

CURTIN - MONASH ACCIDENT RESEARCH CENTRE

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FACT SHEET NO. 6

IMPROVING PEDESTRIAN SAFETY

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1. Purpose of this Fact Sheet

This paper has the following purposes:

- to provide an overview of the pedestrian safety problem in Western Australia and elsewhere; and
- to describe the pedestrian safety problem in the context of Western Australia's *Towards Zero* road safety framework.

2. What is the pedestrian road safety problem?

Pedestrians are considered vulnerable road users largely due to their lack of protection and limited biomechanical tolerance to violent forces if hit by a vehicle. In a collision with a vehicle, pedestrians are always the weakest party and are at a greater risk of injury or death compared with most other road users¹. Pedestrian fatalities are high in low to middle-income countries, particularly those in Asia, Africa and Latin America and account for between 40 and 75 percent of all fatalities. In contrast, in most OECD countries, such as the UK, Sweden, France and Australia, pedestrian crashes constitute between 10 to 15 percent of all road fatalities².

There are traditionally three pedestrian groups that are identified as being at increased injury risk: children under 17 years, the elderly (60 years and older) and intoxicated pedestrians¹. Young children are high risk pedestrians because of lack of experience in traffic situations and restricted development of those skills needed to be safe road users. Adults older than 60 years are at high risk because of changes in their mobility and deteriorating functional performance, especially memory, eyesight and hearing, which makes it harder for them to judge distances and the speed of oncoming traffic¹. Intoxicated pedestrians are at risk because of issues similar to intoxicated drivers: their judgment is impaired and reflexes are slowed after consuming alcohol or drugs³.

In Western Australia there were in total 104 pedestrian deaths and over 950 serious injuries between 2004 and 2008, representing approximately 10% of all road deaths and approximately 9% of all serious injuries.

Figure 1 shows pedestrian fatalities per 100,000 people by age group and gender in Western Australia, 2004-2008. More appropriate denominators to calculate fatality rates (e.g., distance walked, types of roads crossed, etc) were not available.

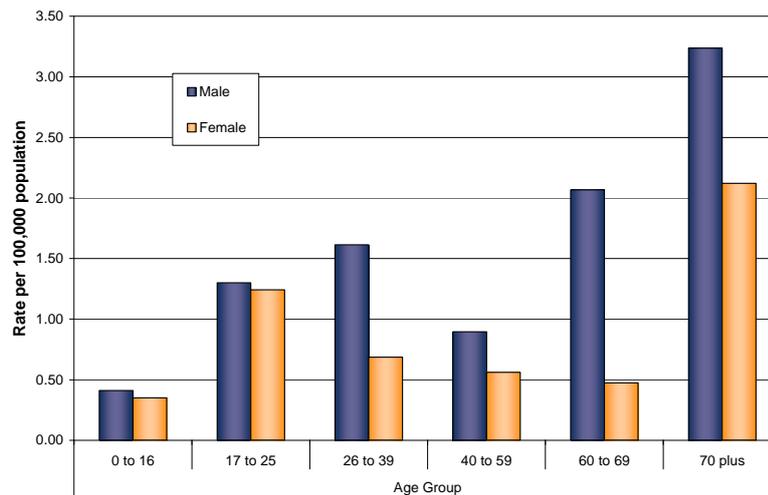


Figure 1: Rate of pedestrian fatalities per 100,000 population by age group Western Australia, 2004-2008 (Source: Office of Road Safety, Western Australia)

Figure 2 shows that while older pedestrians have the highest fatality rates, young children and younger adults also have high per-population serious injury rates in Western Australia.

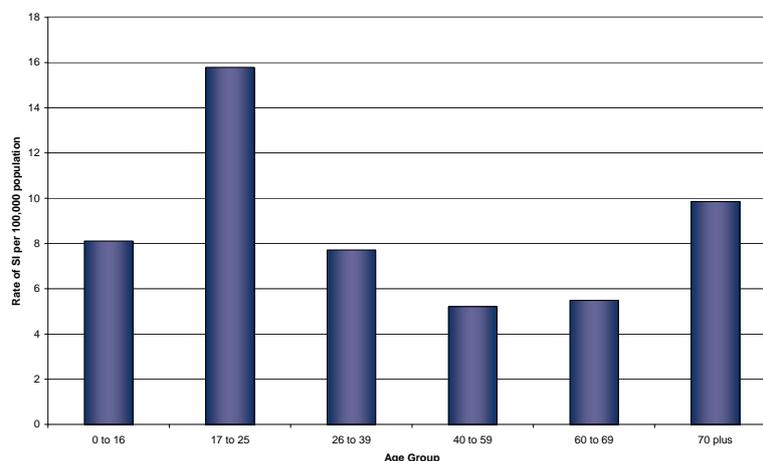


Figure 2: Rate of pedestrian serious injuries per 100,000 population by age group, Western Australia, 2004-2008 (Source: Office of Road Safety, Western Australia)⁷

3. Pedestrian safety and the *Towards Zero* framework

The Safe Systems approach to road safety emphasises *safe drivers in safe vehicles travelling on safe roads at safe speeds*. This basic premise aims to eliminate fatal crashes and reduce serious injury crashes through the provision of a safe, crashworthy system that is forgiving of human error and accommodates vulnerability to serious injury¹.

Safe System principles underpin Western Australia's road safety strategy *Towards Zero*. This strategy aims to reduce the number of people killed or seriously injured on WA roads by 40% between 2008 and 2020. It is intended that this will be achieved by employing evidence-based initiatives under the four Safe Systems cornerstones⁴:

- safe road use (20% reduction in all deaths and serious injuries);
- safe roads and roadsides (25% reduction);
- safe speeds (29% reduction); and
- safe vehicles (26% reduction).

4. Safe road use for pedestrians

It is reported that pedestrian behaviour is a significant cause of their injuries and fatalities⁵. A nationwide study of coroners' reports into pedestrian deaths attributed responsibility for their road crashes fully to the pedestrian in 76% of cases and attributed partial responsibility in an additional 12% of cases⁶. In other cases, dominant attitudes by drivers, failure to acknowledge the rights of pedestrians and fast speeds of drivers in areas of high pedestrian activity greatly increased the potential for crashes and, more importantly, the injury consequences once a collision occurred^{7,8}. There is some evidence that the perception that vehicles have higher status on the road compared with pedestrians and the consequent behaviour of drivers may also contribute to pedestrian crashes^{7,8,9}.

Given that unsafe pedestrian behaviour often increases their crash risk, educational measures that aim to correct or modify these behaviours have been developed. Proponents of training and education initiatives argue that pedestrians can reduce their exposure to risk by identifying age-related functional declines, developing appropriate behaviours to compensate for these limitations and updating knowledge of road regulations^{10,11,12}. It is also considered important to educate both pedestrians and drivers to the rights and responsibilities of all road users. While there are various education and training programs, particularly for children and older adult pedestrians (e.g., 'Safe Routes to School', 'Walking School Bus', 'Walk-With-Care'), these programs are rarely evaluated for road safety benefits. Notwithstanding, education and training programs are components of the Safe System approach and should be encouraged as a support for engineering-based initiatives, subject to on-going evaluation of their effectiveness.

5. Safe roads and roadsides for pedestrians

The safety of pedestrians is compromised to a large extent by the design and operation of the road-transport system which is generally intended for vehicles and, for the most part, seems to be unforgiving of vulnerable road users. Accordingly high pedestrian injury rates are found in urban environments with high traffic flow, high speed limits, and greater population densities^{13,14}.

In Australia, pedestrian crashes are usually an urban phenomenon, with most collisions occurring on urban 50 or 60 km/h zoned roads¹. Child pedestrian crashes usually occur in local streets, close to home and while the child is unsupervised, often on the way to or from school and especially while playing after school. Pedestrian crashes involving older adults also occur in built-up areas, close to home and shops, generally on a regular shopping trip, and in complex environments such as strip shopping centres, intersections and two-way roads carrying heavy and fast traffic. Intoxicated pedestrians are generally struck at night, close to drinking venues and on multi-lane roads¹.

Much of the literature has stressed the importance of separating pedestrians from motorised traffic. This is usually addressed through the use of footpaths, barrier fencing and pedestrian crossings¹. While pedestrian crossings are generally considered a safety feature, possible improvements include:

- appropriate location;
- longer and less confusing walk and clearance phases;
- puffin crossings (where intelligent pedestrian detection is used to automatically extend the pedestrian's crossing time where required);
- leading pedestrian interval phase;
- provision of auditory signals;
- raised crosswalks; and
- improvements to approaches (kerb extensions, ramps, tactile paving).

6. Safe speeds for pedestrians

Speed has a great impact on pedestrian safety and there have been many calls for moderating vehicle speeds in areas with high pedestrian activity. The faster drivers travel, the more likely they are to be involved in a crash and to severely injure vulnerable and other road users. Higher driving speeds reduce predictability and also reduce a driver's ability to control the vehicle, including avoiding other road users. Higher speed also increases the distance a vehicle travels while the driver reacts to a potential collision, reducing the time available to avoid a collision¹.

The severity of injuries arising from a crash increases exponentially with vehicle speed – to a power of four for fatalities, three for serious injuries and two for casualties¹⁹. Even small increases in speed can result in a dramatic increase in the impact forces experienced by crash victims. It is estimated that for every 1 km/h increase in mean speed, the number of injury crashes will rise by around 3% (thus an increase of 10 km/h would result in a 30% increase in injury crashes)¹⁵. At collision speeds above 35 km/h, the probability that a pedestrian will be fatally injured rises rapidly, with death almost certain at impact speeds of around 55 km/h or higher, as shown in Figure 3.

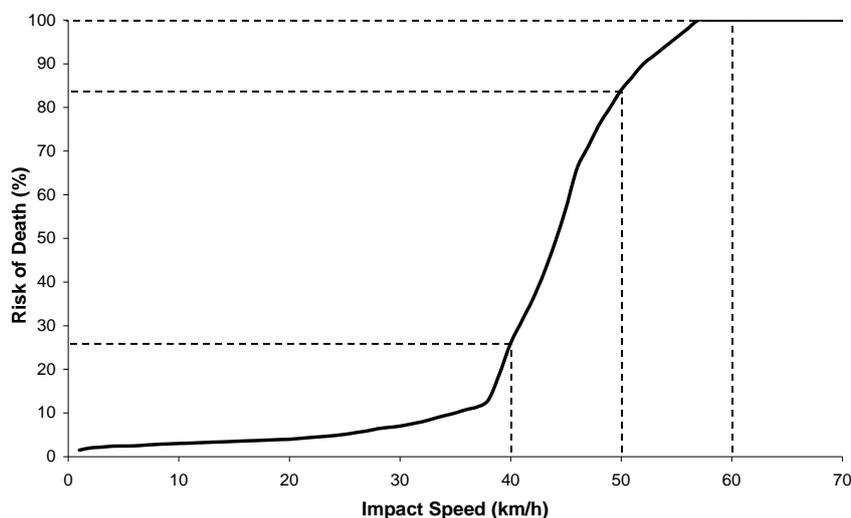


Figure 3: Risk of pedestrian death as a function of vehicle impact speed¹⁶

Moderation of vehicle speeds especially to speeds not exceeding 30 or 40 km/h is critical. This can be achieved through adoption of low urban speed limits (maximum 50km/h) with lower speeds (30-40km/h) in residential and shopping areas and in school zones. Additional measures to increase speed limit compliance and adoption of appropriate travel speeds include out-of-vehicle Intelligent Transport System (ITS) applications (e.g., dynamic messaging in the form of active speed warning signs and variable message signs) and introduction of traffic calming measures (e.g., pavement narrowing, refuge islands, alterations to the road surface, speed humps, roundabouts and gateway treatments). In 'best-practice' designs, these physical modifications to the roadway are part of an overall design concept giving vulnerable road users greater priority and discouraging high speed through-traffic.

7. Safe vehicles for pedestrian safety

Current design of vehicle frontal structures and vehicle mass of both passenger cars and other larger vehicles contribute significantly to the severity of pedestrian injuries. Pedestrians struck by a car or four-wheel-drive vehicle with high bumpers and more blunt frontal profiles are more likely to incur serious head, thoracic, abdominal and spinal injuries than when struck by a passenger car with a conventional bonnet design. In contrast, a pedestrian struck by a passenger car which is more

aerodynamically streamlined and has lower bumpers than heavier vehicles, is much more likely to incur a leg injury^{17,18,19}.

In previous years, there has been no mechanism for determining a car's performance in a pedestrian collision. However the Australian New Car Assessment Program (ANCAP) has recently been extended to include a pedestrian test. The pedestrian impact test estimates injuries to pedestrians struck by a vehicle travelling at 40km/h. It consists of dummy components projected at the vehicle's front and bonnet to evaluate head, upper leg and knee injury risk. To simplify the crash test results, ANCAP assigned a pedestrian protection rating based on an overall score, which is portrayed as a star rating out of 4 – the more stars the better²⁰. It is intended that this process will have a positive impact on safer vehicle choices for both drivers and pedestrians.

8. Summary and conclusions

Pedestrian safety has long posed a major challenge to road safety authorities. However means to improve the safety of pedestrians include^{1,9,10}:

- constructing traffic calming to protect pedestrians;
- providing additional shared paths;
- reducing speed limits in areas of high pedestrian activity such as strip shopping precincts;
- educating the community on the rights and responsibilities of all road users;
- including shared paths and upgraded pedestrian facilities in major infrastructure projects;
- nominating pedestrian and cycling infrastructure for upgrades through the Black Spot program; and
- promoting the manufacture and purchase of more pedestrian-friendly vehicles.

Western Australia's *Towards Zero* road safety strategy⁴ has set an ambitious target of reducing the number of deaths and serious injuries by up to 11,000 by 2020. The measures to be adopted to reduce pedestrian deaths and serious injuries include:

- improved roads and roadsides, including separation, lighting and path definition for pedestrians, particularly around Indigenous communities, traffic calming in areas of high pedestrian activity, increased amount of shared paths for pedestrians and cyclists;
- a review of speed limits in general, and reduction of speed limits in areas of high pedestrian activity; and
- support for national approaches to promote the use of safer vehicles, and identification/evaluation of emerging technologies in crash avoidance and protection for occupants and people outside the vehicle.

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