

PEDESTRIAN FATALITIES IN AUSTRALIA

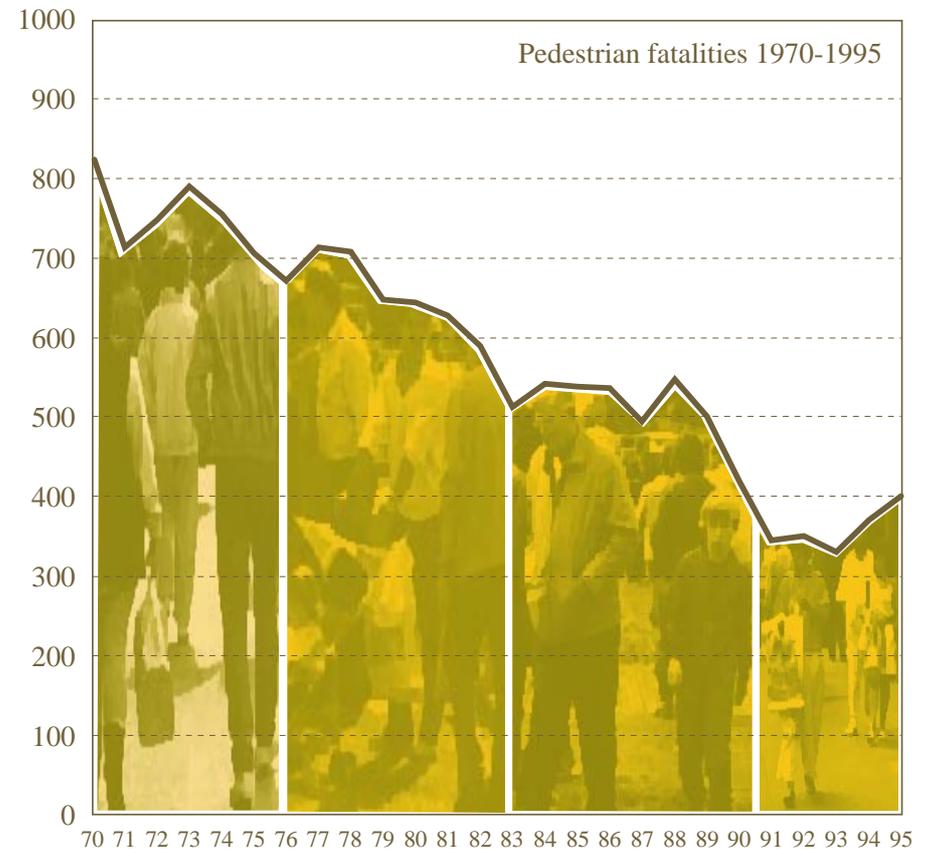
Australia, along with other developed nations, has experienced significant reductions in its road toll in the last twenty five years. The number of people killed has decreased by 47 per cent from 3,798 in 1970 to 2,017 in 1995. Significant features in reducing the road toll include continuing improvements in vehicle design, an improved road network and police enforcement of seat belt wearing, random breath testing and speed limits.

The 47 per cent decrease in fatalities during 1970-95 is even more impressive in view of growth in the population and the number of registered vehicles over the period. The population rose by 40 per cent from 13 million in 1970 to 18 million in 1995 and the number of registered vehicles rose by 120 per cent, from 5 million in 1970 to 11 million.

In 1995, 401 pedestrians were killed on Australian roads, and a further 3,000 suffered injuries requiring admission to hospital. Pedestrian fatalities represented 20 per cent of all those killed (2,017) on the road in 1995. Pedestrian fatalities in that year increased by 8.1 per cent over the previous year, which was the largest increase recorded by any road user group.

The cost of road trauma in Australia has been estimated at approximately \$6.1 billion per annum. Pedestrian crashes cost the Australian community nearly \$1.0 billion each year.

The Federal Office of Road Safety collects national statistics on road trauma in Australia. Many of these statistics are collected from police accident reports. The Federal Office of Road Safety also collects copies of documents used by coroners investigating fatal crashes including autopsy findings, toxicology reports, vehicle inspection reports, police accident data and eye-witness accounts. This information is coded by a



professional team including coders with medical training.

Strict data quality guidelines are observed. The resulting database contains over three hundred variables relating to the crash environment, people involved and the vehicle. It is the most extensive file of fatal crash data available in Australia.

The time involved in conducting coronial investigations, especially those which recommend the laying of criminal charges, is considerable. The most recent year where full data are available for analysis is 1992 and these were used to derive the statistics reported herein.

In 1992, there were 350 pedestrian fatalities. Coronial reports were available for 344 fatalities (ie 98.3% of cases) resulting from 338 crashes. The vast majority of crashes (323) involved a single pedestrian fatality, three crashes

had a double fatality and one crash resulted in four pedestrian deaths. Eleven pedestrian fatalities were excluded from the analysis because ten of these involved a motorcycle and one a bicycle.

Pedestrian behaviour

There were 232 male pedestrian and 100 female pedestrian deaths in 1992. The ratio of male to female involvement is fairly typical of fatalities involving all road users. The accompanying table has details of pedestrian fatalities by age and sex.

Children (defined as 16 years or younger) make up a minority of pedestrian deaths accounting for approximately 15 per cent, and, in fact, children under six years account for only 4 per cent of the total.

In comparison, children comprise 25 per cent of the population while those under six years account for nearly nine percent.

Pedestrian Fatalities by Age and Sex (1992)

	Male	Female	Total
0-16 yrs	33 (14%)	16 (16%)	49 (15%)
17-25	47 (20%)	11 (11%)	58 (17%)
26-59	66 (29%)	24 (24%)	90 (27%)
60-75	47 (20%)	31 (31%)	78 (23%)
over 75	39 (17%)	18 (18%)	57 (17%)

The elderly are far more at risk with 40 per cent of all pedestrian fatalities over the age of 60 years. In comparison, those over 60 years comprise about 15 per cent of the population.

In 30 per cent of fatal pedestrian crashes, the death of the pedestrian is instantaneous, a further 16 per cent die before they reach hospital and 53 per cent die in hospital. On rare occasions, an individual dies after release from hospital.

Whether death occurred instantly or later does not vary by the sex of the victim. However, for those aged from 17 to 59 years, death is instantaneous in 44 per cent of cases while the majority of the young and old tend to die in hospital (over 70%). This is somewhat counter-intuitive as the more physically robust group has the greater rate of instantaneous death.

Over two thirds of pedestrians suffered serious head injuries while 47 per cent had serious chest injuries (these are not mutually exclusive). The younger age groups tended to have even higher rates of severe head injury. The coroner does not always specify a particular body region when describing cause of death. This information is available for two thirds of the cases. Head injury and multiple injuries were the major causes of death recorded by the coroner.

On the basis of evidence gathered by coroners, it is possible to attribute causal responsibility, or fault, for individual crashes. Pedestrians were predominantly

at fault in fatal crashes. Overall, 74 per cent of pedestrians involved in fatal crashes were primarily responsible for the crash and a further 8 per cent were partially responsible. Male pedestrians (79% fully at fault) tended to be more often at fault than females (62%).

Nearly 50 per cent of pedestrians killed entered the road from the side nearest the direction in which the vehicle involved

Pedestrian Fatalities by Blood Alcohol Concentration (1992)

	Male	Female	Total
Not tested	31 (13%)	23 (23%)	54 (16%)
less than .05	86 (37%)	49 (49%)	135 (41%)
over .05	84 (36%)	13 (13%)	97 (29%)
unknown	31 (13%)	15 (15%)	46 (14%)

was travelling. About 10 per cent of these emerged from between parked vehicles. 19 per cent entered the road from the side furthest from the vehicle involved and 17 per cent were on the carriageway.

Alcohol use by pedestrians is a factor in nearly 30 per cent of pedestrian fatalities as evidenced in the accompanying table.

Fatally injured female pedestrians are less likely to be tested for blood alcohol concentration (BAC) than male pedestrians. Where test results are known, over 50 per cent of male fatalities involve blood alcohol levels in excess of .05 gm/litre. Similarly elevated blood

alcohol levels occur in 21 per cent of female fatalities where BAC was measured. Alcohol use is certainly one of the factors in the relatively high "at fault" finding against pedestrians. The main destination of pedestrians involved in fatal crashes was either home or a recreational activity.

When adjusted for missing data and the fact that the elderly and very young are unlikely to have consumed alcohol, it is estimated that one in three pedestrian fatalities involve a pedestrian with a BAC in excess of .05.

This is comparable to the level of alcohol involvement in all fatal crashes (where the driver has an elevated BAC). In Australia, the problem of the drinking pedestrian in pedestrian crashes is of similar dimension to that of the drinking driver in single and multiple vehicle crashes.

Crash site characteristics

Pedestrian crashes are not particularly concentrated by either time or place. Nearly 50 per cent of fatal crashes occur on the weekend and 50 per cent are at night. Approximately 60 per cent of crashes occur in State capital cities and 25 per cent in other towns. The remaining 15 per cent of crashes occur in rural areas. Nearly 75 per cent of fatal pedestrian crashes occurred mid-block and 90 per cent happened in fine weather.

Nearly two thirds of pedestrian crashes occurred on roads where the speed limit is 60 kilometres per hour (kph) or less.

60 kph is the general urban speed limit in Australia. Nevertheless, nearly one in six pedestrian crashes occurred on roads with speed limits of 100 kph or greater.

Normal residential streets accounted for 26 per cent of pedestrian crashes and urban arterial roads for 45 per cent. Highways, both State and Federal, accounted for 22 per cent of crashes.

Vehicle behaviour

As is evident from the high rate of pedestrian responsibility for fatal crashes, the level of responsibility that can be attributed to the driver is relatively low. Drivers were fully responsible for 15 per cent of fatal crashes and partially responsible for another 8 per cent. There were no differences in responsibility that could be attributed to sex or age. It might be noted that 77 per cent of drivers involved in fatal pedestrian crashes were male; however, this is exactly the same rate of involvement as in all fatal crashes.

Drivers were likely to be driving to or from work when involved in fatal crashes and 41 per cent were within five kilometres of home.

The rate of involvement of drivers with elevated BAC's was low as outlined in the accompanying table. Only one in twenty drivers involved in a fatal pedestrian crash had a BAC greater than .05. This is far lower than the overall involvement of drinking drivers in fatal crashes.

Exceeding the speed limit or driving at speeds "excessive for the conditions" was identified as a factor in 7 per cent of fatal

Vehicles Involved in Fatal Pedestrian Crashes (1992)

	Number	Percentage
Car	194	64%
Van, utility, 4WD	43	14%
Bus	7	2%
Rigid truck	36	12%
Articulated truck	16	5%
Other	7	3%

pedestrian crashes. This factor was equally prevalent for male and female drivers.

It should be noted that marginal speed infringements are unlikely to be detected by the police or through the coronial process. The impact speed of the vehicle in a pedestrian crash is a critical determinant of the level of injury sustained. Even small reductions in impact speed can contribute to a significant decrease in the overall level of trauma suffered by pedestrians.

The type of vehicle involved in pedestrian fatalities is given in the following table. Cars comprise nearly two thirds of the vehicles involved in fatal pedestrian crashes, while trucks are involved in one in six crashes. The rate of involvement in pedestrian fatalities is higher for trucks at 5.2 deaths than for cars at 2.5 deaths per 10,000 registered vehicles.

Point of Impact on the Vehicle - The majority of pedestrian fatalities (84%) involve the pedestrian being struck by the

front of the vehicle. About 35 per cent of pedestrians are struck by the front left of the vehicle, which is the side nearest the kerb in Australia. About 25 per cent are struck by the centre of the front and 25 per cent by right front, which is nearest the centre of the road.

The only exception to this is where an articulated truck is involved. About two thirds of these crashes involve an impact somewhere other than the front of the vehicle.

The majority of pedestrians (94%) do not strike the undercarriage of the vehicle. They are thrown over or to the side of the vehicle on impact.

The point of impact on the vehicle is not related to the type or extent of injuries received in fatal crashes, the speed of the vehicle, the propensity to brake or swerve or driver responsibility for the crash. Bull bars were involved in 12 per cent of fatal pedestrian crashes. However, the proportion of missing data for this variable is 55 per cent of the total cases. It is probable that bull bars are involved in up to 20 per cent of pedestrian fatalities.

Braking and swerving - The coroners' records contain details of whether the vehicle braked or swerved prior to the crash. This information is summarised in the accompanying table. A substantial number of vehicles neither braked nor swerved (42%).

Drivers Involved in Pedestrian Fatalities by BAC (1992)

	Male	Female	Total
Not tested	24 (10%)	9 (13%)	39 (12%)
less than .05	156 (68%)	48 (70%)	204 (65%)
over .05	14 (6%)	1 (1%)	15 (5%)
unknown	37 (16%)	11 (16%)	56 (18%)

Braking and Swerving Prior to Pedestrian Crash (1992)

	Number	Percentage
Braked only	63	20%
Swerved only	13	4%
Braked & swerved	68	22%
Did not brake or swerve	131	42%
Unknown	38	12%

This is probably indicative that the driver had little or no time to react rather than lack of attention on behalf of the driver. The relatively low proportion of drivers found at fault on the basis of coronial evidence supports the interpretation that it is action on part of the pedestrian which is crucial.

It is interesting that approximately the same proportion of drivers “braked only” as “braked and swerved” possibly reflecting the traffic conditions at the time of the crash.

Discussion

When considering the implications of the data reported in this paper for vehicle design, the primary considerations are:

1. Pedestrians are deemed responsible for the crash in which they die in 74 per cent of cases.
2. Pedestrians with elevated BAC's are involved in 30 per cent of fatalities.
3. 40 per cent of pedestrian fatalities were over the age of 60 years.
4. In 42 per cent of cases, drivers were unable to brake or to swerve.
5. 30 per cent of pedestrians died instantaneously.
6. Two thirds of pedestrians received severe injuries to the head.
7. The pedestrian was struck by the front of the vehicle in 84 per cent of cases.
8. The involvement of bull bars may be as high as 20 per cent.

It is true that pedestrians to a large degree are responsible for their own fate. They are at fault in the crash in 74 per cent of cases and they have elevated BAC's in 30 per cent. Apparently, their movements in crossing the road or walking along it are such that in 42 per cent of cases drivers had no time to brake or to swerve.

These figures in themselves are a persuasive argument for continuing attempts to change pedestrian behaviour and to study in more detail the involvement of alcohol in pedestrian crashes. Nevertheless, behaviour change on a large scale, while not impossible to achieve, is a difficult and time consuming task. There may be greater road safety benefits to be derived from changing the other variables in the pedestrian crash equation, ie the environment and the vehicle.

Pedestrian safety will benefit by planned reductions in speed limits and through greater enforcement of existing limits. Recently, there has been considerable discussion of the introduction of a general urban speed limit of 50kph to replace the existing limit of 60kph. As noted earlier, the extent of injury and indeed the probability of death is a function of the impact speed of the vehicle.

There are also aspects of vehicle design that can influence the likelihood of survival in a pedestrian crash. These aspects can either assist in avoiding crashes or reduce the impact of crashes once they occur.

Avoidance - Braking and swerving are obviously critical strategies when attempting to avoid or ameliorate a pedestrian collision. Approximately half of all drivers attempted to brake or swerve or both when confronted with a likely pedestrian collision. Continuing improvements in these areas will contribute to improved pedestrian safety.

The gradual replacement of the current fleet with more recent model vehicles should incrementally enhance pedestrian safety and reduce the proportion of fatal outcomes at least in those crashes where the driver had the opportunity to brake or swerve.

Pedestrians may also be able to avoid potential collision if vehicles are made more visible. A number of countries are investigating the benefits of “lights on” legislation for all vehicles.

Harm Reduction - Finally, a significant majority of fatal pedestrian crashes involve the pedestrian striking the front of the vehicle, being thrown over or to the side of the vehicle and dying from head or multiple injuries. Design changes to the front of the vehicle which reduced the severity of impact between the pedestrian, especially the head of the pedestrian, and the body of the vehicle could assist in reducing the number of fatal outcomes in such crashes.

The role of bull bars and their recent proliferation in Australia is no doubt significant in the consideration of pedestrian-friendly aspects of vehicle design. Design changes which effect a reduction in harm potential have the ability to reduce the level of road trauma across the entire spectrum of pedestrian crashes regardless of their cause or circumstance.

The Federal Office of Road Safety has initiated a research program to assess the potential benefits from pedestrian-friendly vehicle design.