Protocol for determining suitability of vehicles for older drivers and passengers

Robyn Seymour – Royal Automobile Association of Victoria (RACV)
Michael Paine – Vehicle Design and Research Pty Ltd

ABSTRACT

Older occupants are particularly susceptible to serious injury or death in the event of a car crash due to their increased level of frailty. Levels of frailty generally begin to increase from the age of 60 to 65 years, although for some women it can be as young as 45 years.

Given the ageing of the population, the suitability of vehicles for older drivers and passengers is a particularly pertinent issue and one that provides great potential in terms of possible safety gains. The population of older people is not only increasing, but older people are also driving for longer and so have a greater exposure to the risk of a crash.

This research was concerned with developing a protocol with which to determine the relative safety and usability benefits of particular vehicles for older drivers and passengers. Some vehicle safety features are likely to be particularly effective for older occupants and these should be encouraged. Usability and accessibility are also important issues for older occupants who may not have the same level of mobility as other people.

This paper outlines the initial findings from this research and discusses the criteria that are being developed for determining the suitability of vehicles for older drivers and passengers.

BACKGROUND

Ageing population

The issue of safety and mobility for older Australians is becoming increasingly important given the projected increases in the number of older drivers in the future. 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 generation of drivers aged 85 years or more will become a more substantial sector of the population in the future as the population continues to age and people live longer.

Common injury types

Older drivers tend to experience particular types of injuries resulting from their increased level of frailty. Analyses of traumatic injuries have shown that injuries to the head are associated with the highest mortality rates, followed by injuries to the chest and abdomen (Wang, 2003). As people age, the risk of rib injuries as a result of the seatbelt increases and older driver's ability to survive these injuries is exacerbated by the ageing of the respiratory system (Wang, 2003). These injuries are associated with fatalities particularly for older drivers.

Similar results were also found in a study by Sjörgen, Björnstig, Eriksson, and Öström (1996). It was revealed that the risk of chest injuries increased with age. The research found that the impact load that just begins to produce rib fractures with no displacement when applied to the chest of a 25 year old male may well generate life threatening fractures in a 65 year old.

Older drivers are particularly susceptible to serious injury or death in the event of a crash due to their increased level of frailty (Evans, 2001). Levels of frailty generally begin to increase from the age of 60 to 65 years, although for some women it can be as young as 45 years (Access Economics, 2001).

The frailty graph in Figure 1 represents the likelihood of being killed in a crash according to age and gender. The graph shows that from the age of 60 people's likelihood of sustaining injuries that result in death in a crash begins to rise due to increased levels of frailty. The level of frailty increases more quickly for females compared with males. From the age of 65 females are more than twice as likely to receive injuries that result in death in the event of a crash compared with people aged 30 to 59 years. For both males and females their level of frailty increases dramatically from the age of 70 years. These data illustrate the importance of vehicle safety in helping to protect older drivers and occupants in the event of a crash.

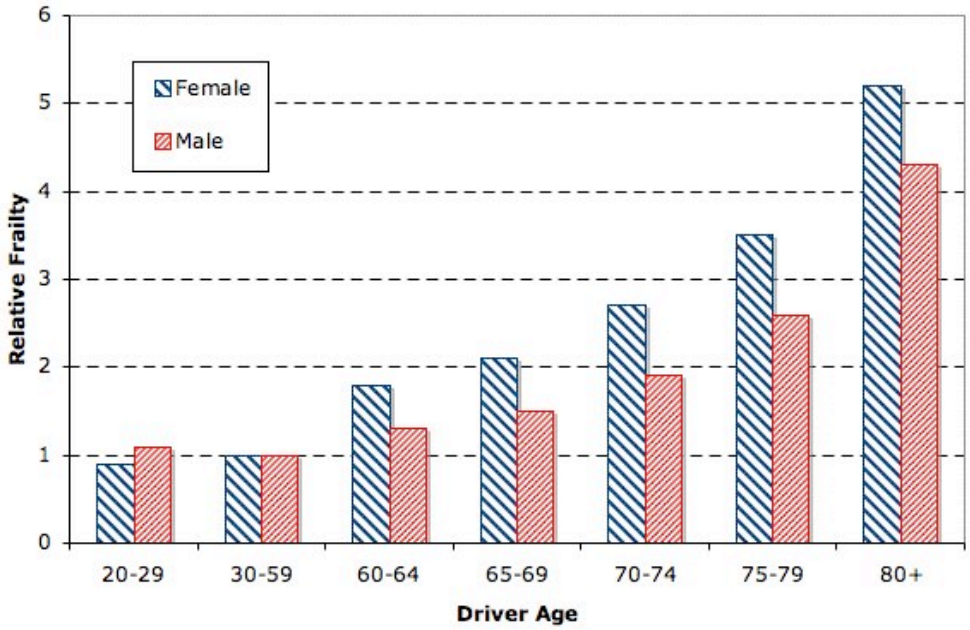

Figure 1: Driver frailty index by age and gender
Source: Li, Braver and Chen 2003.

As people age their level of frailty increases and this can be further exacerbated by medical conditions, such as osteoporosis. The World Orthopedic Osteoporosis Organisation (2003) notes that the risk of developing osteoporosis dramatically increases from the age of 45 years. Osteoporosis causes a decreased tolerance to impacts, substantially increasing the risk of serious injury or death in the event of a crash.

VEHICLE SAFETY & OLDER OCCUPANTS

Older drivers are most at risk of serious injury or death in the event of a crash due to their increased level of frailty. This risk is further exacerbated by the fact that older drivers tend to driver older cars and often smaller cars as well - vehicles that have higher than average risk of serious injury the driver in the event of a crash (UCSR 2005). This problem is also not assisted by older drivers having a limited knowledge of vehicle safety or understanding of why driving a safe vehicle is particularly important for older drivers (Seymour 2005).

Given the ageing of the population, keeping older people safe in vehicles is a particularly pertinent issue and one that offers potentially significant safety gains. In addition to an increasing proportion of older people in the population, people are living longer and driving for longer. They therefore have higher exposure to the risk of a crash.

The capacity for particular features to offer increased levels of protection in the event of a crash is important information for older people. In 2002, RACV developed a brochure

entitled "*Making the Right Choice: vehicle safety advice for seniors*" to highlight the importance of vehicle safety for older people and to help dispel some of the misconceptions older drivers have about particular features. This brochure has been very popular and includes a checklist of some of the features that older people should look for when purchasing a vehicle. The popularity of the brochure suggests that this is an issue that older people are interested in, demonstrating a community need.

Given the interest and popularity of the *Making the right choice* brochure, RACV were keen to take this a step further and develop criterion by which vehicles could be tested to determine the level of benefits they may provide older drivers and occupants. With this in mind RACV in partnership with other Victorian road safety agencies has commissioned research that aims to develop a vehicle safety and functionality criterion for selecting a vehicle that provides particular safety benefits to older drivers.

The overall objectives of this project include:

- To educate older drivers in how to choose a car that is likely to meet their safety and usability needs.
- To determine the specific features that provide increased levels of protection for older drivers.
- To quantify the size of the benefits provided by particular features for both the general population and older drivers.
- To encourage the development of market forces that will ultimately influence vehicle manufacturers to design vehicles that meet the specific needs of the older driver.
- To provide RACV members and the Victorian community, with the information to assist older drivers and their passengers to stay safe on the road.

FINDINGS OF INITIAL RESEARCH

The first phase of the project has been completed and phase two, involving the development of a draft protocol for rating vehicles is underway. This section presents the findings so far.

A consumer rating system that provides information on the suitability of vehicles for older drivers and occupants is considered feasible. There do not appear to be any equivalent rating systems in use throughout the world although several elements of a system have been implemented. The data necessary for conducting ratings appears to be readily available or can be obtained through inspection of sample vehicles.

Possible methods of identifying items for inclusion in a rating system and a recommended process for deriving overall scores and star ratings are described below.

Categories for rating

Five categories have been identified for possible inclusion in a rating system:

- Crash avoidance (active safety) - features that assist in preventing a crash such as electronic stability control and high-conspicuity lighting.
- Injury prevention (passive safety) - features that reduce the likelihood of serious injuries in the event of a crash, such as airbags.
- Post-crash rescue - features that assist in timely medical assistance after a crash, such as mayday radio systems and ease of extricating occupants
- Accessibility - features that enable older drivers and passengers to get in and out of vehicles, such as door aperture dimensions and seat height form the ground.
- Security and comfort - features that improve security (such as remote locking) and comfort (such as power windows)

There are several potential sources of information about these vehicle features. Injury prevention and "rescueability" can be determined from Australasian New Car Assessment Program (ANCAP) ratings. Driver field-of-view, head restraint design and theft/security are currently rated by IAG Insurance. The presence of safety features like ABS brakes can be determined from vehicle brochures. Other items such a door aperture dimensions and seat heights can be measured on sample vehicles.

NCAP Scores

When ANCAP first adopted the European protocol in 1999, discussions with Euro NCAP revealed that the scoring system tended to be biased towards protecting aged occupants. For example, in the offset crash test equal weight (maximum 4 points) is allocated for head, chest, upper leg and lower leg protection. In particular the Euro NCAP protocol is much more stringent for chest injury than equivalent protocols used by NCAP organisations in the USA and Japan. It was explained that this was to take account of the ageing population in Europe and the extra seriousness of chest and hip injuries with aged people (Griffiths, Paine and Haley 1999).

ANCAP crashworthiness ratings can therefore be used directly for determining the safety of vehicles for aged occupants.

Proposed scoring system

It is proposed that a list of key features will be developed for each category, based on costs, benefits and the availability and quality of relevant data. Feature scores will be weighted and summed to give a category score. Category scores will also be weighted and summed to give an overall score. From this a "first pass" star rating will be determined.

To avoid the situation where the absence of an important feature will be lost within the scoring process it is also proposed that the star rating be limited by the absence (or poor score) of a feature. For example, with a five star rating system (five stars best) it might be decided that any three door hatch-style vehicle cannot be awarded more than three stars because of the poor accessibility to the rear seat. In this example, although the overall

score might result in a first-pass rating of four stars, the final star rating is reduced to three stars. This rating system is illustrated in Figure 2.

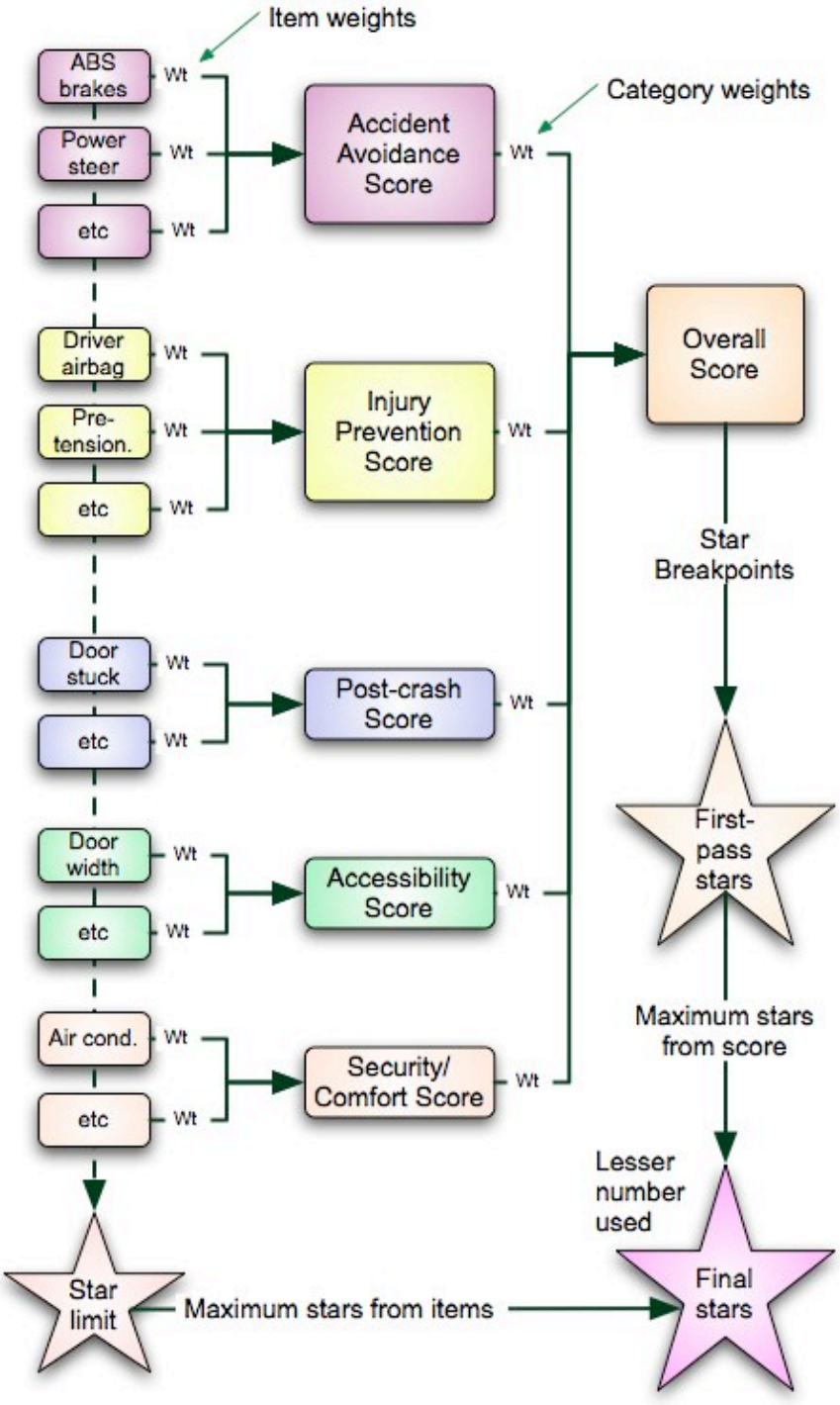

Figure 2. Proposed scoring method

In effect, the ANCAP star ratings are determined in a similar way. For example, a vehicle cannot be awarded five stars if it earns less than 12.5 (out of 16) in the frontal offset crash test or less than one point in the side impact pole test (ANCAP 2005).

An advantage of this approach is that consumers can determine the contribution of each vehicle feature to the score and star rating. If they wish they can then assign their own importance to these factors. It is anticipated, however, that most consumers will simply be interested in the RACV's star rating.

List of features for older drivers to look for when buying a car

Another important outcome from this research will be a list of specific features that older people should look for when buying a car. This list of features will highlight the key safety and accessibility features likely to provide particular benefit to older people. The list of features will be promoted to older drivers to increase their knowledge and awareness of vehicle safety features and to encourage them to choose vehicles that are likely to provide the safety benefits necessary to help keep them safer in the event of a crash. It is also hoped that this will place pressure on vehicle manufacturers to ensure that more vehicles include features as standard that meet the needs of older drivers.

CONCLUSION

Encouraging older drivers to purchase safer vehicles is an important road safety countermeasure, particularly given the ageing of the population and that people are generally driving for longer. With increased levels of frailty, older drivers are vulnerable to serious injury and death in the event of a crash. Educating older people about the importance of vehicle safety is valuable in assisting older drivers to stay safe and mobile.

A method of rating the suitability of vehicles for use by older drivers has been developed and a protocol for assessing vehicles is in preparation. It is proposed to cover accessibility and security issues, in addition to safety, so that the system has more relevance to older drivers.

REFERENCES

Australian Bureau of Statistics. (1999). **Population by Age and Sex**. ABS 3235.2, Canberra, Australia.

ANCAP (2005). Notes about the Assessment Protocol, Australasian New Car Assessment Program, Revised September 2005. http://www.aaa.asn.au/ancap.htm

Charlton, J., Andrea, D., Fildes, B., Oxley, J., Morris, A., Langford, J. and Johnson, L. (2002). **Safer Vehicle Choices for Older Adults**. RACV Report No. 02/01, Victoria, Australia.

Evans, L. (2001). "Age and fatality risk from similar severe impacts", **Journal of Traffic Medicine**, No 29 Vol 1-2, pp.10-19.

Griifths, M., Paine, M. and Haley, J. (1999). Consumer crash tests: the elusive best practice, **Worldwide Harmonization of Crash Tests Seminar**, Germany, Dec 1999.

Li, G., Braver, E., Chen, L. (2003). "Fragility versus excessive crash involvement as determinants of high death rates per vehicle-mile of travel among older drivers", **Accident Analysis and Prevention**, Vol.35, pp.227-235.

Osteoporosis Australia. (2003). About Osteoporosis - who is at risk, **Osteoporosis Australia**, http://www.osteoporosis.org.au/html/aboutosteomain.php, 14/04/03.

Paine, M. (2005). Suitability of Vehicles for Older Drivers - Phase 1: Research Scoping. Report P250A prepared for RACV, April 2005.

Seymour, R., Christie, R. (2003). Vehicle Safety Knowledge and Older Driver Decision Making, **Road Safety Research Policing and Education Conference Proceedings**, Sydney, Australia.

Sjörgen, H., Björnstig, U., Eriksson, A., Öström, M. (1996). "Differences between older and younger drivers; characteristics of fatal car crashes and driver injuries", **Safety Science**, Vol.23, No.1, pp.63-77.

Wang, S.C. (2001). "An Aging Population: Fragile, Handle with Care." **National Highway Traffic Safety Administration**, Washington, DC, http://www.nhtsa.dot.gove/departments/nrd-50/ciren/um_fragile.html, 23/07/03.

UCSR (2005). User Car Safety Ratings. Publication of RACV and others.

World Orthopedic Osteoporosis Organization. (2003). **Recommendations for Care of the Osteoporotic Fracture Patient to Reduce the Risk of Future Fracture**, http//:www.boneandjointdecade.org/news/effort_helsinki_200306_johnell.pdf, 12/03/04.

Contact information:

Robyn Seymour
Road User Team Leader

Royal Automobile Club of Victoria (RACV)
550 Princes Highway
NOBLE PARK NORTH VIC 3174

Robyn_Seymour@racv.com.au