



Curtin-Monash Accident Research Centre

Driving Performance and Self-Regulation Practices in Drivers with Dementia

C-MARC has recently been awarded funding from the Australian Research Council (ARC) to investigate driving performance and self-regulation practices in drivers with mild dementia.

Despite the high prevalence of dementia in older drivers, a substantial gap remains in the evidence regarding the natural progression of the disease and its impact on driving performance and driver self-regulation practices. The aim of this ARC funded project is to assess longitudinal changes in the driving performance, driving self-regulation, mobility and satisfaction with mobility for older drivers with mild dementia, compared to that of older drivers without dementia. A three-year prospective cohort study will be undertaken and will be made up of three phases.

Phase One will be undertaken to examine the natural driving patterns and self-regulation practices of older drivers with mild dementia, compared to older drivers without dementia at baseline and one year after the initial assessment. Mobility and satisfaction with mobility will also be assessed amongst the cohort. A sample of 175 older drivers with mild dementia and a comparison group of 175 older drivers without dementia will be recruited throughout Perth, WA. Data collection will involve a battery of cognitive, visual and motor tests as well as a series of researcher-administered questionnaires. Participants will also have their car fitted with an in-vehicle driver monitoring device at each assessment, which

will record their natural driving patterns for two weeks.

Phase Two of the study will utilise a state-of-the-art driving simulator to assess the driving performance of the 350 participants recruited in Phase One at baseline and one year after the initial assessment. At each assessment, participants will be instructed to operate the simulator as they would normally drive their own car. Furthermore, while driving the simulator, participants will be presented with specific events and hazards that they must respond to. A range of general outcome and performance measures will be assessed.

Phase Three involves undertaking a Delphi Study to establish consensus on evidence-based recommendations arising from Phase One and Two to manage the driving safety for older drivers with dementia. The Delphi Study will comprise of 25 experts representing key stakeholder groups who will be asked questions regarding the relevance of the study's results, the feasibility of the potential recommendations, and how best to implement the given recommendations.

An integral component of this project is to ensure translation of the findings from Phase One, Two and the Delphi Study into practice through Alzheimer's Australia and road safety and licensing authorities. It is anticipated that the results will have relevance for clinicians, road safety and licensing authorities in all the states and territories of Australia and worldwide.

- C-MARC has been awarded an ARC Linkage Project Grant
- The project will assess longitudinal changes in the driving performance, driving self-regulation, mobility and satisfaction with mobility of older drivers with mild dementia

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From the Director

Welcome to the first issue of the Curtin-Monash Accident Research Centre newsletter for 2017.

In this issue we are excited to introduce a new ARC-funded project involving drivers with mild dementia. Over the page we look at a recently completed study evaluating driver performance on a Diverging Diamond Interchange using a driving simulator as well as present findings of an evaluation of the Western Australian State Black Spot Program. We also wish to welcome our newest C-MARC team member, Dr Kate Brameld, who is introduced on page 3. Finally, a list of key upcoming events can be found on the back page.

We hope you enjoy the latest newsletter.



Lynn Meuleners

The DIAMOND Study: Diverging Diamond Interchanges in Western Australia: PerforMance ON a Driving Simulator

A recent investigation conducted at C-MARC suggests that **Diverging Diamond Interchanges should be considered for use on Western Australian roads.**

Over one-third of fatal crashes and close to half of serious injury crashes occur at intersections in metropolitan Perth. Intersections have a higher level of crash risk compared to other types of road infrastructure with crashes at intersections frequently resulting in severe injuries to the head and spine. Therefore, significant effort is being made to reduce crashes at intersections through innovative designs that seek to minimise crash risk and, in particular, eliminate conflict points with other vehicles.

The Diverging Diamond Interchange (DDI) is an intersection where traffic is diverted to the opposite side of the road (depicted by the blue and yellow lines in Image B) which allow right turns to be completed without conflict with other traffic, after which traffic is diverted back to the original side of the road with two-phase traffic signals controlling traffic flow at the cross-overs. The road safety benefits of DDIs include the elimination of right angle crashes, improved sight distance, better traffic calming, reduced crossing distances for pedestrians and fewer conflict points.

The study, conducted by C-MARC's Professor Lynn Meuleners, Dr Kyle Chow and Ms Michelle Fraser in addition to Dr David Logan from Monash University Accident Research Centre and Dr Paul Roberts from ARRB, aimed to evaluate the performance of a sample of Western Australian drivers on a DDI compared to a traditional intersection, using a driving simulator.

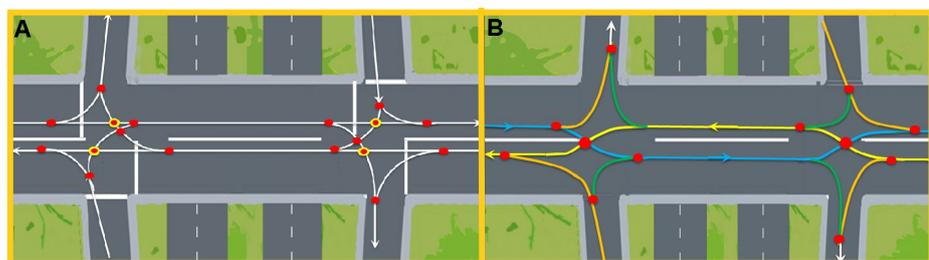
In total, 201 drivers aged 18 to 80 years with a current WA C class license completed the experimental study. Each participant completed a driving simulator assessment that included a driving scenario consisting of the DDI and two traditional intersections for comparison. Additionally, each participant completed a series of researcher-administered questionnaires and the NASA Taskload Index to assess their physical and cognitive workloads whilst navigating the DDI.

No wrong-way violations or navigation errors were observed whilst participants navigated the DDI. Likewise, there were no crashes or near-misses recorded by any participants. A low number of other driver errors were observed, with red light violations being more common while navigating the DDI than the traditional intersections. Drivers also travelled over the speed limit more in the DDI than the traditional intersection. There was some indication that older drivers aged 60+ may have experienced more difficulty negotiating the DDI.

The researchers recommended targeted community education on how to navigate new DDIs safely in order to improve compliance to posted speed limits, avoid red light violations, and to reduce possible crashes.

Overall, this simulator study established that WA drivers experienced minimal difficulties negotiating the DDI. The reduction in conflict points and lower speed limit afforded by the DDI in combination with the very few recorded driver errors, imply that installation of DDIs would have safety benefits and should be considered for use in the WA road environment.

- The DDI is an innovative intersection design that may reduce crashes occurring at intersections
- 201 Western Australian drivers completed a driving simulator scenario that included a DDI and two traditional intersections
- Minimal difficulties were experienced by WA drivers navigating the DDI with no crashes/near-misses, wrong-way violations, or navigation errors being observed



Above Figure A shows a standard WA interchange with 18 possible conflict points of which 4 are classified as causing serious injury. Figure B shows the layout of the DDI with 12 conflict points of which none are classified as serious thereby significantly reducing the potential for death and serious injury from vehicular impact.

Evaluation of the Western Australian State Black Spot Program

The Western Australian State Black Spot Program has been effective at producing positive road safety outcomes for the community a recent evaluation has found.

The Western Australian (WA) State Black Spot Program defined a Black Spot as an intersection or non-intersection road section with a high incidence of crashes. All road classifications were eligible for funding. The program targeted existing Black Spots, and potentially hazardous locations selected on the basis of formal road safety audits.

A recent study by C-MARC researchers, Dr Kyle Chow and Professor Lynn Meuleners, together with Associate Professor Adrian Wong from the Department of Mathematics and Statistics, Curtin University, examined 903 existing Black Spots that were treated under the WA program between 2000 and 2014, and evaluated the effectiveness of the WA program and its various treatment types in reducing the frequency and severity of crashes at these Black Spots.

A quasi-experimental before and after study design was used to compare the frequencies of: (1) all reported crashes; (2) casualty crashes (fatal, hospitalisation, and/or medical treatment crashes); and (3) killed or serious injury (KSI) crashes, at existing Black Spot sites which were treated between 2000 and 2014.

Crash data was obtained up to 31st December, 2015, from the Integrated Road Information System (IRIS) which is maintained by Main Roads WA. Main Roads WA also provided information on the treated Black Spots. This included information about the treatment description and treatment start and finish dates.

The final sample of 903 treated Black Spots included for analysis all had at least one reported crash in the previous five year period prior to treatment. They consisted of 676 metropolitan and 227 rural sites. The average length of follow-up exposure crash data post treatment for the 903 sites was 55.1 months. Overall, they



reported a significant reduction of 17.5% in all reported crashes, a significant 30.3% reduction in casualty crashes, and a significant 22.0% reduction in KSI crashes.

In the metropolitan area, the treatments analysed were heavily weighted towards intersection treatments. The effectiveness of the WA Program in the metropolitan area was mainly due to the high crash reductions at 634 metropolitan intersections, with significant reductions in all reported crashes by 17.5%, casualty crashes by 29.8%, and KSI crashes by 18.3% at these 634 intersections.

The evaluation found 119 rural intersections that received treatments showed significant reductions in all reported crashes by 23.1%, casualty crashes by 46.3%, and KSI crashes by 44.7%. The evaluation found 108 rural road sections that received treatments also showed significant reductions in the same three crash types, by 39.0%, 44.8% and 46.0% respectively.

The fatalities and serious trauma that result from crashes at Black Spots place a great burden on society. The results found the WA State Black Spot Program to be effective at producing positive outcomes for the community in terms of road safety. In light of the positive outcomes in crash reductions at treated Black Spots, it was recommended that the WA program be continued and extended to other Black Spots and potentially hazardous locations not yet treated by the appropriate countermeasures.

C-MARC Team News

Dr Kate Brameld — Senior Research Fellow



Kate has nearly 30 year's experience of conducting epidemiological research and has worked in both academic and government environments. She has developed methods for analyzing linked data, particularly the measurement of trends in incidence and prevalence of disease from administrative hospital data and has developed complex statistical models to measure the effect of various factors on health service utilization and outcomes. In recent years these have been applied in the fields of rare diseases and palliative care. Recently she has contributed to a report on the incidence and costs of injury in Western Australia, commissioned by the Department of Health and been involved in the development of health economics models to estimate the cost of primary care following hospitalisation for injury and the cost of time off work following hospitalisation

C-MARC Seminar Series 2017

The End of the Car Era? Changing Demands and the Transport Experience

Date: Friday May 26, 2017

Time: 9:30 am—11:30 am

Venue: Seminar Room 1, Technology Park Bentley—Conference & Business Function Centre

Address: 2 Brodie Hall Drive, Bentley.

RSVP: matthew.govorko@curtin.edu.au



Professor Mark Stevenson is an epidemiologist and Professor of Urban Transport and Public Health. Prior to this appointment, Prof Stevenson was Director of the Monash University Accident Research Centre, a leading transport safety research Centre in Melbourne, Australia.

Prof Stevenson has a PhD (Distinction) from The University of Western Australia and a Master's degree in Public Health from Curtin University and became a Fellow of the Australasian College of Road Safety in 2008. He is a National Health and Medical Research Council (Australia) Fellow, an Honorary Professor in the Peking University Health Science Centre, China, and an advisor for injury to the Director General of the World Health Organisation. Prof Stevenson has published over 200 peer-reviewed articles, books, book chapters and technical reports and procured more than \$30 million in competitive research funding including funding from the NHMRC, ARC and the US National Institutes of Health.

Upcoming Events

ARSC2017: The Australasian Road Safety Conference

Date: 10—12 October 2017

Location: Perth, WA

Venue: Crown Perth

Website: <http://australasianroadsafetyconference.com.au/>

 #ARSC2017



The Australasian College of Road Safety (ACRS), Austroads, ARRB and Curtin-Monash Accident Research Centre (C-MARC) invite you to attend the largest road safety-dedicated conference in the Southern Hemisphere. The 2017 Australasian Road Safety Conference (ARSC2017) will be held in Perth on the banks of the Swan River at the beautiful Crown complex from Tuesday to Thursday 10-12 October 2017.

With a theme of *"Expanding our horizons"*, ARSC2017 will showcase the regions' outstanding researchers, practitioners, policy-makers and industry spanning the plethora of road safety issues identified in the United Nations Decade of Action for Road Safety, including road safety management, infrastructure, safe vehicles, user behaviour, and post-crash care.

ARSC2017 will bring with it a special focus on engaging all levels of government and community, from the city to the bush, to move Towards Zero. The comprehensive 3-day scientific program will showcase the latest in research, education, policing programs, policies and management strategies, technological developments in the field, national and international keynote speakers, oral and poster presentations, expansive stakeholder exhibition, and workshops and interactive symposia.

C-MARC

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C-MARC is a West Australian based independent multi-disciplinary road safety research centre established by the West Australian State Government's Office of Road Safety in 2009.

The Centre represents a significant partnership between the Office of Road Safety (now the Road Safety Commission), Curtin University and Monash University's Accident Research Centre (MUARC).

C-MARC's mission is *"to be a Centre of excellence in road and other injury research and the translation of that research into policy and practice that will inform government, industry and the wider community."*

