Submission

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DRIVER AND ROAD USER DISTRACTION

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Driver and Road User Distraction
Submission to the Parliament of NSW Joint Standing Committee on Road Safety

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Introduction

The National Road Safety Council appreciates the invitation to make a submission to the Parliament of NSW Joint Standing Committee on Road Safety inquiry into Driver and Road User Distraction, and would welcome the opportunity for the Executive Director, Dr Soames Job, to appear as a witness before the committee on this important and often misunderstood issue.

Involvement in this inquiry is an appropriate activity for the National Road Safety Council (NRSC). The NRSC's objective is to contribute to the reduction and ultimate elimination of death and serious injury on Australian roads by facilitating the development and implementation of effective road safety measures. We are an independent group of opinion leaders made up of road safety experts and community leaders appointed by the Australian Transport Council of Ministers (now Standing Council on Transport and Infrastructure: SCOTI). Our roles are to heighten awareness of road safety issues; undertake research which assists in improving road safety; raise the profile of road safety with key stakeholders including government, industry, business, academia, and the community; provide appropriate support for road safety activities and events; and assist with the timely implementation of road safety measures set out in the *National Road Safety Strategy 2011-20* (NRSS) (Anonymous, 2011) and the *United Nations Decade of Action 2011-2020* (Anonymous, 2011a).

The NRSS makes extensive mention of driver distraction and sets a number of actions and future directions in relation to the issue. The NRSC supports these actions. In anticipation of the receipt of submissions which will provide a detailed review of relevant evidence, the present submission concentrates on a higher level understanding of results and broad in principle issues which are critically relevant to the consideration of actions in relation to road user distraction.

In Principle Comments

The term driver distraction is reasonably well understood, and generally refers to events and activities which may draw attention, processing resources, or physical activity away from a

pre-defined primary task (in this case driving, riding, or other road use). As is often noted there are many sources of distraction within and outside the vehicle.

However, a number of notes of caution are warranted for the interpretation of the evidence on distraction. These are briefly described below.

1. Extensive inclusion of crashes defined as related to distraction

First and paradoxically, distraction may be and typically is defined to include every aspect of normally useful driver scanning as a distraction if the scan fails to identify a subsequently relevant risk. For example, a driver may scan a driving scene at an intersection and identify that a pedestrian is stepping onto the road on the left. Identification and attention to this risk may cause the driver not to see a vehicle emerging on the right, which leads to a subsequent collision. Such a crash may be, and indeed often is, defined as a distraction crash. Concerns arise with this approach. First, it means that activities which we would want for safety, such as identifying a pedestrian about to walk, are defined as a crash causing distraction. This is unhelpful to road safety, especially if the volume of crashes so defined is used as a basis for promotion of activities unrelated to the specific distraction case, such as addressing mobile phones and in car videos.

In addition, in the above instance, rather than treating this as a distraction problem which tends to align the problem with the road user, it may be more useful to road safety to conceptualize this as a problem of excessive complexity in road environment.

2. The true extent of the contribution to road related trauma

The literature on distraction related crashes typically identifies the extent of the subsequent road safety problem in terms of number of crashes to which distraction was judged to be a contributor. However, due to the tendency for these to occur in more complex environments (see review of evidence below), these crashes are more likely than average to be urban, and thus lower speed. Thus, the total numbers of distraction related crashes are not normally distributed across crash severity. Rather, while distraction does contribute to some fatal and serious crashes, on average distraction crashes will be less severe (less likely to involve a fatality or a serious injury) than speed related, or impairment related crashes. (This fact is rarely acknowledged in the distraction literature.) Therefore, careful consideration should be

given to the contribution of various distraction related crash scenarios to serious trauma rather than total crashes, in relation to the context in which they occur and the crash severity involved.

3. Proximal causes versus more distant (but possibly more manageable) causal factors.

A broader understanding of distraction may help identify less immediate and more manageable contributors to distraction itself.

Distraction is often a momentary event occurring immediately prior to the relevant crash. This can be difficult to identify and difficult to manage. On occasions where distraction contributes to a crash, the distracting event or activity must draw sufficient attention or processing resources away from the primary task so that a key failure occurs in the primary task. The extent to which this occurs will depend on three factors: (1) how must attention or processing the primary task requires, (2) how much attention and processing the distractor absorbs, and (3) how much attention and process the road user has available to them to perform the tasks at hand. The first two factors may vary greatly from moment to moment, while the third factor may change gradually or not at all over the time of the journey.

The extent of available processing capacity and mental energy required to maintain attention on the (sometimes boring) primary task of driving, riding, or walking will be significantly determined by the extent of impairment (due to alcohol, drugs, medications, illness and fatigue). However, the proximal cause (distraction) will often be identified as the key contributor (except perhaps in the case of alcohol, which is reasonably rigorously tested).

The management of distraction may be aided by some focus on the more distal contributors such as impairment from various sources and the complexity of the road environment and driving task in specific locations.

4. The inconsistent findings on the effects of mobile phones.

Broadly, there are four research designs which have been employed (in some cases extensively) in attempts to determine the risk associated with the use of mobile phones and other distractions. Each is briefly described below, along with comment on the strengths and weaknesses of these methodologies.

i. *Laboratory studies*

In a typical laboratory study drivers abilities and errors are assessed in a driving simulator under conditions in which they are or are not talking on a mobile phone. Many such studies exist internationally and in Australia. The advantages of these studies include rigorous control of factors such as task complexity, non-reliance on self-report, random assignment of subjects to conditions, and objective performance measurement. Disadvantages include lack of valid real world circumstance, and lack of powerful motivation for participants to drive safety and avoid crashing.

ii. *On road observations*

On road observations of behaviour typically involve comparing the behaviours of those who choose to perform the task with versus those without a distraction such as a mobile phone or audio system. These studies are more common for analysis of pedestrian behaviour (e.g., in Australia, Hatfield et al, 2005, Job et al, 2006).

These studies have the advantage of the validity of real world observation, lack of reliance on self-report, and lack of participant awareness of being observed. However, they suffer from the limitations of non-random assignment of participants to conditions such that those who choose to conduct the behaviour with a phone or other distraction may be different from those who do not choose to do so in various ways (e.g., risk taking attitudes and sensation seeking). Thus, differences in behaviour may not simply reflect causation by the distracting device.

iii. *Case-control self-report studies*

This methodology typically involves comparing cases (say people who crashed) with controls (e.g., people who drove without crashing) in terms of their behaviours at the time (e.g., using a mobile phone or not). For an example of such a study in Australia see McEvoy et al (2005). While case control has some methodological advantages, in the instance of assessment of mobile phone use there are often limitations. First, the method relies to a significant extent on self-report to assign the relevant drivers to use of or no use of a phone at the time. Those approached may also refuse to participate, potentially biasing the result. In

addition, the limitations of non-random assignment of participants to conditions, as described above, also apply.

iv. *Naturalistic driving studies.*

Naturalistic driving studies involve long term observation of driver behaviour through continuous video recording of behaviour and driving circumstance. There may be several cameras mounted in and on the vehicle to achieve this. While such a study is being planned in Australia, none has occurred as yet. For an example from the USA see Virginia Tech Transportation Institute (2009). This methodology has the advantages of objective assessment and the collection of enough data to view real world crashes. It suffers the potential disadvantages of the participants knowing they are being recorded (although the recording goes on for a long time and drivers are likely to revert to their normal driving habits after a few weeks), and again non-random self-assignment of drivers to conditions (i.e., driver choose whether to and when to use their phone while driving).

Brief Summary of Results

As above, none of these methodologies offers a completely unbiased yet real-world-valid analysis of the effects of distraction.

The following broad findings are apparent:

1. Laboratory studies suggest that there is little difference in detrimental effects of hand held and hands free mobile phone use. Epidemiological studies (e.g., McEvoy et al, 2009) support this conclusion and no sound evidence disconfirms this finding. Given the primary detrimental effects of distraction on the driving task are cognitive and emotional rather than physical (car handling requiring two hands), it seems logical that the hands free feature would do little to mitigate any harmful effects.
2. Elements of distraction which require taking visual scanning from the driving task (such as texting) are clearly risky. [This also applies to watching a screen, and advertising visible from the road].
3. Distraction is more harmful to performance for less practiced tasks. This finding fits the basic logic of how distraction impairs performance and there is no strong inconsistent evidence.

4. Distraction effects vary with research methods:
    - Laboratory studies suggest that distraction (e.g., mobile phones) are extremely harmful to driving safety
    - On road observations suggest some detrimental effects (pedestrians)
    - Case-control studies suggest harmful effects
    - Naturalistic studies suggest smaller harmful effect in many circumstances and even some beneficial effects of mobile phone use for long haul truck drivers.

The latter effect seems inconsistent with other results. However, given the validity strengths of this methodology, the finding should not be dismissed lightly. A few possible accounts of the results from the naturalistic method are apparent. First, it may be that once truck drivers are fatigued, conversations helps keep them awake. This beneficial effect may outweigh the distraction effects. Second, it may be that truck drivers choose to use their phones when they are driving in monotonous environments such that the main risk is drifting off rather than distraction. Third, it may be that those who choose to use their phone are more alert and thus judge that they are able to use their phone safety (assuming that a more alert driver on the phone is safer than a tired driver not on the phone). These explanations are possible because of the lack of unbiased assignment of drivers to conditions. Note, however, that the same limitation allows a possible account of the identified negative effects of phone in observational and case control studies: possibly those who use their phone are less obedient of the law and more likely to take risks. Thus crashes by drivers using phones may at least in part be due to the other features of those drivers (or pedestrians) who use their phones while driving or crossing the road.

5. Other in-car devices

There is a strong trend towards more and more information systems in cars, including navigation, video screens for entertainment, and screens constantly promoting the features of the car (such as complex displays of whether the vehicle is operating on the fuel engine, the electric engine, or putting charge back into the battery in some hybrid vehicles). This inevitably increases risk of distraction and designers of such systems should be obligated to build in safe guards for in-car use.

6. Visual distraction and advertising

Our roadsides, especially in urban environments, are often cluttered with advertising which is visible to the driver. Advertising is designed to distract- if it is not seen it is ineffective. The NRSC suggests that there should be a 'do no more harm' policy approach to the proliferation of more advertising. The fact of historical permission for advertising (from times of walking and horses) should not provide reason for putting advertising before safety. On the basis of simple logic (that distraction will create more risk if the driver is in a position which requires attention) it is especially important to minimise distraction at points where decisions are made and conditions may change (intersections, merges, locations where pedestrians may cross the roads, etc.). In Australia, the research of Edquist et al. (2011) confirms this conclusion.

There are few studies which have directly studied changes in crash rates with various types of advertising signs, and those that exist are commonly limited by methodological weaknesses and lack of statistical power to detect differences due to studying few or even only one location. Thus, non-significant results cannot be taken as evidence that the signs are safe. In addition, there are clear pointers to risk. The conspicuity of a traffic sign itself decreases as the number of non-target objects (such as advertising installments) in the driver's visual field increases (Akagi, Seo and Motada, 1996; McNees and Jones, 1987). Advertising may not simply attract visual scanning but also absorb cognitive processing. Thus, studies which only consider the time a driver may spend looking at the advertising are overlooking a key impact of advertising on driving capacity. Advertising may also attract attention involuntarily. Irwin, Colcombe, Kramer, and Hohn (2000) demonstrated that visual signals with sudden onsets and luminescence attract attention involuntarily. Numerous other features of advertising can be employed to attract attention, which is after all the role of an advertising sign. These features include shape, colour, internal contrast, and others (for reviews see Hughes and Cole, 1986; Kuhn et al. 1997). Advertising may also hold attention for longer if it is interesting, is not easily understood, and changing signs are also be likely to hold attention, because drivers sometimes need to see a message twice to process all of its contents, or because the transition itself may be interesting to watch (Farbry et al., 2001).

Two aspects of advertising are of particular concern.

Moving or changing images. There is evidence from a number of overseas case studies that advertising which involves moving images is particularly distracting to drivers (including riders) and compromises road safety. Smiley et al. (2005) reported studies to assess the road

safety impacts of video (full motion) advertising signs. They found glances at the signs which lasted over 1 second and Beijer et al. (2004) found that moving image signs attract more visual attention than static signs. Indeed, if this were not so, it is difficult to see why the advertising industry would be defending so vigorously the supposed safety of such instillations.

The Wisconsin Department of Transportation (1994) compared the crash rates 3 years before and after the installation of a variable message sign at a sports stadium. The sign displayed scores, advertisements and moving images at an average of 12 frames per minute. The eastbound section of the Interstate 94 from where the sign could be seen demonstrated a 36% increased crash rate from before to after installation. The westbound section of the Interstate 94 from where the sign could be seen demonstrated an increased crash rate from before to after installation of 21%. The report suggested that the orientation of the sign towards eastbound traffic caused the greater increase in crash rate eastbound. Other studies have also found either increases in crashes associated with the instillation of such signage (but only at locations where decisions were required due to some complexity: Ady, 1967), or less improvement in crash rates around such instillations (see Farbry et al, 2001).

Advertising structures which obscure pedestrians. In addition to distraction, the use of adverting structures which obscure pedestrians, such as can be seen on many city streets in Australia, should be reviewed. The addition of limiting the drivers view of pedestrians, on top of distraction effects, is a serious safety concern. The claim that there are no good data to support this concern is misleading. The problem is that crash locations are not recorded in relation to footpath advertising and thus no data can be available to address the issue. Polices which limit such advertising to positions away from the road, which do not risk obscured vision of pedestrians should be considered.

7. Deterrence

It is well recognised that mobile phone use is at epidemic proportions in NSW and Australia more broadly. This is commonly reported in the media, and even casual observation of drivers on our streets confirms this. National surveys show that many drivers still use hand-held mobile phones while driving, despite it being illegal in all Australian jurisdictions. One survey found that 61 per cent of drivers reported using mobile a phone while driving, with 30 per cent admitting to reading text messages and 16 per cent to sending them (Petroulias,

2009). Oddly this is used to justify continuing enforcement, whereas these data are the proof of the failure of the current enforcement approach.

This pattern of behaviour compels a number of conclusions. First, further education of drivers on this subject will not be effective. Stories abound in the media on the risk of mobile phone use, but these have been ineffective. Repeated news coverage also reminds drivers that this behaviour is illegal, and that many thousands of drivers are booked for this each year. Most drivers who use their phone are aware it is illegal, but take the risk of not being caught anyway. More education on this will also be ineffective.

A key reason for drivers to continue with illegal behaviour despite deterrence is that they believe that their chance of being caught are quite low, and the penalty is not sufficient to deter given its low probability. Even public statements regarding the number of drivers booked for mobile phone use confirms that these drivers' views on probability are correct. With 20,000 to 25,000 bookings each year in NSW (a focussed effort by police), the risk of detection remains very low for the 61% of around 5 million NSW drivers who admit to using the phone while driving. This is a 1 in over 120 chance of being caught (in the year, not per occasion). If drivers who do use the phone while driving do so say (hypothetically) five times per week, then the risk of being caught per occasion of phone use is less than 1 in 30,000.

8. Maintaining the Safe Systems Focus

The Safe System approach is the sound basis of the NRSS. This approach is briefly outlined in Appendix 1, and is known to be successful in delivering effective efficient substantial road safety gains (Mooren at al, 2011). A strong recommendation of this submission is that this approach be maintained in relation to management of driver and road user distraction and its crash consequences.

The safe system approach suggests:

1. Solutions are often found in managing the consequences of the crash rather than expecting people not to make mistakes. Thus, sound management of roadsides with forgiving barriers and median separation will help prevent serious injuries and deaths when a driver makes an error due to distraction or speeding or impairment or other unknown causes. Singular focus on each cause separately may lead us to miss the

larger picture that people will make mistakes and the road environment must provide for these errors.

2. The best method for prevention of dangerous behaviours is not education, but rather physical barriers to the behaviour. Technologies which prohibit reception by phones when in cars may be effective. This would need to be considered against the naturalistic study evidence for benefits from phone use by long distance truck drivers, although this result does not compel a causal connection and should be interpreted with caution. Technological safeguards should also be applied for other in car distractions.

Recommendations

The NRSC recommends:

1. The safe system approach should be applied to driver distraction. Safer roadsides, safer speed limits, safer vehicles, and safer intersection designs (such as roundabouts) will mitigate the trauma caused by distraction related crashes as well as other crashes.

2. Caution should be exercised when basing policy on results which are supported by one research methodology but not by another.

3. Support of the relevant NRSS actions outlined below, as well as the safe system elements in the strategy:
    i. "Action 24. Investigate technology-based options to minimise driver distraction from in-vehicle devices. (p. 77)."

    This option is important given the likely very limited effects of education and the need for a very substantial increase in enforcement before it reaches a point where it yields a perceived reasonably high chance of detection and thus is likely to be effective. Furthermore, policies demanding a much higher rate of enforcement by police risk distracting police attention from other more critical enforcement behaviours such as RBT, random drug testing, and speed enforcement. Technological barriers to distraction are an excellent alternative approach.

ii. "Actions….39. In relation to mobile phones:

    a. Strengthen education and enforcement measures to improve compliance with current laws."

For the reasons described above this may be difficult to achieve. An in-depth study of driver attitudes and knowledge on mobile phone use may aid the development of these measures.

"b. Promote the safety benefits of phone-off policies (including hands-free) with all fleet operators.

b. Examine the case for extending the coverage of novice driver prohibitions on mobile phone use (including hands-free) to include, for example, all ‘P2’ drivers or all young drivers under 26 years of age.”

It is clear that distraction has more detrimental effects on primary tasks which are less well practiced. Thus the NRSS recommendation above is soundly based and important. Broader bans on all mobile phone use by novice drivers (L, P1 and P2) or those under 26 years old, combined with effective deterrence through enforcement and effective penalties (including loss of licence for any offence) will be useful.

c. “Future steps…. Monitoring and assessing the evidence on driver distraction associated with mobile phones and other communication devices, for identification of potential countermeasures (including for professional drivers). (p. 93).”

This action arises from the inconsistent results of studies of phone use, as described above.

4. Elements of distraction which require taking visual scanning from the driving task (such as texting, watching a screen, and advertising) are clearly risky. A ‘do no more harm’ policy is recommended. More effective limitations on roadside advertising, especially including banning moving, scrolling or changing images and instillations which may obscure pedestrians will be valuable. This should include those masquerading as public telephones which are now, in an age of less use given the carriage of mobile phones by the vast majority of people, installed in pairs perhaps in order to allow larger advertisements on the back of them.

5. The contributions of various forms of distraction to fatal and serious crashes should be considered in determining precise policy, rather than a focus on total crash numbers.

6. The management of factors which contribute to the effects of distraction (such as impairment and driver environment complexity) should be considered in the management of distraction.

7. In-car information and entertainment systems are becoming more common thus increasing the risk of distraction. Designers of such systems should be obligated to build in safe guards for in-car use, and conduct the appropriate research to demonstrate that the risk is managed.

8. The history of road safety successes and failures shows that education alone is unlikely to be effective.

References

Ady, R. W. (1967). An investigation of the relationship between illuminated advertising signs and expressway accidents. *Traffic Safety Research Review, 11 (1),* 9-11.

Akagi, Y., Seo, T, and Motoda, Y. (1996). Influence of visual environments on visibility of traffic signs. *Transportation Research Record*, No. 1553, pp 52-58. Washington, DC: National Academy Press.

Anonymous (2011). *Global Plan for the Decade of Action for Road Safety 2011-2020.* WHO: Geneva.

Anonymous (2011a). *National Road Safety Strategy 2011-2020.* Canberra: Australian Transport Council.

Beijer, D., Smiley, A., & Eizenman, M. (2004). Observed driver glance behavior at roadside advertising signs. *Transportation Research Record, 1899,* 96-103.

Edquist, J, Horberry, T., Hosking, S., & Johnston, I. (2011). Advertising billboards impair change detection in road scenes. *Proceedings of the Australasian Road Safety Research, Education & Policing Conference, Perth, 6-9 November 2011.*

Farbry, J., Wochinger, K., Shafer, T., Owens, N., & Nedzesky, A. (2001). *Research Review of Potential Safety Effects of Electronic Billboards on Driver Attention and Distraction.* Washington, D.C.: Federal Highway Administration.

Hatfield J, Clements S, Cannon G, Montalban M, van Grinsven L, Job RFS (2005) Pedestrian safety and concurrent mobile telephone use. *International Journal of Psychology,* 2005. [Abstracts of the 28th International Congress of Psychology, Beijing, August, 2004]

Hughes, P.K. & Cole, B.L. (1986). What attracts attention when driving? *Ergonomics, 29 (3),* 377-391.

Irwin, D., Colcombe, A., Kramer, A., & Hohn, S. (2000). Attentional and occulomotor

capture by onset, luminance and color singletons. *Vision Research, 40,* 1443-1458.

Job RFS, Sakashita, Job, S.K.F.(2006). Effects of mobile phone use on pedestrian crossing behaviour at major intersections. Paper presented at the 8th World Conference on injury Prevention and Safety Promotion. Durban, 2006.

Kuhn, B., Garvey, P., & Pietrucha, M. (1997). Model Guidelines for Visibility of On-Premise Advertisement Signs. *Transportation Research Record, 1605*, 80-87.

McEvoy SP, Stevenson MR, McCartt AT, Woodward M, Haworth C, Palamara P and Cercarelli R, 2005. Role of mobile phones in motor vehicle crashes resulting in hospital attendance: a case-crossover study, *British Medical Journal, 331*, pp 428-432.

McNees, R.W. & Jones, H.D. (1987). Legibility of freeway guide signs as determined by sign materials. In *Transportation Research Record 1213*, TRB, National Research Council, Washington, D. C.

Mooren, L, Grzebieta, R., Job, R.F.S. Williamson, A. (2011). Safe System – International Comparisons of this Approach. A Safe System- making it happen: Proceedings of the Australasian College of road Safety Conference, Melbourne, September, 2011.

Petroulias, T, 2009. *Community Attitudes to Road Safety: 2009 Survey report*, Road Safety Report 4, Department of Infrastructure, Transport, Regional Development and Local Government, Canberra.

Smiley, A., Persaud, B., Bahar, G., Mollett, C., Lyon, C., Smahel, T., & Kelman, W.L. (2005). Traffic safety evaluation of video advertising signs. *Transportation Research Record, 1937*, 105-112.

VirginiaTech Transportation Institute 2009, *New Data from VTTI Provides Insight into Cell Phone Use and Driving Distraction*, media release, accessed 22 March 2011, http://www.vtti.vt.edu/PDF/7-22-09-VTTI-Press_Release_Cell_phones_and_Driver_Distraction.pdf

Wisconsin Department of Transportation (1994). *Milwaukee County Stadium Variable*

Message Sign Study. Wisconsin, USA: Internal Report, Wisconsin Department of

Transportation.

Appendix 1

Safe Systems Principles

Australia has been committed to the safe system principles for some years through various state and territory strategies, and this was again reinforced nationally in the National Road Safety Strategy (NRSS), endorsed by all the Ministers of Transport or Roads for the Commonwealth, the states and territories. The forward to the NRSS reads, in part: *"This strategy is founded on the internationally recognised 'Safe System' approach formally endorsed by the OECD."* The United Nations Decade of Action explicitly identifies a similar safe systems principles basis. It reads: *"The guiding principles underlying the Plan for the Decade of Action are those included in the "safe system" approach."*

The radical departure from traditional and even evidence-based approaches to road safety is that the safe system demands adapting the road transport environment to the limits of the person rather than attempting to adapt the person to the limits of the road environment. The safe system principles are:

1. Human Fallibility: People will make mistakes; we will not solve the road safety problem simply by improving road users.
2. Human Frailty: Humans have a limited tolerance to violent force, beyond which serious injury or death occurs.
3. System Accountability: Ultimate responsibility for safe transport rests with the system designers and operators.
4. Biomechanical limits: System designers and operators must supply a system which forgives to a level which avoids forces beyond human tolerance, in the event of a crash.
5. Moral demand: People should not die or suffer serious injury on our roads.

The moral demand principle may be controversial to some, who regard the risk of death or serious injury as an inevitable price of efficient (fast) transport. However, we do not hand out the death penalty even for mass murder, but our transport system hands out such penalties for small errors of judgement or lapses of concentration. Concerns regarding the economic cost of slower speeds and safer roads must be tempered by the huge economic cost of crashes which would be saved in a safe system.

The safe system approach aims to develop a road transport system that accommodates human error and physical frailty. It accepts that human error is inevitable and thus that crashes are inevitable, but does not accept that death and serious injury are inevitable consequences of these crashes. In a safe system, the roads, road sides, vehicles, and speeds combine to limit the kinetic energy to which people could be exposed in a crash to a level which is tolerable by the human body without causing death or serious injury.

For our existing vehicles, the chances of surviving a crash decrease rapidly above certain impact speeds which depend on the type of crash:

car into pedestrian	car and motorcyclist	car into tree or pole	car into side of another car	car head on with another car
30 km/h	30 km/h	40 km/h	50 km/h	70 km/h

We can increase speeds within this system by improving the protection offered by the vehicles we drive, or by prohibiting the different crash types. For example, with wire rope barriers in the median head-on crashes may be eliminated and speed restrictions may be raised. Wire rope barriers on the sides of roads eliminating the risk of crashes into trees, may also allow speed limits in excess of those above while still offering a safe system.