

ROAD SAFETY BENEFITS OF AN ACROSS-THE-BOARD 50 KM/H URBAN SPEED LIMIT

Jim Langford, Brian Fildes

Monash University Accident Research Centre

ABSTRACT

Until 2001, each Australian jurisdiction had a default urban speed limit of 60 km/h. However Australia's high urban speed limits came under increasing scrutiny and jurisdictions progressively introduced a default 50km/h speed limit for particular categories of urban roads and streets.

These changes have been accompanied by an extensive number of evaluations, with the common finding being that substantial crash savings accompanied the reduced speed limit. However the full magnitude of crash savings depends upon a number of interrelated factors, including: the proportion of the urban road network converted to a 50km/h limit; the proportion of urban crashes accounted for by the streets and the roads to be converted to a 50km/h limit; and the extent of compliance with the new speed limits.

This paper takes the data for an urban area in an Australian jurisdiction to estimate possible crash savings if an 'across-the-board' 50km/h speed limit were introduced for all undivided streets and roads in urban areas currently posted at 60km/h. It also discusses the subsequent impact on specific road user groups.

1. SPEED LIMITS AND CRASHES

There is an abundance of research evidence attesting to the association between speed and crash outcomes (see Oxley 2006). It is now generally accepted that reduced speeds result in fewer crashes and/or less severe crash outcomes because they:

- allow greater time to recognise hazards;
- reduce the distance travelled while reacting to hazards;

- reduce the vehicle stopping distance after application of the brakes;
- increase other road users' ability to judge vehicle speed and time-to-collision;
- provide a greater opportunity for other road users to avoid a collision;
- make it less likely that a driver will lose control;
- reduce the impact forces in the event of a crash, making severe casualty outcomes less likely.

2. AUSTRALIA'S URBAN SPEED LIMITS

The general urban speed limit introduced in Australia the 1930s was 30mph (48.3km/h). In May 1964, the speed limit was increased to 35mph (56.3km/h) because prevailing road conditions were considered superior to the roads of the 1930s. As part of metrication, the general urban speed limit was changed in 1974 from 35mph to 60km/h, raising the limit by around 4km/h. Had it been decided to 'round down' rather than up, many lives would have subsequently been saved and many serious injuries prevented (McLean, 1998).

The urban speed limit of 60km/h came under close scrutiny especially during the 1990s. Since the 1996 Austroads inquiry into urban speed management, which recommended reduced speed limits on local streets, all jurisdictions have moved to a 50km/h default limit:

- Victoria January, 2001
- Western Australia December, 2001
- Tasmania May, 2002
- Queensland February, 2003
- South Australia March, 2003
- ACT July, 2003
- New South Wales November, 2003
- Northern Territory March, 2005

Despite Australian jurisdictions having adopted a 50km/h default urban speed limit, speed limits especially for the urban road network in Australia are higher than in most European countries (Draskóczy & Mocsári, 1997). In Europe:

- in residential areas, speeds are mainly either 20km/h or 30km/h – in Australia, 50km/h;
- in built-up (non-residential) areas, speeds are mainly 50km/h – in Australia, between 60km/h and 80km/h;
- in traffic calming areas (characterised by heavy pedestrian movements), speeds are between 20km/h and 40km/h – in Australia, mainly 40km/h;
- school areas are mainly 30km/h – in Australia, at least 40km/h.

Australian speed limits in built-up areas are also generally higher than in many states in the USA and Canadian provinces.

Despite the prevailing high speeds in Australia, lower speeds are technically permissible. Australian speed limit designations are based on Standard AS 1742.4 Manual of Uniform Traffic Control Devices, Part 4: Speed Controls, which readily allows for lowered speeds, especially in urban areas. For example, local streets with a high pedestrian/vehicle mix can be posted as low as 10 km/h and local streets in a linear or area speed zone supported by appropriate physical infrastructure can be zoned as low as 40 km/h.

3. IMPACT OF THE 50KM/H DEFAULT LIMIT IN AUSTRALIAN JURISDICTIONS

The introduction of the 50km/h urban speed limit in Australian jurisdictions has been extensively evaluated for safety benefits. Some of the key evaluation studies are briefly described in Table 1.

The safety benefit of reduced speed limits is well supported by overseas findings. While caution must always be exercised when aggregating the results from individual studies, the overall conclusion from the findings from these studies represents compelling evidence that reducing speed limits will led to significant reductions in casualties and particularly the more serious ones (Austroads, 1996).

TABLE 1: Summary of finding from evaluations of the 50km/h default urban speed limit in Australia.

Jurisdiction	Authors	Findings
New South Wales	RTA (2000), Tziotis et al. (2001).	Streets zoned at 50km/h experienced: <ul style="list-style-type: none"> • a 21% reduction in all crashes from expected levels; • a 20% reduction in all casualties, with substantially higher reductions for special road user groups (including young and older drivers) • a reduction in the percentage of drivers travelling at speeds in excess of 60 km/h (38% to 16%).
Queensland	Haworth et al. (2001).	From early 1999 (four years before the Statewide implementation of the 50km/h limit) all South East Queensland had a 50km/h limit on local streets. There was a subsequent 18% reduction in fatalities on local streets in South East Queensland, compared to the previous five-year average.
Victoria	Horeau, Newstead & Cameron, (2006).	The 50km/h limit during the first three years was associated with a reduction in casualty crashes of around 12% in 50 km/h streets, relative to 60 km/h streets.. Fatal and serious casualty crashes fell by around 3% and minor casualty crashes fell by around 16%. Pedestrians particularly benefitted from the new limit with their involvement in fatal and serious injury crashes falling by 25-40% over the period.
Western Australia	Hoareau & Newstead (2004)	A study of the first 24 months showed: <ul style="list-style-type: none"> • in the metropolitan region on 50 km/h and 60 km/h streets, a 21% reduction for all casualty crashes, a 20% net reduction for all crashes, a 51% net reduction for pedestrian crashes and a 19% and 18% net reduction for crashes involving young and older drivers, respectively. These reductions used 70 km/h roads as the control measure; • crash reductions in non-metropolitan regions were generally not statistically significant but there were two exceptions: a 16% decrease in all crashes and a 52% reduction in young driver crashes (for the first twelve months only).
South Australia	Kloeden et al., (2004)	For the first 12 months after the change, casualty crashes were reduced by 20% on 50km/h streets and by 5% on arterial roads. It was estimated that overall, the change saved the South Australian community around \$62m because of the

		reduced casualty levels.
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While these safety benefits are usually widely spread, some specific crash types are more likely to be reduced by lowered speed limits. An influential Australian study in this context looked at changes in pedestrian crash outcomes as the speed of vehicles varied (McLean et al. 1994). The findings showed that:

- a reduction of 5km/h in vehicle travelling speeds in 60km/h zones would result in a 30 per cent reduction in pedestrian fatalities – and in 10 per cent of cases, the collision would have been totally avoided;
- if travelling speed in all 60km/h zones were reduced by 20km/h, 75 per cent of pedestrian fatalities would have been prevented.

The advantage of lowered urban speeds to pedestrians has also been summarised thus (Newstead et al. 2002):

- if hit by a vehicle at 60km/h, a pedestrian has a 70 per cent chance of being killed;
- if hit by a vehicle at 50km/h, a pedestrian has a 40 per cent chance of being killed.

While the 50km/h default urban limit has consistently resulted in reduced crash levels on the streets governed by the new limit, the impact on the total road toll is less certain. The full magnitude of benefits will depend upon a number of interrelated factors, including:

- the proportion of the urban road network to be converted to a 50km/h limit;
- the proportion of urban crashes accounted for by those streets and the roads to be converted to a 50km/h limit;
- the extent of compliance with the new speed limits;
- the amount of education, engineering and, particularly, enforcement effort aimed at ensuring compliance with the new limits.

Based on analyses of hypothetical speed and compliance changes across the South Australian road network (Kloeden et al. 1997), it has been estimated that reducing the default speed on local streets represents a modest road safety benefit of around 6% reduction in casualty crashes. Reducing the limit on all streets and roads that currently have a 60km/h limit produces more substantial benefits (around 33% reduction).

6. THE FOCUS OF THIS PAPER

This paper takes the data from an urban area in an Australian jurisdiction to estimate possible crash savings if an 'across-the-board' 50km/h speed limit were introduced for all undivided urban streets and roads. It also discusses the subsequent impact on specific road user groups and concludes with a set of proposed speed limit changes for Safe System speeds in urban areas.

7. DATA ANALYSES

7.1 Road types, speed zones and crash numbers in an urban area of a major city

Table 2 shows the crash levels per speed zone across the different categories of roads in an urban area in an Australian jurisdiction.

TABLE 2: Crash numbers in speed zones an urban area in an Australian jurisdiction 2003-06

Road category	No. of casualty crashes per speed zone:					
	<50km/h	50km/h	60km/h	>60km/h	Total known speed zones	Unknown
Residential - Built Up	12	137	16	0	165	50
Industrial - Built Up	17	127	34	2	180	67
State Road	9	29	447	369	854	320
Distributor - Built Up	13	88	289	51	441	147
Freeway	0	0	16	49	65	16
Ineligible for Funding	0	3	0	0	3	7
Unknown Road Category	3	5	2	6	16	9
Total crashes in area	54	389	804	477	1724	616

During the period 2003-06, 23% of casualty crashes (where the speed zone was identified) occurred in 50km/h zones. Most of these crashes occurred on two categories of streets and roads, where a default 50km/h limit has been in place for several years. For the same period, 46.6% of casualty crashes (where the speed zone was identified) occurred in 60km/h zones, with almost all of these crashes occurring on two road categories.

7.2 Estimated casualty crash reductions in 60 km/h zones, assuming a reduction in the posted speed limit to 50 km/h by severity of injury.

Table 3 shows the estimated casualty crash savings if the default urban speed limit of 50km/h were extended to all undivided streets and roads with a posted limit of 60km/h.

TABLE 3: Estimated casualty crash changes arising from an extension of the 50 km/h default urban speed limit to all undivided streets and roads with a posted limit of 60 km/h.

Road type	No. of casualty crashes per road type (actual)	Assumed current median speed	Assumed median speed, 50 km/h limit	Estimated No. of casualty crashes	Estimated change in casualty crashes per road type	Estimated change in all urban casualty crashes
Urban Residential	50	50	45	41	-18%	1%
Urban Arterial	736	55	50	650	-12%	5%
Total	786			691	-12%	6%

NOTE: 'Urban Residential' consists of the 'Residential - Built Up' and 'Industrial - Built Up' road categories;

'Urban Arterial' consists of the 'State Road' and 'Distributor - Built Up' road categories;

The estimated numbers of casualty crashes have been calculated thus (Nilsson 1982):

$$\text{Change in casualty crashes} = n_a = (v_a/v_b)^p \cdot n_b$$

where n_a = n of casualty crashes after the speed change

n_b = n of casualty crashes before the speed change

v_a = mean or median speed after

v_b = mean or median speed before

p = 2 for minor casualty crashes

It has been assumed that two-thirds of all casualty crashes on urban arterials occurred on undivided roads.

Based on the underlying set of assumptions, extension of the 50km/h default urban speed limit to all undivided streets and roads with a posted limit of 60km/h would result in an overall 12% reduction in casualty crashes for those roads and streets – and a crash reduction of 6% for all urban crashes.

8. DISCUSSION

Any precise estimate of crash reductions arising from a change in speed limits requires careful consideration of a wide range of factors, many of which will vary from location to location. The above estimates must be regarded as general, especially as many of the underpinning assumptions have been either challenged or remain largely

untested. For example, Nilsson's power formulae have frequently been questioned and revised: however according to Cameron (1993), they are still generally accepted for calculating the effectiveness of speed-related road safety policy. Support for the estimates can also be drawn from recent evaluations – to the extent that the overall 6% reduction in all urban crashes presented in Table 3 may be reasonably conservative.

In the current exercise, crash-reduction estimates have not been prepared for individual road user groups. However there can be no doubt that vulnerable road users would most profit by lower travel speeds (see for example Hoareau & Newstead, 2004). This is a critical factor in a Safe system approach to setting speed limits, where it has been argued that while crashes are inevitable, crash energy needs to be managed below the level where life-threatening injury occurs in humans. For pedestrians, bicyclists and motorcyclists, this means impact speeds not exceeding 30km/h (Tingvall and Haworth,1999; Wramborg 2005). Because the opportunity for effective braking cannot always be assumed, it may be postulated that the closer the maximum-posted speeds reduce to this limit, the greater the safety benefits.

There is another argument for extending the 50km/h default urban speed limit. Since its introduction in Australian jurisdictions from 2001 onwards, one of the most frequent criticisms relates to driver confusion in judging which streets are affected by the new limit. Extending the limit to all undivided urban streets and roads would remove at least this source of criticism by making drivers' recognition an easier task.

8. CONCLUSIONS

Extending the urban default speed limit of 50km/h to include all streets and undivided roads currently zoned at 60km/h will result in a further substantial reduction in urban casualty crashes. This claim is supported by an application of Nilsson's power equations (based on a range of underlying assumptions about travel speed changes), the results of which are fully consistent with existing evaluation findings relating to previous reductions in urban speed limits. The extension would also represent a strong step towards Safe System principles and would counter at least

some of the criticisms from motorists in dealing with the current application of the default urban speed limit.

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