Submission No 26

INQUIRY INTO SPEED ZONING AND ITS IMPACT ON THE DEMERIT POINTS SCHEME

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Inquiry into speed zoning and its impact on the demerit points scheme

Submission to the Parliament of NSW
Joint Standing Committee on Road Safety

The Transport and Road Safety (TARS) Research group are a multidisciplinary team focused on reducing road trauma through identifying evidence-based solutions to crash and injury factors. The topic of speed is an extremely important one, as it is a major factor in road crashes and injury severity. We are pleased to assist the Committee's inquiry.

In this report, we address each of the points included in the Inquiry Terms of Reference:

a) The contribution of speed to crash rates on NSW roads;
b) The rationale for and current operation of speed zones on NSW roads;
c) Key factors for governing the establishment of speed limits;
d) Mechanisms for reviewing the appropriateness of maximum speed limits;
e) The operation of speed limits in other jurisdictions;
f) The appropriateness of current thresholds in the Demerit Points Scheme for speed offences;
g) The impact of demerit points in reducing speed behaviour; and
h) Any other related matters.

Introduction

Australian Governments adopted the Safe System approach to underpin all State and National road safety strategies from the year 2004 onwards. Speed management is an essential component of any road safety strategy that aims to reduce or eliminate road deaths and injury. The speed that vehicles travel on roads will predict the likelihood and severity of crashes. The Safe System approach requires the road traffic management system to limit speeds to survivable levels, taking into account human fallibilities and frailties. That is, the design parameter is human tolerance to physical force as well as the limits to human reaction time to respond to unexpected changes in the road environment.

Generally, the speed zoning across all Australian States and Territories does not comply with Safe System parameters. The reasons for this are largely political. The calculations of survival speeds are known. They are just not being implemented.

a) The contribution of speed to crash rates on NSW roads

Forty per cent of fatal crashes in NSW involve speeding as a contributing factor, making it the largest single contributor to road fatalities (Roads and Traffic Authority NSW, 2011) .

TARS Research has predominantly utilised linked police-reported road crash (provided in Transport for NSW's CrashLink) and hospital-related data (provided in the NSW Ministry of Health's Admitted Patient Data Collection i.e. APDC) to examine various aspects of hospitalised injury following road traffic crashes in NSW.

CrashLink includes data on road crashes that were "an unpremeditated event" (i.e. unintentional); occurred on a public roadway; and involved at least one moving road vehicle, at least one person being killed or injured (identified by police), or at least one motor vehicle being towed away (NSW Centre for Road Safety, 2010). The APDC includes information on all inpatient admissions from all public and private hospitals, private day procedures, and public psychiatric hospitals in NSW. CrashLink provides information on the crash circumstances and the APDC provides information on injuries and their treatment.

Within CrashLink, speed was considered to be a contributing factor to a crash if condition (i) or (ii) or both were satisfied during 2001 to 2009: (i) the vehicle's controller was charged with a speeding offence; or the vehicle was described by the police as travelling at excessive speed; or the stated speed of the vehicle was in excess of the speed limit; (ii) the vehicle was performing a manoeuvre characteristic of excessive speed (i.e. while on a curve the vehicle jack-knifed, skidded, slid or the controller lost control; or the vehicle ran off the road while negotiating a bend or turning a corner and the controller was not distracted by something or disadvantaged by drowsiness or sudden illness and was not swerving to avoid another vehicle, animal or object and the vehicle did not suffer equipment failure (NSW Centre for Road Safety, 2010). The indication of speeding as a contributing factor to a crash was modified from 1 January 2010 to also include that the stated speed of the vehicle was in excess of that permitted for the vehicle controller's licence class or the vehicle weight (Centre for Road Safety Transport for NSW, 2011).

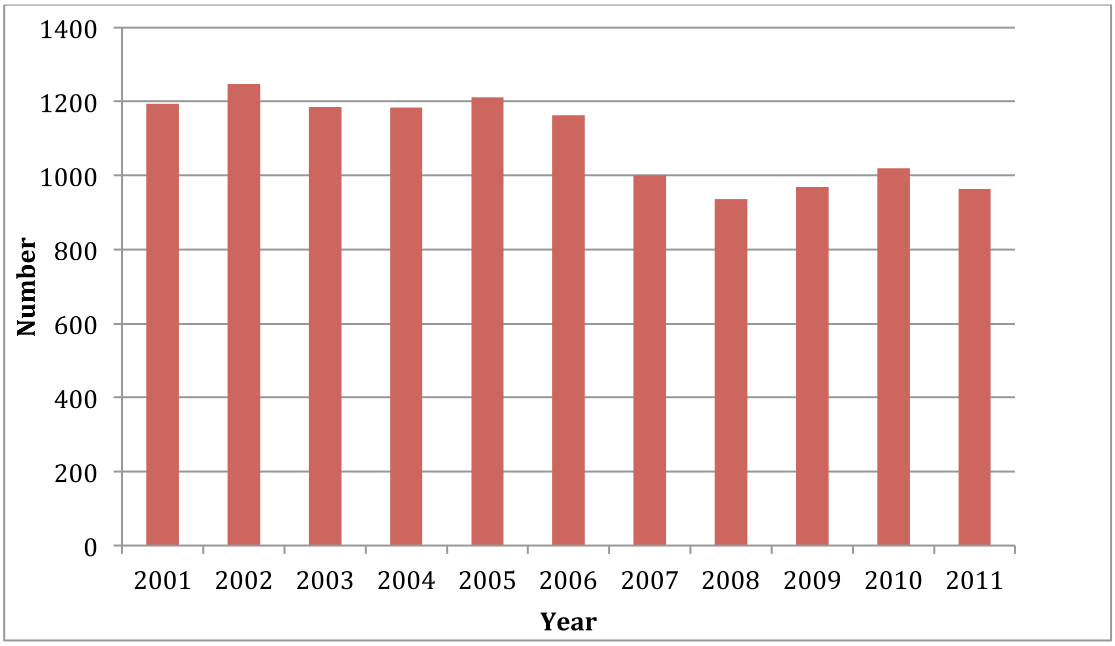
During 2001 to 2011, there were 68,383 individuals identified in the linked CrashLink-APDC data extract who were hospitalised and information on their crash was recorded in CrashLink. Speed was identified as a contributing factor for 12,073 (26.2%) motor vehicle occupants who were hospitalised following their injury (Figure 1). It should be noted that during 2001-2011, there were also 51,570 individuals who were hospitalised following a road traffic crash where their hospital record did not link to CrashLink and no information on the contribution of speed to the crash was available (Mitchell, Bambach, Williamson, & Grzebieta, 2013).

TARS Research also examined the contribution of speed to crashes during 2001-2009 by injury severity where the outcomes examined were multinominal and included: fatal injury, major/severe injury (i.e. ICISS <0.965), minor/moderate injury (i.e. ICISS >0.965), minimal injury (i.e. emergency department (ED) presentation, but no hospital admission) and possible injury (i.e. identified as injury by police but did not present to an ED and was not admitted to hospital). For car occupants, **speed-related crash casualties had a 2.7 times higher risk of involving a car occupant fatality**, a 1.4 times higher risk of involving a major/severe car occupant injury, a 1.2 times higher risk of involving a minor/moderate car occupant injury compared to where speeding was not identified as a factor in the crash (Bambach, Mitchell, Grzebieta, & Williamson, 2012).

For motorcyclists, speed-related crash casualties had a 6.7 times higher risk of involving a motorcyclist fatality, a 1.9 times higher risk of involving a major/severe injury, a 1.3 times higher risk of involving and a minor/moderate injury compared to crash casualties where speed was not identified as a factor in the crash (Bambach, Mitchell, et al., 2012).

Clearly, where speeding is involved as a contributing factor in a crash, the injury is likely to be more severe or fatal.

Figure 1: Number of hospitalised motor vehicle occupants in NSW where speed was identified as a contributing factor in the crash by year, CrashLink-APDC, 2001-2011[1]



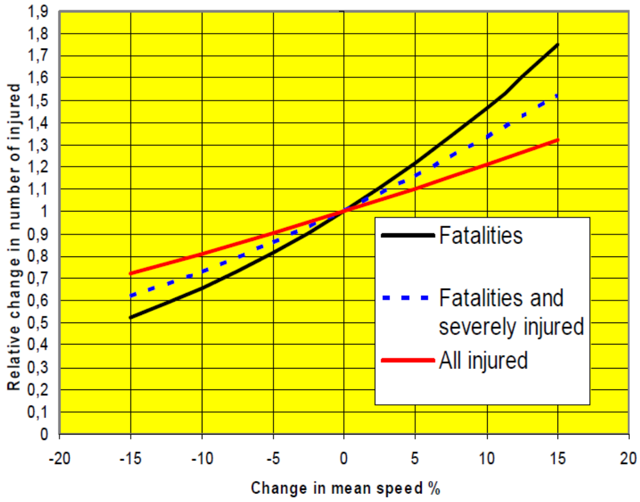
[1] Speed was identified for at least one vehicle controller involved in the crash, but may not necessarily apply to the vehicle where an individual was hospitalised for their injury.

Further work on the effect of speed on crashes involving motorcyclists was investigated in a project focussing on impacts with roadside barriers (Bambach, Grzebieta, & McIntosh, 2010, 2012; Bambach, Grzebieta, Olivier, & McIntosh, 2011; Bambach, Grzebieta, Tebecis, & Friswell, 2012; Grzebieta, Jama, Friswell, & Favand, 2010; Jama, Grzebieta, Friswell, & McIntosh, 2011) National Coroners Information System (NCIS). Data for all motorcycle crashes involving a roadside barrier for the years 2000 to 2006 inclusive were identified. A total of 77 cases were found (approximately 6% of all motorcycle fatalities). It was found that the majority of fatalities occurred on a weekend, during daylight hours, on clear days with dry road surface conditions. Speeding, driving with a blood alcohol level higher than the legal limit and drugs or a combination of any of the three factors, contributed to two out of every three fatalities. However, inappropriate speed was the most dominant factor (Bambach, Grzebieta, Tebecis, et al., 2012; Grzebieta et al., 2010). (Bambach et al., 2011) identified from the NCIS data that there is a general trend towards motorcyclists with greater pre-crash speeds receiving more injuries. Fatal motorcyclist-barrier collisions often result in multiple serious injuries, and all motorcyclists whose pre-crash speed exceeded 100 km/h received at least 4 serious injuries. Thorax, head and lower extremity regions were the most frequently seriously injured body regions.

In regards to motorcycle fatalities in general, Bambach et al (2012C) identified a total of 1,323 motorcyclist fatalities occurred in Australia during the period 2001 to 2006. They found that the motorcyclist was at-fault or partially at-fault in 84% of crashes, and of these, the **motorcyclist was demonstrating risky riding behaviour in 70% of crashes (speed, alcohol, drugs, disobeying a traffic control, or any combination) with speed being the dominant factor**.

Figure 2 illustrates the Nilsson Power model showing how **small changes in the mean speed can have a large effect on the number injured and killed**. For example, the relationship shows that a small speed reduction on a particular road will likely result in a significant reduction in fatalities and casualty crashes. The Australian Transport Council's National Road Safety Strategy document (Australian Transport Council, 2011) cites three examples, one in NSW, another in South Australia and a third in Victoria where a change in speed limit from 100 km/h to 110 km/h resulted in a 20% increase in casualty crashes.

Figure 2: Nilsson Power model illustrating the relationship between change in mean speed and crashes



Source: (Nilsson, 2004, p. 90).

Hence any small reduction in the average speed has considerable benefits in terms of reducing casualty crash outcomes. So, while lowering speed limits may be viewed as unfavourable for mobility, the trade-off is an excessive compromise on safety.

Summary Points

- *Of the vehicle occupants killed or injured in a crash, those in speed-related crashes are 2.7 times more likely to die if they are injured compared with vehicle occupant casualties where speeding was not a factor*
- *Of motorcyclists killed or injured in a crash, those in a speed-related crash are 6.7 times more likely to die compared with being injured in a crash where speeding is not involved.*
- *Small changes in average speeds can produce large changes in road injury outcomes.*

b) The rationale for and current operation of speed zones on NSW roads

While the NSW Speed Zoning Guidelines make reference to basing speed limits on the Safe System approach, they espouse the need "to balance road safety with mobility needs" (Roads and Traffic Authority NSW, 2011, p. 2). The document does not place a priority on safety in the setting of speed limits. It explicitly states that the aim of the document is to guide the setting of speed limits to "ensure that they are practical and balance mobility, road safety and community concerns."

This principle of "balance" between, these sometimes conflicting objectives, may be consistent with the goals of no fatalities nor serious injuries, but allowing any balance may allow trade-offs of safety in favour of greater travel efficiency and or community desires. Table 1 shows a comparison of principles underpinning the NSW road safety and speed zoning practices.

Table 1: Principles of the NSW Road Safety Strategy and the NSW Speed Zoning Guidelines

NSW Safe System strategy & principles*	NSW Key factors in setting speed limits**
Inclusive view of the whole road transport system and the interactions between all elements including roads and roadsides, vehicles, travel speeds and all users of the system. *There are physical limits to what the human body can endure. The impact forces in any major crash type are well known and, if they are exceeded, can result in death or serious injury.* *We must therefore design a road transport system that is forgiving of human error to ensure that users are not killed or seriously injured in any crash.* *We must also ensure that we have safe and compliant road users.* *A critical component of the Safe System approach to road safety is that a speed limits are set so that they are safe for the type of road, and road users.*	*The speed limit must reflect the road safety risk to users while maintaining mobility and amenity.* *The default 50 km/h general urban speed limit should be the initial consideration in urban areas.* *The need for a non-default speed limit should be obvious to drivers.* *The speed limit must not exceed the maximum assessed speed for the road, using crash histories, road use, traffic mix, presence of vulnerable road users, etc.* *Speed zone changes should be kept to a minimum.* *Lower speed limits may be considered for application to at-risk locations.* *The setting and review of speed limits should be part of a route-based approach.* *Restricted use of 70 km/h and 90 km/h speed limits.*

*** Source: NSW Road Safety Strategy 2012-2021 (Transport for NSW, 2013, p. 19 & 30)**
**** Source: NSW Speed Zoning Guidelines (Roads and Traffic Authority NSW, 2011, p. 15)**

The key factors in setting speed limits set out in the NSW Speed Zoning Guidelines appear to be at odds with the Safe System strategy and principles outlined in the current NSW Road Safety Strategy. If it is "*critical*" that speed limits, under a Safe System strategy, are "set so that they are safe for the type of road and road users" then to suggest that mobility and amenity be maintained when setting speed limits is inconsistent with the road safety strategy adopted by the Government. The "factors for setting speed limits suggest that safety and risk should be taken into account. However the Safe System approach goes beyond this, demanding that safety must be the first priority and not traded off for other objectives.

The Government's strategy acknowledges that much is known about human vulnerability and survivability in various types of crashes. Moreover, it recognises that human users also make mistakes in the road environment. Their Speed Zoning Guidelines, however, suggest that various things should be taken into account when setting speed limits – and safety is not necessarily an overriding factor. Indeed, some models of practice suggested in the Guidelines are specifically inconsistent with a Safe System approach.

Adopting a Safe System approach, for example, where there is a possibility of head on crashes the speed limit should be no greater than 70 km/h to allow survival of the occupants. However, the image (Figure 3) used as an example for rural undivided highways models a speed limit of 100 km/h. This is clearly not consistent with a Safe System approach.

Figure 3: Rural undivided road with sealed pavement greater than 5.6 metres

(Source: NSW Speed Zoning Guidelines, page 26)

Whether or not there is a centre line, the reality is that head-on collisions are possible in the type of road shown in the photo above. Proscribing a maximum limit of 100 km/h seems a very high speed limit for these apparent conditions. Having no features that would prevent a head-on crash at 100 km/h is not a Safe System design.

If the photos are a guide, the application of the Guidelines seem to result in a wide variety of road types, with varying conditions to be set at a speed limit of 100 km/h. See Figure 4 for examples of 100 km/h zones.

Figure 4: Examples of 100 km/h zones in NSW

It should be noted that the Government's data indicates that 45% of rural road fatalities in 2010 involved excessive speed (Transport for NSW, 2013). Also, country residents have a road fatality rate (per 100,000 people) that is more than 4 times more than metropolitan residents. In country areas run off road and head-on fatal crash types predominate.

However, speeding is involved in 36% of metropolitan road fatalities, where intersection and pedestrian crashes are the main crash types (Transport for NSW, 2013).

Local traffic areas are described (on page 28 of the Guidelines) as "primarily self-contained, residential precincts with networks of local streets, used mainly for local access". The Guidelines indicate that these precincts usually have physical features that help to "self-enforce" the low speed limit.

Figure 5 is clearly a picture of a residential street, yet it suggests that the speed limit should be set at 50 km/h – well above the survival threshold for vulnerable road users like pedestrians and cyclists. A similar road in many European jurisdictions would set speed limits at 30 km/h for these areas.

Figure 5: 50 km/h default urban speed limit

(Source: NSW Speed Zoning Guidelines, page 24)

Again, this example seems an inconsistent depiction of a good practice Safe System approach to setting speed limits. A vulnerable road user would have little or no chance of surviving a crash where a motor vehicle was traveling at the maximum speed limit on impact. There are also few apparent provisions for vulnerable road users in the picture above, nor traffic calming features.
A final point of criticism is that the NSW Speed Zoning Guidelines make little mention of the importance of giving motorists additional visual cues – beyond posting the legal limit with signs and markings - about the expected maximum speeds that they should travel at. For example, where there is high pedestrian activity, the lanes or roads should have perceptual or physical features that would effectively make drivers uncomfortable if they were to exceed 30-40 km/h. (See New Zealand examples in Section e.) Instead there is a heavy reliance on signs and markings to tell drivers what the legal limits are.

However, to its credit, the NSW road authority has, in the past, carried out some ground-breaking road safety work in speed zoning. In the late 1990's NSW was one of the first Australian States to begin to lower the general urban speed limit from 60 km/h to 50 km/h. The 21-month sign-permissible trial of 50 km/h speed limits in 26 local government areas, succeeded in reducing the risk of crashing in the 50 km/h zones by 25% (Roads and Traffic Authority NSW, 2000). This initiative was also a good example of State and local government collaboration and achieved broad community support for lower urban speed limit – ultimately enabling a 50 km/h general (default) urban speed limit to be put in place.

At this stage, it would be timely to re-examine Version 4 of the Guidelines to determine whether there could be further improvements to align with the Safe System policy.

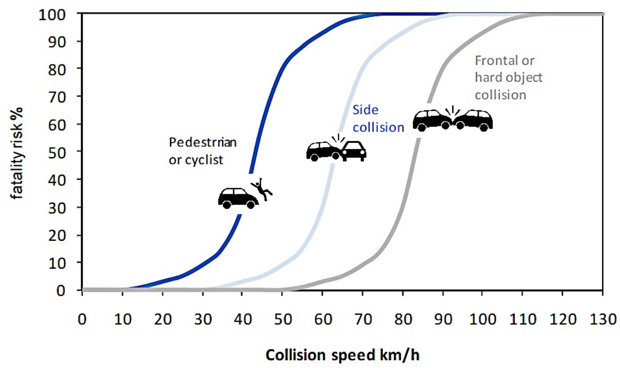
Summary Points

- *The current NSW Speed Zoning Guidelines may not be entirely consistent with the Government's policy of Safe System road safety.*
- *The principles and models that are guiding NSW road and traffic design professionals may be too ambiguous to achieve optimal road safety outcomes.*
- *There may be an over-reliance on signs and markings in conveying the legal and safe speed limits or additional opportunities to redesign road environments to give better visual cues to encourage safer driving speeds.*

c) Key factors for governing the establishment of speed limits

The Safe System policy dictates that speed limits use human biomechanical and performance competency as the design parameter for the road and traffic system. Taking crash injury severity factors into account research into the physics of crashes has determined when the physical forces will be too great for the human body to tolerate and the road user to survive.

Figure 6: Fatality risk curve



Source: A New Approach to a Safe and Sustainable Road Structure and Street Design for Urban Areas (Wramborg, 2005)

So, for example, a pedestrian, if struck by a vehicle travelling at the urban default speed limit of 50 km/h in the area shown in Figure 6 above, would only have around 25% chance of surviving. Occupants in a vehicle that is struck side on at a rural intersection in a 100 km/h zone would not likely not survive the crash albeit in a 60 km/h zone they would have about 65% chance of surviving the crash. Occupants in an errant vehicle involved in a head on collision on a rural road similar to the example shown in Figure 3, would only have around 10% chance of surviving the crash. These risk curves for survivable speeds are based on what we know from physics and biomechanical research.

This knowledge can be used to determine safe speed limits for various crash scenarios. Given the fatality risks for various types of crashes, example maximum speed limits for a Safe System are indicated in Table 2 below.

Table 2: Safe system maximum vehicle speeds related to the infrastructure assuming safest vehicle designs and 100% restraint use

Type of infrastructure and traffic	Possible travel 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 impact or frontal impact (only impact with the infrastructure)	100+

(Source: Vision Zero – An ethical approach to safety and mobility (Tingvall & Haworth, 1999, p. 4)

An OECD guidance document emphasises the need for very low speed limits – no greater than 30 km/h – where conflicts with pedestrians are possible. This would mean that virtually all residential areas and shopping precincts should be zoned at 30 km/h or lower. Indeed, the Dutch experience of

introducing 30 km/h zones was nearly a 70% drop in road casualties across the collective length of these zones in 2002 (F. Wegman, Atze, D., Schermers, G., van Vliet, P., 2005).
However, the Dutch did not simply drop speed limit by putting new numbers on speed limit signs. The Sustainable Safety (safe system) approach took a holistic planning approach to designing road hierarchies that take into account the functions of the roads. Through roads called for designs that would not enable a side or frontal impact and therefore could have limits of 100+ km/h. Local roads where there are possibilities of cars crashing into pedestrians or cyclists called for designs that encouraged drivers to feel more comfortable driving at survivable speeds (for the vulnerable road user), i.e. 30 km/h. See Section e for more discussion on this.
Lowering speed limits may not be welcomed by all road users, particularly if they cannot see the reasons for this. Also, Australia is a much larger country geographically and greater distances are travelled by road. So, part of the challenge will be to find ways to sell Safe System speed management to road users. Part of this should be a consideration of road designs that encourage lower speeds, or accommodate the higher speeds with safety.

Summary Points

- *Speed limits setting should take into account the known fatality risk levels for each type of potential collision for the type of road and traffic.*
- *Areas of potential car to pedestrian collisions should have posted speed limits of no more than 30 km/h.*
- *Advance a greater understanding of Safe System speed zoning with the general community.*

d) Mechanisms for reviewing the appropriateness of maximum speed limits

The NSW Speed Zoning Guidelines prescribe a 10-step process for reviewing speed limits, including crash analyses, site inspections, speed surveys and internal and external consultation with stakeholders. In the Guidelines, the introduction to this process again highlights the need to balance safety with the mobility needs of the community and the need to consider community views. . These objectives may align and they may not. But the Guidelines do not place an unambiguous priority on safety.
Currently, there is a push by some vocal community leaders to allow higher speeds, such as the Liberal Democratic Party's campaign[1] to let motorists decide what the speed limit should be. Indeed, the Northern Territory Government has recently introduced a 12-month trial of open speeds on 200 kms of the Sturt Highway. The idea is to let motorists choose the speed limit by way of identifying the 85th percentile of speeds travelled during the trial. The Chief Executive Officer of the International Road Assessment Program (iRAP) has written to the responsible Minister and advised of his estimate of 20 people being likely to be killed or injured over the next 10 years as a direct result of this trial. A collection of road safety experts, medical and emergency response practitioners, police and community organisations have argued the trial is irresponsible and dangerous[2].
Humans are ill equipped to correctly assess risks such as road travel risks (Gregersen, 1996; Groeger & Brown, 1989; Job, Sakashita, Mooren, & Grzebieta, 2013; Svenson, 1981; Wilde, 1994). Moreover, there is a phenomenon called "evolution of speed" whereby 85th percentile travel speeds drift up over time (Hauer, 2009). Hauer postulates that this occurs when speed limits are set using the 85th percentile method for three possible reasons:

1. Typically half of the drivers tend to drive above the speed limit which gradually pushes the 85th percentile speed up over time;

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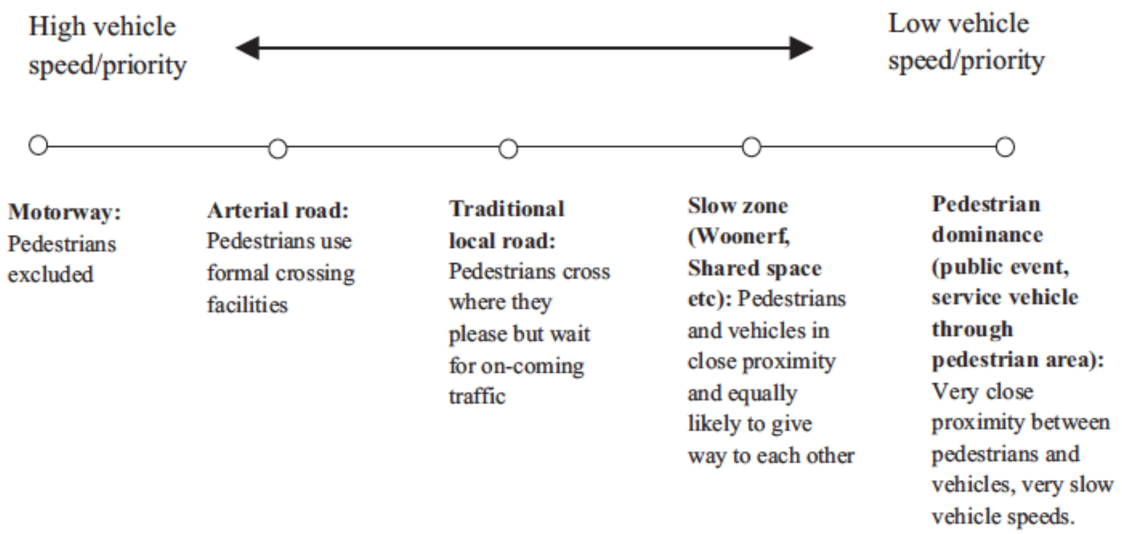
1 See http://aca.ninemsn.com.au/article/8787201/speed-limits-liberal-democratisation

2 See http://www.abc.net.au/news/2014-02-01/speed-limits-shelved-for-nt-highway-sports-cars/5232388

2. Many drivers seek to drive faster than the average speed in effort to self-affirm their image of better than average drivers; and
3. As wider lanes become more prevalent the average speed on roads increases.

As speed increases, both the incidence and severity of road injury also increase. The setting of maximum speed limits must place road user safety as the highest priority criterion if a Safe System approach is adopted. While roads are built for the purpose of mobility – and not for safety – a broader perspective may help to achieve improvements to both objectives. A close examination of the intended functions of each road section, and efforts to design or redesign roads to encourage the road behaviours that are intended my assist to improve both homogeneity of speeds and traffic types, as well as predictability of traffic for road users (J. Theeuwes, Van der Horst, & Kuiken, 2012).
In New Zealand, there has been a concerted move to design roads and streets in a way that effectively modifies road user behaviour to be more consistent with the primary function of the roads. A study using video data collection and analysis found that self-explaining roads (SER) treatments achieved a significant shift in the way people used the roads (Mackie, Charlton, Baas, & Villasenor, 2013). For example, there was a 30% decrease in motor vehicle traffic and a 17% increase in pedestrian counts at sites where roads had been redesigned. Moreover, preliminary crash data indicated that the SER project achieved a 30% reduction in crashes and an 86% reduction in crash costs per annum since implementation of these designs. While it might be argued that as the levels of motor vehicle traffic reduction and crash reductions were the same, the reduced risk exposure accounted for more of the reduction in crashes than improved road behaviour. Indeed, video footage collected in the intervention areas showed less uniformity of road behaviour by both pedestrians and motorists. This was interpreted as pedestrians feeling more comfortable about using the local roads that were redesigned. Notably, the average motorised traffic speeds reduced to 30 km/h consistent with the intention of the project.
From the perspective of pedestrian road users, the authors of the study described above put forward a model continuum of speed and road user priority for different categories of roads.

Figure 7: Continuum of vehicle/pedestrian priority



(Source: (Mackie et al., 2013) page 743)

Unfortunately, the Mackie et al study did not include data collection in the adjacent collector roads to determine changes to motorised traffic behaviour/congestion. More research is needed to understand the way road categories can be redesigned to optimise the safety of traffic speeds for vulnerable and other road users, while maintaining good traffic efficiencies.

Any review of speed limits ought to be consistent with the Government's policy of Safe System road safety. Australian consultant, Eric Howard, led a project to develop a guidance book on speed management for the OECD (OECD, 2006). Using a set of objective criteria, a template for speed limit decision-making was included. Table 2 provides descriptions of characteristics and associated speed limit ranges.

Table 2: Speed management: How to define appropriate speed for different road types

Road category and function	Appropriate range of speed to meet specified objectives: Safety	Environment	Economy and mobility	Quality of residential life
Motorways and principal inter-urban roads High quality network designed for high speed range for long distance movement of people, goods and services	**90 to 130 km/h**[1] Reduced speed may be appropriate in poor weather.	**70 – 90 km/h** Higher speeds lead to high emissions and noise. Reduced speeds needed where air quality or noise issues are important.	**High end of speed range** This is of high importance for commercial and private movements alike.	**Low end of speed range** Little adjacent development but, where there is, speeds should reflect this to improve noise, air quality and severance.
Urban arterial roads and main roads High quality urban network designed to cater to through traffic	**50-60-70 km/h** Reduced to 30 km/h where there are many vulnerable road users.	**30 – 60 km/h** Within optimum range for vehicle emissions.	**High end of speed range** Local traffic as well as through traffic. Often commercial and residential development. Need to balance safety and mobility.	**Low end of speed range** Important where adjacent land use is residential. Need to manage speeds for air quality, noise and severance effect.
Urban residential roads Network designed for living and access only for local traffic.	**30 km/h** Traffic calmed where necessary to achieve lower speeds.	?[2] Below optimal range for emissions, vertical traffic calming elements can cause increase in noise.	Takes second place to safety and quality of life.	Very important on all residential roads.
Rural main roads (not principal inter-urban) Designed for local through traffic.	**70 to 90 km/h** Depending on quality[3]. Reduce for curves and junctions.	**60 to 90 km/h** Lower speeds within optimum range for emissions but higher speeds lead to more emissions and noise.	Important.	
Minor rural roads Designed for local access traffic with presence of vulnerable road users.	**40 to 60 km/h** Depending on quality and presence of vulnerable road users.	Within range of optimum speeds.	Takes second place to quality of life.	

(Source: OECD. (2006). Speed management. Paris: European Conference of Ministers of Transport (ECMT), page 88)

In addition, the Global Road Safety Partnership produced a speed management manual two years later (Howard, Mooren, Nilsson, Quimby, & Vadeby, 2008). It advises that according to Safe System principles setting speed limits should take into account the following factors.

- If there are large numbers of vulnerable road users on a section of road they should not be exposed to motorised vehicles travelling at speeds exceeding 30 km/h.
- Car occupants should not be exposed to other motorised vehicles at intersections where right angle, side-impact crashes are possible at speeds exceeding 50 km/h.
- Car occupants should not be exposed to oncoming traffic where their speed and that of the traffic travelling towards them, in each instance, exceeds 70 km/h, and there are no separating barriers between opposing flows.
- Moreover, if there are unshielded poles or other roadside hazards, the speed limits need to be reduced to 50 km/h or less.

Summary Points

- *The NSW Speed Zoning Guidelines currently do not place sufficient priority on safety.*
- *Setting speed limits based on the 85th percentile of free travel speeds is irresponsible and dangerous[3].*
- *The revision of the NSW Speed Zoning Guidelines should take into account best European practices and Safe System principles.*

e) The operation of speed limits in other jurisdictions

The Sustainable Safety approach taken in The Netherlands is an earlier version of the Safe System policy. This approach was introduced in the early 1990s with recognition that human road users are fallible, but that human life can be sustained if a road traffic system can be made inherently safe (Mooren et al, 2011). The three design principles for road networks that underpin the Sustainable Safety vision are: functionality, homogeneity and predictability (F. Wegman, Atze, D., Schermers, G., van Vliet, P., 2005). From the beginning of implementation of this road safety approach, roads were categorised into three basic functions: through-roads, distributor roads and access roads. Roads in each of these categories were designed to facilitate homogeneity of road use within them, thus enhancing the predictability of the system. However, it is important for road users to easily understand the behaviour that is expected of them based on what they perceive the intended function to be. In other words, roads should be "self-explaining", or such that the traffic environment "elicits safe behaviour simply by its design" (Jan Theeuwes & Godthelp, 1995, p. 217). Beyond signs and pavement markings, roads should have "essential recognisability characteristics" that will send to road users strong messages about how the road should be used, including the selection of travel speed (Stelling-Konczak, Aarts, Duivenvoorden, & Goldenbeld, 2011). The Dutch now have a lot of experience in designing self-explaining roads (SER) instead of only relying on regulatory mechanisms such as speed limit signs and enforcement to encourage safe speeds of motor vehicles. It is estimated that the infrastructure changes alone account for a 9.7% reduction in fatalities in the Netherlands (F. Wegman, Aarts, L. (eds.), 2006).
New Zealand also successfully embarked on the SER approach. In 2004, a National Speed Management Initiative was launched. Describing this initiative, the New Zealand Ministry of Transport advised that *"The emphasis is not just on speed limit enforcement, it includes perceptual measures that influence the speed that a driver feels is appropriate for the section of road upon which the are driving – in effect the self-explaining road" (Charlton & Baas, 2006, p. 7).*

Figure 8: Examples of a shared zone and a self-explaining urban road

[3] Note that this is not recommended practice in the current Guidelines.

In essence, the self-explaining road concept is one that advocates “a traffic environment that elicits safe behaviour simply by its design” (Jan Theeuwes & Godthelp, 1995, p. 217).
The United Kingdom, like the Netherlands is in the top best performing countries in terms of road fatality rates (Koornstra et al., 2002). They recognise the need to keep motorised traffic speeds very low to ensure that pedestrians can use the road without being maimed. In a car to pedestrian crash at 25 km/hour most pedestrians would likely live; whereas in similar crash where the vehicle is traveling at 50 km/h the risk the pedestrian would die is high. In Sweden, 30 km/h speed limits on local roads were introduced in 1972. Where vulnerable road users are present road lanes for cars and buses are narrowed (Johansson, 2009). Figure 9 is an example of a design for spatial separation of vulnerable and other road users where vulnerable road user environments have been redesigned to prohibit fast moving motorised traffic.

Figure 9: Local street in Borlange, Sweden

(Source: Vision Zero – Implementing a policy for traffic safety (Johansson, 2009, p. 830)

Dramatic drops in speeds occurred on New Zealand roads after they applied self-explaining roads redesign to local roads in Auckland (J. Theeuwes et al., 2012). One study found that there was “a significant reduction in vehicle speeds on local roads and increased homogeneity of speeds on both local and collector roads” (Charlton et al., 2010, p. 1989). The mean speeds on the three treated local roads reduced from 44.39 km/h to 29.62 km/h and the 85th percentile speeds decreased from 54.29 km/h to 36.71 km/h.
Moreover, with respect to the higher speed roads, Sweden reduced 110 km/h speed limits to 90 km/h in 1989 (Koornstra et al., 2002). Taking into account the risks depicted in Figure 6, the Swedish road classification system only permits speed limits above 70 km/h on motorways and divided highways, where there is not a chance of a head-on collision (Elvik & Amundsen, 2000).

Summary Points

- *NSW road and traffic planners should consider categorising roads into functional hierarchies and look at ways to make traffic more homogeneous and predictable.*
- *The New Zealand approach to implementing self-explaining roads should be examined for applicability in New South Wales.*
- *Perceptual and other engineering treatments, especially at gateways to speed limit changes, should be more fully considered by NSW road authorities (including local governments).*
- *Research investigating human-centred vehicle and road design and usability for road safety is needed to develop more detailed speed zoning recommendations that focus on assuring safety while meeting the mobility needs of all road users.*

f) The appropriateness of current thresholds in the Demerit Points Scheme for speed offences

Demerit points systems are often considered a levelling penalty structure in contrast to fines which affect drivers differently in accordance with their income or wealth. As a sanction, demerit points also have an advantage over fines in that their purpose cannot be misconstrued as revenue-raising. Even after the NSW Auditor General's report on the review of speed camera found that over a 5-year period the Government spent far more on road safety programs than it collected in speeding fines (Achterstraat, 2011), the less responsible media personalities and many members of the public still tend to label the issue of speeding fines a revenue-collecting scheme (Mooren, Grzebieta, & Job, 2013). Awarding demerit points does not contribute to this notion, although some could argue that the threat of licence loss disproportionately affects people who need to drive for work.

Currently, the penalties for speeding offences are consistent with the principles underlying (European) recommended practices (van Schagen & Machata, 2012). Specifically, points awarded for speed and drink driving offences increase with higher levels of offending, i.e. higher increments of speed above the limit and in accordance with road user experience/risk. It should also be noted that in recent years over 70% of NSW licence holders do not have demerit points recorded[4]. Moreover, fewer than 5% of licence holders had 7 or more points at any time. See Table 3 for details of points and fines penalties.

[4] http://www.rms.nsw.gov.au/publicationsstatisticsforms/statistics/registrationandlicensing/tables/table3111.html

Table 3: Penalties for speeding in New South Wales

Offence		Light Vehicles	Mid Range Trucks (>4.5t but <=12.0t GVM)	Coaches & Heavy Vehicles
Exceed speed limit by:	**Demerit Points**	**Fine**	**Fine**	**Fine**
Not more than 10 km/h	1	$106	$319	$319
Not more than 10 km/h (Learner, P1 or P2 licence holder)	4	$106	$319	$319
Not more than 10 km/h (in school zone)	2	$177	$425	$425
Not more than 10 km/h (Learner, P1 or P2 in school zone)	5	$177	$425	$425
More than 10 km/h but not more than 20 km/h	3	$248	$425	$425
More than 10 km/h but not more than 20 km/h (Learner, P1 or P2 licence holder)	4	$248	$425	$425
More than 10 km/h but not more than 20 km/h (in school zone)	4	$319	$531	$531
More than 10 km/h but not more than 20 km/h (Learner, P1 or P2 in school zone)	5	$319	$531	$531
More than 20 km/h but not more than 30 km/h	4	$425	$531	$531
More than 20 km/h but not more than 30 km/h (in school zone)	5	$531	$638	$638
More than 30 km/h but not more than 45 km/h	5	$815	$815	$1,276
More than 30 km/h but not more than 45 km/h (in school zone)	6	$1,028	$1,028	$1,346
More than 45 km/h	6	$2,197	$2,197	$3,331
More than 45 km/h (in school zone)	7	$2,341	$2,341	$3,612

Source: http://www.rms.nsw.gov.au/usingroads/penalties/speeding.html

Notably, double demerit points apply for speeding, seatbelt and motorcycle helmet offences during all holiday periods such as long weekends, Christmas, New Year and Easter in New South Wales and Western Australia. Indications from evaluations of double demerit schemes in Western Australia are that these programs are effective, but that they must be accompanied by rigorous enforcement to sustain the safety benefits (Batini, 2004). Specifically, the key findings of the WA Double Demerits evaluation were that injury and speed related crashes all decreased to a greater amount during Double Demerit periods compared with non-Double Demerit periods.
As speeding is involved in 40% of fatalities in NSW, it is clear that the deterrence effect of current enforcement and penalty regimes is not sufficient.

The thresholds for demerit points appear to reflect the road safety risk to different types of licence holders as proscribed by a coalition of European research institutes (van Schagen & Machata, 2012). As the system is designed to give drivers notice before licence loss penalties are applied, it is theoretically a warning process that aims to deter rather than punish. In other words, it forgives rare transgressions while retaining the ability to punish chronic offenders. See Table 4 for details.

Table 4: Thresholds for NSW Demerit Points

The thresholds for the NSW Demerit Scheme are:

- Unrestricted licence – 13 points
- Professional drivers – 14 points.
- Provisional P2 licence – 7 points
- Provisional P1 licence – 4 points
- Learner licence – 4 points
- Unrestricted licence with a good behaviour period – 2 points within the term of the good behaviour period.

These are the totals allowable within a three-year period before the driver's licence is suspended.

For unrestricted licence holders, the period of suspension depends on the number of points accumulated:

- 13 to 15 points - three months
- 16 to 19 points - four months
- 20 or more points - five months
- For provisional and learner licence holders, the suspension period is three months

Source: http://www.rms.nsw.gov.au/usingroads/penalties/demeritpoints/index.html

As indicated earlier, most NSW licence holders do not have any points recorded; and less than 5% have 7 points or more. This weakens arguments that it is too easy to lose your licence as a result of rigorous speed enforcement. In fact, arguably speed enforcement perhaps could be improved. The average total road length per camera deployed in Australia is four times less than in Germany and nine times less than the Netherlands. In fact looking at the figures of world's best practicing nations (Table 5), Australia should increase its number of speed cameras by around 30% (Mooren & Grzebieta, 2010).

Table 5: Speed camera per kilometer of road and per million inhabitants

Country	# Speed Cameras	km road per camera	Cameras per million inhabitants	Total road (1000 kms)
Australia	1125	812	55	913
Germany	3489	186	42	650
Netherlands	1406	90	86	126
Sweden	1075	151	119	162
Canada	1342	776	40	1042

(Source: http://www.scdb.info/en/software-statistik/)

Another concern is that when drivers lose their licence, the tendency for a long-term loss of licence can lead to unlicensed driving. However, the fines for unlicensed driving are $3,300 for a first offence and $5,500 for a second or subsequent offences. This may help to ensure the integrity and effectiveness of the demerits scheme.

Summary Points

- *Generally the demerit thresholds in New South Wales appear to be consistent with principles advocated by the European Commission*

- *Consideration of increasing demerit points for speeding is prudent given the level of injury and fatality risk this traffic breach represents.*

g) The impact of demerit points in reducing speed behaviour

When double demerit penalties for speeding offences was first trialled in New South Wales in 1997 over 7 public holiday periods (covering a total of 45 days), there were reductions in traffic infringements with the same level of enforcement – by as much as 26% for Easter, 1998 (Graham, 1998). By June, 1998 (the final trial period) community surveys found that of those drivers who said they usually drove at speed they could be booked for 67% reported that they had slowed down. Moreover, 45% of drivers aged 18-29 also reported slowing down.

The ultimate test of a road safety intervention is road crash injury reduction. There was also a decrease of 25 fatalities (28%) of fatalities compared with the corresponding holiday periods before the double demerits penalty was trialled (Graham, 1998). The Double Demerits for speeding was also trialled and evaluated in Western Australia in 2003 finding that fatal crashes reduced by 52% (Batini, 2004) over the trial period; and speed-related injury crashes were down by 43% during the Double Demerits period compared with the non-Double Demerits control period.

The effectiveness of demerit points was evaluated in Victoria in 1990. It was concluded that the demerit points scheme was an effective deterrent to subsequent offenses being committed (Haque, 1990). A further study found that the number of accumulated demerit points can predict crash risk (Diamantopoulou, Cameron, Dyte, & Harrison, 1997). Moreover, an evaluation in Quebec, Canada, confirmed that “drivers who accumulate demerit points become more careful because they are at threat of losing their license” (Dionne, Pinquet, Maurice, & Vanasse, 2009, p. 2).

A study in Spain found that in the 18 months after implementing a demerit point scheme, 618 fewer people died in road traffic crashes than would have died otherwise (Pulido et al., 2010). This figure represents a 14.5% drop in road fatalities.

The road safety benefits of demerit points systems are strong, but short lived unless other measures are in place to sustain compliance and safe driving (Klipp, Machata, & van Schagen, 2013). A meta-analysis of the effects of points systems showed 15-20% reductions in crashes, fatalities and injuries, but unless enforcement efforts are kept up the deterrent effects wear off (Castillo-Manzano & Castro-Nuño, 2012).

Summary Points

- *Evaluations of demerit point programs have repeatedly found that they improve safe road behaviour and contribute to the reduction of injury crashes.*
- *Rigorous traffic enforcement is needed to sustain the effectiveness of demerit point programs.*

h) Other related matters

An important consideration is that road designs should take into account human factors in such a way as to minimise errors. Current approaches to road safety may take a holistic or system-based approach but the interpretation of the Safe System often appears to emphasise secondary prevention, being based on the premise that human error cannot be prevented. Countermeasures therefore focus on controlling energy in a crash, or the damage caused, by building crashworthy vehicles, installing airbags and constructing roadside barriers, for example, or through controlling speed. This approach overlooks strong evidence from other settings that human error often results from poor compatibility between the human and the system. In road settings this includes road users making errors due to poorly designed vehicles, roads and roadsides and even road rules and regulations.

There is potential for substantial gains in road safety through incorporating human factors and ergonomics considerations in vehicle and road system design, which have not yet been fully explored. For example, the concepts of self-explaining roads, described above has had little attention in Australia. Yet these approaches appear to hold some promise in shaping human behaviours.

TARS Research is currently leading an NHMRC grant bid with the aim of establishing a proposed Centre of Research Excellence (CRE) to conduct research to enable development of best practice guidelines and assessment procedures for design of usable, and therefore safer, vehicles, roads and road environments, and rules and enforcement practices that are compatible with human cognition and behaviour. Research in this CRE will target the development of principles, procedures and guidelines for design that take into account human factors and ergonomics, that is, how human users interact with different aspects of the road system. It will then work with relevant end users to implement and evaluate better design standards for road safety that take into account human users. The CRE will also develop a vital capacity in human-centred design and usability for road safety to ensure that the Australian road transport system is designed for tomorrow's cars, roads and drivers.

While lowering speed limits is viewed as unfavourable for mobility, the trade-off is an excessive compromise on safety. Research such as this can seek to determine more complex and detailed recommendations for setting speed limits with the aim to maximise safety as well as mobility.

Technologies such as Intelligent Speed Adaptation have been around since the mid-1990's and has been well researched and found to have good potential to reduce the incidence of speeding and injury crashes. The NSW Advisory ISA trial found that 89% of the trial vehicles (n=110) reduced speeding when fitted with the ISA devices (Creef et al., 2011). Moreover, some initial modelling based on the trial data suggests that if all vehicles in NSW were fitted with these devices road deaths would be reduced by 8.4% and non-fatal road injuries by 5.9%.

Even greater benefits could be achieved by introducing mandatory speed limiting ISA systems. These systems do not allow the driver to override the speed limit. A study in the United Kingdom concluded that if a simple ISA system was fitted to all vehicles, preventing them from exceeding the speed limit fatal crashes could be reduced by 37% and injury crashes by 20% (Carsten & Tate, 2005). Furthermore, the estimated cost-benefit ratios ranged from 7.9 to 15.4.

ISA could obviate drivers' concerns about keeping to the speed limit and avoiding speeding penalties like demerit points. The NSW Centre for Road Safety should be congratulated for bringing this technology closer to widespread use with the introduction of their free new application for smartphones, "Speed Adviser"(Transport for NSW, 2014).

Finally, while very high speeds for conditions is more dangerous – and thus should carry heavier penalties than low level speeding, low level speeding (10km/h over the limit or less) contributes 38% of speed-related casualties (injuries and fatalities combined) and 76% of speed-related fatalities (Gavin et al., 2010). Low level speeding is the single largest contributing category of speeding to road deaths, because it is such a common behaviour, comprising 78% of speeding vehicles in NSW and 88% in South Australia. Furthermore, data from actual crash investigations suggest that the computed contribution of 38% of casualties by low level speeding is an under-estimate, with 51% of speeding casualty crashes for which a speed could be estimated involving low level speeding in NSW (Job et al., 2013).

Given that low level speeding is a major contributor to lost lives, serious injuries and economic costs, a comprehensive approach to changing the culture of speed in NSW is warranted. The mainstream and social media on the topic of speed is generally quite unhelpful with the anti-speed management attitudes promoted (Mooren et al., 2013). Our recent paper[5] urges road safety researchers and practitioners are urged to:

- gain an understanding of the key anti-speed enforcement positions held by major and minor opinion leaders in Australia;

[5] This paper was awarded "Best Research Paper" at the 2013 Conference of the Australasian College of Road Safety held in Adelaide in early October.

- develop more effective ways of influencing community debate on speeding; and
- explore, develop, trial and evaluate "dialogue communications" campaigns on speeding.

Summary Points

- *A Safe System approach requires a greater understanding of how the vehicle and road systems can be improved to assist humans to avoid injurious errors when using these systems NSW should actively research and implement speed control technologies such as intelligent speed adaptation.*
- *More community education, media issues management and advocacy is needed to support a shift in speeding culture in this State whilst stepping up enforcement of all breaches of speed limits – large or small.*

Final Comments

The terms of reference for this Inquiry is a bit odd, in that it is linking two separate aspects of speed management that don't necessarily have a causal relationship. Speed zoning does not need to have an impact on the demerit points scheme – and arguably shouldn't. Speed zoning is the practice of setting speed limits to regulate motorised vehicle speeds to acceptable levels. Demerit points schemes are set up as mechanisms for encouraging compliance to regulations. Both of these speed management efforts play an important role in road safety and have shown demonstrable safety benefits.

Speed management is a pivotal factor in road safety. If the Government has adopted a Safe System policy, it needs to place a strong focus on the aspects of speed management that we discuss in this submission.

Our key recommendations are that:

- the NSW Speed Zoning Guidelines are revised to be consistent with Safe System in the following ways:
    - remove all references that imply that other objectives can be as important as safety;
    - include a fuller explanation of serious/fatal injury risks associated with impact speeds and implications for speed limits for differing road functions;
    - remove images or model photos that are inconsistent with Safe System road safety practices;
    - include a section on road hierarchies and functional delineation; and
    - include a section on self-explaining roads using successful international evidence-based models of practice.
- Research evidence on self-explaining roads be used to formulate a NSW strategy for road redesign planning at local and State levels;
- Research and optimise the use of road-vehicle speed management – driver assist and mandatory speed limiting – technologies;
- Develop a substantial social marketing and community discussion campaign aimed at shifting the speeding culture to a more pro-road safety culture.

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