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Safe-Street Neighbourhoods: the role of lower speed limits

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Key Findings

- 30 km/h speed limits on local residential streets have the potential to reduce the Australian national road toll by 13% or $3.5 Billion every year.
- For example, the WA Safe Active Streets program receives bilateral political support from successive governments.
- Community fears about impacts on travel time are a political reality but technically unfounded.

- Safe-Street Neighbourhoods require strong leadership – political champions and well-trained street designers.
- The Federal Blackspot program can be readily extended to accommodate Safe Active Street and Safe-Street Neighbourhood initiatives.

Abstract

Neighbourhood streets play a vital role in making places liveable. Rather than seeing them as simply transport corridors for cars, they are important places for walking, cycling, social interactions and even playful exploration by local children. This paper argues that neighbourhood streets provide a valuable focus for a road safety intervention that is low cost and yet promises considerable benefits for road safety, neighbourhood amenity, public health and the community at large. While there is likely to be opposition to the introduction of lower speed limits in local neighbourhood streets, this paper provides evidence that such opposition is not justified. Lower speed limits in residential streets provide an important new strategy for achieving continued reductions in injury rates from road crashes in Australia. Current trials of 30km/h traffic calmed Bicycle Boulevards in Perth are already showing early signs of general community support, while such trials in Adelaide and Melbourne are imminent.

Key Words

30 km/h speed limits, neighbourhood amenity, road safety champions.

Introduction

The February 2014 report by the Australian Bureau of Infrastructure, Transport and Regional Economics (BITRE, 2014) on "Road Safety: Modelling a Global Phenomenon" sounds a sombre warning. While fatality rates have trended down, injury rates show a recent independent upward movement. Moreover, the report warns that as the main measures that have been responsible for downward movements begin to reach maximum effect, the tendency will be for plateauing to rising levels of death and injury, unless previous measures are reinforced and/or new road safety measures are brought into play.

In addition to the worrying general road safety trends, the issues for vulnerable road users are compounded, as discussed in the recent review of the National Road Safety Strategy (Austroads, 2015):

> *"The Safe System philosophy for vulnerable road users is not as well developed as for vehicle occupants. This has been found to be true nationally and internationally, with even leading countries such as Sweden increasing their focus on vulnerable road users. The main finding of the recent review of road safety from the International Transport Forum was that vulnerable road users are receiving smaller benefits from recent road safety improvements than vehicle occupants."*

Original research has delved further into these phenomena, with a focus on pedestrian safety, sourcing data from 6 jurisdictions, including NSW, Australia, The Netherlands, Denmark, the United Kingdom and the United States (van den Dool & Job, 2014). The findings indicated that pedestrian crash numbers in NSW declined dramatically

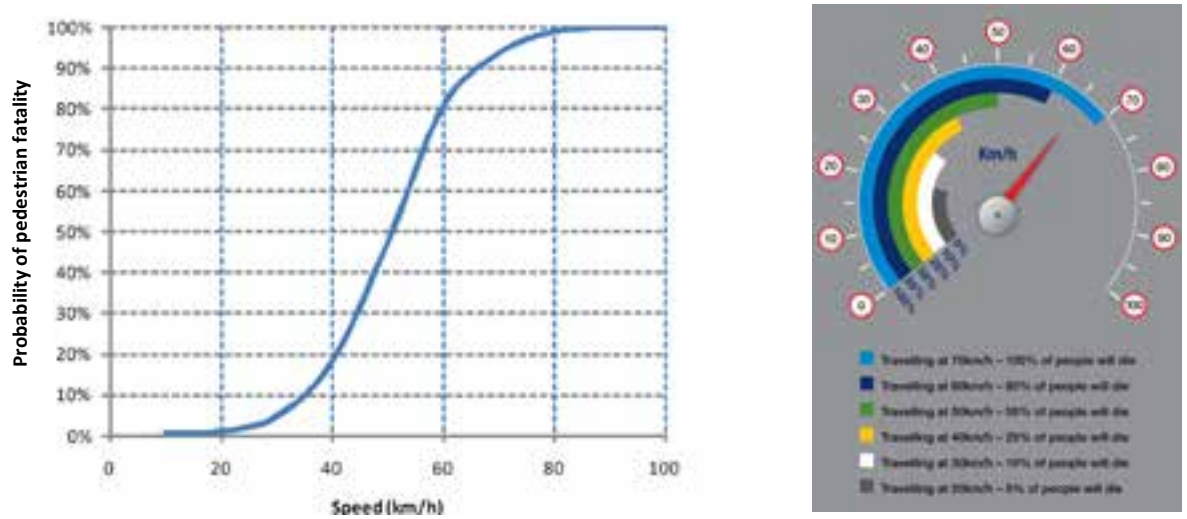

Figure 1. Probability of pedestrian fatality by motor vehicle speed as reported by Austroads (2012) and Transport for NSW (2014a)

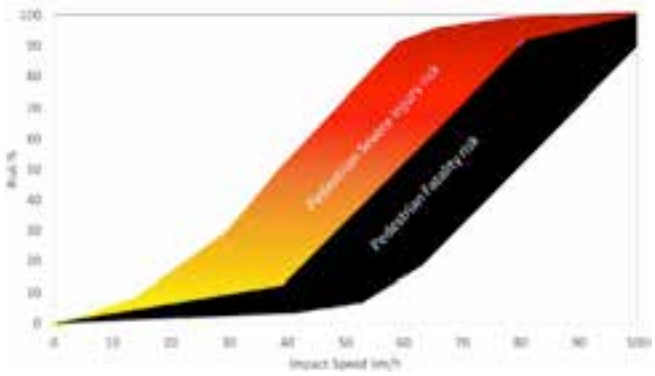

Figure 2. Probability of pedestrian fatality by motor vehicle speed as reported by the NZ Transport Agency (Hughes, 2014)

over the past decade, when compared to "all" crashes. Since 2006 pedestrian crashes at a population level fell below the OECD average for 2009. There appears to be a strong correlation with the expanded introduction of 40km/h High Pedestrian Activity Areas, 40km/h School Zones and related engineering, enforcement and educational measures.

However, as with the BITRE report, trends in pedestrian crashes in NSW are flattening and remain well above the rates in Denmark and The Netherlands. Fatality and injury patterns in the UK are generally ahead of world trends, but not so where pedestrians are concerned. Tolley (2014) explains that while the UK is increasingly expanding its network of slow speed urban environments, to date 20mph zones are limited to about 20% of the urban residential precincts. In contrast, Dutch 30km/h precincts reportedly cover about 80% of urban residential precincts, with the specific and successful purpose to reduce the road toll.

30km/h, 40km/h and 50 km/h speed limits

Over a period of 10 years from about 1995 to 2005 Australian Governments gradually reduced the general urban limit from 60km/h to 50km/h. However, Australian Governments did not simultaneously change the speed limit in 40km/h zones to 30km/h. The road safety benefits of such a change are well-known and widely documented by Austroads and various National, State and Territory transport agencies, as shown for example in Figure 1. The risk of a pedestrian fatality at 40km/h is twice the risk at 30km/h, while the risk at 50km/h is 5 times that at 30km/h (Austroads, 2012; Transport for NSW, 2014a).

As well as a lower risk of fatality or injury at lower speeds, the likelihood of avoiding any collision is much greater at lower speeds due to the much lower stopping distances at 30 km/h compared with 50 km/h (Svenson, et al, 2012):

> *"We assume a reaction time of 1 s and at a speed of 30 km/h a car will travel 8.33 m (30 000/3600) during that time before the brakes start to apply. If the speed is 50 km/h the corresponding distance is 13.89 m. This is a little longer than the total stopping distance from 30 km/h (12.75 m). This means that a driver who could stop from 30 km/h in front of an obstacle would hit that obstacle at a speed of 50 km/h if she drove at 50 km/h under the same conditions".*

This study also identified that drivers were "overly optimistic" about their ability to stop quickly, and showed little understanding of the impact of higher speeds on their stopping ability. The authors suggested that this was an important consideration in attitudes to speed limits.

More recent research in New Zealand (Hughes, 2014) further emphasises the problem (Figure 2), showing that although the fatality rate may be low at speeds of 40 km/h, there are serious concerns about severe injury risk for pedestrians at speeds of 40km/h and above.

Corben, D'Elia and Healy (2006) calculated stopping distances for a range of initial travel speeds, assuming a driver perception-reaction time of 1.2 seconds and a coefficient of friction of 0.7, which they claim are typical values for the analysis of stopping distances. A driver who could stop from 30 km/h in front of an obstacle would hit that obstacle at a speed of approximately 36 km/h if driving at 40 km/h. On the basis of the evidence in Figure 2, this would mean the difference between no impact and very likely serious injury if the obstacle was a pedestrian.

Streets that have cars travelling slowly (at 30 km/h or less) "feel" safer to pedestrians and cyclists. This change in the psychological feel of streets leads to a greater use of the streets by pedestrians, which enhances the levels of connection between people and further reinforces the view that streets are not just for cars, and that drivers have a responsibility to take care around vulnerable road users. A recent Japanese study found that drivers respected the rights of vulnerable users: "a majority of respondents agreed that motorists should give priority to pedestrians/cyclists anywhere they are encountered on 30 km/h residential streets" (Dinh and Kubota, 2013, 35). In a landmark case before the Supreme Court of Queensland (2012) on the responsibility of drivers and child pedestrians, Judge McMeekin ruled:

> *"Hence, in pedestrian cases, typically a heavier share of responsibility falls on the motorist even if the degrees of departure from the standard of reasonable care be more or less equal."*

There is an important distinction between areas that have lower speed limits (30 km/h or 20 mph) only (and few physical changes to the streets apart from line marking) and speed restriction zones, which have both lower speed limits as well as significant physical changes to the streetscape. These changes include road engineering interventions such as chicanes, vertical deflections (speed humps) and other alterations to physically slow traffic.

Engineering changes should be made in preference to reducing speed limits alone, if resources (funding) are available. Low speed limits alone are much cheaper to implement, although they typically lead to smaller reductions in average speed (Calvert, 2016, 56). However, low speed limits can be implemented over much larger areas for the same cost as a small area as a speed restriction

zone. This means that a much larger population is affected and "small improvements to many people add up to a total of much more than large improvements for a few" (King and Semlyen, 2016, 66). Even reducing average speed by 1-2mph can have a significant effect with a wide area. "Each 1mph less is 5-6% fewer casualties. That 1-2mph reduction over the network adds up to much more benefit to more residents than a large reduction on a few streets in a zone" (King and Semlyen, 2016, 66). Thus, while physical low speed zones may be ideal if costs were ignored, for the same cost 50 times more people could be included in area-wide 30 km/h speed limits with line markings than could be included in physical speed zones.

King and Semlyn (2016, 66) further note that isolated and small area physically calmed low speed zones may have the effect of encouraging drivers to 'speed up' as they leave the zone. In contrast, larger areas with 30 km/h speed limits encourage a mindset among drivers that low speeds are appropriate in 'all' neighbourhood streets. Private observations by the authors confirm such patterns may also be true for small 10km/h Shared Zones.

Grundy et al (2009) found that the greatest reduction in road casualties from the introduction of 20 mph zones was amongst young children. The zones were particularly effective in reducing the severity of injury, as well as the total number of collisions. An important point here is that this study also found that there was little, if any, collision migration to surrounding roads after the introduction of these zones in London.

The Challenge

Changing speed limits in residential streets to 30 km/h has met with considerable opposition from the community at large, not just in Australia but overseas. When such limits were introduced in 1992 across the entire city of Graz, Austria, the majority of residents were not in support of them (Heinrich, 2013):

> *"When the discussion around speed reduction started in 1992, the approval for lower speeds was around 44%, but by 1995 this had nearly doubled to 82%".*

In terms of road safety, the Graz project resulted in a 12% reduction of crashes with injury, 24% reduction in serious injury, 17% reduction in pedestrian injury and a 14% reduction in injury to car users. Despite only a 4% reduction in cyclist injuries, 83% of cyclists strongly supported the reduced speed limit. General acceptance soon became so high that in July 1994, the scheme was made permanent.

In 2011, the South Australian Government engaged the services of world-renowned road safety expert Fred Wegman as part of its "Thinker in Residence" program. In the lead up to his engagement, Wegman conducted a media interview (Adelaide Advertiser, 2010), which brought out (South) Australian fears of a Nanny State with the discussion of extensive 30km/h zones in urban residential areas. These same fears were evident in the mid-1990s, when Australia transitioned from a 60km/h urban limit to the now widely applauded road safety success of the 50km/h urban limit (van den Dool, 1992). The important lessons are:

- Yes, careful consideration is required with good and detailed campaigns to inform communities and opinion leaders
- Yes, it is necessary to have strong leadership – a political champion
- Yes, strong improvements are expected in urban road safety.

In NSW, for example, the data shows (Transport for NSW, 2014b):

- two thirds of all crashes occur in urban areas
- in urban areas, more than two thirds of crashes occur on local and collector streets with 50-60km/h speed limits
- 50 and 60 km/h streets have shown a 27% reduction in crashes over the 15 year period from 1997 (almost no 50km/h zones) to 2012 (full implementation of 50km/h urban limit, Figure 3), compared to a 7% crash reduction on 70-110km/h roads and an overall crash reduction of 22%.

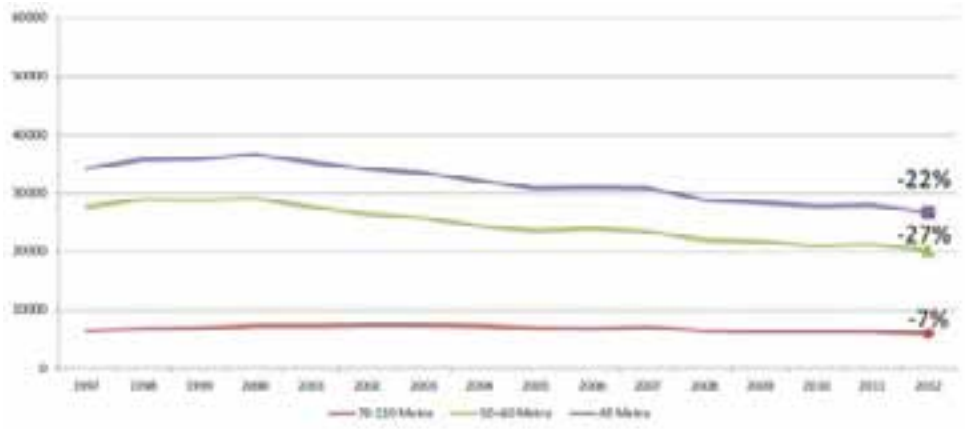

Figure 3. The NSW road toll dropped by 27% following introduction of the 50km/h Urban Speed Limit (Source: GTA Consultants)

Table 1. Travel time implications of 30km/h in urban residential streets, generically in the Sydney Metropolitan Area

	Distance (km)	Time 50km/h (min)	Time 30 km/h (min)	Difference (min)	Difference (seconds)
Home to main road	0.5	0.6	1.0	0.4	24
Main road	13.0	24.8	24.8	0	0
Work to main road	0.5	0.6	1.0	0.4	24
Total	14.0	26.0	26.8	0.8	48
Average Speed		32km/h	31km/h	-1.0km/h	

Figure 4. Applied example of 30km/h in a residential precinct near Maroubra Junction, NSW (source: Google Earth)

One argument used to oppose lower speed limits is that they will impose time costs on motorists. Research suggest most drivers believed that time could be saved by speeding, despite strong evidence that travel time is often unchanged, or even reduced if the speed limit is observed (Wallén Warner and Åberg, 2008). Reducing speed limits to 30 km/h in residential streets may not lead to longer trip times. Indeed, it may even lead to a reduction in time pressure. Garrard (2008) explains: *"Evidence from studies in several countries indicates that the main (publicly articulated) reasons for opposing reduced speed limits in urban areas; namely, increased travel time and costs, are substantially overstated. Small travel time benefits associated with higher speed limits (an average of 9 seconds/km in one study) come at substantial cost in terms of the health and wellbeing of individuals and communities"*. In Bristol (Ingamells & Raffle, 2012), signs-only 20 mph pilots resulted in increased walking and cycling, reduced road speeds, and no impact on journey times or bus reliability.

Table 1 shows that the generic impact of introducing 30km/h in urban residential streets is almost negligible in terms of travel time, i.e. 48 seconds for a 27 minute trip, or less than 3%. There is some evidence that real travel speeds on local streets are well below the nominal 50km/h limit, which reduces the impact on travel times. The travel time and distance data are taken directly from the NSW Bureau of Transport Statistics (2014), including an average journey to work of 14km, which takes 26min. For the purposes of this research, it is assumed that no one lives and works further than 500m from the nearest 50km/h or 60km/h road. This would require the development of a good road hierarchy for each urban residential precinct that sets speed limits in accordance with desired outcomes, i.e. a relatively simple design parameter.

Figure 4 shows an example of how such a system can be effectively achieved in a residential precinct near Maroubra Junction in Sydney's Eastern Suburbs.

The Speed Paradox

In addition to the trivial loss of time in actual trips made by car drivers in areas with low speed limits, there is also evidence (Tranter 2010, 2012) that attempts to save time through increasing trip speeds is a futile exercise. For the majority of motorists, the main time demand of driving is not the time spent in cars, it is the time spent earning the money to pay for the multitude of costs associated with motor vehicle use. When these costs are considered, the "effective speed" of any mode of transport can be calculated. This shows that cycling is effectively faster than cars in most urban areas (Tranter, 2012).

Not only do cars not provide the time savings many people believe they do, when cars become the dominant mode of transport, local shops, schools and services are more likely to be closed, necessitating longer distances to be driven. Evidence of this can be found in Melbourne, where the number of land uses within 800 metres of people's homes has fallen dramatically in the last 50 years, as local shops, schools and services such as post offices are closed. The longer distances to schools (along with other factors) has produced a decline in the proportion of children allowed to walk or cycle to school (Van Der Ploeg, et al, 2008). This means that parents are forced to spend increasing amounts of time transporting and supervising children (Future Foundation, 2006). Decreasing residential speed limits may well mean that residents have less time demands than in areas where speed limits are higher.

The Benefits

Based on the Dutch experience (SWOV, 2006, 2010), the road safety benefits of widespread introduction of 30km/h in urban residential streets can be readily established. Table 2 shows a worked example for 50km/h streets in NSW, with the potential to reduce the total of 10,076 crashes by some 3,241 crashes with a community benefit of $886 million.

Figure 5. Tangential roundabout redesigned to radial, Beulah Road, Norwood, SA (source: GTA Consultants)

On a nation-wide level, the benefits amount to 13% of the Australian road toll (van den Dool & Tranter, 2015):

- $27 billion annual national crash cost
- NSW ± ¼ of all crashes
- NSW crash cost saving = $0.886 billion
- Potential national saving = $3.5 billion
- 13% of national crash cost

It is important to note that the majority of the benefit arises from reduction in injuries. In this context, it is pertinent to reconsider the sombre warning by BITRE (2014) about increasing injury rates and the inability of historic road safety measures to continue into the future.

Many city governments around the world have already discovered that low speed environments have more than just road safety benefits. Low speed environments create more liveable cities, facilitate low crime levels, increase levels of physical activity, increase social connectedness, promote healthier citizens, increase access to local goods and services and lower levels of pollution.

People living in areas with low volumes of motorised traffic experience much higher levels of interaction and friendliness with their neighbours (Appleyard & Lintell, 1972). Children have more local playmates when traffic speeds and volumes are lower. A lack of social connection is now being recognised as a key determinant of poor health, both mental and physical (Berkman & Syme, 1979; Cornwell & Waite, 2009). 30 km/h zones lead to less fuel use and greenhouse gas emissions, and reduced air and noise pollution (Garrard, 2008). "German 30km/h zones led to car drivers changing gear 12% less often, braking 14% less often and using 12% less fuel" (European Federation of Road Traffic Victims, 2013). Compared to 50 km/h, 30 km/h reduces traffic noise by 3 decibels. This also supports greater social connection as people can converse more easily, as well as sleep more easily.

When streets are seen as being safer for children, parents are more likely to allow them to walk and cycle to school and to other places. Freedom to independently explore local neighbourhoods and to partake in outdoor play is vital for children's emotional, social and cognitive development (Tranter & Sharpe, 2012). Higher levels of children's independent mobility also give parents more freedom and time to spend on activities other than driving. Parents in Australia today spend twice the time transporting and supervising children than a generation ago, and children's independent travel has been declining significantly over the last few decades (Freeman & Tranter, 2011). Reducing speed limits to 30 km/h would increase the likelihood that children are given licences to walk to school alone or cycle around their neighbourhoods. "When local authorities introduce speed restrictions within residential areas it may worth promoting the benefits for children, in particular, to gain support throughout the community" (Carver, 2013).

> *"Fewer road victims frees up facilities for other health needs. Fewer work days are lost. Widow, disability benefit and care savings. Active travel cuts obesity and heart disease. Inequalities reduce as less children die. Quality of life rises"* (European Federation of Road Traffic Victims, 2013).

Implementation

Australia-wide road transport agencies have adopted policies (RTA, 2011) requiring that slower speed environments are "self-enforcing". In other words, there is a need for physical measures such as traffic calming, main street programs and local area traffic management. Research suggests that drivers themselves identify "re-designing streets to make them inherently calmer" and implementing traffic calming as the most effective anti-speeding strategies to support lower speed limits (Dinh & Kubota, 2013; Stradling et al, 2003). Experience in The Netherlands (SWOV, 2006) has indicated "sparse" implementation of such measures can be effective with measures focussed on the most important

Table 2. The small price of 48 seconds travel time could save 2 lives and over 2,000 injuries in NSW alone

	Number of Crashes in NSW in 2012 (Transport for NSW, 2014b)	Crash Reduction (SWOV, 2006, 2010)	Savings in Crashes at 80% Conversion	Cost per Crash (RTA, 1999)	Savings in Crash Costs at 80% conversion
Fatalities	29	10%	2	$5,582,000	$13 million
Injuries	4,389	60%	2,107	$410,000	$864 million
Property Damage Only	5,658	25%	1,132	$8,150	$9 million
Total	10,076		3,241		$886 million

Figure 6. Opening of the Safe Active Street along Shakespeare Street, Mount Hawthorn, WA (source: GTA Consultants)

bottlenecks and dangerous locations such as the entry points to residential precincts and at intersections.

Research by GTA Consultants (2014) for Queensland Transport and Main Roads builds on Dutch research indicating roundabouts on local street intersections can be an effective measure to facilitate "sparse" implementation of traffic calming measures. The research indicates that traditional Australian "tangential" designs appear to be too generous, allowing general traffic to flow through the roundabout at relatively high speeds which are incompatible with pedestrian and bicycle movements. Recent trials in South Australia using tightly designed "radial" roundabouts appear to be effective in reducing speeds (Figure 5).

Another example is the WA program on Safe Active Streets or Bicycle Boulevards (DoT-WA, 2017, Figure 6). In essence, Bicycle Boulevards are local residential streets with traditional traffic calming and a cycling overlay, but there is more to it. Key cycling elements include:

- A clearly, self-explaining, legible route (unlike main roads which continue for long distances, a bicycle boulevard typically runs along a series of inter-connected local streets and intersections, which do not naturally provide route continuity)
- Direct connectivity with other elements of the cycle network, often across council boundaries, for access to shops, school, employment and services
- Priority over cross streets – bikes are a vehicle of momentum and stop-start conditions require large amounts of energy
- Excellent crossing facilities at main roads for safety and comfort
- Design speeds (and ideally speed limits) of 30km/h which is slower than the traditional 40km/h for traffic calming in Australia – this is essential for achieving the required safety outcomes.

The Bicycle User Group for Sydney's Eastern Suburbs, BIKEast, has developed a similar initiative on Safe-Street Neighbourhoods (Boss, 2016), which has been endorsed by its state-wide parent organisation, Bicycle NSW. The focus is on changing neighbourhood streets in ways that slow traffic and complements cycling networks under local bike plans and strategies. It is an urban design-based approach to foster redesign of streets, help tame the behaviour of motorists and riders and make local streets safe for everyone to use and enjoy and will also be good for local businesses and service providers. The key elements include designing or re-designing local neighbourhood streets to:

- make all vulnerable users safe by introducing 30km/h speed zoning
- primarily serve residential needs while maintaining essential vehicular access
- further improve amenity through adaptations that serve people's use and enjoyment
- make every street a cycle street for a connected neighbourhood and city.

Political Leadership

Wegman (2012) concludes there is a need for strong, ***paternalistic*** political leadership – a champion who really makes a difference:

> *"I conclude a need for government interventions in road safety, not only because 'harm to others' is involved, but also because personal choices require some sort of paternalistic guidance."*

> *"So far, we have introduced 'the government' as a single entity. As we all know, this is not the case. It is important to make a distinction between elected officials, politicians, and the bureaucracy. It is worthwhile paying specific attention to elected officials, because they have to play an important leadership role. It is not easy to see how progress can be made without giving a key role to politicians. Sometimes we call them 'champions'; politicians who really make a difference."*

The analysis of Wegman's legacy conducted for Walk21 (van den Dool & Job, 2014), further confirms the need for a champion. This requirement for political leadership is also emphasised in the current review of the National Road Safety Strategy (Austroads, 2015):

> *"Many stakeholders thought that the accountability for road safety is unclear and does not assist the leadership task. Improvement in institutional structures, capacities and delivery arrangements at a national level were identified as part of the "First Steps" agenda. Governance arrangements for road safety under the Transport and Infrastructure Council have been modified in the last two years to improve national oversight and coordination of the NRSS and provision of policy advice to Commonwealth, state and territory governments."*

Recommendations

Recognising the challenges ahead for road safety policy in Australia, particularly for vulnerable groups such as children, the elderly, cyclists and pedestrians, the authors make the following recommendations:

1. Appoint and adequately resource political champions who can lead the community debate regarding Safe-Street Neighbourhoods at both a National and State level.
2. Engage with industry to develop a training program on the design of Safe-Street Neighbourhoods and Safe Active Streets.
3. Confirm that the NSW crash patterns (as presented here) are mimicked in the other Australian jurisdictions.
4. With a view to saving an estimated $3.5 billion (13%) annually in crash costs in Australia, extend the Federal Blackspot Funding Program to:
    - develop a road hierarchy for all urban residential areas whereby no one lives further than about 500m from a road with a speed limit of 50km/h or more;
    - change existing 40km/h zones to 30km/h;
    - implement "sparse" extension of 30km/h to 50% of local streets, using "radial" roundabouts and entry thresholds, and treating known crash spots;
    - over time, expand 30km/h to 100% of local neighbourhood streets;
    - there may be a need for more intense treatment in accordance with "safe system" or "sustainable safety" principles;
    - examples of effective and widely supported programs include the Safe Active Streets program in Western Australia and the BIKEast Safe-Street Neighbourhoods initiative.

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Road Safety Case Studies

SARSAI: Low Cost Speed Management Interventions around Schools – Dar es Salaam, Tanzania

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Key Findings

- Low cost road safety interventions have the potential to reduce speeds significantly and hence positively affect traffic injury rates on both paved and unpaved roads.

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