Motorcycle crashes into roadside & median road safety barriers

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NSW Injury Risk Management Research Centre
Index of annual road deaths — to July 2008
Base = YE Dec 2000

NRSS 2001-2010
Commenced 1 Jan 2001

Motorcyclists - up 24%
Total - down 17%
Occupants - down 19%
Pedestrians - down 37%

Source: Road Safety Strategy Panel
Road Safety Branch, Infrastructure and Surface Transport Policy,
Department of Infrastructure, Transport, Regional Development and Local Government
## Road deaths by road user group and crash type

<table>
<thead>
<tr>
<th>Category</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>Change: last two years relative to first two years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle occupant single vehicle crash</td>
<td>577</td>
<td>648</td>
<td>604</td>
<td>658</td>
<td>634</td>
<td>598</td>
<td>594</td>
<td>619</td>
<td>645</td>
<td>3%</td>
</tr>
<tr>
<td>Vehicle occupant multiple vehicle crash</td>
<td>670</td>
<td>654</td>
<td>579</td>
<td>548</td>
<td>532</td>
<td>524</td>
<td>527</td>
<td>473</td>
<td>486</td>
<td>-28%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>299</td>
<td>287</td>
<td>290</td>
<td>249</td>
<td>232</td>
<td>220</td>
<td>225</td>
<td>227</td>
<td>202</td>
<td>-27%</td>
</tr>
<tr>
<td>Motorcyclist: single vehicle crash</td>
<td>66</td>
<td>80</td>
<td>89</td>
<td>101</td>
<td>81</td>
<td>61</td>
<td>80</td>
<td>94</td>
<td>112</td>
<td>103%</td>
</tr>
<tr>
<td>Motorcyclist: multiple vehicle crash</td>
<td>110</td>
<td>111</td>
<td>127</td>
<td>123</td>
<td>127</td>
<td>115</td>
<td>139</td>
<td>126</td>
<td>135</td>
<td>18%</td>
</tr>
<tr>
<td>Bicyclist: single vehicle crash</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>11</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Bicyclist: multiple vehicle crash</td>
<td>38</td>
<td>28</td>
<td>43</td>
<td>33</td>
<td>22</td>
<td>33</td>
<td>30</td>
<td>35</td>
<td>37</td>
<td>9%</td>
</tr>
<tr>
<td>Articulated truck single vehicle crash</td>
<td>20</td>
<td>25</td>
<td>18</td>
<td>31</td>
<td>20</td>
<td>26</td>
<td>28</td>
<td>23</td>
<td>32</td>
<td>22%</td>
</tr>
<tr>
<td>Articulated truck multiple vehicle crash</td>
<td>154</td>
<td>165</td>
<td>142</td>
<td>153</td>
<td>138</td>
<td>110</td>
<td>116</td>
<td>124</td>
<td>121</td>
<td>-23%</td>
</tr>
<tr>
<td>Articulated truck pedestrian crash</td>
<td>17</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>13</td>
<td>14</td>
<td>11</td>
<td>21</td>
<td>19</td>
<td>14%</td>
</tr>
<tr>
<td>All road users</td>
<td>1,764</td>
<td>1,817</td>
<td>1,737</td>
<td>1,715</td>
<td>1,621</td>
<td>1,583</td>
<td>1,627</td>
<td>1,598</td>
<td>1,612</td>
<td>-10%</td>
</tr>
</tbody>
</table>

Source: Road Safety Strategy Panel
Road Safety Branch, Infrastructure and Surface Transport Policy, Department of Infrastructure, Transport, Regional Development and Local Government
Motorcycle impacts into roadside barriers
IRMRC research project

Partners

- WA Office of Road Safety & WA Main Roads
- Australian Automobile Association
- NSW Centre for Road Safety (RTA)
- NSW Motor Accidents Authority
- Transit New Zealand
Motorcycle impacts into roadside barriers
IRMRC research project

Research Investigators

- Raphael Grzebieta (barriers)
- Andrew McIntosh (biomechanics)
- Rena Friswell (causation & epidemiology)
- Hussein Jama (analysis & modelling)
- Jake Olivier (biostatistics)
- Rob Smith (motorcycle expert)
Motorcycle impacts into roadside barriers
IRMRC research project

Methodology

- Statistics (fatalities & serious injury)
- Determine causal factors
  (other vehicle, speed, alcohol, fatigue, bad cornering, inexperience, human error?, etc)
- Determine biomechanical injury causal mechanism
Motorcycle impacts into roadside barriers
IRMRC research project

Methodology

• Determine survivable and non-survivable impact envelopes
• Reconstruct crashes & computer simulation
• Develop / investigate injury mitigation strategies and assess their effectiveness
• Carry out crash tests
Motorcycle into Barrier Fatalities

2001 - 2006 National Coroners Information System data

*In-depth investigation of fatal crashes where information is available*

*In-depth investigation of serious injury crashes through trauma centres & recruitment will also be carried out*
Motorcycle barrier crashes

National Coroners Information System - preliminary findings

Motorbike Fatal Crashes 2001-2006

ACT  NT  SA  TAS  QLD  NSW  VIC  So far

0  21  4  1  19  1  2  122
12  21  48  6  9  14  20  266
57  12  14  8  14  12  150  335
309  1120  217

Total crashes  Barriers crashes  Unknown
Motorcycle into Barrier Fatalities

National Coroners Information System data 2001-2006

Percentage

Age Bracket (Years) N=57

0 - 16 17 - 25 26 - 39 40 - 49 50 - 59 60+
Motorcycle into Barrier Fatalities

National Coroners Information System data 2001-2006 (n=57 fatalities)

- Gender
  Male 52  Females 5

- Rider & Pillion
  Rider & pillion 4 (fatal crashes)
  (3 female pillions killed and 1 male rider)

Rider only - 53
Motorcycle into Barrier Fatalities

National Coroners Information System data 2001-2006

Guardrail | Concrete | WR | Unknown barrier
---|---|---|---
50 | 4 | 2 | 1
Motorcycle into Barrier Fatalities

National Coroners Information System data

Australian total so far (excluding WA)

- Other: 846 (76%)
- Barriers crashes: 217 (19%)
- Unknown: 57 (5%)

IRMRC
Motorcycle into Barrier Fatalities

Other studies

DEKRA – Germany

- 82% involved a steel barrier
- 51% of 57 cases analysed motorcycle impacted the barrier while driving in an upright position
- 45% occurred where the motorcycle slid on its side on the road surface before it first struck the barrier.

Motorcycle into Barrier Fatalities

USA Gabler

- 39% of guardrail fatalities & 24% of concrete barrier fatalities but only 3% of registered vehicles

- Motorcycle guardrail impact 80 times higher risk than car/LTV

- Motorcycle concrete barrier 68 times higher risk than car/LTV

- $0.5 million dollar US “in-depth” TRB study of barrier fatalities

What is a survivable impact?

20 km/hr?
What is a survivable impact?

Hitting an object at 30 km/h is equivalent to jumping off the roof of a house.

At 40 km/h is equivalent to jumping off a 3 story building and hoping you will survive.

At 50 km/h it is equivalent to jumping off a 5 storey building.

At 60 km/h, jumping off a 7 story building.
Motorcycle barrier crashes.

Rider is thrown over concrete barrier into hazard.

Motorcycle barrier crashes.

Rider is thrown over concrete barrier into hazard.

Motorcycle barrier crashes.

Rider thrown onto steel barrier, elbow is torn when it strikes blockout & stomach cut apart when sliding along rail sharp edge.

Motorcycle barrier crashes.

Rider slides and hits post at shoulder

Motorcycle barrier crashes.

Rider impacts & slides along rubrail instead of post

Motorcycle barrier crashes.

Rider is thrown over barrier into hazard.

Motorcycle barrier crashes.

Rider slides and hits post and bends them.

Reproduced with kind permission of Prof Marco Anghileri, Dipartimento di Ingegneria Aerospaziale, Politecnico di Milano, Italy.
Motorcycle barrier crashes.

Rider slides along fabric instead of hitting posts

Reproduced with kind permission of Prof Marco Anghileri, Dipartimento di Ingegneria Aerospaziale, Politecnico di Milano, Italy.
Motorcycle barrier crashes.

Motorcycle snags on posts and rider ejected over top of wire rope barrier

Concrete at 80 km/hr @ 45° – Not survivable
Concrete at 80 km/hr @ 45° – Not survivable

Car barrier crashes.

Car redirected by wire-rope with low deceleration

Survivable crash

Wire rope 80 km/hr @ 45° – very survivable and soft crash – airbags did not fire

Vehicle redirected and can still be driven
Must comply with crash barrier standard AS3845 for cars as well.

Vehicle should not ride over barrier

Barrier cannot be breached for all vehicles
Vehicle should not ride over barrier
## Wire rope barriers - Statistics

Data Compiled by Nicholas Szwed - Vicroads

<table>
<thead>
<tr>
<th>Location</th>
<th>Length (km)</th>
<th>Years</th>
<th>Casualty Crashes</th>
<th>Years</th>
<th>Casualty Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before</td>
<td></td>
<td>After</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F</td>
<td>SI</td>
<td>OI</td>
</tr>
<tr>
<td>Eastern Fwy</td>
<td>8</td>
<td>10</td>
<td>2</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Geelong Rd</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Frankston Fwy (1)</td>
<td>0.42</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Frankston Fwy (2)</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hume Fwy (1)</td>
<td>1.25</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Hume Fwy (2)</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Total ~</td>
<td>17</td>
<td>35</td>
<td>9</td>
<td>33</td>
<td>33</td>
</tr>
</tbody>
</table>

Before-and-after crash summary
Wire-rope barrier installation

- RTA – reductions of around 70-80% in fatalities – lowest road fatalities now in the Australia as a result in part of wire rope and tactile line marking – 5.6 per 100,000.
Wire-rope barrier installation

Arne Carlsson, *Evaluation of 2+1 Roads With Cable Barrier, Swedish Road Administration, VTI Rapport 636A*

- Sweden has noted similar reductions of around 76-82% in road trauma where such barriers have been introduced
- Motorcycle fatality reduction of 40-50%
Wire-rope barrier installation

- US DOT’s are observing similar gains on their high volume (and high speed) freeways in North Carolina. Around 80-90% reductions in trauma.
Summary

- Motorcycle fatalities resulting from roadside barriers crashes are low at around 5-6% which is around 14 per year nationwide of 238 fatalities.
- Guardrail impacts are the most dangerous.
- Only 1 wire-rope rider impact found in WA – excessive speed striking another vehicle before striking barrier. Most likely died on impact with vehicle.
Summary

- Concrete barrier impacts can also be dangerous but very low – 4 fatalities
- Guardrail impacts are the most dangerous and often struck.
- Wire-rope impacts are rare. 70 – 80% reduction in road fatalities wherever installed which is why they are being installed.
- Solutins exist to reduce motorcycle fatalities – but credible science must be used so as not to effect all road users and gains to date