Submission to Victorian Parliamentary Road Safety Committee Inquiry into Motorcycle Safety.

Submission prepared and submitted by:

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Overview

This submission is made on behalf of those individuals working at the Transport and Road Safety (TARS) Research group (formerly the Injury Risk Management Research Centre (IRMRC)) at The University of New South Wales (UNSW) in response to a request from the Victorian Parliamentary Road Safety Committee. It is based on research relating to motorcycle road users that has been conducted by the above individuals at UNSW over the past three years. The main area of research that TARS/IRMRC have been involved in that may be of use to the committee relate to motorcycle into roadside barrier fatalities and motorcycle fatalities and injuries in general. This submission was prepared by Prof. Raphael Grzebieta with the assistance of Dr Michael Bambach and Ms Rena Friswell.

Prof Grzebieta is also Immediate Past President of the Australasian College of Road Safety (ACRS), serves on the ACRS National Executive Committee of the College and is Peer-Review Paper Editor for the Journal of ACRS. The committee should also be aware of a Special Edition published by the College in November 2009 Vol 20 No 4.¹ The Guest Editor for this edition was Ms Liz de Rome from The George Institute, Sydney University. A copy of the contents are provided on the next page. Committee members can download a copy of this special issue if it has not already been referred to in other submissions.

Contents of the Journal of the Australasian College of Road Safety Special Edition on Motorcycle and Scooter Safety

CONTRIBUTED ARTICLES


Motorcycle Safety in Australia – Consulting with Riders and Jurisdictions
Working Together – by Shaun Lennard

A New Strategic Approach to Advance Motorcycle Safety and Mobility in Victoria – by Nicola Fotheringham

Australian Road Safety Equipment Certification in Crisis? - by Tom Gibson

Roads and Motorcycling: Raising the Profile – by Chris Brennan

Effect of Past Black Spot Programs on Motorcycle Safety
– by J.H. Scully, S.V. Newstead, B.E. Corben and N.L. Candappa

Community Policing and Education to Reduce Motorcycle Trauma
– by Ray Shuey and Kevin Casey

Motorcycle Crash Casualties and their In-hospital Management – observations from St Vincent's Hospital, Sydney – by SG Faux, SG, L Donaldson and K J Brook

The Motorcycle Safety Research Program at the George Institute – by Rebecca Ivers and Liz de Rome

A Survey of Motorcycle Safety Programs Across Australasia - by N Haworth, K Greig and D Wishart


PEER-REVIEWED PAPERS

Overview of Motorcycle Crash Fatalities Involving Road Safety Barriers
– by R Grzebieta, H Jama, A McIntosh, R Friswell R, J Favand J, M Attard and R Smith

Motorcycle Rider Protective Apparel Wearing: Observational Study Results from the Brisbane and Canberra Regions – by D. Wishart, B. Watson, and P. Rowden

ROAD SAFETY LITERATURE

Book Review – 'The Good Gear Guide'

New to the College Library

Recent Publications
The TARS research team have predominantly investigated on-road crashes in regards to Australian data although some US data has been used to assess survivability of motorcycle crashes into fixed objects that relate to Australian conditions. While work over the past two to three years has focussed predominantly on fatalities involving motorcycle impacts into roadside barriers, there are currently four studies in total underway at TARS that will provide information concerning motorcycle fatalities and injuries. These studies are:

- analysis of motorcycle impacts into roadside safety barriers that include W-beam, concrete and wire-rope barriers, funded by the Office of Road Safety from the NSW Roads and Traffic Authority (RTA), NSW Motor Accidents Authority (MAA), Office of Road Safety from West Australian Main Roads, New Zealand Transport Agency (NZTA), and the Australian Automobile Association;

- investigation of motorcycle deaths and serious injuries located in the ACT of ACT residents for the years 2000 to 2010, funded by the ACT-NRMA trust;

- investigation of all motorcycle fatalities that occurred in Australia using information from the National Coroners Information System for the years 2001 to 2006. Around 1300 Australian fatalities have been accessed and coded. This work is being mainly funded by TARS and Department of Civil Engineering at UNSW;

- analysis of linked data from all NSW RTA crash data with hospital admissions in NSW. This project is being funded under an Office of Road Safety RTA research contract. Around 12,000 motorcycle crash related hospitalisations have been identified in that work. Material published from this data linkage project will likely not be available until next year at the soonest.

Results from these studies will continue to be published over the next two years in various journals and presented at various Australian and international conferences. Information from the first study and some preliminary information from the second and third studies are presented in this submission. Prof Grzebieta on behalf of the IRMRC researchers (now TARS) also made a submission to the NSW Parliamentary Staysafe Committee on their inquiry into Research Relating to Vulnerable Road Users (submission 54, dated 27/08/2010) which included motorcycle safety.

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General Motorcycle Fatality and Injury Data:

After dramatic reduction in the late 1980’s and early 1990’s, motorcycle fatalities in Australia have been rising over the past decade as shown in Figure 1. They are increasing at an average of 5.7% per annum\textsuperscript{3}. Of particular alarm is the rise in single vehicle motorcycle crashes. They have almost doubled between 2003 and 2008, rising from 61 to 110 deaths\textsuperscript{4}. Single vehicle motorcycle crashes include impacts into roadside barriers.

![Figure 1: Australian Motorcycle fatalities\textsuperscript{4}](image)

The increased numbers of motorcycle crashes are likely in part to be the result of an increase in motorcycle registrations. Australian Bureau of Statistics (ABS) data on motorcycle registrations in Figure 2 indicate the number of motorcycles over the past decade has almost doubled, a trend which

![Figure 2: Motorcycle registrations in Australia](image)


can be expected to continue with increases in fuel costs, parking costs, and traffic density. Motorcycles, and more recently scooters, are perceived as a viable alternate mode of transport to cars. Thus, motorcycle safety is likely to become an increasingly important focus for road safety researchers and practitioners, particularly because reported motorcycle crashes are typically severe.

Figure 3 shows the years 2000 to 2010 highlighted where all road fatalities are compared to just motorcycle fatalities and then a comparison of percentage of motorcycle fatalities compared to all road fatalities. Similar graphs shown in Figure 4 have been extracted from the Department of Infrastructure, Transport, Regional Development and Local Government. It is clear from both these sets of graphs that over the past decade, motorcycle fatalities relative to all road fatalities are rising and in particular single vehicle crashes have risen. It is also the main reason why TARS researchers started to look in detail at motorcycle fatalities over the past few years. It is clear those countermeasures that appear to be working for other road users are not having as substantial an effect in regards to motorcycle riders. It is the opinion of TARS researchers that insufficient research ‘independent’ of research funded by motorcycling lobby groups, has been carried out. That is now being addressed at TARS.

Figure 3: Comparison of motorcycle fatalities to all road fatalities
Figure 4: Comparison of motorcycle fatalities to all road fatalities relative to 2010 showing road user fatalities have reduced for driver, passenger and pedestrians whereas motorcycle fatalities have risen significantly over the past 10 years. (Source: Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2011, Road deaths Australia 2011 statistical summary, Canberra ACT).  

5 http://www.bitre.gov.au/publications/05/Files/2010_Annual_road_deathsR.pdf
**ACT –NRMA Road Safety Trust Study:**

The ACT –NRMA Road Safety Trust study currently under way focused on a retrospective descriptive analysis of hospital separations data for ACT residents. All trauma cases requiring public hospital admission treated at Canberra Hospital were investigated. A preliminary report has been submitted recently and can be requested from the Trust.6

Key findings in the preliminary report related to the analysis of ACT motorcyclists injured during the ten year period between 2001 and 2010 (inclusive) are:

- A total of 1,199 ACT residents presented to Canberra hospital with injuries sustained in a motorcycle crash;
- The 16-25 year old age group had the highest number of individuals;
- The majority of crashes (51%) occurred without a collision with a counterpart
- The number of injured motorcyclists per year has increased around two times in this period, roughly in-line with the increase in motorcycle registrations;
- Of concern, these increases in injuries are nearly six times higher for motorcyclists aged 46 years and over;
- Older riders also experienced more severe injury outcomes and longer stays in hospital;
- Nearly one third of motorcyclists were injured in non-traffic areas (non-public roads), i.e. off-road;
- The majority of separations in the less than 15 years group occurred in non-traffic areas, likely due to the fact that these persons would not be licensed and would therefore be unable to ride in traffic area;
- The highest frequency of crash modes was non-collisions, e.g. single vehicle sliding, which accounted for more than half of separations, and had less severe injury outcomes than other crash modes;
- Motorcycle into passenger vehicle collisions, followed by motorcycle into fixed object collisions, resulted in the most severe injury outcomes;
- Motorcycle into passenger vehicle collisions and motorcycle into fixed object collisions were more likely to result in head and spine injuries, than non-collision crashes.

**Motorcycle Impacts Into Roadside Barriers Study:**

This study effectively arose as a result of motorcyclists in Europe, US, Australia and New Zealand vocalising serious concerns over the installation of wire-rope barriers (WRBs). News items appear from time to time by motorcyclists regarding wire-rope barriers (WRBs).7 Claims are sometimes made that these barriers are dangerous and act like ‘cheese cutters’, and that WRBs have been banned in other countries, with absolutely no supporting proof. All of the concerns have been found to be completely unfounded once the statistical data, the circumstances of the crash and crash forensics were investigated carefully. Claims that WRBs have been banned in other countries are

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also completely erroneous. In fact quite the opposite has been found. Anywhere wire-rope barrier systems have been installed they have found to have a dramatic effect in reducing fatalities and serious injuries for all road users including motorcyclists. Moreover, the term ‘cheese cutters’ is a myth promulgated by some ill-informed motorcyclists who do not understand how riders are seriously injured or killed when impacting roadside barriers.

This section presents some of the key results of this research investigating motorcycle crashes into roadside safety barriers. The material is extracted essentially from reports and research papers published to date by the authors of this submission. Some of the statistics have also been extracted from a Flinders University report by Henley and Harrison. It refers to Australia in general albeit there is a breakdown of some of the findings for Victoria.

In 2007 in Australia:

- the proportion of registered vehicles on the road that were motorcycles was 4.5%, however the proportion of the total number of road user fatalities that were motorcyclists was 15%. Motorcycle fatalities are over represented in terms of road crash fatalities.
- the number of fatalities per billion vehicle kilometres travelled was 3.9 for cars and 116.9 for motorcycles - motorcyclists were 30 times more likely to be killed than car occupants per distance travelled;
- the number of serious injuries (non-fatal injury requiring hospital admission) per 100 million vehicle kilometres travelled was 10.3 for cars and 385 for motorcycles - motorcyclists were 37 times more likely to be seriously injured than car occupants per distance travelled;
- the serious injury rate per 100,000 population (age-standardised) for motorcyclists was 35.3, and has increased steadily from 24 in 2001. Actual case numbers of seriously injured motorcyclists increased from 4,642 in 2001 to 7,303 in 2007 (an increase of more than 50% in only 6 years).

In NSW

- in 2007, in NSW, the number of serious injuries per 100 million vehicle kilometres travelled was 10.8 for cars and 370 for motorcycles - motorcyclists were 34 times more likely to be seriously injured than car occupants per distance travelled;

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In Victoria

- in 2006, the proportion of registered vehicles that were motorcycles in Victoria was 3.06% as shown in Table 1;

- in Victoria between 2001 and 2006, there were 299 motorcycle fatalities, of which 3.2% are known to have occurred as a result of a collision with a roadside barrier (Table 2).

| State                        | Total Vehicle Population | Motorcycle Population | Proportion of motorcycles (%) *
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Capital Territory</td>
<td>224 076</td>
<td>8 022</td>
<td>3.58%</td>
</tr>
<tr>
<td>New South Wales</td>
<td>4 268 631</td>
<td>122 211</td>
<td>2.86%</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>114 015</td>
<td>3 950</td>
<td>3.46%</td>
</tr>
<tr>
<td>Queensland</td>
<td>2 897 867</td>
<td>110 501</td>
<td>3.81%</td>
</tr>
<tr>
<td>South Australia</td>
<td>1 137 957</td>
<td>33 772</td>
<td>2.97%</td>
</tr>
<tr>
<td>Tasmania</td>
<td>374 846</td>
<td>10 488</td>
<td>2.80%</td>
</tr>
<tr>
<td>Victoria</td>
<td>3 740 726</td>
<td>114 438</td>
<td>3.06%</td>
</tr>
<tr>
<td>Western Australia</td>
<td>1 600 566</td>
<td>59 675</td>
<td>3.73%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>3,308,142</td>
<td>49,283</td>
<td>1.49%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14 358 684</strong></td>
<td><strong>512,340</strong></td>
<td><strong>2.90%</strong></td>
</tr>
</tbody>
</table>

*Motorcycles as a proportion of the population of registered motor vehicles

**Table 1:** Population of vehicles and motorcycles in Australian jurisdictions and New Zealand in 2006

The percentage of Australia’s road fatalities that are motorcyclists has increased over the last decade and is much higher as a percentage of road users than in the USA and New Zealand as shown in Figure 5. A breakdown of the percentages for each state is shown in Table 2.
Figure 5: Motorcyclists as a percentage of all road fatalities in Australia, NZ and the USA
(Data sources: Australian Bureau of Statistics, NZ Crash Analysis System and US
Fatality Analysis and Reporting System)

<table>
<thead>
<tr>
<th>State</th>
<th>Total MC fatalities</th>
<th>Barrier related MC fatalities</th>
<th>Non-barrier MC fatalities</th>
<th>Not known</th>
<th>Barrier/Known (%)</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Capital Territory</td>
<td>21</td>
<td>4</td>
<td>17</td>
<td>0</td>
<td>19.0%</td>
<td>0.077 – 0.400</td>
</tr>
<tr>
<td>New South Wales</td>
<td>335</td>
<td>23</td>
<td>277</td>
<td>35</td>
<td>7.7%</td>
<td>0.052 – 0.112</td>
</tr>
<tr>
<td>North Territory</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
<td>----</td>
</tr>
<tr>
<td>Queensland</td>
<td>266</td>
<td>13</td>
<td>251</td>
<td>2</td>
<td>4.9%</td>
<td>0.029 – 0.082</td>
</tr>
<tr>
<td>South Australia</td>
<td>121</td>
<td>13</td>
<td>108</td>
<td>0</td>
<td>10.7%</td>
<td>0.064 – 0.175</td>
</tr>
<tr>
<td>Tasmania</td>
<td>48</td>
<td>8</td>
<td>40</td>
<td>0</td>
<td>16.7%</td>
<td>0.087 – 0.296</td>
</tr>
<tr>
<td>Victoria</td>
<td>309</td>
<td>10</td>
<td>299</td>
<td>0</td>
<td>3.2%</td>
<td>0.020 – 0.063</td>
</tr>
<tr>
<td>Western Australia</td>
<td>142</td>
<td>2</td>
<td>140</td>
<td>0</td>
<td>1.4%</td>
<td>0.003 – 0.049</td>
</tr>
<tr>
<td>Total Australia</td>
<td>1261</td>
<td>73</td>
<td>1149</td>
<td>37</td>
<td>6.0%</td>
<td>0.052 – 0.080</td>
</tr>
<tr>
<td>New Zealand</td>
<td>201</td>
<td>4</td>
<td>196</td>
<td>1</td>
<td>2.0%</td>
<td>0.008 – 0.050</td>
</tr>
<tr>
<td>Total</td>
<td>1462</td>
<td>77</td>
<td>834</td>
<td>38</td>
<td>5.4%</td>
<td>0.044 – 0.068</td>
</tr>
</tbody>
</table>

Table 2: Breakdown of motorcycle crashes in Australia and New Zealand, 2001-2006

There was approximately one fatality per year Australia wide in regards to wire-rope barriers, i.e.
0.4% of all motorcycle fatalities. W-beam related motorcycle fatalities constitute around 4.4% of all
rider fatalities. Half of the motorcyclists strike the barrier upright whereas half slide into the barrier.
The raw number of motorcycle fatalities involving road side barriers is presently around 15 per
annum out of about 200 to 230 motorcycle fatalities and around 1300 to 1500 road fatalities each
year in Australia.

It has been proposed by motorcycle advocates, motorcycling clubs and Australian Motorcycling
Council, etc, that all W-beam barriers be retrofitted with shrouds that reduce the severity of the
impact for motorcyclists sliding into the posts. Considering that only half of those riders killed and injured slide into the barrier, it is clear that any initiatives involving major design changes to roadside barriers or retrofitting W-beam barriers to make them ‘motorcycle friendly’ when struck will be costly if applied to all roadside barriers in Australia and will have little effect on reducing motorcycle fatalities overall.

Figure 6 shows fatalities of motorcyclists involving impact with a roadside barrier predominantly involve W beams (72.7%). This was followed by concrete and wire rope barriers that accounted for 10.4% and 7.8% respectively. An additional 3.9% of impacts involved steel barriers, but there was insufficient information available to determine whether these barriers refer to W beams, Tubular or Thrie Beam steel barriers. These fatality proportions were compared to the proportions of barriers installed, which showed that: W beam comprises 71.5% of the barriers and results in 72.7% of the fatalities; concrete comprises 8.6% of the barriers and results in 10.4% of the fatalities; and wire rope comprises 15.9% of the barriers and results in 7.8% of the fatalities. Therefore assuming the probability of a fatality occurring across the network of barriers is similar, wire rope barriers have around half the fatality rate of W beam barriers.

In a single-vehicle motorcycle collision with a fixed object, trees and poles were found to be particularly hazardous, and more so than barriers. Of particular interest are the findings by Daniello and Gabler (2009) looking at US motorcycle crashes, that the risk of a motorcyclist dying as a result of impacting a tree as opposed to impacting a W-Beam barrier is double (2), i.e. there is half the risk of dying colliding with a roadside barrier as opposed to running off the road and colliding with a tree. Similarly the risk of dying when striking a sign post, utility pole or other support is 1.5 times the risk of dying when striking a W-beam. In the case of concrete barriers, the risk of dying hitting the hazard changes respectively to 3.5 (tree) and 2.6 (post, signs, etc) times that of hitting the barrier. Similar values were confirmed by the authors of this submission in a recent analysis where it was found that the risk of being killed when striking a barrier is 3.6 times less than when striking a tree.

In regards to when motorcycle into barrier fatalities occur, Figures 7, 8, 9 and 10 imply that such crashes are mostly the result of recreational riding, i.e. fatalities predominantly occur on weekends, on bends, at around midday to early afternoon and on clear days. Indeed, it was noted that there were black spots at locations in windy mountainous regions where motorcycles like to enjoy their ride and apply their riding skills. Hence any countermeasures to reduce motorcycle fatalities involving road side safety barriers should be targeted at black spot roads in known recreational riding areas, e.g. the Great Ocean Road and The Black Spur in Victoria, rather than spending large sums of money retrofitting all barriers for little or no return. It would be more effective to spend money on countermeasures other than roadside barriers to reduce motorcycle casualties.

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Figure 6: Roadside barrier types involved in motorcyclist fatalities in Australia and New Zealand (2000 to 2006)

Figure 7: Day of the crash of motorcyclist fatalities involving impact into a roadside safety barrier in Australia and New Zealand (2001 to 2006)
Figure 8: Horizontal alignment of roadside barrier impacted resulting in a fatality in Australia and New Zealand (2001 to 2006)

Figure 9: Time of Crash of motorcyclist fatalities involving impact into a roadside safety barrier in Australia and New Zealand (2001 to 2006)
In regards to the issue of the effectiveness of wire-rope installations, some recent work has also been carried out in Sweden\textsuperscript{17}. Around 1,800 km of wire-rope safety barrier systems have been installed in Sweden. A study by the Swedish National Road and Transport Research Institute (VTI) to evaluate the in-service performance of this road safety barrier type was published in January 2009. It showed that this barrier system significantly reduces road trauma. The evaluation covered 470 km of what the Swedish researchers called “collision-free” expressways of which 336 km have a speed limit of 110 km/h. These are also sometimes referred to as 2+1 roads.

Sweden’s 2+1 roads are a category of three-lane road, consisting of two lanes in one direction and one lane in the other, alternating every few kilometres, and separated with a steel wire-rope barrier. Traditional roads of at least 13 metres width can be converted to 2+1 roads.

The evaluation also examined data from 1,275 km of 2+2 roads of which 400 km had a posted speed limit of 100 km/h. A 2+2 road is a specific type of dual-carriageway built in Sweden, consisting of two lanes in each direction separated by a steel wire rope barrier. These roads do not have hard shoulders.

The Swedish report\textsuperscript{17} found that compared to normal 13 metre wide roads and expressways, 2+1 and 2+2 roads with a speed limit set at 110 km/h showed an overall reduction in fatalities and serious injuries of about 57% and 39% respectively. For the roads with a posted speed limit of 90 km/h, the fatalities and serious injuries were reduced by 62% and 63% on the 2+1 and 2+2 road types, respectively.

\textsuperscript{17}Carlson, A., Evaluation of 2+1 roads with cable barriers. 2009, Swedish National Road and Transportation Research Institute (VTI): Linkoping, Sweden.
The Swedish study also looked into the road safety outcome of the 2+1 roads for motorcyclists. This was in response to complaints registered by motorcyclists concerning the safety of 2+1 roads. Fatal and seriously injured (FSI) motorcyclists were found to constitute 7.8% of the total FSI’s for this road type being slightly lower than the Swedish nationwide proportion of 9.3%. When compared to standard 13 metre wide roads (without a wire-rope median barrier) and accounting for the mileage covered by motorcyclists, the 2+1 road type showed a 65-70% reduced number of motorcyclists killed or seriously injured. Carlson points out that even when the mileage travelled by motorcyclists was reduced significantly, the 2+1 road type still showed a reduction of 32% to 35% in the number of killed or serious injured motorcyclists.

A recent similar effective installation of wire-rope barriers was noted in New Zealand\(^\text{18}\) on the Centennial Highway. Prior to installation of the barriers there were 12 fatalities and 4 serious injuries over a 10 year period (1996 – 2004). After installing median wire-rope barrier and reducing the speed limit from 100 km/h to 80 km/h, there have been no fatalities or serious injuries over the past five years (2005 – 2009). Other examples demonstrating the safety benefits of installing wire-rope barriers have been referenced in Grzebieta et al (2009)\(^\text{8}\)

One of the reasons that Carlson\(^\text{17}\) found that median wire rope reduced motorcycle injuries was that these barriers prevent barriers cross over crashes. It also prevents motorcycle riders taking unnecessary risks overtaking other vehicles at high risk locations, such as those where median double lines are painted. An example that demonstrates how median wire-rope barriers protect motorcyclists is evidenced by a video taken and described by Marsh and Pilgrim.\(^\text{18}\) The sequence of images in Figure 11 shows a small truck striking the median barrier and then being redirected. The truck continued to drive and did not stop. Three and a half seconds later two motorcyclists riding close to each other drove by the point of impact. They were following by two vehicles which swerved into the emergency lane as did one of the riders. Had the barrier not been in place the motorcyclists would like have crashed with associated injuries or been killed.

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On the issue of rider behaviour, a recent bulletin from the National Road Safety Council Priority Area: Motorcycle Safety\(^{19}\) reported that “in \textit{70 per cent of single vehicle crashes involving the death of a motorcyclist, excessive speed (either above the limit or excessive for the conditions) was identified as one of the main factors in the crash}.” The study focusing on motorcycle impacts into roadside barriers shows that indeed speed is an important factor.

In Australia and New Zealand between 2001 and 2006, rider behaviour played a significant role in motorcyclist into roadside barrier fatalities. Alcohol, drugs or speed, or a combination thereof, played a role in 3 out of every 4 fatal barrier crashes as shown in Figure 12. Moreover, the injury severity was found to be directly and linearly related to the pre-crash speed as shown in Figure 13.\(^{10,11}\) Little information has been analysed for motorcycle crashes in general for the whole of Australia, however, a similar trend is also observed in motorcycle fatal crashes other than into roadside barriers.

While engineering measures such as retrofitting W-beam barriers could be considered, behavioural countermeasures in these areas such as speed enforcement, random breath testing (RBT) and drug testing on weekends during midday to mid afternoon would likely yield more effective results.

Fatality risk increased sharply above a ‘travel’ speed of about 100 km/h, while serious injury risk was greater than 20% even at the lowest travel speeds. The tool developed from fatality risk as a function of travel speed from the TARS analysis, predicts that motorcyclists travelling less than about 55 km/h could be expected to survive a collision with a fixed object. The survivability curves from the study are presented in Figure 14. These curves were modeled based on US motorcycle crashes. Sufficient detailed knowledge of crash characteristics for non-injured, injured (KSI) and killed (F), are not available from Australia. The assumption made was that the road environment (surface, barriers, lighting, rural roads, etc) closely approximates Australian conditions.
In summary, the TARS/IRMRC motorcycle into barrier study found that

- around 74% of fatalities were found to involve either speed, alcohol or drugs, or a combination thereof, i.e. 3 in 4 fatalities;
- there is a strong linear association between injury severity and pre-crash speed (crash severity);
- fatalities of motorcyclists involving impact with a roadside barrier predominantly involved steel W beams, half of which are sliding crashes and the other half are upright crashes into the barrier;
- **wire rope barriers were found to have around half the fatality rate of W beam and concrete barriers:**
- installing a road side barrier to protect road users striking trees will also reduce the risk of a motorcyclist that strikes the barrier. The risk of being killed is up to 3.6 times less than if the barrier was not present;
- Half of the fatalities involving a roadside safety barrier usually occurred on a weekend and around 60% of all barrier impact fatalities are during recreational riding and mostly in the afternoons;
- any strategies regarding retrofitting or installing ‘motorcycle’ friendly barriers should focus on black spot locations in areas of high activity motorcycling recreational rides, i.e. mountainous curving roads, Great Ocean Road in Victoria, etc.;
- the focus of any mitigation strategies should be on behavioural issues such as speeding, alcohol, drugs and fatigue.

**NCIS study of fatal crashes from 2001 to 2006:**

The results of this work will be published over the next six or so months. Figure 15 shows the breakdown of the motorcycle fatalities from Table 2. Because speed, alcohol or drugs, or a combination thereof accounted for around 75% of motorcycle into roadside barrier fatal impacts, it was decided to look at the remaining motorcycle crashes other than barrier impacts to assess what factors were involved in those crashes. The data has been compiled into a database and a preliminary analysis has been carried out but has yet to be published

![Figure 14](image.png)

**Figure 14:** Fatal motorcycle crashes in Australian jurisdictions and New Zealand (2001 to 2006)

Some of the preliminary findings for the years 2001 to 2006 are as follows:

- around 1423 Australian motorcycle fatalities were identified and have been coded\(^{20}\);

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\(^{20}\) A number of cases were still open when the motorcycle into barrier study started in 2008.
- Victoria, NSW and Queensland constitute the bulk of the fatalities at around 300 each closely followed by WA (150) and SA (120).
- 95% of the fatalities are male and 5% are female;
- no toxicology reports were available for 559 cases;
- 35% of fatalities were rural/bush roads;
- Crash predominantly occurred either at a bend (377 cases) or at a junction (361 cases);
- 26% of cases could be attributed to speeding;
- 38% were single vehicle collisions, multivehicle collisions were 48% and 15% were unknown;
- most crashes occurred on a Saturday and Sunday, on a clear dry day;
- of the 764 cases where toxicology was available:
  - 30% had alcohol with 22% over 0.05 (41 cases where BAC >0.2)
  - 26% were using illicit drugs
  - 39% had used either drugs and/or alcohol (BCA > 0.05)
  - 45% had used either drugs and/or alcohol

**Note on Additional Issues:**

Motorcycle rider safety has received patchy research attention. Although some issues, such as risk taking and rider education and training, have received more attention than others, the knowledge base around rider safety is insufficient to underpin a comprehensive road safety strategy. Some areas are particularly under-researched, including:

1. **Rider fatigue**

Despite anecdotal evidence that fatigue is an issue for motorcyclists, there has been almost no scientific research conducted on this issue to inform effective road safety policy.

- Haworth and Rowden (2006)\(^{21}\) concluded that the crash data sets currently available across Australia do not permit the calculation of reliable estimates of fatigue involvement in motorcycle crashes. In the data sets they examined, the estimated involvement of fatigue varied widely from 2% to 16% of crashes but none of the data sets could isolate fatigue crashes well from crashes involving other factors (e.g., speeding, alcohol, drug use, etc). Some of the data suggested that fatigue may be involved in a smaller proportion of motorcycle crashes than car crashes but other data suggested the reverse.

- Forty percent (40%) of the recreational riders participating in a small pilot study (n=20; Ma, Williamson and Friswell, 2003)\(^{22}\) reported experiencing fatigue on at least half of their longer trips. In the previous 4 months, 22% reported nodding off while riding, 56% had a fatigue-related near miss and more than 50% had crossed lane lines, over- or under-steered, and/or braked late while riding fatigued. These results suggest that rider fatigue is common and

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contributes to potentially dangerous on-road behaviour. Confirmation in a larger, more representative group of riders is clearly called for.

- It is not known whether the development of fatigue in riders is similar to that in drivers, but there are good reasons to suspect that it may be different. Although riders and drivers share basic human vulnerabilities to circadian, sleep, and task-related contributors to fatigue, motorcycle riders are subject to unique stressors that may exacerbate or attenuate fatigue effects. These include the greater physical demands of riding compared to driving and, potentially, greater mental demands in terms of ongoing attention and vigilance. Both might increase riders’ vulnerability to fatigue and performance impairment after a period of riding. On the other hand, riders might be protected from fatigue effects early in a ride by an ‘adrenalin rush’ that temporarily heightens their alertness. We do not know the typical time course for the development of rider fatigue. However, a pilot study of rider fatigue conducted by the NSW IRMRC (Ma et al., 2003)\(^2\) found that self-reported fatigue started to increase towards the end of a trip with 3 hours 40 minutes of riding (interspersed with 1:10 of breaks). Reaction speed and sustained attention performance did not decline over this length of ride, but the effects of a longer ride are not known.

In summary, there is preliminary evidence suggesting that fatigue is common, impairs riding performance and may contribute to a significant proportion of crashes. However, strategic investment in good quality research is required to properly understand the extent and nature of the problem so that targeted, evidence-driven policy responses can be developed.

2) Rider behaviour

Like all crashes, motorcycle crashes often involve behavioural contributors (e.g., speed, alcohol and drug impairment etc; e.g. Grzebieta et al, 2009\(^9\)) which may occur on the part of the rider or other road users. As a result, strategies for encouraging safer behaviour will be a necessary part of any efforts to improve the safety of motorcyclists. Of course, it is possible to legislate around some behaviours (e.g., helmet wearing, blood alcohol, speeding) and to enforce the laws with some level of success. However, the legislate-enforce model cannot realistically be expected to address all behaviours all of the time. Other strategies that target behaviour, such as education, training, and media campaigns, will also be necessary.

These strategies must be devised and targeted with a clear understanding of the rider population if they are to be effective. The motorcycling population covers the full age spectrum and contains diverse subgroups of people whose riding patterns and motivations vary (e.g., commuters versus recreational riders). Research to identify the important dimensions of this diversity must inform any strategy to improve rider safety, but particularly when the strategy targets rider behaviour. For example, recent research conducted by the IRMRC to evaluate the RTA’s 2007 direct mail campaign about safe cornering (Friswell & Williamson, 2008)\(^2\) provided evidence of a modest (10%) increase in reported safe cornering behaviour among riders. Of interest to future interventions, however,

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was the finding that younger riders (17-24 years) were over-represented among those who knew but did not practice the safest cornering style. In contrast, the oldest group of riders (50+ years) were over-represented among those who neither knew nor practiced the safest cornering style. Understanding this diversity leads to different recommendations about appropriate interventions for different subgroups of riders. In this example, information-based strategies are unlikely to impact younger riders who already know the appropriate behaviour but such strategies may be effective for older riders who do not. Whether an information-based strategy for older riders would be more effectively delivered via a media campaign or via a system of mandatory refresher training, however, requires investigation. Evaluation research that quantifies the impact of strategies targeting behaviour is critical to ensure that the best interventions are pursued and less effective interventions are not.