Introduction

Vision Zero is a "philosophy of road safety that eventually no one will be killed or seriously injured within the road transport system" (Tingvall & Haworth, 1999, p.1). Vision Zero is an expression of the ethical imperative that:

> *"It can never be ethically acceptable that people are killed or seriously injured when moving in the road transport system." (Tingvall & Haworth, 1999, p.1)*

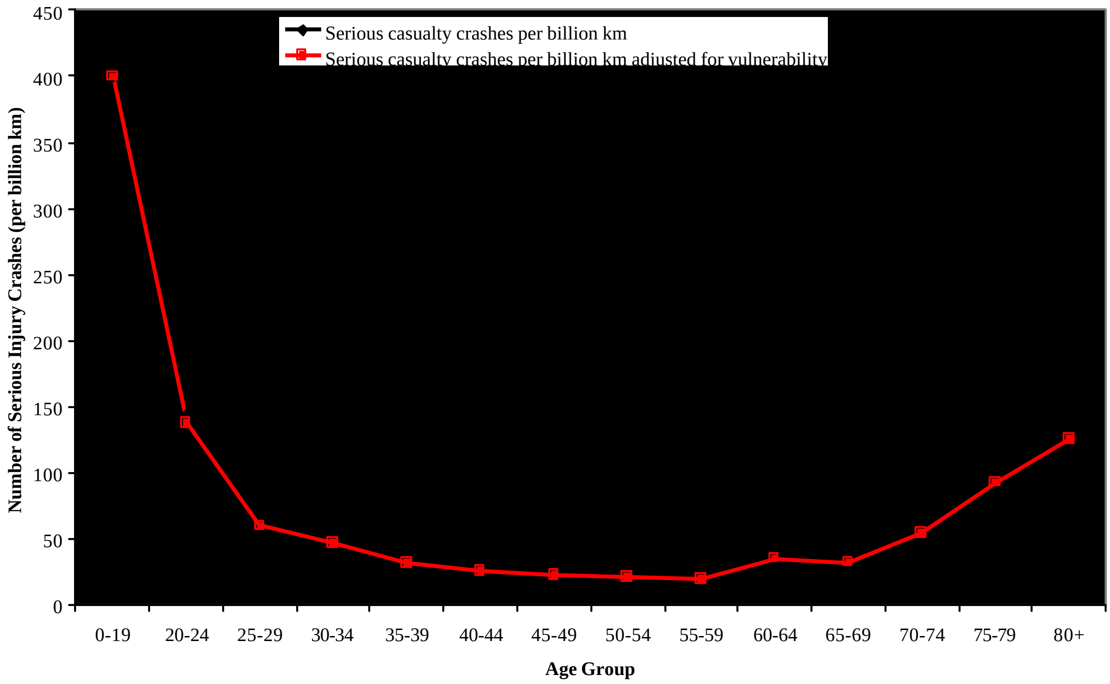
Vision Zero accepts that accidents will occur as people do make errors while moving within the road transport system (Tingvall & Haworth, 1999). A key premise of the Vision Zero philosophy is that the system be designed in a manner such that when accidents do occur, that "no foreseeable accident should be more severe than the tolerance of the human in order not to receive an injury that causes long term health loss" (Tingvall, 1998, p.6). Vision Zero demands that safety is placed before the need for mobility, and that the value of human life should not, and indeed cannot, be quantified (Tingvall & Haworth, 1999; Vaa, 1999). The acceptance of the ethic that the value of human life cannot be quantified should promote the development of the road transport system in line with the philosophy of Vision Zero. As such, Vision Zero provides a guide for the selection of safety strategies and countermeasures (Tingvall & Haworth, 1999).

The implications of Vision Zero are profound and represent an enormous challenge to the designers of the road transport system. However, it is argued that the benefits to society as a whole would far outweigh the challenges faced by those designing the interface between the road transport system and the end-user (Tingvall, 1998; Tingvall & Haworth, 1999). The older driver poses a particular challenge to Vision Zero for a number of reasons: older drivers will increase significantly in number in the future, be healthier for longer, and more mobile than past cohorts. Further, it is generally accepted that older drivers are more likely to have functional limitations that are seen to be detrimental to driving performance. Moreover, due to the ageing process itself, the biomechanical tolerances of older persons to injury are generally lower than that of younger persons. Herein lies a challenge for Vision Zero: to design a crashworthy road transport system for an ever-increasing number of older drivers.

Crash involvement of older drivers in Australia

Currently, older drivers are not a large road safety problem in Australia in terms of the absolute number of crashes relative to other age groups. In 1996, drivers aged 65 years or more accounted for only 8.1% of serious casualty crashes while comprising 12% of the total Australian population (ABS, 1997; FORS, 1996). By contrast, younger drivers aged less than 25 years accounted for 28.4% of serious casualty crashes while forming 13% of the total Australian population (ABS, 1997; FORS, 1996). However, there are fewer older drivers on the road relative to their younger counterparts, and older drivers tend to travel fewer kilometres overall per year (ABS, 1995, 2000).

Research has consistently indicated that there are age differences in drivers' crash risk even after controlling for differences in exposure and physical vulnerability (Wylie, 1996). Figure 1 shows the number of serious injury crashes per billion kilometres travelled by age group for drivers with and without adjustment for differences in physical vulnerability. The data indicate that both younger and older drivers have high levels of crash involvement compared to other age groups, even after controlling for differences in exposure. The involvement of older drivers in serious injury crashes is seen to increase markedly from age 65 years, and indeed the upward trend can be seen to commence at age 60.



Source: ABS, 1995; FORS, 1996a

Figure 1. Involvement in serious injury crashes by age adjusting for exposure and vulnerability, Australia, 1996.

Research in the USA suggests that males are 2.3 per cent more likely to die in the same severity crash for each year above 20, while for females this likelihood rises by 2.0 per cent (Evans 1991, 1994 cited in FORS 1996b). After adjusting for increased frailty it is evident that the crash risk reduces for all age groups with the exception of younger drivers. It does, however, remain the case that older drivers have an increased involvement in serious injury crashes even after controlling for the additional 'vulnerability' factor. For example, drivers aged 80 years and above have a crash involvement level 6 times that of the statistically safest group (50-54 years), and 2.6 times that of the 30 – 34 year old age group.

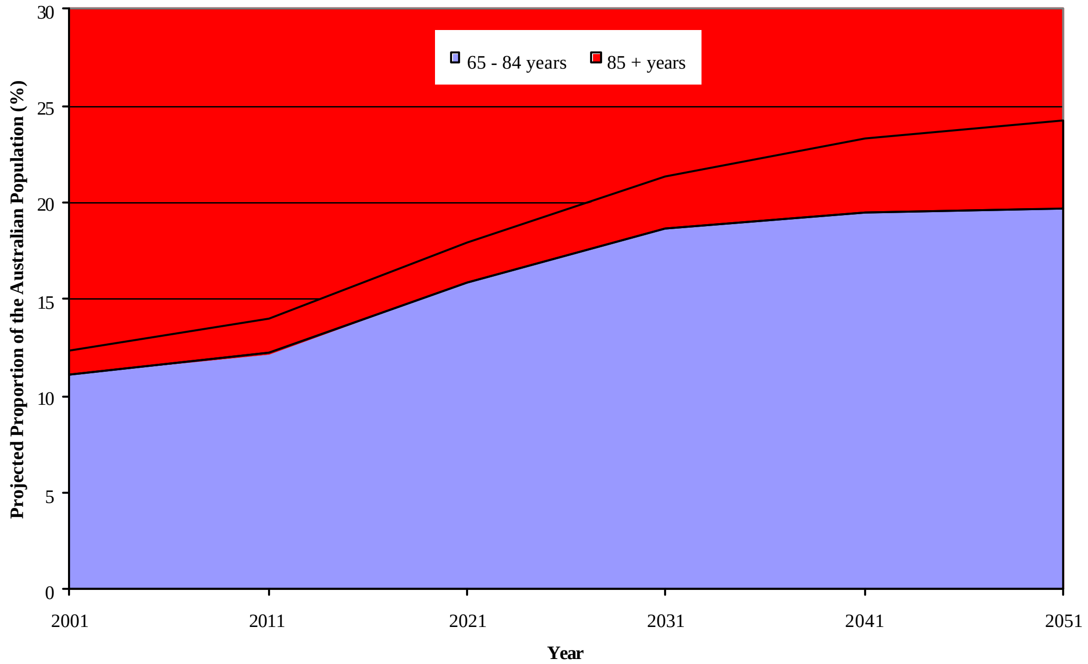
There may, however, be an additional bias in the exposure-adjusted crash rates presented in Figure 1. It has been reported that, independent of age, drivers who travel longer distances have a lower crash risk than those who drive shorter distances (Hakamies-Blomqvist, 1998). Consequently, older drivers' crash risk, when based on distance travelled, may be overestimated when compared to younger drivers with higher annual kilometres travelled (Hakamies-Blomqvist, 1998). As the next cohort of older drivers become more mobile, the crash risk of older drivers may be moderated by larger annual distances travelled.

It is also of interest to note that in the 10 years from 1986 – 1995, Australia's road toll declined by approximately 30% across all groups of road users. Among drivers, there was a 27%, 28%, and 23% reduction in driver fatalities in the under 25, 25 – 39, and 40 – 59 year old age groups respectively (FORS, 1996b). At the same time, however, there was a 1.8% increase in the number of 60 + year old drivers killed. Wylie (1996) suggests that in addition to there being more older persons, and hence more licensed drivers in the community, older drivers have benefited less than the younger age groups from the extensive array of countermeasures relating to speeding and drink driving implemented by various agencies in Australia. This may be the case as speeding and drink-driving behaviours are more commonly associated with younger drivers than with older drivers.

The Australian population: the concept of structural ageing and implications for vehicle use

Structural aging refers to a shift in the composition of the population from younger age groups and the consequent increase in the proportion of persons found in the older age groups (Jackson, 1999). Australia, like most western societies, predicts substantial changes in the proportion of older persons in the foreseeable future as the current population ages (ABS, 1999).

Figure 2 shows that the proportion of persons aged 65 years and older in the Australian community is predicted to increase from 11.1% in 2001 to 24.2% in 2051 (ABS, 1999). While the number of persons aged 65 – 84 years is predicted to approximately double, the percentage of persons aged 85 years and above is predicted to increase four-fold (ABS, 1999). In 2051, it is predicted that persons aged 85 years and over will increase from 1% to 5% of the total population compared with 2001 (ABS, 1999). The growth is expected to be most rapid in the period mid-2031 to mid-2041, during which a 50% increase is projected in the number of people in this age group (ABS, 1999). Thus, the old-old generation will become a more substantial sector of the population in future.



Source: ABS (1999). Older people: A social report. Cat. No. 4109.0

Figure 2. Projected proportions of 65 – 84 year old adults and 85 + year old adults in the Australian population, 2001 – 2051

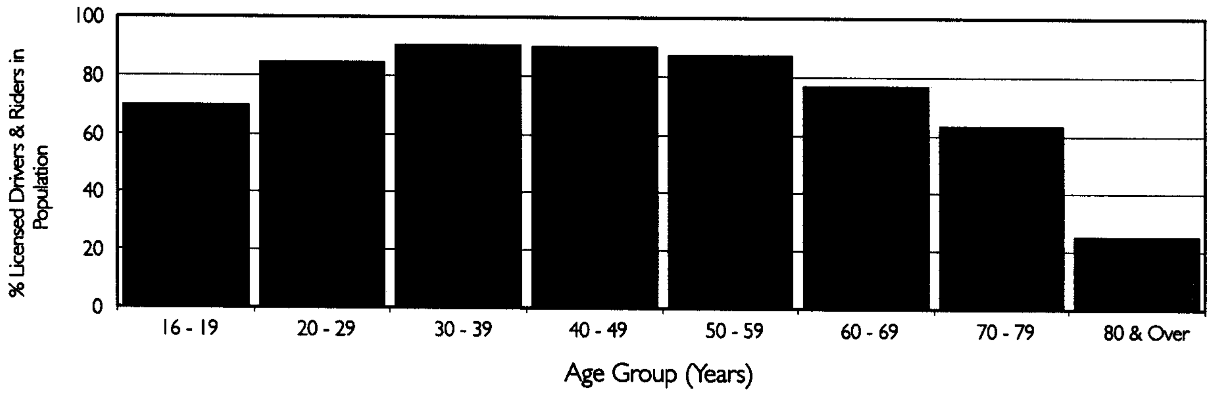
The ageing of the Australian population has, in the main, been attributed to the sustained increase in fertility that characterised the period termed 'the post-war baby boom' (AusStats, 1999). The post-war baby boom was the period of time extending from the end of World War II until the mid 1960's (1946 to 1965). The youngest 'baby-boomers' will be 65 years of age in 2031, and between 2031 and 2051 baby boomers are projected to increase the population aged 85 and over from 612,000 to 1.1 million (refer to Figure 2) (AusStats, 1999).

In addition to increased birth rates in the baby-boom period, increases in life expectancy have also contributed to the predicted growth in the number of older persons in the Australian population. Lifestyle changes (e.g., education, sanitation, nutrition) and medical advances (improved therapeutic measures and advances in drug therapy) have seen the life expectancy of Australians increase remarkably (ABS, 2001). For instance "…a baby girl born at the time of Federation could expect to live to 58.84 years of age, while her counterpart a century later (1998) could look forward to 23 years more life" (ABS, 2001, p.172). Similarly, the life expectancy of males increased 17.06 years in the same period to be 75.9 years for those born in 1998 (ABS, 2001).

On the basis of growth in the older population, older driver safety is likely to become a bigger issue in the years ahead, in part, as a consequence of the increased number of older, potentially more mobile, drivers in the community. Recent predictions suggest that the older driver problem will become an even larger concern given the demographics of the baby-boom cohort of drivers. The baby-boomers have grown up with the car, are generally more car-dependent, have higher licensing rates, and travel longer distances by car than persons of their parents' generation. It would be useful then to examine the effects of each of these characteristics in an attempt to predict the size of the older driver safety problem over the next 20-30 years.

Licence rates and vehicle use

Figure 3 shows the percentage of licensed drivers and riders in the NSW population as at the end of June 1997. The minimum age for a learner drivers' licence in NSW is 16 years of age while the minimum age for a provisional licence is 17 years of age. Figure 3 shows that approximately 80% - 90% of persons aged 20 years and above held a current drivers licence, while a high proportion (75%) of persons aged 60 – 69 years of age also held a current drivers licence. Licence rates as a proportion of the NSW population is seen to drop from 70 years of age and above, with 60% of the 70 – 79 year adult in the population holding a current drivers licence and only 25% of the 85 plus year old age group holding a current drivers' license.



Source: RTA (1998)

Figure 3. Percentage of drivers and riders in the population aged 16 years and older in NSW as at end June 1997

These figures are representative of licensing rates across the other states and territories in Australia. With the expected marked increase in this segment of the population, drivers aged 80 years and older will potentially become more noticeable in future crash statistics as they become more mobile and vehicle dependent.

Car use and distance travelled

Age and gender of drivers and passengers has also been shown to influence patterns of car use. Table 1 shows the average time spent using a car each day by men and women in Australia during 1992 (AusStats, 1996). It is clear that the time spent in vehicles decreases with age, particularly after age 65 years, and that males aged 75 years and above spend less than half of the time in the car as a driver than 45 – 54 year old male drivers. Interestingly, males and females aged 75 + years show similar vehicle time use, either as a driver or passenger.

Table 1. Time spent using a car in minutes each day

Type of Car Use	15-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75 + years	**Mean**
Men								
Driver	93	92	105	113	96	68	52	**97**
Passenger	55	42	50	67	70	60	54	**54**
Women								
Driver	72	72	79	70	63	58	51	**72**
Passenger	65	54	63	61	67	56	49	**61**
Mean	**84**	**85**	**96**	**96**	**86**	**67**	**54**	**87**

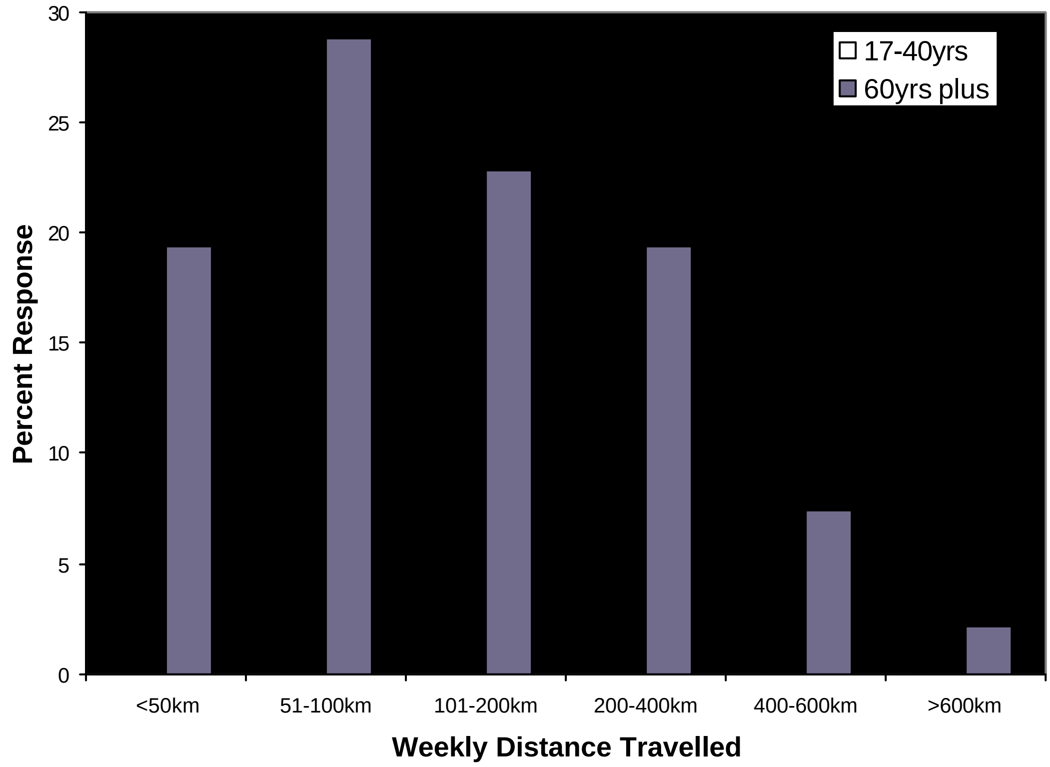
Source: ABS, 1996

In addition to spending less time in cars, either as a driver or a passenger, fewer older adults actually use cars (AusStats, 1996). Among young adults (15-24yrs), 71% used cars but only 47% were drivers. For those aged 35-44, the proportion of people using a car increased to 80% of which 74% were drivers. For those aged 75 years and older, car use decreased to 40%, while the proportion who were drivers fell to only 26% (AusStats, 1996).

Figure 4 shows the average self-reported distance driven each week by a sample of younger (17-40 years of age) and older (60 years and above) drivers in a survey of behavioural and travel patterns conducted in Canberra and Sydney during the mid-1990s (Fildes, Lee, Kenny & Foddy, 1994). This shows that a greater proportion of older drivers surveyed drove distances of 200 kilometres or less in a week while younger drivers were more likely to drive larger distances (i.e., 200km or greater).

The observations that older drivers spend less time in the car as either a driver or passenger, report using the car less than their younger counterparts as a means of transport, and travel fewer total kilometres in an average week is perhaps indicative of a diminished need for car use in retirement. The survey noted fewer weekly journeys generally and less work-related and holiday journeys but more shopping and health visits among the older group compared with the younger age group (Fildes et al., 1994). No information was gathered on average journey length for the two groups.

Notwithstanding the patterns of vehicle usage of the current cohort of older drivers, the mobility patterns of future generations of older adults, including the ‘baby-boomers’ are likely to differ in the manner described above. The predicted increase in car use, licensing rates, and distances travelled will impact upon the older driver road safety problem.



Source: Fildes et al., 1994

Figure 4. Reported weekly distance travelled in ACT and Sydney

Functional disabilities of ageing and relationship to crash risk

A number of functional disabilities are known to be associated with an increased risk of crash involvement (see summaries by Fildes, 1997 & Austroads, 1998). The disorders commonly associated with an increased risk of crash involvement, and to which older people appear particularly prone, include:

- Visual conditions (e.g., cataracts, glaucoma, diabetic retinopathy, major field of view losses);
- Cardiac conditions (e.g., irregular heartbeat, history of heart problems, severe angina);
- Cerebrovascular conditions (e.g., stroke with permanent impairment, history of transient ischaemic attacks);
- Insulin-dependent hypoglycaemia;
- Memory impairment and decline in cognitive skills (e.g., moderate and severe dementia including Alzheimer's disease, reduced ability to divide attention);
- Mental illness (e.g., severe depression);
- Severe muscular and skeletal disorders, including severe arthritis;

- A range of conditions resulting in loss of upper body strength (e.g., restricted head and neck mobility, incomplete use of arms, excess tremor, weakness, rigidity, paralysis, severe loss of breath);
- A range of conditions resulting in loss of lower body strength (e.g., unable to walk unaided, loss of leg or foot, excessive tremor, rigidity, paralysis);
- History of falling;
- Conditions resulting from use of particular prescribed drugs and polypharmacy (e.g., anti-depressants, anxiolytics, sedatives / hypnotics);
- Alcoholism and drug abuse (e.g., abuse of prescribed, heightened sensitivity to alcohol)
- Sleep disorders (Sleep apnoea, narcolepsy), and
- Neurological conditions (e.g., Multiple Sclerosis and Parkinson's disease).

A note of caution is required here, however. These medical conditions have not been listed in any order of importance or priority with respect to the severity of their impact upon drivers' crash risk. Further research is clearly required in this area.

Projected future older driver crashes

With the predicted increases in survival rates and continued motorisation among the older age group, it is inevitable that the older driver crash problem will increase in the future. While the precise extent of this expected increase in road crashes in Australia has not been accurately determined, estimates have been proposed for other countries based on many economic, driving habit, and urban development factors among others.

The Oak Ridge Study

Hu, Jones, Reuscher, Schmoyer and Truett (2000) set out to project the size of the safety problem involving future elderly cohorts, taking into account driving behaviour, population migration, personal wealth and health, infrastructure and technological impacts in the USA. They developed models to predict the growth in older drivers from year 2000 to 2025 and consequent changes in crash involvement. They noted a number of challenges in projecting the probability of an older person continuing to drive, such as understanding what influences older drivers' decisions to continue to drive, and attempting to predict and understand future economic and related developments that are likely to alter historical trends in driver behaviour. Based on personal travel surveys available in the USA, they reported that an older driver's decision to drive decreased with:

- Living in an urban community;
- Being out of the labour force;
- Having a lower income;
- Having other drivers in the household (this may affect men and women differently);
- Having a disability, and
- Age.

Hu et al (2000) reported a higher likelihood of men to continue to drive than women, and that having another driver in the family had little influence on that decision. The authors predicted an overall 286% increase in fatalities from 1995 to 2025. A more detailed analysis of this, showing the proportion attributed to increased population, driving, and probability to drive and a decrease in crash risk is shown in Table 2 (see below). The assumptions of Hu and colleagues' model were (Hu et. al., 2000; Reuscher, 2001):

- The surrogate link for health status formed using National Personal Transportation Survey (NPTS) data accurately reflects that seen in the National Health Institute Survey (NHIS);
- A 0.2-1.5% increase in income was projected for the whole population;
- The level of workers was assumed to increase by between 0.1-1.5% for the whole population;
- Certain historical increases cannot continue indefinitely since doing so will yield highly unrealistic and improbable results, such as more than 100% of the elderly population driving or older drivers driving more miles than younger drivers;
- The rate of urbanisation and health status will remain constant from 1995 to 2025, based on data published by the NHIS, and
- The rate of seatbelt use will increase to levels projected by National Highway Traffic Safety Administration (NHTSA) in 2025 (85%).

Table 2. Predicted increase in fatalities, ages 65 and older, USA (Hu, et al., 2000)*

	Number of Fatalities			Contributing Factors			
Sex	1995	2025	% ↑	% ↑ Population	% ↑ Probability of driving	% ↑ driving	% ↓ in crash risk
Male	2568	6695	261%	82%	14%	37%	33%
Female	1323	4444	336%	46%	34%	52%	31%
Total	3891	11,139	286%				

Preliminary Future Australian Fatality Predictions based on the Hu et al (2000) model

Assuming that the Hu et al (2000) model could be applied to Australia, the predicted equivalent increase in fatalities by age group would amount to an increase in older driver fatalities from 121 in 1995 to 341 in 2025, an overall increase of 281% above 1995 figures. As with the US model, known fatalities in Australia for the 1995 calendar year were used as the base from which predictions were made (ATSB, 2001). The

* NB: The percentage increases shown for population, probability of driving, increase in driving and decrease in crash risk are derived from regression modelling. They are multiplicative & interactive in a complex regression model and hence do not add up to the total percent increase shown.

projected outcomes from this modelling are shown in Table 3 and Figure 6 for males and Figure 7 for females below.

Table 3. Predicted increase in driver fatalities aged 65 and older, Australia, 1995-2025*[1]

	Number of Fatalities			Contributing Factors			
Sex	1995	2025	% ↑	% ↑ Population	% ↑ Probability of driving	% ↑ in driving	% ↓ in crash risk
Male	87	227	261%	82%	14%	37%	33%
Female	34	114	336%	46%	34%	52%	31%
Total	121	341	281%				

[1] Note: The percentage increases shown are based on the assumptions described by Hu et al (2000).
[1] Note: Australian fatalities for 1995 provided by Australian Transport Safety Bureau Monthly Fatality Crash Database, 03/01.

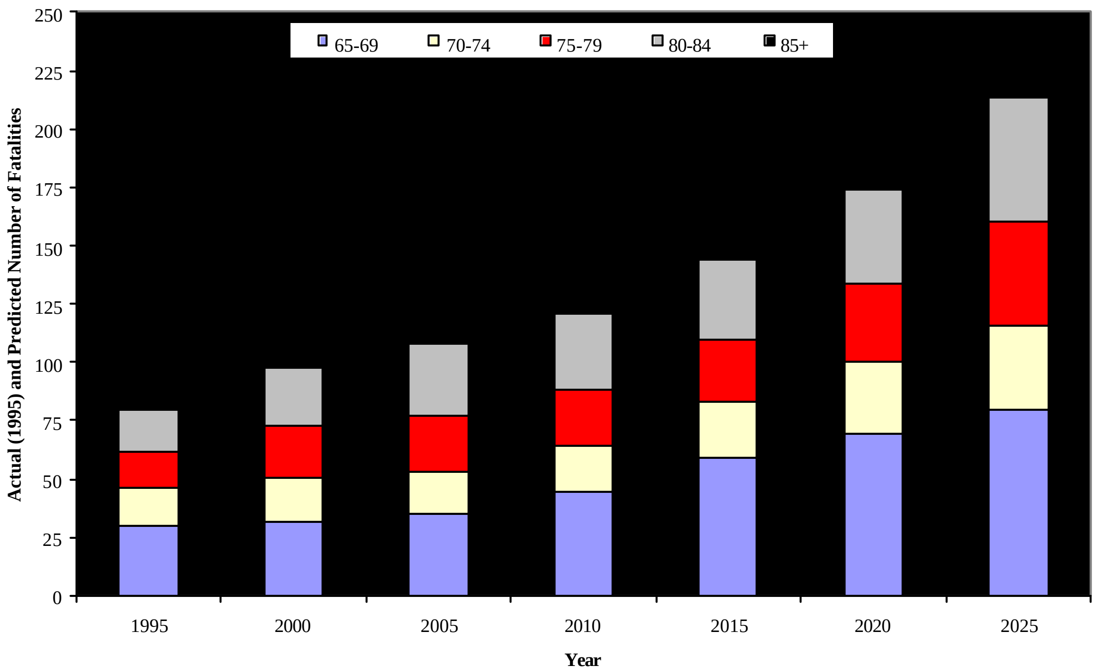


Figure 6. Projected older male driver fatalities in Australia, 1995 – 2025

* NB: The percentage increases shown for population, probability of driving, increase in driving and decrease in crash risk are derived from regression modelling. They are multiplicative & interactive in a complex regression model and hence do not add up to the total percent increase shown.

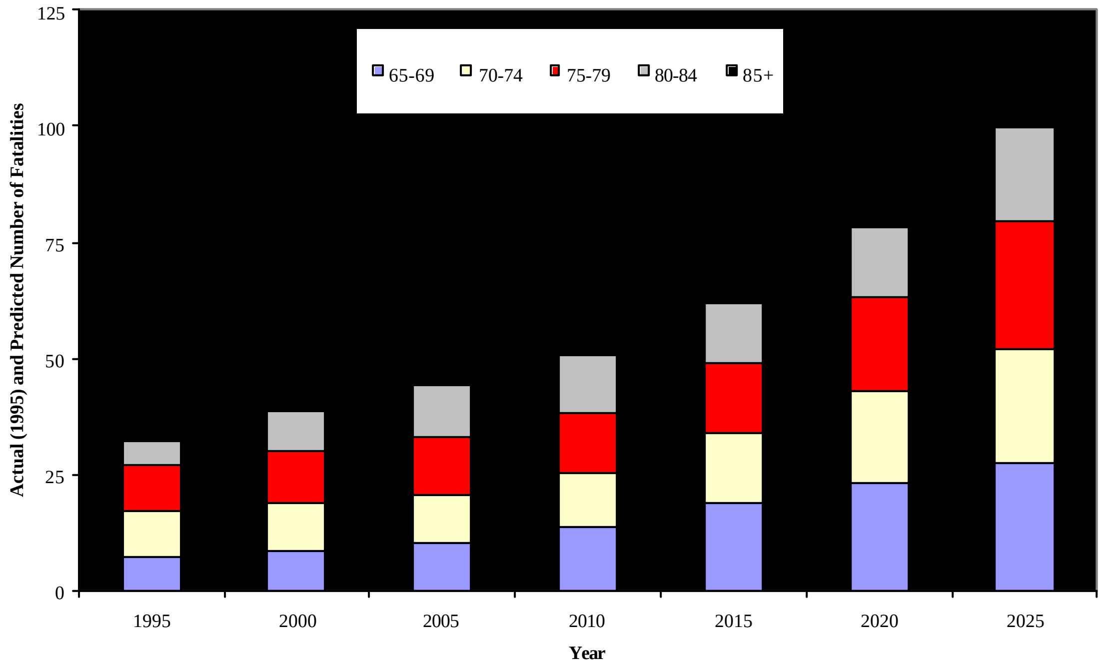


Figure 7. Projected older female driver fatalities in Australia*

Comments on these predictions

While these predictions are for fatalities only, a similar predicted increase in serious injury casualty crashes would be expected using this model. It should be stressed that these early predictions are based on assumptions specific to the US, some of which may or may not apply in Australia. It is reasonable to expect similar a population, urbanisation, motorisation and income status to exist in both countries, given that they are both relatively young countries and have similar lifestyle, mobility and transportation patterns. However, some of Hu et al's (2000) assumptions do not seem applicable. The level of seatbelt wearing, for example, is much higher in Australia and given the benefits of seatbelt wearing in preventing fatalities, these fatality rates may be slightly overestimated. It was not possible to model these effects more thoroughly from the information available at the time and additional research in this area is clearly warranted to provide a more accurate prediction of the likely effect of ageing on the predicted future Australian road toll.

Discussion and challenges for vision zero

It is clear that there will be a substantial increase in the number of older drivers on the road in the coming years and they are likely to be more mobile than the current older driver cohort. While the precise number of older drivers and their future exposure is not clear at this stage, future US predictions suggest that fatal crashes could be as much as *three* times greater than at present without active intervention. Clearly, this will present a major challenge for road safety in future years and in particular, efforts to achieve a 'Vision zero' outcome for older road users. A number of issues and hurdles will need to be overcome if Vision Zero is to be addressed seriously. These are discussed below.

Ageing demographics

The biggest challenge for achieving 'Vision Zero' for older road users, of course, will be from the substantial expected growth in numbers over the next 20 to 30 years, along with increased health and mobility of this cohort. Drivers aged 65 years and older will have a much higher presence on the road and thus, a higher likelihood of crash involvement. Moreover, the associated increase in frailty with ageing means that given a higher crash involvement, older adults are more likely to suffer serious injury or death than younger adults. It is unrealistic to believe that older driver exposure per se will be able to be restricted by mandatory cessation of driving policies, so other solutions to address this increased presence will need to be found.

Infrastructure and speed

Johannson, Lie and Tingvall (1998) argued that 'Vision Zero' could be summed up by two axioms: first, the tolerance of the human, and second, that human errors do occur. Johannson et al (1998) claim that there are only two fundamental approaches to adopt to achieve vision zero, namely:

- Invest substantial resources in making the road environment more safe for human mobility and more able to absorb impact energy during a crash;
- Reduce travel speed to a level that ensures that human tolerance to injury is not exceeded.

Either or both of these two approaches would seem essential if there is to be substantial improvement in older road user safety in the coming years. Acceptance of these approaches requires responsibility for the system to be shared among the designers and end-users of all parts and aspects of the road transport system.

Reduced exposure

Reducing exposure at certain dangerous locations and for particular high-risk manoeuvres could be useful strategies for older drivers to adopt to reduce older drivers' crash risk. Examples of safe strategies include avoiding complex intersections, minimising right-turn manoeuvres by improved route planning and guidance, and avoiding driving at high-risk times (peak periods and night driving). Strategies designed to avoid complex decision-making tasks for older people have also been shown to have benefits for older persons' safety (Oxley 2000). This could include programs aimed at informing older drivers of strategies to minimise their exposure to a collision. The degree to which the older driver population currently practices these strategies is not clear. MUARC is currently investigating the self-regulatory practices of older drivers.

Reduction in risk

Understanding the types of crashes that older driver's experience will highlight appropriate risk reduction strategies. As well as the exposure measures discussed above, there are other mechanisms that should be considered here for improving the safety of older people. Intelligent Technology Systems (ITS) are finding their way into vehicles to provide drivers with additional feedback and assistance with the driving task (intelligent cruise control, gap acceptance, reversing information, blind-spot avoidance, etc). In addition to ITS, training programs specifically designed to cater for the needs of older drivers could be developed with the aim of reducing their risk of collision. Use of alternative transport methods, such as public transport where feasible, may further reduce exposure and risk for older persons.

Crashworthy environment and occupant protection

Preventing the risk of serious injury through secondary safety prevention is another strategy that will require greater attention. For car occupants, this means better "packaging" of the occupant to reduce contacts within or outside the vehicle during a crash. Restraint systems can play a major role here (better seatbelt systems, airbags, etc) in minimising the impact forces to the occupant (improved vehicle crashworthiness). A more forgiving exterior vehicle design would potentially enhance older pedestrian safety when struck by a car. Older drivers should be encouraged to use the latest vehicles with the best available safety features, suitable for their more frail bodies. A larger car is likely to reduce the crash severity through its increased mass, although it is recognised that this is not always possible for financial reasons. However, incentives may be used to help overcome some of these hurdles in future.

Crashworthiness is typically focussed on making the car user-friendlier in a crash. However, there is scope also for the infrastructure to contribute much more here in future. Poles and trees and fixed barriers and abutments are a major source of trauma for car occupants in collisions with these objects. Barriers to separate traffic from rigid objects and designs that absorb more of the crash energy are urgently required. Also, there is a pressing need for appropriate separation of vehicle and pedestrian traffic in high volume pedestrian areas and for safer road crossing facilities. Older pedestrians, in particular, would also benefit from increased signal crossing times and a safer crossing environment generally.

Concluding Comments

To achieve 'Vision Zero' there must be a significant change in current traffic management philosophy in Australia from one of emphasis on high levels of mobility to a more health-focussed model that places highest priority on road-user safety. A desired model is one where the community will not tolerate the continuing loss of life and serious health losses that currently happens daily on our roads. Older road user safety will become a major road safety issue over the next 20-30 years if we continue to stress mobility at the expense of safety. It will be difficult simply to maintain current fatality and casualty statistics in the face of the present ageing demographics without adopting a more radical approach to safety. There are a number of research endeavours underway that address various aspects of the older road user safety problem which are expected to lead to future improvements in their safety. However a strong commitment to the 'Vision Zero' philosophy by the designers (i.e., vehicle designers, road engineers, policy-makers) of all aspects of the road transport system to ensure the safety of older drivers, passengers and pedestrians in the years ahead is required.

Acknowledgements

The authors are particularly indebted to Patricia Hu, Tim Reuscher and their colleagues at the Oak Ridge National Laboratory (Tennessee, USA) for their generous assistance with the adaptation of their older driver projections to Australia. Thanks to Jim Langford for comments on the draft manuscript. The authors would also like to thank Tom Roberts from ATSB for his generous and timely assistance in supplying Australian fatality data. The views expressed in this paper are those of the authors and do not necessarily represent those of any of the references cited or Monash University.

References

Australian Bureau of Statistics (ABS) (1995) *Survey of Motor Vehicle Use 1995* Cat. No. 9208.0 Canberra: ABS

Australian Bureau of Statistics (ABS) (1996) *Australian Social Trends 1996 – Transport – Special Features: Car Use* Canberra: ABS

Australian Bureau of Statistics (ABS) (1997) *Basic Community Profile: 1996 Census of Population and Housing* Cat. No. 2020.0 Canberra: ABS

Australian Bureau of Statistics (ABS) (1999) *Older people: A social report* Cat. No. 4109.0 Canberra: ABS

Australian Bureau of Statistics (ABS) (2000) *Survey of Motor Vehicle Use 12 months ended 31 July 1999* Cat. No. 9208.0 Canberra: ABS

Australian Bureau of Statistics (ABS) (2001) *Year Book Australia 2001 (Number 83)* Cat. No. 1301.0 Canberra: ABS

AusStats (1996) *Australian Social Trends 1996: Transport – Special Features: Car Use* Website: http://www.ausstats.abs.gov.au/

AusStats (1999) *Australian Social Trends 1999: Population - Population Projections: Our ageing population*. Website: http://www.ausstats.abs.gov.au/

Austroads (1998) *Assessing Fitness to Drive* Canberra: Austroads

Australian Transport Safety Bureau (ATSB) (2001) *Driver fatalities by age and gender Australia 1995 – 2000*. Australian Transport Safety Bureau Monthly Fatality Crash Database Personal Communication, March 2001

Fildes, B (1997) *Safety of older drivers: strategy for future research and action initiatives* Report 118 Clayton: Monash University Accident Research Centre

Fildes, B Lee, S Kenny, D & Foddy, W (1994) *Survey of older road users: behavioural and travel issues* Report No. 57 Clayton: Monash University Accident Research Centre

Federal Office of Road Safety (FORS) (1996a) *Serious Casualty Rates Among Drivers* Canberra: Federal Office of Road Safety

Federal Office of Road Safety (FORS) (1996b) *Older drivers: Calculating the risk of involvement in fatal crashes* Monograph 6 Canberra: FORS

Hakamies-Blomqvist, L (1998) Older drivers accident risk: Conceptual and methodological issues *Accident Analysis and Prevention* 30, 293-297

Hu, P Jones, D Reuscher, T Schmoyer, R & Truett, T (2000) *Projecting fatalities in crashes involving older drivers* Report for the National Highway Traffic Safety Administration, Oak Ridge National Laboratory Tennessee: ONRL

Jackson, N (1999) *Understanding Population Ageing* Paper presented to Department of Family and Community Services Seminar Canberra: Department of Family and Community Services

Johannson, R Lie, A & Tingvall, C (1998) *The vision zero: what it is and what it has done for Sweden* Paper presented at the 1998 Traffic Safety Summit Kannanaskis, Canada

Oxley, J (2000) *Age-crossing behaviour of older pedestrians* Unpublished PhD Dissertation Clayton: Monash University

Roads and Transport Authority (RTA) (1998) *NSW Vehicle and Driver Statistics* Sydney: RTA

Reuscher, T (2001) *Personal Communication* 7th March 2001

Tingvall, C & Haworth, N (1999) Vision Zero: An ethical approach to safety and mobility, *Papers of the 6th ITE International Conference - Road Safety and Traffic Enforcement: Beyond 2000* Melbourne: ITE

Tingvall, C. (1998). The Swedish 'Vision Zero' and how Parliamentary approval was obtained Keynote address, pp 6 – 8 Volume 1 of *Papers of the Road Safety Research – Policing – Education Conference 1998* Wellington NZ: LTSA

Vaa, T (1999) *Vision Zero and sustainable safety: A comparative discussion of premises and consequences* Institute of Transport Economics Working Paper O-2506 Sweden: Swedish National Road Administration (SNRA)

Wylie, J (1996) *Variation in relative safety of Australian drivers with age* FORS OR19 Canberra: AGPS