

CURTIN - MONASH ACCIDENT RESEARCH CENTRE

C-MARC

FACT SHEET NO. 2

SETTING SAFER SPEEDS

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1. Purpose of this Fact Sheet

The purposes of this paper are:

- to show the association between speed and crash outcomes;
- to describe the current speed limits in Western Australia; and
- to outline the safety benefits if future speed limits were more consistent with the underlying principles of Western Australia's *Towards Zero* road safety strategy.

2. Travel speed, speed limits and safety

It has been consistently found that the higher a vehicle's travel speed (even when driving at or under the legal limit), the greater the likelihood of crashing and the more serious the crash outcomes¹. Even relatively small changes in vehicle speed can result in substantial crash reductions. As an example: a study in Adelaide found that one-third of pedestrian fatalities would probably have survived if vehicles had been travelling only 5 km/h slower – and one in ten pedestrians would not have been hit at all².

This association can be easily explained, as higher vehicle speeds:

- allow less time to recognise hazards;
- increase the distance the vehicle travels while reacting to hazards;
- increase the vehicle's stopping distance after braking in response to the hazard;
- reduce the opportunity for other road users to avoid a collision;
- make it more likely that a driver will lose control of the vehicle; and
- increase the impact forces in the event of crash, making severe injuries more likely.

Much of the association between travel speed and crashes is explained by stopping distance. Stopping distance is the distance travelled by the vehicle during the time it takes the driver to react to a hazard plus the distance travelled once the brakes are applied. The importance of travel speed and stopping distance is illustrated by the following example²:

- a car travelling at 50 km/h is being overtaken by a second car travelling at 60 km/h;
- at the moment of overtaking, a child runs onto the road about 40 metres in front of both cars;
- the car travelling at 50 km/h will be able to come to a total standstill within the 40 metres and the child will escape injury;

- the car overtaking at 60 km/h will hit the child while travelling at 44 km/h and there will be a more than 50 percent probability that the child will be killed or severely injured.

Because vehicle travel speed is heavily influenced by the speed limits set by transport authorities, speed limits also have direct safety consequences. To be more specific, increased speed limits are associated with increased frequency of crashes of greater severity, whereas reduced limits are associated with fewer crashes and of less severity – with the changes usually being greatest for crashes involving fatalities³.

The recent reduction in the urban speed limits in Australian jurisdictions illustrates this association. Until 2001 the speed limit for local, neighbourhood streets in all Australian jurisdictions was generally 60 km/h. Jurisdictions then moved to a default 50 km/h limit, with the move having been closely evaluated for safety and other outcomes. The different evaluations consistently show that the lowered speed limit is associated with reduced crash numbers and reduced crash severity. In Western Australia for example⁴, reduced crash frequencies in metropolitan streets were found for: crashes involving pedestrians (51 percent reduction), crashes involving young drivers (19 percent) and crashes involving older drivers (18 percent) – with an overall reduction of 21 percent for all casualty crashes. It was also found that community support for the reduced limit increased once it was implemented, consistent with support for reduced excessive speeding in 50 km/h zones in both metropolitan Perth and regional Western Australia.

Many other studies can be cited to support the safety benefits of reduced speeds – and conversely, the increases in crashes that accompany increases in speed limits. Despite these findings, Australian and Western Australian speed limits, especially in urban areas, are amongst the highest in the world⁵.

3. Setting and enforcing speed limits in Western Australia

There are many systems used around the world to set speed limits. In Western Australia speed limits are currently set mainly in response to road engineering considerations – including the type and amount of roadside development, ‘free flow’ traffic speeds, crash data, road geometry and the numbers and types of road users. This approach allows road engineers to set speed limits that customarily represent a balance between mobility (the capacity to keep traffic flowing) and safety (acceptable crash levels).

The main speed limits in Western Australia based on this approach are shown in Table 1. (see over page).

The speed limits shown in Table 1 are the maximum permissible speeds, with drivers required to drive at a speed appropriate to the circumstances, up to the speed limit. Further, these general limits may vary along a given road according to changes in road and other conditions. For example, speed limits in school zones are usually set at 40 km/h, with road work zones and areas of heavy pedestrian activity also often having reduced speed limits. In addition, road authorities often advise lower speeds in response to dangerous conditions (for example, a sharp corner or steep descent).

Police in Western Australia use a variety of strategies and equipment to enforce these speed limits. Speed cameras represent the principal means of enforcement, with around two-thirds of all speeding offenders detected by cameras. Currently speed cameras operate only at sites which represent pressing road safety concerns, including sites which have:

- high crash levels;
- high levels of speeding motorists, as reported by the public; or

- have high pedestrian levels.

A later paper will examine the issue of police enforcement of speed limits and especially the use of speed cameras in more detail.

Table 1 Main speed limits for Western Australian streets and roads

Speed Limit (km/h)	Description of road
Urban	
50	Generally a residential street carrying mainly local traffic
60	Generally a street with a high level of residential or other development, with some out-of-area traffic
70	Generally either: (a) a divided road with direct access to/from residential or other streets, having provision for safe turning or crossing of vehicles; or (b) a higher standard undivided road having low levels of direct access to/from residential or other streets
80	As for 70 km/h roads, except generally higher road design standards
90	Generally either: (a) a lower standard urban freeway; or (b) an outer urban arterial road
100	Generally a high standard urban freeway
110	Generally sections of a very high standard urban freeway
Rural	
80, 90	Generally stretches of road through small settlements with some residential or other development.
100	Generally all other rural roads with no specified or signed speed limit.
110	Generally a high standard rural freeway or high standard rural arterial road, highway

Source: based on Australian Standard AS 1742.4, Manual of Uniform Traffic Control Devices, Part 4: Speed Controls (1999)⁵.

Drivers caught exceeding the speed limits face the range of penalties shown in Table 2⁶.

Table 2 Penalties for speeding in Western Australia

Above speed limit by:	Fine (light vehicles)	Fine (heavy vehicles)	Demerit points
No more than 9km/h	\$75	\$150	0
10-19 km/h	\$150	\$250	2
20-29 km/h	\$300	\$400	3
30-40 km/h	\$700	\$850	5
More than 40 km/h	\$1000	\$1000	7

The demerit point penalties shown in Table 2 may be doubled on long weekends and for other designated holiday periods. An accumulation of twelve demerit points in a three-year period results in loss of licence.

4. Setting speed limits for *Towards Zero*

Western Australia is the first jurisdiction in Australia to commit politically to a Safe System approach to road safety. The approach is termed *Towards Zero* - a strategy comparable to those in

Sweden (*Vision Zero*) and the Netherlands (*Sustainable Safety*)⁷. These two countries, along with the United Kingdom, have consistently produced the world's best road safety performances. Safer speeds is a key component of *Towards Zero* and the other Safe System strategies, whereby speed reductions are seen as a complementary measure to road-based improvements, especially for roads with high crash histories and for which there are no immediate engineering options.

Table 3 compares the speed limits in Western Australia, Sweden and the Netherlands⁵.

Table 3 Speed limits in Western Australia, Sweden and the Netherlands

Road Type	Speed limits (km/h)		
	Western Australia	Sweden	Netherlands
Local streets	50+	30	30
Other urban streets	60+	50	50
Undivided roads (low quality)	100	70	80
Undivided roads (good quality)	100-110	90	100
Motorways/divided roads	100-110	110	120

The speed differences between the three jurisdictions can be readily explained. In both Sweden and the Netherlands and in accordance with Safe System principles, speeds have been set to reduce exposure to crash forces leading to either death or serious injury. As stated, in Western Australia speed limits currently represent a balance between mobility and safety.

In setting speed limits for a Safe System strategy such as *Towards Zero*, the critical consideration is the limited tolerance of the human body to withstand physical trauma. The crash energies to be withstood by the human body depend mainly upon the impact speeds of vehicles involved in crashes – with impact speeds being determined largely by pre-crash travel speeds. The maximum impact speeds if death and serious injury are to be avoided, are shown in Table 4^{8,9}.

Table 4 Maximum permissible impact speeds for different crash types to avoid death and serious injury.

Crash type	Maximum permissible impact speed (km/h)
Car impact with pedestrian, cyclist	30
Car-car (side impact)	50
Car-car (frontal impact)	70
Impact with road infrastructure only	100+

Note: These travel speeds assume best practice in vehicle design and 100 percent occupant-restraint use.

The distinctions between impact speeds, travel speeds and speed limits need to be recognised. Speed limits can be higher than the permissible impact speeds without violating *Towards Zero* and Safe System principles if road design can otherwise protect road users. As examples:

- if vehicles travelling in opposing directions were separated by a flexible wire barrier running along the middle of the road, thereby avoiding the possibility of head-on crashes, posted speeds could be in excess of 70 km/h;
- if vulnerable road users (pedestrians and cyclists) were separated from motorised traffic by barriers and use of designated bicycle paths, then adjacent traffic could travel above 30 km/h.

These infrastructure options notwithstanding, achieving *Towards Zero's* ambitious targets may mean that speed limits especially in urban areas will need to be lowered.

5. Summary and conclusions

The higher a vehicle's travel speed (even when driving at or under the legal limit) and the higher the speed limits, the greater the crash risk and the more serious the crash outcomes. There are many research studies that support these associations – a recent example being the evaluation of Western Australia's default 50 km/h urban speed limit which resulted in a 21 percent reduction in casualty crashes in metropolitan streets⁴. Despite these findings, Australian and Western Australian speed limits, especially in urban areas, remain amongst the highest in the world⁵.

With its recent commitment to *Towards Zero* as a strategy for reducing crash frequency and severity, it can be expected that Western Australia's current speed limits will increasingly be examined from a perspective to give greater weight to safety considerations.

6. References

¹ For a comprehensive summary, see: Patterson, TL, Frith WJ and Small, MW (2000). *Down with Speed: A Review of the Literature, and the Impact of Speed on New Zealanders*. Accident Compensation Corporation/Land Transport Safety Authority, Wellington.

² McLean, A J, Anderson, RWG, Farmer, MJB, Lee, BH. and Brooks, CG (1994). *Vehicle Travel Speeds and the Incidence of Fatal Pedestrian Collisions*. Federal Office of Road Safety, Department of Transport, CR 146. Canberra.

³ Elvik, R and Vaa, T (eds) 2004. *The Handbook of Road Safety Measures*. Elsevier, Oxford, UK, pp 517-529

⁴ Hoareau, E and Newstead, S (2004). *An Evaluation of the Default 50 km/h Speed Limit in Western Australia*. MUARC Report No. 230, Monash University Accident Research Centre, Clayton, Victoria.

⁵ Fildes, B, Langford, J, Andrea, D and Scully, J (2005). *Balance Between Harm Reduction and Mobility in Setting Speed Limits: A Feasibility Study*. Austroads Report AP-R272/05, Sydney, Austroads.

⁶ See: <http://www.ors.wa.gov.au/index.cfm?event=topicsSpeeding>

⁷ For further details about *Towards Zero*, see:

<http://www.officeofroadsafety.wa.gov.au/index.cfm?event=strategiesNewStrategy2008-2020>

⁸ Wramborg P (2005). *A New Approach to a Safe and Sustainable Road Structure and Street Design for Urban Areas*. Paper presented at Road Safety on Four Continents Conference, Warsaw Poland.

⁹ Tingvall, C and Haworth, N (1999). *Vision Zero – an Ethical Approach to Safety and Mobility*. Paper presented at the 6th ITE International Conference Road Safety & Traffic Enforcement: Beyond 2000, Melbourne, 6-7 September 1999.

Acknowledgement

This fact sheet has been produced with funding from the Road Safety Council in the interest of saving lives on our roads.

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