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Abstract

This report summarises different types of fatal road crashes based on Australian data from 1988 in the FORS Fatality File.

Fatal pedestrian, bicycle, motorcycle, bus and articulated truck crashes, single and multiple vehicle crashes invclving passenger vehicles and/or rigid trucks in rural high and urban low speed zones, and crashes involving children are characterised in terms of frequency, timing, location, prevailing road and driving conditions, vehicle movements, fault, contributory factors (such as alcohol and speed), persons involved and medical details of the fatalities and injuries.

This is a summary report of CR 105.

Keywords
Fatal crash; pedestrian crash; bicycle crash; motorcycle crash; bus crash; articulated truck crash; single vehicle crash; multiple vehicle crash; crashes involving children

FATAL CRASH TYPES
SUMMARY REPORT
ANALYSIS OF 1988 FATALITY FILE

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1992

Executive summary

This report characterises different types of fatal road crashes. It is based on the 1988 FORS Fatality File for Australian road crashes. Each crash type is described in terms of frequency, timing, location, prevailing conditions, vehicles involved, crash events, fault, contributory factors, persons involved and details of injuries received and cause of death for those killed.

This report (CR 104) is a summary of a separate, more detailed document (CR 105).

Fatal crashes in Australia 1988

There were 2561 road crashes in 1988 in which at least one person was killed or died within 30 days. These crashes resulted in 2875 fatalities and involved 3718 vehicles.

Pedestrian crashes

Pedestrians accounted for 19% of all road fatalities and these crashes generally occurred in the afternoons and evenings on weekdays, and at night on weekends. A disproportionately high number occurred in Winter. Most pedestrians were killed in urban areas, away from intersections and while crossing the road where there were no marked crossings. Most (69%) of the pedestrians were considered to be responsible for the crashes. The pedestrians killed included children who did not look before crossing, young alcohol affected adults and the largest group (40%) comprised older persons who generally made misjudgments. Pedestrians, like cyclists, had a high incidence of death due to head injuries; 19% died instantly and half died in hospital. Many had lower extremity injuries. The drivers involved in these crashes tended to be younger, but not speeding or driving under the influence of alcohol.

Bicycle crashes

Bicycle crashes comprised only 3% of all fatal crashes. There were 86 cyclist fatalities. Most occurred in urban areas (81%), similar to pedestrian crashes. An after school peak was also observed. Almost half occurred within or near intersections and 44% were rear end collisions. Cyclists were often at fault (67%) and visibility played a role, both at night and during the day. Two thirds of the bicycles involved at night had no lights. Alcohol (15%) and speed (3%) were less common than in other fatal crashes. Cyclist fatality characteristics resembled those of pedestrian fatalities, though there were more school aged children (22%) and proportionally more males (86%). Almost half died of head injuries. Only 3% wore helmets.

Motorcycle crashes

Thirteen percent of fatal crashes involved motorcycles. Motorcyclists accounted for 10% and pillion passengers 1% of road fatalities. Motorcycle crashes often occurred on Fridays and weekends (60%), in urban areas (67%), and in fine conditions (92%). The motorcyclist often lost control on curves and collided head-on with another motor vehicle. The motorcyclists were generally young males, often inexperienced and considered solely responsible for just over half the fatal crashes with other vehicles. Speeding and alcohol were common contributory factors with 40% of motorcyclists involved in fatal crashes over 0.05 gm/100 ml blood alcohol (compared with 24% of other drivers) and 32% of motorcyclists were speeding (vs 10% other drivers). The other persons involved in these crashes often failed to observe the motorcycle. Approximately 80% of motorcyclists killed were wearing helmets.

Bus crashes

The 53 fatal crashes involving buses (>9 seats) comprised only 2% of all fatal crashes. Most occurred during the day in urban regions. One third involved the death of pedestrians. Bus drivers were older and less often responsible for multiple vehicle crashes than other drivers. Speeding, fatigue, alcohol and drugs were rarely contributory.

Articulated truck crashes

Eleven percent of fatal crashes (289) involved articulated trucks. Most occurred on weekdays (81%) and involved more than one vehicle (75%). Two thirds occurred on rural roads with speed limits at least 80 km/h. Many urban articulated truck crashes occurred within or near intersections (41%). Only 22% of the drivers of these trucks were at fault in collisions with other types of vehicles. Speeding, alcohol and drug use were uncommon. The truck drivers were older than other drivers. Only 23% of truck drivers wore seat belts. However, most (79%) of the 353 resultant fatalities were persons external to the trucks.

Rural and urban crashes involving passenger vehicles (& rigid trucks)

Single vehicle crashes involving passenger cars or rigid trucks accounted for more fatal crashes (28%) and more fatalities (28%) than multiple vehicle crashes involving these vehicles (18% of all fatal crashes and 20% of fatalities). They generally occurred on the weekend, unrelated to intersections with the car running off a level road. The drivers were generally young males, coming home from recreational activities, often affected by alcohol and not wearing seat belts.

Multiple vehicle, passenger car crashes generally occurred in day light on weekdays and within intersections. Though the drivers were older and more experienced, driver errors or bad visibility often contributed to these crashes. There was a high incidence of death due to chest injury (19%).

Single vehicle, passenger car, rural high speed (>=80 km/h) **(SVR)** crashes (19% of all fatal crashes and fatalities) generally occurred in good conditions, with the driver losing control on the road shoulder and overturning. Alcohol and fatigue were common contributory factors.

Single vehicle, passenger car crashes in **urban low speed** (<80 km/h) areas **(SVU)** (8% of fatal crashes) occurred mostly at night. Speed and alcohol were common contributory factors.

Multiple vehicle, passenger car, rural high speed (MVR) crashes (11% of road fatalities) were generally head-on, non-intersection crashes occurring during daylight hours on weekdays resulting in multiple fatalities. The road surface contributed to a disproportionately high number of these crashes (12%).

Multiple vehicle, passenger car, urban low speed (MVU) crashes (9% of all fatal crashes) were mostly weekday, daytime crashes, occurring within intersections as a consequence of driver errors.

Crashes involving children

Children up to 12 years of age, though constituting only 6% of road fatalities overall, accounted for a significant proportion of bicycle fatalities (22%), 13% of pedestrian fatalities and 10% of passenger fatalities. Both child pedestrians and cyclists were often killed in coming out from behind a parked vehicle or entering the road from the footpath or driveway. They were more likely than adult pedestrians or cyclists to die of head injuries. Child pedestrians killed were also more likely to sustain serious injuries to the abdomen or spine.

Children killed were more likely than other passengers to be in the rear of a vehicle, particularly the centre back seat. Child passengers were more likely to die of head injuries than other motor vehicle occupants, and less likely to sustain serious chest injuries.

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Chapter 1. Introduction

Objectives

The major aim of this project was to describe and characterise different types of fatal crashes occurring in Australia based on detailed data from the 1988 Fatality File. The ten crash types reported here are pedestrian, bicycle, motorcycle, bus, articulated truck, single passenger vehicle rural high speed, single passenger vehicle urban low speed, multiple passenger vehicle rural high speed, multiple passenger vehicle urban low speed crashes, and crashes involving children.

Report structure

This summary report follows the structure of the detailed report[5].

Each of the chapters on the different fatal crash types is relatively self contained and can be read independently. The salient features of each crash type are listed in point form on a summary page at the beginning of each chapter.

The different aspects of each crash type dealt with in each chapter are:

Frequency
Timing (time of year, day of week, hour)
Location (States, urban/rural, road type, intersections)
Road and driving conditions (weather, road surface)
Vehicle characteristics (type, age, condition)
Crash events (pattern of vehicle movements and point of impact)
Fault & contributory factors(speed, alcohol, road rules, surface, visibility)
Persons involved (age, sex, location in vehicle, experience, BAC, drugs)
Medical details (timing, cause of death, injuries)

Where appropriate, a section describing homogeneous subgroups of the crash type under study is included. A summary concludes each chapter.

Data sources

All crash data come from the Federal Office of Road Safety's (FORS) Fatality File for 1988[1,2]. This includes details of all fatal road crashes reported in all States and Territories of Australia in 1988. The Fatality File is the only comprehensive, nationally consistent data base for fatal crashes. It includes over 100 variables relating to the crash (timing, location etc), vehicles involved (make, model etc) and people involved (age, sex etc). The Fatality File draws on data not only from the police, but also from coroners' courts and in some cases original reports were read.

A fatal road crash is defined as a collision in which at least one person is killed or dies within thirty days of the crash as a result of injuries sustained. A total of 2561 crashes are reported in this file, with details of the 3718 vehicles and 7498 persons involved in these crashes. Of these persons, 2875 died.

Statistical methods

Chi-square tests were used to test whether the number of crashes, vehicles or persons with particular characteristics were unevenly distributed between the particular crash types. Quantitative characteristics, such as age or years of driving experience, were compared using the non-parametric Mann-Whitney's *U*-test. Medians were generally used as summary measures for such variables.

Unless stated otherwise, only statistically significant differences with $p < 0.05$ were reported. It should be noted that the size of the groups being tested and th frequency of the characteristic being tested within the groups affects the power the test. The ability to detect a difference at the 5% level increases with the group sizes. Thus, in the smaller crash types, it is possible to detect only larg differences, whereas, in the larger crash types, finer distinctions can be detected.

Statistically significant differences are usually indicated in tables by highlighting the larger of the percentages which are statistically significantly different at the 5% level.

Interpretation

All comparisons are always within the context of fatal crashes. The frequency of fatal crashes of various types is reported, not the risk of dying or being involv in a fatal crash.

The analyses reported were generally univariate, with each type of characteristic analysed separately. Some multivariate analyses were also included, such as detailing the time of day for weekends and weekdays, separate analyses in rural areas and considering age and alcohol levels together.

Due to the considerable detail contained in the fatal file, this report cannot purport to be an exhaustive list of significant results. For the larger crash types, additional significant results could possibly be obtained by further multivariate analyses or finer crosstabulation. Results based on small numbers ne to be replicated on further data sets.

Missing data

Percentages are calculated excluding missing data. Thus, x% of crashes with a particular characteristic means x% of crashes where information was available. In most tables and graphs, the actual denominators for the percentages are given.

Notation

Percentages are expressed as integers after appropriate rounding. In some tables percentages may not sum to 100% as a consequence of this.

Terminology

Definitions of terms used in the report are detailed in the glossary.

Crash events are described in terms of "DCA" codes (Definition for Classifying Accidents). For example, a single DCA event may describe a head-on collision between two vehicles. DCA events have, for ease of presentation, been grouped intc a number of categories. Thus, for example, crashes involving "vehicles from opposing directions" will include a number of specific crash types (including heac on collisions). In addition to the "DCA" event, complex crashes often have "prior' and "subsequent" events. For example, if vehicle A were to hit an animal, lose control and hit vehicle B and then hit vehicle C, (killing the driver of vehicle C), the crash would have a prior (hit animal), DCA (A hits B) and a subsequent (A hits C) event.

Diagrams describing DCA, prior and subsequent event codes are included in the Appendix.

Chapter 2: Fatal pedestrian crashes

Timing
- Proportionally more fatal pedestrian crashes than other fatal crashes occurred in Winter.
- A high percentage of fatal pedestrian crashes occurred in the afternoon and evening (46% between 3 pm and 8 pm).
- An after school peak was observed on weekdays.

Location
- Most fatal pedestrian crashes (89%) occurred in urban areas.
- 71% of fatal pedestrian crashes occurred more than 10m from intersections.
- For 76% of the crashes, the pedestrian was crossing the road.
- 87% of fatal pedestrian crashes occurred where there were no marked crossings.

Crash conditions
- Most fatal pedestrian crashes (87%) occurred in fine/dry conditions.
- 23% of night time urban pedestrian crashes occurred in areas with no lights.

Vehicle characteristics
- In 78% of pedestrian crashes, a passenger vehicle hit the pedestrian and no other vehicles were involved.

Contributory factors
- A high proportion (69%) of the pedestrians were considered solely responsible for the crash.
- Alcohol/drug use by pedestrians was considered contributory for 28% of the fatal pedestrian crashes. A higher percentage of pedestrians tested had blood alcohol values (BAC) >0.15 gm/100 ml than drivers/riders(30% vs 24%).
- Factors such as speed, fatigue, driver intoxication, driver errors, vehicle defects and surface conditions were less likely in pedestrian than in other fatal crashes.

Pedestrians
- There were relatively high percentages of older persons and children among the pedestrians killed; (40% were 60 years or older, 13% were 12 or younger).
- There was a significantly higher percentage of females among the pedestrians killed (33%) than among other road fatalities (28%).

Medical details
- Death from head injuries was more common for pedestrians than other fatalities.
- Similar to other road accident victims, one third of pedestrians died from multiple injuries.
- Pedestrians killed were more likely to sustain serious lower extremity injuries (39%) than other road user groups.
- 53% of the pedestrians involved in these crashes died in hospital.

Drivers
- Drivers involved in pedestrian crashes were younger than drivers involved in other fatal crashes.
- Drivers of vehicles striking pedestrians were less likely to be intoxicated than other drivers involved in fatal crashes.

Definition

A pedestrian crash was defined as any crash in which at least one **pedestrian** wa **killed** or **died** within 30 days as a result of injuries sustained in the crash.

Frequency

There were 535 such crashes in 1988 with 542 pedestrians killed. This represent 20% of all fatal crashes and 19% of road fatalities in Australia that year. Pedestrians are thus the third largest fatality group, behind drivers (40% of a fatalities) and passengers (27%) and larger than motorcyclists (11%) and bicyclists(3%). The predominant crash form involved a single passenger vehicle (78%).

Timing

Proportionally more pedestrian crashes than other fatal crashes occurred from April through July.

As with other fatal crashes, most pedestrian crashes occurred on Saturdays. However, there were proportionally more pedestrian crashes than other fatal cras earlier in the week (Wednesday and Thursday) and fewer on Sunday.

Most pedestrian crashes occurred in the afternoon and evening, between 3 and 8 p

The weekday pedestrian crashes differed from the other crashes with a pronounced afternoon peak after 3 pm. (Figure 1).

Location

Proportionally more pedestrian crashes than other fatal crashes occurred in Victoria (29% vs 23%) and fewer in Queensland (15% vs 20%).

A higher percentage of pedestrian crashes occurring in the southern States in Winter was not associated with adverse weather conditions or shortened daylight hours, as the disproportionately high number of crashes occurred both during the day and night and in good and bad weather.

Pedestrian crashes predominantly occurred in urban areas (89%) compared with onl 44% of other fatal crashes.

Almost three quarters (71%) occurred mid-block. Most (94%) of the mid-block pedestrian crashes occurred where there were no marked crossings, whereas 31% of pedestrian crashes within intersections occurred at intersections controlled by traffic lights where there were 'Walk' and 'Don't walk' signals.

Road and driving conditions

Of night time crashes, proportionally more pedestrian cra :her fatal crashes in both urban (23% vs 15%) and rural (56% vs 38%) :red in area with no street lighting.

Vehicle characteristics

The predominant form of crash was with a single, passenger vehicle (78%). Most vehicles were considered to be within the speed limits (89%) prior to pedestrian crashes, in contrast to other fatal accidents (72%).

Figure 1a Pedestrian and other fatal crashes by hour for weekdays and weekends in urban areas

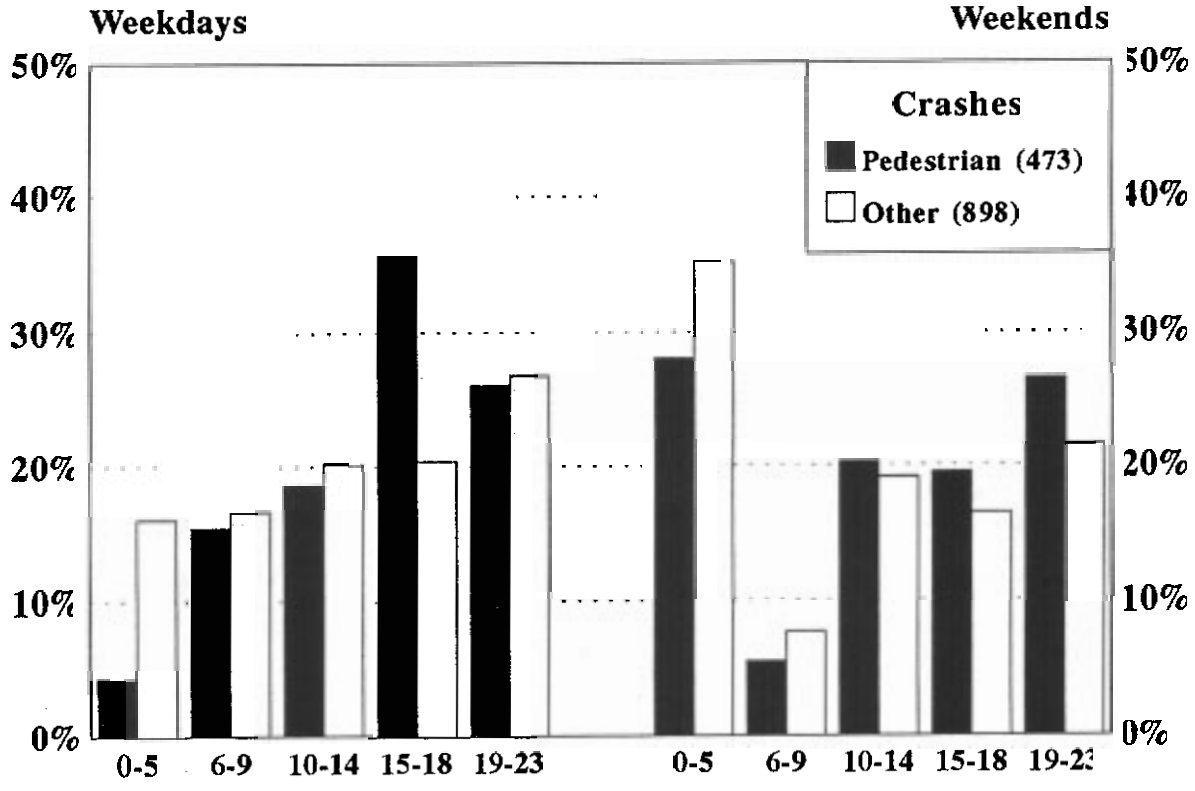
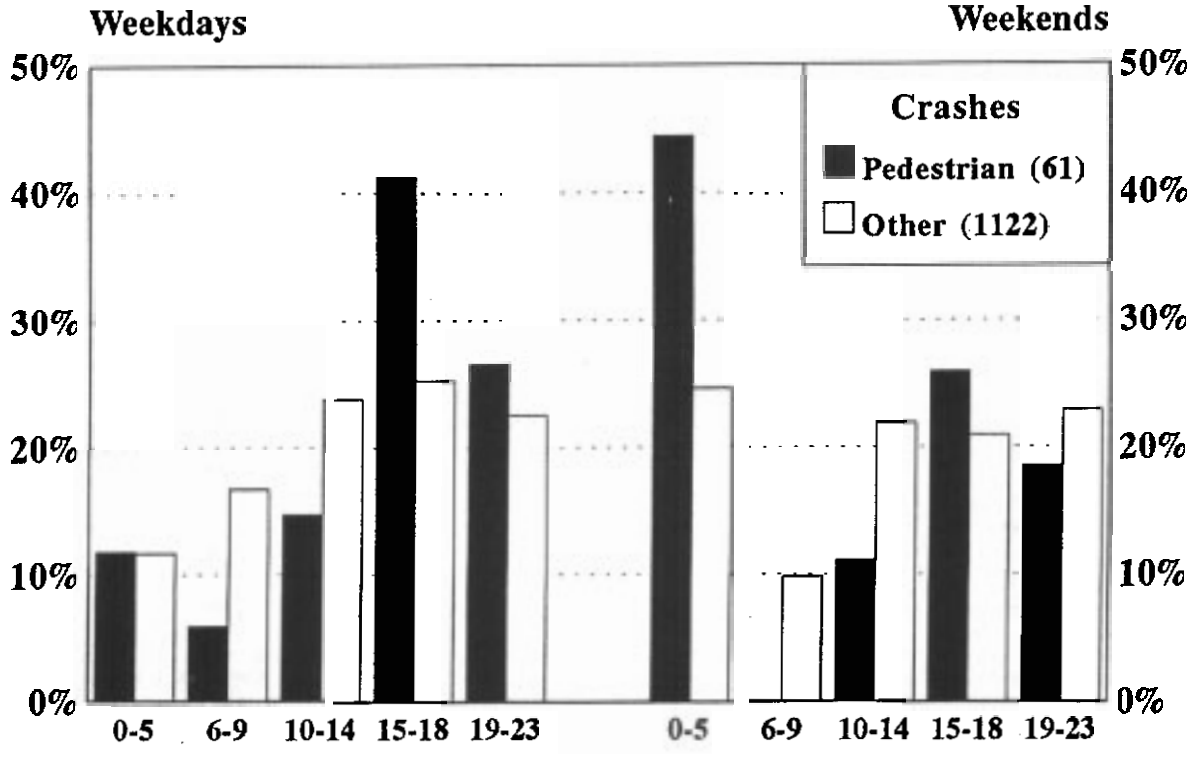


Figure 1b Pedestrian and other fatal crashes by hour for weekdays and weekends in rural areas



Source FORS 1988 Fatal file

Crash description

There were fewer prior and subsequent events than in other crashes. Most (76%) of the crashes involved the pedestrian crossing the road. (Table 1).

Table 2.3 Major DCA types for 535 pedestrian crashes.

DCA	n	%
Near side (hit by vehicle from right)	193	36%
Far side (hit by vehicle from left)	[1] 171	32%
Playing, working, lying, standing on carriageway	[2] 52	10%
Emerging from behind a parked vehicle (hit by vehicle from right)	44	8%
Walking with traffic	30	6%
Other (includes pedestrian movement unspecified)	13	2%
Pedestrian struck on footpath or median strip	9	2%
Cross traffic/turning vehicle[3]	7	1%
Walking against/facing traffic	6	1%
Pedestrian boarding or alighting vehicle	6	1%
Vehicle out of control and/or into object[3]	4	1%
Total pedestrian crashes	535	100%

[1] In 50 of the far side crashes, the pedestrian stepped off a median strip.
[2] 37 lying/sitting/standing, 5 playing , 3 walking, 2 working, 5 unknown.
[3] Pedestrian killed in subsequent event (off carriageway).

Contributory factors

For 358 (69%) crashes, the pedestrian was deemed solely responsible. Speed, fatigue, driver errors, vehicle defects, surface conditions were less frequent factors than in other fatal crashes. 'Failure to see the other unit' was more common among pedestrian crashes in which both parties were at fault (42%) or the driver was at fault (23%) than among those where the pedestrian was at fault (7%) (Table 2).

Table 2 Number and percentage of pedestrian and other fatal crashes attributed to various factors. Significantly high percentages are highlighted.

Factor	Pedestrian crash		Other crash	
	n	%	n	%
Pedestrian factor	**417**	**79%**	0	0%
Pedestrian error	(341)	(65%)	(0)	(0%)
Alcohol/drugs	(146)	(28%)	(0)	(0%)
Failure to observe other unit	71	13%	225	12%
Visibility	46	9%	127	7%
Driver error	42	8%	**557**	**29%**
Alcohol/drug use by driver	35	7%	**624**	**33%**
Speed	27	5%	**501**	**26%**
Surface conditions	6	1%	125	7%
Vehicle defects	5	1%	81	4%
Fatigue	4	1%	**167**	**9%**
At least one major factor noted	526		1891	

The percentages do not sum to 100% since up to 3 major factors can be recorded for each crash. The 'n' in the table is the number of crashes with at least one of the specific major factors recorded for the crash. The percentage is calculated with the denominator as the number of crashes with some information on major factors.

Persons involved

Pedestrians

Ninety-four percent of pedestrians in fatal crashes were killed. Children (<=12 years) and aged persons (60+ years) were over represented among pedestrian fatalities relative to other road user fatalities in non-pedestrian fatal crashes (Figure 2).

Information on employment status was available for 82% of the road accident victims in the fatal file. Due to the larger numbers of children and older persons, only 27% of the pedestrian fatalities were active in the work force, compared to 60% of other road fatalities. Of those employed, there tended to be proportionally more plant operators and labourers (49%) among the pedestrian fatalities than among the other road user fatality groups (36% of motor vehicle occupant fatalities) and the work force in general (23%). See Appendix Table A1 for total road user fatalities by age group and sex.

Alcohol/drugs

Significantly more pedestrian fatalities than other road user groups were over 0.05 gm/100 ml blood alcohol content (BAC) within each of the age groups (Table 3). The non-zero BAC values were higher for pedestrians than for other operator fatalities (driver, cyclist and motorcyclist) (median 0.19 vs 0.17 g/100ml). The percentage of pedestrian fatalities with BAC>0.15 was 30% of those tested. This was also significantly higher than the corresponding percentage (24%) for operator fatalities.

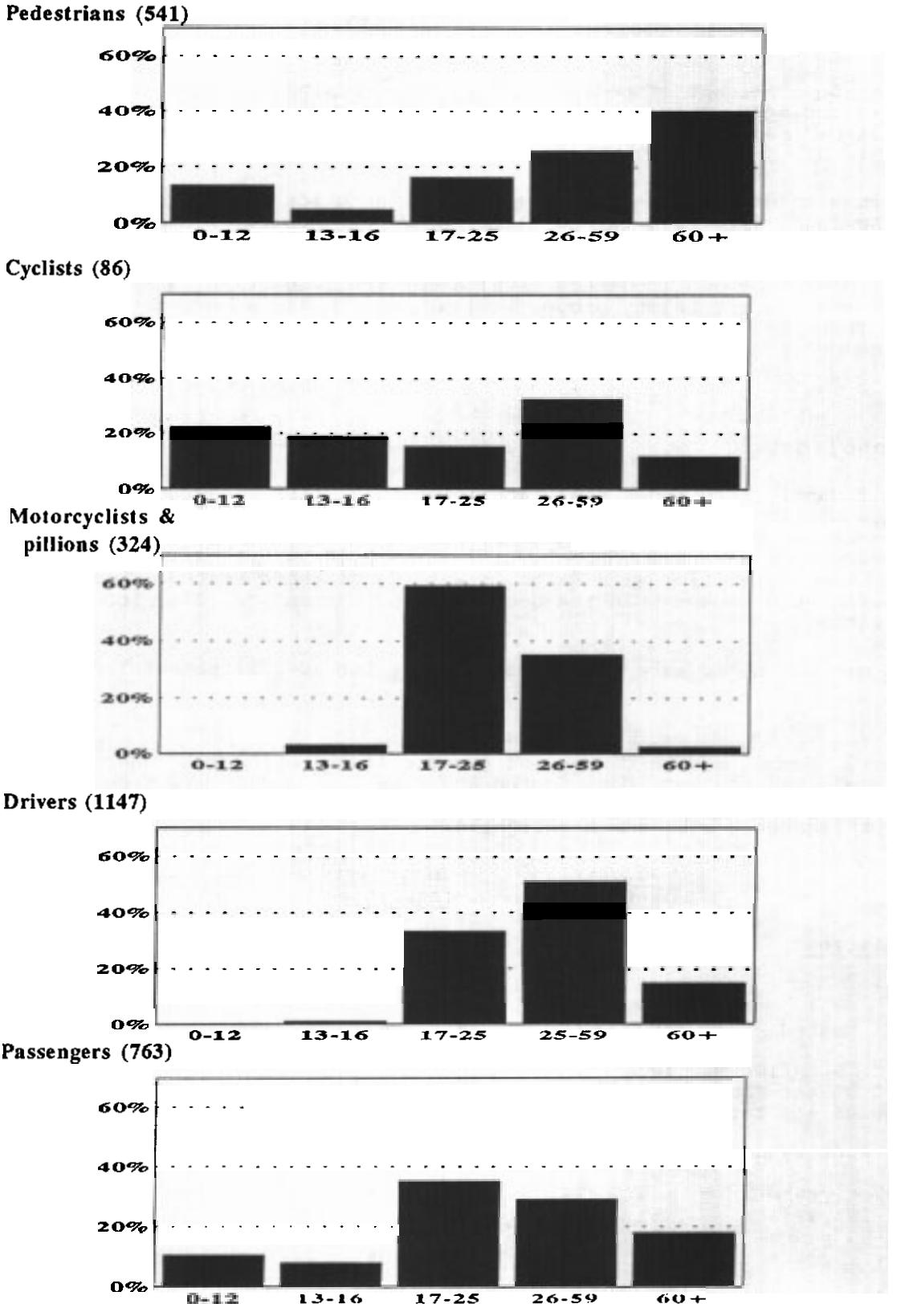
Drug use was noted as a significant factor for 10 (2%) pedestrians killed.

Table 3 Number and percentage of pedestrian and other road user fatalities with blood alcohol content (BAC) tested and over 0.05 gm/100 ml. Figures are also given broken down by age. Significantly high percentages relative to other road user groups (across a row) are highlighted.

	Pedestrian fatalities		Bicyclist fatalities		MC rider[1] fatalities		Driver fatalities	
Fatalities	n	%	n	%	n	%	n	%
Total	542		86		295		1147	
Total tested	350	65%	54	63%	242	82%	912	80%
BAC>0.05 gm/100 ml	143		7		98		334	
BAC>0.05,%of those tested		**42%[2]**		**13%[2]**		**41%[2]**		**37%[2]**
BAC>0.05,%of total		**26%[3]**		**8%[3]**		**33%[3]**		**29%[3]**
BAC >0.05 by age								
<17 years	4	**17%[2]**	0	0%[2]	2	40%[2]	2	29%[2]
17-25 years	51	**73%[2]**	2	22%[2]	55	39%[2]	140	45%[2]
26-59 years	59	**59%[2]**	5	25%[2]	41	47%[2]	178	39%[2]
60+ years	29	**19%[2]**	0	0%[2]	0	0%[2]	14	11%[2]

[1] MC riders excluding pillion passengers
[2] Percentage of those tested with accurate results (1% of those tested had inaccurate results).
[3] Percentage of total (tested plus not tested)

Figure 2 Road user fatalities by age group



Source: FORS 1988 Fatal file

Drivers/riders

Drivers in pedestrian crashes were younger than other drivers in fatal crashes (median age 28 vs 30), but a lower fraction tested were over the 0.05 limit for alcohol (11% vs 29%).

Medical details

Half of the pedestrians and cyclists died in hospital. A higher proportion of instantaneous deaths occurred for motorcyclists and motor vehicle occupants (Table 4). Further subdivision showed that these patterns characterised urban fatalities. In rural areas, approximately one third of the fatalities were instantaneous and about 38% occurred before medical attention for **all** road user groups. Thus, although Table 4 shows significant differences in the timing of death for different road users, these differences are primarily due to the fact that pedestrian and bicyclist crashes tend to occur in urban areas.

Table 4 Timing of death for different road user categories. Significantly high percentages within columns are highlighted.

	Timing of death								
	Instantaneous		Before med. attention		During med. attention[1]		In/after hospital		Total 100%
Road user fatality group	n	%	n	%	n	%	n	%	n
Pedestrian	103	19%	101	19%	48	9%	**280**	**53%**	532
Bicyclist	9	10%	20	23%	12	14%	**45**	**52%**	86
Motorcyclist	**91**	**29%**	**85**	**27%**	32	10%	107	34%	315
Vehicle Occupant	**588**	**32%**	598	32%	196	11%	453	25%	1832
Total fatalities	791	28%	801	29%	288	10%	885	32%	[2]2765

[1] includes in transit to hospital
[2] excludes 103 with time to death unknown and 5 road user category unknown and 2 riders of animals

Serious head injuries were more common among pedestrian, cyclist and motor cyclist fatalities compared with motor vehicle occupants. There were fewer chest and abdomen/pelvic injuries for pedestrians than for the other road user groups. The incidence of lower extremity injuries was high compared with motor vehicle occupants and bicyclists (Table 5). The higher incidence of head injuries was also reflected in the final cause of death (Table 6)

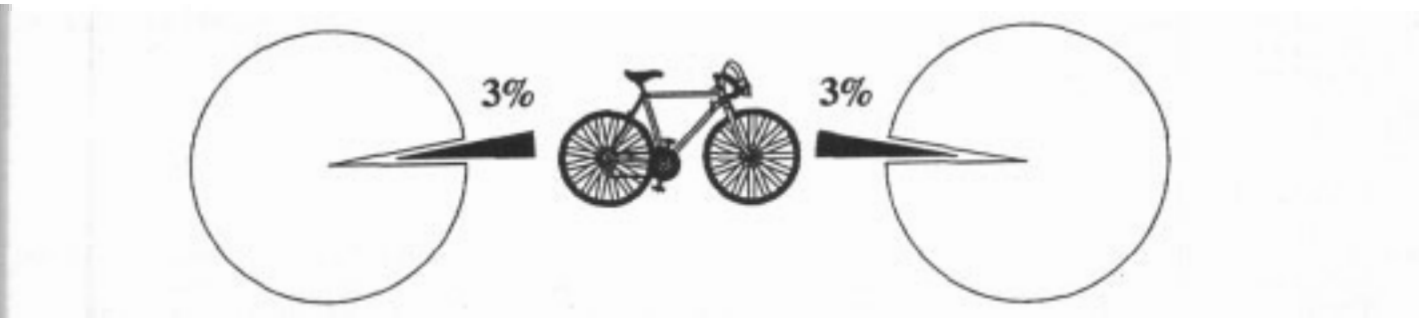
Table 5 Number and percentage of persons killed sustaining at least one serious injury (AIS Abbreviated Injury Score 3-6, 1985 Version) in different body regions. Different road users are tabulated separately. Because a person may sustain one or more serious injuries in one or body region, percentages do not sum to 100%.

	Road user fatality group							
	Pedestrian		Bicyclist		MC rider or pillion		Motor vehicle occupant	
Fatalities with at least one serious injury to the:	n	%	n	%	n	%	n	%
Head	**424**	**78%**	**69**	**80%**	224	75%	1295	68%
Face	8	1%	1	1%	8	2%	59	3%
Neck	5	1%	2	2%	7	2%	30	2%
Chest	323	60%	54	63%	223	69%	1267	66%
Abdomen/pelvis	135	25%	23	27%	**103**	**32%**	**600**	**31%**
Spine	75	14%	7	8%	44	14%	208	11%
Upper extremity	31	6%	2	2%	33	10%	140	7%
Lower extremity	**209**	**39%**	18	21%	106	33%	515	27%
Total fatalities	542		86		324		1916	

Table 6 Coroner's assessment of final cause of death for different road user groups.

	Road user category							
	Pedestrian		Bicyclist		MC rider or pillion		Motor vehicle occupant	
Cause of death: body region	n	%	n	%	n	%	n	%
Head	**233**	**43%**	**40**	**47%**	122	38%	690	36%
Chest	37	7%	4	5%	39	12%	241	13%
Abdomen/pelvis	6	1%	2	2%	7	2%	44	2%
Spine	26	5%	2	2%	10	3%	91	5%
Lower extremity	28	5%	3	3%	15	5%	75	4%
Other	0	0%	0	0%	3	1%	42	2%
Multiple	179	33%	30	35%	123	38%	601	31%
Indirect/non-crash	33	6%	5	6%	5	2%	132	7%
Total fatalities	542	100%	86	100%	324	100%	1916	100%

Chapter 3: Fatal bicycle crashes



Timing

- Bicycle crashes peaked after school on weekdays(32% of crashes between 3 & 6pm).
- There was a morning peak on weekends (22% of crashes between 9 and 12 noon).

Location

- Most fatal bicycle crashes (81%) occurred in urban areas.
- Compared with other fatal crashes, an unexpectedly high percentage of bicycle crashes occurred in mid-sized towns (1 000-50 000 inhabitants).
- A high percentage (46%) occurred within or near intersections.

Crash type

- 44% of fatal bicycle crashes were rear end collisions. In 24% of crashes, a vehicle ran into a bike, and in 20% the bike ran into a vehicle.

Contributory factors

- The cyclist was deemed solely at fault in 67% of fatal bicycle crashes.
- 67% of bicycles in night time fatal crashes had no lights.
- In 50% of the crashes at night, the driver did not see the cyclist.
- There was low alcohol and drug involvement among both the cyclists and drivers involved in these crashes.

Cyclists

- 86% of cyclists killed were male.
- 22% of the cyclists killed were children (aged 4-12 years).
- 19% of the cyclists killed were school aged teenagers (aged 13-16 years).
- 3% of cyclists killed wore helmets.
- 47% of cyclists killed died of head injuries, 33% died of multiple injuries.
- 52% of cyclists killed died in hospital.

Definition

A bicycle crash was defined as any crash in which at least one bicyclist was killed or died within 30 days as a result of injuries sustained. A bicyclist may be a bicycle or tricycle rider or a pillion passenger.

Frequency

There were 85 such crashes in 1988 (with 86 cyclists killed). This represents 3% of all fatal crashes and 3% of road fatalities in Australia that year. Of persons involved in these accidents, the only fatalities were the 86 cyclists. There were no bicycle pillion riders involved in these accidents.

Timing

Proportionally more bicycle accidents occurred between 3 and 6 pm on weekdays (32% vs 19%) and in the morning (9-12) on weekends (22% vs 11%) (Figure 3).

Location

Bicycle crashes predominantly occurred in urban areas with 81% in cities and towns compared with 53% of other crashes. There were more bicycle crashes associated with intersections than other fatal crashes (46% vs 25%). This was most pronounced in rural areas (Figure 4).

Road and driving conditions

Of crashes occurring at night, the proportions of bicycle and other crashes occurring in dark conditions of limited visibility (i.e., no street lights) were similar (72% vs 75%). Even within urban and within rural areas the percentages were effectively the same.

Crash description

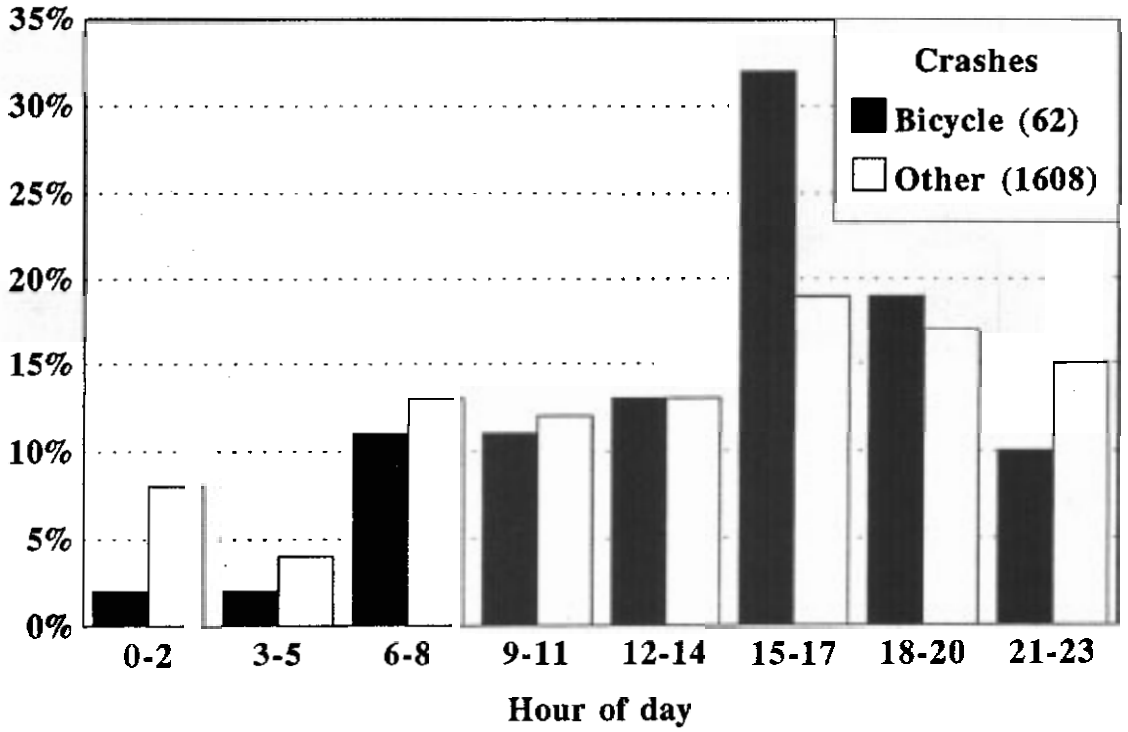
Rear end collisions comprised 44% (Table 7). Of these, there were almost as many involving the bike running into the other vehicle, as with a motor vehicle running into a bicycle. The most common bike manoeuvre resulting in the bike hitting a vehicle travelling in the same directions was a lane change from the left to the right lane (5 cases).

Table 7 Bicycle crashes grouped by road crash pattern.

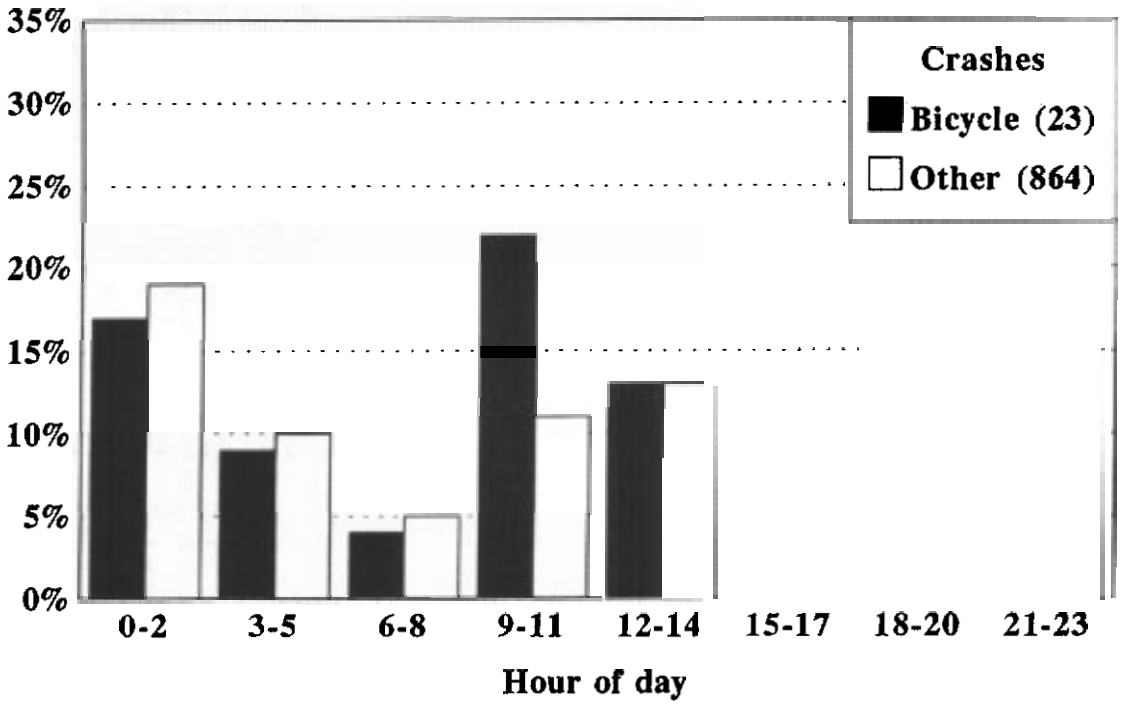
Crash pattern		
Bike struck **from behind**	20	24%
Bike hits other vehicle **same direction**	17	20%
Cross traffic accident at or near intersection	20	24%
Bicycle **entering** carriageway from driveway/footpath/median	13	15%
Bicycle **out of control**	8	9%
Bike into **car door** or **parked vehicle**	2	2%
Head on crash	2	2%
Unknown	3	4%
Total bicycle crashes	85	100%

Figure 3 Bicycle and other crashes on weekdays and weekends in 3 hour periods

Weekdays

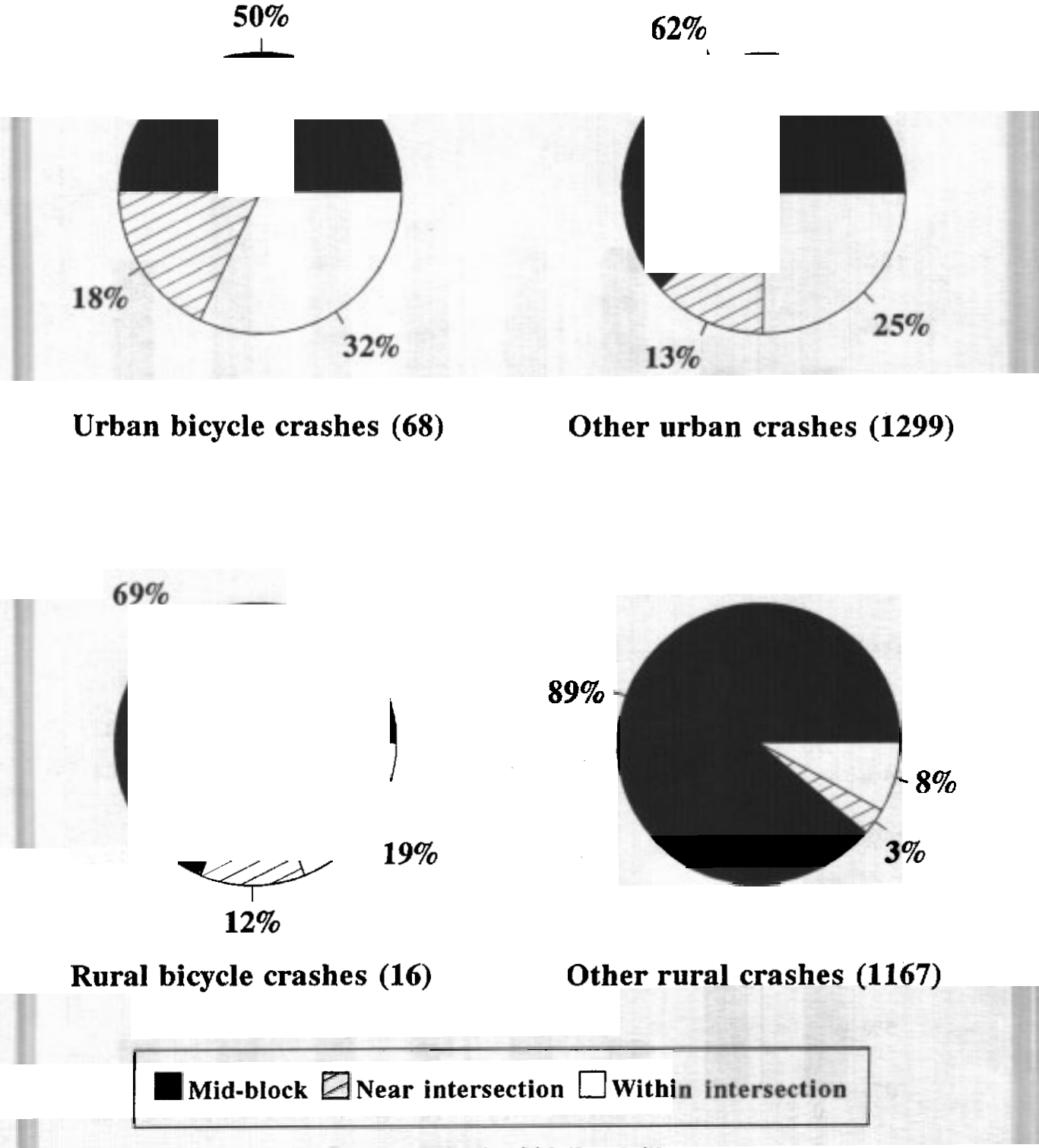


Weekends



Source: FORS 1988 Fatal file

Figure 4 Location of urban & rural bicycle & other fatal crashes with respect to intersections



Source: FORS 1988 Fatal file

Contributory factors

In 67% (53) of the crashes, the cyclists were assessed as being responsible for the initial events. Alcohol/drugs, driver errors and excessive speed were less frequent in bicycle crashes than in other fatal crashes. The factor 'failure to observe the other unit' (cyclist (12), motor vehicle (14)), was more frequent for bicycle crashes (Table 8). Of the 21 bicycles involved in fatal crashes at night, two thirds (14; 67%) had no lights and, of these, 10 had no reflectors or other aids for visibility. Nine of the cyclists out at night wore dark clothing.

Table 8 Number and percentage of bicycle and other fatal crashes attributed to various factors. Significantly high percentages across rows are highlighted.

Factor	Bicycle crash		Other crash	
	n	%	n	%
Cyclist factor	39	49%	1[1]	0%
Failure to observe other unit	**26**	**33%**	268	11%
Alcohol/drugs	12	15%	**786**	**34%**
Driver error	8	10%	**594**	**25%**
-Road rule breach	2	3%	**274**	**12%**
Visibility	6	8%	167	7%
Vehicle defects	5	6%	81	3%
Speed	2	3%	**526**	**23%**
Total crashes with at least one major factor noted	79		2333	

The percentages do not sum to 100% since up to 3 major factors can be recorded for each crash. The 'n' in the table is the number of crashes with at least one of the specific major factors recorded for the crash. The percentage is calculated with the denominator as the number of crashes with some information on major factors.

[1] This was not included as a bicycle crash as the cyclist was not killed. It involved a collision between a cyclist and a pedestrian, both of whom were intoxicated. The pedestrian was killed.

Persons involved: Cyclists

The cyclists were predominantly male (86% vs 71%) and younger than other road fatalities (median age 21 vs 28). There were proportionally more teenage cyclists killed than teenage pedestrians (19% vs 5%) and child cyclists killed than pedestrians under the age of 13 (22% vs 13%) (Figure 2). The majority (70%) of cyclists were killed within 5km of their homes. Helmets were worn by only 3 of the victims. They died of multiple (2) and head (1) injuries. A lower fraction of cyclists than other fatalities (13% vs 38%) were over the 0.05 limit (Table 3).

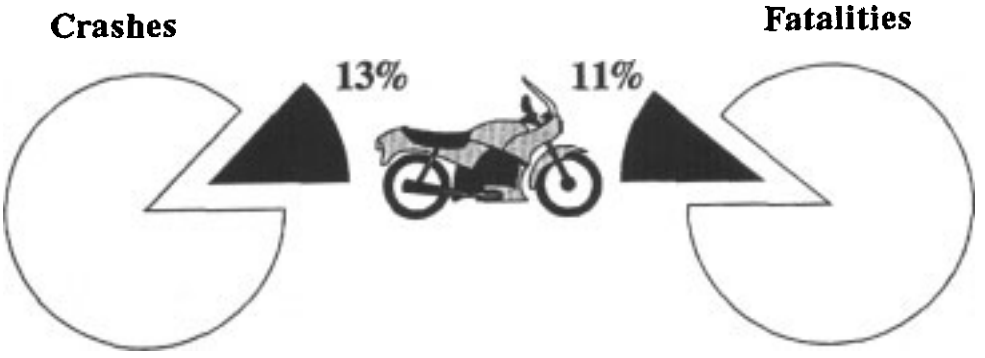
Drivers

Compared with drivers of vehicles in other fatal crashes, the drivers involved in fatal bicycle crashes were not, in general, alcohol affected or speeding.

Medical details

Cyclists resembled pedestrians in terms of the timing, injuries received and cause of death (Tables 4,5,6).

Chapter 4: Fatal motorcycle crashes



Frequency
- 13% of fatal crashes involved motorcycles (MCs).
- 10% of fatalities were motorcycle riders.
- 1% of fatalities were pillion passengers.
- 9% of vehicles in fatal crashes were motorcycles.

Timing
- 60% of fatal MC crashes occurred on Fridays and weekends (22% on Sundays, compared with only 15% of other fatal crashes).

Location
- 67% of fatal MC crashes occurred in urban areas.
- 41% of fatal MC crashes occurred on curves.

Conditions
- Fatal MC crashes were less likely to occur in adverse weather than other fatal crashes. (92% of fatal MC crashes occurred in fine/dry conditions).

Vehicles
- Roughly 25% of the MCs involved had an engine capacity of 800cc or more.
- MCs were newer than other vehicles in fatal crashes (median 5 vs 8 yrs).
- 17% of motorcycles in daytime fatal crashes had their lights on.

Crash description
- 26% of all fatal MC crashes involved vehicles from opposing directions.
- In 25% of all fatal MC crashes, MCs left the road, out of control, on curves.
- 87% of the impacts occurred at the front of the MC.

Contributory factors
- In 72% of MC crashes, the MC rider was solely at fault, and in an additional 6%, partially responsible for the crash.
- In 54% of MC crashes with other types of vehicles, the MC rider was solely at fault, and an additional 10%, partially responsible.
- 40% of the motorcyclists in fatal crashes had blood alcohol levels (BAC)>0.05 compared with 24% of drivers in other fatal crashes. The corresponding percentages for 0.15 gm/100 ml were 25% and 14%.
- 45% of motorcyclists over 25 years were over 0.05 vs 20% of drivers of same age
- 32% of MCs in fatal crashes were speeding (vs 10% of other vehicles).

Persons
- 98% of motorcyclists in fatal crashes were male.
- 60% of motorcyclists in fatal crashes were aged 17-25.
- 14% of motorcyclists in fatal crashes had learners licences.
- 9% of motorcyclists in fatal crashes had no valid licence.
- 20% of motorcyclists in fatal crashes were carrying pillion passengers.
- 46% of pillion passengers in fatal crashes died.
- 29% of motorcyclists killed were killed instantaneously.
- 38% of motorcyclists(+pillions) killed, died of head injuries, 38% died of multiple injuries.

Helmets
- Approximately 80% of motorcyclists and pillion passengers killed wore helmets.
- 52% of fatalities not wearing helmets died of head injuries.

Definition

A motorcycle (MC) crash was defined as any crash involving at least one motorcycle, trail bike or moped.

Frequency

A total of 322 such crashes occurred in 1988, 13% of all fatal crashes. Of the resultant 338 fatalities, 295 were motorcyclists and 29 were pillion passengers. Together they represent 11% (10% and 1%) of all road fatalities. Motorcycles constituted 9% of all vehicles involved in fatal collisions.

Timing

Motorcycle crashes were more likely to occur on Sundays than other crashes (22% vs 15%) and fewer earlier in the week.

Approximately half of all motorcycle accidents (48%), as for other fatal crashes (51%), occurred during the day. Fewer MC crashes occurred during the day on weekdays (47% vs 57%).

Location

Compared with other fatal crashes, fewer motorcycle crashes occurred in Victoria (19% vs 25%), and proportionally more in the ACT (3% vs 1%).

Approximately two thirds of the motorcycle crashes occurred in urban areas; a higher proportion than other fatal crashes (67% vs 52%). The percentage of MC crashes occurring within urban intersections was higher than expected (32% vs 24%). MC crashes were more likely to occur on curves than other crashes (41% vs 32%). This difference was more pronounced in urban locations (36% vs 20%) than rural locations (50% vs 45%).

Road and driving conditions

Only 8% of MC crashes occurred in adverse weather conditions (compared with 16% of other crashes).

Vehicle characteristics

There were 311 (94%) motorcycles, 17 (5%) trail bikes and 2 (1%) mopeds. Information on engine capacity was available for 66% of the motorcycles. Thirty-eight percent were up to 250cc, 37% 300-750cc and 25% 800-1500cc.

Information on whether lights were on or not at the time of the crash was available for 91% of the motorcycles. Sixteen (17%) of the MCs involved in daytime crashes, 93 (89%) of the MCs in night time crashes and 9 (53%) of the MCs in crashes occurring at dawn or dusk, were known to have had their lights on.

The motorcycles were newer than other vehicles involved in fatal crashes (median year of manufacture 1983 vs 1980).

Crash description

A total of 127 (39%) of the MC crashes were single vehicle crashes (i.e. involving only the motorcyclist and no pedestrians); the same proportion as other fatal crashes. As many as 24% of the MCs were involved in subsequent events (vs 12% for other vehicles).

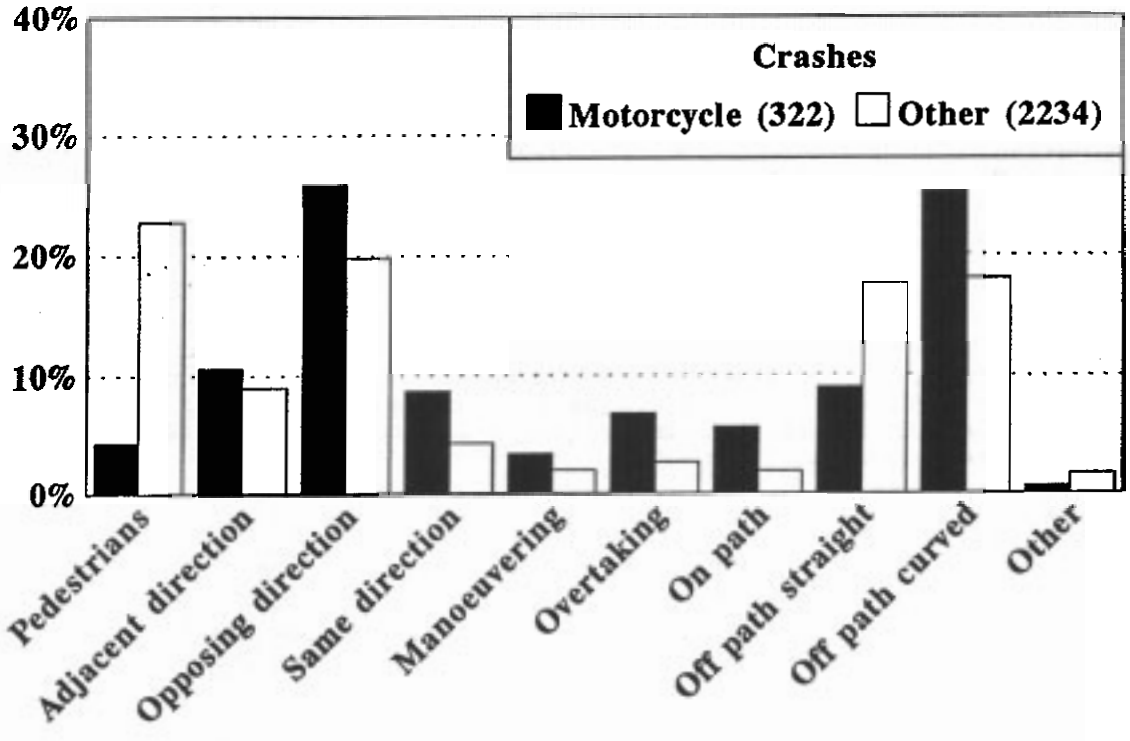
The major differences in the percentage of DCA events were fewer pedestrian and off path crashes on straight roads, and more crashes with vehicles from opposing directions, off path on curved roads, rear end, overtaking and on path crashes (Figure 5).

The point of primary impact was more often centre front of the MC (83% vs 52%), and less often the sides (11% vs 27%) or rear (2% vs 5%) compared with other vehicles.

Contributory factors

For 78% of all motorcycle crashes, the motorcyclists were considered to be at least partially at fault (72% solely at fault and 6% partially at fault). Motorcyclists were solely at fault for approximately half (54%) of the crashes with other types of vehicles and jointly responsible for a further 10%. These figures were similar to those of passenger car drivers (Table 9).

Figure 5 Motorcycle and other fatal crashes by major crash classification (DCA)



Source: FORS 1988 Fatal file

Table 9 **Number and percentage of crashes involving MCs and crashes involving** passenger vehicles (<=9 seats) in which the motorcyclist, car driver, other road user, both or no one was considered to be responsible (based on evidence from the coroner or police accident report).

	Road user responsible for MC crash								
	Motorcyclist		Other road user		Both		No one		Total
MC crash vehicle mix	n	%	n	%	n	%	n	%	100%
MC(s) only[1]	130	98%	-	-	-	-	2	2%	132
MC + pedestrian	4	33%	7	58%	1	8%	0	0%	12
MC + other vehicle[2]	93	54%	58	34%	17	10%	3	2%	171
Total MC crashes	227	72%	65	21%	18	6%	5	2%	315[5]

	Road user responsible for passenger vehicle crash								
Vehicle mix for crashes involving passenger vehicles (<=9 seats)	Car driver		Other road user		Both		No one		Total
	n	%	n	%	n	%	n	%	100%
Cars only[3]	1145	95%	-	-	23	2%	32	3%	1200
Car + pedestrian	101	23%	292	68%	27	6%	10	2%	430
Car + other vehicle[4]	275	58%	161	34%	23	5%	14	3%	473
Total passenger vehicle crashes	1521	72%	453	22%	73	3%	56	3%	2103

[1] includes 4 MC-MC crashes
[2] 'other vehicle' includes bicycles, cars, buses and trucks
[3] includes car-car crashes
[4] 'other vehicle' includes bicycles, buses, motorcycles and trucks
[5] Responsibility missing for 7 MC crashes

MC crashes were characterised by alcohol (39%), speeding (37%) and failure to see the other unit (18%). In MC crashes in which the motorcyclist was considered solely responsible, speed and alcohol were frequent, whereas if the other driver was responsible, driver errors (particularly road rule breaches) and failure to observe the other unit predominated (Table 10).

Table 10 Number and percentage of MC crashes attributed to various factors tabulated by unit considered responsible for the MC crash. Significantly high percentages across rows are highlighted.

	Unit considered responsible for MC crash					
	Motorcyclist		Other vehicle/ pedestrian		Both	
Factor	n	%	n	%	n	%
Alcohol/drug use by driver/rider	**105**	**48%**	12	19%	4	22%
Speed	**97**	**44%**	4	6%	**10**	**56%**
Driver/rider error	64	29%	**28**	**44%**	6	33%
- Road rule breaches	(14	6%)	**(19**	**30%)**	**(5**	**28%)**
- Dangerous driving	(19	9%)	(6	10%)	(0	0%)
Failure to observe other unit	21	10%	**25**	**40%**	**9**	**50%**
Crashes for which at least one factor noted	220		63		18	

The percentages do not sum to 100% since up to 3 major factors can be recorded for each crash. The 'n' in the table is the number of crashes with at least one of the specific major factors recorded for the crash. The percentage is calculated with the denominator as the number of crashes with some information on major factors.

The proportions of motorcyclists considered to be possibly (22%), or definitely speeding (32%), were both high compared with other vehicles (10% and 11%, respectively). These differences were observed in both urban and rural areas and in low and high speed zones.

Blood alcohol levels (BAC)

Compared with other drivers involved in fatal crashes, a higher proportion of motorcyclists were tested for alcohol (83% vs 72%) and a higher proportion were over the 0.05 gm/100 ml limit (40% vs 24%). The distinction was most pronounced for those aged more than 25 (and under 60) (45% vs 20%), and less pronounced among fatalities only (Table 3).

Blood alcohol values for the motorcyclists were available in 98 (95%) of the 103 crashes where the motorcyclist was considered to be solely at fault and alcohol and/or drugs were considered to play a role. Of these, the BAC was greater than 0.05 for 88 (85%) and zero for only one. The motorcyclist who had zero BAC, tested positive for drugs.

Drugs

The proportion of motorcyclists tested for drugs was significantly higher than drivers of other motor vehicles (47; 14% vs 4%), but, of these, the proportion with positive tests was not significantly higher (24; 51% vs 34%, p=0.07) except for marijuana (18; 50% vs 24%).

Persons involved

Motorcyclists

The motorcyclists were younger (median age 24 vs 31 years). The proportion of motorcyclists in the age group 17-25 was 60% vs 34% of drivers of other motor vehicles. Higher proportions of motorcyclists had learners' licences (35; 14% vs 1%) or were disqualified from having a licence due to a traffic offence (10; 4% vs 1%). A total of 23 (9%) had no valid licence, compared with 2% for drivers of other vehicles.

Only 5 motorcyclists were female (2% vs 19% other drivers).

A higher proportion of motorcycle riders than drivers in other fatal accidents were unemployed (10% vs 5%). Of those males actively employed, there was a high percentage of motorcyclists employed as tradesmen (42% vs 23% of male motor vehicle occupants and 23% of male work force, in general) (Appendix Table A1).

Pillion passengers

There were 63 pillion passengers, but no side car passengers involved in these crashes. Thus, 20% of the MCs involved in fatal crashes were carrying pillions. The pillion passengers were younger than the motorcyclists (median age 20 vs 24 years). Proportionally more were female (24% vs 2%).

Fatalities

Of the 330 motorcyclists involved fatal crashes, 295 (89%) died. This is higher than the corresponding figure for drivers of other motor vehicles involved in fatal crashes (36%). Of the 63 motorcycle pillion passengers in fatal crashes, 29 (46%) died.

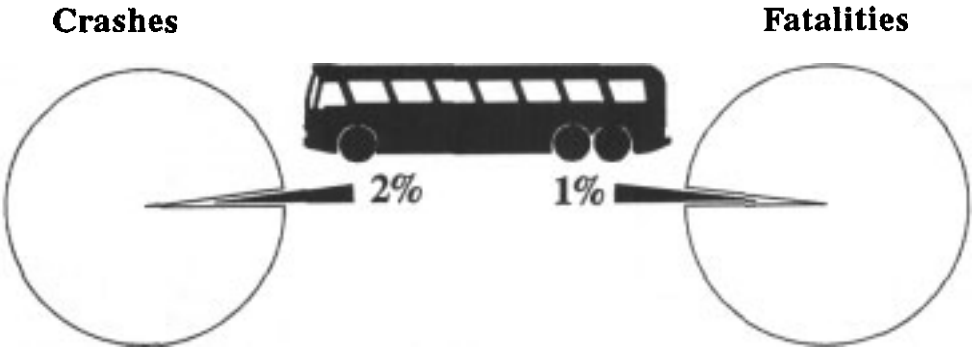
Medical details: Fatalities

The timing, pattern of serious injury and cause of death did not differ significantly between motorcyclists and motor vehicle accident fatalities (Tables 4,5,6)

Helmets

Between 79% and 84% of motorcyclist fatalities were wearing helmets (according to whether those motorcyclists found with a helmet beside them were assumed to have been wearing it at the time of the crash). A higher proportion of those not wearing helmets died due to head injuries (52% vs 34%). Those wearing helmets were more likely to die of injuries to the thorax (16% vs 0%).

Chapter 5: Fatal bus crashes



Vehicles

- Only 1% of vehicles involved in fatal crashes were buses.
- Of the buses involved, 47% were urban route buses, 36% were inter/intrastate coaches, 15% were large vans and 2% were of unspecified type.

Timing

- Most fatal bus crashes (72%) occurred during the day.
- In rural areas there were more bus crashes at night (36%) than in urban areas (11% at night).

Location

- 53% of fatal bus crashes occurred in urban regions.
- 52% of urban bus crashes occurred at mid-block (not intersection) locations
- 92% of rural bus crashes occurred at mid-block (not intersection) locations

Crash description

- Pedestrians were hit in 32% of fatal bus crashes.
- 26% of all fatal bus crashes were head-on crashes.

Contributory factors

- The bus drivers were considered solely responsible for 34% of all fatal bus crashes and only 11% of bus crashes involving multiple vehicles. These figures were lower than for cyclists, motorcyclists and passenger vehicle drivers.
- Only 11% of bus drivers involved in fatal crashes were speeding compared with 26% of other drivers involved in fatal crashes.
- Fatigue or alcohol or drug use by the bus driver rarely contributed to these crashes.

Drivers

- Bus drivers were older than other drivers (median age 40 years vs 30 years).

Fatalities

- 69% of bus crash victims were external to the buses (i.e. pedestrians or in other vehicles).
- 13% of bus drivers (7) were killed and 11% (64) were hospitalised with non-fatal injuries
- 3% of bus passengers (13) were killed and 27% (118) were hospitalised with non-fatal injuries
- 31% of bus passenger fatalities (4) sustained serious spinal injuries

Definition

A bus crash was defined as any crash involving at least one bus. Any motor vehicle with over 9 seats was defined as a bus.

Frequency

There were 53 such crashes with 64 fatalities in 1988. This represents 2% of all fatal crashes and 2% of road fatalities in Australia that year. The fatalities included 7 bus drivers and 13 bus passengers and 18 pedestrians. Bus occupants thus accounted for 1% of road fatalities. The number of people requiring hospitalisation for non-fatal injuries sustained in these accidents was 132 or 9% of all hospitalisations after fatal crashes. Buses alone accounted for 1% of vehicles in fatal crashes.

Timing

Proportionally more bus crashes occurred during the day (72% vs 53%). There were morning and afternoon peaks. More rural bus crashes occurred during the night (9; 36% compared with only 3 (11%) in urban areas.

Location

Proportionally more bus crashes occurred in NSW (51% vs 35%) and fewer in Victoria (15% vs 25%) and Western Australia (2% vs 8%).

As observed for other fatal crashes, bus crashes were equally likely in urban and rural areas, with mid-block locations accounting for just over one half of all urban bus crashes (52%) and almost all (92%) rural bus crashes.

Vehicle characteristics

About half (47%) the buses were urban, 36% were interstate or intrastate coaches, 15% (8) were large vans or 4 wheel drive vehicles and 2% were of unspecified type.

Crash description

Compared with other fatal crashes, there were proportionally more bus crashes involving pedestrians, head-on crashes and crashes in which both vehicles were travelling in the same direction and fewer 'out of control' crashes (Figure 6).

Impacts with pedestrians were generally on the front left side of the bus.

Contributory factors

For 34% of the bus crashes, the bus driver was considered to be at fault (Table 11). Bus drivers were less often solely at fault (11%) in crashes between different types of motor vehicles than car (58%) or motorcycle riders (54%) (Table 9).

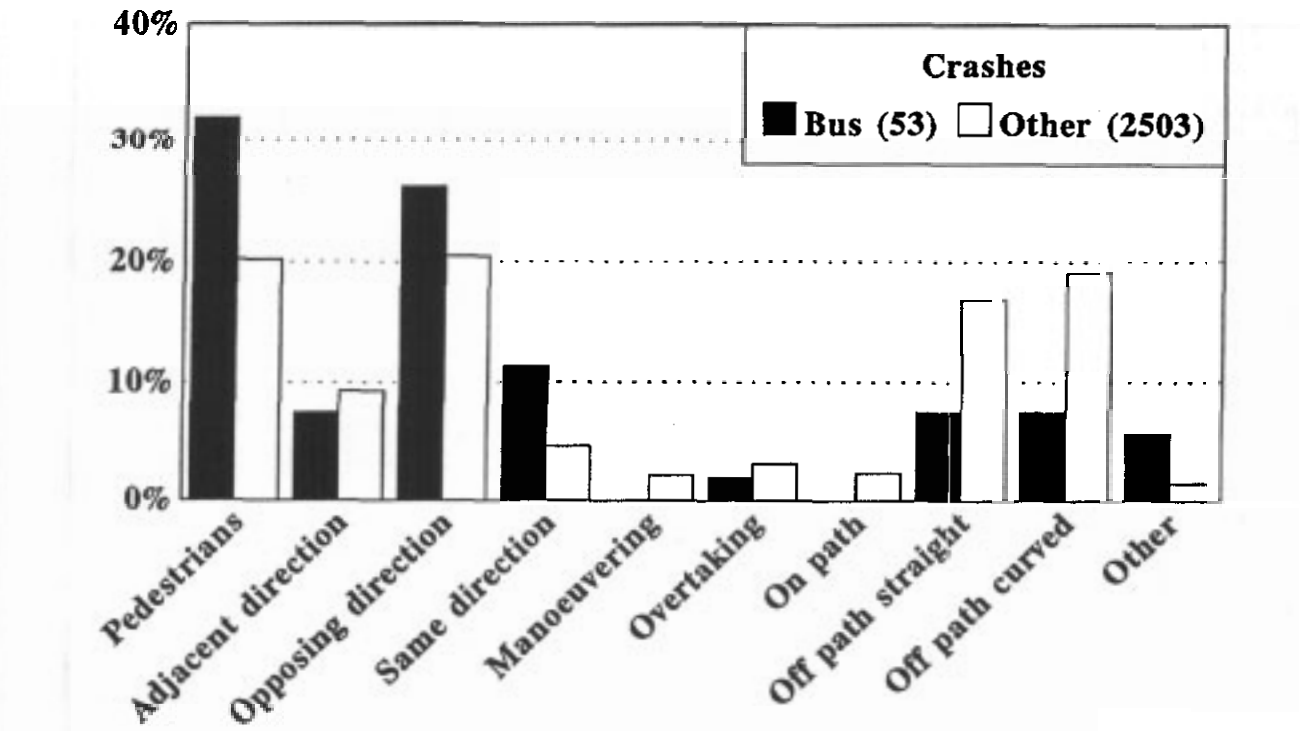
Table 11 Number and percentage of bus crashes in which the bus driver, other road user, both or no one was considered to be responsible (based on evidence from the coroner or police accident report).

Bus crash vehicle mix	Road user responsible for bus crash: Bus driver n	%	Other road user n	%	Both n	%	No one n	%	Total 100%
Bus only	9	100%	–	–	–	–	0	0%	9
Bus + pedestrian	6	35%	10	59%	1	6%	0	0%	17
Bus + other vehicle	3	11%	22	82%	0	0%	2	7%	27
Total bus crashes	18	34%	32	60%	1	2%	2	4%	53

There was no specific type of factor relating to the buses or bus drivers which was more frequent than in other fatal crashes. Driver related factors, speeding and alcohol/drug use were **less** frequent than in other fatal crashes.

Ninety percent of buses were considered to be within the speed limit, a higher proportion than in other fatal crashes. However, of those 5 that were over the speed limit, 4 were in rural areas.

Figure 6 Bus and other fatal crashes by major crash classification (DCA)



Source: FORS 1988 Fatal file

Journey details

As with other urban crashes, over 90% of bus crashes occurred within 50 km of commencement of the trip, whereas in rural areas only about two thirds occurred in the same radius. There was no indication that bus crashes were any different from other rural crashes in this respect.

Persons involved

In 39 (74%) crashes, only persons external to the bus and/or in other vehicles were killed. These fatalities numbered 44 and comprised 69% of victims of bus crashes Only 13% (7) of bus drivers and 3% (13) of the bus passengers were killed, but 27% (118) of bus passengers were hospitalised.

Drivers

Bus drivers were, in general, older than drivers of other vehicles involved in fatal accidents (median age 40 vs 30). Five (9%) were women.

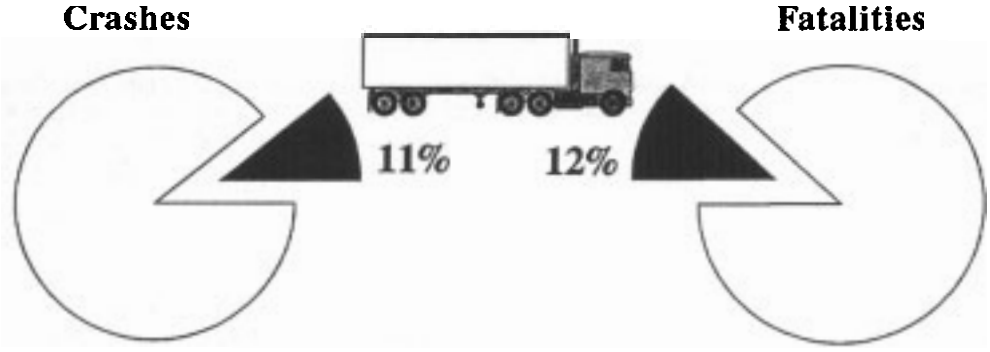
A total of 37 (70%) were tested for blood alcohol content and only one had a value of 0.05 or more; a lower fraction than other drivers tested and positive (3% vs 26%). Only one was tested for other drugs (with a negative result).

Fatalities: Medical details

Despite the small numbers, the frequency of death due to spinal injuries among the bus passenger fatalities was higher than expected compared with passenger fatalities in other vehicles in other fatal crashes (3;23% vs 32;4%). This was also observed in the comparison of the serious injuries among passenger fatalities (4; 31% for bus vs 77; 10% for other passengers).

Comparison of the bus drivers with other driver fatalities failed to reveal any significant differences, partly due to the small numbers.

Chapter 6: Fatal articulated truck crashes



Vehicles
- Articulated trucks (ATs) accounted for 8% of vehicles in fatal crashes.
- Articulated trucks accounted for 61% of trucks in fatal crashes.
- Articulated trucks in fatal crashes were newer than vehicles in other types of fatal crashes.

Timing
- Most fatal crashes involving articulated trucks (81%) occurred on weekdays.
- 62% of AT crashes occurred during the daytime; slightly more than other fatal crashes.

Location
- 66% of AT crashes occurred on rural roads with speed limits at least 80 km/h.
- 85% of rural AT crashes were not related to intersections.
- A higher than expected number of urban AT crashes (41%) occurred within intersections.

Crash description
- Many AT crashes (75%) involved at least two vehicles.
- A relatively high proportion of AT crashes (33%) were head-on (involving no turning vehicles).
- The impact was most often the front of the truck hitting another vehicle at the side or rear.

Contributory factors
- 35% of AT drivers were considered solely responsible for the AT crashes and 22% were considered solely responsible for AT crashes with other types of vehicles. These percentages were low compared with cyclists, motorcyclists and passenger vehicle drivers involved in fatal crashes.
- The other drivers more often disobeyed road rules or failed to observe the AT.
- There was a low incidence of alcohol/drug use and speeding among the AT drivers involved in fatal crashes.
- Only 12% of AT drivers were speeding before fatal crashes.
- Only 3% of AT drivers were over the alcohol limit.
- Drug use and fatigue were not significantly more common factors among AT drivers than other drivers in fatal AT crashes.

Drivers
- Almost all AT drivers (99%) were male.
- AT drivers were older than other drivers in fatal crashes(median age 35 vs 29).
- 42% of AT drivers had travelled more than 100km before the crash.

- Only 23% articulated truck drivers wore seat belts at the time of the crash.
- 44% articulated trucks were not fitted with seat belts for the drivers.
- Just under half the AT drivers did not wear seat belts even when available.

Fatalities

- 79% of AT crash fatalities were external to the trucks (pedestrians, cyclists or in other vehicles).
- Only 20% of AT drivers involved in fatal crashes were killed.
- A lower proportion of AT truck driver fatalities (54%) sustained head injuries compared with other drivers killed (70%).

Definition

An articulated truck (AT) crash was defined as any crash involving at least one moving articulated truck. An articulated truck was defined as any prime mover able to attach or detach the body from the cabin. The abbreviation **AT** refers to articulated trucks.

Frequency

Crashes of this type totalled 289 in 1988 and with the resulting 353 fatalities represent **11%** of all fatal **crashes** and **12%** of **road fatalities** in Australia that year. Truck occupants represented 3% of road fatalities. Articulated trucks accounted for **8%** of **vehicles** involved in fatal accidents and 61% of all trucks involved in fatal accidents.

Timing

Proportionally more AT crashes occurred on each weekday with weekday AT crashes totalling 81% compared with 62% for other fatal crashes (Figure 7). Slightly, but significantly, more AT crashes occurred during the day (62% vs 52%). This was more pronounced on weekdays. Disproportionately more AT crashes occurred on weekday mornings between 5 am and 10 am and fewer at night. Weekend crash times followed that of other fatal crashes (Figure 8).

Location

Two thirds of all fatal AT crashes occurred in rural high speed zones (>=80 km/h), compared with only 40% of other crashes. Most of these occurred on highways. Almost one quarter of AT crashes occurred in urban low speed zones.

The location of the AT crashes with respect to intersections was similar to other fatal crashes in rural areas (85% mid-block). However, in urban regions there was a higher incidence within intersections (41% vs 24%).

Vehicle characteristics

The ATs were newer than vehicles involved in other crashes (median age 5 years vs 8 years) and were more often registered interstate (31% vs 8%), for both urban and rural crashes.

Fewer ATs were damaged than vehicles involved in other fatal accidents (62% with major damage vs 77%). Most (95%) of the other moving vehicles involved in AT crashes sustained serious damage.

Crash description

Only 17% of AT crashes were single vehicle crashes compared with 42% of other crashes. The most common DCA (95; 33% vs 15%) was a head-on collision involving no turning vehicles. In comparison with other fatal crashes, AT crashes were more often cross traffic, opposing direction, or same direction and less often pedestrian or out of control crashes off the carriageway. Of the crashes with vehicles travelling in the same direction, the distinction was greatest for 'rear end' crashes (8% vs 2%) (Figure 9)

These differences were observed in urban low speed and rural high speed zones. Additionally, overtaking crashes were more common with 7% of the rural high speed AT crashes involved overtaking (compared with none of the urban low speed AT crashes).

Compared with the ATs, the other vehicles in AT crashes had fewer frontal impacts and more on the sides, especially the right hand side, and were more often hit from the rear.

Figure 7 Articulated truck and other fatal crashes by day of week

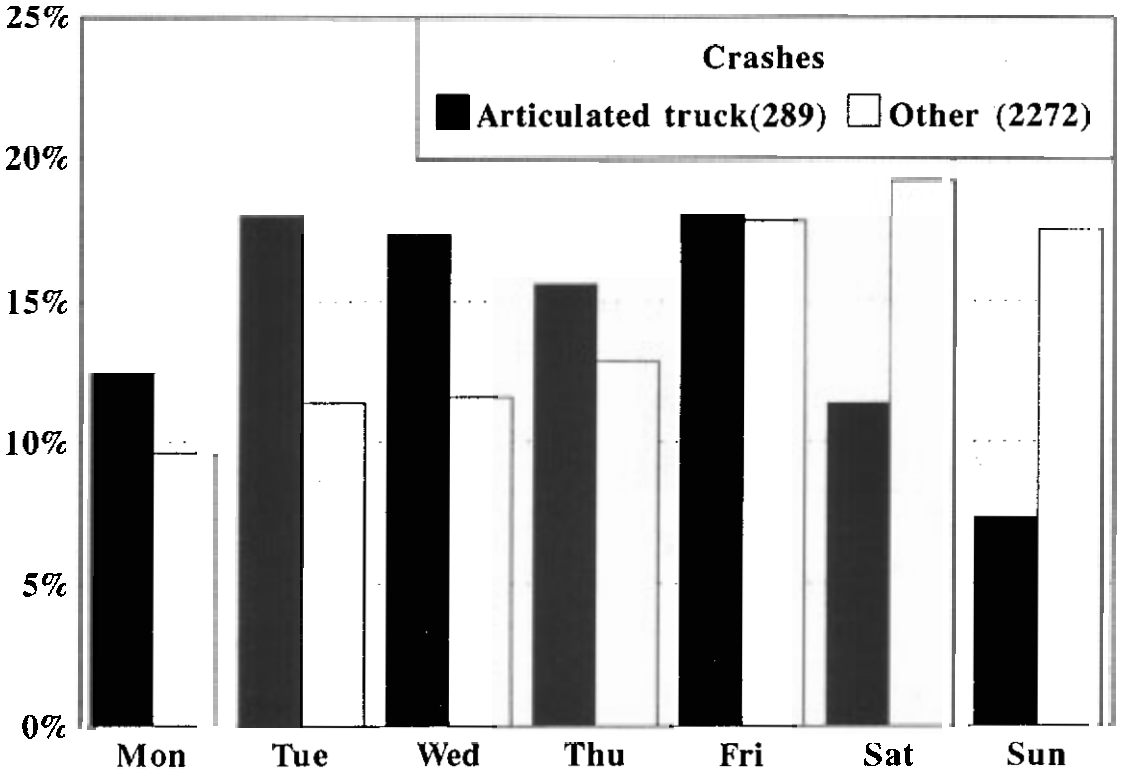
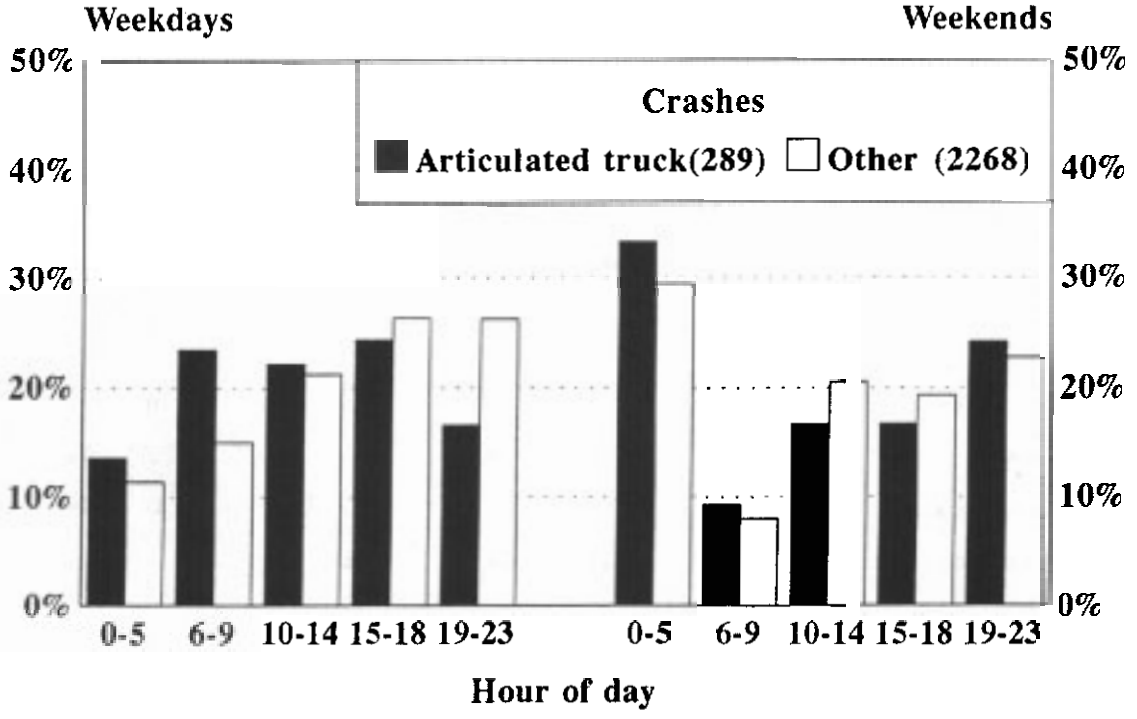
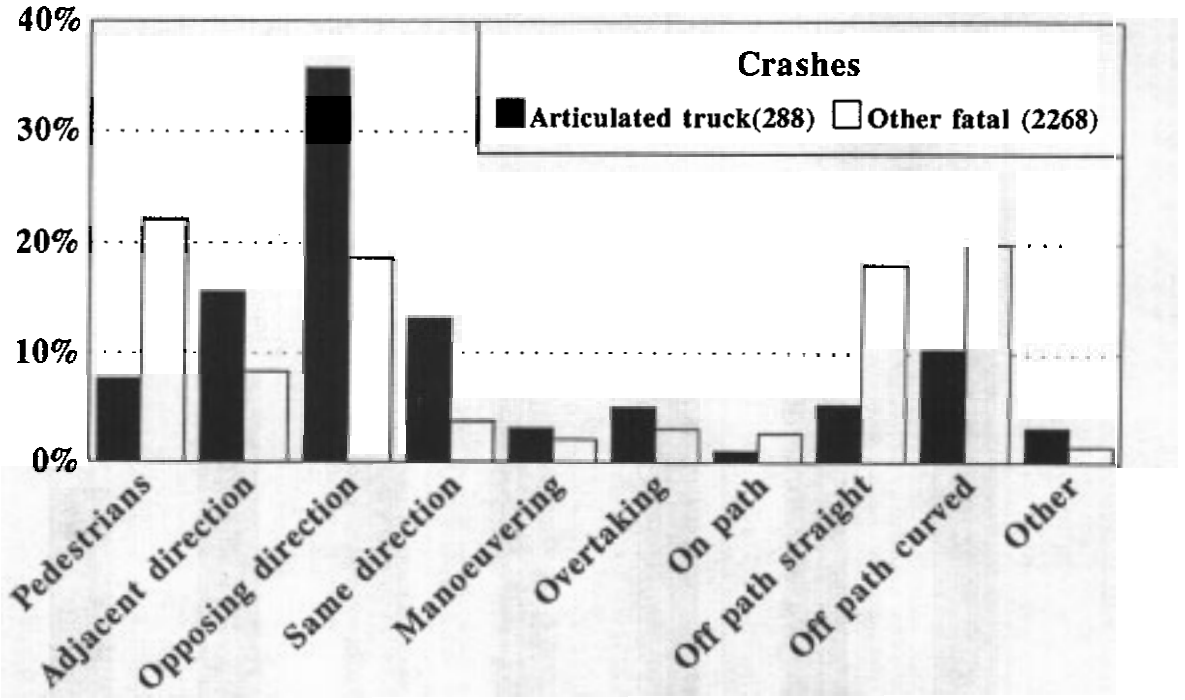


Figure 8 Articulated truck and other fatal crashes by hour on weekdays and weekends



Source: FORS 1988 Fatal file

Figure 9 Articulated truck and other fatal crashes by major crash classification (DCA)



Source: FORS 1988 Fatal file

Contributory factors

The articulated truck drivers were considered solely responsible for only 100 (35%) of the AT crashes. AT drivers had a lower fault rate (22%) than car drivers (58%), motorcyclists (54%) and a rate not significantly higher than bus drivers (11%), based on fatal multiple vehicle accidents between vehicles of different types (Tables 12, 11, 9).

Table 12 Number and percentage of articulated truck (AT) crashes in which the truck driver, other road user, both or no one was considered to be responsible (based on evidence from the coroner's or police accident report).

	Road user responsible for articulated truck crash								
	Truck driver		Other road user		Both		No one		Total
AT crash vehicle mix	n	%	n	%	n	%	n	%	100%
AT(s) only	53	95%	-	-	-	-	3	5%	56
AT + pedestrian	1	4%	19	83%	3	13%	0	0%	23
AT + other vehicle	46	22%	153	74%	6	3%	3	1%	208
Total AT crashes	100	35%	172	60%	9	3%	6	2%	[1]287

[1] In 2 AT crashes fault information was missing or inconsistent.

AT crashes were characterised by driver road rule breaches and unintentional failure to see the other unit, but less often speeding, alcohol and/or drug use and pedestrian factors compared with other fatal crashes. Of the 51 AT crashes involving road rule errors, when subdivided by who was deemed responsible, it was the drivers of the other vehicles who were more often at fault (38 other drivers vs 11 AT drivers) (Table 13).

Drug use in the absence of alcohol was considered contributory in two of the AT crashes in which the AT driver was considered responsible.

Fewer ATs were considered to be over the speed limit than vehicles in other crashes (12% vs 28%). This was observed in both rural and urban areas and speed zones.

Of the 13 AT crashes in which the AT was responsible and fatigue considered to play a role, 12 occurred in rural high speed zones. Compared with other fatal crashes in rural high speed zones, the incidence of fatigued AT truck drivers was not higher (19% rural high speed AT crashes with AT at fault vs 13% other rural crashes).

Table 13 Number and percentage of AT and other fatal crashes attributed to various factors. Significantly high percentages comparing AT drivers with other drivers at fault and AT crashes with other fatal crashes are highlighted.

	Articulated truck crashes						Other fatal crashes	
	Vehicle responsible for AT crash				Total			
	AT		Other vehicle					
Factor	n	%	n	%	n	%	n	%
Driver/rider error	17	20%	**51**	**35%**	74	28%	528	25%
-Road rules	(11	13%)	**(38**	**26%)**	**(51**	**19%)**	(225	10%)
Failure to observe other unit	8	9%	**33**	**23%**	**50**	**19%**	244	11%
Alcohol/drugs (driver)	12	14%	29	20%	41	15%	**621**	**29%**
Speed	11	13%	20	14%	33	12%	**495**	**23%**
Fatigue	13	15%	13	9%	26	10%	145	7%
Pedestrian factor					20	8%	**397**	**18%**
Visibility					17	6%	156	7%
Vehicle defects					15	6%	71	3%
Surface conditions					15	6%	116	5%
Crashes with at least one factor noted	85	100%	146	100%	265	100%		2148

The percentages do not sum to 100% since up to 3 major factors can be recorded for each crash. The 'n' in the table is the number of crashes with at least one of the specific major factors recorded for the crash. The percentage is calculated with the denominator as the number of crashes with some information on major factors.

Persons involved

Almost all pedestrians, bicyclists and motorcyclists involved in these crashes were killed and higher proportions of drivers and passengers of the other vehicles in these accidents were killed compared with the AT occupants. Persons external to the AT trucks accounted for 79% of the AT truck crash fatalities.

Drivers

The AT drivers were more often over 100km from home compared with other drivers (64% vs 21%) and they had more frequently travelled more than 100 km before the crash (42% vs 10%). There were more interstate drivers (31% vs 8%). Similar differences were observed in both urban and rural areas.

AT drivers were older than other drivers (median age 35 vs 29). Only 14% were aged 17-25 compared with 38% other drivers. Based on the information available (only 44% of total), the AT drivers had more driving experience than other drivers (median years of experience 15 vs 13).

Only 3 AT drivers were women (1% vs 19% of drivers of vehicles in other fatal crashes).

A lower percentage of the AT drivers were killed compared with drivers of other vehicles (20% vs 44%). The fraction of AT passengers killed was not significantly different from other passengers (19% vs 25%).

Seat belts

Seat belt availability was recorded for 68% of AT occupants and 82% of passenger vehicle occupants. Whether they were actually worn during the crash was recorded for 91% of the AT occupants and 87% of the passenger vehicle occupants who were noted as having a seat belt available to them.

Whereas most cars (99%) were fitted with seat belts for the drivers, 56% of AT drivers had no seat belt available to them. This, coupled with the AT drivers' reluctance to wear them, even if available, led to only 23% of AT drivers actually wearing seat belts during the crash, compared with 83% of car drivers. Just under half the AT drivers and 15% of the car drivers did not wear seat belts even though available.

The AT passengers had an even lower rate of seat belt use (2%), which was also due to both non-availability and non-use.

Only 3 of the 69 AT occupants who were killed were definitely wearing seat belts.

The proportions of AT drivers (4%) and passengers (9%) who were ejected from their vehicles, were not higher than for car occupants (7% and 11% for car driver passengers, respectively).

Alcohol and drugs

The proportion of AT drivers tested for alcohol (73%) was similar to that for other drivers involved in other fatal crashes. There were fewer values greater than 0.05 (7; 3% vs 28%). The median non-zero blood alcohol reading was 0.06, compared with 0.15 for other drivers.

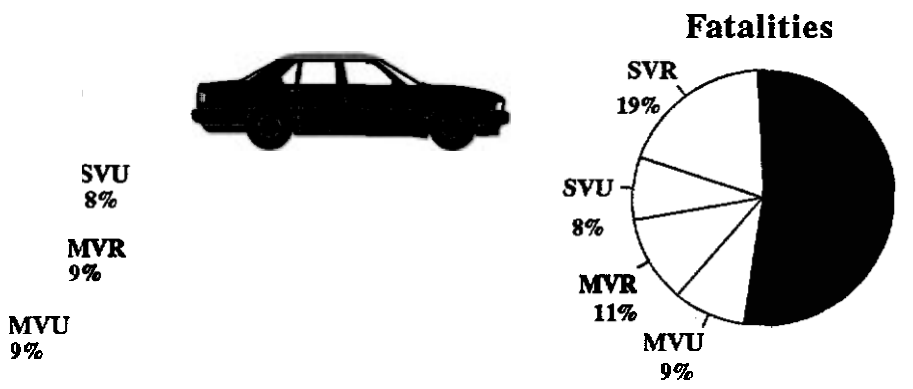
Twelve were tested (4%) for drugs with positive results for 5 (42%) drivers. Neither percentage is higher than for other drivers.

Medical details

The coroner's assessment of final cause of death for the 59 AT driver fatalities was similar to that of other driver fatalities, except there were more external injuries (3; 5% vs 1%). There was a lower incidence of head injury (54% vs 70%).

The 15 AT passenger fatalities had a pattern of injury and cause of death nc significantly different from the AT driver fatalities or other passenger fatalities.

Chapter 7: Single and multiple vehicle crashes in rural high speed and urban low speed zones



This chapter describes the following four types of fatal crashes:

SVR Single vehicle rural high speed crashes
Fatal crashes involving a single passenger vehicle or rigid truck occurring on rural roads with speed limits at least 80 km/h.

SVU Single vehicle urban low speed crashes
Fatal crashes involving a single passenger vehicle or rigid truck occurring on urban roads with speed limits less than 80 km/h.

MVR Multiple vehicle rural high speed crashes
Fatal crashes involving at least two passenger vehicles and/or rigid trucks occurring in rural high speed zones.

MVU Multiple vehicle urban low speed crashes
Fatal crashes involving at least two passenger vehicles and/or rigid trucks occurring in urban low speed zones.

The features of these four types of crashes are summarised by first listing the common characteristics of the single compared with the multiple vehicle crashes, the rural versus the urban crashes, and then the individually distinguishing characteristics of each of the four crash types.

Single vehicle crashes (SVR+SVU)	**Multiple vehicle crashes (MVR+MVU)**
Many occurred on **weekends** (44%)	Many occurred on **weekdays** (67%) Many occurred during the day (64%)
Many occurred **after recreational** activities (59%)	Relatively large number of drivers were on **work** related trips (19%)
Most (91%) occurred mid-block	36% occurred within **intersections**
Most vehicles (92%) **out of control**	
Most vehicles (87%) ran off the road	
46% of crashes were **alcohol** related	**Visibility** problems contributed to 12%
Driver and passenger blood alcohol readings tend to be related	**Driver errors** contributed to 46%
Many **younger** drivers (47% <=25 yrs)	**Older**, more experienced drivers
Mainly **male** drivers (83%)	77% male drivers
High percentage (11%) **unemployed**	
Relatively **low** (59%) **seat belt use**	Relatively **high** (88%) **seat belt use**
Many (39%) **head injury** deaths	Many **chest** injury deaths (19%)

Rural high speed crashes (SVR+MVR)	Urban low speed crashes (SVU+MVU)
	Urban crashes in **Victoria** much more likely to involve multiple vehicles than other States.
Most (91%) occurred **mid-block**	Many (42%) occurred at **intersections**
Most (96%) occurred on roads with **loose shoulders**	Most (92%) drivers were <50km from home
Drivers in rural high speed crashes were slightly **older** than drivers in urban low speed crashes	Drivers in urban low speed crashes were slightly **younger** than drivers in rural high speed crashes
Many (40%) died **before medical assistance**	Many died in **hospital** (38%)

Single vehicle rural crashes (SVR)	Single vehicle urban crashes (SVU)
41% occurred on weekends 48% occurred at night Most (87%) occurred in **fine weather**	50% occurred on weekends 73% occurred at **night**
Only 4% occurred at intersections	22% occurred at **intersections**
Fatal impact was **overturn** for 50% **Road shoulder involvement** for 23%	84% of vehicles **hit an object**
49% of drivers **over 0.05 alc limit** 18% of drivers **fatigued** 22% of drivers **ejected** from car	65% of drivers **over 0.05 alcohol limit** **Speed** contributed to 50% of crashes 33% of drivers **died instantly**

Multiple vehicle rural crashes(MVR)	Multiple vehicle urban (MVU)
65% of MVR occurred on **weekdays** 68% of MVR occurred during the **day**	69% occurred on **weekdays** 59% occurred during the **day**
Only 19% occurred at intersections	**54% occurred within intersections**
Many (71%) were **head-on** crashes	**45% of MVU crashes were head-on,** 38% of crashes between vehicles from **adjacent directions**
Road surface contributed to 12% Relatively high percentage of MVR crashes (27%) resulted in **multiple fatalities**	**Road rule errors** contributed to 39%
	A relatively high percentage of vehicles in MVU crashes had **no passengers** (52%)
Abdomen, extremity injuries common	46% of deaths occurred in **hospital**

Definitions

A **single vehicle rural (SVR)** crash was defined as a single motor vehicle crash involving either a non-stationary passenger vehicle or rigid truck occurring in a rural high speed zone (>=80 km/h) (excluding all crashes involving any pedestrians, bicycles or non-stationary motorcycles, buses or articulated trucks).

A **single vehicle urban (SVU)** crash was defined as a single motor vehicle crash involving either a non-stationary passenger vehicle or rigid truck occurring in an urban low speed (<80 km/h) zone.

A **multiple vehicle rural (MVR)** crash was defined as a multiple motor vehicle crash involving at least two non-stationary passenger vehicles or rigid trucks or combinations of these occurring in a rural high speed zone.

A **multiple vehicle urban (MVU)** crash was defined as a multiple motor vehicle crash involving at least two non-stationary passenger vehicles or rigid trucks or combinations of these occurring in an urban low speed zone.

These four crash types exclude fatal crashes involving pedestrians, cyclists, motorcyclists, buses and articulated trucks as these have been covered in previous chapters. Also excluded, but not already covered are 27 crashes in rural low speed areas and 117 crashes in urban high speed zones.

Frequency

There were 499 single vehicle rural (SVR) crashes (19% of all fatal crashes) with 552 resultant fatalities (19% of all road fatalities for 1988).

There were 219 single vehicle urban (SVU) crashes (8% of crashes) with 240 resultant fatalities (8% of fatalities).

There were 234 multiple vehicle rural (MVR) crashes (9% of crashes) with 320 resultant fatalities (11% of fatalities).

There were 230 multiple vehicle urban (MVU) crashes (9% of crashes) with 257 resultant fatalities (9% of fatalities).

Timing

SVU crashes had the highest proportion on the weekend with 50%, whereas MVU crashes had the lowest weekend figures (31%) and proportionally more earlier in the week. Single and multiple vehicle crashes in rural high speed zones did not differ from each other with respect to day of the week (Figure 10).

Equally many SVR crashes occurred during the day and night, whereas as many as 73% of SVU crashes occurred at night. Multiple vehicle crashes in both rural high speed and urban low speed areas were more likely to occur during the day with only 26% and 35% occurring at night, respectively (Figure 11).

Location

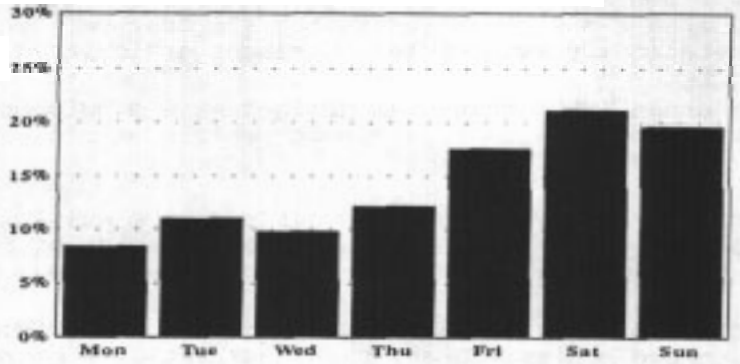
NSW had proportionally the most SVU crashes (43%) and Victoria the most MVU (37%). In fact, urban crashes in Victoria were much more likely to be multiple than single vehicle crashes relative to the other States. Queensland and SA were characterised by relatively high proportions of single and multiple rural high speed crashes, and WA with SVR crashes.

Almost all SVR crashes occurred mid-block, whereas a considerable proportion of MVR crashes occurred within or near intersections. The largest proportion of crashes within intersections was 54% for MVU crashes (Figure 12).

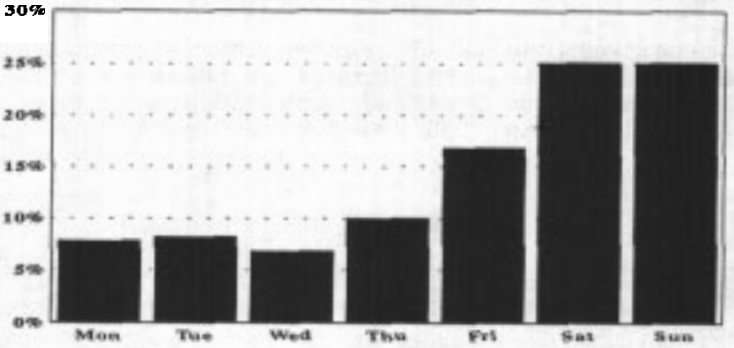
Proportionally more single vehicle than multiple vehicle crashes occurred on unsealed rural roads.

Figure 10 Single/Multiple Vehicle, Urban low/Rural high speed crashes by day of week
(Fatal crashes involving passenger vehicles and/or rigid trucks only)

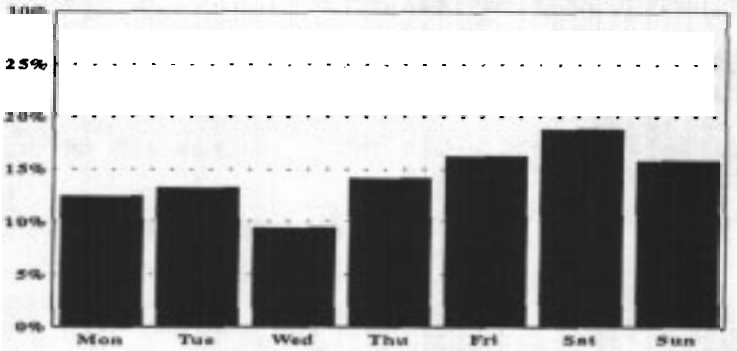
Single Vehicle Rural (499)



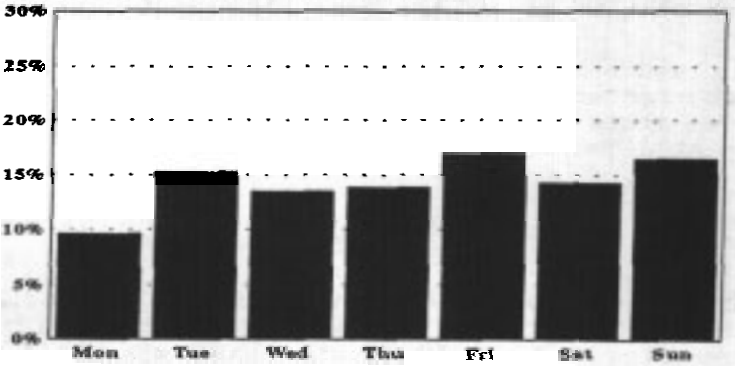
Single Vehicle Urban (219)



Multiple Vehicle Rural (234)

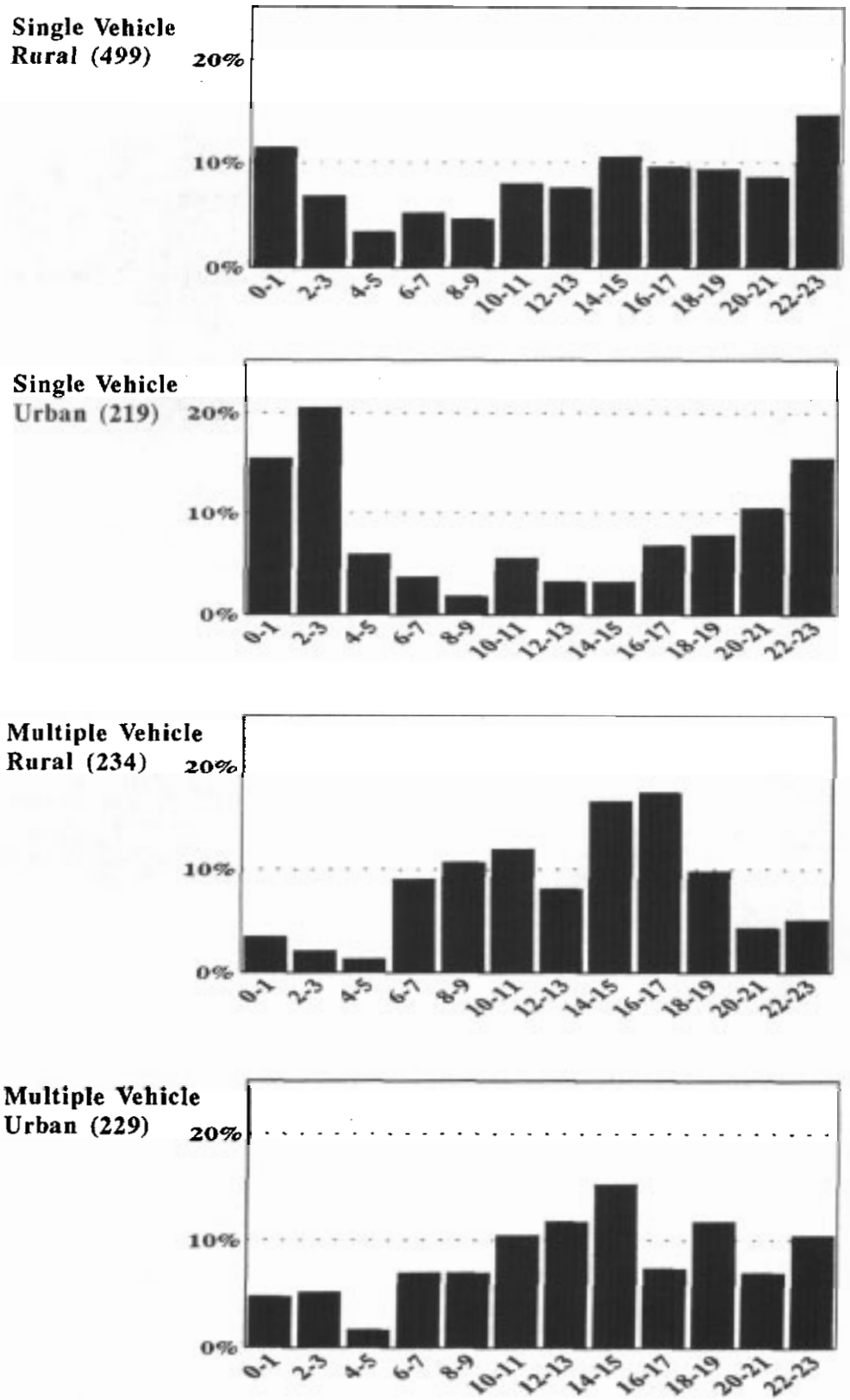


Multiple Vehicle Urban (230)



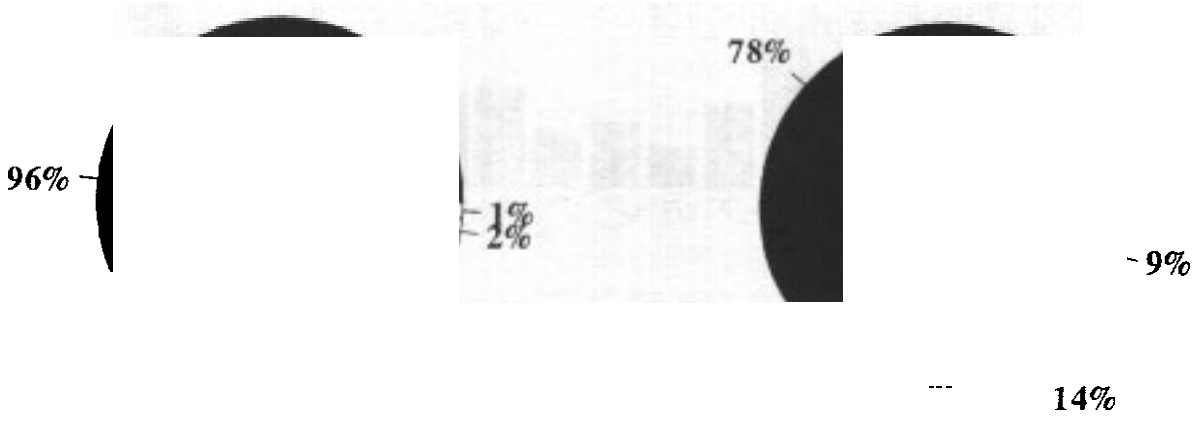
Source: FORS 1988 Fatal file

Figure 11 Single/Multiple Vehicle, Urban low/Rural high speed crashes by time of day
(Fatal crashes involving passenger vehicles and/or rigid trucks only)

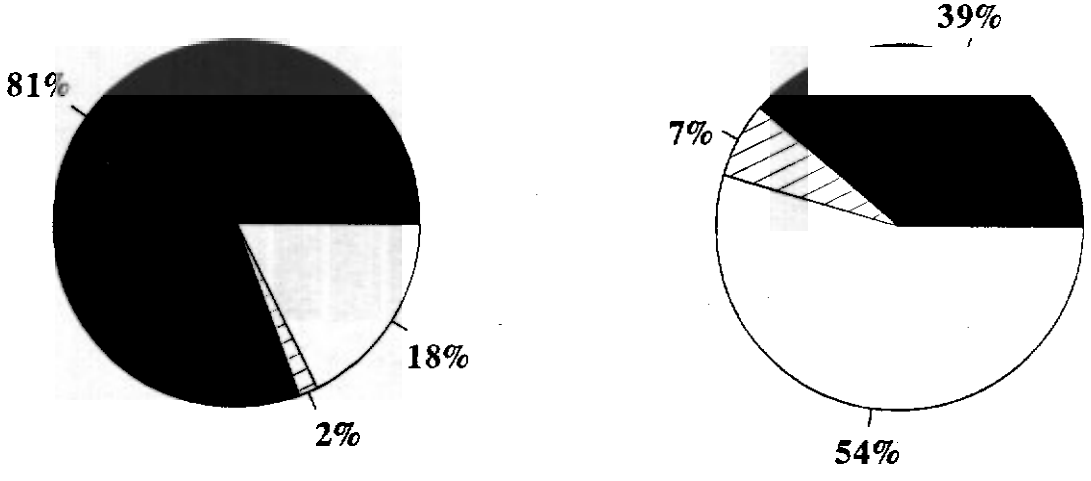


Source: FORS 1988 Fatal file

Figure 12 Single/Multiple Vehicle, Urban low/Rural high speed crashes by intersection location
(Fatal crashes involving passenger vehicles and/or rigid trucks only)



SVR (499) SVU (218)



MVR (234) MVU (228)

Mid-block Near intersection Within intersection

Source: FORS 1988 Fatal file

Figure 13a Single Vehicle Rural high/Urban low speed crashes by major crash classification (DCA) (Fatal crashes involving passenger vehicles and/or rigid trucks only)

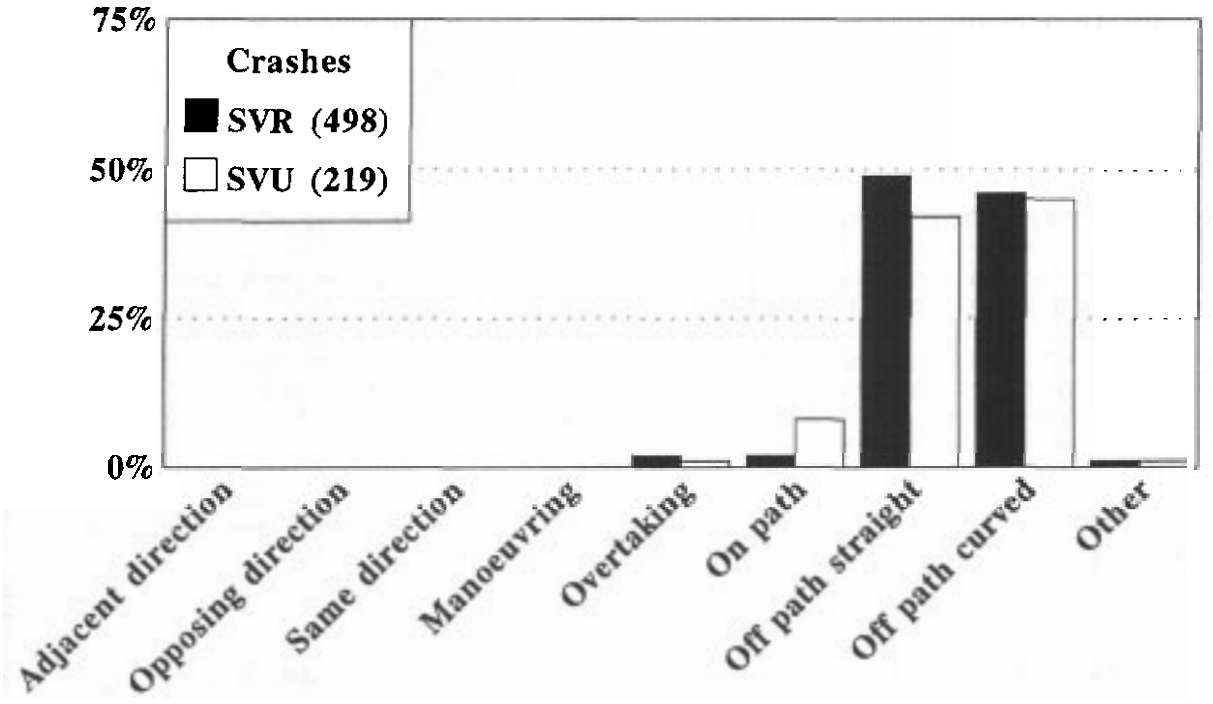
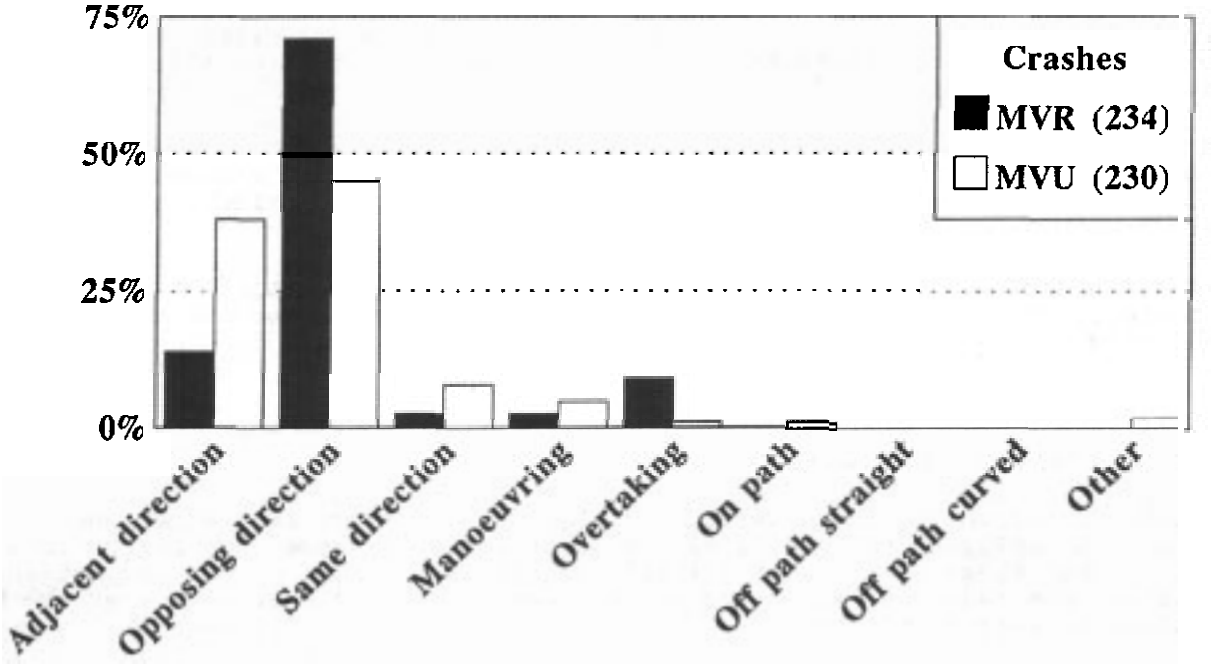


Figure 13b Multiple Vehicle Rural high/Urban low speed crashes by major crash classification (DCA) (Fatal crashes involving passenger vehicles and/or rigid trucks only)



Source: FORS 1988 Fatal file

Road and driving conditions

Almost all the rural high speed crashes occurred on roads with loose, soft or narrow shoulders (97% SVR, 93% MVR, 28% SVU, 14% MVU).

Proportionally more single vehicle rural crashes (87%) than the other three groups (75%) occurred in good (dry) driving conditions.

Crash description: Single vehicle crashes (SVR and SVU)

'Out of control and running off the carriageway' classifications accounted for almost all the single vehicle crashes (Figure 13a).

Vehicles in SVU crashes were more likely to run into objects than SVR crashes, both on and off the carriageway. The objects hit also varied in rural and urban areas, with trees accounting for 46% in rural regions and electricity or light poles accounting for 41% in urban areas.

Almost one quarter of vehicles in SVR crashes lost control on the left shoulder of the road, 29% had prior events, 61% overturned and in 50% the overturn was considered the fatal impact; much higher than any of the other groups.

Crash description: Multiple vehicle crashes (MVR and MVU)

Crashes between vehicles from **opposite** directions predominated in **rural** areas, whereas vehicles from **adjacent** directions or the **same** direction were more common in MVU crashes (Figure 13b).

Contributory factors

Single vehicle crash factors were more often **alcohol** and/or drug related, whereas **multiple vehicle crashes had proportionally more instances of driver errors, visibility problems and unintentional failure to see** the other unit (partly by definition) (Table 14).

Speed played a greater role in urban crashes in low speed zones, whereas **fatigue** figured more prominently in **rural** crashes in high speed zones. Figure 14 shows that over two thirds of the vehicles in SVU crashes were possibly exceeding the speed limit.

There were higher proportions of **'failure to see the other unit'** factors and road rule breaches for multiple vehicle urban crashes and more **surface condition** factors for multiple vehicle rural crashes.

Persons involved: Drivers

The drivers involved in single vehicle crashes were younger, less experienced, more often male, unemployed and more likely to be on their way home from recreational activities than those involved in multiple vehicle accidents. Higher proportions were killed, ejected, and tested for alcohol and drugs, and more were over the 0.05 blood alcohol limit (Table 15).

Drivers in urban crashes were younger than those involved in fatal crashes in rural areas, both for single and multiple vehicle crashes.

There were fewer professionally employed persons and more tradesmen involved in the SVU crashes than other crashes. See Appendix Tables A2 and A3 for further details.

Table 14 Number and percentage attributed to various factors. Fatal crashes involving passenger vehicles and/or rigid trucks only. Significantly high percentages across rows are highlighted.

	Single vehicle				Multiple vehicle			
	Rural high speed (SVR)		Urban low speed (SVU)		Rural high speed (MVR)		Urban low speed (MVU)	
Factor	n	%	n	%	n	%	n	%
Alcohol/drugs	**196**	**42%**	**117**	**56%**	42	20%	46	21%
Speed	132	28%	**104**	**50%**	36	17%	50	23%
Driver error	87	19%	38	18%	**76**	**37%**	**118**	**54%**
-Dangerous manoeuvre skylarking	(15	3%)	(11	5%)	**(15**	**7%)**	**(17**	**8%)**
-Road rules breach	(1	0%)	(2	1%)	**(39**	**19%)**	**(85**	**39%)**
-Other driver error	(71	15%)	(25	12%)	(26	13%)	(22	10%)
Fatigue	**82**	**18%**	18	9%	17	8%	1	0%
Surface conditions	39	8%	15	7%	**25**	**12%**	12	6%
Vehicle defects	25	5%	8	4%	6	3%	6	3%
Visibility	14	3%	10	5%	**28**	**13%**	**24**	**11%**
Driver ill health	5	1%	**6**	**3%**	1	0%	**7**	**3%**
Passenger	3	1%	0	0%	0	0%	1	0%
Failure to observe other unit	3	1%	5	2%	**25**	**12%**	**49**	**23%**
At least one factor noted	464		210		208		217	

The percentages do not sum to 100% since up to 3 major factors can be recorded for each crash. The 'n' in the table is the number of crashes with at least one of the specific major factors recorded for the crash. The percentages are calculated with the denominator as the number of crashes of each type with some information on major factors.

Passengers

The distinctions between the passengers in different crash types with regard to age, sex, use of alcohol/drugs and injury severity were similar to the driver differences mentioned earlier. The BAC readings of drivers and passengers tended to be related.

Seat belts

Information on whether seat belts were available was recorded for 86% of the persons in non-stationary vehicles. Use was recorded for 77%.

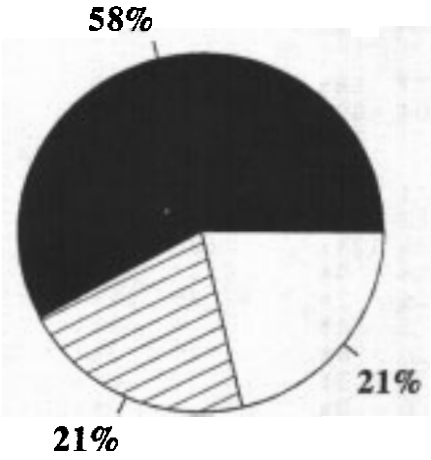
Fewer drivers in single passenger vehicle crashes wore seat belts (SVR: 62%; SVU 71%) compared with drivers in multiple vehicle crashes (MVR: 92%; MVU 91%). Passengers in single vehicle crashes were less likely to have seat belts available to them and also less likely to wear them (SVR: 58% wearing belts; SVU 47%; MVR: 83%; MVU 85%).

The availability of seat belts was lower in rigid trucks than in passenger vehicles Fewer belts were available and fewer worn in the single vehicle crashes as compared to the multiple vehicle crashes.

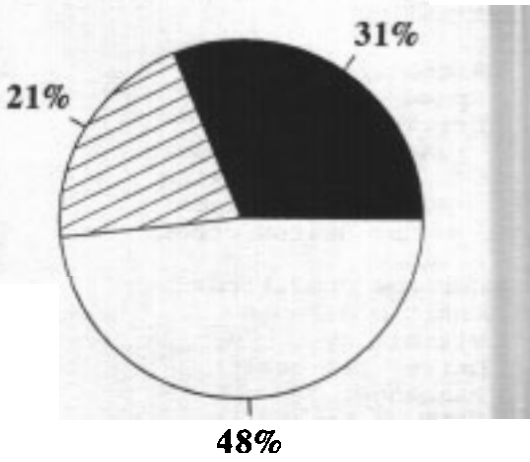
Fatalities

The percentage of MVR crashes resulting in multiple fatalities was high (27%) compared with approximately only 10% for the other three crash types.

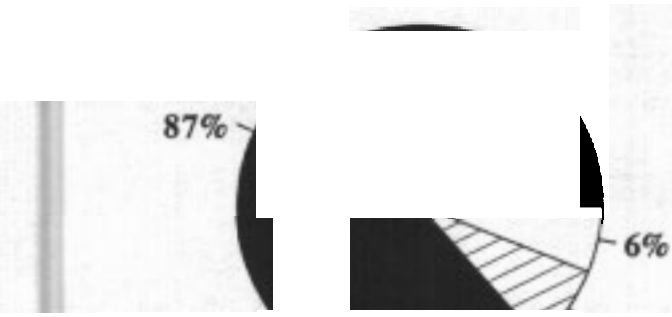
Figure 14 Single/Multiple, Urban low/Rural high speed crash vehicles by speeding
(Fatal crashes involving passenger vehicles and/or rigid trucks only)



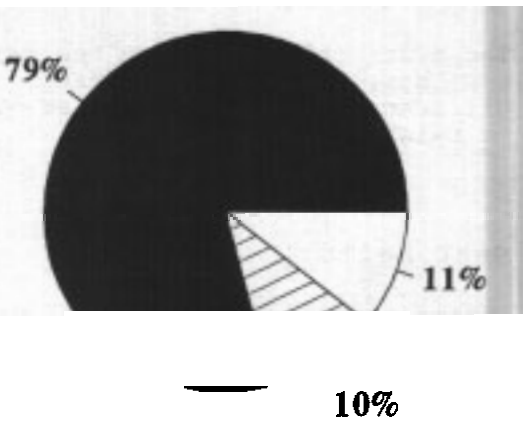
SVR (420 vehicles)



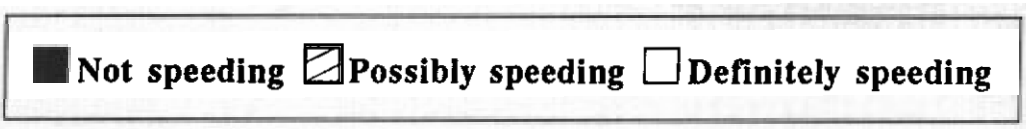
SVU (195 vehicles)



MVR (433 vehicles)



MVU (434 vehicles)



Source: FORS 1988 Fatal file

Table 7.12 Characteristics of the drivers involved in single/multiple vehicle, rural/urban, passenger vehicle/rigid truck crashes. Significantly high percentages across rows are highlighted

Driver characteristics	Single vehicle: Rural high speed (SVR)		Single vehicle: Urban low speed (SVU)		Multiple vehicle: Rural high speed (MVR)		Multiple vehicle: Urban low speed (MVU)	
Age, years	Median 28		Median 24		Median 36		Median 33	
Driving experience, years	6		4		18		12	
	n	%	n	%	n	%	n	%
Age <=25 years	213	44%	122	56%	135	29%	153	33%
Male drivers	405	82%	185	85%	362	76%	366	79%
Provisional licence	48	11%	30	16%	33	8%	40	9%
Learners licence	11	3%	5	3%	4	1%	2	1%
Licence disqualified	7	2%	7	4%	5	1%	4	1%
Unemployed	42	12%	13	9%	10	3%	12	4%
Tested for alcohol	379	79%	174	83%	315	69%	314	69%
Over 0.05 Blood Alcohol[1]	182	49%	112	65%	39	13%	54	17%
Median non-zero BAC	0.16		0.16		0.15		0.14	
Median BAC>0.05 gm/100 ml	0.18		0.17		0.19		0.15	
Tested for drugs	47	10%	18	8%	15	3%	14	3%
Positive drug test[1]	17	36%	7	39%	3	20%	4	29%
Killed	323	65%	136	62%	188	40%	142	30%
Ejected from vehicle	101	22%	22	10%	16	4%	19	4%
Total drivers[2]	495(100%)		218(100%)		474(100%)		467(100%)	

[1] Percentage over the limit, calculated as percentage of those drivers tested
[2] Total refers to all crashes with some driver information. The totals used to calculate percentages for each characteristic vary due to different amounts of missing information for each.

Medical details

Proportionally more deaths resulting from **single** vehicle crashes occurred before medical assistance arrived (SVR 43% vs MVR 35%) and more of the fatalities from multiple vehicle crashes occurred in hospital (SVR 17% vs MVR 24%).

This same distinction was observed in urban areas with 30% of SVU crash fatalities in hospital compared with as many as 46% of MVU deaths occurring in hospital. Additionally, more instantaneous deaths occurred in the SVU crashes (33%) than the MVU crashes (21%).

Compared with single vehicle crashes, multiple vehicle crash victims included proportionally more chest injury deaths (19% vs 10%) and fewer head injury deaths (31% vs 39%)

The persons killed in MVR crashes were more likely to have sustained at least one serious injury to the abdomen and pelvic region (20%), and to the arms (12%) and legs (40%) than any of the other three crash types (SVR,SVU,MVU).

Chapter 8: Multiple vehicle crash scenarios

Common elements of crashes involving multiple passenger vehicles derived from reading original crash documentation.

Multiple passenger vehicle rural high speed crash scenarios:

1. Daytime crash caused by one vehicle driven by an elderly driver failing to give way while entering a major road.

2. Non-intersection, head-on crash on a two-way undivided road caused by one vehicle coming onto the wrong side of the road.

Multiple passenger vehicle urban low speed crash scenarios:

1. Non-intersection, head-on crash on a two-way undivided road.

2. A vehicle turns right at an intersection in the face of oncoming traffic.

3. Two vehicles from adjacent directions and not intending to turn collide within an intersection.

Based on the original police and coroner's reports of random samples of 25 fatal multiple passenger vehicle rural high speed (MVR) crashes and 25 fatal multiple passenger vehicle urban low speed (MVU) crashes (defined in the previous chapter), the following scenarios were formulated and then checked against the total database. Percentages given below refer to the entire database, not the sample.

MVR crash scenario 1: MVR intersection crashes (18% of MVR crashes)

These crashes formed a small, but reasonably uniform group. They tended to occur during the day (76%), at intersections of highways or major roads with minor roads, and the vehicle on the minor road, generally driven by an elderly driver (41%), failed to give way.

MVR crash scenario 2: MVR head-on crashes (74% of MVR crashes)

The head-on crashes, being a much larger group, were more diverse, yet invariably occurred on two way undivided roads with one lane each way, with one vehicle coming onto the wrong side of the road causing the crash. The reasons could not always be established, as often the drivers and passengers were killed or badly injured.

The contributing factors were either solely driver related for crashes occurring during optimal driving conditions (89%) or combinations of driver error and surface or visibility conditions (i.e. a overtaking manoeuvre resulting in a vehicle losing control in a soft road shoulder) or depended primarily on misadventure or bad road/weather conditions (i.e tyre blow-out or two vehicles meeting on a narrow crest).

The persons killed were not always those in error. Indeed, in some cases, the vehicle causing the crash did not come into contact with any other vehicles. However, it appeared that intoxicated drivers tended to be killed (70%) rather than the sober drivers in the car hit (38%), and this could be partially explained by non-use of seat belts by the drunk drivers (50%). Crashes in which alcohol was a contributing factor were more typical of night time crashes (53% vs 12% day time). Crashes in which surface conditions or visibility played a role occurred during the day (28% daytime vs 14% night time).

MVU crash scenario 1: Mid-block crashes (39% of MVU crashes)

Though less frequent, MVU mid-block crashes were similar to MVR mid-block crashes. They were generally head-on crashes (70%) occurring on undivided two way roads with one driver coming onto the wrong side of the road colliding with oncoming traffic. Common factors were alcohol related at night (53%) or misadventure during the day.

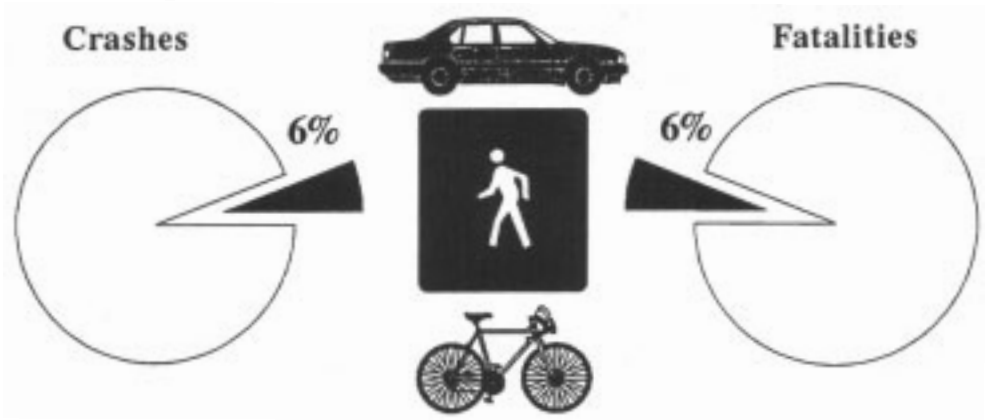
MVU crash scenario 2: Right turn intersection crashes (13% of MVU)

These crashes were characterised by a vehicle making a right hand turn and colliding with oncoming traffic within an intersection. The intersection was often controlled by lights (50%), but not necessarily turning arrows. The turning vehicle often failed to observe the oncoming traffic or misjudged their speed (68%). Occasionally, the other vehicle contributed to the crash by accelerating through the intersection on an amber light or, in general, exceeding the speed limit (25%).

MVU crash scenario 3: 'Straight through' intersection crashes (29%)

These crashes typically involved two vehicles approaching an intersection from adjacent directions without intent to turn; one of the vehicles ignoring a traffic control (87%), resulting in a collision. Usually, a single vehicle was at fault (97%). These crashes generally occurred during the day (73%), but those occurring at night were often caused by alcohol affected drivers (29%).

Chapter 9: Fatal crashes involving children



Children aged up to 12 years accounted for 6% of road fatalities.
22% of bicycle fatalities.
13% of pedestrian fatalities.
10% of passenger fatalities.

Timing
- Most fatal crashes involving children (78%) occurred during the day.
- A high proportion (42%) of weekday fatal crashes involving children occurred between 3 and 6 pm (after school).
- A relatively high proportion (32%) of weekend crashes involving children occurred between 12 noon and 3 pm.

Crash description
- 28% of child pedestrians were killed emerging from behind a parked vehicle.
- 47% of child cyclists were killed emerging from a footpath or driveway.

Contributory factors
- Most of the child pedestrians killed (81%) were judged to be responsible for the crash in which they were killed.
- Most of the child cyclists killed (94%) were judged to be responsible for the crash in which they were killed.

Children
- 61% of children killed were boys, 39% were girls.
- Girl fatalities were more likely to be aged 6-9 (52% vs 30%).

Medical details
- Children killed in road crashes were more likely to die of head injuries, than other, older road crash victims.
- 54% of child pedestrians died of head injuries, 32% of multiple injuries.
- 58% of child cyclists died of head injuries, 37% of multiple injuries.
- 53% of child passengers died of head injuries, 27% of multiple injuries.

- Only 7% of child pedestrian fatalities died instantaneously.
- Child pedestrians killed were more likely to sustain at least one serious injury to the head, abdomen and/or spine than adult pedestrian fatalities.

- Child passengers killed were less likely to sustain serious injuries to the chest than other, older passenger fatalities.
- Most child passenger fatalities (70%) were in the rear of the vehicle and the most common seating position compared with any other was the rear centre seat.
- 73% of children in passenger vehicles involved in fatal accidents were wearing seat belts or in child restraints.

Drivers
- Most of drivers of vehicles in which children were killed(71%) were aged 26-49.
- 43% of drivers of passenger vehicles in which children were killed were female.

Definition

Crashes involving children were defined as crashes in which at least one child was killed or died within 30 days of the crash. A child was defined as aged 12 years or younger.

Frequency

A total of 160 such crashes occurred in 1988, 6% of all fatal crashes. As a result of these crashes, 170 children were killed, 6% of all road fatalities; 79 (10%) passenger fatalities, 72 (13%) pedestrian fatalities and 19 (22%) bicycle fatalities.

Timing

As for other fatal crashes, approximately one third of the crashes involving children occurred during the weekend (31%), but there was no increasing trend through the weekdays up to Friday.

Most (78%) fatal crashes involving children occurred during the day, compared with only 49% of other fatal crashes, but the pattern differed according to weekdays and weekends, with the peak 3 hour period being 3-6pm on weekdays (42% weekday crashes), and earlier (12-3pm) on weekends (32% weekend crashes).

Crash description

Relative to other fatal crashes, there were high proportions of pedestrian and bicycle crashes involving children.

Compared with other (older) pedestrians, children were more likely to be killed as they emerged from behind a parked or stationary vehicle (28% vs 5%).

Child cyclists were more often killed while manoeuvring (emerging from footpath or driveway), overtaking or crossing the path of oncoming traffic, whereas the older cyclists were killed in rear end crashes, or where their bicycle was out of control on the carriageway.

There were fewer crashes with vehicles from adjacent directions in which child passengers were killed (3% vs 11%), and more crashes with vehicles from opposing directions (33% vs 27%) or overtaking (7% vs 3%). The point of primary impact was less often the front (35% vs 53%) and more often the left hand side of the vehicle (27% vs 12%) as compared with other motor vehicles involved in other fatal crashes. For many of the crashes in which the impact was the left hand side, the vehicles were originally from opposing directions (e.g. starting to turn right).

Contributory factors

Higher proportions of child **pedestrians** (81% vs 67%) and child **cyclists** (94% vs 59%) were **at fault** compared with teenagers and adults. Children were more likely to step from behind obstructions, whereas older pedestrians were more often indecisive, slow and/or alcohol affected. Child cyclists more often rode dangerously, thus contributing to their deaths.

Surface conditions contributed more often, and alcohol and speed less often in **motor vehicle accidents** in which child passengers were killed.

Persons involved: Children

Almost twice as many boys died (104; 61%) compared with girls (66; 39%). However, the male/female ratio was less than all other road fatalities.

There were relatively more boys in the younger (0-5) and older (10-12) age groups, whereas there were more girls (34; 52%) than boys (31; 30%) in the age group 6-9 both in terms of the percentage and the number of deaths.

Children were more likely than other passengers to be killed sitting in the rear of the vehicle (70% vs 34%) or on someone's lap (5;8% vs 1;0.2%). The front centre, back centre and standing or lying positions were more frequent for child passenger fatalities. More children killed sat in the rear centre seat than any other position.

Drivers

Though the median age of the drivers of vehicles in which child passengers were killed was the same as other drivers in fatal crashes (34), the drivers of vehicles in which child passengers were killed were more likely to be aged between 26 and 50 (71% vs 47%).

There was a higher proportion of women driving the passenger vehicles in which children were killed (43% vs 22%). The nine trucks and buses in which child passengers were killed were driven by men.

Seat belts and child restraints

Information on availability of seat belts existed for 84% of motor vehicle occupants. Use was recorded for 89% of persons with seat belts available to them.

Children in passenger vehicles were less likely than other (older) occupants to have a seat belt or restraint available to them (85% vs 96%). The children's positioning in the vehicles contributed to this with 12 of the children sitting on either the driver's or a passenger's lap. Sixteen were lying down.

The use of seat belts and restraints was slightly, but not significantly, higher for children compared with other occupants of passenger vehicles (87% vs 82%).

This resulted in an overall seat belt/restraint use of 73% for children which was not significantly different from other, older occupants of passenger vehicles involved in fatal crashes (79%).

The protective effect of seat belts in passenger vehicles was observed for both children and adults with higher proportions of both age groups in the vehicle at the time of the crash dying if unrestrained (children 45% died unrestrained vs 20% died restrained; persons >12 years 62% vs 32%).

The proportion of children restrained was similar among children of different ages.

Medical details: Fatalities

For the **pedestrian** fatalities, children were more likely to have suffered at least one serious injury to the head, abdomen/pelvis or spine. The cause of death was more often considered to be due to injuries to the head (54% vs 41%; p=0.06) and less likely chest injuries (1% vs 8%). A smaller proportion of child pedestrians died instantly (7% vs 21%) compared with other, older pedestrians.

For the **motor vehicle occupants**, proportionally more children killed had serious head injuries and fewer had chest injuries than other, older occupants killed. This was also reflected in that head injuries were a more common cause of death for these children (53% vs 35%).

Appendix Tables

A1. Percentage of road fatalities in different occupations by age group and sex. ABS data for the Australian population in 1986 are also shown. Note that these figures exclude persons not in the work force such as students, unemployed and retired persons, and persons at home.

	Road fatalities Age groups			Total road fatalities	Australian work force[1]
Employment category	15-24	25-59	60+		
Manager/ professional	6%	18%	23%	13%	32%
Trades	35%	21%	21%	27%	23%
Clerical/sales/ service	10%	12%	5%	11%	15%
Plant op/labourer	44%	42%	33%	42%	27%
Other employed	5%	7%	19%	7%	3%
Total males	414 (100%)	587 (100%)	43 (100%)	1044 (100%)	3951924 (100%)
% of males in the work force	72%	84%	16%	67%	

Females	Road fatalities Age groups			Total road fatalities	Australian work force[1]
Employment category	15-24	25-59	60+		
Manager/ professional	12%	28%	50%	22%	27%
Trades	4%	1%	50%	3%	4%
Clerical/sales/ service	69%	44%	0%	54%	51%
Plant op/labourer	11%	20%	0%	16%	16%
Other employed	3%	7%	0%	5%	2%
Total females	89 (100%)	120 (100%)	2 (100%)	211 (100%)	2561623 (100%)
% of females in the work force	51%	51%	1%	35%	
Total employed	503	707	45	1255	6513547
% of road fatalities in work force[2]	67%	75%	10%	58%	

[1] Source ABS ASCO 1986

[2] Percentage of road fatalities with information on employment status who were in the work force

A2. **Percentage of drivers in different occupations involved in single/multiple vehicle, rural/urban, passenger vehicle/rigid truck crashes by sex. The ABS figures for the Australian population in 1986 are also shown. Note that these figures exclude persons not in the work force such as students, unemployed and retired persons, and persons at home.**

Male

Employment category	SVR driver	SVU driver	MVR driver	MVU driver	Total driver	Australian work force[1]
Manager/ professional	21%	14%	22%	22%	20%	32%
Trades	21%	31%	25%	23%	24%	23%
Clerical/sales/ service	11%	13%	9%	11%	10%	15%
Plant op/labourer	40%	34%	34%	38%	37%	27%
Other employed	7%	9%	11%	7%	8%	3%
Total males (100%)	214	88	199	178	679	3951924
% of males in the work force	72%	77%	76%	74%	74%	

Female

Employment category	SVR driver	SVU driver	MVR driver	MVU driver	Total driver	Australian work force[1]
Manager/ professional	42%	0%	18%	24%	24%	27%
Trades	0%	0%	3%	4%	2%	4%
Clerical/sales/ service	32%	80%	64%	52%	55%	51%
Plant op/labourer	16%	13%	10%	16%	14%	16%
Other employed	10%	7%	5%	4%	6%	2%
Total females (100%)	31	15	39	25	110	2561623
% of females in the work force	47%	62%	51%	38%	47%	
Total employed	245	103	238	203	789	6513547
% of drivers in the work force	68%	75%	70%	66%	69%	

[1] Source ABS ASCO 1986

A3. Percentage of drivers in different occupations involved in single/multiple vehicle, rural/urban, passenger vehicle/rigid truck crashes by age group. The ABS figures for the Australian population in 1986 are also shown. Note that these figures exclude persons not in the work force such as students, unemployed and retired persons, and persons at home.

15-24 years

Employment category	SVR driver	SVU driver	MVR driver	MVU driver	Total driver	Australian work force
Manager/ professional	10%	4%	13%	14%	11%	14%
Trades	31%	33%	28%	31%	**30%**	20%
Clerical/sales/ service	16%	24%	28%	17%	21%	**41%**
Plant op/labourer	38%	33%	24%	34%	**32%**	22%
Other employed	6%	7%	8%	5%	6%	2%
Total 15-24 (100%)	90	46	72	65	273	1442136
% in the work force	67%	74%	87%	78%	75%	

25-59 years

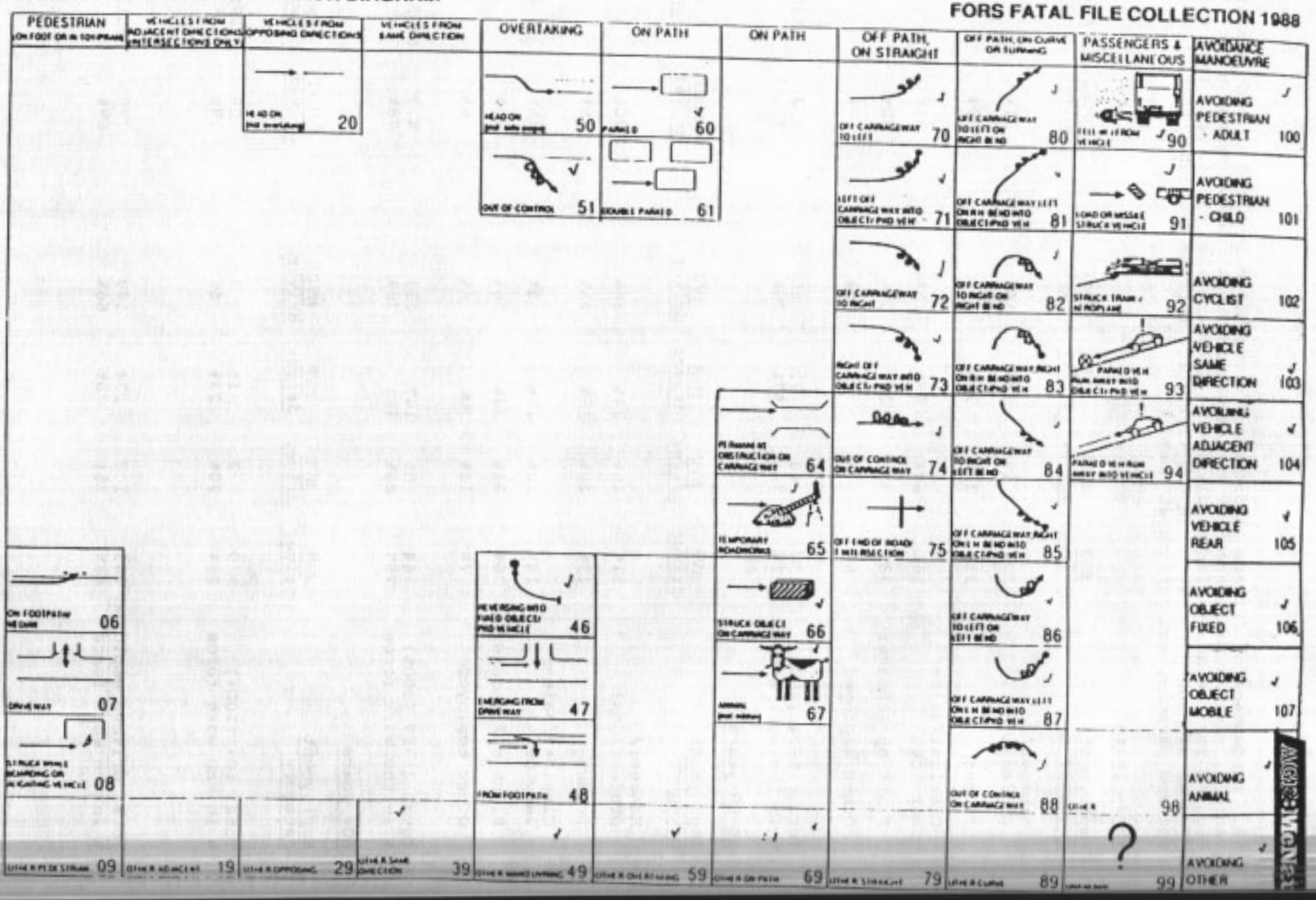
Employment category	SVR driver	SVU driver	MVR driver	MVU driver	Total driver	Australian work force
Manager/ professional	31%	18%	24%	26%	26%	**34%**
Trades	13%	20%	18%	15%	16%	14%
Clerical/sales/ service	14%	20%	15%	15%	15%	**26%**
Plant op/labourer	36%	31%	34%	36%	**35%**	23%
Other employed	7%	11%	9%	8%	8%	3%
Total 25-59 (100%)	144	55	147	131	477	4793194
% in the work force	75%	85%	79%	78%	78%	

60+ years

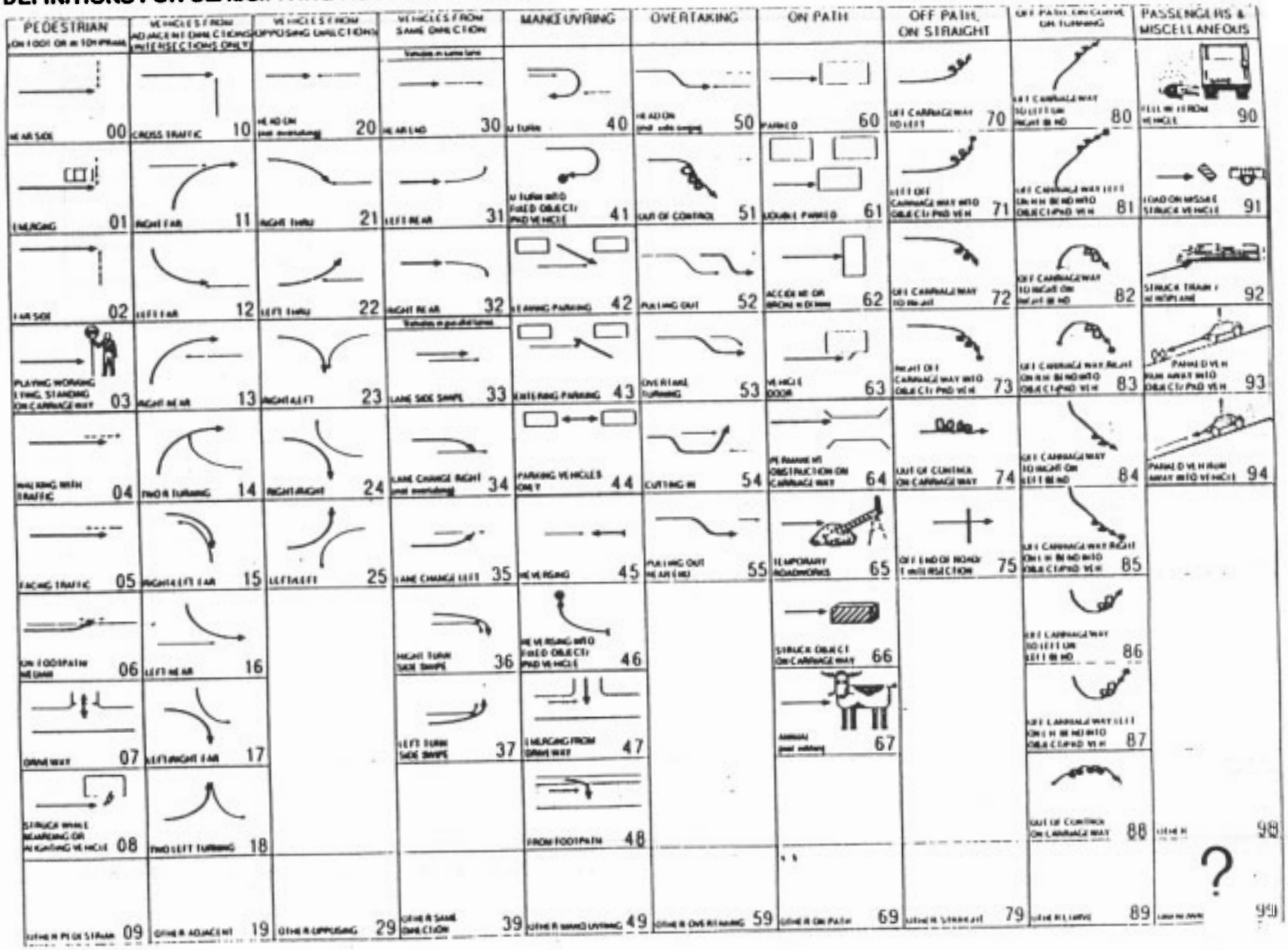
Employment category	SVR driver	SVU driver	MVR driver	MVU driver	Total driver	Australian work force
Total 60+ (100%)	9	2	15	3	29	278217
% in the work force	29%	20%	23%	6%	19%	
Total drivers employed	243	103	234	199	779	6513547
% in the work force	68%	75%	70%	66%	69%	

PRIOR EVENTS - CLASSIFICATION DIAGRAM

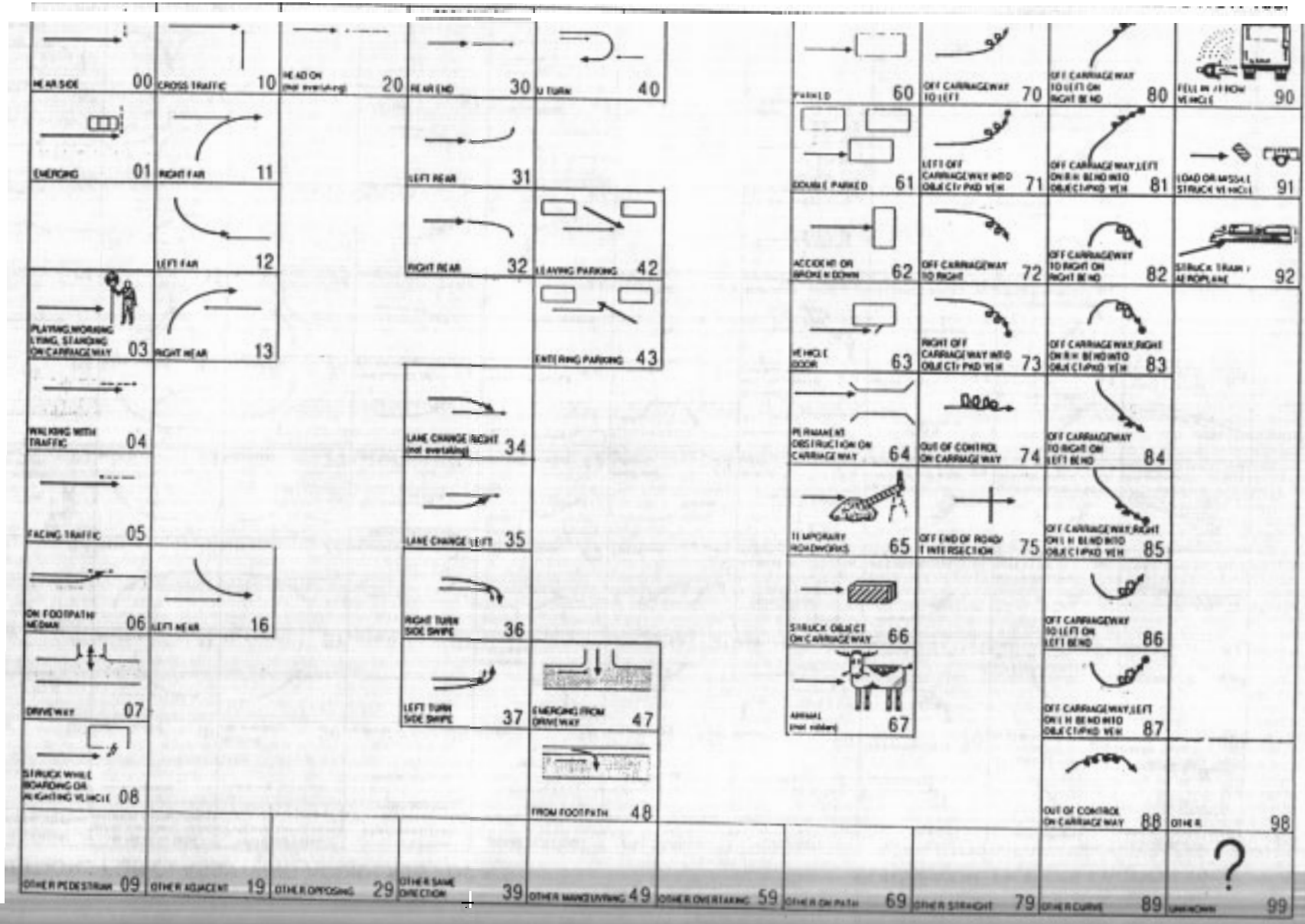
FORS FATAL FILE COLLECTION 1988



DEFINITIONS FOR CLASSIFIYING ACCIDENTS - DCA'S



SUBSEQUENT EVENTS - CLASSIFICATION DIAGRAM



Glossary of terms/definitions

AIS Abbreviated Injury Scale, 1985 version. American Association for Automotive Medicine

AIS severity codes 1-Minor 2-Moderate 3-Serious 4-Severe 5-Critical 6-Virtually unsurvivable

articulated truck Truck with detachable cabin

AT Articulated truck

BAC Blood alcohol content

bicycle Bicycle or tricycle

bus Motor vehicle with more than 9 seats

carriageway That part of the road which normally carries traffic; does not include median strips

child Person aged 12 or younger

crash Fatal crash

cross traffic crash Crash type involving vehicles from adjacent approaches at an intersection

cyclist Bicyclist

DCA Definition for Classifying Accidents, 3 digit code.

DCA event The central crash event, often the first collision on the carriageway; >100 possible codes. See diagrams in Appendix.

head-on crash Crash type involving vehicles from opposing directions at an intersection or mid-block

manoeuvring Major crash type including vehicles making U turns, parking reversing, emerging from a driveway/laneway/footpath/median, but excluding overtaking

MC Motorcycle

mid-block More than 10m from an intersection

motorcycle Motorcycle, motor scooter, trail bike or moped

motorcyclist Person in control of motor cycle

multiple motor vehicle crash A fatal crash involving at least two non-stationary motor vehicles

multiple vehicle rural (MVR) crash A multiple motor vehicle crash involving at least two non-stationary passenger vehicles or rigid trucks or combinations of these occurring in a rural high speed zone, excluding all crashes involving any pedestrians, bicycles or non-stationary motorcycles, buses or articulated trucks

multiple vehicle urban (MVU) crash
A multiple motor vehicle crash involving at least two non-stationary passenger vehicles or rigid trucks or combinations of these occurring in an urban low speed zone, excluding all crashes involving any pedestrians, bicycles or non-stationary motorcycles, buses or articulated trucks

near intersection Less than 10m from intersection but not within intersection

non-stationary Not parked

off path crash A crash in which the vehicle loses control and leaves the carriageway; also includes crashes with the vehicle out of control on the carriageway and not hitting an object

on path crash A crash in which the vehicle collides with a stationary object on the carriageway

pedestrian Person other than a driver, passenger, cyclist or motorcyclist

pedestrian crash A crash in which at least one pedestrian dies.

passenger vehicle Motor vehicle with up to 9 seats and/or not exceeding 3.5 tonnes:cars, station wagons, utilities, passenger vans and 4 wheel drive vehicles

prior event Event prior to DCA event. Generally involves vehicle leaving the carriageway or loss of control due to avoidance manoeuvre.

rear end crashes Vehicle colliding with rear of another vehicle in the same lane

remote Rural land classification; West of 151° longitude and between 11.5 and 31° latitude.

rigid truck A truck with a non-detachable cabin. This includes vans over 3.5 tonnes, table top trucks, tip trucks and other non-articulated trucks.

rural Includes a) Rural, b) small towns 1-200 people and c) town/city boundaries

rural high speed Road with a speed limit of at least 80 km/h in a rural area, small town (1-200 people) or rural boundary land classification

rural low speed Road with speed limit of less than 80 km/h in a rural area, small town (1-200 people) or rural boundary land classification

same direction crash
Crash involving vehicles travelling in the same direction

school age Age 16 or younger

single motor vehicle crash
A fatal crash involving a single moving/non-stationary motor vehicle; crashes involving one vehicle hitting a parked vehicle are included, but collisions with bicycles or pedestrians are excluded

single vehicle rural (SVR) crash
A single motor vehicle crash involving either a non-stationary passenger vehicle or rigid truck occurring in a rural high speed zone, excluding all crashes involving any pedestrians, bicycles or non-stationary motorcycles, buses or articulated trucks

single vehicle urban (SVU) crash

A single motor vehicle crash involving either a non-stationary passenger vehicle or rigid truck occurring in an urban low speed zone, excluding all crashes involving any pedestrians, bicycles or non-stationary motorcycles, buses or articulated trucks.

stationary	Parked
subsequent event	**Fatal** *event occurring* after the DCA event which was clearly caused directly or indirectly by the DCA or prior event. Generally involves the vehicle losing control and leaving the carriageway after the DCA collision.
urban	City, town population >200, not urban/rural boundaries
urban high speed	**Road with a speed limit of at least 80 km/h in an urban** or rural boundary land classification; see additional text under rural high speed
urban low speed	Road with a speed limit of less than 80 km/h in an urban or rural boundary land classification; see additional text under rural high speed

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