Characteristics of Fatal and Severe Pedestrian Accidents in South Australia

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**A Report for the
Transport Technology Program
of Transport SA**

by

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EXECUTIVE SUMMARY

Characteristics of Fatal and Severe Pedestrian Accidents in South Australia

Aim of project

A detailed analysis of available data on pedestrian accidents in South Australia was undertaken with the aim of characterising these accidents and identifying possible measures to reduce their frequency and severity.

Sources of Information

Information on 190 fatal pedestrian accidents for the years 1991-1997 was obtained from the South Australian Coroner's files; data on 2,295 serious injury pedestrian accidents was extracted from the Traffic Accident Reporting System (TARS) database; and maps of the locations of fatal and serious pedestrian crashes in South Australia between 1993 and 1998 were obtained from the Police Traffic Research and Intelligence Section.

The Magnitude of the Problem

Four pedestrians are injured seriously enough to be admitted to hospital each week, on average, in South Australia. Two to three pedestrians are fatally injured per month.

Pedestrian Behaviour

Three groups of pedestrians have a comparatively high risk of being involved in an accident. They are: children, particularly when on their way to or from school; older pedestrians during the day; and middle aged males at night, often when intoxicated. It is recommended that:

- Children should be supervised by an adult when in the vicinity of a busy road.
- Elderly pedestrians should be reminded of the need for care when crossing a busy road and encouraged to make use of signalised crossings or pedestrian median refuges wherever possible.
- The very high risk associated with walking when intoxicated be publicised, emphasising that, if a driver becomes intoxicated, walking home is not a safe alternative to driving.
- Police be encouraged to remove intoxicated pedestrians from public roadways for their own protection.

Driver Behaviour

Young male drivers, up to 30 years of age, are very much more likely to hit and fatally or seriously injure a pedestrian. This is related to their greater risk-taking behaviour especially in the areas of drink driving and speeding, which leads to the following recommendations:

- The level of enforcement of drink driving legislation by SA Police be maintained or increased.
- The level of enforcement of speed limits by SA Police be maintained or increased.
- The enforcement tolerance allowed by SA Police when enforcing the urban speed limit of 60 km/h be reduced or eliminated.

Vehicle Design

The frontal design of the vehicle has a major effect on the level of pedestrian protection from injury in the event of a collision. Test procedures for pedestrian protection are about to be incorporated into the Australian New Car Assessment Program (NCAP). As Transport SA is a sponsor of the Australian NCAP program it is recommended that:

- Transport SA continue as a sponsor of the Australian NCAP program and publicise the results of the forthcoming tests of the level of pedestrian protection provided by new cars on the Australian market.
- Transport SA maintain a watching brief on the work of the Standards Association Committee on Vehicle Frontal Protection Systems (bull bars) with a view to considering the adoption of the resulting standard as legal requirement for such systems in South Australia.

Road Environment

The great majority of serious and fatal pedestrian accidents happen on mid-block sections of metropolitan arterial roads. Very few pedestrian accidents occur on local streets. As a reduction in the urban area speed limit to 50 km/h, as is common in most other developed countries, could be expected to prevent four or five pedestrian deaths a year, and an average of one admission to hospital per week in South Australia from pedestrian accidents alone, it is recommended that:

- The South Australian road safety strategy include the aim of working towards an urban area speed limit of 50 km/h on all roads.

As children and the elderly often have no option but to travel by bus, it is recommended that:

- Median refuges for pedestrians be provided adjacent to all bus stops on arterial roads that do not already have a median divider.

On average, one child pedestrian is hospitalised per month in South Australia after being struck by a vehicle in the one hour period between 3 and 4 pm. It is recommended that:

- The effectiveness of the recently introduced school zones in South Australia in reducing vehicle travelling speeds to 25 km/h when children are present be evaluated.

Street lighting is more important for the safety of pedestrians than for any other type of road user. It is therefore recommended that:

- The adequacy of the level of illumination provided by street lighting on arterial roads in the metropolitan area be reviewed and a program be instituted to ensure compliance with the relevant Australian Standard.

The Traffic Accident Reporting System Data Base

There are features of the TARS data base which inhibit efficient and timely use of the data from police reports on road accidents. It is therefore recommended that:

- The structure and content of the TARS data base be reviewed and appropriate changes made to render it more useful.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Initiation of this Project

The Road Accident Research Unit (RARU) was funded by the Transport Technology Development Program of Transport SA in 1998 to analyse a series of fatal pedestrian accidents in South Australia. The investigation also included a less detailed examination of a series of serious injury pedestrian accidents in South Australia and mapping of the location of both serious and fatal pedestrian accidents.

1.2 Aims of this Project

Pedestrians are particularly vulnerable road users with the majority of pedestrian accidents resulting in serious injury to the pedestrian. Measures which enhance the safety of vehicle users may not provide similar benefits for the pedestrian and in some instances may be counterproductive.

The objectives of the current project are to characterise pedestrian accidents in South Australian and identify possible countermeasures for the reduction of the frequency and severity of these accidents. The areas to be addressed include behavioural factors and vehicle characteristics, together with the road infrastructure and traffic control measures. The results of the study will contribute to the provision of a rational basis for an allocation of resources to reduce the magnitude of the pedestrian accident problem. They will be presented in ways which will maximise their value to persons and organisations charged with ensuring the safety and mobility of pedestrians in South Australia.

The desired benefits are a reduction in the frequency of pedestrian accidents and the resulting injuries and deaths while enhancing the ease with which pedestrians of all ages can use the road system.

The aim of this research is to identify opportunities to prevent pedestrian accidents resulting in fatal or severe injury in South Australia and to reduce the severity of the injuries sustained by the pedestrian when struck by a vehicle. The secondary aim of the project is to document the geographical distribution of serious and fatal pedestrian accidents in South Australia.

1.3 Background

The primary causes of pedestrian accidents in South Australia and their relative contributions need to be known so that current accident countermeasures can be evaluated and possible new countermeasures developed. There is also a need to find ways to reduce the severity of those pedestrian accidents that do occur.

In the second Adelaide in-depth accident study, conducted by the Road Accident Research Unit in 1976-77, attention was drawn to the difficulties confronting pedestrians, particularly children and the elderly and infirm, when attempting to cross arterial roads in Adelaide, even when approaching vehicles are travelling at no more than the urban area speed limit of 60 km/h (McLean, Brewer and Sandow, 1979).

In the early 1980s, McLean and Woodward examined trends in pedestrian accidents from the mid-1960s in Adelaide. They suggested that a reduction in pedestrian accidents as a percentage of all accidents during that period may have arisen, at least in part, from the change from a continuous flow of traffic on arterial roads to flow in platoons as a consequence of the considerable increase in the number of signalised intersections in the Adelaide metropolitan area.

The relationship between the striking vehicle's travelling speed and involvement in fatal pedestrian collisions was studied by the Unit in 1995 (Anderson, McLean, Farmer, Lee and Brooks, 1997). More than 170 fatal pedestrian accidents were investigated by staff of the Unit from 1983 to 1991 as part of an ongoing study of brain injury mechanisms. Those cases in which the vehicle had a free travelling speed before the collision were analysed to predict the likely outcome had the travelling speed been lower than was actually the case. The results showed that small differences in travelling speed can mean large differences in impact speed. Small differences in travelling speed can also be reflected in very large differences in the probability of the pedestrian being fatally injured as the probability increases rapidly with the speed of the striking vehicle, from about 30 per cent at 40 km/h to 80 per cent at 50 km/h.

The study of fatal pedestrian accidents that had been investigated by the Unit also showed that the great majority of these accidents occurred on arterial roads or major traffic routes. This distribution was also found in the two in-depth studies, albeit with a much smaller number of cases (80 in the first and 40 in the second).

1.4 Scope of this Project

Pedestrian accidents were examined using three parallel methods as outlined below.

1.4.1 Fatal Pedestrian Accidents in South Australia

The Coroner's records of accidents in which a pedestrian was fatally injured in South Australia for a 7 year period (1991-1997) were obtained. The usually detailed information available in these files enabled a large number of fatal pedestrian accidents to be studied in as much detail as possible without a dedicated team actually attending road accident scenes.

1.4.2 Serious Pedestrian Accidents in South Australia

The Traffic Accident Reporting System (TARS) data was obtained from Transport SA and the 1986-1996 data on accidents in which a pedestrian was admitted to hospital were examined.

1.4.3 Location of Fatal and Serious Pedestrian Accidents in South Australia

The geographical distribution of both fatal and serious pedestrian accidents in South Australia for the years 1993-1998 was studied to determine the regions that these types of accident occur in.

2. FATAL PEDESTRIAN ACCIDENTS IN SOUTH AUSTRALIA

Generally, a great deal of information is routinely collected about fatal pedestrian accidents. This information is collected by a number of organisations and is brought together by the Coroner to make a determination about the resulting death. However, this information is not generally analysed as a whole from a road safety perspective which is what the current study set out to do.

2.1 Source of Data

Permission was received from the South Australian Coroner to copy the Coroner's files on pedestrian accidents for the years 1991-1997. These files generally contain a large amount of information on the accident including: police accident report forms, a report by the Police Major Accident Investigators, interviews with participants and witnesses, autopsy reports, blood alcohol analyses, and Coronial inquest findings.

2.2 Method of Analysis

Accidents were selected on the basis that the accident involved a pedestrian fatality in South Australia. A fatality was defined as death within 30 days of the accident event as a result of the injuries sustained in the accident.

The complete selection criteria for cases was as follows:

- the accident occurred within the South Australia borders
- the vehicle was travelling in a public area before the accident
- the pedestrian died within 30 days
- the pedestrian died as a result of the injuries sustained in the accident
- the pedestrian collided with a vehicle (including non-motorised vehicles)
- the pedestrian was on the ground before impact (lying, sitting or standing)
- the pedestrian was not in, on, boarding, alighting or falling from a road vehicle

A total of 190 accidents met the above criteria. All accidents except one involved a single pedestrian fatality. The remaining accident had two pedestrian fatalities giving a total of 191 pedestrian fatalities.

Some cases were excluded as they did not meet the above criteria. These were:

- A accident involving a bus on the Obahn track, which was deemed to not be a public area
- Two accidents on driveways, which were not public areas
- A pedestrian that was attempting to jump onto the back of a moving truck, and fell under the rear wheels, was deemed to be attempting to board a vehicle

Some files could not be retrieved from the Coroner's office, including one case in 1991, three cases in 1992 and six cases in 1993. It could not be confirmed that these cases met the criteria for the study.

Information on the pedestrian, driver, vehicle and the accident time and scene were extracted from the files and coded into a database. The analyses of these variables are presented in the following sections.

2.3 Pedestrian Demographics

Sixty one per cent of the pedestrians fatally injured in South Australia in the seven years from 1991 were males (Table 2.3.1).

Table 2.3.1
Sex of Pedestrians Fatally Injured in Accidents in South Australia 1991-1997

Sex	Number	Per cent
Male	117	61.3
Female	74	38.7
Total	**191**	**100.0**

Table 2.3.2 shows the age distribution of the fatally injured pedestrians in five year age groups. It can be seen that the cases are mainly clustered in two age groups: 15-39 and over 64 years of age. Children, age less than 15 years, accounted for 10 per cent of the total.

Table 2.3.2
Age of Pedestrians Fatally Injured in Accidents in South Australia 1991-1997

Age (Years)	Number	Per cent
0-4	6	3.1
5-9	9	4.7
10-14	4	2.1
15-19	16	8.4
20-24	16	8.4
25-29	14	7.3
30-34	12	6.3
35-39	15	7.9
40-44	4	2.1
45-49	6	3.1
50-54	4	2.1
55-59	2	1.0
60-64	7	3.7
65-69	18	9.4
70-74	16	8.4
75-79	22	11.5
80-84	13	6.8
85-89	7	3.7
Total	**191**	**100.0**

Table 2.3.3 shows that fatally injured male pedestrians were much more likely to have been in the 15 to 39 year age group than were females (46% and 26% respectively). Conversely, half of the females were over 64 years of age compared with one third of the males.

Table 2.3.3
Age and Sex of Pedestrians Fatally Injured in Accidents in South Australia 1991-1997

Age (Years)	Males (Number)	Females (Number)	Males (Per cent)	Females (Per cent)
0-4	4	2	3.4	2.7
5-9	6	3	5.1	4.1
10-14	-	4	-	5.4
15-19	12	4	10.3	5.4
20-24	15	1	12.8	1.4
25-29	10	4	8.5	5.4
30-34	7	5	6.0	6.8
35-39	10	5	8.5	6.8
40-44	1	3	0.9	4.1
45-49	4	2	3.4	2.7
50-54	4	-	3.4	-
55-59	2	-	1.7	-
60-64	3	4	2.6	5.4
65-69	7	11	6.0	14.9
70-74	6	10	5.1	13.5
75-79	13	9	11.1	12.2
80-84	9	4	7.7	5.4
85-89	4	3	3.4	4.1
Total	**117**	**74**	**100.0**	**100.0**

Table 2.3.4 shows the occupation of fatally injured pedestrians in South Australia. Note that almost two thirds were unemployed, pensioners or retired.

Table 2.3.4
Occupation of Pedestrians Fatally Injured in Accidents in South Australia 1991-1997

Occupation	Number	Per cent
Student or child	29	15.4
Employed	29	15.4
Unemployed	31	16.5
Home duties	9	4.8
Invalid pensioner	4	2.1
Pensioner or unemployed	12	6.4
Pensioner or retired	74	39.4
Unknown	3	-
Total	**191**	**100.0**

2.4 Pedestrian Alcohol Use

Alcohol use is known to be a high risk factor in all forms of road accident. This was confirmed in the current fatal pedestrian sample with 37 per cent of the pedestrians having a positive blood alcohol concentration (BAC). Table 2.4.1 shows the BAC distribution of the pedestrians and it can be seen that very high levels of alcohol were involved, but comparatively few pedestrians had low positive BACs. The mean positive BAC reading was 0.213 and the median was 0.233.

Table 2.4.1
Blood Alcohol Concentration
of Pedestrians Fatally Injured in Accidents
in South Australia 1991-1997

BAC (g/100mL)	Number	Per cent
Zero	112	62.9
.001 - .049	5	2.8
.050 - .099	6	3.4
.100 - .149	5	2.8
.150 - .199	10	5.6
.200 - .249	11	6.2
.250 - .299	17	9.6
.300 - .349	10	5.6
.350 - .399	2	1.1
Unknown	13	-
Total	**191**	**100.0**

As is commonly the case, males were much more likely than females to have been drinking, but those females who had been drinking had similar BAC levels to the male pedestrians (Table 2.4.2).

Table 2.4.2
Blood Alcohol Concentration and Sex
of Pedestrians Fatally Injured in Accidents
in South Australia 1991-1997

BAC (g/100mL)	Males (Number)	Females (Number)	Males (Per cent)	Females (Per cent)
Zero	56	56	50.9	82.4
.001 - .049	4	1	3.6	1.5
.050 - .099	3	3	2.7	4.4
.100 - .149	5	-	4.5	-
.150 - .199	10	-	9.1	-
.200 - .249	9	2	8.2	2.9
.250 - .299	14	3	12.7	4.4
.300 - .349	7	3	6.4	4.4
.350 - .399	2	-	1.8	-
Unknown	7	6	-	-
Total	**117**	**74**	**100.0**	**100.0**

Table 2.4.3 gives the breakdown of blood alcohol concentration by both the age and sex of the fatally injured pedestrian. It can be seen that most of the elderly male pedestrians, and almost all of the female pedestrians, were sober at the time of the accident. Very high blood alcohol levels (0.150 and above) were observed among male pedestrians over a wide age range, from the late teens to the seventies. Female pedestrians with very high BACs were concentrated in the 25 to 44 year age range.

Table 2.4.3
Age, Sex and Blood Alcohol Concentration of Pedestrians Fatally Injured in Accidents in South Australia 1991-1997
(Numbers of Cases)

Age (Years)	Sex of Pedestrian					
	Male			Female		
	BAC (g/100mL)			BAC (g/100mL)		
	Zero	**.001-.149**	**.150+**	**Zero**	**.001-.149**	**.150+**
0-4	4	-	-	1	-	-
5-9	6	-	-	2	-	-
10-14	-	-	-	4	-	-
15-19	3	3	6	3	-	-
20-24	3	1	11	1	-	-
25-29	2	-	8	2	-	2
30-34	2	1	3	1	1	3
35-39	5	2	3	4	-	1
40-44	-	-	1	1	-	2
45-49	1	1	2	2	-	-
50-54	-	1	3	-	-	-
55-59	2	-	-	-	-	-
60-64	-	1	2	3	1	-
65-69	4	1	1	9	1	-
70-74	4	-	1	9	-	-
75-79	9	-	1	8	-	-
80-84	7	1	-	4	-	-
85-89	4	-	-	2	1	-
Total	**56**	**12**	**42**	**56**	**4**	**8**

Note: 13 pedestrians had an unknown BAC

2.5 Pedestrian Injuries

Head injuries were the leading cause of death of the fatally injured pedestrians (Table 2.5.1). Two thirds of the cases had a fatal head injury, often in combination with a fatal injury to another body region. A fatal head injury was somewhat less common as a cause of death among the elderly pedestrians (Table 2.5.2).

Table 2.5.1
Cause of Death of Pedestrians Fatally Injured in Accidents in South Australia 1991-1997

Cause of Death	Number	Per cent
Head injury only	71	37.4
Head and other injury	55	28.9
Other injury only	64	33.7
Unknown	1	-
Total	**191**	**100.0**

Table 2.5.2
Cause of Death by Age
of Pedestrians Fatally Injured in Accidents
in South Australia 1991-1997
(Column Percentages)

Cause of Death	**Age (Years)**		
	0-14	**15-64**	**65+**
Head injury only	47.4	39.6	31.6
Head and other injury	21.1	30.2	28.9
Other injury only	31.6	29.2	39.5
Unknown	-	1.0	-
Total	**19**	**96**	**76**

Table 2.5.3 shows that a higher proportion of the elderly survived for more than one day after being injured than was the case for the younger adult pedestrians, ie: the elderly pedestrians who died were much more likely to have died in hospital. The distribution of survival times for all of the fatally injured pedestrians is shown in Table 2.5.4. (Note that deaths occurring after 30 days are, by definition, not included as fatalities in the statistical collections of road accident data).

Table 2.5.3
Survival Time by Age
of Pedestrians Fatally Injured in Accidents
in South Australia 1991-1997
(Column Percentages)

	Age (Years)		
Survival Time	**0-14**	**15-64**	**65+**
Died same day	73.7	90.3	63.2
Survived at least 1 day	26.3	9.7	36.8
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**19**	**93**	**76**

Note: 3 pedestrians in the 15-64 age group had an unknown survival time

Table 2.5.4
Survival Time
of Pedestrians Fatally Injured in Accidents
in South Australia 1991-1997

Survival Time (Days)	**Number**	**Per cent**
0	146	77.7
1	10	5.3
2	3	1.6
3	5	2.7
5	4	2.1
6	3	1.6
7	2	1.1
8	1	0.5
9	1	0.5
12	3	1.6
13	1	0.5
14	2	1.1
16	2	1.1
19	1	0.5
20	1	0.5
21	2	1.1
23	1	0.5
Unknown	3	-
Total	**191**	**100.0**

2.6 Driver Demographics

Eighty per cent of the drivers of the vehicles involved in these fatal pedestrian accidents were males (Table 2.6.1).

Table 2.6.1
Sex of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Sex	Number	Per cent
Male	145	80.1
Female	36	19.9
Unknown	9	-
Total	**190**	**100.0**

Almost half of the drivers were under 30 years of age and one quarter were in the 20-24 year age range (Table 2.6.2). Fewer than 5 per cent of the drivers were over 64 years of age. This differs markedly from the pedestrians, 40 per cent of whom were over 64.

Table 2.6.2
Age of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Age (Years)	Number	Per cent
15-19	20	11.2
20-24	45	25.3
25-29	21	11.8
30-34	29	16.3
35-39	15	8.4
40-44	13	7.3
45-49	6	3.4
50-54	9	5.1
55-59	6	3.4
60-64	6	3.4
65-69	2	1.1
70-74	2	1.1
75-79	3	1.7
80-84	1	0.6
Unknown	12	-
Total	**190**	**100.0**

There were some differences in the age distributions of the male and female drivers (Table 2.6.3). The male drivers were younger, with 29 per cent being in the 20-24 year age range, whereas the female drivers were more evenly distributed by age, but with 28 per cent in the 30 to 34 year age range.

Table 2.6.3
Age and Sex of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Age (Years)	Males (Number)	Females (Number)	Males (Per cent)	Females (Per cent)
15-19	16	4	11.3	11.1
20-24	41	4	28.9	11.1
25-29	18	3	12.7	8.3
30-34	19	10	13.4	27.8
35-39	12	3	8.5	8.3
40-44	10	3	7.0	8.3
45-49	4	2	2.8	5.6
50-54	6	3	4.2	8.3
55-59	5	1	3.5	2.8
60-64	4	2	2.8	5.6
65-69	1	1	0.7	2.8
70-74	2	-	1.4	-
75-79	3	-	2.1	-
80-84	1	-	0.7	-
Unknown	3	-	-	-
Total	**145**	**36**	**100.0**	**100.0**

Note: the sex of 9 drivers was unknown

Almost 78 per cent of the drivers were employed, and only 13 per cent were pensioners, retired or unemployed (Table 2.6.4). The corresponding percentages for the pedestrians who were fatally injured by the vehicles driven by these drivers were 15 and 64 per cent.

Table 2.6.4
Occupation of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Occupation	Number	Per cent
Employed	123	77.8
Pensioner or retired	12	7.6
Unemployed	9	5.7
Home duties	9	5.7
Student	5	3.2
Unknown	32	-
Total	**190**	**100.0**

The occupation of the driver is compared with the occupation of the pedestrian in each accident in Table 2.6.5. It is interesting to note that vehicles driven by retired drivers only collided with retired pedestrians.

Table 2.6.5
Occupation of Drivers and Fatally Injured Pedestrians in South Australia 1991-1997

Driver Occupation	**Pedestrian Occupation**				
	Employed	Retired	Unemployed	Home duties	Student
Employed	22	44	30	7	21
Retired	-	12	-	-	-
Unemployed	1	3	5	-	-
Home duties	1	4	2	-	2
Student	-	1	2	-	2

2.7 Driver Alcohol Use

Only 15 per cent of the drivers involved in these fatal pedestrian accidents had been drinking compared to 37 per cent of the pedestrians (Tables 2.7.1 and 2.4.1). Twenty three per cent of the drivers with a positive BAC were above 0.150 whereas 76 per cent of the pedestrians who had been drinking were above that level.

Table 2.7.1
Blood Alcohol Concentration of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

BAC (g/100mL)	**Number**	**Per cent**
Zero	149	85.1
.001 - .049	5	2.9
.050 - .099	3	1.7
.100 - .149	12	6.9
.150 - .199	4	2.3
.200 - .249	2	1.1
Unknown	15	-
Total	**190**	**100.0**

Almost all of the drinking drivers were male, and so their blood alcohol distribution was almost identical to that for all drivers (Table 2.7.2). The two female drinking drivers both had high BACs, in the 0.100 to 0.149 range.

Table 2.7.2
Blood Alcohol Concentration and Sex of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

BAC (g/100mL)	**Males (Number)**	**Females (Number)**	**Males (Per cent)**	**Females (Per cent)**
Zero	115	34	82.7	94.4
.001 - .049	5	-	3.6	-
.050 - .099	3	-	2.2	-
.100 - .149	10	2	7.2	5.6
.150 - .199	4	-	2.9	-
.200 - .249	2	-	1.4	-
Unknown	6	-	-	-
Total	**145**	**36**	**100.0**	**100.0**

Note: the sex of 9 drivers was unknown

Most of the drivers with a BAC above the legal limit of 0.05 were under 40 years of age (Table 2.7.3). Drivers under 30 years of age were 2.5 times more likely to have been drinking than were older drivers, and almost all of those who had been drinking had high blood alcohol levels (Table 2.7.4)

Table 2.7.3
Age and Known Blood Alcohol Concentration of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997 (Numbers of Cases)

Age (Years)	BAC (g/100mL) Zero	.001-.049	.050+
15-19	17	1	2
20-24	34	3	6
25-29	13	-	6
30-34	24	1	3
35-39	13	-	2
40-44	13	-	-
45-49	6	-	-
50-54	8	-	1
55-59	5	-	1
60-64	6	-	-
65-69	2	-	-
70-74	2	-	-
75-79	3	-	-
80-84	1	-	-
Unknown	2	-	-
Total	**149**	**5**	**21**

Note: the BAC of 15 drivers was unknown

Table 2.7.4
Blood Alcohol Concentration and Age of Drivers Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

BAC (g/100mL)	Driver Age (years) <30	30+	Unknown
Zero	64	83	2
Positive	18	8	0
Unknown	4	1	10
Total	**86**	**92**	**12**

Vehicles driven by sober drivers were most likely to collide with sober pedestrians, and those driven by drivers who had been drinking were most likely to collide with pedestrians who had been drinking (Table 2.7.5). This simply indicates that drivers and pedestrians are likely to have been drinking at the same times of day, or night.

Table 2.7.5
Blood Alcohol Concentration of Drivers and Fatally Injured Pedestrians in South Australia 1991-1997 (Numbers of Cases)

Driver BAC (g/100mL)	Pedestrian BAC (g/100mL) Zero	.001-.049	.050+	Unknown	Total
Zero	97	3	39	11	**150**
.001-.049	3	-	2	-	**5**
.050+	8	2	10	1	**21**
Unknown	4	-	10	1	**15**
Total	**112**	**5**	**61**	**13**	**191**

Note: the BAC of the driver who hit 2 pedestrians is counted twice in this Table

2.8 Pedestrian Actions

Most of the pedestrians were attempting to cross the road when they were hit by a vehicle, as shown in Table 2.8.1. There was a slightly higher percentage attempting to cross from the driver's left compared to crossing from the driver's right, which may reflect the better sight distance in the latter case. Pedestrians who were hit when walking on the road were much more likely to have been walking with their back to the traffic rather than facing it. About one eighth of these pedestrians were standing on the road, or lying or sitting on the road, at the time of the collision. Some pedestrians were not on the roadway itself but were struck by an out of control vehicle which left the carriageway. Four unusual cases are grouped together here as "other".

Table 2.8.1
Actions of Fatally Injured Pedestrians
at Time of Accident
South Australia 1991-1997

Action	Number	Per cent
Crossing from driver's left	69	37.1
Crossing from driver's right	62	33.3
On road with traffic	13	7.0
On road against traffic	3	1.6
Standing on road	10	5.4
Lying/sitting on road	12	6.5
Next to road	13	7.0
Other	4	2.2
Unknown	5	-
Total	**191**	**100.0**

Table 2.8.2 shows the age and action of the pedestrian. It can be seen that children and the elderly were more likely to have been attempting to cross the road than were pedestrians in the 15 to 64 year age group. One of the reasons for this difference can be seen in Table 2.8.3.

Table 2.8.2
Actions of Fatally Injured Pedestrians
by Age at Time of Accident
South Australia 1991-1997
(Number of Cases)

Action	Age (Years)		
	0-14	15-64	65+
Crossing from driver's left	6	24	39
Crossing from driver's right	11	24	27
On road with traffic	-	12	1
On road against traffic	-	2	1
Standing on road	-	8	2
Lying/sitting on road	-	11	1
Next to road	2	8	3
Other	-	3	1
Unknown	-	4	1
Total	**19**	**96**	**76**

Most of the pedestrians who were walking along the road with the traffic, or standing or lying on the road, had been drinking and most of them had very high blood alcohol levels (Table 2.8.3). It is also interesting to note that the proportion of pedestrians with a very high BAC was greater among those who were attempting to cross the road from the driver's right than from his or her left. In other words, the severely intoxicated pedestrian appeared to be particularly likely to walk, or perhaps "stagger", across the road into the path of a vehicle approaching from the pedestrian's left, with the risk of a collision resulting possibly being increased even further by the driver assuming that the pedestrian would wait until it was safe to continue crossing the road.

Table 2.8.3
Blood Alcohol Concentration by Actions of Adult Pedestrians Fatally Injured in Accidents in South Australia 1991-1997
(Number of Cases)

Action	BAC (g/100mL)		
	Zero	.001-.149	.150+
Crossing from driver's left	44	5	7
Crossing from driver's right	27	5	16
On road with traffic	3	2	8
On road against traffic	3	-	-
Standing on road	4	2	4
Lying/sitting on road	1	-	11
Next to road	9	2	-
Other	2	-	1
Unknown	2	-	3
Total	**95**	**16**	**50**

Adult is defined as over 14 years of age.
Note: 11 pedestrians over 14 years old had an unknown BAC.

2.9 Visual Obstructions

There was no recorded obstruction to the driver's view of the pedestrian in almost three quarters of these fatal pedestrian accidents (Table 2.9.1). Other vehicles, either in the traffic lane or parked at the side of the road, accounted for three quarters of those obstructions to vision that were reported.

Table 2.9.1
Visual Obstructions
for Drivers Involved in Fatal Pedestrian Accidents
in South Australia 1991-1997

Visual Obstruction	Number	Per cent
No obstruction	130	73.4
Vehicle in traffic lane	23	13.0
Parked vehicle	13	7.3
Trees or bushes	8	4.5
Other physical obstruction	3	1.7
Unknown	13	-
Total	**190**	**100.0**

2.10 Vehicle Characteristics

Almost all of these fatal pedestrian accidents involved only one vehicle (Table 2.10.1). In the accidents involving more than one vehicle, there were six cases where the pedestrian was struck sequentially by two vehicles, and one case where the pedestrian was struck sequentially by three vehicles. Two pedestrian were struck by a vehicle which was out of control following a collision, one involving two vehicles, the other five vehicles. The remainder of this section considers only the vehicle that struck the pedestrian, or the first such vehicle if there was more than one.

Table 2.10.1
Number of Vehicles Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Number of Vehicles	Number	Per cent
1	181	95.3
2	7	3.7
3	1	0.5
5	1	0.5
Total	**190**	**100.0**

Eighty per cent of the vehicles involved in these fatal pedestrian accidents were passenger cars or passenger car derivatives (station wagons and utilities) (Table 2.10.2). Most of the remaining vehicles were trucks or vans used for commercial purposes. The five cases in which the vehicle type was unknown were all hit-run accidents.

Table 2.10.2
Types of Vehicle Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Type of Vehicle	Number	Per cent
Passenger car	117	63.2
Station wagon	24	13.0
Utility	8	4.3
Large articulated truck	7	3.8
Small truck	7	3.8
Large truck	6	3.2
Motorcycle	5	2.7
Van	5	2.7
Bus	3	1.6
Four wheel drive	2	1.1
Bicycle	1	0.5
Unknown	5	-
Total	**190**	**100.0**

The make of the striking vehicle is listed in Table 2.10.3. The distribution of makes does not appear to have any particular significance other than being generally consistent with the relative numbers on the road.

Table 2.10.3
Makes of Vehicle Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Make of Vehicle	Number	Per cent
Holden	38	20.5
Ford	29	15.7
Toyota	25	13.5
Nissan	20	10.8
Mitsubishi	19	10.3
Chrysler	14	7.6
Mazda	8	4.3
Other	32	17.3
Unknown	5	-
Total	**190**	**100.0**

The ages of the vehicles involved in these fatal pedestrian accidents are shown in Table 2.10.4. The mean age was 11.8 years and the median age was 11 years, both measures being similar to those of the vehicle fleet in general.

Table 2.10.4
Ages of Vehicles Involved in Fatal Pedestrian Accidents in South Australia 1991-1997

Age of Vehicle (years)	Number	Per cent
0	4	2.3
1	8	4.6
2	8	4.6
3	4	2.3
4	3	1.7
5	6	3.4
6	12	6.9
7	11	6.3
8	6	3.4
9	7	4.0
10	12	6.9
11	10	5.7
12	10	5.7
13	8	4.6
14	5	2.9
15	8	4.6
16	7	4.0
17	5	2.9
18	9	5.2
19	2	1.1
20	8	4.6
21	5	2.9
22	1	0.6
23	2	1.1
24	5	2.9
25	1	0.6
26	1	0.6
27	3	1.7
28	1	0.6
30	1	0.6
34	1	0.6
Unknown	16	-
Total	**190**	**100.0**

Table 2.10.5 shows the number of occupants in the vehicles involved in these fatal pedestrian accidents. In three cases there was no occupant at the time of the accident. Two of these three cases involved a parked vehicle that rolled down a slope and struck the pedestrian, and the third was a vehicle that was being towed when it struck the pedestrian.

Table 2.10.5
Number of Occupants in Vehicles
Involved in Fatal Pedestrian Accidents
in South Australia 1991-1997

Number of Occupants	Number	Per cent
0	3	1.7
1	123	68.0
2	41	22.7
3	7	3.9
4	4	2.2
5	1	0.6
7	1	0.6
12	1	0.6
Unknown	9	-
Total	**190**	**100.0**

There were 16 cases in which a bull bar was fitted to the front of the vehicle which hit the pedestrian (Table 2.10.6). Three quarters of these cases involved a commercial vehicle (Table 2.10.7).

Table 2.10.6
Bull Bars on Vehicles
Involved in Fatal Pedestrian Accidents
in South Australia 1991-1997

Bull Bar Fitted	Number	Per cent
Yes	16	8.8
No	165	91.2
Unknown	9	-
Total	**190**	**100.0**

Table 2.10.7
Types of Vehicles with Bullbars Fitted and
Involved in Fatal Pedestrian Accidents
in South Australia 1991-1997

Type of Vehicle	Number	Per cent
Articulated heavy vehicle	6	37.5
Rigid truck	4	25.0
Four wheel drive	3	18.8
Light van	2	12.5
Passenger car	1	6.3
Total	**16**	**100.0**

In two of the 16 cases in which the striking vehicle was fitted with a bull bar the pedestrian was not struck by the bar. The presence of the bull bar probably adversely affected the outcome of the collision in two cases, and possibly did so in a further four. In other words, those pedestrians may not have been fatally injured had the vehicle not been fitted with a bull bar. In the remaining eight cases the bull bar did not affect the outcome, mostly because the impact speed was very high. In some of those eight cases the injuries sustained by the pedestrian were clearly related to the bull bar.

2.11 Pedestrian and Vehicle Impacts

Table 2.11.1 shows the location on the vehicle of the initial impact with the fatally injured pedestrian. The great majority (84%) were struck by the front of the vehicle, as would be expected. About 9 per cent of the pedestrians were run over by the vehicle when they were sitting or lying on the roadway.

Table 2.11.1
Point of Impact on Vehicle
for Pedestrians Fatally Injured in Accidents
in South Australia 1991-1997

Impact Point on Vehicle	Number	Per cent
Front centre	41	23.6
Front right side or corner	48	27.6
Front left side or corner	57	32.8
Right side	2	1.1
Left side	8	4.6
Rear	2	1.1
Under wheels	16	9.2
Unknown	17	-
Total	**191**	**100.0**

The most significant head impact points for these fatally injured pedestrians are shown in Table 2.11.2. The most common head impact point (where there was one and it could be identified) was the windscreen of the vehicle followed by the bonnet and windscreen frame, including the A-pillar (at either side of the windscreen). The road surface was rarely the most significant object struck by the head of the pedestrian.

Table 2.11.2
Head Impact Point for
Pedestrians Fatally Injured in Accidents
in South Australia 1991-1997

Head Impact Point on Vehicle	Number	Per cent
Windscreen	50	50.5
Bonnet	13	13.1
Windscreen frame	10	10.1
A-Pillar	5	5.1
Bull bar	5	5.1
Under wheels	4	4.0
Other vehicle part	3	3.0
Road surface	9	9.1
No head impact	38	-
Unknown	54	-
Total	**191**	**100.0**

2.12 Vehicle Movements and Speeds

The vehicle that struck the pedestrian was moving straight ahead in 89 per cent of the cases (Table 2.12.1). Changing lanes was the most common of the remaining manoeuvres. The five unknown cases refer to hit-run collisions.

Table 2.12.1
Vehicle Movements
in Fatal Pedestrian Accidents
in South Australia 1991-1997

Motion	Number	Per cent
Straight ahead	165	89.2
Changing lanes	8	4.3
Turning left	4	2.2
Turning right	3	1.6
Reversing	2	1.1
Out of control	2	1.1
Starting engine in gear	1	0.5
Unknown	5	-
Total	**190**	**100.0**

Just over 40 per cent of the drivers of the vehicles that struck a pedestrian were known to have been able to brake before the impact (Table 2.12.2). This does not necessarily mean that the impact speed was the travelling speed in the remaining 59 per cent of known cases because there were some cases in which the vehicle which struck the pedestrian was accelerating or was out of control following a collision with another vehicle.

Table 2.12.2
Pre-Impact Braking of Vehicles
Involved in Fatal Pedestrian Accidents
in South Australia 1991-1997

Pre-Impact Braking	Number	Per cent
Yes	74	41.3
No	105	58.7
Unknown	11	-
Total	**190**	**100.0**

The travelling speeds shown in Table 2.12.3 are for all of the case vehicles regardless of the speed limit at the location of the accident. Nearly 65 per cent of the vehicles were thought to have been travelling at a speed of 60 km/h or less. It should be noted that the travelling speeds were derived from information in the Coroner's file. In some cases reliance had to be placed on the driver's estimate of his or her travelling speed, which may have been less than the actual speed, particularly if the latter was above the speed limit.

Table 2.12.3
Vehicle Travelling Speeds
in Fatal Pedestrian Accidents
in South Australia 1991-1997

Travelling Speed (km/h)	Number	Per cent
<11	6	3.4
11-20	8	4.5
21-30	4	2.3
31-40	10	5.6
41-50	16	9.0
51-60	71	40.1
61-70	20	11.3
71-80	17	9.6
81-90	9	5.1
91-100	10	5.6
101-110	4	2.3
111-120	1	0.6
121-130	1	0.6
Unknown	13	-
Total	**190**	**100.0**

Whereas an estimate of the travelling speed of the striking vehicle was available in more than 93 per cent of the cases, a similar estimate of the speed of the vehicle on impact could only be obtained in 78 per cent (Table 2.12.4). The impact speed was estimated to have been at or below 60 km/h in 70 per cent of the known cases and at or below 40 km/h in 28 per cent.

Table 2.12.4
Vehicle Impact Speeds
in Fatal Pedestrian Accidents
in South Australia 1991-1997

Impact Speed (km/h)	Number	Per cent
<11	7	4.7
11-20	8	5.4
21-30	10	6.8
31-40	17	11.5
41-50	22	14.9
51-60	40	27.0
61-70	13	8.8
71-80	18	12.2
81-90	6	4.1
91-100	4	2.7
101-110	3	2.0
Unknown	42	-
Total	**190**	**100.0**

Since 74 per cent of the fatal pedestrian crashes occurred in 60 km/h speed zones (See Table 2.15.3 later in this report), the travelling and impact speeds of vehicles involved in pedestrian collisions in 60 km/h zones are of particular interest. As shown in Table 2.12.5, 9 per cent of these vehicles were exceeding the limit by up to 10 km/h and a further 8 per cent by more than 10 km/h.

Table 2.12.5
Vehicle Travelling Speeds
in Fatal Pedestrian Accidents in 60 km/h Speed Zones
in South Australia 1991-1997

Travelling Speed (km/h)	Number	Per cent
<11	4	3.1
11-20	6	4.7
21-30	3	2.4
31-40	9	7.1
41-50	16	12.6
51-60	68	53.5
61-70	11	8.7
71-80	3	2.4
81-90	0	-
91-100	4	3.1
101-110	1	0.8
111-120	1	0.8
121-130	1	0.8
Unknown	8	-
Total	**135**	**100.0**

Younger drivers, under 30 years of age, were seven times more likely to have been exceeding the 60 km/h speed limit than were older drivers (Table 2.12.6).

Table 2.12.6
Travelling Speed and Age of Drivers
Involved in Fatal Pedestrian Accidents
in 60 km/h Speed Zones
in South Australia 1991-1997

Speed (km/h)	Driver Age (years)		
	<30	30+	Unknown
<61	51	53	2
61+	18	2	1
Unknown	2	3	3
Total	**71**	**58**	**6**

Table 2.12.7 shows the distribution of impact speeds of the vehicles that struck a pedestrian in 60 km/h speed limit zones. Eighty eight per cent of the vehicles were travelling at or below 60 km/h on impact and 35 per cent at or below 40 km/h.

Table 2.12.7
Vehicle Impact Speeds
in Fatal Pedestrian Accidents in 60 km/h Speed Zones
in South Australia 1991-1997

Impact Speed (km/h)	Number	Per cent
0-10	5	4.7
11-20	7	6.6
21-30	9	8.5
31-40	16	15.1
41-50	19	17.9
51-60	37	34.9
61-70	6	5.7
71-80	4	3.8
81-90	1	0.9
91-100	2	1.9
Unknown	29	-
Total	**135**	**100.0**

2.13 When the Accidents Happened

The number of fatal pedestrian accidents per year in South Australia from 1991 to 1997 is shown in Table 2.13.1. The annual number of cases ranged from 20 to 40 but this variation is likely to be due largely to chance. It is not repeated in the distribution of the annual number of pedestrians who were seriously injured (Table 3.12.1). A similar comment applies to the monthly distributions of fatal and severe pedestrian accidents (Tables 2.13.2 and 3.12.2).

Table 2.13.1
Year of Occurrence of Fatal Pedestrian Accidents in South Australia 1991-1997

Year	Number	Per cent
1991	23	12.1
1992	28	14.7
1993	26	13.7
1994	29	15.3
1995	40	21.1
1996	24	12.6
1997	20	10.5
Total	**190**	**100.0**

Table 2.13.2
Month of Occurrence of Fatal Pedestrian Accidents in South Australia 1991-1997

Month	Number	Per cent of total	Per cent normalised
January	18	9.5	9.3
February	14	7.4	7.9
March	17	8.9	8.8
April	15	7.9	8.0
May	23	12.1	11.9
June	19	10.0	10.1
July	16	8.4	8.3
August	13	6.8	6.7
September	17	8.9	9.1
October	8	4.2	4.1
November	11	5.8	5.9
December	19	10.0	9.8
Total	**190**	**100.0**	**100.0**

Note: The "per cent normalised" takes into account differences in the number of days in the month.

The daily number of fatal pedestrian accidents increased from Monday to Friday and then decreased on Saturday and Sunday (Table 2.13.3). This was similar to the day of week distribution of severe but non fatal pedestrian accidents (Table 3.12.3).

Table 2.13.3
Day of Week of Fatal Pedestrian Accidents in South Australia 1991-1997

Day of Week	Number	Per cent
Monday	12	6.3
Tuesday	24	12.6
Wednesday	33	17.4
Thursday	32	16.8
Friday	40	21.1
Saturday	31	16.3
Sunday	18	9.5
Total	**190**	**100.0**

The hour of day at which these fatal pedestrian accidents occurred is shown in Table 2.13.4. Once again, reference to the similar Table (3.12.4) for serious pedestrian accidents, and the related information, gives a more reliable indication of the distribution of pedestrian accidents by hour of day.

Table 2.13.4
Hour of Day of Fatal Pedestrian Accidents
in South Australia 1991-1997

Hour of Day	Number	Per cent
12.00-12.59 am	5	2.6
01 am	8	4.2
02 am	4	2.1
03 am	5	2.6
04 am	3	1.6
05 am	1	0.5
06 am	2	1.1
07 am	2	1.1
08 am	8	4.2
09 am	9	4.7
10 am	10	5.3
11 am	7	3.7
12 pm	5	2.6
01 pm	8	4.2
02 pm	4	2.1
03 pm	12	6.3
04 pm	12	6.3
05 pm	13	6.8
06 pm	22	11.6
07 pm	9	4.7
08 pm	13	6.8
09 pm	12	6.3
10 pm	9	4.7
11 pm	7	3.7
Total	**190**	**100.0**

2.14 Where the Accidents Happened

Eighty five per cent of these fatal pedestrian accidents occurred in either the Adelaide metropolitan area or in rural towns (Table 2.14.1).

Table 2.14.1
Location of Fatal Pedestrian Accidents
in South Australia 1991-1997

Location of Accident	Number	Per cent
Adelaide metropolitan	149	78.4
Rural town	13	6.8
Rural outside town	28	14.7
Total	**190**	**100.0**

The geographical distribution of fatal pedestrian accidents in South Australia is shown in Section 4 of this report.

2.15 Road Characteristics

Table 2.15.1 shows the class of road on which the fatal pedestrian accidents occurred. The "other" location category includes a driveway, road works, and three accidents in car parks. Note that, for the whole State, 79 per cent of the cases occurred on arterial roads or highways/expressways. In the Adelaide metropolitan area this percentage was even greater, at 83 per cent (Table 2.15.2).

Table 2.15.1
Class of Road of Fatal Pedestrian Accidents in South Australia 1991-1997

Class of Road	Number	Per cent
Arterial road	134	70.5
Local street	35	18.4
Rural highway	15	7.9
Expressway	1	0.5
Other	5	2.6
Total	**190**	**100.0**

Table 2.15.2
Class of Road of Fatal Pedestrian Accidents in the Adelaide Metropolitan Area 1991-1997

Class of Road	Number	Per cent
Arterial road	123	82.6
Local street	22	14.8
Other	4	2.7
Total	**149**	**100.0**

Consistent with the distribution shown in Table 2.14.1, almost three quarters of these accidents happened in 60 km/h speed limit zones (Table 2.15.3).

Table 2.15.3
Speed Limit at the Site of Fatal Pedestrian Accidents in South Australia 1991-1997

Speed Limit (km/h)	Number	Per cent
<60	1	0.5
60	135	73.8
70	2	1.1
80	19	10.4
90	1	0.5
100	10	5.5
110	15	8.2
Unknown	7	-
Total	**190**	**100.0**

Almost all (94 per cent) of these fatal pedestrian accidents occurred on straight roads (Table 2.15.4), reflecting the general topography of much of South Australia, particularly the major part of the Adelaide metropolitan area.

Table 2.15.4
Road Alignment of Fatal Pedestrian Accidents
in South Australia 1991-1997

Road Alignment	Number	Per cent
Straight	174	94.1
Horizontal curve	10	5.4
Horizontal and vertical curve	1	0.5
Not applicable	4	-
Not recorded	1	-
Total	**190**	**100.0**

More than 80 per cent of these cases occurred on mid-block sections of road rather than at intersections, as shown in Table 2.15.5.

Table 2.15.5
Road Layout of Fatal Pedestrian Accidents
in South Australia 1991-1997

Road Layout	Number	Per cent
Mid-block	152	80.4
Intersection	33	17.5
Car park	3	1.6
Driveway	1	0.5
Not recorded	1	-
Total	**190**	**100.0**

A median or pedestrian refuge was present at the location of just over half of these fatal pedestrian accidents (Table 2.15.6). This is consistent with the very high proportion of these case which occurred on arterial roads (Table 2.15.2).

Table 2.15.6
Presence of Median or Refuge
at Fatal Pedestrian Accident Locations
in South Australia 1991-1997

Median or Refuge	Number	Per cent
Present	95	51.9
Not present	88	48.1
Not applicable	4	-
Unknown	3	-
Total	**190**	**100.0**

Despite the provision of median strips or refuges, some arterial roads consist of more than two lanes in one direction, which makes it difficult for pedestrians, particularly the aged and infirm, to cross safely. At about one third of the locations studied here, a pedestrian would have had to cross three or more traffic lanes before reaching either the other side of the road or the median strip, if present (Tables 2.15.7 and 2.15.8).

Table 2.15.7
Number of Lanes
at Fatal Pedestrian Accident Locations
in South Australia 1991-1997

Number of Lanes*	Number	Per cent
1	19	10.6
2	105	58.3
3	29	16.1
4	24	13.3
5	1	0.6
6	1	0.6
7	1	0.6
Unknown	10	-
Total	**190**	**100.0**

* the number of lanes the pedestrian needed to cross before being off the roadway

Table 2.15.8
Number of Lanes at Fatal Pedestrian Accident Locations
With a Median or Pedestrian Refuge
in South Australia 1991-1997

Number of Lanes*	Number	Per cent
1	5	5.3
2	56	59.6
3	26	27.7
4	6	6.4
6	1	1.1
Unknown	1	-
Total	**95**	**100.0**

* the number of lanes the pedestrian needed to cross before being off the roadway

In the four cases that occurred at pedestrian crossings, two were due to the pedestrian walking against the red signal, and two were due to the vehicle failing to stop at the red signal (Table 2.15.9).

Table 2.15.9
Traffic Controls at the Site of Fatal Pedestrian Accidents
in South Australia 1991-1997

Traffic Controls	Number	Per cent
None	175	92.1
Traffic signals at intersection	10	5.3
Pedestrian crossing signals	4	2.1
Stop sign	1	0.5
Total	**190**	**100.0**

2.16 Lighting Conditions

About half of these fatal pedestrian accidents occurred in daylight (Table 2.16.1). Of those that occurred at night, less than half were at locations where there was adequate street lighting, as shown in Table 2.16.2. The street lighting was classed as being inadequate if there was a reference to that effect in the Coroner's or police reports. When looking only at night-time pedestrian accidents on arterial roads (Table 2.16.3) the proportion of crashes at locations with adequate street lighting was greater but still only just over half.

Table 2.16.1
Natural Light at the Site of Fatal Pedestrian Accidents in South Australia 1991-1997

Natural Light	Number	Per cent
Day	93	49.2
Night	85	45.0
Dusk	9	4.8
Dawn	2	1.1
Unknown	1	-
Total	**190**	**100.0**

Table 2.16.2
Artificial Lighting at the Site of Night-Time Fatal Pedestrian Accidents in South Australia 1991-1997

Artificial Lighting	Number	Per cent
Street lighting: adequate	39	46.4
Street lighting: inadequate	18	21.4
No artificial lighting	27	32.1
Unknown	1	-
Total	**85**	**100.0**

Table 2.16.3
Artificial Lighting at the Site of Night-Time Fatal Pedestrian Accidents on Arterial Roads in South Australia 1991-1997

Artificial Lighting	Number	Per cent
Street lighting: adequate	31	55.4
Street lighting: inadequate	13	23.2
No artificial lighting	12	21.4
Total	**56**	**100.0**

2.17 Weather Conditions

Inclement weather may have been a relevant factor in a small number of these fatal pedestrian accidents but in general the weather conditions reflected the reputation of South Australia as being the driest state on the driest continent (Table 2.17.1).

Table 2.17.1
Weather Conditions at the Time and Site of Fatal Pedestrian Accidents in South Australia 1991-1997

Weather Conditions	Number	Per cent
Dry	168	89.4
Raining	13	6.9
Road wet, not raining	7	3.7
Unknown	2	-
Total	**190**	**100.0**

3. SERIOUS PEDESTRIAN ACCIDENTS IN SOUTH AUSTRALIA

This Chapter examines the characteristics of pedestrians admitted to hospital as the result of an accident in South Australia and is based on the information recorded in police reports on road accidents for the years 1986-1996.

3.1 Source of Data

When a road accident occurs in South Australia, the operators of the motor vehicles involved are required to report the accident to the police, in all but minor property damage cases. The data collected is limited to the fields on the report forms and the reliability of the information is determined by the reports of the participants in the accident and the police, in serious cases. In due course, the police accident report forms are forwarded to Transport SA where the information is entered into the Traffic Accident Reporting System (TARS) database.

3.2 Method of Analysis

TARS data for the years 1986-1996 was obtained from Transport SA for analysis.

The TARS data file consists of three levels of information. Information on the accident is held in the accident file. Under this is the unit file which records information on each unit involved in the accident (a unit may be a vehicle, pedestrian, animal or a roadside hazard). Finally the casualty file records information on each casualty for each unit.

Since interactions between units involved in the accident are not recorded in the database, there is no way to tell in pedestrian accidents that involved more than one vehicle which vehicles actually came into contact with a particular pedestrian. Therefore analysis of vehicle and driver factors had to be limited to single vehicle pedestrian accidents. An extension to the TARS database that allowed interactions between vehicles and other kinds of units to be recorded would allow investigations such as the present one to be much more relevant.

Accidents that involved at least one pedestrian being admitted to hospital (and not dying within 30 days) were selected from the database. Vehicle and driver data was also extracted in single vehicle accidents. Pedestrian data was extracted for all pedestrians who were admitted to hospital.

A total of 2,295 pedestrian accidents in which at least one pedestrian was admitted to hospital occurred in South Australia between the years 1986 and 1996, inclusive. Table 3.2.1 shows the total number (2,339) of pedestrians admitted to hospital from these accidents.

Table 3.2.1
Number of Pedestrians Admitted to Hospital per Pedestrian Accident* in South Australia 1986-1996

No. of Pedestrians Admitted per Accident	Number of Accidents	Number of Pedestrians
1	2256	2256
2	36	72
3	1	3
4	2	8
Total	**2295**	**2339**

*A pedestrian accident is defined here as one in which at least one pedestrian was admitted to hospital and survived for at least 30 days after the accident.

3.3 Pedestrian Demographics

Table 3.3.1 shows the sex of pedestrians admitted to hospital in South Australia between 1986 and 1996. The majority were males with the percentage being virtually the same as that for pedestrian fatalities (60.9% vs 61.3% respectively).

Table 3.3.1
Sex of Pedestrians Seriously Injured in Accidents in South Australia 1986-1996

Sex	Number	Per cent
Male	1419	60.9
Female	912	39.1
Unknown	8	-
Total	**2339**	**100.0**

The age distribution of seriously injured pedestrians is shown in Table 3.3.2. Over one quarter were less than 15 years of age but only 15 per cent were over 64 years of age. Thirty eight per cent were in the 15 to 34 age group.

Table 3.3.2
Age of Pedestrians Seriously Injured in Accidents in South Australia 1986-1996

Age (Years)	Number	Per cent
0-4	97	4.8
5-9	201	10.0
10-14	221	11.0
15-19	298	14.8
20-24	219	10.9
25-29	128	6.4
30-34	124	6.2
35-39	86	4.3
40-44	71	3.5
45-49	72	3.6
50-54	55	2.7
55-59	69	3.4
60-64	65	3.2
65-69	75	3.7
70-74	64	3.2
75-79	73	3.6
80-84	59	2.9
85-89	30	1.5
90-94	7	0.3
95+	1	0.0
Unknown	324	-
Total	**2339**	**100.0**

The age distributions of seriously injured pedestrian were very similar for both males and females (Table 3.3.3), apart from a much higher proportion of females than males above 65 years of age (22% compared with 10%).

Table 3.3.3
Age and Sex of Pedestrians Seriously Injured in Accidents in South Australia 1986-1996

Age (Years)	Males (Number)	Females (Number)	Males (Per cent)	Females (Per cent)
0-4	60	37	4.8	4.8
5-9	136	65	11.0	8.4
10-14	122	99	9.8	12.8
15-19	185	113	14.9	14.6
20-24	150	69	12.1	8.9
25-29	87	41	7.0	5.3
30-34	87	37	7.0	4.8
35-39	59	26	4.8	3.4
40-44	49	22	3.9	2.8
45-49	49	23	3.9	3.0
50-54	38	17	3.1	2.2
55-59	43	26	3.5	3.4
60-64	41	24	3.3	3.1
65-69	39	36	3.1	4.7
70-74	30	34	2.4	4.4
75-79	28	45	2.3	5.8
80-84	24	35	1.9	4.5
85-89	9	21	0.7	2.7
90-94	5	2	0.4	0.3
95+	1	-	0.1	-
Unknown	177	140	-	-
Total	**1419**	**912**	**100.0**	**100.0**

Note: the sex of 8 pedestrians was unknown

3.4 Pedestrian Alcohol Use

While blood alcohol concentrations of pedestrians are recorded in the TARS database (Table 3.4.1), a large percentage (56%) is unknown. This limits the reliability of the distribution as a measure of the BACs of all pedestrian hospital admissions. However, given these limitations, it was found that about 40 per cent of the seriously injured pedestrians had a positive BAC. This is slightly higher than for fatalities (37%) but it is suspected that a larger proportion of the missing serious injury BAC readings were zero, meaning that in reality the percentage positive would be lower. This conclusion is reinforced by the lower mean BAC of 0.170 and median BAC of 0.177 for serious injury cases compared to the mean for fatalities of 0.213 and median of 0.233 g/100mL.

Table 3.4.1
Blood Alcohol Concentration
of Pedestrians Seriously Injured in Accidents
in South Australia 1986-1996

BAC (g/100mL)	Number	Per cent
Zero	611	59.8
.001 - .049	44	4.3
.050 - .099	46	4.5
.100 - .149	68	6.7
.150 - .199	92	9.0
.200 - .249	93	9.1
.250 - .299	43	4.2
.300 - .349	22	2.2
.350 - .399	2	0.2
Unknown	1318	-
Total	**2339**	**100.0**

As was the case for fatalities, seriously injured male pedestrians were much more likely than females to have been drinking, and those males who had been drinking had much higher BAC levels than did the female pedestrians (Table 3.4.2).

Table 3.4.2
Blood Alcohol Concentration and Sex
of Pedestrians Seriously Injured in Accidents
in South Australia 1986-1996

BAC (g/100mL)	Males (Number)	Females (Number)	Males (Per cent)	Females (Per cent)
Zero	307	302	47.1	82.3
.001 - .049	32	12	4.9	3.3
.050 - .099	33	13	5.1	3.5
.100 - .149	54	14	8.3	3.8
.150 - .199	85	7	13.0	1.9
.200 - .249	80	13	12.3	3.5
.250 - .299	39	4	6.0	1.1
.300 - .349	21	1	3.2	0.3
.350 - .399	1	1	0.2	0.3
Unknown	767	545	-	-
Total	**1419**	**912**	**100.0**	**100.0**

Note: the sex of 8 pedestrians was unknown

Table 3.4.3 gives the breakdown of blood alcohol concentration by both the age and sex of the fatally injured pedestrian. It can be seen that almost all of the elderly pedestrians were sober at the time of the accident. Very high blood alcohol levels (.150 and above) were observed among male pedestrians over a wide age range, but notably from the late teens to about 50 years of age. Female pedestrians with very high BACs were concentrated in the 20 to 34 year age range.

Table 3.4.3
Age, Sex and Blood Alcohol Concentration of Pedestrians Seriously Injured in Accidents in South Australia 1986-1996 (Numbers of Cases)

Age (Years)	Sex of Pedestrian					
	Male			Female		
	BAC (g/100mL)			BAC (g/100mL)		
	Zero	.001-.149	.150+	Zero	.001-.149	.150+
0-4	-	-	-	1	-	-
5-9	1	-	1	1	1	-
10-14	9	2	1	8	1	-
15-19	58	23	24	53	6	1
20-24	28	27	38	21	6	8
25-29	15	7	31	18	3	6
30-34	23	10	24	9	4	3
35-39	18	4	16	9	1	2
40-44	11	7	14	14	1	-
45-49	13	5	13	8	2	2
50-54	12	6	7	11	-	-
55-59	15	5	8	14	-	-
60-64	16	-	9	12	3	-
65-69	13	3	5	19	-	-
70-74	10	2	3	19	1	-
75-79	9	4	2	16	1	-
80-84	7	2	-	16	1	-
85-89	7	-	-	8	-	-
90-94	2	-	-	-	-	-
Total	**267**	**107**	**196**	**257**	**31**	**22**

3.5 Pedestrian Injuries

Data on the injuries sustained by seriously injured pedestrians was collected and entered into the TARS database up until 1992 when the practice stopped. The information that is available shows that multiple injuries were the most common followed by injuries to the limbs and the head (Table 3.5.1).

Table 3.5.1
Injuries to Pedestrians Seriously Injured in Accidents in South Australia 1986-1996

Injuries	Number	Per cent
Multiple	784	50.4
Limbs	379	24.3
Head	220	14.1
Chest/body	79	5.1
Shock	23	1.5
Internal	7	0.4
Neck	7	0.4
Other	58	3.7
Unknown	782	-
Total	**2339**	**100.0**

3.6 Driver Demographics

Since the TARS database does not record interactions between units it is not possible to tell in multiple vehicle accidents which vehicle impacted the pedestrian. Therefore, driver characteristics can only be obtained for the 2,167 single vehicle accidents. In these accidents, the majority of drivers were male (Table 3.6.1) but not to the same extent as drivers in fatal accidents (71% vs 80% for fatalities).

Table 3.6.1
Sex of Drivers Involved in
Single Vehicle Serious Pedestrian Accidents
in South Australia 1986-1996

Sex	Number	Per cent
Male	1451	70.5
Female	607	29.5
Unknown	109	-
Total	**2167**	**100.0**

More than half of the drivers were under 30 years of age and 20 per cent were in the 20-24 year age range (Table 3.6.2). This age distribution is very similar to that for drivers involved in fatal pedestrian accidents and markedly different from that for seriously injured pedestrians (see Table 3.3.2).

Table 3.6.2
Age of Drivers Involved in
Single Vehicle Serious Pedestrian Accidents
in South Australia 1986-1996

Age (Years)	Number	Per cent
10-14	3	0.2
15-19	317	16.5
20-24	385	20.0
25-29	285	14.8
30-34	213	11.1
35-39	193	10.0
40-44	142	7.4
45-49	98	5.1
50-54	70	3.6
55-59	74	3.9
60-64	47	2.4
65-69	36	1.9
70-74	24	1.2
75-79	17	0.9
80-84	17	0.9
85-89	-	-
90-94	-	-
95+	1	0.1
Unknown	245	-
Total	**2167**	**100.0**

The age distributions of male and female drivers involved in serious pedestrian accidents were found to be very similar (Table 3.6.3).

Table 3.6.3
Age and Sex of Drivers Involved in Single Vehicle Serious Pedestrian Accidents in South Australia 1986-1996

Age (Years)	Males (Number)	Females (Number)	Males (Per cent)	Females (Per cent)
10-14	3	-	0.2	-
15-19	220	97	16.5	16.5
20-24	277	108	20.8	18.3
25-29	203	81	15.3	13.8
30-34	152	61	11.4	10.4
35-39	130	63	9.8	10.7
40-44	92	49	6.9	8.3
45-49	61	37	4.6	6.3
50-54	44	26	3.3	4.4
55-59	53	21	4.0	3.6
60-64	34	13	2.6	2.2
65-69	29	7	2.2	1.2
70-74	16	8	1.2	1.4
75-79	7	10	0.5	1.7
80-84	9	8	0.7	1.4
85-89	-	-	-	-
90-94	-	-	-	-
95+	1	-	0.1	-
Unknown	120	18	-	-
Total	**1451**	**607**	**100.0**	**100.0**

Note: the sex of 109 drivers was unknown

3.7 Driver Licence Type

As noted above, the TARS database does not record interactions between units and so it is not possible to tell in multiple vehicle accidents which vehicle impacted the pedestrian. Therefore, driver licensing information is only relevant in the present context for the 2,167 single vehicle accidents. As expected, most drivers were fully licensed (Table 3.7.1). However, nearly 10 per cent of the drivers were on a provisional licence. Given that less than 10 per cent of drivers on the road hold a provisional licence, this suggests that holders of provisional licences are particularly susceptible to being involved in a serious pedestrian accident.

Table 3.7.1
Licence Type of Drivers Involved in Single Vehicle Serious Pedestrian Accidents in South Australia 1986-1996

Licence Type	Number	Per cent
Full licence	1552	88.5
Provisional licence	172	9.8
Learners permit	9	0.5
Unlicensed	21	1.2
Unknown	413	-
Total	**2167**	**100.0**

3.8 Driver Alcohol Use

Only 33 per cent of drivers involved in serious pedestrian accidents had a known blood alcohol concentration. It is likely that most of the missing BACs were zero. However, it is clear in Table 3.8.1 that in most of the cases for which the driver's BAC was measured and recorded it was at very high levels, although not as high as the BACs for the injured pedestrians (see Table 3.4.1).

Table 3.8.1
Blood Alcohol Concentration of Drivers Involved in Single Vehicle Serious Pedestrian Accidents in South Australia 1986-1996

BAC (g/100mL)	Number	Per cent
Zero	655	91.6
.001 - .049	5	0.7
.050 - .099	16	2.2
.100 - .149	13	1.8
.150 - .199	21	2.9
.200 - .249	5	0.7
Unknown	1452	-
Total	**2167**	**100.0**

3.9 Pedestrian Actions

The movement of the pedestrian at the time of the accident is coded in the TARS database according to the categories in Table 3.9.1. Crossing the road at a location where there were no traffic controls was by far the most common movement recorded.

Table 3.9.1
Movement of Pedestrians Seriously Injured in Accidents in South Australia 1986-1996

Movement	Number	Per cent
Crossing road without traffic control	1332	56.9
Walking on road	168	7.2
Between parked vehicles	123	5.3
On pedestrian crossing	84	3.6
Walking on footpath	80	3.4
Crossing with traffic signals	78	3.3
Within 30m of pedestrian crossing	44	1.9
On road against traffic	39	1.7
Playing on road	29	1.2
Pushing/working on vehicle	28	1.2
From a parked vehicle	24	1.0
Other	310	13.3
Total	**2339**	**100.0**

An examination of the pedestrian's movement by the age of the pedestrian revealed some interesting differences. Young pedestrians were more likely than older pedestrians to have been attempting to cross the road at locations having no traffic control, playing on the road, or to have come from between parked vehicles. Middle aged pedestrians were least likely of these three age groups to have been attempting to cross the road in the absence of a traffic control but more likely to have been walking on the road or have been pushing or working on a vehicle. Older pedestrians were more likely than the other age groups to have been on a pedestrian crossing when they were struck by a vehicle (Table 3.9.2).

Table 3.9.2
Movement and Age of Pedestrians Seriously Injured in Accidents in South Australia 1986-1996 (Column Percentages)

Movement	**Age (Years)**		
	0-14	**15-64**	**65+**
Crossing without control	66.1	52.1	61.8
Walking on road	2.9	10.4	5.2
Between parked vehicles	9.6	3.8	3.9
On pedestrian crossing	3.3	3.0	4.9
Walking on footpath	2.3	4.1	4.2
Crossing with traffic signals	1.2	4.0	3.6
Within 30m of pedestrian crossing	1.0	2.0	1.6
On road against traffic	0.4	2.2	1.6
Playing on road	3.9	0.6	-
Pushing/working on vehicle	0.2	1.6	0.3
From a parked vehicle	1.3	1.3	0.6
Other	7.9	14.7	12.3
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**519**	**1187**	**309**

Note: the age of 324 pedestrians was unknown

As was observed with fatally injured pedestrians, alcohol intoxication at very high levels was associated with those seriously injured pedestrians who were struck by a vehicle when walking on the road (Table 3.9.3).

Table 3.9.3
Movement and Blood Alcohol Concentration of Adult (aged 15+) Pedestrians Seriously Injured in Accidents in South Australia 1986-1996 (Column Percentages)

Movement	**BAC (g/100mL)**		
	Zero	**.001-.149**	**.150+**
Crossing without control	60.8	51.5	59.3
Walking on road	6.3	13.4	15.7
Between parked vehicles	5.0	0.7	1.9
On pedestrian crossing	3.8	0.7	2.8
Walking on footpath	2.6	3.7	1.9
Crossing with traffic signals	6.1	3.7	3.2
Within 30m of pedestrian crossing	1.2	1.5	2.8
On road against traffic	1.4	2.2	1.4
Playing on road	0.2	2.2	0.9
Pushing/working on vehicle	1.2	0.7	-
From a parked vehicle	0.4	2.2	0.5
Other	11.1	17.2	9.7
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**505**	**134**	**216**

Note: 641 pedestrians aged 15+ had an unknown BAC

3.10 Vehicle Characteristics

Since the TARS database does not record interactions between units it is not possible to tell in multiple vehicle accidents which vehicle impacted the pedestrian. Therefore, relevant vehicle characteristics can only be reported for the 2,167 single vehicle accidents (see Table 3.10.1). The 128 multiple vehicle accidents will be omitted.

Table 3.10.1
Number of Vehicles Involved in Serious Pedestrian Accidents in South Australia 1986-1996

Number of Vehicles	Number	Per cent
1	2167	94.4
2	102	4.4
3	20	0.9
4	3	0.1
5	3	0.1
Total	**2295**	**100.0**

Cars and car derivatives accounted for about 90 per cent of the vehicles involved in single vehicle serious pedestrian accidents (Table 3.10.2). Motorcycles and trucks also featured to a much lesser extent, as did pedal cycles. The vehicle categories listed may appear to be unusual in some respects (eg: car sedan, car tourer). This is because they have been in the TARS data base for many years without being updated.

No information on bull bars is included in the TARS data base.

Table 3.10.2
Types of Vehicles Involved in Single Vehicle Serious Pedestrian Accidents in South Australia 1986-1996

Type of Vehicle	Number	Per cent
Car sedan	1459	67.3
Station wagon	214	9.9
Utility	116	5.4
Panel van	107	4.9
Motorcycle	63	2.9
Truck	53	2.4
Taxi	33	1.5
Pedal cycle	30	1.4
Omnibus	22	1.0
Semi	14	0.6
Car tourer	4	0.2
Railway vehicle	4	0.2
Forward control van	1	0.0
Tram	1	0.0
Animal drawn vehicle	1	0.0
Other Defined	11	0.5
Other unknown	34	1.6
Total	**2167**	**100.0**

The ages of the vehicles involved in single vehicle serious pedestrian accidents are shown in Table 3.10.3. The mean age was 10.2 years and the median age was 10 years, both measures being similar to those of the vehicle fleet in general and slightly less than for the ages of vehicles involved in fatal pedestrian accidents (fatal mean 11.8 years, median 11 years). This slight variation may be partly due to the year of manufacture of older cars involved in serious pedestrian accidents being more likely to be recorded as "unknown".

Table 3.10.3
Ages of Vehicles Involved in
Single Vehicle Serious Pedestrian Accidents
in South Australia 1986-1996

Age of Vehicle (years)	Number	Per cent
0	40	2.7
1	87	5.9
2	75	5.1
3	73	5.0
4	72	4.9
5	58	3.9
6	80	5.4
7	76	5.2
8	69	4.7
9	100	6.8
10	76	5.2
11	74	5.0
12	74	5.0
13	69	4.7
14	70	4.8
15	70	4.8
16	58	3.9
17	43	2.9
18	47	3.2
19	24	1.6
20	29	2.0
21	27	1.8
22	21	1.4
23	16	1.1
24	11	0.7
25+	30	2.0
Unknown	698	-
Total	**2167**	**100.0**

3.11 Vehicle Movement

Most (86%) of the vehicles involved in these single vehicle serious pedestrian accidents were travelling straight ahead at the time of the accident (Table 3.11.1). A further 3 per cent were also travelling more or less straight ahead but were also overtaking or swerving.

Table 3.11.1
Movements of Vehicles Involved in
Single Vehicle Serious Pedestrian Accidents
in South Australia 1986-1996

Movement of Vehicle	Number	Per cent
Straight ahead	1858	85.7
Reversing	94	4.3
Right turn	62	2.9
Swerving	52	2.4
Left turn	31	1.4
Leaving driveway	28	1.3
Unparking angle	11	0.5
Unparking parallel	7	0.3
U-Turn	5	0.2
Parking Parallel	5	0.2
Overtaking on right	5	0.2
Entering driveway	3	0.1
Parking angle	1	0.0
Overtaking on left	1	0.0
Other	4	0.2
Total	**2167**	**100.0**

The travelling speeds of vehicles involved in accidents are not recorded on the TARS database.

3.12 When the Accidents Happened

From 1986 to 1996, inclusive, the total number of accidents in which at least one pedestrian was admitted to hospital in South Australia was 2,295. Table 3.12.1 shows the number of these accidents each year. There was a general downward trend from 1986. A linear regression line shows an average reduction of 13.7 fewer such accidents each year (R^2 = 0.77). This decline was slightly greater than the decrease in the total number of casualty accidents of all kinds in South Australia over the same general period (Road Accidents in South Australia, 1995; 1998 - Safety Strategy Section, Transport SA).

Table 3.12.1
Year of Occurrence of Serious Pedestrian Accidents and All Casualty Accidents in South Australia 1986-1996

Year	Serious Pedestrian Accidents (P)	All Casualty Accidents (C)	P/C (%)
1986	280	9244	3.03
1987	275	8619	3.19
1988	222	7881	2.82
1989	241	7815	3.08
1990	272	7606	3.58
1991	194	6506	2.98
1992	164	6258	2.62
1993	172	6467	2.66
1994	143	6410	2.23
1995	182	6448	2.82
1996	150	-	
Total	**2295**	-	

The number of serious pedestrian accidents was generally lower in the summer than in the winter months (Table 3.12.2).

Table 3.12.2
Month of Occurrence of Serious Pedestrian Accidents in South Australia 1986-1996

Month	Number	Per cent of total	Per cent normalised
January	154	6.7	6.6
February	147	6.4	6.9
March	202	8.8	8.6
April	200	8.7	8.8
May	195	8.5	8.3
June	211	9.2	9.3
July	207	9.0	8.9
August	225	9.8	9.6
September	179	7.8	7.9
October	206	9.0	8.8
November	190	8.3	8.4
December	179	7.8	7.7
Total	**2295**	**100.0**	**100.0**

Note: The "per cent normalised" takes into account differences in the number of days in the month.

There was a clear trend in the frequency of serious pedestrian accidents by day of week, with the daily number increasing steadily from Sunday to Friday (Table 3.12.3).

Table 3.12.3
Day of Week of Serious Pedestrian Accidents
in South Australia 1986-1996

Day of Week	Number	Per cent
Monday	276	12.0
Tuesday	303	13.2
Wednesday	316	13.8
Thursday	409	17.8
Friday	437	19.0
Saturday	319	13.9
Sunday	235	10.2
Total	**2295**	**100.0**

There are two peaks in the distribution of serious pedestrian accidents by hour of day, one at 8 to 9 am and the other from 3 to 5 pm (Table 3.12.4). The hourly frequency of these accidents is also above average from 11 am to 3 pm and from 5 pm to 9 pm.

Table 3.12.4
Hour of Day of Serious Pedestrian Accidents
in South Australia 1986-1996

Hour of Day	Number	Per cent
12.00-12.59 am	52	2.3
01 am	41	1.8
02 am	38	1.7
03 am	26	1.1
04 am	16	0.7
05 am	15	0.7
06 am	19	0.8
07 am	40	1.7
08 am	110	4.8
09 am	75	3.3
10 am	78	3.4
11 am	99	4.3
12 pm	110	4.8
01 pm	99	4.3
02 pm	106	4.6
03 pm	257	11.2
04 pm	252	11.0
05 pm	207	9.0
06 pm	157	6.8
07 pm	130	5.7
08 pm	105	4.6
09 pm	91	4.0
10 pm	87	3.8
11 pm	85	3.7
Total	**2295**	**100.0**

There is a clear relationship between the time of day at which serious pedestrian accidents occur and the age of the pedestrian, as might be expected (Table 3.12.5). Young pedestrians typically are involved in accidents on the way to school and on the way home from school (based on the time of day distribution). Pedestrians aged between 15 and 64 years have a particularly high accident frequency starting at about 3pm and continuing through to midnight but with significant numbers in the hours after midnight. Older pedestrians are involved in accidents relatively uniformly through the period from 9am to 8pm.

Table 3.12.5
Accident Time and Age of Pedestrians
Seriously Injured in Accidents
in South Australia 1986-1996 (Numbers)

Time of Day	**Age (Years)**		
	0-14	**15-64**	**65+**
12am	-	43	2
01am	1	35	-
02am	-	35	-
03am	-	27	-
04am	-	11	1
05am	-	11	-
06am	-	16	1
07am	12	24	1
08am	43	43	11
09am	4	30	26
10am	10	22	33
11am	20	35	28
12pm	24	48	23
01pm	25	41	20
02pm	28	44	24
03pm	136	69	28
04pm	90	101	33
05pm	59	92	23
06pm	30	89	20
07pm	16	88	17
08pm	8	74	8
09pm	6	71	5
10pm	2	66	3
11pm	5	72	2
Total (N)	519	1187	309

3.13 Where the Accidents Happened

Serious pedestrian accidents were found to be a primarily urban phenomenon due mainly to the much greater number of pedestrians in urban areas (Table 3.13.1). The Adelaide City Council, despite its small area, has a comparatively high proportion (16%) of all serious pedestrian accidents in the State. Almost 18 per cent of the serious pedestrian accidents occurred in rural areas of South Australia.

Table 3.13.1
Location of Serious Pedestrian Accidents
in South Australia 1986-1996

Location of Accident	**Number**	**Per cent**
Adelaide City Council	359	15.6
Adelaide metropolitan	1529	66.6
Rural	407	17.7
Total	**2295**	**100.0**

Table 3.13.2 shows the distribution of serious pedestrian accidents by local government area for those areas in which there were at least two such cases per year. Because of changes due to local government amalgamations during the period covered by the data presented here, some areas are represented under more than one heading.

Table 3.13.2
Local Government Area of Serious Pedestrian Accidents in South Australia 1986-1996
(in areas with at least 2 serious accidents per year)

Local Government Area	Number	Per cent
Adelaide	359	15.64
Port Adelaide Enfield	124	5.40
Woodville	120	5.23
Salisbury	111	4.84
Marion	106	4.62
Mitcham	101	4.40
Noarlunga	90	3.92
West Torrens	90	3.92
Port Adelaide	78	3.40
Unley	69	3.01
Tea Tree Gully	64	2.79
Elizabeth	60	2.61
Campbelltown	49	2.14
Whyalla	44	1.92
Payneham	41	1.79
Burnside	40	1.74
Kensington and Norwood	40	1.74
Prospect	40	1.74
Glenelg	39	1.70
Munno Para	39	1.70
Mount Gambier	35	1.53
Meadows	35	1.53
Thebarton	34	1.48
Port Lincoln	33	1.44
Brighton	28	1.22
St Peters	25	1.09
Port Augusta	24	1.05
Other	377	16.43
Total	**2295**	**100.00**

3.14 Road Characteristics

The TARS database does not code crash locations by the class of road (arterial or local street). However, the individual road that the crash occurred on is designated as being a traditional Transport SA road or a local government road (some of these roads have changed hands since the coding was initiated). This coding is the best estimate available in the TARS database for estimating the proportion of pedestrian crashes on major traffic routes compared to local streets since it can be assumed that Transport SA controls the more major traffic routes.

Table 3.14.1 shows the class of the road for serious pedestrian crashes. It can be seen that more than two thirds of pedestrian crashes happen on Transport SA "major traffic routes". The geographical distribution of serious pedestrian accidents in South Australia shown in Section 4 of this report is consistent with this finding that the great majority of serious pedestrian accidents occur on main roads.

Table 3.14.1
Class of Road and Serious Pedestrian Accidents in South Australia 1986-1996

Road Controlled by	Number	Per cent
Transport SA	1651	71.9
Local Government	644	28.1
Total	**2295**	**100.0**

Table 3.14.2 shows a breakdown of serious pedestrian accidents by class of road and age of the pedestrian. It can be seen that older pedestrians are more likely to be involved in pedestrian accidents on major traffic routes (81% for 65+, 75% for 15-64, and 56% for 0-14 year olds).

Table 3.14.2
Class of Road and Serious Pedestrian Accidents by Age of Pedestrian Seriously Injured in Accidents in South Australia 1986-1996 (numbers)

Road Controlled by	Age of Pedestrian (Years)		
	0-14	**15-64**	**65+**
Transport SA	293	890	249
Local Government	226	297	60
Total (N)	**519**	**1187**	**309**

Nearly 93 per cent of serious pedestrian accidents in South Australia occurred in 60 km/h speed zones (Table 3.14.3). Note that this speed limit data is taken straight from the TARS database so the reasons for the lower speed limits are unknown.

Table 3.14.3
Speed Limit at the Site of Serious Pedestrian Accidents in South Australia 1986-1996

Speed Limit (km/h)	Number	Per cent
5	1	0.0
10	24	1.0
15	2	0.1
20	2	0.1
25	11	0.5
30	3	0.1
40	2	0.1
55	1	0.0
60	2123	92.7
70	8	0.3
80	61	2.7
90	1	0.0
100	11	0.5
110	39	1.7
Unknown	6	-
Total	**2295**	**100.0**

More than two thirds of serious pedestrian accidents happened mid-block rather than at an intersection (Table 3.14.4).

Table 3.14.4
Road Layout at the Site of Serious Pedestrian Accidents in South Australia 1986-1996

Road Layout	Number	Per cent
Mid-block	1576	68.7
Intersection	719	31.3
Total	**2295**	**100.0**

Most mid-block serious pedestrian accidents (57%) happened on undivided roads (Table 3.14.5) and three quarters of the remainder were on divided roads. The cases not included under these two headings occurred either at one of the location types specified or under "other" in the TARS data base. Forty three cases (2.7%) occurred at a pedestrian crossing.

Table 3.14.5
Road Type at the Site of Mid-Block Serious Pedestrian Accidents in South Australia 1986-1996

Mid-block Road Type	Number	Per cent
Not divided	896	56.9
Divided road	507	32.2
Pedestrian crossing	43	2.7
One way	13	0.8
Rail crossing	4	0.3
Ramp on	2	0.1
Other	111	7.0
Total	**1576**	**100.0**

Of the serious pedestrian accidents at intersections, by far the most common intersection type was a T-junction followed by a four way intersection (Table 3.14.6).

Table 3.14.6
Intersection Type at the Site of
Serious Pedestrian Accidents at Intersections
in South Australia 1986-1996

Intersection Type	Number	Per cent
T-Junction	446	62.0
Four way	254	35.3
Multiple	13	1.8
Y-Junction	4	0.6
Interchange	1	0.1
Rail crossing	1	0.1
Total	**719**	**100.0**

3.15 Lighting Conditions

While most (65%) serious pedestrian accidents happened during daylight, more than one third (34%) happened at night with very few cases being coded as having happened at dawn or dusk (Table 3.15.1).

Table 3.15.1
Natural Light at the Site of
Serious Pedestrian Accidents
in South Australia 1986-1996

Natural Lighting	Number	Per cent
Daylight	1497	65.2
Dusk/Dawn	19	0.8
Night	779	33.9
Total	**2295**	**100.0**

3.16 Weather Conditions

Nearly all of the serious pedestrian accidents in South Australia happened when it was not raining (Table 3.16.1). However, this is primarily due to the low rainfall in South Australia. In fact it rains in Adelaide about 4.7 per cent of the hours in a year (McLean and Robinson, 1979) so fatal pedestrian crashes are actually over represented in wet weather. As most rain fall occurs in the winter months, the distribution presented here is consistent with the excess of cases in those months as shown in Table 3.12.2.

Table 3.16.1
Weather Conditions at the Site of
Serious Pedestrian Accidents
in South Australia 1986-1996

Weather Conditions	Number	Per cent
Not raining	2104	91.7
Raining	191	8.3
Total	**2295**	**100.0**

3.17 Number of Pedestrians per Accident

Table 3.17.1 shows the number of pedestrians (regardless of injury level) involved in accidents in which at least one of them was admitted to hospital. Nearly all of the cases were single pedestrian accidents.

Table 3.17.1
Number of Pedestrians Involved in Serious Pedestrian Accidents in South Australia 1986-1996

Number of Pedestrians	Count	Per cent
1	2203	96.0
2	81	3.5
3	6	0.3
4	2	0.1
5	2	0.1
8	1	0.0
Total	**2295**	**100.0**

4. LOCATION OF FATAL AND SERIOUS PEDESTRIAN ACCIDENTS IN SOUTH AUSTRALIA

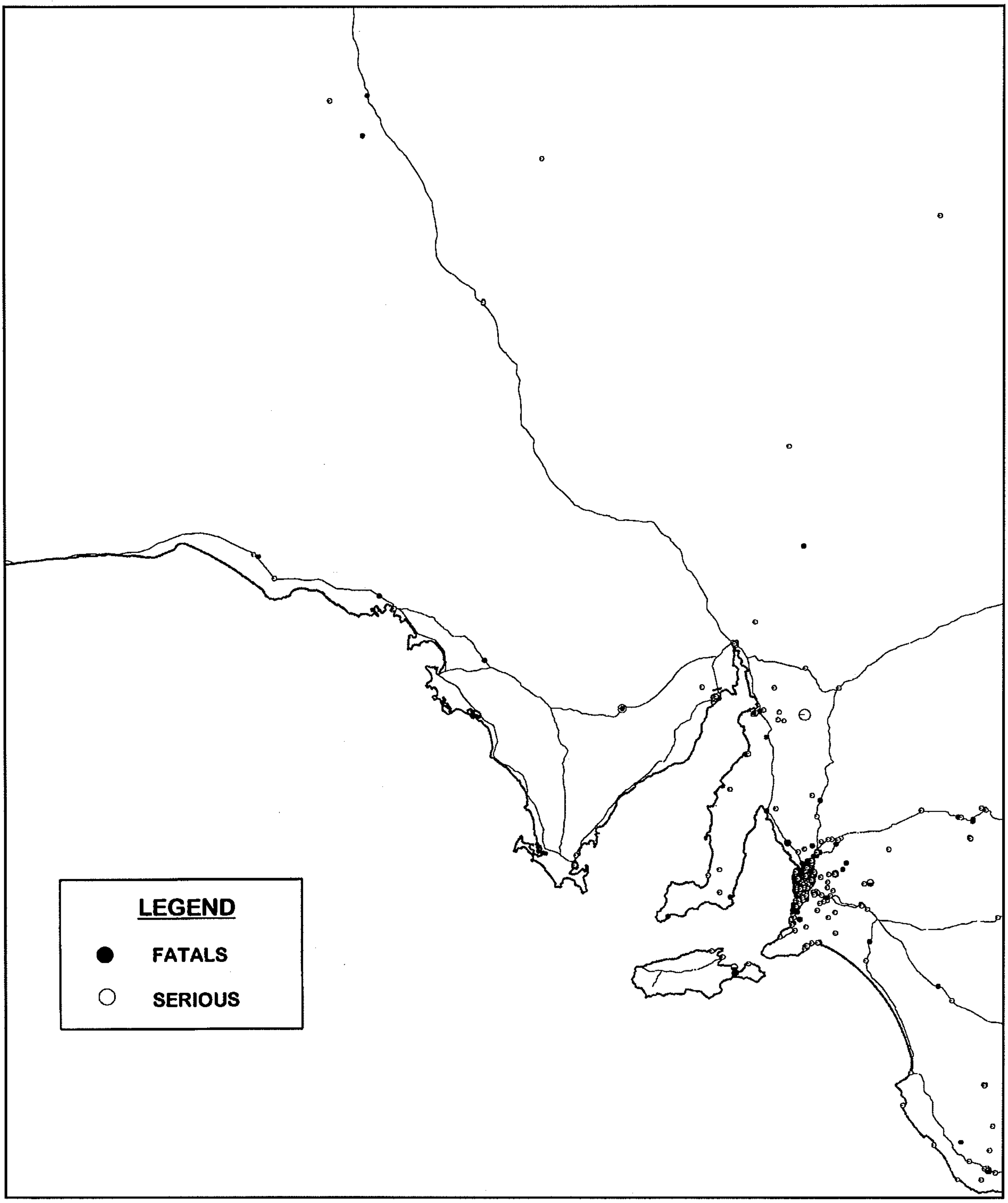
4.1 Source of Data

The South Australia Police Traffic Research and Intelligence Section produced the following maps showing the location of the fatal and serious pedestrian accidents which occurred in South Australia from 1993 to 1998, inclusive (Figures 4.1 and 4.2). A "serious" accident is one which resulted in a pedestrian being admitted to hospital.

4.2 Pedestrian Accidents in South Australia

The location of pedestrian accidents in South Australia as a whole is shown in Figure 4.1. Most of the cases are in or near the Adelaide metropolitan area, as would be expected. Elsewhere, it is apparent that the major highways, shown in Figure 4.1, account for a substantial proportion of the pedestrian accidents which occur outside the regional cities.

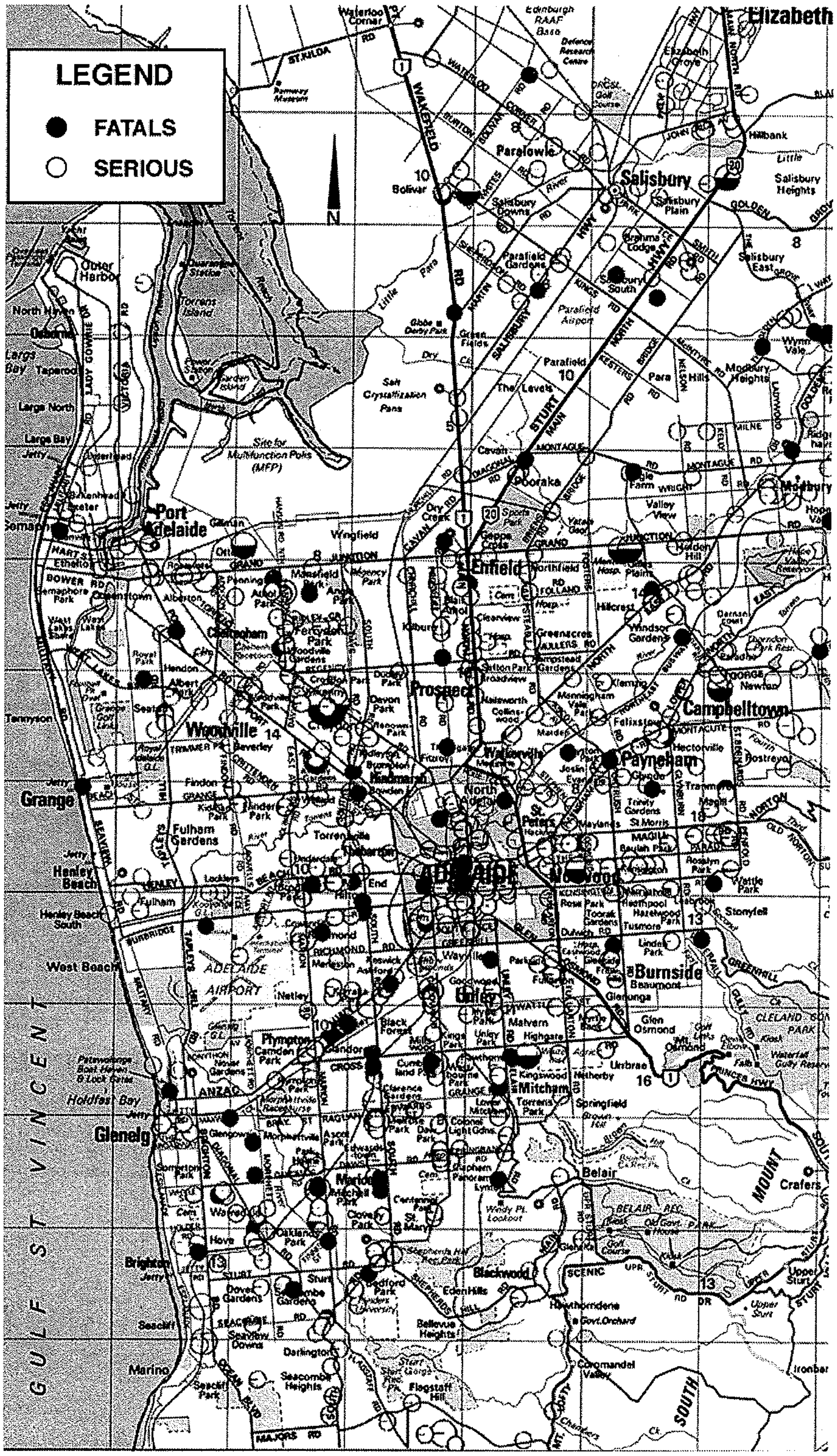
Figure 4.1
Serious and Fatal Pedestrian Crashes in South Australia 1993-1998



4.3 Pedestrian Accidents in the Adelaide Metropolitan Area

Figure 4.2 shows that most of the pedestrian accidents in the Adelaide metropolitan area occur on the major traffic routes or in the central city, with only a small proportion on local streets.

Figure 4.2
Serious and Fatal Pedestrian Crashes
in the Adelaide Metropolitan Area 1993-1998



5. DISCUSSION

Pedestrian accidents are not random events. There are many factors involved in the causation and consequences of collisions between a vehicle and a pedestrian but some factors are clearly more important than others. Similarly, some factors are more amenable to change than others.

In this section we comment on the relative importance of some of the factors listed in the previous sections of the report, with particular reference to the possibilities for change.

5.1 Trends in Fatal and Serious Pedestrian Accidents

In 1996 there were 24 pedestrians fatally injured, and 150 admitted to hospital, in South Australia.

As shown in Section 3.12, in South Australia from 1986 to 1996 there was a clear downward trend in serious pedestrian accidents (defined here as resulting in a pedestrian being admitted to hospital but not dying within 30 days of the accident). This downward trend was slightly greater than the proportional reduction in the total number of casualty accidents of all kinds in South Australia over the same period.

The annual number of fatal pedestrian accidents in South Australia ranged between 20 and 40 from 1991 to 1997, with no apparent downward trend (Section 2.13). However, when viewed over the same period as for the serious but non-fatal pedestrian accidents, 1986 to 1996 as noted above, there is also a clear downward trend in fatal pedestrian accidents.

The annual number of fatal pedestrian accidents has decreased by about one third in South Australia during the past 30 years but the rate of decrease has been much less since the early 1990s (above data, and Office of Road Safety, 1991).

5.2 Characteristics of Pedestrians and Drivers

5.2.1 Pedestrian and Driver Demographics

Males were much more likely than females to be seriously or fatally injured in pedestrian accidents. The proportion of males was virtually the same (61%) for both the fatal cases and for those who were seriously injured. However, this difference is not found among elderly pedestrians; 56 per cent of the seriously injured pedestrians over 64 years of age were females. This percentage is almost the same as the percentage of females in that age group in the South Australian population (Australian Bureau of Statistics, 1997).

Seriously injured pedestrians tended to be younger than those who were fatally injured. They included a much higher proportion of children than did the fatal cases (26% compared with 10%) and 58% were less than 30 years of age compared with 34% for those pedestrians who were fatally injured. There was also a smaller percentage over 64 years of age (15% compared with 40%). This latter difference partly reflects the comparatively high case fatality rate of the elderly; they are more likely to die from injuries sustained in an impact of a given severity.

Eighty per cent of the drivers of the vehicles which hit and fatally injured a pedestrian were males, which is a much greater percentage than for the fatally injured pedestrians (61%). One quarter of them were in the 20 to 24 year age group and only 4 per cent were over 64 years of age (compared with 40 per cent of the fatally injured pedestrians). This age and sex distribution was similar to that for the drivers involved in serious, but not fatal, pedestrian accidents.

Almost 78 per cent of the drivers involved in fatal pedestrian accidents were employed, and only 13 per cent were pensioners, retired or unemployed. The corresponding percentages for the pedestrians who were fatally injured by the vehicles driven by these drivers were 15 and 64 per cent. It is interesting to note that vehicles driven by retired drivers only struck retired pedestrians.

Information on occupation is not routinely available for non fatal pedestrian accidents.

5.2.2 Blood Alcohol Levels of Pedestrians and Drivers

Over one third of the fatally injured pedestrians had been drinking, and most of those who had were at very high blood alcohol levels. Fifty eight per cent of the male pedestrians in the 15 to 64 year age range were at or above 0.15. However only 9 per cent of the male pedestrians over 64 years of age who were fatally injured had a blood alcohol level in this very high range. As with other categories of fatally injured road users, females were much less likely to have been drinking.

Twelve per cent of drivers involved in fatal pedestrian accidents had an illegal blood alcohol concentration (0.05 or above) and over half of those drivers were in the 20 to 29 year age range. As noted in Section 2.7, drivers under 30 years of age were two and a half times more likely to have been drinking before being involved in a fatal pedestrian accident than were older drivers.

Vehicles driven by sober drivers were most likely to collide with sober pedestrians, and those driven by drivers who had been drinking were most likely to collide with pedestrians who had been drinking. This simply indicates that drivers and pedestrians are likely to have been drinking at the same times of day, or night.

The blood alcohol levels of the majority of the seriously, but not fatally, injured pedestrians were not recorded. Nevertheless, the information that was recorded was almost identical to that obtained in a study conducted by Holubowycz (1992) of 213 adult pedestrians admitted to hospital in Adelaide. The information that was available (see Section 3.4) indicates that both the percentage of male pedestrians who had been drinking before the accident (53%) and the percentage who had positive blood alcohol levels up to about 0.10 (10%) were both very similar to those for the fatally injured pedestrians (49% and 6%). The fatally injured male pedestrians had a higher percentage (29%) with a BAC at or above 0.20 than did those who were seriously injured (22%).

The limited data on the blood alcohol levels of drivers involved in accidents in which a single vehicle seriously injured a pedestrian (a restriction imposed by the structure of the TARS data file) indicates that alcohol was less of a factor for drivers in those crashes than for ones in which the pedestrian was fatally injured. However, the smaller proportion of drinking drivers who were involved in these serious pedestrian accidents also had high blood alcohol levels (two thirds were above 0.10).

5.2.3 Pedestrian Injuries

Head injuries were the leading cause of death of the fatally injured pedestrians. This finding is consistent with the results of in-depth investigations of fatal pedestrian accidents conducted by the Road Accident Research Unit with support from NHMRC from the early 1980s. In those investigations it became apparent that the severe head injuries to pedestrians were mainly a result of the head striking the car rather than the road surface.

Two thirds of the cases had a fatal head injury, often in combination with a fatal injury to another body region. A fatal head injury was somewhat less common as a cause of death among the elderly pedestrians, possibly reflecting their greater risk of dying from complications such as pneumonia while in hospital, rather than from the direct effects of the impact from the striking vehicle.

Most (78%) of the pedestrians who died did so within 24 hours of being struck by the vehicle, although fatally injured elderly pedestrians were likely to survive longer, again possibly reflecting their greater risk of dying from complications while in hospital.

5.2.4 Pedestrian Actions

Most of the fatally injured pedestrians (70%) were attempting to cross the road when they were hit by a vehicle. There was a slightly higher percentage attempting to cross from the driver's left compared to crossing from the driver's right, which may reflect the better sight distance in the latter case. However, one third of the pedestrians who were struck when attempting to cross the road from the driver's right were severely intoxicated (BAC of 0.15 or greater).

There was no recorded obstruction to the driver's view of the pedestrian in almost three quarters of these fatal pedestrian accidents. Other vehicles, either in the traffic lane or parked at the side of the road, accounted for most of the obstructions to vision that were reported.

Most of the fatally injured pedestrians who were walking on the road, standing on the road, or lying or sitting on the road at the time of their accident were severely intoxicated. In 7 per cent of the cases the pedestrians were not on the roadway itself but were struck by an out of control vehicle which left the carriageway.

The actions of seriously injured pedestrians at the time of the accident were similar to those of fatally injured pedestrians but a direct comparison is not possible due to differences in the coding of pedestrian actions between these two groups.

The larger numbers in the group of seriously injured pedestrians made it practicable to examine the pedestrian's actions by the age of the pedestrian. Young pedestrians were more likely than older pedestrians to have been attempting to cross the road at locations having no traffic control, playing on the road, or to have come from between parked vehicles. This latter characteristic is relevant to the current speed restriction signs near schools and playgrounds which rely on drivers being able to see whether or not children are present before deciding whether they have to slow from 60 to 25 km/h. Almost one tenth of these seriously injured child pedestrians came from behind parked vehicles.

5.3 Characteristics of the Vehicles Involved

5.3.1 Types of Vehicle

The vehicles which collided with a pedestrian were a reasonably representative sample of the mix of vehicles on the road in South Australia. Most of them were passenger cars or passenger car derivatives, but there was a higher proportion of heavy vehicles in the fatal cases. This greater involvement of heavy vehicles in fatal accidents was as much a reflection of the speed of the impacts involving these vehicles, which often occurred on rural highways, than any characteristic of the vehicle itself.

5.3.2 Pedestrian and Vehicle Impacts

Because most of the vehicles that collide with pedestrians are passenger cars, any factors that influence the outcome of the car/pedestrian impact are of great importance. A standing adult pedestrian is run under, not over, by a striking car (Ryan and McLean, 1965) and so relevant characteristics of the front of the car are major determinants of the nature and severity of a pedestrian's injuries. Eighty seven per cent of the head injuries sustained by the fatally injured pedestrians were caused by an impact with some part of the front or upper frontal surface of the striking vehicle (Table 2.11.2).

The proposed vehicle safety standard for pedestrian protection currently being considered by the European Parliament (EEVC, 1998) is likely to result in major improvements in new vehicles. A similar set of subsystem tests to those specified in the proposed standard is being used by the European New Car Assessment Program (EuroNCAP). These tests will be introduced into the Australian NCAP later this year and conducted by the Road Accident Research Unit (RARU) in Adelaide. More generally, the International Harmonised Research Activities (IHRA) Pedestrian Safety Expert Group is charged with recommending, by 2001, internationally acceptable vehicle impact test procedures to assess the level of pedestrian protection. The Director of RARU is a member of that Expert Group.

However, any safety developments introduced in new cars, such as design changes to reduce the severity of a pedestrian's injuries, will be relevant to no more than half of the vehicle fleet a decade later. This is because the median age of the striking vehicles, 10 to 11 years, was similar to that of the vehicle population as a whole.

Bull bars probably or possibly played a role in the outcome of six of the 14 fatal cases in which a pedestrian was struck by a bull bar. Had a bar not been fitted to the vehicle those six pedestrians might have survived. In the remaining eight cases other factors, such as the speed of the vehicle on impact, meant that although the bull bar affected the nature and, with some exceptions, the severity of the injuries, the pedestrian would still have been fatally injured had a bull bar not been fitted to the vehicle.

In the event of a new vehicle safety standard for pedestrian protection being introduced in Europe, as seems likely, a similar standard may be introduced in Australia. That would probably mean that a bull bar would have to be no more injurious to a pedestrian than the front of the car (indeed a literal reading of ADR 42/03 12.1.1 implies this is the case now). A Standards Association Committee on Vehicle Frontal Pedestrian Systems is currently considering this matter together with other issues involved in the development of a standard for such systems. The Director of RARU is convenor of the pedestrian protection working group of the Standards Association Committee.

5.3.3 Vehicle Manoeuvres and Travelling Speed

In about nine out of ten cases the vehicle that struck the pedestrian was travelling straight ahead or, in a few cases, changing lanes immediately before the collision. There was a slightly greater percentage of cases involving other vehicle manoeuvres among the non-fatal but serious injury cases. This would be expected because the impact speed, and hence the risk of a fatal injury, would generally be less when the vehicle is turning rather than proceeding straight ahead.

Little or no information was available on the speed of the striking vehicle in the serious injury cases, apart from the speed limit at the accident site. However, an estimate of travelling speed was available in 93 per cent of the fatal cases; two thirds of the vehicles were travelling at or below 60 km/h before the collision. The estimated impact speeds, which were available in 78 per cent of the fatal cases, were often less than the travelling speeds, as would be expected. In 70 per cent of the known cases the impact speed was estimated to have been at or below 60 km/h.

In the fatal pedestrian accidents that occurred in 60 km/h speed zones (74% of all fatal pedestrian accidents), 83 per cent of the vehicles were travelling at or below 60 km/h. This is an important finding because it has been estimated that reducing the urban area speed limit from 60 to 50 km/h would reduce the incidence of pedestrian fatalities by 27 per cent (McLean et al, 1994; Anderson et al, 1997). Such a measure would effectively reinstate the urban area speed limit of 30 mph that existed in NSW and Victoria until the early 1960s.

It is also notable that there was a very strong negative correlation between driver age and speeding. As shown in Table 2.12.6, drivers under 30 years of age were seven times more likely to have been exceeding the speed limit before being involved in a fatal pedestrian accident than were older drivers.

Nine per cent of the vehicles involved in fatal pedestrian accidents in 60 km/h speed zones were exceeding the speed limit by up to 10 km/h and a further 8 per cent were exceeding the speed limit by more than 10 km/h (this may be an underestimate of the percentage of speeding vehicles due to the need to rely on driver and witness reports in some cases). If the 60 km/h speed limit were able to be enforced with total effectiveness, so that no vehicle exceeded 60 km/h, that could be expected to reduce pedestrian fatalities by about 13 per cent (McLean et al, 1994; Anderson et al, 1997). Note that lowering the urban area speed limit, even with the same level of non-compliance as at present, is potentially a far more effective way to reduce pedestrian fatalities than the elimination of speeding vehicles.

Whereas an estimate of the travelling speed of the striking vehicle was available in 94 per cent of the fatal pedestrian cases in 60 km/h speed zones, a similar estimate of the speed of the vehicle on impact could only be obtained in 79 per cent (Table 2.12.7). The impact speed was estimated to have been at or below 60 km/h in 88 per cent of the known cases but at or below 40 km/h in only 35 per cent. This latter result is interesting in light of the proposed European car safety standard for pedestrian protection which assumes an impact speed of only 40 km/h (EEVC, 1998).

5.4 Pedestrian Accidents by Time and Place

5.4.1 Year, Month and Day of Week

Pedestrian accidents resulting in serious injuries to the pedestrian decreased from 1986 to 1996 in South Australia. There was no clear trend in fatal pedestrian accidents, mainly because of the smaller number of cases per year compared to the serious injury cases.

Serious pedestrian accidents also decreased as a proportion of all casualty accidents on the roads. This reduction is doubtless due to many factors, some of which were discussed in a paper on time trends in pedestrian accidents in South Australia over two decades from the mid-1960s (McLean and Woodward, 1983). In that paper it was noted that most serious and fatal pedestrian accidents occurred on arterial roads where the increasing provision of median strips greatly reduced the risks involved in a pedestrian crossing the road. Furthermore, the increase in the number of signalised intersections, particularly during that period, changed continuous traffic flows into platoons, with the gaps between the platoons making it easier for a careful pedestrian to cross the road safely.

There was some variation in the frequency of serious pedestrian accidents by month, with there being more cases in the winter months. This is likely to be due to a combination of factors such as higher rainfall in winter (see Table 3.16.1) and the shorter period of daylight during those months.

There was a clear trend in the frequency of serious pedestrian accidents by day of week, with the daily number increasing steadily from Sunday to Friday (Table 3.12.3).

5.4.2 Time of Day

While the number of fatal pedestrian accidents is too few to show reliable patterns by time of day, the distribution is similar to that for serious pedestrian accidents which show a morning peak between 8 am and 9 am and particularly high rates between 3pm and 8pm.

Young pedestrians typically are involved in accidents on the way to school and on the way home from school. On average, one child pedestrian is hospitalised per month in South Australia after being struck by a vehicle in the one hour period between 3 and 4 pm. Middle aged pedestrians have a particularly high accident frequency starting at about 3pm and continuing beyond midnight. Older pedestrians are involved in accidents relatively uniformly through the day from 9am to 8pm.

5.4.3 Where the Accident Happened

Eighty five per cent of the fatal pedestrian accidents examined here, and a similar percentage of the serious pedestrian accidents, occurred in either the Adelaide metropolitan area or in country towns. As the urban area speed limit is 60 km/h, it is not surprising that 74 per cent of the fatal pedestrian accidents happened in 60 km/h speed limit zones as did 93 per cent of the serious pedestrian accidents.

The majority (83%) of fatal pedestrian accidents in the Adelaide metropolitan area occurred on arterial roads. A similar distribution of fatal pedestrian accidents was observed among cases investigated by the Road Accident Research Unit in the Adelaide metropolitan area from 1983 to 1991 (McLean et al, 1994). Serious pedestrian accidents appear to follow a similar distribution by type of road, as indicated in Figure 4.2. This is not a new phenomenon. The two Adelaide in-depth studies of representative samples of accidents to which an ambulance was called, conducted in 1963-4 and 1976-7, showed that the great majority of pedestrian accidents occurred on arterial roads (Robertson et al, 1966; McLean et al, 1979; McLean and Woodward, 1983).

This indicates that the potential for reducing pedestrian deaths and injuries by reducing speed limits is very much greater on arterial roads than on local streets. As noted above, it has been estimated that lowering the urban area speed limit to 50 km/h on all roads, including arterials, would reduce pedestrian fatalities by 27 per cent (McLean et al, 1994; Anderson et al, 1997). This potential reduction is almost entirely on arterial roads. The current move to lower speed limits in residential areas has much to commend it but it will have little effect on the pedestrian fatality rate in metropolitan Adelaide.

Eighty per cent of the fatal and 69 per cent of the serious injury pedestrian accidents occurred on mid-block sections of road rather than at intersections. The lower percentage for serious injury pedestrian accidents on mid-block sections of road may be partly due to a turning vehicle at an intersection hitting a pedestrian at a lower speed than is common in a mid-block collision. It is also interesting to note that of the collisions at intersections which resulted in the pedestrian being seriously injured, 62 per cent were at T-junctions.

A median or pedestrian refuge was present at the location of just over half of the fatal pedestrian accidents. This may appear to be an unexpectedly high proportion but it is consistent with the very high proportion of these accidents which occurred on arterial roads, many of which have median strips.

Despite the provision of median strips or refuges, some arterial roads consist of more than two lanes in one direction, which makes it difficult for pedestrians, particularly the aged and infirm, to cross safely. At about one third of the locations of fatal pedestrian accidents studied here, a pedestrian would have had to cross three or more traffic lanes before reaching either the other side of the road or the median strip.

The difficulty confronting a pedestrian in crossing a road is related to the speed of the traffic as well as the width of the road. The role of these two factors was examined in detail in the second Adelaide in-depth accident study (McLean et al, 1979). At 11 of 16 mid-block locations where a pedestrian accident was investigated, the road width and the 85th percentile speed of the traffic were such that a vehicle approaching at that speed would have been at least 200 metres away when an elderly pedestrian had to decide whether it was safe to cross the road without having to rely on the driver seeing them and avoiding a collision. (These estimates were based on measurements of the walking speed of elderly pedestrians crossing a major road). Some pedestrians, particularly among the elderly, cannot see a car clearly at 200 metres, let alone estimate its speed accurately at that distance. Road widths are difficult to change but speed limits are largely a political decision.

In the four fatal pedestrian cases that occurred at pedestrian crossings (2% of the total), two were due to the pedestrian walking against the red signal, and two were due to the vehicle failing to stop at the red signal. Among the serious injury pedestrian accidents, 3 per cent occurred at a pedestrian crossing.

5.4.4 Lighting

The requirements for adequate street lighting for pedestrian safety have been known for many years (see, for example, Road Research Laboratory, 1963 and Australian Standard 1158). However, at almost one third of the night time fatal pedestrian accident locations where street lighting was present the level of illumination was considered to have been inadequate. This is of particular concern because most of these accidents were on arterial roads, not local streets. There are, of course, many other factors involved in the causation of night time pedestrian accidents, notably alcohol intoxication, but, given the presence of street lighting, the pedestrians may not realise that the drivers have difficulty in seeing them. Unfortunately, on some multi-lane roads there is no way for an aged or infirm pedestrian to cross without having to rely on the driver of an approaching vehicle seeing and avoiding them (McLean et al, 1979).

The effects of inadequate street lighting are made worse at intersections by the currently illegal, but largely unenforced, practice of applying tinted film to the front side windows of vehicles and, more generally but probably to a lesser extent, by the repeal some years ago of the clause in the relevant Australian Design Rule for Motor Vehicle Safety which prohibited tinting of the windscreen in the field of view. South Australia is the only jurisdiction in Australia to retain a prohibition on applying tinted film to the front side windows. The change from prohibition in some other states was made at the political level despite strenuous objection from government technical advisers in road safety.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 The Magnitude of the Problem

Four pedestrians are injured seriously enough to be admitted to hospital each week, on average, in South Australia. Two to three pedestrians are fatally injured per month.

The rate of occurrence of fatal and serious pedestrian accidents is decreasing in South Australia, at a slightly greater rate than for casualty accidents as a whole. However, this reduction has been less evident in the 1990s than in the two previous decades

6.2 Pedestrian Behaviour

All pedestrians are at some risk of being struck by a vehicle when crossing a road but three groups of pedestrians have a comparatively high risk of being involved in an accident. They are: children, particularly when on their way to or from school; older pedestrians during the day; and middle aged males at night, often when intoxicated.

6.2.1 The Safety of Child Pedestrians

Much has been written about the prevention of child pedestrian accidents. Instruction in safe crossing behaviour is important but the behaviour of children is naturally immature and so there is a need for adult supervision wherever possible when a child has to cross a road. The need for such supervision near a busy road is at least as great as near a swimming pool, to take an example of a situation where the need is more generally recognised.

The unpredictable behaviour of children leads to the following recommendation:

- Children should be supervised by an adult when in the vicinity of a busy road.

6.2.2 The Safety of Elderly Pedestrians

Many elderly pedestrians cannot walk rapidly and have poor visual acuity. It is therefore particularly difficult for them to cross many arterial roads without having to rely on the drivers of approaching vehicles seeing them and avoiding them.

Consequently:

- Elderly pedestrians should be reminded of the need for care when crossing a busy road and encouraged to make use of signalised crossings or pedestrian median refuges wherever possible.

6.2.3 The Safety of Intoxicated Pedestrians

The risks associated with driving when intoxicated are widely recognised but the risks are also very high for an intoxicated pedestrian, many of whom have exceptionally high blood alcohol levels (see, for example, Haddon et al, 1961). It is therefore recommended that:

- The very high risk associated with walking when intoxicated be publicised, emphasising that, if a driver becomes intoxicated, walking home is not a safe alternative to driving.
- Police be encouraged to remove intoxicated pedestrians from public roadways for their own protection.

6.3 Driver Behaviour

Young male drivers, up to 30 years of age, are very much more likely to hit and fatally or seriously injure a pedestrian. This is related to their greater risk-taking behaviour especially in the areas of drink driving and speeding, which leads to the following recommendations:

- The level of enforcement of drink driving legislation by SA Police be maintained or increased.
- The level of enforcement of speed limits by SA Police be maintained or increased.

Because small differences in travelling speed can mean very large differences in impact speed, the risk of a pedestrian being fatally or severely injured when struck by a vehicle can be greatly reduced by even small reductions in travelling speed. Therefore it is recommended that:

- The enforcement tolerance allowed by SA Police when enforcing the urban speed limit of 60 km/h be reduced or eliminated.

6.4 Vehicle Design

There is now general agreement that the frontal design of the vehicle has a major effect on the level of pedestrian protection from injury in the event of a collision. The test procedures specified in the proposed European car safety standard for pedestrian protection are about to be incorporated into the Australian New Car Assessment Program (NCAP). As Transport SA is a sponsor of the Australian NCAP program it is recommended that:

- Transport SA continue as a sponsor of the Australian NCAP program and publicise the results of the forthcoming tests of the level of pedestrian protection provided by new cars on the Australian market.

Some bull bars substantially degrade the level of pedestrian protection provided by the front of a vehicle. It is therefore recommended that:

- Transport SA maintain a watching brief on the work of the Standards Association Committee on Vehicle Frontal Protection Systems with a view to considering the adoption of the resulting standard as legal requirement for such systems in South Australia.

6.5 Road Environment

The great majority of serious and fatal pedestrian accidents happen on mid-block sections of metropolitan arterial roads. Very few pedestrian accidents occur on local streets. As a reduction in the urban area speed limit to 50 km/h, as is common in most other developed countries, could be expected to prevent four or five pedestrian deaths a year, and an average of one admission to hospital per week in South Australia from pedestrian accidents alone, it is recommended that:

- The South Australian road safety strategy include the aim of working towards an urban area speed limit of 50 km/h on all roads.

Provision of a median refuge greatly assists all pedestrians, but particularly children and the elderly, to cross an arterial road safely by allowing them to concentrate on traffic approaching from only one direction and more than halving the width of the carriageway that must be crossed while doing so. As children and the elderly often have no option but to travel by bus, it is recommended that:

- Median refuges for pedestrians be provided adjacent to all bus stops on arterial roads that do not already have a median divider.

The frequency of child pedestrian accidents before and after school leads to the following recommendation:

- The effectiveness of the recently introduced school zones in South Australia in reducing vehicle travelling speeds to 25 km/h when children are present be evaluated.

Street lighting is more important for the safety of pedestrians than for any other type of road user. It is therefore recommended that:

- The adequacy of the level of illumination provided by street lighting on arterial roads in the metropolitan area be reviewed and a program be instituted to ensure compliance with the relevant Australian Standard.

6.6 The TARS Data Base

Since the TARS database does not record interactions between units it is not possible to tell in multiple vehicle accidents which vehicle impacted the pedestrian. There are also other features of the TARS data base which inhibit efficient and timely use of the data from police reports on road accidents. It is therefore recommended that:

- The structure and content of the TARS data base be reviewed and appropriate changes made to render it more useful.

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