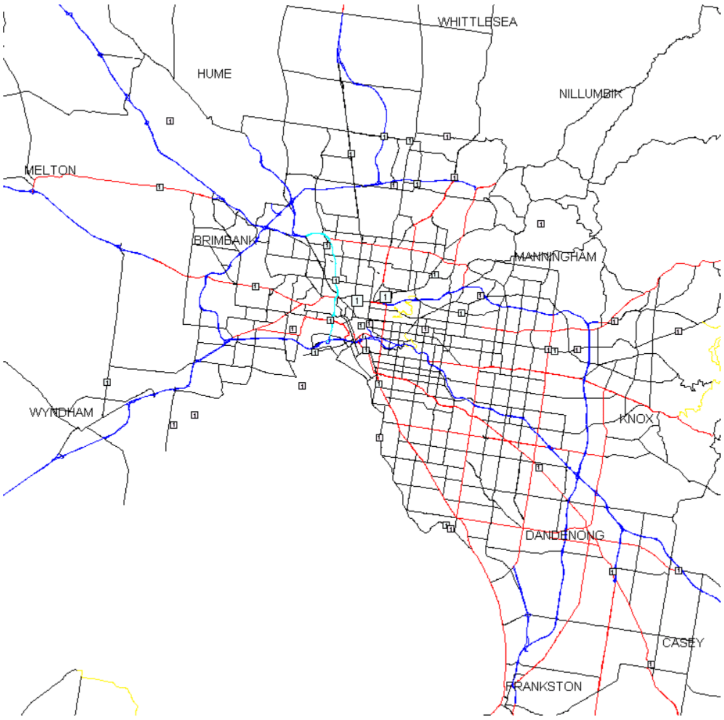


Figure 58 Cluster of fatal bike rider road crashes in Melbourne metropolitan area, 2002–2012

Serious injury crashes

All police-reported bicycle rider serious injury crashes that occurred in Victoria from 2002 to 2012 are mapped in Figure 59. Crashes resulting in bike rider serious injury outcomes were reported across Victoria, with higher incidence among more densely populated locations. All bicycle rider other injury crashes that occurred in Victoria from 2002 to 2012 are mapped in Figure 60 below.

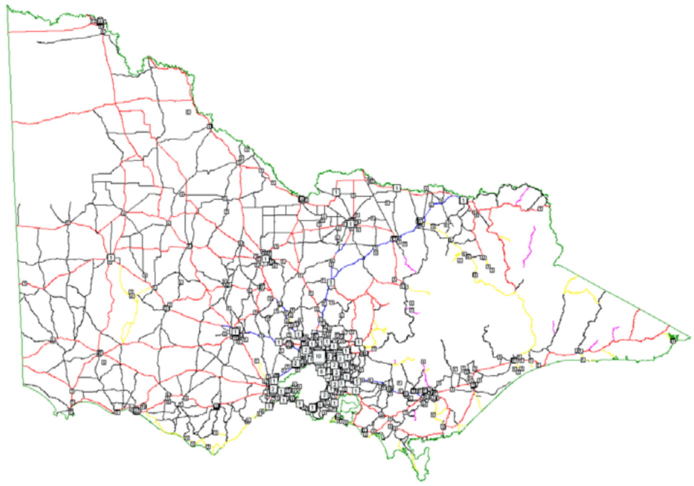


Figure 59 Map of serious injury bike rider crashes in Victoria, 2002–2012

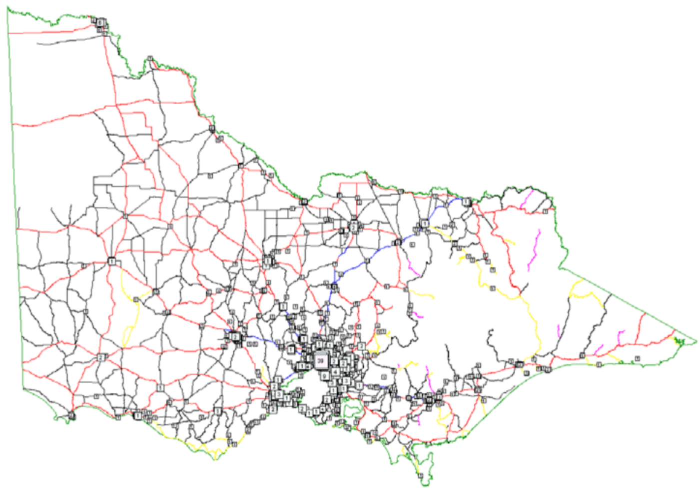


Figure 60 Bike rider road crashes in Victoria 2002–2012 which resulted in other injuries

4.3.1 Crashes by Victorian municipality

Bicycle crashes were analysed for all municipalities in Victoria for the period from 2002 to 2012. The 20 municipalities with the highest total numbers of bike rider crashes and the proportion of crashes for that municipality as a percentage of the state-wide bike crashes are listed in the table below.

Table 14 Top 20 municipalities for all police-reported bike rider crashes, Victoria, 2002–2012

Municipality	n	%
Melbourne	2031	13.7
Yarra	1281	8.7
Port Phillip	997	6.7
Boroondara	663	4.5
Moreland	619	4.2
Bayside	548	3.7
Kingston	539	3.6
Stonnington	530	3.6
Darebin	468	3.2
Geelong	455	3.1
Glen Eira	446	3.0
Mornington Peninsula	381	2.6
Monash	342	2.3
Monee Valley	305	2.1
Dandenong	262	1.8
Frankston	254	1.7
Whitehorse	250	1.7
Bendigo	249	1.7
Knox	240	1.6
Casey	234	1.6
Total	11094	75.1

Table 15 Top municipalities for bike rider crashes by injury outcomes, Victoria, 2002-2012

Fatal	%	Serious injury	%	Other injury	%
Whittlesea	6.8	Melbourne	12.2	Melbourne	14.5
Geelong	5.7	Yarra	8.5	Yarra	8.8
Melbourne	5.7	Port Phillip	6.9	Port Phillip	6.7
Mornington Peninsula	4.5	Boroondara	5.2	Moreland	4.6
		Bayside	4.6	Boroondara	4.1
Total	22.7	Total	37.4	Total	38.7

4.3.2 Fatality crashes

One in five (21.3%) bike rider fatality crashes in Victoria from 2002 to 2012 occurred in four municipalities: Whittlesea, Geelong, Melbourne and Mornington Peninsula.

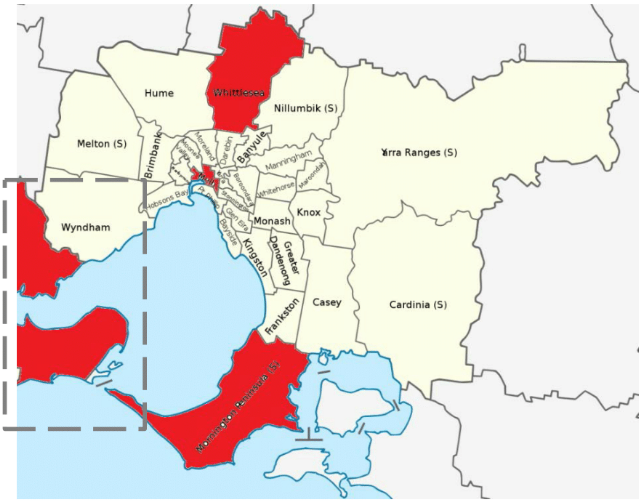


Figure 61 Map of metropolitan Melbourne indicating the municipalities with the most bike rider fatalities (2002–2012) (dashed box outlines the municipality of Geelong)

The other 69 bike rider fatality crashes occurred across Victoria, as included in Table 16.

Table 16 Numbers of bike rider fatality crashes in Victorian municipalities, 2002–2012

No. bike rider fatality crashes	Municipality
3	Boroondara, Campaspe, Port Phillip, Whitehorse
2	Alpine, Baw Baw, Cardinia, Casey, Dandenong, Hepburn, Hobsons Bay, Hume, Indigo, Kingston, Latrobe, Maribyrnong, Maroondah, Mount Alexander, Moyne, Surf Coast, Yarra
1	Ballarat, Banyule, Bass Coast, Bayside, Bendigo, East Gippsland, Frankston, Horsham, Mansfield, Melton, Moonee Valley, Moreland, Nillumbik, Northern Grampians, Shepparton, Towong, Wangaratta, Warrnambool, Wellington, Wodonga, Wyndham Yarra Ranges

4.3.3 Municipalities where bike rider crashes are increasing

A third of all crashes in Victoria (34.8%) between 2002 and 2012 occurred in five municipalities: Melbourne, Yarra, Port Phillip, Boroondara and Moreland.

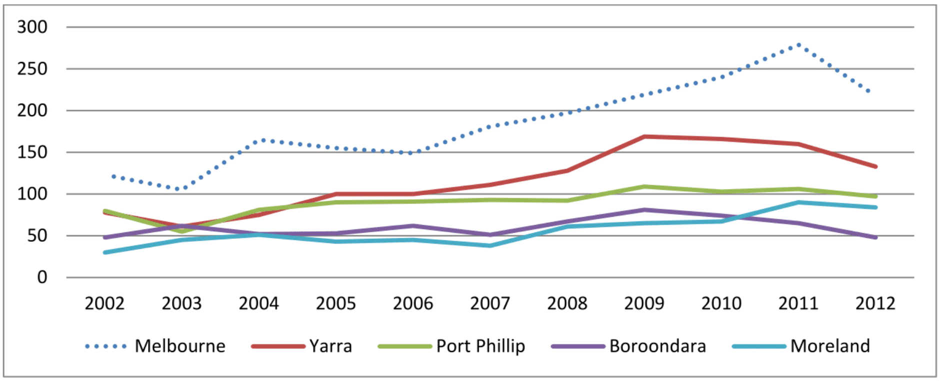


Figure 62 Total number of crashes in municipalities with the highest number of bike rider crashes (2002-2012)

In Figure 63, the municipalities in red are those with the highest number of bike rider crashes. The map provides a clear illustration of the density of the crashes occurring in the inner city/inner suburb areas.

Figure 63 Map of metropolitan Melbourne indicating the municipalities with the most bike rider crashes (all injury outcome crash types) (2002-2012)

Bike rider crash numbers for each of the four municipalities with the highest number of bike rider crashes were analysed. **Note:** Cycling exposure data are not available and are likely to have had an impact on the number of bike rider crashes.

4.3.4 City of Melbourne

The City of Melbourne had the highest number of bike rider crashes per year across the study period, with crashes in the Melbourne CBD itself almost doubling from 2002 to 2012. The majority of bike rider crashes occurred in the eastern side of the city in the proximity of high-density commercial offices and educational institutions when compared to the western side of the city, which is comprised of light-industrial and low–medium density offices.

The most common crash type in the municipality of Melbourne involved unexpectedly opened vehicle doors (DCA 163). Over 1 in 5 bike rider crashes (n=453, 22.3%) (including fatality, serious injury and other injury outcomes) from 2002 to 2012 were due to dooring. Figure 64 and Figure 65 map the crashes that occurred in the municipality of Melbourne in 2002 and in 2012, and clearly illustrate the increase in the number of crashes.

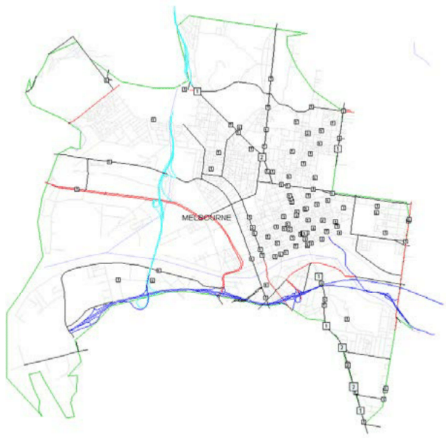


Figure 64 Map of all bike rider crashes in Melbourne (2002)

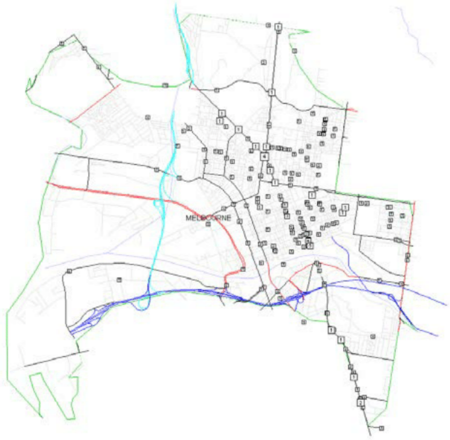


Figure 65 Map of all bike rider crashes in Melbourne (2012)

4.3.5 Municipality of Yarra

Bike rider crashes in the municipality of Yarra steadily increased over the study period. This increase is likely to be a function of the increasing number of people who are riding bikes, as the municipality of Yarra has invested extensively in cycling facilities and has one of the most extensive cycling-inclusive approaches to road design in Victoria. Figure 66 and Figure 67 map the crashes that occurred in the municipality of Yarra in 2002 and in 2012, and clearly illustrate the increase in the number of crashes.

Figure 66 Map of all bike rider crashes in Yarra (2002)

Figure 67 Map of all bike rider crashes in Yarra (2012)

4.3.6 Municipality of Port Phillip

Bike rider crashes in the municipality of Port Phillip numbered the third highest in the state. Port Phillip includes the northernmost section of Beach Road, one of the most heavily cycled routes in Victoria, particularly for sport/recreation riders in the early mornings and on weekends. Figure 68 and Figure 69 map the crashes that occurred in the municipality of Port Phillip in 2002 and in 2012.

Figure 68 Map of all bike rider crashes in Port Phillip (2002)

Figure 69 Map of all bike rider crashes in Port Phillip (2012)

4.3.7 Municipality of Moreland

Bike rider crashes steadily increased in the municipality of Moreland from 2002 to 2012. In 2002 there were 45 bike rider crashes; this had almost doubled to 84 in 2012 and is approaching the same number of bike rider crashes as in Port Phillip.

According to the Moreland City Council (2013), the number of residents riding bikes has increased, with 5–10 per cent of residents riding to work. The Moreland Council has outlined a number of projects planned in order to help make Moreland a safer location for bike riders, including the upgrading of existing bike riding paths both on and off road and installing traffic control systems to help ensure better traffic flow (Moreland City Council 2013). Over the past 10 years, crash frequency has been increasing, in particular on Sydney Road, as demonstrated in Figure 70 and Figure 71.

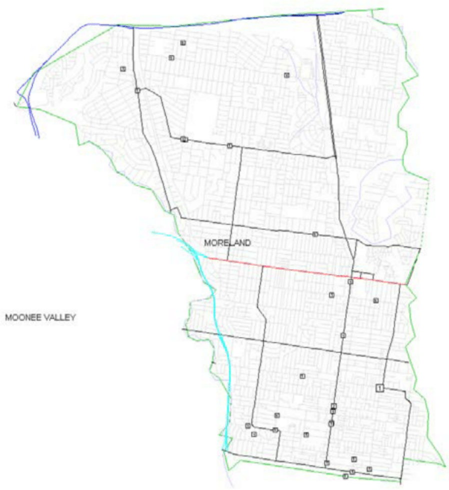


Figure 70 Map of all bike rider crashes in Moreland (2002)

Figure 71 Map of all bike rider crashes in Moreland (2012)

5 Discussion

This study has analysed the police-reported bike rider crashes in Victoria in the period from 2002 to 2012 using the publicly available CrashStats database delivered by the state road authority, VicRoads. This section of the report is a discussion of the crash data and outlines ways to improve cycling safety in Victoria.

Reminder: Crashes reported to Victoria Police are more likely to involve a motor vehicle, due to the circumstances being such that people request police attendance or report to police post-crash.

5.1 Overview of bike rider crashes

The number of bike rider crashes in Victoria steadily decreased from 1987 to 2003. However, from 2003 to 2012 the number of bike rider crashes has shown an increasing trend. Over the period of analysis, the total number of police-reported bike rider crashes in Victoria was 14,270, an average of 1296 crashes per year. Across the study period, the number of bike crashes increased by 19.7 per cent, from 1144 in 2002 to 1395 in 2012. This equates to an average annual increase in bike rider crashes in Victoria of 1.8 per cent. Annually, since 2009, over 1000 people have been involved in bike rider crashes in Victoria. It is not known if the rate of bike rider crashes has changed over that time, as accurate cycling exposure data (i.e. number of trips, frequency of trips, time cycled) are not recorded in Australia.

The number of bike rider crashes reported to police is different to that reported by Victorian hospitals, both in terms of total number of crashes (total police: 14,270; annual police: 1297; total hospital: 34,417; annual hospital: 3128).

Because not all bike rider crashes need to be reported to police and an unknown number of injured cyclists seek medical attention outside the hospital system, the total number of bike riders who are injured is unknown. This gap in the available data is an important factor in understanding bike rider safety.

What is the magnitude of bike rider crashes in Victoria?

Incompleteness of data continues to be a barrier to determining the magnitude of bike rider trauma in our community. Victorian law requires that any crash resulting in an injury must be reported to police (Victoria Police); however, for people involved in a crash that resulted in little or no property damage or minor physical injury, there can be reluctance to involve the police. Reasons that bike rider crashes are not reported to police include:

- Perception of wasting scarce resources (Amoros et al. 2006)
- Fear that reporting may result in prosecution (Amoros et al. 2006)
- Misconception that bike riders crashes are not considered road traffic crashes by the parties involved or attending authorities (Langley et al. 2003, Amoros et al. 2006)
- Misclassification of injury severity (Tsui et al. 2009).

This is an important finding in terms of the representativeness of the number of police-reported crashes. Police-reported bike rider crashes arguably contain the most comprehensively available details on the crash circumstances; however, because not all crashes need to be or are reported, there is a limitation on the types of crashes that are included in the data.

Over the study period, 2.41 times more bike rider crashes were reported to Victorian hospitals than to police. The findings and comparisons with the hospital data in this study concur with previous research that police-reported data do not include all bike rider crashes. Previous research by Andrew and colleagues (Andrew et al. 2012) in their review of sports and recreation trauma in Victoria (2001–2007) reported an increase in cycling injuries of 16 per cent per year. In an earlier review of hospital data by Sikic and colleagues (2009) for the five-year period from July 2001 to June 2006, a total of 25,920 bike riders who had crashed and presented to hospital were identified. Further, it is probable that hospital data are also an underrepresentation, given that not all bike riders who crash present to hospital.

One solution to increasing our awareness of the extent of bike rider crashes may be via an online registry. Online facilities for the public to self-report crashes are currently available in South Australia, Western Australia and the Australian Capital Territory (ACT Government 2014, Government of South Australia 2014, Insurance Commission of Western Australia and Western Australia Police 2014). This type of crowdsourced reporting option removes some of the barriers to reporting bike rider crashes, including waiting for police to attend the crash site and attending a police station. More bike riders may be likely to report crash types that are currently unreported in Victoria. It would be valuable to evaluate these facilities to establish if they do capture more data than are currently being reported to police or hospitals.

From a public policy perspective, the limitations of police-reported crashes need to be considered in both the development and evaluation of programs and initiatives to improve cycling safety. While police data provide an important part of the solution, greater information is needed.

Cycling exposure data – a critical gap

For us to have meaningful context for the number of bike rider crashes, the counterpart to having comprehensive crash data is cycling exposure data, that is, how often people ride. Lack of exposure data is the most significant gap in cycling safety research in Victoria and Australia (Sikic et al. 2009, Garrard et al. 2010) and this gap limits the usefulness of any review of crash data.

It is important to highlight the fundamental distinction between cycling ***participation*** data and cycling ***exposure*** data. What is typically reported in Australia is cycling *participation*. This is essentially the binary result of questions that can be distilled to: ‘Do you ride a bicycle?’ with yes/no responses. Question variations may include a time period (e.g. in the last week, in the last year). To date, these results do not include any measurement of cycling exposure (e.g. trip frequency, duration, distance, route choice). Without these measurements, standard indices for safety cannot be calculated. Currently in Australia, vehicle occupant (driver and passengers) fatality rates are calculated and published. For example, from 2003 to 2012, the rate of vehicle occupant fatalities decreased by an average of 3.8 per million vehicle-kilometres per year (2003: 0.79; 2012: 0.57) (BITRE 2013). Similar measurements are required for bike riders.

Comprehensive cycling exposure measurements will provide context for assessing, analysing and understanding crashes. One hypothesis is that increased bike rider bicycle rider fatality and serious injury crashes are a function of an increase in cycling activity. Put simply, the more people who ride bikes, the more people will crash. However, internationally the opposite effect has been reported. Increased cycling trips in countries including the Netherlands and Denmark have produced a ‘safety in numbers’ effect that is, the more cyclists on the road, the lower the risk of any individual bicycle rider being involved in a collision (Jacobsen 2003,

We do not know where Victoria is positioned relative to achieving a ‘safety in numbers’ effect for bike riders.

Bonham et al. 2006, Johnson et al. 2014). We do not know where Victoria is positioned relative to achieving a 'safety in numbers' effect for bike riders.

From a public policy perspective, as for comprehensive crash data, accurate cycling exposure data are essential in order to monitor the long-term impacts of public policies, road safety messaging and investments in infrastructure in order to maximise the safety of cyclists. The federal government's target is to double cycling participation by 2016 (Austroads 2010). The context of changes to cyclists' safety is essential if governments are to be responsible about encouraging people to continue and to increase cycling.

Traditional methods of surveying, such as using Computer-Assisted Telephone Interviewing (CATI) technologies, are becoming less reliable due to falling response rates and limited demographic availability (Bracken et al. 2009). Observational counts of bike riders can be problematic due to susceptibility to overcounting (counting the same rider multiple times en route). The practice of advertising locations and dates of intended data collection by researchers may also create a sampling bias. Data collection bias (sympathetic bias) may also affect counts if the observers are part of the observed cohort and so have a vested interest in the outcomes of the study (Spano 2005).

While this analysis of bike crash data improves our understanding, its usefulness remains limited without knowing how often people ride. Knowing how often people ride would help to put bike crash statistics into context. A smart approach that uses proven methods and integrated technology is needed to creating meaningful cycling exposure data in Victoria.

5.2 Overview of bike rider crashes – police-reported

This section of the Discussion is an overview of police-reported bike rider crash data. The Safe System approach was used to structure the discussion of specific crash factors. Ways to improve cycling safety are included throughout this section.

5.2.1 Time of crash

Peak commuter travel times (8–10am and 4–6pm) were the peak times for bike rider crashes for all injury outcome crashes, and the majority of crashes occurred during the day in clear and dry conditions. These two temporal details are not unexpected, given the likelihood that many bike riders will ride during the day in favourable weather conditions.

A greater proportion of crashes occurred during the week compared to weekends. Given the high rate of crashes during peak commuter travel times, this suggests that more crashes occur during commuting or utilitarian trips compared to sport/fitness or recreational/leisure bike trips.

Bike rider crashes occurred in all months of the year, with March the single month with the most crashes (10.2%) and fewer crashes occurring in June (7.2%) and July (7.1%). January and December were the most common months associated with bike rider fatality, with 13 bike riders killed in each of these months; fatalities were least likely to occur in June, with only two reported between 2002 and 2012.

5.2.2 Crash types

The most common crash type in all bike rider crashes were crashes when travelling in the same direction. This category of crash type (DCA 130–139) includes lane side-swipe, left-turn side-swipe and rear-end crashes, and accounted for almost half of all bike rider fatality crash in Victoria and at least 20 per cent of all non-fatal crashes.

Rear-end crashes resulted in the greatest proportion of bike rider fatality crashes (26%). Details of the rear-end fatality crashes are:

- 59% rural area; 32% in metropolitan Melbourne (excluding CBD)
- 45% in speed zones of 100kph
- 86% involved a car (as opposed to another motor vehicle type)
- 91% occurred **not** at an intersection (mid-block)

This crash type also accounted for serious injury (6%) and other injury (4%) crashes.

5.2.3 Crash location

Overall, the majority of bike rider crashes occurred in metropolitan Melbourne. Bike rider crashes occurred across Victoria over the study period, with greater crash density in populated and urban areas. The municipality of Melbourne had the highest total number of crashes and this is not unexpected given the increasing number of people who are riding their bikes to and in Melbourne's CBD area. Bike rider crashes also increased in inner city suburbs when there has been a reported increase in bike trips, particularly in the municipalities of Yarra, Port Philip, Boroondara and Moreland.

Mapping the crash locations of the municipalities that have had marked increases in bike rider crashes is useful to understanding changes in crash patterns over time. However, this analysis must be contextualised with broader land use details. For example, Moreland City Council has identified congestion problems emerging on shared pathways within the region, which may contribute to the increasing number of crashes on Sydney Road, as bike riders are unable or unwilling to commute via pathways shared with pedestrians.

5.2.4 Fatalities in regional Victoria

While the majority of non-fatal bike rider crashes occurred in metropolitan Melbourne, almost half of the bike rider fatality crashes occurred in regional Victoria. Recent research in regional Victoria (Baw Baw Shire Council area) (Johnson and Le 2012, Johnson and Davey 2013) has reported that some of the cycling safety concerns in regional areas are similar to those in metropolitan areas, particularly in towns, including: parking-related driver behaviour, lack of space on the road, lack of bike lanes and opening of car doors.

However, there are also regional-specific cycling safety issues that cannot be addressed with generic metropolitan-centric strategies. For example, in regional areas, the majority of roads are high speed, typically 80kph, 100kph or 110kph. Poor road surfaces, lack of sealed road shoulders and narrow, winding roads with poor sightlines in high-speed zones often means that drivers and bike riders must share roads that are ill designed for mixed modes. Yet in country areas, these are often the only available roads for drivers and bike riders.

For bike riders in regional areas to be able to cycle safely and to access the same benefits from cycling as bike riders in metropolitan areas, action needs to be taken to address a wide range of issues, including:

- Improvements to the quality of the roads
- Increased and connected cycling facilities, including on-road lanes and off-road paths
- A review of speed limits, with particular attention to the standard of the road
- An education campaign to correct current misinformation about bicycle rider and driver rights and responsibilities
- Permanent roadside signage, particularly in relation to regularly used

commuter/recreational training cycling routes
- Greater police enforcement of dangerous driving and non-compliant bicycle rider behaviour
- A collaborative approach to road use, particularly in relation to bunch riders and commercial heavy vehicles
- Increased education for heavy-vehicle drivers about how to interact safely with vulnerable road users.

5.3 Safe System approach – Safe People

Safe People is one of the four key tenets of the Safe System approach that underpins road safety in Australia. Safe People includes education and information to inform road users, as well as compliance. Safe People factors specific to bike rider crashes are discussed in this section.

5.3.1 Gender

Across all bike rider crash types and injury outcomes, more male bike riders were involved in bike crashes than females. The high proportion of males in crashes is likely to be the result of more males cycling in Victoria and concurs with findings in previous Melbourne-based cycling research (Biegler et al. 2012). Data describing the cycling population indicated 64.3 per cent of bike riders were male (Department of Communications Information Technology and the Arts 2011). In addition, the higher proportion of male crashes may be because males ride greater distances than females or ride more regularly (O'Connor and Brown 2010). There may also be behavioural characteristics related to risk-taking behaviour that contribute to more males being involved in crashes compared to females. However, this could not be determined from the CrashStats data.

5.3.2 Age

Almost 85 per cent of police-reported bike rider crashes involved adult riders aged 18 years and older. Of the male riders who crashed, almost two thirds were aged between 18 and 49 years (64.6%). Almost two thirds of female bike riders who crashed were aged between 18 and 39 years (64.2%). In fatality bike rider crashes, the age groups with the highest proportion of deaths were 30–39 years (18%), 40–49 years (17%) and 60–69 years (17%). The majority of bike riders involved in serious injury crashes were aged 18–49 years (64%). Half the bike riders involved in other injury crashes were aged 18–39 years. These age profiles differ from the research conducted by Boufous and colleagues (2012), which reported that bike riders aged 50 years and older were twice as likely to be severely injured as compared to younger bike riders.

The low number of police-reported bike rider crashes involving children may be affected by footpath riding in Victoria, which permits children under the age of 12 years and accompanying riders to ride on footpaths. If cycling crashes involving children are more likely occur off-road (e.g. bike paths, footpaths) and not involve motor vehicles, these crashes are less likely to be reported to police.

5.3.3 Helmets

Victoria has mandatory helmet use legislation, yet a quarter of bike riders who crashed were not wearing a helmet. This level of non-helmet wearing is higher than in other Melbourne-based studies, which have reported helmet use of over 90 per cent (Johnson et al. 2011, Biegler et al. 2012). Of note are the bike rider fatality crashes: in 2004 and 2008, half of the riders who were killed were not wearing a helmet at the time of the crash. Given the small number of bike rider fatalities in any one year, it is important to interpret these figures with caution. However, across the period, these two years were among those with the highest number of bike rider fatalities in Victoria (2006: 15; 2004: 9; 2008: 9).

Across the other two injury outcome categories, serious injuries and other injuries, the proportion of helmet use increased over the study period. CrashStats does not provide detailed data on the injuries sustained, so it is not possible to investigate helmet wearing/not wearing and body region injured. However, recent studies provide support for the conclusion that helmets are protective. Biegler et al (2012) reported that almost half the bike riders who crashed sustained helmet damage due to a head strike during the crash and that head protection becomes increasingly important with increased bicycle speed. Further, Yilmaz and colleagues (2013) reported that bike riders in Victoria suffered from less serious head injuries when compared to non-helmeted Dutch bike riders who had crashed.

5.4 Safe System approach – Speed Limits

Speed limit setting is a key element for best practice approaches to road safety.

Currently in Victoria and other Australian jurisdictions, the default urban speed limit is 50kph, and many metropolitan roads and roads in regional towns have a speed limit of 60kph. Most bike riders who start their trip from home will travel through these speed zones; for some, their entire trip in their local area may be on roads that have a 50kph or 60kph speed limit.

Previous research has clearly identified that increased speed is correlated with increased injury severity in the event of a crash between a bike rider and a vehicle (Andrew et al. 2012, Biegler et al. 2012, Boufous et al. 2012). For non-occupant, physically unprotected road users, including bike riders, pedestrians and to some extent motorbike riders, the maximum speed that a crash can occur at without injury is 30kph, considerably lower than the current 50kph default urban speed limit and when compared to countries that have created a safe environment for cycling.

Figure 72 shows the approximate risk of being killed for different road users across all speeds. The green represents unprotected road users. At 50kph, 7 out of 10 unprotected road users will be killed, whereas at 30kph, 1 out of 10 will survive.

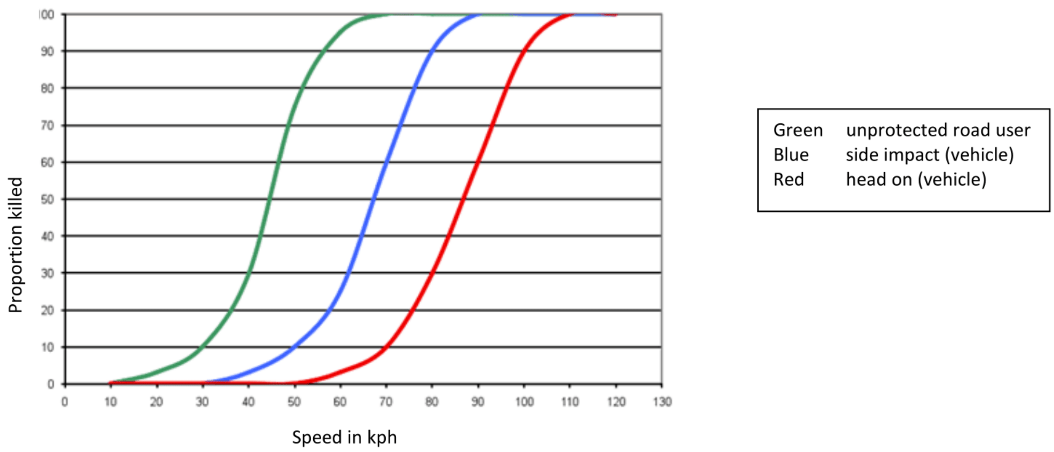


Figure 72 Approximate risk of being killed for different crash speeds and crash types (European Transport Safety Consortium 2008)

In the Netherlands, the mobility of all road users is considered in the allocation of speed limits. Local roads with a speed limit of 30kph are considered safe for bike riders and drivers to interact without any cycling-specific facilities, while roads up to 50kph require a dedicated cycle lane or separate cycle track. In speed zones of 60kph, the Dutch do combine bike riders and motor vehicles, but only if the density of motor vehicles is less than 2500 cars per day (CROW 2006).

Vehicle speed has been of central importance in the Netherlands, with the threshold for action being 60kph. 'A maximum speed of 60kph is too high to ensure optimum safety and a comfortable cycling environment. In order to do so, the speed of the motorised traffic has to be adjusted' (CROW 2006: 126).

Changes are needed to improve road safety in Victoria in relation to speed. A committed revision of the urban speed zones to reframe the public road space around our neighbourhoods is essential to improving the safety of everyone in local streets. In the road around our homes, we need to shift from spaces that maximise the speed of motor vehicle travel to spaces that are safe for active travel, including walking and cycling and use by everyone, including children.

Reducing speed zones will require community involvement to ensure that there is support for improved amenity in our neighbourhoods. Lahausse and colleagues (2010), in a study of over 4000 people in Victoria, South Australia, Western Australia and Tasmania, reported that the majority of respondents considered 50kph or 60kph speed zones to be 'about right' (71%) but proposed lower speed limits of 30kph or 40kph to be 'too low' (70%). However, other countries have faced similar community attitudes and successfully lowered speed limits. The engagement of the community may be as important as the operational process of revising street signage.

5.5 Safe System approach – Safe Roads and Roadsides

From the Safe System approach, Safe Roads and Roadsides identifies the need to design roads and roadsides to the highest safety standards possible. For many years in Australia, this safety measurement focused on vehicle occupants: drivers and passengers.

As work continues on our roads, road design remains a major contributing factor in bike rider crashes. Primarily, Victorian roads have been designed and built to maximise the safe and efficient flow of motorised vehicles, with space allocated to bike riders when available and often discontinued to prioritise motorised traffic. Action in the City of Melbourne and inner city suburbs is beginning to prioritise bike riders and reporting an increase in bike rider trips.

There are a wide range of actions that need to be taken to improve Victorian roads for bike riders. In this section, we highlight three crash types where it is evident that the road design has been a major contributing factor: intersections, vehicle doors, and emerging from lanes and driveways (drivers and bike riders) and shared paths and footpaths (bike riders).

5.5.1 Crash type – intersections

The two crash types that resulted in over 1 in 5 non-fatal crashes were Cross traffic (DCA 110) and Right through (DCA 121). Details of these crashes are:

- 100% involved a motor vehicles (98% car)
- 93% occurred at an intersection
- 81% occurred in metropolitan Melbourne

The current Austroads standard discontinues the bike lane on approach to an intersection (Levasseur 2014). This requires bike riders and drivers to somehow work out a safe approach. While this practice may be safe and intuitive when traffic is slowing towards an intersection, this configuration fails to provide any guidance to road users when negotiating the space. Typically in Victoria, intersections have no guide lines for bike riders.

Greater consideration of safe interactions of mixed road user types at intersections is needed. Models from Europe that provide a designated bike lane through intersections could offer a safer solution.

In Denmark, blue cycle crossings are installed to guide bike riders up to the stop line and then right through complex intersections. This option improves the clarity of the purpose of the road, allocates space to biker riders and reminds drivers to consider bike riders through the space (City of Copenhagen 2014). Notably, these blue cycle crossings are wide enough for bike riders to have a safe space within the bike lane from passing motor vehicles.

Figure 73 Blue cycle crossing (Denmark)

5.5.2 Crash type – vehicle doors

Almost 1 in 10 serious non-fatal crashes involved a vehicle door. One fatality dooring crash was reported during the study period. This crash type has been increasing over recent years.

Johnson and colleagues (2013) analysed this crash type in Victoria from 2000 to 2011 (police data from 2000 to 2011 and hospital data from 2000 to 2010, and naturalistic footage from 2009 to 2010) and reported that bike riders' exposure to this crash type was high, with 0.59 open door events per trip: on average, on every second trip a door was opened in front of a bike rider. On average, commuter bike riders in metropolitan Melbourne passed a parallel parked vehicle every 8 seconds and were required to be constantly vigilant to assess the potential threat of an opened vehicle door.

The major contributing factor in this crash type is the road design and the allocation of parallel parking bays in relation to on-road space for bike riders. Given that the current road design positions bike riders directly in the path of opening vehicle doors, greater resources are required to create safe vehicle-occupant behaviour. With the high rate of exposure to this risk, it is likely that bike riders develop the necessary skills to reduce their crash risk.

The practice of placing bike lanes alongside parallel parking bays needs to be revised. There are a range of options that could form a solution. Wider bike lanes that allow bike riders to avoid opening vehicles would improve safety, as would 'Copenhagen lanes' that place the bike lane between the footpath and the parked vehicles. Increased clearways, particularly along busy cycling routes, are also needed.

Drivers and passengers also must check for bike riders before opening vehicle doors. Some action was taken following the death of a bicycle rider in 2011 in Victoria, with the on-the-spot fine increased from $141 to $352 and from 1 penalty point to 2.5, and the maximum court penalty increased from $423 and 3 penalty units to $1408 and 10 penalty units. Preventative action is also needed including for example, safe door opening behaviour in road safety education in schools and as a mandatory accessible task in the new driver licensing (testing) process.

5.5.3 Crash type – emerging

Two prevalent crash types arise from bike riders and drivers emerging from driveways, lanes and paths into the pathway of other road users. That is, 16 per cent of bike rider crashes were caused by Vehicle off footpath strikes vehicle on carriageway (DCA 148) and Vehicle strikes another vehicle while emerging from driveway-lane (DCA 147). Further, over half of the child bike rider crashes reported in CrashStats from 2002 to 2012 involved being hit after emerging from a footpath or driveway.

5.6 Safe System approach – Safe Vehicles

Safe Vehicles has been an important tenet of the Safe System approach for motor vehicle occupants, with advances in vehicle technology having a significant impact on increasing safety. However, safe vehicle design for non-occupants is yet to reach the same safety gains for people outside the motor vehicle as it has for those inside.

The majority of all bike rider crashes reported to police involve a motor vehicle. As discussed above, this is likely to be a function of the minimum requirements, or the public perceptions of the minimum reporting requirements, that need to be met in order to report a crash to police. The high proportion of vehicle involvement in crashes also reinforces the low reporting of single-vehicle (bicycle-only) crashes. The majority of crashes involved passenger and small vehicles. This section focuses on two factors for safer vehicles – heavy vehicles and the bicycle, in particular bike lights.

5.6.1 Vehicles – heavy vehicles

Crashes between bike riders and heavy vehicles (including medium-sized transport and commercial vehicles and heavy vehicles) are relatively infrequent occurrences. However, over one third of bike rider fatalities involved a heavy vehicle.

Given the risk of injury severity in a crash between a heavy vehicle and bike rider, it is essential that drivers and bike riders interact safely. For drivers, it is important that training includes safe practices when sharing the roads with bike riders. For example, the approach used in the partnership between the Amy Gillett Foundation and Toll, a leading Australian logistics company, which includes information about sharing the road with bike riders. As part of the partnership, the 'a metre matters' message has been added to heavy vehicles to create a moving billboard message to other road users. Bike rider awareness training is essential for all professional drivers of large vehicles, including buses, coaches, delivery vans etc. Building on this partnership, AGF and Toll joined with Volvo Trucks to create a video illustrating how heavy vehicles and bike riders could share roads safely.

Bike riders also need to take greater care when sharing the road with heavy vehicles and large vehicles. Safe interaction with heavy vehicles is a message that has been extensively developed in the UK and lessons could be adopted for Victoria.

5.6.2 Vehicles – bicycle: bike lights

Over a third of bike rider fatality crashes occurred at night or in low light conditions. It was not possible from the CrashStats data to determine whether the bike riders' visibility was a factor in these crashes. However, of the bike rider fatality crashes that occurred in dark light conditions, over half occurred where the street lights were off or there were no street lights. Previous research has identified that riding at night, especially in areas that are unlit or have poor lighting increases the risk of injury severity in bike rider-motor vehicle crashes (Boufous et al. 2012). Further, there is an increased likelihood of alcohol and potentially illicit drug use by the bike rider or the driver at night that may be a contributing factor in the crash.

Bike lights law

- flashing or steady
- visible for at least 200m
- front: white; rear: red

Also, red reflector visible for at least 50m (when reflecting low beam vehicle headlights)

In Victoria, bike lights must be fitted to bicycles by law. Bike lights are essential for riding in low light and at night but the use of bike lights could not be determined from the CrashStats data.

Using bike lights is a critical action cyclists must take to improve their visibility to other road users. In addition to the use of bike lights being legally required, this action is also about mutual respect between bike riders and other road users. A bike rider at night can be virtually invisible to others on the road and increases the risk that drivers would not see, and could potentially hit, a bike rider on a bike without adequate lighting.

Use of adequate bike lights at night and in low light conditions is part of the Amy Gillett Foundation's *It's a 2 way street* campaign and the education and awareness of the requirements for bike lights would be addressed in a statewide campaign.

5.7 Electric bikes – the next generation

An emerging vehicle type in the bicycle fleet that requires a separate mention is electric bikes. Electric bikes are legally recognised as bicycles in Australia and riders are subject to the same road rules and permitted to ride their ebike as if it were a pedal bike. In 2012, the Australian Government adopted the European Union design standard for electric bikes, which included increasing the power output from 200 watts to 250 watts. This change has dramatically expanded the ebike models available for legal sale in Australia. While currently ebike sales figures for Australia are not collected or published, ebike retailers are reporting unprecedented and increasing demand and cannot import ebikes fast enough to meet demand (Dolomiti Electric Bicycles 2014).

Currently the official crash data reported in both police and hospital data do not include details of the bike type. This gap needs to be addressed, given the significant increases in sales and use of electric bikes and the differences in crash characteristics between ebikes and pedal bikes.

Prior to the policy change, ebikes were frequently sold with a handlegrip throttle that engaged the pedals without the rider needing to pedal. In adopting the EU standard, the power assistance can only be engaged by pedalling, also called pedal assist or pedelec (Australian Government 2012, Rose 2012). These models are still part of the existing Australian ebike fleet and are reported to be a crash-contributing factor (Johnson and Rose 2014).

Early research on the use of electric bikes In Australia has reported that people who were infrequent bike riders reported that their ebike is integrated into daily travel, often replacing the car (Johnson and Rose 2013). While there are definitely gains in shifting people from their sedentary motor car to active transport (Simons et al. 2009, Gojanovic et al. 2011), there are also new ebike-specific safety concerns.

With a wider range of people with different levels of skills and experience now choosing to ride an electric bike, there may be an increase in bike crashes from ebike riders with crash profiles that are distinctly different from those of pedal bike crashes (Johnson and Rose 2013). Crashes that involve ebikes must be clearly identified in the reported crash data to ensure accurate monitoring of ebike crashes, as distinct from pedal bike crashes, over time. This will ensure the magnitude of ebike related crashes can be accurately determined and provide evidence should ebike-specific countermeasures be required to improve safety outcomes.

6 Conclusion

This study demonstrates that analysis of bike rider crashes is an important component to understanding how to create a safe cycling environment. It clearly shows that there are distinct differences in the crash profiles of fatal bike rider crashes compared to non-fatal crashes. The highest proportion of bike rider crashes are occurring in urban areas, mainly metropolitan Melbourne. However, almost half of all bike rider fatality crashes in Victoria occur in regional areas. Rear-end crashes with the vehicles travelling in the same direction are the crash type which results in the greatest proportion of bike rider fatality crashes. Crashes are more likely to occur at non-intersections and heavy vehicles are involved in over one third of crashes. While it is important to take action to improve the safety of the circumstances that result in fatality crashes, it is also important to recognise the enormous number of people who are injured in non-fatal crashes.

In this report, factors that contributed to bike rider crashes reported in CrashStats have been highlighted and some potential countermeasures highlighted.

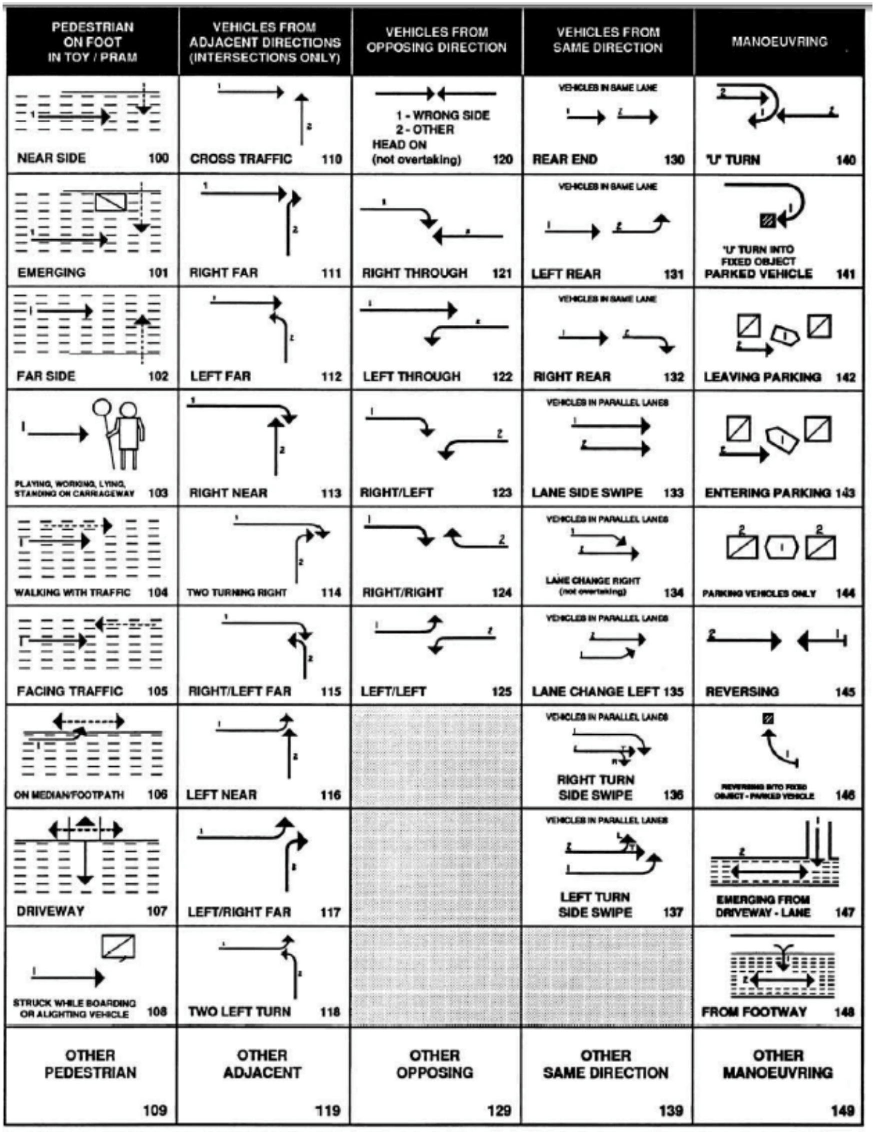
However, as shown, the insight offered by crash data analysis alone is limited and it requires comprehensive data about cycling trips to understand how changes in participation affect crash rates. Further, it is important to acknowledge that while police data provide one of the most comprehensive data sources about road user crashes, there are important limitations that need to be considered.

Further research to fill these gaps and address these limitations includes:

- Evaluate online crash self-reporting systems in other jurisdictions and compare with data reported to police and hospitals to determine the value of generating a similar online system in Victoria
- Research to identify the most effective questions to include in driver licence written test and on-road skills training and tests; and
- Review international best practice for generating cycling exposure data to develop a robust cycling exposure measurement.

7 Appendix

Source: VicRoads (2008)



1. Definition for classifying accidents (DCA) should be determined by first selecting a column using the text above & then by diagrammatic sub-division.
2. The sub-division chosen should describe the general movement of vehicles involved in the initial event. It does not assign a cause to the accident.
3. Supplementary codes have been defined for most sub-divisions. These codes give further detail of the initial event.

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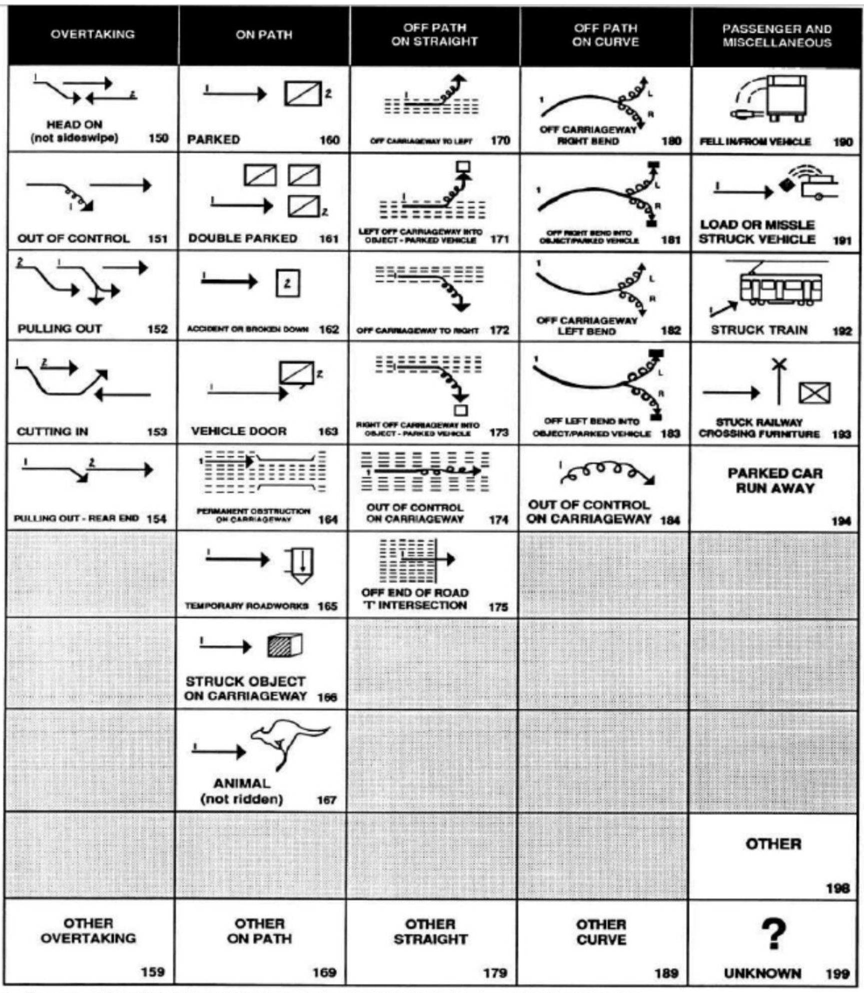

4. The number 1,2 identify individual vehicles involved when the DCA is linked with other vehicle/driver information.
5. These codes were used for 1987 accidents and replace the Road User Movement (RUM) code.

Produced by the Road User Behaviour Branch, Road Safety Division, VIC ROADS - DCA.pm4 & DCA2.pm4

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Appendix E

State and territory government websites visited to review messaging about speed

Australian Capital Territory	http://www.justice.act.gov.au/
New South Wales	http://roadsafety.transport.nsw.gov.au/index.html
Northern Territory	https://nt.gov.au/
Queensland	https://www.tmr.qld.gov.au/
South Australia	https://www.mac.sa.gov.au/
Tasmania	http://www.transport.tas.gov.au/
Victoria	http://www.tac.vic.gov.au/home
Western Australia	https://www.rsc.wa.gov.au/

Appendix F – AGF Submission to NSW Inquiry into heavy vehicle safety and the use of technology to improve road safety

19 February 2018

Attention: Mr Greg Aplin
Chair of Staysafe – Joint Standing Committee on Road Safety
Parliament of New South Wales
Macquarie Street, Sydney
NSW 2000

Lodged online via:
www.parliament.nsw.gov.au/staysafe

Dear Mr Aplin,

Amy Gillett Foundation Submission to Inquiry into heavy vehicle safety and the use of technology to improve road safety

The Amy Gillett Foundation (AGF) welcomes the opportunity to provide a response to the Inquiry into heavy vehicle safety and use of technology to improve road safety. Technology presents significant opportunities to increase safety on our roads and reduce trauma. We ask the Committee throughout the Inquiry and in preparing their recommendations to the New South Wales Government to keep in mind one question:

How will the use of technology in heavy vehicles impact the safety of vulnerable road users?

The Amy Gillett Foundation has a direct interest in contributing to the conversation about safe vehicles, including heavy vehicles, particularly regarding the interaction with cyclists. Technology has a big part to play in reducing the high casualty rates associated with heavy vehicles. There is already technology that addresses driver fatigue through monitoring, autonomous emergency braking and technology that is capable of detecting cyclists and pedestrians. This needs to be integrated into the heavy vehicle fleet as a matter of urgency.

To date, technological advancements with regard to communication have largely focused on motor vehicle to motor vehicle (V2V) or connecting motor vehicles to infrastructure (V2I). However, both approaches overlook the people moving on our roads who are not inside a motor vehicle, namely pedestrians and cyclists. It is easy enough to include people in an inclusive approach to safety. By making small, incremental extensions of existing, and future, V2V technology, vulnerable road users can be included immediately as V2X (vehicle to anything, e.g. using smartphones carried by most pedestrians and cyclists).

The purpose of this submission is to share recent research findings into heavy vehicle safety generated by a review conducted by the AGF in collaboration with Monash University through

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ABN: 46 200 981 503 / ACN: 118 522 375

our partnership with Toll Logistics and to draw the Committee's attention to the need for safer trucks in relation to vulnerable road users.

Please do not hesitate to contact me directly if you have any questions or require any additional information.

Yours sincerely,

Phoebe Dunn
Chief Executive Officer
Amy Gillett Foundation

Amy Gillett Foundation

The Amy Gillett Foundation (AGF) is a national organisation with a mission to reduce the incidence of serious injury and death of bicycle riders in Australia. We draw on evidence and international best practice, and collaborate with governments, business and the community to create a safer environment for cyclists, while maintaining an efficient road network for all road users.

Terms of Reference – AGF response

This inquiry provides an opportunity to address a significant gap in the current approach to motor vehicle technological advances, that vulnerable road users are being overlooked as manufacturers focus on the motor vehicle to motor vehicle (V2V) and motor vehicle to infrastructure (V2I) technology. There is little evidence that the potential for harm to vulnerable road users including cyclists, pedestrians and motorcyclists is being prioritised.

In this submission we have focused on one of the Terms of Reference:

b) The development of connected and automated vehicle technologies specific for the heavy vehicle industry and opportunities for further development in this space.

Definitions

We have used a broad definition of heavy vehicles in this study. We have included all types of trucks including:

- Prime mover (including all trailers)
- Rigid truck (all weight)
- Prime mover only, single trailer, B double, B triple
- Light commercial vehicle (rigid) <=4.5 tonnes
- Heavy vehicle (rigid) > 4.5 tonnes

We have also included waste management trucks, street sweepers, buses and coaches.

In addition, the terminology related to the road network, automation and connective have several initialisms that are often used interchangeably, but have specific meanings. We have used the following in this submission:

- V2V connectivity between motor vehicle and motor vehicle
- V2P connectivity between motor vehicle and a person (i.e. non-motorised road user, e.g. pedestrian and cyclist)
- V2I connectivity between motor vehicle and infrastructure
- V2X connectivity between motor vehicle and any other entity on the road network (i.e. person, other motor vehicle, infrastructure)

- P2I connectivity between person (e.g. pedestrian and cyclist) and infrastructure

To address Term of Reference b), the following submission is presented in three sections: inclusive safety, technology and insights from AGF partnership with Toll Logistics. Finally, concluding remarks have been included for the Committee's consideration.

Inclusive safety

In the main, the AGF welcomes technology as a means of improving vulnerable road user safety around heavy vehicles. Increased visibility with on-board monitoring cameras, other recording devices and automatic braking are all positive changes in the heavy vehicle fleet.

However, to date, the focus of connected and automated vehicle technologies, for all motor vehicles, has been the connectedness with other motor vehicles (V2V) and infrastructure (V2I) (Figure 1). This motor vehicle-centric approach was highlighted in a recent Austroads report: *Safety benefits of cooperative ITS and automated driving in Australia and New Zealand*.[i] Of 22 technologies reviewed in the study, only **one** related to the safety of cyclists, and the authors predicted the safety benefits of the cyclist-related technology to be Low. Many of the technologies being developed for the safety of people when we are inside the car were predicted to have a high safety impact.

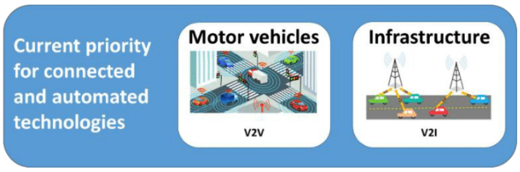

Figure 1. Current priority for connected and automated motor vehicle technologies

Small nudge will bring big safety gains for all road users

For incremental investment, technology can be extended to enter the market connect to all road users, connecting motor vehicles to other motor vehicles (V2V) and connecting motor vehicles to people (V2P, i.e. cyclists and pedestrians). Mobile phone use is almost ubiquitous in Australia and extending the V2V technology to include smartphone applications would connect the majority of Australians (Figure 2).

From our discussions with the automotive industry, they do have plans to include V2P and V2X technology, but it's on their long-term agenda and will not be realised in the short term. We encourage the Committee to recommend to the Government that V2P technology be included in all connected and automated technology, including heavy vehicles.

Smartphone based technology gives people the opportunity to opt-in. For example, most cyclists ride with their mobile phone in their pocket or bag, extended technology would mean the motor vehicle technology would detect the cyclist and assist drivers to avoid conflict.

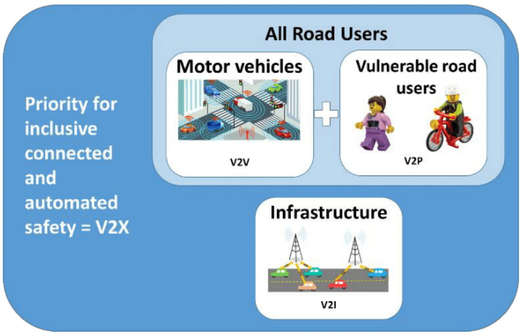

Figure 2. Priority for inclusive safety

Technology

In relation to specific technology, we request that the Committee consider vulnerable road users in relation to any connected or automated vehicle technology, for both heavy vehicles and the entire motor vehicle fleet. This is particularly important to avoid unintended consequences that are foreseeable if the impact is considered from the perspective of the vulnerable road users.

Under the Safe System approach that underpins road safety in Australia, governments have a shared responsibility with other stakeholders, including motor vehicle manufacturers, to ensure that safety gains benefit all road users. This is clearly stated in the Safe System principles:

> ***Principle 2: the health and well being of our society should not be traded off against other societal benefits…we should not be prepared to accept additional death or serious injury on our roads as trade-off for increased productivity***[ii]

Example of unintended consequences

From the perspective of driver and occupant safety, Lane Keep Assist technology provides breakthrough technology to help prevent motor vehicle crashes, in particular, run-off-road crashes. However, Lane Keep Assist technology is one example where the intended outcome of the technology (keep motor vehicles central to the lane) has unintended consequences.

Figure 3 below is an example from Mazda of their Lane Keep Assist System, it clearly shows that the steering assist begins when the driver veers away from the central lane position.

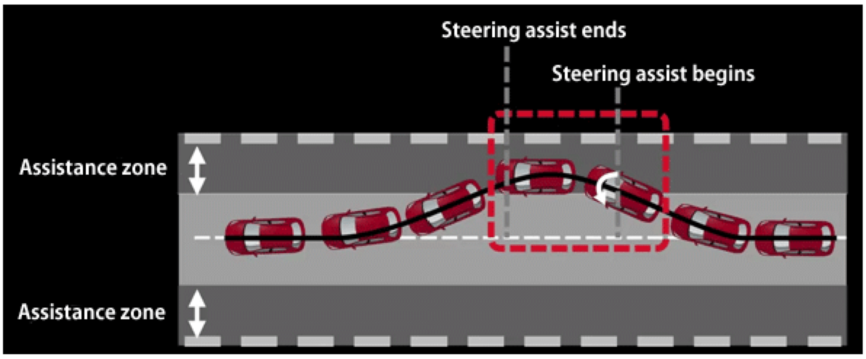

Figure 3. Illustration of Lane Keep Assist technology (Lane Departure Avoidance)[iii]

Current technology relies on cameras detecting the lane edge lines and positioning the vehicle central to those two outer lane markings (Figure 4).

Figure 4. Illustration of camera detection used in Lane Keep Assist technology[iv]

However, if we consider this technology from the perspective of a cyclist, this 'safety' technology is less clear. Figure 4 shows the same image, this time with cyclists in the image. If the driver moves out of their lane to provide a cyclist with more lateral distance when passing (which is a mandated requirement in most Australian states and territories), some versions of Lane Keep Assist technology will activate and 'assist' the driver back into the centre of the lane.

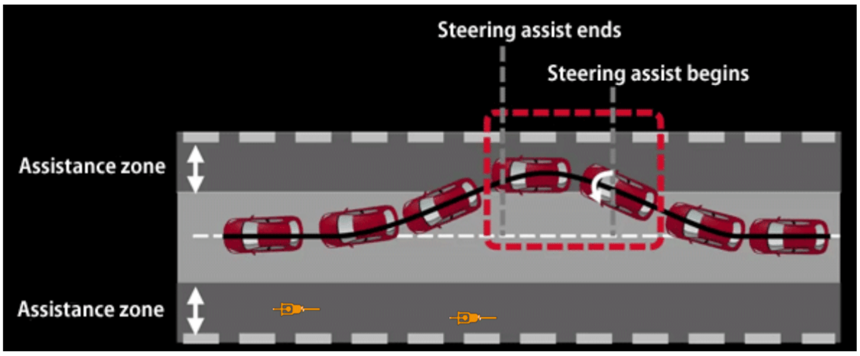

Figure 3. Illustration of Lane Keep Assist technology with other roads users (cyclists)

The nudge

As mentioned above, an incremental extension to the technology by the manufacturing industry can remove the risk the current Lane Keep Assist technology creates for cyclists. A camera aimed to the left of the vehicle that detected the presence of a cyclist to the left and used in conjunction with the Lane Keep Assist would ensure that the motor vehicle maintains a safe passing distance.

From a driver/occupant perspective, the benefits of this technology are clear. However, the risks are equally clear to vulnerable road user experts. We recommend that as part of this Inquiry, the Committee considers including a recommendation to Government that all new technologies introduced in to the heavy vehicle fleet are reviewed by vulnerable road user experts with the aim to reduce safety risks being introduced to non-occupant road users (e.g. cyclists and pedestrians).

Insights from AGF partnership with Toll Logistics

For the last six years, the partnership between the AGF and Toll has led to considerable changes for improved safety for vulnerable road users. In this section, we have provided a summary of a recent review undertaken in collaboration with Monash University.

Summary: Review of coroners' recommendations following fatal cyclist crashes involving heavy vehicles

The AGF in collaboration with Dr Marilyn Johnson (AGF/Monash University) and Associate Professor Lyndal Bugeja (Monash University) has recently completed a review of all coroners' recommendations following cyclist fatality crashes that involved a heavy vehicle. The analysis was conducted as part of the partnership with Toll Logistics. We bring the report to the Committee's attention as it contains numerous recommendations by Australian coroners that are pertinent to this Inquiry.

From 2000 to 2016, there were 141 cyclist fatality crashes that involved a heavy vehicle in Australia. The crashes involved people of all ages who were riding their bikes, including children. The heavy vehicles were classified as either 'truck' (84%) or bus/coach (16%). One case was still under investigation (Open) and was excluded from the analysis.

Of the 140 case analysed, coroners made recommendations in 17 cases (12%). Several of these recommendations included changes to technology and we have highlighted these below:

Safe vehicles

The most frequently made vehicle-related recommendation focused on visibility and maximising the drivers' capacity to see the road user outside the cabin, including:

- Rear vision camera – trial and install to maximise driver accessibility and visibility
- Prohibit conventional shaped heavy vehicles unless fitted with appropriate warning technology

Safe roads and roadsides

Most road related recommendations related to the need for a review of guidelines and design standards and the restriction of parking to improve safety. One recommendation made was for Person-to-infrastructure technology (P2I) with the increased use of technology that enables a person on a bicycle to activate a head-start light at a bike box at a signalised intersection. Allowing the bicyclists to begin moving ahead of other vehicles allows them to gain sufficient momentum to reduce lateral movement common in bicycles at low speed. It also helps remove them from heavy vehicle blind spots.

Safe people

Almost half the recommendations related to safer behaviours. In particular, coroners highlighted the need for increased public awareness of visibility restrictions for heavy vehicles drivers and the need for parental supervision of young children around heavy vehicles.

Concluding remarks

The Amy Gillett Foundation is optimistic that advancements in connected and automated technology in heavy vehicles can lead to improved road safety outcomes for all road users. However, we also note that vulnerable road users are a secondary consideration for motor vehicle manufacturers. We encourage the Committee to use this Inquiry to take leadership in road safety and ensure new technology for road safety means all road users including people when they are riding a bicycle. We submit the following recommendations to the Committee:

Recommendations

- All new technologies introduced into the heavy vehicle fleet are reviewed by vulnerable road user experts with the aim to reduce safety risks being introduced to non-occupant road users (e.g. cyclists and pedestrians).

We also endorse the recommendations already made by coroners' following cyclist fatality crashes:

- Installation of rear vision cameras are mandatory on all heavy vehicles with a time limit in place to allow current operators to retrofit cameras to existing heavy vehicles
- Prohibit conventional shaped heavy vehicles unless fitted with appropriate warning technology with a time limit in place to allow current operators to install the technology
- Increase inductive loop technology installed at bike boxes to provide cyclists with a head-start light to ensure they enter the intersection ahead of motor vehicle traffic, including heavy vehicles where drivers have visibility restrictions.

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[i] Austroads (2017) Safety benefits of cooperative ITS and automated driving in Australia and New Zealand. https://www.onlinepublications.austroads.com.au/items/AP-R551-17
[ii] Victorian Community Road Safety Partnership Program (2010) Guide for understanding and applying 'Safe System' principles. VCRSPPDraftGuideforUnderstandingandApplyingSafeSystemPrinciplesDec2010.pdf
[iii] Source: Mazda. LAS (Lane Keep Assist System). http://www.mazda.com/en/innovation/technology/safety/active_safety/las/
[iv] Source: Kia. Lane Keeping Assist (LKA). http://www.kia.com/eu/models/sorento/

Appendix G

Link to article

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Cyclist-related content in novice driver education and training

Jennifer Bonham[a,*], Marilyn Johnson[b,c]

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Driver training
Cyclist
Content analysis

ABSTRACT

In Australia, the increasing public profile and policy interest in cycling contrasts with variable cycling participation rates across jurisdictions (Australian Bicycle Council, 2017) and lack of cyclist-specific infrastructure. Cyclists and drivers often share road space, usually without indication from the built environment about how to maximise each other's safety and utility. Yet despite this regular interaction, cyclists are largely absent from the driver licensing process in Australia. That is, novice drivers are not taught how to share the road with cyclists. This case study used a mixed methods approach to examine the cyclist-related content in the Graduated Driver Licensing System (GDLS) in the Australian Capital Territory (ACT). The case study was conducted in four stages: 1) content analysis of all documents used through the GDLS; 2) observations of the *Road Ready* course and learner driver lessons; 3) online survey; and, 4) semi-structured interviews. Cyclists are rarely mentioned in the GDLS in the ACT and references often constructed cyclists as problematic or were based in instructors' personal opinion (rather than scripted responses). Outcomes from this study have directly informed a new vulnerable road user driver licence competency in the ACT and findings include recommendations for greater inclusion of cyclists in the driver licensing system.