Vol 30, Issue 1, 2019

Journal of the Australasian College of Road Safety

Peer-reviewed papers

Original Road Safety Research

- Extent of mobile phone use by pedestrians on controlled crossings in central Hobart, Tasmania
- Trial of improved procedures for driver licence testing by occupational therapists
- What are Australian drivers doing behind the wheel? An overview of secondary task data from the Australian Naturalistic Driving Study

Road Safety Policy & Practice

- The Relevance of Australasian Road Safety Strategies in a Future Context

Road Safety Case Studies

- Road Safety – Is It a Local Government Priority? (What Does the Experience Suggest?)

Contributed articles

Road Safety Media Review

- Coverage of commuter and recreational cycling in major Australian newspapers

Road Safety Policy & Practice

- Sharing road safety education and enforcement knowledge and practice throughout developing nations - challenges create opportunities!

Interested in road safety crash data?

Interactive crash statistics available for NSW

To better understand road safety issues and trends, Centre for Road Safety road crash data is available via interactive reports.

Dynamic reports include detailed NSW statistics on road user deaths and serious injuries, crash types, injury trends and locations. Presentations and road safety data reports on speed, drug driving, heavy vehicles and younger drivers are also available on the website.

Serious injuries 2017

Road user:

1114 WALKING — 832 / 253

1986 ON BICYCLES — 1214 / 736

5884 IN VEHICLES — 3353 / 2368

2575 MOTORBIKES — 1339 / 1158

Gender:

7821 MALES — 4459 / 3151

4320 FEMALES — 2599 / 1617

Sydney RMS Region Rest of NSW

Excludes unknown locations, road user and gender. RMS Region is a proxy for Roads and Maritime Services (RMS) Region derived from the location of the hospital where the person was first admitted.

Visit **roadsafety.transport.nsw.gov.au/statistics** to view the latest Quarterly Bulletin of Serious Injury Crash Data and interactive crash statistics.

NSW GOVERNMENT

Lives lost on NSW roads.
Our goal is zero.

TOWARDS ZERO

ABSTRACT SUBMISSIONS AND REGISTRATION NOW OPEN

MARK YOUR DIARY WITH THESE KEY DATES:

Abstract Submission Deadline: **15 February 2019**
Early Bird Registration Deadline: **28 June 2019**

2019 AUSTRALASIAN ROAD SAFETY CONFERENCE

Adelaide Convention Centre
25-27 September 2019

FOUNDING PARTNERS: ACRS Australasian College of Road Safety, Austroads

PLATINUM SPONSOR: NSW Government

The Australasian College of Road Safety (ACRS) and Austroads invite you to attend the largest road safety-dedicated conference in the Southern Hemisphere. The 2019 Australasian Road Safety Conference (ARSC2019) will be held in Adelaide at the Adelaide Convention Centre from Wednesday 25 to Friday 27 September 2019.

ARSC2019 will showcase the region's 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: Road Safety Management, Infrastructure, Safe Vehicles, User Behaviour, and Post-Crash Care. ARSC2019 will bring with it a special focus on engaging all levels of government and community, from the city to the bush, to move "Leading the Way – Towards Zero". The comprehensive 3-day scientific program will showcase the latest research; education and policing programs; policies and management strategies; and technological developments in the field, together with national and international keynote speakers, oral and poster presentations, workshops and interactive symposia.

WHO SHOULD ATTEND?

ARSC2019 is expected to attract 500-700 delegates including researchers, policing and enforcement agencies, practitioners, policymakers, industry representatives, educators, and students working in the fields of behavioural science, education and training, emergency services, engineering and technology, health and rehabilitation, policing, justice and law enforcement, local, state and federal government, traffic management, and vehicle safety.

REGISTRATION NOW OPEN

ABSTRACT SUBMISSIONS NOW OPEN

Register Your Interest

To register your expression of interest as a delegate, speaker, sponsor or trade exhibitor, or for further information about the conference, please visit **www.australasianroadsafetyconference.com.au.** Additional enquiries should be directed to the Conference Secretariat, Premier Event Concepts on **(+61) 437 377 107** or **shanna@premiereventconcepts.com.au**

YOUR HOST CITY: ADELAIDE

Adelaide is bursting with culture, flavours, events and entertainment. Taste your way through world-famous wine regions only minutes away from the city, soak up the sun at one of our picture-perfect metropolitan beaches, join the party at our immersive festivals and events or spend the night exploring Adelaide attractions and a thriving restaurant and bar scene. Adelaide is a gateway to some of Australia's best wine country as well as historic buildings, lush parklands and some of the country's best beaches.

www.australasianroadsafetyconference.com.au

3M Science. Applied to Life.™

3M-ACRS Diamond Road Safety Award Since 2011.

Submit your Road Safety Program for a chance to **Win a trip to the USA!**

Enter & Get Recognised!

Have you or a colleague recently developed a road safety treatment/initiative that stands out beyond traditional activities and delivered improved road safety? You could be the winner! We are looking for entries from any road safety practitioner who works within the Australasian private or public sector. Don't miss out on your chance to win and be recognised!

The individual team leader from the winning project will receive a trip to the USA to attend the 49th ATSSA annual convention and also **visit 3M head office in Minnesota.**

Who will judge entries?

All entries will be judged by an independent committee of industry representatives, established by the ACRS.

To enter & more information, visit theaustralasianroadsafetyawards.com.au

Entries open 1st March 2019 and close 5pm (EST), 30th June 2019

3M-ACRS Diamond Road Safety Award 2019

ACRS
AUSTRALASIAN COLLEGE OF ROAD SAFETY

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Cover image

Everyday Australian vehicles are instrumented with driving sensor and video recording equipment to capture driver behaviours under real-world driving conditions in the Australian Naturalistic Driving Study (ANDS). See Original Road Safety Research article on a study examining what people do when driving their cars in everyday and safety-critical situations (Young, K.L., Osborne, R., Koppel, S., Charlton, J.L., Grzebieta, R., Williamson, A., Haworth, N., Woolley, J. and Senserrick, T. (2019). What are Australian drivers doing behind the wheel? An overview of secondary task data from the Australian Naturalistic Driving Study. *Journal of the Australasian College of Road Safety*, 30(1), 27-33.).

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The *Journal of the Australasian College of Road Safety* aims to publish high quality papers and provides a means of communication for the considerable amount of evidence being built for the delivery of road safety, to inform researchers, policymakers, advocates, government and non-government organisations, post-crash carers, engineers, economists, educators, psychologists/ behavioural scientists, communication experts, insurance agencies, private companies, funding agencies, and interested members of the public. The Journal accepts papers from any country or region and has an international readership.

All papers submitted for publication undergo a peer-review process, unless the paper is submitted as a *Perspective*/ *Commentary on Road Safety* or *Correspondence* or the authors specifically request the paper not to be peer-reviewed at the time of original submission. Submissions under the peer-review stream are refereed on the basis of quality and importance for advancing road safety, and decisions on the publication of the paper are based on the value of the contribution the paper makes in road safety. Papers that pass the initial screening process by the Managing Editor and Peer-Review Editor will be sent out to peer reviewers selected on the basis of expertise and prior work in the area. The names of the reviewers are not disclosed to the authors. Based on the recommendations from the reviewers, authors are informed of the decision on the suitability of the manuscript for publication.

When papers are submitted and the authors specifically request the paper not to be peer-reviewed at the time of original submission, the papers will be published under the non peer-review stream. Submissions under the non peer-review stream, *Perspective*/ *Commentary on Road Safety* and *Correspondence* are reviewed initially by the Managing Editor, who makes a decision, in consultation with the Peer-Review Editor and/or Editorial Board when needed, to accept or reject a manuscript, or to request revisions from the author/s in response to the comments from the editor/s.

As a rule of thumb, all manuscripts can undergo only one major revision. Any editorial decisions regarding manuscript acceptance by the Managing Editor and Peer-Review Editor are final and further discussions or communications will not be entered into in the case of a submission being rejected.

For all articles which make claims that refute established scientific facts and/or established research findings, the paper will have to undergo peer-review. The Editor will notify the author if peer-review is required and at the same time the author will be given the opportunity to either withdraw the submission or proceed with peer-review. The Journal is not in the business of preventing the advancement or refinement of our current knowledge in regards to road safety. A paper that provides scientific evidence that refutes prevailing knowledge is of course acceptable. This provision is to protect the Journal from publishing papers that present opinions or claims without substantive evidence.

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Editorial Board

From the President

Congratulations to all our readers – your interest and your efforts in road trauma reduction do ensure less die and are injured from road crashes. We often overlook the many successes we have had in reducing road trauma as we press ahead with finding solutions to reduce that trauma even more.

Late last year the Bureau of Infrastructure, Transport and Regional Economics published **Vision Zero—years with zero road crash fatalities** a dashboard showing the number of years of zero deaths from road crashes from 2008-2107 in all local government areas across Australia (https://bitre.gov.au/dashboards/#vision). A similar dashboard based on the International Road Traffic Accident Database (IRTAD) has been published by Dekra for the USA, Europe and Japan (https://www.dekra-vision-zero.com).

Over 150 of around 550 Local Government areas, including areas in regional Australia have been fatality free for at least a year, some for 10. Analysing why that is so, should be a major, and urgent national project.

David McTiernan in a paper in this Issue "Road Safety – Is It a Local Government Priority? (What Does the Experience Suggest?)" is very clear in reporting that Local Government is "under-resourced, under-funded, lacking appropriate skills and expertise, and applying an outdated approach to road safety mean that road safety is not the priority across their networks that it should be" and that "Government road safety funding models need to change to encourage (and reward) councils for adopting a pro-active risk management approach that supports a Safe System approach to road safety."

You and your colleagues do know what to do, but we do need to convince the community and hence Governments that success in our progress "Towards Zero" is not only possible, but happening. Knowing more about those successes and translating them into action wherever we can have to be a key priority.

This Issue publishes a range of interesting and relevant papers and information. I commend them to you.

Lauchlan McIntosh AM FACRS FAICD
ACRS President

ACRS Chapter reports

Chapter reports were sought from all Chapter Representatives. We greatly appreciate the reports we received from ACT, NSW, Queensland and South Australia.

Australian Capital Territory (ACT) and Region

ACT Graduated Licence Scheme Review

The Chapter has been working with the ACT Justice and Community Directorate on its review of the ACT Graduated Licensing Scheme. The Chapter managed a Consultation Forum which brought together the outcomes of community consultation held from mid-2018.

Extensive consultation occurred between 3 April and 22 June 2018.This included conversations with young people, input from driving instructors and industry representatives, community online and phone surveys. Over 4,000 responses were received. The largest proportion of responses was from young people, with almost 60 percent of survey respondents aged 16-25 years.

These views were considered by the ACT Government and a revised draft model was developed taking into consideration issues raised in the initial consultation round.

The Forum was held was held on 10 October 2018. Around 50 representatives of organisations involved in the development and implementation of the policy and road safety and user groups attended and were involved in discussions. Expert speakers and ACT Justice and Community Safety (JACS) representative delivered presentations outlining:

- the results and issues raised in the consultation phase (Ms Belinda Owen, JACS);
- the research underpinning of graduated licensing programs (Associate Professor Teresa Senserrick – UNSW Sydney);
- experience and outcome of policies implemented in the surrounding jurisdiction of New South Wales provided by Ms Julie Thompson & Ms Rachel Butterly, New South Wales Centre for Road Safety;
- Implementation of NSW programs at the local level - Ms Tracey Norberg, Road Safety & Traffic Officer, Goulburn Mulwaree Council.

Attendees participated in table discussions that were reported to the whole group present.
This session also enabled issues to be raised with a Panel of the presenters.

ACT Road Safety Minister, Shane Rattenbury, MLA, participated in the forum. At the end of proceedings, he advised that the Government would consider the issues raised in the forum and release its formal revised model in the week ending 19 October 2018 for consultation with the community before finalising and implementing the final agreed model.

The ACT response to the Forum is outlined in the document ACT Graduated Licensing Reform at the following ACT Government website:

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/2715/3974/5621/Community_Feedback_Discussion_Paper.pdf

The responses to the most recent consultation have been received and the future policy is under active consideration by the ACT Government.

Wild life collisions in ACT and surrounding area

This is a joint project involving the Chapter, ACT Health and the Royal Australasian College of Surgeons on concerns about the number and seriousness of casualties presenting at Canberra Hospital resulting from crashes with wild life on ACT and surrounding NSW roads.

The objective of the project is to attempt to quantify more accurately the extent and severity of such crashes in the region so that suitable cost effective countermeasures can be developed.

In August the project committee met with interested parties. Since then approvals for access to some data has been under consideration and details from insurers have been received. A meeting to progress the issues will be scheduled for early 2019.

ACT Chapter Chair and Secretary
Mr Eric Chalmers & Mr Keith Wheatley

New South Wales (NSW)

2018 was a very busy and significant year for the NSW Chapter. As host State for the Australasian Road Safety Conference 2018, there was a significant role for the Chapter Committee in planning and shaping of the annual Conference which saw over 690 registered delegates attending over 150 paper and poster presentations, as well as listening to Key Note/Plenary speakers from across Australia and internationally and workshops. From the outset, the NSW Chapter set the goal for the Conference to have researchers and practitioners engaged with one another to

share their experiences and from this to establish a platform from which we all can make Vision Zero happen. By all accounts the Conference was well received and successful in bringing to the fore current road safety issues, research and practice, with a particularly inspiring presentation by the Key Note speaker The Honourable Dr T Bella Dinh-Zarr of the US National Transportation Safety Board.

As Chapter Chair and Co-Convenor of ARSC2018, I would like to congratulate and sincerely thank the NSW Chapter for their efforts and contributions to making the ARSC2018 such a successful Conference, and acknowledge the following key roles – Dr Teresa Senserrick (Co-Chair and Co-Convenor ARSC2018), Dr Lisa Keay and Dr Julie Brown (Co-Chairs of the Scientific Committee), Dr Liz de Rome (Chair of the Social Committee), Bianca Albanese and Gray Knight (Organisers of the Early Career Development session), Dr Mark King (Chair of the International Delegates Committee) and Prof. Raph Grzebieta (Editor in Chief for ARSC2018). Also thanks must go to all the ARSC2018 Conference Organising Committee and sponsors for their contributions, and to the team at Encanta our Professional Conference Organiser who ensured that everything went well on the day.

While being heavily involved in organising ACRS2018, the NSW Chapter also worked to ensure a regular rollout of local presentations and seminars to NSW Chapter members. Through the continued use of webinar software such as GotoMeeting and Zoom, the Chapter ensured that regional members from across NSW could participate, as readily as those based in the Sydney metro area.

The seminar series developed in 2018 was supported by funding from the Community Grants scheme developed by Transport for NSW, and the Chapter sincerely thanks the NSW Centre for Road Safety for this, as well as making key people available to present at some of the seminars. A list of the seminars given in 2018 by the NSW Chapter is:

The New NSW Road Safety Plan 2021, presentation by Bernard Carlon, Executive Director NSW Centre for Road Safety at Transport for NSW

- ***The NSW CrashLink Reporting System***, presentations by Bernard Carlon, Dr Hassan Raisianzadeh, and Emma Shearer at NSW Centre for Road Safety at Transport for NSW
- ***Reality Check on the Road to Automated Vehicles***, presentations by Jessica S. Jermakian, D.Sc., Insurance Institute for Highway Safety, United States and Prof. Ann Williamson, Ph.D., Transport and Road Safety Research Centre, UNSW Sydney

The Chapter is able to advise that we have received a second round of funding from the Community Grants scheme and look forward to being able to host more seminars throughout 2019 (with topics and presenters currently being considered) for the interest and benefit of NSW Chapter members, and others in the community who work in and support road safety.

Other activities of the Chapter Committee during 2018 include:

- Meeting with Minster for Roads, Maritime and Freight, Hon. Melinda Pavey MP
- Radio interviews (2GB) – NSW Road Safety Plan 2021, Average speed cameras, mobile phone use
- Attended the launch of National Road Safety Week – Yellow Ribbon event, at the NSW Museum of Contemporary Art
- Ongoing presence on the IPWEA (NSW) Road Safety Panel
- Contribution to the ACRS Strategic Review

We look forward to working more with Chapter and ACRS members to improve road safety in 2019.

NSW Chapter Representative
Mr David McTiernan

Queensland (QLD)

Seminar 4th December 2018: Dr Mark King provided feedback from National Transport Commission (NTC) recent work-shops on *driver distraction* and on *sharing pathways safely with innovative transport.*

Recently the National Transport conducted two workshops that are expected to lead to changes in the Australian Road Rules:

1. Developing Technology Neutral Road Rules for Driver Distraction: Our National Agenda
2. Sharing the Pathway Safely: Innovative Vehicles in our community

Attendees were drawn from government, research, industry and community groups. The workshop discussions are intended to form one of the inputs to separate issues papers on each of the topics. In this seminar, some of the main objectives and debates on these issues were described, along with feedback from the discussions and workshopping. The intention was to give ACRS Chapter members an opportunity to share their own views on these issues, which could assist in focusing responses to the issues papers from the NTC, once they are released (note that the issues paper on driver distraction was released a week after the seminar).

Next meeting and seminar is scheduled for 5th March 2019.

QLD Chapter Chair
Dr Mark King

South Australia (SA)

The South Australian Chapter has increased activity with a recent professional development event and more being planned for 2019.

Where are the opportunities for South Australia from the Inquiry into the Australian National Road Safety Strategy 2011-2020? – 6 December 2018.

Over 80 people attended a lunchtime presentation and heard A/Prof Jeremy Woolley talk about the recent report on the Federal Inquiry into the National Road Safety Strategy. Jeremy highlighted the importance of not blaming crash victims, nor managers of the various aspects of the transport system for the situation where essentially much of the road transport system is not safe for human operation given our natural vulnerabilities, both physical and mental. He made it clear that just making things safer is inadequate if the future problem of 12,000 fatalities over the next decade is to be addressed in a strategically meaningful way. Rather the system needs to be made safe, a subtle but important distinction to just safer. The 12 recommendations from the report were presented and the 2030 and 2050 zero fatalities and serious injury targets were outlined. The strategic opportunities for South Australia were posed as questions such as: what does the journey to zero look like? what likely contributions will be needed from all parts of the system? does your organisation understand its role in harm elimination? can we cease building harmful infrastructure immediately and mainstream the Safe System approach? The audience came from a wide range of backgrounds and the many questions was indicative of the high level of interest shown. Thanks to the Department of Planning, Transport and Infrastructure for providing the venue.

Chapter Committee

The Chapter Committee has reformed with Jeremy Woolley and Jamie MacKenzie as co-chairs, Jeff Dutschke (Treasurer) and Phil Blake (Secretary). Other committee members include Robert Gray (SAPOL), Stephen Pascale and Amit Dua (DPTI), Martin Small (Martin Small Consulting), Matthew Vertudaches (RAA) and Josephine Wilkins (MAC). Several members are also involved on the ARSC2019 Organising Committee.

Next Seminar – Lunchtime Thursday 7 March 2019.
Road Safety and Work Health and Safety.

SA Chapter Chairs and Secretary
Jeremy Woolley, Jamie MacKenzie and Phil Blake

ACRS News

THE CEO'S 2018 WRAP - MS CLAIRE HOWE: A QUICK REVIEW OF OUR SUBSTANTIAL ACHIEVEMENTS IN 2018 & THANK YOU FOR YOUR CONTINUED EFFORTS TO SAVE LIVES AND INJURIES ON OUR ROADS

2018 was a very productive for the College, and as CEO I am very happy to report that the Canberra office has managed to support such significant growth in the College over the last several years on such a modest budget and with limited staffing resources.

I'd like to thank our volunteer Executive Committee and office bearers both at Australasian and Chapter level who we heavily rely on, and am especially pleased that the growth of the College is supporting a justified lift in profile for our organisation, office bearers and indeed all members. This in turn helps maintain pressure on keeping road trauma levels and road safety improvements as a priority across the political and community spectrum. This flows to all other areas including supporting our researchers, policing and education agencies, and the many many other stakeholder groups who work so hard in this sector.

Much of the role of the Canberra office is centred on ensuring our members receive their benefit of membership to the College as well as supporting the wider group of stakeholders gain traction in terms of advocacy. In terms of member benefits, head office activities have included the following highlights:

- **PATRON:** Maintaining a positive relationship with our Patron, His Excellency Sir Peter Cosgrove,the Governor-General of Australia.
- **PRESIDENT & ACRS's 30TH ANNIVERSARY:** Our long-reigning President Lauchlan McIntosh AM announced his intention to step down as President at the 2019 AGM, so we celebrated his inspirational tenure and achievements during the College's 30th Anniversary Celebration during ARSC2018, with 700 delegates in attendance.
- **STAKEHOLDER ENGAGEMENT:** We continue to build on a positive working relationship with all stakeholders, including the Deputy Prime Minister, Michael McCormack, also Minister for Infrastructure

and Transport. Many of you will remember Michael from our ARSC2018 Conference Dinner where he spoke passionately about road safety and awarded the ACRS Fellowship to Dr John Crozier and A/ Professor Jeremy Woolley and the 3M-ACRS Award to Christine Thiel and her team.

- We also continue to be actively engaged with the Parliamentary Friends of Road Safety, particularly the co-Chairs Senator Alex Gallacher and Llew O'brien, meeting independently and also arranging meetings with sector representatives.
- **INQUIRY INTO THE NATIONAL ROAD SAFETY STRATEGY:** The College has been actively involved in supporting the Inquiry into the Effectiveness of the National Road Safety Strategy during 2018, with the co-Chairs and Expert Panellists all being ACRS Fellows: A/Professor Jeremy Woolley, Dr John Crozier, Mr Rob McInerney & Mr Lauchlan McIntosh. The College hosts the video for the Inquiry Report Launch Event which took place at Parliament House in September and included speeches from the Deputy Prime Minister, Hon Michael McCormack, and Shadow Minister Anthony Albanese. The comprehensive Final Report can be downloaded here and we will continue to support the timely implementation of the 12 recommendations as we see this as a pivotal moment for road safety in Australia. Please read Claire Howe›s LinkedIn piece ‹If the outcome of the 2018 National Road Safety Strategy Inquiry is providing the initial spark, are we all ready to fuel the fires of change?› for further information.
- **NATIONAL ROAD SAFETY STRATEGY ACTION PLAN 2018-2020:** The College continues to support our umbrella policy: the National Road Safety Strategy, which dovetails with the Global Plan for the United Nations Decade of Action for Road Safety 2010-2020. We see the recently released NRSS Action Plan 2018-2020 as a huge step forward in cross-jurisdictional support for targeted road trauma reduction activities. We will continue to remain strong advocates for this Action Plan moving forward.
- **ACRS STRATEGIC REVIEW:** We continue to be busy supporting the ACRS Strategic Review, and encourage all members and non-members to share their views in order to ensure our organisation continues our growth onward and upwards, and most importantly to support everyone in our united aim as we all strive Towards Zero.
- **CONFERENCES:** Due to the size and complexity of this annual event, the conference has become one of our major activities and a major focus of our somewhat limited resources are directed. At any time we will have 3 conferences active – for example at present we have ARSC2019 very much taking up our time, but we are also finalising ARSC2018 and progressing ARSC2020 (we have locked in a venue, dates, signed contracts with various suppliers and have met with potential Platinum Sponsors) and ARSC2021 locations and venues are being considered and meetings being held. We are carefully managing staffing and finance around the conference as it has a major impact on the College's viability. We are very mindful and grateful for our ongoing very good relationship with Austroads, representing all levels of government for Federal, State and Local agencies. We have built a mutually respectful relationship which is underpinning the success of our conferences. For 2018, and again in tandem with Austroads, we held the third Australasian Road Safety Conference in Sydney, an event which has now been cemented as the premier road safety-dedicated event in our region. Again a great deal thanks goes to Austroads (particularly Nick Koukoulas and David Bobbermen) and all Australasian road transport and traffic agencies for their continuing engagement and support in the merging of our two conferences.
- We thank the NSW Government for their generosity and Platinum Sponsorship of $100,000 for ARSC2018. This sponsorship ensured we could provide a 3 day event in Sydney for significantly reduced registration fees, ensurig the event was accessible to the broad coss-section of the road safety community.
- The federal Department provided support of $50,000 for ARSC2018 LMIC Scholarships & Gold level sponsorship (a $20,000 increase on prior support), and the ACT Government again confirmed their commitment to sponsor our Early Career Professionals event for $10,000.
- Thanks to this ongoing support from Austroads and our Executive Committee, Chapters and Fellows, and the support of around 700 delegates and more than 40 sponsors, exhibitors and supporters, Australasia's fourth Australasian Road Safety Conference (ARSC2018) was a great success. There were over 200 papers and posters, 13 workshops & symposia, plus keynotes, invited speakers & panellists who ensured there was something for everyone in our combined efforts to drive down road deaths and injuries.In terms of ARSC2017, my sincere thanks go to Mr David McTiernan and A/Professor Teresa Senserrick, our conference co-Chairs, the entire ACRS NSW Chapter Executive Committee and members, and all of you for your generous support in ensuring the success of ARSC2018. We certainly could not continue to do this without your support.
- We are continuing the momentum with ARSC2019 to be held in Adelaide in September next year, planning of which is well underway - thanks very much to Martin Small, Jeremy Woolley, Matthew Baldock, Philip Blake, Raph Grzebieta, and the entire SA Chapter for helping this along. We are joined again by our Founding Partner Austroads, plus South Australia's Centre for Automotive Safety Research, as Inviting Partners for ARSC2019. We thank the SA Chapter for their generosity and continued hard work in ensuring the event is a success. We are currently awaiting advice from the South Australian government regarding the Platinum Sponsorship and hope to make an announcement shortly.

- **AWARDS:** During the past 12 months we have continued to celebrate outstanding achievements in the road safety sector at the 2018 ACRS Award Ceremony held during the ARSC2018 Conference Dinner, celebrating and rewarding the achievements of the many varied sectors working to reduce road trauma. The Canberra office continues to be the administrative hub for all of our awards and we work hard to promote and encourage wide-ranging applications to ensure best outcomes. For the 3M award we have built a very strong relationship with key 3M people and look forward to them having a higher profile at this year's conference as they are based in Sydney. A special congratulations to Dr John Crozier and A/Professor Jeremy Woolley, our new ACRS Fellows, awarded for her outstanding commitment and achievement in reducing road trauma, and to Christine Thiel, awarded Australasia's most prestigious road safety award for an exemplary road safety project - the 2018 3M-ACRS Diamond Road Safety Award. We look forward to Eric's plenary presentation on his award-winning work at ARSC2018.
- ARSC2018 also provided the opportunity to recognise outstanding conference presentations, with 7 awardees recognised sharing in $6,000 worth of awards.
- **SUBMISSIONS:** Over the last 12 months we have presented 3 Submissions. These included - 1) ACRS 2018-19 pre-Budget Submission 2) ACRS 2018 Submission into the Inquiry into the United Nations Sustainable Development Goals. Thanks especially to ACRS Vice-President Martin Small for his help with these submissions – he has been integral in the development of very strong priorities being put forward to our stakeholders.
- **SUPPORTING CHAPTERS:** We are also continuing to support the effectiveness of ACRS Chapters who have also been presenting submissions and running successful events which we will hear about during our Chapter Reports coming up next. Congratulations to all Chapters for their continuing efforts to engage with their regional stakeholder communities in order to improve road safety outcomes.

COMMUNICATIONS: As a major member benefit we have continued to provide regular, informed communications over the past 12 months to members via the following channels:

- Quarterly Journal**:** Thanks to Dr Chika Sakashita for the work in pulling together these excellent publications. The journal continues to be a mainstay of College activities and we thank Chika for her continued vision and drive in further ramping up engagement and professionalism standards. Chika is also driving our engagement with the United Nations Road Safety Collaboration of which we have recently been elected a member. I also thank Raph for his continued dedication and skill in overseeing the online submission and review process via Editorial Manager, and the expertise-filled JACRS Editorial Board for their continuing engagement and supoprt.
- Weekly Alert**:** 48 Alerts have been sent to members during the past 12 months.
- Submissions**:** as per above, 2 comprehensive submissions were presented during the past 12 months.
- Membership Alerts**:** 8 for the year (invitations to comp members etc)
- Conference Alerts: 21 comprehensive Alerts were issued for ARSC2018.
- **Websites:** we have 3 websites up and running and being updated as often as possible ACRS Website, Conference Website, Awards Website. We are currently developing a new website for the College, which is a very exciting time for us and we look forward to launching mid-2019.
- **Social Media:** We remain active on LinkedIn, Twitter and Facebook – members are encouraged to join and engage with us through these networks.
- **Photos:** we maintain a comprehensive library of photos from events on Flickr - our album of 2018 conference photos for example has been opened over 2,000 times, and the photo views are sitting at 725,411 which is a fantastic reach.
- **Videos:** we have added 15 new videos this year to the ACRS Youtube channel

Particular thanks to our Australasian Executive Committee and our esteemed Fellows who have generously committed their resources throughout 2018 to ensure this has been another active and successful year for the College - a College that continues to engage with a collaborative road safety community:

- **Mr Lauchlan McInosh AM** - President - Interdependent Consultant
- **Professor Raphael Grzebiet**a - Immediate Past President - Transport and Road Safety
- **Mr Martin Smal**l - Co Vice-President - Interdependent Consultant
- **Dr Marilyn Johnso**n - Vic Chapter Chair - Monash University
- **A/Prof Jeremy Woolley** - SA Chapter Chair - CASR - Univeristy of Adelaide
- **Dr Mark King** - Treasurer & QLD Chapter Chair - CARRS-Q
- **Mr David McTiernan** - NSW Chapter Chair - ARRB Group
- **Dr Paul Graham**- NZ Chapter Chair - NZTA
- **Dr Paul Roberts** - WA Chapter Cahir - ARRB Group
- **Mr Eric Chalmers** - ACT Chapter Chair - KidSafe
- **Dr Julie Hatfield** - Committee Member - TARS @ UNSW
- **Professor Mark Stevenson** - Committee Member - University of Melbourne

- **Professor Narelle Haworth** - Committee Member - CARRS-Q
- **Associate Professor Teresa Senserrick** - Committee Member - TARS @UNSW
- **Dr Blair Turner** - Committee Member - ARRB
- **Dr Liz De Rome** - Committee Member - Deakin University

ACRS Awarded Fellows:

- 2018 **A/Professor Jeremy Woolley & Dr John Crozier**
- 2017 **Ms Samantha Cockfield**
- 2016 **Professor Ann Williamson**
- 2015 **Mr Rob McInerney**
- 2014 **Mr Iain Cameron**
- 2013 **Professor Narelle Haworth**
- 2012 **Ms Lori Mooren**
- 2011 **Mr David Healy**
- 2010 No award
- 2009 **Professor Barry Watson**
- 2008 **Professor Mark Stevenson**
- 2007 **Professor Raphael Grzebieta**
- 2006 **Mr Lauchlan McIntosh AM**
- 2005 No award
- 2004 **Dr Soames Job**
- 2003 No award
- 2002 **Mr Ray Taylor**
- 2001 **Mr Colin Grigg**
- 2000 **Professor Mary Sheehan**
- 1999 **Mr Ken Smith**
- 1998 **Dr Jim McGrath**
- 1997 **Dr Gordon Trinca**
- 1996 **Mr Peter Makeham**
- 1995 **Dr Michael Henderson**
- 1994 **Mr Frank Green**
- 1993 **Dr Brian Connor**
- 1992 **Mr Harry Camkin**

And lastly my thanks go to the College President, Lauchlan McIntosh, who along with our Fellows and the Executive Committee and Chapter Executives, continues to be engaged and committed in this space. In conjunction with you, our members, all of us continue to see the relevance of our organisation in bringing stakeholders together and providing an independent voice and platform for road trauma reduction advocacy. I would like to specifically say thank you to our outgoing VP, Mr David Healy, who has been a wonderful mentor for me in my role here, and I look forward to David continuing his involvement through the VIC Chapter.

In terms of the Canberra Office, including my work which has become full-time, we now have the equivalent of 2.6 Full-time staff , plus our Journal Managing Editor (Chika), a Conference Manager (Shanna Sheldrick from Premier Event Concepts, based in Adelaide) and a Peer-Review Manager (Professor Raphael Grzebieta who continues to work on our Conference and Journal peer-review system). In total we currently have the equivalent of around 3.5 full-time staff overall managing the huge range of activities we support.

So a huge thank you goes to the ACRS staff here at the corporate office – as you have heard we do a lot with very limited resources. We welcomed Kim Winks as our Office Manager, who is doing a wonderful job revamping our IT capabilities and financial systems, has refreshed our office space, and is now heavily involved in conference-related work, especially sponsorships. We have also welcomed Kirra Penny as our Communications and Marketing Officer who has hit the ground running and is working hard on our e-communications and doing the groundwork for our new website. As CEO I'm very proud of the committed team we have built to support you all from the Canberra office.

We continue to have times of increased workload, and with the growth the College is experiencing are looking forward to the strategic review to cement our way forward while being mindful of our heavy reliance on a conference surplus.

To finish up I would like to say a very sincere thank you also to the many people involved in ARSC2018, and now ARSC2019 and ARSC2020 from the Organising Committees to the various sub-Committees, through to our 50 conference editors and over 100 peer-reviewers for each conferences. Our Conferences are certainly the result of a

massive collaborative effort from many stakeholders and sectors of the road safety community across Australasia.

We continue to expand our horizons as evidenced by the engagement with all of our communications, submissions & events. To finish I'll repeat what I said last year as it's still very relevant…..whilst we may receive some push-back in various quarters in terms of advocating for road trauma reductions, we definitely do need to remind ourselves to have 'courageous patience' and perhaps to include 'strategic perseverance' in the mix moving forward.

OVERVIEW OF 2018 AND BIG THANKS FROM THE MANAGING EDITOR, DR CHIKA SAKASHITA: AN EXCITING AND SUCCESSFUL YEAR FOR THE *JOURNAL OF THE AUSTRALASIAN COLLEGE OF ROAD SAFETY (JACRS)*

A big thank you to the authors who made contributions to the JACRS in 2018. It is thanks to the JACRS authors that we are able to continue disseminating valuable road safety research and experiences. Many fantastic road safety papers were published in 2018. Please see the comprehensive list below. Electronic copies of the papers can be obtained from the ACRS website: http://acrs.org.au/publications/journals/current-and-back-issues/

JACRS 2018 papers

- Young, K.L., Charlton, J.L., Koppel, S., Grzebieta, R., Williamson, A., Woolley, J. and Senserrick, T. (2018). **Distraction and Older Drivers: An Emerging Problem?** *Journal of the Australasian College of Road Safety*, *29*(4), 18-29.
- Chan, H., Chiang, T., Yip, R., Shih, Y., Ho, V., Brar, R. and Brubacher, J. (2018). **Driving Ability and Transportation Needs of Older Drivers Treated in an Emergency Department.** *Journal of the Australasian College of Road Safety*, *29*(4), 30-38.
- Eby, D.W., Molnar, L.J., Kostyniuk, L.P., Zakrajsek, J.S., Ryan, L., Zanier, N., St. Louis, R.M., Stanciu, S.C., Bogard, S.E., Demchak, D.H., DiGuiseppi, C., Li, G., Mielenz, T.J., Strogatz, D., LeBlanc, D., Smith, J., Yung, R. and Nyquist, L. on behalf of the LongROAD Research Team. (2018). **The Association between Visual Abilities and Objectively-Measured Driving Space, Exposure, and Avoidance among Older Drivers: A Preliminary Analysis.** *Journal of the Australasian College of Road Safety*, *29*(4), 39-45.
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- Hua, P., Charlton, J.L., Koppel, S., Griffiths, D., St. Louis, R.M., Di Stefano, M., Darzins, P., Odell, M., Porter, M.M., Myers, A., & Marshall, S. (2018). **Characteristics of low and high mileage drivers: Findings from the Ozcandrive older driver cohort study.** *Journal of the Australasian College of Road Safety*, *29*(4), 53-62.
- Agramunt, S., Meuleners, L., Fraser, M., Chow, K., Ng, J., Raja, V. and Morlet, N. (2018). **An Examination of Driving Exposure, Habits and Harsh Braking Events in Older Drivers with Bilateral Cataract Using Naturalistic Driving Data.** *Journal of the Australasian College of Road Safety*, *29*(4), 63-71.
- Harkin, J.M., Charlton, J.L. and Lindgren, M. (2018). **Older Drivers in the News: Killer Headlines v Raising Awareness.** *Journal of the Australasian College of Road Safety*, *29*(4), 72-83.
- Vissers, L., Houwing, S., and Wegman, F. (2018). **Recording of alcohol in official crash statistics: underreporting and procedures to improve statistics.** *Journal of the Australasian College of Road Safety*, *29*(3), 15-22.
- Keall, M.D., D'Elia, A., Newstead, S., and Watson, L. (2018). **Analysis of trends in the composition of Australasian vehicle fleets associated with pedestrian injury severity.***Journal of the Australasian College of Road Safety*, *29*(3), 22-29.
- Esmaeilikia, M., Grzebieta, R., and Olivier, J. (2018). **A Systematic Review of Bicycle Helmet Laws Enacted Worldwide.** *Journal of the Australasian College of Road Safety*, *29*(3), 30-38.
- Docke, J., and Johnson, M. (2018). **Safe Roads for Cyclists: An Investigation of Australian and Dutch Approaches.** *Journal of the Australasian College of Road Safety*, *29*(3), 39-49.
- Ponte, G., and Nishimoto, T. (2018). **Development of a pedestrian injury prediction model for potential use in an Advanced Automated Crash Notification (AACN) system.** *Journal of the Australasian College of Road Safety*, *29*(3), 50-57.
- Smith, J. (2018). **The Age of Light Vehicles Involved in Road Fatalities.** *Journal of the Australasian College of Road Safety*, *29*(3), 58-64.
- Job, R.F.S. (2018). **Safe Speeds Part 1: Political Decisions and the Limited Adoption of Speed Management for Road Safety.** *Journal of the Australasian College of Road Safety*, *29*(3), 65-69.
- Hidalgo, D., López, S., Lleras, N. and Adriazola-Steil, C. (2018). **Using Big Data for Improving Speed Enforcement and Road Safety Engineering Measures: An Application in Bogota, Colombia.** *Journal of the Australasian College of Road Safety*, *29*(2), 12-19.
- Marsh, F. and Webster, R. (2018). **Mitigating localised sand accumulation using wire rope safety barrier.** *Journal of the Australasian College of Road Safety*, *29*(2), 20-26.

- Phan, V.L., Dang, D.V., Evdorides, H., Lawson, S., Bradford, J. (2018). **Crash Risk Models for A Motorcycle - Dominated Traffic Environment.** *Journal of the Australasian College of Road Safety*, *29*(2), 27-43.
- Holgate, J. (2018). **It is time to consider a presumed liability law that protects cyclists and other vulnerable road users. [Letter to the Editors].** *Journal of the Australasian College of Road Safety*, *29*(2), 44-45.
- Boufous, S. (2018). **Response: It is time to consider a presumed liability law that protects cyclists and other vulnerable road users. [Letter to the Editors].** *Journal of the Australasian College of Road Safety*, *29*(2), 45.
- Paine, M. (2018). **Telematics and Vehicle Safety.** *Journal of the Australasian College of Road Safety*, *29*(2), 46-49.
- Devalla, J. (2018). **Who violates traffic rules?** *Journal of the Australasian College of Road Safety*, *29*(2), 50-53.
- Muthubandara, N., Eveleigh, M., Kung, L., and Spathonis, J. (2018). **A Crash Testing Evaluation to Prevent Injuries and Fatalities by Mitigating Vehicle Windscreen Spearing Risk from Road Signs.** *Journal of the Australasian College of Road Safety*, *29*(1), 13-20.
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- Seah, R., Lystad, R. and Mitchell, R.J. (2018). **Risk factors associated with severity of hospitalised injury outcome for vulnerable-road users in New South Wales, Australia: A population-based study.** *Journal of the Australasian College of Road Safety*, *29*(1), 30-38.
- Middleton, N. and Cartwright, F. (2018). **Review of the graduated driver licensing programs in Australasia [Letter to the Editors].** *Journal of the Australasian College of Road Safety*, *29*(1), 39-40.
- Scott-Parker, B. and Rune, K. (2018). **Response: Review of the graduated driver licensing programs in Australasia [Letter to the Editors].** *Journal of the Australasian College of Road Safety*, *29*(1), 40-42.
- Sarkissian, W. (2018). **A collaborative road safety survivor mission: the sacred work of sorrow.** *Journal of the Australasian College of Road Safety*, *29*(1), 42-48.

In line with the new ACRS logo and to reflect our increasingly global coverage and reach of the JACRS, we also introduced a new cover for the JACRS since the last NOV 2018 Issue.

With our passionate and committed road safety expert Prof. (Em.) Raphael Grzebieta as the Editor-in-Chief and strong Editorial Board consisting of international road safety experts of high calibre (see the list of members p.3), JACRS is continuing to improve and taking on a new exciting path towards attaining an impact factor.

We hope that the authors and readers will continue to find JACRS valuable and exciting and look forward to your continued support and contributions. We welcome your submissions online: https://www.editorialmanager.com/jacrs/default.aspx Author Instructions and WORD Template to guide your writing are available from the ACRS website: http://acrs.org.au/contact-us/em-journal-conference-contacts/ (scroll down). A**ny questions and suggestions for improvement, please contact Dr Chika Sakashita:** journaleditor@acrs.org.au

JACRS EDITOR-IN-CHIEF AND IMMEDIATE PAST PRESIDENT OF ACRS, PROFESSOR RAPHAEL GRZEBIETA IS HONORED WITH US TRB'S 2019 KEN STONEX AWARD FOR WORK ON ROADSIDE SAFETY

KENNNETH A STONEX Roadside Safety Award was presented to Professor Raphael Grzebieta on 16th January 2019 at the TRB's Annual Meeting in Washington DC, USA in recognition of his inspiring devotion, commitment, and contribution to the goal of reducing run-off-the-road injuries and deaths worldwide.

From left to right: Ms Lidia Grzebieta (Bridge design engineer and wife), Prof Raphael Grzebieta (Stonex Award recipient) Dr Roger Bligh (Chair AFB20 Roadside Safety Design Committee), Mr Eric Donnell, (Chair TRB Design Section) and Mr Nelson Gibson (TRB Senior Program Officer).

The plaque reads:

"Raphael Grzebieta's long and distinguished career has been devoted to promoting best practices in transportation design and management to develop a "human error tolerant" roadway system. Through active participation in summits, forums, and conferences worldwide, he has been a staunch advocate for a "Vision Zero" approach to road safety, and

supporter of innovative counter-measures that reduce crash severity to compensate for human error. His insightful publications have increased knowledge and provided design guidance in many areas of transportation safety.

Professor Grzebieta's research has focused on identifying leading causes of roadside fatalities and injuries and developing mitigation techniques using full-scale crash testing and computer simulation. He has investigated almost all types of vehicles including bicycles, motorcycles, sedans, all-terrain vehicles, and heavy vehicles. His research emphasis has included vehicle rollovers, pedestrian safety, helmet safety and legislation, posted speed effects, and roadside barrier safety, just to name a few.

Professor Grzebieta is the definition of what it means to be passionate about the safety of motorists throughout the world. He has done a phenomenal job leading and articulating direction for advancements in roadside safety. His devotion, commitment, and contribution to roadside safety are extraordinary, and he is truly deserving of the

Kenneth A. Stonex Award. Thank you Raph!"

The Kenneth A. Stonex Roadside Safety Award was established in 1991 to recognise lifetime contributions to roadside safety. It was originally sponsored by General Motors and was named for Ken Stonex, a GM employee who was a pioneer for roadside safety long before the seriousness of ran-off-road crashes was recognised by most transportation agencies. The United States Academy of Sciences Transportation Research Board's AFB20 Committee on roadside safety now presents the award annually to a deserving individual during TRB's Annual Meeting.

WORLD HEALTH ORGANISATION RELEASES GLOBAL STATUS REPORT ON ROAD SAFETY 2018

A new report by the World Health Organization (WHO) indicates road traffic deaths continue to rise, with an annual 1.35 million fatalities. The WHO *Global status report on road safety 2018* highlights that road traffic injuries are now the leading killer of children and young people aged 5-29 years.

"These deaths are an unacceptable price to pay for mobility," said WHO Director-General, Dr Tedros Adhanom Ghebreyesus. "There is no excuse for inaction. This is a problem with proven solutions. This report is a call for governments and partners to take much greater action to implement these measures."

The WHO *Global status report on road safety 2018* documents that despite an increase in the overall number of deaths, the rates of death relative to the size of the world population have stabilized in recent years. This suggests that existing road safety efforts in some middle- and high-income countries have mitigated the situation.

"Road safety is an issue that does not receive anywhere near the attention it deserves - and it really is one of our great opportunities to save lives around the world," said Michael R Bloomberg, Founder and CEO of Bloomberg Philanthropies and WHO Global Ambassador for Noncommunicable Diseases and Injuries. "We know which interventions work. Strong policies and enforcement, smart road design, and powerful public awareness campaigns can save millions of lives over the coming decades."

In the settings where progress has been made, it is largely attributed to better legislation around key risks such as speeding, drinking and driving, and failing to use seat-belts, motorcycle helmets and child restraints; safer infrastructure like sidewalks and dedicated lanes for cyclists and motorcyclists; improved vehicle standards such as those that mandate electronic stability control and advanced braking; and enhanced post-crash care.

The report documents that these measures have contributed to reductions in road traffic deaths in 48 middle- and high-income countries. However, not a single low-income country has demonstrated a reduction in overall deaths, in large part because these measures are lacking.

In fact, the risk of a road traffic death remains three times higher in low-income countries than in high-income countries. The rates are highest in Africa (26.6 per 100 000 population) and lowest in Europe (9.3 per 100 000 population). On the other hand, since the previous edition of the report, three regions of the world have reported a decline in road traffic death rates: Americas, Europe and the Western Pacific.

Variations in road traffic deaths are also reflected by type of road user. Globally, pedestrians and cyclists account for 26% of all road traffic deaths, with that figure as high as 44% in Africa and 36% in the Eastern Mediterranean. Motorcycle riders and passengers account for 28% of all road traffic deaths, but the proportion is higher in some regions, e.g. 43% in South-East Asia and 36% in the Western Pacific.

Find the Full Report here: https://www.who.int/violence_injury_prevention/road_safety_status/2018/en/

Diary

8-13 April 2019
Sixth Global Meeting of Nongovernmental Organizations Advocating for Road Safety and Road Victims
http://roadsafetyngos.org/sh_conference/sixth-global-meeting/
Chania, Greece

22-24 May 2019
ITF 2019 Summit: Transport connectivity for regional integration
https://www.itf-oecd.org/itf-2019-summit-transport-connectivity-regional-integration
Leipzig, Germany

26-31 May 2019
15th World Conference on Transport Research
http://http/www.wctrs-conference.com/
Mumbai, India

9-12 June 2019
Global Public Transport Summit
https://uitpsummit.org/
Stockholm, Sweden

25-27 September 2019
Australasian Road Safety Conference
http://australasianroadsafetyconference.com.au/
Adelaide, Australia

6-10 October 2019
26th World Road Congress
www.piarcabudhabi2019.org
Abu Dhabi, United Arab Emirates

Peer-reviewed Papers

Original Road Safety Research

Extent of mobile phone use by pedestrians on controlled crossings in central Hobart, Tasmania

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Key Findings

- Pedestrian phone use was recorded for 16,032 people over 70 hours on 10 signalised crossings in central Hobart, Tasmania.
- On average, 12.4% were using their phones while crossing: 4.6% were looking down at their phone to read or type, 2.3% were talking and another 5.5% were listening to headphones.
- At busy crossings, as many as 158 people per hour were looking down at their phones to read or type as they crossed the road, including on steady red with conflicting motor vehicle movements.
- These results suggest various levels of cognitive and visual impairment while on the roadway, although further work is required to determine how this behaviour might link to the crash risk.

Abstract

Distracted walking is one way that pedestrians increase their risk of injury, but little is known about the extent of the problem. I quantified the extent of phone use by pedestrians over seven hours at each of the 10 signalised crossings in central Hobart. Of the 16,032 people counted, 12.4% of pedestrians were using phones: 4.6% were reading or typing on their phone, 2.3% were talking and another 5.5% were listening to headphones. The latter figure will be an underestimate because of the difficulty of seeing headphones obscured by hats and long hair. At the busiest sites at two ends of a pedestrian mall, there were as many as 155 and 158 people in a one hour period looking down at their phones to read or type. Fortunately these two roads had slow moving vehicle traffic, meaning consequences of crashes would likely be minor. However, four of the sites crossed wide, 50kph, arterial roads, so a combination of responses will be needed to lower crash risk, including education, enforcement and consideration of safe road speeds.

Keywords

Pedestrian, mobile phone, vulnerable road user, inattention, distraction, Tasmania

Introduction

Distracted walking is one way that pedestrians increase their risk of injury (Cassell et al., 2011). Although traffic-related pedestrian deaths have been decreasing over the past several decades (Cassell et al., 2011; BITRE 2015), pedestrians remain at increased risk of fatality and serious injury in a crash compared with motor vehicle occupants because of their lack of physical protection (Bungum et al., 2005). Pedestrians represented 14% of overall fatalities in Australia in 2017; a statistics that has not improved over the medium term (BITRE 2018; cf 14% average over 2003-2012; Williamson and Lennon, 2015). This is despite efforts to address pedestrian safety during this Decade of Action for Road Safety (2011-2020). In this paper, I present some preliminary results of pedestrian use of mobile phones on signalised crossings in central Hobart, Tasmania; only the third such study in Australia and the first in Tasmania.

Previous research on pedestrian mobile phone use

Distraction is inherent while using a mobile phone (Saltos et al., 2015). Using phones while walking is known to increase the frequency of motor vehicle-pedestrian crashes (e.g. Hatfield & Murphy, 2007; Alejalil & Davoodi, 2016). There has been a rapid increase in phone ownership (Pew Research Centre 2018) and in the number of people using a mobile phone while crossing a road (Neider et al., 2010; Schwebel et al., 2012; Thompson et al., 2013). Mobile phone ownership has risen from 77% of Americans in 2011 to 95% in 2018 (Pew Research Centre 2018) and mobile phone related injuries have increased relative to total pedestrian injuries in the US between 2004 and 2010 (Nasar & Troyer, 2013). Around 88% of Australians owned a mobile phone in 2017, including 95% of 18-34 year olds (Deloitte 2017).

Pedestrians using phones have been shown to experience cognitive distraction, reduction in their awareness of their surroundings and situation, reduced perceptual visual field, and reduced attention (e.g. Hatfield & Murphy, 2007; Hyman et al., 2010; Stavrinos et al., 2011; Nasar & Troyer, 2013; Alejalil & Davoodi, 2016; Banducci et al., 2016). These behaviors puts pedestrians at higher risk of collision with a motor vehicle (Schwebel et al., 2012; Nasar & Troyer, 2013). Inattentiveness has been found to be a crash factor in as much as 15% of pedestrian fatalities (Bungum et al., 2005). Studies in virtual road environments have found that mobile-phone users were less likely to 'successfully' cross the road and phone users were more likely than non-phone users to crash with a motor vehicles (Neider et al., 2010; Alejalil & Davoodi, 2016).

Most naturalistic research of pedestrian mobile phone use in real road crossing settings has been done in the United States. A Seattle study of 1102 people across 20 crossings found that 24.7% of pedestrians were using their phones as they crossed the street. Of the total of 1102, 7.3% were reading or typing, 6.2% were talking on the phone and 11.2% were listening (Thompson et al., 2013). A 2005 Las Vegas study of 886 people on a crossing near a university found that 20.8% of people were distracted by phones, eating, drinking, smoking or talking. Of the 886, 5.7% were distracted by phones (Bungum et al., 2005). A study of two

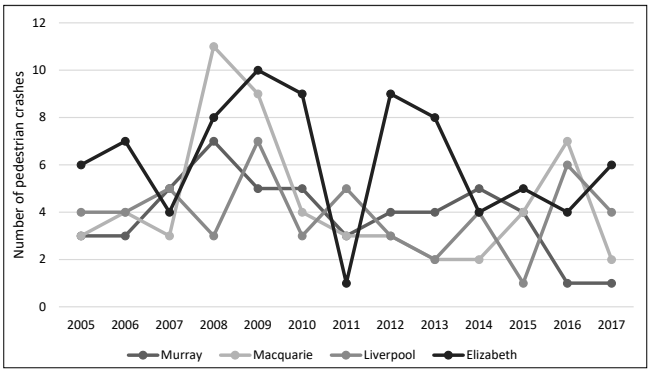

Figure 1. Number of pedestrian crashes on four major roads in central Hobart, Tasmania (Department of State Growth)

American college campuses found 8% reading or typing, 5% talking on the phone and 19% listening via headphones (Wells et al., 2018). A study of self-reported pedestrian crash history among US teenagers (13 to 18 years) found that 30% reported having been hit, or almost hit, by a car, cyclist, or motorcyclist while walking and 71% reported using of a device when walking 'all of the time', 'often' or 'sometimes' (Rosenthal et al. 2016). Rosenthal (et al. 2016) found that frequent use of mobile devices while walking or crossing the street resultsed in increased odds of self-reported crash history among these teens.

In Australia, Williamson and Lennon (2015) asked 211 pedestrians in Brisbane to self-report their smart phone use while crossing the road. More than half the group were aged 18-30 years (56%) and this cohort reported particularly high levels of mobile phone use; 32% texted at high frequency levels and 27% used internet at high frequency levels while on the roadway. These data were self-reported, so actual use may have been quite different, but the study clearly showed that many people were aware of their regular use of distractions while crossing roads. A 2007 study in three Sydney suburbs found that 33% of 546 people crossing the road were on the phone; 27% were talking and 6% were texting (Hatfield & Murphy, 2007). To my knowledge, these are the only two existing studies of phone use on crossings in Australia.

Hobart context

This study adds to our understanding of mobile phone use on roadways and provide some data for Tasmania. Annual pedestrian road fatalities are low in Tasmania compared with larger jurisdictions, but pedestrians are still over-representation in the crash record in Tasmania (Department of State Growth 2018). Data from arterial roads in central Hobart over 2005 - 2017 showed a consistent level of pedestrian involvement of around 10-30 crashes per year, with little sign of a downward trend (Department of State Growth unpublished data). The crash statistics for four roads in central Hobart showed large variability from year to year and site to site over 2005 to 2017 (Figure 1).

For this paper, the number of people using their mobile phones were observed while crossing at ten signalised crossings in central Hobart, Tasmania. I targetted intersections because most pedestrian crashes occur at intersections, particularly when the crossing has a high number of 'red walkers' who cross illegally (Gårder 1989). People were counted over 7 hours each at 10 locations in order to quantify the extent to which pedestrians were (a) looking at their phone to read or type (cognitive and visual distraction), (b) talking (active cognitive distraction), or (c) listening to headphones (passive cognitive distraction). The research question was 'what proportion of people crossing the study crossings were using their mobile phones?'

Table 1. Total people crossing and the average and standard deviation of the percentage of pedestrians using phones for each of the study intersections. These data are based on seven hours of observations for each crossing.

	Total people crossing over 70 hours	Average % looking at phone (reading or typing)	Average % talking on phone	Average % listening to phone (headphones)	Total % using phone
1	841	5.2 ± 0.9	1.3 ± 0.3	2.9 ± 0.5	9.4± 0.5
2	361	3.9 ± 0.4	2.5 ± 0.3	3.6 ± 0.3	10.0 ± 0.3
3	3566	3.8 ± 0.7	1.7 ± 0.4	7.2 ± 1.0	12.7 ± 0.7
4	1573	3.8 ± 0.5	2.6 ± 0.5	3.8 ± 0.5	10.2 ± 0.5
5	2202	2.7 ± 0.5	2.2 ± 0.5	3.0 ± 0.6	7.9 ± 0.5
6	1423	6.5 ± 0.5	2.8 ± 0.3	7.0 ± 0.5	16.3 ± 0.5
7	1280	6.1 ± 0.5	3.5 ± 0.4	5.5 ± 0.5	15.1 ± 0.4
8	4029	3.9 ± 0.6	1.7 ± 0.4	5.8 ± 0.7	11.5 ± 0.5
9	267	5.6 ± 0.3	0.7 ± 0.1	6.0 ± 0.3	12.4 ± 0.3
10	490	5.1 ± 0.3	3.5 ± 0.4	10.2 ± 0.5	18.8 ± 0.4
Total	16032	4.6 ± 0.5	2.3 ± 0.4	5.5 ± 0.6	12.4 ± 0.5

Methods

Ten study sites were chosen in the central business district of Hobart. Hobart is the capital city of Tasmania, and the largest urban centre with a population of 222,356 at the last census (ABS 2017). All ten crossings were in speed zones of 50km/hr or less; had high pedestrian activity; were signalised; and had no filtering traffic, i.e. no left or right-turning vehicles entering the pedestrian crossing. The lack of filtering motor vehicles is important to note, given that the most common crash scenario involving pedestrians is right-turning motor vehicles and the second most common is left-turning motor vehicles (Mantilla & Burtt, 2016). There were some differences in the characteristics of each site, such as distance across the road and time allowed for crossing. In this paper, I sought to quantify the extent of the problem rather than look for covariates that might explain variation between sites.

The data were collected over two weeks in May, 2017. Autumn weather in Hobart tends to be fairly stable, with large high pressure system moving slowly over the state bringing mild, calm and generally sunny conditions over the two weeks of data collection. Maximum daily temperatures ranged from a low of 9˚C to a high of 18˚C, and averaged 13˚C. Wet weather was avoided because of lower pedestrian numbers and greater difficulty of observing pedestrians from a sheltered location.

Data were manually recorded over seven 1-hour periods at each of the 10 crossings, totaling 70 hours of data collection. Data collectors positioned themselves in a location where they had a good sightline of the crossing, but remained unobtrusive. Data were collected during busy periods on Mondays, Wednesdays and Fridays, from 8 to 9am and again 4 to 5pm. A seventh hour was added to capture some weekend traffic on Saturday from 10 to 11am. Time of day was a means of stratifying the data collection, rather than being a variable of interest in the study. The light sequence was variable with some crossings cycling every minute and some every two minutes.

A total of 11 data collectors were used. One person did 16 of the 70 hours of data collection and acted in the role of data coordinator/quality control. She was responsible for training the other observers and attended the first data collection session with new people to ensure that their technique was correct. The data collection was simple and there was not much scope for error. The main difficulty was in counting the number of people wearing in-ear headphones (or earbuds) because they could be difficult to see under hats or long hair. Therefore, the figures presented in this study were likely to be an underestimate. Herein, both earbuds and over-ear headphones are referred to as 'headphones'.

Descriptive statistics were used to describe the proportion of pedestrians engaged in each type of phone use at each crossing. Average and standard deviation were calculated, with each green light phase acting as one data point. Therefore, a crossing with a light sequence of one minute for the three phases (green, flashing red and steady red) yielded 60 separate records over an hour of data collection for the three variables: people texting, talking and listening to their phones.

Results

A total of 16,032 people were recorded over the seven hours of data recording at each of the 10 sites. No crashes were recorded during the two weeks of the study, although some near misses were observed during periods when pedestrians were on the roadway during the steady red pedestrian lantern phase. The crash history for the 10 study sites showed that there were nine incidents over a 10-year period (2007 – 2016). Of these nine, two were serious (requiring hospital stay), four were minor (brief visit to hospital), and three required first aid. The locations with the most crashes were the two ends of the main pedestrian mall (Elizabeth Street

Mall), with the northern end having one crash (serious injury) and the southern end having four crashes (2 minor, 2 first aid). This result was to be expected statistically because these two crossings were the busiest of the 10 study crossings with 22% (3566 people; northern end) and 25% (4029 people; southern end) of the total number of people counted. It is not known how many of these crashes involved pedestrian inattention.

Overall, 12.4% of pedestrians were using phones: 4.6% were reading or typing on their phone, 2.3% were talking and another 5.5% were listening to headphones (Table 1). The number of people looking down at their phone to read or type while they cross the road was as high as 155 per hour (Site 3) and 158 per hour (Site 8), which represented a large number of occasions where a pedestrian's attention was potentially compromised.

Discussion

This study found that of 16,032 people counted at the ten signalised crossings, an average of 12.4% of pedestrians used phones to talk, text, or listen to headphones. This high proportion of distracted pedestrians is of concern, given the established connection between mobile phones and reduced attention (e.g. Nasar & Troyer, 2013; Alejalil & Davoodi, 2016). It is known that these behaviors put pedestrians at higher risk of crash (Schwebel et al., 2012; Nasar & Troyer, 2013) and mean they are less likely to successfully cross the road (Neider et al., 2010; Alejalil & Davoodi, 2016).

These results for Hobart were lower than those reported for Sydney in 2007, where 27% of people were talking on their phones and 6% were texting (Hatfield & Murphy, 2007). The Hobart figure of 12.4% is also lower than studies of phone use on road crossings in the United States:

- A Seattle study of 1102 people across 20 crossings found that a total of 24.7% of pedestrians were using their phones as they crossed the street: 7.3% reading or typing, 6.2% talking on the phone and 11.2% listening (Thompson et al., 2013).
- A Las Vegas study of 886 people on a crossing near a university found that 20.8% of people were distracted by phones, eating, drinking, smoking or talking and 5.7% of the total were distracted by phones (Bungum et al., 2005).
- A Norfolk (VA) and Birmingham (AB) study of 10,543 people on US college campuses found that 32% were using their phones as they crossed the road: 8% texting or reading, 5% talking and 19% listening (Wells et al. 2018).

In the Hobart study, only 4.6% of pedestrians were using headphones while crossing at crossings compared with 11.2% in Seattle, 16% in Birmingham, and 21% in Norfolk. The difference between the results might partly be accounted for by the cool, hat-wearing autumnal weather during the Hobart study and the resulting underestimate of headphone use, compared with the American studies that were all done over summer or early autumn (fall). The only study that reported lower distraction by phones compared with Hobart was the Las Vegas study that is now more than 13 years old and is likely to be out of date, given the rapid rise in phone ownership since 2005 (Pew Research 2018).

The link between headphone use and crash risk has not been well established. A US study of pedestrian injuries or fatalities from crashes involving trains or motor vehicles during 2004 - 2011 found that in 74% of the 116 reports of death or injury the pedestrian was using headphones (Lichenstein et al., 2012). However, further research is needed to establish a causal link.

Implications for road safety campaigns

The type of phone use that has been of most concern has been texting, where the pedestrian is looking down, rather than at their surroundings (e.g. Saltos et al., 2015; Banducci et al., 2016). In our study, 5.6% of pedestrians were looking down at their phones, which was similar to the older study of 5.7% in Las Vegas but lower than for the college campuses (8%) and Seattle (7.3%). The first pieces of legislation related to distracted walking specifically target texting while walking. Some US jurisdictions, including parts of Hawaii and New Jersey, have passed legislation to target people looking down at their phones while on a road crossing (e.g. City and County of Honolulu 2017). In Australia, there is no fine for pedestrians who use their phones on the roadway, but people can be fined AU$110 fine for 'not considering other road users'.

As with other road safety issues, multiple tools are likely to be needed as part of a safe system approach to tackle distracted walking. Enforcement, education and engineering responses all have a role to play in ensuring that any mistakes that result from distracted walking do not result in serious injury or fatalities. A safe systems approach requires appropriately low speed limits in areas of high pedestrian activity. We observed near misses at the two crossings with the highest pedestrian volume in Hobart, but motor vehicles were travelling slowly and both parties had time to compensate. However, four of the ten sites were on the main arterial couplet for through traffic (Davey and Macquarie Streets), and any move to reduce speed limits to 30 or 40 kph would present considerable socio-political challenges.

Education campaigns may help raise public awareness of how mobile phones contribute to safety risk (Hatfield & Murphy, 2007). However, the difficulty of communicating the safe walking message should not be underestimated, given that campaigns about the risks of mobile phone use while driving do not appear to be succeeding (Rowden & Watson, 2014). Road safety education campaigns have been found to change road crossing behaviour, but the effect is highly variable between different studies and it is not known whether the campaigns reduces the risk of pedestrian injury (Duperrex et al., 2002).

In terms of engagement between authories and road users, the US National Safety Council (2018) has recommended that pedestrians not wear headphones or use a cell phone while walking, and the World Health Organisation (2013)

highlights talking and walking as an emerging problem for children, but offers no advice on tackling the issue in adults beyond boosting law enforcement. In Australia, the Austroads Research Report: Guide Information for Pedestrian Facilities only mentions phones once in the context of pedestrians being 'GPS enabled' through their phones (Austroads, 2013). The design of interventions and education campaigns needs to be carefully targetted to suit the particular context and more work is needed on the role and effectiveness of education in reducing pedestrian risk from distracted walking.

Limitations and further research

This study was done opportunistically as a side project in an evaluation of pedestrian countdown timers in central Hobart. Given the large number of pedestrians in this study, the paucity of data on pedestrian phone use in Australia and the different issues involved in phone use versus timer compliance, it was decided to separate out these data from the project on countdown timers. It would have been desirable to collect more detailed information on the gender and age category of the pedestrians and also the road environment, but this was not possible.

Phone use by university or 'college' age pedestrians is of particular interest in Hobart because their numbers are set to increase with the University of Tasmania's plans to shift campuses from an inner suburb into the central business district. University students have been shown to be particularly susceptible to pedestrian injuries through intensive use of mobile phones and risk taking behaviour (Stavrinos et al., 2011; Byington & Schwebel, 2013; Williamson & Lennon, 2015; Stavrinos et al., 2017). A study of 405 university students found that there was a perception that they could compensate for the negative effect of mobile phone distractions while crossing (Jiang et al., 2016). These studies are suppported by evidence from studies of teenagers (13 to 18 years) that found teens were at high risk because of frequent use of mobile phones while walking, and group norms encourage mobile phone use while crossing the road (Lennon et al., 2017).

A number of informal observations were made during data collection that could inform further work and education campaigns but for which no data were collected. It was noted that some people who were not using phones when they approached the study crossings proceeded to take their phones out of their pocket and use them while waiting for the green light. They then continued to use them while crossing the road. We observed that phone checking behaviour appeared to influence other people waiting at lights to also check their phones. Phone checking while waiting appeared to mostly be restricted to crossings with long wait times for pedestrians, such as the legs across the major arterial road of Macquarie Street.

Conclusions

Technology-related distractions are a growing concern for road safety. The use of mobile phones while crossing the street divides attention, potentially increasing the risk of crash with a motor vehicle (Basch et al. 2014). This study helps fill a knowledge gap by quantifying the extent of the problem of distracted walking in central Hobart. While the percentages of the total number of people was not as high as in some other recent studies, almost 5% of people crossing at our sites were reading or typing on their phone, which translated into as many as 158 people per hour at a single crossing who were on the road while looking down at their phone. These figures are not encouraging in the context of work that has shown distracted walking decreases the number of successful road crossings by pedestrians (Hatfield & Murphy, 2007). More work needs to be done to establish a causal link between pedestrian crashes and mobile phone use. However, the trends and correlative work to date present a worrying picture.

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Trial of improved procedures for driver licence testing by occupational therapists

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Key Findings

- Trialling revealed that the requirements specified in a draft manual could not be satisfied in a test limited to 35 minutes duration.
- It was necessary to reduce the number of compulsory assessable driving tasks in a standard test route.
- The licence reassessment must allow time for assessment of client-specific tasks if required, in addition to the compulsory standard driving tasks.

Abstract

A draft manual for the Occupational Therapy Driving Test had previously been developed via a consultation process, setting out detailed specifications intended to improve the validity and reliability of the test and its consistency with other VicRoads licence tests. A trial was conducted to assess the feasibility, acceptability and effectiveness of the documented procedures and requirements. The trial involved (a) upgrading existing test routes to comply with the updated requirements, and (b) conducting licence tests using the updated procedures. Detailed written feedback was obtained from the occupational therapy driver assessors (OTs) who upgraded test routes and from the OTs who conducted the licence tests. Analysis of 156 feedback forms from 19 OTs revealed that the updated requirements resulted in a test that exceeded the preferred timeframe (35 minutes). The number of compulsory tasks required for all clients precluded sufficient time to conduct additional, client-specific tasks with those clients who needed them. This led the project team to reduce the number of compulsory tasks, relax some constraints regarding task locations, and reclassify two previously compulsory tasks as client-specific (optional) tasks. Extra guidance was added to the manual covering various procedural and assessment issues, and supplementary documentation was developed to assist OTs to comply with VicRoads requirements. The updated test is expected to provide a valid test of driving skills, while offering greater reliability than previous OT licence reassessment procedures.

Keywords

Driver licence testing, functionally impaired driver, occupational therapy driver assessment

Glossary

Local area test	A driver licence test that, if passed, results in a licence condition restricting driving to a specified geographic area (e.g. within 10 km of the driver's home)
Open area test	A driver licence test that, if passed, entitles the driver to a licence with no geographic restriction on driving
OT	Occupational therapist. In this paper, OT refers specifically to an occupational therapist with a postgraduate qualification in driver assessment.

Introduction

In line with national medical fitness to drive requirements (Austroads, 2016), VicRoads is responsible for assessing the driving competence not only of novice drivers applying for a first licence but also of current licence holders who have been referred for reassessment due to medical conditions, disability or observed unsafe driving.

Novice drivers applying for a first licence are assessed using the VicRoads Drive Test, which replaced the former test in 2008 following several years of rigorous, evidence-based development and trialling (Catchpole et al., 2008). The Drive Test implemented a new scoring protocol involving multiple assessment items for each assessable driving task. Standard test routes were developed for each VicRoads Customer Service Centre to ensure all licence applicants encounter a similar level of challenge during their test drive. Assessment criteria and test route requirements were documented in detail to help maximise the validity and reliability of the new test.

Reassessment of current licence holders with suspected or documented medical conditions is the responsibility of VicRoads Medical Review. In many cases, reassessment includes a practical driving test conducted on public roads to determine whether the driver is able to drive safely, legally and independently. For drivers with no major health issues, the onroad test is conducted by a VicRoads Driver Testing Officer.

If the driver has significant health issues, including cognitive, psychiatric or physical impairments, or if the driver may require aids or vehicle modifications, the licence reassessment is conducted on behalf of VicRoads by an OT who specialises in driver assessment. The reassessment comprises an assessment of the client's abilities, impairments and associated medical issues (conducted in the OT's office) and a practical driving test (conducted on public roads). The on-road component, known as the Occupational Therapy Driving Test (OTDT), is conducted over a fixed, predetermined test route if the client wishes to retain an unconditional ('open area') licence, or over an ad hoc route within a defined local area if a licence that limits driving to a local area is more appropriate for the client.

A driving instructor provides a dual-control vehicle for the test and accompanies the client and OT during the test drive. The instructor provides route instructions from the front passenger seat, where access to the dual controls also permits them to maintain safety during the drive. The OT directs the test, provides instructions and asks impairment related questions. Both the instructor and OT can offer feedback during certain sections of the test procedure (e.g. familiarisation drive) and can seek feedback or clarification from the client regarding performance during and/or at the conclusion of the test procedure.

Driver assessments conducted by OTs have an established role within adult rehabilitation and as a component of driver licensing authority medical review licensing processes (Dickerson, Reisletter, Schold Davis & Monahan, 2011; Di Stefano, 2017). Research has identified existing limitations in test standardisation, validity and reliability (e.g. Classen, Krasniuk, Alvarex & Danter, 2016; Di Stefano & Macdonald, 2010; Kay, Bundy, Clemson & Jolly, 2008) and informed the development of the OTDT procedures discussed here (Berndt, May & Darzins, 2015; Classen, et al., 2010; Di Stefano & Macdonald, 2003; Di Stefano & Macdonald, 2011; Schechtman, et al., 2010).

Updating the OTDT

Following the development and implementation of the VicRoads Drive Test, VicRoads reviewed the licence reassessments conducted by VicRoads staff and by OTs to identify changes needed to improve the validity and reliability of the reassessments and their consistency with the new Drive Test. A key finding was that a manual should be developed to provide clear guidelines to OTs concerning the driving tasks that should be included in a licence test route and the criteria used to assess driving performance. VicRoads therefore developed a draft manual for the OTDT (Catchpole & Di Stefano, 2012) that aimed to provide OTs with:

- detailed guidance on VicRoads criteria for assessing whether a person is able to drive safely, legally and independently and meets the requirements for a Victorian licence
- detailed specification of the type and number of driving tasks to be included in a licence test route
- additional information concerning testing procedures, including checklists used to record test routes and observations of driving performance.

Trialling the updated test

VicRoads commissioned a trial of the test procedures in the draft OTDT manual. The trial was conducted by a team of representatives of the Australian Road Research Board, VicRoads and Occupational Therapy Australia–Victoria Division (OTA). The trial aimed to:

- test the feasibility, effectiveness and acceptability of the procedures and requirements set out in the draft manual and associated documentation
- collect feedback from OTA representatives who modified open area test routes and OTs who conducted licence tests during the trial to guide revision of the draft manual and associated documentation.

The trial had three components.

Component C1: Open area tests conducted using the procedures specified in the draft manual, but using existing test routes that did not fully comply with the updated requirements in the manual.

Component C2: Local area tests conducted using the procedures in the manual, including the test route requirements.

Component C3: Open area tests meeting all requirements in the draft manual, including the preparation of the test route.

Stage 1: Upgrading open area test routes for use in the trial

C3 required the use of open area test routes that fully complied with the updated requirements in the draft manual. Fifteen open area test routes were upgraded to comply with the new requirements, comprising five routes in inner urban areas of Melbourne, five in outer urban Melbourne and five in regional cities.

Method

Three experienced OTs were engaged to upgrade existing open area test routes. The routes underwent iterative improvements involving multiple reviews. Errors and non-conformances that indicated difficulty in complying with requirements in the draft manual were discussed within the project team and issues were resolved by consensus.

Results

The OTs who upgraded the routes found the task very difficult and needed multiple rounds of review and comment on each route to help them achieve compliance with the requirements in the manual. It was not possible at most testing locations to devise routes that included the required number of instances of each driving task type specified in the manual, while still allowing a licence test to be completed within the required maximum 35 minute duration. Difficulties included the requirement for multiple instances of many task types, the tight specification of road environments in which each task must occur and the distance that must be driven between locations suited to various tasks.

Changes to requirements for open area test routes

Based on feedback received during route upgrades, some requirements in the draft manual were relaxed to allow the upgrades to be completed. The major changes were as follows:

- The maximum permitted duration of an open area licence test was increased to 40 minutes.
- For some task types (turns, lane changes etc.), the minimum number of instances in a test route was reduced. This reduced the minimum number of tasks in an open area test route from 57 to 44.
- For some driving tasks, speed zones requirements were relaxed (for example, a requirement that a task occur at a location with a 50 or 60 km/h speed limit was relaxed to also allow 40 km/h).
- Other road environment limitations (e.g. number of lanes) were relaxed for a small number of task types.

Following these changes, all 15 open area test route upgrades were successfully completed.

Stage 2: Licence reassessments using the upgraded test

All three trial components involved OTs conducting on-road licence tests with VicRoads clients who had been referred for licence reassessment. As is standard practice, the outcomes of all licence reassessments conducted during the trial were reported to VicRoads Medical Review and provided the basis for VicRoads licensing decisions.

Participants

A total of 19 volunteer OTs participated across the three components of the trial. All were experienced driver assessors who had previously received copies of the draft OTDT manual and were broadly familiar with its content. Most of the volunteer OTs participated in more than one trial component.

Procedure

Before conducting licence reassessments during the trial, the volunteer OTs were issued:

- a new copy of the draft manual
- a document listing several minor revisions to the manual
- a feedback questionnaire to be completed after each licence reassessment during the trial
- trial versions of upgraded forms for reporting reassessment results to VicRoads Medical Review
- VicRoads responses to queries received from OTs during consultation sessions discussing the content of the draft manual.

The feedback questionnaire to be completed by the volunteer OTs after each licence reassessment sought information on the type of test conducted (open area or local area), test administration procedures, assessment criteria, driving tasks, test route construction and test documentation, including suggestions for changes or improvements to any of these. Most questions were open or semi-open, allowing the volunteer OT to provide free-format text responses. The questionnaire was distributed in the form of an electronic document. Most volunteer OTs chose to print multiple paper copies of the questionnaire and complete a copy by hand after each test; a few OTs chose to complete the questionnaire in electronic form on a computer. Responses provided by OTs were classified and summarised by a team member for consideration and action by the project team.

Results

Across the three trial components, completed feedback questionnaires pertaining to a total of 156 licence tests were returned by participating OTs. A selection of the most important comments and issues is presented below.

Familiarisation drive

Each test includes a short familiarisation drive to allow the client to become familiar with the test vehicle before assessment begins. It was noted that if the test starts on a busy road (as sometimes happens for tests starting from a hospital or from the client's home) then the familiarisation drive will start in a challenging driving environment.

Test duration

Analysis of the collected responses revealed that 81% of open area tests completed in C1 and C3 took longer than the trial limit of 40 minutes. Most upgraded routes used in C3 were considered too long by the OTs who used them. OTs noted that if the standard route is excessively long, there is not enough time left in the session for extra tasks that may be required for some clients due to their individual health conditions or disabilities. Furthermore, an excessively long test could fatigue the client and impact driving performance.

The draft manual specified that the duration of a local area test, excluding introduction to the vehicle and the familiarisation drive, should be in the range 20–30 minutes. However, 83% of tests completed in C2 took longer than 30 minutes. Some OTs omitted driving tasks to avoid adding excessive time to the test.

Assessable driving tasks (open area tests)

The draft manual specified the types of driving task and the minimum number of instances of each type that must be included in an open area test route. To facilitate a gradual increase in task complexity ('grading'), it also specified that the first 10 minutes of each test route should be limited to low-demand driving tasks, with high-demand tasks permitted in the remainder of the route.

Some OTs considered that the emergency stop and three-point turn are not necessary in every test because similar skills are tested in other situations (e.g. when driving in a carpark with pedestrians present).

Assessable driving tasks (local area tests)

The manual also specified the driving task types that must be included in a local area test route. OT feedback revealed tension between the need to include the driving tasks specified in the manual and allowing clients to self-navigate on routes they drive regularly and are familiar with. Including the required driving tasks may mean departing greatly from clients' usual routes. OTs noted the difficulty of devising extra destinations and manoeuvres during the course of the test to ensure all required driving tasks are included. Additional preparation time is required before the test to identify the client's usual destinations, check the distance from the client's home and identify additional manoeuvres to be included in the test. Some OTs allowed the client to choose the entire test route, meaning that some required tasks would not have been assessed during the test. As with open area tests, OTs considered an emergency stop should not be required in all local area tests.

Client-specific driving tasks and test customisation

Due to wide variations in health conditions and disabilities, some clients need to be assessed on additional tasks that are not relevant to other clients. Feedback revealed that:

- Some OTs frequently add client-specific tasks to open area tests, whereas others do so rarely or never. One OT argued that client-specific tasks cannot be implemented in a manner that is fair to all clients.
- In most cases, the standard route was too long to allow time for client-specific tasks.
- Self-navigation was considered an important task for many clients, but is difficult to assess when using a standard route with detailed navigation instructions. One OT routinely requires all clients to self-navigate home from the finish of the test route, and another included an assessable self-navigation task in a lesson before the licence test.
- For clients who were not ready to commence the test or failed early in the test, the remainder of the session was used to provide feedback or driver rehabilitation.

Assessment criteria

The draft manual set out detailed criteria identifying a range of 'Fail Errors' (serious errors that lead automatically to test failure) and 'Performance Errors' (less serious errors that result in feedback after the test rather than failure and help to identify the client's rehabilitation needs). OT comments concerning these criteria included the following:

- The speed tolerances set out in the manual are too strict. Clients should not automatically fail for going more than 5 km/h over a speed limit.
- Clients who are anxious and driving an unfamiliar vehicle may forget to release the handbrake. This should not be considered a Fail Error.
- When performing the emergency stop task, clients probably do not meet the requirement stated in the manual to 'bring the vehicle to a complete stop quickly, as may be required in a genuine emergency'.

OTs also asked for clarification or additional guidance regarding a range of assessment issues.

Test procedures

The draft manual specified that tasks performed during the familiarisation drive are not assessable for the purposes of driver licensing. Feedback on driving performance may be given to the client during the familiarisation drive, but not during the licence test. However, some OTs queried this separation, with one arguing that errors committed during the familiarisation drive may be part of a pattern that reveals an underlying problem. Another asked whether a task that is performed satisfactorily during the familiarisation drive needs to be assessed again during the licence test. It was also argued that providing feedback during the test would allow assessment of the client's ability to learn and improve.

Changes to the test following the trial

In response to feedback received during the trial, numerous adjustments and improvements were made to all aspects of the test and associated documentation before the updated OTDT was implemented across Victoria. The most important of these are summarised below.

Test routes and driving tasks

The maximum time allowed for a standard open area test route, which had been increased to 40 minutes for the trial, was returned to 35 minutes. This change ensured that up to 10 minutes would be available in the standard one-hour session to administer additional, client-specific tasks for those clients who need them. To ensure this reduced time allocation could be achieved:

- Further reductions were made in the number of instances of some driving tasks required in a standard open area test route.
- Two of the most time-consuming tasks, the emergency stop and the three-point turn, were reclassified as client-specific tasks, to be included in the test only when warranted by the health condition or disability of the client.
- Restrictions on road environment factors (such as speed limits) were further relaxed for some tasks without compromising client safety. This reduced the likelihood of having to drive a long distance to reach a suitable road location for the relevant task.

Text was added to the test manual to clarify that every open area test route must include one or more intersections controlled by traffic signals; signals controlling access to a bridge or signals at a mid-block pedestrian crossing are not sufficient.

Assessment criteria

The criteria for compliance with speed limits listed in the draft manual were markedly stricter than those previously applied by OTs. This was of concern to some OTs, who considered that the change may increase the proportion of clients failing the test. In response to this concern, an explanation of the importance of strict compliance with speed limits for safe driving and for consistency with other VicRoads licence tests was added to the manual.

The OTs considered that failure to release the handbrake before moving off is often a result of the test situation (either nervousness about being tested or lack of familiarity with the test vehicle) and should not automatically result in test failure. A new provision was therefore documented allowing the driving instructor or OT to verbally remind the client to release the handbrake if necessary without recording a Fail Error.

The emergency stop task, when used, is conducted at a time and place decided by the driving instructor or OT, who takes responsibility for observing traffic behind the test vehicle and deciding whether it is safe to perform the task. Observation was therefore removed from the list of assessment items applicable to the emergency stop task. Thus the only item to be assessed for this task is Vehicle Control.

Test procedures

New material was added to the test manual to provide additional guidance on a range of issues, including:

- whether the client is ready to attempt the on-road test
- communication with clients with special needs (such as hearing impairment)
- the role of interpreters (who accompany some clients who have poor English proficiency)
- how the OT and instructor should deal with advanced driver assistance systems that may be present in the test vehicle, such as cruise control, reversing camera or assisted parking
- the requirements that must be satisfied for a licence test to be regarded as complete (and hence able to lead to a Pass outcome) if some parts of the planned route were omitted (for example due to unforeseen roadworks).

Documentation

Apart from the changes and improvements made to the test manual, several additional documents were developed to assist OTs and driving instructors to conduct the OTDT according to the procedures required by VicRoads. These included:

- Information for driving instructors: an explanation of the OTDT and the role of the driving instructor in the test for instructors who may be unfamiliar with the test.
- OT and driving instructor communication form: a structured format for the OT to record client training needs and for the driving instructor to report lesson outcomes to the OT.
- Summary of requirements for open area test routes: a four-page summary of key points from the manual concerning the number and type of driving tasks required in an open area route and the road environment (speed limit, number of lanes etc.) required for each (intended as an aid to an OT who is preparing an open area test route).
- Open area test route compliance tool: a one-page checklist of requirements for open area test routes that can be used to review the compliance of a newly-completed or newly-upgraded route.

Implementation of the updated test

Training OTs to deliver the test

VicRoads organised a full-day training seminar to disseminate the revised OTDT documentation and procedures to OTs who conduct licence tests in Victoria. The seminar also provided opportunities for OTs to ask questions about any aspect of the test on which they were not clear.

The seminar was attended by 69 OTs from across Victoria, the largest ever face-to-face gathering of OTs who conduct licence tests in Victoria. Attendees had the opportunity to sign up for additional support for OTDT implementation.

To cater for OTs who were unable to attend the seminar and for newly-trained OTs in the future, VicRoads produced a self-directed learning package that contains all of the training materials, including the seminar presentations.

Development of compliant open area test routes

As a result of the changes made to open area test route requirements following the trial, the 15 routes developed for use in the trial were no longer fully compliant. VicRoads therefore commissioned OTA to revise these routes again to ensure compliance with the final route requirements. The upgraded routes will be available for use by other OTs who have a need to conduct an open area test in any of those 15 localities.

All Victorian OTs who conduct licence reassessments were asked to upgrade their standard open area test routes to comply with the requirements set out in the final OTDT manual. To assist them with this task, VicRoads commissioned OTA to support OTs working on route upgrades with help from the three experienced OTs who upgraded the routes used in the trial.

Discussion

Validity

The OTDT assesses whether a VicRoads client is able to drive safely, legally and independently. A Victorian licence holder is entitled to drive on public roads throughout Australia, ranging from busy shopping strips to high-speed freeways to unsealed bush tracks. It is desirable for the test to include a wide variety of driving tasks to assess driving performance in a wide range of environments. However, the financial costs of the OTDT – payments for the services of the OT and the driving instructor – are often paid by the client being tested. It is important that these costs are not so high that drivers who have been referred for licence reassessment cannot afford to attempt the test. It is also desirable for as many clients as possible to be tested near where they live, rather than being required to travel a long distance to another part of Victoria to be tested in a road environment (such as a freeway) that may not be available near their home.

To address these competing requirements, the OTDT manual sets out minimum requirements for road features that must be available to permit the development of a valid open area test route. An open area test route must include roundabouts, intersections controlled by traffic lights, multi-lane roads (with lane lines marked on the road) and roads with a speed limit of at least 60 km/h (at least 80 km/h preferred). Localities in which one or more of these features are unavailable are not suitable for open area licence testing. Clients living in these areas can travel to a larger town or city to attempt an open area licence test, or can undertake a local area test close to home. Clients who pass a local area test will have a condition added to their licence limiting them to driving in the local area in which they were tested.

To gauge the suitability of the open area route requirements for use across Victoria, the trial included the development of open area routes at five locations in inner urban Melbourne, five locations in outer urban Melbourne and five large regional cities. After revision of the route requirements following the trial, complying open area routes were successfully developed at all trial locations. As yet, there is no confirmation of how many other regional cities and towns will meet all of the requirements for OTDT open area testing.

Reliability

A key requirement both of VicRoads and of clients who undergo licence reassessment is that the OTDT should have high reliability: when a client is tested, the outcome should be determined by the client's ability to drive safely, legally and independently; as far as practicable, the outcome should not be influenced by extraneous factors, such as where in Victoria the client lives, or whether they are assessed by an OT who works in a hospital or an OT in private practice. VicRoads has therefore established statewide standards for the driving tasks that should be included in a licence reassessment and standard criteria for assessing the client's performance of those tasks.

Maintaining high reliability is more challenging in the case of the OTDT than in the testing of probationary licence applicants. In the entry-level test, all clients are assumed to be fairly similar, not subject to individual special needs, and thus it is appropriate to deliver, as far as possible, the same test to every client. OTDT clients, however, often have significant health conditions or disabilities that need to be taken into account when assessing their driving performance. For example, a client with the use of only one hand may need to use adaptive equipment such as a spinner knob on the steering wheel; testing of such a client may need to put extra emphasis on assessment of vehicle control when negotiating roundabouts and performing low-speed manoeuvres such as three-point turns. The OTDT includes a core set of standard driving tasks that must be assessed for all clients, but also allows for the inclusion of client-specific driving tasks to cater for individual clients who need additional assessment.

The OTDT is delivered by a large group of assessors, some of whom work for hospitals or area health services, whilst others work in private practice and have limited opportunities to meet or discuss assessment issues with other OT driver assessors. The professional association (OTA) has a large driving special interest group that meets quarterly and provides a forum for practice, research and other issues to be discussed. In addition, VicRoads organises seminars for OTs, usually held twice a year. While many OTs attend these seminars, others find the travel and time required make attendance impractical. Thus OTs delivering the OTDT have varying levels of contact with each other

and with VicRoads. It is therefore critical that the statewide standards established by VicRoads and documented in the OTDT manual be disseminated and promoted as thoroughly and effectively as possible to all OTs conducting driver assessments in Victoria. It will also be important for VicRoads to offer refresher training to help OTs continue to adhere to VicRoads standards as time passes following the implementation of the updated OTDT.

Evaluation

Once the implementation of the updated OTDT has been completed and any initial problems have been addressed, it would be valuable to evaluate the test to assess whether it is achieving its objectives and whether any fine-tuning is required to allow the test to function more effectively or more efficiently.

Conclusions

Feedback from OTs who conducted licence tests during the trial revealed that the requirements for an open area test set out in the draft manual could not be satisfied in a test that could be routinely completed in 35 or even 40 minutes. It was therefore necessary to reduce the minimum number of assessable tasks to be included in a test route and to relax some of the environmental constraints, such as speed limits, applying to the locations where tasks are conducted. OT feedback also highlighted the importance of limiting the time allocated to standard driving tasks to ensure time is available to conduct additional, client-specific tasks when necessary. The emergency stop and three-point turn tasks were found not to be acceptable as compulsory tasks for all clients, and were therefore reclassified as client-specific tasks, to be conducted when appropriate to the needs of the individual client.

It was necessary to add material to the test manual to provide additional guidance on compliance with speed limits, dealing with advanced driver assistance in vehicles, criteria for a test to be considered complete and numerous other issues. It was also necessary to develop additional documentation to assist OTs and driving instructors to conduct the OTDT according to VicRoads procedures.

The upgraded OTDT is expected to provide a valid test of the driving skills required to drive safely, legally and independently, and to achieve a higher level of reliability than the previous test. An evaluation will be needed to confirm that these expectations are being met and to identify any fine-tuning that may be required.

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What are Australian drivers doing behind the wheel? An overview of secondary task data from the Australian Naturalistic Driving Study

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Key Findings

- Driver engagement in secondary tasks is frequent;
- Drivers engage in a secondary task every 96 seconds, on average;
- It is not unusual for drivers to engage in multiple tasks at once;
- Drivers were significantly more likely to initiate a secondary task when stationary;
- Only 5.9% of the secondary tasks events were associated with a driving incident.

Abstract

Using data from the Australian Naturalistic Driving Study (ANDS), this study examined patterns of secondary task engagement (e.g., mobile phone use, manipulating centre stack controls) during everyday driving trips to determine the type and duration of secondary task engaged in. Safety-related incidents associated with secondary task engagement were also examined. Results revealed that driver engagement in secondary tasks was frequent, with drivers engaging in one or more secondary tasks every 96 seconds, on average. However, drivers were more likely to initiate engagement in secondary tasks when the vehicle was stationary, suggesting that drivers do self-regulate the timing of task engagement to a certain degree. There was also evidence that drivers modified their engagement in a way suggestive of limiting their exposure to risk by engaging in some secondary tasks for shorter periods when the vehicle was moving compared to when it was stationary. Despite this, almost six percent of secondary tasks events were associated with a safety-related incident. The findings will be useful in targeting distraction countermeasures and policies and determining the effectiveness of these in managing driver distraction.

Keywords

Distracted driving, Secondary tasks, Road safety, Naturalistic driving study; Safety-related incident

Introduction

Distracted driving is widely acknowledged as a significant threat to the safety of all road users (WHO, 2011). While the exact role of distraction in road crashes in Australia is difficult to quantify, given a lack of systematic reporting, there is growing evidence that it is an important contributor to both fatal and serious injury crashes. Indeed, in an in-depth crash investigation study, driver distraction was identified as the main contributing factor in almost 16 percent of serious injury road crashes resulting in hospital attendance in Australia (Beanland et al., 2013). Similar figures are reported in the United States, where distracted driving is a main contributing factor in 10 percent of fatal and 15 percent of injury crashes (NHTSA, 2017).

Research shows that drivers spend a vast amount of driving time engaging in secondary tasks that are unrelated to driving (Dingus et al., 2016; Lansdown, 2012; Young & Lenné, 2010). A secondary task is a discretionary task,

performed concurrently with driving, but that is not critical to the primary driving task. Engagement in secondary tasks plays a large role in distracted driving because it requires drivers to divert their visual and/or cognitive resources away from the primary driving task of safe vehicle control. To date, much of our knowledge of Australian drivers' engagement in distracted driving has been informed by self-report surveys and crash data, both of which are subject to reporting bias (Shinar, 2017). The Australian Naturalistic Driving Study (ANDS) involved instrumenting everyday Australian's vehicles with driving sensor and video recording equipment and offered a unique opportunity to capture driver engagement in secondary tasks under real-world driving conditions and for an extended period of time (e.g., four months).

Using naturalistic driving data from the ANDS, this study examined patterns of secondary task engagement during everyday trips to determine the type and duration of secondary task engagement and the number and type of safety-related incidents (e.g., errors, risky driving behaviours and conflicts) associated with secondary task engagement. To extend previous naturalistic driving study research which has focussed on mobile phone use (Funkhouser & Sayer, 2012; Tivesten & Dozza, 2015), this paper examined a wide range of technology- and non-technology based secondary tasks, including interacting with centre stack and steering wheel controls, eating, drinking, mobile phone use and interacting with passengers.

Methods

This study used data collected as part of the ANDS (Williamson et al., 2015). Three hundred and forty-six privately owned vehicles (n = 185 from New South Wales; n = 161 from Victoria) were equipped with Data Acquisition Systems (DAS) and driven for a period of four months by 346 primary drivers and 33 additional drivers who also drove the participating vehicles on some occasions (n = 379).

The DAS equipped to each vehicle was supplied by the Virginia Tech Transportation Institute (VTTI) and had been used in the Strategic Highway Research Program (SHRP2) study (Antin et al., 2011). These comprised sensors and data-loggers, allowing the continuous recording of vehicle data and video while the vehicle ignition was on. Variables captured included: acceleration in multiple axes, gyroscopic motion, indicator status, speed and Global Positioning System (GPS) position (see Antin et al., 2011 for further details). A continuous multi–camera video recording system captured the driver's face, forward- and rear-views, and a view of driver interaction with the dashboard and other devices at a rate of 15 Hz. The resolution of the cameras was not high enough to determine what specific tasks were being performed in relation to the vehicle controls and buttons (e.g., using radio or climate controls) or portable devices (e.g. texting or dialling a phone), thus broader categories of 'manipulating phone' and 'adjusting centre stack controls' were used.

Trip selection and coding

Approximately 1.95 million kilometres of driving was collected during the study from the 379 participating drivers. The data used in this paper comprised randomly selected trips from the available data set of 194,961 trips. A random number table conforming to the Trip ID parameters was used to select the trips for analysis. A total of 185 trips (i.e., 2,592 minutes of driving) were viewed and manually coded for secondary task engagement, of which 175 (95%) contained one or more secondary task events and only ten trips involved no secondary tasks. The average length of the coded trips was 14 minutes (SD = 10.9 mins; Range: 2-54 mins). In total, 117 different drivers were observed during the coded trips (M = 46.7 years, SD = 12.3 years; 45% males). The number of trips coded for each driver ranged from one to 12.

Two analysts viewed entire driving trips and manually coded sections where drivers were observed engaging in at least one secondary task (termed secondary task events). Trips were not coded if they lasted less than one minute, longer than one hour or if a camera view was missing. The four camera angles were viewed using Camtasia video viewing and editing software and the coded secondary task event data was entered into an electronic database.

A range of categorical variables were coded for each secondary task event identified using the video data. These included: secondary task type, passenger presence, driving context, self-regulatory behaviour (task interruptions) and any safety-related incidents that occurred while the driver was engaged in the secondary task. All variables were coded once at the point of secondary task initiation for each secondary task event, apart from self-regulation and incidents which were coded whenever they occurred. The start of each secondary task event (and the coding) depended on the specific task being carried out, but was typically defined as the first glance to an area, object or event of interest, when the driver's hand first touched an object, or they first opened their mouth to speak. The end of the event was defined as the last glance to the area, object or event, when the hand was first removed from the object or drivers closed their mouth. Drivers had to disengage from the task for at least 20 seconds for it to be classified as the end of the task, otherwise it was coded as an interruption, whereby drivers would temporarily stop the task and turn their attention elsewhere (usually the roadway) and then resume the same task.

Safety-related incidents involved driving errors (e.g., failing to indicate), unsafe driving behaviours (e.g., swerving in lane) and conflicts with other road users (e.g., failing to yield to pedestrians) that appeared to be directly caused by engagement in the secondary task(s).

A modified version of the SHRP2 coding protocol was used to classify 29 different types of secondary tasks. Table 1 lists the secondary tasks engaged in during the 1,603 secondary task events identified. A secondary task was defined as a discretionary task, performed concurrently with driving, but that is not critical to the primary driving

task. Thus, secondary tasks do *not* include tasks such as changing gears, using indicators, checking the speedometer or mirrors (unless drivers were clearly using the mirrors to perform a non-driving task), or looking out the windows to check traffic or perform head checks. A range of non-critical vehicle tasks are included, however, such as adjusting mirrors, windows, seatbelt and sun visor, because these tasks are not directly related to the primary tasks of vehicle control and safe travel. If drivers engaged in multiple secondary tasks at the same time (e.g., pressing radio button while conversing on a hands-free phone), the number and type of secondary tasks engaged in were recorded.

Results

Secondary task engagement and duration

A total of 1,603 secondary task events were identified from the coded driving trips. On average, drivers engaged in a secondary task every 96 seconds (1.6 mins) of driving. Table 1 displays an overview of driver engagement in secondary tasks. The most commonly performed tasks were of short duration (< 5 seconds) and involved drivers adjusting the centre stack controls (e.g. radio) and vehicle devices and controls that are not critical to driving (e.g., seat belt, mirrors, sun visor). Looking at events and objects outside the vehicle (e.g. pedestrians, buildings) was also common.

Table 1. Number of secondary tasks and mean (SD) duration (seconds) of individual secondary tasks when moving and stationary

Secondary Task	Moving		Stationary	
	N	Duration	N	Duration
All secondary tasks	*1,176*	*41.3 (159.1)*	*427*	*47.3 (190.8)*
Adjusting steering wheel buttons	44	1.7 (2.3)	11	2.9 (2.5)
Adjusting centre stack controls (e.g. radio, climate controls)	217	4.3 (8.3)	45	3.4 (3.5)
Adjusting non-critical vehicle devices (e.g. seatbelt)	263	2.5 (4.9)	42	5.6 (7.7)
Drinking	14	72.1 (121.8)	10	81.2 (121.9)
Eating	17	253.2 (311.7)	1	414.8 (0)
Holding object (other than phone)	18	53.7 (73.8)	9	16.4 (15.6)
Looking at an object/event OUTSIDE vehicle	117	8.3 (12.7)	79	14.2 (14.6)
Looking at object INSIDE vehicle (not reaching/ touching it)	42	3.9 (6.0)	24	6.5 (8.7)
Manipulating object (other than phone)	16	56.0 (122.9)	22	17.9 (18.6)
Mobile phone, holding	14	116.4 (211.6)	3	95.2 (153.3)
Manipulating phone (hand-held)	31	24.3 (24.6)	23	30.7 (25.1)
Manipulating phone (hands-free)	12	28.2 (45.5)	6	6.4 (7.7)
Mobile phone, talking/listening (hand-held)	5	398.2 (485.6)	2	55.8 (30.7)
Mobile phone, talking/listening (hands-free)	13	273.3 (310.5)	3	517.1 (515.3)
Personal hygiene	84	9.3 (15.3)	57	12.7 (11.6)
Reaching for object/phone (includes moving object/phone)	67	6.3 (8.7)	49	8.5 (10.0)
Reading	0	-	1	9.0 (0)
Talking to front passenger	82	296.6 (433.3)	17	522.0 (659.9)
Talking to rear passenger	5	281.0 (319.8)	7	541.3 (395.4)
Talking/Singing to self	94	33.1 (57.0)	7	9.0 (11.3)
Writing	0	-	1	36.8
Other	21	12.8 (13.9)	8	14.9 (7.5)

Using a mobile phone, including holding, manipulating or talking on a hand-held or hands-free phone, accounted for 7.4 percent of the secondary tasks observed. Of concern, 7.2 percent of the secondary tasks involved drivers engaging in the high-risk task of reaching for objects (e.g., hairbrush, book) or their mobile phone, with over half of these reaching events (57.8%) undertaken while the vehicle was moving. The least common tasks were (paper-based) reading and writing and both of these tasks were initiated only while the vehicle was stationary.

Whether the vehicle was stationary or moving at the time of secondary task initiation was examined. Stationary included any time during the trip that vehicle speed was 0 km/h, including when stopped in heavy traffic, at traffic lights or stop signs, or when parked. When looking at the overall numbers, drivers initiated engagement in a greater number of secondary tasks while the vehicle was moving (M = 6.3 tasks) compared to when stationary (M = 2.3 tasks). However, it is important to take into account the fact that drivers in the sample spent an average of 80.6% of their trip with the vehicle moving, meaning there was greater opportunity for drivers to engage in secondary tasks while in motion. A negative binomial regression was conducted to examine if the number of secondary tasks engaged in per minute of driving differed according to whether the vehicle was moving or stationary, taking into account the proportion of time spent moving and stationary. The Generalised Estimating Equation (GEE) model was specified with a negative binomial error function and a log link function, while the inter-correlation between the repeated measures was specified as unstructured. The natural log of duration moving and stationary was used as an offset variable. A significant difference was found in the number of secondary tasks initiated per minute of driving when moving versus stationary (Wald χ^2 (1) = 20.3, $p < 0.001$). The incidence rate of secondary tasks initiated per minute was 47% higher when stationary than when moving (Incidence rate ratio (IRR) = 1.465, $p < 0.001$). In other words, drivers initiated a secondary task every 107 seconds, on average, while the vehicle was moving and every 68 seconds, on average, while the vehicle was stationary.

The mean duration (in seconds) of the secondary tasks engaged in when driving was also examined to identify if drivers regulate the time they spend engaged in secondary tasks according to whether they initiated the task when moving versus stationary. There was large variability in the duration of the secondary tasks, even within the task categories, as reflected in the high standard deviation values (Table 1). Across all secondary tasks combined, drivers spent longer engaging in individual tasks that were initiated when the vehicle was stationary (M = 47.3 s) compared to those tasks initiated when the vehicle was moving (M = 41.3 s); however, this difference was not statistically significant, t(114) = -0.54, p = 0.592. When looking at the secondary task categories individually, it is apparent that around half of the tasks had longer mean durations if they were initiated while in a moving vehicle, while the other half had longer mean durations if they were initiated when stationary. Two general patterns were discernible when comparing the task duration and vehicle movement data. First, drivers spent longer talking with passengers when these tasks were initiated while moving, likely reflecting that drivers spent more of their driving time with the vehicle in motion than stationary. Second, drivers limit their exposure to phone-related secondary tasks, with the mean duration of the phone tasks considerably lower when initiated while the vehicle was moving compared to when it was stationary.

A Mann-Whitney U test was also conducted to examine if the number of secondary tasks engaged in differed according to passenger presence. Tasks involving talking with passengers were excluded from this analysis. Results revealed that, while there was a trend for drivers to engage in a higher number of secondary tasks per trip when no passengers were present (M = 8.7 vs. 6.9 tasks), this was not a statistically significant difference (U = 3770.5, p = 0.701).

Just over 20 percent (20.7%) of the secondary task events identified involved the driver engaging in multiple non-driving tasks at once. When multiple tasks were engaged in, this typically involved drivers interacting with passengers while also adjusting non-critical vehicle controls or devices (i.e. adjusting seatbelt), performing personal hygiene tasks or looking at objects and events outside the vehicle.

Safety-related incidents

A total of 95 (5.9%) of the secondary tasks events were associated with a safety-related incident (Table 2). Many of these incidents involved a failure to use the indicators or a delay in drivers detecting that the traffic lights had turned green or that vehicles in front had moved away from the lights. However, several incidents were more serious, with drivers veering out of their lane, drivers failing to detect the vehicle ahead braking suddenly and failing to yield to pedestrians on a pedestrian crossing. There was also a number of incidents where it was clear that the directing of attention away from the driving task to secondary tasks led to 'poor situation awareness', or attentional failures. Examples of these failures included not seeing a cyclist until the last second, failing to react to a bus indicating to pull out of a stop, driving much slower than the surrounding traffic and failing to see traffic backed up on the other side of a roundabout and then blocking the roundabout.

The majority of the observed incidents occurred while drivers were engaged in secondary tasks that have been shown in previous research to have a high crash/near crash risk (Klauer et al., 2006). Just under one quarter (23.2%) of the incidents observed occurred while the driver was using a mobile phone (hand-held or hands-free). A further 20% of incidents occurred while the driver was engaging in personal hygiene tasks, 10.5% occurred when drivers were reaching for an object or phone and 9.5% occurred when drivers were holding or manipulating an object other than a mobile phone (e.g., sunglasses). Finally, 20 (21%) of the incidents occurred while drivers were engaging in more than one secondary task at once (e.g., adjusting controls while also interacting with passengers).

Table 2. Number and percentage of safety-related incidents occurring during secondary task engagement

Incident	N	%
All incidents	*95*	*100*
Apparent failure to see traffic lights change from red to green/ vehicle ahead move off	48	50.5
Poor situation awareness	20	21.1
Lane excursion	11	11.5
Swerving in lane	8	8.4
Failure to indicate	5	5.3
Hard braking	2	2.1
Failure to yield to pedestrians	1	1.1

Discussion

The ANDS data revealed some interesting findings regarding Australian drivers' engagement in secondary tasks and context in which they choose to engage. Driver engagement in secondary tasks was frequent, with drivers engaging in a secondary task once every 96 seconds, on average. It was also not unusual for drivers to engage in multiple tasks at once. The more common secondary tasks tended to involve short (< 5s), discrete button presses of the centre stack controls or interactions with non-critical vehicle controls and devices, such as the seat belt and mirrors. However, tasks of longer duration and those shown in previous research to be high-risk were also observed. Using a mobile phone, for example, accounted for seven percent of all secondary tasks and was associated with almost one quarter of the safety-related incidents observed. Hand-held phone use was more common than hands-free (82.1% of phone tasks) despite being illegal in both Victoria and New South Wales. There was, however, there was some evidence that drivers attempted to limit their exposure to risk, with the duration of hand-held phone tasks typically lower when initiated while the vehicle was moving. Another high-risk activity frequently observed was reaching for objects or a phone, which made up 7.2% of the secondary tasks observed. Previous naturalistic driving research has shown that reaching for an object is associated with up to a 9.1 greater odds of being involved in a crash or near-crash (Dingus et al., 2016; Klauer et al., 2006). Both these findings highlight that there is much more work to be done to reduce the prevalence of hand-held phone use and to educate drivers of the dangers of some non-technology based tasks, such as reaching for objects, that they may view as innocuous, but that present a real crash risk.

After exposure was taken into account, it was found that drivers were significantly more likely to initiate engagement in secondary tasks when the vehicle was stationary. Indeed, drivers initiated 47 percent more secondary tasks per minute of driving when stationary (one task every 68 seconds) compared to when moving (one task every 107 seconds). This finding is consistent with the results of previous naturalistic driving work, which has found that drivers were more likely to engage in secondary tasks when stationary (Funkhouser & Sayer, 2012; Tivesten & Dozza, 2015). The current study extends the findings of these two studies as it included a large range of secondary tasks, whereas Funkhouser and Sayer (2012) and Tivesten and Dozza (2015) both focused on mobile phone use only. The results of this and previous studies suggest that drivers do engage in some level of self-regulation with respect to being more likely to initiate secondary tasks when stationary. There were also some secondary task categories, such as (paper-based) reading and writing, which drivers did not initiate at all while the vehicle was moving and only very infrequently while stationary. However, when looking at the absolute numbers, almost three quarters of the secondary tasks observed were initiated while the vehicle was moving and some of the tasks initiated have been shown in other studies to have high crash and near crash risk, such as reaching for objects and manipulating a mobile phone. Moreover, although not formally captured in the current data coding, there were a large number of cases observed where drivers, who initiated a secondary tasks while stationary, continued to perform that task after the vehicle has started moving. Most commonly, this involved drivers entering an intersection after moving off from traffic lights while they were still engaging in the secondary task. Thus, while a degree of self-regulation was evident, drivers still regularly place themselves at risk by either initiating secondary tasks while moving or continuing to engage in tasks once the vehicle has started moving.

In addition to deciding when to engage, it appears that drivers further attempted to limit their exposure to risk by engaging in some secondary tasks for shorter periods when the vehicle was moving compared to when it was stationary. For example, the mean duration of phone tasks initiated when the vehicle was moving was considerably lower than the phone tasks initiated when the vehicle was stationary. This suggests that while drivers are willing to initiate phone tasks when moving, they do at least limit the amount of time they spend engaged in these activities. There were, however, a number of secondary tasks that had higher mean durations when the vehicle was in motion, including manipulating objects (other than phone) and reaching for

objects/phone. It is possible that these higher duration values reflect that drivers were sharing the tasks with driving and thus it took them longer to complete them compared to when stationary. Further analysis of the data will examine if drivers interrupted the secondary tasks more often and for longer while the vehicle was in motion compared to when stationary.

A small percentage (5.9%) of the secondary tasks events were associated with a driving incident. Many of these incidents were minor and involved a delay in drivers detecting that the traffic lights had turned green or that vehicles in front had moved away; however, several of the incidents were more serious, with drivers veering out of their lane or failing to detect the vehicle ahead braking suddenly. Not surprisingly, the majority of the incidents occurred while drivers were engaged in secondary tasks that have been found to be associated with a doubling of the odds of being involved in a crash and near crash, including using a hand-held phone, manipulating objects and reaching for objects/phone (Dingus et al., 2016; Klauer et al., 2006). Given that only data related to the secondary task events was coded, it is not known what proportion of normal, baseline driving involved safety-related incidents. Future work should establish the relative proportion of unsafe incidents occurring when drivers are engaged in secondary tasks and when they are not.

The findings in this paper need to be interpreted in light of a number of strengths and limitations. One of the key strengths is the use of naturalistic driving data which allows the examination of the patterns and prevalence of drivers' secondary tasks engagement in a natural, real-world driving setting, free from the constraints and artificial nature of more traditional experimental environments. The sheer amount of data collected, however, meant that only a fraction of the available data set was coded and analysed for this paper. The manual coding of the 185 trips took two analysts approximately 700 hours (over 95 working days) to complete. Future work with NDS data should examine ways to at least partially automate the coding of secondary task events to ensure that larger amounts of data can be analysed without the burden and expense of manual coding. Further, the random selection process used to select trips for coding meant that there was variability in the number of trips analysed for each driver; the number of trips coded for individual drivers ranged from 1 to 12. Thus, individual differences in the propensity to engage in secondary tasks may have had more of an influence on the data for those drivers with a greater number of trips coded. Future analysis of the ANDS data will include a greater number of trips with a more even distribution of coded trips across drivers. Finally, given the available resources, the secondary task data were only coded for the point at which the secondary tasks were initiated, not for the entire duration of the secondary tasks. It was, therefore, not possible to examine certain aspects of task engagement such as the percentage of moving and stationary time engaged in secondary tasks, or if drivers disengaged from the task once the vehicle started moving again, or the impact of dynamic contextual factors that can change throughout the duration of engagement (e.g., traffic density and road curvature). Future work with the ANDS data will seek to code the secondary task data for the entire duration of the task events.

Conclusions

This study is one of only a handful to use naturalistic driving data to examine driver engagement in secondary tasks beyond mobile phone use. The findings will be useful in targeting distraction countermeasures and policies and determining the effectiveness of these in managing driver distraction. In particular, the findings suggest that countermeasures such as continued driver awareness and education programs may need to target the dangers of non-technology based tasks such as reaching for objects, which are performed commonly and are associated with a high crash risk. Improved enforcement of existing hand-held mobile phone laws through the use of widespread automated enforcement cameras is also indicated, as hand-held phone use is still common and there is a perception among drivers that they are unlikely to get caught using their phone (Young & Lenné, 2010). Finally, our findings indicate that even though secondary task engagement is prevalent when driving, drivers are capable of making strategic decisions about when they engage, such as waiting until stationary, and reducing the amount of time engaged when the vehicle is moving. Driver training programs could take advantage of these natural self-regulatory behaviours by encouraging drivers to adopt those strategies that are effective at mitigating the negative impact of distraction when engaging in secondary tasks.

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Road Safety Policy & Practice

The Relevance of Australasian Road Safety Strategies in a Future Context

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Key Findings

- This paper developed and applied a rating scale to assess road safety strategies against criteria for: 1. a comprehensive framework for road safety, and 2. the anticipated changing, difficult and unpredictable nature of future transport and its context.
- The ten Australasian road safety strategies assessed were historical in nature and weak in terms of a comprehensive systems approach for safety management and readiness for future circumstances and challenges.
- The strategies could be improved by more thoroughly including concepts from systems approaches; particularly other parts (or components) and processes, broader policy tools, a greater diversity of participants and clearer relationships within the road safety system.
- The strategies could be improved by preparing for future changes impacting on road safety including technology, emerging markets and business models, and changing consumer preferences.
- The strategies could also be improved by adopting relevant analytical techniques to respond to the uncertainties of the future transport system that makes road safety outcomes more unpredictable.

Abstract

The improvements to road safety since the 1970's are becoming increasingly difficult to sustain in many developed countries. This paper analyses ten Australasian Government road safety strategies against two key criteria: 1. a comprehensive framework for road safety, and 2. the anticipated changing, difficult and unpredictable nature of future transport and its context. The analysis concludes that current Australasian road safety strategies are weak in some areas of content and do not address future challenges. Improvements are suggested to strengthen strategies' thoroughness and robustness, as well as ways that the strategies can be more resilient to future circumstances.

Keywords

System, Future, Strategy, Plan, Policy, Assessment, Road Safety.

Introduction

Road deaths in Australasia have reduced since the peak in the early 1970's. Yet, over the last few years, the long term declines have lessened, and become increasingly difficult to maintain (OECD/ITF, 2016; Beck et al., 2017). The previous target set in the National Road Safety Strategy was a 40% reduction in fatalities, whereas 34% was achieved. The current target of a 30% reduction in fatalities by 2020 is unlikely to be met, since the reduction from 2010 to March 2018 is 5%. Road deaths in Australia have not reduced in quantum over the last five years and may be increasing (BITRE, 2018). This phenomenon is not unique, but is being observed in many developed countries (OECD/ITF, 2016) and raises many questions; firstly, as to why it is occurring? Secondly, how can road safety management

continue to improve road safety, especially in times of rapid contextual change? In addition, road safety in Australia has not improved at the same rate as the most successful countries internationally. The 'Safe Systems' basis of current Australasian road safety strategies is more than 10 years old, but the underlying policy tools and parts of the system they are applied to are at least 80 years old. Thorough application of systems approaches is not yet realized (Peden et al., 2004; Hughes, 2017).

The efficiency and effectiveness of road safety strategies is important in reducing the road toll. However, assessing whether road safety strategies are valuable has been problematic (Wegman et al., 2015; Hauer, 2018; Elvik, 2012), because it is difficult to demonstrate cause and effect, especially over extended periods of time when many factors change, such as economic conditions (Sivak, 2009; Wegman & Hagenzieke, 2010; Hughes et al., 2016). Therefore, assessments that can be conducted during the development and implementation of a road safety strategy (ex ante) could be valuable and are more timely than assessments that occur long after (ex post). A confusing factor either way is the level of implementation, which is critical to success, because any well developed strategy could fail due to poor implementation.

This paper describes the assessment of current road safety strategies in Australia against two frameworks. The first is the seven elements of a newly developed comprehensive framework for road safety management based on systems theory and practice (Chapanis, 1996; Hughes et al., 2016; Hughes, 2017). The second framework is the changes that are expected in the transport system and its context that are likely to affect road safety (EU, 2016; NTC, 2016), including the changing and variable nature of future transport (Rasmussen, 1997; Eurocontrol, 2013; Bennett & Lemoine, 2014; Hughes, 2017). The contemporary Safe Systems approach described in Australasian road safety strategies (MOT, 2010; ATC, 2011) is based on important road safety principles applied to road users, vehicles, roads and speeds in order to achieve a purpose that is often stated as a target or general objective. The practical application continues the traditional policy tools of engineering, enforcement and education applied to road users, vehicles and roads.

7P Systems Framework Criteria

In contrast to road safety, safety management in other hazardous industries based on system theory and best practice, takes a more comprehensive approach and broadens the range of policy tools and that can be applied to a wider range of component parts that comprise the system. This approach also specifically recognises the full range of participants (or actors), the relationships and interactions within the system, and the necessary processes to efficiently and effectively achieve the purpose. Based on a comprehensive systems theory approach, the 7P System framework (Hughes, 2017) is shown diagrammatically in Figure 1 and described in Table 1 that can be summarised as:

Participants use *processes* based on *principles* to apply *policy tools* to affect contributing component *parts* in order to achieve a *purpose* (improved road safety). These all occur in complex interdependent *partnerships* or interactions within the system.

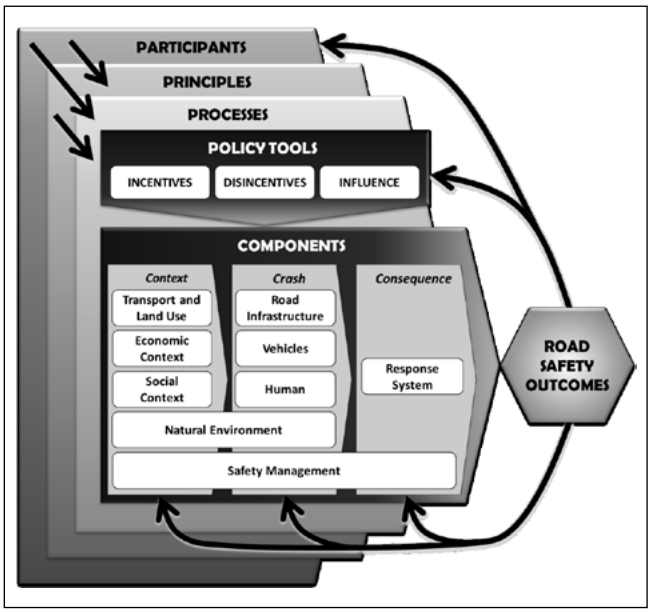


Figure 1. The 7P System framework for road safety management

Future Changes Criteria

Criteria for Future Changes were based on the changes that are expected in the transport system and its context that are likely to affect road safety (Hughes, 2017). Changes may be manageable trends (incremental and foreseeable), such as population and demographics; transport costs including fuel, vehicle prices and other charges; or economic factors such as Gross Domestic Product. Other changes have become more increasingly disruptive (unexpected, uncertain and profound). While there are numerous commentaries about future changes, several key topics commonly arise (Fishman, 2012; Eurocontrol, 2013; Deloitte, 2015; EU, 2016; NTC, 2016; USDOT, 2016), particularly automation and other innovative applications enabled by electronic, information and communications technology (EICT). Automation in road transport has evolved through several phases including Intelligent Vehicle Highway Systems and transport telematics into what is commonly called Intelligent Transport Systems (IRF, 2012; Hughes, 2017). Automation in vehicles is not new, dating back to electromechanical devices including automatic transmissions. However, the opportunities provided by EICT have resulted in modern vehicles being loaded with a multitude of applications for engine and transmission management, comfort, driver information, driver assistance and control systems. The latter have included automated braking systems (ABS) and cruise control for many years, but nowadays commonly include advanced emergency braking (AEB) (EU, 2009), while others alternative names including autonomous emergency braking, advanced emergency braking or other similar terms. Amongst the wide variety of driver assistance and

safety applications, other common technologies include dynamic or adaptive cruise control and electronic stability control (ESC). It is widely expected that automation will dramatically change road safety by dramatically reducing or eliminating driver error. It is expected that automation will also change productivity, ownership, privacy, data, terrorism and other outcomes, as has occurred in industries other than road transport. System theory and practice also suggests that new technologies and applications will introduce other new failures that will need to be managed, due to increasing complexity and because it will take some time for the maturity to occur.

In the wider context, new business models are disrupting traditional commercial enterprises. One of the most obvious of these is the sharing economy, such as Airbnb, Uber and other new information and transaction enterprises that have emerged extremely quickly over the last few years (Quick and Platt, 2015). In transport, new business models are converging with new technologies to service different transport user demands or preferences. Perhaps the most commonly described example of these developments is called Mobility-as-a-Service (MaaS) (Holmberg et al., 2015; TSC, 2016). These changes affect transport operations, types of vehicles, users, road use and other aspects that could have positive or negative effects on road safety.

The second aspect of future circumstances are the changing and variable nature of conditions, which continue to be more unpredictable and difficult to manage. (Rasmussen, 1997; Hovden et al., 2010; Eurocontrol, 2013). The historical environment that has been simple, stable, clear and certain is increasingly becoming more volatile, uncertain, complex and ambiguous (Bennett & Lemoine, 2014; Solomon & Ertel, 2014). "*Organisations today are under stress from a number of dynamic factors in their environment, such as technological changes, globalization, and market conditions. Modern socio-technical systems are characterized by increased complexity and coupling, and are as a consequence increasingly intractable*." (Hovden et al., 2010, p955). These conditions make outcomes more difficult to achieve, requiring more integration and collaboration and thus a more robust and comprehensive framework and practice.

Modern safety management takes account of the fact that the future will be different in nature to the present situation. Various analyses are currently applied to determine the impact of road safety actions, including before-and-after studies and cost-benefit analyses. However, the impact of road safety strategies as a whole provides information that can be used for performance measurement and understanding the success of the strategies (or lack thereof). These often assume steady state conditions that are not reasonable in the changing circumstances described above. Processes need to be applied to ensure that the strategies are relevant to the future. Relying on analyses that are based on historical information and perspectives introduces a risk that a strategy will not suit the future conditions. Other analytical techniques can take account of changes that are expected in the future (Kosow & Gaßner, 2008; Aven & Zio, 2011), such as real options analysis, scenario analysis and systems

Table 1. Strategies assessed

Strategy	Jurisdiction	Period of coverage
Towards Zero – Road Safety Strategy	Western Australia (WA)	2008-2020
Safer Journeys New Zealand's road safety strategy	New Zealand (NZ)	2010-2020
Road Safety Strategy*	Australian Capital Territory (ACT)	2011-2020
Towards Zero Together	South Australia (SA)	2011-2020
National Road Safety Strategy*	Australia (Aus)	2011-2020
NSW Road Safety Strategy*	New South Wales (NSW)	2012-2021
Safer Roads, Safer Queensland Queensland's Road Safety Strategy*	Queensland (Qld)	2015-2021
Towards Zero 2016/2020 Victoria's Road Safety Strategy & Action Plan	Victoria (Vic)	2016-2020
Towards Zero Tasmanian Road Safety Strategy 2017-2026*	Tasmania (Tas)	2017-2026
Towards Zero: Road Safety Action Plan	Northern Territory (NT)	2018-2022
* supported by separate action plan or work program		

dynamics (BITRE, 1999; TRKC, 2004; Leveson, 2011; Salmon et al., 2016).

Methods

Ten current road safety strategies from Australasia were downloaded from the jurisdictions' websites, as summarised in Table 1. All strategies were assessed by the lead author, to ensure consistency, according to seven systems framework criteria and five criteria representing future situations. The two national strategies were from Australia and New Zealand, six strategies were from the Australian States, and two strategies were from the Australian Capital Territory and the Northern Territory. The oldest strategy was from 2008, while the newest was from 2018. The most common horizon year was 2020 with one strategy to 2026. All strategies were based on the contemporary Safe System philosophy. The active time of the strategies varied from four to 12 years. Five strategies had action plans or work programs for intermediate periods, one of which was out of date.

A five point scale was used for assessment of the extent to which the strategies reflect the criteria. The assessment criteria are summarised in Tables 2 and 3. The score of 2 was selected to represent common attributes of an acceptable strategy, although there are no clear guidelines for development of road safety strategies in Australia. The indicative search terms were common in the road safety strategies and other relevant literature previously investigated (Hughes 2017).

The basic scoring scale is as follows, which is tailored according to the concepts and indicative search terms where appropriate to ensure relevance to each specific criterion.

> 0 - keywords or concepts not mentioned
>
> 1 - keywords or concepts directly *or* indirectly mentioned *and* not directly discussed
>
> 2 - keywords or concepts mentioned and briefly discussed *or* addressed
>
> 3 - keywords or concepts discussed *or* has actions to address
>
> 4 - keywords or concepts thoroughly discussed *and* has comprehensive actions to address.

A central mark of '2' represents that the criteria inclusion in the strategy is minimally adequate.

Table 2. Summary of 7P System criteria and scoring

7P System criteria	Description	Concepts and indicative criteria terms
1. Purpose (outcomes)	Consequences of a system when it is functioning, or something of value that is produced or as a result.	*Score 2:* goal, objective, target, aim, outcome (e.g. fatalities, serious injuries). *Higher score:* broader range and description or greater level of detail (e.g. segregation into specific factors or groups).
2. Policy Tools	Any specific intervention or countermeasure applied to improve safety including policies, programs and/or projects, e.g. pricing, education or regulation.	*Score 2:* engineering, enforcement, education. *Higher score:* funding, investment, incentives, pricing, subsidies, fees, charges, leadership, integration, implementation, participation, behaviour change, skills, expertise, capability, industry change, competition, consumer choice, innovation, research.
3. Parts (system components)	A subordinate component of a system, e.g. drivers, vehicles and roads in the road safety system.	*Score 2:* road users, vehicles, roads. *Higher score:* transport, land use, economy, society, natural environment, other users, crash response, safety management.
4. Participants (actors)	Any individual or entity that has the capability to affect road safety, including government, agency, association, company or individual person. Sometimes categorised as users or stakeholders.	*Score 2:* police, road authority, licensing authority, road safety agency. *Higher score:* additional participants (e.g. courts, educators, researchers, industry advocates & associations, community groups, general public, other government agencies, companies, media, transport users, unions, transport & other government departments, crash responders, etc.).
5. Principles	A general rule to be followed, or moral value to be used as a guide or put into practice.	*Score 2:* common Safe Systems principles. *Higher score:* additional principles (e.g. innovation, administrative efficiency & effectiveness, resilience to future change, national consistency, practicability, operational & commercial efficiency & effectiveness).

7P System criteria	Description	Concepts and indicative criteria terms
6. Processes	A series of complementary activities to achieve an outcome.	*Score 2:* common processes mentioned (data analysis, safety management, research, strategic planning, project design/ implement/ operate, communications, evaluation, etc.) *Higher score:* other processes (e.g. in-depth crash investigation, safety/risk management, scenario assessments, benefit-cost assessment, evaluation, etc.)
7. Partnerships (relationships)	The interactions between actors, policy tools, components and outcomes, which may be positive or negative, forwards or feedback.	*Score: 2:* integrate, connect, interconnect, interact, synergy, complement, conflict, dependency, etc. *Higher score:* broader range and description or greater level of detail.

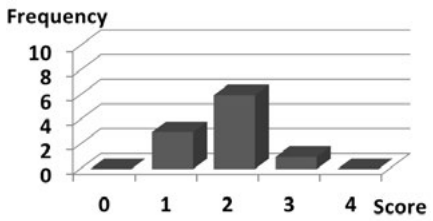
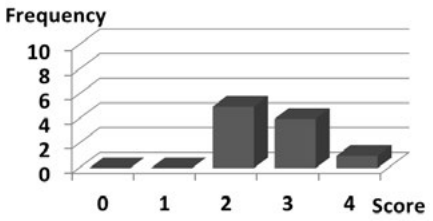
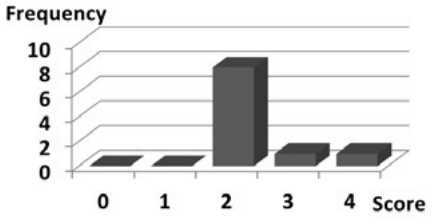
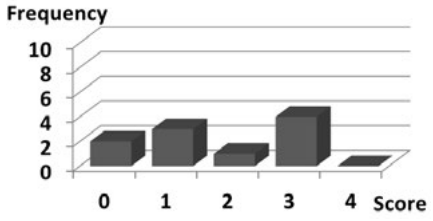
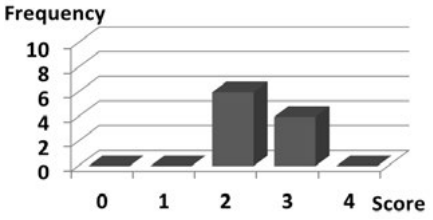
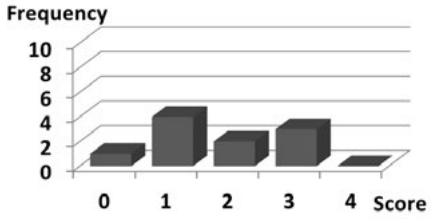
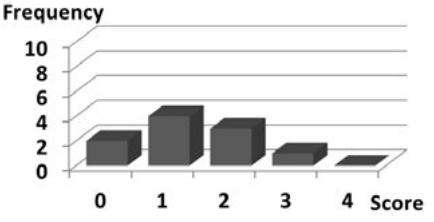
Table 3. Summary of Future Changes criteria and scoring

Future Changes criteria	Description	Concepts and indicative criteria terms
1. New technologies	New electronic information communications technology applications or vehicle types that change road transport.	*Score: 2:* electronic, autonomous, automated, driverless, disrupt, big data, innovation, etc. *Higher score:* broader description or greater level of detail.
2. New markets and business models	New ways that businesses operate commercially, or new transport market delivery structures that change the way that road transport broadly operates.	*Score: 2:* mobility-as-a-service, transport-as-a-service, market, business, demand, etc. *Higher score:* broader description or greater level of detail.
3. Different consumer demands	Changing consumer preferences or demands, or new markets that change the demand for transport.	*Score: 2:* consumer, preference, choice, demand, etc. *Higher score:* broader description or greater level of detail.
4. Nature of the future	Continuing movement away from the previous context that has been simple, stable, clear and certain.	*Score: 2:* volatile, uncertain, complex, ambiguous, scenario, future, etc. *Higher score:* broader description or greater level of detail.
5. Future situation assessment	Clear, accurate and considered appreciation of the future situation.	*Score: 2:* trend, context, estimate, future, forecast, model, economic/ social/ environmental context or effects, etc. *Higher score:* broader description or greater level of detail.

Results

Seven 7P Systems criteria were assessed, where a score of '2' represents a minimum acceptable pass. This provides 70 individual scores, as summarised in Table 4. Five strategies scored a minimum acceptable level of two or above for these seven framework criteria as a whole, with an average score of 1.97. There were only two individual maximum individual criteria scores of four, 18 scores of three and 19 scores less than two. These equate to 29% of scores above a minimum acceptable level, 44% at minimum acceptable level and 27% below an acceptable level. The highest average scores for these criteria were for 2.60 for policy tools and 2.40 for principles, while the lowest average scores were 1.30 for partnerships and 1.70 for participants and processes. Four strategies scored above an average of two for the seven framework criteria, while five strategies scored below an average of two, indicating they were basic and inadequately described a comprehensive framework.

Table 4. Summary of 7P System criteria assessment

7P System criteria and scores	Examples from the highest scored strategies	Distribution
1. Purpose Average Score: 1.8 Range: 1 to 3	Specific challenges described, specific targets described for road use and other sectors.	
2. Policy Tools Average Score: 2.6 Range: 2 to 4	Include land use or transport system planning, safety culture or safety management, incentives, trials.	
3. Parts Average Score: 2.3 Range: 2 to 4	Integrating with land use planning & active transport.	
4. Participants Average Score: 1.7 Range: 0 to 3	Recognise wider stakeholders during consultation or implementation.	
5. Principles Average Score: 2.4 Range: 2 to 3	Supporting cultural change, integrating engineering and speed management, applying best practice, appreciating safety is a lifelong issue, corporate responsibility, international collaboration.	
6. Processes Average Score: 1.7 Range: 0 to 3	Performance monitoring & management, investment decisions, governance, research, knowledge transfer (capability), innovation, evaluation. Impact analysis.	
7. Partnerships Average Score: 1.3 Range: 0 to 3	Ensuring strong alignment with stakeholders' activities, public policy integration, shared implementation, integration. Descriptions of all partners, linkages & synergies.	

Five criteria representing future changes in which the road safety strategies are expected to be applied were assessed, where a score of '2' represents a minimum acceptable pass. This provides 50 individual scores, as summarised in Table 5. There were no scores of four, only three scores of three and six scores of two, with the vast majority of scores (41) below a minimum acceptable score. These equate to six per cent of scores above a minimum acceptable level, 12% at minimum acceptable level and 82% below an acceptable level. None of the strategies achieved a total average score above one, well below the acceptable level of two for these five criteria, with an average overall score of an extremely low 0.52 for all strategies. The highest average criteria score of 1.70 was for new technologies, while all other scores averaged below 1.0. None of the strategies reflected the future situations to any degree of adequacy, with all but one of the strategies scoring zero in at least three Futures Changes criteria.

Table 5. Summary of Future Changes criteria assessment

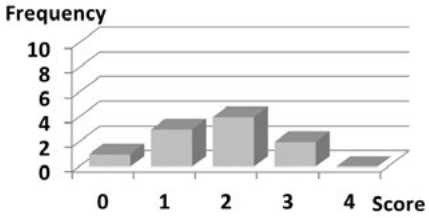
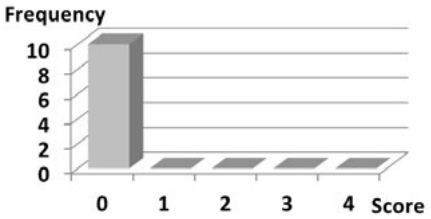
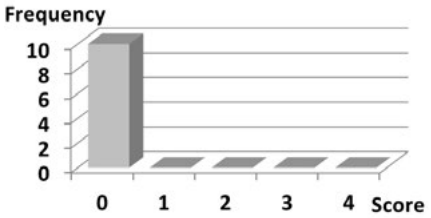
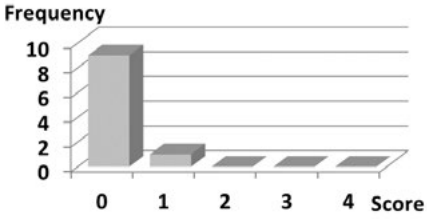
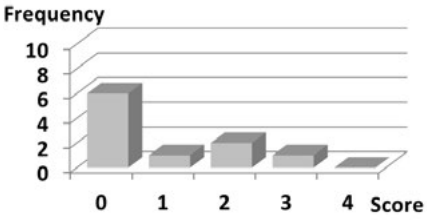
Future Changes criteria and scores	Examples from the highest scored strategies	Distribution
1. New technologies Average Score: 1.7 Range: 0 to 3	Descriptions about new technologies and potential for road safety, self-driving cars, driver assistance, Intelligent Transport Systems, camera technology and monitoring trends.	
2. New markets and business models Average Score: 0 Range: 0		
3. Different consumer demands Average Score: 0 Range: 0		
4. Nature of the future Average Score: 0.1 Range: 0 to 1		
5. Future situation assessment Average Score: 0.8 Range: 0 to 3	Appreciation of demographic, economic and social factors. Considered elsewhere in government.	

Table 6 summarises the assessment for the 7P System criteria and the Future Changes criteria as a whole. This summary illustrates the moderate level of score against the 7P System criteria overall and the low scores against the Future changes criteria.

Table 6. Summary of all criteria assessment

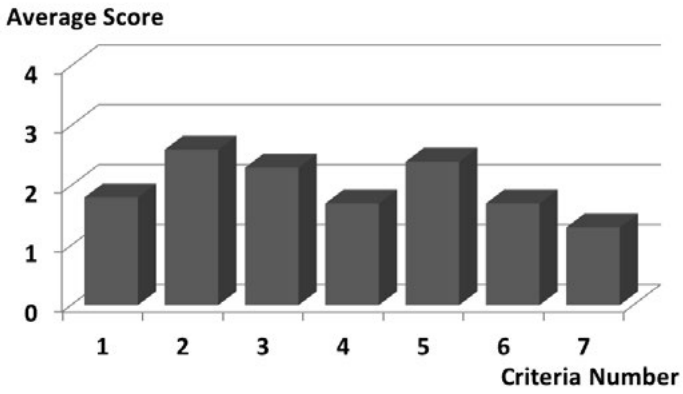
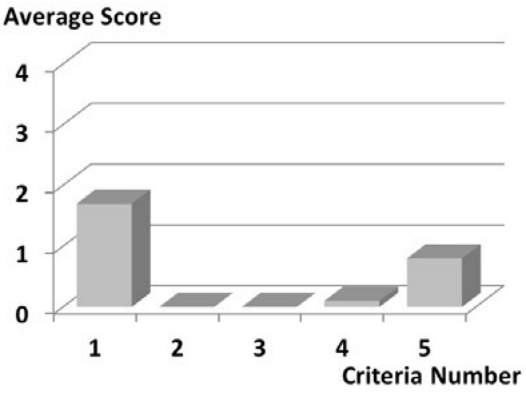
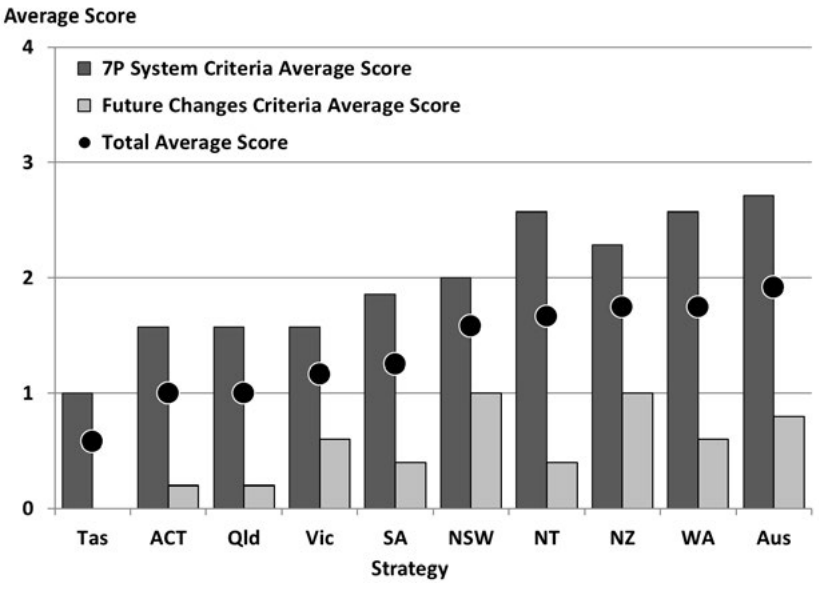
Criteria and scores	Distribution
7P System criteria Average Score: 1.97 Range: 1.30 to 2.60	
Future Changes criteria Average Score: 0.52 Range: 0 to 1.70	
All 12 criteria Average Score: 1.37 Range: 0.58 to 1.92 **Score for each strategy**	

Table 7. Summary of individual strategy assessment scores

Jurisdiction	All 12 criteria average score	7P System criteria							Future Changes criteria					
		Purpose	Policy tools	Parts	Participants	Principles	Processes	Partnerships	All 7p System criteria average score	New technologies	New markets & business models	Different consumer demands	Nature of the future	Future situation assessment	All Future Changes criteria average score
Tas	**0.58**	1	2	2	0	2	0	0	**1.00**	0	0	0	0	0	**0.00**
ACT	**1.00**	1	2	2	1	3	1	1	**1.57**	1	0	0	0	0	**0.20**
Qld	**1.00**	2	2	2	1	3	1	0	**1.57**	1	0	0	0	0	**0.20**
Vic	**1.17**	2	2	2	1	2	1	1	**1.57**	3	0	0	0	0	**0.60**
SA	**1.25**	2	3	2	0	2	3	1	**1.86**	2	0	0	0	0	**0.40**
NSW	**1.58**	2	2	2	2	2	2	2	**2.00**	3	0	0	1	1	**1.00**
NT	**1.67**	1	4	4	3	2	1	3	**2.57**	2	0	0	0	0	**0.40**
NZ	**1.75**	3	3	2	3	2	2	1	**2.29**	2	0	0	0	3	**1.00**
WA	**1.75**	2	3	2	3	3	3	2	**2.57**	1	0	0	0	2	**0.60**
Aus	**1.92**	2	3	3	3	3	3	2	**2.71**	2	0	0	0	2	**0.80**

Table 7 summarises the assessment, for each individual strategy. As a total, no strategy achieved a minimum score of 2 as an average across all 12 criteria. Of the 120 individual scores overall, this equates to 19% of all individual scores above a minimum acceptable level (3 or 4), 31% at minimum acceptable level (2) and 50% below an acceptable level (0 or 1).

Discussion

The study is limited by the published road safety strategies available and within the scope of the review. Some strategies may have additional information available in complementary documents such as actions plans. Other supporting information, such as analysis of the anticipated impacts of the strategies may be available, but is not referred to in the strategies. It is also important for a comparative assessment that strategies are compared on an equal basis, and searching for additional information can threaten the equivalence of assessments. In addition, some strategies may lean towards brevity in order to maximise readability for a general audience. This raises the question beyond the scope of the study as to the purpose of the strategies themselves. For instance, they should be written very differently if they are for public engagement and motivation, for political justification, or to provide clear guidance and requirements for professionals, practitioners and other participants involved.

The analysis found that current road safety strategies were minimally adequate for some criteria (policy tools, principles and parts) but weak on participants, processes and partnerships. However, the strategies hardly reflected the anticipated future changes to the transport context, while the changing and variable nature of future conditions was missing almost entirely from consideration and response in the strategies. Tables 3 and 4 describe examples in the strategies of criteria that were scored highest and discussed further below.

All strategies mentioned engineering, enforcement and education policy tools. However, other policy tools were rarely or never mentioned included incentives, alternative funding and investment (e.g. private sector), pricing, subsidies, fees, charges, leadership, integrating techniques, consumer choice, industry change or innovation. All strategies mentioned several types of road users, roads (sometimes with the wider infrastructure) and vehicles. Due to the Safe Systems framework, all strategies mentioned speed management as a primary issue. Interestingly other behaviours such as 'safe alcohol and drugs', 'safe fatigue' or 'safe distraction' etc., were not given the same level of significance. Also, other parts of the road safety system were rarely mentioned including land use, the economy, social context, crash response, and thorough risk and safety management.

All the strategies clearly described Safe Systems principles, but did not recognise other valuable principles to ensure the strategies were cost effective, acceptable and timely, such as innovation, administrative efficiency and effectiveness, resilience to future change, national consistency, practicability or operational and commercial efficiency and effectiveness. The Safe Systems approach clearly focusses on the number of people killed and seriously injured as the Purpose. However, more specific targets or objectives could be described for specific road user groups, contexts or causal factors.

All the strategies were weak in thoroughly describing processes that need to be applied, in order for the strategies to be successful in achieving the intended improvements to road safety. Most strategies described something about the process to develop the strategy. However, there were almost no descriptions of processes for safety management, research, project design and implementation or operation, communications, evaluation, etc. Other processes to apply best practice safety management that exist in other safety domains were also missing. These include in-depth crash investigation, thorough safety or risk management, scenario assessments, benefit-cost assessment, program evaluation, etc. None of the strategies include an evaluation of the efficiency or effectiveness of previous strategies as a whole, as opposed to individual actions in isolation. So, there is no mechanism for knowing whether previous strategies were successful in achieving their intended purpose, although some strategies proposed evaluation of the current strategy.

Any comments about the future in the strategies reflected a 'business-as-usual' approach rather than recognising any future changes. There was no discussion about the effects of new markets, business models or different consumer demands on road safety, even though these changes are recognised in wider transport policy and planning, and have been changing transport for several years. Comments about the future performance were based on continuance of trends of the past, despite transport (and its wider context) continuing to become less simple, stable, clear and certain. The little discussion in the strategies about the impact on future road safety performance was almost entirely limited to notional targets in the purpose. There were no forecasts for future performance, scenarios of alternative circumstances or assessments that took account of future uncertainty.

One important issue that emerged from the study was the timeliness of strategies. The time the strategies were intended to be relevant varied from four to 12 years, during which time considerable changes can occur to the context that the strategies operate in; the pre-crash or 'Context' phase (Hughes, 2017). It is noted that some of the older strategies scored high and some later strategies scored low. However, this issue was not assessed in this study and only ten strategies is too few to make any conclusions, so this issue could benefit from further consideration. One technique for maintaining relevance over time is to use Action Plans or Work Pans, which specify actions over a shorter period of time within the strategy period, as five of the strategies do.

While new technologies were mentioned, the comments were mainly focussed on the impact of technology on distraction, and automated enforcement. There was little discussion about new technologies to improve road safety directly (such as in-vehicle safety systems and driverless technology), and no clear actions to apply such technologies. AEB is an interesting example of technology and an opportunity for improving Australasian road safety. AEB was mandated by the European Union in 2009 for certain vehicles (primarily trucks) manufactured from 2013 and all other vehicles from 2015 (EU, 2009). As such, many new vehicles in Australasia have AEB, but it is not required under Australasian road safety regulation. The only mention of AEB in these strategies is the potential for its introduction, and only as far as conducting some investigation. Electronic brake technologies were recommended in the 2008 National Heavy Vehicle Braking Strategy, but despite the clear benefits of AEB, there are no concrete proposals for it to be a requirement in Australasian vehicles. This puts Australasian road safety at least ten years behind Europe for this safety improvement. It also indicates the general lack of appreciation of changing technology and the opportunities that arise, and the capability to apply technology to achieve road safety outcomes.

The same is true for other vehicle automation and particularly the introduction of driver assistance systems, to the point of driverless cars. Australia is planning to change the safety regulatory regime from a prescriptive rule and enforcement based regime to a performance based approach (as used in aviation, railways and other hazardous industries) by 2020 to cater for vehicle automation. The changing regulatory approach is necessary to deal with the complexity and diversity of the new technologies, and the dynamic nature of the systems that can change literally overnight (with new software downloads). Yet a government response to the introduction of such technologies is almost completely absent in Australasian road safety strategies, despite such technologies being deployed elsewhere, and sometimes mandated, at the present time. While car automation is a major focus of government and industry interest, the same or other technologies exist or are emerging for other interests such as pedestrian, cycling, heavy vehicle and motorcycle safety which also need to be accounted for to improve safety outcomes.

While most of these strategies are quite strong in terms of the Safe Systems approach, there are several improvements that can be made if the strategies are to closer match the best approaches based on systems theory and best practice safety management in other hazardous industries. The weakest aspect of the strategies analysed is the historical nature of the perspectives that they are based on; backward looking information that becomes out of date due to time, and continuing to rely on the same types of actions as those used for many years. Therefore, they do not take account of future situations, including several types of variability, or apply wider policy tools that are available to more participants or parts of the system.

As noted in the Introduction, the recent history of Australian road safety is that the intended objectives are not being met. Continuing to use the same approach is therefore unlikely to achieve the intended objectives in future. The strategies are generally only minimally acceptable. Broader, deeper and more insightful consideration of structural elements in a comprehensive framework needs to occur.

The following recommendations are made to improve Australasian road safety strategies, based on systems theory and best practice in safety. With respect to a comprehensive framework, based on Hughes (2017) that is consistent with systems theory and practice, these include:

- thoroughly appreciate the roles of all relevant participants (Leveson, 2011; Salmon et al., 2016) and develop actions to maximise the benefits of actions of participants who can positively contribute to road safety outcomes and minimise the negative effects of participants with conflicting objectives;
- explore and develop alternative policy tools to enforcement, engineering and education that broaden the range of actions that can be applied. These may include economic incentives, developing safety culture and climate (Wiegmann et al., 2007), or capability development and standards for participants with poorer skills and knowledge;
- identify other components that can be influenced to improve road safety or defend against if they would result in adverse road safety outcomes. These could include aspects of the transport and land use system, society or economic context including broader government policy;
- thoroughly describe and apply the processes required to manage road safety, including implementation. Other processes not yet widely applied in road safety include contemporary risk analysis and management such as fault tree analysis (Leveson, 2011), MORT (Johnson 1980), STAMP (Leveson, 2011), SAFETY II (Eurocontrol, 2013), and systems dynamics (TRKC, 2004; Leveson, 2011; Salmon et al., 2016);
- clearly describe numerical targets to recognise external factors (such as fatality rates versus population or vehicles, or economic indicators) and for individual target areas (such as road user groups or types of crash);
- clearly identify the relationships between participants, policy tools, components and outcomes to understand and maximise the positive synergies and minimise the negative conflicts;
- describe the outcomes or purposes of individual actions in addition to the strategies as a whole, or for specific sectors (such as heavy vehicles, geographic areas, road user groups of participants); and
- broaden the range of principles that need to guide strategies to be most effective, such as cost efficiency, innovation, best practice, and evaluation.
- With respect to ensuring that the strategies are more suitable for the future circumstances, the recommendations include:
- estimate the future road safety outcomes, with and without individual actions and the strategy itself;
- ensure the strategies are resilient to alternative futures caused by changing circumstances;
- employ contemporary futures analytical techniques (Aven & Zio, 2011), such as scenario analysis (Kosow & Gaßner, 2008), real options analysis (BTRE, 1999) and Monte Carlo simulation for analysis of future consequences caused by the strategies, individual actions, and external factors and participants;
- consider influences and factors that will change in future that will affect road safety outcomes;
- develop actions to maximise the benefits of positive contextual influences and minimise the effects of negative external influences. Automation and technology, new business models and the effects of changing consumer preferences should be the first factors to be considered;
- develop and apply techniques to manage future influences that are unpredictable; and
- ensure an appropriate time period that strategies should be applied to, so they remain relevant throughout their lifespan.

Conclusion

To summarise, this study demonstrates that Australasian road safety strategies could be developed more thoroughly, be more timely and be designed to more robustly respond to future changes in transport and economic contexts. Strategies with horizon years of 2020 or 2021 urgently need updating to maintain currency. They can be improved in accordance with the 7P System and the Future Changes criteria to be applicable and thereby successful in the future. Implementing such recommendations will bring Australasian road safety strategies up to the standard of good practice for safety management in hazardous industries. It is expected that doing so will result in further improvements to road safety that have been more elusive and difficult to achieve in recent years.

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Road Safety Case Studies

Road Safety – Is It a Local Government Priority? (What Does the Experience Suggest?)

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Key Findings

- Crashes occur on local roads every day, and represent just over half of all fatal and serious injuries each year across the Australian and New Zealand road network;
- Local government are the road authority for local roads and as such have a duty of care to ensure the safe mobility of their road users;
- Under-resourced, under-funded, lacking appropriate skills and expertise, and applying an outdated approach to road safety mean that road safety is not the priority across their networks that it should be;
- Government road safety funding models need to change to encourage (and reward) councils for adopting a pro-active risk management approach that supports a Safe System approach to road safety.

Abstract

As the road authority for the unclassified (i.e. local) roads in their local government area, councils have the legislated responsibility to manage their road infrastructure; this fundamentally includes the safety of road users on their networks. Almost 70% of the 392 fatalities on NSW roads in 2017 occurred on country roads (Transport for NSW, 2018). The contribution of the local road network to road trauma across Australasia is significant with over half (52%) of all fatal and serious injuries recorded on roads that are the sole responsibility of local government (McTiernan et. al., 2016). Governments at all levels - Local, State and Federal – can no longer ignore the contribution of local roads to the national tragedy and trauma occurring each year. Without a concerted effort by all tiers of government to address road safety performance on the vast local road network, Australia will not achieve the 30% reduction target in fatal and serious injuries as set out in the National Road Safety Plan. Unfortunately, the current status for managing safety on local roads sees a myriad of systemic hurdles and failures that ultimately result in local government not making road safety a genuine priority. But what is required to change this situation? Two case studies are presented to assist a discussion about some of the systemic failures that contribute to local councils not taking, or not being able to take, action to make road safety a genuine priority.

Keywords

Local government road safety, Safe System approach

Introduction

Two case studies are presented in this paper to help illustrate the type and range of systemic barriers that work against local government making road safety a genuine priority. The first describes a potential future tragedy that, if realised, will impact a small rural community. The second describes an example that has already had tragic consequences and questions the adequacy of the Council's response when called upon by victim's families, friends and local community for action to prevent more harm occurring.

The experiences outlined in this paper explore a series of questions about whether councils are genuinely interested in understanding why people are being killed and seriously injured in road crashes in their local government area (LGA). Are councils equipped to learn from crashes on their networks and thus prevent similar incidents from occurring? Are they able to apply best practice principles, drawing from the nationally accepted Safe System approach, and so contribute to the national and state goals of zero death and serious injury on the country's public roads?

And what is an appropriate response to crashes occurring on local roads? How do practitioners understand the impact on victims and local communities involved? What lessons are there on how to prevent crashes occurring, and what measures are effective for reducing the severity of crashes that will still occur, and thus make 'Toward Zero' a reality?

In highlighting the hurdles faced by local government, the discussion in this paper focuses on where systemic change and improvement can be applied to allow councils to better identify road safety risks on their networks and to develop appropriate strategies that allow better manage of these risks. As a road manager and the tier of government closest to the community, local councils need to 'make it happen' on their network, and so help move the nation towards zero death and serious injury on our roads.

The Case Studies

The following case studies briefly present only some of the areas where local government struggle to balance the competing demands they face as road authorities responsible for the condition and safety performance of their local road networks.

These case studies are not isolated examples selected to highlight a 'worst-case scenario'; they do not represent outlier experiences, situations that might be considered rare and extreme. Unfortunately, they are an all too common experience for this author.

Figure 1. Typical configuration of the local haul road

Case Study 1 – A Predictive Risk Management Approach

Background

The operator of a hard rock quarry sought development approval to increase production from 700,000 tonnes per annum (tpa) to 2 million tpa. At full production, the increase in heavy vehicle movement of aggregate to construction markets in and around Sydney was projected to increase from an existing average of 164 trucks per day (tpd) to 440 tpd; the limit on maximum truck movements during periods of peak demand was proposed to rise from 360 tpd to 590 tpd.

The haul route between the quarry and the State Highway to Sydney is approximately 8 km of local road under the care and control of a regional council; it is a typical two-way,

Table 1. Existing, conditioned and alternate road formation arrangements

Design feature	Existing (typical)	Condition of consent	Austroads				Haul route
			Standard x-section		WCLT		ARRB recommended formation
			500 - 1000 vpd	1000 – 3000 vpd	Normal DD	Extended DD	
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
CLT width, (m)	0.1 – 0.3	0.3	0.3	0.3	1.0	1.0	1.0
Lane width (m) (x2)	3.1 - 3.4	3.1	3.1	3.5	3.25	3.25	3.25
Seal shld. (m) (x2)	0.5 – 1.5	0.5	0.5	1.0	1.75	1.25	1.25
Shld. width (m) (x2)	< 0.8	1.5	1.5	2.0	1.75	1.25	1.75
Unseal shld. (x2)	< 0.5	1.0	1.0	1.0	n/s	n/s	0.5
Total seal width (m)	~ 8.4	7.2	7.2	9.0	11.0	10.0	10.0
Total form. width (m)	< 9.4	9.2	9.2	11.0			11.0

two lane rural road that connects outlying villages, rural residential properties and farms to the local town and the Highway.

Excluding traffic associated with the quarry operations, the traffic volume on the haul route varies between 180 and 400 vehicles per day, placing it at the lower-mid range of local roads. The default rural speed limit of 100 km/h applies; remnant native vegetation is present along most of the roadside, often immediately adjacent the tabledrain or just off the edge of the road shoulder. The local council has progressively upgraded the haul route, strengthening and widening the pavement so the road between the quarry and the Highway now has marked centreline and edgelines, with regularly spaced guideposts to enhance delineation, particularly at night and in fog conditions.

The road has a curvilinear alignment with long straight sections where overtaking is permitted. A 600 m length of steep grade in the last 2 kilometres results in loaded trucks slowing to less than 40 km/h. A typical view of the existing road formation is illustrated in Figure 1.

The width of the marked traffic lanes and the road shoulders vary, but there is generally an overall sealed formation of approximately 8.4 m, with narrow to zero unsealed shoulders that roll into a shallow table drain, see column A in Table 1. Some of the steeper roadside embankments and culvert headwalls have guardrail protection to redirect an errant vehicle. However, none of the trees along the roadside have barrier protection.

Court and Council Requirements

The Applicant for the quarry expansion referred the matter to the Land and Environment Court for determination on a deemed refusal basis, due to the significant delay in gaining a decision on the matter. As the proposal was considered a State significant development, the Court proceedings involved the State Planning Assessment Commission (PAC), which engaged with the Court, the regional council, the local community and the applicant to assess the areas of concern and objection.

A key issue for Council and the PAC was ensuring that the road was of a standard appropriate for the volume of vehicles projected to be using it. In response, the Applicant proposed improvements to the haul route to improve the safety of road users.

The technical experts for the Applicant and the PAC each provided their respective opinions to the Court. Following review of the merits of the submissions, the Court issued orders that included conditions of consent stipulating *'the primary transport route shall be upgraded such that it conforms with current Austroads standards'* (emphasis added). The orders made it clear that design plans *'shall be submitted to the local roads authority for approval'* and that that the designs are *'subject to any requirements or variations requested by Council as the roads authority'*. In addition to these general conditions, the consent provided specific requirements about the road that stipulated the width of the formation, refer to column B of Table 1.

Comparing columns A and B in Table 1 it can be seen that the existing road met or exceeded the requirements of the conditions of consent. In consultation, this was a situation that neither the applicant nor the council were comfortable with, particularly given the proposed increase in truck numbers, since it essentially meant no road works were required.

Step Towards a Safer System

With concerns about the implications of the conditions of consent for safety and road condition performance, the applicant sought independent expert advice from the Australian Road Research Board (ARRB). The approach adopted by ARRB was to first review the road safety risk of the existing and conditioned road formation arrangements. Applying the iRAP risk assessment method, ARRB demonstrated the existing road formation achieved a mid-range 2 Star rating; further assessment indicated the formation that was conditioned on the development resulted in a 2 Star rating that bordered on a 1 Star, effectively an increase in road safety risk.

It was ARRB's view that applying some of the fundamental Safe System principles to determine a road formation could achieve a superior outcome for road safety, while doing so within the context of the existing road reserve. For this, an alternate road formation was proposed that incorporated a wide centreline treatment (WCLT), combined with narrower traffic lanes, wider sealed shoulders and a reduced speed limit of 80 km/h, see column G of Table 1.

The principle of this design formation included multiple considerations. Central was the WCLT which is designed to increase separation of opposing traffic, thus reducing the potential for head-on collisions by giving drivers room to recover their steering line before entering the opposing lane; the wider sealed shoulders are also part of a 'more forgiving road' approach, again increasing the space available for drivers to regain control of their drifting or errant vehicle. The narrower marked lanes are designed to complement improved vehicle control, and supported by a reduction in the speed limit, drivers would be expected to experience less lane drift.

An assessment of this configuration applying the iRAP protocols resulted in a 3 Star rating. This objectively demonstrated the improvement that could be achieved; even while retaining the 100 km/h speed limit, the 3 Star rating was maintained.

For the applicant, the significant improvement in safety resulting from the innovative treatment was appealing. There would also be a benefit from the wider road formation, giving improved durability along the road edges and shoulder areas. For the applicant, these outcomes justified the capital investment in the road they would need to make.

However, initial discussions with Council about the alternate road formation were not well received as they were of the view that the road formation, if widened, should be as conditioned and adopt the 'Austroads standards' presented

Figure 2. View towards the site of two fatal crashes

in column D of Table 1. This approach would require two 3.5 m wide traffic lanes, with a standard double barrier centreline (BB) separating opposing traffic – i.e. the typical rural road configuration.

The implications of this on road safety performance, from a Safe System perspective, are discussed later.

Case Study 2 – A Reactive Black Spot Approach

In January 2015 a driver lost control of her vehicle on a winding section of rural road. Sliding across the centreline, her vehicle collided with another heading in the opposite direction. The force of the crash resulted in seven casualties – four children and their mother in the second vehicle were injured; a 15-year-old girl in the first vehicle was critically injured, her mother, the driver, died at the scene. A week later, the teenage girl died of her injuries in hospital.

In February 2016, Karl and Wendy were heading home on the same local country road when Karl lost control of his vehicle on the same bend where the multiple fatal crash occurred the year before.

For Karl and Wendy no traffic was coming the other way and as a result their vehicle slid across the road and hit the low concrete kerb. As a result, it flipped and rolled 30 metres down a steep embankment, landing upside down in the river, below. Wendy's seat was pushed back by the force of the crash; while she sustained injuries, her life was saved by her seatbelt and the firing of the airbags, but she was now caught upside down in her seat and she could see the car was slowly filling with water. Dazed and confused, Wendy released herself from the seatbelt and was able to sit upright on the ceiling of the vehicle. Karl, meanwhile, also upside down and strapped in his seat, was unconscious.

The water continued to rise until it stopped at Wendy's chin, leaving her an air pocket in the footwell of the car. Being on the low side of the upside-down vehicle, Karl's space quickly filled with water. Wendy, unable to reach around and unfasten Karl's seatbelt calls to him, but he is unresponsive. In Wendy's words, *'he has no option but to surrender to the water…he does not struggle. I hold his hand as he drowns, hearing a shocking gurgle of water, like a large sink emptying. His head flops to one side.'* (Mooren 2017)

Fearing for herself and desperate to get help for Karl, Wendy dived under the water that filled the vehicle cabin and managed to force herself through the open window of the front door on the passenger side where she was sitting. She stood free of the vehicle which lay in just over a metre of water. By this time passersby were scrambling down the embankment; one managed to free Karl from his seatbelt and pull him from the car, but it was too late.

The road is typical of the area; a two-lane, two-way rural road that connects local villages with the main population centre and the coast. It traverses the hills of the hinterland, following the upper reaches of the river. The rural default speed limit does not apply on this section, instead, reflecting the winding and undulating terrain as the road passes through pockets of rural residential development; a speed limit of 80 km/h is signposted.

The road has a marked centreline, edgelines and guideposts; there are raised pavement markers along the centreline to improve night time delineation. Some sections have chevron alignment markers installed to warn drivers of the tight radius curves; some curves have warning and 45 km/h speed advisory signs; some locations have a guardrail, providing a measure of reassurance to drivers that they are safe from the river. However, many curves are not similarly marked, and long sections of the road, such as where Karl and Wendy lost control, have no barrier to prevent an errant vehicle from going over the edge of the road into the river below. A view of the site of the two fatal crashes is shown in Figure 2.

The curve warning and speed advisory signs were installed following the first fatal crash, on the suggestion of the Coroner and investigating police, who also suggested *'... that the surface be upgraded'*. Police tend not to make suggestions for road improvements based on a single crash. However, their firsthand experience of repeat crashes on this road motivated them to seek Council intervention.

Police estimated that Karl's speed into the corner was between 50 and 60 km/h. The road at the time of both fatal crashes was wet; Karl's loss of control was sudden and occurred at a point where water had allegedly ponded in the gutter from a blocked culvert, spilling into wheel depressions in the travel lane. Police later commented to Wendy that not only was the road surface wet, but it was regularly affected by leaves and fruit from overhanging vegetation, causing the surface to be slippery. The three attending Police officers also told her that if guardrail were in place, Karl would not have died.

Crash history

A review of crash data published by the State road agency identified that, for the five-year period prior to the 2015 fatal head-on collision, there were 22 crashes along a 2.4 km section of road centred around this fatal curve, including 15 single vehicle crashes and 4 head-on collisions, which resulted in 1 fatality and 22 injuries. For the five-year period, 2013 – 2017, this same section of road has recorded 22 crashes involving 16 single vehicle crashes, 4 head-on collisions and 1 intersection crash, which resulted in 23 casualties and 3 fatalities.

The Conventional vs. Safe System

The Safe System approach was introduced to the Australian road safety lexicon in 2004/05 as part of the national road safety action plan. It has been a central tenet of road safety in Australia and New Zealand since that time. However, the application of its principles by practitioners, at least in this country, is best described as limited. There are many reasons for this, but citing a lack of available research material, practitioner guidelines, training workshops and tools to assist understanding and interpreting the concept are not legitimately some of them.

A situation has developed amongst road practitioners that sees parallel road safety perspectives being applied – the conventional and the Safe System approach. Identifying the difference between these is illustrated in the Austroads report *Towards Safe System Infrastructure – A Compendium of Current Knowledge* (Woolley et. al. 2018), see Table 2, below.

This same published Austroads report, freely available to all road practitioners, draws together concepts that have been the subject of local and international research and practice for the last 20 years.

Table 2. The difference between the conventional and Safe System approach to road safety

	Conventional	Safe System
What is the problem?	Accidents	Fatalities and Serious Injuries
What causes the problem?	Mainly poor road user performance Speeding, drink driving, inattention, deliberate risk taking	System failures
Who is ultimately responsible?	Individual road users	System designers and operators
What is the major planning approach?	Incremental approach to reduce the problem with an associated residual crash problem	A systemic approach to build a safe road system and minimise the harm
What is the appropriate goal?	Optimum number of fatalities and serious injuries based on competing objectives	Towards the virtual elimination of death and serious injuries
What is the trade-off?	A balance between mobility and safety	Maximising safe mobility
How is the effort coordinated?	Incremental gain within individual pillars (roads / speeds / vehicles / people)	Optimise solutions across pillars (roads / speeds / vehicles / people) – pillars compensate for each other where performance is poor
What are the cultural manifestations?	Legal liability avoidance and risk aversion	Risk assessment, innovation, trials and demonstrations
Context of tools in use	Bias towards pre-existing crash history, understanding crash causes and likelihood, optimising the network for motor vehicles	Risk analysis based on network design attributes supplemented by crash data, understanding crash consequence, optimising the network for all road users and human frailty

Source: Woolley et. al. (2018).

The Local Government Approach to Road Safety

For many road managers, particularly local government, the approach to road safety is firmly embedded in the 'conventional' approach in Table 2. As a result, the response to dealing with road safety in a proactive, harm minimisation way to achieve safe mobility falls short of what is necessary to make the step change required if the national vision is to be realised. Applying Table 2 as a general framework to both of the case studies, it is suggested that the conventional approach to road safety is firmly entrenched in the attitude and practice of local road managers. Taking case study #1 and considering the outcome of the Court and Council deliberations:

- There are no crashes on the existing road. Therefore, there is no catalyst for council to consider enhancements that address future risk with the increase in heavy vehicle traffic.

  Outcome – Council/Court adopt a typical profile of the Austroads rural 'standard'.

- The quarry operations will generate more traffic.

  Outcome – The Court imposed conditions of consent for a road formation based only on AADT, resulting in a formation that is narrower than the existing road; Council sought provision of wider lanes, equating safety with wide lanes, narrow shoulders, a fixed (3 m) clear zone, standard linemarking and guardrail, making this road just like other rural roads in their LGA.

- The applicant proposed an alternate design solution (i.e. WCLT, narrower lanes, wider sealed shoulders, reduced speed limit) to target risk factors, changing the iRAP Star rating from 2 Stars to 3 Stars for the alternate design concept.

  Outcome – Council do not initially accept the alternate design as it is not to the Austroads 'standard', it is not applied to local roads, it is not in accordance with conditions of consent or the Council DCP, and it potentially leaves Council exposed if a crash occurs as it is a 'non-standard' design configuration.

Applying the framework to case study #2, with direct reference to the questions:

- What is the problem?

  Council claims *'despite anecdotal evidence of repeated non-casualty crashes, there were few official crash statistics at this location prior to the two fatal crashes'*.

  Situation – Council's assertion about a lack of crashes is not supported by the readily available data available from the state agency.

  The state agency provides crash data directly to all councils on a quarterly basis; since May 2015 this has been by a secure online file transfer, with GIS mapping, and a detailed set of data visualisations specifically designed and developed for local councils; prior to this it was via CD-ROM.

  It is clear from a review of the crash data on the state agency website that the subject section of road had a significant crash history for a period of more than five years prior to Karl and Wendy's crash, which included fatal, serious and non-injury crashes.

- What causes the problem?/Who is ultimately responsible?

  Council held the view that inappropriate driving speed for the conditions was the 'root cause' of the crash; Council rejected the conclusion that the road conditions were responsible for the fatalities.

  Situation – The attending investigating officer from NSW Police concluded *'the location of the accident is known for fatalities as the area has no barriers in place to stop vehicle/s losing control and driving over the embankment. This accident* (Karl's) *occurred less than 10 metres from a previous fatal…Police are of the opinion that the roadway was a factor when wet, as the roadway bends to the left and right causing vehicle/s to lose control and slide over the embankment. If barriers are in place this fatal and many others could be avoided.'*

- What is the major planning approach?

  Council advised Wendy that *'actions were prioritised to address the root causes of the* [fatal] *crashes at this location being speed, not driving to conditions, and the road geometry and surface'* and '*Council has not pursued guardrail at this location in isolation as it does not address these root causes of the crashes at this location. If Council does not address the factors leading to loss of control on the corner, which it considers to be mainly speed related, Council will potentially be faced with a maintenance issue from vehicles impacting with the guardrail, and new hazards the guardrail may create'*.

  Outcome - Following the fatal crash in January 2015, curve warning/speed advisory signs were installed on the suggestion of NSW Police; following the fatal crash in February 2016, a vehicle activated curve warning/speed advisory sign was installed and the speed limit was reduced to 60 km/h. At the suggestion of the Coroner, pavement friction testing was undertaken by Council to assist assessment of vehicle traction in wet conditions. Council prepared applications to the Federal Black Spot Program, drawing on evidence of the extensive crash history at the site to support the applications.

- What is the appropriate goal?

  Council adopted a conventional approach of focusing solely on crash prevention, attributing the crashes to driver error by inappropriate speed for the conditions; they did not consider options that treat crash severity.

Outcome - Crash mitigation measures focused only on treating driver behaviour; no action was considered to address crash severity – e.g. speed reduction and guardrail.

- How is the effort coordinated?

  Council's view about the cause of the crash (inappropriate speed for the conditions) focused action only on the people pillar.

  Outcome - The reduction in speed limit may technically fall under the speed pillar, however the rural road environment does not support lower speed behaviour, and therefore road safety relies solely on driver compliance (noting that even 60 km/h is likely too fast for wet road conditions) and provided no system-based response to reduce crash severity.

- What are the cultural manifestations?/Context of tools in use?

  Council refused to accept that road conditions played any part in either of the fatal crashes and referenced skid test results as a defence, seemingly without considering the extensive crash history of single vehicle loss of control crashes along this section of road. The Police Crash Investigation Unit declined to attend the site due to the 'at fault driver' being the deceased.

  Outcome - There was no system-based investigation to answer the question *'How did the road transport system allow this crash to occur and cause the death and serious injury of the vehicle occupants in a 5 Star car?'*

So Why Does This Situation Occur?

So, what is it about road safety management and practice in Australia that sees local government road practitioners, managers and authorities hold on to the conventional approach, particularly in the face of long-term efforts to implement the 'new' Safe System paradigm? While the issue is complex and involves all tiers of government, the key areas of concern, largely from a local government perspective, are briefly discussed below.

The road safety narrative – until recently, road safety strategies and action plans promoting the Safe System approach have been developed by national and state level agencies. This has essentially left local government 'outside the tent' and the strategies and action plans have had limited connection with local government. While councils are the road authority for local roads in their LGA, there is no legislated requirement to include road safety in their corporate and community planning processes. The result is an all care and no responsibility disconnect of local government from road safety action.

Road safety funding – the funding model for road safety has traditionally been a targeted approach focused on recorded crash locations. National and state governments have been slow to move from this reactive approach of funding infrastructure improvements to a proactive approach that encompasses all pillars of the transport system, noting that Black Spot funding continues to increase year-on-year.

While the national and state Black Spot Programs have served road safety well, it seems to have only addressed the lower hanging fruit in terms of the road safety challenge. Now, at a time when road fatalities are on the rise, it is increasingly difficult to identify Black Spot locations. This perhaps highlights the lack of sustainability of focusing on a purely reactive funding model and it may be appropriate to review how the funding is allocated to address infrastructure-based road safety issues.

For local government, the Black Spot Program has assisted addressing the considerable gap in funding road infrastructure improvements. However, a consequence of this is arguably local government deferring their own strategic planning and delivery of road safety action.

It is not suggested that the Federal Black Spot Program be shut down; the cessation of the Federal Black Spot Program without an alternate funding model risks the infrastructure funding gap widening, such that neither state nor local government will be able close it.

The modern road safety approach, however, would suggest that greater emphasis be placed on managing risk and ensuring that on-road works demonstrate a clear improvement in the safety rating to meet an established target.

A system perspective – the investigation of road crashes, even fatal crashes, falls short of examining where the transport system has failed to allow people to be killed and seriously injured.

There were 1,295 deaths on Australian roads in 2016; by comparison there were 21 fatalities in the Australian aviation sector, that year. The response to aviation crashes and near-miss incidents adopts a whole of system approach. Findings generate alerts and recommendations that are made available to industry, and where required, are fed back into the regulatory and safety framework. This generates a continuous learning shared with operators and pilots to prevent repeat incidents. The same occurs in the mining industry, itself a significant road transport operator and manager.

For road crashes, the situation is very different. Most incidents are investigated only by police, whose primary purpose is to determine culpability in the prosecution of driving offences. Lacking a multiple disciplinary team approach which includes road engineers, human factors and vehicle dynamics specialists tasked with investigating from a Safe System perspective, results in lost opportunities to determine 'root causes' and where failures in the system occur. Findings of coronial inquiries, if held, are rarely shared with road managers or followed up for action, so there is limited feedback, learning and improvement, particularly at the local road level.

Training and professional development – there is a lack of systems-based training and mentoring available to road practitioners, which includes the engineering, planning and legal consultants advising them. The limited professional development that is available in Safe System thinking does not provide a cross-discipline approach amongst local government practitioners and decision-makers. This means that there is a failure to develop a broad awareness of changes in road safety roles and responsibilities.

Technical guidelines – practitioner guidelines have traditionally focused on issues pertaining to higher order networks. These problems and suggested solutions, including the processes for analysis and investigation, are not always scalable to local roads and the needs of councils. As a result, suggested solutions are seen as inappropriate and unaffordable by local road managers who typically revert to 'traditional' practice.

Views also persist amongst practitioners that compliance with standards equates to safety performance. Adding to this is the perception that Austroads guidelines are 'standards' to be adhered to, instead of guidelines to consider. A consequence of such a rigid application of practitioner guidelines is to constrain the ability of competent road safety engineers to innovate and develop safer roads.

Whole of council commitment – the lack of integration of road safety across council departments and management functions makes road safety vulnerable to priorities being diverted elsewhere. Managing a Safe System requires constant consideration of the system as a whole. Local government, more than either of the other two tiers of government, has carriage of every aspect of road safety within its LGA. There remains, however, a lack of understanding and commitment to ensure each part of council delivers its contribution to road safety and monitors its effectiveness.

Conclusions

Road safety should be a priority for local government; the National vision lays out the challenge and there is a framework to achieve its delivery. But the experience suggests that councils struggle to make road safety a priority. Fundamentally local government needs to shift from a conventional, victim-blaming view of road crashes, to one that is more humanist focused, and adopts a systemic approach to building and operating road systems that minimise harm to its users.

Significant impediments exist to this happening. While some are within the scope of councils to overcome, we must recognise the issues that are outside the influence of any one council and even local government as a whole. It is imperative that there is Federal and State Government action to reconfigure road funding priorities and to actively engage local government in the conversation that shapes the national and state strategies. There needs to be a whole-of-government commitment to a Safe System approach and more transparent interaction with councils.

There also needs to be investment in training and skills development across the broadest range of road practitioners, not simply council road engineers, but also the police, the coroner, land-use planners, health professionals, educators, consulting engineers and planners, lawyers and the insurance industry.

Local government is capable of rising to the challenge and contributing to the National vision for zero death and serious injury on our roads. With this type of support and investment in local government, the case studies outlined in this paper can eventually be the exception and no longer the norm.

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Contributed Articles

Road Safety Media Review

Coverage of commuter and recreational cycling in major Australian newspapers

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Key findings

- Positive coverage of cycling in Australian newspapers is on the rise.
- A significant number of negative stories where the focus is on cyclists, particularly those involved in crashes, is still being published.
- Partnership between cycling safety advocates and journalists are needed to improve media coverage, particularly of cyclist crashes.

Abstract

The study examined the framing of commuter and recreational cycling in Australian newspapers between 2010 and 2013. The number of newspaper articles on cycling over the study period increased by over 30% annually. The proportion of positive stories on cycling also increased from 46.2% in 2010 to 67.4% in 2012 before decreasing to 53.9% in 2013. There was a significantly higher proportion of negative stories amongst articles with a focus on cyclists (66.3%) compared to cycling (12.3%). "Cycling crashes" was the most common theme representing 38% of all published stories, followed by "cycling safety" (13.9%) and "cycling infrastructure" (13.1%). While positive coverage of cycling in major Australian newspapers seems to be on the increase, there is still a significant number of negative stories, particularly those reporting cyclist crashes. Building partnerships between cycling safety advocates and media reporters has the potential to improve the coverage of and public perception about cycling.

Keywords

Cycling; Media; Safety; Promotion

Introduction

Concerns about safety, particularly fears of sharing the road with motor vehicles and the lack of adequate infrastructure, are often reported as the main barriers to cycling (Fishman et al. 2012). As with other car-dependent countries, negative attitudes of many motorists towards cyclists and the failure to recognise cycling as a legitimate mode of transport is also believed to contribute to a reduction in cyclist safety and participation in Australia (Johnson et al, 2014, Australian Bicycle Council, 2017).

It has been suggested that these attitudes are shaped by the portrayal of cyclists and cycling in the Australian media which in turn impacted on the level of cycling uptake and the development of supportive public policy in this area (Rissel et al. 2010). The power of media in shaping public perceptions, through the control and selection of information presented and how it is framed, is well recognised (McCullagh and Campling, 2002). While framing is important in making an issue accessible to lay audiences, it is also a powerful tool that allows the communicator to package the issue thereby shaping the way audiences receive and interpret information (Maniou, 2015).

This study aims to investigate how commuter and recreational cycling was portrayed and framed in major newspapers circulated in all Australian states and Territories between 2010 and 2013.

Methods

The Factiva electronic news archive was searched for articles referring to cycling using search terms "cycling", "cyclist" or "bicycle". The database includes articles published in all newspapers owned by the two major Australian print media groups, Fairfax and News Limited. Articles examined in this study were published in the most widely circulated metropolitan newspapers between 2010 and 2013. Selected newspapers covered all Australian state and Territories and included: The Australian, The Australian Financial Review, Daily Telegraph, The Sydney Morning Herald, The Age, Herald-Sun, The Courier-Mail, The Advertiser, The West Australian, Hobart Mercury, Canberra Times and the Northern Territory News.

The focus was on commuter and recreational cycling (urban cycling). Articles on off-road cycling, professional sports cycling, cyclo-tourism, reviews of books about cycling or articles about cycling-related products were excluded. Retrieved articles were reviewed by two separate reviewers.

Content analysis was used to examine the portrayal of cycling in major Australian newspaper articles. A content analysis coding system was developed based on predetermined explicit rules, with the newspaper article as the unit of analysis. The principal frame or angle was determined based on coders' impression about whether the journal article was overall positive or negative in its portrayal of cycling or cyclists. Other relevant frames included the main theme of the article (e.g. cyclist crash, benefits of cycling and cycling infrastructure) and the overall focus of the paper (cycling or cyclist). Examples of a negative angle include articles with clear negative themes "cyclist as irresponsible road uses", or where during the reporting of cycling crashes cycling is portrayed as a dangerous activity. Examples of a positive angle include reporting on the benefits of cycling or when the coverage of cycling crashes is sympathetic to cyclists and include strategies to improve cycling safety.

In addition, the overall political leaning of reviewed newspapers was determined by their affiliation with the corresponding print media group. Newspapers owned by Fairfax Media group were classified as left-centre left leaning and those owned by News Corp were categorised as representing central to centre-right views (Muller, 2017).

Kappa statistics was computed to establish inter-rater reliability between coders. Chi-square statistic was used to test differences in portraying cycling between various newspaper types and according to the focus of the article. Mantel-Haenszel Chi-Square/test was used to examine the significance of trends of the main frame or angle over time.

Results

A total of 519 articles were published about commuter and recreational cycling in major Australian newspapers with over a 30% yearly increase over the study period between 1st January 2014 and 31st December 2013. There was also an increase in the proportion of positive stories about cycling from 46.2% in 2010 to 67.4% in 2012 before decreasing to 53.9% in 2013 (Table 1). While the trend for the whole period was not significant (*Mantel-Haenszel Test= 0.61, p= 0.43*), it became significant when excluding 2013 *(Mantel-Haenszel Test= 9.36, p= 0.002).*

Table 1. Number and proportion of negative and positive reporting by year, articles focus and Newspapers political leaning

Angle	Positive		Negative		All
Year					
2010	36	46.2%	42	53.8%	78
2011	61	58.7%	43	41.3%	104
2012	97	67.4%	47	32.6%	144
2013	104	53.9%	89	46.1%	193
Trend. Mantel-Haenszel Test= 0.61, p= 0.43					
Articles Focus					
Cycling	200	87.7%	28	12.3%	228
Cyclists	98	33.7%	193	66.3%	291
Chi-Square= 152.71, p <0.001					
Newspapers political leaning					
Right-leaning	202	53.6%	175	46.4%	377
Left-leaning	96	67.6%	46	32.4%	142
Chi-Square= 18.29, p= 0.004					
Total	298	57.4%	221	42.6%	519

There was a significantly higher proportion of negative stories where the focus of reviewed articles was on "cyclists" (66.3%) compared to those where the focus was on cycling (12.3%), ($\chi 2 = 152.71$, $p < 0.001$). In addition, there was a significantly higher proportion of positive stories in left leaning newspapers (67.6%) compared to right leaning newspapers (53.6%) ($\chi 2 = 18.29$, $p = 0.004$).

As shown in Table 2, "Cycling crashes" was the most common theme representing 38.2% of all stories published during the study period followed by "cycling safety" (13.9%), "cycling infrastructure" (13.1%) and "benefits of cycling" (7.7%). The most common themes varied according to the main frame or angle of the article with "cycling crashes" dominating stories with a negative angle (76.9%) followed by "cyclist as irresponsible road uses" (7.2%), "cycling infrastructure" (5%) and "popularity of

Table 2. Number and proportion of most common reported themes by main angle of the article

All articles	n	%
Cycling Crashes	198	38.2%
Cycling safety	72	13.9%
Cycling infrastructure	68	13.1%
Benefits of cycling	40	7.7%
Cycling in local and national politics	34	6.6%
Popularity of cycling	26	5.0%
Advocacy and support for cycling	24	4.6%
Community cycling events	20	3.9%
Cyclists as irresponsible road users	16	3.1%
Barriers to cycling	9	1.7%
Road safety	5	1.0%
Road rage between cyclists and other road users	5	1.0%
Need for bicycle registration	2	0.4%
Total	519	100%
Articles with a positive angle	n	%
Cycling safety	70	23.5%
Cycling infrastructure	57	19.1%
Benefits of cycling	40	13.4%
Cycling Crashes	28	9.4%
Cycling in local and national politics	27	9.1%
Advocacy and support for cycling	24	8.1%
Community cycling events	20	6.7%
Popularity of cycling	18	6.0%
Barriers to cycling	9	3.0%
Road rage between cyclists and other road users	3	1.0%
Road safety	2	0.7%
Total	298	100%
Articles with a negative angle	n	%
Cycling Crashes	170	76.9%
Cyclists as irresponsible road users	16	7.2%
Cycling infrastructure	11	5.0%
Popularity of cycling	8	3.6%
Cycling in local and national politics	7	3.2%
Road safety	3	1.4%
Cycling safety	2	0.9%
Need for bicycle registration	2	0.9%
Road rage between cyclists and other road users	2	0.9%
Total	**221**	**100%**

cycling" (3.6%). For articles with a positive angle, the most common themes were "cycling safety" (23.5%), "cycling infrastructure" (19.1%), "benefits of cycling" (19.1%) and "cycling crashes" (9.4%).

While some themes were common for both types of articles, the actual content varied according to the angle of the story. For instance, while "cycling infrastructure" was portrayed as important to reduce dependence on cars and encourage cycling in stories with a positive angle, articles with negative angles report cycling infrastructure as a "waste of public money that is never or hardly ever used by cyclists" and is a "threat to parking spaces" and "anti-businesses". Similarly, while stories with a positive angle highlight the increase in the popularity of cycling, particularly in inner suburbs of big cities, and portray cycling as the "future" in terms of providing a "viable transport alternative", those with a negative angle report on geographical areas where there was a decline in the popularity of cycling. While cycling crashes overwhelmingly dominated stories with negative connotations towards cyclists they also appeared in positively framed stories that were sympathetic to cyclists injured or killed in the crashes and included recommendations for safety strategies designed to prevent future crashes involving cyclists.

Inter-rater agreement, as measured by Cohen's Kappa, was 0.75 for coding of main frame (negative/positive), 0.82 for the main theme and 0.95% for the focus (cycling/cyclist).

Discussion

The findings show a significant increase in the number of articles about commuter and recreational cycling in the major newspapers in Australia reflecting the prominence the issue has gained over the years. This was also accompanied by a significant increase in the proportion of positive stories about cycling and cyclists. This proportion has increased from less than half (46.2%) in 2010 to over two thirds (67.4%) in 2012 before dropping to 53.9% in 2013. The latest year was a particularly bad year for cycling in Australia with an epidemiological study showing that while cyclist deaths decreased steadily from 58 deaths in 1991 to 33 in 2012, a marked increase to 50 deaths was recorded in 2013 (Boufous and Olivier, 2016). This might explain the rise in the proportion of negative stories during that particular year as crash reporting dominates articles adopting a negative angle.

An interesting finding is the very high proportion of negative stories (66.3%) where the focus is on cyclists, compared to only 12.3% of articles focusing on cycling. This reflects the prevailing negative views about cyclists in some sections of popular media as a group that is very different to the rest of the population in a society where the car culture is dominant. The finding is also important for policy makers and cycling advocates to focus on the activity rather than the people in their effort to promote cycling and cycling safety in the community. For instance, it is more effective to advocate for the provision of cycling facilities rather than facilities for cyclists (Rissel et al. 2010).

The results also indicate that the proportion of positive stories was higher in left leaning newspapers (67.6%) compared to those on the right (53.6%). This finding is supported by those of a British study indicating that opinions about cycling were significantly linked to voting intention in the population with an overall gradient of decreasing positivity when moving from the political left to right (Tapp et al. 2016).

The most common theme of all articles reviewed were cyclist crashes (38%) which also made up 77% of all negative stories. Among the crashes reported in all reviewed newspapers, 44% resulted in cyclist fatalities while during the same period only 1% of actual cyclist hospitalisations resulted in death (Boufous et al. 2016). The higher proportion of cyclist crashes reported, including fatalities, reflects the tendency of the media to focus on the "unusual" and "newsworthy" rather than on factual common trends. This type of reporting is likely to overestimate the risk of cycling crashes and deaths and negatively influence public perception towards cycling.

A small proportion of the 198 articles that reported cyclist crashes (14%) adopted a positive angle because they were sympathetic to cyclists involved and included recommendations about strategies to improve cyclist safety. There has been calls to increase similar reporting and improve the coverage of cyclist crashes through collaboration between road safety advocates and media professionals (Yankson et al. 2010; Boufous et al. 2016).

Despite the high proportion of articles reporting crashes that highlight the risk of cycling in the community, there are increasingly positive newspaper stories promoting the safety of cycling through education, legislation and better infrastructure as well as those highlighting the benefits of cycling to the individual and society at large.

Some of the limitations of the study stem from the focus on metropolitan newspapers, as the coverage of cycling might differ in newspapers published in regional areas; and the exclusion of cycling tourism and sports cycling that are more likely to be covered in a positive light by newspapers. However, the focus was on the most common type of cycling and on metropolitan newspapers widely circulated in a largely urban Australian population.

Conclusions

The coverage of cycling in major Australian newspapers as a generally positive activity seems to be on the rise. However, a significant number of negative stories, particularly those reporting cyclist crashes, is also being published. More efforts are needed to improve the reporting of cyclist crashes, and cycling related issues in general, as part of an overall strategy to improve attitudes towards cycling in the community as a safe and legitimate mode of transport.

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Road Safety Policy & Practice

Sharing road safety education and enforcement knowledge and practice throughout developing nations - challenges create opportunities!

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Key Findings

- The benefits of combining education and enforcement are confirmed in practical applications where behavioural change has been achieved in low and middle-income countries (LMICs);
- A professional development model for traffic police is considered a successful methodology for nation-wide capacity building in LMICs using a practical train the trainer approach where trainers are assessed for their competence and coached through their initial knowledge transfer;
- Quick fix short training sessions do not achieve capacity building outcomes;
- Expenditure on road safety is an investment not a cost in LMICs;
- Police enforcement as demonstrated in a seat-belt wearing intervention is cost effective.

Abstract

This paper presents a practitioner's perspective of implementing road safety strategies in low and middle-income countries. It identifies a gap in traffic law enforcement capability and describes professional development train the trainer programs to build capacity. The costs and benefits of road safety reform are raised in conjunction with the need to provide adequate funding to support the behavioural change of drivers. Understanding the challenges of piecemeal reform, policing capability, corruption and under-reporting of crashes provides opportunities to use this knowledge to impact behavioural change and road trauma reduction. The findings confirm education and enforcement as a successful methodology for reform as well as the need to create the perception of certainty of being caught and punished when breaking the law.

Keywords

Enforcement, Education, Training, Challenges, Perception, Driver Behaviours

Introduction

High-risk driver behaviours, low socio-economic environment and limited police enforcement capability are key issues for road safety in low and middle-income countries (LMICs). The aim is to build capacity of all road safety agencies while the challenge is to ensure interventions are sustainable.

The driving force for reform is the annual estimate of 1.3 million road fatalities globally and 20-50 million serious injuries. 90% of this trauma occurs in LMICs where a *neglected epidemic* exists with poor enforcement, poor administration, inadequate resources and corruption (Nantulya 2002). Laws are not enforced and a piecemeal approach to road safety is the lack of strategic planning, leadership and government commitment (WHO 2004).

High density traffic, poor road conditions and poor road user behaviours are compounded by the diversity of vehicles and pedestrians all vying for road position. The perceived lack of road safety discipline is balanced with a degree of *order in chaos* especially at low speeds, less than 30kph. However, the discipline to achieve road safety outcomes needs a foundation shift in road user behaviours as risks are high at intersections and high-speed, high-risk roads.

Motivations for driver compliance are *general* and *specific* deterrence via enforcement which must be highly visible, repeated often, fair and consistent and well publicised (Homel 1988, 1990). Creating the perception of being caught and punished is fundamental with the certainty of detection being more important than penalty (Zaal 1994, Radin 1998, Isah 2012). Perception is reinforced by an *anywhere, anytime, anybody* enforcement strategy (Shuey 2013). Effective enforcement is further founded on a critical mass of compliant road users impacting the driving culture, otherwise, police consider enforcement futile.

Road safety research often calls for *more* enforcement without providing advice. The identified gap is the lack of specific guidance for road policing on *how* to improve enforcement capability in a sustained manner. This deficiency is as fundamental as where to start the process, how to improve enforcement practices and how to progress to a higher level of competence to significantly impact road trauma. This paper describes programs where that gap has been addressed to assist police enforcement capacity and capability. Key challenges to road safety reform are identified to ensure consideration in future interventions.

Methodology

This paper draws upon a practitioner's road safety experience in LMICs over 15 years and research to provide good practice opportunities for road safety reform for police enforcement and education. Programs which have been implemented and evaluated are described to enable enhancement and replication of the designed activities. The direct experiences of working with road safety practitioners, living within the communities, and, specifically as a participant observer and assessor at police operations were analysed to provide extensive insights into the challenges, opportunities and cautions for road safety professionals in LMICs.

An assessment of law enforcement capability consolidated 10 critical deficiencies, namely: data analysis, partnerships, community engagement, strategic planning, use of the media, education campaigns, technology, road policing capability, operational effectiveness and performance measures (Shuey 2006). These components were used as a foundation for road safety reviews, strategic plans, training programs and capacity building for LMICs as well as incorporating the principles of *Vision Zero,* the *Safe Systems Approach and the Decade of Action.*

Demonstration Programs

Programs undertaken in Malaysia, China and the Philippines are described below to demonstrate the benefits of a professional curriculum, a professional delivery framework, a structured research and evaluation program and optimum methods of reaching police officers in an entire country. The benefits of community support, data collection and political commitment are included.

Professional Development of Traffic Police, Malaysia 2007-2008

This holistic program commenced with Ministerial meetings to endorse a national commitment to the professional development of traffic police officers. A ½ day executive workshop with senior police and transport officers then committed to support the capacity building program. The two-day leadership program for senior officers addressed; Benchmarking and Leadership; Effective Use of Intelligence and Analysis; Planning Strategies and Tactics and Focus on the Future - Developing the Plan. For this component, 500 officer days were committed to the program. A *train the trainer* model followed for the delivery of a 5 day course nation-wide (Figure 1).

A key practical approach was to involve the trainers in the Leadership program, developing two-way trust and strengthening the relationship with senior officers. The interactive workshops then sourced *real* data to identify critical risks, develop strategies and conduct on-road practical enforcement. Finally, the *trainers* were coached through their initial knowledge transfer ensuring competent and credible program delivery.

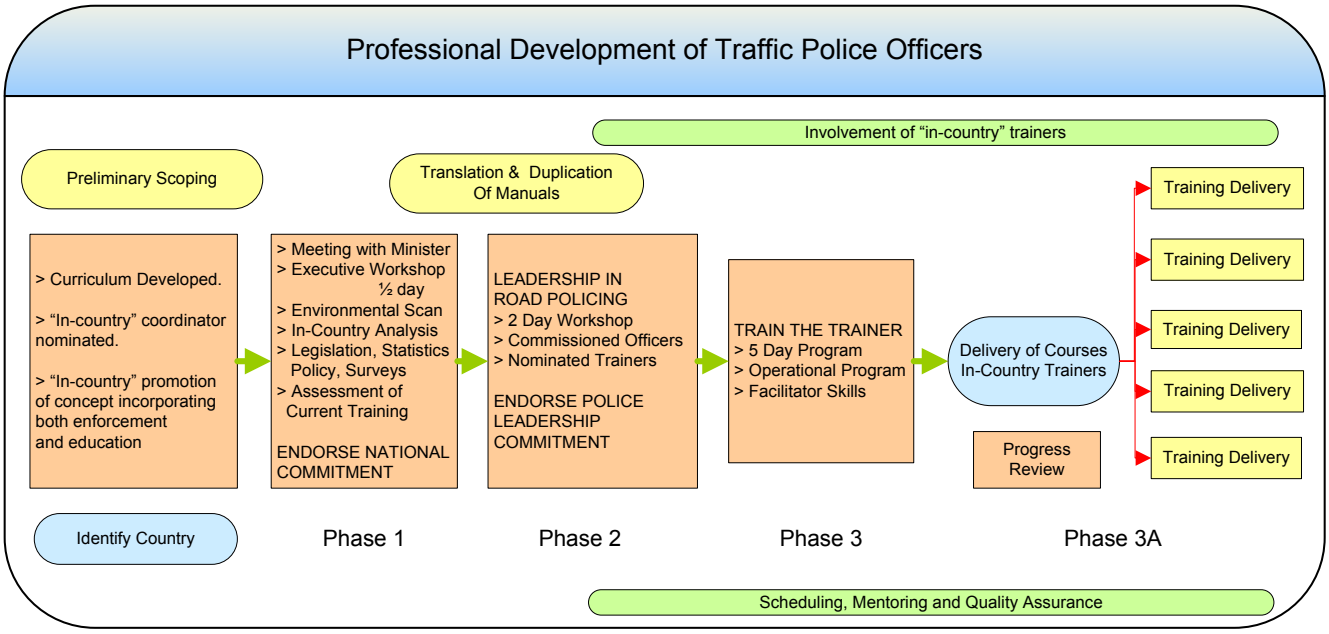

Figure 1. Professional development program for traffic police - Malaysia

Program success was determined through formative evaluation commencing at development through the life of the program and was undertaken by the Malaysian Institute of Road Safety Research (MIROS). Process implementation and progress impact culminated in summative evaluation in the later stages. Phase 2 and 3 workshops, modules and content were scored by participant agreement/disagreement scales with positive results of 70% -90% in all criteria. The highest agreement scores were in 'mindset change' being 98% and trainers' expertise and knowledge at 94.1%. Lower scores in any category indicated the need to review those components. Evaluation and on-site longitudinal surveys by MIROS at the target checkpoint locations, pre-course, at intervention and post-intervention identified trauma reduction at those locations over a period of twelve months (MIROS 2007, 2008).

China Seat Belt Intervention, Guangzhou 2005-2006

The initiative was the first comprehensively implemented road safety strategy in China comprising health promotion, social marketing, enhanced police enforcement and input from scientists and educators. Although a law since 1993, seat-belt wearing rate was low. The objectives over 12 months, were to increase seat-belt wearing by 20%, build capacity in road traffic injury prevention, estimate cost-effectiveness of the intervention and reduce the number and severity of injuries.

A roadside audit identified taxi-drivers refusing to buckle up, faking use by deception to fool police or only fastening their seat-belt on approach to a check-point. The key deception was a bolt, clip or other obstruction preventing the seat-belt retraction operating, with the sash draped across the shoulder and without the buckle engaged (Figure 2). This practice was observed in 90% of taxis and *Operation Taxi-Driver* was instigated to assist 20 major companies educate over 20,000 drivers.

A police *train the trainer* program involved two cohorts of 25 senior police who were trained in seat-belt enforcement, traffic safety and checkpoint operations with responsibility to train all 1,125 traffic police in Guangzhou, a mega city of 8.5 million people. Although enforcement activities were 40% less than targeted, 44,430 seat-belt infringements were issued during the intervention.

The analysis of pre and post research showed a significant increase in general population seat-belt use from 50%-62% compared to a decrease of 6% in the control city. Seat-belt use by taxi drivers increased by 21%. The estimated total number of Disability Adjusted Life Years saved (DALYs) was 530 (USD $418 per DALY - costs vs cost savings). Behavioural change was achieved through combining education and enforcement in a traditional road safety approach.

An economic analysis of police resources in training, operations and promotions compared with the outcomes achieved determined that this enforcement program was cost-effective. Further, the cooperation and collaboration of the partners was an essential component of the intervention reinforcing the value of combining education and enforcement (George Institute 2007). The World Health Organisation has endorsed this innovative intervention supported by research, as valuable in achieving continuous improvement (WHO 2009).

Training Programs - China 2010-2016

Road policing training programs were undertaken in 12 major cities throughout China targeting primarily drink-driving and speed management interventions which were identified as the two high-risk driver behaviours. The programs included checkpoint operations, safe vehicle interceptions, operational planning and performance monitoring. Field observations and capacity reviews ensured a structured evaluation for continuous improvement (Figure 3).

A nation-wide road safety enforcement training program was provided through the central academy of Wuxi Traffic Management Research Institute in June 2012. Four senior traffic police from all 23 provinces, 4 municipalities and autonomous regions in China, in two cohorts undertook a professional development program in *Strategic Leadership and Traffic Law Enforcement.*

With five modules, the program provided an holistic approach to road policing enabling the participants to understand the fundamentals of road safety, behavioral change, evaluating programs and importantly, setting their own goals to develop strategic plans. This program was the **how** of effective enforcement emphasising *efficiency, effectiveness and safety* in all enforcement operations. The

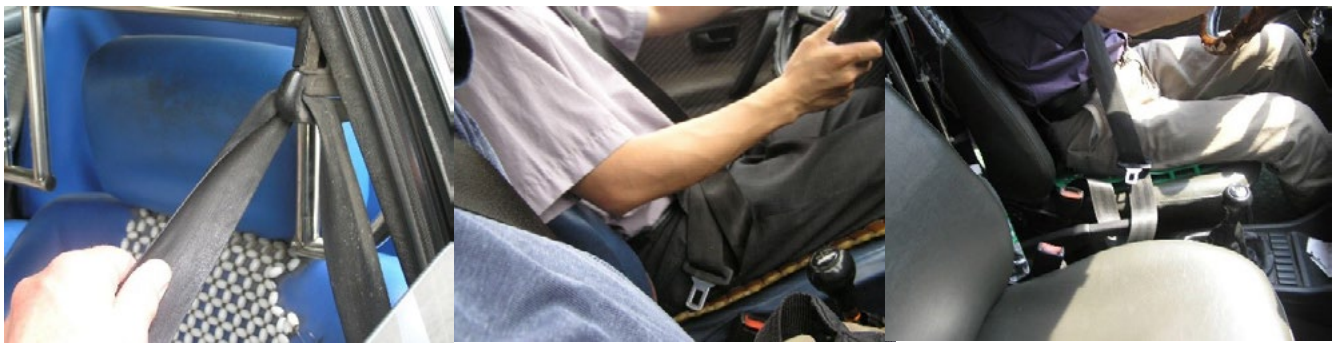

Figure 2. Unsafe and deceptive use of seat belts by taxi drivers, Guangzhou, China

Figure 3. Police training checkpoint operations, China

strategic and practical operational modules were applicable and adaptable to the diversity of local social, economic, political and cultural needs throughout China.

Development of Master Trainers - Asia Pacific 2014 -2015

An Asia Pacific Road Safety Program, in Manila included an enforcement *train the trainer* program for 33 participants from 10 ASEAN countries who were coached as *master trainers.* The structured workshops enabled rich discussion on critical issues of traffic law enforcement with a representative mix of professional backgrounds. Each participant was provided with a road safety manual, power-points, facilitation skills and reference materials to deliver a 5-day training program.

The program provided focus for each country to determine its capacity building needs and interventions, particularly in road policing and traffic law enforcement. Workshop discussions highlighted the need to improve community relationships, partnerships; driver attitudes; develop leadership strategies; strengthen task force and operational policing; database enhancement; and, to improve management. The program is a model for future delivery of *train the trainer* programs.

Youth empowerment programs - Cambodia

A cooperative approach of education and enforcement is demonstrated in Cambodia in youth empowerment programs. The Cambodian Red Cross Youth are a team of 60 university students who have undertaken a two-day road safety program and operate across six provinces. They work with police on night-time checkpoints providing education to offenders on *respect for the law,* the *risks* of not wearing a helmet and the risks in drinking and driving/riding.

The Young Ambassadors for Road Safety network empowers students to design sustainable road safety awareness initiatives for their peers. They educate students on the importance of helmet-wearing and have been instrumental in a national head-safe helmet-on project.

CamSafe is another not for profit organisation optimizing youth participation in community road safety. Participants undertake a *Go Gens* spirit training program, develop and promote road safety videos, assist with disability services and educate school children on road safety. Members coordinate with Red Cross, non-government organisations and private sectors during major events such as the Khmer New Year, Pchum Ben Day and Road Safety Week (Figure 4).

On analysis, these youth programs provide community and peer education aligned with policing activities with the common target to reduce road trauma. Youth working on police checkpoints enhance the visible and active presence of the interventions and demonstrate a community policing approach to the problem. Helmet-wearing awareness initiatives address the safety benefits in parallel with enforcement activities. Similarly, drink driving awareness videos produced by the youth volunteers and released pre-festival provide strong messages to complement enforcement.

While success cannot be attributed to individual activities, surveys indicate driver respondents' attitudes to drinking and driving dropped from 55% to 22% over six months and the driver impaired related crash fatalities decreased by 34% in 2016. Helmet-wearing surveys identified an improvement in attitude to passenger wearing from 86% to 98% in target communes and increased compliance on actual wearing rate of passengers from 10% to 14% (RCVIS 2014).

Study tours for police - practical application of knowledge transfer

Study tours for LMIC police officers have directly applied knowledge transfer in practice-based learning and observations. Officers from Cambodia and China who have observed the practical application of checkpoint operations and vehicle interceptions with Queensland and Victoria Police have implemented good practice solutions in their country.

The Cambodian checkpoint model has been replicated throughout the country while the model in Suzhou, China with 50 police and 10 police cars, test drivers for alcohol impairment across 3 lanes of traffic. It operates weekly supported by 8 smaller satellite operations during the week promoting highly visible and active enforcement and efficiency in testing throughput. The Chinese model is the most efficient observed. Both models achieve road safety credibility in visible police presence and demonstrate the practical outcomes of police commanders understanding a strategic approach.

Figure 4. Camsafe youth road safety programs

Developing road safety data systems - Cambodia 2004 onwards

A good practice data collection program is the Cambodian Road Crash and Victim Information System (RCVIS), developed in 2004 using police and health data for evidence-based reform (RCVIS 2004 onwards). Progressive training and improvement using this system provides the framework for the National Road Safety Action Plan.

An evaluation found 100% of police districts and 65% of hospitals reporting to the system in 2010 and concluded that the RCVIS provides a strong foundation for road crash injury and fatality surveillance (Parker 2014). An analysis supports observations of data retrieval and use being a primary driver and valuable resource for helmet-wearing, drink driving and speed management interventions.

Government commitment to enforcement - Vietnam 2007

Helmet-wearing laws commenced in Asia from 2000 however, with little impact and minimal enforcement until education and enforcement workshops commenced in 2006. The Vietnamese government decreed an enforcement date of 15th December 2007. This *national enforcement threat* raised the helmet-wearing rate virtually overnight *on that date* from 10%- 30% to almost 100%. An analysis confirmed the perception of apprehension was a major motivator for compliance rather than a concern for safety.

Unfortunately, the threat of enforcement was not sustained, and helmet-wearing rates dropped especially at night-time. Police maintained they had done the enforcement package therefore the community should know and comply - neglecting the principles of *sustained enforcement* and *repeated often*. The outcome is also a practical reminder of the need to reinforce the *perception* of being apprehended.

Key Challenges to Road Safety Reform in LMICs

Identification of challenges to road safety reform in LMICs provides opportunities to further improve enforcement training and behavioural change programs. Key challenges are discussed in turn below.

Piecemeal reform

The enormity and complexity of road trauma in LMICs provide challenges for all road safety professionals with foundation issues such as where to start and how to achieve value for money and services in sustainable programs. These challenges are exacerbated by the socio-economic, cultural and political environments. It should also be appreciated that countries such as Australia, United Kingdom and Sweden have been progressively developing road safety interventions over 50 years.

Effective police enforcement is achieved through professional development in competency-based training and coaching to ensure sustainability and capacity building. Barriers to achieving these outcomes are: (a) lack of funding for extended programs; (b) lack of political commitment to enforcement programs; (c) police and donors seeking *quick fix* solutions and training packages e.g. 2-3 days maximum; and (d) donors and police unwilling to support structured *train the trainer* programs e.g. Donors and police agencies will support the training of 50 officers and call it a *train the trainer* program notwithstanding most officers do not have the competence to re-train others.

Further, both donors and police fail to appreciate the time commitments of police competency-based training in high income countries. *Quick fix* short training sessions are piecemeal solutions and do not build capacity or ensure continuos improvement.

Failing to consider road safety as an investment

Governments fail to appreciate and commit to counteracting the *real* costs of road trauma. These costs vary from 1.5% to 3.5% of the Gross Domestic Product (GDP) e.g. Cambodia 2.3% GDP = USD $337 million, Malaysia 1.7% GDP (OECD 2017). Overall, government expenditure on road safety in LMICs is insignificant when compared to their GDP costs of road trauma.

An educative example is that of the Japanese Government in 1970 whereby an investment of 0.06% of its GDP resulted in a 50% fatality reduction over 10 years (Japanese White Papers 1971 onwards). The challenge is to use the Japanese example, understand the country's expenditure and costs and

present the argument that *expenditure on road safety is an investment not a cost*.

Cost-benefit analysis as a pre-requisite of road safety reform

Cost-benefit studies are available internationally for road safety interventions. Behavioural reforms such as drink driving enforcement and speed management can be assessed against engineering solutions such as new roads and wire-rope barriers. In these studies, enforcement and education programs will achieve short-term results which must be sustained vs building a divided highway leading to longer term and usually permanent gains. *Notwithstanding these differences, all road safety programs require a cost/benefit ratio assessment.*

Traffic police capability to commit to visible enforcement

LMIC road policing bodies are transitioning from para-military organisations to traffic law enforcement and often focused on traffic control, registration and licensing, VIP escorts, motorcades, vehicle inspections and administration. Enforcement basics are often lacking such as accurate observations, note taking, safety procedures, planning, strategies and presenting evidence. Resource availability for enforcement may only be 10% compared to higher income countries with historically dedicated traffic services able to commit 90% plus of available resources (Shuey 2013).

Enforcement activities are rarely self-initiated and require an *order* for operations and checkpoints and then only activated in locations often requiring government or provincial authorization. Politically, enforcement is viewed as confrontational to the public and softer approaches are preferred. The results are that checkpoint operations for two hours per week are perceived as satisfactory.

Instilling a culture of *active and visible police presence* and *repeated often* is a major challenge. Limited enforcement is confounded by natural disasters, floods, demonstrations and elections in LMICs. In these situations, enforcement activity reduces to zero and road users take advantage disrespecting their legal and safety obligations. Understanding these issues are pre-cursors to training and development programs.

Corruption

Corruption is an abuse of power breeding mistrust in the community and police, lowering community standards, resulting in loss of international reputation and damaging the reputation of all honest traffic officers and supervisors. Importantly, because there is no official sanction, poor driving behaviours continue and there are no incentives for drivers to modify their behaviour.

The limited controls and secrecy of corrupt activity inhibit accurate recording, so perceptions form the basis for country-wide rankings globally of their public sector in the 'corruption perceptions index' reported annually by Transparency International. Bribery of/by traffic police may be a component of a broader culture where corruption by officials exists in transport, driver licensing, construction, health and politics. Nevertheless, police corruption undermines public trust, cooperation, victimizes vulnerable groups and impedes strategic countermeasures.

On-the-spot roadside police fines are endorsed in legislation as an incentive base in some Asian countries where fines are collected, receipted and apportioned according to law. This rationale exists because vehicle ownership, recording of addresses and licence records are poor, negating any option to pay later as well as the fine being due in the province where the offence was committed. However, there is no excuse for any activity outside this legislated framework.

Abuse of power by officials is a greater impediment to road safety. VIP expectations to be exempt from law and demanding immunity at checkpoints are prevalent occurrences. In China, an offender may initiate g*uanxi,* a moral obligation to/from a higher official to instruct the commander to release the offender. This *abuse of power* has been minimised by body-worn cameras, ethics training and the commanders' prohibiting police mobile phones on checkpoints rendering personal contact impossible and therefore due process occurs *at least until the following day!* Anti-corruption strategies include; training; accountability regimes; officials collecting fines at checkpoints; receipts issued for fines; and, large banners at checkpoints listing offences and fines.

Government officials and employees not complying with the helmet-wearing laws, government and military officials not wearing seat-belts and Ministerial motorcycle escorts wearing ballistic vests, however, no helmets are also damaging to road safety reform. For example, the Thai Prime Minister was filmed riding with 200 motorcycle supporters during a public election campaign without a helmet - resulting in a justifiable '*why should I'* excuse from civilian motorcycle riders.

Under-reporting of road crash data

Under-reporting of crash data is a serious concern in LMICs (Odero 1997), with estimates varying from 25% to 60% of crashes not reported (Aeron-Thomas 2003). Explanations range from definitional issues, deliberate misrepresentation, crash reporting, investigation difficulties, and lack of competence in data collection.

China excludes some highways as well as fatalities involving government employees and rail/road incidents. In Vietnam, notwithstanding recommendations from the World Bank, *National Road Accident Database* upgrade 2012, there was no national commitment to reconcile the huge discrepancy between police data and injury surveillance data from 100 hospitals. In Yemen and Ethiopia, the lack of crash investigation capability and rudimentary data collection minimises data analysis. The common theme identified is that the lack of, and underuse of, available data does not enable a true road trauma assessment and therefore reduces the impact of positive interventions.

Figure 5. Helmet-wearing intervention Cambodia - purchase of 3 quality helmets

In Indonesia, Police Command undertook a concerted effort to improve data collection and quality from 2009-2010 resulting in a substantial increase of 10,000 fatalities in one year (20,000 to 31,234). During a *Driver Licensing Review* in Dubai, alcohol was not considered relevant in fatalities in 2005. However, on this being drawn to police attention, in 2006, alcohol was classified as the primary crash cause in 76 or 24.4% of the 312 fatalities. *In both examples, data quality now provides a more realistic approach to strategies and interventions*.

Unintended consequences of enforcement

Unintended consequences of enforcement observed in Asia include motorcyclists driving on the footpath, undertaking "u" turns or riding through barriers to evade checkpoints; riders putting on a helmet or buckling a seat-belt only on approach to a checkpoint; riders renting helmets before a checkpoint and helmet return past the checkpoint on national highways in Vietnam. In addition, donor funded helmets in Thailand were sold in markets and special helmets provided by the King were sold as a collector's item. Checkpoint evasion strategies were developed to strengthen enforcement, however, auditing the trail of donated helmets is a major task considering the poverty of nations.

An unintended consequence of the helmet-wearing implementation in Vietnam, was the failure to proclaim and enforce safety standards in parallel, resulting in *fake* and makeshift helmets, rudimentary head coverings, construction helmets and poor-quality imports from China with no protective polystyrene inserts. Many riders opted for cheap imitations at USD $2 rather than a quality helmet at USD $12 (Compliance vs Safety). To this day, fake helmets and fake standards stamped on poor quality helmets are a major safety hazard and have compromised the positive initial impact of an overnight cultural change. Interestingly, other Asian countries, including China, have not suffered a prevalence of fake helmets.

Conclusion

This paper has provided an overview of police professional development and train the trainer enforcement programs designed to build nation-wide capacity for road safety reform in LMICs. The benefits of combining education and enforcement are confirmed. Understanding the challenges of piecemeal reform, policing capability, corruption and under-reporting of crashes provides opportunities to use this knowledge in future programs for road trauma reduction. The Japanese financial model provides an example for governments to treat road safety as an investment rather than a cost and the China seat-belt intervention demonstrates police enforcement as cost-effective.

Road safety capacity building in LMICs bring about achievements and satisfaction in sharing knowledge internationally with road safety colleagues, volunteers and professionals supported by donor organisations. The real rewards lie in observing the children now wearing helmets. Figure 5 depicts a grandmother, mother and daughter riding into a village during a *head-safe, helmet-on* program in Cambodia and leaving after purchasing quality helmets.

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