



REPORT ➤ 2004



➤ Centre for
Automotive Safety Research



➤ CASR – THE CENTRE FOR AUTOMOTIVE SAFETY RESEARCH – IS SUPPORTED BY SUSTAINING FUNDS FROM THE SOUTH AUSTRALIAN DEPARTMENT OF TRANSPORT AND URBAN PLANNING AND SOUTH AUSTRALIA'S MOTOR ACCIDENT COMMISSION, TOGETHER WITH INCOME FROM CONTRACT RESEARCH



Government of South Australia
Department of Transport and
Urban Planning



> CASR conducts research in road safety and injury control that contributes to the reduction of the human and economic costs of road crashes.



> **contents** 02 | HIGHLIGHTS 04 | THEN, NOW + TOMORROW 05 | UNDERSTANDING ROAD CRASHES
06 | SHOWCASE 12 | APPLYING OUR UNDERSTANDING 13 | SHOWCASE 18 | PROJECT INDEX 23 | PUBLICATIONS



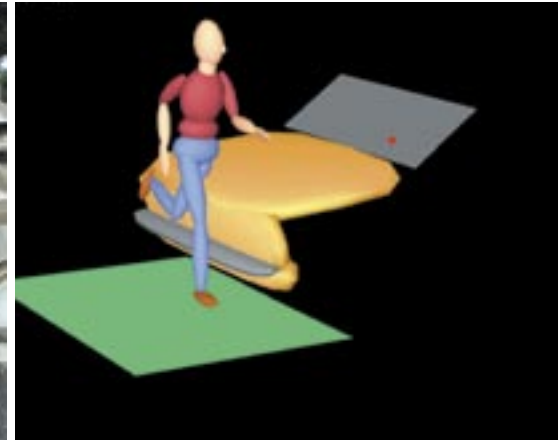
> performance highlights

> IN-DEPTH INVESTIGATIONS BY CASR INTO CRASHES IN METROPOLITAN ADELAIDE HAVE ESTABLISHED CAUSES OF CRASHES AND INJURIES AND PROPOSED POSSIBLE COUNTERMEASURES.

> FURTHER RESEARCH INTO THE MECHANISMS OF BRAIN INJURY DETERMINED RELATIONSHIPS BETWEEN IMPACT AND INJURY. THE RESULTS ARE RELEVANT TO THE IMPROVEMENT OF INJURY CONTROL CRITERIA AND VEHICLE DESIGN STANDARDS.

> AN EVALUATION BY THE CENTRE OF THE EFFECTIVENESS OF THE 50KM/H DEFAULT URBAN SPEED LIMIT IN SOUTH AUSTRALIA HAS IDENTIFIED AN OVERALL REDUCTION IN MEAN SPEEDS AND CRASHES.

> TESTING CONTINUES AT THE CASR IMPACT LABORATORY, THE ONLY FACILITY IN AUSTRALIA OFFERING PEDESTRIAN IMPACT ASSESSMENT FOR CLIENTS, INCLUDING THE AUSTRALIAN NEW CAR ASSESSMENT PROGRAM (ANCAP).



➤ A MAJOR STUDY EXAMINED THE ADJUSTMENTS OLDER DRIVERS MAKE TO THEIR DRIVING BEHAVIOUR IN ACCORDANCE WITH DECLINES IN THEIR FUNCTIONAL AND DRIVING ABILITIES.

➤ CASR MAINTAINS AN ACTIVE CONTRIBUTION TO THE INTERNATIONAL HARMONISED RESEARCH ACTIVITIES PEDESTRIAN SAFETY EXPERT GROUP AND DEVELOPMENT OF IMPROVED COMPUTER SIMULATION OF PEDESTRIAN IMPACTS.

➤ SPEED LIMIT REDUCTIONS AND RAISING THE AGE OF LICENSURE HAVE BEEN HIGHLIGHTED IN A STUDY IDENTIFYING COST-EFFECTIVE ROAD SAFETY MEASURES.

➤ THE CENTRE HAS LAUNCHED A REPORT SERIES TO DOCUMENT PROJECT FINDINGS, COMPLEMENTING OUR ONGOING PROGRAM OF PUBLISHING RESEARCH IN JOURNALS AND CONFERENCE PROCEEDINGS.

➤ CASR DIRECTOR PROFESSOR JACK McLEAN (RIGHT) + DEPUTY DIRECTOR DR ROBERT ANDERSON.



➤ then, now + tomorrow

THE CENTRE FOR AUTOMOTIVE SAFETY RESEARCH AT THE UNIVERSITY OF ADELAIDE, IS INTERNATIONALLY RECOGNISED AS A LEADING RESEARCH ORGANISATION IN ITS FIELD.

IT BEGAN LIFE IN 1973 AS THE ROAD ACCIDENT RESEARCH UNIT (RARU) WITH THE PLANNING AND UNDERTAKING OF AN IN-DEPTH STUDY OF ROAD ACCIDENTS IN THE ADELAIDE METROPOLITAN AREA. FROM 1981 THROUGH 1998, THE UNIT'S WORK WAS SUPPORTED BY A GRANT FROM THE NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL.

During that grant period RARU's research program was concentrated in two areas: the study of brain injury mechanisms in fatally injured road users and the epidemiology of drink driving and alcohol related crashes. Notably, an investigation of the influence of vehicle speed in fatal pedestrian accidents led on to case control studies of the relationship between a driver's travelling speed and risk of involvement in a casualty crash in both urban and rural areas.

RARU's analysis of the occurrence of brain injury in road crashes called into question the then prevailing paradigm of brain injury mechanisms. This prompted the development of an experimental study of axonal injury that, in turn, led to the Japan Automobile Research Institute initiating a formal collaborative research agreement with RARU, and now with CASR, in the area of crash injury biomechanics.

Also a part of our legacy is that over 40 years ago the Centre's Director, Professor Jack McLean, co-authored the first paper in the world to show that car design played a major role in pedestrian protection, revealing that pedestrians are run under, not over, by the striking car.

Today CASR is researching improvements in vehicle design to further protect pedestrians from injury. This work, in collaboration with an international committee and the automobile industry, involves at-scene crash investigations, computer modelling of pedestrian-vehicle collisions and physical reconstruction of the impacts between car and pedestrian.

A stand-out facility is the CASR Impact Laboratory, the only one of its type in Australia. Here, testing of the level of protection given to a pedestrian by new cars is done as part of the Australian New Car Assessment Program (ANCAP).

In investigating crashes at the scene, we focus on the role of driver, vehicle, and road and traffic engineering factors in crash and injury causation. The information collected at the scene and elsewhere is reviewed with the State road authority with a view to making improvements in road safety through changes in legislation and road infrastructure.

Among other initiatives, CASR is contributing to the University of Adelaide's degree in automotive engineering. We are developing a subject on automotive safety, with an emphasis on engineering for prevention of crash injury, to final-year students in the degree.

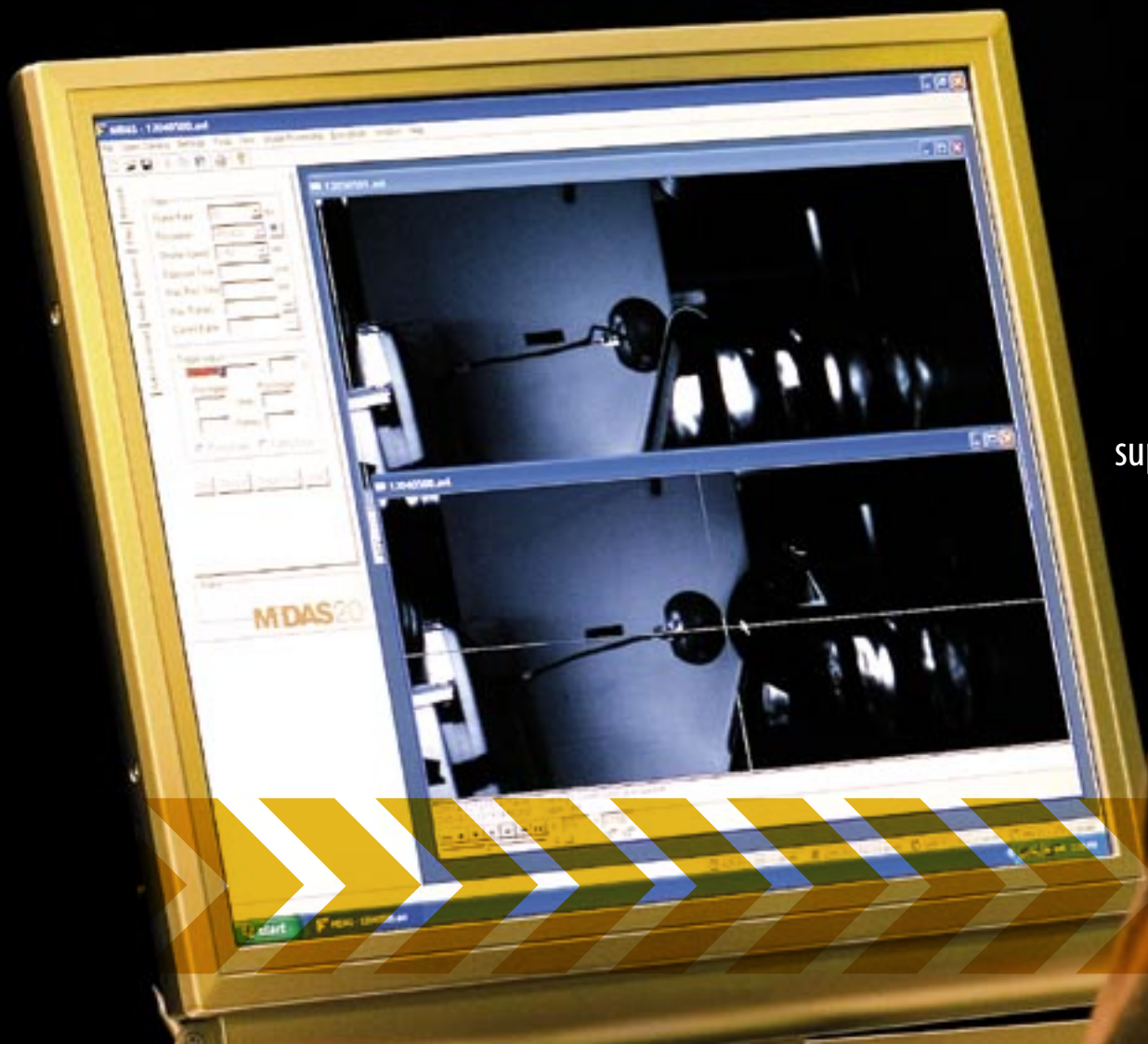
Through our understanding of what happens in road crashes we are well placed to interpret mass accident data from Police reports in evaluating the effectiveness of various road safety measures. We often combine these evaluations with specific studies such as the extent to which older drivers adjust to their declining cognitive abilities with advancing age.

We gratefully acknowledge the sponsorship we receive for our core work from the South Australian Motor Accident Commission and the South Australian Department of Transport and Urban Planning. The Centre also conducts commercial research for other organisations, locally, nationally and overseas.



> understanding road crashes

The complementary traditions of our road safety research – statistical analysis and in-depth crash investigation – are clear strengths of CASR's research program and are supported by laboratory testing and studies of human factors.



➤ crash investigation + reconstruction



CASR'S ON-GOING PROGRAM OF AT-SCENE CRASH INVESTIGATION DISTINGUISHES IT FROM OTHER ROAD SAFETY RESEARCH GROUPS IN AUSTRALIA AND FROM MOST OVERSEAS.

It involves a team of CASR crash investigators attending the scene of a road crash when an ambulance is called. One member of the team photographs the crash scene and marks the final positions of the vehicles, while another investigator identifies the people involved in the crash, including those transported to hospital by ambulance, and attempts to speak with any witnesses to the crash. Detailed photographs and measurements are taken of relevant damage to the vehicles and the site is surveyed and a scale plan prepared. At a later date

information is obtained on the injuries sustained and interviews conducted with those crash participants and witnesses who are willing to be interviewed. Factors involved in the causation of both the crash and the resulting injuries are reviewed at regular CASR meetings. The crash history of the site is then examined and compared with findings from the case review. About 100 casualty road crashes are investigated in this manner each year. Periodical presentations are made to regional managers and senior engineers at the South

Australian Department of Transport and Urban Planning on matters arising from the investigations that are relevant to the safety of particular locations and generally to the safety of the road and traffic system. Our at-scene, in-depth, approach yields a wide range of detailed information that can be gathered in no other way. Two studies by the Centre on travelling speed and the risk of crash involvement were feasible because we were able to collect at the scene the data needed to calculate speeds.

We obtain a much clearer understanding of the nature of road crashes than is possible from the very limited information contained in routine police reports. This is important because the number of topics that could be examined under the heading of road safety research is limitless but many, if not most, would be of little or no value in identifying effective crash and injury countermeasures. With our continuing scrutiny of actual crashes we can be confident that the topics we select for more formal investigation have been wisely chosen.

➤ CASR USING THE POLAR II DUMMY TO RECONSTRUCT AN ACTUAL PEDESTRIAN COLLISION.

CRASH SAFETY TECHNOLOGY DEVELOPS THROUGH BETTER UNDERSTANDING OF THE WAY THE FORCES PRODUCED IN A CRASH ACT ON THE HUMAN BODY, AND THE BODY'S TOLERANCE TO THOSE FORCES. FOR EXAMPLE, THE DESIGN OF A MOTORCYCLE HELMET MUST TAKE ACCOUNT OF THE SPEED AT WHICH AN IMPACT MIGHT OCCUR, THE CHARACTERISTICS OF THE SURFACES THAT THE HELMETED HEAD MAY STRIKE AND THE TOLERANCE OF THE HUMAN HEAD TO IMPACT FORCES.

➤ crash injury biomechanics

Brain injury research

One method to investigate the biomechanical aspects of brain injury causation is crash reconstruction, looking at the mechanisms of injury in crash victims. CASR has unique data on fatal brain injuries, including those sustained by pedestrians, making the biomechanical reconstruction of the brain injuries possible. The data has been compiled in close collaboration with the Division of Tissue Pathology at the Institute of Medical and Veterinary Science in Adelaide, South Australia.

When sufficient information is available from the crash investigation, computer simulation (see later section) is used to estimate the head impact velocity in the collision. Physical reconstructions are performed in the Centre's Impact Laboratory. The information gained enables us to estimate the severity of the impact or and carry out further simulation to estimate the forces generated in

These considerations are used to choose appropriate materials and designs for a helmet, and the manufacturer of the helmet is required to demonstrate the head would be adequately protected in a crash. Similar principles apply across different areas of injury biomechanics.

CASR has a long standing interest in the biomechanics of head and brain injury and injury causation in pedestrian collisions. The way in which the brain is injured in an impact is still not fully understood despite half a century of research on the subject, due to the complex interaction of forces, anatomy and physiology.

Our study of injury causation in pedestrian collisions links into several international projects that are formulating pedestrian safety criteria for new vehicles.

the brain during the impact. In the latter analysis, patterns of stress and strain in the brain tissue are compared with the microscopic distribution of brain injury in the actual case.

Uncertainties in the reconstruction are included in our analyses to allow a probabilistic estimate of head impact conditions. The project overall has involved collaborations with Honda R&D, Japan and Wayne State University, USA.

The combination of medical, analytical, laboratory and field data means we have a unique vantage-point from which to survey and contribute to the literature on brain injury biomechanics. On behalf of the Centre, Professor Jack McLean and Dr Robert Anderson co-authored a chapter for the book "Head Injury" (edited by P Reilly and R Bullock), a text promoted by the prestigious National Neurotrauma Society of the United States.



Computer modelling and reconstruction of pedestrian crashes

CASR continues to develop simulation tools to study how pedestrians are injured in collisions with vehicles. The simulation represents the pedestrian as a 'multi-body' model of segments connected by kinematic joints. The properties of the model are based on the properties of the human body as measured in human volunteer tests, and validated against published data from tests on human cadavers.

The modelling provides for the reconstruction of pedestrian crashes, determining pedestrian kinematics in collisions with various profiles of vehicles, and providing information on head impact speeds typically encountered in the crashes. This in turn is used to assist in the development of test methods to assess the pedestrian safety of vehicles.

Honda R&D Ltd has created a dummy, the POLAR II, for simulating a collision between a car and pedestrian. CASR has conducted several reconstructions of actual accidents to see how the dummy simulation compares with computer modelling, sub-system tests and the actual accident. Much of this work took place at the Japan Automobile Research Institute and at Honda R&D, Tochigi, Japan.

➤ impact laboratory testing



CASR HAS DEVELOPED AN IMPACT LABORATORY TO STUDY THE INFLUENCE OF VEHICLE DESIGN ON PEDESTRIAN INJURY IN A COLLISION. THIS LABORATORY IS A CENTRAL COMPONENT OF OUR PEDESTRIAN SAFETY RESEARCH, WHICH CONSIDERS BOTH ACCIDENT PREVENTION AND INJURY MITIGATION THROUGH VEHICLE DESIGN.

It is the only laboratory in Australia able to conduct pedestrian “sub-system” impact tests on vehicles. These impact tests do not use crash test dummies, as is done with occupant protection, but “sub-system” tests that represent, separately, impacts between the vehicle and the head, upper leg and lower leg of a pedestrian.

The laboratory is used by CASR researchers to reconstruct pedestrian crashes they have investigated, and by government and industry to assess the level of pedestrian safety afforded by vehicles and attachments such as bull-bars.



Australian New Car Assessment Program

One of our most significant clients is the Australian New Car Assessment Program (ANCAP). It provides vehicle buyers with information on the crash performance of vehicles based on crash tests, including side impact tests, offset-frontal tests and pedestrian tests. Since 1999 we have been contracted to perform the latter tests, and since 2000 we have tested 40 vehicles for the program.

Generally, the testing has shown a range of results, with some vehicles clearly designed to ensure some level of protection for pedestrians, while other vehicles have performed very poorly.

Testing the pedestrian safety of vehicles for industry

Our Impact Laboratory is available to industry. Several manufacturers have engaged us to perform development and assessment tests, and other clients include car makers and producers of after-market accessories. Pedestrian safety and vehicle design have not always sat easily together, but regulatory changes overseas have meant manufacturers must now consider pedestrians in the designs of their cars. While there are no regulatory requirements in Australia yet, manufacturers which look to overseas market share will increasingly need to design for, and demonstrate, the pedestrian safety of their cars.

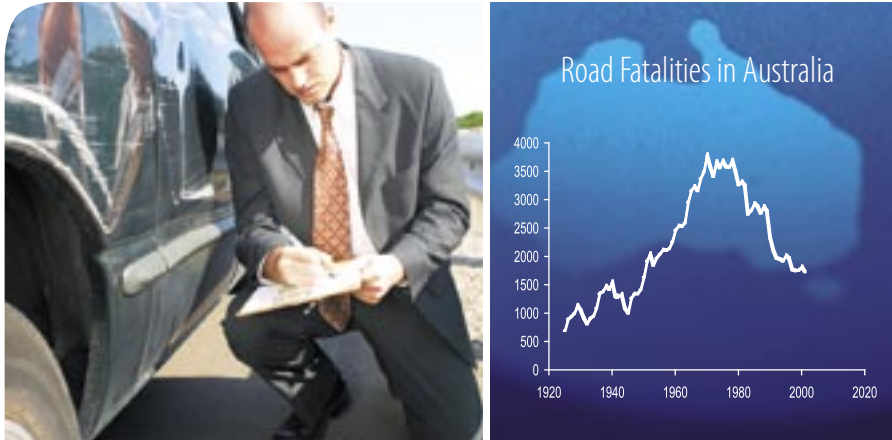
Reconstruction of pedestrian crashes

Our Impact Laboratory was conceived to assist us in studying real-world pedestrian crashes. While computer simulation can tell us something about the motion of a pedestrian in a crash we have investigated, it cannot reliably provide estimates of the severity of impacts on the body of the pedestrian.

Understanding the severity of an impact allows the forces that cause injury to be quantified, and this can lead to a better standard of pedestrian protection. We have used the laboratory extensively in the reconstruction of actual pedestrian crashes in order to relate injuries to the head to the forces that produced the injury. Our expertise in the laboratory complements the unique data on real-world pedestrian injury we have compiled, in building a knowledge bank that will help ensure greater protection of pedestrians in the future.



> analysis of routinely-collected data



IN SOUTH AUSTRALIA AND MANY OTHER JURISDICTIONS, SOME DETAILS ABOUT ROAD CRASHES ARE ROUTINELY RECORDED BY THE POLICE. THIS INFORMATION IS VALUABLE FOR TACKLING MANY RESEARCH QUESTIONS, THOUGH THE BIASES AND ERRORS PRESENT IN ROUTINE DATA ALWAYS NEED TO BE KEPT IN MIND.

For some projects, the tabulation of data is tightly focused on a particular question (eg involving the effect on crashes of some change that has occurred), while other projects are broader and more exploratory in style. Data can be classified and tabulated straight-forwardly, or much more complex processing may be required. Three project examples are:

Tracking trends

Experts and public alike are interested in how the numbers of road crashes of different types have changed over the years. Time series of road crash numbers are presented as tables and graphs in the annual statistical summaries of many jurisdictions. CASR has completed a more detailed study of this kind, utilising the database of road crashes reported to police.

The stimulus for this project was the reduction in traffic fatalities in South Australia between 1981 and 2003 without an accompanying fall in the total number of traffic casualties and recognising that even the number of fatalities declined very marginally since about 1992. In our report, many different disaggregations of data were plotted as time series and it was found that from 1992 there was in fact a continued decline in the fatality rate per distance travelled.

Other sources of data

Although road crash statistics originating from police are useful for many purposes, other sources prove valuable at times. In particular, mortality and hospital in-patient statistics often give better information about injury. Some of our research also involves interrogating or analysing other large databases or datasets (eg driver licences, vehicle registrations and travel surveys).

Driver licensing

It is well known that young, inexperienced drivers have a disproportionate number of crashes. Licensing of drivers therefore is an important to help manage this problem. In 2004, at the request of the South Australian Minister for Transport, Sir Eric Neal (Chair of the South Australian Road Safety Advisory Council) held an enquiry into the novice driver licensing system, assisted by CASR.

An unusual feature of the licensing system is that two methods are available – a vehicle on-road test and competency-based training. CASR staff constructed and analysed a dataset consisting of the records of 18 to 25 year-old, newly-licensed drivers including whether they had a road crash within 180 days of getting their Provisional licence. The data included all drivers in that age range in South Australia who gained their Provisional licence in the years 1998 to 2002.

We examined if certain characteristics of the drivers influenced the probability of crashing. These characteristics were: age, sex, area of residence, method by which they obtained their licence, and the period spent on an L (Learner's) permit. No clear evidence of any differences between the two methods of licensing in respect of subsequent crash experience was detected. Further, there was no evidence that examiners or instructors differed in respect of the subsequent crash experience of their students.

➤ human factors research

THE HUMAN OPERATOR (DRIVER, RIDER, PEDESTRIAN) INVARIABLY IS IMPLICATED IN INVESTIGATIONS OF ROAD CRASHES. UNDERSTANDING THE DIFFICULTIES FACED BY, AND THE NEEDS OF, THE OPERATORS WHEN THEY USE THE ROAD SYSTEM IS A KEY CONCERN IN IDENTIFYING HOW CRASHES CAN BE PREVENTED. IF TASKS CONFRONTING ROAD USERS CAN BE MADE EASIER THEN FEWER MISTAKES WILL HAPPEN, LEADING TO FEWER CRASHES.

Such an understanding is best reached through multi-disciplinary teams embracing fields such as psychology, health and engineering. By employing experts in a variety of disciplines, CASR is able to study effectively the human factors that contribute to crash occurrence. Our studies may be observational in nature, or involve interviews, focus groups, laboratory testing or analysis of data from in-depth crash investigation.

We are experienced in testing various aspects of functioning required for safe driving. These include sensory abilities (particularly vision), physical abilities (such as head-neck flexibility) and cognitive abilities (such as visual attention and speed of information processing), with some experiments using instrumented vehicles driven on a closed-road circuit. Furthermore, we run studies utilising standardised on-road driving tests conducted by driving instructors and occupational therapists that yield detailed assessments of a person's fitness to drive. As methodologies featuring driving tests are difficult to

implement, few other road safety research bodies in the world have the capability to employ them.

CASR has concluded a three-year study of older drivers designed to show a comprehensive picture of the nature of the self-regulatory practices of drivers in this age group. Over 100 drivers were asked to complete a detailed questionnaire about their driving behaviour, a series of functional tests, and a standardised driving test on public roads. This study enabled an investigation of the extent to which older drivers are able to amend their driving behaviour in accordance with declines in their functional and driving abilities.



An ongoing study at CASR aims to isolate subgroups of younger drivers who have a high likelihood of crash involvement. Using questionnaires completed by younger drivers recruited from the general community and by younger drivers who have lost their probationary licences, we are exploring the relationships between driver personality, experience, risky driving behaviours and crash involvement.

Both the older driver and young driver studies have been done in collaboration with the University of Adelaide's Department of Psychology. Additional collaboration with the Department is aiding examination of the Useful Field of View test.

This commercially available test measures visual perception, and is claimed by its manufacturers to be especially useful in determining the crash risk of older drivers. We will examine whether the test does

measure something unique or if it explains nothing beyond basic processes that can be measured more simply and for a lower cost.

Another CASR project examined the use of child restraints in cars. This comprised an observational study of the prevalence of use, and the interviewing of adult drivers to assess their knowledge, attitudes and practices pertaining to the child restraints. This identified factors related to either not using the restraints, or incorrect use of restraints, which in turn offers information to develop and target necessary interventions.

➤ literature reviews

THESE REVIEWS BRING TO LIGHT THE CURRENT STATE OF KNOWLEDGE ABOUT A TOPIC AND AID IN IDENTIFYING ISSUES THAT NEED TO BE RESOLVED THROUGH FURTHER RESEARCH. OFTEN, IT IS ONLY AFTER PREVIOUS RESEARCH HAS BEEN EXAMINED THAT AN APPROPRIATE FOCUS CAN BE BROUGHT TO PROPOSED RESEARCH QUESTIONS. IN MANY CASES, A REVIEW OF LITERATURE IS SUFFICIENT TO DETERMINE THE BEST POLICY FOR A PARTICULAR ROAD SAFETY ISSUE OR PROBLEM.

CASR's long-held priority has been the development and maintenance of its world-class road safety research library. In addition to library searches, up-to-date knowledge also is obtained at conferences and professional meetings.

Staff at CASR have reviewed the literature on numerous road safety topics. One of the most extensive reviews concerned older drivers. It critically analysed the literature dealing with crash involvement rates and patterns of older drivers, the health-related and functional correlates of crash involvement and deficits in on-road driving ability, and the means by which older driver crash rates can be reduced. It gave the necessary background for a large-scale study of the self-regulation of driving behaviour practised by older drivers in South Australia.

Another review tackled issues associated with the high crash rates of younger drivers. Specifically, it focused on the possible role of personality, as well as the motivations and attitudes of younger driver subgroups. Together with a review of the relationship between crash culpability and prior driving records, this review yielded the knowledge used to shape a major study of younger drivers.



As part of a multi-faceted study into rear end crashes, literature pertaining to the nature and possible means of reducing such crashes was reviewed. This considered factors associated with drivers (eg attention), vehicles (eg crash avoidance systems) and road infrastructure (eg pavement skid resistance) so that all factors contributing to rear end crashes could be identified. It enabled a full discussion of the methods available to reduce the occurrence of rear end crashes, and was complemented by an examination of both in-depth and routinely collected crash data.

Other recent reviews focused on the causes of crashes at signalised intersections and the degree to which road safety policy evaluations typically conform to the evidence-based methods used in medicine and other fields. Forthcoming reviews will cover the



desirability of permitting U-turns at intersections and the best methods for evaluating the driving ability of medically referred drivers.

Additionally CASR is well positioned to conduct meta-analyses of previous research. Such analyses increasingly are being advocated in medicine and social science, and are a valid way to review previous work pertaining to many facets of road safety. Meta-analyses emphasise a tightly specified research question, selection of relevant studies of high quality, and some form of averaging of the results from these studies. The availability of a comprehensive library and considerable statistical expertise at the Centre make the use of meta-analyses possible for appropriate projects.

➤ applying our understanding

We apply our understanding of road crashes to tangible effect. We nurture active local, national and international collaborations with government and industry, find commercial applications for technology we develop, and inform the wider community of the latest findings of road safety research.

➤ countermeasure evaluation

MUCH OF THE ROAD SAFETY PROBLEM IS DUE TO THE LEGACY OF ROAD TRANSPORT NETWORKS DESIGNED TO DIFFERING STANDARDS AND PHILOSOPHIES IN YEARS GONE BY. GOVERNMENTS NOW WANT TO IMPROVE THESE NETWORKS AND THE WAY IN WHICH THEY ARE USED. EXAMPLES OF POSSIBLE IMPROVEMENTS INCLUDE THE INSTALLATION OF CRASH BARRIERS, CHANGING ROAD GEOMETRY, ADOPTION OF EMERGING INTELLIGENT TRANSPORT SYSTEM TECHNOLOGIES AND LOWER SPEED LIMITS.

However the expectations of the effectiveness of some road crash countermeasures often far exceed actual benefits, and the way in which the benefits are delivered is often misunderstood and sometimes counterintuitive. With few exceptions, countermeasures commonly adopted tend to deliver small incremental improvements to the overall road situation, usually over long periods, such as through the introduction of speed cameras or shoulder sealing on major highways.

With backgrounds spanning decades in road safety research, CASR staff have a comprehensive understanding of the role and application of countermeasures. We frequently undertake research combining behavioural studies, mass data analysis and process reviews to determine the impact of specific actions. The outcomes help ensure governments can make informed decisions about protecting the community using limited resources in an efficient manner.

50km/h speed limit

On 1 March 2003, the default urban speed limit in South Australia changed from 60 to 50km/h. This meant that unless otherwise signed, motorists had to assume the lower limit applied. In a study commissioned by South Australia's Department of Transport and Urban Planning, CASR was provided with data on speeds at 52 randomly selected sites across the state on a variety of road types prior to and a year after the introduction of the change. Crash data also was compared for the 12 months before and after.

Our report included analyses of both vehicle speeds and crashes, comparing the 12 months before the change with the 12 months after. We found that on roads where the speed limit was reduced from 60 to 50 km/h, average vehicle speeds decreased by 2.3 km/h and casualties by 24 per cent. Interestingly, the effect seems to have spread to roads where the speed limit remained at 60 km/h: on such roads, average vehicle speeds dropped by 0.9 km/h and casualties by 7 per cent.



Evaluation of the red light and speed camera program

This study scrutinised the number and types of crashes at locations in Adelaide, South Australia where red light cameras have been installed. While there are indications that cameras installed in 1988 did reduce the incidence of some types of road crash, the cameras installed in 2001 appear to have had no effect. It is suggested inadequate driver awareness of the 2001 camera locations is the primary reason for this outcome. Initial results from combined red light and speed camera operations also were examined and their potential benefit assessed.

Cost-effective road safety measures

The Centre was asked by South Australian Government agencies to identify cost-effective road safety measures with a real potential to significantly reduce the number of crashes resulting in one or more fatalities or hospital admissions. We first made estimates of the effectiveness of a wide range of measures and extracted from records the number of serious casualty crashes potentially affected by each measure.

The crash figures then were combined to produce an estimated reduction in all serious casualty crashes in South Australia for each measure, and the cost to government of implementing each measure was calculated. Among the most effective measures identified were speed limit reductions, raising the age of licensure and the sealing of shoulders on the outside of curves.

Right turn crashes at signalised intersections

The issue of right turn crashes at Adelaide's signalised intersections has been investigated through a literature review, followed by analyses of relevant South Australian fatal crashes and Adelaide metropolitan crashes reported to the police, plus in-depth crash investigation. Right turn crashes at signalised intersections were found to be relatively common and involved both older and younger drivers. Full control of right turn movements at all times of the day appears to be the most effective treatment, while dedicated right turn lanes and the use of red light and speed cameras also appear to offer some safety benefits.

> informing government + community



CASR HAS A STRONG CHARTER TO SERVE GOVERNMENT AND THE COMMUNITY AND STRIVES TO DISSEMINATE ITS KNOWLEDGE AND EXPERTISE AS WIDELY AS POSSIBLE. AS WELL AS PUBLISHING RESEARCH FINDINGS IN JOURNAL ARTICLES AND CONFERENCE PAPERS, WE HAVE LAUNCHED A REPORT SERIES TO PROVIDE CONSISTENT AND COMPLETE DOCUMENTATION OF OUR WORK IN THE PUBLIC DOMAIN.



An influential body we assist is the Road Safety Advisory Council, established by the Government of South Australia in 2003 to advise and inform it of road safety strategies and initiatives. The Director of CASR is a member of the Council and our senior researchers are in the Council's Taskforces that focus on areas including roadside hazards, alcohol and drugs, medical fitness to drive and road safety education.

Supporting the Centre's functions, we maintain the premier library of road safety material in Australia. The library offers researchers access to the world's



main journals, the latest research reports, books and conference proceedings and, importantly, significant holdings of archival items.

This bank of knowledge is made more widely available through the authoring of electronic fact sheets — disseminating the findings of academic research in short, easy to read questions and answers suitable for schools and community interest groups. The library also has an email news-alert service, advising road safety professionals of the latest developments in Australia and internationally.



The Centre's website (<http://casr.adelaide.edu.au>) is an avenue for not only the promotion of activities and services but for the provision of road safety information resources, including electronic copies of Centre reports and current awareness bulletins listing recently published items added to the library's collection.

The delivery of safety information also includes speaking engagements by Centre staff and media interviews.

CASR DEVELOPS TECHNOLOGIES RELATED TO ITS RESEARCH. WE DO THIS TO MAKE THE INTELLECTUAL OUTPUT OF THE CENTRE AVAILABLE TO THE COMMUNITY AND RELEVANT INDUSTRIES.

technology development

Laser Speed Measurement Device

CASR's Laser Speed Measurement Device (LSMD) is designed for use in crash testing laboratories and for pedestrian sub-system testing in particular. The speed of a projectile in a crash test or impact test needs to be measured and this is especially difficult in pedestrian sub-system testing where the headform or legform is launched at various angles and is in free flight for only a short period before impact.

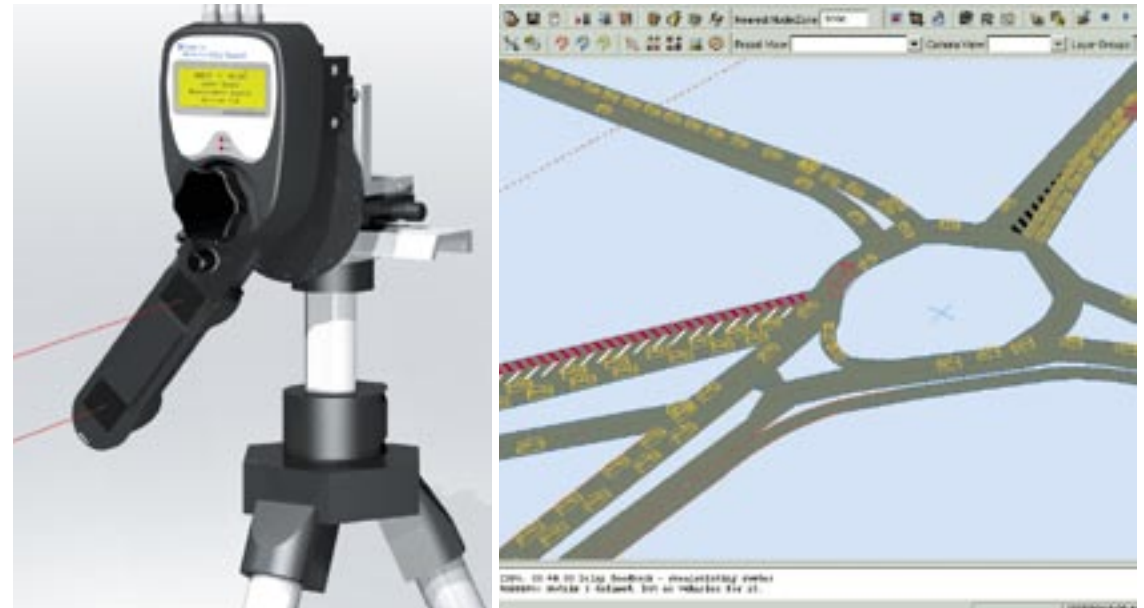
So we developed a speed measurement device using two lasers matched to two sensors: the projectile breaks each laser beam in sequence. The time between these events is measured and as the distance between the lasers is known, the speed can be calculated. Originally created as a working prototype for use in our own laboratory, the LSMD is being commercialised with the assistance of Tiller and Tiller, one of Australia's leading industrial design firms.

Traffic micro-simulation to assess the impact of ITS technology

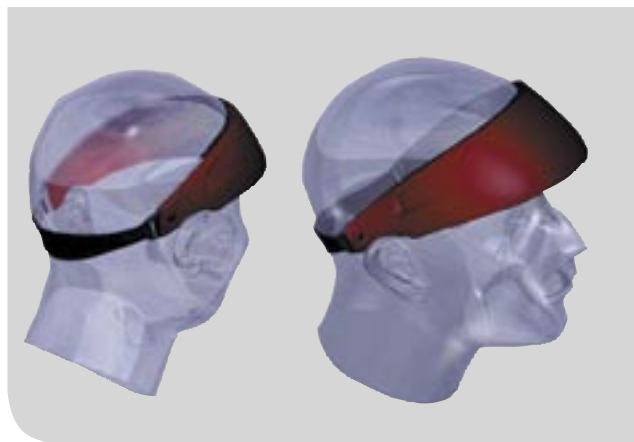
Intelligent Transportation Systems (ITS) promise the possibility of more efficient and safer transportation. CASR, with the Transport Systems Centre at the University of South Australia, is studying the effect of ITS in an Australian Central Business District (CBD) environment. This is being funded jointly by CASR and the Australian Research Council.

Traditionally ITS effects have been hard to quantify due to difficulties in isolating network effects, and

➤ LASER SPEED MANAGEMENT DEVICE DEVELOPED BY CASR (LEFT) AND EXTRACT FROM MICROSIMULATION PROJECT SHOWING BRITANNIA ROUNDABOUT, ADELAIDE, SOUTH AUSTRALIA.



limitations with normal traffic models. Our project therefore takes advantage of state-of-the-art traffic microsimulation models to test various ITS scenarios in an accurate representation of a real world CBD. The model provides a tool for studying the effect on traffic flows of safety related traffic controls.



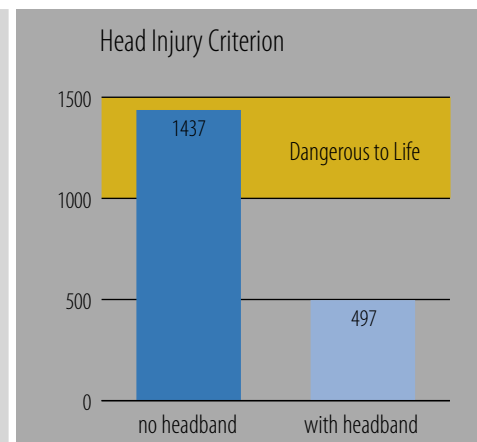
Padded headband

We have pursued the development of head protection for car occupants – the CASR headband – for some years. This arose from a request by the Federal Office of Road Safety to estimate the effect of mandating the padding of the upper interior of passenger cars, which meant looking at the structures commonly hit by the head of an occupant in a crash.

An analysis of CASR's previous investigations of fatally injured car occupants showed nearly half of all serious head injuries came from impacts with an area of the head from the forehead to behind the ears. We deduced it was likely that a device padding the head would be more effective than padding the upper interior of the car – it would be protective in about half of all crashes that otherwise would lead to serious head injury.

The Federal Office of Road Safety then sponsored a series of projects, asking the Centre to develop concepts of what form the protective headband might take. It was recognised the purpose of the proposed device was to provide protection to drivers of older vehicles not equipped with advanced crash protection (the median age of the vehicle fleet in South Australia being around 11 years).

Prototype headbands have demonstrated a significant protective effect in simulated frontal impacts.



TARS interface

The Traffic Accident Reporting System (TARS) provides the official record of traffic accidents in South Australia. It consists of three linked databases (crashes, units and casualties). Analysis of the data in the past has required specialised skills and a close knowledge of the databases' structure.

To assist our own research, we have developed a web-based interface with TARS, permitting easily customised queries to be made, with results displayed as cross-tabulations – for example, crashes of a particular type by time of day and day of week for a series of years – or as histograms such as the distribution of ages of fatally injured pedestrians. Analyses of the crash history of a particular road or

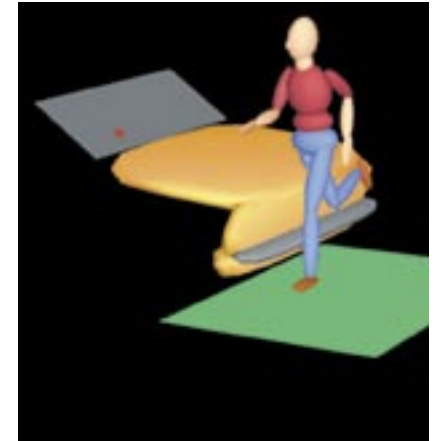


intersection also can be performed, and we are able to examine the effect of changes to urban speed limits in given locations.

The Department of Transport and Urban Planning maintains TARS and has access to our web-based interface to answer its own queries. Opportunity exists to provide access to the interface to a wider range of users, including local government agencies.

international status

WE RANK THE QUALITY OF OUR RESEARCH ON A WORLD-WIDE BASIS, WITH ONE MEASURE OF OUR SUCCESS BEING THE LEVEL OF RECOGNITION OUR STAFF AND THE WORK OF THE CENTRE RECEIVE FROM RESEARCHERS AND SIMILAR ORGANISATIONS IN OTHER COUNTRIES.



- In 2004 CASR's Director, Professor Jack McLean, was one of 21 invited participants at an experts meeting on International Drugged-Driving Research Initiatives convened in Glasgow by the United States National Institute on Drug Abuse.
- We participate in the International Harmonised Research Activities Pedestrian Safety Expert Group which is charged with developing internationally acceptable vehicle impact tests to set the level of protection afforded a pedestrian in the event of a collision. Professor McLean is the Australian representative on the Expert Group and our Deputy Director, Dr Robert Anderson, chairs the Computer Modelling Committee.

- The Centre actively contributes to the International Research Council on the Biomechanics of Impact (IRCOBI). Professor McLean is a member of the Council and CASR papers have been presented on a regular basis to the annual IRCOBI conference on crash injury research.
- Centre senior researcher Dr Jeremy Woolley is the International Scientific Committee member for Australia of the Eastern Asia Society for Transportation Studies (EASTS). This gives close working links with key people in Asian countries and involvement in the organisation of the Society's biennial conference.

- In 1997 CASR was the first research organisation outside Japan to enter into a research contractual arrangement with the Japan Automobile Research Institute. Initial work has been on brain injury mechanisms. We have a similar arrangement with Honda R&D Company Ltd.
- A study of pedestrian accidents in Adelaide is being conducted for Mitsubishi Motor Corporation in Japan, and Mitsubishi Motors Australia Ltd, with emphasis on vehicle factors, including computer modelling and physical reconstruction of selected cases in our Impact Laboratory.

- The International Council on Alcohol, Drugs and Traffic Safety (ICADTS) has for more than 50 years been the pre-eminent international body in these areas. In 1995 we convened the biennial international conference of ICADTS in Adelaide and for the following two years, CASR Director Professor McLean, served as the Council's President. We now host and maintain the ICADTS home page.

Along with the direct benefits emanating from these international activities we gain a clearer and more timely understanding of relevant research completed or in progress in other countries. This prevents needless duplication of research or laboratory demonstration programs.

> project index

THE FOLLOWING CASR PROJECTS WERE ACTIVE IN 2004. REPORTS MAY BE VIEWED ON OUR WEBSITE: WWW.CASR.ADELAIDE.EDU.AU



50KM/H ON LOCAL STREETS EVALUATION

Review of the effects of the default 50km/h urban speed limit in South Australia. It affected mainly local streets and came into effect on 1 March 2003. Published as part of the CASR Report Series. Contact: Craig Kloeden (craig@casr.adelaide.edu.au)

ACCURACY OF EYE-WITNESS ACCOUNTS OF CRASHES

Comparison of information obtained from drivers involved in road crashes with corresponding information collected by crash investigators. Paper presented to the 2004 Road Safety Research, Policing and Education Conference, Perth, Western Australia. Contact: Sean Versteegh (sean@casr.adelaide.edu.au)

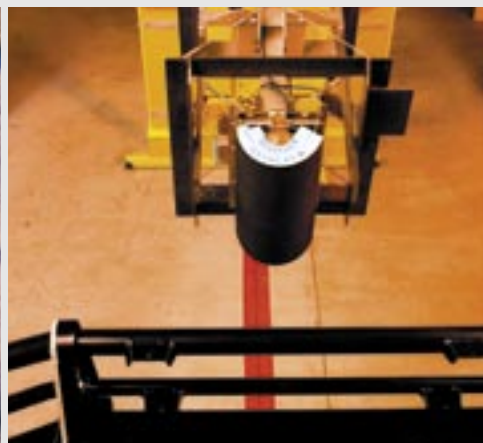


ANCAP PEDESTRIAN TESTING

Ongoing — testing of vehicles for the pedestrian component of the Australian New Car Assessment Program (ANCAP) vehicle crash performance ratings. Contact: Robert Anderson (robert@casr.adelaide.edu.au)

ANNUAL PERFORMANCE INDICATORS FOR ENFORCED BEHAVIOURS

Yearly review of police enforcement of traffic law in South Australia with particular reference to drink driving, speeding and restraint usage. Published as part of the CASR Report Series. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)



BEST PRACTICE CRITERIA IN PRACTICAL DRIVING TESTS OF MEDICALLY REFERRED DRIVERS

Ongoing — compilation and analysis of Australian and international methods for practical assessment of fitness to hold a driver's licence with regard to medical conditions. Contact: Matthew Baldock (matthew@casr.adelaide.edu.au)

BICYCLE HELMET WEARING SURVEY

Observational survey of bicycle helmet wearing by school children in South Australia conducted in collaboration with the Department of Health. To be included in the CASR Report Series. Contact: Robert Anderson (robert@casr.adelaide.edu.au)

BULLBARS AND PEDESTRIANS

Investigation of the role bullbars may have in increasing the severity of pedestrian injuries. Involving work in the CASR Impact Laboratory and use of data from in-depth crash investigations. To be included in the CASR Report Series. Contact: Robert Anderson (robert@casr.adelaide.edu.au)

CAUSES OF CRASHES AT SIGNALISED INTERSECTIONS

Literature review examining crashes at signalised intersections and analysis of data on these crashes in South Australia. To be included in the CASR Report Series. Contact: Craig Kloeden (craig@casr.adelaide.edu.au)

CHILDREN IN ADULT SEAT BELTS

Ongoing — study of child restraint usage in South Australia in cooperation with the Department of Health. Includes a description of injury patterns, observational and interview surveys. Contact: Robert Anderson (robert@casr.adelaide.edu.au)

COST EFFECTIVE COUNTERMEASURES FOR SOUTH AUSTRALIA

Identification and cost-benefit analysis of road crash countermeasures with potential to reduce serious casualty crashes in South Australia over the period 2003 to 2010. To be included in the CASR Report Series. Contact: Craig Kloeden (craig@casr.adelaide.edu.au)

CREATING A COMMUNITY ROAD SAFETY RESOURCE

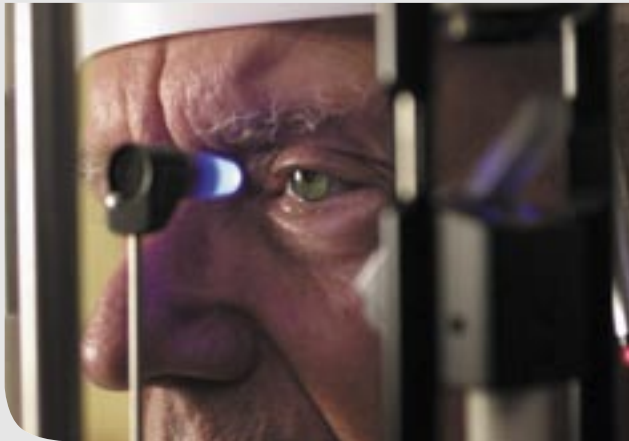
Ongoing — production of fact sheets offering questions and answers relating to road safety topics and targeted at the general public. Contact: Andrew Meier (andrew@casr.adelaide.edu.au)

CRITICAL REVIEW OF LITERATURE ON CANNABIS AND CRASH RISK

Literature review examining the relationship between cannabis use and the risk of crash involvement in the light of recently published research on the subject. To be included in the CASR Report Series. Contact: Matthew Baldock (matthew@casr.adelaide.edu.au)

DEVELOPMENT OF A PROTECTIVE HEADBAND FOR CAR OCCUPANTS

Ongoing — Assessment of production and marketing considerations for a protective headband developed by CASR for use by the occupants of cars without airbags. Contact: Jack McLean (jack@casr.adelaide.edu.au)



DEVELOPMENT OF PERIPHERAL VISION TESTS FOR DRIVER ASSESSMENT

Evaluation of a software program designed to test peripheral vision capabilities of older drivers. Project work by the Psychology Department of the University of Adelaide. To be included in the CASR Report Series. Contact: Matthew Baldock (matthew@casr.adelaide.edu.au)

DOCUMENTING THE TARS DATABASE

The Traffic Accident Reporting System (TARS) database contains information on road crashes reported to the police in South Australia. This project involved documenting the structure of the database, the variables used and changes in recording and coding practices over time. It will assist in the interpretation of data both within the Centre and for external users such as those using WebTARS. Contact: Craig Kloeden (craig@casr.adelaide.edu.au)



ECONOMIC COST OF ROAD CRASHES

Assessment of the economic costs of road crashes in South Australia for the year 2002 using Bureau of Transport and Regional Economics costings. To be included in the CASR Report Series. Contact: Matthew Baldock (matthew@casr.adelaide.edu.au)

EDGE DELINEATION

Examination of issues related to tactile lane markings on road edges including cost-effectiveness as a crash prevention measure. To be included in the CASR Report Series. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)

ELDERLY DRIVERS: CRASH CAUSES AND PERFORMANCE

Following on from the findings of a PhD thesis, further examination of older driver issues in crashes using data from CASR in-depth crash investigations. To be included in the CASR Report Series. Contact: Matthew Baldock (matthew@casr.adelaide.edu.au)



EVALUATION OF RED LIGHT AND SPEED CAMERA PROGRAM

This project compared crash rates at Adelaide signalised intersections before and after red light cameras were installed. It also examined speeds of vehicles travelling through selected intersections and made recommendations about the use of red light and speed cameras at signalised intersections. To be included in the CASR Report Series. Contact: Craig Kloeden (craig@casr.adelaide.edu.au)

EVALUATION OF YOUTH DRIVER EDUCATION PROGRAM

Assisting the South Australian Police Force to review the effectiveness of its student driver education program through statistical analysis of data collected on participants. Contact: Paul Hutchinson (paul@casr.adelaide.edu.au)



EVALUATION OF THE SOUTH AUSTRALIAN ALCOHOL INTERLOCK SCHEME

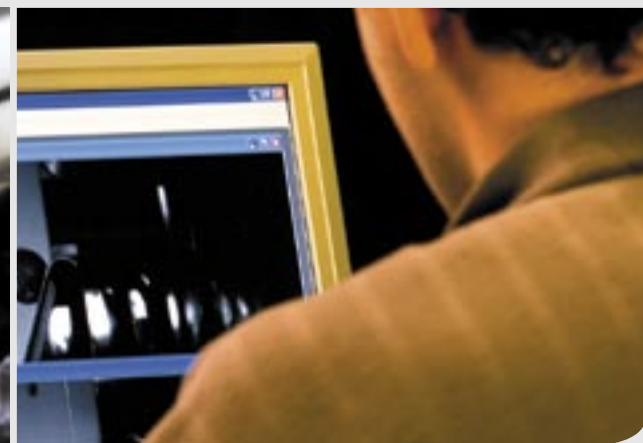
Review of the Alcohol Interlock Scheme that commenced operation in South Australia in 2001. Includes interviews with administrators, counsellors and participants. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)

FRONT SIDE WINDOW TINTING: VLT REQUIREMENTS

A literature review and visual task assessment of the extent to which dark tinting of the front side windows of a car affects a driver's ability to detect the presence of other road users. Published as part of the CASR Report Series. Contact: Jack McLean (jack@casr.adelaide.edu.au)

HEAD INJURY STUDY

Ongoing - investigation into the mechanisms of brain injury including further testing of a finite element model of the skull and brain. Contact: Robert Anderson (robert@casr.adelaide.edu.au)



IHRA PEDESTRIAN SAFETY ACTIVITY

Ongoing representation on the International Harmonized Research Activities Pedestrian Safety Expert Group and further development of the IHRA computer model of the pedestrian-car collision. Contact: Jack McLean (jack@casr.adelaide.edu.au)

IMPACT OF LATE NIGHT BUS SERVICES

Cost-benefit analysis of the "Wandering Star" bus service, introduced to discourage drink driving through the provision of late night transportation of patrons from designated stops in metropolitan Adelaide. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)

IMPEDIMENTS TO USE OF CHILD RESTRAINTS

Exploration of the social, educational and economic barriers that may exist to prevent South Australian families fully accessing correct child restraints; connected to work undertaken in the study Children in adult seat belts. To be included in the CASR Report Series. Contact: Robert Anderson (robert@casr.adelaide.edu.au)

LASER SPEED MEASUREMENT DEVICE

Ongoing — refinement and commercialisation of an impact testing measurement tool that incorporates lasers and sensors to assist in calculating projectile speeds. Contact: Robert Anderson (robert@casr.adelaide.edu.au)

METHODOLOGY OF EVALUATING INTERVENTIONS

Examination of evidence-based research methods in the field of road safety including the extent to which these have been used and implications for the future. Papers presented to the 2004 Australasian Transport Research Forum, Adelaide, South Australia and the 2004 Road Safety Research, Policing and Education Conference, Perth, Western Australia. Contact: Paul Hutchinson (paul@casr.adelaide.edu.au)

METRO AT-SCENE CRASH INVESTIGATION

Ongoing at-scene investigation of casualty crashes in metropolitan Adelaide to identify factors contributing to the causation of the crash and the resulting injuries and to propose possible countermeasures. 189 crashes were investigated from July 2003 to the end of December 2004. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)

NECK INJURIES

Ongoing — comprehensive report on whiplash disorders encompassing epidemiology, clinical interventions, biomechanics and biomechanical interventions. Contact: Robert Anderson (robert@casr.adelaide.edu.au)

PERFORMANCE OF ROAD SAFETY AUDITS

Ongoing — evaluation of road safety audit processes currently practised at state and local government levels. Data from CASR in-depth crash investigations is used to establish what role a road safety audit may have had in influencing the crash outcome. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)



REAR-END CRASHES

Incorporates the work of the CASR in-depth crash investigation team to examine rear-end crash causal factors and identify possible countermeasures; also includes a literature review. To be included in the CASR Report Series. Contact: Matthew Baldock (matthew@casr.adelaide.edu.au)

ROLL-OVER CRASHES

Analysis of rollover crashes in South Australia using data from the Traffic Accident Reporting System. Includes literature review with emphasis on vehicle design issues. To be included in the CASR Report Series. Contact: Jack McLean (jack@casr.adelaide.edu.au)



SHOULD U-TURNS BE PERMITTED AT INTERSECTIONS IN SOUTH AUSTRALIA?

Review of literature and the experiences of other Australian states and territories to determine the implications of introducing the Australian Road Rule allowing U-turns at signalised intersections where a sign is erected. To be included in the CASR Report Series. Contact: Paul Hutchinson (paul@casr.adelaide.edu.au)

SPEED RECONSTRUCTION FROM CRASH SCENE DATA

Testing of devices fitted to a vehicle in an effort to examine the relationship between crash scene skid marks and the speed of the vehicle from the moment of braking to impact. To be included in the CASR Report Series. Contact: Robert Anderson (robert@casr.adelaide.edu.au)



TRAFFIC MICRO-SIMULATION

Ongoing — investigation of the advantages and disadvantages of using Intelligent Transport Systems (ITS) technologies, with a state-of-the-art traffic micro-simulation model testing scenarios on a duplicate of the Adelaide Central Business District. Undertaken in conjunction with the Transport Systems Centre of the University of South Australia and the Adelaide City Council. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)

TRENDS IN CASUALTY AND FATAL CRASH NUMBERS IN SOUTH AUSTRALIA

Examines the road crash statistical trend over the past two decades that has seen a general decline in fatalities but a rise in casualties. To be included in the CASR Report Series. Contact: Paul Hutchinson (paul@casr.adelaide.edu.au)



TRIAL OF A DYNAMIC SPEED FEED-BACK SIGN

Evaluation of the effects that a sign that measures and displays the speed of a passing vehicle has on vehicle speeds on metropolitan arterial roads. Sub-contracted project with the Transport Systems Centre, University of South Australia. To be included in the CASR Report Series. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)

WHY DOES CRASH RISK RISE DURING THE DAY?

Literature review and data analysis examining possible causes for the increase in serious crash risk from mid-morning to late evening. Sub-contracted project with the Transport Systems Centre, University of South Australia. To be included in the CASR Report Series. Contact: Jeremy Woolley (jeremy@casr.adelaide.edu.au)

> selected publications

Journal articles

Anderson RWG, Brown CJ, Blumbergs PC, McLean AJ, Jones NR (2003) **'Impact mechanics and axonal injury in a sheep model.'** Journal of Neurotrauma; 20(10): 961-974

Anderson R, Streeter L, Ponte G, van de Griend M, Lindsay T, McLean J (2003) **'Pedestrian subsystem head impact results reflect the severity of pedestrian head injuries.'** International Journal of Vehicle Design; 32(1/2): 1-15

Klungboonkrong P, Woolley J (2003) **'Modelling the environmental adaption of a collector road in an area of high pedestrian activity in the City of Khon Kaen.'** Transport Engineering in Australia; 9(1): 25-34

CASR report series

Reports are available online at: www.casr.adelaide.edu.au/reports.html

Baldock MRJ, McLean AJ, Kloeden CN (2004) **'Front side window tinting visual light transmittance requirements.'** CASR Report Series CASR002. 13pp

Kloeden CN, Woolley JE, McLean AJ (2004) **'Evaluation of the South Australian default 50km/h speed limit.'** CASR Report Series CASR005. 37pp

Wundersitz LN, McLean AJ (2004) **'Annual performance indicators of enforced behaviours, 2002.'** CASR Report Series CASR001. 54pp

Reports

Anderson R, Streeter L, Ponte G, Van de Griend M, McLean J (2003) **'Vehicle safety standards report: Vehicle design and operation for pedestrian protection - Accident simulations and reconstructions.'** Canberra: Department of Transport and Regional Services

Harrison W, Newman S, Baldock M, McLean J (2003) **'Drink driving enforcement: Issues in developing best practice.'** Sydney: Austroads. 78pp

McLean J [technical committee member] (2004) **'Interventions'** in world report on road traffic injury prevention. Geneva: World Health Organization, pp 107-154

Thesis

Baldock MRJ (2004) **'Self-regulation of the driving behaviour of older drivers.'** Thesis submitted for the degree of Doctor of Philosophy, University of Adelaide. 420pp

Conference papers

Anderson R (2004) **'Finite element modelling of impact-induced axonal injury in sheep'** in Proceedings of 7th International Neurotrauma Symposium, 12-16 September 2004 Adelaide, South Australia. Bologna: Medimond

Anderson R, McLean J, Ponte G, Lindsay T, Wundersitz L (2004) **'Patterns in the incidence and consequences of pedestrian accidents'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia: volume 1: peer reviewed papers. Perth: Office of Road Safety

Anderson R, McLean AJ, Streeter L, Ponte G, Sommariva M, Lindsay T, Wundersitz L (2002) **'Severity and type of pedestrian injuries related to vehicle impact locations and results of sub-system impact reconstruction'** in Proceedings of International IRCOBI Conference on Biomechanics of Impact, 18-20 September 2002 Munich, Germany. Bron, France: International Research Council on Biomechanics of Impact, pp 289-299

Anderson R, Ponte G, Streeter L (2002) **'Development of head protection for car occupants'** in Proceedings of Road Safety Research, Policing and Education Conference, 4-5 November 2002 Adelaide, South Australia: volume 1. Burnside: Plevin and Associates, pp 9-14

Baldock MRJ (2004) **'Self-regulation of driving and its relationship to driving ability among older adults.'** Presented to 3rd International Conference on Traffic and Transport Psychology, 5-9 September 2004 Nottingham, United Kingdom. Paper online at: <http://www.psychology.nottingham.ac.uk/IAAPdiv13/ICTTP2004papers2/Ageing/Baldock.pdf>

Baldock MRJ, Kloeden CN, McLean AJ (2002) **'In-depth study of rural road crashes in South Australia'** in Proceedings of 16th International Conference on Alcohol, Drugs and Traffic Safety (pp 517-522), 4-9 August 2002 Montreal, Canada

Baldock MRJ, Mathias JL, Kloeden CN, McLean AJ (2002) **'The effects of age on road crash patterns in South Australia from 1994 to 1998'** in Proceedings of Road Safety Research, Policing and Education Conference, 4-5 November 2002 Adelaide, South Australia, volume 1. Burnside: Plevin and Associates, pp 15-20

Baldock MRJ, Mathias JL, McLean AJ, Berndt A (2004) **'Self-regulation of driving and its relationship to driving ability among older adults'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia: volume 2: presented papers. Perth: Office of Road Safety

Baldock MRJ, Matthias JL, Berndt A, McLean AJ (2004) **'Self-reported medication use and on-road driving performance of older drivers'** in Proceedings of 17th International Conference on Alcohol, Drugs and Traffic Safety, 8-13 August 2004 Glasgow, Scotland. Glasgow: Organising committee, ICADTS

Hutchinson TP (2004) **'Control groups, randomisation, double-blinding, meta-analysis: can road safety research learn from evidence-based medicine and social welfare?'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia: volume 1: peer reviewed papers. Perth: Office of Road Safety

Hutchinson TP, Meier AJ (2004) **'Evidence-based road safety policy? Evidence-based transport policy? A discussion of randomised experimentation and meta-analysis in the evaluation of interventions'** in Papers of 27th Australasian Transport Research Forum, 29 September-1 October 2004 Adelaide, South Australia: South Australian Department of Transport and Urban Planning and Transport Systems Centre, University of South Australia

Kloeden CN, McLean AJ, Lindsay V (2004) **'Cost-effective road safety measures for reducing serious casualty crashes in South Australia'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia: volume 1: peer reviewed papers. Perth: Office of Road Safety

Kloeden C, Woolley J, McLean J (2004) **'Evaluation of 50km/h default urban speed limit in South Australia'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia: volume 1: peer reviewed papers. Perth: Office of Road Safety

McLean AJ, Kloeden C (2002) **'Alcohol, travelling speed and the risk of crash involvement'** in Proceedings of 16th International Conference on Alcohol, Drugs and Traffic Safety (pp 73-80), 4-9 August 2002 Montreal, Canada

Ponte G, van den Berg A, Streeter L, Anderson R (2004) **'Pedestrian protection in vehicle impacts: further results from the Australian New Car Assessment Program'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia: volume 1: peer reviewed papers. Perth: Office of Road Safety

Sommariva M, Ponte G, Streeter L, Anderson R (2002) **'Protecting pedestrians in vehicle collisions: Results from 2 years of the Australian New Car Assessment Program and the analysis of actual accidents'** in Proceedings of Road Safety Research, Policing and Education Conference, 4-5 November 2002, Adelaide, South Australia, volume 1. Burnside: Plevin and Associates, pp 255-262

Versteegh S (2004) **'The accuracy of driver accounts of vehicle accidents'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia: volume 2: presented papers. Perth: Office of Road Safety

Woolley J (2003) **'Further insights into an urban area with lower speed limits: The Unley case study'** in Proceedings of Road Safety Research, Policing and Education Conference, 24-26 September 2003 Sydney, New South Wales, volume 1. Sydney: International Conference and Events Australia, pp 295-302

Woolley J (2003) **'The lowering of speed limits in the Adelaide hills - public opinion and on road observations'** in Proceedings of Road Safety Research, Policing and Education Conference, 24-26 September 2003, Sydney, New South Wales, Australia, volume 1. Sydney: International Conference and Events Australia, pp 303-308

Wundersitz L, Kloeden C, McColl R, Baldock M, McLean J (2002) **'Speeding in metropolitan Adelaide: A situation analysis'** in Proceedings of Road Safety Research, Policing and Education Conference, 4-5 November 2002 Adelaide, South Australia, volume 2. Burnside: Plevin and Associates, pp 257-262

Wundersitz LN (2002) **'An evaluation of coin operated breath testing machines in South Australian licensed premises'** in Proceedings of 16th International Conference on Alcohol, Drugs and Traffic Safety (pp 817-824), 4-9 August 2002, Montreal, Canada

Wundersitz LN, Burns NR (2004) **'Relationships between prior driving record, driver culpability and fatal crash involvement'** in Proceedings of Road Safety Research, Policing and Education Conference, 14-16 November 2004 Perth, Western Australia, volume 1: peer reviewed papers. Perth: Office of Road Safety



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