



# Speed-Limits in Local Streets: Lessons from a 30 km/h Trial in Victoria, Australia

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## Abstract

Fatal and Severe Injuries (FSI) to vulnerable road users is a major road safety problem internationally. Recent resolutions by the Global Ministerial Conference on Road Safety called for a blanket 30 km/h speed limit in urban areas to address this problem. A project undertaken in Melbourne, Australia, set out to evaluate the effectiveness and benefits of a lower speed limit in a local residential area in the City of Yarra. The intervention comprised replacing 40 km/h speed limit signs in the treated area with 30 km/h signs with an adjacent untreated control area. A before and after study was employed with speed, resident surveys, and estimated safety benefits as measures of its success. Modest reductions in mean speed were observed in the after-phase of the study while benefits were impressive for vehicles travelling at higher speed levels where the risk of severe injury or death is greater. These findings represent an estimated 4% reduction in the risk of severe injury for pedestrians in the event of a collision. Questionnaire responses showed an increased degree of support for the 30 km/h speed limit in local streets in the trial area. The implication of these findings for road safety is discussed, along with the challenges and potential hurdles. Lower speed limits in local streets and municipalities is one important measure to help address vulnerable road users in residential local streets.

## Keywords

Road safety · Speed limits · Local streets · Vulnerable road users · Severe Injury

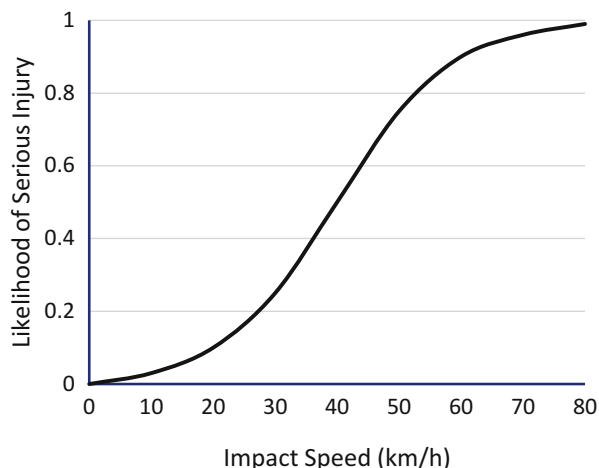
## Introduction

Lowering speed limits in local streets addresses two of the five pillars on which the Global Plan for the United Nations (UN) Decade of Action for Road Safety is founded. These are Pillar 1 – building road safety management capacity; and Pillar 4 – safer road user behavior and the issue of speed control (WHO 2005). The UN also note the importance of speed management as a key element in adopting a safe system approach to road safety. Other publications by WHO (2004), Corben et al. (2006), and TAC (2018) identify speed as a key risk factor in road traffic collisions, with pedestrians and cyclists at increased risk of a severe or fatal injury given a road crash.

Vehicle speeds in residential areas has long been associated with the risk of a serious injury and death to Vulnerable Road Users (VRU) specifically pedestrians and cyclists. There is a breadth of literature describing the relationship between the risk of injury and vehicle speed (e.g., Davis 2001; Rosen et al. 2011; Logan et al. 2019). Figure 1 shows an example of this relationship.

The World Health Organization (2018) recently reported that the number of traffic deaths reached a high of 1.35 million in 2016 and that globally, more than half of

**Fig. 1** Severe injury risk curve for pedestrians. (Source: Logan et al. (2019))



these were among pedestrians, cyclists, and motorcyclists (Vulnerable Road Users). They further pointed out that road traffic injuries are the leading cause of death among children and young adults, aged 5–29 years. The Transport Accident Commission of Victoria, the statutory insurer of personal liability for road accidents in this state, further reported that from 2009 to 2018, more than 400 pedestrians lost their lives on Victorian roads of which one third of those were aged 70 years or older, and that most died in the metropolitan area of Melbourne (TAC Victoria 2018).

## Speed Limits in Local Urban Streets

A 30 km/h (20 mph) speed limit is commonly adopted in many European, UK, and USA municipalities, given these are predominant residential precincts. ETSC (2015) noted that many European countries such as Austria, Brussels, France, Germany, Italy, Netherlands, Spain, Sweden, and Switzerland have implemented 30 km/h speed zones in many of their regions. In addition, several states in the USA such as New York, Wisconsin, Oregon, and Boston, too, have also implemented 20 mph limits on low volume local streets, work zones, and schools (Small 2019). Finally, Auckland city in New Zealand, also recently announced they had cut speed limits in the CBD to 30 and 40 km/h on other major roads (NZ Herald 2019). These countries have recognized the safety benefits of lower speed limits in urban areas with frequent and planned interactions between VRU and cars.

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## Global Mandate for 30 km/h Speed Limits

### Global Ministerial Conference

In February 2020, the third Global Ministerial Conference on Road Safety was held in Stockholm, Sweden, and one outcome of the conference was the release of a formal statement related to road safety objectives up until 2030 (Trafikverket 2020).

The report from this meeting proposes a vision for the evolution of road safety and recommends a new target of 50% reduction in road deaths and serious injuries by 2030 based on expanded application of the five pillars, adoption of Safe System principles, and integration of road safety among Sustainable Development Goals.

A set of *nine* recommendations were proposed from the meeting to realize the vision over the coming decade. One resolution of this declaration (Recommendation 8) was for countries to mandate a maximum road travel speed of 30 km/h in urban areas where there is a mix of vulnerable road users and vehicles. It noted that a speed limit in urban areas commensurate with this maximum travel speed was necessary to prevent serious injuries and deaths to vulnerable people when human errors occur.

## A Safe System Approach

The Safe System methodology has become a preferred philosophical approach to achieving greater improvements in road safety around the world. It calls for the adoption of a systemic view of road safety involving safe vehicles, safe human behavior, safe roads and road infrastructure, and importantly, safe speeds, when examining road safety improvements.

It is no longer acceptable to simply blame the driver as the main cause of road crashes, but rather one element in a much wider view of causal factors in road crashes. While crashes will inevitably continue to occur, it is important that the kinetic energy imparted to the car occupants in a crash should be less than what they are able to tolerate resulting in severe injury or death.

Tingvall and Haworth (1999) first listed these values dependent of the type of collision, vehicle design, and full use of the vehicle's restraint system. Mooren et al. (2014) subsequently published these figures dependent on the type of infrastructure and traffic as shown in Table 1.

Many countries including Australia and New Zealand have adopted these values when setting speed limits in urban and rural settings. Unfortunately, the degree to which they are adhered to is variable across various states and territories. An OECD guidance document on the Safe System approach emphasizes the need for very low speed limits – no greater than 30 km/h – where conflicts with pedestrians are possible (OECD 2008).

**Table 1** Safe System maximum vehicle speeds. (Source: Mooren et al. (2014))

Type of infrastructure & traffic	Possible traffic speed (km/h)
Locations with possible conflicts between pedestrians and cars	30
Intersections with possible side impacts between cars	50
Roads with possible frontal impacts between cars	70
Roads with no possibility of a side or frontal impact (only impact with the infrastructure)	100+

## The Benefits of Lower Speed Zones

Grundy et al. (2009) set out to estimate the benefit of 20 mph (32 km/h) traffic speed zones on traffic collisions, injuries, and fatalities in London, using an observational study of geographically coded police data on road casualties between 1986 and 2006. They examined changes in road casualties, estimating the effect of introducing 20 mph zones on casualties on a range of existing speed zones, based on these crashes.

They reported that the introduction of 20 mph speed limits was associated with a 42% reduction in casualties, when accounting for changes in casualty rates on adjacent roads. They also reported that reductions were greater for young children and the elderly, and for the more serious injury outcomes. They concluded that 20 mph speed zones would be effective measures for reducing serious injuries and death among pedestrians involved in car crashes.

Ingamells and Raffle (2012) and Steeve Davies Gleeve (2014) further claimed that a 20 mph speed limit is the right policy on the grounds of safety, sociability, and ensuring a healthy population. While the focus of this Chapter is on the safety benefits in terms of fewer fatal and severe injuries, they noted other benefits for the residents include street calmness, incentives for more walking and cycling, reduced pollution and noise, improved mobility and independence, and physical and mental wellness.

### *20s Plenty for Us*

The “*20s Plenty for Us*” in the United Kingdom is a non-profit organization formed in the UK early this century by Rod King MBE, Founder and Campaign Director. He noted that the objective of the campaign is for 20 mph (32 km/h) to become the default speed limit on residential and urban streets in the UK. Goodyear (2015) reported that by 2015, there were more than 15 million people in the United Kingdom living in communities where the speed limit is 20 mph (a figure of around 23% of the UK population). Goodyear claimed that this was achieved without the need for any additional physical calming on most streets while allowing for some streets to have a higher limit on particular roads when justified. She stressed, however, that any limit above 20 mph should only be after a considered decision based on local circumstances.

The Nottingham City Council is a member of the “*20's Plenty for Us*” program. In 2012, the Council conducted a survey of its residents in Sherwood (of Robin Hood fame) and found that 63% of respondents supported the introduction of a 20 mph (32 km/h) speed limit on their street and 52% of them would like to see 20 mph speed limits extended to other parts of the City. From a before-and-after trial of lower speed limits on local streets in Sherwood, they found a speed reduction of 1.0 mph (1.6 km/h) average speed in the trial region with a 3.0 mph (4.8 km/h) reduction in the 85th percentile speed limit. They claimed these reductions include reductions in crashes and injuries to VRU, in these streets (Fildes et al. 2017).

## Community Acceptance

The Global Road Safety Partnership (Silcock et al. 2008) noted that crash risk for Vulnerable Road Users is a special problem in most countries that warrants special attention. In setting local speed limits, however, they claimed it is important to know what the public is likely to accept first before committing to lower speed limits. They stress the need for community surveys to be undertaken to indicate the level of public support for these lower limits.

More recently, the ETSC (2015) pointed out that opinion polls in several countries have repeatedly shown majority public support for lower speed limits in urban areas. In a response to the EU's Urban Mobility Package last year, they called on the EU to encourage all member states to adopt speed limits of maximum 30 km/h in residential areas and zones where there are large numbers of VRUs.

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## Speed Limits in Urban Victoria

The current default urban speed limit in Victoria, Australia, is 50 km/h (31.3 mph) although speed limits on major urban arterial roads are typically posted up to 60 km/h (37.5 mph). On heavily congested roads and in school zones, though, limits have also dropped to 40 km/h (25 mph).

Among other Local Government Areas in the state, the City of Yarra, an inner urban Local Government Authority in Melbourne, recently adopted a blanket speed limit on local roads across its municipality of 40 km/h (25 mph) as part of its commitment to the Towards Zero program, widely adopted in Australasia. We understand that while there have been a few examples of the introduction of 30 km/h speed limits in select regions in Australia with a high mix of vulnerable road users and vehicles, none of these have ever been evaluated in terms of their safety benefits (Fig. 2).

**Fig. 2** Typical streetscape in Fitzroy municipality in the City of Yarra



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## The City of Yarra

The City of Yarra is an inner urban metropolitan municipality in Melbourne, Victoria, Australia. It has a population of around 100,000 residents over 2000 ha and includes 12 inner suburbs. It is located on the fringe of the Central Melbourne Business District and is one of the older Melbourne metropolitan municipalities. Its age profile shows it is over-represented in young (<20 years) residents and those aged more than 30 years. It also has twice the proportion of older (65+ years) residents than the rest of Victoria. Given its location adjacent and within comfortable cycling and walking distance to the CBD, it typically has a high number of pedestrians and cyclists, and Council is concerned that 40 km/h is too fast in its residential areas (Fildes et al. 2017).

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## The 30 km/h Trial

### Motivation Behind Trial

The City of Yarra Council is motivated to enhance the safety of vulnerable road users and move toward their vision of zero travel-related deaths and serious injuries within the municipality. The trial was seen as an opportunity to offer a demonstration of the challenges and benefits of lowering speed limits in an urban setting without substantive changes to the road infrastructure, as they relate to speed and community acceptance. It was also seen as an avenue to raise public awareness of the relationship between speed, safety, and local amenity. Public awareness campaigns were not limited to the community within the trial area but communicated throughout the whole municipality.

Key decisions related to the trial were passed through formally constituted Council meetings, and this included identifying an area within the municipality that would be amenable to a trial. A key consideration here was to identify an area without planned modifications to the road or built environment that would meaningfully show the trial outcomes. Moreover, it was also an area that was modest in size with demarcated clear boundaries. It is important to note that the trial area was not identified based on classic road safety selection criteria, such as addressing a poor crash history or speeding concern.

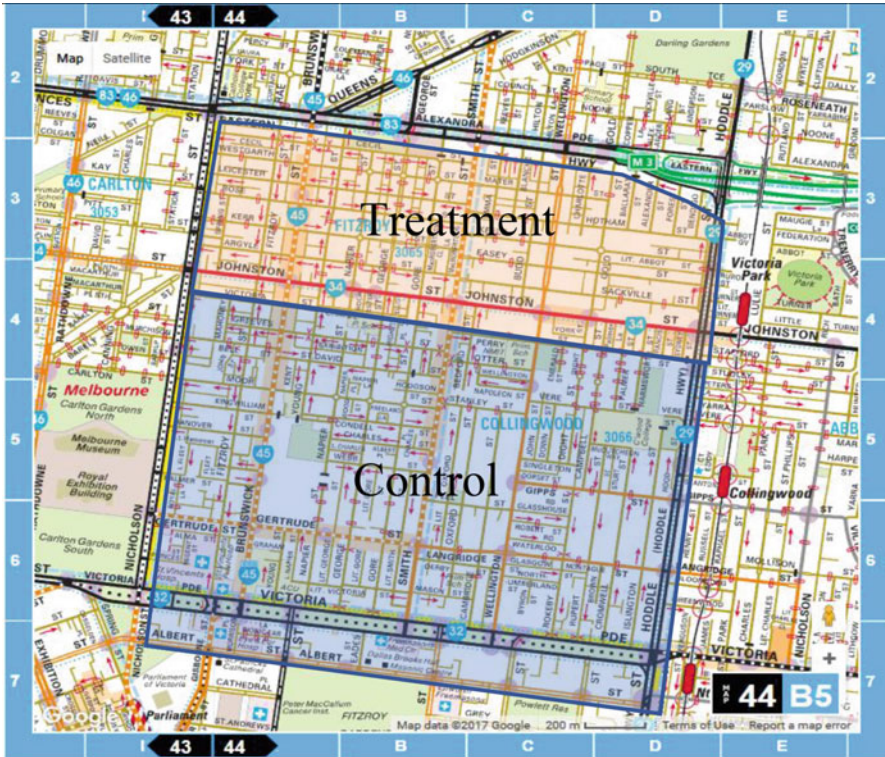
Two adjacent traffic management zones (or local area places) in the suburbs of Fitzroy and Collingwood were identified as candidates, and these were combined as the trial area. Two additional adjacent traffic management zones in the same suburbs were endorsed as a control area, for the purpose of providing exposure measures for observations made in the trial area.

## Study Methodology

### Study Design

In June 2017, the council approached the Monash University Accident Research Centre (MUARC) to assist in implementing a 30 km/h trial in a selected region of





**Fig. 3** Regions selected for the treated and untreated regions in the City of Yarra trial

Fitzroy and Collingwood with an associated untreated adjacent control region. MUARC’s role was also to oversee the implementation of the trial and evaluate the outcome from a safety perspective.

The study design aimed to assess differences in travel speed before and after implementation of the 30 km/h speed limit with an adjacent untreated control region still set at 40 km/h. Figure 3 shows the area in the City of Yarra selected for the lower speed limit trial. The trial ran for 12 months from September 2018.

**Speed Observations**

Speeds were measured from 91 sites located across both the treated and untreated regions covering both collector and one-way streets and cul-de-sacs. Speed data were collected 24/7 across both weekdays and weekends using road tubes installed at specified sites by contracted traffic surveyors.

**Attitudes**

It was also important to assess residents’ attitudes to these changes as a measure of likely acceptability. Two online community surveys were conducted during the before and after phases. Invitations were mailed to a random selection of property



addresses in the treatment area ( $n = 2000$ ) and in the non-treatment area ( $n = 2000$ ). The approach was the same for the baseline and the 12-month after samples. The questionnaire comprised 24 questions focused on their demographics, a range of questions related to their attitudes to the trial, and other associated local issues. Respondents were asked to complete an online questionnaire and sampling rates were 484 (24%) at baseline and 548 (27%) on completion of the trial.

## Safety

Given the size of the trial, it was not possible to expect enough data on crashes that occurred during the study period. However, it was possible to compute the likely injury benefits in terms of Killed and Severe Injuries (KSI) from the observed speed changes, both before and after the trial. In addition, the speed distributions for those travelling above the speed limits before and after the trial as well as those travelling above the Safe System recommended speed categories.

## The Findings

### Speed Reductions

#### Average Speed

The average and 85th percentile speeds observed before and after the 30 km/h trial in the treated and untreated (control) locations are shown in Table 2 below.

The average and 85th percentile speed reductions were modest in both regions (median values were similar to the mean values and trends). The reductions in speeds in the control regions were unexpected, and interpreted as a carry-over effect, given that the control region was immediately adjacent and marketing for the trial did not clearly separate the two regions. Nevertheless, it did have a negative impact for the analysis, discussed further below.

#### Speed Categories

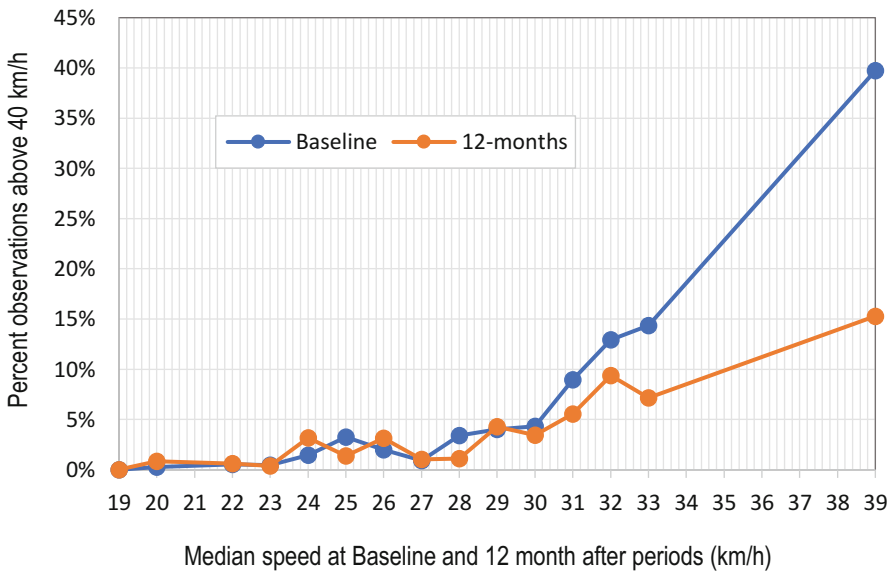
Importantly though were the speed findings above the speed limit, shown in Table 3. The three values were chosen based on the speed limit and Safe System values for these localities. The average percent speed reductions for the three-selected speed categories shows significant larger speed reductions for the 40 and 50 km/h

**Table 2** Mean and 85th percentile speed, before and after the 30 km/h trial

Measures	Before (km/h)	After (km/h)	Reduction (%)
Treated – average speed	27.6	27.3	-1.1
Treated – 85thile speed	36.0	35.0	-2.8
Control – average speed	29.4	28.6	-2.7
Control – 85thile speed	38.0	37.0	-2.6

**Table 3** Observations exceeding speed categories, before and after the 30 km/h trial

Measures	Before (%)	After (%)	Reduction (%)
Treated – 30 km/h	36.71	34.42	6.24
Treated – 40 km/h	5.38	3.89	27.73
Treated – 50 km/h	0.41	0.25	38.69
Control – 30 km/h	46.76	42.68	8.72
Control – 40 km/h	7.95	6.43	19.15
Control – 50 km/h	0.63	0.51	18.44



**Fig. 4** Percent exceeding 40 km/h by mean speed at baseline

categories at the treated sites and at the controls. These equate to significant reductions in the likelihood of severe injury at the treated sites with the 30 km/h speed limit, compared with the untreated control sites.

**Speed Trends: Before and After**

The relationship between the median speed at baseline and at 12 months by speed category is a further indicator of speed changes at the various sites and/or traffic conditions where the lower speed limit had its greatest impact. Figure 4 shows the percent of observations at the treated sites exceeding 40 km/h before and after treatment. As the mean speed increased, the percent of observations also increased but noticeably less after the treatment than before. It further confirms that the speed attributed to the lower speed limit had its greater impact on sites with higher initial speeds.

**Table 4** Overall treatment effect of the 30 km/h trial in speed reduction benefits

Measure	Odds ratio	CI (95%)		Significance
Exceeding 30 km/h	1.07	–	–	$P > 0.05$
Exceeding 40 km/h	0.89(–11%)	0.87	0.92	$P < 0.001$
Exceeding 50 km/h	0.75(–25%)	0.67	0.84	$P < 0.001$

### Treatment Effect

The final speed analysis assessed the overall “treatment effect” of the trial used a modelling approach that adjusted for the difference between the treated and control speed reductions, that is, what was the real effect of the 30 km/h trial (see Table 4). The treatment effect was assessed against the odds of a speed observation exceeding 30, 40, and 50 km/h, in the treatment area, minus the reductions observed at the control sites.

Thus, the real treatment effect of the 30 km/h trial after adjustment was a reduction in the odds of a vehicle speed exceeding 40 km/h by around 11% and exceeding 50 km/h by 25% in the after phase. The treatment was found to not reduce the odds of a speed observation exceeding 30 km/h.

Thus, it can be concluded that the expected overall benefit of the City of Yarra 30 km/h trial in terms of speed reductions was achieved. While there was little difference in average speed before and after the trial, the main benefits were among the higher speeders where greater benefits in terms of fewer severe injuries were likely in a crash.

### Community Survey

The community survey key question asked during the trial was whether the respondent would support the introduction of a 30 km/h speed limit on the street in which I live/work/own in the City of Yarra (Lawrence et al. 2017). Their responses to this question are shown in Fig. 5.

Interestingly, the yes responses to that question went from 42.7% before to 50.3% after, that is, an 18% increase in support for the trial and an associated decrease in non-support. While many of the other question responses showed little difference before and after, there was an increase in support of 10% that the reduced speed limit will not impact on travel time, another 4% that it will be safer for children and the elderly, and 3% that lower speed limits will reduce injury severity in a crash.

### Safety Benefits

The final analysis was to estimate what the likely percent reduction in severe injuries would be given the speed reductions above. This estimate was based on modelling the association between the speed reductions of the treatment effect, given the severe injury risk curve for pedestrians, shown earlier. The modelling approach is illustrated in Fig. 6 below.

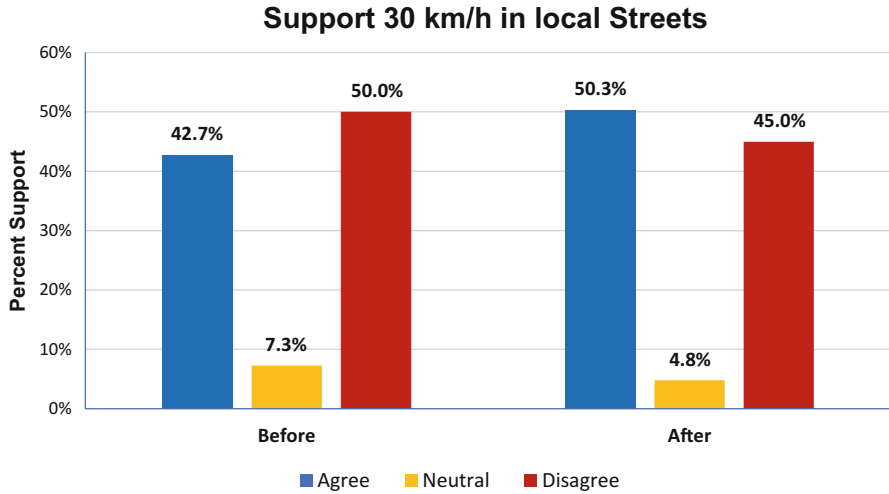


Fig. 5 Residents' support for a 30 km/h speed limit where they lived, worked, or owned

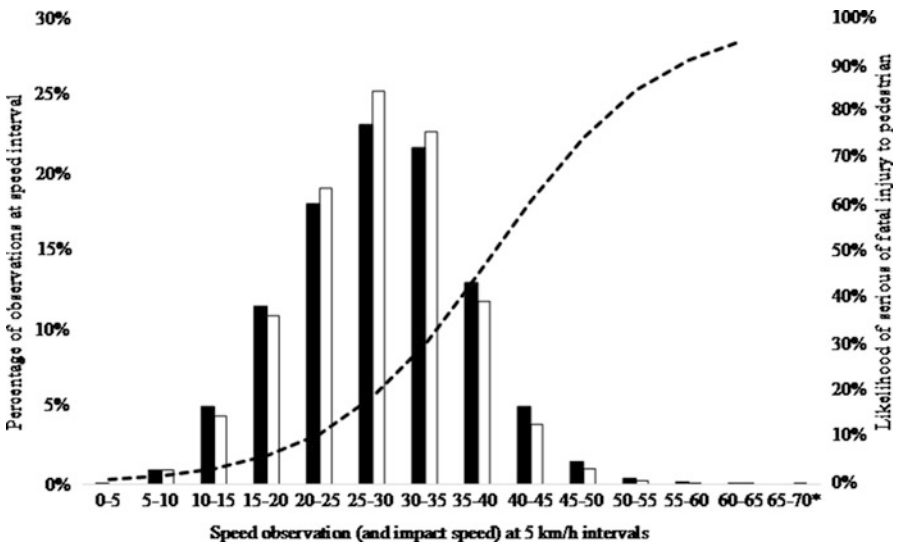


Fig. 6 Crash distributions before and after by the injury risk curve shown earlier in Fig. 1

The potential injury savings from the 30 km/h speed-limit trial over the previous 40 km/h speed-limit, were estimated by identifying the difference in the relative risk of injury, before and after the intervention, using the Davis (2001) risk curve.

The findings showed that the risk of sustaining a serious or fatal injury, given collision involvement, reduced from 24% before, to 23% after treatment. This represents a 4% reduction in the risk of sustaining a severe injury, should a collision occur between a motor-vehicle and a pedestrian. While this might sound like a

relatively small improvement, it does represent a sizeable number of vehicles (between 200,000 and 300,000 annually) that will travel at excessive speeds likely to cause severe injuries to vulnerable road users. This analysis does not account for any reductions in the risk of a collision on account of the reduced speed, although this may also occur due to the lower speed limit (WHO 2004).

## Crash Reductions

The risk of having or not having a collision given the speed reductions noted above was beyond the scope of this trial. Nevertheless, there are physical relationships between speed and the distance it takes to stop, reported in studies by Anderson et al. (1997) and Corben et al. (2006). Factors that affect stopping distance include initial travel speed, driver reaction time, braking capability of the vehicle, and the coefficient of friction between the tyres and the road surface. Corben et al. (2006) estimated that for a reduced travel speed from 40 to 30 km/h, the stopping distance reduces from 22 to 15 m (a 32% reduction), leading to a potential added saving in injury from total preventing the crash thereby adding additional safety benefits from those noted above (Fig. 7).

## Summary of Results

In summary, there were modest reductions in average and 85th percentile speeds in both the trial and control areas, although larger reductions were observed at higher

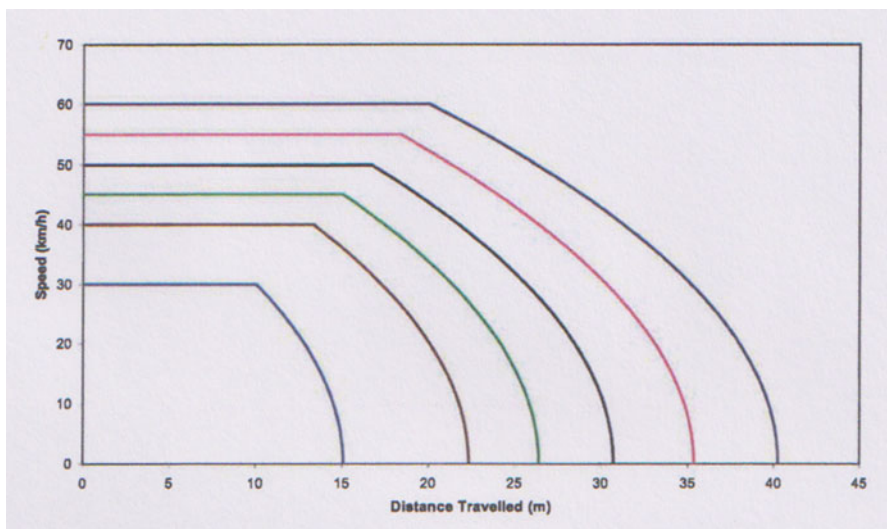


Fig. 7 Stopping distance by travel speed (Corben et al. 2006)

speed levels above 40 and 50 km/h in both regions. After adjusting the trial findings for the unexpected speed differences in the control region, there was still a significantly “treatment effect” attributed to the 30 km/h trial with a 4% reduction in likelihood of a fatal and serious injury. These reductions are likely to led to a reduction in risk of a pedestrian and other VRUs sustaining a fatal or serious injury in a crash.

Residents’ positive attitudes to a 30 km/h lower speed limit increased significantly by 17% at the conclusion of the trial with a sizeable reduction in opposition. There was also a 10% increase in the belief that the 30 km/h trial would have little effect on travel time in these local streets. Small increases were observed in the agreement that the 30 km/h speed limit was safer for children and elderly pedestrians and that lower speed limits are likely to reduce injury severity in a crash. No support was observed, however, for reducing the speed limits in the neighboring main feeder streets.

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## Implications from the Trial

As noted earlier, this was the first evaluated trial of a 30 km/h speed limit in a residential environment in Victoria, Australia. The trial was expected to achieve reductions in area-wide travel speeds and community acceptance, and this was observed after a 12-month introductory period, especially among the higher speeders in the region. A 4% reduction in the risk of a severe or fatal crash injuries to pedestrians and an increase in community acceptance were also anticipated. A 4% increase in safety for vulnerable road users in Victoria is a worthwhile improvement for pedestrians and bicyclists in residential areas and likely to help address their over-involvement in crashes in these regions.

The findings from the trial support previous published benefits on the effectiveness of adopting a lower 30 km/h speed limits in urban areas (Grundy et al. 2009; Fildes et al. 2017a) and in current best practice in many international countries. It is consistent also in line with the recent call from the Global Ministerial Conference on Road Safety for countries to mandate a maximum road travel speed of 30 km/h in urban areas where there is a mix of vulnerable road users (Trafikverket 2020). It also supports the recommendation from adopting a Safe System approach toward speeds in residential areas (Tingvall and Haworth 1999; Mooren et al. 2014).

It must be stressed though, that 30 km/h speed limits in local streets is not a particularly new finding internationally for protecting pedestrians and cyclists in residential areas. As noted earlier, 30 km/h (20 mph) speed limits are relatively common in areas with high volumes of vehicles and vulnerable road users in many countries around the world. The World Health Organization (2018) noted that Vulnerable Road Users (pedestrians, cyclists, and motorcyclists) are disproportionately impacted globally, accounting for half of all road deaths in 2018. Further, the Global Road Safety Partnership (GRSP 2008) pointed out that in some regions, speed limits on local urban streets need to consider a variety of functions in these

regions (school zones, shopping precincts and purely residential areas) and that for some of these zones, limits as low as 20 km/h may be appropriate.

## Enforcement

There was a deliberate decision taken at the outset of the City of Yarra trial not to compound the findings of the trial with any police enforcement effects. The Victorian police agreed to this request and while they oversaw the conduct of the study, did not perform any speed enforcement in the area. Thus, the findings reported above are purely based on the motorists' behavior. It is anticipated, though that with time, speed enforcement in the area will be needed to maintain the speed benefits observed.

The Nottingham police reported that, the 20 mph speed limit is enforceable in the Nottingham trial where the limit is clearly marked, and that offenders may be prosecuted. They noted that the primary infringement means is by using speed cameras in 20 mph zones. They claim that this technology is more important than the use of speed humps. Afukaar (2003), however, noted that while active enforcement (e.g., speed cameras and police presence) should be the primary "weapon" used against speeding motorists, supplementary engineering treatments such as rumble strips and speed humps are also effective for speed controls in low speed environments.

From an extensive inquiry conducted by the Auditor General of the Victorian Parliament following a review of the "Arrive Alive" camera enforcement program (VicParl. 2006), they concluded that the enforcement program had reduced speeding by up to 20% with no evidence that the program was focused on raising revenue. While most of the speeding reductions were focused on speeds above 60 km/h, they also reported there had been significant reductions in pedestrian trauma and severity of serious injuries during the program: measures sensitive to changes in lower travel speeds.

It is important when speed changes are introduced that it is accompanied with on-going speed enforcement, mass media, public education programs and possibly infrastructure improvements. The Transport Accident Commission stress the need for public acceptance, show the risk of detection is real and the use of the latest enforcement technologies (TAC 2020).

## Speed Technology

In addition to police enforcement, there are other technologies available and under investigation to help address police enforcement. Intelligent Speed Adaptation devices can be fitted to vehicles that alert the driver to the fact that he/she is travelling above the speed limit, with and without pedal activation. In a study in Belgium by Vlassenroot et al. (2007), they found large differences between drivers using the technology. While there was evidence of some drivers slowing down and driving at the speed limit, others speeds even increases despite activation of the system. Frequent speeders tend to accelerate quickly up to the speed limit causing average speeds to increase.





**Fig. 8** Photo of a Geofence bus trial in Sweden. (Source: Tom Stone (2018))

More recently in Sweden, Payne (2020) reported on a new concept for speed control where vehicle speeds are digitized. The technology is known as Geo-fencing and is currently undergoing city bus and truck trials in Sweden and Norway to evaluate its potential to end speeding in these countries. Using GPS or cellular technologies, the system creates a virtual fence around the vehicle that triggers a pre-programmed action, keeping vehicles under 30 km/h as it enters the trial area (Fig. 8). The author notes that geo-fencing “*has the potential to change the way traffic infrastructure is developed and how different vehicles use the roadway.*”

Finally, in future, Connected and Autonomous Vehicles (CAVs) in use are expected to sense the legalized speed limit in the area they travel at by software using either sign-recognition or GPS interaction and then maintain the appropriate speed autonomously, ensuring the vehicle does not exceed beyond the legal speed for the region. These vehicles are still some time away from widespread use but may well be the ultimate solution, taking the choice of what speed to travel at away from the human occupants of the vehicle.

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## Challenges and Potential Hurdles

### Community Acceptance

As noted above, there is considerable evidence showing that lowering a posted speed limit will increase safety and decrease the number of crashes (Afukaar 2003; WHO 2004; VicParl 2006;). Nevertheless, the greatest challenge in introducing a new (lower) speed limit is always gaining community acceptance of any such change.

As pointed out by Mooren et al. (2014) and others (Lahousse et al. 2009; McGuffie and Span 2009; Soole et al. 2013), part of the problem for governments when introducing safe speed limits is the amount of vocal opposition to lowering the limits. Typically, there is always enthusiasm (positive and negative) when new safety measures are introduced, but it is likely to take significant effort over a long period of time to ensure it becomes commonplace in local streets.

When mandatory wearing of seat belts was first introduced in Australia in the 1970s, more than 90% wearing rates were achieved quickly and maintained through ongoing speed enforcement. Ultimately, behavioral change occurred from early and continual enforcement (Robinson 2011) as well as in marketing programs over a constant prolonged period.

## Government Support

Government support is also important which sometimes is not always forthcoming for changing speed limits, given the potential political consequences. Svensson et al. (2013), for instance, noted that in most European countries, the process of setting and implementing speed limits is often delegated to local and regional administrators. They examined the perspectives and priorities of administrators and elected officials in setting speed limits and identified two groups with different philosophies, namely, (i) those who support a mobility perspective (e.g., traffic planners for example), and (ii) those who share a traffic safety perspective (e.g., committed to improve traffic safety through lower speed limits). Further, they noted that in general, municipal politicians, officials in the regional development council, and planners share a strong commitment to regional development and economic growth, but often fail to recognize that these goals may be at the expense of a higher rate of road accidents (and injuries).

## Societal Lethargy

There is also a degree of lethargy or resistance within the system generally that needs to be overcome when adopting new systems and procedures. Best evidence for adoption of a lower speed limit can be overlooked for reasons of fear or change to the status quo. In an interesting article by Paul Lawrence in the Harvard Business Review Paul Lawrence in the Harvard Business Review as far back as January 1969, he noted that one of the most baffling and recalcitrant problems that business executives face is gaining employee resistance to change. He noted many reasons for this and identified five principle causes for this challenge. These can include the following:

1. Lack of strong leadership and effective collaboration in making the change.
2. Failure to understand that sometimes, resistance may not be technical but social change.

3. Resistance by certain blind spots and attitudes which staff have because of their preoccupation with the technical aspects of new ideas.
4. Management need to take concrete steps to deal constructively with these staff attitudes.
5. Top executives also need to make greater positive efforts and be more effective at meetings of staff where change is being discussed.

He concluded, however, that once people see that the change is of benefit to them, they acquiesce and often champion the change. This would be expected to occur with the introduction of a lower speed limit in local streets once the benefits are realized and accepted.

### **Added Costs**

To reduce speed limits to 30 km/h, there will be some associated costs in signage and possibly a need for some additional road treatments and maintenance to overcome any local hazards. However, the ratio of benefit to cost is likely to be very positive, given the potential benefits in terms of reduced serious injuries and death to Vulnerable Road Users. As noted earlier, severe injuries to this group is on the rise and it is essentially an inner urban problem.

Furthermore, WHO (2004) maintained that reductions in travel speeds, even at lower speeds, can still result in a meaningful reduction in deaths and serious injuries to VRU in the event of a collision with a motor vehicle.

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### **Conclusion**

If Vision Zero's new target of a 50% reduction by 2030 is to be achieved, then reducing travel speed to a level within the human biomechanical tolerance needs to be a priority. As noted earlier, the European Commission noted recently that while the number of crashes has become significantly safer for most road users, the same cannot be said for pedestrians, cyclists, and motorcyclists, who are rapidly becoming the most killed and injured group on their roads and especially in urban areas. The TAC (2018) noted that in the last 10 years, more than 400 pedestrians lost their lives on Victorian roads, with one third of the fatalities to people aged 70 years or over. Around three-quarters of these happened in Metropolitan Melbourne. Similar trends have also been reported by Transport for NSW.

There is a burgeoning problem worldwide among Vulnerable Road Users and speeding in urban streets is seen as a major cause of many of these injuries. Lower speed limits in areas where people live offer some promise to help in the push toward Zero. The third Global Ministerial Conference on road safety in Sweden called for countries to "*mandate a maximum road travel speed of 30 km/h in areas where vulnerable road users and vehicles mix in a frequent and planned manner.*" This will certainly require some serious attempts to address all road users, and those more

vulnerable. Lower speed limits in local streets and municipalities are important measures to help reduce severe injuries to vulnerable road users in residential local streets.

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