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ROAD SAFETY RESEARCH AND ANALYSIS REPORT
MONOGRAPH 20

Fatal and serious road crashes involving motorcyclists

Road Safety
April 2008

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Abstract

Motorcycle usage is increasing in Australia, and the numbers of serious crashes are also rising. This report analyses recent data on fatal and serious motorcycle crashes. Time trends are shown and comparisons made across road user groups, crash type and national and international jurisdictions. Analysis of the crashes includes road-type, weather, and main contributory factors. Analysis of rider characteristics include age, and helmet use. In addition to fatal crashes, included are tabulations of non-fatal crashes where a motorcyclist was seriously injured.

Notes

(1) Road Safety reports are disseminated in the interest of information exchange.
(2) The views expressed are those of the author(s) and do not necessarily represent those of the Australian Government or the Department of Infrastructure, Transport, Regional Development and Local Government.

CONTENTS

EXECUTIVE SUMMARY

Motorcycles account for 4.5 per cent of all Australian passenger vehicle registrations and 0.9 per cent of vehicle-kilometres travelled. However, motorcycle riders account for approximately 15 per cent of all road crash deaths and an even higher proportion of serious injuries. Per distance travelled, the Australian rate of motorcyclist deaths is approximately 30 times the rate for car occupants. The corresponding rate for a serious injury is approximately 41 times higher. Similar elevated rates are also found in other developed countries.

Motorcycle usage has increased each year since 2002. For motorcycle registrations there has been an average growth rate of 6.8 per cent per year. Vehicle kilometres travelled have grown at 5.7 per cent per year. Usage of other passenger vehicles has also increased, but at a lower rate than for motorcycles.

Over the last five years numbers of motorcyclist deaths have increased at an average annual growth rate of 3.6 per cent. Car driver deaths have increased at an annual rate of 0.4 per cent. Over the last ten years, counts of single vehicle crashes involving a motorcyclist death have grown at around 4.9 per cent per year. For fatal multiple vehicle motorcycle crashes, annual growth has been 2.4 per cent.

Over the last ten years, the total decrease in risk in terms of deaths per vehicle-kilometre (VKT) for car occupants has been approximately 20% (4.3 deaths per billion VKT in 1998 and 3.9 in 2007). For motorcyclists, no improvement in safety has been observed (116.4 deaths per billion VKT in 1998 and 116.9 in 2007).

An analysis of the age distribution of motorcyclists killed shows that over the last ten years, riders aged over 44 years accounted for most of the annual increase in deaths.

A large proportion of fatal motorcycle crashes occur during weekends. Also, on any day of the week, most fatal crashes occur during the middle to late afternoon period (2.00 pm to 6.00 pm). These facts suggest that a significant proportion of fatal motorcycle crashes are associated with recreational riding rather than commuting.

Approximately 20 per cent of motorcyclists killed do not have a valid motorcycle licence. Of all riders killed, 10 per cent were not wearing a helmet and 20 per cent were wearing an incorrectly fitted helmet.

1 INTRODUCTION

Motorcycles account for 4.5 per cent of all Australian motor vehicle registrations and 0.9 per cent of vehicle-kilometres travelled (VKT). However, motorcycle riders account for approximately 15 per cent of all road deaths and an even higher proportion of serious injuries. Such elevated rates are also found in most other countries: in the USA, the fatality rate per VKT for motorcyclists during 2005 was 37 times that of car occupants, and in the UK during 2006 it was 29 times the rate for car occupants.

Over the last decade, the number of motorcycle deaths in Australia has increased, whereas the trend for drivers was flat, and for pedestrians and vehicle passengers it has fallen.

Section 2 provides an overview of trends in motorcycle fatalities in Australia over the last decade, nationally and by jurisdiction. Data on the number of registered motorcycles and distances travelled are presented with comparative data for other vehicle types. Some comparative data on motorcycle fatality rates in other OECD countries are also presented as well as data on serious injuries in motorcycle crashes.

Section 3 provides analyses of the types of fatal crashes involving motorcyclists. Location of crash, time, speed-limit and numbers of vehicles are investigated, as are rider and driver behaviours such as alcohol involvement and speeding.

Section 4 investigates rider characteristics such as age, helmet use and licence status as well as analysing injury patterns for fatal crashes.

2 OVERVIEW OF RECENT TRENDS

2.1 Road user comparisons

Table 1 presents the annual numbers of deaths of each road user group. Also shown is the percentage of deaths of motorcyclists relative to total road deaths.

Table 1. Annual numbers of deaths by road user type

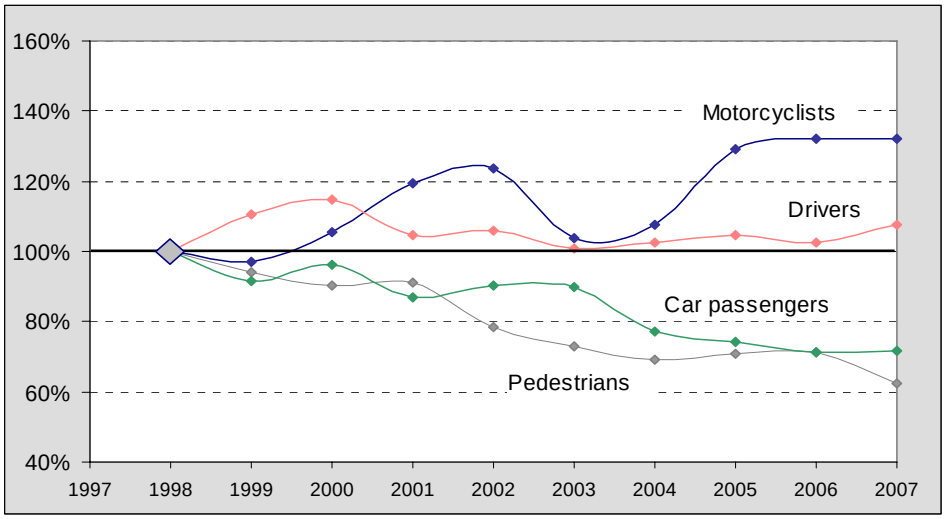
Year ended December	Driver	Passenger	Pedestrian	Motorcycle rider	Motorcycle passenger	Motorcyclists deaths as a proportion of all road deaths
1998	741	468	318	170	11	10.3 %
1999	820	428	299	164	12	10.0 %
2000	852	450	287	182	9	10.5 %
2001	776	407	290	210	6	12.4 %
2002	785	422	249	215	9	13.1 %
2003	747	420	232	178	10	11.6 %
2004	761	361	220	184	11	12.3 %
2005	775	347	225	224	10	14.4 %
2006	759	334	227	230	9	15.0 %
2007	796	339	201	228	11	14.8 %
Ave. annual change – last 5 yrs [1]	0.4 %	-5.1 %	-3.1 %	3.7 %	1.7 %	
Ave. annual change – last 10 yrs	-0.2 %	-3.2 %	-4.8 %	3.4 %	-1.2 %	

The number of motorcyclist deaths has increased over the last decade. Motorcyclist deaths as a proportion of all road deaths has also been increasing, and was about 15% in 2007. There has been little change in the annual number of driver deaths, while passenger and pedestrian deaths have shown a downward trend.

Figure 1 below presents the data in Table 1 in index form. The base year is 1998.

1 The average annual rates used throughout the document are estimated average annual changes under an exponential model.

Figure 1. Indices showing change in numbers of deaths since 1998



Although there was a general upward trend in motorcyclist deaths over the last decade, changes from year to year were not uniform. Numbers in 2003 and 2004 were below the long term trend, while the preceding and following years were above the trend. It is not clear why these departures from the trend occurred and it is possible that these are random fluctuations. The dip in 2003 and 2004 occurred across all age groups, but only in some states (Victoria, Queensland and South Australia).

2.2 Motorcyclist deaths by jurisdiction

Table 2. Annual numbers of motorcyclist deaths by jurisdiction

Year	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Aust
1998	52	48	25	13	28	7	5	3	**181**
1999	55	38	41	15	19	2	5	1	**176**
2000	62	46	33	16	23	5	5	1	**191**
2001	70	64	29	14	28	7	3	1	**216**
2002	55	56	53	22	23	10	4	1	**224**
2003	59	39	42	13	23	11	0	1	**188**
2004	58	37	48	21	22	7	0	2	**195**
2005	64	48	64	19	22	7	2	8	**234**
2006	66	47	58	22	32	5	6	3	**239**
2007	63	45	73	8	37	7	3	3	**239**
Ave. annual change – 5 yrs	3.2 %	-0.8 %	8.5 %	-9.7 %	10.1%	-	-	-	**3.6 %**
Ave. annual change – 10 yrs	2.7 %	0.1 %	8.0 %	0.4%	3.7%	-	-	-	**3.1 %**

Data for most jurisdictions show flat or slight upward trends. Queensland shows the most pronounced trend, and recent increases are also evident in Western Australia.

2.3 Motorcycle usage and rates

Measures of recent motorcycle usage also show increases. Australia-wide data for registrations are given in Table 3.

Table 3. Number of registered vehicles (thousands) by vehicle type [2]

Year	Motorcycles	Passenger Vehicles	All Others[3]	Total	Motorcycles per 100 passenger vehicles
1998	329	9,527	2,211	12,067	3.5
1999	334	9,686	2,248	12,268	3.4
2000 [4]	342	9,761	2,269	12,373	3.5
2001	351	9,836	2,290	12,477	3.6
2002	371	10,101	2,350	12,822	3.7
2003	377	10,366	2,420	13,163	3.6
2004	396	10,629	2,507	13,532	3.7
2005	422	10,896	2,602	13,920	3.9
2006	463	11,189	2,707	14,359	4.1
2007	512	11,462	2,801	14,775	4.5
Ave. annual change – 5 yrs	6.8 %	2.6 %	3.6 %	2.9 %	

Total numbers of registered vehicles have grown at approximately 2.9 per cent per year over the last five years. In comparison, motorcycle registrations have grown at an average annual rate of 6.8 per cent.

Table 4 below gives motorcycle registrations by jurisdiction. Registrations have been growing fastest in Queensland and Western Australia with average annual rates of 9.8 per cent and 8.0 per cent respectively. These jurisdictions have also shown the largest increases in motorcycle deaths (Table 2). NSW has recorded a substantial increase in motorcycle numbers (with an average annual growth of 6.9 per cent) but had a smaller increase in motorcycle deaths than Queensland and Western Australia.

2 Australian Bureau of Statistics—*Motor Vehicle Census* 9309.0

3 'All Others' comprises mainly trucks and buses.

4 Year 2000 is missing from ABS publications. Data shown is a linear interpolation of two surrounding years.

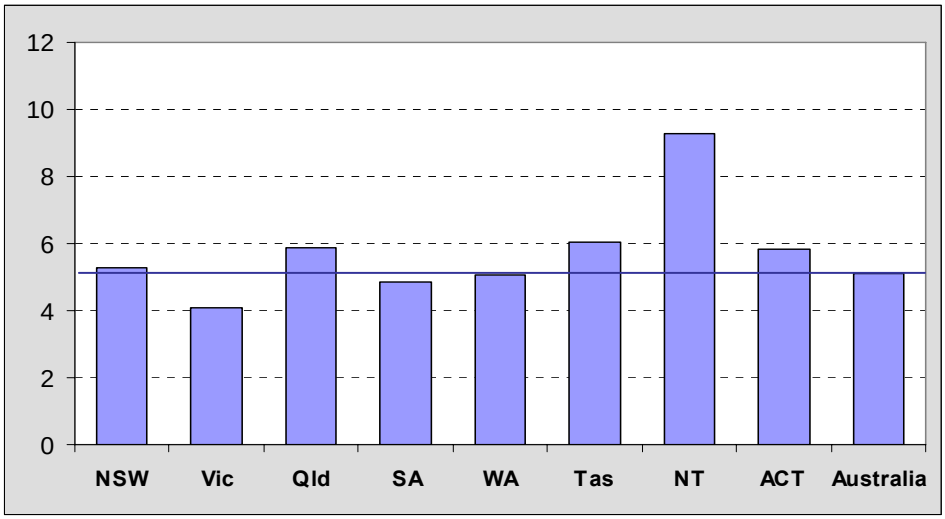
Table 4. Number of registered motorcycles (thousands) by jurisdiction

Year	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Aust
2001	91	95	74	28	45	8	4	6	**351**
2002	96	103	79	28	47	9	3	7	**371**
2003	100	99	84	28	47	9	3	7	**377**
2004	106	102	89	29	49	9	3	7	**396**
2005	113	108	97	31	53	9	3	7	**422**
2006	122	114	111	34	60	10	4	8	**463**
2007	133	124	126	37	68	11	4	9	**512**
Ave. annual change – 5 yrs	6.9%	4.1%	9.8%	5.5%	8.0%	5.4%	5.5%	4.9%	**6.8%**

Nationally, as well as in most jurisdictions, numbers of registered motorcycles have been increasing faster than the numbers of motorcycle deaths.

Figure 2 below compares the number of deaths per registered motorcycle across jurisdictions. The rates for Queensland and Western Australia are close to the Australian average.

Figure 2. Motorcyclists deaths per ten thousand registrations by jurisdiction, 2005-2007[5]



Looking at vehicle kilometres travelled (VKT) a similar picture appears. Per distance travelled, the rate for motorcycle rider deaths is much higher than that of drivers of light vehicles.

Table 5 gives numbers of VKTs for the last ten years.

5 Shown is the average number of deaths over the three years 2005–2007, divided by registrations in 2006.

Table 5. Kilometres travelled (billion) by vehicle type — Australia [6]

Year	Motorcycle	Cars and LCV
1998	1.46	174.45
1999	1.40	178.77
2000	1.42	182.50
2001	1.46	181.46
2002	1.48	186.57
2003	1.52	191.72
2004	1.66	199.11
2005	1.73	200.00
2006	1.81	199.71
2007	1.95	203.58
Ave. annual change – 10 yrs	2.8 %	1.8 %

Table 6 gives comparative data for deaths per VKT for drivers and motorcycle riders. The 'risk multiple' is the ratio of the motorcycle rider death rate to the driver death rate.

Table 6. Deaths per kilometres travelled (billion) by vehicle type — Australia

Year	Motorcyclist riders	Drivers [7]		Risk multiple
1998	116.4	4.3		27.4
1999	116.8	4.6		25.5
2000	128.0	4.7		27.4
2001	143.5	4.3		33.6
2002	145.5	4.2		34.6
2003	116.9	3.9		30.0
2004	111.1	3.8		29.1
2005	129.8	3.9		33.5
2006	127.4	3.8		33.5
2007	116.9	3.9		29.9
Ave. annual change – 10 yrs	0.5%	-2.0%		

Over the last ten years, there has been a slight downward trend in the driver death rate per distance travelled, but no clear trend in motorcycle rider death rate.

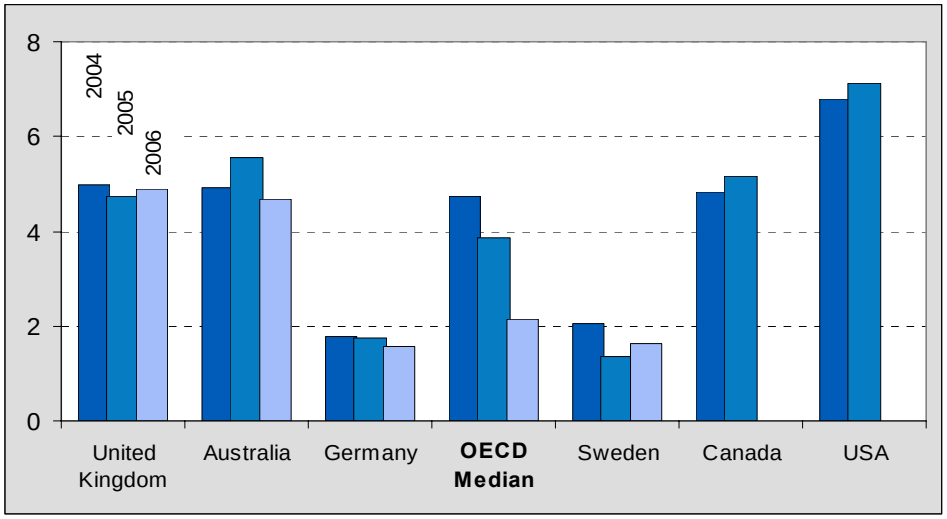
6 Source for VKT data is the Bureau of Infrastructure, Transport and Regional Economics *Working Paper* (in press).

7 The data for 'Drivers' has been calculated by dividing total driver deaths by the distance travelled by cars and light commercial vehicles. Deaths of truck and bus drivers have been included in the count of driver deaths. The result provides an upper bound estimate of the true death rate of light vehicle drivers.

2.4 International comparisons

Comparing standardised road crash data across international jurisdictions shows that Australia's rate of motorcyclist deaths per registered motorcycle is above the OECD median. Recent data for selected OECD countries is given in Figure 3.

Figure 3. Motorcyclist deaths per registration (ten thousand) for selected OECD countries, 2004, 2005, 2006 [8]



A comparison across several countries for motorcycle kilometres travelled per registered motorcycle is given in Table 7.

Table 7. Motorcycle vehicle kilometres travelled (million) per thousand registered motorcycles, selected countries, 2004-2006

Country	2004	2005	2006
Australia	4.19	4.10	3.91
Canada	7.50	7.48	-
UK	4.23	4.40	4.14
Germany	3.08	3.07	3.12
Austria	3.34	3.36	3.33
Switzerland	2.90	2.93	2.90
France	3.27	3.45	-

8 Source Figure 3: International Road Traffic Accident Database (IRTAD). Data for 2006 are not available for Canada and the USA. As 2006 data for some countries are unavailable, the median for that year shows more volatility than expected.

2.5 Serious injuries

As mentioned in the introduction, this report focuses on fatal crashes. This section augments fatal crash data with an analysis of serious injuries (SI). Counts and rates are compared across road user groups and types of crash are categorised.[9] Table 8 provides an analysis of serious injuries by vehicle type.

Table 8. Serious injury cases for road crashes and rates per 100 million VKT, financial year 2003-04

	Cars and LCV [10]	Motorcycles	Heavy transport vehicles [11]	Buses	Total
SI counts	16,121	5,385	406	152	**22,064**
SI rate per 10^8 VKT	9.0	364.0	3.0	8.0	**11.0**
Relative rate	1.0	40.9	0.3	0.9	

The standardised rate in the last row shows that motorcycle riders are 41 times more likely to sustain a serious injury per VKT than car occupants. This is higher than the corresponding rate for fatalities of 30, (see Table 6).

Table 9 categorises the type of crash in which a motorcyclist was seriously injured. Both traffic and non-traffic (off-road) crashes are shown.

Table 9. Type of crash where motorcyclists are seriously injured in traffic and non-traffic crashes, 2003-04

Type of Crash	Traffic		Non-Traffic	
	Count	%	Count	%
Non-collision transport accident	1,724	32%	3,298	42%
Collision with car, ute or van	1,405	26%	46	1%
Collision with fixed or stationary object	503	9%	627	8%
Collision with pedestrian or animal	114	2%	73	1%
Collision with 2 or 3 wheeled motor vehicle	112	2%	-	-
Collision with heavy transport vehicle	59	1%	-	-
Other and unspecified transport accident	1,468	27%	3,829	49%
Total	**5,385**	**100 %**	**7,873**	**100%**

9 Source: Australian Institute of Health and Welfare – Research Centre for Injury Studies. *Serious Injury due to Land Transport Accidents, Australia 2003-04.* Counts and rates refer to occupants of the listed vehicle type.

10 Cars and LCV – includes vehicles classified in the National Hospital Morbidity Database as cars, pickup trucks or vans, and vehicles classified in the ABS Survey of Motor Vehicle Use as passenger vehicles or light commercial vehicles.

11 Heavy transport vehicles – includes vehicles classified in the ABS Survey of Motor Vehicle Use as rigid trucks or articulated trucks, but excludes cases and VKT data for non-freight carrying trucks.

Counts of road traffic injuries are further analysed in Table 10 below. Shown, for each of the last five financial years are numbers of injuries by sex and road user group.

Table 10. Serious injuries in road crashes: gender and road user group

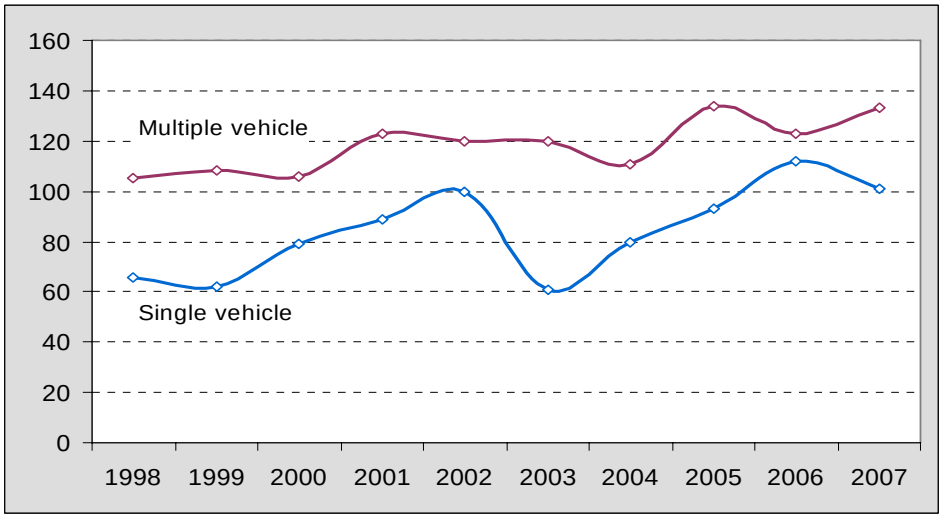
Gender	Road User Group	Counts of Serious Injuries					Average annual change (%)
		1999-00	2000-01	2001-02	2002-03	2003-04	
Male							
	Car Driver	4,874	5,122	5,588	5,085	5,490	2.3%
	Car passenger	2,151	2,255	2,306	2,132	2,251	0.3%
	Motorcyclist	4,151	4,252	4,683	4,630	4,891	4.2%
	Pedal cyclist	2,719	2,455	2,672	2,905	2,951	3.4%
	Pedestrian	1,769	1,731	1,777	1,633	1,568	-3.0%
Female							
	Car Driver	3,596	3,691	3,944	3,992	4,248	4.2%
	Car passenger	2,804	2,772	2,966	2,683	2,656	-1.4%
	Motorcyclist	363	390	413	410	494	6.9%
	Pedal cyclist	705	601	620	686	725	1.9%
	Pedestrian	1,161	1,185	1,124	1,037	1,010	-4.0%
Persons							
	Car Driver	8,470	8,813	9,532	9,077	9,738	3.1%
	Car passenger	4,955	5,027	5,272	4,815	4,908	-0.6%
	Motorcyclist	4,514	4,642	5,096	5,040	5,385	4.4%
	Pedal cyclist	3,424	3,056	3,292	3,591	3,676	3.1%
	Pedestrian	2,930	2,916	2,901	2,670	2,578	-3.4%

3 CRASH CHARACTERISTICS

3.1 Number of vehicles involved

This section compares *single* and *multiple* vehicle crashes involving a motorcyclist fatality.

Figure 4. Annual counts of single vehicle and multiple vehicle crashes involving the death of a motorcyclist



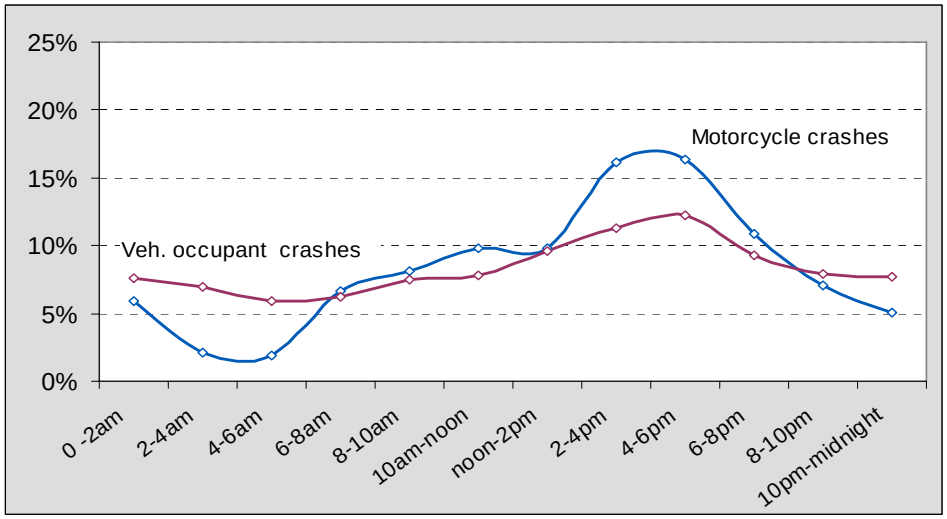
Nationally, the proportion of all fatal motorcycle crashes that involve single vehicles only has been increasing and currently stands at approximately 42 per cent. Over the last ten years, counts for single vehicle crashes have grown at an average annual rate of 4.9 per cent per year. For fatal multiple vehicle motorcycle crashes, average annual growth has been 2.4 per cent. As shown in Figure 5, there was a sharp drop in the national count of single vehicle crashes in 2003. This mainly arose from reductions in NSW, Victoria and South Australia.

The single versus multiple vehicle classification is an important crash characteristic and appears in several of the following analyses.

3.2 Temporal Characteristics of crashes

Crash frequencies vary by time of day, day of week and to some extent, month of year. This section analyses these variables.

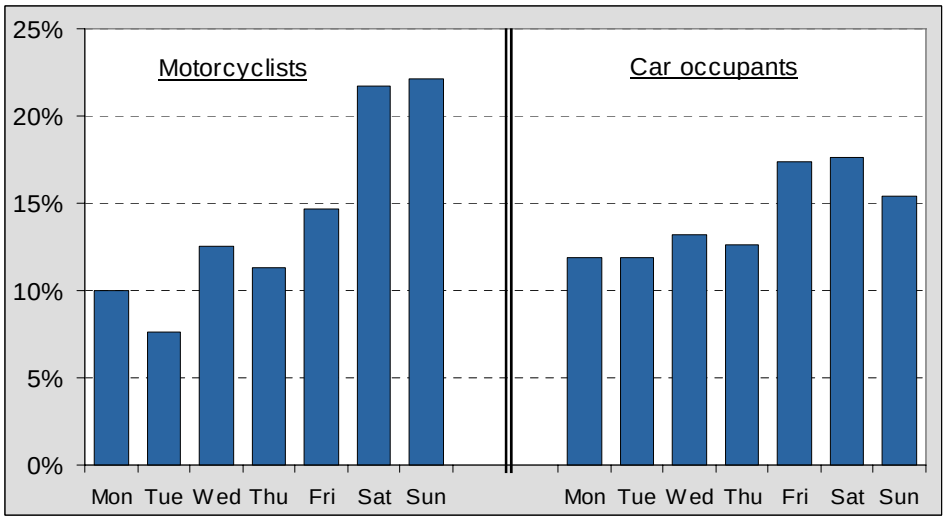
Figure 5. Comparisons of time of day for crashes involving the death of a motorcyclist with crashes involving the death of a vehicle occupant [12]



The distribution of fatal road crashes throughout the day peaks during the 2pm–6pm period. This is true both for crashes involving motorcyclists and those involving only vehicle occupants. However, there is a greater concentration of motorcycle crashes in this 4-hour afternoon period. Also, motorcycle crashes are less frequent in the early morning hours.

In Figure 6 comparisons are made for the day of week.

Figure 6. Comparing day of week for crashes with a motorcyclist killed with crashes involving vehicle occupants killed [13]



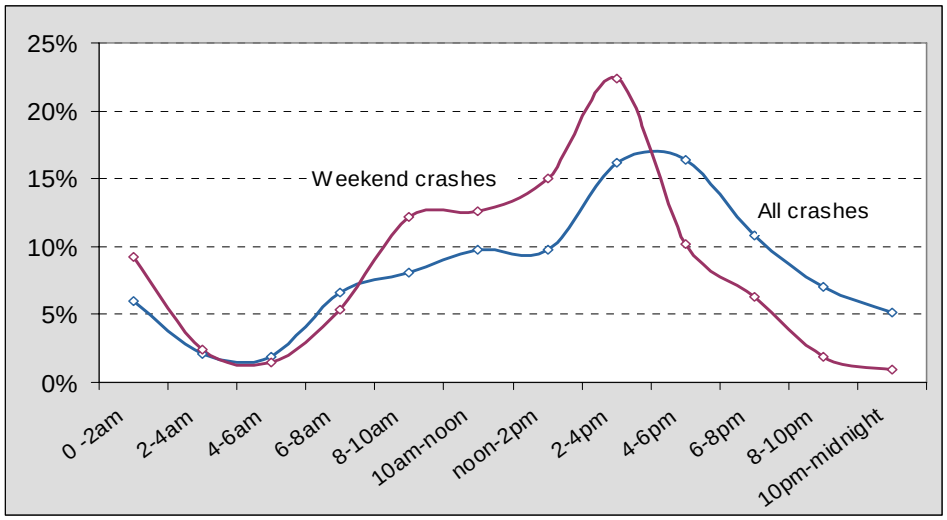
12 Data shown relates to the two-year period, 2006-2007.

13 Data shown relates to the two-year period, 2006-2007.

As can be seen in Figure 6, fatal motorcycle crashes are more clustered into the weekend than crashes involving killed vehicle occupants.

The following figure looks at the hourly distribution of crashes over the Saturday-Sunday period and compares it to the hourly distribution of crashes over the whole week.

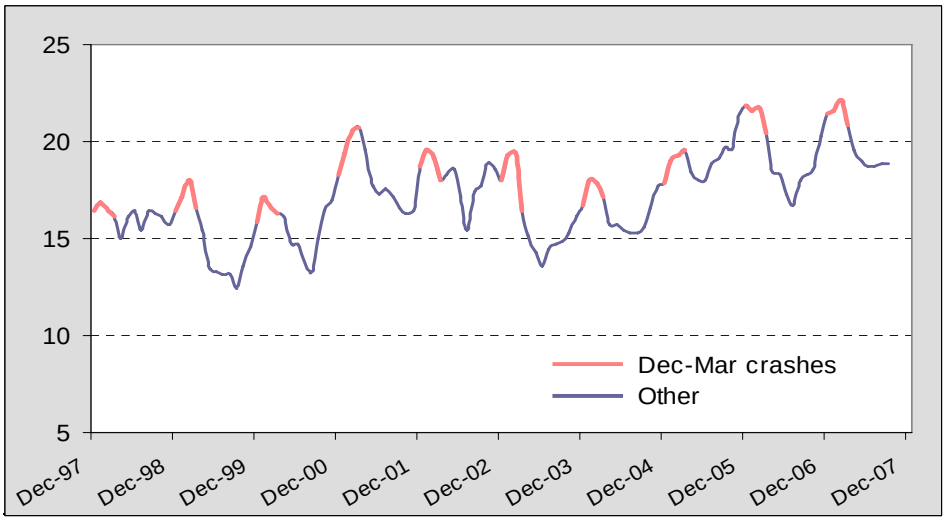
Figure 7. Time of day for weekend crashes and all crashes involving the death of a motorcyclist



Comparing fatal motorcycle crashes occurring during the weekend with those occurring at any time during the week, it is seen that weekend crashes tend to occur during the mid-morning and early afternoon period, and decline in frequency after 6 pm. In comparison (not shown) for fatal crashes involving only car occupants, the weekend period shows an increased proportion of crashes occurring in the early hours of the morning.

There is some seasonality in the distribution of fatal motorcycle crashes throughout the year. Figure 8 presents smoothed monthly counts of fatal motorcycle crashes. Crash frequency peaks in the summer months. The December to March period accounts for 37 per cent of all crashes, and the winter months of June to September account for 27 per cent.

Figure 8. Monthly frequency of crashes involving the death of a motorcyclist [14]



14 Shown in figure 8 is monthly data that have been smoothed by a moving average(7) filter.

Table 11 examines the weather conditions at the time and place of the fatal crash.

Table 11. Weather conditions for crashes involving the death of a motorcyclist, 1999-2003

Weather	Single vehicle			Multiple vehicle	
	Count	%		Count	%
Fine	347	87 %		462	90 %
Rain-light / moderate	7	2 %		11	2 %
Fog	3	1 %		5	1 %
Rain-heavy	1	0 %		2	0 %
Strong winds	1	0 %		0	0 %
Unknown	39	10 %		34	7 %
All	**398**	**100 %**		**514**	**100 %**

3.3 Location of crashes

Approximately 40 per cent of fatal motorcyclist road crashes occur on major roads such as arterial roads and national highways. The remainder occur on minor roads including suburban and smaller rural roads. Table 12 classifies the crashes according to the number of vehicles involved and road type.

Table 12. Road type for crashes involving the death of a motorcyclist, 1999-2003

Road type	Single vehicle			Multiple vehicle	
	Count	%		Count	%
Major arterial (inc. highway)	113	28 %		225	44 %
All others	271	68 %		288	56 %
Unknown	14	4 %		1	0 %
All	**398**	**100 %**		**514**	**100 %**

Comparing single and multiple vehicle crashes, single vehicle crashes are more likely to occur on minor roads.

In Table 13 below, crashes are classified by urban/rural location as well as number of vehicles.

Table 13. Urban/Rural[15] classification for crashes involving the death of a motorcyclist, 1999-2003

Locality	Single vehicle			Multiple vehicle	
	Count	%		Count	%
Urban	177	44 %		274	53 %
Rural	204	51 %		231	45 %
Unknown	17	4 %		9	2 %
All	**398**	**100** %		**514**	**100 %**

Comparing single and multiple vehicle fatal crashes, a greater proportion of the single vehicle crashes occur in the rural environment.

Table 14 categorises crashes by road configuration.

Table 14. Road configuration for crashes involving the death of a motorcyclist, 1999-2003

Road configuration	Single vehicle			Multiple vehicle	
	Count	%		Count	%
Mid-block	357	90 %		298	58 %
Within intersection	29	7 %		215	42 %
Unknown	12	3 %		1	0 %
All	**398**	**100** %		**514**	**100 %**

Almost all fatal single-vehicle crashes occur mid-block (or located away from intersections). Multiple-vehicle crashes are more evenly dispersed between mid-block and intersection locations.

Table 15 presents posted speed limit at the crash location.

15 'Urban' is defined as a locality of greater than 1,000 people.

Table 15. Posted speed limit for crashes involving the death of a motorcyclist, 1999-2003

Limit (km/h)	Single vehicle			Multiple vehicle	
	Count	% of known[16]		Count	% of known
≤ 50	20	8%		15	4%
60	83	32%		118	34%
70	18	7%		48	14%
80	34	13%		39	11%
90	5	2%		4	1%
100	81	31%		100	28%
≥ 110	17	7%		28	8%
Unknown	140	-		162	-
All	**398**	**100 %**		**514**	**100 %**

The distribution of posted speed limit is similar both for single and multiple vehicle crashes. Around 40 per cent of fatal crashes occur at a limit less than or equal to 60 km/h, 20 per cent between 65 and 90 km/h, and 40 per cent over 90km/h.

The final two tables in this section examine the surfaces both of the road and the shoulder.

Table 16. Road surface at location of crashes involving the death of a motorcyclist, 1999-2003

Road surface	Single vehicle			Multiple vehicle	
	Count	%		Count	%
Sealed / paved	361	91%		486	95%
Unsealed	24	6%		28	5%
Unknown	13	3%		0	0%
All	**398**	**100 %**		**514**	**100 %**

16 The 'per cent of known' effectively allocates the same percentage of the known categories to the unknown cases.

Table 17. Shoulder surface at location of crashes involving the death of a motorcyclist, 1999-2003

Shoulder surface	Single vehicle			Multiple vehicle	
	Count	%		Count	%
Kerb	103	32 %		64	25 %
Sealed (exceeds 1m)	16	5 %		22	9 %
Unsealed	186	57 %		146	58 %
Shoulder present, unknown surface	21	6 %		20	8 %
Unknown	48	-		50	-
All	**374**	**100 %**		**302**	**100 %**

Data for *Shoulder* is not defined for crashes occurring at intersections. The majority of both single and multiple vehicle crashes occur where there is no sealed shoulder.

3.4 Crash Events

Detailed examination of road crashes reveals that most may be categorised into a pre-defined set of classes. For example, 'collision with another vehicle' or 'lost control on bend' are common classes. Sub-categories within each class may then be further defined. The classes of outcomes tabulated in this section are referred to as *definitions for coding accidents* (DCA). Crashes involving a single moving vehicle (a motorcycle) are shown and compared with non-motorcycle crashes and then multiple vehicle crashes are then examined.

Table 18. DCA for single vehicle crashes involving the death of a motorcyclist, 1999-2003

DCA	Frequency	%
Off carriageway – right bend	135	34 %
Off carriageway – left bend	92	23 %
Off carriageway – straight	86	22 %
Collision (object on Carriageway) [17]	25	6 %
Overtaking – lost control	16	4 %
Other	44	11 %
Total	**398**	**100 %**

17 Refers to collisions with objects other than another moving vehicle.

Table 19. DCA for non-motorcycle single vehicle fatal crashes, 1999-2003

DCA	Frequency	%	% of known
Off carriageway – right bend	602	19 %	23 %
Off carriageway – left bend	424	13 %	16 %
Off carriageway – straight	1,241	39 %	47 %
Collision (object on carriageway)[18]	62	2 %	2 %
Overtaking – lost control	52	2 %	2 %
Other	251	8 %	10 %
Unknown	575	18 %	-
Total	**3,207**	**100 %**	**100 %**

Comparing road curvature at the locations of single-vehicle motorcycle crashes with that for single-vehicle non-motorcycle crashes, motorcycle crashes are more likely to be located on a bend (57 per cent for motorcycles and 39 per cent for others) .

Most fatal single-vehicle crashes involve the vehicle running off the carriageway and then colliding with a fixed object. For fatal motorcycle crashes, the types of objects are tabulated in Table 20.

Table 20. Objects hit for single vehicle crashes involving the death of a motorcyclist, 1999-2003

DCA	Frequency	%
Tree	94	24 %
Fence	41	10 %
Street light or traffic light pole	34	9 %
Drain or pipe	21	5%
Electricity pole	17	4 %
Animal	13	3 %
Other	76	19 %
Unknown	45	11%
Not applicable	57	14%
Total	**398**	**100 %**

Similarly to Table 18 above, Table 21 gives the main DCA classes for fatal multiple vehicle crashes in which a motorcyclist was killed.

18 Refers to collisions with objects other than another moving vehicle.

Table 21. DCA for multiple vehicle crashes involving the death of a motorcyclist, 1999-2003

DCA	Frequency	%
Opposing directions head-on	146	28 %
Opposing directions straight *vs* right turn	119	23 %
Perpendicular directions straight *vs* right turn	36	7 %
Perpendicular directions straight *vs* straight	32	6 %
Same direction — rear end	15	3 %
Same direction — other	52	10 %
Overtaking	39	8 %
Other	75	15 %
Total	**514**	**100 %**

3.5 Contributory factors in fatal motorcycle crashes

Section 3.4 provided a broad categorisation of events *during* the crash sequence. In this section, factors that may have contributed to the initiation of the sequence are examined. The factors presented here are based on police and coroners findings, and if any are allocated they are associated with a particular vehicle in the crash. This section does not provide a thorough analysis of the initial events, which often combine in complex ways, but does point to the most common conditions found in fatal motorcycle crashes. Up to three factors are coded per crash. Table 22 examines single-vehicle crashes and Tables 23(A) and 23(B) provide information for multiple vehicle crashes.

Table 22. Main factors involved in single vehicle crashes involving the death of a motorcyclist, 1999-2003

Factor	Count	% of Known
Excessive speed	232	70 %
Alcohol and / or drugs	152	46 %
Learner rider	27	8 %
Skylarking or racing	8	2 %
Hit animal	15	5 %
Road Infrastructure	6	2 %
No Factor recorded	67	-

Table 23 A. Main factors allocated to the motorcycle in multiple vehicle crashes involving the death of a motorcyclist, 1999-2003

Factor	Count	% of Known
Excessive speed	175	41 %
Alcohol and / or drugs	91	21 %
Not see other roaduser	23	5 %
No Factor recorded for crash	67	-

Table 23 B. Main factors allocated to the other vehicle in multiple vehicle crashes involving the death of a motorcyclist, 1999-2003

Factor	Count	% of Known
Not see other roaduser	85	19 %
Fail to give way	31	7 %
Alcohol and / or drugs	10	3 %
Excessive speed	6	2 %
No Factor recorded for crash	71	-

'Excessive speed' refers to a vehicle speed that was above the posted limit or deemed by police to be too fast for the conditions. It was allocated to a majority (58 per cent) of fatal single vehicle motorcycle crashes and to a significant proportion (34 per cent) of motorcycles in multiple-vehicle crashes. Alcohol and/or drugs also appear to be involved in many single vehicle crashes. Regarding multiple vehicle crashes, often no factor is allocated to the other vehicle. As shown in Table 11B, the largest category (with 19 per cent of crashes) involves the driver not seeing the rider.

In addition to the major crash factors shown above, responsibility for the crash can be allocated to either or both of the operators in multi-vehicle crashes. For example, an operator who violates another vehicle's right of way and then collides with that vehicle would likely be allocated responsibility in the crash. In Table 24 the responsibility of each operator in multiple-vehicle crashes is shown.

Table 24. Responsibility allocated to operators in multiple-vehicle crashes involving the death of a motorcyclist, 1999-2003

Factor	%
Motorcycle rider	55 %
Other vehicle operator	29 %
Both	13 %
Unknown	3 %
Total	**100 %**

4 RIDER AND DRIVER CHARACTERISTICS

4.1 Ages of riders

Motorcycling is increasing in popularity, as shown in Section 2.3. The numbers of fatal crashes are also increasing. This section analyses the ages of riders killed to determine if the increase is concentrated in any age group. Included also is the distribution of driver ages for vehicle operators other than the rider.

Table 25 presents numbers of deaths by age group for motorcyclists.

Table 25. Annual numbers of deaths of motorcyclists by age-group

Year	≤ 24 yrs	25 – 44 yrs	≥ 45 yrs
1998	66	96	18
1999	46	109	21
2000	56	105	30
2001	62	115	39
2002	50	132	42
2003	49	104	35
2004	58	96	41
2005	59	113	62
2006	67	129	43
2007	60	116	63
Ave. annual change – 5 yrs	5.5 %	0.5 %	9.1 %
Ave. annual change – 10 yrs	0.3%	2.1%	12.3%

Older motorcyclists in particular are involved in an increasing number of fatal motorcycle crashes. Table 26 sets out the average annual growth rates for each age group by crash type (single or multiple vehicle).

Table 26. Average annual percentage change (1999-2003) by age-group and crash type

	≤ 24 yrs	25 – 44 yrs	≥ 45 yrs
Single	8.3 %	3.6 %	9.9 %
Multiple	3.7 %	- 1.8 %	9.8 %
All	**5.5%**	**0.5%**	**9.1%**

Table 27 examines the ages of the *other vehicle operator* in two vehicle crashes in which a motorcyclist was killed.

Table 27. Ages of other driver in two vehicle crashes involving the death of a motorcyclist

Year	≤ 24 yrs	25 – 44 yrs	≥ 45 yrs	Mean age
1999	17 %	44 %	39 %	36.1
2000	25 %	43 %	32 %	40.3
2001	18 %	43 %	38 %	42.1
2002	15 %	50 %	35 %	37.3
2003	21 %	58 %	21 %	40.2

An increase towards the middle age group occurred during the latest two years. Table 27 compares this data with ages of drivers in fatal two vehicle *non-motorcycle* crashes.

Table 28. Ages of driver in two vehicle fatal crashes with no motorcyclist deaths

Year	≤ 24 yrs	25 – 44 yrs	≥ 45 yrs	Mean age
1999	20%	43%	37%	41.3
2000	20%	41%	39%	41.6
2001	22%	35%	43%	42.5
2002	20%	39%	41%	43.1
2003	18%	35%	47%	45.9

In fatal motorcycle crashes, the mean age of the *other driver* is slightly younger than that of driver ages in two vehicle non-motorcycle crashes.

An analysis of fatal crashes in which a motorcyclist was involved but in which no motorcyclist died shows that these events are quite rare. During the five years 1999-2003, 25 such crashes occurred. In 11 of these crashes a pedestrian died, in three a cyclist died and in the remaining 11 a car occupant died.

4.2 Helmet usage

A correctly fitted helmet – complying with standard AS/NZS1698 – will provide protection against head injury. Likewise, protective clothing and shoes will minimise other injuries. In Table 29, fatalities to riders and pillion passengers are categorised according to helmet usage. The data relates to the period 1999-2003.

Table 29. Helmet usage for motorcyclists killed, 1999-2003

Helmet Usage	Frequency	Per cent		Per cent of knowns
Worn	501	53 %		73 %
Came off [19]	121	13 %		18 %
Not worn	67	7 %		10 %
Unknown	252	27 %		
Total	**941**	**100 %**		**100 %**

4.3 Licencing

Approximately one-fifth of rider fatalities occur when the rider has an inappropriate licence or does not possess a licence. Table 30 presents licensing data for the years 1999-2003.

Table 30. Licence status for killed motorcyclist riders, 1999-2003

Licence status	Frequency	Per cent		% of knowns
Normal full	328	37 %		65 %
Learners	26	3 %		5 %
Initial P-plate	18	2 %		4 %
Probationary	1	0 %		0 %
Other appropriate licence	28	3 %		6 %
Not appropriately licensed	107	12 %		21 %
Unknown	389	43 %		-
Total	**897**	**100 %**		**100 %**

19 The helmet category ‘Came off’ includes ‘probably came off’ as reported by police or coroner.

4.4 Injuries for killed motorcyclists

The following tables categorize the mechanism of fatal injury. Single-vehicle crashes are shown in Table 31 and multiple vehicle crashes in Table 32.

Table 31. Mechanism of fatal injury for motorcyclist deaths in single vehicle crashes, 2001-2003

Mechanism of injury	Frequency	%
Impact with veh exterior	12	5%
Impact with road	34	13%
Impact with other object	193	75%
Other	3	1%
Unknown	14	5%
Total	**256**	**100%**

The majority of fatal injuries in single-vehicle crashes occur as a result of impact with an object other than the road (see also Table 20).

Table 32. Mechanism of fatal injury for motorcyclist deaths in multiple vehicle crashes, 2001-2003

Mechanism of injury	Frequency	%
Impact with veh exterior	189	57%
Impact with road	54	16%
Impact with other object	40	12%
Other	35	11%
Unknown	15	5%
Total	**333**	**100%**

Most fatal injuries to motorcyclists in multiple vehicle crashes occur as a result of an impact with another vehicle.

Table 33 categorises coroner's findings as to which area of the body sustained the injury causing death.

Table 33. Coroners findings on fatal injury, 2001-2003

Area of body	Frequency	%
Head	287	30 %
Multiple	197	21 %
Thorax	117	12 %
Neck	16	2 %
Abdominal/pelvic	14	1 %
Spine	12	1 %
Other	13	1 %
Unknown	285	30 %
Total	**941**	**100 %**

In Table 34 this is further classified according to helmet use.

Table 34. Coroners findings by helmet usage, 2001-2003

Helmet use	Worn	Came off	Not worn	Unknown
Area of body				
Head	32 %	36 %	45 %	20 %
Multiple	21 %	21 %	18 %	21 %
Thorax	15 %	8 %	7 %	11 %
Neck	2 %	2 %	0 %	1 %
Abdominal/pelvic	2 %	1 %	0 %	1 %
Spine	2 %	2 %	0 %	1 %
Other	2 %	2 %	1 %	1 %
Unknown	24 %	28 %	28 %	44 %
Total	**100 %**	**100 %**	**100 %**	**100 %**

Despite helmet usage, injury to the head is relatively common. The proportion increases when the helmet comes off or is not worn at all.

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APPENDIX A: DATA SOURCES

The main sources for fatal road crashes data used in this report are the State and Territory road safety agencies. These agencies collate data from police departments and forward extracts to the Department of Infrastructure, Transport, Regional Development and Local Government. The result – the *Monthly Road Death Series* (MRDS) – is a database containing basic crash and demographic data for all fatal crashes from 1989 to the present. Another source of data used in this report is the *National Coroners Information System* (NCIS), managed by the Victorian Institute of Forensic Medicine. The NCIS database contains a great deal of information about road crash deaths but is relatively recent (2000 onwards) and at present is incomplete for the years from 2004. These two sources have been used for all Australian crash data in this report. International data are sourced from the Department's *International Road Safety Comparisons: The 2005 Report*, and the International Road Traffic Accident Database (IRTAD).

All data for 'motorcyclists' include data relating to scooters.

Data relating to serious injuries was obtained from a report prepared for the Australian Transport Safety Bureau by the Australian Institute of Health and Welfare. This data was derived from the AIHW National Hospital Morbidity Database (NHMD). In this report, *serious injury* is defined as an injury which results in the person being admitted to hospital, and subsequently discharged alive either on the same day or after one or more nights stay in a hospital bed (i.e. deaths are excluded).

Vehicle-kilometre data are sourced from a Bureau of Infrastructure, Transport and Regional Economics (BITRE) working paper (in press). Data on vehicle registrations are sourced from the Australian Bureau of Statistics *Motor Vehicle Census* 9309.0.