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In this edition —

Contributed articles:

Peer-reviewed papers:

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Cover photo: A Federal police officer conducts a Random Breath Test. In his paper on the successful NSW RBT policy (see Refereed Papers), Greg Casey shows that it followed sound scientific and deterrence theories and a proven public policy cycle.
(Photo courtesy Australian Federal Police

Contents

From the President

Dear Members,

We are all aware of the effects of heavy vehicle driver fatigue. In 2005, 158 people died from 135 fatal crashes involving articulated trucks (1). Diver fatigue is thought to be a factor in up to 30 % of these fatal crashes (2). The expansion in road freight transport is likely to continue, presenting more challenges in reducing the national road fatality rate.

The National Transport Commission (NTC) has just released the public submissions on its Heavy Vehicle Driver Fatigue Reform consultation process. Draft legislation based on this reform process is to be delivered to Australian Transport Ministers in December this year in accordance with the Council of Australian Government (COAG) timelines for fatigue reform.

However the NTC comments that:

"Fatigue management is all about looking out for the driver by planning trips and rest breaks, checking for sleep disorders and better training and education. We want every driver to return home safely to their family (3)."

"Apply just as much to the light and short haul road transport sector which is experiencing similar challenges to the heavy vehicle sector. "

Three reports on the affects of fatigue on safety performance in the short haul and light trucking sector have recently been released. The first of the reports "Company perspectives on work, fatigue and occupational health and safety in the light and short haul transport sector" (4) describes the results of a survey of management representatives of companies in this industry. Specifically, the survey examined their attitudes, knowledge and experience of driver fatigue, whether the companies had formal fatigue management policies in place and how these were applied. One of the findings which is of concern is that unlike drivers, company representatives did not regard fatigue as a significant problem. They were also more likely to attribute fatigue problems to the individual drivers rather than to organisational factors within the company or sector. At the same time the management representatives reported that while drivers mainly worked day shift over a five day week, working hours were generally a nine hour day with some drivers working 12 to 16 hour shifts. Drivers usually worked 45 hours a week although some drivers worked up to 72 hours a week. Driving only took up half of each shift, with drivers also spending considerable time loading, unloading and sorting freight. Each shift for each driver contained an average of 35 freight stops.

While the majority of drivers did not believe that fatigue was a problem in the industry, around 40% of drivers reported experiencing fatigue at least once a week. This was more prevalent for Sydney based drivers and owner drivers/operators. Friswell et al reported that long working hours, high workloads and door to depot work were the strongest set of work predictors of fatigue (5). Stress was also a major contributor. Owner drivers reported that fatigue was a greater personal problem than employee drivers.

The effects of fatigue found in this study are of particular concern, with most of the drivers who reported that they experienced fatigue said that it impaired their driving ability – in particular their vehicle control skills and their attention to their on-road environment. Two thirds of drivers who experienced fatigue reported a near-miss incident as a result of fatigue, with a sizeable minority having run a red light, driven off the road or collided with something. These results demonstrate that this industry also needs to be the focus of strategies to reduce these risks while not imposing unworkable restrictions and penalties on owners and operators.

The third of the reports provides a comparison of fatigue experiences between drivers in the light and long distance heavy vehicle transport sectors (6). While driver fatigue is a feature in both, there were differences in the causes, resulting impairment and strategies used to manage fatigue in the two groups. However drivers in both sectors reported similar effects of fatigue on safety incidents while driving. Both groups reported falling asleep at the wheel. However reports of collisions and near miss incidents were more common for light truck drivers than among heavy truck drivers. Also of concern was that both groups reported fatigue affecting their driving skills such that it slowed their response times.

The report found that driver fatigue experience by long distance heavy truck drivers was mostly the result of the monotony of long hours with few other activities than driving, whereas light truck drivers' fatigue resulted from pressure to produce a large amount of driving and delivery work in daytime business hours. In addition, strategies to reduce the affects of fatigue differed between the two groups. Heavy vehicle truck drivers mainly reported strategies such as rest, sleep, caffeine and drugs to help them stay awake, whereas reported temporary strategies - turning on the radio and eating while driving.

Clearly though the results of this latest research show that the light and short haul transport sector has a problem with fatigue. The reports suggest that strategies to reduce fatigue in this sector include easing unreasonable schedules that do not allow sufficient time for rest, sleep and recovery between work shifts. Reviewing the length of work days and reviewing the extent that light truck drivers feel pressured to maximise the number of pick ups and deliveries required in each shift are also recommended.

However, fatigue needs to be addressed through an occupational health and safety focus. The need for more information and training on fatigue issues was identified by drivers. Companies and operators also need to be aware of the risks to drivers and their business of having fatigued drivers on the road. Road safety authorities, work cover authorities, industry and drivers themselves all have a stake in this issue.

On a different subject, I congratulate the first three Associate Fellows of the College to qualify for the College's Register of Road Safety Professionals. Further details are given under 'Australian News'. The Register is still in its infancy, but the Executive Committee anticipates that in the long term it will become a matter of form for those following careers closely associated with road safety to seek recognition of their expertise by means of the Register.

On a final note, I would like to congratulate the 2006 Fellow of the College, Mr Lauchlan McIntosh, Executive Director of the Australian Automobile Association, whose Fellowship, announced in the February 2006 Journal (7), was presented on 4th October 2006 at a reception at Government House, Canberra. (See report under 'Australian News). Special thanks to all those who helped to arrange or attended this Vice-Regal reception for the College. It was an excellent event, and one that we are hoping can be repeated for future ACRS Fellows.

Kerry Fitzgerald

President

1) ATSB (2005) Road Deaths Australia: 2005 Statistical Summary, Canberra. www.atsb.gov.au/publications/2006/pdf/rda_ss_2005.pdf

2) ATSB (2003) Fatigue: the hidden killer. http://www.atsb.gov.au/publications/2005/pdf/Fatigue_hidden_killer.pdf

3) NTC (2006) News Release: Heavy Vehicle Driver Fatigue Reform Consultation: A Message from the NTC Chairman. http://www.ntc.gov.au/NewsDetail.aspx?page=A0240030550000002000209

4) Williamson, A., Friswell, R., Dunn, N. (2006) Company perspectives on work, fatigue and occupational health and safety in the light and short haul transport sector. NSW Injury Risk Management Research Centre, University of New South Wales. http://www.irmc.unsw.edu.au

5) Friswell, R., Williamson, A., Dunn, N. (2006) Driver perspectives on work, fatigue and occupational health and safety in the light and short haul transport sector. NSW Injury Risk Management Research Centre, University of New South Wales. http://www.irmc.unsw.edu.au

6) Friswell, R., Williamson, A., Dunn, N. (2006) Road transport work and fatigue: A comparison of drivers in the light and long distance heavy vehicle road transport sectors. NSW Injury Risk Management Research Centre, University of New South Wales. http://www.irmc.unsw.edu.au

7) The February Journal announcement referred to the Fellowship as the “2005 Fellowship”, but due to the long delay in making the presentation, it is more appropriate to call it the “2006 Fellowship”. No Fellowship was presented in 2005.

Letter sent by the College on 21 August 2006 to the Hon Alexander Downer MP, Minister for Foreign Affairs

Dear Minister

As the organisation representing road safety professionals in Australia, the College is extremely concerned at the growing global crisis caused by road death and trauma. Low and middle income countries are suffering the greatest burden having to bear the economic and social consequences of more than a million people dying on their roads each year. Additionally, some 40 million people who are injured on the roads in these countries strain scarce medical resources.

While road death and trauma now equates to a public health crisis on a scale comparable with malaria and tuberculosis, road safety has not received the recognition it warrants in either the Millennium Development Goals or your Government's White Paper. This is even more concerning given predictions that global road deaths will double by 2020 and that the greatest burden will fall in South East Asia.

A recent report by the Commission for Global Road Safety has highlighted the substantial economic impact of road death and trauma. Direct economic costs have been estimated at US$64.5 billion – US$100 billion per annum across developing countries. The Commission concluded that preventing road death and trauma should now be set as a priority goal in sustainable development strategies.

Achieving economic growth in order to reduce poverty in recipient countries will require substantial investment in their road transport infrastructure. If part of this investment does not ensure new roads meet recognized safety standards, the aid program will be contributing to unnecessary death and trauma amongst the very people it is striving to help. The infrastructure for growth initiative announced in the White Paper must enshrine the principle that new road developments are designed and constructed to ensure the best possible road safety outcomes. The College strongly supports the Commission's recommendation that at least 10 per cent of all road infrastructure project funds should be committed to road safety.

Equally, the aid program must fund capacity building amongst those responsible for road safety implementation and enforcement to reverse current behaviours such as drink driving, lack of helmet use, seat belt non-compliance and excessive speed which are known to be major contributors to road deaths in developing countries. The Commission concluded that weak governance structures in many developing countries are at the core of their road safety problems. Corruption among road traffic police, vehicle and driver testing authorities can also severely impede road safety improvements.

Australia is well equipped to take a leadership role in addressing this growing road safety crisis. In 2007, there will be several opportunities to focus domestic and international attention on the issues involved and the contribution Australia can make. It would be extremely disappointing if the APEC Transport Minister's Forum in Adelaide in March, did not take the opportunity to address this very real impediment to sustainable development. The first United Nations Global Road Safety Week in April is an opportunity for our aid program to work with regional governments and assist recipient countries raise the profile of road safety by contributing to public awareness and education at the local level. The Week will focus on road safety and youth, given the particular risk faced by children as vulnerable road users and with over 95% of child road fatalities occurring in low and middle income countries.

With a membership base of around 400 road safety professionals and organisations across Australia and New Zealand, the College has a significant level of expertise to offer. We hope that your initiative for mobilizing new Australian links to the region may be an opportunity to strengthen our ties with road safety professionals in aid recipient countries, allowing them to benefit from the professional development and networking opportunities we currently provide to our members in Australia. We would be pleased to assist in any way we can to ensure that road safety receives the priority attention it deserves in Australia's Aid Program.

I would very much welcome an opportunity to discuss this with you and have attached a brief overview of the College for your information. Should you require any further details on the activities of the College please do not hesitate to contact me.

Yours sincerely

Kerry Fitzgerald

ACRS President

Diary

14 – 15 November 2006: Local Road Safety and Traffic Engineering Conference 2006
at the Powerhouse Museum, Sydney.
Contact: registration@halledit.com.au;
tel: 03-8534 5000; fax: 03-9530 8911.

31 Oct – 2 Nov 2007: Australian Institute of Traffic Planning and Management National Conference
at the National Convention Centre, Canberra. Enquiries:
Kim Thomas, tel: 08 8372 7878 or aitpm@aitpm.com

QUARTERLY NEWS

Chapter News

Australian Capital Territory and Region

The Chapter will be responsible for the first of the ACRS Australasian Series of Seminars on Older Drivers to be held on 30 October 2006 in Canberra and during 2007 in other State capitals. The lead speaker at all the seminars will be road safety consultant Mr Robin Anderson. Robin was the Road Safety Manager in the ACT Department of Urban Services from 1998-2002 and in 2005 was awarded the NRMA-ACT Road Safety Trust Churchill Fellowship to study community based programs for older drivers in Europe, USA and Britain. Other speakers at the Canberra Seminar will be Mr Allan Brownsdon, consultant to the Council of the Ageing (ACT), Dr T.Bella Dinh-Zarr, member of the US White House Conference on Ageing Advisory Committee, Professor Drew Richardson of the Australian National University Medical School and Dr Jim Langford of the Monash University Accident Research Centre.

New South Wales (Sydney)

The Chapter Chairman, Professor Mark Stevenson and two committee members, Ms Liz de Rome and Mr Jeff McDougall, met with the NSW Minister for Roads, the Hon. Eric Rozendaal MLC on 26 July 2006 to discuss road safety matters. The Minister seemed receptive to the Chapter's proposal that an independent road safety advisory panel, or think tank, be established to provide frank, fearless and independent advice from a variety of experts and practitioners to the Minister for Roads direct. A detailed proposal is to be sent to the Minister.

Crossing Sydney Harbour Bridge

The Chapter Committee is pleased to report that the Motor Accidents Authority of NSW has agreed to fund the seminars for 2006-2007. Plans for future seminars are as follows:

- Alcohol, other drugs and road safety (October 2006)
- Railway level crossing safety (late September 2006, in Wagga Wagga)
- Children and road safety (December 2006, in conjunction with the Chapter annual general meeting)
- Transport policy and road safety (February 2007)
- First UN Global Road Safety Week (April 2007)
- Decision making in driving (Second quarter, 2007)

Queensland

The Chapter held another quarterly seminar on 5 September when the subject was Intelligent Transport Systems and Road Safety. The final meeting for the year is planned for 5 December when the subject will be 'Emerging Issues Internationally and how they relate to Australia'.

Victoria

The theme for the Chapter's August seminar was "Exploring solutions to various high-risk behaviours and situations". The audience engaged with local speakers on hoon and alcohol interlock legislation and programs; electronic stability control; the use of global positioning systems to monitor safety in the trucking industry; and work done with young people as part of the 'common problems to common solutions' project.

In November the Chapter plans to have an update on Vision Zero from Claes Tingvall, one of the key driving forces of the strategy in Sweden as well as a local take on Victoria's road safety strategy. The final meeting of the year will look at the contribution played by technology and NCAP to vehicle safety.

For 2007 the Chapter is planning seminars and guest speakers on: Victoria's Road Safety Strategy to replace the 'arrive alive!' program and the implementation of the Graduated Licensing System in Victoria. Also planned is a hypothetical on Driver Distraction. Given that a report on driver distraction was tabled with the Victorian Parliament in August this year, an interactive discussion in the first part of 2007 will be timely. The Chapter is also looking forward to hosting the ACRS Series Seminar on Older Drivers in March 2007.

Western Australia

As we go to press, the Chapter is planning a breakfast seminar on Friday October 27 2006 at Main Roads, Perth with Dr T Bella Dinh-Zarr. Her topic will be "Making Sausage – Using Science to Advocate for Road Safety in the United States", which will also contain a brief overview of past and current traffic safety in the US): The Chapter's new Executive Committee is also processing plans for meetings in 2007.

Australian News

Governor General Presents ACRS Fellowship

A reception was held at Government House, Canberra on Wednesday 4th October 2006 at which the Governor General, His Excellency Major General Michael Jeffery AC CVO MC presented the 2006 ACRS Fellowship to Mr Lauchlan McIntosh, Director of the Australian Automobile Association. Over 60 people attended the reception, including some interstate members of the College. The Governor General's speech appears later in this Journal. Our President, Ms Kerry Fitzgerald responded on behalf of the College. The reception, the first of its kind for the College, is indicative of the wider recognition that road safety and the work of the College is now receiving.

His Excellency Major General Michael Jeffery AC CVO MC (Retd), Governor-General of the Commonwealth of Australia, presenting Mr Lauchlan McIntosh, Director of the Australian Automobile Association with the 2006 ACRS Fellowship.

His Excellency, Major General Michael Jeffery with ACRS President Kerry Fitzgerald and the ACRS Immediate Past President Professor Raphael Grzebieta at the reception.

ACRS Register of Road Safety Professionals – Announcement

The ACRS Executive Committee has announced that the first three applicants approved for listing on the Register are as follows:

Ms Eve Somssich RRSP (Driver Education);

Mr Raymond Shuey RRSP (Enforcement and Road Safety Education); and

Mr Roger Stuart-Smith RRSP (Road Crash Reconstruction).

To be listed on the Register, applicants must already be in Associate Fellow membership of the College and satisfy a panel of experts that they have acquired a high level of academic qualifications and experience working in their particular discipline.

Tasmanians Choose Top Five Road Safety Issues

The Tasmanian Department of Infrastructure, Energy and Resources recently invited the general public to assist in developing a new road safety strategy for Tasmania. The survey provided a questionnaire that could be downloaded from the DIER website. The questionnaire invited contributors to say what they considered to be the 5 most important issues of road safety needing attention. The Tasmanian Road Safety Council is using the responses received, together with an analysis of road crash data by MUARC to develop the new strategy *(Source: http://www.transport.tas.gov.au)*.

Kids' Road Safety in WA

There are three curriculum packages that have been developed as part of the WA Road Safety Project, Kid's and Traffic for early childhood years, Kid's and Roads for students from Years 1 to 7 and Road Smart for students Years 8 to 10. The aim of this program is to reduce the number of children killed or injured as a result of road crashes. The support materials are available as printable files.
See http://www.schoolroadsafety.wa.edu.au/currsupmat.htm

Indigenous Road Safety

The school of Indigenous Australian Studies at Edith Cowan University WA has published a CD ROM of the information available on the HealthInfoNet website at www.healthinfonet.ecu.edu.au/roadsafety. This will be useful for those people who do not have Internet access or wish to obtain information that is on the website without using extensive time online. The HealthInfoNet has been collecting, developing and sharing information online about the health and wellbeing of indigenous peoples since 1997. The website provides a valuable and time-saving source of accurate, up-to-date information. This resource has been developed with funding from Federal and State Governments. Core funding for HealthInfoNet is provided by the Office of Aboriginal and Torres Strait Islander Health, with other support from Edith Cowan University. To obtain a copy of the CD ROM contact Ineke Krom, School of Indigenous Studies, Edith Cowan University, 2 Bradford St, Mt Lawley WA 6050, tel: 08-9370 6470 or email: Indigenousroadsafety@ecu.edu.au. *(Source: Edith Cowan University)*

Brisbane's Late Night Free Travel Reduces Crash Risks

A record number of late-night revellers took advantage of NightLink services during September's Valley Fiesta weekend celebrations. Almost 6,500 people travelled home on NightLink services during the celebrations, thanks in part to major sponsor TransLink providing free bus and train services. 5039 passengers travelled on the free NightLink bus and train services to 19 destinations across Brisbane and 1440 people opted for FlatFare taxis.

Transport and Main Roads Minister, Paul Lucas, said "NightLink has been an enormous success story since it began, and from the Fiesta numbers it's evident these services are proving very popular with late-night revellers. Brisbane and Valley late night partygoers have proven they want these services to continue and we're looking at even further initiatives to make it even easier for people to take advantage of NightLink,".

This month TransLink launched the NightLink SMS services, which allow late-night revellers to be sent bus and train timetables to their mobile phones for any NightLink service home. Since NightLink was launched in December 2005, NightLink services have taken home more than 130,000 people from the Valley and inner-city entertainment precincts.

Churchill Fellowship Awarded for Road Safety Studies

Mr Rifaat Shoukrallah, Manager, Traffic Management and Safety, ACT Department of Territory and Municipal Services in Canberra has been awarded a Churchill Fellowship worth some $25,000 to spend up to eight weeks abroad to investigate road safety policies, and particularly engineering measures, in countries where greater levels of road safety have been achieved than in Australia. The NRMA – ACT Road Safety Trust has sponsored an annual Churchill Fellowship in road safety since 1996. *(Source: NRMA-ACT Road Safety Trust)*

New Study on Driver Distraction

The George Institute for International Health, together with the University of Western Australia has recently published new research results on driver distraction in the journal 'Injury Prevention'. The research, funded by the Motor Accidents Authority of NSW, shows that, on average, drivers engage in a distracting activity once every six minutes. The study states that on a driving trip 72% of drivers will display a lack of concentration, 69% will adjust in-vehicle equipment, 58% will be distracted by outside events and 40% will talk to passengers. The research involved more than 1,300 drivers aged between 18 and 65 in NSW and WA. Chief Investigator Dr Suzanne McEvoy said that driving errors following a distraction included braking suddenly, failing to see road signs and taking wrong turns. Drivers aged 18-30 were found to be significantly more distracted than older drivers and were more likely to crash as a result of distraction. In the light of this study, Professor Mark Stevenson, Senior Director of the George Institute and chairman of the NSW (Sydney) Chapter of the ACRS, recommends that action is urgently needed to reduce crashes caused by distracting activities. He said "Policies that include driver education and innovative enforcement practices are essential to decrease the prevalence of these behaviours and thereby, reduce the adverse outcomes." *(Source: Newsletter of the George Institute September 2006)*

Victoria's 'arrive alive!' strategy reaches its final year

The Victorian road safety strategy, known as 'arrive alive!', which commenced in 2002, is due to end in 2007. The aim of the program was to reduce deaths and serious injuries by 20 per cent, and undoubtedly significant gains have been made, though the overall outcomes will not be known till next year. The strategy listed 17 key issues including road design, speeding, drink driving, fatigue and vehicle safety.

Key initiatives in the program have included:

- The introduction of the default 50km/h speed limit for roads in built up areas, school speed zones, 40km/h speed limits in metropolitan shopping strip centres and 50km/h speed limits in rural and outer metropolitan town centres;
- Alcohol interlocks for repeat and serious first time drink driving offenders returning to driving after having their licence cancelled;
- Random roadside drug testing to detect drivers under the influence of the illicit drugs cannabis and methamphetamine (speed).
- Vehicle safety: launch of Victoria's Vehicle Safety Strategy 2004-2007, which included actions to increase consumer demand for safer vehicles; and
- Road infrastructure programs, especially 'Black Spot' amelioration.

The 'arrive alive!' program is complemented by the Safe System approach to road safety, which is seen as the future direction for road safety in Victoria. This assumes that accidents will happen and therefore the road system should be designed and built to protect road users as much as possible. The key elements of the approach are:

- Safer roads – improving the infrastructure and usage of roads to reduce the likelihood of crashes causing injury or death.
- Safer speeds – relies both on road authorities identifying and setting appropriate limits, and on road users accepting responsibility for obeying road rules and speed limits.
- Safer vehicles – driving a safer vehicle greatly increases the likelihood of surviving a crash without major injury.
- Safer road users – increasing the safety of road users primarily through education.

(Source: Vicroads - http://www.vicroads.vic.gov.au)

Advice for Truck Operators Expected to Improve Safety

A new initiative launched by the Transport Safety Industry Group (TISG) in Victoria will provide advice for truck operators about technology that improves the safety of new and used trucks. Philip Lovel, Chairman of the TISG, said "Improving the safety of trucks will save lives, reduce injuries and have a flow-on effect and save on operating costs such as WorkCover premiums and down-time caused by crashes." He said that the technologies that would most benefit safety included anti-lock braking systems, electronic braking systems and electronic stability control. Members of the TISG include the Victorian Transport Association, VicRoads, Victoria Police and the Transport Workers Union. *(Source: Vicroads Media 31August 2006)*

New Zealand

New Funding Approach for Road Safety

Land Transport New Zealand has announced changes to funding and planning community road safety activities. The changes, which will be adopted from the 2007-2008 financial year, affect activities formerly known as the Community Road Safety Programme, Safer Routes and travel behaviour change initiatives. It is expected that under the new arrangements approved organisations (mainly local authorities and regional councils) will have greater flexibility to address local land transport safety and sustainability issues. They will also only need one contract for all funding projects, rather than multiple contracts as under the previous arrangements. "Guidelines for 2007/08 land transport programmes" will soon be available to approved organisations for use in preparing their programmes. *(Source: Transport NZ News Sept 06)*

Puppeteers Teach Road Safety to Schoolchildren

A group of puppeteers in Tauranga have established 'Puppet Vision' to present a 30 minute road safety show at schools in the area. Funding was provided by the local Road Safety Committee. In view of the positive response from schools visited, planning is underway for Puppet Vision to take their show to other parts of New Zealand.
(Source: Transport NZ News Sept 06)

Conference Discusses Safe and Sustainable Transport Issues

Some 250 delegates travelled to Hamilton in August to attend the 3-day 2006 Community and Land Transport Conference "Journeys Forward – Collaborating for Safe, Sustainable Travel". The delegates represented the land transport sector, health, not-for-profit organisations, community groups and various councils. For more information visit www.crsp.net.nz/conference2006/index.php *(Source: Transport NZ News Sep 06)*

European News

UK Researcher Claims Cycle Helmet Increased Accident Risk

Dr Ian Walker, who works as a traffic psychologist at the University of Bath, fitted his bicycle with a computer and ultrasonic distance sensor to record data from some 2,500 overtaking vehicles. The data showed that vehicles passed 8.5 cm closer on average when he wore his helmet, than when not wearing it, thus increasing the risk of a collision. Dr Walker also disguised himself as a female cyclist (with a long wig) and found that drivers then gave him an average of 14 centimetres (5.5 inches) more space when passing. The data also showed that buses and trucks passed considerably closer than cars. The average car passed 1.33 metres (4.4 feet) away from the bicycle, whereas the average truck got 19 centimetres (7.5 inches) closer and the average bus 23 centimetres (9 inches) closer. There was no evidence of 4x4s (SUVs) getting any closer than ordinary cars, though the ubiquitous white vans did inch a little closer than cars.

Dr Walker spent half the time wearing a cycle helmet and half the time bare-headed, as currently allowed by UK law. He was actually struck on two occasions (by a bus and a truck) and in each case was wearing his helmet. Dr Walker commented, "This study shows that when drivers overtake a cyclist, the margin for error they leave is affected by the cyclist's appearance. We know helmets are useful in low-speed falls, and so definitely good for children, but whether they offer any real protection to somebody struck by a car is very controversial. Either way, this study suggests wearing a helmet might make a collision more likely in the first place."

Dr Walker suggests that drivers' perceptions of cyclists affect their driving behaviour. "We know from research that many drivers see cyclists as a separate subculture, to which they don't belong. As a result they hold stereotyped ideas about cyclists, often judging all riders by the yardstick of the lycra-clad street-warrior. This may lead them to believe cyclists with helmets are more serious, experienced and predictable than those without." Dr Walker's research has been accepted for publication in Accident Analysis & Prevention, the peer-reviewed ergonomics journal.
(Source: http://www.medicalnewstoday.com)

UK Road Casualties 2005

'Road Casualties Great Britain', the annual analysis of casualties on the UK's roads, was published by the UK Department of Transport on 28 September 2006. Key figures were:

3,201 people were killed on Britain's roads in 2005, 20 less than in 2004;

28,954 people were seriously injured, 7 % lower than in 2004;

There were 271,017 casualties in 2005, making the overall casualty rate per 100 million vehicle kilometres 3 % lower than in 2004;

Child fatalities were 9% lower and 5% fewer pedestrians were killed or seriously injured than in 2004;

The number of cyclists killed increased by 10% to 148, the highest level since 1999; and

The number of motorcyclists killed dropped by 3%.

Commenting on the figures, Rob Gifford, Executive Director of the Parliamentary Advisory Council for Transport Safety (PACTS is a registered charity) said, "We are pleased to see the drop in casualties across most categories. The rise in cyclist deaths is of concern and we have previously called for an in-depth study into these deaths, as was done for car-occupants and motorcycling."

Mr Gifford went on, "However, examining the figures more closely shows some areas where further action is needed. The number of people killed in drink-drive accidents reduced 3%, from 580 to 560, but little progress has been made in the trend since the mid-nineties. This is particularly concerning because it is estimated that 6% of all road casualties and 17% of road deaths occur when someone is driving whilst over the legal limit for alcohol." PACTS is concerned that the failure to undertake higher numbers of breath tests is contributing to the lack of progress, as the number of tests has been declining while positive results have been rising. *(Source: PACTS - 29 Sept 06)*

Finland Launches New Road Safety Strategy

The strategy has set a new target of not exceeding 250 road deaths annually by 2010 and not exceeding 100 road deaths by 2025. [Ed. It is interesting that the targets chosen are actual fatalities and not fatalities related to vehicle kilometres travelled or the population size.] In order to achieve these targets, automatic speed surveillance will be increased so that fixed automatic surveillance will cover 3,000km of main roads by 2010. Also, new technology mobile surveillance will be stepped up to a total of 25 units. The margins for excess speed intervention will be reduced. *(ETSC Safety Monitor 65, July 2006)*

Slovenia's Ambitious Program

A new Road Safety Program is under discussion that would aim to halve road deaths by 50% by 2011 compared with 2001. This would mean a reduction of 600 fatalities. The Program also plans to adopt a 'Vision Zero' policy. The Program will not contain any 'silver bullets', but emphasise the need for increased

use of seat belts and child restraints, a reduction in speeding and alcohol abuse and greater safety features for pedestrians. To achieve these changes enforcement will also be given a boost. *(ETSC Safety Monitor 65, July 2006)*

Spain Betters its own Road Safety Target

Spain is already ahead of its 2008 target to reduce road deaths. For the first time a Spanish President included road safety as a topic worthy of mention in his 'State of the Union' address to Parliament.

Laying the Blame for Speeding

Member countries of the European Union have different practices for fining speed offenders using automatic camera systems. In the UK and France the follow-up relies on the owner identifying the driver. In the Netherlands, the vehicle owner has to pay the fine no matter who was driving the car (though no doubt the owners chase up the guilty party!). In Germany and Poland follow up relies on driver liability, and if the driver is not the vehicle owner, the police have to undertake an investigation. *(ETSC Enforcement Monitor 07, July 06)*

Ireland Wants Crack-down on Drink Driving

The Irish Government is considering introducing new measures to discourage drink-driving, including random breath testing of motorists in areas and times where the risk of road death is greater, such as on weekend nights. Previously, the police have had to show that they suspected a driver of being over the alcohol limit before testing. It is thought that such testing could save 150 lives per year. (*ETSC Enforcement Monitor 07, July 06)*

World Soccer Cup Drink-drive Campaign

Coinciding with the World Cup in Germany, 19 European nations cooperated in a large-scale clampdown on drink-driving. Nearly 13,000 motorists or 2.18% were caught drink-driving out of 600,000 tested in the week-long campaign. The highest proportion of motorists who exceeded the alcohol limit was in the UK where of 10,500 tested, 916 or 8.8% proved positive. *(ETSC Enforcement Monitor 07, July 06)*

Field Trial with Alcolocks

Belgium, Germany, Norway and Spain were recently chosen for an in-depth qualitative field trial on alcolocks . The aim of the trial was to study the psychological, sociological, behavioural and practical impact of alcolocks on five groups of thirty drivers (Spanish and Norwegian public transport drivers, German goods transport drivers, Belgian recidivist drink drivers and Belgian alcohol dependent patients). The study leaders presented the results in June. These showed an in-depth exploration of people's real life experiences with alcolocks in a European context. To download the presentations, visit http://www.ibsr.be.

More on Europe's Seat Belt Campaign

As reported in the August Journal, there is still much ground to be gained in convincing the European motoring public to 'belt-up'. A further campaign was organised by the European Network of Traffic Police (TISPOL) in May 2006 in 19 countries. It uncovered widespread low levels of seat belt use. In total, 171,458 drivers and passengers were found not to be wearing seat belts in checks that included all vehicle types. The police also found that thousands of children were not wearing appropriate restraints. *(ETSC Enforcement Monitor 07, July 06*)

Ranking road safety performance across the EU

In June 2006 the European Transport Safety Council (ETSC) launched its Road Safety Performance Index - a new policy instrument to help EU Member States in improving road safety. The aim is to compare Member States' performance and thus help to identify and promote Best Practice in Europe and apply political pressure to create a road transport system that offers a maximum of safety.

The Index will cover all relevant areas of road safety including road user behaviour, infrastructure and vehicles, as well as general road safety policymaking. National research organisations and independent researchers from 25 countries participating in the program are ensuring that any assessment carried out within the program is based on scientific evidence and is effectively communicated to European road safety policymakers. A recent media release gave the following information: between 2001 and 2005, France has achieved a 35% drop in road deaths, closely followed by Luxembourg (34%) and Belgium (27%). Among the countries which have progressed least over the last four years are Lithuania, Hungary, Ireland and Poland.

Russia

Police Commanders Prefer Women for Traffic Duties

The Russian 'Izvestia' newspaper recently reported that a women-only traffic police unit is to be established, because police commanders believe women are less corrupt than men. It claimed that the male-dominated traffic police routinely forgive traffic violations in exchange for bribes. Many believe this culture helps make Russia's roads among the world's most dangerous, with an annual death toll of some 35,000 people. Regional police chief Mikhail Tsukruk was quoted as saying " There is research which proves that women are not inclined to bribe-taking, The first female platoon of 26 traffic officers will patrol the centre of Volgograd (in southern Russia),". A few women already serve in the traffic police. *(Source: Reuters 29 August 06)*

North American News

Anti-Rollover Technology Proposed for all New US Vehicles

The National Highway Traffic Safety Administration (NHTSA) announced in September a proposal to require auto manufacturers to install electronic stability control (ESC) as a standard feature on all new passenger vehicles. The rule would be introduced gradually, requiring all manufacturers to begin equipping passenger vehicles under 10,000 pounds with ESC, starting with the 2009 model year and to have the feature available as standard equipment on all vehicles by the 2012 model year.

A 2004 study by NHTSA estimated that ESC reduced fatalities in single-vehicle crashes by 30 percent for passenger cars and 63 percent for SUVs. Some commentators consider ESC to be the greatest life saving improvement since the safety belt. The NHTSA estimates that ESC will save between 5,300 and 10,300 lives annually in the USA and prevent between 168,000 and 252,000 injuries. ESC will prevent between 4,200 and 5,400 of the more than 10,000 deaths that occur each year as a result of rollover crashes.

In the United States almost 29 percent of all 2006 models and 57 percent of SUVs are available equipped with ESC. *(Source: www.nhtsa.dot.gov)*

Safety Evaluation of New Cars Made Easier with Star System

The National Highway Traffic Safety Administration has announced a new rule on providing information to consumers about car safety ratings. The rule will require every new car, beginning with the 2008 model year, to display the star safety rating with its price sticker. Consumers will be able to measure the safety information by the number of stars on the sticker. The information will cover three aspects of safety - front and side crash and non-destructive rollover tests. All three tests use the five-star rating, with five stars being the safest. **(Source: www.nhtsa.dot.gov)**

Positives and Negatives in US Statistics for 2005

The number of young drivers dying in car crashes in the USA declined in 2005 for the third straight year. Between 2004 and 2005, the number of young drivers (16-20) killed declined by 4.6 percent from 3,538 to 3,374. Fatal crashes involving young drivers declined by 6.3 percent from 7,431 to 6,964. The number of children who were killed in crashes also declined from 2,622 in 2004 to 2,348 in 2005. The largest drop was for children ages 8-15. However, an increase in motorcycle and pedestrian deaths contributed to an overall rise in road deaths in 2005. Motorcycle fatalities rose 13 percent from 4,028 in 2004 to 4,553 in 2005 and almost half of those who died were not wearing a helmet. The number of pedestrian fatalities increased to 4,881 in 2005 from 4,675 in 2004. The total number of road fatalities for the USA rose 1.4 percent from 42,836 in 2004 to 43,443 in 2005 while the rate of fatalities was 1.47 fatalities per 100 million vehicle miles travelled, up from 1.45 in 2004. *(Source: www.nhtsa.dot.gov)*

South American News

World Bank supports road safety developments in Argentina

Argentina is one of those countries with a very high level of fatal road accidents. Despite this fact, provincial road agencies do not have adequate plans to improve road safety. The World Bank has therefore decided to include substantial support for a road safety strategy in its loan of US$116.7 for a major highway development costing US$159 million in the Province of Santa Fe. This is an area with a population of some 3.2 million, or 8.9% of Argentina's population. The World Bank's objective is to help the road agency to implement a comprehensive road safety program in the Province. This may include minor works in 'hot spots', public campaigns, inclusion of road safety activities in schools and training of public servants. This will be a pilot scheme, but it is hoped that it will increase the road agency's capacity to design and implement other road safety programs. *(Source: World Bank Report AB2164)*

Road Improvements in Paraguay

The World Bank is providing a loan of US$74million to Paraguay to establish a sustainable road management strategy that provides for the upgrading and maintenance of the road network through the strategic and transparent use of scarce resources. The approach is critical for Paraguay, which relies almost entirely on roads for transport in domestic and international goods. The road network will provide crucial links to ports in neighbouring countries and markets in the Mercosur region. *(Source: "http://web.worldbank.org/)*

Asian News

India Seeks European Help with Road Safety

European industry will support campaigns in India to demonstrate Information Technology System tools that could improve India's road safety. India has one of the highest road traffic accident rates in the world, with almost 80,000 fatalities annually. *(ETSC Safety Monitor 65 July 06)*

Contributed Articles

Speech by His Excellency Major General Michael Jeffery AC CVO MC (Retd), Governor-General of the Commonwealth of Australia

On the occasion of the Reception for the Australasian College of Road Safety and Presentation of the College's 2006 Fellowship Award to Lauchlan Mcintosh, Government House, Wednesday 4th October 2006

"Ms Kerry Fitzgerald, President, Australasian College of Road Safety and Mr Warwick Grigg, Mr Lauchlan McIntosh, Executive Director, Australian Automobile Association and Mrs Lynda McIntosh, Members of the College Executive, Ladies and Gentlemen

Welcome to Government House this evening. I am especially pleased to welcome members of the College, to learn more about your outstanding work, to encourage your ongoing contribution to our national life, and to emphasise how crucial it is.

Road safety is extraordinarily complex. But as I see it there are three critical issues:

- encouraging manufacturers to build and people to buy the safest vehicles in the market;
- building roads to a high standard and eliminating high risk elements in existing roads; and
- investigating and improving driving behaviour.

As a former military commander, this systems approach is applied to preparing soldiers for battle - ensuring they have the very best of training, have access to the very best equipment, and that they are deployed by the safest means of transport possible.

Sadly, road deaths and injury continue at staggering levels. Even one road death a day is too much and yet we are now confronted with a national average of five deaths a day on our roads. An even greater number of people suffer very serious injuries, paraplegia, limb amputation, and brain damage. That 60 people a day are seriously injured on our roads is an awful fact. Take the mortality rate alone - if a similar statistic applied to Australians in battle, the public outcry would galvanise the country into action.

We may well have the world's eleventh lowest rate of road deaths in proportion to population numbers, the ninth lowest in terms of registered vehicles and the fourth lowest in relation to vehicle kilometres travelled, but this is no cause for complacency. Far from it; we should be aiming for the lowest.

Global figures, and indeed our national statistics, simply show how profound is the challenge of improving road safety. It is worth noting that from 1970 until 2002 the road fatality rate in Australia dropped from 30.4 to 8.8 deaths per 100,000 population. This reduction was achieved in spite of a huge increase in motor vehicle use.

The introduction of seat belts, improved car design, improved road design and maintenance, driver education, air bags, and a heightened awareness of the dangers of drink driving, are amongst the factors that have helped to lower the statistics. But again there is no cause for complacency.

What is disappointing is that the road toll is now starting to trend upwards and we may not meet the National Road Safety Strategy for 2010 of reducing road trauma to 5.6 road deaths per 100,000.

One of the big issues for road safety is speed. Most drivers travel above set speed limits, and it seems the elements of speed and power are still selling points for new vehicles – features that inevitably appeal to the aspirational 18 to 25 year old drivers - unfortunately the highest risk category in road crash statistics

I know that a Voluntary Code of Practice for Advertising New Vehicle Models has been developed, however there seems to be ongoing friction between road safety authorities and the vehicle manufacturing industry on advertising power and speed in appealing to motorists. Perhaps we have to place greater emphasis on for example fuel efficiency and good engineering.

In terms of driver behaviour and community attitudes – the critical challenge is to get most drivers to slow down. The ACT has a high standard of road systems, a pool of relatively new cars and a highly educated population.

However despite this combination of 'choice factors', the majority of crashes are 'rear-enders' – people travelling too close and at too great a speed. Why is this? I think it tells us that attitudes behind the wheel are formed by personal choice, often based on ignorance, haste and selfishness.

Significant reduction in road accidents would occur if speed limits better reflected the road environment.

Monash University's Accident Research Centre conducted a study five months after the introduction of a state-wide general urban speed limit of 50 km/h. The study showed:

- a 13 per cent reduction in all serious casualty crashes involving all road users;
- a 22 per cent reduction in casualty crashes involving pedestrians; and
- a 40-46 per cent reduction in serious pedestrian casualty crashes that required admission to hospital.

What a small price to pay for such significant results. The big challenge is communicating this to the population. But the community still receives mixed messages. Many still hold perceptions of speed cameras linked to 'revenue raising'; current affairs programs continue to churn over old ground reporting inaccuracies in speed camera operations.

Then there are the powerful mental and physical messages about the sexual attraction and power dynamics linked to fast car ownership, which appeal to potential young drivers and continue to be reinforced everyday through TV and print media advertising.

Australia's road network is vast, so much so that we are not going to be able to transform it overnight. The reality for our roads – be they 0 to 5 star rated – is that there is no quick fix ahead. I support the concept of ensuring more 'forgiving' road systems.

This includes the 'Road Safety Risk Manager' technology which assesses road conditions and helps rank priorities - enabling engineers and authorities to best allocate available funds to the highest priorities - for example by installing guard rails, shoulder realignments and upgradings, or removing trees or similar danger points.

We must continue working on community attitudes. Is there value in introducing a national accreditation scheme for driving instructors? Whilst there is contradictory argument about the merits of this, I am strongly of the view that driving instruction programs must do more than simply instruct in the mechanics of driving.

Is there not room to tackle the matter of respect for other drivers, of developing a program that taps into good driving role models? How do we build a strong national culture of the essentiality of good behaviour on our roads?

There is no silver bullet for the problem of reducing road trauma, though it's not all doom and gloom. The contributions of the College and kindred motoring and road safety organisations have triggered the dramatic drop in per capita crash rates in Australia over the past 30 years. Indeed most of you in this room have had a significant role to play in achieving these results.

We need to keep working at this. And we need to comprehensively impart the excellent philosophy espoused by the Australasian College of Road Safety - that obtaining a licence is just the beginning of a life time driving learning process.

Ladies and gentlemen. I am delighted to have been asked to present the College's 2006 Fellowship Award to Lauchlan McIntosh. Lauchlan retires this year as Executive Director of the Australian Automobile Association.

But more than that, he has given outstanding service and leadership in national and international advocacy for members of motoring clubs and associations.

He has lobbied nationally and internationally on new car safety assessment, road safety, risk assessment of the national highway system, improving road infrastructure and road engineering programs. He introduced the very successful 'Think Before You Drive' campaign in Australia in conjunction with Bridgestone.

His enthusiasm, his knowledge and his leadership have played a major role in reducing road trauma in Australia. And thus it is my great pleasure to present the 2006 Fellowship to Lauchlan McIntosh."

Australia's First Star Ratings of Our National Highways

Article contributed by SaferRoads www.aaa.asn.au/saferroads

To view a version of this map in colour, visit www.ausrep.org

The Australian Automobile Association (AAA) – Australia's peak motoring body -released on 3rd October 2006 the first Star Ratings for Australia's AusLink non-urban national road network, which shows most national highways are not up to acceptable safety standards. The Star Ratings classify roads from 1-star star (least safe) to 5-star (safest). AAA's Australian Road Assessment Program (AusRAP) star rated some 19,000km of our national highway network, with the majority of roads rating 3 stars - not good enough according to AAA Executive Director, Lauchlan McIntosh.

Mr McIntosh said the 3-star ratings were below those expected of a national network of roads. "Our highways, which link the capital cities and freight terminals, carry millions of people and goods every day for work, business or pleasure - these national roads are the lifeblood of Australia's transport system – and a 3-star rating is simply sub-standard," he said.

The star ratings program was developed in consultation with Australia's motoring clubs, State/Territory road and traffic agencies and research organisation ARRB, using data provided by the agencies and analysed in line with international standards established through the AusRAP. The program also benefitted from a grant from the Australian Transport Safety Bureau (ATSB).

The national highway audit shows that, of 18,332km analysed, 2% of the length was 2-star, 51% was 3-star and 47% was rated a 4-star road. There were no significant stretches of 5-star or 1-star roads.

Under the AusRAP star ratings, a 3-star road has deficiencies in the design elements which can raise the risk of a crash and being injured in one - these design flaws include poorly sealed road shoulders, lack of safety barriers, narrow lanes, poor alignment (bends/curves), or too many intersections and roadside hazards such as unguarded trees or poles and undivided high traffic sections.

Mr McIntosh said, “While we believe the 3-star rating is not good enough for a national highway many of the deficiencies can be fixed at relatively low cost. But it is vital for Australian road users that governments and the community realise the importance of road design in road safety. Roads are more important than you think - we all need to recognise the different risks on different parts of a road system.

“ While the last Federal Budget allocated considerably more money to road construction for the AusLink network - and this was certainly welcomed by AAA - much more needs to be done to bring the entire Network up to at least 4 stars. We should expect that, with increasing traffic, we can have a national network which has low risk and hence a low crash rate.

“Five people die every day on Australian roads and 61 are seriously injured - these tragic statistics could be significantly lowered if more attention is paid to incorporating simple safety features in all road design and maintenance. Research confirms that improving roads can contribute more to reducing road deaths than improving driver behaviour and vehicle safety. AAA and the motoring clubs strongly support the systems approach to road safety - safer drivers in safer cars on safer roads. A safe driver in a safe car should not risk serious injury or loss of life for making a simple driving error, such as a momentary lapse in concentration, because of a road with poor design elements.”

The AusRAP Star Ratings Report was released by Australia's motoring clubs to highlight the condition of the AusLink National network. A National colour-coded map showing the Star Ratings for most sections of the highways in all States and Territories, except NSW (which was unable to provide AusRAP with the data), is available at www.ausrap.org.

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Simulating Police Urgent Duty Missions

The following is an abridged version of a translation of an article that appeared in the German Journal for Police and Traffic Management - Police and Safety Technology, Volume 50-July/August 2005.

By Senior Police Superintendent Jürgen Pfaffenzeller, Bavarian Police, Sulzbach-Rosenberg

Blue Light Action!

The blue light is flashing and the urgent duty siren wailing for another Urgent Duty Mission. These calls are part of daily police life - traffic accident, bank security alarm, assault, brawl or whatever. But the young police driver is sweating. His heart is beating fast! He has heard the siren on many occasions, but this is his first time sitting behind the steering wheel. This is his first Urgent Duty Mission.

There's lots of traffic around. Nonetheless he is doing 100 km/hr. through the city. Oh no! The next traffic light is on “ red”. And there's a long queue of vehicles waiting. What now? Pass on the left against the oncoming traffic? Traffic is heading towards us. We'll try, anyway. The driver of the red “Golf” heading towards us jams on his brakes and pulls to his right. The young police driver also. All went well. Now foot hard down once again, but seconds later it's hard on the brakes. The pedestrians have “green”.

Again put your foot down. Why doesn't the guy in front pull over? Now he's even braking! Again jam on the brakes. But not enough! The police car shunts the car in front. Trouble! Switch off the engine. The young colleague is completely shattered. He gets out of the police vehicle.But he doesn't have to worry. He just steered the Urgent Duty car through a *virtual world* in the Police Urgent Duty Driving Simulator.

Fig. 1: High-End-Simulator with 6-legs movement system.
En route to the destination all inertia forces are simulated.

Future Dream?

No, because the Bavarian Urgent Duty Police have been using the most up-to-date simulation technology to train their police drivers in "Urgent Duty Missions" since 2002.

Junior officers do their Urgent Duty Missions training in a fully equipped, but modified 300 series BMW in a virtual environment. Practically all driving situations that occur in real traffic can be simulated and influenced in training sequences. The handling of stressful situations for the driver and co-driver, which can be boosted at will, is of principal significance. Both of them are under such pressure within a short time interval that their attention can be lost for a short moment resulting in fatal mistakes. Virtual mistakes are without consequences, but teach how difficult the first real mission will be. For the very first time simulation offers the opportunity to prepare Urgent Duty Missions within a no-damage framework.

Judgements becoming less favourable towards police crashes

At one time, if there was a smash between a police car and a private vehicle during an Urgent Duty Mission, the private vehicle driver was usually considered at fault. However, for some time judges have not been prepared to trust police urgent duty drivers unconditionally. Recent judgments testify to a trend reversal. Professor Dr. Dieter Müller from the Saxony Police Academy has therefore recommended that Urgent Duty Mission drivers receive more intensive training in traffic rights under urgent duty conditions. After all, urgent duty and scout driving, which occur first and foremost on the public roads, are part of the basic task of a police officer. To conform to this requirement basic training and Continued Professional Development (CPD) form a non-negotiable part of modern police education.

Driving is only a Means to an End

The Urgent Duty Mission contains more than the component "driving". It entails the management of Police-specific tasks. Therefore training in an ordinary driving simulator alone is not sufficient. The goal of the total project "Simulation of Urgent Duty Missions" was to develop and test a training system supported by technology and based on didactic principles, in which the complex spectrum of tasks involved in a Police Urgent Duty Mission could be trained effectively and beneficially with regard to costs.

Scientific Parallel Project

In order for us to carry out the training project, the "Interdisciplinary Centre for Traffic Sciences" at the University of Würzburg, under the direction of Professor Dr. Hans-Peter Krüger, was commissioned to conduct a study.

The most important tasks were:

- Establishment of a total education concept on the basis of an analysis of work and traffic science;
- Definition of learning targets for the driving simulation itself as well as for the planned satellite learning stations;
- Concept preparation for methods of implementation;
- Preparation of options for examination of individual learning achievements;
- An inventory of knowledge elements that had to be understood in Urgent duty Missions;
- Development and execution of a targeted program for education of driving instructors;
- Establishment of an evaluation plan to compare the learning results of conventional training with those achieved using the simulation-supported concept.

The various curricula were agreed by the stakeholders, including police experts, with reference to objectives and practical applications. Among other subjects a catalogue of objectives for the training concept, as well as the traffic environment to be portrayed, was created. Specifically relevant training contents were defined and typical traffic scenarios were set out in which these objectives could be achieved effectively. Examples are the complex variations of critical driving situations in crossings and T-intersections, during overtaking and when driving in dedicated special lanes.

With the aid of these results it was possible to inform the simulator manufacturer of the requirements necessary to achieve the relevant traffic situation training.

Technology Project "Simulator "

The engineering task was to produce the technology (hardware and software) required for the training system. A Europe-wide tender was called in 2000 and Rheinmetall Defence Electronics, a manufacturer of training simulators in Europe, obtained the order for this part of the project. Rheinmetall modified an existing driving simulator for the training of road transport drivers. BMW AG of Munich made available a motor vehicle body cab used for Police Urgent duty Missions and integrated it with the simulator system.

The more difficult task was the development of the software required for the project, because this would constitute the difference between a training simulator for normal driver training (handling of the vehicle) and the goal aimed at the integration of Urgent Duty and other Special Missions ignoring conventional legislation with the traffic environment.

Structure of the new Training System

The new training concept for the schooling of Urgent Duty Missions consists of 4 modules.

1.Training in the Driver Training Simulator

Central to the simulator training is the training in danger situations, and this includes two centres of attention:

Fig. 2: The driver sits in an original BMW Vehicle Cab

Firstly the young officers should learn the various and typical reaction behaviours of other traffic participants when an Urgent duty Mission vehicle approaches. Then they must learn how to overcome repetitive and known dangerous traffic situations as far as possible with minimum risks for themselves and other traffic participants.

All distinct component exercises complement each other. They consist of getting used to missions (get to know the simulator), training drives (exercise of correct reactions) and test drives (evaluation of things learned). The specific functions of Urgent Duty Missions on motorways, highways and in urban areas are covered by means of dedicated databases.

Fig. 3: Control Room with Monitors for Co-driver and Instructor

The safe response to numerous traffic situations is trained such as:

- Driving across intersections with varying right-of-way rules;
- Crossing of several traffic lanes involving vision obscuration;
- Formation of traffic lanes and demanding “make way” situations;
- Driving on special driving lanes;
- Overtaking exercises.

The primary learning goal is the promotion of anticipatory driving technique and the achievement of handling competencies while interacting with other traffic contestants.

An instructor conducts the driving exercises individually in the simulator while observing the reactions of the trainee at an observation desk. The instructor assumes in addition the role of the command centre via a voice intercom.

At the conclusion all missions are discussed with the aid of a playback function, and the driving performance is judged compared with a catalogue of criteria. It is not necessary to completely play back each trip for the discussion, because the instructor can save specific situations during the training mission with a marker, and instead can jump from each stored situation to the next one.

2.Computer based Training

Working at PC learning stations as computer-based training is another important training concept (CBT).

In a multi-media application text material, images, sound tracks and film segments are presented that the cadet officers compose themselves. An instructor accompanies the learning of these lectures. A total of 4 lectures each requiring an execution of approximately 60 - 90 minutes has to be accomplished:

- Legal bases of the Urgent Duty Mission
- Team co-operation
- Orientation and navigation
- Risk minimization

(For example typical hazard situations are visualized and appraised by the assessor such as formation of lane grid locks or the crossing of several traffic lanes, with hidden vehicles crossing, by means of real-life photos as well as specifically programmed mission aspects stored in the simulator.)

3. Group Exercises

3.1 Specific Urgent duty Missions: Hot Pursuit

The challenge of a hot pursuit assignment is the most difficult and risky form of Urgent Duty Mission and is frequently the subject of public debate and is treated with the trainees within the framework of group discussions. Central to this are the reasons for hot pursuit missions, the mental progression for the escape and pursuit motivation of the fugitive and pursuing officer as well as the weighting of tactical aspects of the mission.

We have deliberately refrained from the implementation of this subject in the driving simulation. Although it would be technically possible to simulate a virtual fleeing vehicle of the fugitive the danger of a "navigation motivation" had to be considered. The trainees would frequently try not to lose the fugitive vehicle from their field of vision, and therefore act contrary to public safety, which has to have priority over catching the fugitive.

3.2 Crew Management

This integrated practical training is performed in real traffic outside the Police stations and is intended to foster the teamwork of driver and co-driver in order to sensitize as a central criterion the efficiency for Urgent Duty Missions. Central in this is the efficient sharing out of the tasks in the mission vehicle and the reactions to stress situations.

Particularly the orderly procedure of the radio traffic with the Police Centre, mutual support to discover the approach route, recognition of dangers, and error-free handling of street directories and maps, as well as agreement for the tactical approach method to resolve the conflict at the destination of the mission is trained here.

4.Detention in real Traffic

The exercises also have to be carried out in real traffic. Central to these exercises to be passed under the theme "The vehicle as mission tool" is the most unlike variations of methods of detention in the public traffic arena.

The following topics are acted through:

- The nature of specific driving environment dangers in towns, highways and motor ways;
- The safe approach and unambiguous directing to suitable locations of the person to be detained;
- Competent actions in connection with uncertain or wrong reactions of the other traffic participants.

The instructor conducts a discussion after each exercise.

Experiences

Since commencement more than 2,800 young Police officers have undergone this training. The acceptance of the separate training modules is very high among the officers taught. This particularly applies to the training equipment - the driving simulator. After a short acclimatization phase the training officers hardly notice any difference between virtual and real traffic environments.

The performance of the CBT segments is equally appreciated. The officers-in-training generally handle the Computer Based Training well and feel motivated because of the management of the "computer" medium. Effective transfer of things learned into practical use is generally assured.

In summary the evaluation of results demonstrates that officers using the modular simulator-supported training concept obtain the necessary engagement competencies in order to accomplish real Urgent duty Missions in a professional and safe manner. By offering the only safe option to portray relevant danger situations, simulation presents a unique opportunity to teach safe driver training strategies while excluding all types of risk.

Judging by requests, not only from Police Departments, but particularly also from Urgent Duty Services and Fire Brigades, there is a vast potential for training requirements using the system described above. As an integrated concept the simulator-supported driver training by the Bavarian Urgent Duty Police is unique, because it is far more extensive than pure simulator driving.

Translation by Max R. Pallavicini
ALP Risk Management
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Policies of the Australasian College of Road Safety

By Ken Smith, Fellow ACRS

Have you ever looked at the policy page on the ACRS website? ACRS policy statements were created for two reasons: to have a reasoned statement on where the ACRS stands on different road safety issues and problem areas, and to provide a resource for ACRS members when needed for media statements, response to questions and the like.

Each policy statement is made up of the policy position statement itself, a short statement of the objective/s that implementation of the policy would achieve, and a discussion providing background and reasoning behind the policy position being adopted. There is usually also a list of references to substantiate the points being made and provide a source for further information.

It has been the practice for the National Executive to review policy statements to see whether new or updated statements are needed, or to respond to an emerging need. If so a new or updated statement is written, reviewed by the Executive or in cases an 'expert' in the field co-opted by the policy committee, and submitted to members for consideration and adoption amongst the papers sent to members for the AGM. Because of the complexity of issues and the time available before the AGM it is usually not possible for members to seek amendment to policies - they have to be accepted or rejected by members voting at the AGM. On occasion, however when there has been an objection to a proposed policy statement it has been further considered, modified or withdrawn altogether.

There are now some 24 policy statements in four groups. It has not been possible to review them every year, and some it must be admitted are very much in need of updating. The ACRS National Executive at a recent meeting decided that policy

statements would be reviewed in a more systematic way, with a more formal process of examining in turn the ones in need of updating, and seeking the assistance of experts in the fields covered by each. Hopefully all the experts we need can be found in the ranks of ACRS members, but we will go wherever we need to find the expertise.

In 2006 the National Executive policy committee is made up of

Dr Barry Watson, Chair

Dr Raphael Grzebieta

David Healy

Anne Harris

Ken Smith (assisting)

We propose a series of articles in succeeding issues of the Journal presenting one or more of the policy statements and discussing or presenting more background information about them. Where necessary we will seek comment on them, but we will be happy to have your views in any case. We begin the series this issue with two policy statements.

Carriage of Driver's Licence

ACRS Policy Position

All drivers should be required to carry a valid driver's licence and produce it on demand.

Producing a driver's licence on demand should be a primary enforcement measure, ie Police may ask a driver to show a licence without any other infringement having first been committed.

Objective

To enhance effectiveness of provisional licence restrictions and licence suspension, and disqualification penalties.

Discussion

At present most jurisdictions except NSW give a period of grace in which to produce a driver's licence. This gives scope for circumventing such requirements as provisional or probationary licence restrictions and licence suspension.

In the case of suspension or disqualification, the penalty is intended to maintain respect for and effectiveness of socially approved sanctions for breaches of licence conditions.

If restrictions and penalties are able to be easily circumvented by non-production of a driver's licence, they lose their force. The effectiveness of sanctions can only be maintained if drivers can be sure that they are likely to be asked to produce a photographic driver's licence on the spot with no option to produce it later.

It is suggested that there is a need for measures to identify persons who produce a licence that has been suspended or cancelled, to eliminate evasion by this means. Technological means such as 'smart' licences with embedded chips that can be read and status determined instantly would be a means to this end.

Comment

This position is still valid and still needed. The reasons for requiring compulsory carriage of a driver's licence are just as valid as when the policy statement was written. To these reasons might be added another one: that serious and habitual criminal offenders are often also unlicensed, and if compulsory licence carriage were a universal requirement then it is possible that some of these might be apprehended in licence checks, whether under a requirement to produce on demand or in licence checks at random breath tests (see Watson, reference tba).

In passing, even in NSW where production of a licence on demand is mandatory, requiring the licence to be produced in random breath tests is not universal. This should be reinstated.

Queensland Transport has produced a proposal for a 'smart' driver's licence [reference tba].

It has been noted recently that in NSW suspension of the driver's licence is among the penalties for some offences having nothing to do with vehicle use, such as non payment of fines for failing to vote at a local government election. Whether this practice has also been adopted in other jurisdictions is unknown. This is iniquitous and should be protested against very strongly.

Enforcement and Penalties

ACRS Policy Position

ACRS supports enforcement measures that:

- enhance respect for road law
- emphasise certainty of detection and punishment
- demonstrably have the safety of road users as a primary concern, and by corollary reject implications of revenue raising.

Compulsory carriage of a driver's licence is an essential component of enforcement and a deterrent to unlicensed driving.

Penalties for traffic infringements should be sufficient to act as an effective deterrent, appropriate to the offence and applied rigorously.

Revenues from traffic fines should be directed to enhancement of safety.

Objective

To support effective, equitable enforcement of road law.

Discussion

Enforcement is a critical component of maintaining order and safety in road traffic, and public respect for and compliance with road law. The weight of enforcement should be directed to behaviours and locations that are known crash problems.

The ACRS policy position follows the basic principles of effective deterrence and application of penalties when infringements are detected.

A brief statement of these principles is:

- Enforcement should in general involve a visible Police presence (this does not prevent random techniques or operations), and be carried out in a fair manner
- Enforcement should emphasise certainty of detection and apprehension before severity of penalty
- Enforcement should be seen to be rational and to have a safety objective. Accusations of revenue raising, whether justified or not, reduce respect for the law.

Enforcement of road law should have a preventative function. Enforcement practices such as those outlined should be aimed as much at preventing infringements as detecting them. Appropriate measures can include information and education, speedometer checks and messages, warnings, and a high level of visible police presence on the roads.

Penalties for traffic offences need to be sufficient to be an effective deterrent against offending, but should be appropriate to the safety implications of the offence and provide for a mix of administrative and court-imposed sanctions. Severity of penalty should not be substituted for certainty of detection: there is little sense in applying a very severe penalty as a deterrent if the perceived probability of detection is so low as to make the likelihood of incurring the penalty negligible. Some principles are:

- There should be reasonable certainty that penalties for infringements will be imposed, and will be not easily escapable
- Penalties should be imposed as soon as possible after the infringement is detected, especially in the case of camera offences where the infringement is notified some time after the offence
- The severity and scale of penalties should be appropriate to the offence, and should provide a range of financial, licence and custodial or community service sanctions
- There may be case for scaled penalties that include official cautions and warnings that refer directly to the safety issue.

Licence removal should be used sparingly and for serious offences, and should carry with it a real threat of detection of unlicensed driving. Therefore, one component of enforcement policies should be compulsory carriage of the driver's licence.

A frequent public concern is that enforcement and traffic fines are perceived as 'revenue raising'. This should be avoided by ensuring that enforcement is carried out in a fair manner and towards behaviours, and in locations that are recognised safety problems. The proceeds of traffic fines should not go into general State revenues, but should preferably be applied to road safety improvement. This could take the form of 'black spot' removal, public education and information campaigns, or road safety research.

Comment

This policy statement probably also requires little modification. However it glosses over one point on which there is some debate: covert detection of offences as against visible police presence, particularly with respect to speed offences. Arguably, covert detection using speed cameras deters speeding because road users do not know where or when they might be under surveillance and likely to be caught, and therefore in theory, always drive within the law. This requires fairly heavy and continuing publicity to ensure that road users remain aware of the possibility of being caught anywhere, any time.

On the other hand, if the speed camera unit is operating covertly and not seen, and drivers do not know they have been caught, they do not modify their behaviour as they do on seeing a police or speed camera vehicle. It is entirely possible under these circumstances to lose one's licence in an afternoon without knowing and without the chance to modify one's behaviour. The deterrent effect is lessened if the punishment for the offence is not directly linked in place and time with the offence. There is also an element of procedural fairness.

This debate is probably not over. The ACRS policy statement leans towards a visible police presence and on-the-spot enforcement – combined, of course, with checking the driver's licence.

Ken Smith, FACRS

Peer Reviewed Papers

Simulation of vehicle lateral side impacts with poles to estimate crush and impact speed characteristics

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Abstract

Current techniques used to evaluate and analyse lateral impact speeds of vehicle crashes with poles are based on measuring the deformation crush and using lateral crash stiffness data to estimate the impact speed. However, the stiffness data is based on broad object side impacts rather than pole impacts. The premise is that broad object side impact tests can be used for narrow object impacts; previous authors have identified the fallacy of this premise. Publicly available pole crash test data is evaluated. A range of simulated pole impact tests at various speeds are conducted on validated publicly available Finite Element Vehicle models of a 1991 Ford Taurus, a 1994 Chevrolet C2500 and a 1997 Geo Metro (Suzuki Swift), providing a relationship between impact speed and crush depth. This paper builds on a previous publication (1) and contains additional pole tests and new data based on Finite Element Analyses.

Introduction

Side impacts involving fixed objects such as trees, poles or posts are a particularly severe crash type resulting in a disproportionate level of severe and fatal injuries. This paper firstly considers background data on such impacts, and then addresses the problem of speed estimates for these impacts from vehicle crush.

Kent (2) (1998) considered 1992-1995 US data, and reported that impacts with trees and wooden utility poles represent a significant subset of vehicular collisions. For example, while fixed object collisions account for less than 8% of all crashes, they represent nearly 30% of all fatal crashes. Also, nearly half (over 43%) of all fixed-object impacts are into a tree, pole, or post. Fildes (3) et al (2003) field study of serious injury crashes in Australia, where at least one of the vehicle occupants was hospitalised, identified that for side impact crashes, nearly 40% involved a tree, pole or post.

Data has been extracted for the USA from the Fatal Accident Reporting System (FARS) for the period 2000 to 2004. **Table 1** details the yearly 'Most Harmful Event' for all impact vehicle orientations and the combined data shows that: vehicle to vehicle crashes predominate (42.0%), with fixed object crashes (21.3%) and rollover (19.5%) at similar levels, pedestrian and cyclists (13.9%) and other (4.0%).

Most Harmful Event	2004	2003	2002	2001	2000	00 to 04	%
Vehicle-to-Vehicle	16994	17268	16903	16950	16995	**85110**	**42.0%**
Fixed Object	8548	8896	8967	8450	8329	**43190**	**21.3%**
Rollover	8241	7829	8037	7724	7636	**39467**	**19.5%**
Pedestrian/Cyclist	5265	5249	5371	5484	5352	**26721**	**13.2%**
Other	1784	1729	1599	1563	1477	**8152**	**4.0%**
Total	**40832**	**40971**	**40877**	**40171**	**39789**	**202640**	

Table 1 – 2000 to 2004 FARS Most Harmful Event for all impact vehicle orientations

Table 2 is a subset of **Table 1** in which the vehicle impact orientation is considered. **Table 2** details the yearly 'Most Harmful Event' for principal side impact and the combined data shows that: vehicle to vehicle crashes predominate (66.8%), with fixed object crashes (20.1%) second, rollover crashes (8.0%) third and pedestrian and cyclists (2.6%) and other (2.6%) at similar levels.

Most Harmful Event	2004	2003	2002	2001	2000	00 to 04	%
Vehicle-to-Vehicle	7673	7953	7885	7602	7645	**38758**	**66.8%**
Fixed Object	2390	2426	2367	2224	2240	**11647**	**20.1%**
Rollover	1112	932	864	879	832	**4619**	**8.0%**
Pedestrian/Cyclist	318	295	265	316	327	**1521**	**2.6%**
Other	328	316	295	278	290	**1507**	**4.0%**
Total	**11821**	**11922**	**11676**	**11299**	**11334**	**58052**	

Table 2 – 2000 to 2004 FARS Most Harmful Event for principal side impact

Table 3 is a subset of **Table 2** examining the difference between the types of fixed object in fixed object - principal side impact crashes and the combined data shows that: narrow object predominate (78.9%), with broad objects (13.7%) and other (7.4%).

Most Harmful Event	2004	2003	2002	2001	2000	00 to 04	%
Narrow Object	1903	1919	1887	1741	1741	**9191**	**78.9%**
Broad Object	312	328	298	321	338	**1597**	**13.7%**
Other	175	179	182	162	161	**859**	**7.4%**
Total	**2390**	**2426**	**2367**	**2224**	**2240**	**11647**	

Table 3 - 2000 to 2004 FARS Most Harmful Event for fixed object – roadside – principal side impact

Lateral pole impacts and injury mechanisms

Lateral narrow impacts into the occupant compartment of a passenger vehicle represent an injurious and often fatal crash mode due to the focused intrusion and the proximity of the intrusion to the vehicle occupants. The typical serious and fatal injuries occur to the vehicle occupant whose space is violated by the laterally impacting pole, restrained occupants whose space is not violated typically survive with relatively minor injuries. **Figure 1** is a lateral pole style impact involving a 1995 Subaru Impreza[1] ; the front left seat passenger was fatally injured while the front right seat driver survived with relatively minor injuries. The common injury mechanism that typifies a fatality even at lower speeds is head strike into the incoming pole, where modern side airbag systems are not present[2].

The European New Car Assessment Program (EuroNCAP) and the Australian New Car Assessment Program (ANCAP) has introduced a lateral pole impact test as part of the overall assessment protocol and other authorities and consumer-testing bodies have conducting similar style tests. The inclusion of lateral pole impact tests corresponded to the introduction of side curtain air bags in some vehicles. The side and curtain air bags attenuate the impact forces, particularly head strike, and separate vehicle occupants whose space is violated by the incoming pole. The deformation pattern from a lateral pole impact test[3] and[4] (Figure 2) is significantly different from a lateral side impact test[5] (Figure 3) [broad object impact test].

Figure 1 - Collision of a 1995 Subaru Impreza into a tree

1 Note: the vehicle is Australian and is therefore driven from the right hand side.
2 See Insurance Institute for Highway Safety, http://www.iihs.org/sr/pdfs/sr3210.pdf
3 United States of America National Highway Transport Safety Administration (NHTSA) Test 4580
4 EuroNCAP Test http://www.euroncap.com/content/test_procedures/pole_test.php
5 United States of America, NHSTA Test 4093

Figure 2 - 412mm deformation of a 2003 Toyota Camry as a result of a 32km/h lateral pole impact (254mm) test

Figure 3 - 302mm deformation of a 2002 Toyota Camry as a result of a 62km/h side impact moving barrier (broad object at least 1500mm wide) test

Analysis of lateral pole impacts

The collision reconstructionists' analysis of lateral pole impact crashes can be problematic as the typical approach is to use broad object impact test data to define the crush stiffness characteristic for pole impacts. The crush profile is then combined with the crush characteristic to estimate the absorbed energy and therefore the impact speed of the vehicle into the pole. The fundamental assumptions are that:

1. The crush stiffness characteristic is independent of the shape of the crushing object.
2. Broad object side impact crash test data can be used for lateral pole impacts.

Vehicle to barrier, vehicle to vehicle and or bullet dolly to vehicle [broad object] crash tests, both frontal and side impacts, have been conducted over a range of impact speeds. The analyses of the broad object crash tests have enabled these types of impacts to be characterised as a linear plastic spring. Campbell (4) presented a methodology to estimate the collision severity based on vehicle damage (crush) and the dynamic force deflection characteristics of a vehicle structure. The amount of crush can be used to estimate the energy absorbed, which in turn can be expressed as an Equivalent Barrier Speed (EBS). Campbell developed three variations to the basic equation for different crush profiles: Full, Segment and Offset.

The methodology developed by Campbell requires access to vehicle crash test data and a crush profile of the damaged vehicle. In a collision the structure of a vehicle is presumed to behave as a linear plastic spring. The crash test data is used to establish the stiffness variables for the linear plastic spring, these variables are commonly known as the "A" and "B" stiffness values. The stiffness data in combination with crush profile can be used to estimate the EBS.

It should be noted that Jiang (5) et al have illustrated a weakness with Campbell's base assumption that the vehicle behaves as a linear plastic spring. Jiang et al demonstrated that there was no unique frontal stiffness equation that could represent all vehicle models' frontal crush behaviour. Unless the stiffness equation for a particular vehicle could be determined via a range of crash test data points, a linear stiffness equation could be used for forward impact speeds of up to 56 km/h and a bi-linear model could be adopted for high severity collisions with forward impact speeds ranging from 56km/h to 80km/h.

Varat et al (6) demonstrated the inappropriateness of using generic "A" and "B" stiffness values to estimate the impact speeds for lateral pole impacts. Varat et al collected data from 22 vehicles into rigid pole tests and 6 repeat barrier moving pole tests. The impact speeds ranged from 17km/h to 46km/h, with the majority of the tests occurring around 32km/h. Varat et al demonstrated that using the generic broad object "A" and "B" stiffness values can under predict the impact energy by -40.9% or over predict the impact energy by +357.5%. The variability is based on how the "B" stiffness value is calculated[6]. Varat et al concluded that: *"When using distributed barrier impact to determine structural parameters to apply to a pole impact, **significant errors** in predicting energy may result. Therefore eliminating inconsistencies between the data used to calculate the stiffness parameters and the application of those parameters in a reconstruction will avoid undesired simplifications from adversely affecting the result."*

Varat et al illustrated two outcomes, with respect to the rigid pole and repeat barrier moving pole tests.

1. A relationship between absorbed energy and crush.
2. An analysis of the stiffness method based on lateral pole impact crash tests.

Absorbed enerfy and crush

Varat et al presented data for 16 small cars (less that 1110 kg): 1986 Ford Escort (3 cars), 1987 Volkswagen (3 cars), 1979/1980 Doge Colt (2 cars), 1980 Plymouth Champ (1 car), 1984 Plymouth Colt (1 car), 1979 Honda Civic (1 car), 1979/1980 Volkswagen Rabbit (4 cars) and 1993 Toyota Corolla (1 car)

6 Varat et al has assumed that the "A" stiffness value is zero. This is a valid assumption as the "A" stiffness value represents the initiation of damage. Typically for frontal impacts this is set at 8km/h. However in lateral pole impacts damage is likely to be initiated at very low impact speeds.

The absorbed energy verses maximum crush was plotted and Varat et al observed that: *"the data indicates a clearly second order relationship between the absorbed energy and crush. As this is to be expected for a linear, isotropic material, [it] demonstrates the linear, plastic spring may serve as an adequate model for these vehicles".*

Varat et al observed that the point of impact between the vehicle and the pole and the orientation of the vehicle at impact affected the absorbed energy verses crush.

A weakness with the Varat et al analysis is the limited available data, specifically the absence of a spread of data points with respect to one vehicle type and or model. Where there is a spread of data for one vehicle type it has been obtained either from repeat barrier moving pole tests or different impact orientation.

Pole stiffness method

Using 19 pole crash tests Varat et al evaluated the "B" stiffness[7] values for each test and demonstrated that the method could be applied to estimate the impact energy. However the "B" stiffness values used varied from test to test. This included three tests of three vehicle types (Golf, Escort and '81 Rabbit). Varat et al data demonstrated that a generic "B" stiffness values are inconsistent with the collected crash test data. The generic "B" stiffness values resulted in both under and over estimates of the absorbed crash energy of -47.4% to 357.5%.

Offset

The car to rigid pole impact data collated and presented by Varat et al can also be examined to evaluate the relationship between the approach energy, the absorbed energy and impact offset moment arm[8]. If the ratio of absorbed energy to approach energy is plotted against the impact offset moment arm a distribution function is evident as shown in **Figure 5**. The difference between the approach energy and the absorbed energy is the spin and separation energy. The smaller the moment arm the less energy is left to spin the vehicle and or separate the impacting vehicle from the pole. [In **Figure 1** the Subaru Impreza has rotated approximately 180∞around the pole but has not separated from the pole. The moment arm on the Subaru Impreza is estimated at 0.2m to 0.3m, indicating that up to 4% of the available energy was used in rotating the Subaru Impreza around the tree (pole).]

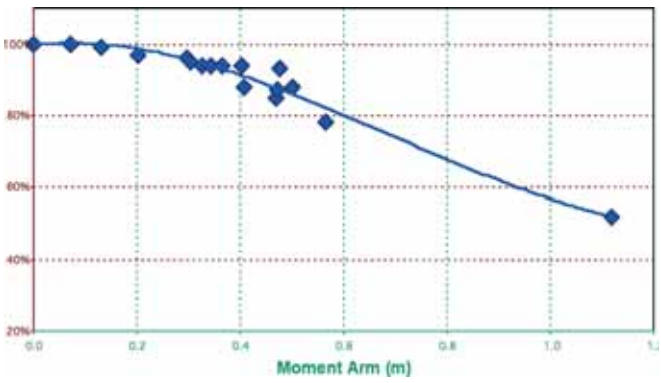

Figure 5 - Plot of the ratio of absorbed energy to approach energy verses moment arm

Currenty available lateral pole crash tests

Appendix A details the currently publicly available lateral pole crash tests.

The purpose of the majority of the lateral pole tests was to evaluate safety systems, typically the vehicle structure and active safety systems such as side curtain air bags. Collision reconstruction analysis was not the primary or secondary purpose of these lateral pole tests. Nevertheless this data provides useful information to validate in part the pole impact crash reconstruction methodology proposed in this paper. Collision analysis of the data presented in **Figure 6**, which plots the impact velocity against the depth of crush[9], shows a wide spread of data without any clear trend(s). A lateral pole crush depth of between 305mm to 914mm can be equated to a lateral impact speed of between 17km/h to 46km/h. There is insufficient data resolution to establish or estimate a characteristic relating impact speed and crush depth. **Figure 6** could allow the interpretation that for a crush depth of 800mm for a vehicle the lateral impact speed is between 32km/h to 46km/h.

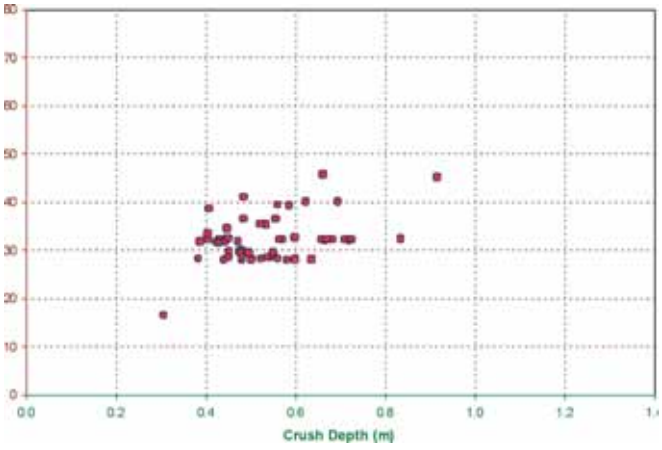

Figure 6 - Plot of Impact speed verses crush depth for available crash tests (Appendix A)

What is needed is a series of lateral pole crash tests using the same model and make of vehicle, laterally impacting a pole at different speeds. Such a series of tests would characterise the relationship between impact speeds and crush depth.

7 Varat et al has assumed that the "A" stiffness value is zero.

8 The impact offset moment arm is the distance, perpendicular to the direction of travel of the vehicle, between the centre of gravity of the car and the point of impact with the pole.

9 The crush depth is determined by the perpendicular crush and the angle with which the vehicle approached the pole.

Finite element model testing

In the absence of a series of crash tests to characterise the relationship between impact speeds and crush depth a Finite Element simulation was developed based on models available from the National Highway Safety Administrations database (7). Three series of lateral pole impacts crashes were simulated using finite element models of a 1991 Ford Taurus, a 1994 Chevrolet C2500 and a 1997 3-door hatchback Geo Metro (Suzuki Swift).

LS-DYNA3D (8) and ANSYS 8.0 (9) were used in this study. The pole was modelled using the Rigidwall-Geometric-Cylinder option in LS-DYNA3D (10). **Figure 7** shows the model set-up for the 1997 Geo Metro (Suzuki Swift).

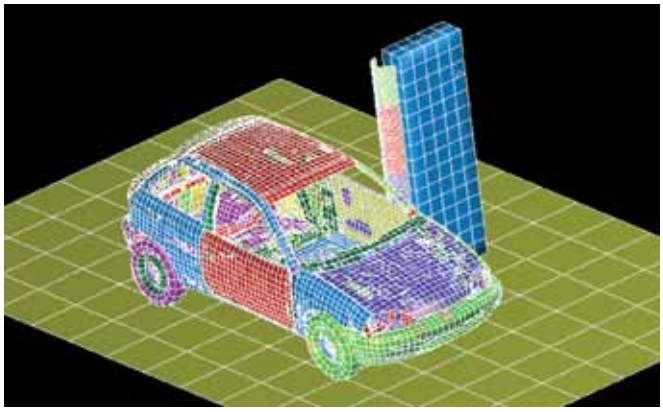

Figure 7 - Set up for the 1997 Geo Metro (Suzuki Swift) crashing into a rigid pole

Lateral pole side impact testing was conducted by Turner-Fairbank Highway Research Center (11) of a 1990 Ford Taurus crashing into a fixed rigid pole at 32.8 km/h. The test mass of the 1990 Ford Taurus was 1639 kg. The simulated mass of the 1991 Ford Taurus was 1374 kg. The impact speed of the simulation was increased to 35.8 km/h, so that equivalent impact energies could be compared between the 1990 Ford Taurus fixed rigid pole crash test and the 1991 Ford Taurus simulated rigid pole crash. The pole diameter was 0.220m and the point of impact was 1.150m rearward of the front axle. The residual sill crush depth and front end yaw was 0.527m and 10∞for the crash test and 0.537m and 8.5∞for the simulation.

Figure 8 compares the deformation of the Ford Taurus body between the crash test and the simulation.

The comparison between the crash tests and the simulation indicated that the simulation replicated the basic phenomena observed in the lateral pole crash test, providing confidence in the simulation.

A series of lateral pole impacts were simulated at lateral impact speeds of 10km/h to 70km/h. **Figures 9, 10, 11, 12, 13, 14** and **15** shows the bottom view deformation to the 1997 Geo Metro (Suzuki Swift) at lateral impact speeds of 10km/h, 20km/h, 30km/h, 40km/h, 50km/h, 60km/h and 70km/h respectively.

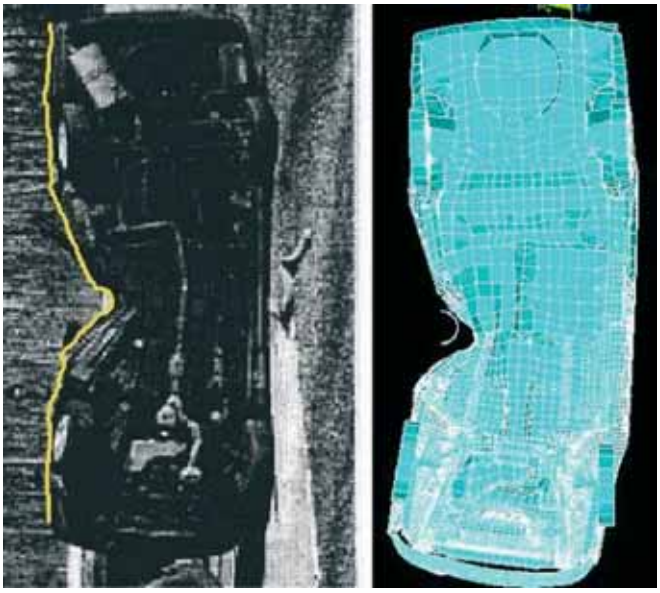

Figure 8 - Compares the deformation of the Ford Taurus body between the crash test (left) and the simulation (right)

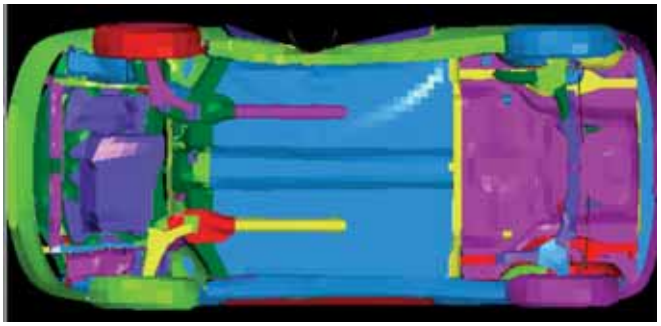

Figure 9 - 10km/h lateral pole impact (bottom view)

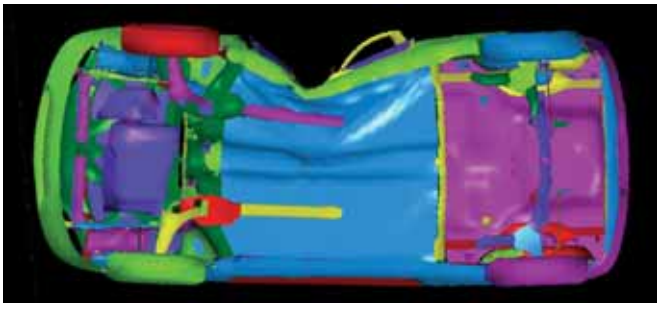

Figure 10 - 20km/h lateral pole impact (bottom view)

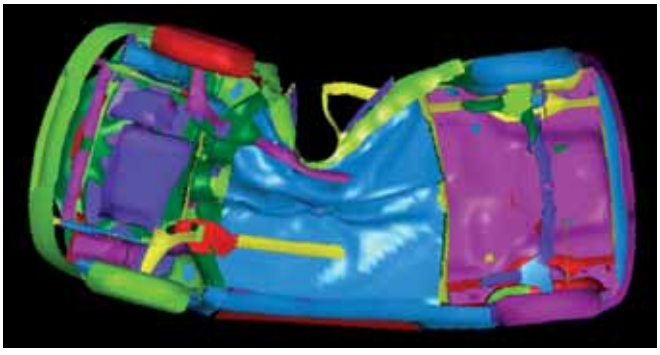

Figure 11 - 30km/h lateral pole impact (bottom view)

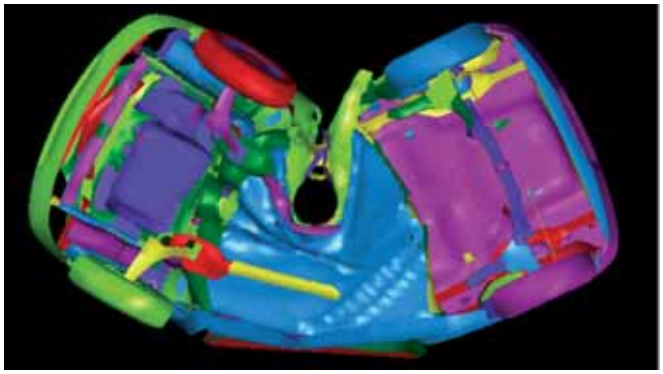

Figure 12 - 40km/h lateral pole impact (bottom view)

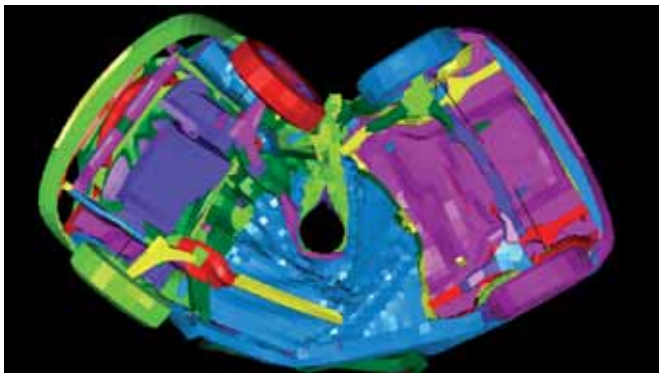

Figure 13 - 50km/h lateral pole impact (bottom view)

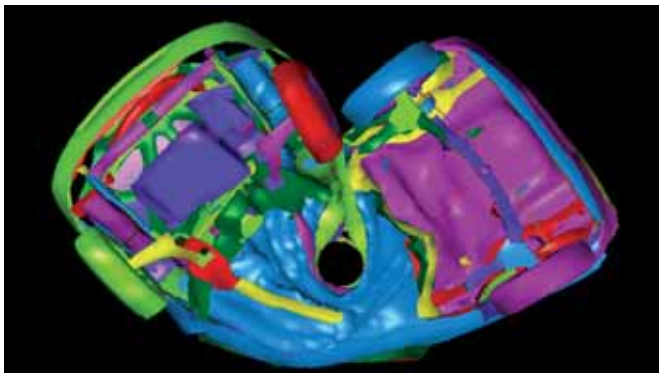

Figure 14 - 60km/h lateral pole impact (bottom view)

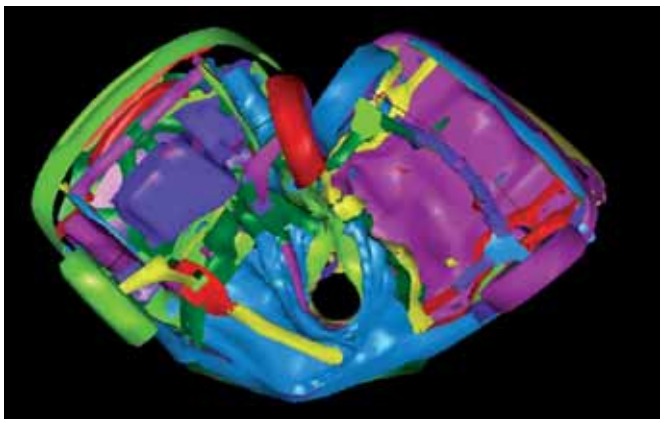

Figure 15 - 70km/h lateral pole impact (bottom view)

Similarly, the simulation process was repeated for the finite element models of the 1990 Taurus and the 1994 Chevrolet C2500 pickup truck crashing into a fixed rigid pole. (The base model which involved a 1994 Chevrolet C2500 pickup truck crashing into a fixed rigid pole at 50 km/h was developed by Reid (11)). Figure 16 shows a plot of the simulated crush depth versus impact speed for the 1991 Ford Taurus finite element model, the 1994 Chevrolet C2500 finite element model and the 1997 Geo Metro (Suzuki Swift) overlayed on the available lateral pole impact crush depth

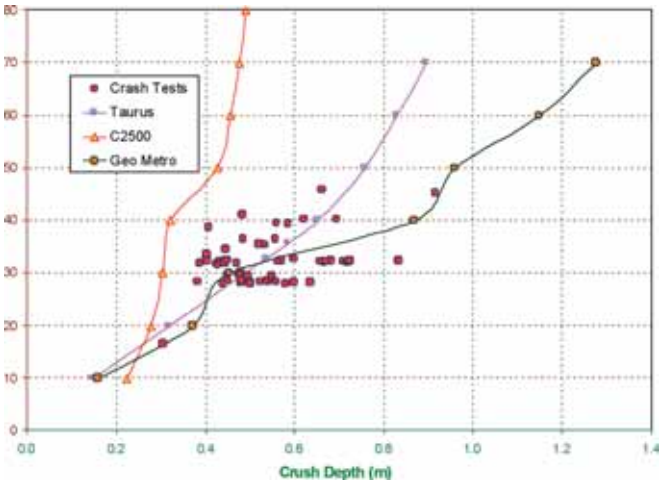

Figure 16 - Plot of Impact speed v's crush depth for available crash tests (Appendix A)

[Note that the Taurus, C2500 and Geo Metro data points are generated from Finite Element simulated lateral pole impacts]

The relationship between impact speeds and crush depth for the 1991 Ford Taurus appears to be bi-linear while 1994 Chevrolet C2500 pickup truck and 1997 Geo Metro (Suzuki Swift) have distinct knees and/or trend change in the data. The simulated crash test data also illustrates that the vehicles have quite different non-linear stiffness. The non-linear nature of the simulated lateral pole impacts further illustrates that using linear broad impact cash test data to reconstruct impact speeds for lateral pole impacts is flawed.

Figure 17 provides the following non-linear (second order polynomial) relationships between impact speed (km/h) and perpendicular crush depth (m):

1. 1991 Ford Taurus: Speed = 65.8(crush)2 + 7.5(crush) + 8.8
2. 1994 Chevrolet C2500 pickup truck: Speed = 332.9(crush)2 + 10.1(crush)
3. 1997 Geo Metro (Suzuki Swift) : Speed = 11.2(crush)2 + 34.2(crush) + 6.4

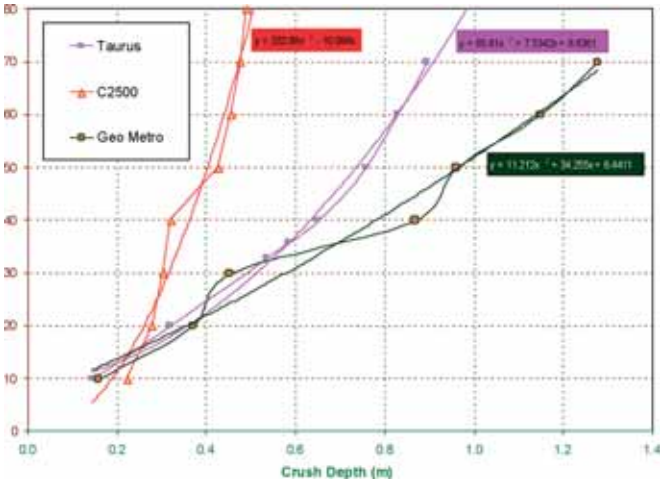

Figure 17 - Plot of the Taurus, C2500 and Geo Metro crush data points from the Finite Element Simulated lateral pole impacts and their non-linear relationships between impact speed and crush depth

Figure 17 also shows that, for example, at an impact speed of around 60 km/h, the Cheverolet C2500 displays approximately double the crush stiffness of the Ford Taurus and three times the crush stiffness of the Geo Metro [i.e crush is 425mm vs 850mm vs 1150mm,respectively]. This is to be expected when considering the differences in the respective vehicle's design and structure. What appears to be clear is that for sedans and smaller cars constructed in a manner similar to the Ford Taurus and the Geo Metro, intrusion into the occupant compartment is around half a metre at an impact speed of 30km/h. The level of intrusion, particularly at higher speeds (+30km/h), raises concerns regarding the effectiveness of any side impact system installed into such vehicles to mitigate occupant injuries. The magnitude of such intrusion violates one of the fundamental principles set down by Hugh De Haven (12, 13) well over 60 years ago, i.e. *"The package should not open up and spill its content and should not collapse under expected conditions of force and thereby expose objects inside to damage."*

Conclusions

Lateral impacts involving poles, posts or trees are a particularly severe crash type, resulting in high levels of vehicle intrusion, crush and consequential occupant trauma. Generally, reconstruction of vehicle speeds from crush measurements has utilised stiffness values based on 'broad side impact' data' and not narrow pole crash based data.

This paper has highlighted that vehicle specific data needs to be used in analysing narrow object lateral impacts for crash reconstruction purposes. Such data is typically not readily available, and the use of broad side based data is likely to lead to erroneous impact speed estimates.

The relationship between impact speeds and crush depth for a 1991 Ford Taurus, 1994 Chevrolet C2500 pickup truck and a 1997 Geo Metro (Suzuki Swift) have been developed from crash data and finite element modelling, and are presented.

More data needs to be collected on lateral narrow object impacts to enable a better understanding and more accurate reconstruction of these types of crash events.

The high level of intrusion arising from such narrow object impacts raises concerns regarding the vehicle structure design and the ability of any side impact airbag or air curtain installed into such vehicles to be effective to mitigate occupant injuries. It highlights incompatibility with current vehicle design and impacts with narrow objects such as poles and trees.

Acknowledgements

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- The publicly available Finite Element Models (developed by the United States of America National Highway Safety Transport Administration).
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Random Breath Testing – a Successful Policy Recipe

An analysis of the policy process and recommendations for future road safety success

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Photo: Greg Casey

Introduction

Australia, amongst the most highly motorised countries in the world (1), pays a high price for motorised transport. Deaths and injuries aside, the financial costs are estimated to be in the vicinity of $15 billion annually (2). Crash causation is constantly examined by a broad range of bureaucracies, researchers, motoring organisations, community groups and Government committees so that policies are focussed on counteracting the most prominent issues in a cost effective manner (3).

Numerous public policies implemented throughout New South Wales (NSW) in the 1970s and early 1980s years have attempted to curb the alcohol related road toll. The list includes the introduction of a legal blood alcohol limit of 0.08 in 1968, increases in fines for drink-driving from $400 to $1000 in 1978, licence disqualification for first offenders in 1979, mandatory breath testing of drivers following a crash or certain traffic offences in 1980 and later that year, a reduction of the legal blood alcohol concentration (BAC) from 0.08 to 0.05. (4; 5)

Despite these measures and in response to the death and injuries still occurring on the roads and community pressure to do something about it, the NSW Government, on 17th December 1982, implemented what was then a radical move in an attempt to curb alcohol related road crashes – Random Breath Testing (RBT). History now shows RBT as something of a 'silver bullet'(6) with RBT operations now a widely accepted part of driving in New South Wales. Yet as one of a considerable number of policies designed to target alcohol related driving, it differs significantly from that which commenced in 1982. Ongoing evaluations have resulted in further policy and legislative enhancements to the initial version.

Many drink driving studies recognise the success of RBT in the context of the *behavioural* effects it achieved, but do not discuss the *public policy* context. In fact, the path it followed throughout its policy implementation and development is a major reason for its success. This paper discusses that policy process within the context of a 'policy cycle' (7), including the actors involved, identification of the issue, analysis, policy instruments and implementation and evaluation. Clear implications for those seeking to implement future road safety policy initiatives are drawn out between the policy theory and the RBT example. A conclusion is then drawn about why the policy succeeded and why it maintains very high levels of community support.

Alcohol related driving – the policies and the literature

The New South Wales experience

Strong evidence exists supporting RBT's implementation in NSW as being amongst the best working model in Australia and internationally. Police and the then Traffic Authority were awarded for the 'Most outstanding road safety initiative in the world' (8). Many others have also recognised its success (9; 10; 11; 12; 13; 14). Homel (5) recognised that:

> 'As more and more jurisdictions in various parts of the world experiment with changes to the drink-drive laws and their methods of enforcement, the New South Wales RBT campaign may emerge as being, from a scientific point of view, of particular importance.'

The 'boots and all' model used in New South Wales used 'intensive police activity, extensive advertising and free coverage generated by wide-spread media interest' (13). The Australian Transport Safety Bureau (ATSB) noted that despite the introduction of RBT in Victoria in 1976, it was the NSW effort, involving high enforcement levels 'that saw real, sustained and significant gains' (14a). Sheehan (12) comments, 'There has been extensive Australian research done on this method of deterrence and it is generally accepted that the implementation of RBT in NSW has been the most effective model.' The NSW example is thus applicable far beyond state borders.

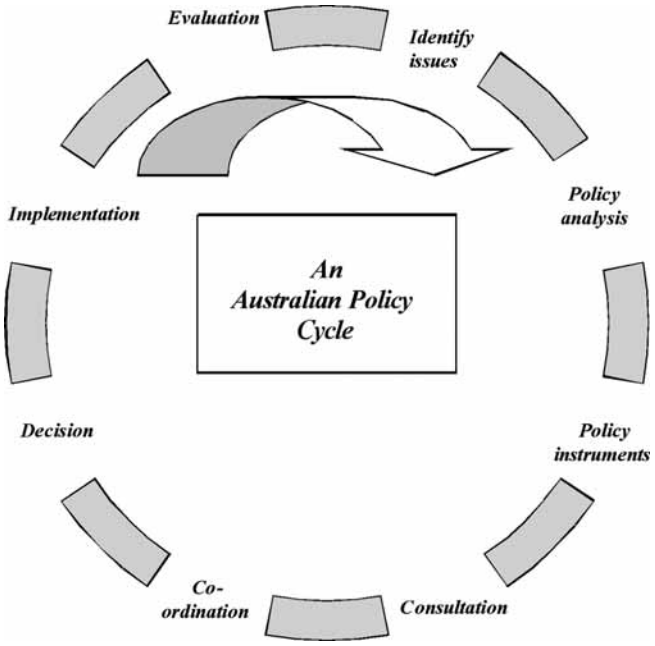
The Policy Actors

The States and Territories of Australia have primary responsibility for the management and regulation of roads within their jurisdictions (15). In NSW, the Roads and Traffic Authority (RTA), have primary responsibility for delivering road safety policy, through management of most facets of the States road network including the safety of the road environment and road users (16). NSW Police have responsibilities for road safety through enforcement and facilitation of the free movement of traffic (17). Local Government responsibilities lie with local traffic management and both environmental and more recently, behavioural road safety programs (18).

The Staysafe inquiry and corresponding consultation that preceded RBT saw the whole scope of *policy actors* involved in the policy process, i.e. elected and appointed officials, interest groups, research organisations and mass media (19), albeit in the somewhat controlled environment of a committee hearing. Yet the decision making phase remained solely at State Government level. At the implementation phase, it was the Police who were the primary agency involved, with the RTA playing a community education and publicity role through the mass media.

The literature makes much of the threats to successful policy implementation if too many agencies are involved. Pressman & Wildavsky (20) comment, 'When a program depends on so many actors, there are numerous possibilities for disagreement and delay.' Others conclude that the probability of a successful outcome is reduced when responsibility is shared amongst too many players and when implementation requires agreement at each stage among a large number of participants (7) (21). Gerston & Sharpe (22) restate the axiom of Robert Lineberry in that:

> 'successful implementation depends upon simplicity and simplicity demands that authority and administrative responsibilities be shared amongst the fewest possible agencies.'



Source: Bridgeman & Davis (2000:27)

The implementation of a 50km/h urban speed limit in NSW provides an example of the difficulties raised above. State Ministers, the Staysafe Committee, Local Traffic Committees as well as the full Council for each of the 172 councils (23) in NSW were all involved, resulting in 'disagreement and delay' and an ad-hoc policy implementation. Statewide uniformity was not achieved until the State Government 'overruled the bureaucracy' (22) and reduced the default urban speed limit. In RBT's case, these problems were avoided by virtue of the minimal number of actors involved - a major hint regarding reasons for success.

A Policy Cycle

Whilst some authors discuss the policy process (24), Bridgeman & Davis (7) detail the concept of a *policy cycle*, which they suggest, arises from the 'endless interactions' of the political, policy and administrative worlds, the routines that define the roles and responsibilities of each of the players and the recognised sequence taken by policy ideas on their way to cabinet consideration and subsequent realisation. They cite the work of Lasswell (1951), Simeon (1976), Sabatier & Jenkins-Smith (1993)

and Burch & Wood (1989) before arriving at their own eight stage *Australian policy cycle*. This they describe as 'merely a tool, a small machine for making sense', with numerous applications for their model demonstrated and discussed throughout their work (7). Their model provides an excellent framework for examining the introduction of RBT in NSW.

Identification

The first issue discussed is the need to *identify issues* (7). Between 1964 and 1982 at least 1,000 people were killed each year on NSW roads, reaching a peak of 1,384 in 1978 (25) and the Government of the day was under pressure to act (5). The Minister for Transport, the Honourable Mr Peter Cox moved in the Parliament that a joint standing committee be appointed to monitor, investigate and report on road safety issues in NSW and also to 'review and report on countermeasures aimed at reducing deaths, injuries and the social and economic costs to the community arising from road accidents' (27).

Amongst the various physiological causal factors identified (26), alcohol related driving was one that had been recognised by legislators for a number of years, however existing legal, financial and technological constraints were apparently doing little to deter drivers from drinking too much before driving - in 1981, 41.5% of all drivers killed had a blood alcohol level at or above 0.05 grams of alcohol in 100 millilitres of blood (27).

Alcohol is described as a drug that affects the central nervous system and results in cognitive and psychomotor impairment (27; 28). Katter mentions that; 'Alcohol severely restricts the amount of information that the brain can cope with at any one time' (27). In addition, alcohol 'increases confidence and aggression' (29). Thus alcohol increases crash risk (11) and its influence as a causal factor is 'widely accepted' (30).

The Chairman of the committee, which became known as Staysafe, Mr George Paciullo, openly acknowledged the drink driving problem, citing the need for drivers to accept 'the principle that driving combined with drinking over the legal limit is incompatible with the safety interests of other motorists and themselves' (27). Thus the problem having been identified, the committee moved on to analysing the potential policies that could stem the alcohol related death toll.

Policy analysis

The *policy analysis* phase considered existing and proposed policies. Amongst these was the existing offence of 'Drive under the influence of alcohol' (DUI) (31). This cumbersome process relied upon Police providing the court with evidence of the subjects driving style, their appearance and demeanour (28;32) and could only be invoked post incident. Scientific research was however, coming to the rescue.

As far back as 1932, Widmark (28) established a relationship between alcohol consumption and blood alcohol content (BAC). Chemical testing was developed to determine the concentration of alcohol in a subject's blood and thus their level of impairment. Some countries - Norway and Sweden - then implemented legislation based upon a specific BAC (4; 28; 33).

It was not until the development and implementation of the 'Breathalyser' in 1968 and in NSW, the subsequent introduction of the *'per se'* offence of driving with the 'Prescribed Concentration of Alcohol' (PCA) on 16th December of that year that the system became easier to use (4; 28; 31; 32). Cashmore (4) explains *'per se'* legislation as where 'a driver's blood alcohol concentration is by itself evidence of alcohol intoxication: no other evidence is necessary to prove legal incapacity to drive.' The new equipment combined with 'per se' legislation made it possible to measure and act against alcohol affected drivers based solely upon their blood alcohol concentration without necessarily relying upon proof of the subjects 'drunkenness' (28;33).

The creation of the offence of PCA, saw a legal blood alcohol concentration set at below 0.08 grams of alcohol in 100 millilitres of blood (34). How this limit was arrived at is not clearly defined in the literature. Zaal (28), whilst not giving specific reasons for a 0.08g/100ml limit, states that legislators used information on the relationship between BAC and impairment to, 'determine a socially responsible and acceptable level of alcohol risk.' This tends to suggest a reflection of the social use of alcohol at the time, which has been described by Smith (6) as:

> 'a culture that valued the manly ability to hold one's liquor, and although driving under the influence had been an offence since the 1920s the existence of legal sanctions could make little headway against popular culture.'

Whatever the reasons for such a limit, abundant research since then sets out the dangers that remain between BAC's of 0.05g/100ml and 0.08g/100ml. Moskowitz & Robinson (28) carried out a comprehensive review of over 200 studies on the effects of BAC and concluded that even a BAC of less than 0.02g/100ml can reduce driver performance.

Facing such research and a mounting alcohol related road toll, the NSW Government introduced a new policy in December 1980 reducing the legal blood alcohol content for drivers from 0.08g/100ml to 0.05g/100ml (34). (Homel (5) notes a common misconception that lowering the legal BAC coincided with RBT's introduction in 1982.)

Policy analysis showed however, that existing laws restricted the use the 'Breathalyzer' to circumstances involving; a) a breach of the regulations; b) an attempt to drive whilst apparently having alcohol in one's body, or; c) a drivers involvement in a crash. On such an occasion a screening test was conducted involving a 'Dräger Alcotest' (i.e. blowing into the bag), involving colour-change crystals in a glass tube. Each tube could only be used once and involved a cost of $1.18 to the Government (27) which constrained the amount of roadside testing, thus further reducing the risk to a driver of being breath tested.

Policy instruments and consultation

The Staysafe inquiry was particularly detailed, perhaps due to their and the Government's consciousness of potential political ramifications. Smith (35) supports their concern by commenting:

> 'Measures that result in dollar cost to the community, curtailment of freedoms or coercion are only likely to be instituted by governments where there is a proven benefit or strong research to justify the action. Therefore, measures that cannot be demonstrated to be effective are unlikely to be endorsed or required by governments or authorities.'

Staysafe's first report to Parliament, 'Staysafe 1 - Alcohol and other drugs and road safety' shows that a large number of policy instruments were considered. These included 'non-coercive' options (7) such as school and community education programs, improving driving and social skills, self testing for alcohol, alternative transport, road safety slogans and even temperance clubs (27).

Legislation surrounding DUI, PCA and lowering of the PCA limit from 0.08g to 0.05g/100ml blood could all be considered strictly compulsory policy instruments because they 'compel or direct the action of target individuals……who are left with no discretion'(36). Other coercive types of instruments (7) considered included tighter alcohol controls, zero blood alcohol content for first year drivers, Police blitzes, increased Police visibility and the introduction of Random Breath Testing. Some post-offence policy instruments suggested included legislating for ignition interlocks, more severe penalties and rehabilitation programs for offenders. Improving the road environment and vehicle safety through engineering measures was also considered (27).

Of all the policies and programs suggested, consultation showed that perhaps one of the most controversial was RBT (4; 37; 38; 39; 40). In a number of submissions to Staysafe, Glynn (27) felt Police powers were sufficient and that 'too many civil liberties have already been ceded to the Crown.' Chamberlain (27) felt highway patrols were 'inadequate and inefficient'. Submissions from the corporate sector, such as the Cronulla-Sutherland Leagues Club (27) opposed RBT as an infringement of civil liberties, adding that the effect of alcohol varies between individuals - 'an issue for which the 0.05 limit has no regard'. Random licence inspections were suggested, with follow up breath tests only if a person is found 'obviously under the influence of alcohol' (27), a proposal to which the Traffic Accident Research Unit (27) responded, stating that the function of RBT was 'to dissuade from driving those drivers who were not obviously under the influence of alcohol, but were nevertheless in the range (above 0.05 per cent BAC) in which their driving was affected.'

Having considered the plethora of information and 'strong research' (35) put before it, the Committee was able to single out RBT as potentially the most effective policy instrument available. Education programs could not expect to change driver behaviour in the short term because of the 'culture' referred to by Smith (6) above and as Homel (5) found:

> 'Driving after drinking is common behaviour in New South Wales….. High alcohol consumption, perceived pressure to drink and driving while intoxicated comprise a cluster of correlated attributes.'

In such a social environment, non-coercive campaigns could only be expected to have had limited success. Post-incident policies, whilst warranting consideration, may be construed as punitive rather than preventative actions, applicable only to those who have already had a crash. Vehicular and road environment engineering solutions carry with them long lead times and considerable costs. RBT however, as a general deterrent, was obviously swifter than the many other concepts suggested as well as being more than cost effective (4).

Fildes & Lee (41) describe *general deterrence* as 'the assumption that those exposed to enforcement, apprehended or not, will be discouraged… through fear of detection and punishment' and *specific deterrence* as 'the assumption that drivers who are caught and punished….will be discouraged from committing further offences.' RBT was intended to reduce alcohol related crashes through general deterrence - impressing upon drivers that being subjected to a roadside breath test was 'highly probable,' (27) even without crashing or otherwise attracting the attention of police and thus inducing voluntary compliance with drink-driving laws. It was also practical - with a limited number of Police, thousands of kilometres of road and in 1982, some 2,788,000 vehicles driven by about 3,198,000 licensed drivers in NSW (25), a specific deterrence focus simply would not work. As Anderson (24) states:

> 'Policies depend greatly for their effectiveness upon voluntary or non-coerced compliance, because those responsible for implementation cannot effectively handle and apply sanctions in large numbers of cases.'

Fildes & Lee (41) also mention the three 'classic mediators of behaviour modification' as the 'certainty, severity and celerity of punishment.' Therefore, simply applying more coercive post-offence policies, such as increasing penalties, would not suffice on their own. As Staysafe noted, 'even if the penalty is very large, if a driver believes that the risk of detection is very low, the effect of the legislation will be small (27).

To increase perceptions of 'certainty', RBT was implemented in an environment of high publicity with community education and encouragement programs. Whilst having a 'compulsory' element to it - that one could not drive at or above a blood alcohol limit of 0.05g/100ml blood - it also had a 'voluntary' element, encouraging the individual to choose to either drink or drive. Thus, RBT can be considered a mixed policy instrument (36) due to its combination of both voluntary and compulsory elements.

Coordination, the decision and implementation

Recognising the need for a *coordinated* approach, RBT was introduced for a trial period of not less than two years (27), with operations coinciding with greater conspicuity of Police, highly visible breath testing, media publicity and education. It was recommended that the operation of RBT should be monitored and evaluated and importantly, that appropriate 'administrative resources' such as roadside screening equipment and breath analysis instruments be provided, thus facilitating policy implementation by addressing major equipment issues (7; 27).

The Parliament made a *decision* to introduce RBT and on 17th December 1982, the *implementation* of RBT in NSW commenced in accordance with the conditions specified by Staysafe and a blaze of media publicity (4; 5; 37; 38). To coincide with this, penalties for PCA offences were increased and expanded from a two to a three tier system. *Low range* PCA penalties rose from $400 to $500 and 6 months automatic licence disqualification (1st offence), *medium range* PCA remained the same at $1,000 and/or 6 months gaol with automatic licence disqualification of 12 months (1st offence) whilst the new *high range* PCA penalty stood at $1,500 and/or 9 months gaol with a 3 year automatic licence disqualification. Blood testing of drivers, motorcyclists and pedestrians older than 15 years admitted to hospital following a crash also became mandatory. (4)

Evaluation

Since its introduction the Government via Staysafe have held numerous inquiries evaluating RBT. An evaluation in 1985 revealed that 'there can be no question that RBT has had a major and enduring effect on reducing the carnage on NSW roads' (40). The passage of legislation making RBT permanent was recommended (40). Such action was doubtless made easier after a March 1984 survey found overwhelming public support for RBT, citing 91.5% in favour (40).

Proposed enhancements were assessed including the introduction of mobile RBT. Reasons included a waning of the deterrent effect because offenders could simply avoid stationary RBT in back streets and during heavy rain. At the time though, Staysafe felt that Police were using a lack of 'guile' in the placement of RBT units. Concerns regarding targeting of offenders and victimisation surfaced and police were not 'given the power to operate RBT in the mobile mode' (40). However, subsequent surveys supported the claim that drivers could avoid RBT by driving through back streets. Accordingly, the Government set aside Staysafe's recommendation and Mobile RBT was introduced in NSW in November 1987 (32).

Further policy enhancements took place in 1989 when Staysafe published their 13th report (42), relating to the immediate loss of licence for persons found with a high range BAC (>0.150g/100ml blood). Moynham, a medical doctor, testified that if one is capable of consuming that much alcohol and is still capable of driving, then their problem is one of 'alcohol addiction' (42). The committee agreed with Homel (42) that such a policy would deter many motorists through 'a more immediate, more certain and substantial penalty.'

The Government, no doubt comforted by a survey showing 76% community support for the concept, introduced a policy of immediate licence suspension for high range PCA offenders in November 1989 (31). This has since been reduced to include drivers charged with mid range PCA (0.08g/100ml blood) or higher (43).

Discussion

In a policy context, RBT's success can be measured against the writing of Lewis Gunn (7), who lists ten conditions for perfect implementation of a policy. These are:

1) No crippling external constraints
2) Adequate time and resources
3) A suitable combination of resources at each stage
4) A valid theory of cause and effect
5) Direct links between cause and effect
6) A single implementation agency or at least a dominant one
7) Understanding and agreement on the objectives to be achieved
8) A detailed specification of tasks to be completed
9) Perfect communication and coordination
10)Perfect obedience. *Source:Gunn (7)*

Considering the manner of RBT's implementation, almost all of Gunn's conditions were met. First, the Government was so keen to introduce RBT that all external constraints for the Police, such as legislative issues and community concern, were amended and allayed. (All relevant legislation was carried over in December 1999 to the current Road Transport Legislation) (48) The timeframe was obviously sufficient, as were the human, physical (eg. breath testing equipment) and financial resources. A valid theory of cause and effect was established and was directly linked to the existing road crash situation. Police were the one dominant implementation agency, with the RTA responsible for publicity and community education programs. The objectives were clearly understood and the specified tasks of each agency were clear, right down to the individual Police on site, who subsequently received praise for their vigour (12). Communication and co-ordination were a major success, as the expensive publicity had to correlate with the heightened Police activity for its effectiveness. (5)

Perhaps the only area where the policy did not fulfil Gunn's conditions was that of perfect obedience, demonstrated by the number of drivers who were not deterred by the policy. In 1983 alone, of some 900,000 breath tests 5,348 people were charged with PCA offences (4). Yet as a measure to deter the majority of drivers and as a corollary, reduce the road toll, its success is without doubt (11; 44; 45; 46).

Photo: Greg Casey

Annual evaluations of community attitudes confirm that some 97% of the community consider RBT as 'reasonable' (47), suggesting why drink driving laws work, or at least why they are perceived to work. They also support evidence of an attitudinal shift in the social acceptability of drink driving. More people are now inclined to label a drink-driver as 'irresponsible, a criminal or a potential murderer.' (28)

There is no doubt that RBT in NSW is an extremely successful policy. It has had a major positive effect upon alcohol related road crashes in a highly cost effective manner (4; 28). For a policy about which the doomsayers were so loud, the very high degree of community acceptance and support (47) has no doubt come about through the manner in which it was implemented and has since been developed.

Conclusion

Abundant information is available throughout the road safety literature regarding the reasons behind the success of a public policy implemented in NSW, which gives Police the power to stop drivers anywhere, at any time and in any type of motor vehicle for no reason other than to subject the driver to a breath test. Theories of deterrence exist against which RBT's success can be measured (5; 41) and there is no doubt as to its ability to cause people to voluntarily think about either their alcohol consumption or their subsequent mode of transport. Yet other policies, such as lowering the urban speed limit in NSW, have been introduced on a similarly sound theoretical basis, with direct links between cause and effect, but without the smoothness of RBT. It is obvious then that there is more to making policies successful than just sound theory in the subject area.

It has been shown that one of the reasons for RBT's success was that the policy process flowed in an almost textbook fashion. Correlations exist between the policy stages and the ultimate result. The issue was identified, the policy instruments and subsequent enhancements were thoroughly analysed, the community was consulted, resources were considered, decisions were made with a minimum of fuss and the policy was implemented with the support of the bureaucracy charged with its implementation. Evaluation has occurred many times and is ongoing.

Whether the flow of alcohol related driving policy in New South Wales followed the textbook models intentionally or accidentally may never be known. What has been shown is that there are two sides to the success of RBT policy - first, it followed sound scientific and deterrence theories and second, it followed a proven public policy cycle. This has no doubt contributed to a policy that not only has achieved its objective but continues to engage overwhelming community support.

There are clear implications for those seeking to implement future road safety policy initiatives. Consideration of theoretical policy processes as in this example should ensure a greater chance of success.

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47 Mitchell-Taverner, Phillip., 2002, *Community Attitudes to Road Safety: Community Attitudes Survey Wave 15, 200*2, Australian Transport Safety Bureau, CANBERRA.

48 Parliament of New South Wales, 1999, Road Transport (Safety & Traffic Management) Act, accessed August 2003 from;http://www.austlii.edu.au/au/legis/nsw/consol_act/rtatma1999412/

Road Safety Literature

Correction: We apologise that in the section on 'New to the College Library' of the August edition of the Journal, we inadvertently referred to the "Western Australian Department for Transport, Energy and Infrastructure", whereas this should have been the "South Australian Department of Transport, Energy and Infrastructure".

Book review

Underwood, RT, Road safety strategies and solutions, Engineers Media, Sydney 2006

This review represents the views of the reviewer, Mr Ken Smith, and does not purport to represent the position of the Australasian College of Road Safety Inc.

This is a road safety source and resource book for a range of readers, from professionals and sub-professionals through to the general reader. Its aim is to provide a resource for people who in the course of their work need to know about road safety issues but are not informed at the professional level.

The book should prove valuable for local government, community road safety groups and others who need to know about some of the basics of road safety to properly inform decisions that may affect transport safety. There is a short but useful section on the role of local government and community effort in road safety, which is to be applauded. I think that with proper guidance there is a significant role for road safety action at the local and community level, which can achieve things that cannot be achieved using mass state – or nation-wide approaches and media.

The book sets out basic facts on road trauma in the population and transport context. It sets out the relationship between road and road environment, vehicles and behavioural factors. There are chapters on each of these and more detailed chapters on specific issues such as alcohol, drugs, fatigue, novices and elderly road users. There are chapters on road hierarchy and management, intersection treatment, on pedestrian, bicyclist, motorcycle and public transport issues, and land planning. Enforcement has a chapter on its own and there is a useful chapter on road safety investigation.

It is comprehensive in its coverage, but by its nature lacks detailed examination of road safety problems. For example, the section on fatigue (pages 80-81) gives a fairly good estimate of the contribution of fatigue to road trauma and comments that the extent of the problem approaches that of alcohol (his estimate is 20-30% of fatal crashes) but by omission largely perpetuates the mistaken idea that fatigue is mainly an issue of the road transport industry. To illustrate the problems with this, it has been estimated from biennial ATSB Fatality File data for 1990 to 1996 that in nearly 60% of fatigue related crashes involving heavy vehicles it was the driver of the light vehicle involved in the crash who was fatigued (1). Problems of this sort are probably largely inevitable if the writer is not himself an expert in individual fields and has gained the material for the book from general sources. It is now emerging that fatigue is a community wide problem the ramifications of which are insufficiently understood. I have written elsewhere (2) that effectively managing fatigue could have a significant impact on road trauma, and that one of the prerequisites is a much better community understanding of the problem.

Similarly, the coverage of novice driver issues is sufficient only for a broad understanding of the ramifications of the problem, the role of training and experience and the basic facts on graduated licensing. There is, however, no discussion of the different graduated licensing models in use in Australia or the extent to which 'initiatives relating to young drivers' are in use. This is a more important matter than it appears, since the lack of this information could lead to (say) a community road safety group proposing initiatives that ignore what is being done in practice. A book with the purpose and target audience of this one should inform about what is being done, or at least direct readers to the relevant authority web sites for further information.

Usefully, the book includes discussion of national and international injury prevention strategies and philosophies. This is a valuable means of putting Australian activities into context. Safety strategies in various countries are discussed, including the best-known Swedish Vision Zero and the Netherlands' 'sustainable safety'. Against these, Australia's 'safe system' approach stands up well. There is a discussion of the desirable form of a road safety strategy. In the 1990s there was debate about whether it was desirable to set a 'road safety target' in terms of the number or rate of deaths or injuries that should be aimed for as a measure of the effectiveness of the nation's road safety activities. Thankfully that debate passed and it is pleasing to see that Underwood regards this as a necessary step and proceeds to discuss the factors to be taken into account in setting a target.

In his brief discussion of Vision Zero Underwood makes the comment that if this were to be considered as a long term road safety target, it would be useful to have an informed

community debate on how it might best be achieved, with a view to obtaining an indication of community and political acceptance of it (p.59). This is a useful thought that could be applied more widely. In Australia there has been a tendency for the outcomes of research on measures that might be effective in road trauma terms to be developed into policy proposals without much consideration of community acceptance. This applies particularly to technological measures that under some circumstances may take control away from the driver. Although measures like this are at present at best experimental, there is an implicit assumption in road safety management and the research community that because such measures are likely to be effective they are by definition good. While this may be so, there has been no known attempt to establish what the community thinks.

The book will not satisfy those whose need is for detailed, professional level coverage of specific matters, such as relationship with traffic management or town planning, or those who need detailed information on particular subject areas such as novice drivers or vehicle safety, or electronic vehicle control systems. Someone wanting more detailed knowledge and perhaps examination of the issues and differing viewpoints will need to look further. But the book does not aim to meet these needs.

Reference lists are given at the end of each chapter, following end notes that also frequently refer to sources. This makes it possible to refer to appropriate sources for further information or more depth. Most of the sources cited are Australian and of relatively recent date, but someone in the field might want better coverage - although that same person would probably already be aware of the most significant and useful sources, and especially research reports, or at least where to find them.

A book like this is likely to date simply because the field of study changes, but it should remain valuable as a general reference for some time to come, even though as time goes on there will be need for readers to have some awareness of the changing scene to know what is still relevant. An updating supplement a few years down the track may be worth considering.

Ken Smith, FACRS

(1) NRTC and Smithworks Consulting (2001) Heavy vehicle driver fatigue: review of the regulatory approach. Discussion paper Melbourne, September, p.33

(2) Smith K B (2006) managing fatigued driving: public information and education, J.ACRS 17:1, February 2006. 18-24

New to the College Library

'Road Safety, Strategies and Solutions'
by Robin T Underwood, published by Engineers Media 2006.

Recent Publications

Australia and New Zealand

Charlton J L, Oxley J, Fildes B, Oxley P, Newstead S, Koppel S, O'Hare M, 2006, (Monash University) **"Characteristics of older drivers who adopt self-regulatory driving behaviours"**, pp. 363-373, Transportation Research, Part F: Traffic Psychology and Behaviour, Vol. 9 No. 5, Elsevier Publishing.

A survey was carried out to determine self-regulatory driving practices of 656 drivers aged 55 years and older. The prevalence and type of self-regulation were studies to identify the key characteristics of persons who are self-regulators. The majority of drivers reported being very confident in potentially difficult driving situations and relatively few avoided these situations. However, the most commonly avoided situations were driving at night (25%), on wet nights (26%) and in busy traffic (22%). There was a strong association between drivers' avoidance of and confidence in specific driving situations (e.g. night driving) and ratings of relevant functional abilities (e.g. vision for night driving).

Logistic regression modelling was applied to the data. This revealed that those most likely to adopt avoidance behaviour were:

- female,
- 75 years and older,
- not the principal driver in the household,
- had been involved in a crash in the last 2 years,
- reported vision problems, and
- had lower confidence ratings.

Fitzharris M, Fildes B, Charlton J, 2006, (Accident Research Centre, Monash University Melbourne, Australia; Department of Trauma Surgery, National Trauma Research Institute The Alfred Melbourne) "Anxiety, acute- and post-traumatic stress symptoms following involvement in traffic crashes", pp. 283-301, *Annual Proceedings of the Association for Advancement of Automotive Medicine,* Association of Automotive Medicine.

Common post-crash symptoms are anxiety and traumatic stress. This study examines and documents:

- generalised anxiety responses post-crash, and
- the association between Acute Stress Disorder and Post-Traumatic Stress Disorder (PTSD) with personality and coping styles.

Sixty-two hospital patients aged 18-60 were interviewed:

- prior to discharge,
- at 2-months post-crash
- at 6-8 months post-crash.

Anxiety symptoms were common, with 55% of participants experiencing moderate-severe levels prior to discharge, with

this decreasing to 11% and 6.5% at 2-months and 6-8 months post-discharge. Females reported significantly higher levels of anxiety and acute distress. Neuroticism and generalised coping styles were associated with acute stress responses but not PTSD. These results have important theoretical and practical implications, and indicate that females are at risk of poorer acute anxiety outcomes following injury.

Langford J, Koppel S, 2006, (Monash University Accident Research Centre) **"Epidemiology of older driver crashes - Identifying older driver risk factors and exposure patterns"**, pp.309-321, *Transportation Research, Part F: Traffic Psychology and Behaviour,* No. 9 Vol. 5, Elsevier Publishing

The crash involvement of any road user is a function of two sets of factors:

a *risk* – this covers aspects relating to the individual **road user**, to his or her **vehicle** and to the **road environment** through which he or she is travelling; and

b *exposure* – the amount of travel under the different combinations of risk aspects.

Accumulating knowledge from research covering older drivers has shown that this road user group has distinct risk factors, relative to young and middle-aged drivers. For example: frailty and hence vulnerability to injury in the event of a crash; for many, a general slow-down in physical, sensory and cognitive functioning; and for some, the onset of specific conditions leading to significant functional impairments. Many older drivers, perhaps more so than other road user groups, are aware of their heightened crash risk and have accordingly adjusted their exposure at least in part as a protective measure. In other words, they have attempted to minimise any travel under conditions that are threatening and/or cause discomfort and conversely, have attempted to restrict their travel to conditions perceived as safe and/or comfortable. This self-regulation of driving has resulted in distinct driving exposure patterns, often reflected in crash circumstances.

The national fatal crash data in Australia for the period 1996-1999, have been analysed:

a to identify indicators of older driver risk;

b to identify indicators of older driver exposure patterns; and

c to indicate the extent to which and how the risk/exposure-reduction strategies have proven ineffective, by identifying crashes for which older drivers may be deemed responsible.

Further countermeasures suggested by these analyses, have been identified.

Oxley J, Fildes B, Corben B, Langford J, 2006, (Accident Research Centre, Monash University) **"Intersection design for older drivers"**, Vol. 9 No. 5, Transportation Research, *Part F: Traffic Psychology and Behaviour,* pp. 335-346, Elsevier Publishing.

Older drivers are currently over-represented in severe injury crashes at intersections due in part to increases in frailty and functional disabilities that occur with age. Moreover, this rate is expected to increase as older people drive more and the population ages. A major road safety factor is road design. There has been a general lack of consideration of the needs of older road users and this is likely to contribute to their driving difficulties. In particular, intersections can be identified as a major problem for older road users. This study included a review of age-related performance deficits that affect driving. A crash `black-spot' site analysis was carried out to examine the relationship between intersection design features (believed to influence the safety of older drivers) and the older driver crash experience in Australasia. As a result, a number of intersection designs that cause problems for older drivers were identified.

The authors have made recommendations for changes in *road design* features and *traffic management practices* that have the potential to reduce the risk for older drivers of crashes and injuries at intersections.

Fildes B, 2006, **"Older drivers' safety and mobility: Current and future issues"**, pp. 307-308, *Transportation Research, Part F: Traffic Psychol;ogy and Behaviour,* Vol. 9, No. 5, Elsevier Publishing.

(Abstract unavailable)

Australian Transport Safety Bureau

Australian Transport Safety Bureau, **"Deaths of cyclists due to road crashes Research and Analysis Report"**, July 25, 2006, Canberra, ACT

Summary

The report gives an overview of the circumstances of road crashes in which cyclists died in the period 1991 to 2005 and provides more detail for 1996 to 2004, the latest period for which detailed data were available. It examines the incidence of helmet wearing among cyclist deaths, the major factors in fatal crashes involving cyclists and the main crash types. Age and gender distributions, day of week, time of day and speed limit at the crash site are also examined. Download Complete Document, [PDF 1258Kb], at: http://www.atsb.gov.au/publications/2006/death_cyclists_road

Australian Transport Safety Bureau, **"Characteristics of Fatal Road Crashes During National Holiday Periods Research and Analysis Report"**, July 28 2006, Canberra, ACT

Summary

The study examines annual trends in road fatality numbers for Christmas and Easter holiday periods, and undertakes a

comparative analysis of crash factors between holiday periods and the remainder of the year. Pronounced year to year fluctuations in the data suggest that the number of people killed in any given holiday period is significantly influenced by random events. Data for fatal crashes and deaths in Christmas and Easter periods during the last 15 years were examined. There is considerable fluctuation from year to year. Between 1996 and 2005, the number of fatalities ranged between 48 and 86 during Christmas periods and between 14 and 31 during the Easter period. When expressed as 'average number of deaths per day' fatality rates are not systematically higher or lower, with any statistical significance, than at other times of the year. Between 2001 and 2005 there was an average of 4.4 deaths per day during Christmas periods, 4.6 deaths per day during Easter periods and 4.5 deaths per day over other days.

However, differences in the Christmas and Easter periods compared with the rest of the year are consistent with previous findings, viz.,

- a greater proportion at rural locations
- a greater proportion in high speed zones
- a greater proportion of single vehicle crashes
- a lower proportion of articulated truck crashes
- a greater proportion in the early morning period (3am to 5am)

The data analysis indicated no differences in reported primary causal factors of speed, alcohol or fatigue. There were differences in the characteristics of those killed in holiday periods compared with other times in the year. Fatalities in holidays involve higher proportions of vehicle passengers, females , and children aged under 15 years. The findings are broadly consistent with the results of a similar study undertaken in 2003. Download Complete Document, PDF [383Kb], at: http://www.atsb.gov.au/publications/2006/Holiday_fatalities.aspx

Reports from the Centre for Automotive Safety Research, University of Adelaide:

CASR021 – **South Australia's Driver Intervention Program: Participant characteristics, best practice discussion and literature review**
http://casr.adelaide.edu.au/reports/CASR021.pdf

CASR022 – **The crash and offence experience of drivers eligible for the South Australian Driver Intervention Program**
http://casr.adelaide.edu.au/reports/CASR022.pdf

CASR024 – **Reduction of speed limit from 110km/h to 100 km/h on certain roads in South Australia: a preliminary evaluation**
http://casr.adelaide.edu.au/reports/CASR024.pdf

CASR025 – **Edge delineations**
http://casr.adelaide.edu.au/reports/CASR025.pdf

CASR020 – **Performance of bull bars in pedestrian impact tests**
http://casr.adelaide.edu.au/reports/CASR020.pdf

Reports from Monash University Accident Research Centre

Delaney, A., Diamantopoulou, K. & Cameron, M. (2006) **Strategic principles of drink-driving enforcement**, Monash University Accident Research Centre, Report No. 249
http://www.monash.edu.au/muarc/reports/muarc249.html

Charlton, J., Koppel, S., Fitzharris, M., Congiu, M. & Fildes, B. (2006) **Factors that influence children's booster seat use,** Monash University Accident Research Centre, Report No. 250
http://www.monash.edu.au/muarc/reports/muarc250.html

Watson, L. & Cameron, M. (2006) **Bicycle and motor vehicle crash characteristics**, Monash University Accident Research Centre, Report No. 251
http://www.monash.edu.au/muarc/reports/muarc251.html

Stephan, K., Hosking, S., Regan, M., Verdoorn, A., Young, K. & Haworth, N. (2006) **The relationship between driving performance and the Johns Drowsiness Scale as measured by the Optalert system,** Report No. 252
http://www.monash.edu.au/muarc/reports/muarc252.pdf [838KB]

Regan, M., Triggs, T., Young, K., Tomasevic, N., Mitsopoulos, E., Stephan, K. & Tingvall, C. (2006) **On-road evaluation of Intelligent Speed Adaptation, Following Distance Warning and Seatbelt Reminder Systems: final results of the TAC SafeCar project**, Monash University Accident Research Centre, Report No. 253
http://www.monash.edu.au/muarc/reports/muarc253.html

Churchill Fellowship Report

A detailed report on Mr Robin Anderson's Churchill Fellowship studies on older road users is now available on the Internet. The document comprises a 23 page basic report, plus a further 30 pages of appendices, which are the edited records of the meetings Robin had during his study tour. The document is on the 'Reports' section of the NRMA-ACT Road Safety Trust website. See: www.roadsafetytrust.org.au

Other Country Publications

Fell J C, Voas R B, 2006, **"Mothers Against Drunk Driving (MADD): the first 25 years"**, pp. 195 - 212, Traffic Injury Prevention, Vol. 7 No. 3.

The organisation Mothers Against Drink Driving (MADD) is a "grass-roots" citizen advocacy organisation in the United States of America, which has been very successful in the public health field. It was recognised by 94% of citizens in a national poll by the Gallup organisation in 2005. It is generally given credit for changing American attitudes toward drinking and driving.

In 2005, the organisation celebrated its 25th anniversary. Since its founding in 1980, alcohol-related traffic deaths in the United States have decreased from an estimated 30,000 to 16,694 in 2004, according to the National Highway Traffic Safety Administration. These authors have reviewed the growth of the organisation since it was established. They have attempted to gauge its contribution to the community conception of the impaired-driving problem and to the reductions in alcohol-related highway deaths and injuries.

Goodwin A H, Wells J K, Foss R D, Williams A F, 2006, **"Encouraging compliance with graduated driver licensing restrictions"**, Journal of Safety Research, U.S. National Safety Council, Published by Elsevier.
[ePub (volume, issue, and page range not yet available)]

Graduated driver licensing programs have reduced the high crash rates for 16-and 17-year-old drivers. However, research suggests that some teenagers fail to comply with restrictions on nighttime driving and carrying passengers. A program to encourage compliance with graduated driver licensing restrictions and seat belt requirements was implemented in Guilford County, North Carolina. The program combined increased enforcement with a multi-faceted publicity campaign drawing attention to the enforcement activity. A comparison group was studied to assess whether changes over time could be reasonably attributed to the program.

Observations in the intervention sample indicated that teenagers perceived greater enforcement. However, self-reported data and direct observations of young drivers in the intervention and comparison groups showed the program resulted in only modest changes in compliance with graduated driver licensing restrictions. However, the modest changes in young driver behavior plus the clear changes in both actual and perceived enforcement suggest that high visibility enforcement programs merit further use and evaluation in other communities, particularly those where compliance with GDL provisions is lower than in Guilford County.

Hennessy DA, Lanni-Manley E, Maiorana N, 2006, **"The effects of fatal vision goggles on drinking and driving intentions in college students"**, pp. 59-72, Journal of Drug Education, Vol. 36 No.1, Baywood Press.

This study was designed to examine the effectiveness of "Fatal Vision Goggles" in reducing intentions to drink and drive. Participants performed a field sobriety task and drove in a traffic simulator while wearing the goggles.

A regression analysis was performed in order to predict changes in intentions to drink and drive, using typical drinking patterns, perceived likelihood of getting into a collision when drinking and driving, self efficacy, and driving independence as predictor variables. The results of the study showed that intentions to drink and drive were reduced following the use of "Fatal Vision Goggles" among a range of groups viz.,

- those that typically drink more during outings,
- those that believe the likelihood of collisions when drinking and driving are greater, and
- those less likely to drive to achieve independence and autonomy.

These results indicate that "Fatal Vision Goggles" can be an effective tool in altering drinking and driving attitudes among drivers with specific attitudinal and personal characteristics.

Tse J L M, Flin R, Mearns K, (Industrial Psychology Research Centre, University of Aberdeen, Scotland), 2006, **"Bus driver well-being review: 50 years of research"**, pp. 89-114, Transportation Research, Part F: Traffic Psychology and Behaviour, Vol. 9, No. 2

Key research on the occupational health of urban bus drivers, in the period since the 1950s, is consolidated in this review paper. To develop the basis for this study, several electronic databases were searched and 27 key studies were identified. Previous findings that bus drivers are liable to suffer ill health as a result of the job are still valid to the present time. However, the research has demonstrated a greater understanding of the effects of specific stressors, viz.,

a physical (cardiovascular disease, gastrointestinal disorders, musculoskeletal problems, fatigue),

b psychological (depression, anxiety, post-traumatic stress disorder) and

c behavioural outcomes (substance abuse).

The resulting ill health of bus drivers will have consequences for the performance of the employing organisation in terms of employee absence, labour turnover and accidents. Stressors for bus drivers include poor cabin ergonomics, rotating shift patterns and inflexible running times. The conditions for the drivers have intensified over the last few decades by other work stressors such as traffic and violence from passengers. Consequently, more recent research has focussed on salient moderating and mediating variables in the stressor-strain relationship.

These theoretical advances in the research need to focus on practical interventions that are systematically implemented and evaluated, to improve the well-being of bus drivers. By improving conditions for drivers, it is expected that the efficiency of bus transport will be enhanced for bus drivers, operators and passengers alike.

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