Proceedings of the 2024 Australasian Road Safety Conference

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Proceedings Editors

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Preface

Welcome to the proceedings for the 2024 Australasian Road Safety Conference (ARSC2024) held in Hobart, Tasmania. This is the ninth conference in the series, which began with the merging of the Road Safety Research and Education Conference and the Australasian College of Road Safety Conference. This conference provides a unique platform for road safety professionals, including researchers, practitioners, policymakers, police, educators, community and advocacy groups to connect, present their work, and engage in discussions on critical issues. These proceedings reflect the diverse road safety work presented, highlighting from research and practice aligned with the conference theme: *Target 2030: What's the pathway forward?* With almost 600 delegates from 20 countries in attendance, the conference demonstrates the broad and collaborative effort toward reducing trauma caused by crashes on our roads.

This year's plenary speakers featured a dynamic range of experts, including: Dr Amantha Imber (*Driving Change*), Dr Lars Ekman (*The implementation of Vision Zero in Sweden*), Dr Helen Wells (*Technology and road policing*) and Carla Hoorweg (*The role of safe vehicles in meeting Vision Zero*), as well as an overview from road and transport stakeholders from across Australia and New Zealand (*Austroads plenary: Picking up the pace*). ARSC2024 also included three interactive workshops: *The planning for zero framework, Aligning perspectives for safer shared spaces*, and *Motorcycle safety*.

A total of 291 submissions were received for ARSC2024. Each submission underwent an initial screening, followed by a double-anonymised peer-review by two subject matter experts. Reviewers were matched according to their expertise, ensuring practitioners reviewed practitioner submissions and researchers reviewed researcher submissions. Reviewers were instructed to assess each submission on the following criteria: contribution to road safety knowledge, alignment with the conference theme, and clarity and relevance to policy or practice. After the review process, 81 percent of submissions were accepted for presentation at ARSC2024.

More than 200 presenters shared valuable insights into road safety challenges, including education, policing, implementation of programs and projects, policy and management strategies. ARSC2024 covered addressed a comprehensive extensive range of critical topics including such as crash data analysis, pedestrians, motorcyclist safety, rural roads, road design and road environment, personal mobility devices, safe trips to school, and enforcement practices. Authors of accepted Extended Abstracts represented both international and local institutions organisations from all aspects of their respective communities including universities, research centres, private companies, government agencies and community groups. These Extended Abstracts provide highlight significant road safety initiatives across an indication of the important work being done in Australia, New Zealand and internationally globally, aligned with as part of the United Nations, One UN Vision for Road Safety to reduce the number of road crashes by on the road by 50 percent by 2030. Authors were also able to submit a Full Paper, which is HERDC¹ compliant, to be considered for publication in the Journal of Road Safety².

¹ https://www.education.gov.au/research-block-grants/higher-education-research-data-collection-herdc

² https://journalofroadsafety.org/

For the fourth time in the conference series, ARSC partnered with Monash University's Monash Art, Design and Architecture (MADA) to connect poster authors with graphic design students. This collaboration provides authors with the opportunity to enhance the visual presentation of their poster. Four authors opted for this service, and their enhanced posters are featured in these proceedings. Poster authors were also provided a three minute oral presentation slot during a concurrent podium session, followed by a 30 minute poster session for attendee questions. In an extension of the collaboration with MADA, A/Prof Marilyn Johnson worked with graphic designer Sienna Fernando to develop a series road safety icons representing 28 common road safety topics highlighted at ARSC. These icons were used at ARSC2024 to facilitate networking among delegates. The icons featured on nametag stickers and at designated meeting points throughout the conference venue, helping delegates easily connect with others interested in similar road safety issues.

Seven presenters attended the ARSC2024 with support from the LMIC scholarship program and were from the following countries: Ethiopia, Malaysia, Nepal, Philippines, Viet Nam and two delegates from India. The LMIC program was funded by the Australian Government Department of Infrastructure, Transport, Regional Development, Communications and the Arts

ARSC2024 was made possible through the contributions of many dedicated and passionate individuals. We thank the peer reviewers who meticulously reviewed almost 300 submissions, ensuring the high calibre of the conference proceedings. We are profoundly grateful for their invaluable time and effort. Our sincere appreciation also goes to the keynote speakers, interactive workshop organisers and presenters, as well as the ARSC2024 Organising Committee, Scientific Committee, International Committee, Interactive Workshop liaison, the judging panels, the conference sponsors, and the session Chairs and Co-chairs. Your collective efforts were essential to the success of ARSC2024.

The invaluable input and enthusiasm from every individual and group have played a crucial role in ensuring ARSC2024 addresses the diverse needs of its participants and contributes to the overall success of the event. We are confident that the work described in these proceedings, along with the full papers to be published in the Journal of Road Safety, will advance efforts to reduce in fatalities and serious injuries on roads across Australia, New Zealand, and internationally. These proceedings include a comprehensive list of the conference committees and members; conference peer reviewers; prize judges; a copy of the conference program; and a list of all the Extended Abstracts.

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ACRS	Australasian College of Road Safety
CARRS-Q, QUT	Centre for Accident Research and Road Safety – Queensland, Queensland
	University of Technology
CASR	Centre for Automotive Safety Research
MUARC	Monash University Accident Research Centre
NRSPP	National Road Safety Partnership Program
NTRO	National Transport Research Organisation
TAC	Transport Accident Commission
TARS	Transport and Road Safety
TMR	Transport and Main Roads
UNSW	University of New South Wales
WALGA	WA Local Government Association

Organising Committee

- Jenny Branch-Allen, KidSafe Tasmania (Chair)
- Yasmin Maskiell, Tasmanian Government, Department of State Growth (Deputy Chair)
- A/Prof Sjaan Koppel, Monash University Accident Research Centre (MUARC) (Scientific Committee Chair)
- Ange Green, Tasmanian Government, Department of State Growth
- Gary MacDonald, ACRS Tasmanian Chapter
- Michael Nieuwesteeg, Austroads
- Emily Studley, Tasmanian Government, Department of State Growth
- Susan Teerds, KidSafe Queensland
- Gary Williams, Tasmania Police
- Teresa Williams, Main Roads WA

ACRS

- Ingrid Johnston
- Cecily Michaels (until July 2024)

Scientific Committee (SC)

- A/Prof Sjaan Koppel, Monash University Accident Research Centre (MUARC) (Chair)
- David McTiernan, NTRO (Deputy Chair)
- A/Prof Marilyn Johnson, UNSW and ACRS (Editor-in-Chief)
- A/Prof Lyndel Bates, Griffith University (ARSC2023 SC Chair)
- Alison Hetherington, Bicycle Network (ARSC2024 Interactive Workshop Liaison)
- Craig Hoey, Tasmanian Government, Department of State Growth
- Dr Jamie Mackenzie, University of Adelaide, Centre for Automotive Safety Research (CASR)
- Prof Teresa Senserrick, The University of Western Australia, Centre for Road Safety (ARSC2025 SC Chair)
- Dr Shane Turner, Abley, New Zealand
- Aimee Wescombe, GHD

ACRS

- Ingrid Johnston
- Cecily Michaels (until July 2024)

Low- and Middle-Income Countries (LMIC)

- Dr Judy Fleiter, Global Road Safety Partnership
- Dr Lori Mooren, Safety and Communications Pty Ltd
- Dr Tana Tan, Safe Systems Solutions Pty Ltd
- Dr Ray Shuey, International Safety Foundation



Conference Committee members, Closing plenary

Left to right: Yasmin Maskiell, Jamie Mackenzie, Ange Green, Craig Hoey, Jenny Branch-Allen, Sjaan Koppel, Lyndel Bates, Shane Turner, Teresa Senserrick, David McTiernan, Marilyn Johnson, Michael Nieuwesteeg, Emily Studley, Teresa Williams

Awards Judging Panel

- Jenny Branch-Allen, KidSafe Tasmania
- Jerome Carslake, NRSPP
- Tim Cumming, Victoria Police
- Alison Hetherington, Bicycle Network
- Craig Hoey, Tasmanian Government, Department of State Growth
- A/Prof Marilyn Johnson, UNSW and ACRS
- A/Prof Sjaan Koppel, Monash University Accident Research Centre (MUARC)
- Yasmin Maskiell, Tasmanian Government, Department of State Growth
- Dr Jamie Mackenzie, University of Adelaide, Centre for Automotive Safety Research (CASR)
- Michelle McLaughlin, Little Blue Dinosaur
- David McTiernan, NTRO
- Prof Teresa Senserrick, The University of Western Australia, Centre for Road Safety
- Emily Studley, Tasmanian Government, Department of State Growth
- Scott Tilyard, Tasmanian Government, Road Safety Advisory Council
- Dr Shane Turner, Abley, New Zealand
- Aimee Wescombe, GHD
- Teresa Williams, Main Roads WA

Conference prize winners

Prize		W	vinners	
	First Author	Organisation	Submission title	Sponsored by
Best Conference Theme	David Moyses	Main Roads Western	Reducing WA's rural unzoned speed limit	
Submission		Australia	to achieve 2030 target	
Best Submission by a New	Amalia	Center for Policy	A pathway for metro Manila-enhanced road	
Practitioner	Rolloque	Studies and	safety by 2030	
		Advocacy on		
		Sustainable		
		Development Inc.		
Best Submission by a New	Lyndall Cook	Neuroscience	Crash protection of modified child	
Researcher	-	Research Australia	restraints for children with disabilities	
Best Submission by a Practitioner	David Moyses	Main Roads Western	Reducing WA's rural unzoned speed limit	Work Zone Training
		Australia	to achieve 2030 target	
Best Submission by a Researcher	Hassan Tahir	Queensland	AI-based video analytics for estimating	
		University of	pedestrian crash risks in real time	
		Technology		
Best Poster (judged)	Brett Williams	ACRS Local	Local Government Network, Uniting	Road Sense Australia
		Government	Council road safety practitioners	
		Network		
Best Poster (popular vote)	Brett Williams	ACRS Local	Local Government Network, Uniting	
		Government	Council road safety practitioners	
		Network		
Tom McLaughlin Prize for Best	Kylie Wilson	Transport Accident	Victorian schools survey to understand road	Little Blue Dinosaur Foundation
Submission with Implications for		Commission	safety knowledge and practice	
Improving Child Road Safety				
Best Submission with Implications	David Wakelin	Transport for NSW	Evaluation of the NSW combined drink and	Griffith University, Griffith
for Improving Road Safety Policing			drug driving offence	Criminology Institute
Best Submission with Implications	Rachel Mason	NZ Police	Future safeguards for enforcement and	National Road Safety Partnership
for Workplace and Work-related			emergency	Program (NRSPP)
Road Safety				

Peer Reviewers

All the subject matter experts who completed over 600 reviews. We thank them for their generous contribution of their time and expertise.

Subject matter peer-reviewer	·s	
Title and Name	Organisation	Country
Dr Ibraheem Abdul-Azeez	Lagos State University	Nigeria
Dr Oluwayemi Aderibigbe	University of Johannesburg	South Africa
Mr Blair Aitken	Swinburne University of Technology	Australia
Mr Matt Allan	Road Safety Victoria	Australia
Miss Merna Alqas-Elyas	Transport Accident Commission	Australia
Dr Richard Amoh-Gyimah	Main Roads Western Australia	Australia
Mr Eaysir Arafat	Queensland University of Technology (QUT)	Australia
Prof Kerry Armstrong	University of the Sunshine Coast	Australia
Prof Charles Asenime	Lagos State University	Nigeria
Dr Guneet Singh Assi	Health Equity Action Learnings Foundation	India
Ms Kardina Nawassa Setyo Ayuningtyas	University of New South Wales	Australia
Dr Rasheed Azeez	Lagos State University	Nigeria
Ms Joanne Baker	Transport for NSW	Australia
Mr Ben Barnes	Transport for New South Wales	Australia
A/Prof Lyndel Bates	Griffith Criminology Institute	Australia
Mr David Beck	Transurban	Australia
Mr Kenn Beer	Safe System Solutions Pty Ltd	Australia
Dr Joanne Bennett	Australian Catholic University	Australia
Mrs Christy Bisiriyu	Lagos State University	Nigeria
Mr James Boylan	Swinburne University of Technology	Australia
Ms Anna Bray Sharpin	Waka Kotahi NZ Transport Agency	New Zealand
Mr Chris Brennan	Victorian Department of Justice and Community Safety	Australia
Dr Anna Cai	Department of Transport and Planning	Australia
Prof Maxwell Cameron	Monash University Accident Research Centre (MUARC)	Australia
Dr Vanessa Cattermole-	Department of Transport and Main Roads, Queensland	Australia
Terzic	Government	Malazzaia
Dr Elizabeth Eu Mee Chong	Neurossienes Bessensk Australia	
Mis Lyndan Cook	Neuroscience Research Australia	Australia
Mr. Christenhen Devis	Vision Zero Austrolia	Australia
A /Draf A shine Daku ath	Vision Zero Australia	Australia
A/Prol Ashim Debhain	Deakin University	Australia
Mis Robynann Dixon	Northern Beaches Council	Australia
Dr Sam Doecke	University of Adelaide, Centre for Automotive Safety Research	Australia
Ms Kathy Doukouris	Safe System Solutions Pty Ltd	Australia
Mr Paul Durdin	Abley	Australia
Dr Erik Eenkhoorn	Acorns b.v.	The Netherlands
Dr Mohammed Elhenawy	CARRS-Q	Australia

Subject matter peer-reviewer	^S	
Title and Name	Organisation	Country
Mr Martin Elsegood	University of Adelaide, Centre for Automotive Safety Research	Australia
Mr David Elston	RAC WA	Australia
Dr Ian Faulks	Blacktown City Council	Australia
Mr Shaluka Fernando	University of Moratuwa	Sri Lanka
Dr. Judy Fleiter	Western Australian Centre for Road Safety Research	Australia
Mr Stephen Kome	University of Rome. World Bank	Italy
Fondzenyuy		10019
Ms Jeanine Foster	NZTA Waka Kotahi	New Zealand
Dr Olayiwola Giwa	Lagos State University	Nigeria
Prof Raphael Grzebieta	Professional Engineering Consultants	Australia
Ms Dale Harris	Abley Ltd	New Zealand
Mr Adrian Harrison	Department of Transport and Main Queensland	Australia
Mrs Rachel Harrison	Clutha District Council	Australia
Dr Razi Hasan	University of Western Australia	Australia
Prof Narelle Haworth	Queensland University of Technology (QUT), Centre for Accident Research & Road Safety – Queensland (CARRS-Q)	Australia
Dr Wei He	SCHN - CHW	Australia
Ms Alison Hetherington	Bicycle Network	Australia
Mr Craig Hoey		Australia
Miss Victoria Opeyemi	Lagos State University	Nigeria
Hunga		
M Mohammad Nabil Ibrahim	Monash University	Australia
Dr Chianebeng Japhet Kuma	University of Bamenda	Cameroon
Mr Shadi Jaradat	Queensland University of Technology	Australia
A/Prof Marilyn Johnson	UNSW (Sydney) and Australasian College of Road Safety	Australia
Dr Ingrid Johnston	Australasian College of Road Safety	Australia
Mr Chris Jurewicz	SafeMobility	Australia
Ms Chamila Kariyawasam	Main Roads Western Australia	Australia
Dr Sherrie-Anne Kaye	Queensland University of Technology - CARRS-Q	Australia
Dr Mahrokh Khakzar	National Heavy Vehicle Regulator	Australia
A/Prof Sjaan Koppel	Monash University Accident Research Centre (MUARC)	Australia
Mr V S Sanjay Kumar	NATPAC	India
Dr Satoshi Kurita	National center for geriatrics and gerontology	Japan
Dr Aine Kusumawati	Institut Teknologi Bandung	Indonesia
A/Prof Gregoire Larue	MAIC/UniSC Road Safety Research Collaboration	Australia
Ms Helen Lindner	MACA Ltd	Australia
A/Prof David Logan	Monash University Accident Research Centre (MUARC)	Australia
Mr Justin Lu	Real Time Traffic Pty Ltd	Australia
Dr Rebecca Luther	Mackie Research	Australia
Ms Paula Macias	Queensland University of Technology	Australia
Dr Jamie Mackenzie	The University of Adelaide - CASR	Australia
Mr Lewis Martin	Abley	New Zealand
Dr Hayley McDonald	Monash University Accident Research Centre	Australia

Subject matter peer-reviewers

Title and Name	Organisation	Country
Dr Thomas McGuckian	Australian Catholic University	Australia
Mr Duncan McRae	Safe System Solutions Pty Ltd	Australia
Mr David McTiernan	NTRO	Australia
Mrs Mayssaa Mezher	Monash University	Australia
Dr Navid Mohajer	Deakin University	Australia
Dr Lori Mooren		Australia
Mr Rob Morgan	Robert Morgan Traffic Engineering and Road Safety	Australia
Dr Fiona Morrison	Inside Psychology Pty Ltd	Australia
Mr David Moyses	Main Roads Western Australia	Australia
Dr Matin Nabavi Niaki	Austroads	Australia
Prof Sharon Newnam	QUT	Australia
Dr Helen Nguyen	The George Institute for Global Health	Australia
Miss Jodi Page-smith	Transport Accident Commission	Australia
Mr Anvay Parab	Neuroscience Research Australia	Australia
Dr Hadunneththi Pasindu	University of Moratuwa	Sri Lanka
Miss Rukayat Pelumi	Lagos State University	Nigeria
Mrs Gisoo Pishdad	Transport and Main Roads	Australia
Mr Giulio Ponte	Centre for Automotive Safety Research, The	Australia
	University of Adelaide	
Dr Wahi Rabbani	Queensland Department of Transport and Main Roads	Australia
A/Prof Paul Roberts	UWA	Australia
Dr David Rodwell	CARRS-Q, QUT	Australia
Dr Rusdi Rusli	Universiti Teknologi Mara	Malaysia
Mr Saransh Sahu	Queensland University of Technology	Australia
Mr Blessing Sai	Traffic Safety Council of Zimbabwe	Zimbabwe
Mr Harish Kumar Saini	Indian Institute of Technology Jammu	India
Ms Karen Schoots	QUT	Australia
Mrs Michelle Scully	Transport Accident Commission	Australia
Prof Teresa Senserrick	WA Centre For Road Safety Research, UWA	Australia
Mr Kerry Shaz	Transport for NSW	Australia
Mr Vadhiraj Shrinivas	Coventry University	United Kingdom
Dr Chen-Chun Shu	The George Institute For Global Health	Australia
Dr Ray Shuey	Strategic Safety Solutions Pty Ltd	Australia
Mr Sunny Singh	Queensland University of Technology	Australia
Dr Amolika Sinha	NTRO	Australia
Dr Amir Sobhani	Safe Path Consulting Pty Ltd	Australia
Dr Kayla Stefanidis	MAIC/UniSC Road Safety Research Collaboration,	Australia
Dr Muhammad Navid Tahir	University of the Sunshine Coast	Delvictor
Dr Toro Tor	Safe System Solutions Dty I td	Australia
Dr Tana Tan	Sale System Solutions Pty Ltd	Australia
Mis Tamina Tasmin	Queensiand University of Technology	Australia
Mrs Susan Teerds	Kidsate Qid Inc	Australia
Dr James Thompson	Centre For Automotive Safety Research, University Of Adelaide	Australia
A/Prof Amelia Thorpe	UNSW (Sydney)	Australia
Dr Richard Tooth	Sapere	Australia

Subject matter peer-reviewers				
Title and Name	Organisation	Country		
A/Prof Verity Truelove	MAIC/University of the Sunshine Coast Road Safety Research Collaboration	Australia		
Dr Long Truong	La Trobe University	Australia		
Mr Joel Tucker	RACQ	Australia		
Dr Georgia Tuckwell	CQU	Australia		
Dr Blair Turner	Road Safety Advisory Services	Australia		
Dr Shane Turner	Abley Ltd	New Zealand		
Mr David Wakelin	Transport for NSW	Australia		
Mr John Wall	Transport for NSW	Australia		
A/Prof Angela Watson	Queensland University of Technology	Australia		
Prof Barry Watson	Queensland University of Technology (QUT), Centre for Accident Research & Road Safety – Queensland (CARRS-Q)	Australia		
Dr Natalie Watson-Brown	Queensland University of Technology - CARRS-Q	Australia		
Dr Helen Wells	Keele University	United Kingdom		
Dr Thomas Whyte	Neuroscience Research Australia	Australia		
Mr Alastair Wiggins	Sensys Gatso Australia Pty Ltd	Australia		
Mr Brett Williams	City of Onkaparinga	Australia		
Dr Amy Williamson	New Zealand Transport Agency	New Zealand		
Mr Adrian Wilson	Department of Transport and Main Roads	Australia		
Dr Lisa Wundersitz	Centre For Automotive Safety Research, University Of Adelaide	Australia		
Mr Ali Zayerzadeh	Road Safety Pioneers (RSP)	Iran		

Communicating our road safety science

Design collaboration: Australasian College of Road Safety + Monash University

This is the four year of collaboration between the Australasian College of Road Safety and Monash University's Department of Design. The collaboration brings together road safety professionals and communication designers and a class of Communication Design students from Monash Art, Design and Architecture (MADA). This year's collaboration was led by Hannah Evans (Lecturer) and Sienna Fernando (Assistant Art Director) and with oversight by Warren Taylor (Art Director).

The collaboration was created in 2021 by A/Prof Marilyn Johnson (ARSC, UNSW) and A/Prof Robbie Napper (Monash University). The designers created posters to translate key findings from research and practice to engage readers and encouraged them to find out more about the project.

In a new initiative for 2024, A/Prof Marilyn Johnson extended the collaboration to road safety icons. Designed by Sienna Fernando, 28 road safety icons represent the topics that were presented at ARSC2024. Created to assist networking, delegates were able to add a sticker to their nametag to show their road safety topics of interest and expertise.

All the artwork created for ARSC2024 is included in the proceedings following the Extended Abstract.

Design collaboration credit

Designers Hannah Evans, Lecturer Sienna Fernando, Assistant Art Director Warren Taylor, Art Director In collaboration with MADA Communication Design students

Project Directors A/Prof Marilyn Johnson, UNSW and ARSC A/Prof Robbie Napper, Monash University

Design collaboration posters

First author	Title	Lead student designer
Pavica Kupcak	Truck safety and blind spot awareness project	Kevin Zekai Zhou
Robbie Napper	Identifying six bicycle journey types for a path forward	Emilia Undurraga
Brett Williams	Local Government Network: uniting council road safety	Lucy Corcoran
	practitioners*	

*Winner, Best Poster (judged), Best Poster (popular vote)

ARSC2024 Summary of submissions

- 291 Total number of submissions received
- 109 Withdrawn or rejected
- 182 Total number of submissions presented in the ARSC2024 program



Lead author by Sector (n=182)



All authors by Sex (n=182) * No authors identified as non-binary



Author location (n=182)



All Authors by Sector (each submission) (n=182)



Number of organisations (each submission) (n=182)



Author from Low or Middle Income Country (LMIC) (n=182x)

2024 Australasian Road Safety Conference

30 SEP - 3 OCT · HOBART, TASMANIA

2024 Australasian Road Safety Conference 30 September - 3 October, Hobart, Tasmania, Australia

	Pre-Conference: Monday 30 September 2024				
Time	Grand Ballroom 1	Grand Ballroom 2	Grand Ballroom 3	Harbour Room 1	Off-site
12:00-12:30					
12:30-13:00	Farly Career Network		Matching solutions to problems	Emergency vehicle safety	
13:00-13:30	12:00-14:20		(IGN workshop)	12:00-14:20	
13:30-14:00	12.00-14.30		(LGN WORKShop)	12.00-14.30	
14:00-14:30			12.30-14.30		
14:30-14:45		Low and Middle Income (LMIC)			
14:45-15:00		Vision Zero Workshop			
15:00-15:30	Woman in Road Safaty	13:00-17:00			
15:30-16:00	14.45-17.20		Road Policing Network meeting		People, Place and Road Safety
16:00-16:30	14.45-17.50				Walking tour
16:30-17:00			13.00-17.30		15:00-17:30
17:00-17:30					
17:30-18:00					
18:00-18:30					
18:30-19:00			Welcome Reception		
19:00-19:30	Venue: The IXL Atrium, Henry Jones Art Hotel				
19:30-20:00					

Proceedings of the 2024 Australasian Road Safety Conference, Hobart Tasmania

		Day 1: Tuesda	ay 1 October			
Time		Session Chair: Ar	nn Williamson	1		
09:00-09:30		Weloo Welcome to Country, N Taumanian Government, Road Safety /	ime Aerinda Sainty-White Advisory Council Chair, Scott Tilyard			
09-30-10-30		Morning Plenary Dr Amantha Imb Involvement mode pou	Driving Change Ber, Hwenthum able by Sensys Gotso			
10:30-11:00		Morning Tea - Fed	eration Ballroom			
	Federation Plenary Hall	Grand Ballroom 1	Grand Ballisson 2	Grand Ballroom 3		
11:00-12:00	Session 1 Local Government and data	Session 2 Cyclists	Session 3 Workplace and work-related safety	Session 4 Crash slata and analysis		
	Chain: Alison Balding Co-Chain: Arthur Tsoutsoulis	Chair: Aimee Wescembe Co-Chair: Alison Hetherington	Chair: Craig Heey Co-Chair: Jasmine Proval	Chair: Matthew Albrecht Co-Chair: Lewis Martin		
11:00-11:15	Business case for safety improvements on high-speed local government roads David Elston RAC WA	Cyclist dearance times at signilised dual left turn intersections Wahl Rabbani Department of Transport and Main Roads	Using connected wehicle data to monitor traffic along roadworks David Beck Transurban	Crash prevention and mitigation: updated evidence from in-depth crash investigations Sam Decke University of Adelaide, Centre for Automotive Safety Research		
11-15-11-30	Managing periurban local raods by setting usfer speed limits Brett Williams City of Onkaparinga	How To Reduce Pedestrian and Pedal Cyclist Fatal/Bes: Poland Demonstrates Raphael Graebieta Professional Engineering Consultants	Ocular measures predict increased crash risk in fatigued drivers Anna Cai Department of Transport and Planning	Victorian Road Safety Linked Dataset: 13 years of road trauma (Renee Schuster), Michelle Sculty Transport Accident Commission		
11:30-11:45	Network Safety Plan Process - Bundaberg Regional Council Melanie Verter NTRO	Footpath interactions between delivery and non-delivery bicyclists and pedestrians Narelle Haworth CARRS-Q, Queenaland University of Technology	Future safeguards for enforcement and emergency workers on the road (Rachael Mason), Peter McKennie NZ Police	Can we achieve the 2030 30% reduction for serious injuries? Bernard Carlon Transport for NSW		
11:45-11:52	Safety effectiveness of the Metropolitan Intersection Program (MIC) in Western Australia Muhammad Hussain The University of Western Australia	Safe streets for cycling in Taumania: Planning and Design Guidance Oscar Hayes WSP	Best practices in end- of-queue risk management at roadworks Ashim Debnath Deakin University	Factors Influencing Hospital Admissions of Road Users: Deep Learning Approach (Saled Afshari), Ali Soltani Flindets University		
11:52-11:55	Local Government Network uniting council road safety practitioners (Brett Williams), Melanie Suitor Parkes ACRS Local Government Network	identifying six bicycle journey types for a path forward Robbie Napper Monash University	Workplace road safety education - truck safety awareness Pavica Rupcak Northern Beaches Council	Revisiting Desived Headway to Extimate Rear-end Crash Risk Shubham Parashar Gueensland University of Technology		
11:55-11:58	Intergovernmental Road Safety Data Sharing Agreement Finliased (Teresa Holtby), James Waldersee Department of Infrastructure, Transport, Regional Development, Communications and the Arts					
12:00-12:30	Poster author discussion in the Exhibition Hall					

Tuesday...

12:30-12:45					
12:45-13:30	Lunch - Federation Ballroom			Journal of Road Safety Marilyn Johnson and Ingrid Johnston Q&A session, all welcome	
	Federation Plenary Hall	Grand Ballroom 1	Grand Ballroom 2	Grand Ballroom 3	
13:30-14:45	Session 5 Child restraints	Session 6 Crash data and analysis	Session 7 Technology	Session 8	
	Chair: Jenny Branch-Allen Co-Chair: Carla Schiemer	Chair: Sam Doecke Co-Chair: Newton Wiseman	Chair: Sjaan Koppel Co-Chair: Muhammad Hussain	Interactive Workshop 1	
13:30-13:45	Seat Me Safely: Professional Development for Caseworkers Transporting Vulnerable Children Cassie Kite and Priscilla Page Kidsafe NSW and Transport for NSW	Approaches to Serious Road Crash Injury Data Linkage in Queensland Jesani Catchpoole Road Safety Data Bureau, Department of Transport and Main Roads	Advancing Heavy Vehicle Fatigue Risk Management: Evidence- Based Insights from Technology Mahrokh Khakzar National Heavy Vehicle Regulator		
13:45-14:00	Challenges of Child Seat Legislation Enforcement in the Philippines Ray Adrian Macalalag The University of Sydney	Enhancing Road Safety: Improving Injury Severity Assessment and Post-Crash Care Analysis Giulio Ponte Centre for Automotive Safety Research, The University of Adelaide	Exploring the Burnley Tunnel Enhancement Project (Daniel Barro), Andrew Eckersley Transurban		
14:00-14:15	Transport for children with disabilities evaluation of health professionals' experience Helen Lindner MACA Ltd.	Analysing crash data: Is empirical Bayes the best method? Matthew Albrecht WACRSR - UWA	Utilising Artificial Intelligence to Improve Safety at School Crossings Justin Lu Real Time Traffic Pty Ltd	The Planning for Zero Framework: Develop your Pathway to Zero Hafez Alavi, Jessica Truong and Kenn Beer	
14:15-14:30		Exploring crashes involving Light Rail Vehicles in Canberra Hayley McDonald Monash University Accident Research Centre	Vehicle factors explaining sex differences in crash outcomes: scoping review Helen Nguyen The George Institute for Global Health		
14:30-14:37	Safe child restraint use: urgent change to Australian Road Rules Susan Teerds Kidsafe Qld Inc	Tram crashes involving pedestrians and cyclists: a severity analysis Long Truong La Trobe University	Comparing vehicle probe speeds with spot and space mean speeds Ashim Debnath Deakin University		
14:38-14:45	Crash protection of modified child restraints for children with disabilities Lyndall Cook Neuroscience Research Australia	Frequency analysis of crashes involving heavy vehicles (Paula Macias), Alexander Paz Queensland University of Technology			
14:45-15:15	Afternoon Tea - Federation Ballroom				

Proceedings of the 2024 Australasian Road Safety Conference, Hobart Tasmania

Tuesday

	Federation Plenary Hall	Grand Ballroom 1	Grand Ballroom 2	Grand Ballroom 3	
15:15-16:30	Session 9 Enforcement Chain: Scott Tilyard Co-Chain: Tahlia Wyer	Session 20 Intalligent Transport Systems Chair: David Legan Co-Chair: Alysse Gavlik	Session 31 Motorcyclints Chain Tanesa Sensemtick Co-Chain Mohammad Brakim	Session 12 Interactive Workshop 2	
15:15-15:30	Developing an integrated safety camera network to 2030 Graeme Noble N2 Transport Agency, Waka Kotahi	Al-based video analytics for estimating pedestrian crash risks in real-time (Hassan Tahir), Shimul (Md) Haque Queenaland University of Technology	Modelling The Impact of Anti-lock Braking System For LANS Tana Tan Safe System Solutions		
15:30-15:45	Overlength vehicle detection and classification using tracking radar Alastair Wiggins Sensys Gatso Australia Pty Utd	Automated iRAP encoding using computer vision and deep learning Ishan De Silva Tranzen Digital Pvt Ltd.	MotoCAP program enhances motorcycle diothing safety in Australasia (Yao Yu), Christopher Humen Deakin University		
15:45-15:52	We Need To Talk About Handsfree: Changing roads policing practice	Google Street View, Zero-Shat Learning for Road Safety Attributes Extraction	Improving Motorcycling and Cycling Safety at Urban Intersections Kat Gilbert Mackie Research		
15:53-16:00	Helen Wells Keele University	Mohammed Elhenawy CARES-Q	Improving Motorcycle Conspicuity in Mix Traffic: A Systematic Review Muhamad Abdul Khalid Malaysian Institute of Road Safety Research (MIROS)	Aligning Perspectives for	
16:00-16:07	6:07 Estimating an optimal enforcement program for speeding and impaired driving Maxwell Cameron Monash University Accident Research Centre	Retrofit Advanced Driver Assistance Systems (R-ADAS) in Australia	Characterising motorcycle rider anthropometry for better understanding of injury mechanisms Anvay Parab Neuroscience Research Australia	Matin Nabavi Niaki, Michael Nieuwesteeg and Lars Ekman	
16:08-16:15	Safety of Police staff conducting road safety enforcement (Rachael Mason), Peter McKennie NZ Police	Johann Tay Traffic Vehicles & Logistics Pty Ltd			
16:15-16:22	16:22 Showcasing impact in road policing funding agreements Neil Macrae NC Fonce	Enhancing Traffic Safety Analysis with Multimodal Data and GPT Models (Shadi Jandat), Muhammad Hussain The University of Western Australia			
16:23-16:30	Optimising fixed automated road safety enforcement for Victoria Mayseas Mecher Monash University	Road Safety Audit in and Around Construction Sites Using NearMiss Justin Lu Real Time Traffic Pty Ltd			
		Federatio	n Plenary Hall		
10.00.00.00		Session: A	nn Williamson		
10.00 11.00		Afternoon Plenary - Vision Zero The implementation of Vision Zero in Sweden Dr Lats Clonan Involvement made possible by Department of Infrastructure, Transport, Regional Development, Communications and the Arts			
	Road Safet Made passible by 5	Road Safety Trivia Night Bonorong Wildlife SOLUTIONS Bonorong Wildlife			
	Location: Fex Friday, 105 Marray St, Hebart Tas 7000 Time: Starts 6:30pm arrival from 6pm		Location: 593 Briggs Rd, Brighton Tas 7030 Bus transfer: Campbell St Bus Stop Bus pick ym Sufform		

Wednesday

	Day 2: Wednesday 2 October								
		Federation	Plenary Hall						
09:00-10:15	Austroads plenary: Austroads: Picking up the Pace This plenary session will showcase eleven recent examples of successful road safety activities implemented by road and transport authorities across Australia and New Zealand. The session will involve presenters from across the Austroads membership and will be moderated by Austroads' Program Manager Road Safety & Design, Michael Nieuwesteeg.								
10:15-10:20	ACRS Capacity Building Project								
10:20-10:45		Morning Tea - Feo	deration Ballroom						
	Federation Plenary Hall	Grand Ballroom 3							
10:45-12:00	Session 13 Rural roads	Session 14 Communications and Community programs	Grand Ballroom 2 Grand Ballroom 3 grams Session 15 Pedestrians Session 16 Interactive Workshop 3 Chair: Giulio Ponte Co-Chair: Gisoo Pishdad Interactive Workshop 3 vers Validation of a Virtual- Reality Pedestrian Street-Crossing Task Thomas McGuckian Australian Catholic University our Estimating pedestrian crash risks using autonomous vehicle sensor data Suny Singh Queensland University of Technology						
	Chair: Paul Durdin Co-Chair: Mark Bandick	Chair: Natalie Watson- Brown Co-Chair: Yvette Stubbs	Chair: Giulio Ponte Co-Chair: Gisoo Pishdad	Interactive Workshop 3					
10:45-11:00	Developing a Rural Network Safety Plan for Victoria Matt Allan and Maria Rizzi Road Safety Victoria, Strandroth Incorporated	AFTER IMPACT: Reaching Young Drivers Through Serious Injury Videos Peter Rubinstein RADD Australia	Validation of a Virtual- Reality Pedestrian Street-Crossing Task Thomas McGuckian Australian Catholic University						
11:00-11:15	Reducing WA's rural unzoned speed limit to achieve 2030 target Nudging to improve driver behaviour David Moyses Ioni Lewis and Vanessa Cattermole-Terzic Main Roads Western Australia CARRS-Q, Queensland University of Technology Optimum speeds on New Zealand rural state highways: An update Changing dangerous behaviours through highly targeted digital communication Maxwell Cameron Adrian Harrison Monash University Accident Research Centre (MUARC) Department of Transport and Main Roads Queensland		Estimating pedestrian crash risks using autonomous vehicle sensor data Sunny Singh Queensland University of Technology						
11:15-11:30			Street-Crossing in Older Adults: Exploring Decision- Making Joanne Bennett Health Brain and Mind Research Centre, Australian Catholic University	Motorcycle Safety Workshop – evidence- based initiatives					
11:30-11:45	Safer Speeds on Rural Roads - A Systemic Approach Mathew McQuinn and Brett Whitwam Mornington Peninsula Shire	Safer Speeds on Rural Roads - A Systemic Approach Evaluation of messaging strategies to Mathew McQuinn and Brett Whitwam Ioni Lewis Mornington Peninsula Shire CARRS-Q,		Matthew Baldock, Samantha Buckis, Duncan McRae and Christopher Hurren					
11:45-11:52	Road safety improvements for rural Utilization of social media on road local roads in Western Australia safety campaigns in LMICs Malcolm Mak (Phuong Nguyen), Huong Pham NTRO AIP Foundation		Paediatric Pedestrian Injuries in Greater Western NSW: 10- Years' Insights Wei He SCHN - CHW						
11:53-12:00	Developing Targeted Safety Performance Indicators for Rural Networks Melanie Muirson Stantec New Zealand Ltd.	The Prepared Bystanders Social Impact Campaign Sophia Cull The Health Exchange	Estimating pedestrian crash frequencies from conflicts by applying video analytics Tamina Tasmin Queensland University of Technology						
12:00-13:00	Lunch - Federation Ballroom								

	Federation Plenary Hall	Grand Ballroom 1	Grand Ballroom 2	Grand Ballroom 3	
13:00-14:15	Session 17 Policy development and implementation	Session 18 Novice and young drivers	Session 19 Roads, road design and road environment	Session 20 Personal Mobility Devices and, Safe Streets and Neighbourhoods	
	Chair: Justin Lawson Co-Chair: David Wakelin	Chair: Vanessa Cattermole-Terzic Co-Chair: Yasmin Maskiell	Chair: Paul Roberts Co-Chair: Samantha Chapman	Chair: Elspeth Moroni Co-Chair: Lyndall Cook	
13:00-13:15	Eliminating road trauma: a pathway forward Craig Hoey	Tasmania's graduated licensing system enhancements: Perspectives three years on Natalie Watson- Brown Queensland University of Technology - CARRS-Q	Challenging roundabout safety assumptions on high-speed arterials Chris Jurewicz Safe Mobility	Risky behaviours when e-scootering in the ACT Patricia Brown University of Canberra	
13:15-13:30	Advanced Driver Assistance Systems in Driver Testing and Consumer Awareness Paul Rajan Austroads	Applying technologies in youth empowerment for safer roads Anh Hoang AIP Foundation	Year 2 of the WA observational study of eRiders Paul Roberts UWA		
13:30-13:45	Assessing Fitness to Drive - Prioritising health professional education An Rendell Austroads	How does training affect 'different types' of drivers' speed compliance? Oleksandra Molloy University of New South Wales	AusRAP Star Rating using αiRAP Methodology Fritha Argus Main Roads Western Australia	An intercept survey of eRideable regulation awareness Angela Yan Western Australian Centre for Road Safety Research	
13:45 -	Uber insights: getting answers from commercial transport big data Marilyn Johnson UNSW	Novice drivers' perceptions of on- road policing and procedural justice Karen Schoots QUT	Improving Safety on the Midland Highway: Key Challenges and Lessons Jonathan Elliott Jacobs	Monitoring Personal Mobility Device emergency department injury presentations and trends Brett Droder Jamieson Trauma Institute	
13:53-14:00	A Body of Knowledge for Road Safety Engineers Rob Morgan Robert Morgan Traffic Engineering and Road Safety	Driver Licensing Access Challenges for Neurodivergent Young Adults Teresa Senserrick WA Centre For Road Safety Research, UWA	The Shaanxi Mountain Road Safety Demonstration Project (Gregory Smith), Judy Williams iRAP	Charging Ahead: A Survey-Based Exploration of E- Mobility Parking Challenges Natasha Basso Department of Transport and Main Roads Queensland	
14:00-14:07	Transport is dirty, but is it safe to be clean? Vanessa Johnston RMIT University	Learner Driver First Aid eLearning Program: A pre-post evaluation Sharon Newnam QUT	Assessing road infrastructure for compatibility with ADAS Jamie Mackenzie The University of Adelaide - CASR	Road Safety Incident Investigation Camera in Varied Settings Kerry Shaz Transport for NSW	
14:08-14:15	Is that evidence-based? Practical tips for practitioners Marilyn Johnson UNSW	Do vehicle characteristics influence driving behaviour in young people? James Boylan Swinburne University of Technology	Target 2030: Global learnings for Safer Australasian Roads Judy Williams iRAP	Route-Level Cycling Safety: A Sustainable Safety Approach Matin Nabavi Niaki Austroads	
14:15-14:45		Afternoon Tea - Fe	ederation Ballroom		

strates et	Federation Pionary Hall Grand Bailroom 1		Grand Ballroom 2	Grand Ballroom 3			
34:45-36:00	Session 21 Road user behaviours and human factors	Session 22 Roads, road design and road environment	Session 23 Crash data and analysis	Section 24 Road safety management			
	Chair: Hayley McDonald Co-Chair: Levi Anderson	Chair: David McTierman Co-Chair: Prus Oswin	Chair: Anir tebhani Co-Chair: Adam Silban	Chair: Issone Bernett Co-Chair: Keith Brown			
14.45-15.00	Ethnographic Research With Young Risk-Taking Drivers Merna Alque-Elyar Transport Accident Commission	Lessons from road user trajectories Matin Nabawi Niaki Austroads	Crisish Prediction at Rural Crossroads: Did we get it Right? Dale Harris Abley Itd	Safe System Skills Roadmapper - building capability and capacity Kenn Beer Safe System Solutions			
15:00-15:15	Decoding the Brain's Perception of Crash Risks: Pilot results (Andry Riskotoninsiny), Mohammed Elhenawy CARRS-Q - Queensland University of Technology	Modelling KSI reductions of potential lower speed limits in WA Shamsumahar Yasmin CARRS-Q, Queensland University of Technology	An iterative approach for the use of administrative crash diatasets Jasmine Proud Monash University Accident Research Centre	Vision Zero Planning for Road Safety in New Zealand (Johan Strandroth), Jessica Truong Lösningar Pty Ltd			
15-15-15-22	CARBE-G- Observation Monash University of Technology Monash University Accident A 5:22 The role of safety in modal choice and shift Monash University Effectiveness of Chevron Speed Reduction Marking Aine Kusumawati Institut Teknologi Bandung Serious Road Crash Injury O Spatial Analysis Prelimina Gisso Pishdad Transport and Maini 5:30 Older Adults' Driving Self-Regulation Patterns Over Time Niae Widgastudi University of Dtago Road condition elements influencing road crashes in Kuching, Malaysia Eliabeth Eu Mee Chong Swinburne University of Technology Sarawak Campus Emerging Post-Covid Tree Trauma from New Ze Paul Durition Abley Ltd. 5:87 Seniors' opinions on fitness to drive assessments: a qualitative study Multi-sectoral Metropolitan Road Safety Action Plan: Construction Plane OPRC India - Reduction in the balance		Serious Road Crash Injury Data Unkage: Spatial Analysis Preliminary Findings Gisco Pishdad Transport and Main Roads	Hazardous location identification for head-on collisions with roadside objects (Amolika Sinha), Thevor Wang NTRO			
15-23-15-30	B-13:30 Olider Adults' Driving Self-Regulation Patterns Over Time Nia Widyatuti University of Dtago Road condition elements influencing road crashes in Kuching, Malaysia Elasbeth Eu Mee Chong Swinburne University of Technology Satawak Campus 0-15:37 Seniors' opinions on fitness to drive assessments: a qualitative study Kayla Stefanidis MAIC/UniSC Road Safety Research Collaboration, University of the Sumbine Coast Multi-sectoral Metropolitan Road Safety Action Plan: Case Study from Chennai Nishnan Scinivasan The World Bank 8-15:45 Road user behaviour and safety on left-turn slip lanes Eappir Aratat QUT Safety Benefits of New Roads (Bypasses) Mark Newsome		Emerging Post-Covid Trends in Road Trauma from New Zealand Paul Durdin Abley Ltd.	Benefit cost ratios in road safety evaluation and funding Natthew Albrecht WWCFSR - UWW Road safety investment in transport infrastructure in Gandaki Province, Nepal Mahendra Bahadur Baniya Ministry of Physical infrastructure Development and Transport Management Advancing Road Safety in Ontario, Canada: Lessons from Instantional Models Safet Budler Good Roadii			
15:30-15:37			OPRC India - Reduction in Grathes by Applying Systems Principles Yogen Bhatnager TNM Limited				
15:38-15:45			The Lost Art of Crash Investigation Rob Morgan Robert Morgan Traffic Engineering and Road Safety				
15:45-15:52	Improving road safety outcomes with Milori Maree Kilkolly Waka Kotahi - NZ Land Transport Agency		Why so few randomised controlled trials in road infrastructure research? Matthew Albrecht WACR5R - UWA	Cost-effective crash analysis models using data science and machine learning Ishan De Silva Transen Digital Pvt Ltd			
	Federation Plenary Hall						
		Session Chair L	yedel Bites				
28100-28135		Afternoon Plenary Technology in so Dr. Jelen Wells, Ki Involement made possible by Department of Infrastructure, Tra	- Enforcement and policing cele University import, Regional Development, Communication and the Arts	Barrierte annuelle Researche annuelle Researche Angeler de Barrierte			
14:35-17:00	0 Panel facilitated by Lyndel Dates Panel Ist: Helen Wiells, Keele University Road Safety Camera Commissioner Neville Taylor, Office of the Road Safety Camera Commissioner Uval Driv, Assistant Commissioner of Police Operations, Fiji Police Force						
19:00-22:00		Conference G Verve: Centurion Ballr Dress code: Se Mode possible by Department of Infrestructure. Transport	ala Dinner room, Crowne Plaza emi formal . Reaional Develoament, Communications and the Arts	Antoning Concernant			

2024 Australasian Road Safety Conference 30 September -3 October, Hobart, Tasmania, Australia

Proceedings of the 2024 Australasian Road Safety Conference, Hobart Tasmania

	Day 3: Thursday 3 October							
		Federation	Plenary Hall					
09:00-10:00		Session Chair:	Jerome Carslake					
09:00-09:30	Morning plenary - Vehicle Safety The role of Safe Vehicles in meeting Vision Zero Carla Hoorweg , ANCAP Safety							
09:30-10:00	Panel facilitated by Jerome Carslake, Director of the National Road Safety Partnership Program Panellists: Carla Hoorweg, ANCAP Safety David Logan, Monash University Accident Research Centre Melissa Cashman, Assistant Secretary, Department of Infrastructure, Transport, Regional Development, Communications and the Arts Nick Stowe, Hydro Tasmania							
10:00-10:30	Morning Tea - Federation Ballroom							
	Federation Plenary Hall	Grand Ballroom 1	Grand Ballroom 2	Grand Ballroom 3				
10:30-12:00	Session 25 Safe trips to school	Session 26 Road safety management	Session 27 Crash data and analysis	Session 28 Enforcement and road users				
	Chair: Judy Fleiter Co-Chair: Angela Yan	Chair: Martin Crane Co-Chair: Serena Gore	Chair: Jamie Mackenzie Co-Chair: Emily Studley	Chair: Hayley McDonald Co-Chair: Levi Anderson				
10:30-10:45	Safety of School Bus Journeys in New Zealand Dale Harris Abley Ltd	A Pathway for Metro Manila-Enhanced Road Safety by 2030 Amalia Rolloque Center for Policy Studies and Advocacy on Sustainable Development Inc.	A Safe System aligned fatal crash reporting management system Lewis Martin and Michael Brown Abley	Addressing Victoria's seatbelt non-compliance (Sitthana Theerathitiwong), Kristina Tarascio Department of Justice and Community Safety				
10:45-11:00	What, where and now - safe routes to a local school Prue Oswin Sidelines Traffic	it, where and now - safe routes to a local school Measuring the Safe Systems Approach: Prue Oswin A Validated Scale Sidelines Traffic Candice Potter		Evaluation of the NSW Combined Drink and Drug Driving Offence David Wakelin Transport for NSW				
11:00-11:15	Safe transportation of children in early education and care settings Louise Cosgrove Kids and Traffic, Macquaire University	Multi-Function Enforcement Solution Working Towards Addressing the Fatal Five Alexander Jannink Acusensus	Multimodal large language model framework for safety-critical event detection (Mohammad Tami), Mohammed Elhenawy CARRS-Q	Identifying the contribution of fatigue to injury crashes Lisa Wundersitz Centre for Automotive Safety Research, University of Adelaide				
11:15-11:30	Victorian schools survey to understand road safety knowledge and practice Analysis of crashes on wirerope sections of TWTL Intercity Expressways Injury and fatality risk by transport mode: A systematic revier Rebecca McLean University of Otago Transport Accident Commission Nippon Expressway Research Institute Company Limited University of Otago		Injury and fatality risk by transport mode: A systematic review Rebecca McLean University of Otago	Preliminary impact evaluation of penalty increases for high-risk driving offences Adrian Wilson Department of Transport and Main Roads				
11:30-11:45	Enhancing Road Safety: Vietnam's Safe School Zones Advocacy Journey Development of Road Safety Assessment Framework in Nepal Anil Marsani Huong Pham Thu AIP Foundation Institute of Engineering, Pulchowk Campus		Gravel cyclists' self- reported crash risk factors Chris Jurewicz SafeMobility	Deterrence and technology that notifies drivers of enforcement locations Verity Truelove MAIC/University of the Sunshine Coast Road Safety Research Collaboration				
11:45-12:00	Everyone Wins a Prize: Navigating Hobart's Streets Stuart Baird City of Hobart	OPRC Georgia: meeting road safety challenges at the summit Yogen Bhatnagar TNM Limited	Meta Regression: An Assisted Crash Prediction Framework Zeke Ahern Queensland University of Technology	The path forward for better interventions to reduce drug driving (Razi Hasan), Narelle Haworth University of Western Australia				
12:00-13:00		Lunch - Feder	ration Ballroom					

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	Federation Plenary Hall	ration Plenary Hall Grand Ballroom 1 Grand Ballroom 2		Grand Ballroom 3				
13:00-14:30	Session 29 Safe speed Chair: Verity Truelove Co-Chair: Maria Eugenia Keller	Session 30 Motorcyclist Chair: Shane Turner Co-Chair: Samantha Ellis	Session 31 Road user behaviours and human factors Chair: Lisa Wundersitz Co-Chair: Emily Morrison	Session 32 Pedestrians Chair: Karen Schoots Co-Chair: Mayssaa Mezher				
13:00-13:15	The impact of navigation application enforcement alerts on road safety (David Soole), Kerry Armstrong University of the Sunshine Coast	Attitudes and behaviours of NSW motorcycle riders towards road safety (Natalie Reily), Ben Barnes Transport for NSW	Understanding high- risk traffic offenders using infringement, debt, and crash data Angela Watson Queensland University of Technology	Pedestrian Safety Interventions: Effective "Safe System" and "Institutional Management" Measures Hafez Alavi HA Consulting				
13:15-13:30	Testing messages to build community support for speed limit reductions David Elston RAC WA	Hiding in plain sight: unlicensed motorcycle riders in Victoria Jodi Page-Smith Transport Accident Commission	The impact of test anxiety on practical driving test performance Natalie Watson- Brown Queensland University of Technology - CARRS- Q	Protecting vulnerable road users: A rural citizen science project (Kim Jose), Verity Cleland University of Tasmania				
13:30-13:45	Fatality risk versus impact speed for frontal car crashes Kardina Nawassa Setyo Ayuningtyas UNSW	Serious motorcycle crashes: Does criminal and traffic history predict involvement? Peter Flanders Queensland Police Service	Developing a driving simulator assessment scenario for impaired research Gregoire Larue MAIC/UniSC Road Safety Research Collaboration	Vision Zero for Pedestrians. What's the pathway? Phil Harbutt PivotSpace				
13:45-14:00	Setting safe speed limits: Is our current approach fatally flawed? Blair Turner Road Safety Advisory Services	Effectiveness of Raised Safety Platforms: A Systematic Review (Wahi Rabbani), Alexander Paz Queensland University of Technology	A Corridor-level approach for demarcation of pedestrian vulnerability V S Sanjay Kumar NATPAC	Brain and body: Predicting older adult safe street-crossing Ann Carrigan Australian Catholic University				
14:00-14:07	Evaluating impact of 30 km/h speed limit trial	Performance of post- production protective helmet through impact absorption test Muhamad Syukri Abdul Khalid Malaysian Institute of Road Safety Research (MIROS)	Smart phone usage and road crashes among University students in India Guneet Singh Assi Health Equity Action Learnings Foundation	A data-led approach to pedestrian safety				
14:08-14:15	- Amir Soonani Safe Path Consulting Pty Ltd		Attitudes and behaviours towards driving under the influence of drugs (Aaron Mackay), Amie Hayley Swinburne University of Technology	Abley				
14:15-14:22	Exploring enhancement of community understanding of safe system speeds Judy Fleiter Western Australian Centre for Road Safety Research			A road user safety- field theory for estimating pedestrian crash risks Saransh Sahu Queensland University of Technology				
		Federation	Plenary Hall	·				
		Session Chair: Sjaan Koppel						
14:30-15:30		Closing Ceremony inclu	uding Conference Prizes					
15:30	End of Conference							

Posters

Name	Organisation	Title
Zeke Ahern	Queensland University of	Analysing the impact of raised platforms on rider
	Technology	safety
Ashim Debnath	Deakin University	Evaluation of side road activated signs treatment
		at rural intersections
(Olivia Della-Martina),	WACRSR - UWA	Cannabis and driving - Australian medical
Matthew Albrecht		practitioner perspectives
(Teresa Holtby), James	Department of Infrastructure,	Intergovernmental Road Safety Data Sharing
Waldersee	Transport, Regional	Agreement Finliased
	Development, Communications	
	and the Arts	
Pavica Kupcak	Northern Beaches Council	Workplace road safety education - truck safety
		awareness
Robbie Napper	Monash University	Identifying six bicycle journey types for a path
		forward
Shubham Parashar	Queensland University of	Revisiting Desired Headway to Estimate Rear-end
	Technology	Crash Risk
(Abbey Smith), Matthew	Western Australian Centre for	Self-perceptions of driving safety while hungover:
Albrecht	Road Safety Research, School of	semi-naturalistic randomised controlled trial
	Psychological Science, UWA	
(Brett Willliams), Melanie	ACRS Local Government	Local Government Network uniting council road
Suitor Parkes	Network	safety practitioners

Improving motorcycle conspicuity in mix traffic: a systematic review

Muhamad Syukri Abdul Khalid¹, Ahmad Azad Ab Rashid¹, Zulhaidi Mohd Jawi¹, Juffrizal Karjanto², Nor Kamaliana Khamis³

¹ Malaysian Institute of Road Safety Research (MIROS), ² Universiti Teknikal Malaysia Melaka, ³ Universiti Kebagnsaan Malaysia

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Abstract

Motorcycle conspicuity and detectability on the road are critical factors contributing to motorcycle crashes in Malaysia. This led to daytime running lights (DRL) legislation exclusive for motorcycle in Malaysia. As DRL becomes more common to other vehicles as well, motorcycles' detectability in mix-traffic reduces. To address this, researchers are exploring innovations on motorcycle headlight to improve its detectability. This review, employing PRISMA methodology, produces 8 relevant articles reporting various headlight improvements including various headlight configurations and color changes. The finding offers potential direction for future research to enhance motorcycle safety in mixed traffic environments.

Post on X

Adding an advance arrangement, modulating and/or changing the color of the standard motorcycle headlight configuration could significantly improve motorcycle conspicuity and detectability in mix-traffic.

Introduction

In Southeast Asia region, motorcycle population constitutes more than 70% of total traffic. The selection of motorcycle is popular, especially for commuting, because of its affordability, small in size enabling for quick maneuver in the traffic (Khalid et al., 2020). Subsequently, motorcycles contribute significantly to the road crashes and fatalities in the region. For the case of Malaysia in 2023, over half a million crashes and more than 6,000 road fatalities of which motorcycles were the most prominent.

Studies shows that 26% of motorcycle crashes are related to their conspicuity (Abdul Manan & Varhelyi, 2012; Khalid et al., 2020). The Malaysian government responded by legislating motorcycle daytime running light (DRL) since the past 20 years with 29% reduction of motorcycle conspicuity related crashes (Sohadi, 2005).

Nowadays, DRL has become a popular trend for other vehicles as well, especially among the cars in Malaysia. This situation poses a threat to motorcycle safety as DRL is no longer their exclusive visual signature. Consequently, the perception and detection of motorcycle is reduced significantly, especially at greater distance (Cavallo & Pinto, 2012).

To address this concern, we explored the literature through a systematic review for potential innovations of motorcycle headlight or DRL to improve their conspicuity and detectability in mix mode traffic.

Methodology

The researchers employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline to search online databases using keywords related to motorcycle conspicuity, headlight or DRL improvement, motorcycle detectability in mix mode traffic (see Table 1). As the study intends to explore recent motorcycle conspicuity intervention, only articles published from 2010 are included. Figure 1 portrays the selection procedure using the following criteria:

- Published or accepted proceedings, journal articles, and reports;
- Related to motorcycle conspicuity issues in mix mode traffic;
- Discussed on intervention or recommendation through headlight or DRL in improving motorcycle conspicuity; and
- Positive outcome or findings from the experiments, other methods, and approaches.

Results and Discussion

The background searches produced 1,690 articles with 134 duplicates. After their removal, 1556 articles went through filtering and screening resulting to 17 articles possible for the study. Further scrutiny of these revealed only eight articles appropriate for the study. The remaining nine articles were removed because of less relevant and their scope of study are not focusing on intervention or innovation of the current headlight, but more about legislation of DRL. Table 2 entails details of the eight articles.

Table 1. Keywords used in article searches process

Databases	Group	Keywords/search terms
Science Direct, PubMed,	Vehicle	Motorcycle, motorbike, Moped, powered two-wheeler, PTW,
IEEE, MDPI, Google Scholar		two-wheeled vehicles
and Research gate	Conspicuity Aid	Conspicuity, visibility, detectability, colour, headlamp,
		headlight, lamp, light, daytime running light (DRL), daytime
		running headlight (DRH)



Figure 1. The process of articles selection using PRISMA guideline

Authors	Method	Sampling	Innovation	Categorisation	Effectiveness
Al-Awar Smither & Torrez (2010)	Video clips	75	Low beams and headlight modulator	Modulation	Modulating headlight improves motorcycle detection time by near 5% when compared to unlit headlight
Shaheed et al. (2012)	Driving simulator	36	Modulating headlights	Modulation	Detection improvement for almost 50% more when compared to motorcycles with DRL only
Rößger et al. (2012)	Video clips	56	Headlight T- configuration	Arrangement	Motorcycle detection is significantly quicker (almost 20%) for additional light configuration than normal
Pinto et al. (2014)	Image clips	60	Yellow headlight configuration	Arrangement & colour	Relative to standard configuration, motorcycle detection improved more than 20% with yellow headlight
Cavallo et al. (2015)	Driving simulator	23	Advanced headlight configuration	Arrangement	Combination of all additional lights configuration (handlebars, helmet and fork) improved motorcycle detection time to 720ms when compared to normal headlight on.
Ranchet et al. (2016)	Image clips	57	Vertical yellow headlight configuration	Arrangement & colour	Motorcycle with yellow configuration shows an improvement of motorcycle detection by more than 30% when compared to normal headlight.
Khalid et al. (2020)	Video clips	30	Retroreflective tape at the front facade	Passive	No significant improvement to motorcycle detection distance when compared to normal headlight
Cavallo et al. (2021)	Real driving	27	Vertical yellow-white headlight configuration	Arrangement & colour	The headlight configuration provides a better detection and safe turning judgement for car drivers

The conspicuity innovations from the studies fall into four categories: modulation, arrangement, colour, and passive. Most studies examined the effect of arrangement and colour of the headlight. Two studies explored the arrangement of headlights and additional lights at various locations to produce promising improvement for motorcycle detection (Rößger et al., 2012; Cavallo et al., 2015).

Further, Pinto et al. (2014), Ranchet et al. (2016) and Cavallo et al. (2021) explore not just the arrangement of headlights, but also a combination with the headlight colour (mostly yellow). Similarly, the results are significant improvement to motorcycle detection and provides benefits to car drivers judgement on safe turning.

Meanwhile, Al-Awar Smither and Torrez (2010), as well as Shaheed and colleagues (2012) demonstrated the effect of modulating headlight on motorcycle detectability. Their results also offer promising avenue to improve motorcycle detection time in the traffic.

Nevertheless, study from Khalid et al., (2020) shows that no significant improvement in motorcycle detection distance is observed when standard motorcycle headlight configuration is added with reflective tapes at the front façade of motorcycles.

Another noteworthy observation for future exploration is the longitudinal effect of headlight innovation. This is because of the potential confounding of novelty to the improvement: unfamiliar situation catches attention faster and better. Despite efforts in measuring the effect after repeated exposure of the innovations in some of the studies (e.g. Rößger et al., 2012), future research should consider the exploration for longer period, especially to determine the point when the innovation is habituated or normalized.

Conclusion

The daytime running light has become an *exclusive* visual signature for motorcycles in Malaysia for past two decades, producing significant reduction of motorcycle conspicuity related crashes. With more cars also being equipped with daytime running lights, this poses a safety threat to motorcycles. Nonetheless, the review shows potential innovations to address this conspicuity and detectability risk through various improved configurations of motorcycle headlights.

References

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- Al-Awar Smither, J., & Torrez, L. I. (2010). Motorcycle conspicuity: effects of age and daytime running lights. Human factors, 52(3), 355-369.Pinto M, Cavallo V, Saint-Pierre G (2014). Influence of front light configuration on the visual conspicuity of motorcycles. Accid Anal Prev,62:230–7.
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Performance of post-production protective helmet through impact absorption test

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Abstract

Motorcycle fatalities constitute a significant number of road fatalities in Malaysia, with head injuries being the primary cause. Compulsory helmet laws were implemented in 1973, resulting in increased helmet usage and a notable reduction in fatal motorcycle injuries. Despite the law, variations in helmet quality persist throughout the design, manufacturing, and retail processes. This study intends to quantify compliance deviations by retesting post-production helmets certified with UN R22 in the Malaysian market. Fourteen different brands and models of protective helmets underwent impact absorption tests using the test method and requirement in accordance with the standards outlined in UN R22. The result shows that only six tested helmets past the test, revealing a concerning discrepancy between certification and actual performance. The study highlights the need for post-production mechanisms, such as assessment or rating programs, to ensure helmets provide adequate protection for motorcyclists in Malaysia, addressing a critical gap in road safety.

Post on X

Fourteen standard-compliant protective helmets in the market, underwent an impact absorption retest using the test procedure and requirement from UN R22 standard. Only six helmets passed the test indicating the need for post-production performance assessment.

Introduction

Motorcyclists constitute over 60% of road fatalities in Malaysia; with head injuries being the primary cause (RMP, 2021). In response to this, the government introduced the helmet law in 1973 to enforce compulsory helmet wearing for all motorcycle users, leading to increased use of helmet and reduction of 30 percent of fatal motorcycle injuries in Malaysia (Supramaniam, van Belle, & Sung, 1984). The law stands until today resulting to high compliance among adult riders and pillions (93.4% and 85.8%, respectively; Oxley, O'Hern & Jamaludin, 2018).

Equally important to helmet wearing is the helmets' quality. Malaysia has established its helmet standards (MS1:1996) to outline specifications for protective helmets (Malaysian Standard, 1996). Furthermore, Malaysia's recognition of the United Nations Regulation No. 22 (UN R22) (UNECE, 2021) signifies only helmets with either MS1 or UN R22 certification are allowed in Malaysia. The revised MS1:2011 standards, which has a strong resemblance to the UN R22, are more comprehensive and have more demanding requirements for existing helmet range to comply with (Hamzah et al., 2019).

Despite the establishment of these standards, potential variations arise throughout the helmet design, manufacturing, and retail process, affecting the final product's efficacy. To test this postulation, the study sought to quantify the compliance deviations by retesting post-production helmets certified with UN R22 in the Malaysian market.

Methodology

The experiment involved protective helmets, of different but established brand and model, available in the Malaysia market. All protective helmets were purchased brand new after passing some selection criteria such as standard compliant, brand popularity, and shell material.

The retest involved all criteria of the impact absorption test, including the test condition, methodology and procedure, passing requirements and criteria, in accordance with the standards outlined in UN R22, fifth revision with the impact area as shown in Figure 1 (UNECE, 2001).

The impact absorption tests were performed using a calibrated CADEX Impact Absorption Test Equipment, model number 1001_00_TWSM . The test requirements included assessing the resultant acceleration (maximum 275 g), Head Injury Criterion (HIC) (maximum 2400), and speed (7.5 m/s with a tolerance of +0.15 / -0.0 m/s), using a flat steel anvil.



Figure 1. Location of impact sides of the test (UNECE, 2001)

Results

Fourteen different brands and models of protective helmet, procured from different motorcycle helmet shops, were verified to comply with UN R22 standards. The results of the test are tabulated as in Table 1. Most of the helmets failed at the front impact area, while all helmets passed the rear and crown tests. Only three helmets failed the side impact area of the test. Overall, only six (i.e., 42.9%) of the tested helmets passed the impact absorption test following the UN R22 standard, despite all of them being certified with it.

Helmet	Maga	Front		F	Rear		Side		Crown	
	IVIASS	g	HIC	g	HIC	g	HIC	g	HIC	
1	1800	345	2520	211	1640	265	2206	240	2307	
2	1570	229	1655	163	1179	255	2089	226	2176	
3	1370	210	1871	231	1939	240	2121	226	2211	
4	1630	314	2234	158	1103	233	1793	186	1888	
5	1530	160	1208	181	1271	259	2100	184	1897	
6	1630	371	2589	188	1408	221	1859	186	1870	
7	1350	168	1270	141	826	223	1885	230	2108	
8	1580	273	1771	210	1697	297	2732	203	1863	
9	1020	515	4547	196	1484	281	2305	201	2023	
10	1360	403	3597	167	1202	228	1993	192	1692	
11	1810	464	2721	242	2012	263	2106	177	1725	
12	1770	202	1495	177	1213	231	1687	214	1970	
13	1780	337	2130	163	1140	278	2302	182	1930	
14	1471	217	1796	213	1901	233	1940	210	2338	

 Table 1. Result from the impact absorption test for all protective helmets

Note: Passing criteria: maximum resultant acceleration value = 275g; maximum HIC value = 2400. Green shaded box contains passed value while red shaded shows otherwise

Discussion

The retest of impact absorption test on various post-production helmets in Malaysian market revealed many of them, despite being certified with UN R22 regulation, failed the standard's test protocol. Even though the limitation of the study hinders generalisability of the results, it indicates a significant risk to the motorcycle users. While the study is insufficient to reveal the source of the variations, potential factors exist across the production chain, as well as the retail process: beginning from designing of the helmet, manufacturing, testing process, post-production factors such as the distribution, storage, and retail processes; *inter-alia*. As much as all the efforts to ensure all helmets in the market can provide a quality protection the users during impact, a post-production mechanism, such as an assessment or a rating programme, would be beneficial not only to inform the users, but also to instil their confidence on the helmet.

Conclusion

Retesting of fourteen post-production certified helmets in the market revealed unsatisfactory results indicating a critical risk of head injury for the helmet users.

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Investigating factors influencing hospital admissions of injured road users

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Abstract

In the realm of road safety research, understanding the multifaceted factors influencing the number of injured individuals admitted to hospitals is paramount for effective policy-making and intervention strategies. This paper delves into this critical area by harnessing machine learning techniques to analyse historical road injury data (2011-2021) collected by the Australian Institute of Health and Welfare (AIHW). Specifically, the study investigates the impact of various factors, including personal characteristics such as gender and age, as well as locational factors such as urban and regional settings, on both the frequency and duration of hospital length of stay for injured road users. Through the utilisation of machine learning techniques, this research endeavors to unveil intricate patterns and relationships within the dataset.

Post on X

New research uses machine learning to analyse hospital admitted road injury data from @AIHW. Investigating factors like gender, age, counterpart, and location, we aim to enhance road safety interventions for different road users. #RoadSafety #Research #Australia #australiasianroadsafetyconference

Introduction

Studying road crash injuries is important for several reasons. Firstly, it allows for a more accurate identification of the injured population, as relying solely on hospital discharge data or police crash reports may result in a biased undercount of injuries (Lombardi et al., 2022). Secondly, understanding the facilitators and barriers for providing post-crash emergency care can help improve pre-hospital care and mitigate the consequences of serious injuries (Khalique & Ahmad, 2022). Furthermore, analysing the association between the rush hour period and crash injuries can help identify patterns and risk factors that contribute to fatal and non-fatal injuries, leading to more effective crash injury prevention strategies (Adeyemi et al., 2021). Studying crash injuries are important for several reasons. Firstly, it helps identify and assess the risk factors that contribute to the severity of crashes (Filipović et al., 2022). This information is crucial for understanding the current road safety situation and developing effective action plans and measures for sustainable urban mobility planning (Leo et al., 2021). Secondly, studying crash injuries allows for the development of risk-informed road safety policies (Afschrift et al., 2022). By analysing the correlation and contributions of different risk factors, authorities can prioritise their efforts and allocate resources accordingly (Ravensbergen et al., 2022). Additionally, studying crash injuries that contribute to these crashes (Soltani & Qadikolaei, 2024), such as the condition and behavior of the road users, the road environment, and the other party involved (Soltani et al., 2024).

Objective of Research

The primary objective of this research is to investigate the role of various factors, including personal characteristics such as gender and age, as well as locational factors, on the frequency and severity- duration of hospital length of stay for injured road users. Utilising machine learning techniques applied to historical road injury data collected by the Australian Institute of Health and Welfare (AIHW, 2023), the study aims to discern complex patterns and relationships to enhance understanding of road injury dynamics and inform evidence-based interventions.

Research Questions

1. What is the impact of personal factors on the frequency and duration of hospital admissions for injured road users? 2. How do locational factors, influence the likelihood and severity of road injuries requiring hospitalisation?

Methodology

Pre-processing of Data

Prior to analysis, it is imperative to preprocess the data to ensure its cleanliness and readiness for learning. This initial step involves several stages of data cleansing to prepare it for further investigation. Firstly, in the preprocessing phase, we address missing values in the dataset. Upon examination, it was evident that some columns contained undefined values, necessitating their replacement with appropriate entries. In this study, following an assessment of different models, the Decision Tree model was selected to impute missing values due to its minimal error rate, ensuring a comprehensive treatment of missing values in the dataset. Following data preprocessing, the next phase entails converting non-numeric data types into numeric formats, a critical step in data preprocessing. Seven columns within the

dataset exhibit non-numeric data types, necessitating conversion. To achieve this, we employed dummy variables, effectively transforming data into numeric formats to mitigate potential obstacles. Furthermore, to optimise predictive accuracy and algorithm performance, data scaling was applied to address significant numerical disparities across data ranges. Additionally, data visualisation techniques were employed to derive meaningful insights, aiding in identifying and addressing potential challenges within the dataset.

Description of Data

While off-road crashes only happen in locations other than public roads or streets, on-road crashes usually happen on these types of roads. Transport crashes are a significant public health concern in Australia, leading to thousands of hospitalisations and deaths each year. Car occupants, motorcyclists, and pedal cyclists are among the most commonly involved modes of transport in injury hospitalisations. Previous studies (AIHW, 2024) shows that the most frequent mechanisms of injury in off-road crashes involved motorcyclists and pedal cyclists involved in non-collision incidents decreased, while there was a slight increase in the rate of transport injury deaths from 2020-21 to 2020-21. Hospital admissions due to transport injuries show seasonal patterns, with peaks around October and April, potentially due to increased traffic during school holidays. Indigenous Australians are at a higher risk of hospitalisation and death due to transport crashes compared to non-Indigenous Australians. People living in remote areas are also at a higher risk of hospitalisation and death from transport crashes compared to those in major cities. However, this paper gives more detailed information at the national level, while it attempts to examine the casual factors of road injuries. The distribution of road users by gender and location, sheds light on patterns and vulnerabilities. Notably, the data reveals a relatively balanced gender distribution across road user categories, with slight variations. Female representation is slightly higher among car passengers (54.3%) and pedestrians (46%), while males predominate among motorcycle riders (68.6%). Moreover, regional disparities exist, with motorcycle riders and pedal cyclists showing a higher prevalence in regional areas compared to major cities, with percentages reaching up to 46.61% and 39.2% respectively. Conversely, car passengers and pedestrians are more represented in major cities, with percentages of 53.92% and 63.52% respectively. This suggests differing risk profiles and emphasises the need for tailored interventions across locations. Furthermore, the data shows that the majority of road users fall within the age group of 18 to 64, with percentages ranging from 62.2% among pedal cyclists to 55.61% among pedestrians. This highlights the significance of this demographic in road incidents. Older individuals (over 65) are notably present among car passengers (32%) and pedestrians (27%), indicating their vulnerability in crashes. Conversely, younger individuals (less than 18) are prominent among car passengers (27%) and pedestrians (21%), underlining their susceptibility to road crashes. Motorcycle riders and pedal cyclists primarily consist of individuals between 18 and 64, with percentages reaching up to 68% and 55% respectively, suggesting a higher risk demographic among adults. This analysis underscores the importance of age-specific safety measures to protect vulnerable groups. Moreover, the data explores the distribution of road users based on their counterparts in road collisions, offering insights into collision patterns and associated risks. Car drivers and passengers frequently collide with counterparts such as cars, trucks, and vans, indicating collisions involving other motor vehicles, with percentages ranging from 20.44% to 29.73%. Motorcycle riders and pedal cyclists also frequently collide with motor vehicles, albeit to a lesser extent. Notably, pedestrians primarily collide with cars (55.61%) but also face risks from fixed station objects, with percentages reaching up to 14.09%, highlighting their vulnerability to multiple hazards. This underscores the need for comprehensive pedestrian safety measures beyond vehicle-related interventions.

Modelling

The road crash severity data spanning from 2011 to 2021 reveals notable trends in National Australia. Overall, there has been a gradual decline in road crash severity, indicating improvements in road safety measures and awareness campaigns over the past decade. However, it is essential to delve deeper into the contributing factors influencing these trends.

SHAP Values

Injury Frequency

The Poisson-based SHAP values for the frequency of crashes across various road user categories are discussed below. Notably, car drivers exhibit heightened crash frequency when involved in collisions with heavy vehicles, with a substantial SHAP value of 0.14, indicating a significant impact on crash occurrence. Similarly, car passengers demonstrate increased crash frequency, particularly in regional areas (SHAP value of 0.08) and when crashes involve cars, trucks, or vans (SHAP value of 0.14). Moreover, the gender of the involved person appears to influence crash frequency more prominently for motorcyclists, with a notable SHAP value of 0.25, underscoring the importance of considering demographic factors in road safety analysis. Pedal cyclists, on the other hand, exhibit heightened crash frequency when involved in collisions with cars, trucks, or vans (SHAP value of 0.31), suggesting a critical need for targeted interventions to enhance cyclist safety on the road. Additionally, crashes involving fixed stationary objects or counterparts categorised as "other" yield noteworthy SHAP values across several road user categories, indicating their varying impacts on crash frequency. Furthermore, the age of the involved person emerges as a significant factor affecting crash frequency for car passengers and pedestrians, particularly within the age range of 64-75, with a SHAP value of 0.013 and 0.04 respectively. Regional disparities also play a role, with car passengers and motorcyclists showing higher crash frequencies in regional areas compared to major cities, with SHAP values of 0.11 and 0.07

respectively. Conversely, pedal cyclists exhibit heightened crash frequency in major cities (SHAP value of 0.17), aligning with urban infrastructure challenges.

Injury Severity

The Poisson-based SHAP values for the severity of crashes across various road user categories are discussed below. Age is a crucial factor in determining vulnerability among car drivers. The demographic of elderly drivers, specifically those aged 75 and above, demonstrates the greatest vulnerability to road crashes. Additionally, age groups of 65-74 and 40-64 also exhibit heightened levels of risk. Furthermore, the geographical location of crashes assumes a crucial role, as incidents taking place in regional areas have a substantial impact on the injuries sustained by car drivers. This highlights the significance of customising safety protocols to effectively tackle the distinct obstacles presented by various road conditions. In contrast, when analysing car passengers, the influence of particular years of incidents on the probability of injury seems insignificant. Nevertheless, age continues to be a significant determinant, as individuals aged 75 and older demonstrate diverse degrees of susceptibility. The subgroups falling within the age range of 40-64 exhibit heightened vulnerability to injury, indicating the necessity for focused interventions aimed at reducing risk factors within this demographic. When considering motorcyclists, it is important to note that the influence of years of incidents is relatively insignificant. However, it is worth mentioning that motorcyclists face a considerably greater risk when involved in collisions with larger vehicles, such as cars, trucks, or vans. This highlights the significance of taking into account the attributes of counterparts when evaluating the likelihood of injuries. Furthermore, it is worth noting that age cohorts falling within the ranges of 40-64, 17-25, and 26-39 exhibit moderate effects on motorcyclist injuries, thereby underscoring the necessity for safety interventions tailored to specific age groups. Pedal cyclists encounter distinct obstacles while traversing roadways, wherein age and gender have emerged as noteworthy factors influencing their susceptibility. The age cohorts of 17-25, 26-39, and 8-16 demonstrate elevated levels of vulnerability among individuals engaged in pedal cycling, with males displaying a moderately higher likelihood of experiencing injuries compared to females. In addition, collisions involving non-car counterparts or other vehicles have a moderate effect on injuries sustained by pedal cyclists. This highlights the need for customised safety measures that specifically target different types of counterparts.

Finally, it is worth noting that pedestrians, specifically individuals aged 75 and above, have a notably substantial influence on the probability of sustaining injuries. Collisions involving large vehicles also have a moderate impact on pedestrian injuries, highlighting the importance of implementing comprehensive safety measures that address the specific characteristics of these vehicles. While there is no substantial correlation between specific years of incidents and pedestrian injuries, the general susceptibility of pedestrians highlights the necessity of implementing focused interventions to improve pedestrian safety.

Conclusion and further research

In summary, this paper highlights important findings about the severity and frequency of traffic crashes in Australia, highlighting the complex nature of traffic safety issues. Trends like the frequency of transport crashes and differences in injury risks between demographic groups and geographical areas were brought to light by descriptive data. Age, gender, and temporal variables were found to be significant predictors of crash outcomes through predictive modelling. Future directions for research should include spatial analysis to identify high-risk areas, behavioural studies to address human factors in road crashes, longitudinal analyses to track changes over time, and advanced machine learning techniques for improved predictive modelling. Further research should concentrate on assessing the efficacy of interventions, identifying vulnerable road user groups, incorporating big data sources, and examining how climate change affects traffic safety. By focusing on these areas, evidence-based interventions will be strengthened and the number of traffic injuries in Australia and elsewhere will eventually decline.

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Analysing the impact of raised platforms on rider safety: a video analytics approach

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Abstract

Motorcycle crashes continue to pose a significant risk to road safety, prompting the need for strategic interventions. Our study employs video analytics to assess how raised safety platforms affect rider safety and driver behavior. By calibrating cameras to correct perspective distortion, we achieved accurate vehicle recognition and speed tracking. This allowed us to develop a risk profile framework based on vehicle speeds and proximity. We examined how safety platforms affect motorcycle rider behavior, focusing on dynamics like speed variation, collision potential, jerk reactions, and rider adjustments. Our findings reveal cautious behavior, with riders decelerating upon approaching platforms, indicating compliance with their intended safety function. We also investigated the broader impact on traffic, analysing how these platforms influence vehicle behavior. Our research offers valuable insights for urban planners and traffic engineers, delivering data-driven recommendations to bolster road safety for the growing motorcycle populace.

Post on X

Unveiling the influence of raised platforms on motorcycle traffic through video analytics. #TrafficSafety #MotorcycleDynamics #UrbanPlanning #VideoAnalytics

Introduction

The Raised Safety Platform (RSP) is a rather new approach to road safety, akin to speed bumps but more subtle. It aims to enhance safety by gently moderating traffic speed with a noticeable vertical alteration in vehicle pathways (Lawrence et al., 2021). For instance, in the Netherlands, RSPs are strategically placed before signalised intersections to protect cyclists and pedestrians who have limited control to stop abruptly (Corben et al., 2022).

Despite speed being a key behavioral factor in road fatalities and injuries in Australia, crash databases in many regions, both locally and internationally, often lack detailed data on speed's contributory or causal role (Mooren, n.d.; Peiris et al., 2022). Therefore, reducing speed through non-invasive measures can help lower crash rates with minimal disruption. For instance, speed bumps, while effective, have drawn criticism from cyclists and motorcyclists, and some health experts raise concerns about their impact on well-being. (Advani et al., 2024).

Methodology

In the literature on video analysis for single-lane roadways, the most frequently examined safety measure is Time-to-Collision (TTC) (Li et al., 2020; Minderhoud & Bovy, 2001). The TTC is determined by assessing whether any pair of these projected positions will intersect, given the assumption that both parties maintain their current speeds and directions. TTC for rear-ends is expressed as the following:

Where:

$$TTC = \frac{D}{V_{\{rel\}}}$$

- TTC is the Time to Collision, typically expressed in seconds.
- D is the distance to the lead vehicle, or the gap between the two vehicles, measured in metres.
- V_{rel} the relative speed of the following vehicle with respect to the lead vehicle. It is calculated by subtracting the speed of the lead vehicle (V_{lead}) from the speed of the following vehicle (V_{follow}).

On single-lane roadways, while rear-end collisions are common, the impact of RSPs also demands analysis. A key metric for this is the jerk profile, which measures how a vehicle's acceleration changes over time. Jerk specifically refers to the rate of acceleration change. It is commonly used in the literature during evasive actions like emergency braking, resulting in a rapid shift to intense deceleration, which may occur to the oncoming RSP. As a quantifiable index (Akinapalli et al., 2022; Zaki et al., 2014), jerk reflects a rider's dynamic reaction to sudden events on the road, essentially deriving from deceleration rates.

Data Collection

To address the significant paucity of the proposed approach, we implemented a video surveillance strategy along Gap Creek Road in Brisbane, Australia. Our objective was to comprehensively record the traffic, including vehicles and motorcycle riders. Strategically positioned cameras were set up to document road users speeds prior to entering the road segment containing a RSP and their speeds while traversing the RSP zone. The methodology was designed to evaluate how the design affects the speeds of both vehicles and motorcycle riders, thereby measuring its effectiveness in improving road safety.

Camera Calibration

The cameras underwent calibration against real-world coordinates, which were meticulously charted by land surveyors. These precise measurements were then aligned with the corresponding positional coordinates within the camera system. This calibration provided a real-world reference framework, enabling the accurate extraction of positional data, from which precise timings and velocities could be deduced. The configuration of this setup is depicted in Figure 1.



Figure 1. Camera tracking, detection, and reference to real-world coordinate system

Proposed Analysis of Metrics

The refined metrics obtained from the analysis encompass vehicle detection, jerk profile upon encountering raised platforms, as well as monitoring speed before, throughout, and after these events. By meticulously tracking these parameters, we have compiled a comprehensive suite of summary statistics for various vehicle types. All these metrics could be combined using the Extreme Value Theorem (EVT) thus utilising this we can identify probabilities of crashes based on the collected values (Borsos et al., 2020; Zheng et al., 2019). Through this approach, these metrics enable us to determine whether there are any changes in driver behavior in response to the approaching RSP.

Results

We observed observational level statistics from the profiles and discovered some insights at the population level amongst our class types (trucks, cars, motorcycles). Notably motorcycle riders, took more caution as the RSP's were encountered, many dropping their speed significantly before the RSP as can be seen in Figure 2.



Figure 2. Motorcycle rider, significantly reducing speed before the RSP

While similar effects can be observed across different vehicle classes at the population level, there is notable variability in the jerk profile among cars. This variation could indicate that some drivers perceive RSP as a minor safety threat and, as a result, may approach them with less caution, potentially even deriving a sense of enjoyment from the experience. (Chouhan et al., 2022).

Conclusion

The study's objective was to determine the impact of Raised Safety Platforms (RSP) on motorcycle rider safety. We noted a general decrease in speed as motorcycle riders approached RSPs. However, despite an observed reduction in average speed across vehicle classes, car jerk profiles showed some inconsistency. Remarkably, RSPs appeared to encourage reckless behavior in certain drivers. Due to low traffic, there was scant evidence of following vehicles, rendering the common Time to Collision (TTC) value less applicable for assessing safety in our preliminary analysis. Future research will explore additional parameters such as deceleration rates, lane infractions, and employ Extreme Value Theory (EVT) to estimate crash probabilities based on our video data.

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Analysing the Impact of Raised Platforms on Rider Safety



Meta Regression: An Assisted Crash Prediction Framework

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Abstract

Crash analysis frequently encounters unobserved heterogeneity, typically addressed through random parameters and specific distributions. Random parameters depend on contributing factors and can be treated at the observational level or grouped based on data characteristics. Choosing the optimal method hinges on these characteristics and requires hypothesis testing, along with a careful evaluation of functional forms, transformations, and key contributing factors. Addressing all these elements simultaneously requires numerous modeling decisions and hypothesis tests, which, if not adequately conducted, impose bias's and miss critical specifications. To overcome these challenges, a metaheuristic solution algorithm is proposed that enhances the efficiency of crash prediction model development. This approach provides a supportive framework for analysts and researchers, enabling them to develop more effective crash models by utilizing a guided search process. Such models are crucial for better understanding and mitigating crash factors, ultimately contributing to the goal of achieving zero deaths on roads by 2030.

Post on X

MetaCountRegressor. A Framework for Estimation of Crash Prediction Models.

Introduction

Crash frequency models leverage a combination of data on road infrastructure, vehicle characteristics, and human factors to provide knowledge and insights to develop such prevention strategies (Ambros et al., 2018). These models are critical for road safety management, helping to identify factors that contribute to crashes and informing the design of safer roads and effective prevention measures (Marshall et al., 2023).

The inherent unpredictability and stochastic characteristics of road crashes introduce significant modeling challenges (Hess & Train, 2017). Models that account for unobserved heterogeneity can mitigate some of this randomness, providing deeper insights by stabilizing model parameters and yielding less biased estimates (Ahern et al., 2024; Behara et al., 2021; Shirazi & Geedipally, 2023). These models also help address temporal instability issues that can affect crash data. However, the increased complexity of such models requires a greater depth of domain expertise, along with substantial experience and a commitment of time to the development process. It is essential, therefore, that crash prediction models are developed with a comprehensive understanding of the data elements involved to ensure predictions are as reliable as possible (Mannering et al., 2016).

As a result, analysts that develop models are bounded by their time, resources, and introduce biases in estimating these models. They also are stricken by their knowledge, as there exists limited studies that guide them to efficient model estimation (Ahern et al., 2024).

Even when the estimated model is well-fitted, conducting validation is crucial to assess generalization and transferability as well as to prevent overfitting (Parady et al., 2021). Additionally, validation confirms the logical justification of the proposed models, evaluates their performance across various locations and time periods, and identifies areas for model enhancement. Unfortunately, validation is often neglected due to time constraints and limited knowledge of data splitting techniques, despite being an essential step for mitigating bias'. Embedding validation into the modeling process through a statistical framework could alleviate this neglected issue (Rashidi et al., 2022).

As a result, this research introduces a framework that combines a systematic and guided approach for hierarchical heterogeneous modeling of crash frequencies. The goal is to reduce subjectivity and bias in the estimation process, thereby avoiding errors that could result in incorrect analysis. The framework achieves this by minimizing the Bayesian Information Criterion (BIC) to prevent overfitting and minimizing the RMSE to facilitate validation. It is an optimization-driven framework that preserves all fundamental concepts of model development from statistics and road safety, ensuring statistical model interpretability (Das & Sun, 2016).

Methodology

One should consider the approach undertaken in for a single objective minimization of BIC for crash prediction modelling (Ahern et al., 2024). In this paper we extend this process, including heterogeneity in the means, correlated as decisions and search for models focusing on two objectives. BIC and RMSE. This is a complex approach and requires an efficient solution algorithm. As such, a metaheuristic solution algorithm was developed to wrap the modeling

decisions and explore the search for efficient solutions. Therefore, we performed an extensive search with this approach for data on Queensland's road highways. This data has records about historical crash counts, and 60 contributing factors, that could potentially explain these incidences, and thus serve as potential hypothesis for our framework. To see the output of the result, consider Figure 1.



Figure 3. Multi-Objective Crash Prediction Search, Guided by a Metaheuristic Solution Algorithm

Here, the metaheuristic algorithm searched for solutions and constructed a Pareto front, enabling analysts to explore trade-off solutions for efficient crash prediction modeling. The Pareto front is depicted by the red line. Additionally, the blue dots represent the validation metric, which was recorded to ensure that the model avoided overfitting. As such, the outputs of one of these models can be used to make inference on road-safety, and further provides analyst with multiple equally good models to consider drawing inferences from. For example, consider one of the solutions from the pareto front here in Figure 2.

Effect	t	Coeff	Std. Err	z-val	Р	
Constant	no	-15.46	0.30	-50.00	0.00***	
Shoulder Width (SW)	arcsinh	0.99	0.03	36.08	0.00***	
Urban Single Carriageway (US)	no	1.99	0.14	14.59	0.00***	
Rural Single, High Speed (RSHS)	no	4.23	0.21	20.52	0.00***	
Random Parameters						
Urban Single (US) (Std. Dev.) normal		0.08	0.03	2.77	0.01*	
RSHS (Std. Dev.) triangular		0.89	0.25	3.53	0.00***	
Heterogeneity in the Means						
AADT	arcsinh	0.81	0.44	1.85	0.07.	
Sharp Curvature (S Curve)	no	-0.85	0.09	-9.44	0.00***	
AADT: S Curve: (Std. Dev.) normal		0.09	0.04	2.25	0.02*	

Table 2. Poisson	Model, Fo	und by the	Proposed	Framework and	d Selected from	the Frontie
	,	•				

Conclusion

The introduction of an optimization framework marks a significant advancement in the analysis of crashes considering simultaneously a broad range of data and associated model characteristics. This framework employs a mathematical programming formulation to minimize two objectives BIC and RMSE to assist with model estimation and validation. Metaheuristic solution algorithms are used to efficiently search for effective and useful solutions. Effectiveness was

assessed using three real-world datasets and associated published models and analyses, confirming accuracy and efficiency in estimating crash frequencies at a lower cost compared to using conventional methods. The proposed framework is characterized by its ability to streamline the identification of suitable hierarchical modeling structures, reducing variable selection bias and circumventing less effective methods that might overlook key hypotheses. This process results in estimations that are both more accurate and efficient, enabling practitioners to derive critical insights from various road-related factors. For instance, the model displayed in Table 2 was developed using the proposed framework, which involved minimal human intervention. This streamlined approach allows analysts to effectively observe and interpret key insights that can influence road safety strategies.

Key findings from the model include observations such as increased shoulder widths correlating with a higher number of crashes. This may be due to drivers feeling a false sense of security and maintaining higher speeds or due to increased complexity in navigating wider areas. Additionally, the model highlights that rural single roads with higher speeds significantly contribute to the likelihood of accidents. Speed plays a critical role in crash severity and the reduced response time available for drivers to react to unexpected obstacles or road conditions.

Furthermore, the model examines the impact of sharp curvature combined with high Annual Average Daily Traffic (AADT). Typically, sharp curves are associated with an increased likelihood of crashes due to the challenges they pose in navigation and the potential for high-speed encounters. However, in densely trafficked areas, these curves often lead to naturally lower speeds as drivers exercise caution, potentially mitigating some crash risks. Moreover, roads in these areas are frequently designed with additional safety features to accommodate high volumes of road users, such as better signage, enhanced road markings, and effective barriers.

These insights are crucial for developing targeted interventions and enhancing road safety measures. By understanding the specific factors that contribute to road accidents, transport planners and safety engineers can implement more informed and effective strategies to reduce crash occurrences and improve overall traffic safety. This is very much more evident considering that the proposed framework proposes multiple models for an analyst to observe and draw inferences from, all whilst not requiring to be as involved in developing the model.

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Pedestrian safety interventions: effective "Safe System" and "Institutional Management" measures

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Abstract

This paper investigates the integration of "Safe System" and "Institutional Management" measures to enhance pedestrian safety in Australia and New Zealand, using a systems-based approach. Drawing on extensive research including literature reviews, surveys, and data analysis, the Austroads Project "Keeping People Safe When Walking" underscores the necessity for comprehensive strategies that address the multifaceted nature of pedestrian safety challenges. It advocates for the implementation of 54 key interventions, categorised under Road and Road Safety Management and Safe System approaches, highlighting the critical importance of speed management, infrastructure improvements, and the adoption of advanced vehicle technologies. The findings suggest that a holistic approach, prioritising pedestrian-centric urban planning and inclusive policy development, is essential. Collaboration among federal, state, and local governments, alongside active public engagement, emerges as pivotal for realising the Vision Zero targets, aiming for significant reductions in pedestrian fatalities and serious injuries by 2050.

Post on X

Discover how a systems-based approach integrating Safe System and Institutional Management measures can revolutionise pedestrian safety in Australia and New Zealand, paving the way to achieving Vision Zero targets. #PedestrianSafety #VisionZero

Introduction

Pedestrian safety issues in Australia and New Zealand are critical concerns that demand comprehensive analysis and targeted interventions. Austroads' project, "Keeping People Safe When Walking," among other objectives, focuses on evidence-driven interventions to enhance pedestrian safety across Australia and New Zealand. This research paper delves into these by synthesising a wide array of data sources, including literature reviews, online surveys, focus group discussions, detailed data analysis, trauma modelling, and in-depth interviews. With a goal to help eliminate pedestrian fatalities and serious injuries by 2050, the project developed a strategic framework for identifying and implementing effective pedestrian safety interventions through a systems-based approach, guiding various levels of governments across Australasia and other stakeholders towards significant reductions in pedestrian trauma. In the next sections of this abstract, we will introduce the key steps we took to systemically develop these interventions and recommendations.

Systems-Based Approach to Pedestrian Safety

According to Mooren and Shuey (2024), a systems thinking approach to road safety management is essential for a holistic and integrated strategy that addresses all road safety disciplines. This approach emphasises understanding and managing the complex interactions within the road environment to prevent road trauma. It involves comprehensive data collection, root cause analysis, and performance monitoring to proactively identify and eliminate systemic risks. The approach leverages lessons from other safety-critical industries, such as aviation and healthcare, to support a more dynamic and interconnected analysis of road safety issues. It calls for a paradigm shift from traditional, linear models to a more integrated and proactive framework, recognising that road safety involves continuous interactions among road users, vehicles, and infrastructure. This systems thinking promotes the integration of safety measures across all aspects of the road system, ensuring a collaborative effort towards achieving road safety targets.

A systems-based methodology is essential for enhancing pedestrian safety. Traditional methods, focused on singular aspects of pedestrian safety, are found to be inadequate in comprehensively addressing the complex and interconnected challenges in this domain. A holistic approach is imperative to highlight and investigate the intricate relationship between pedestrian safety and the broader transportation and urban system. A systems-based approach underscores the transition to proactive risk management, the integration of all components of the Safe System approach, and the use of data to inform strategies. Further, this approach examines the synergy between different pillars of the Safe System, the importance of inclusive design, comprehensive risk assessments, resource optimisation, continuous improvement, stakeholder engagement, and alignment with Vision Zero and Safe System principles. These aspects are not only crucial in justifying a systems-based approach but are also fundamental in guiding the effective development and

Implementation

Advancing Equity in

Pedestrian Safety Outcomes

implementation of pedestrian safety interventions. Based on the detailed analysis of the findings of the project, several specific insights can be drawn. **Table 1** presents these insights.

Table 1 Specific insights for a systems-based development of pedestrian safety interventions Title Description Proactive Risk Management Transition from a reactive to a proactive approach in pedestrian safety, focusing on predictive risk models and pre-emptive measures. Holistic Safe System Ensure integration of all Safe System components (Safe Roads, Speeds, Vehicles, People, Post-Integration Crash Care) in pedestrian safety strategies. Data-Driven Decision Leverage pedestrian data and travel patterns for developing effective safety measures and Making strategies. Universal Design in Safety Adopt an inclusive and universal design approach in developing pedestrian safety interventions. Measures Network-Wide Safety Shift focus from high-risk spots to a network-wide risk assessment for pedestrian safety. Assessment **Resource** Optimisation Strategically allocate resources for maximum impact in pedestrian safety enhancements. Continuous Improvement and Foster a culture of ongoing evaluation, adaptation, and innovation in pedestrian safety strategies. Innovation Collaborative Leadership and Involve diverse stakeholders and ensure strong leadership in guiding pedestrian safety Stakeholder Engagement interventions. Alignment with Vision Zero Utilise Vision Zero and Safe System principles as a foundation for pedestrian safety goals. Principles Systems-Based Approach Implement the Systems-based approach in pedestrian safety, integrating various elements of the

transportation ecosystem.

heightened risks.

Our findings align with systems thinking by emphasising the interconnected and proactive strategies necessary to significantly improve pedestrian safety. Proactive risk management/tools and data-driven decision-making facilitate the transition from reactive measures to pre-emptive actions. Holistic Safe System integration ensures that all components—Safe Roads, Speeds, Vehicles, People, and Post-Crash Care—are considered in a "complete" strategy. Universal design in safety measures promotes inclusivity, while network-wide and area-wide safety assessments shift focus from isolated high-risk spots to a comprehensive view of pedestrian safety. Resource optimisation and continuous improvement help effective and innovative interventions. Collaborative leadership and stakeholder engagement ensure that diverse perspectives and expertise guide the development and implementation (and troubleshooting) of safety strategies. Aligning with Vision Zero principles and advancing equity ensures that the most vulnerable pedestrians are protected, highlighting the essential nature of a systems-based approach to achieving significant reductions in pedestrian fatalities and injuries.

Pedestrians, inherently more vulnerable than car occupants, encompass subgroups facing

Key Findings on Effective Safe System and Road Management Interventions

In this section, an analysis of effective interventions for enhancing pedestrian safety is presented and detailed under the two categories of Road and Road Safety Management, and Safe System. This distinction is critical as the key pedestrian safety issue is not just about knowing what interventions to make under the Safe System approach, but also how changes and actions under Road and Road Safety Management are crucial to enable and support these Safe System interventions.

Building upon the systems-based approach introduced in the previous section, this chapter synthesises findings from a variety of sources, including literature reviews, focus groups, surveys, and interviews. These sources have been collated to emphasise the multifaceted nature of pedestrian safety interventions and the necessity for an integrated approach. The chapter provides a structured breakdown of 54 key interventions aimed at improving pedestrian safety (32 under Road and Road Safety Management, and 22 under the Safe System). Under the Safe System approach, our project provides a comprehensive analysis of various Safe System pedestrian treatments and their effectiveness in reducing pedestrian Fatal and Serious Injury (FSI) crashes, and FSIs. This synthesis focuses on the critical aspects of the analysis, emphasising key interventions across the Safe System pillars - Safe Roads, Safe Speeds, Safe Vehicles, Safe Road Users, and Post-Crash Care - with particular attention to those with significant potential for reducing pedestrian fatalities and serious injuries across Australia and New Zealand.

The methodology, informed by **Error! Reference source not found.**, involved an in-depth examination of various pedestrian safety interventions, drawing from diverse sources to evaluate their effectiveness. It incorporates crash reduction metrics, implementation types (site, area, or systemic), and alignment with pedestrian safety under the Safe System framework. This synthesis critically reviews these aspects, extracting and highlighting the most impactful interventions.

Key Safe System Components to Drive Significant Reduction in Pedestrian FSIs

- 1. **Safe Speeds**: Alterations to speed limits, supported by speed management infrastructure and vehicle technologies like Intelligent Speed Adaptation (ISA), show substantial FSI crash reduction. Lower speed limits are crucial as they provide increased reaction time and reduce crash severity.
- 2. **Safe Roads**: Infrastructure improvements are key, with a particular emphasis on treatments like raised safety platforms and mid-block raised pedestrian crossings, which effectively reduce vehicle speeds and align with the Safe System collision speeds.
- 3. **Safe Vehicles**: Technologies such as Autonomous Emergency Braking (AEB) and Intelligent Speed Adaptation (ISA) significantly enhance pedestrian safety.

Supportive Safe System Components

- 1. **Safe Road Users**: Interventions like enforcement of drink-driving laws, and assumption of driver fault in pedestrian collisions, and speed limits enforcement play a supportive role.
- 2. **Post-Crash Care**: While critical for minimising the consequences of crashes, it is more about response and care post-incident, thus not directly contributing to the reduction of crashes themselves.

The synthesis of literature reviews, focus groups, online surveys, in-depth interviews, and workshops with Austroads Members highlighted the complexity and multifaceted nature of Safe System interventions, and the importance of institutional management to enable them. The necessity for a cohesive system integrating components such as policy, regulation, infrastructure development, public education, and stakeholder engagement was emphasised, illustrating that these interventions form part of an overarching framework aimed at embedding safety principles in all aspects of road use and management.

Our institutional management improvement recommendations to improve pedestrian safety can be categorised into several thematic areas:

- 1. **Data-Driven Approaches**: The importance of utilising crash data to inform safety interventions was highlighted, as seen in recommendations for data-driven safety analysis and continuous pedestrian safety evaluation.
- 2. **Policy and Legislation**: Numerous recommendations focused on integrating pedestrian safety into policy and legislation. This includes walking legitimacy in urban policy, pedestrian safety in transport policy, and the development of pedestrian-specific legislation.
- 3. Urban Design and Planning: A significant emphasis was placed on designing urban spaces with a pedestrian focus, including pedestrian-focused urban design, pedestrian priority in planning, and the integration of pedestrian safety in new developments.
- 4. **Funding and Resources**: The allocation of funds and resources was identified as crucial for implementing safety measures, such as funding pedestrian infrastructure.
- 5. **Partnerships and Collaboration**: Establishing partnerships and fostering community involvement were seen as vital for the success of safety initiatives.
- 6. Educational and Behavioural Changes: Recommendations highlighted the role of education and behaviour change in improving safety, including pedestrian safety campaigns and inclusion in school curricula.
- 7. **Technology and Innovation**: The adoption of advanced technologies and innovative solutions like pedestrian detection systems and innovative pedestrian crossings was emphasised.
- 8. **Special Considerations for Vulnerable Groups**: Tailoring interventions to cater to vulnerable populations, such as the elderly and children, was deemed essential for a comprehensive approach to safety.
- 9. **Infrastructure Development**: Investment in pedestrian-friendly infrastructure, such as crosswalk enhancements, pedestrian-only zones, and connected pedestrian network (to key pedestrian destinations and public transport facilities), was recommended to create safer, more connected urban environments.
- 10. Evaluation and Continuous Improvement: Continuous assessment and refinement of safety measures were stressed, underlining the importance of adaptability and responsiveness to emerging challenges.

Our institutional management improvement recommendations align with systems thinking by emphasising a holistic and data-driven approach to pedestrian safety. Data-driven approaches leverage crash and fatal/serious injury data for continuous monitoring and evaluation, enabling more effective interventions. Integrating pedestrian safety into policy and legislation ensures that safety considerations are embedded in urban planning and transport policies, promoting a systemic shift towards safer urban environments, precincts, activity centres, etc. Urban design and planning with a pedestrian focus create inherently safer spaces and road/street stereotypes, aligning infrastructure development with safety goals. Allocating funds and resources strategically optimises impact, ensuring that financial investments translate into tangible safety improvements. Partnerships and collaboration help create a robust approach, engaging diverse stakeholders in the shared goal of enhancing pedestrian safety. Embracing technology and innovation introduces advanced solutions that can preemptively and cost-effectively address safety risks. Special considerations for vulnerable groups and cohorts ensure that interventions are inclusive and equitable, protecting those at higher risk. Continuous evaluation and improvement maintain the adaptability of safety strategies, ensuring they evolve in response to emerging challenges and data insights, and the results of Pedestrian Safety Performance Indicator monitoring. This comprehensive approach, rooted in systems thinking, aims to create a safer and more pedestrian-friendly urban environment using enhance institutional management practices.

Future Directions for Pedestrian Safety

For Australia and New Zealand to transform pedestrian safety and realise a future where walking is an integral part of societal well-being, it is crucial to create an inherently safe walking environment. This vision contributes not only to mental and physical health but also to wider societal benefits including decarbonisation, climate action, social cohesion, urban quality of life, and a reduction in noise and pollution. To achieve the ambitious Vision Zero targets—a 50% reduction in pedestrian fatalities and serious injuries by 2030 and their complete elimination by 2050—immediate and decisive actions are imperative. The current trajectory must shift to prevent unmet targets and a potential decline in pedestrian safety amidst emerging issues.

The Keeping People Safe When Walking Project has charted a reasonable path forward, highlighting substantial improvements in pedestrian safety data and delineating effective interventions within the Safe System and Road and Road Safety Management frameworks. This body of work underlines the urgent need for a comprehensive suite of actions to protect all pedestrians, with special emphasis on the most vulnerable groups including children, the elderly, individuals with disabilities, and First Nation pedestrians. Implementing a curated package of proven Safe System interventions—including aspects like Safe Speeds, Safe Roads, Safe Vehicles, and Technology—coupled with robust Road and Road Safety Management strategies, can lead to a reduction in pedestrian fatalities and serious injuries in Australia and New Zealand by 70-90% by 2050.

It is a pivotal moment for Australia and New Zealand to wholeheartedly embrace and implement the strategies recommended by the Keeping People Safe When Walking project. The journey towards zero pedestrian fatalities and serious injuries requires not just vision, but action—action that starts today.

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The Planning for Zero Framework: Develop Your Pathway to Zero

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Abstract

This workshop provides a practical, structured pathwayto systemically apply Safe System and institutional management interventions to achieve 2030 and 2050 road safety targets. This interactive workshop will introduce Austroads' "Planning for Zero Framework," a cornerstone of the "Charting a Path to Zero" project. A key objective of the workshop is to help delegates methodically examine the Framework and its processes–especially as applicable to their role and local context– to:

- identify potential gaps and improvement areas how to develop practical, effective pathways to Zero
- explore the appliocaion of the Frameork to guide their future practices and strategy/action plan developments.

Working in small groups, participants will put the framework to the test, engaging in comparative gap analyses and collaborative Zero Pathway development exercises that will build a deep understanding of the Framework's application in their respective contexts and provide the Framework's architects with valuable feedback.

Post on X

Join us at ARSC 2024 for our workshop on Austroads' Planning for Zero Framework. Discover how to apply this novel framework to enhance your own road safety strategy development and implementation work, and create effective pathways to eliminate serious road trauma.

Introduction

Around 1,500 people lose their lives each year in road crashes in Australia and NZ. Another 40,000 people suffer serious injuries each year. The current trends of road fatalities and serious injuries in both countries are upwards.

Austroads project, *Charting a Path to Zero*, aims to help enhance road safety management and strategy development across Australia and New Zealand to achieve 2030 and 2050 road safety targets. In Stream 1 (there are three streams), key road safety terms and their definitions were investigated, and Safe System End States and systemic risks were identified through the review of previous works. Systemic and safety gaps were assessed using available jurisdictional analyses, and these assessments were validated and benchmarked against available data and expertise. Enablers and blockers of road safety progress were evaluated, leading to the development of the Planning for Zero Framework intended for implementation across Australia and New Zealand. Furthermore, generic jurisdictional and government-level circumstances, enablers, and blockers for the framework's implementation were identified.

Charting a Path to Zero will support road safety management, strategy development, change management, investments and life-saving impacts across Australia and New Zealand over the next decade.

This interactive workshop plays a pivotal role in promoting the Planning for Zero Framework among the broader road safety community. Although representatives from Austroads member jurisdictions are already familiar with and supportive of the Framework, the workshop is essential for catalysing change and encouraging widespread adoption of this effective tool.

Facilitator

Dr Hafez Alavi is Austroads Project Manager for the Charting a Path to Zero Project. He is the Pricnipal and Transport Lead of HA Consulting, and has over 22 years of experience in the fields of road safety, injury prevention research, transport planning and sustainable mobility in the public/private sectors and the academia. He was a key contributor in strategising, planning, developing, delivering, and evaluating the Victorian Government's ambitious Towards Zero Strategy and Action Plan, amongst other national and international road safety strategies. He is a regular guest speaker at national and international road and transport safety conferences and has multi-disciplinary communication skills to forge lasting relationships with key stakeholders and the community to drive transformational agendas. Hafez has run numerous interactive workshops (in person and virtually), and is adept with a variety of techniques to elicit effective participation and contribution in his workshops.

Workshop leaders

Jessica Truong is a tireless road safety advocate/practitioner, and her international work includes leadership roles with the Towards Zero Foundation and the Global New Car Assessment Program, and road safety target management and strategy development.

Dr Johan Strandroth has advised many countries and jurisdictions around the world in road safety target management and strategy development. Methodologies developed in his research are the foundation of the analytical framework and target management system for Sweden's Vision Zero road safety strategy.

Kenn Beer is one of Australia's most active Safe System practitioners. His extensive knowledge has contributed to road safety guidelines and training across Australasia and internationally.

Interactive workshop description

- Workshop Open & Icebreaker
- Deep Dive into Charting a Path to Zero
 - Mini-presentations on:
 - Key Terms and Definitions (Zero Harm; Serious Injury; Network Safety Plan)
 - Proposed Safe System End States, Current States, and Systemic/Safety Gaps
 - Key Enablers and Blockers: Technical and Institutional Management
 - Proposed Planning for Zero Framework
- Breakout Session 1: Compare and Gap Analysis
 - Compare the Planning for Zero Framework with respective jurisdictional road safety strategy and road safety planning frameworks.
- Breakout Session 2: Develop a pathway
 - Develop a pathway to adopt the Framework in different jurisdictions
- Call to Action
 - Articulate the Call to Action with a powerful, motivating closing statement that emphasises the critical role participants play in achieving zero road trauma

Analysing crash data: Is empirical Bayes the best method?

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Abstract

Estimating reliable causal estimates of road safety interventions is challenging, with a number of these challenges addressable through analysis design. Current preferred crash analysis method is the empirical Bayes (EB) before-after analysis but requires complex bespoke analysis and may not be the best performing method. I compare the EB with negative binomial generalized linear mixed models (NB-GLMM) for analysing treatment effects in crash data. Data were simulated using an idealized randomized controlled design varying treatment effects, overdispersion, and sample size. The NB-GLMM performed best, maintaining type I error rate and providing unbiased estimates. Standard EB methods were too liberal and often biased. Incorporating mixed-effects into the EB procedure improved bias. Using a "standard" NB-GLMM with an interaction term is sufficient for crash analysis, reducing complexity compared to bespoke EB solutions. Future studies and case series should consider this simpler approach that requires the same data as the empirical Bayes.

Post on X

Mixed-effects models better for crash analysis! Outperforming the empirical Bayes method.

Introduction

Estimating reliable causal estimates of road safety interventions possess a number of challenges. Central to the problem is that analyses are on retrospective observational data, with the assignment of an intervention to a site made on the basis of the road authorities' decisions. Usually, this means treating sites with the highest number of fatal or seriously injured (FSI) or other crash metric at a snapshot in time. This is not ideal from a causal perspective - observational studies using sites selected for treatment based on crash rates results in problems estimating the causal effect due to:

- Selection bias and regression-to-the-mean
- Unknown confounding
- Endogeneity

Indeed, regression-to-the-mean is practically guaranteed when the baseline event rate is used to allocate sites to treatment (Senn, 2011). This has been repeatedly shown (Bland & Altman, 1994; Gross et al., 2010), such that there is considerable angst by statisticians across all literature where this occurs. The road safety crash literature has echoed these sentiments. As one of the flagship methods for road safety crash analysis, the empirical Bayes (EB) before-after design has been noted to address many critical confounding factors that are present in simpler designs, including regression-to-the-mean due to selection bias (e.g., Choi et al., 2018)). Though, it can never be a complete solution. For example, Wood & Donnell (2017) state "*The weighted average of reported and predicted crash frequencies accounts for selection bias when the treatment selection was based on reported crashes from the period before the treatment was implemented, but it does not account for all initial differences (before-period) between the treated and reference groups*". Other simulation studies and "null-treatment" studies have consistently shown that EB crash modification factors (CMFs) may not be as accurate as anticipated (Kuo & Lord, 2017; Lord & Kuo, 2012).

Other methods may perform as well, or even better, than the EB, and may be more easily implemented. For example, an "off-the-shelf" negative binomial mixed-effects regression model using the interaction contrast between treatment grouping (i.e., reference/control vs treated sites) and time with respect to the intervention (i.e., pre- vs post-intervention) may perform as well as the EB.

Aim

I compare different incarnations of the EB method and contrast this with mixed-effects regression and hybrid approaches for crash analysis. Simulations are created that mirror a treatment Program commonly applied by road authorities allowing the characterization of each method's bias, and type I and II error rates. A subset of the analysis is presented highlighting the performance of the methods under an ideal randomized allocation to treatment scenario.

Methods

Simulation Design

The study was a simulation study of commonly observed crash data at sites that will be eventually treated. The simulation was run 1,000 times for each parameter combination. crash data for 2000 sites were simulated using:

- Intercept (or base crash rate): the beta coefficient for the intercept (i.e., β_0) was set at -7
- *Traffic volume*: site traffic volume came from a uniform distribution between 200 and 20000 with a growth rate of 2% per annum. The volume coefficient (β_I) = 0.7, as seen in crash studies (Albrecht et al. 2022; 2023).
- *Yearly trend*: The coefficient for year (i.e., β_2) was set at -0.05.
- *Random or site-specific intercepts*: for each site, the random intercept effect was taken from a normal distribution with mean = 0 and SD = 1
- *Treatment effects*: the treatment coefficient (β_5) was set at five values a null effect of 0 (or odds of 1), 20% decrease and 25% increase (or odds of 0.8 and 1.25), and 50% reduction and doubling (or odds of 0.5 and 2).
- *Dispersion parameter*: we explored the outer ranges using three values on a half-log scale 3, 10, and 30
- *Sample size*: EB studies typically have between 10 and 30 treatment sites, usually with a larger number of reference sites proportional to the number of treatment sites. We simulated sample sizes across a half-log scale of 10, 30, and 100 treatment sites with double the number of reference sites (i.e., 20, 60, and 200).

For the ideal scenario (sites randomly allocated to treatment), sites from the top 4*N_{Treat} ranked candidate sites were selected using baseline crashes (i.e., top 40, 120 and 400 sites). A "biased" scenario was conducted but not presented. For treatment sites, post-treatment crash counts were calculated using the Time (pre vs post) by Treatment interaction.

Statistical Analysis

EB method: The EB before-after method uses a weighting of predicted and actual crashes to account for various biases. Briefly, it requires estimation of a safety performance function using a negative binomial model. The dispersion parameter α from the negative binomial model is used to generate weights (W) for each site:

$$W_i = \frac{1}{1 + \alpha * \lambda_i^{before}}$$
 1

Where, $\alpha = 1/\text{dispersion}$ parameter. Weights are used to calculate the expected number of crashes in the before period for each site *i* as a weighted sum of predicted and observed crashes:

$$Expected_i^{before} = W_i * \lambda_i^{before} + (1 - W_i) * Crash_i^{before}$$
2

Then the odds ratio, its correction, and the 95% CI around the corrected odds ratio are calculated. Interestingly, different formulations of the EB have been used and produce slightly different results (see results below). *Mixed-effects model:* The negative binomial generalized linear mixed model (NB GLMM) formulation adds a couple of features. First, site-specific random-effects are modelled, adapting the safety performance function to:

$$y_{i,t} \sim NB2(\mu_{i,t}, \mu_{i,t}[1 + \alpha \mu_{i,t}])$$
$$\ln(\mu_{i,t}) = \beta_0 + \beta_1 \ln(Volume_{i,t}) + \beta_2 Year_{i,t} + \delta_i + \epsilon_i$$
$$\delta_i \sim N(0, \sigma)$$

Where, the random effects usually follow a normal distribution, with mean = 0 and the standard deviation estimated. The mixed-effects model can be used in two ways. First, we can estimate a "Time by Treatment" interaction, e.g..: $\beta_0 + \beta_1 AADT_{i,t} + \beta_2 Year_{i,t} + \beta_3 Time_{i,t} + \beta_4 TreatmentGroup_{i,t} + \beta_5 Time: TreatmentGroup_{i,t} + \delta_i + \epsilon_i = 4$

Where, *Time* refers to whether the time is before or after the treatment implementation, *Treatment Group* refers to

whether the site is treated or control, and *Time:TreatmentGroup* is the interaction between the two variables and = 1 for sites in the post-treatment period in the treatment group. The second applies the mixed-effects procedure to the EB, with the advantage of incorporating site-specific intercepts, improving predictive ability.

Results

Type I error and bias of various crash analysis methods

Does the empirical Bayes (EB) method provide appropriate control for type I error for the effect of treatment when sites are randomised to treatment (effectively under the ideal scenario for inference)?

Figure 1 (above) presents the type 1 error results for the scenario with a null treatment effect and sites randomised. The straightforward interaction effect from the NB GLMM performs precisely at the nominal alpha of 0.05 for all combinations of parameters. By contrast, the standard EB is too liberal between 0.1 and 0.3. Hybrid mixed-effects regressions with the EB perform better.

What methods are biased under the null condition in a relatively ideal scenario, i.e., when sites are randomised?

3

Figure 2 presents the CMFs for the same randomised scenario. The NB GLMM interaction is unbiased for all combinations of parameters. By contrast, the EB methods are mildly biased towards showing effectiveness when there should not be any effect. Incorporating a mixed effects model into the EB procedure improves the bias.



Figure 1. Type I error of various empirical Bayes methods, negative binomial mixed model (NB GLMM), and hybrid methods. Only the NB GLMM performed consistently at the nominal alpha of 0.05.



Figure 2. Crash modification factor (CMF) biases estimation across the different methods. The NB GLMM is unbiased and hybrid methods also perform well.

Pathway forward

It is unnecessary to use a bespoke and complex EB solution when "standard" NB GLMMs are sufficient for crash analysis. The GLMM-NB model's interaction term performs the best out of all methods under the ideal circumstance of random allocation to treatment. Future crash analyses should strongly consider using this simpler approach to reduce analysis complexity. The data needs compared to an empirical Bayes are practically identical. Future studies may compare the full Bayes landscape.

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Benefit cost ratios in road safety evaluation and funding

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Abstract

Economic effectiveness of road safety treatments is an important component of the funding allocation process of both federal and states government. However, an economic analysis can only be as good as the analysis of crash reduction effectiveness. Further, the benefit-cost ratios that go into selecting a project site or location for treatment can differ substantially from how the project may be evaluated. For example, a BCR calculation used to justify the selection of a site for treatment may be derived from a naïve before-after analysis without control, but then analysed after implementation using a more robust methodology like the empirical Bayes before-after with control. Due to well-known issues in crash data analysis, the former will over-state the crash effectiveness and therefore the BCR, relative to a more methodologically rigorous approach. Thus, using better methodology may end up punishing road authorities with respect to funding, promoting a negative incentive to using better methodology.

Post on X

We highlight the downfall of using low-quality overly optimistic BCRs, how the current system punishes groups from shifting towards high-quality BCRs, but we propose a pathway forward to encourage more rigorous statistical approach.

Background

Economic effectiveness of road safety treatments is an important component of the funding allocation process. Applications for various Federal, State, and Local government schemes require certain criteria to be met. These criteria often include some justification of the expected benefit-cost-ratio (BCR) of the project. This presents the first negative incentive to proper methodology: finding the largest possible BCR to apply to a site will more likely result in that project being funded than a more rigorously applied and conservative BCR estimate. Agencies or individuals, who are rightly invested in improving road safety and trying to do the best for their respective communities, may not even recognise the poor methodology that provided the overly optimistic BCR. It is important to recognise that negative incentives are subtle and do not necessarily imply that the agent falling under the negative incentive is acting in any way improperly. Most likely, this is a knowledge deficit, more than anything else. At the heart of the knowledge deficits are the many issues that have surrounded crash analysis methodology for decades.

Crash effectiveness analysis

To perform a BCR calculation, the cost-savings of the intended or implemented treatment is estimated relative to the costs that went into implementing the treatment, i.e., the BCR is calculated by:

$$BCR = \frac{PB}{PC}$$
 1

Where, the dollar cost of crashes saved (Present Benefit [PB]) and the dollar cost of treatments (Present Costs [PC]) forms the numerator and denominator to calculate the BCR. The PC is often more easily estimated due to receipts. The PB though depends on reliable estimation of the crash modification factor (CMF) for that treatment.

There are guidelines for deriving quality CMFs (e.g., the CMF Clearing House website). The issues in road safety analysis and CMF estimation can be distilled into one overarching factor with several specific components that each contribute to analysis quality and inferential validity. The overarching factor is:

There are very few (practically no) high-quality <u>experimental</u> studies of road safety infrastructure treatments to derive high-quality crash modification factors for BCR calculation.

Practically all infrastructure research is observational/non-experimental. This means that we have no CMFs of road infrastructure treatments that are clearly unconfounded, even using complex statistical approaches, and which could be considered as "gold-standard" in some way. It is highly likely that the overall average of CMFs in use are overly-optimistic because the biases in such designs usually favour the intervention. This is clearly acknowledged in road safety literature, which identifies several methodological shortcomings affecting CMF calculation and therefore the BCR calculation, these can be summarised in different ways:

- 1. *Cross-sectional studies*: which take a snapshot of the road environment and aggregate crashes for analysis across multiple risk variables, are highly unreliable with respect to the derived CMFs (Hauer, 2010), and suffer profoundly from endogeneity biases (Elvik, 2011).
- 2. *Naïve before-after studies*: take the crashes in the before period and compare them to the crash count or rate in the after period, without making use of controls. These studies may or may not use statistical models to do so. These studies suffer from regression-to-the-mean, and lack of accounting for ongoing trends in the background (Bland & Altman, 1994; Choi et al., 2018; Senn, 2011)

We can categorise more specifically the problems as:

- 1. **Regression-to-the-mean and selection bias**: The issue of regression-to-the-mean has been detailed in statistical literature since the 1800s (Senn, 2011) crashes at a site are a combination of trend plus random fluctuations. Usually, sites are entered into a treatment program due to the number of crashes. But this could be a random fluctuation that will return to "normal" regardless of an intervention. The effect is magnified for low crash counts and overdispersion (B. N. Persaud & Hauer, 1984).
- 2. Failure to use control sites: The incorporation of controls is fundamental to all research. For road safety evaluations, the inclusion of control or reference sites allows several important confounders to be tracked and potentially corrected for, including any background trends that would either affect all sites on the network, or sites proximal to the treatment site. Importantly, questions of effectiveness should always consider effectiveness "with respect to" something, the best something for many reasons is contemporaneous controls that account for temporal changes alongside the treatment sites.

Low quality methodology and optimistic BCR calculations

In current road safety analysis, these broad methodological problems usually give rise to overly optimistic CMFs. Regression-to-the-mean inflates effectiveness quite directly as the CMF estimate contains the random pre-treatment fluctuation in the baseline estimate of crash rate, and this is expected to drop in the post-treatment period, generating an overly-optimistic CMF. An overly optimistic CMF directly creates an overly-optimistic BCR by inflating the Present Benefit calculation that is driven by crash-cost-savings (see Eq1).

Similarly, not using control sites will fail to account for the general ongoing trend of reductions in crash rates over time due to the landscape of road safety interventions that are applied at one time, including police operations, vehicle safety, educational campaigns, etc. As a methodological point, for crash analyses, there would appear to never be a situation where control data could not be used.

Better methodology and less optimistic BCR calculations

Knowing that experimental or randomised trials in road safety are sparse, statistical analysis methods in the field have been developed to address these problems. For example, the empirical Bayes (Persaud & Hauer, 1984), full Bayes (Persaud et al., 2010), and mixed-effects regression models, all with control sites have been proposed that (at least partially) account for the issues identified above. These methods also generally give more conservative (less optimistic) accounts of the road safety treatment, and so provide a better calibrated BCR to reality. For example, a systematic review and meta-analysis on the effect of red-light cameras on crash savings demonstrates lower crash savings in higher quality studies (Cohn et al., 2020), i.e., as biases are increasingly addressed in studies that evaluate treatments using empirical Bayes, the treatment effectiveness becomes more modest.

These statistical approaches are much preferred over the simplistic naïve before-after or cross-sectional approaches for generating CMFs (Cairney et al., 2012; Gross et al., 2010). Given their preference in the field for CMF calculation, and more accurate elicitation of the CMF, they should be used for estimating BCRs during funding requests for a program and in the evaluation of that program.

Uncertainty estimates for BCR calculations

Commonly BCR estimates are presented as a point estimate using the mean of the CMF parameter or a simple beforeafter difference. However, this omits important information about the reliability of the BCR and the expected range of outcomes of the BCR to funding bodies. They might wish to only support projects that are guaranteed to provide a more moderate effect for high-cost projects relative to a project that has an uncertain benefit. Similarly, they may be more inclined to accept low-cost projects that could have highly variable BCRs.

Pathway Forward

- Better quality CMFs need to be developed to have certainty that treatments are effective.
- High quality BCRs derived from high quality CMFs that use appropriate methodology should be used at the proposal stage to justify road safety projects.
- Naïve before-after CMFs created without controls should be very rarely used to justify a project without also either proposing a proper evaluation, and understanding that that BCR is inflated.
- High quality CMF methods should also be used at the evaluation stage.

• Estimates of the uncertainty of the BCR should be presented/provided at the proposal and evaluation stages, and these should be relied upon more than the single mean estimate of the BCR.

Ideally, we propose that BCRs used for project justification should use only higher quality CMFs from appropriate studies, and that the planning and evaluation stages appropriately reflect the quality of evidence that goes into producing a BCR. For example, the CMF Clearing House delineates explicit criteria for rating a study as high quality (https://www.cmfclearinghouse.org/sqr.php) based on factors such as: inclusion of appropriate control sites, a high number of crashes for the target crash type (>500), a large number of treatment and control sites (>50), includes traffic volumes, accounts for time trends, and whether the analysis uses an appropriate methodology to address regression-to-the-mean bias. A CMF and a resulting derived BCR developed on a data and analysis pipeline that obtained a high score on these features would go some way to enabling a more accurate perception of the BCR overall. On the other hand, a study with a low number of sites (<10), a low number of crashes (<100), no controls, no time-trend analysis, and a statistical approach that does not address regression-to-the-mean, could only offer a highly uncertain estimate of the BCR and should perhaps not be used to justify funding decisions given the substantial uncertainty, or at least have the uncertainty embedded in the decision-making process.

Given that this is not something that can be changed overnight, as it requires more studies using rigorous methodologies and statistical analyses to develop a more thorough suite of high-quality CMFs, the proposed pathway forward is two-fold.

Firstly, by openly discussing these issues we are reducing the knowledge deficit that may be present. This is important because without an understanding of the issue, people and organisations may not see the need or benefit from any change. One method to help make this shift more obvious is to provide a quality rating alongside any CMF and BCR reported. This is similar to the approach taken by the CMF Clearing House. This method would enable governments and organisations submitting funding requests to show both their higher lower quality BCR and the more conservative higher quality BCR. In this way they would not be needlessly punished (through lack of successful funding applications) for using more rigorous but more conservative high quality BCRs.

Secondly, in future, funding agencies could actually require BCRs and CMFs with higher quality scores to be used. Further encouraging both research agencies and government organisations to a) undertake road safety treatment and program evaluations using more rigorous design and this resulting in higher quality CMFs, which feeds back into the pool of higher quality CMFs to be used for funding applications, and then b) use these higher quality CMFs to calculate higher quality BCRs for their funding applications.

Although this is potentially a long journey of change, the first concerted steps on our pathway towards start today.

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Why so few randomised controlled trials in road infrastructure research?

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Abstract

Randomised controlled trials (RCTs) are widely regarded as the gold standard for evaluating the effectiveness of interventions, yet are rare in the field of road safety infrastructure evaluation research. While sophisticated methods have been implemented to address the fact that crash analyses are observational in nature, there is still no deep body of literature allowing us to calibrate these findings with unbiased and unconfounded designs. An increase in the use of RCTs in road safety infrastructure is necessary for improving the overall quality of evidence, reducing bias, and ensuring that resources are allocated to the most effective interventions. Increased use of RCTs could lead to more accurate estimates of intervention effectiveness, better-informed decision-making, and ultimately, improved road safety outcomes. While challenges exist, they can be addressed through careful planning. Such challenges are also often reasons *in favour* of conducting more randomised experiments.

Post on X

Let's do more randomised controlled experimental trials and raise body of evidence to improve road safety

Introduction

A recent paper by Elvik (2021) titled "Why are there so few experimental road safety evaluation studies: Could their findings explain it?", and riffing off earlier work by Hauer (2019), provocatively argued that they are not run because

"...negative reactions to the findings of experimental studies partly explains why there are so few of them and why they are rarely replicated. The desire for "positive" findings seems to be stronger than the desire for rigorous knowledge." (Elvik 2021, p5)

While the inventory of randomised controlled trials (RCTs) that Elvik pulls from clearly shows very modest, if any, benefits to road safety for an array of interventions (and below I will argue that this is to be expected from a rigorous design), I suspect (given some experience trying to propose and set up several infrastructure RCTs) that the problem of so few studies is more related to:

- 1. Insufficient knowledge of the problems that randomisation addresses. I.e., why run an RCT when we have before and after crash data that can provide the desired crash modification factor (CMF)?
- 2. Beliefs about "experimenting" on a population.
- 3. Unclear idea about how to implement a randomised controlled design and associated organizational inertia.

Why run RCTs? What problem does randomisation address?

Estimating reliable causal estimates of road safety interventions possess a number of challenges. We hear of various problems like:

- Selection bias and regression-to-the-mean
- Unknown confounding
- Endogeneity

Certainly, methods have been proposed that may at least partially address these issues, but the fact remains that we will never know whether we have captured the necessary information in order to alleviate these issues. These problems usually leave us with a considerable overestimation of treatment effects. Furthermore, simulation studies of the currently preferred empirical Bayes before-after crash analysis method, do not convincingly show sufficient minimisation of the confounding problem (Kuo & Lord, 2017; Lord & Kuo, 2012; Wood & Donnell, 2017). How can randomisation help with confounding?

The goal of randomisation is to:

- 1. Eliminate selection biases
- 2. Enable clear statements about the similarity of two (or more) groups with respect to the outcome of interest, i.e., without treatment we would expect both groups to have practically the same outcome.

Fundamentally, converting "irreducible complexity into error" (Dahly 2019). Note, it is not necessarily the goal of randomisation to create balance over some set of confounding variables that will influence the outcome, although this

will happen with a large enough sample size and appropriate randomisation mechanics. The goal is to "reduce to error" the likely outcomes of the groups had no intervention occurred.

This will provide the least biased and most accurate inference possible under a given set of conditions and constraints. As noted by Elvik (2021), this usually means a more subdued estimate of the effectiveness of the intervention compared to other methods.

One outcome from an increase in the number of RCTs in road safety is that we may better calibrate the findings from other methods of investigation. We may find that measuring traffic volume, along with a suitable analytical model is sufficient to provide minimally biased effects. But, currently, the inventory of studies suggests over-estimation.

An example treatment that could be easily adapted to an RCT design is the installation of red-light cameras. In a recent meta-analysis, studies with a higher risk of bias and less control of confounds show better outcomes for red-light cameras compared to higher quality studies, including differences in reducing right angle crashes and increasing rearend crashes (Cohn et al., 2020). Indeed, one of the conclusions from the review was:

"Policymakers and practitioners need to use evidence from better quality studies, particularly randomized controlled trials (RCTs)..." (Cohn et al., 2020, p. 4)

Is it ethical to experiment on a population?

Certainly, for a highly effective intervention that clearly reduces fatal or serious injury crashes, and running the trial might withhold treatment from necessary sites, the answer is clearly "no".

But, how many interventions possess these qualities? How many treatments are so clearly established? How often is it that we have the resources to treat all sites at once, instantly? What about the roll out of treatments that have more modest effects that possess only low-quality evidence?

In medicine, a drug would not usually be approved for an indication without a high-quality RCT (often requiring two RCTs, plus a series of preliminary investigations), even for severe and life-threatening illnesses. This is because the failure rate that occurs between low-quality pharmacoepidemiology, before-after trials, or pre-clinical research and the eventual high-quality large RCT is very high. This should give road safety research pause for concern – what is the failure rate between road safety observational (including before-after) assessments of interventions and clear unbiased assessments of interventions? Again, according to one of the few inventories of this, it is probably very low (Elvik 2021).

Given that we don't know the ultimate failure rate, and it is probably high, we can look at current road safety interventions implemented using low-quality evidence in a different light – most road safety interventions are already an "experiment" on the population. Worse, they're experiments where we often learn little about their actual effectiveness. This is a more ethically problematic situation than running RCTs or experimental trials.

Finally, implementing ineffective treatments, or treatments of unknown effectiveness, is problematic. Principally, it is wasteful and diverts resources from other more worthwhile interventions. Implementing interventions without rigorous evidence of their effectiveness is more ethically problematic than conducting well-designed RCTs.

Logistical and organisational inertia and RCTs

This, I believe, is a substantial problem. RCTs require planning and proper implementation to maintain their validity.

- Organisations may believe the ethical problems with respect to "experimenting" on the population which precludes them from running experimental studies. Often this is presented as a legal issue. "We must treat the high FSI sites", without also realising that predicting future crashes across equivalent sites is especially difficult.
- Expertise on the methods is locked away in separate groups who don't interact with each other.
- Funding is not available to pay for the appropriate expertise (if it exists) to design the trial.
- Funding is not available to pay for a Program of treatments that would enable a robust RCT

Running an RCT clearly increases overhead for a Program of treatments. There is unfortunately no way around this, but the overhead compared to the treatment costs is actually small and increasing implementation of these methods will eventually reduce overhead as organisations take on the role themselves. Furthermore, the implementation of an RCT can be made to work within the timeframes and budget of a Program. One of the best ways to implement an RCT in the current environment would be to randomise the order of sites to treatment, such that all sites on a list get that treatment, but they may get that treatment at different times. For example, if a low-cost treatment program was to be implemented over a span of several years, a random selection of sites could be treated each year, satisfying the core advance in trial design of randomisation. This leverages the constraint that it is impossible to treat everything at once.

Flow-on advances from considering RCTs

One of the major methodological improvements to medical clinical trials was the establishment of various preregistration repositories. We currently have little idea of the file drawer problem in road safety, and of other problems like p-hacking and "hypothesising after results are known" (HARKing). Indeed, road safety evaluations are commonly conducted in-house by government aligned organisations with no requirement to show or report on their own internally requested evaluations. In medicine, this was often in-house pharmaceutical clinical trials. The medical field saw this as a major problem and required registration of trials for them to be allowed to be conducted. E.g., the National Health and Medical Research Council in Australia requires all clinical trials run in Australia to be registered on the Australian Clinical Trials registry (or equivalent) before they are eligible for ethical approval. Unfortunately, all of this is bypassed in road safety infrastructure research, magnifying the file drawer problem and ensuring that evaluations do not receive the appropriate prospective consideration they deserve. This would substantially improve also the quality of evaluations, regardless of whether the evaluation proposed was an RCT or an observational study.

Pathway Forward

Conducting more RCTs and experimental studies in road safety infrastructure research would substantially improve the evidence base for the treatments we implement on the roads. We are currently beginning a small RCT of a low-cost treatment to reduce speeds. The treatment is an application of road markings on entry into townships where the speed drops to a safer speed for travel through the town. Before treatment application commences, we requested the organisation to provide a list of all possible sites that could be treated under the scheme. From this list, we randomised 50% of the sites to treatment using a random number generator. The trial has been especially helpful in understanding the different perspectives, conveying the utility of such a design, and appreciating the logistical aspects of such a design. For us, this was an ideal start due to the low-cost of the intervention and high uncertainty of the effectiveness of the intervention. Hopefully, this will be the thin end of the wedge that creates a culture of demanding higher quality evidence for road safety interventions.

We should integrate pre-registration of evaluations into federal and state government programs. I.e., these programs should mandate that in order to gain access to the funding, you register your treatment and evaluation pipeline on a central public repository, and must publicly report on the results at the agreed upon follow-up. This would reduce the file drawer problems inherent in existing evaluations and overall improve the reporting and conduct of evaluations even without requiring the running of RCTs.

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Developing a Rural Network Safety Plan for Victoria

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Abstract

The Network Safety Plan (NSP) is the next generation in road safety planning. The NSP is a network wide safety planning approach providing guidance on the future needs of any road section or intersection across the State of Victoria considering road infrastructure, speed limit setting and safe travel speeds and advancements in vehicle safety performance in the fleet. The plan creates a clear vision for how Victoria can progressively achieve its ultimate road safety trauma reduction targets.

Post on X

Victoria's Network Safety Plan is a planning approach providing guidance on the future safety needs of any road section or intersection across the state and creates a clear vision for how Victoria can progressively achieve its ultimate road safety trauma reduction targets.

Introduction

The <u>Victorian-road-safety-strategy-2021-2030</u> sets the ambitious target of eliminating death and serious injury from our roads by 2050. The Strategy is being implemented via a series of action plans of specific programs and initiatives. The Network Safety Plan (NSP) is a key initiative committed under the <u>Victorian Road Safety Action Plan 2021-2023</u>.

The NSP is the next generation in road safety planning. The NSP is a network-wide safety planning approach providing guidance on the future needs of any road section or intersection considering road infrastructure, speed limit setting and advancements in vehicle safety performance. The plan creates a clear vision for how the state can progressively achieve its ultimate road safety trauma reduction targets.

The NSP considers all corridors and intersections across Victoria, including state controlled and local government roads and will be delivered in two parts, with the first part being roads in rural areas.

Approach

The NSP is developed to leverage off of the Victorian <u>Movement and Place (M&P)</u> framework and its planning concepts to ensure consistency with other modal and network operation plans. The process of NSP development considers all Safe System elements within a single planning framework, with a strengthened focus on infrastructure, vehicle safety technology and speed management. The development of the NSP consists of six major steps which are outlined below.

- 1. **Determining systemic risks -** A network risk assessment is undertaken by analysing enriched trauma data to determine the systemic crash types that result in deaths or serious injuries (MAIS3+injuries). While crash circumstances are unique, the same crash types occur repeatedly.
- 2. **Defining the Safe System End-states** for each road stereotype. This step describes end states for various M&P road classifications, in combination of travel speed, infrastructure and modern five-star vehicle technology (2030), which as far as practicable, eliminate the risk of deaths or serious injuries as a result of road crashes.
- 3. Validating Safe System End-states to ensure that all systemic crash types will be addressed by achieving each end-state and clearly outlining any remaining residual risks/crash types.
- 4. **Network Gap Analysis** which quantifies the proportion of the network that currently does not meet the Safe System End-state requirements to inform the modelling of future trauma.
- 5. **Modelling future trauma** to inform different scenarios for investing in Safe System End-state infrastructure and associated speed management. This will include estimating the magnitude and nature of future residual risks and crashes that may result in death and serious injury.
- 6. **Generating key analytical outputs** from the NSP process, such as required investment levels and timing to deliver the estimated savings in deaths and serious injuries.

Results

Systemic Risk and Safe System End-States for Rural Roads

Victoria's M&P Framework and resultant road classifications were used to define rural road stereotypes. Using the movement categorisation of rural roads (as the place component for roads that are rural in nature is the lowest

classification and do not typically vary), Safe System End-states were developed for eight rural road stereotypes that categorise the entire Victorian rural road network. The Safe System End-state requirements for midblock and intersections varied by road stereotype, drawing on combinations of the following main infrastructure elements and speed limit settings:

- **High-speed, high movement function roads (100 or 110 km/h)** invest in Safe System aligned infrastructure to roads to allow safe travel with high mobility, such as continuous mid- and side-barriers to address head-on and run-off-road crashes, and control access from intersections and private properties.
- Medium movement function roads with existing 100 km/h speed limits Investing in a combination of infrastructure and reduced speed limits to 80 km/h (or 60 km/h on roads with poor alignment) to allow safe travel with good mobility. Infrastructure improvements include sealing of gravel shoulders, quality delineation and targeted side-barriers at locations of elevated risk of lane departure crashes.
- Lower movement function roads with existing 100 km/h speed limits Reduce speed limits to 70 km/h (or 60 km/h on roads with poor alignment and/or unsealed surfaces) to allow safe travel, within the capabilities of modern five-star vehicles. Minimal infrastructure improvements are required, except for quality delineation and highly targeted sealing of gravel shoulders and/or side-barriers at locations of elevated risk.

The following main intersection design forms were identified as meeting Safe System principles as well as being suitable, in aggregate, for a wide range of combination of road stereotypes:

- **Grade-separation** eliminates major conflict points (though some residual risk remains, such as involving heavy vehicles, motorcyclists, rear-end and side-swipe impacts). Grade-separation also requires Safe System-aligned intersections where on- and off-ramps meet the intersecting road.
- **Roundabouts** eliminate major points of conflict (i.e., locations within an intersection where road user paths intersect) by reducing the number of potential conflict points from 32 to just four, for a cross-road. Roundabouts also reduce travel speeds and create more favourable angles of conflict, thereby ensuring lower energy exchange when vehicles collide. Roundabouts take multiple forms, including compact, signalised, turbo, but are not recommended on M1 roads with speed limits above 100 km/h
- Left-in/Left-out only movements (with acceleration and deceleration lanes of adequate length and with safe and convenient U-turn facilities) limits impacts to 70 km/h and shallow angles, allowing energy at impact to be safely dissipated. To limit Impact Speeds to a maximum of 70 km/h, side-road vehicles must accelerate and join the major traffic stream with a speed differential not greater than 70 km/h
- Side-road closures eliminates conflict points and may be possible where traffic volumes are very low and/or traffic can be re-directed along an alternative route/s, with no or only minor inconvenience. Where the existing network allows a number of nearby intersections to be consolidated into fewer intersections, it may be possible/more affordable to provide high standard designs at remaining intersections
- **60 km/h platforms** reduce the amount of harmful kinetic energy exchanged in vehicle-to-vehicle crashes, provided drivers comply with speed limits. Ramp profiles that elicit the required travel speed of not greater than 60 km/h are needed to keep travel speeds within the Safe System Boundary Conditions for intersection crashes
- **60 km/h speed limits** –regulate legal travel speeds to avoid crashes outside the Boundary Condition for sideimpacts. Active ISA can assist with driver speed limit compliance, though additional measures, such as safety cameras, may be needed.

The above Safe System End-states, while broadly indicative of the outcomes of rural midblock safe-system end-states, have been specified in greater detail than can be captured within the restricted scope of this paper. These Safe System End-states, in combination with the expected improvement in vehicle safety performance, were developed to address as comprehensively as is practical the main systemic crash types characteristically leading to death and serious injury on each road stereotype. The systemic crash types for each stereotype were identified through the Systemic Risk analytical task and were based on 5 years of historic trauma on Victorian rural roads between 2015 and 2019.

For midblock sections, the main rural road systemic crash types present on rural roads were Head-on collisions (14% of rural road FSIs in Victoria), Run-off-Road crashes - rollovers or collisions with trees, poles, embankments, culverts or numerous other hazards in the roadside (54%), adjacent direction (mainly side-impacts) (12%) and Rear-end collisions (8%). For rural intersections, numerous high-severity crash types occurred at rural intersections, with the most threatening, common crash configuration involving adjacent directions (54% of FSIs and 56% of MAIS3+ injuries). Also problematic were run-off-road crashes (23% of FSIs and 23% of MAIS 3+), opposing direction collisions (10% of FSIs and 10% of MAIS3+ injuries) and same direction collisions (10% of FSIs and 8% of MAIS3+ injuries), which were mainly rear-end collisions.

While the proportions of deaths and serious injuries varied across the eight road stereotypes, these systemic crash types consistently accounted for 80-90% of all deaths and serious injuries on Victoria's rural roads.

Gap Analysis of the state-owned rural road network

The scale of gap between the current speed limit setting and infrastructure present on the Victorian rural state-owned network and the defined Safe System end-state is shown in the following table for both midblock sections and intersections. For midblocks, the scale of network gap is shown in kilometre (km) length and in addition to network length, VKT (vehicle kilometres travelled) is used to capture exposure in relation to network length which is a useful measure for understanding personal risk on the road network. For the state-owned intersection network, a single measure is used to assess whether each individual intersection meets the defined Safe System end-state or not. In this assessment, a state-owned intersection is defined as an intersection where any intersection leg is on a state-owned corridor.

	Meets Safe System	Does Not Meet Safe System	Total
State owned Network	1095 (6%) km	17,665 (94%) km	18760 km
State-owned Network	4.9 Billion (28%) VKT	12.8 Billion (72%) VKT	17.7 Billion VKT
All State-owned Intersections	1298 (8%) Intersections	15,940 (92%) Intersections	17,238 Intersections

Over time, as Victoria continues to invest on its network these metrics will continue to be updated to track network change over time. These insights are reflective of 2021 network infrastructure, traffic volumes and speed limits.

Validation and Modelling

The validation of the developed Safe System End-Sates is based on a case-by-case approach (Strandroth 2015) where real world crashes are used as a baseline, and for each crash the question is asked whether this crash would have resulted in a fatal or serious injury outcome if infrastructure treatments and vehicle safety technologies had existed in line with the Safe System End-states. Whereas the purpose of trauma modelling was to compare different pathways for implementing the Safe System End States by comparing the estimated trauma savings to 2050. The method used is described in Strandroth et al 2016 and was designed to estimate the combined future benefit of road safety interventions in different areas.

From a case-by-case assessment of 100 fatal cases and 109 MAIS3+ injury cases, the number of fatalities is expected to be reduced by 73%, and MAIS 3+ injured are estimated to be reduced by 58%, hence the reduction is greater for fatalities compared to MAIS 3+. The largest reductions of both fatalities and MAIS 3+ were found among car occupants which were estimated to be close to zero with the Safe System end states are implemented.

For the crash modelling exercise, three different implementation scenarios were developed. The Baseline Scenario aimed to show a business-as-usual development by extrapolating existing planned treatments and delivery rate to 2050. The Medium Scenario aimed to deliver the Safe System End-state in 2050 but was designed to focus more on speed and optimised delivery of infrastructure treatments. The High Scenario was designed to fully implement the respective Safe System End-states for rural roads in 2050 and included more infrastructure treatments with a faster implementation rate. It also delivered a faster implementation of speed limit reductions.

The crash modelling results showed that the Medium Scenario resulted in a 59% reduction of FSIs and MAIS 3+ injuries, and a 65% reduction of fatalities to 2050. It also resulted in an additional 3,847 FSI saved cumulatively to 2050 compared to the baseline scenario. In the High Scenario, the reduction is 61% of FSIs and MAIS 3+ injuries, and 67% of fatalities to 2050. The high scenario was also estimated to result in 4,818 FSI saved cumulatively to 2050 compared to the baseline scenario.

Conclusions

Victoria's NSP defines end-state visions aligned with the Victorian Government's target of eliminating serious road trauma by 2050. The process considers all Safe System elements within a single planning framework (i.e., the interactions between roads and roadsides, vehicle safety, road users and speed management), ensuring that the Victorian Government will be better informed on how to optimise road system investments over the coming 30-year period. Through the creation of these compatible combinations of road infrastructure, vehicle system functionality and travel speeds, Victoria's road network can by 2050 be progressively transformed to operate at near-zero risk of serious road trauma.

Validation of end-states and crash modelling of alternative investment scenarios indicate that up to three-quarters of all FSIs can be eliminated by 2050, through the combination of infrastructure, speed management and the gradual evolution of Victoria's vehicle fleet. A significant residual risk of FSIs remains (around 20-30% of today's level of FSIs), which requires further research and development to find additional high-impact system-based solutions. While Victoria's NSP has resulted in a high-quality, scientifically robust plan for future investment in road safety on the rural road network, the effective and efficient translation into practice of the plans will be crucial to Victoria's success in meeting the 2050 target.

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Ethnographic research with young risk-taking drivers

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Abstract

Young drivers have a high risk of road crash involvement, with nearly one in five (19%) of drivers who lost their lives in Victoria, Australia between 2017 to 2021 were aged between 18 and 25 (TAC, 2023). Therefore, there is still more work to be done to address the disproportionate burden of crash-related injury and death in young drivers. This research study uses ethnographic methods to produce unique insights into the attitudes and behaviours of high-risk young Victorian drivers aged between 18 and 25 years to understand the broader underlying tendency to engage in risk-taking. This in-depth qualitative research method has allowed ethnographers to observe and interact with participants in their real-life environment. The insights will inform the development of targeted road safety initiatives and campaigns for young people.

Post on X

Young drivers continue to be overrepresented in road trauma statistics. The TAC conducted ethnographic research with risky young drivers to examine the underlying factors behind their risk-taking. This research has produced unique insights into the attitudes, behaviours, and motivations for engaging in risky driving.

Background

Young drivers are more likely than older drivers to adopt risky driving behaviours. For young people, their lifestyle and their desire for thrill seeking may outweigh the perceived benefits of road safety. An Australian study of 797 drivers aged under 25 found that participants with high-risk perceptions and low sensation seeking demonstrate lower rates of risky driving behaviours including drink driving and driving while fatigued (Hatfield, Fernandes & Job, 2014).

The purpose of this research is to explore the context influencing youth risk-taking while driving and dissect the true complexities of these influences. This will aid in informing future approaches to improve the safety of young drivers. Using ethnographic methods, this research study specifically examine the attitudes, behaviours and motivations behind risk-taking.

The research focuses on key areas of driving and lifestyle behaviours such as speeding, drink and drug driving and media usage, and probe to understand the behaviours of the participants – how do they behave individually, as a group and with their peers. It specifically seeks to answer questions about risky behaviour (e.g., what 'risk' means to these individuals) and risky driving (e.g., what they think is risky when it comes to driving). Also of interest is their opinions and response to Government, Police and their parents. Lastly, it explores the young driver's perceptions of existing and potential road safety campaign themes to identify levers that can inform possible directions for future campaigns.

This research builds on the ethnographic studies conducted by TAC with young drivers in 2003 and 2013. Both studies offered important insights about the exacerbating factors associated with risky driving, possible communication routes and the role of social media and peer/parental influences. These insights have informed numerous TAC young driver programs.

Methodology

The TAC engaged Quantum Market Research to conduct this study. The study sample consisted of 12 participants in addition to 3 affinity groups. Males were deliberately oversampled in this study, due to this group traditionally reporting higher propensity for risk-taking. Participants were chosen from metropolitan and regional areas in Victoria.

Two stages of engagements were undertaken with participants: first, potential participants who met the screening criteria undertook an initial 40-minute engagement after completing an online personality quiz. Second, a half-day ethnographic emersion took place at the participant's home. This study was purposefully designed to be conducted over two stages to allow ethnographers to progressively elicit different perspectives, enhance the rapport building process and produce a multi-dimensional representation of the risk-taking

behaviour and its explanatory factors. These ethnographic engagements were filmed to produce multiple documentary style short videos that visually show case and provide insights about the real-life contexts of the risk-takers.

Outcome of the work

Overall, the findings from this research indicate that there are new challenges faced by Gen Z which exacerbate tendencies to look for release in driving. Behaviours like hooning and speeding have a high degree of intentionality and emotional payback. By contrast, driving tired and using a mobile phone are more inadvertent or automatic behaviours. On the other hand, getting a driver's licence and a car is a celebrated milestone for these high-risk young drivers as they see the car as their domain, which leads to resistance to rules and a sense of entitlement while driving. Overall, young people in this research indicated that driving and their vehicle serves as a means for escape, or for personal development not found in traditional educational settings.

High-risk young drivers are also selective about risks and partaking in risky driving does not necessarily mean that these young people have an excessively disrupted life in general, or that high risk-taking is sought in other aspects of life. High risk young drivers come from across the socio-economic spectrum. However, low school engagement was common among participants and often led to seeking an outlet in the car as they seek alternative avenues for achievement and approval to overcome feelings of social exclusion. Additionally, risk-taking behaviour may be driven by a desire to prove themselves and overcome feelings of social exclusion or marginalization experienced during their teenage years.

Furthermore, results from this study indicate that parents are key to driving attitudes, and for this cohort, perceptions of their fathers being a 'risk taker in his youth' creates permissibility and aspiration. Importantly, peers and social circles then normalise risky driving behaviours to the point that young drivers can be shocked to find out those who drive like them are in the minority.

Finally, findings from this research suggest that deterrents from risky driving are common across the group with fear of losing freedoms; negative impacts on employability; concern about hurting others and desire to avoid fines and demerits are key. High-risk young drivers are diverse in background and interests so reaching them as a collective is a challenge. Social media is one common space, and interactions with police are also common.

Implication for policy and/or practice; Road safety benefit

Beyond the insightful findings that this research has produced, there are other additional values in terms of thinking, provocation and empathy produced amongst policymakers and communicators exposed to the research. While viewing the documentary style short videos, audiences were able to transcend their own worlds and be immersed into the participants' world. This process has generated empathy and a strong rapport with the participants and helped expand/transform the worldview of the audiences. The stories shared by our research participants convey an intuitive understanding and were powerful in their ability to provoke new thinking and engagement. This research has proven that ethnographic engagements can be an effective way for policymakers to unpack their own values and help them see the issues from the point of view of their target audience. Ultimately, this ethnographic research was a very different and unique way for professionals working on young driver safety policy, programs or communication to engage with, discuss and understand some of the underlying issues and/or factors involved with risk-taking by young drivers.

Conclusion

Young people commonly underestimate the consequences of risky behaviour and overestimate their capability to manage the risks. Victorian youth continue to be over-represented in road trauma. Therefore, this research used ethnographic methods to develop a deeper understanding of the crash risk factors, motivations, attitudes and behaviours of a high-risk group of young drivers. This kind of approach was quite different to conventional qualitative research. Overall, the research has provided unique insights that have broadened our understanding of why young drivers engage in risky driving behaviours. Thus, these insights gained will be used to inform ongoing work with young drivers.

The final results including segments of the documentary style short videos will be presented at the conference.

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Road user behaviour and safety on left-turn slip lanes

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Abstract

Left-turn slip lanes are widely implemented to alleviate traffic congestion at signalised intersections, but their effects on safety are not known well. This study proposes a game theory-based approach to examine vehicle-pedestrian interactions and associated crash risks on left-turn slip lanes by applying Artificial Intelligence (AI)-based video analytics. A total of 48 hours of video data were collected from two signalised intersections in Brisbane. The driver-pedestrian interactions were modelled by logit models, and subsequently, the associated crash risk was estimated by applying a game theoretical approach with both Nash equilibrium (NE) and Quantal Response Equilibrium (QRE). Results show that vehicle speed, pedestrian distance from approaching vehicle, and pedestrian occurrence significantly influenced interactions between pedestrians and motorists and associated crash risks measured in terms of traffic conflicts. This study demonstrates the potential of the game theory in capturing road user interactions and estimating associated crash risks.

Post on X

Dive into the world of traffic dynamics! Discover how game theory captures road user interactions on left-turn slip lanes using AI and econometric models to shed light on road user behaviour and safety.

Background

Left turn slip lanes are integral components of traffic infrastructure, designed to optimise vehicular flow and alleviate congestion. However, concerns persist regarding their impact on pedestrian safety, necessitating a deeper investigation into this critical issue. Recent research has highlighted the complexity of interactions between pedestrians and motorists within slip-lane environments (Muley et al., 2017; van Haperen et al., 2018). Between 2011 and 2020, statistics from Queensland, Australia, unveiled a total of 179 fatal and severe injury crashes involving pedestrians and left-turning vehicles at slip lanes (Government, 2022). Despite this, there remains a notable gap in understanding the joint behaviours of pedestrians and motorists, particularly in slip lanes equipped with zebra crossings (Muley et al., 2017). Addressing these gaps is crucial for enhancing pedestrian safety. Therefore, this study investigates the complexities arising from pedestrians' and drivers' beliefs about each other's actions at left turn slip lanes to estimate conflict risk and confusion to enhance pedestrian safety.

Methods

Drawing upon recent advancements in video analytics and artificial intelligence, this research analysed 48 hours of video data captured by roadside cameras at signalised intersections featuring left-turn slip lanes. Data collection was conducted in the metropolitan area over two consecutive weekdays, from 6 am to 6 pm each day, at each slip lane. Through artificial intelligence-based trajectory extraction techniques shown in **Error! Reference source not found.** and detailed insights into the interactions between motorists and pedestrians, 1,538 interactions were obtained, facilitating a nuanced understanding of safety dynamics. Leveraging findings from previous studies (Li et al., 2023; Zhang & Fricker, 2021), relevant variables were identified to elucidate their impact on pedestrian crossing and driver yielding decisions by developing a random parameters logit model. Additionally, a novel game theoretical framework for non-cooperative, non-zero-sum, and strategic game, incorporating Nash equilibrium (NE) and Quantal response equilibrium (QRE), was introduced to model road user behaviour and estimate conflict risk at crossing points. Cross-validation was conducted to evaluate the effectiveness of the QRE and NE framework in modelling interactive decisions. The dataset was divided into an 80/20 split, with 80% of observations utilised for model calibration and the remaining 20% for verification testing.

Results

This study investigated pedestrian-vehicle interactions on slip lanes using three logit models (Fixed, Random and Random parameter logit model with heterogeneity in mean) and compared two game theoretical models considering Nash Equilibrium (NE) and Quantal Response Equilibrium (QRE) for their prediction accuracy with observed data. The random parameters logit model with heterogeneity in means provided a better model fit than its counterparts with lower AIC and BIC values and larger McFadden pseudo-R-squared values, revealing significant factors influencing drivers' and pedestrians' crossing decisions. Drivers were less likely to yield to pedestrians at higher speeds ($\beta = -1.543$, p < 0.001) and when pedestrians initiated crossing from the curbside ($\beta = -0.836$, p < 0.05). Conversely, drivers were more

likely to yield when the distance between the vehicle and pedestrian increased ($\beta = 0.173$, p < 0.05). For pedestrians, they were less likely to start crossing when vehicle speed was higher ($\beta = -1.648$, p < 0.001) and when initiated crossing from the curbside ($\beta = -0.791$, p < 0.05). Pedestrians were more likely to start crossing when the distance between approaching vehicle and pedestrian was higher ($\beta = 0.181$, p < 0.05).





Figure 4. Trajectory profile of different road users in one of the slip lane sites

Figure 2. Speed profile of different road users

The estimated logit model was used within the game theory with Nash Equilibrium (NE) and Quantal Response Equilibrium (QRE). The QRE model outperformed the NE model in predicting pedestrian and driver decisions. It achieved higher precision (0.93), recall (0.98), F1 score (0.96), and accuracy (0.93) compared to the NE model (0.92, 0.89, 0.91, and 0.84, respectively). The QRE model also exhibited lower Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) values, indicating its ability to closely approximate observed pedestrian crossing and driver-yielding behaviours shown in Table 2. Results indicate that QRE outperforms NE in predicting both P_{cross} and P_{yield} values, as measured by RMSE and MAE metrics, suggesting that QRE offers more accurate insights into pedestrian crossing and driver-yielding decisions. The QRE model estimates of crossing and yield probabilities were used to calculate conflict risk as (P_{cross} *(1 - P_{yield})). Results suggest that slip lanes of this study are associated with 5.8% conflict risks for pedestrians, implying that an average of 6 pedestrians (\approx 5.8) out of 100 will be involved in traffic conflicts on those slip lanes.

Table 2. Comparison of observed values with QRE and NE considering five-fold cross-valida	tion.
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			RMSE		MAE	
	Pcross	Pyield	Pcross	Pyield	P _{cross}	Pyield
Observed value	93.56%	92.78%		-		-
Quantal response	94.44%	93.76%	2.2*10-4	2.6*10-4	8.8*10 ⁻³	$1.0*10^{-2}$
equilibrium						
Nash equilibrium	92.54%	90.92%	2.5*10-4	4.7*10-4	9.8*10 ⁻³	$1.8*10^{-2}$
$\mathbf{D} = \mathbf{D}_{robability} \circ \mathbf{f} \mathbf{C}_{ro}$						

 $P_{cross} = Probability of Cross$

 $P_{yield} = Probability of Yield$

Benefits to road safety

A game theoretical framework provides a valuable method for understanding the complex interactions between pedestrians and motorists in left-turn slip lanes. This analytical approach shows potential for uncovering the inherent conflict risks. The proposed framework can help identify pedestrians road crossing ambiguities across various types of slip lanes (e.g., uncontrolled, give-way controlled, raised platform with pedestrian priority controlled, and raised platform with give-way controlled slip lanes). Moreover, a framework predicting pedestrian crossing intentions in such scenarios has significant implications for developing automated vehicle systems in a connected environment. By enabling automated vehicles to discern pedestrian intentions accurately, proactive decisions can be made to yield and prevent conflicts, ultimately enhancing safety in such situations.

Implications for policy and practice

With the help of the developed model, policymakers, practitioners, and stakeholders can effectively deploy appropriate types of left-turn slip lanes in signalised intersections to ensure pedestrian safety. These findings hold significant

implications for policy formulation and practical implementation, guiding decision-makers towards safer urban traffic safety.

Conclusions

The findings indicate that vehicle speed, pedestrian crossing start location and the distance between pedestrians and approaching vehicles significantly influence pedestrian crossing decisions and driver-yielding behaviour. The Quantal Response Equilibrium (QRE) model outperformed the Nash Equilibrium (NE) model in predicting these decisions. Additionally, QRE-based game theoretical approaches offer a promising avenue for modelling pedestrian-vehicle interactions and estimating crash risks associated with interacting road users.

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Road safety for women public transport users in LMICs

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Abstract

Road safety in middle- and low-income countries is a major concern and this is a challenge especially for disadvantaged groups. This paper discusses issues affecting the transport and mobility needs of women in LMICs and how gender intersects with a range of other factors to impact on safety, use and engagement. The study assesses the women's safety in public transport and examines its gender inclusiveness in Mekelle, Ethiopia. Mixed research method was instrumented; exploratory and confirmatory data analysis for quantitative data, and thematic analysis for qualitative data was utilized to obtain the findings. Over half of women respondents (51%) have faced gender-based harassment in one form or another while using urban public transport in the city. The bulk majority of harassment was reported to have been performed by conductors followed by passengers. Ethical training, awareness creation and strict rule enforcement are recommended as a mean to alleviate.

Post

Women in LMICs face a series of gender-based violence when using public transport that negatively impact their freedom of movement, to note that one out in two women public transport users in Mekelle faced harassment is alarming.

Introduction

Road safety in low- and middle-income countries (LMICs) remains a major concern. Due to the relatively rapid motorization of transport in LMICs increase in traffic exposure is expected, it is imperative to better understand the underlying mechanisms of road safety. More LMICs take the position to develop a road safety strategy which is connected with their strategic development goals, and by looking the transportation system as a whole. This policy implies the creation of urban and rural development patterns which stimulate the use of public transport, walking and cycling as a primary mode of transport and which support vibrant, diverse and liveable communities (World Bank, 2021).

A policy of improving public transport facilities and making urban and rural areas more attractive for walking and cycling should be based on a road safety strategy that focuses on the protection of vulnerable road users. This paper discusses issues affecting the transport and mobility needs of women in middle- and low-income countries and how gender intersects with a range of factors to impact on safety, use and engagement. The study is intended to stimulate discussion and identify areas key issues around equitable and inclusive transport provision, including patterns of transport use, safety and security, solutions and policy directions, measuring access and inclusion, policies and strategy. The study assesses the women's safety in public transport and examines its gender inclusiveness in Mekelle, Ethiopia.

Road transportation safety issues rate highly as a challenge especially for disadvantaged groups globally. However, understanding who is the most severely affected, remains challenging (Kuneida & Roberts, 2006). Globally, there have been increasing efforts to address inclusion and ensure 'no one is left behind', culminating in the Sustainable Development Goals (SDGs), with the aim of equity for all by 2030 (PIARC, 2023). While all 17 goals are linked to social sustainability and yet ways and means to achieve these objectives remain diffuse. This is particularly the case for gender-based analyses and policy-making. In the field of road safety and transport, the issue gets further complicated in the Global South (Kett & Turner, 2020).

The overall aim of the research project is to investigate gender inclusiveness in public transport with particular reference to the safety of women public transport users in Mekelle city. The transport safety concern of women especially in low-income countries (LIC) is critical not only crush accident but also exposure to gender-based violence/harassment. Thus, this general objective can be further broken down into the specific objectives of women's daily mobility experience and mode of transport choice, exposure to safety risks such as harassment, perpetrators of harassment, reaction to harassment, their level of satisfaction and possible improvement mechanisms are investigated.

Method

Mekelle, the capital city of the national regional state of Tigray, is the second-largest city in Ethiopia next to Addis Ababa, with 51% women in a population of more than half a million. Transport in the city is composed of both non-motorised (66.5%) and motorised (33.5%) (Gebre, 2018). The urban public transport services in the city covers, see Figure 1, City bus (5.3%), Mini-bus taxi (35.2%) and three-wheel Rickshaws/Bajaj (41.4%). Of the three modes of

transport, the Mini-bus taxi is most dominant in the city as a means of formal public transport. Significant portion of the Bajaj/Rickshaws serves as informal or unregulated transport means.



Figure 1. Different type of public transport vehicles in Mekelle city

This study on women's safety in urban transport comprises a two-pronged approach of primary data collection using various quantitative and qualitative methods, and reviewing relevant existing literatures using systematic review. Mixed research method was instrumented; exploratory and confirmatory data analysis for quantitative data, and thematic analysis for qualitative data was utilized to obtain the findings, and extract evidences from the data. Besides, systematic review was also used to strengthen the findings of the study.

The exploratory data analysis of quantitative survey questionnaires is predominantly made use of simply to summarize and characterise the safety and nature of inclusiveness of public transport to women and women with special needs. A confirmatory data analysis, chi-square independence test, was used to determine whether two categorical variables of interest and the contingency coefficient was also computed to know the magnitude of association between the two attributes. The qualitative data obtained from KII, IDI, FGD and participant observations (PO), collected to consolidate and enrich the evidence from survey.

Results

Women's safety in the urban public transport sector is a function of various factors. This includes inclusiveness and convenience of mode of transport to women, awareness of laws by service providers and service users, adherence to laws by service providers and related issues. The age, marital status and educational level of women public transport users can be associated with varying degree of vulnerability to harassment at different times.

Women have particular purpose and reasons for the choice of particular mode of transport which translates into proximity, cost and efficiency. The choice of mode of transport naturally varied among women of different demographic characteristics, Mini-bus taxis are the main transport frequently used (81%) by the women respondents in the city. Respondents also reflect the main reason for choosing the mode of transport to travel from a place to another in the city is affordability (52%) followed by efficiency (31%). The result also suggested that safety and comfort are problems of these mode of transport. This goes in line with the fact that only 6.5 % of the women surveyed indicated they choose the specific mode because of its safety.

Public transportation plays a crucial role in women's daily activities, without it their economic and social interactions are at risk. However, from the survey study, it is observed that over half of about 700 women respondents (51%) have faced gender-based harassment in one form or another while using urban public transport in the city. To note that one in two women transport users in Mekelle faced harassment is disturbing. One of the participants in the study characterised the situation as follows:

"When I thought of using a public transport, I could only wish that the fellow passenger ... beside me to be a woman or an old man. It seems it is a must to be verbally harassed if you are female passenger. If I don't give a positive response to them, they insult and discourage me. Such harassments were common and happened in my everyday life."

From the ethnographic survey it is found that most of the harassments tends to be verbal and were exercised in the form of insults, teasing and mockery. During the in-depth interviews one of the interviewees pointed out that she has to pay more money because of her body size: "*You are fat. You need to pay more!*" insulted by the conductor. The bulk majority of harassment was reported to have been performed by conductors (37 %); followed by the passenger (24 %), the remaining accounts to passer-by, drivers, station managers and beggars.

Respondents in the study were also indicate about their reactions when they get harassed by another person or group of persons. Most of the women (about 42 % of respondents) do nothing as a reaction to harassments they encountered. However, a good proportion of the respondents (32 %) said they would confront the offenders head on, one way or another. Attempts were made to see differences in reaction to harassment by educated and uneducated women. The assumption that educated women are likely to become assertive to react to harassment is not supported by evidence, a

greater number of those who are highly educated (i.e., over 44 % i.e., 72 out of 162 of those who have degree and above) also choose to keep silent and non-reactive to the offences.

The majority of women covered in the study (51.2 %) expressed their dissatisfaction with the current service provision and safety in the public transport. To assess the practice and experience how to deter the problems of safety and security, respondents of the survey were also asked what kind of measures they would suggest to improve the safety of women in public transport. Over half of the respondents, in aggregate, believed women's safety in the public transport can be alleviated through ethical training, awareness creation and strict rule enforcement mechanisms as illustrated in Figure 2.



Figure 2. Respondents' suggestion to improve women's safety in public transport

Benefits for road safety

Road safety is considered as part of the major global development agenda and SDGs. One was integrated into SGD 11.2 "By 2030, provide access to safe, affordable, accessible and sustainable transport systems to all, improved road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations...". One of the 9 clear recommendations proposed in the Academic experts group report for the third Ministerial Conference in Stockholm on Road safety (Stockholm declaration, 2019) is – modal shift from personal vehicles toward safer mobility. Cities and urban areas must afford new ways of safe mobility like public transit, walking, cycling, clean and adequate sidewalks and safer streets. Provision of safe public transport benefits to reduce motorisation and improve road safety.

Implications for policy and practice

Strong institutions to monitor and evaluate the existing, different laws on safety and security with strong emphasis on investigating incidents on women harassment in the public transport in Mekelle city (similar to many LICs) should be put in place and strengthened. Currently, though there are institutions, they are not functioning effectively in respect of their capacity, personnel and autonomy. In addition, the existing institutions seems to have the problem of coordination. One of the results of this research was developing a draft policy brief. The policy brief aims to serve as a vehicle for providing evidence-based advice to government policy makers and other stakeholders to make informed decisions.

Conclusions

Public transport in Mekelle city is unsafe for women commuters, one in two public transport users encounter harassment one or the other. The major factors that adversely affect women's safety in public transport are poor status of road infrastructure, gender insensitive service provision, repressive cultural norms and values, poor awareness of women's rights etc. Incidents of gender-based violence are common but rarely reported because of repressive cultural norms and weak legal and regulatory frameworks.

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AusRAP Star Rating using aiRAP Methodology

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Abstract

Following the announcement of α iRAP by iRAP in 2019, and a pilot study to investigate the potential use of LiDAR and 360° imagery for autonomous extraction of AusRAP features, Main Roads Western Australia partnered with Anditi in 2023 to deliver the world's largest α iRAP project to date. Main Roads has collected LiDAR using mobile laser scanning for the entire, ~20,000km, of Western Australia's state road network. Using artificial intelligence and machine learning we extracted and coded features in the road corridor according to the emerging α iRAP framework. The extracted features were used to obtain AusRAP Star Ratings for all state roads. Star Ratings form an important basis to support improvements and treatment decisions; the results will help us find the best pathway forward to reduce trauma on our state road network. Here we share the learnings from this project including data collection, feature extraction, assumptions, estimations, and resulting Star Ratings.

Post on X

Main Roads Western Australia provides insight on innovative project to AusRAP Star Rate the WA state road network using aiRAP methodology.

Background

iRAP Star Ratings provide an objective and proactive way to assess a road's safety performance based on the physical characteristics of the road environment, as well as road user flows and speeds. Historically, iRAP Star Ratings have been undertaken by manually coding video and street images in accordance with iRAP specifications. Manually video coding a road network is expensive and prone to human error. In 2019, iRAP announced the introduction of α iRAP, accelerated and intelligent RAP data collection, and coding. According to iRAP (2023) ' α iRAP seeks to use existing stores of readily available commercial and open-source data (including LiDAR, video, and satellite data) and automated data analytics techniques including machine learning and artificial intelligence to deliver 'accelerated and intelligent' RAP data for Australia and the world to use'. The implementation of α iRAP has the potential to reduce error, time and effort required to undertake reliable, repeatable, and scalable road safety assessments.

Interestingly, in the same year, in the quest to move away from using manually coded data for its AusRAP Star Rating assessments, Main Roads piloted a study to investigate the potential use of LiDAR and 360° imagery for autonomous extraction of some AusRAP features. The pilot project used 2,000 km of off-the-shelf LiDAR and 360° imagery data purchased from TomTom, and from this dataset successfully extracted roadside hazards, barrier types, and median types which are critical road features in developing AusRAP Star Ratings. Following the success of the pilot project, Main Roads in 2022 embarked on a new project, the Network LiDAR Project, to 1) collect LiDAR using mobile laser scanning for the entire, ~20,000km, of Western Australia's state road network, 2) procure a web-based portal to access and interact with the resulting 3D point cloud and imagery data and 3) use artificial intelligence and machine learning, to extract and code AusRAP road features according to the newly emerging α iRAP framework.

Noting that the use of this LiDAR technology and the automated feature extraction process is currently the largest α iRAP initiative in the world, there have been collaborations with several stakeholders with many lessons learnt. In this study we therefore share the learnings from this project including data collection, feature extraction, assumptions, estimations, and resulting Star Ratings.

Data collection, feature extraction and Star Rating

Two sources of LiDAR and 360° imagery data were used. TomTom provided off-the-shelf MoMa (Mobile Mapping) LiDAR and imagery data covering initially ~4,000km of the state road network. Data on the remaining ~14,000km of state roads was procured through the Main Roads Survey & Mapping Panel Contract, conducted by 5 panel contractors. All data procured as part of the project is hosted in the Main Roads LiDAR Portal, where it was accessed for α iRAP feature extraction.

The extraction and coding of road features to α iRAP file specification and format from LiDAR and 360° imagery was undertaken by Anditi. A total of 44 attributes (excluding location information fields) were extracted by Anditi. It took approximately 8 months for Anditi to complete the α iRAP coding of the WA state road. A large part of this time was taken in developing and refining algorithms that matched the intent of the iRAP coding manual such that results using

αiRAP methodology would be compatible and comparable to Star Ratings developed using traditional methods. Some of this involved discussion and approval by iRAP itself. Now that these algorithms have been refined it is expected that future extraction and coding would be much faster. Additionally, in consultation with Main Roads and iRAP, Anditi developed a data dictionary of refined definitions for AusRAP Star Rating attributes. The automated extraction of features as used for αiRAP requires definitions of each of the Star Rating attributes to be sufficiently defined to enable each attribute to be coded without relying on human judgement. The data dictionary provides clarity regarding the definitions used for each of these features and makes this information available both for Main Roads staff but also for other jurisdictions who may wish to use αiRAP methodology in future.

Internally, Main Roads worked on obtaining reliable data on 17 other AusRAP features not provided by Anditi (again excluding location information fields). These features are mostly to do with vulnerable road user flows, vehicle flow, and operational speeds. Discussions are still ongoing on whether vulnerable road user flows will be estimated using iRAP-Pre-processor or other estimation techniques utilised previously by other jurisdictions. Vehicle flows were extracted from Main Roads corporate database. Vehicle speed values were provided by Compass IOT. Compass IOT is a cloud-connected in-vehicle data provider that capture information about vehicles (e.g., cars, buses, trucks) including speed, braking, swerving and G-forces every ~3seconds across the entire network. The resulting data for these 17 features were merged with the data from Anditi to achieve a complete AusRAP ViDA compatible ready file. Star Ratings for the four road users (vehicle occupants, motorcyclists, pedestrians, and bicyclists) were developed for the entire WA state road network.

Lessons Learnt

The win-win lesson

LiDAR mapping provides contemporary, accurate road network data that can improve the overall quality of information used to manage the network, as well as allowing the validation and cleansing of existing information. Having better data also improves the quality of investment decisions across Main Roads and delivers considerable benefit across our business. There was therefore great interest in the project from various departments such as Network Management, Heavy Vehicle Services, Project Development, Asset & Geospatial Information, Environmental and even Occupational Health & Safety, and Fleet management. Without the buy-in from other areas, the initial cost of the project may not have had corporate support for a solely road safety purpose, however, given the huge range of business areas that gained a benefit from various aspects of the Network LiDAR Project the result was a win-win-win, meaning it was the obvious pathway forward.

The quality of data lesson

Data obtained from LiDAR is of high quality compared to video survey leading to accurate feature identification for extraction. The LiDAR data is uploaded to the Main Roads LiDAR Portal and cloud storage. This online platform generates a user interface for the obtained point cloud data that could be interrogated and annotated by internal users (not publicly available). Also, the 3D portal allows users to navigate the roads online and validate search query results if necessary. Finally, the LiDAR point cloud data allows hazards such as bridges, trees, and other overhead hazards to be accurately measured remotely which significantly reduces travel, traffic management and surveying costs while still producing high quality outputs. Figure 1 gives an example of the quality and utility of coloured point cloud that is generated from LiDAR and 360° imagery compared to video recorded output of the same section of road in WA. The coloured point cloud is effectively a high-resolution digital twin of the road network that can be used to accurately measure lane widths, width and reflectivity of line markings, height and exact location of safety barriers, clearance heights etc.

The manual/automation of features lesson

The iRAP coding manual was developed with the focus on human coding of the necessary features and relied heavily on human judgement and interpretation. One major lesson from this project is the level of definition that is required to automatically identify and differentiate attributes and attribute sub-categories in a logically consistent manner. The use of remote sensing data such as LiDAR enables a much higher level of accuracy and consistency to be achieved but does require detailed definitions for each attribute and the iRAP logic that guides the Star Rating process. Key learnings have involved how to train algorithms to make decisions that were previously made by humans to achieve the same or a better outcome. The use of data from 6 different suppliers added to the complexity of this project. In some instances, attributes such as road condition which is categorised into good, medium, and poor could not be reliably determined from LiDAR and 360° imagery that was captured under a range of lighting and weather conditions using different LiDAR scanners and camera systems. This is further complicated by the fact that the functional application of definitions of good, medium, and poor to determine if remedial action is required can also vary between developed and developing countries or even across different jurisdictions. It is therefore particularly challenging to train an algorithm to be as close as possible to being globally consistent.



Figure1: (Left) Coloured point cloud from LiDAR; (Right) Photo imagery.

Benefits and Implication for road safety

The quality and utility of road data is vital to effectively undertake road assessment and implement appropriate countermeasures to eliminate road crashes. By using LiDAR technology, feature extraction is done autonomously using the 3D point cloud data to accurately pinpoint and measure road and roadside characteristics and hazards. This significantly removes the degree of manual intervention and potential for human error. The detailed data obtained from the project allowed Main Roads to conduct an AusRAP Star Rating assessment of the entire state road network in line with our obligation under the National Road Safety Action Plan. Furthermore, Star Ratings form an important basis to support improvements and treatment decisions; the results are vital in helping us find the best pathway forward to reduce trauma on the state road network.

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Smart phone usage and road crashes among university students in India

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Abstract

This research study investigates the relationship between smart phone usage while driving, driving history, and involvement in road crashes among 372 students enrolled in a university in India. Utilizing descriptive statistics, correlation analysis and principal component analysis, the study examines parameters of smart phone usage on driving behavior and its association with road crash. Results reveal that students with a history of road crashes exhibited a positive relationship with smart phone usage while driving while principal component analysis identified two factors with distracted driving being majorly influenced by texting and calling while driving. These findings underscore the importance of addressing distracted driving among young drivers in India. Policy implications include the implementation of stricter regulations on smart phone use while driving, educational campaigns to raise awareness about the dangers of distracted driving, and initiatives to promote responsible driving habits among university students. Such measures are essential for enhancing road safety and reducing the incidence of crashes among this demographic.

Post on X

This study examines use of smart phones while driving among 372 university students in India, revealing a positive correlation between smart phone usage and road crashes. Findings emphasize the need for stricter regulations, educational campaigns, and initiatives to promote responsible driving habits among young drivers.

Introduction

Road safety is a major public health issue in India due to alarming rise in road crashes and fatalities (World Health Organization, 2015). Globally there has been a 5% reduction but India's numbers continue to rise with number of road crash deaths being reported as 1,53,792 as per Government of India statistics in 2022, nearly 28% increase from the last decade (Ministry of Road Transport and Highways, 2022). Road injury has been leading cause of death among males aged between 15 to 39 years of age while it was second leading cause in the same group for both gender (Dandona et al. 2020). With the proliferation of smart technology and increasing vehicle ownership, distractions like texting, phone use, and multitasking have become prevalent among drivers, especially young ones. One cannot undermine a significant influence of smart phone usage on road crashes and injuries. Therefore, studying distracted driving behavior in the Indian context is essential for understanding its prevalence, identifying risk factors, and informing evidence-based policy interventions to enhance road safety. Such studies can also raise awareness among the public and promote a culture of responsible driving, ultimately reducing the incidence of crashes and saving lives on Indian roads.

Research studies indicate a pressing need for distracted driving studies in India due to its significant impact on road safety. A systematic review and meta analysis study on assessment of smart phone addiction among Indian adolescents revealed that smart phone addiction magnitude in India ranged from 39% to 44% cautioning for severe negative health risks and harmful psychological effects (Davey and Davey, 2014). One of the studies on smart phone usage on driving based on naturalistic driving data revealed strong correlation between distracted operations and driving control behavior (Zhang et al., 2019). Because of the limited research available concerning young drivers in India, this research study was initiated to address this gap in understanding.

Method

A sample of 372 drivers, consisting of both two-wheeled and four-wheeled vehicle riders/ drivers was chosen for the study. Recruitment was conducted on a voluntary basis, with drivers opting to participate in the study. Participants were administered survey designed to collect data on aspects of distracted driving related to smart phone usage. Participants were asked to provide information regarding their driving experience, including years of driving, their smart phone usage, history of receiving traffic challan (tickets) and any prior involvement in road crashes. Collected data was analyzed using descriptive statistical techniques to characterize the prevalence and nature of distracted driving behaviors among the sample population. A Cronbach's alpha reliability coefficient of 0.85 was reported suggesting a high level of internal consistency among the items in the measurement instrument used in the study. Statistical analyses, such as correlation coefficients and principal component analysis were employed to explore the relationship between distracted driving behaviors, driving history, and involvement in road crashes. Prior to participants were provided with information regarding the study objectives and its purpose. Informed consent was obtained from all participants. Confidentiality and anonymity of participants' responses were ensured by the researcher.
Results

The research study examined the relationship between smart phone usage while driving and road crashes among university students, accepting the alternate hypothesis indicating a significant positive relationship (Table 1). Results of Principal component analysis identified two factors, distracted driving was majorly influenced by texting and calling while driving (Figure 1). Listening to music and using navigation systems were identified as positive behaviors, and did not influence driving in a negative way. Conversely, engaging with social media, browsing the internet, or using dating apps, among other activities, were recognized as negative behaviors contributing to driver distraction.

Analysis of demographic characteristics revealed that a majority of the respondents involved in road crashes were aged between 18-20 years, predominantly female and unmarried. Most participants were graduates, with some pursuing post-graduation studies. Notably, approximately 77% of respondents were riding two-wheelers, with varying levels of driving experience, ranging from less than two years to 6-10 years. Smart phone usage patterns indicated that a significant proportion (more than 50%) of respondents spent considerable time on their phones daily. Surprisingly, only half of the participants held a valid driving license, highlighting a potential regulatory issue. Although the majority claimed to have knowledge of traffic rules while driving, a notable portion lacked this understanding. These findings underscore the urgent need for interventions targeting distracted driving behaviors and enhancing road safety awareness among university students.

Table 1: Correlation coefficient table showing relationship	of following variables with in	nvolvement in road crash
while driving	_	

Variables	Correlation Coefficient (r)	p-value
Received traffic ticket from traffic police on violation of traffic laws	.132*	< 0.05
Using texting while driving on smart phone	.071	.171
Calling while driving on smart phone	.064	.218
Using social media on smart phone while driving	.173**	<0.01
Using email on smart phone while driving	.187**	< 0.01
Using dating app on smart phone while driving	.130*	< 0.05
Browsing internet on smart phone while driving	.188**	< 0.01
Using video on smart phone while driving	.155**	< 0.01
Gambling on smart phone while driving	.139**	< 0.01
Playing music on smart phone while driving	.110*	< 0.05
Using navigation on smart phone while driving	.055	.290

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed).



Figure 1: Scree plot derived from Principal Component Analysis

Benefits to road safety

The study helped in identifying specific smart phone usage behaviors that contribute to road crashes among university students, such as texting, browsing social media, or using navigation apps while driving. Understanding these risk factors is crucial for developing targeted interventions to mitigate distracted driving. Findings from the study could be used to raise awareness among university students about the dangers of smart phone usage while driving. Educational campaigns based on research evidence can effectively communicate the risks associated with distracted driving and encourage safer behaviors behind the wheel. Certain behavioral interventions can also be advocated. The study results can influence policy makers to draft regulations reducing smart phone related distractions while driving and help develop technological solutions to address smart phone-related distractions, as well as smart phone apps designed to minimize interruptions while driving. This research has the potential to significantly improve road safety outcomes by informing interventions at individual, societal, and policy levels hence influencing at both macro and micro levels.

Implications for policy and /or practice

The study results could inform the development of policies and regulations aimed at reducing smart phone-related distractions while driving. For example, policymakers may consider implementing stricter laws or penalties for using smart phones while operating a vehicle. Moreover, it will serve as a valuable tool for increasing awareness about the consequences of distracted driving within road safety initiatives.

Conclusions

This study sought to shed light on the factors associated with distracted driving behaviors among drivers in India, with the aim of informing the creation of focused interventions related to calling and texting while driving to enhance road safety. The road safety awareness program can also highlight the significance of involvement in crash due to distracted driving. However, it is important to acknowledge a limitation of the study: the potential for self-reporting bias, where respondents may have provided socially desirable responses, impacting the accuracy of reported distracted driving behaviors.

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Fatality risk versus impact speed for frontal car crashes

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Abstract

Frontal crashes, including head-on and run-off-the-road crashes, are one of the most dangerous crash modes that typically occur on undivided rural roads without safety barriers. The Safe System Approach recommends setting a speed limit of 70 km/h for a 10% fatality risk based on Wramborg's (2005) impact speed versus fatality risk curve for a head-on crash. Wramborg (2005) does not provide any evidentiary basis to this value. Nevertheless, a review of published frontal impact crash data reveals that the impact speed for a 10% fatality risk ranges from 50 km/h to 69 km/h for head-on car crashes and 55 km/h to 82 km/h for frontal crashes. Given this large speed variation from prior studies, it was decided to conduct a comprehensive study to find a more representative relationship between fatality risk and impact speed, which can then be considered by regulators for setting survivable speed limits on undivided rural roads.

Post on X

A 10% fatality risk by impact speed ranges from 50 to 69 km/h for head-on car crashes, and 55 to 82 km/h for frontal crashes using all available real world crash data. This compares to the Safe System Approach's 70 km/h speed limit for rural roads.

Introduction

Impact speed is a primary determinant of injury outcomes in road transport crashes. Speed management including the setting of speed limits is at the core of a forgiving road transport system (Austroads, 2021). Based on the Decade of Action for Road Safety, one of the targets in 2030 is to halve the number of deaths and significantly reduce the number of injuries, most of which are speed-related (WHO, 2021).

The recommended speed limit for a single carriageway, undivided rural road, without any road safety barriers, according to the Safe System Approach (Austroads, 2021) based on Wramborg's (2005) proposed 10% fatality risk is 70 km/h for a head-on crash. However, there is no evidentiary basis for choosing this value presented by Wramborg (2005) or indeed other researchers, despite this speed limit being proposed for such roads (GRSP, 2008; NRSS, 2022). Moreover, it is common to see rural roads in Australia such as the examples shown in Figure 1, where the speed limit is set to 100 km/h. A crash into a tree, such that the entire kinetic energy of the crash is dissipated by the frontal crush of the vehicle, i.e. a velocity change (delta-V) for the vehicle occupants of 100 km/h, is not survivable.



Figure 1. Rural roads in Australia where the speed limit has been set to 100 km/h.

A systematic review of published real world crash data by the Authors, where the injury risk curves for head-on carinto-car crashes were examined, has revealed that an impact speed of around 50-69 km/h was equivalent to a 10% risk of fatality (Ayuningtyas et al., 2023). However, using a similar method, real world crash data from previous published studies for more general run-off-the-road frontal crashes that include impacts into a fixed object such as a tree, needs to be determined. Therefore, the purpose of this paper is to repeat such a systematic review albeit specifically for car/SUV run-off-the-road frontal crashes to establish an evidentiary based fatality risk versus impact speed curve that could be generally considered when setting safe speed limits on rural undivided roads with or without safety barriers of the type shown in Figure 1.

Method

A systematic literature review was conducted to determine the fatality risk versus impact speed for run-off-the-road frontal car crashes into fixed objects. The inclusion criteria of articles for this study were: (1) all types of occupant vehicles (car, SUVs, automobile) involved in a single vehicle run-off-the-road frontal car crash with a fixed object that did not rollover; (2) studies that provided the impact speed (delta-V) as well as fatal and non-fatal injury outcomes; (3) drivers and occupants were wearing a seatbelt. Seven electronic databases (Scopus, Web of Science, PubMed, Embase, IEEE Xplore, CINAHL, and Compedex) were searched to identify relevant studies. Records were assessed and reviewed by two of the authors with a third author acting as an adjudicator, in adherence with the PRISMA statement (Page et al., 2021). Relevant crash data will be using a random effects logistic regression model and will be used to determine the 10% probability of fatal outcome and impact speed for general frontal crashes. Full text studies will be included if they report sufficient summary statistics or raw crash data.

Delta-V was used as a speed parameter in this research, as delta-V has been considered the most reliable estimate of crash severity in crash reconstruction analysis. It is a measure of the severity of a traffic collision, defined as the change in velocity between the immediate pre and post-crash velocity of a vehicle (Shelby, 2011). Additionally, EES (energy equivalent speed) could also be used for the estimation of delta-V in this study. The 10% fatality risk threshold will be chosen because evidence appears to show that cumulative injuries and fatalities rise at a rapid rate above this threshold (Ayuningtyas et al., 2023, Jurewicz et al., 2015; Wramborg, 2005).

Results

Forty-seven studies were included in the systematic review for fatal frontal crashes. Seven studies were included for the analysis, which consisted of two studies which provided fatality risk versus impact speed curves, and five studies which provided sufficient data for the random effects logistic regression model. The crash data were collected between 1970 to 2020 in the United States, France, and Sweden. It was established from the seven studies that the 10% of fatality risk occurred at: 82 km/h according to Funk et al. (2008); and 60 km/h according to Kahane et al. (1994); 63 km/h according to Foret-Bruno et al. (2001); 73 km/h according to Kullgren (2008); 67 km/h according to Stigson et al. (2012); 75 km/h according to Foret-Bruno et al. (1998); and 55 km/h according to Dean et al. (2023). In other words, impact speed ranged between 55 km/h to 82 km/h for a 10% fatality risk for frontal crashes. This contrasts with Wramborg suggestion that a 70 km/h speed limit should be set albeit for a head-on crash. Hence, further research needs to be done to establish a more representative value that could be considered by regulators for setting safer speed limits for rural undivided roads with poor infrastructure as well as for roads where median barriers have been installed to prevent head-on crashes.

Benefits to Road Safety

Obtaining evidence based real world crash data that establishes a more representative relationship between impact speed and fatality risk in frontal car crashes, particularly in regard to Wramborg's widely cited study, could provide valuable insights for regulators setting safer speed limits to help reduce road trauma. Moreover, this information will be an important road safety factor that can be considered by government policy makers and road authorities when considering how to achieve the 2030 road safety target of halving road fatalities.

Implication for Policy and/or Practice

The results of this study will show that in the event of a frontal car crash, the impact speed ranges from 55 km/h to 82 km/h for a 10% risk of a fatality, whereas the Wramborg (2005) proposed value of 70 km/h may not be representative of real-world crashes in all frontal impact circumstances. Further research is required to determine a more representative value of crash risk versus impact speed for real world frontal crashes particularly for different types of infrastructure installed. This information could then be considered for updating and implementing safer speed limits on rural roads where road infrastructure is poor, e.g., no safety barriers, narrow shoulders, or no tactile line marking, or where a road has been upgraded with a median barrier, wider sealed shoulders and/or tactile line marking.

Conclusion

Setting safer speed limits on roads where significant reductions in fatalities and serious injuries can be achieved is one of the most important aspects of road safety. Wramborg's (2005) study suggested setting a speed limit of 70 km/h for 10% fatality risk in the case of head on crashes. However, it has been widely proposed in the Safe System Approach, despite a lack of evidentiary support from Wramborg (2005) that such a speed limit could be applied for all frontal crash modes and road infrastructure. A review of published literature for frontal crashes using real world crash data show that the 10% fatality risk for frontal car crashes ranges between 55 km/h to 82 km/h. Given this speed variation from prior studies, it is important to conduct a more comprehensive study to find a more representative relationship between fatality risk and impact speed. This information could then be considered by regulators when establishing survivable speed limits on undivided rural roads with poor infrastructure quality.

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Everyone wins a prize: navigating Hobart's streets

Stuart Baird City of Hobart

Abstract

Join us for an insightful examination of Inner Hobart's Transport Network Operations Plan (TNOP), a strategic framework designed to efficiently manage the complex demands on the city's road network while prioritising efficiency, safety, and community well-being. In this presentation, we will explore how the TNOP addresses various challenges faced by road users and how it aims to enhance overall transportation effectiveness. Through a detailed analysis, we will delve into the methodologies and strategies utilized within the TNOP, highlighting key initiatives and their impact on the city's transport landscape. By understanding the TNOP's approach to optimising traffic flow, improving safety measures, and promoting sustainable transportation practices, attendees will gain valuable insights into the city's ongoing efforts to create a more integrated and user-friendly transport system. This presentation offers a comprehensive overview of the TNOP's objectives, methodologies, and outcomes, providing a deeper understanding of Inner Hobart's transportation planning and management processes.

Post on X

Join us for an in-depth exploration of Inner Hobart's Transport Network Operations Plan, where every road user wins a prize. In this presentation, we will delve into the strategic framework employed by the TNOP to effectively manage the diverse demands placed on the city's road network, ensuring efficiency, safety, and community well-being

Introduction

In the heart of Tasmania, Hobart stands as a vibrant cityscape characterised by its unique blend of natural beauty and urban vitality. However, like many cities around the world, Hobart faces the challenge of managing competing demands on its road network. With a growing population, increasing urbanisation, and evolving mobility patterns, the need for a strategic approach to transport management, particularly within the city centre, has never been more crucial.

An Integrated Approach to Transport Management

The TNOP represents a collaborative effort between the Department of State Growth and the City of Hobart, aiming to integrate operational decisions with strategic planning principles. Unlike previous ad hoc approaches, the TNOP provides a systematic framework for managing competing priorities on the road network while aligning with broader city objectives. By acknowledging the dynamic nature of transport-related needs, the TNOP seeks to balance the needs of different road user groups and optimise the overall performance of the transport network.

Strategic Objectives

Central to the TNOP are the strategic objectives set forth by various planning documents, reflecting Hobart's long-term vision for sustainable development and community well-being. These objectives encompass a wide range of priorities, including promoting active transport, enhancing accessibility, mitigating climate change impacts, and fostering vibrant public spaces. By aligning operational decisions with these strategic objectives, the TNOP ensures that Hobart's transport network serves the needs of both present and future generations.

Road User Hierarchies

A key component of the TNOP is the establishment of Road User Hierarchies (RUH) for different modes of transport, including walking, cycling, general traffic, bus, and freight These hierarchies categorise road users based on their strategic importance and prioritisation within the network, guiding resource allocation and operational decisions. By recognising the varying needs and characteristics of different road user groups, the TNOP seeks to create a balanced and inclusive transport system that accommodates all users.

Place Values

In addition to functional considerations, the TNOP acknowledges the role of roads and streets as vital public spaces within the urban fabric. Through the assignment of place values to different street segments, based on their characteristics and pedestrian activity levels, the TNOP aims to create vibrant and welcoming environments for residents and visitors alike. By prioritising place-making initiatives, the TNOP seeks to enhance the quality of urban life and promote community engagement and social interaction.

Operational Strategies

The TNOP does not offer a one-size-fits-all solution to Hobart's transport challenges but provides guidance to road authorities on balancing competing demands and optimising the level of service for each mode of transport. This

approach enables flexibility in decision-making while ensuring alignment with broader city objectives. Through the adoption of innovative operational strategies, such as signal timing adjustments, lane reallocations, and mode-specific infrastructure enhancements, the TNOP aims to improve the efficiency, safety, and sustainability of the transport network.

Traffic Signal Operation Review

A particular feature of the TNOP is a focus on intersection operation, including nominating specific Level of Service descriptors relating to signalised intersections. This allows planning for the operation of traffic signals to occur in line with the TNOP, and also gives guidance for day-to-day operational decisions being made by the Traffic Management Centre, in response to prevailing conditions. The TNOP includes a process for working through the competing priorities at each intersection, and determining what treatments could and should be applied to support the wider objectives of the TNOP and higher level strategies.

Relevance to a National Audience

The lessons learned from Hobart's experience with the TNOP are highly relevant to a national audience grappling with similar transport challenges. By showcasing the innovative strategies employed by Hobart to manage its transport network, this presentation offers valuable insights and best practices that can be applied in other cities across the country. From the integration of strategic objectives to the establishment of road user hierarchies and applicable levels of service, the Inner Hobart TNOP provides a blueprint for sustainable and inclusive transport management that can serve as a model for cities nationwide.

Conclusion

In conclusion, Hobart's TNOP represents a pioneering approach to transport management that prioritizes efficiency, safety, and community well-being. By integrating operational decisions with strategic planning principles, the TNOP ensures that Hobart's transport network serves the needs of all road users while aligning with broader city objectives. As cities around the world continue to grapple with the challenges of urbanisation and mobility, the lessons learned from Hobart's experience with the TNOP offer valuable insights and best practices that can inform transport policy and planning efforts on a national scale. Join us as we explore the dynamic world of transport operations and discover how Hobart's TNOP ensures that everyone wins a prize

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Link the final Report

Find the link below to the final TNOP: https://www.hobartcity.com.au/Council/Strategies-and-plans/Inner-Hobart-Transport-Network-Operations-Plan

Road safety investment in transport infrastructure in Gandaki Province, Nepal

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Abstract

Insufficient budget allocation to road safety elements in detailed estimation of road transport infrastructure is one of the main reasons of Road Traffic Accident (RTA) in rural roads in context of Nepal. The research is conducted to explore the existing investment scenario on road safety for major thirty-six (36) number of rural roads within the Gandaki province. After implementation of Federal Democratic Republic of Nepal in 2018, Government of Gandaki Province invested \$59.90M in transport infrastructure development in these 36 number of roads during five years. The number of registered vehicles as well as the investment budget in transport sector in the Gandaki Province is increasing whereas the number of road traffic accidents under serious injury category (Kaski District) is also increasing year by year, indicating an alerting alarm after road upgrading. The increasing road traffic accidents on upgraded road surface may be the higher speed of the vehicle, negligence and over confident of the road users. An average of nearly 2% budget is invested on road safety elements such as traffic sign posts, road markings and road safety barriers. Minimum investment on road safety in transport infrastructure development within the province indicates that the road safety has low priority. To decrease the road accident in rural area, province should allocate additional budget for road safety programs for these constructed roads and road users.

Background

Globally, Road Traffic Accident (RTA) became a serious issue and ranked as 8th leading cause of human death. The yearly number of fatalities and injuries is increasing in many Asian low- and middle-income countries and the vulnerable road users such as pedestrians, cyclists, and motorcyclists are particularly at risk zone (Wismans et al., 2016). Nepal has one of the highest estimated road traffic crashes (RTC) fatality rates in South Asia, with 15.9 fatalities per 100,000 population (World Health Organization, 2019). The recorded number of road traffic accidents are 13,366 in the fiscal year 2018/19 resulting 2,789 fatalities, 4376 serious injuries and 10,360 minor injuries in Nepal (Ojha, 2021). This data showed that the road safety became a critical issue and number of fatalities on the roads remains unacceptably high in these days. RTA related fatalities and injuries increasing day by day in Nepal and also in Gandaki Province, which became a serious concern in transport sector. Human factors, Road conditions, Vehicle conditions and environmental conditions became the major causes of road accidents. The report provided by traffic police summarized that there were 10,178 road crashes, with 2,384 fatalities, 4,250 serious injuries, and 8,290 minor injuries in 2016 (Khadka et al., 2022). Yadav et al. (2021) reviewed and explored the crash report ingrate to be higher in high-income countries (HICs) for fatal injuries (35% to 96.6%) compared to low- and middle-income countries (LMICs, 4.2% to 77.8%). The data showed that the rate of non-fatal injuries was found to be between 16% and 82% for HICs and 6.7% and 24.7% for LMICs (Yadav et al., 2021).

The main causes of traffic accidents were road user negligence, speeding, and overtaking operations (Kuikel et al., 2022). In conclusion, the majority of the young population is prone to be at risk of road traffic accidents and deaths which are preventable.

Methods

The Gandaki Province lies between $27^{\circ}-20' \text{ N} \sim 29^{\circ}-20' \text{ N}$ latitude and $82^{\circ} 52' \text{ E} \sim 85^{\circ}-12' \text{ E}$ longitude, extending with an area of 21,773 Km². The geographical area of this province is comprised of Himalaya, Hilly and Terai region. About 5,819 Km² (26.8%) of the area lies in the Himalayan region, 14,604 Km² (67.2%) of the area lies under the Hilly region and 1,310 Km² (6%) of the area lies under the Terai region. The lower elevation of Gandaki Province ranges from 450 m and highest is 8091 m. The area having elevation less than 2000 m having no snowfall, 2000- 4700 m having seasonal snowfall, 4700- 5200 m having complete snowfall except 1 or 2 months and elevation greater than 5200 m having permanent snowfall (Baniya et al., 2019). There are eleven districts in Gandaki province and total 36 number of major roads are taken in to consideration for investment on road safety. The major road network of eleven district within the province is shown in Figure 1.

The allocated budgets as well as detail estimate for upgrading of 36 number of roads within the Gandaki Province is collected, analyzed and identified the budget investment on "Road Safety" sector. The road safety budget allocation and expenditures of respective districts are analyzed and made assessment of their safety activities



Figure 1. Major Road network within the Gandaki Province

Results and discussion

The total number of major roads in Gandaki Province is 36 and the completed black topped road length within the province is 347.2 km with total investment (Table 1).

S.No.	Name of District	Number of Road Projects	Completed Road Length (km)	Investment in Million \$	Type of Road	Remarks
1	Lamjung	2	18.71	3.497	Black topped	
2	Gorkha	4	49.14	8.939	Black topped	
3	Tanahau	4	42.00	7.300	Black topped	
4	Kaski	6	56.27	9.827	Black topped	
5	Syangja	4	37.00	7.895	Black topped	
6	Baglung	4	45.28	7.737	Black topped	
7	Parbat	2	23.00	1.998	Black topped	
8	Nawalpur	4	39.00	6.124	Black topped	
9	Myagdi	2	15.00	3.085	Black topped	
10	Manang	2	0.80	0.081	Black topped	
11	Mustang	2	21.00	3.420	Black topped	
	Total	36	347.20	59.900		

Table 1. Completed major road length in Gandaki Province

The total investment on 36 major roads is \$59.90 M for upgrading of transport infrastructure development as shown in Table 1. The Kaski district has highest investment and Manang has lowest investment budget on the upgrading of road transport infrastructure.

The total number of vehicles registered till in Gandaki Province is 401,602. Out of total vehicles, majority of traffic consists of Motorbikes and scooter (325459 Nos.) and Car, Jeep, Van and Taxi (23602 Nos.). The two-wheeler covers 81.04%, whereas four wheeled medium vehicle covers 5.88%. The two-wheeler vehicle suffers higher accident rate compared to medium four wheeled vehicle.

Major investment prioritized given on surface upgrading, road side drain and retaining structures, whereas less prioritized on road safety. Hardly about 2% budget is invested on road safety elements such as traffic sign posts, road markings and road safety barriers.



Figure 2. Historical road traffic accident data of Kaski District

The historical road traffic accident data of Kaski District (Figure 2) showed an increasing trend from Year 2021/22 to 2023/24. A highest peak of serious injury occurred in Year 2023/24 indicated an alerting alarm regarding road safety.

Conclusion

The number of registered vehicles in the Gandaki Province is increasing year by year and also the investment budget in transport sector in Gandaki Province is increasing. The number of accidents under serious injury category is increasing year by year, which is serious concern. The upgraded road surface after investment may trigger the speed of the vehicle, negligence and over confident of the road users. Only 2% of upgrading road infrastructure budget could not fully addressed the road safety within the Gandaki Province. The increasing accident rate indicates a traffic safety intervention needed during and after upgrading of roads in Gandaki Province. The allocated budget is only focused on road structure construction. Provincial Government should take an intervention on traffic safety by allocating additional budget for traffic safety structures as well as road safety programs for road users of completed road projects within the province.

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Exploring the Burnley Tunnel Enhancement Project

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Abstract

The Burnley Tunnel is a 3.4km-long, major east-west corridor, located south of Melbourne's CBD, Victoria. The tunnel links Australia's busiest freeway (with over 21 million annual trips) to the south-east suburbs of Melbourne, and is the major congestion point on this route. The tunnel has a steep incline leading to the exit portal, and was slowing down drivers without their realisation. This created speed fluctuations that caused congestion, breakdown and speed differentials. The result was unsafe movement and heightened crash risk. This paper presents a comprehensive study on the implementation and effectiveness of human-centric design (including use of pacemaker lighting) as a solution to improve road safety and improve traffic flow. Since implementation we have found substantial benefits to both road safety and traffic performance. The insights from the Burnley Tunnel Enhancement Project serve as a compelling case-study for policymakers, engineers, and stakeholders seeking to revolutionise road safety strategies globally.

Post on X

Exploring the Burnley Tunnel Enhancement Project's impact on traffic flow and road safety: the data, benefits, and insights of human-centric design

Introduction

The enhancement project was undertaken to improve traffic flow and road safety within the tunnel, and to make the tunnel environment more appealing to be in. The tunnel's steep incline and dark environment meant drivers would not realise they were going uphill and were inadvertently slowing down, causing frequency speed fluctuations, and increasing crash risk. The project was also designed to improve driver perceptions of the tunnel environment, alleviate safety fears, and make navigating the tunnel's steep incline easier. Addressing all the above required a major revamp of the tunnel environment.

Existing literature highlights the significance of lighting in enhancing driver perception and reducing accidents in tunnels. However, apart from (Kato et al., 2015), limited research has focused on the specific application of pacemaker lighting to regulate traffic speed and mitigate congestion. This study fills this gap by investigating the practical implications of pacemaker lighting alongside general enhanced lighting in a real-world tunnel environment. The aim of the Burnley Tunnel Enhancement project was to make the environment safe and more efficient than ever before.



Figure 5 Before and after tunnel enhancement project Source: Internal Road Safety Audit Report

Overview

Wall painting and lighting upgrades

The proposed enhancement works were informed by a two-phase study. Phase 1 of the enhancement works was to study current driver perceptions of the tunnel. The study found the general emotions drivers felt in transit were anxiety and fear, and cognitive load was also a common theme. These perceptions were commonly associated with trucks, unpredictable speed changes and restricted vision.

Phase 2 of the driver perception study was to address these emotions, the enhancements were decided from extensive human factors assessments, virtual reality trials and user interviews. VR trials involved tracking users eye movements and neural reactions to different scenarios and solutions for the tunnel. Iterating on a solution to find the best response from users ensured confidence in the solution. An independent road safety audit was also conducted on the proposed design, and Safe Systems assessment and Human Factors assurance reports were produced to ensure the solution was suitable.

Enhancement works included installing new LED lighting, 30-40% brighter than existing, to better illuminate the tunnel roof and walls. Walls were given a thorough cleaning and painted with new, reflective paint, the tunnel's fake ceiling was removed, and a pacemaker lighting system was installed. The latter provides visual guidance for drivers, helping them maintain a consistent speed within the tunnel.

Pacemaker lighting system

The pacemaker lighting is the centrepiece of the enhanced Burnley Tunnel. They operate as green bands of light running dynamically along the tunnel walls at the required speed, encouraging drivers to match their pace with the lights, particularly when driving up the tunnel's inclined exit section.

The methodology involved integrating data-driven evidence into decision making. This was by installing pacemaker lights at strategic locations within the Burnley Tunnel and by collecting vehicle-detector traffic data before and after implementation. Speed variations, throughput rates, and driver behaviour were analysed to assess the lighting intervention's effectiveness. Data was collected during different traffic conditions, including peak and interpeak periods, weekdays, and weekends.

Results

Wall painting and lighting upgrades

The new, brighter, more open-appearing environment is far more appealing to drivers and has produced more consistent and higher flows with no detriment to safety. The new, white LED lighting and wall painting had massive impacts on people perception of safety with reactions from drivers such as "*can concentrate more*" and "*feel safer*". The design of the new tunnel lighting has also increased the focal length for drivers, improving their perception of vehicles around them and the road ahead.

Pacemaker lighting system

The findings reveal the introduction of pacemaker lighting delivered substantial improvements in traffic flow and speed consistency. During interpeak periods, average speed increased by up to 5.5km/h, while peak times saw gains of up to 9.5km/h compared to pre-implementation. Notably, there was a 11% increase in average speed throughout the tunnel. Performance data shows a 10% increase in average speed during peak periods, a 12% increase in average speed in the interpeak and a 4.3% total increase in average volume throughout the day. The road safety results show reduced vehicle breakdowns and smoother traffic flows, reducing chances of accidents and people on foot within the tunnel. There are substantial improvements in shortening the peak hour congestion period. This shortening reduces the time drivers spend in unstable traffic flows and heightened crash risk times. There's also a reduction of 22% in stop-start traffic, which is associated with reduced vehicle wear and tear. Vehicle mechanical failures in the tunnel have also declined.

The pacemaker lighting has smoothed traffic flow and reduced stop-start traffic by promoting harmonised speeds. This has reduced speed differentials and delivered positive impacts for drivers, including reduced stress levels, cognitive load, and crash likelihood. The reduction of stop-start traffic has resulted in less vehicle mechanical breakdowns, and less time on the road for incident response crews.

The pacemaker lighting is also contributing to enhancing climate resilience and road transport sustainability. Vehicle CO2 emissions within the tunnel reduced by 2.2% following the implementation, due to the improved traffic flow and reduced instances of sudden stops and starts. The new LED lighting is also far more energy efficient than the former lighting system, decreasing emissions further.

Benefits to road safety

The pathway forward for Target 2030 is for mainstreaming infrastructure that is human centric. The Burnley Tunnel Enhancement Project demonstrates that putting human-centric design first can create better user outcomes and improve road safety. The new LED white lighting has illuminated the tunnel environment substantially, creating a lighter, brighter driving environment that looks and feels safer, and that delivers better safety performance. The pacemaker lighting has been proven to reduce stop-start traffic in the tunnel, decreasing congestion, emissions and enabling smoother traffic flows. And all of these have contributed to an improved driving experience that is quicker, safer, and more reliable for all road users. Human centric design should always be a priority for any road upgrade and this project acts as a reference case for the road tunnel community.

Implications for policy and/or practice

The project has shown how innovative visual enhancements can solve traffic congestion and improve road safety. The human factors assessment work and the complexity of the virtual reality trials contributed greatly to the project's success. Targeting cognitive load was a key factor in, as this can narrow drivers' visual field and ability to process visual information, potentially leading to accidents.

Conclusions

This study demonstrates the efficacy of pacemaker lighting in enhancing tunnel traffic flow and reducing speed differentials. The results underscore the value of innovative lighting solutions in addressing congestion and improving overall driver experience. While the findings are promising, further research is needed to explore the long-term effects and scalability of pacemaker lighting in tunnel environments.

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Charging ahead: a survey-based exploration of e-mobility parking challenges

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Abstract

E-mobility devices, such as e-bikes and e-scooters (also known as Personal Mobility Devices or PMDs), are widely used across Queensland. With the popularity of these devices comes the issues of where the devices are parked when not in use. Often, the devices are parked poorly, creating safety and amenity issues on paths, especially impacting people with a disability. A survey of Queenslanders has revealed that the parking of e-mobility devices is an issue for many, regardless of geographical location around the state. Respondents to the survey also reported that there was no single method for parking scooters. As we get closer to Brisbane 2032, approaches to e-mobility parking need to be standardised to impact positive behavior change.

Post on X

So, e-mobility devices are a great end-to-end transport option but where do you park them? Qlders have a lot to say about this issue and are helping to find solutions.

Background

In recent years, there has been a boom in both shared e-scooter schemes and personal ownership of PMDs. For instance, Brisbane's e-mobility strategy for 2021-2023 (Brisbane City Council, 2021) states that since November 2018, there has been more than 4 million PMD rides, with an average of 5,000 trips taken per day. The Department of Transport and Main Roads (TMR) also estimates that there are approximately 10-20 e-scooters sold each day to private owners by retailers based on anecdotal evidence.

This increase in popularity has created some safety issues as PMD riders share a range of infrastructure with other road and path users. Queensland is an Australian leader in the regulation of e-mobility devices, with a comprehensive review of the regulatory framework undertaken in 2022. The parking of shared e-mobility devices was a key issue raised by stakeholders during consultation about PMD reforms. While regulatory changes have aimed to improve the safe and efficient use of these devices, the issue of safe and convenient parking remains. There are currently no regulatory mechanisms to address unsafe or inconsiderate parking of devices.

There are clear public health benefits to enabling e-mobility devices safe access to Queensland's transport network, such as increased time outdoors and social cohesion (Burke et al., 2023), reducing traffic congestion as well as supporting multi-modal connections to public transport, such as at rail and bus stations (Vallmuur et al., 2023). The rapidly rising popularity of e-mobility has introduced challenges, including conflict over public spaces, such as roads and paths, and concerns regarding safety and amenity for riders and other road and path users. Figures collated by the Jamieson Trauma Institute (JTI) between November 2018 and December 2023, found that 4003 people presented to hospitals across Queensland after being injured on PMD, including 45 presentations of injury to pedestrians or bystanders (JTI, personal communication, 2024). Community complaints to TMR would indicate unsafe parking is a factor in some incidents. TMR want to ensure PMD parking does not contribute to injuries on Queensland's road transport system.

For this reason, TMR released the E-Mobility Parking Plan (the Plan) in December 2022. The Plan sets out clear actions for improving parking for e-mobility devices. The actions focus on: solutions such as the design and installation of designated e-mobility parking areas / e-mobility parking hubs; reporting poor parking; communication and education; and, potential regulation.

To deliver on the actions contained in the Plan, the e-mobility parking working group was established to collaboratively develop solutions to address e-mobility parking in Queensland. Reflective of the shared responsibility for e-mobility parking, the working group includes representatives from disability advocacy organisations, shared e-mobility providers, path user associations and advocacy groups, and a range of local and state government representatives with expertise spanning policy, planning and accessibility. As we approach the Brisbane 2032 Olympic and Paralympic Games, it is anticipated that the use of e-mobility devices will only increase. It is imperative that the views of stakeholders are listened to and actioned to ensure the safety of those on paths both now and into the future.

Approach

TMR has taken a collaborative approach to address the issue of e-mobility parking, with an aim of creating more accessible and inclusive paths for all who use them. The approach includes:

- Ongoing quarterly stakeholder meetings which commenced in 2022, with the aim of investigating solutions for e-mobility parking with participation from all stakeholders.
- A longitudinal survey with approximately 1800 participants, made up of users and non-users of e-mobility devices. The survey is being undertaken twice per year over a four-year period (2023/24 to 2026/27), with the next survey due to be conducted in October 2024. The primary purpose of the survey is to understand community perspectives and experiences about e-mobility parking in the Queensland context.

Undertaking the surveys over a four-year period will enable trend analysis, to potentially identify the best approach to parking as well as user behaviors. The continued surveying is also anticipated to highlight preferred parking solutions, in turn providing improved e-mobility parking outcomes. Given this is an emerging area of research, the longitudinal study will enable TMR to collect sufficient data to notice trends, understand evolving issues and start the process of measuring impacts of any initiatives that are rolled out to support improved e-mobility parking outcomes.

While it is desirable that path users benefit from improved e-mobility parking at the earliest opportunity, it is imperative that solutions are found over the longer term, particularly for the major event which is Brisbane 2032 when competition for path space will be at a premium.

Findings

The first two e-mobility parking surveys were undertaken in October 2023 and May 2024, through an online panel of Queensland residents. All respondents were aged 16 years and older with the following sub-group samples:

Sample	Date	n	e-scooter use	Notes
e-scooter	October 2023	802	own an e-scooter or use shared device	
users	May 2024	800	(hire company) use at least several	
			times a year	
Non-user	October 2023	827	aware of hire e-scooters in their local	~15% identified as living with a
			community	disability including mobility issues
			very low usage (for example, a one-	(8%) and vision impairment (3%)
	May 2024	806	time hire)	~27% identified as living with a
				disability including mobility issues
				(8%) and vision impairment (13%)

Table 1. Summary of samples (users and non-users)

Survey questions investigate a number of topics, including designated parking area availability, problems with emobility parking including path obstruction and poorly parked devices and community sentiment about the current state of e-mobility parking. The survey also asks seeks to investigate the understanding and compliance with the road rules that apply to e-scooters, however that is out of scope here.

Summarising the responses from the two surveys that have been undertaken to date:

- approximately half of residents continue to experience problems with PMDs causing an obstruction due to poor parking. This is unchanged since 2023 and is consistent across both riders and non-riders.
- Approximately one in ten people reported a poorly parked e-scooter or e-bike (decline in reporting for e-riders, no change for non-riders).
- While there is no difference in the issue of poorly parked e-scooters (rating 6/10 as an issue), non-users have a sense that the problem is getting worse.
- There is no single method of finding a place to park a hired e-scooter. Some riders park beside other e-scooters, some use the hire app to find a spot and others look for places away from the footpath. There is an increase in hire users reporting that they keep clear of crossings, ramps, loading zones and bus stops when parking their e-scooter.
- In 2024, those hiring an e-scooter see 'no change' in the availability of parking areas through the hire company apps. There is a decline in the number who report that parking availability is 'getting better' from 2023 to 2024. Almost two thirds of hire riders find it difficult to locate a parking spot either often or sometimes (no change to 2023).

Designated parking area availability: In May 2024, shared e-mobility device users report that the number of marked parking areas available through hire company apps has not changed. In October 2023, users were more likely to report that the number of parking areas was 'getting better'.

Path obstruction: Around half of community experienced problems with e-scooters being left on footpaths causing an obstruction or blockage.

Obstruction: There are no changes for the sample of e-scooter riders.

Obstruction: For non-riders, however, the issue of e-mobility devices causing an obstruction is getting worse.

Reporting of poorly parked devices: In May 2024, fewer people reported poorly parked e-scooters or e-bikes compared to October 2023. 61 per cent of respondents reported a poorly parked device to rental providers, 46 per cent to council.

	May 2024	October 2023
Which of these describes the number of marked parking greas available through the	111ay 2024	000001 2023
which of these describes the number of marked parking areas available through the		
Costing botton	200/14	409/
No shares	560/ ▲	4970
	50%	4/%
Getting worse	5%	4%
Base: Those hiring an e-scooter	(n=545)	(<i>n</i> =398)
Have you ever experienced a problem with e-scooters or e-bikes being left on		
footpaths, causing an obstruction, or blocking access?		
Yes – e-scooter user	54%	51%
Yes – non-user	48%	48%
Yes – those living with disability or mobility issues	52%	54%
Base: Total sample	(n=1,606)	(n=1,629)
Have you ever reported a poorly parked e-scooter or bike?		
Yes – e-scooter user	11%↓	17%
Yes – non-user	8%	9%
Yes – those living with disability or mobility issues	13%	16%
Base: Total sample	(n=1,606)	(n=1,629)
Which of these describes the issue of e-scooters or e-bikes causing an obstruction?		
e-scooter user		
Getting better	20%	25%
No change	56%	54%
Getting worse	24%	21%
Base: e-scooter users	(n=800)	(n=802)
Non-users		
Getting better	8%	9%
No change	54%↓	60%
Getting worse	38%个	31%
Base: Non-users of e-scooters	(n=806)	(n=827)

Implications for practice

A key theme from the survey is that respondents are unsure where to park their device. Moving forward, simple parking models could be adopted, tailored to the needs of the community, including those with a disability, such as blind and low vision. TMR has noted this key theme and has utilised the e-mobility parking working group to discuss and test parking models. This has enabled shared scheme operators, local councils and disability advocates to collaborate on ways to standardise parking. This collaboration has resulted in a range of e-mobility parking models that have been trialed across Queensland. The coverage across Queensland is important given different regions have different parking challenges. Models include:

- restricted parking which requires users to park in designated virtual or physical parking areas. This controls where emobility devices are parked and provides consistency and certainty for riders. However, this can result in reduced usage if designated areas are not located conveniently for users. This approach requires more planning, engagement and set up costs, especially when using physical parking infrastructure.
- free floating parking means users can park close to their desired location, resulting in a door-to-door journey. Users must comply with parking rules set by local councils and, as a result, can benefit through financial incentives. This parking approach also defines no parking zones to restrict users from unsuitable and unsafe parking areas. No costs are incurred to establish parking infrastructure with this model and parking areas can be spread across more locations rather than in concentrated areas.
- A hybrid model is a combination of the two above parking models and means that restricted parking can be provided in high activity areas and free floating applied in less dense residential areas. Further, parking can be more customised to the needs of specific areas/locations. However, it can also create confusion for riders and the broader community to understand parking requirements in different locations.

If these models are 'universally' accepted and used by councils and device operators, shared device users would have a better understanding of where to park their device. This collective understanding would alleviate some of the issues, particularly around accessibility and inclusion, enabling safe and effective path access for all users for Brisbane 2032.

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Using connected vehicle data to monitor traffic along roadworks

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Abstract

This paper investigates using anonymised connected vehicle data from Compass IoT to enhance road-worker safety along the Westlink M7 motorway, during delivery of the M7-M12 Integration Project in Sydney. Transurban used this data to develop a Tableau monitoring platform. Results indicate speed compliance improves over time, with notable non-compliance during peak shoulder periods. Targeted police operations during these times could enhance compliance. We also found speed compliance improves within roadworks zones, suggesting enhanced speed messaging at roadworks' starting points could be effective in increasing compliance.

Connected vehicle data offers insights into driver behaviour and helps proactively address safety concerns at on-road construction sites. This research contributes to the broader goal of achieving zero fatal or serious injuries on roads, particularly in high-speed environments where workers are vulnerable. The study underscores the value of leveraging technology to safeguard road workers amid evolving road conditions.

Post on X (limit: 280 characters)

New Transurban research explores how anonymised connected vehicle data from Compass IoT enhances worker safety on Sydney's Westlink M7 motorway during construction. Insights inform targeted interventions, contributing to a vision of zero fatal or serious injuries on our roads.

Background

The Westlink M7 is a major connecting road on Sydney's orbital network, linking the M2, M4 and M5 South West. The motorway was built by Transurban (and partners) and opened to traffic in December 2005. The M7 is 50% Transurban owned and under concession until 2048.

The Westlink M7-M12 Integration Project has been commissioned by the NSW Government to support future development growth in Western Sydney and to improve access to commercial and residential hubs, and the new Western Sydney International Airport. As part of this project, Transurban is expanding the M7 Motorway with an additional lane in each direction, for 26 kilometres. Work began in October 2023, with construction running alongside live traffic on the M7. The M7 roadworks are expected to continue throughout 2025, with speed limits in the area reduced from 100km/h to 80km/h.

As an operator of high-speed motorways, road-worker safety is a high priority for Transurban. To ensure a greater understanding of M7 driver and traffic behaviours, and potential risks to project workers, we used Compass IoT connected vehicle data to develop a traffic-monitoring platform for the worksite corridor. This platform is now used by the project team to inform and validate intervention strategies.

Compass IoT uses anonymised connected vehicle data from newer model vehicles from 64 different manufacturers to capture vehicle movement and driver behaviour insights, including speed, braking and steering metrics (Compass IoT, 2022). Transurban has obtained vehicle telemetry records through API queries to develop a Tableau dashboard to develop its own Tableau dashboard to monitor traffic along the roadworks and determine if drivers are responding appropriately to signage and delineation.

Using this tool, we can also identify areas with higher speed-limit non-compliance and roll out strategies such as adding or relocating speed-actuated messaging and working with Transport for NSW to utilise speed cameras. The tool also helps us identify times of day when non-compliance is high, informing strategies such as more visible police operations to encourage compliance.

Results

The traffic monitoring dashboard has provided insights and learnings that will inform future traffic management activities.

Speed compliance improves after a week of operation. In the week following commencement of roadworks, speed patterns remained largely the same, before starting to decrease (Figure 1). This suggests drivers take some time to adapt to new road conditions and indicates other approaches, such as staging, would be beneficial in giving motorists time to adjust before significant works commence.

Unfortunately, as shown, even after decreasing motorway speeds from 100km/h to 80km/h, daily median speeds often exceeded the construction speed limit of 80km/h. This is most noticeable on weekends, when traffic volumes are lowest. Figure 1 also demonstrates the significant variability in travel speeds during peak periods.



Figure 1. 85th, median and 15th percentile vehicle speeds for traffic through work zone (both directions) over time

While vehicle non-compliance is consistently poor, it is worse just outside of peak periods. Figure 2 shows of vehicle non-compliance rates within the 80km/h roadworks speed zone (southbound). The rate of non-compliance is consistently high (over 40%), but it peaks between 4am and 6am (71%) and between 6pm and 8pm (73–77%). During these time periods, while significant volumes of traffic remain on the roadway (Figure 3), traffic is low enough to allow free-flowing movement. A similar pattern is seen when reviewing compliance by day-of-week, with poorer compliance during the weekend versus during weekdays.

This suggests drivers are more constrained by traffic flow than by stated speed limits. Visible police operations at targeted times of day would be an effective option to encourage greater compliance (Debnath et al. 2024).



Figure 2. Vehicle non-compliance rates for traffic through roadworks zone by hour of day (1/2/24-26/4/24)



Figure 3. Count of vehicles travelling through roadworks zone captured by Compass IoT by hour of day (1/2/24-26/4/24)

Speed non-compliance improves as drivers travel through the roadworks zone. Figure 4 indicates areas with a higher frequency of vehicles travelling over 15km/h above the roadworks speed limit. This heat diagram demonstrates that speed compliance improves as vehicles travel through the roadworks zone. This finding suggests enhanced speed messaging at the start of roadworks zones – such as speed-activated messaging – would support greater compliance in these areas (Debnath et al. 2024).



Figure 4. Heatmap of roadworks zone indicating locations of more frequent high-range speeding of 95km/h for southbound traffic (1/2/24-26/4/24).

The heatmap can also be used to identify locations of harsh braking. The area with the greatest concentration of harsh braking shown (Figure 5) is a location with frequent truck and car lane changing as they enter and exit the motorway. More notably, this behaviour is also seen throughout a 3km steep incline in the southern section of the motorway, which is consistent with real-world experience. Treatments to discourage unnecessary lane-changing could include special-purpose line marking and warning signage.



Figure 5. Heatmap of roadworks zone indicating locations of more frequent harsh braking for southbound traffic (1/2/24-26/4/24).

Conclusions

As the road-transport industry moves towards a vision of zero fatal or serious injuries on our roads, it is becoming increasingly important to proactively identify emerging issues before crashes occur. This is particularly the case at roadworks sites, where vulnerable workers are positioned close to high-speed traffic; where the road environment may be changing; and where delineation and wayfinding may vary as works progress.

Using anonymised connected vehicle data to monitor how drivers are responding to changed road environments and to identify opportunities to further protect road workers is an important tool for protecting this vulnerable group.

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Motorcycle Safety Workshop – evidence-based initiatives

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Abstract

Motorcyclists play an important role in our transportation system, yet they are overrepresented in road trauma. Various factors contribute to this, including travel speeds, vehicle safety, road design, and maintenance. On 19th May 2022, the Victorian Chapter of the Australasian College of Road Safety organised a Motorcycle Safety Workshop (see output report here). Attendees comprised motorcycle and scooter riders, engineers, academics, police officers, rider trainers, researchers, community representatives, road safety auditors, practitioners, and agency members. The workshop generated a list of initiatives to reduce motorcycle trauma, although the evidential support for these initiatives was not extensively discussed. Theproposed interactive Conference Workshop seeks to categorise these initiatives: those supported by solid evidence, those worth trialling despite limited evidence, and those not worth trialling due to insufficient evidence. This categorisation will aid in prioritising effective strategies to enhance rider safety. This will be achieved by gathering participant insights and also by short presentations from researchers and practitioners.

Post on X

Motorcyclists are overrepresented in road trauma. This Conference Workshop aims to prioritise previously identified rider safety initiatives.

Introduction

Motorcycles represent 4.5% of all Australian passenger vehicle registrations and cover 1.1% of vehicle kilometres. Yet, motorcyclists and passengers contribute to about 15% of road crash fatalities and a disproportionate number of serious injuries. Comparatively, the rate of motorcyclist deaths per distance travelled in Australia is approximately 30 times higher than that of car occupants, with serious injuries being 41 times more frequent (NRSPP 2024).

Future projections on road trauma until 2050 highlight motorcycles as a significant concern despite existing preventative measures (Lösningar 2024).

Various stakeholders have proposed initiatives to mitigate motorcycle-related trauma. The Victorian Chapter of the ACRS organised a motorcycle safety forum to gather these initiatives, with the aim of cataloguing rather than extensively analysing them.

While evidence for each initiative may not be immediately available, many have undergone trials and evaluations. The focus should be on categorising the extensive list of initiatives. This proposed workshop will tap into the expertise of both academics and practitioners present at the conference, using an interactive approach to gather evidence supporting these initiatives.

Facilitator

Kenn Beer is a highly experienced facilitator of road safety workshops. He has an ability to manage groups so that everyone is heard, outcomes are produced, objectives are met, and people have fun while participating. Kenn has recently facilitated motorcycle safety workshops for ACRS, the Victorian Government, Austroads, Transport for NSW and the Department of State Growth Tasmania.

Workshop Leaders

Dr Tana Tan is a highly regarded motorcycle safety expert having completed motorcycle safety projects for Austroads, Victorian Government, NSW Government and the World Bank.

Dr Matthew Baldock is a leading expert in motorcycle safety – especially in relation to vehicle safety features, rider training and testing.

Samantha Buckis is a highly experienced practitioner coordinating various studies over her career into motorcycle safety across vehicles, speed and enforcement.

⁴ Deakin University

Duncan McRae is a motorcycle rider training, testing and licensing expert. Commissioned by various Australian states to assist in the implementation of their Motorcycle Graduated Licensing Systems.

Christopher Hurren is a leader of MotoCAP and worldwide expert in motorcycle protective clothing, helmets and gear.

Dr Trevor Allen is an accomplished researcher into motorcycle trauma prevention. Has undertaken in-depth research into motorcycle crash causation, injury severity and methods to lessen risk.

Interactive Workshop format

- Icebreaker introduction by Kenn Beer
 - Introduction to task, and categories for filtering initiatives:
 - Has been done, comprehensive evidence to show it doesn't work.
 - Has been done, comprehensive evidence to show it does work
 - Nothing concrete in terms of evidence. Could be worth a trial based on there being some logic to it.
 - Nothing concrete in terms of evidence. Could be worth a trial based on there being some logic to it.
 - This is not a motorcycle safety initiative it's something else (motorcycle promotion, environmental, congestion)
- Initial short presentations from each expert explaining each issue
- Open comments/catagorisation from the audience
- Additional short presentations by the experts
- If time allows, further categorisation from the audience.

The ouputs of the workshop will be documented and reported to the Victorian Chapter of the ACRS.

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Safe System Skills Roadmapper – building capability and capacity

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Abstract

This paper delves into the issue of capability and capacity within the Safe System approach to road safety that has been identified by various governmental bodies across Australia and New Zealand as deficient. Despite the Safe System's long-standing presence as the foundation of national road safety strategies, deficiencies in embedding Safe System principles within governmental agencies, especially in planning and transport sectors, have been highlighted in recent reviews. To address this concern, the Transport Accident Commission (TAC) in Victoria is spearheading efforts to enhance practitioners' proficiency in identifying and applying Safe System treatments. One initiative is the development of the Safe System Skills Roadmapper tool. This tool, tailored to individual needs based on role, leadership status, learning preferences, and self-assessed skills, then generates personalised Professional Development Plans. Drawing from over 150 activities, including formal training, on-the-job learning, eLearning, and networking opportunities, this innovative tool aims to bolster Safe System capability among practitioners, particularly as the TAC prepares to invest \$200M in the Safe Local Roads and Streets Program.

Post on X

To enhance capability in Safe System, the TAC and Safe System Solutions present the Safe System Skills Roadmapper. Tailored to individual needs, it provides practitioners with personalised Professional Development Plans.

Introduction

Austroads, 2023, (as part of the project: *Charting a path to eliminating road death and serious injury*) noted that one of the main blockers to the implementation of the Safe System approach to road safety is a lack of capability and capacity. Government bodies in Australia and New Zealand recognise this challenge persists despite the Safe System's longstanding integration into national strategies. Recent studies (Muir et al., 2018; Green et al., 2023) highlight the need for broader adoption of Safe System principles across government agencies, particularly within planning and transport sectors.

In response to this challenge, the Transport Accident Commission (TAC) in Victoria is actively pursuing initiatives to bolster practitioner proficiency in identifying and applying Safe System treatments. As the TAC prepares to invest \$200M in the Safe Local Roads and Streets Program, enhancing capability and capacity becomes a priority. Collaborating with Safe System Solutions, the TAC's research into contemporary professional development practices has resulted in the development of the innovative Safe System Skills Roadmapper. This tool, tailors to individual roles, leadership status, and learning preferences, aims to cultivate Safe System capability by generating personalised Professional Development Plans. By leveraging over 150 professional development activities, this approach seeks to empower practitioners and advance road safety efforts.

Method

The methodology commenced with a review of existing literature to identify blockers and enablers of the Safe System approach. Interviews were then conducted with practitioners to understand the challenges faced and opportunities present in the implementation of Safe System principles. In parallel, an investigation into contemporary adult learning methods was undertaken. This involved engaging communication experts and adult learning specialists through interviews to gather insights into effective pedagogical approaches applicable to the development process. Key competencies necessary for various roles within road authorities, notably in engineering, roads/street design, planning, and communications, were delineated (Table 1). This process was facilitated by collaborative workshop sessions and validation exercises, ensuring alignment with the objectives of Safe System implementation.

A catalogue comprising over 150 activities aimed at enhancing capability and capacity in Safe System implementation was compiled. These activities were gathered to cover a spectrum of learning modalities and skill areas relevant to the Safe System. The identified competencies were then mapped and weighted against the catalogue of 150 activities to discern their respective impacts on different skill domains, thereby facilitating prioritisation for the individual learner.

As an output, a tool was developed capable of analysing input data from subjects, encompassing variables such as role, leadership status, and preferred learning modalities (e.g., formal training courses, on-the-job learning, eLearning). The tool's inputs include a self-assessed (or manager/team leader assessed) skills/knowledge in key Safe System areas.

With these inputs, a series of algorithms then generates a personalized Professional Development Plan tailored to individual profiles and identified learning needs.

Capability	Description
Safe System Principles	Key principles, their origins, and how they differ from traditional road safety practices
Safe System Thinking	The ethical imperative behind the Safe System, vision zero and the Safe System, safer vs
	safe, Primary Safe System treatments and Supporting treatments, Vision Zero planning.
Safe System	The fundamentals of each of the elements/pillars of the Safe System. What works and
Elements/Pillars	what doesn't work
Energy Management	Kinetic energy tolerance of humans under different crash conditions, the influence of
	crash angle on energy transfer, speed mass angle calculations, vehicle energy
S. C. C. Marine Transformer	management features, estimating acceptable energy levels in crash predictions
Sale System Treatment	Addressing exposure, likelihood and sevenity. Calegorising treatments into Primary and Supporting treatments. Combining treatments (redundency in the system)
F Infosophy Safa System	Treatments that align highly with Safe System principles within categories of a
Treatments	Movement and Place framework
Low-Cost Safe System	Effective low-cost treatments and their development design and application
Treatments	Effective fow cost deathents and then development, design and appreation.
Highly Effective	Effective conventional treatments, their development, design, and application.
Conventional	
Treatments	
Benefits of Safe System	The expected impact of various treatments on fatal and serious injury outcomes. Wider
Treatments	benefits or challenges such as environmental impacts, gender impacts, mode shift and
	traffic movements. Linking with other policy objectives, including health, active
	transport, workplace health and safety, environmental sustainability, social equity, and
	economy.
Innovative Treatments	Using Safe System principles and thinking to solve unsolved issues. The process for
	innovation within the public road/street environment.
Survivable Speeds	Assumptions and estimates within Safe System speeds. Speed basics (mean speeds, 85th
	or 95th percentile speeds, outliers, speed limits (advisory and regulatory)). Using speeds
Safa System Sneed	The conventional process for setting speed limits vs a Safe System approach to speed
Limits	limit setting.
Safe System Speed	Infrastructure techniques to achieve speed outcomes. Speed limit as a Supporting
Management Options	treatment. Speed as a final filter for Safe System outcomes.
Speed Limit Reviews	Process for undertaking a conventional speed limit review, and how to add contemporary
	Safe System thinking into the process.
Traffic Calming	Treatment choice, effectiveness, design and application.
Treatments	
Road safety in the	Risk profiles of various land uses. Access management. Pedestrian generators and their
planning process	location in proximity to movement corridors.
Data analysis	averages GIS manning, crash data systems, non-crash based data ontions to understand
	risk (speed volume RAP etc.) basic statistics
Network Safety	The basics of what Network Safety Plans are, how they are developed and how to
Planning	interpret them for on-ground decision making
Identify High Risk	Techniques to identify high risk locations including crash based and non-crash based
Locations	(e.g. AusRAP, ANRAM, IRR, Audits, Assessments, etc.)
Safe System Crash	Preparing for, undertaking and reporting a crash investigation. Understanding Safe
Investigations	System elements and thinking within the investigation (i.e. crash force tolerances,
	system boundaries, etc.). Reporting and proposing countermeasures.
Apply Safe System	Choosing treatments based on Safe System alignment, land use, road/street function, cost
Treatment Philosophy	and site constraints.
Design Safe System	Concept, functional and detailed design of known Safe System solutions such as:
1 reatments	separated biovele facilities, etc.
Conduct Road Safaty	Undertake a Road Safety Audit in accordance with the Austroade Guide to Pood Sofety
Andits	Part 6: Road Safety Audit - including Safe System energy assessment and Safe System
	categorisation of recommendations.

 Table 1. Key Safe System competencies for road authority practitioners

Capability	Description			
Conduct Safe System	Undertake a Safe System Assessment in accordance with the Austroads Safe System			
Assessments	Assessment Framework.			
Deliver Safe System	Understand delivery constraints and challenges associated with common Safe System			
Treatments	infrastructure. Techniques for communication of project objectives. Scheduling,			
	contracting and economies of scale to maximise safety outcomes.			
Sell Safe System	Translating key Safe System principles into key messages for varied stakeholder groups.			
Treatments for	Understanding typical enablers and blockers for different stakeholders when it comes to			
Decision Makers,	Safe System solutions. Knowing what works and what doesn't work in road safety			
Stakeholders and	messaging, campaigns and community initiatives.			
Community				
Collect Baseline Data	Types of data relevant to road safety decision making. Data collection methods. Data			
	cleaning and housing. Privacy and security of data.			
Collect Data Post	Bedding in periods, use of control site data, types of data relevant to road safety decision			
Treatment	making. Data collection methods. Data cleaning and housing. Privacy and security of			
	data.			
Analyse Pre and Post	Causation vs correlation in road safety. Control data. Statistical analysis. Development			
data	and presentation of treatment effectiveness measures.			
Share Outcomes	Reporting outcomes in abstracts, journal articles, papers and reports. Development of			
	fact sheets, social media content and easily consumable messages from results.			

Results

This tool holds promise for advancing the implementation of the Safe System approach to road safety through tailored Professional Development Plans. Although specific outcomes and empirical data are yet to be obtained, the systematic approach undertaken in this study lays a foundation for future evaluations.

The comprehensive literature review provided insights into the prevailing blockers and enablers of Safe System implementation, facilitating a deeper understanding of the challenges and opportunities inherent in this approach. Though institutional frameworks were the highest identified blocker, capacity and capacity was a closely followed second across all levels of government and the private sector.

Exploration of contemporary adult learning methodologies through expert interviews identified avenues for enhancing the professional development of practitioners involved in Safe System implementation. Additionally, the compilation of a comprehensive catalogue comprising over 150 activities aimed at building capability and capacity in Safe System implementation provides a comprehensive resource for practitioners seeking professional development opportunities.

The delineation of key competencies required for different roles within road authorities represents a crucial step towards aligning organisational capabilities with the objectives of Safe System implementation. Workshopping sessions and validation exercises ensured the relevance and applicability of identified competencies to real-world scenarios.

And finally, the mapping and weighting of identified competencies against the catalogue of 150 activities offer a structured framework for prioritizing learning interventions and resource allocation. This process facilitates strategic decision-making and ensures optimal utilization of available resources.

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Street-crossing in older adults: exploring decision-making

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Abstract

Older adult pedestrians are over-represented in road-related fatality statistics. Understanding their decision-making when crossing roads is critical if we are to develop training interventions to support them to be safer road users. This study aims to examine the key behaviours of hazard perception and gap acceptance using virtual reality. 100 older adult participants will complete a validated virtual reality street-crossing task. This task captures response time, accuracy, eye tracking and head movement data so that we can get a comprehensive understanding of how older adults explore a roadway environment prior to making decisions about hazards and safe gaps to cross. Testing is still underway for this study that will be completed by July 2024. The results from this study will be used in the development of an evidence-based, professionally developed and user-friendly online pedestrian training program for older adults.

Post on X

By understanding how older adults make decisions when crossing roads we can help save their lives through training.

Introduction

A sobering fact is that pedestrian fatalities are on the rise in Australia (Australian Automobile Association [AAA], 2022). Older pedestrians account for 40% of pedestrian crash fatalities despite only making up around 18% of the population (Bureau of Infrastructure and Transport Research Economics [BITRE], 2019). Older adult pedestrians are the second highest at-risk group to incur an injury which requires hospitalisation (BITRE, 2019) and are 4.5 times more likely to require long-term care than younger adults (Rod et al., 2021). Given the higher risk for older adults, understanding their street-crossing behaviours is critical.

Understanding Pedestrian Street-Crossing Behaviours

Pedestrian street-crossing behaviours are defined as the processes involved in the decision making and transportation between two points (Yıldırım & Çelik, 2023). Pedestrian behaviours can be observed during the three stages of a street crossing: (1) Initial Stage - Before Crossing, (2) Middle Stage - Initiation of Crossing, and (3) Final Stage -Completion of Crossing. Various behaviours can be examined to determine pedestrian safety when crossing the road including choice of crossing location, walking speed and distance, and crossing time. This study focuses on key behaviours that occur at the initial and middle stages of crossing. These stages are critical because this is when the individual is standing on the side of the road and making the decision to cross. Pedestrians need to survey the roadway to determine whether it would be safe to initiate crossing, which involves identifying hazards and determining a safe gap between moving vehicles to cross the road. Hazard perception (HP) encompasses the identification, interpretation, and subsequent response to a hazard during the initial stage of a road crossing (e.g., approaching vehicles; Rosenbloom et al., 2015). Gap acceptance (GA) is the point at which a pedestrian will judge that there is a sufficient gap in the flow of traffic in which they can safely cross the road (Oxley et al., 2005). There is a dearth of research into understanding these behaviours in pedestrians (Moran et al., 2019). HP and GA are related but distinct skills. Although selecting a safe gap to cross requires an awareness of hazards, recognising a hazard does not necessarily dictate a pedestrian's decision to either cross or wait. For example, a pedestrian may see a potential hazard but still opt to cross the road because they have adequate time to cross the road. Conversely, a pedestrian might decide to cross without recognising a hazard. Being able to differentiate between GA and HP is therefore necessary when examining street-crossing safety.

Using Virtual Reality to Examine Street-Crossing

The use of virtual reality (VR) to examine street-crossing behaviours is becoming more common as the technology enables more realistic representation of the complexity of the roadway environment and enables participants the freedom to explore the 360-degree roadway environment (Tapiro et al., 2020). VR headsets can display 360-degree video footage, which enables researchers to display real-world visual stimuli (i.e., street-crossing situations) in a safe setting while allowing exploration of the situation that is more natural to human visual and auditory senses.

Aim

To use VR to examine the critical street-crossing behaviours of HP and GA in older adults. By understanding older adults' patterns of behaviour when making these street-crossing decisions, we will be able to develop targeted training programs to support their safety as pedestrians.

Method

Participants

A total of 100 older adult participants will be recruited for this study. To ensure we fully represent the older adult population, we aim to recruit 50 participants who are between 60-74 years, and 50 participants who are 75 years and older. A gender split of 50 females and 50 males will also be sought. Testing will occur in both Sydney and Melbourne to increase generalizability however it is acknowledged that this may not be representative of the Australian population. Testing occurs in a single face-to-face session lasting approximately 2 hours (including cognitive, perceptual and motor tests not examined in this presentation). Testing will be completed by 30 June 2024.

Virtual-Reality Pedestrian Street-Crossing Task

Participants complete the pedestrian street crossing task using a head-mounted VivePro Eye headset powered by an Alienware X17 laptop. The VivePro Eye displays 360-degree video clips of un-staged roadway scenarios via a custombuilt Unity project. Two versions of the street-crossing task were administered: the HP task and the GA task. See Figure 1 for a visual representation of both tasks. Response time was used to measure performance in both tasks. Response time (in seconds) is calculated as the time between the window start and the point at which the participants pulled the controller trigger (HP) or took a step (GA). Faster response times indicate better HP and GA skill. Eve-tracking and head movement data is also collected to understand the specific areas of the roadway environment that they look at prior to making their decision about the presence of a hazard or to cross the street.

Hazard Perception Task

Participants were instructed to imagine they were the pedestrian on the side of the road waiting to cross to the other side of the street. They were instructed to pull on the controller trigger when they first identified a potential hazard on the road which would make it unsafe to cross the street. A hazard was defined as either an object or event present in the road environment which would make it unsafe to cross the street safely. Following every clip, participants are asked to name the hazard they responded to a measure of hazard perception accuracy.

Gap Acceptance Task

Participants were instructed to imagine they were the pedestrian on the side of the road waiting to cross to the other side of the street. They were instructed to take a step to identify when it would be safe to cross the road safely at their normal walking pace (i.e., if they would have to run at any time to make it across safely, then that would not be a safe crossing time).



Figure 1. Visual depiction of the hazard perception and gap acceptance clip response windows.

Results

Findings from a pilot study of 14 younger and 14 older adults conducted by the research team as a feasibility study demonstrated that older adults performed more poorly on the HP and GA tasks than younger adults. This suggested that older adults saw hazards later than younger adults, were less accurate in the hazards they identified, and chose to cross the street in smaller gaps between vehicles. Given these preliminary findings, the current study will further explore these deficits.

To date, data has been collected from 91 participants (Age: M = 68.64yrs, SD = 5.21yrs; Sex: 44 female). No relationship was found in performance on the HP and GA tasks, r = .08, p = .473. Older adults correctly identified hazards in 84.4% of clips, and a safe gap in 65.9% of clips. Older adults were significantly slower to identify a hazard once it was present than they were to start crossing the road when a safe gap appeared, t(2182.12) = 17.62, p < .001, d = 0.75. Older adults were significantly slower to identify a safe gap to cross in a cluttered environment than an uncluttered environment, t(1017.08) = -4.20, p < .001, d = -0.25. Unexpectedly, older adults identified hazards significantly faster in a cluttered environment than an uncluttered environment, t(914.57) = 6.14, p < .001, d = 0.34. These difference resulted in a mean discrepancy of between 1-1.5 seconds in taking action. Further analysis on head movements and eye tracking will be presented once data analysis is completed.

Benefits to Road Safety

Australia has an ageing population with more than 22% of Australians expected to be over the age of 65 by 2026. Older adults in this cohort are expected to be more mobile than previous generations Due to this the already disproportionate number of older adult pedestrian fatalities are expected to increase. To reduce these high fatality rates, targeted interventions are necessary. If we are to meet the goal of halving road fatalities by 2030, we require strategies which target all aspects of the safe road system. This research is focused on understanding older adult pedestrian street-crossing decisions to facilitate improving their capacity to be safe road-users. The findings from this research will directly inform the development of a training intervention to improve pedestrian outcomes for older Australians.

Implications for policy/practice

The findings from this project will be directly incorporated into the development of an evidence-based professionally developed online training program for older adult pedestrians. This training program will be accessible to older adults nationally and internationally.

Conclusions

Improving the safety of older adults is essential if we are going to see reductions in road fatalities for this cohort. By better understanding their street-crossing behaviours we will be able to create targeted training interventions which will directly improve older adults' agency and safety.

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OPRC Georgia: meeting road safety challenges at the summit

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Abstract

This paper describes the successful implementation of road safety measures employed during the implementation of Output and Performance-Based Road Contracts (OPRC) for rehabilitation works on 241 km of road network in Georgia to ensure safety of workers and all road users. The OPRC road network was in the picturesque region of Guria province, consisting of rugged mountain terrain with high-altitude roads, steep grades, sharp curves, fog, heavy rain and snow. Addressing the road safety challenges, especially during the construction phase of the project, were multidimensional because of rapidly changing weather conditions, landslides, rockfalls, and avalanches. Ensuring a safe road environment for both - road workers and road users - under such testing conditions, required a comprehensive safe systems approach, thorough risk assessment and extensive collaboration between client, policymakers, police, and local communities. By integrating conventional and innovative safety measures at every stage of the project (Planning - Design - Construction - Maintenance), significant improvements in road safety were achieved, resulting in significant reduction in the incidence of crashes and serious injuries.

Post on X

Scaling Summit of Road Safety with Innovative Engineering Measures

Introduction

Economic growth, tourism and sustainable development of Georgia largely depended on facilitation of creation of a safe and efficient transport infrastructure. The Government of Georgia received a loan from the International Bank for Reconstruction and Development (World Bank) to implement the improvement, rehabilitation and maintenance of 241km of secondary roads in Guria Region, through Output and Performance-based Road Contracts (OPRC), executed from January 2018 to June 2024. Integrating road safety measures into OPRC Project was an essential requirement not only for meeting legal obligations but also for safeguarding public welfare, preserving infrastructure, and promoting economic well-being.

Objective

Integrating road safety was aimed for promoting public safety, optimizing project performance, ensuring compliance with regulations, enhancing public perception, fostering sustainable development, and realizing long-term societal benefits. Some key objectives of integrating road safety in OPRC Project were:

Legal Obligations: The World Bank mandated specific safety standards and regulations for OPRC contracts. Failing to adhere to these standards could lead to legal consequences and liabilities for all parties involved.

Minimizing Crashes, Injuries and Fatalities: Rehabilitating roads involved various hazards such as uneven surfaces, construction materials, and heavy machinery. Implementing safety measures minimizes the risk of crashes and fatalities during the construction process and afterward when the road was opened for public.

Protecting Workers: Road construction and rehabilitation works involved heavy machinery and a significant workforce exposed to various risks. Proper safety protocols, training, and equipment were essential to protect the workers from industrial accidents and occupational hazards.

Preserving Infrastructure: Safety measures not only protected people but also helped preserve the infrastructure itself. For example, installing guardrails, proper drainage systems, and signage prevented damage to roads, reducing the need for frequent repairs and maintenance.

Public Confidence: Ensuring road safety enhanced public confidence in the project and the authorities overseeing it. People are more likely to support and use the rehabilitated road if they trust that it has been constructed with their safety in mind.

Economic Impact: Road crashes and fatalities have significant economic costs, including medical expenses, property damage, and loss of productivity. By prioritizing safety in OPRC Project, these costs were reduced, benefiting the local economy and society as a whole.

Approach

Road safety measures were integrated during the 3 phases of the OPRC project, viz Activity 1 (Engineering Assessment and Planning), Activity 2 (Design and Contract Preparation) and Activity 3 (Supervision of Construction and Contract Administration). Following methodology was employed:

Thorough Risk Assessment: Conducted a detailed risk assessment to identify potential hazards specific to hilly terrain, such as steep slopes, sharp curves, adverse weather conditions, and geological hazards like landslides and rockfalls. *Strategic Road Design*: Designed the roads with appropriate alignment, gradients, and signage to enhance safety. This involved widening lanes, installing guardrails, and incorporating features like shoulders, sidewalks and traffic calming measures.

Effective Traffic Management Plan during Road Works: Implementing traffic management strategies to minimize disruptions and ensure safety for both workers and motorists during the construction phase. Stringent provisions were included in the contract document by mandating Traffic Control Plans (TMP) during road works; deploying temporary traffic control measures and maintaining road in safe and trafficable conditions during heavy rain and snow; and maintaining clear communication with the stakeholders.

Utilization of Advanced Technologies: Employed advanced technologies to ensure safety of workers and public using timely snow cleaning activities, de-icing, slope reinforcement techniques, rock-fall protection nets, use of geo-textiles and real-time weather forecasting to enhance safety and improve decision-making throughout the project execution. *Steep Grades and Curves*: OPRC roads had steep grades and sharp curves, making them more prone to crashes, especially for large vehicles. Proper signage, enhanced delineation measures, specialized pavement surface, metal crash safety barriers, guard rails and guideposts were installed to enhance safety on these challenging sections.

Limited Access and Emergency Response: Some sections of OPRC roads impeded access for emergency vehicles in the event of heavy snow and landslides. Establishing emergency response protocols, including ambulance evacuation routes were identified for timely assistance to those in need.

Animal Crossings: OPRC roads were frequented by cattle, horse and diverse wildlife populations, leading to potential collisions between vehicles and animals. Appropriate signage for animal crossings, fencing, and implementing speed reduction measures helped in mitigating the collision risks and protecting both wildlife and road users.

High Pedestrian Activity Areas: OPRC roads encountered many sections with high pedestrian activities such as schools, colleges, residential areas, shopping centers, cemeteries etc. To address road safety challenges in such high pedestrian activity areas - traffic calming measures, speed humps, pedestrian crossings, improved signage, side walks, and speed limit enforcement initiatives - were deployed. Collaboration between residents, local authorities, and law enforcement helped in creating safer environments for all road users in residential areas.

Community Engagement and Education: Engaged with local communities to raise awareness about road safety measures and soliciting feedback on potential hazards. Training and educational campaigns were conducted to promote safe driving practices and foster a culture of responsibility among road users.

Continuous Monitoring and Evaluation: Established a robust mechanism for continuous monitoring and evaluation of road safety measures to identify areas for improvement and to ensure compliance with standards and regulations. This involved regular audits, risk analysis, and community feedback mechanisms.

Crash Analysis and Findings

A crash analysis conducted after the implementation of road safety measures has revealed a significant reduction in the number of crashes and fatalities (Table 1 and Table 2).

			Before safety measures				After safety measures		
Length	AADT 2017	AADT 2023	2018	2019	2020	2021	2022	2023	May-24
241	2,400	3,907	21	24	26	32	20	15	5

Table 1. Fatal and serious injury crashes – OPRC Georgia Network

Table 2. Total fatalities - OPRC Georgia Network

В	efore safe	ty measur	After safety measures					
2018	018 2019 2020			2022	2023	May-24		
3	3	5	4	0	0	0		
+0)(

*Source: Monitoring Consultant's Monthly Progress Reports - OPRC Project Georgia

The analysis highlights the effectiveness of various safety measures in mitigating road traffic accidents and saving lives. Key findings from the crash analysis include:

100% reduction in Fatalities: Significantly there was no fatality during the entire 3 years of rehabilitation works. This exceptional result indicated that the safety measures employed during road works had successfully mitigated critical factors contributing to severe injuries and fatalities on the roads.

Reduction in number of crashes: There has been a substantial decline (50%) in the occurrence of fatal and serious crashes. This outcome suggests that the safety improvements have effectively minimized the severity of crashes and reduced the number of life-threatening injuries among road users.

Impact of Intersection Improvements: 18 Intersection improvements, including improvements to road design, signage, lighting, and traffic management systems, have played a significant role in enhancing road safety. These enhancements have contributed to better road visibility, smoother traffic flow, and reduced conflict points, thereby lowering the risk of severe crashes.

Extended Abstract (Practitioner)

Effectiveness of Speed Management Measures: Speed management measures, such as speed limit enforcement, installation of speed humps, and implementation of traffic calming zones, have proven effective in reducing the likelihood of high-speed collisions. Project Manager proactively devised a comprehensive strategy for installation of 28 additional speed humps, in addition to what was envisaged in the design. This was necessary to slow vehicles down to the design speed and to ensure that the recently rehabilitated road stayed safe for vulnerable road users and residents. This measure proved effective as no speed related crash was reported in the year 2023 and 2024, after the installation of these traffic calming measures.

Positive Impact of Public Awareness Campaigns: Public awareness campaigns focusing on safe driving practices, pedestrian safety, and the importance of seat belt usage have yielded positive results. Increased awareness among road users about the risks associated with reckless behavior has led to more responsible driving habits and a reduction in road crashes.

Collaborative Efforts and Stakeholder Engagement: The success of road safety improvements can also be attributed to collaborative efforts involving various stakeholders, including government agencies, law enforcement authorities, community groups, and road users. Strong partnerships and coordinated action have facilitated the implementation of comprehensive safety initiatives and contributed to the overall reduction in crashes.

Long-Term Impact and Sustainability: The findings suggest that the benefits of road safety improvements extend beyond immediate outcomes, indicating a positive long-term impact on road safety. By prioritizing sustainable safety measures and ongoing monitoring and evaluation, communities can continue to sustain the downward trend in fatal and serious crashes, ultimately creating safer road environments for all.

Conclusion

Successfully implementing road safety measures in the OPRC Project in this hilly region was paramount for ensuring the safety of all road users and minimizing the risks associated with challenging terrain. By integrating comprehensive safety measures into every stage of the project and pro-actively addressing the unique challenges posed by hilly terrain, OPRC Project achieved significant improvements in safety outcomes - had no fatal crash after the road safety measures were implemented. There was a significant reduction in the incidence of crashes. Moreover, successful implementation of road safety measures not only enhanced the efficiency and effectiveness of the transportation network but also contributed to the overall well-being and prosperity of the communities served by these vital infrastructure assets.



Figure 1. Examples of Road Safety Measures in OPRC Project

OPRC India – crash reduction by applying Safe Systems principles

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Abstract

This paper highlights the significant reduction achieved in number of fatal and serious crashes by applying Safe Systems principles on India's first Output and Performance-Based Road Contract (OPRC) for improvement, rehabilitation and maintenance of 204 km road network. The OPRC road network was located in the northern Indian state of Punjab, traversing mostly through semi urban areas with high volume of heterogenous traffic and high pedestrian activity. Integrating road safety by applying safe systems principles from planning and design to construction, operation, and maintenance paid rich dividends. The application of innovative road safety measures led to a significant reduction in fatal and serious crashes, demonstrating the effectiveness of a comprehensive approach that combined infrastructure improvements, public awareness campaigns, and community engagement. These successful outcomes underline the importance of proactive measures and collaborative efforts in creating safer road environments.

Post on X

Driving Change: Implementing Safe System Principles to Drastically Reduce Crashes

Introduction

Economic growth, tourism and sustainable development of Punjab largely depended on facilitation of creation of a safe and efficient transport infrastructure. The Government of India received a loan from the International Bank for Reconstruction and Development (World Bank) to implement the improvement, rehabilitation and maintenance of 204km of secondary roads in the Punjab State, through Output and Performance-based Road Contracts (OPRC), executed from January 2013 to December 2017. Integrating road safety measures into OPRC Project was an essential requirement by the World Bank, not only for meeting legal obligations but also for safeguarding public welfare, preserving infrastructure, and promoting economic well-being. The paper provides the details of innovative road safety measures employed. The paper carries out an analysis of road crashes - before and after the implementation of these road safety measures during 5-year period from Jan 2013 to Dec 2017.

Objective

Integrating road safety was aimed for promoting public safety, optimizing project performance, ensuring compliance with regulations, enhancing public perception, fostering sustainable development, and realizing long-term societal benefits. Some key objectives of integrating road safety in OPRC Project were:

- *Legal Obligations*: The World Bank mandated specific safety standards and regulations for OPRC contracts. Failing to adhere to these standards could lead to legal consequences and liabilities for all parties involved.
- *Minimizing Crashes, Injuries and Fatalities*: Rehabilitating roads involved various hazards such as uneven surfaces, construction materials, and heavy machinery. Implementing safety measures minimizes the risk of crashes and fatalities during the construction process and afterward when the road was opened for public.
- *Protecting Workers*: Road construction and rehabilitation works involved heavy machinery and a significant workforce exposed to various risks. Proper safety protocols, training, and equipment were essential to protect the workers from industrial accidents and occupational hazards.
- *Preserving Infrastructure*: Safety measures not only protected people but also helped preserve the infrastructure itself. For example, installing guardrails, proper drainage systems, and signage prevented damage to roads, reducing the need for frequent repairs and maintenance.
- *Public Confidence*: Ensuring road safety enhanced public confidence in the project and the authorities overseeing it. People are more likely to support and use the rehabilitated road if they trust that it has been constructed with their safety in mind.
- *Economic Impact*: Road crashes and fatalities have significant economic costs, including medical expenses, property damage, and loss of productivity. By prioritizing safety in OPRC Project, these costs were reduced, benefiting the local economy and society as a whole.

Approach

Road safety measures were integrated at every stage of the OPRC Project, from planning and design to construction, operation, and maintenance phase. Improving road safety in both rural and urban areas of the project roads required a multifaceted approach that addressed the unique challenges and characteristics of each environment. Here are some main road safety measures tailored for both rural and urban settings:

- *Road Design and Maintenance*: Implemented measures to address hazards such as sharp curves, narrow lanes, and inadequate shoulder space.
- *Speed Management*: Installed speed limit signs and enforced speed limits through regular policing. Implemented traffic calming measures such as speed humps and transverse road markings to reduce vehicle speeds in rural communities.
- *Visibility and Signage*: Improved visibility by trimming vegetation along roadways and ensuring adequate sight distance at intersections. Installed reflective road signs and markers to enhance visibility, especially during nighttime.
- *Education and Awareness*: Conducted road safety education programs targeting rural communities, schools, and local organizations. Raised awareness about the dangers of speeding, drink-driving, and other risky behaviors.
- *Emergency Response*: Enhanced emergency response capabilities by training first responders and improving access to medical facilities in rural areas.
- *Pedestrian Safety*: Improved pedestrian infrastructure with designated crosswalks, raised pedestrian crossings, and refuge islands. Implemented traffic calming measures in high pedestrian activity areas to reduce vehicle speeds and enhance pedestrian safety.
- *Road User Behavior*: Promoted safe road user behavior through public awareness campaigns and educational initiatives. Conducted public workshops to encourage responsible driving, pedestrian behavior, and respect for traffic regulations.



Figure 1. Examples of Road Safety Measures in OPRC Project

Crash Analysis and Findings

A crash analysis conducted after the implementation of road safety measures has revealed a significant reduction in the number of fatal and serious crashes. The analysis highlights the effectiveness of various safety measures in mitigating road traffic accidents and saving lives. Key findings from the crash analysis include:

• *Decrease in Fatalities*: The analysis showed a notable decrease in the number of fatalities resulting from road traffic crashes. This reduction indicates that the implemented safety measures have successfully addressed critical factors contributing to severe injuries and fatalities on the roads.

- *Reduction in Serious Injuries*: There has been a substantial decline in the occurrence of serious injuries sustained in road crashes. This outcome suggests that the safety improvements have effectively minimized the severity of crashes and reduced the number of life-altering injuries among road users.
- *Impact of Intersection Improvements*: Intersection improvements, including improvements to road design, signage, lighting, and traffic management systems, have played a significant role in enhancing road safety. These enhancements have contributed to better road visibility, smoother traffic flow, and reduced conflict points, thereby lowering the risk of severe crashes.
- *Effectiveness of Speed Management Measures*: Speed management measures, such as speed limit enforcement, installation of speed humps, and implementation of traffic calming zones, have proven effective in reducing the likelihood of high-speed collisions. By encouraging compliance with speed limits and slowing down vehicle speeds, these measures have contributed to a decline in the severity of crashes.
- *Positive Impact of Public Awareness Campaigns*: Public awareness campaigns focusing on safe driving practices, pedestrian safety, and the importance of seat belt usage have yielded positive results. Increased awareness among road users about the risks associated with reckless behavior has led to more responsible driving habits and a reduction in road crashes.
- *Collaborative Efforts and Stakeholder Engagement*: The success of road safety improvements can be attributed to collaborative efforts involving various stakeholders, including government agencies, law enforcement authorities, community groups, and road users. Strong partnerships and coordinated action have facilitated the implementation of comprehensive safety initiatives and contributed to the overall reduction in crashes.
- Long-Term Impact and Sustainability: The findings suggest that the benefits of road safety improvements extend beyond immediate outcomes, indicating a positive long-term impact on road safety. By prioritizing sustainable safety measures and ongoing monitoring and evaluation, communities can continue to sustain the downward trend in fatal and serious crashes, ultimately creating safer road environments for all.

Conclusion

In conclusion, the crash analysis provides compelling evidence of the effectiveness of road safety improvements in significantly reducing the number of fatal and serious crashes. The findings underscore the importance of investing in comprehensive safety measures, infrastructure upgrades, public awareness campaigns, and collaborative efforts to achieve lasting improvements in road safety. Successful implementation of road safety measures not only enhanced the efficiency and effectiveness of the transportation network but also contributed to the overall well-being and prosperity of the communities served by these vital infrastructure assets.

Do vehicle characteristics influence driving behaviour in young people?

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Abstract

Young drivers are more prone to being involved in a road traffic collision compared to more experienced drivers. However, the influence of vehicle characteristics on the driving behaviour of young drivers is relatively unknown. This study aimed to determine whether these characteristics influenced braking behaviour in young drivers and whether these characteristics influenced the relationship between braking behaviours and demographical characteristics. 37 participants were asked to drive as they normally would with a telematics device installed into their vehicles for a period of one month. Linear Mixed Modelling and Generalised Linear Mixed Modelling were used to analyse the data and it was found that vehicle engine power and vehicle safety rating were associated with safer braking performance, indicating that vehicle choice may be important in reducing road traffic collisions for this demographic. There were no significant relationships between braking performance and any of the demographic variables.

Post on X

This study investigated whether the driving performance of young people is influenced by the characteristics of the vehicles that they drive. In-vehicle telematics was used to record trip data and linear mixed modelling was used for analysis. Engine power and vehicle safety rating were associated with better performance.

Introduction

It is predicted that road traffic injuries will be the seventh leading cause of death by 2030 (World Health Organisation, 2021). Road traffic outcomes for young drivers are worse compared to more experienced drivers, with road traffic accidents accounting for 1 in 5 deaths for people aged between 15 and 24 years of age in Australia (Vicroads, 2023). A lack of experience and a higher propensity to take risks are among the reasons for these inflated crash statistics (Bates et al., 2014), however, the choice of vehicles in young drivers and how this influences their driving behaviour and driving outcomes is relatively unknown. This study aims to determine the influence of vehicle characteristics on driving behaviour and whether these characteristics influence the relationship between demographic characteristics and driving behaviour. The study suggests that the braking capabilities of the vehicles chosen by young drivers are worthy of more attention.

Method

20 females and 17 males aged between 19 and 28 (mean age: 23.84) were recruited and given a telematics device to insert into their vehicles for the duration of one month. Braking behaviours were recorded throughout the month using the telematics device, a braking score was assigned to each driving trip while the number of braking events exceeding a threshold of -.02g was recorded. Higher braking scores are consistent with safer braking behaviours. Linear Mixed Modelling (LMM) and Generalised Linear Mixed Modelling (GLMM) were used to firstly determine whether vehicle characteristics including vehicle weight, engine power, model year, and vehicle safety rating had an influence on braking behaviours, and secondly to determine whether adding vehicle characteristics to models based on demographic characteristics resulted in significant improvements. Initially only demographical variables such as sex, age, and license type were included in the models with vehicle characteristics variables being included later.

Results

The LMM with braking score as the dependent variable indicated that vehicles with higher engine power were associated with higher braking scores on average. The results of this LMM were validated using a GLMM with number of braking events as the outcome variable, assuming a Gamma distribution.. Engine power was again significant, with vehicles with a higher engine power having fewer harsh braking events. A higher vehicle safety rating was also associated with fewer harsh braking events on average. There were no significant demographical variables in either model, though including vehicle characteristic variables improved each of the models. This was surprising given that other naturalistic driving studies have found driving behavioural differences between demographical groups. Simons-Morton et al., (2019) found that harsh event incidence rate was higher for males compared to female drivers and the rates were also higher for drivers in the 18 to 20 year old age group compared to the 21 to 25 year old age group.

The more powerful vehicles in the study tended to be larger vehicles. Larger vehicles have the capacity to have disk brakes in both the front wheels and the back wheels (Cars24, 2024). These vehicles also have wider tyres, which creates

more traction compared to narrower tyres (Jones and Childers, 2001), which may explain why the more powerful vehicles in the study had better braking performance. There was also a correlation between vehicle safety rating and model year which may explain why these vehicles with higher safety ratings were better at braking. A vehicle's braking performance is considered in the ANCAP safety ratings (ANCAP, 2024), so it is probably not surprising that the safety rating was significant in the Harsh braking model.

Benefits to road safety

This study has shown that young people demonstrate better braking performance in vehicles with higher engine power. Having young people drive such vehicles may therefore lead to safer roads.

Implications for policy

Since vehicles with higher engine power and a better safety rating were associated with improved driving performance in young drivers, these drivers could be incentivised to purchase vehicle featuring these characteristics. These incentives would assist in the more rapid turnover of current vehicle fleets, resulting in safer vehicles being driven and consequently, improving driving behaviour by 2030.

Conclusions

Though there was no significant relationship between demographical variables and young driver braking behaviours, some vehicle characteristics were associated with braking behaviours. The results highlight the need for future road safety studies to consider vehicle characteristics when analysing driving data for young drivers.

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Risky behaviours when e-scootering in the ACT

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Abstract

Despite rapid expansion of electric scooters (e-scooters), there is a paucity of literature regarding their use. We conducted an online survey of e-scooter riders in the Australian Capital Territory to assess risky riding behaviours. We examined factors associated with different risky behaviours across a range of demographic and contextual variables and examined reasons for not wearing a helmet while riding. Results from 367 participants (41% male, $M_{age} = 22.7$ years) showed that the majority (83%) used shared e-scooters. Risky behaviours were common, especially when riding late at night. Preliminary analysis of reasons given for not wearing a helmet included: aesthetic concerns, low perceived risk, being uncomfortable, hygiene concerns, embarrassment, lack of availability, and having consumed alcohol. Findings highlight the need for further study, especially observational accounts of behaviour. Additionally, it is imperative to consider strategies to encourage safer riding behaviours, including facilitators for helmet use which address identified barriers.

Post on X

A survey of e-scooter riders in the Australian Capital Territory found very high levels of risky behaviours, especially when riding late at night. What needs to be done to facilitate safer riding?

Introduction

In Australia, shared e-scooters have recently been trialled in all major cities. With the increased presence of e-scooters, there have been accompanying concerns regarding their safety. Reports of risky practices have included the non-use of helmets, excessive speed, carrying multiple passengers, and riding when impaired by alcohol or other drugs (Gioldasis et al., 2021; Haworth et al., 2021a). The Australian Medical Association (AMA) recently called for greater community education regarding the potential dangers of using e-scooters following a large increase in presentations to emergency departments involving e-scooter crashes (AMA, 2022). The most common trauma observed for e-scooter crashes is head injuries (Crowe & Elkbuli, 2021) suggesting use of helmets is especially important to prevent injuries to riders. However, risky behaviours such as excessive speed, impairment and distraction may contribute to injuries to pedestrians and are also important to consider.

In September 2020 the Australian Capital Territory (ACT) introduced a shared e-scooter scheme (Transport Canberra, 2022) with two private operators (Beam and Neuron) operating. Legislation in the ACT requires riders to wear a helmet, keep to the speed limit, not ride under the influence of alcohol or drugs, not use a mobile phone while riding, have only one person per scooter, and use the footpath rather than the road where practical to do so (ACT Policing, 2023). Given the relatively recent introduction of e-scooters, little is known about potential risky behaviours associated with their use. However, the evidence from observational studies across a number of countries suggests high levels of non-helmet wearing (e.g., Arella & Fang, 2019: USA; Siebert et al., 2021: Germany) but relatively low levels of dual use (more than one passenger; Siebert et al., 2021). An observational study conducted by Haworth and colleagues (2021a) in February, 2019, in the CBD of Brisbane found that almost half of the observed shared e-scooter riders engaged in some form of illegal riding. Around 39% of riders were not or incorrectly wearing a helmet; however, levels of dual use were low (2.1%). A second study conducted in October, 2019, found rates of non-helmet wearing had dropped somewhat but still represented a third of riders (Haworth et al., 2021b). In a multi-country survey study (Sucha et al., 2023) it was found that half of e-scooter rider respondents had experienced a "near miss", defined as an unplanned event which has the potential to cause an accident.

While the frequency of some risky behaviours has been established, there is a paucity of research regarding factors associated with engaging in these behaviours. There is mixed evidence regarding the demographic factors associated with risky riding of e-scooters. A survey of e-scooter riders in Paris, France, found that being young (17 – 24 years) and male were associated with risky e-scooter behaviours such as riding after consuming alcohol or drugs, and using a phone while riding (Gioldasis et al., 2021). Likewise, an observational study in California, USA, found males riders were more likely to speed than female riders (Arella & Fang, 2019). Haworth and colleagues (2021a) found riders of shared e-scooters were over four times more likely to engage in risky e-scooter riding behaviours compared with private e-scooters. They did not find any relationship of gender or age with non-helmet wearing (analysis included both e-scooter and bicycles). However, they did find that non-helmet wearing was significantly higher from 2-4pm time compared to 7-9am. Note that their study did not include any observations after 6pm.

Acknowledging the increasing availability of e-scooters and the lack of data regarding e-scooter behaviours in Australia, including the ACT, the current study aimed to: assess the self-reported engagement in a range of risky escooter behaviours among a sample of riders in the ACT; examine differences in engagement in different risky behaviours across a range of demographic and contextual variables; examine predictors of risky e-scooter behaviours; and examine reasons given for not wearing a helmet while riding an e-scooter.

Method

Participants

Participants comprised 367 people aged 17-72 years ($M_{age} = 22.7$, $St_{dev} = 7.5$; 41% male) who had ridden an e-scooter in the past 12 months in the Australian Capital Territory Region.

Measures

Demographic and contextual variables were assessed including age (in years), gender (male/female/non-binary/prefer not to say), frequency of e-scooter riding (less than monthly/monthly/weekly/daily), type of e-scooter ridden (hired/private/both) and time of day mostly likely to ride an e-scooter (morning/afternoon/evening/late at night). We also asked participants if they had ever been injured while riding an e-scooter (yes/no). Self-reported risky e-scooter behaviours were measured using six items asking participants how frequently they had done the following while riding an e-scooter: worn a helmet, had more than one person on the e-scooter, ridden when possibly affected by alcohol, ridden when possibly affected by drugs, exceeded the speed limit, and used a smartphone. Response were on a 7-point scale (never/seldom/rarely/sometimes/often/very often/always). For analyses, we dichotomised these measures (0 = never, 1 = seldom-always). Finally, given the identified importance of wearing a helmet, participants responded to an open-ended question which asked "if you do not always wear a helmet when riding an e-scooter, can you tell us why?"

Procedure

The study received institutional ethics approval. Participants were recruited from a local ACT university and from the wider community via online advertising. Participants responded to an online survey administered via Qualtrics. Upon completion of the survey, participants had the options of either receiving course credit (if students) or entering a prize draw for one of five \$50 e-gift cards. Upon conclusion, they were provided with a link which provided information on e-scooter laws in the ACT. The survey data was collected during 5 April and 26 May, 2023.

Results

Most participants (83%) had ridden a hired scooter in the prior year (rather than private or both shared/private) and the greatest frequency of e-scootering was less than monthly (75%). Twelve percent of participants reported having injured themself while riding an e-scooter. Risky behaviours were common: 66% had exceeded the speed limit, 61% had ridden with at least one passenger, 60% had not always worn a helmet and 55% had used the phone while e-scootering. Other behaviours (riding when affected by alcohol and/or drugs) were reported by less than half of the sample (45% and 13.6%, respectively). Contextual differences across each risk behaviour were examined and identified that a significantly higher proportion of those riding scooters late at night (compared with those who ride only morning/afternoon/evenings) engaged in each of the risky behaviours. Sixty-six percent of those who reported having injured themselves while riding reported that they used an e-scooter while under the influence of alcohol. A higher proportion of those in the youngest age group (17-24 years) reported not always wearing a helmet and riding with multiple passengers. Logistic regressions identified that being younger in age and riding late at night (compared with riding in the morning, afternoon or evening) were important predictors of having multiple passengers, not always wearing a helmet, speeding and use of a smartphone while riding (with consideration of other demographic and contextual factors), while only riding late at night was a significant predictor of riding under the influence of alcohol or riding under the influence of other drugs. Preliminary analysis of the open text comments of reasons for not wearing a helmet included: aesthetic concerns, low perceived risk, being act uncomfortable, hygiene concerns, embarrassment, lack of availability, and having consumed alcohol.

Implications/Conclusions

The current study investigated risky e-scooter behaviours in the ACT region. Findings highlighted the frequency of risky behaviours when riding. In contrast to prior research, the current study identified a high proportion of multiple passengers on e-scooters. In particular, the increased vulnerability of harm (to self and others) when riding late at night was identified. The current study was limited by its reliance on self-report measures which may not accurately reflect actual behaviour. It is recommended that observational studies occur in the ACT to corroborate the findings of this study. Future research is needed to examine ways we can reduce the identified concerns of wearing a helmet via addressing aesthetic and hygiene concerns, as an example, and highlighting the risk to further promote safe riding behaviours.

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Advancing road safety in Ontario, Canada: lessons from international models

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Abstract

Ontario, Canada, grapples with persistent road safety challenges. The Canadian 2025 Road Safety Strategy aims to elevate performance nationwide, but Ontario lacks a comprehensive framework for road safety capability improvements. In response, Good Roads, representing 432 municipalities and 40 First Nations, initiated capacity-building efforts. An international scan identified municipal capability building programs, of which Australian programs emerged as world leaders. An initial pilot program of road safety audit capability building (through the development of guidelines and training courses) was deployed in 2023. Key elements of the program are the integration of Safe System principles, the interactive nature of the training courses, and the delivery by road safety practitioners with real-world experience. The *Ontario Road Safety Audit Guidelines* were endorsed by independent reviewers. The pilot training courses yielded positive feedback, and participants have begun initiating on-ground audits. The province has committed to ongoing capability building in road safety auditing.

Post on X

The absence of a complete road safety framework leaves Ontario facing persistent road safety challenges. Good Roads, representing 430+ municipalities, turned international best practices into tailored training. Positive feedback and early audits show promise for safer roads.

Introduction

The province of Ontario, Canada, faces significant challenges in ensuring the safety of its community on their roads and streets. Trauma rates are persistently high despite efforts between the various levels of government, which have been highly uncoordinated. Responsibility for road safety in Ontario is distributed among federal, provincial, and municipal authorities. At the federal level, vehicle safety oversight falls under the purview of the Canadian government, while the province of Ontario is tasked with legislative and regulatory frameworks governing its extensive network of roads, bridges, and culverts, managed by municipalities encompassing over 305,000 lane kilometres.

The 2019 Ontario Road Safety Annual Report (latest full version published) reveals alarming trauma rates, with 584 fatalities and 47,023 injuries resulting from collisions on Ontario's roads and streets that year. Moreover, the fatality rate per 100 million vehicle kilometres has shown a concerning trend of incremental increases since 2014. Preliminary data from 2022 (Ontario Ministry of Transportation, 2023) indicates that 592 people were killed.

The Canadian Council of Motor Transportation Administrators spearheads the Road Safety Strategy 2025 (RSS2025), aiming to elevate Canada's road safety standards and practices to global excellence. While several provinces and territories have adopted comprehensive strategies aligned with the principles of the RSS2025, Ontario has yet to establish such a framework. One key element that was missing is a dedicated program of capacity building.

Recognizing the imperative for systemic improvements, Good Roads (a municipal association concerned with the quality and design of roads in Ontario that represents 432 municipalities and 40 First Nations), has been advocating for wider capability building initiatives in road safety. Working with the provincial government, they looked for international best practices, particularly from leading programs in New Zealand and Australia. They have a particular interest in integrating Safe System principles into infrastructure improvements, and finding programs and initiatives that build this capability.

Method

Good Roads carried out an international scan of existing capacity building programs that are targeted, in the main part, at municipalities. They looked for programs that focused on enhancing road safety using a Safe System approach, were practical for municipalities, were delivered through engaging formats, that foster actionable outcomes and offer proactive risk management. A variety of programs were identified, and to pilot the initiative, a road safety audit program was selected. This is primarily because road safety audits are recognised globally and have been evaluated to return between 11 and 54 per cent reduction in crashes (FHWA, 2012). In the absence of Good Roads' efforts, the concept of road safety auditing was virtually non-existent in the province. The handful of public road authorities that were engaged in the practice of road safety auditing relied on guidelines that were outdated.

Critical to this process was the development of the *Ontario Road Safety Audit Guidelines* (Good Roads, 2023) which drew inspiration from reputable sources such as the Austroads Guide to Road Safety Part 6: Road Safety Audit (Austroads, 2022). Using these guidelines as a foundation, a road safety audit technical training course was developed for the Canadian context. The collaborative efforts between Good Roads and their selected consultants produced a tailored framework to build capability in the proven road safety technique of road safety auditing.

The decision to replicate leading Australian programs leveraged inherent strategic/political advantages that increased the likelihood of Good Roads succeeding. Australia– more than any other jurisdictions in the world – is considered by Ontario decisionmakers to be an aspirational and analogue jurisdiction. Unlike similar initiatives in the United States, the United Kingdom, Scandinavia or Ireland, the decision to benchmark Ontario against Australia has been greeted by a consensus that Ontario "needs to do something".

More specifically, Good Roads has focused on the collaborative capacity-building efforts between the State of Victoria, Victorian councils and the Transport Accident Commission to provide a template for future policy and program directions in Ontario. The leading metrics indicate that Victoria has levels of road trauma that are proportionately between one-third and one-half less than Ontario.

Political motivation and the real world results of outcomes of Victoria's coordinated efforts led Good Roads to conclude that this Canadian-Australian collaboration was the most expedient and efficient means to move Ontario toward trauma outcomes like those that Victoria has realized.

The course structure encompassed a blend of in-person instruction, interactive exercises, practical fieldwork, and a comprehensive final exam. Through this holistic approach, participants were equipped with the necessary knowledge and skills to effectively identify and address road safety concerns within their respective municipalities.

Results

The Guidelines were reviewed by an array of independent practitioners and road experts comprised of experienced municipal engineers, planners, and designers within Ontario. This endorsement underscores the value and applicability of the guidelines in addressing road safety challenges specific to Ontario's diverse landscape. The Guidelines were published in 2023.

Once the Guidelines had been developed, pilot training courses were conducted in-person, targeting relevant stakeholders within the municipal road and street management sector. Feedback received from participants was overwhelmingly positive, attesting to the effectiveness of the courses in imparting practical knowledge and skills. Encouragingly, these training initiatives are beginning to yield tangible outcomes, with participants actively engaging in on-ground road safety audits. This early indication of success highlights the potential for sustained improvements in road safety practices across Ontario, as stakeholders continue to leverage the insights gained from the training courses to inform their decision-making and operational strategies. Most importantly, this training is building road safety capacity within local road authorities and setting the stage for a province-wide road safety funding scheme to address Ontario's most problematic local roads.

Conclusion

The collaborative efforts to enhance road safety within Ontario have yielded promising results. Through the development and adoption of guidelines (informed by international best practices) and robust training initiatives, stakeholders across the municipal landscape are better equipped to address the multifaceted challenges inherent in ensuring safe road and street infrastructure.

The positive reception and endorsement of the Guidelines by experienced practitioners underscore their relevance and potential impact in driving systemic improvements at the municipal level. Furthermore, the success of the pilot training courses, evidenced by participant feedback and the initiation of on-ground road safety audits, signifies a step forward in the practical application of Safe System principles within Ontario's road and street management industry.

As these initiatives continue to gain momentum and support, it is envisaged that Ontario will witness a sustained trajectory towards improved road safety outcomes. By fostering a culture of collaboration, knowledge exchange, and proactive engagement, stakeholders are poised to effect meaningful change. Moving forward, continued investment in capability building, strategic partnerships, and evidence-based interventions will be paramount in driving further advancements in road and street safety across the province.

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Ocular measures predict increased crash risk in fatigued drivers

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Abstract

Fatigue is a major contributor to fatal and serious-injury crashes. Currently there are limited screening tools for fatigue as a fitness-for-duty or roadside test. We examined the capacity of the Pupillographic Sleepiness Test (PST) to predict fatigue-related driving impairment (near crash events). Fifteen young drivers completed a 2h drive around a closed track loop in an instrumented vehicle following varying levels of sleep and completed the PST before and after each drive. Results showed increased driving impairment with sleep loss, with more lane deviations and near crashes. A "failed" PST combined with a horizontal gaze nystagmus test led to almost 20x increased near crash events, with good sensitivity and very high specificity. These results offer a novel, evidence-based roadside screening protocol for fatigued drivers, with potential utility in a roadside setting, or as a fitness-for-work tool in workplace settings e.g., heavy vehicle sector.

Post on X

When your eyes can predict whether you will fall asleep at the wheel – DTP and Monash Uni have validated a screening device for fatigue-related impairment using pupil diameter changes to predict near crash events in an on-road track trial. This device can be used to improve road safety through roadside or fitness-for-duty testing.

Introduction

Despite fatigue contributing to 20-30% of motor vehicle crashes in Australia (National Road Safety Strategy, 2018; Transport Accident Commission, 2019), there is currently no objective screening tool for fatigue. A screening device for fatigue-related impairment may reduce the incidence of fatigue-related crashes, through deployment at the roadside, or as a fitness-for-work or fitness-for-duty tool to contribute to fatigue-related policy in high-risk work environments (i.e., heavy vehicle sector, mining industry, health care and emergency services, etc.). A screening device discussed here differs from continuous drowsiness monitoring devices such as Seeing Machines, as it measures drowsiness in a single point in time to predict subsequent impairment.

A phased approach was used to identify and validate a screening device that can predict fatigue-related impairment. The first step was identifying any existing technologies that may be suitable through an international literature review. From there, the most promising devices were included in a highly controlled laboratory sleep deprivation study, where their capacity to accurately predict time spent awake and fatigue-related impairment were assessed. The Pupillographic Sleepiness Test (PST) was identified as the most appropriate candidate for roadside testing. The PST is an 11-minute test measuring pupil instability (spontaneous changes in pupil diameter) under near-zero light. The outcome of the PST is the pupillary unrest index (PUI), whereby low PUI values indicate an alert, awake state, and relatively stable pupil diameter, whereas high PUI values indicate a fatigued, sleepy state with greater pupillary instability (Lüdtke et al., 1998). The laboratory-based sleep deprivation study demonstrated the PST as a significant predictor of performance impairment as measured by a sustained attention task and physiological sleepiness as measured by EEG-derived microsleeps and slow eye movements (Maccora, Manousakis, & Anderson, 2018).

Standardised Field Sobriety Testing (SFST) assesses behavioural impairment due to drugs. SFSTs include the horizontal gaze nystagmus (HGN) test, which assesses smooth eye tracking with a stimulus. While nystagmus has been observed in sleep deprived individuals (Fransson et al., 2008), there currently has been no validation of the efficacy to detect fatigue in real world conditions. HGN offers potential to be an efficient, non-invasive preliminary screening test for fatigue.

Study Aim and Rationale

Following the extensive validation process undertaken to develop a roadside/screening tool for fatigue, the next step was to examine whether the PST could accurately predict on-road driving impairment under varying levels of sleep. Developing an accurate device to detect fatigue-related impairment could lead to establishment of a fatigue screening protocol/policy that can be widely adopted in operational or workplace settings (i.e., heavy vehicle sector, shift work, etc.) which will ultimately reduce the number of fatigued drivers on the road and the overall death toll.

Methodology

Study Design

This study utilised a repeated-measures design with varying amounts of sleep the night prior to the drive, including a baseline well rested condition with 8h sleep prior.

Participants

Fifteen drivers aged 20-35 completed at least two conditions of the study (N=13 completed all conditions). Participants were free of medical, mental or sleep disorders and had regular sleep-wake schedules. They were regular and experienced drivers.

Procedure

Participants completed a 2h drive around a closed track loop in Melbourne, Victoria in an instrumented vehicle. Participants were accompanied by a driving instructor in the passenger seat, with a dual-control brake pedal. All participants completed the same driving route for all four drives.

Pupillographic Sleepiness Test

Prior to and immediately after each drive, participants completed the PST, where they were required to maintain their gaze on red LED light. The measure of pupil instability was the Pupillary Unrest Index (PUI) where a higher PUI value indicates greater pupil instability.

Horizontal Gaze Nystagmus

The Horizontal Gaze Nystagmus (HGN) is a component of Standardised Field Sobriety Tests (SFST). This study reports on the Smooth Pursuit test for nystagmus – where the participant is asked to smoothly track the movement of a pen moving from left to right in front of their nose. Nystagmus is defined as the jerky motion of the eyes when tracking an object, such as a pen. Participants completed the HGN after each drive.

Driving Performance Measures

Near crash events were defined as instructor interventions (where the instructor had to step on the emergency brake, or straighten the steering wheel), or drive terminations (where the instructor ended the drive early as the driver was too fatigued to continue safely). Lane departures are defined as two wheels leaving the carriageway, as scored by the driving instructor, and verified by visually scoring video footage. Near crash events represent the most severe level of impairment, while lane departures represent a moderate level of impairment.

Statistical Analysis

To examine the effect of sleep loss on driving outcomes (i.e., lane deviations, instructor interventions, and drive terminations), poisson regression and Kaplan-Meier survival probability was conducted. To examine the capacity of the PST and HGN to predict driving impairment, Receiver Operating Characteristic curve analysis were conducted for continuous PUI scores. Chi-Square analysis with contingency tables were used to determine the predictive capacity of a Pass/Fail PST test.

Results

Driving Outcomes

As expected, we report an increasing driving impairment with increasing sleep loss. This is evidenced by significantly greater lane deviations with increasing sleep loss (p<.05), and the risk of near crash events increasing to greater than 10-fold (p<.05).

Predictive Capacity of PST Combined with the HGN

Overall, in predicting severe impairment (i.e., drive terminations), the PST combined with the HGN demonstrated very high specificity (few false positives) and moderate to good sensitivity (true positives). Sensitivity increased with increasing severity of impairment, whereby drive terminations had the highest sensitivity and lane deviations had the lowest sensitivity. This suggests that this combination of tests is more suitable when applied to severe levels of fatigue where crash risk is highest.

Benefits to Road Safety

Predicting driving impairment in an on-road setting

We demonstrate a novel and evidence-based roadside screening protocol for drivers impaired due to fatigue. We show that the PST with the HGN is associated with adverse driving outcomes due to fatigue. The PST combined with the HGN demonstrates capability to discriminate between severely fatigued drivers and alert drivers. The PST and HGN test can detect this impairment with good sensitivity and very high specificity (no false positives). While many individuals report having driven while sleepy or experienced falling asleep at the wheel, this number is disproportionately high in vulnerable populations such as shift workers (e.g., healthcare workers post-night shift, Anderson et al., 2018). The fatigue detection protocol we have developed has potential to be used on shift-workers postnightshift to determine whether they are safe to drive home. To determine whether the fatigue impairment detection protocol has utility in road safety practice, next steps could be testing the device in a field study with real-world drivers. The development of fatigue screening protocols can assist establish workplace safety practices such as fitness-for-duty in industries where fatigued driving is more common (i.e., heavy vehicle sector), or identify those who are too fatigued to commute home post nightshift (i.e., emergency services, shift-workers).

Implications for Policy and/or Practice

This work has implications for improving workplace health and safety policies in high-risk industries such as the heavy vehicle sector. Fitness-for-duty tests could be implemented in commercial driving sectors such as heavy vehicle, emergency service, taxi, or gig economy drivers, etc. Heavy vehicle drivers are required to drive for extended periods of time, as well as through the night, where the risk of a crash is highest (Sandberg et al., 2011). In addition, those driving while fatigued often are motivated to continue driving, even if they are aware of the risk (Watling et al., 2014). Commercial drivers on duty have even higher motivation and subsequently greater risk to continue driving even when sleepy, due to risk of loss of income or meeting performance requirements if they cease driving. If fatigue detection protocols utilizing the PST and HGN are used prior to driving, this could considerably reduce the number of fatigued heavy vehicle drivers on the roads and reduce fatigue-related crashes. Many heavy vehicle operators utilize continuous, in-vehicle driver monitoring to address the issue of driver fatigue, such as the use of Seeing Machines Guardian system or other continuous driver monitoring systems. However, this device is novel and non-comparable to Seeing Machines devices as it measures fatigue at one point in time and predicts subsequent impairment. By developing a screening tool with the capability to detect subsequent driving impairment, this is a proactive and protective measure against fatigue driving before a driver starts to fall asleep.

Conclusions

This research is the first in Australia to identify, validate, and develop a screening tool/roadside fatigue impairment testing protocol that can discriminate between severely impaired vs. alert drivers in an on-road setting. This technology has potential utility in both operational settings (roadside testing) and workplace health and safety policy (fitness-for-duty/fitness-for-work). Future work can take this fatigue impairment testing protocol into the field with the aim of developing a regulatory model for fatigue.

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Estimating an optimal enforcement program for speeding and impaired driving

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Abstract

The Norwegian Institute for Transport Economics has developed three strategic packages of road safety programs that span the years 2002 to 2030. These packages were based on economic analysis of the benefits and costs of each program. Effective programs were proposed for expansion up to the level where marginal benefits still exceeded marginal costs, representing the optimum for each individual program. The Traffic Enforcement Resource Allocation Model (TERAM) developed for Victoria Police was used to estimate the optimal intensity level of each program aimed at speeding or drink or drug driving. Complementary enforcement programs were estimated to achieve greater crash savings in combination than alone. An optimal and more cost-effective enforcement package was determined.

Post on X

Estimating an optimal traffic enforcement program aimed at reducing speeding and drink and drug driving

Introduction

The theme of the Australasian Road Safety Conference for 2024 is *Target 2030: What's the pathway forward?* This theme calls for a focus on strategic planning of road safety programs and initiatives with the aim of reaching the 2030 target. This target, at least for road fatalities, has been set at a 50% reduction in all Australasian jurisdictions. Commensurate targets for a reduction in the seriously injured vary. Against this background, Australia and New Zealand would do well to follow Norway who appear to be in advance of achieving their 2030 target. This appears to be based on the strategic planning of the Norwegian road safety programs by Rune Elvik and others at the Institute for Transport Economics in Oslo. Programs aimed at improving road user behaviour (such as traffic enforcement) principally aim to achieve an improvement in the short-term.

A jurisdiction can choose the initiatives to include in its road safety package according to a number of strategies. Elvik (2003) considered three general strategies in developing a package for 2002 to 2012: *The Cost-Benefit Strategy* consisting of all road safety measures whose marginal benefits are greater than their marginal costs of implementation and operation; *The Vision Zero Strategy* consisting of applying, as consistently as possible, the road design principles of Vision Zero; and *The Maximum Safety Potentials Strategy* involving implementing all potentially effective road safety measures to the maximum conceivable extent. Elvik (2003) reviewed all potentially effective road safety measures in Norway for assessment of their safety potential, cost-effectiveness and benefit-cost ratio, then developed packages of 59 effective measures. Only the Cost-Benefit strategy produced a package of measures whose overall benefits exceeded the cost of implementation (benefit-cost ratio of 1.79). The other two strategies led to packages with small benefit-cost ratios (0.47 and 0.28 respectively).

Elvik (2008) used a similar approach for packaging of effective, cost-beneficial measures to be introduced in Norway during 2010 to 2019. He proposed the optimal use of each road safety measure. All road safety measures were to be used up to the point at which marginal benefits equal marginal costs. Elvik (2014) extended Elvik's (2008) analysis to consider the optimal selection among three measures aimed at speeding. Elvik noted important interactions of the effects of these three measures that affect their application. This analysis demonstrated the optimal combination and operational levels of three measures aimed at the same road safety problem. Methods of estimating the combined crash effect of more than one measure are given in Elvik (2009).

Elvik and Hoye (2020) went further in considering the use of road safety measures in Norway during 2018 to 2030, choosing the maximum use of current measures. All currently used measures were to be implemented at their maximum level, but stopping short of complete renewal of the car fleet, and mandatory Intelligent Speed Adaptation, alcohol interlocks and seatbelt ignition interlocks in all vehicles. Current measures implemented at their maximum level could reduce annual road deaths in Norway by 44% to 50 and seriously injured by 35% to 340 in the year 2030.

Method

Road safety benefits expected from the implementation of various traffic enforcement options in Victoria have been estimated using TERAM (Traffic Enforcement Resource Allocation Model) (Cameron, Newstead and Diamantopolou, 2016). TERAM estimates the savings in fatal, serious injury and minor injury crashes for any given percentage increase in each type of traffic enforcement, valued by weighting each crash saved by the unit crash cost valued by either the Human Capital method or the Willingness-to-Pay method (TIC, 2015;). TERAM also estimates the additional cost of

the specific percentage increase of each enforcement, whether it be the capital cost, operating cost, other cost of offence detection, or detected offence processing cost. Finally, TERAM estimates the benefit-cost ratio (BCR) of the given increase in enforcement and then the marginal BCR of the next small increase in enforcement of each type. Here the social cost per crash of each injury severity level has been valued using the Hybrid Human Capital method (ANU 2022) in 2020 prices, then updated to 2023 using the Consumer Price Index, as have the unit costs of offence detection and offence processing from each enforcement method.

Results

A new TERAM analysis of speeding and impaired driver enforcement in Victoria was conducted based on an earlier analysis by Cameron et al (2016; Tables 11-13), updated modelling of rural mobile speed cameras (Cameron and Newstead 2021; Table 2), new modelling of roadside drug testing (Cameron et al. 2022; Tables 4-7) and updated analysis of roadside breath testing (Newstead et al. 2020; Section 7.4).

The intensity of each individual enforcement method was increased to a level at which its marginal BCR is approximately one. Space constraint does not permit the presentation of the crashes saved and economic analysis achieved by each enforcement method. The results have been grouped in Table 1 into those methods aimed at speeding and, separately, those aimed at impaired driving, on rural and urban roads. An estimate of the combined effect of increases of the two different types of enforcement operating in the same road environment, is labelled "multiplicative effects". Where the two types of enforcement operate on the same roads, the crashes remaining after one type of enforcement has its effect can then be considered to be the basis for further crash reduction by the second type of enforcement. In Table 1, the 41.0% reduction in rural fatal crashes due to the increase in rural speed enforcement is considered to leave 59% of crashes as the basis for the 29.6% reduction in fatal crashes due to the increase in impaired enforcement on rural roads. Thus the estimated effect on fatal crashes of their combined effect on rural roads was:

$$[1 - (1 - 41.0/100) \times (1 - 29.6/100)] \times 100\% = 58.5\%$$
 reduction

This is substantially less than the estimated 70.6% reduction when the fatal crash savings were simply added. However, Elvik (2009) has pointed out that this "multiplicative" method can still exaggerate the combined effects when the two types of enforcement interact, for example when they are effective on drivers who are both speeders and drug-drivers. Discouraging them from driving while drug-impaired also prevents them from speeding, at least some of the time.

TARGET ROAD ENVIRONMENT	Fatal crashes saved per year	Percent reduction in fatal crashes	Serious injury crashes saved per	Minor injury crashes saved per	Total crash cost saving (\$m pa)	Total addit- ional cost (\$m pa)	BCR: Increase benefits	Marg- inal BCR
	per year	erasites	year	year	(¢m pu)	(om pa)	increase costs	
RURAL								
Speed enforcement	50.2	41.0%	390.6	474.8	333.173	39.297	8.48	1.00
Impaired enforcement	36.4	29.6%	99.2	NK	168.120	84.103	2.00	0.99
~multiplicative effects	71.8	58.5%	464.7	474.8	437.989	123.400	3.41	0.74
URBAN								
Speed enforcement	71.1	59.1%	382.4	630.3	413.839	133.012	3.11	1.01
Impaired enforcement	39.2	32.6%	288.5	NK	241.498	97.636	2.47	0.99
~multiplicative effects	87.2	72.4%	643.4	630.3	559.983	230.648	2.33	0.74

Table 1. Crash savings and economic benefits of optimal increases of each individual enforcement measure

The final step was to revisit the increased investment in each individual enforcement program in Table 1 because, as a combined program, its marginal BCR based on the multiplicative effects is substantially below 1. This suggested that the total program investment no longer returns benefits to justify its costs at the margin. Elvik (2014) addressed this issue and suggested that the program investment should be reduced. An analysis was conducted to find the reduced investment that resulted in marginal BCRs of 1 in both the rural and urban sets of programs. The implied reduced levels of increase in each individual program, their estimated combined savings in crashes, and their BCRs at the program and marginal levels, are shown in Table 2. The reduced increases in each program could be considered optimal as a package of increases, at least in economic terms.

Conclusion

Table 3 makes a comparison of the crash savings and economic benefits from the two approaches, namely:

a) Each individual enforcement method is increased to a level at which its marginal benefits due to crash savings still just exceeds its marginal costs of offence detection and processing.

b) The enforcement methods are increased strategically so that their combined effects in the same road environments achieve an optimal package with marginal benefits just exceeding its marginal costs.

The optimal package of increased enforcement was estimated to be \$74 million per year cheaper to fund the increase, and would produce better economic returns in terms of crash cost savings per dollar invested in the increased enforcement (BCR of 3.2, compared to 2.7). However, increasing each individual enforcement measure to its optimal level could potentially save an additional 8 fatal crashes and 104 serious injury crashes per year.

Table 2: Crash savings and economic benefits of an increased enforcement program with marginal BCR of 1 for the full package of measures

TARGET ROAD ENVIRONMENT	Increase in camera sites or sections	Increase in roadside tests* or MSC** hours (%)	Fatal crashes saved per year	Serious injury crashes saved per year	Minor injury crashes saved per year	Total crash cost saving (\$m pa)	Total addit- ional cost (\$m pa)	BCR: Increase benefits \div increase costs	Marg -inal BCR
RURAL									
Speed enforcement	1565	MSC 100%	48.9	380.7	464.3	324.503	33.795	9.60	1.38
Impaired enforcement		PBT 297% POFT 283%	34.0	92.9	NK	157.268	74.048	2.12	1.17
~multiplicative effect			69.4	450.8	464.3	424.173	107.843	3.78	1.00
URBAN									
Speed enforcement	570	MSC 329%	66.1	316.4	532.5	369.797	97.099	3.81	1.23
Impaired enforcement		PBT 243% POFT 188%	34.4	256.7	NK	213.090	74.758	2.85	1.52
~multiplicative effect			81.6	552.8	532.5	505.838	171.857	2.83	1.00

* Preliminary Breath Tests (PBT) or Preliminary Oral Fluid Tests (POFT) ** Mobile Speed Camera (MSC)

 Table 3: Comparison of packages of enforcement measures

TARGET ROAD	Fatal	Serious	Minor	Total	Total	BCR:	Marg-	NPV:
ENVIRONMENT	crashes	injury	injury	crash	addit-	Increase	inal	Net
	saved	crashes	crashes	cost	ional	benefits	BCR	Present
	per year	saved per	saved per	saving	cost	÷		Value
		year	year	(\$m pa)	(\$m pa)	increase		(\$m pa)
						costs		
a. Optimal increase of each	150.0	1108 1	1105.0	007 072	354 048	2 71	0.74	604 406
enforcement measure	139.0	1100.1	1105.0	991.912	334.048	2./1	0.74	004.490
b. Optimal package of	151.0	1003.6	006.7	030 010	270 700	3 20	1 00	614 746
increased enforcement	151.0	1005.0	<i>99</i> 0.7	930.010	219.700	5.20	1.00	014./40

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Optimum speeds on New Zealand rural state highways: an update

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Abstract

An optimum cruise speed is one that balances the increased cost of travel time with the benefits of reduced costs of road trauma, vehicle emissions and vehicle operating costs. In 2012, the optimum speeds were estimated for light and heavy vehicles on six categories of New Zealand rural highways, based on relationships and unit costs in the government's Economic Evaluation Manual. For each cruise speed, the benefits and costs were assessed in terms of crash costs, travel time costs, vehicle operating costs and air pollution costs, then the speed that minimizes the total costs was found. Since that time, surveys of the New Zealand population have found that preventing road trauma is now valued substantially higher, with a fatal crash valued 3.3 times higher than previously. The values placed on reduced travel time have also significantly increased. Optimum speeds on undivided rural highways are now generally at most 70 km/h. On divided motorways/expressways, the optimum is 95-100 km/h for light vehicles and 80 km/h for trucks. These optima are consistent with the Safe System speeds recommended for each category of rural road.

Post on X

Estimating economically optimal speeds based on increased costs of road trauma and travel time in New Zealand

Introduction

The theme of the Australasian Road Safety Conference for 2024 is *Target 2030: What's the pathway forward?* This theme calls for a focus on effective road safety programs and initiatives that contribute to reaching the 2030 target. At least half of all fatal crashes in the Australasian jurisdictions occur on rural roads, principally because speed limits are set too high for the quality of the road and the type of vehicle. However, proposals to reduce rural speed limits often face opposition from those pointing to the additional cost of travel time, particularly by heavy commercial vehicles.

In 2012, the New Zealand Transport Agency (NZTA) commissioned an economic analysis of the benefits and costs to society of different speeds on six categories of New Zealand rural State Highways by five classes of vehicle ranging from passenger cars to heavy commercial vehicles type II (Cameron 2012). For each cruise speed (unimpeded free speed), the benefits and costs relative to current average speeds were assessed in terms of crash frequencies and costs; travel time costs; vehicle operating costs; and air pollution costs. The changes in crash frequency and severity with speed were based on recalibration of Nilsson's (1981) power model by Cameron and Elvik (2010). Relationships with speed for all other factors were based on NZTA's (2010) Economic Evaluation Manual (EEM) that also included the unit cost of each societal impact. For example, a fatal crash was valued at NZ\$ 4.332 million in year 2009 prices. Additional travel times, vehicle operating costs and air pollution emissions due to stops and decelerations for slow curves by each vehicle type in each road environment (relatively straight compared with winding) were included.

Update of EEM parameter values in 2023

In 2021, NZTA commissioned Resource Economics Ltd, Auckland to derive new unit costs for road trauma, travel time and reliability of trips (Denne et al., 2023). The new values have been included in an update of EEM released by NZTA (2023) retitled as the Monetised Benefits and Costs Manual (MBCM). The values placed by New Zealand society on road trauma have been substantially increased, as has the valuation of travel time. In year 2021 prices, a fatal crash is now valued at NZ\$ 14.2 million (3.28 times increase) and the values placed on serious and minor injury crashes have increased 1.64 and 2.92 times, respectively. Business travel time cost by light vehicles has increased by 22.5% to 25% and travel time cost by trucks has increased by 44% to 46.5%. Commuting travel time costs have increased by 35% for light vehicles and 57% for trucks. Leisure trip costs have increased 51% for light vehicles and 72% for trucks. Together these increases in road trauma values and travel time costs suggested that optimum speeds in NZ may have changed.

Method

The method was the same as that described by Cameron (2012), readily downloadable from the NZTA website. Each of the costs of crashes, travel time, vehicle operations and air pollution emissions on each category of rural State Highway for each vehicle type were valued using the unit costs in MBCM updated to 2021 prices. For each cruise speed, the total economic cost was aggregated and the speed that minimises the total cost of the impacts of all light vehicles, in steps of 5 km/h within the range 50 to 110 km/h, was found. The optimum speed that minimises the total economic cost due to heavy vehicles aiming to travel at each cruise speed was found in the same way.

Results

The estimated optimum speeds in 2021, in comparison with current cruise speeds and estimated optima in 2012, are shown in Table I. Where the total economic cost was almost identical for two adjacent cruise speeds, both speeds are shown as a range. The true optimum speed that minimizes the total cost lies between them.

		Cruise speed	ls on straight	Optimu	m cruise	Optimum cruise speeds		
		sections of ru	ural highway	speeds (k	m/h) 2012	(km/h) 2021		
		(km/h) 2012					
	Road Category	Cars & light	Heavy	Light	Heavy	Light	Heavy	
		commercial	commercial	vehicles	vehicles	vehicles	vehicles	
		vehicles	vehicles	(Cars &	(MCVs	(Cars &	(MCVs &	
		(LCV)	(HCV I)	LCVs)	& HCVs)	LCVs)	HCVs)	
1.	Motorways/Expressways	00.1	02.5	105	80	95-100	80	
	(divided four-lane) roads	99.1	92.5					
2.	High Volume National	02.0	077	85	70	75	70	
	Strategic roads	95.9	07.7					
3.	Straight National &	05.9	80.5	80	70	70-75	65-70	
	Regional Strategic roads	93.8	89.5					
4.	Winding National &	92.6	70.4	75	65	65-70	60-65	
	Regional Strategic roads	83.0	/8.4					
5.	Straight Regional	05.7	80.4	80	70	70	65	
	Connectors & Distributors	93./	89.4					
6.	Winding Regional	70.7	74.0	65	55	60	55	
	Connectors & Distributors	/9./	/4.9					

Table 1. Cruise speeds by vehicle type and estimated optimum speeds in 2012 and 2021.

The optimum speeds for light vehicles during 2021, based principally on the higher values given to preventing road trauma and travel time, were about 10 km/h lower than in 2012. For heavy vehicles, their estimated optimum speeds during 2021 were generally about the same as in 2012 or at most 5 km/h lower.

It is noteworthy that, with the exception of light vehicles on Category 2 and 3 roads, the optimum speeds on undivided roads are a most 70 km/h, the recommended Safe System speed limit for high speed roads on which head-on crashes can occur (i.e., roads without a central median or central wire-rope barrier). On divided roads like Category 1, the recommended Safe System speed limit is 100 km/h, however the optimum speed for trucks is 20 km/h lower.

Figures 1 and 2 illustrate the estimation of the optimum cruise speed for the light and heavy vehicles, respectively, on the Category 3 rural State Highways. The arrow indicates where the estimated optimum lies between two speeds.



Monetary impacts of different cruise speeds on Category 3 rural roads (NZ\$'000 per year): Cars and Light Commercial Vehicles only

Figure 1. Optimum cruise speed of light vehicles on relatively straight National & Regional Strategic roads



Monetary impacts of different cruise speeds on Category 3 rural roads (NZ\$'000 per year): Truck costs only

Figure 2. Optimum cruise speed of trucks on relatively straight National & Regional Strategic roads

Conclusions

The substantially higher values now placed by New Zealand society on preventing road trauma, off-set by somewhat higher values of saving travel time, have resulted in the optimum cruise speeds of light vehicles on rural highways being about 10 km/h lower than they were in 2012. The optimum speeds of trucks have generally not changed due to these higher values of road trauma and travel time, however they remain about 5 km/h lower than for light vehicles on undivided rural roads. On divided rural roads, the optimum speed was found to be 95-100 km/h for light vehicles (5-10 km/h lower) and 80 km/h for trucks (unchanged from 2012).

The finding that 70 km/h is generally the optimum speed for light vehicles on undivided rural roads may assist the social acceptability of this speed as the general rural speed limit in New Zealand. The analysis outlined here has fully considered the costs of additional travel time with such a speed limit, while taking into account the benefits of reduced air pollution emissions and vehicle operating costs as well as reduced road trauma.

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Can we achieve the 30 per cent reduction for serious injuries by 2030?

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Abstract

NSW is the only jurisdiction in the world that publishes quarterly online serious injury data from road crashes. More than 182,000 records are published in the largest publicly available set of road trauma data on the outcomes of crashes where people are admitted to hospital as a result of their injuries from a crash on our roads. By linking health, police, insurance and crash data, we have revealed the characteristics and trends since 2005 of the serious injuries from crashes on NSW public roads. Interactive crash data provides evidence on serious injuries that wasn't previously available. Using this, we can better research and analyse the broader trauma impacts of road crashes, and develop targeted road safety initiatives to reduce serious injuries. This presentation provides insights into the changing dimensions of serious injury road trauma in NSW, where we have been successful in designing safe systems approaches to trauma reduction and emerging challenges for the reduction in Serious injury road trauma in NSW.

Post on X

NSW is linking health and crash data to develop safety countermeasures to address different road related risks and driving behaviours.NSW plans to halve deaths and reduce serious injuries by 30 per cent by 2030. We aim for zero fatalities and serious injuries on our roads by 2050. Learn more.

Background

NSW has set an ambitious but achievable trauma reduction target to help guide our investment – and reflect the NSW Government's commitment to eliminate death and serious injuries on our roads.

Our target is to halve deaths and reduce serious injuries by 30 per cent from 2018-2020 levels by 2030. NSW has set an aspirational target of zero fatalities and serious injuries on our roads by 2050.

As part of the 2026 Road Safety Action Plan and the previous plans, NSW has achieved significant reductions in road trauma in some categories of serious injury trauma. Our actions have had an impact but not in all areas, there remains key areas of serious injury trauma that are on the rise.

The current plan aims to put NSW at the forefront of road safety globally, in focusing on serious injury trauma, aligning with the long-term vision for zero trauma by 2025 outlined in both the NSW and the National Road Safety Strategy 2021 - 2030.

There are five key priority areas outlined in the 2026 Road Safety Action Plan including:

- Creating safer country roads and urban places
- Enhancing safety in local communities
- Increasing the safety of light vehicles, heavy vehicles and protective equipment
- Making safer choices on our roads
- Ensuring the safety of vulnerable and other at risk road users

These priority areas assist Transport in addressing the key challenges that we face in NSW where nearly two – thirds of the NSW road fatalities occur on country roads while, two – thirds of serious injuries occur on urban roads. The challenge for road safety is focusing on the different dimensions of serious injury trauma and how to apply safe systems approaches that will achieve the 30 per cent reduction target by 2030.

Overview of work

NSW is the only jurisdiction in the world that publishes quarterly online serious injury data from road crashes. More than 182,000 records are published in the largest publicly available set of road trauma data on the outcomes of crashes where people are admitted to hospital as a result of their injuries. By linking health, police, insurance and crash data, we have identified the number of serious injuries from crashes on NSW public roads.

Interactive matched crash data provides evidence on serious injuries that wasn't previously available. Using this, we can better research and analyse the broader trauma impacts of road crashes, and develop targeted road safety initiatives to reduce serious injuries.

This presentation provides insights into the changing dimensions of serious injury road trauma in NSW, where we have been successful in designing safe systems approaches to trauma reduction and emerging challenges for the reduction in road trauma in NSW.

The Data, Advice, Research & Testing team in Transport regularly receives road trauma and crash data to analyse. The interactive crash statistics reports provide evidence for organisations, researchers and the public to assist in creating new educational resources, research and road safety programs and initiatives.

Details of the work completed

The data collection from 2005 to 2022, displayed significant trends such as the rate of persons hospitalised per 100,000 people was 118.9 in 2022, which was the lowest since 2005.

Data suggests that:

- drivers comprise the largest road user group (32 per cent).
- motorcyclists and pedal cyclists (17 per cent) with serious injuries have increased.
- passengers (33 per cent) and pedestrians (18 per cent) injuries have decreased between 2005 to 2022.

This analysis has informed the development and implementation of targeted road safety campaigns.

Outcome of the work

Centre for Road Safety has linked crash data, Health admission and emergency department data, Ambulance services data, State Insurance Regulatory Agency, CTP claims data and LifeTime Care data. This positions NSW as the only jurisdiction with public access to such rich and complete information on injury severity on roads.

This information is essential in shaping the road safety plan and policies for achieving the 30 per cent reduction in serious injuries by 2030 on our way to our vision of zero road trauma by 2050.

Benefits of road safety

The crash data is important to understand the road safety issues that exist on our network. It enables us to adopt a Safe Systems approach and use the data as evidence to support new safety measures such as improving community education, road environment and the design of safer vehicles and equipment.

Implications for policy and/or practice

Transport policies are focused on developing frameworks, standards, programs, projects and campaigns to promote and improve safety on NSW roads. Policy reform essentially requires the ability to examine the underpinning evidence for serious injury trauma to provide expert advice regarding safe systems outcomes for the community.

Conclusions

This presentation provides insights to the changing dimensions of serious injury road trauma in NSW. Examples of Transport's success in designing safe systems approaches to trauma reduction and the emerging challenges for the reduction in road trauma in NSW.

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Brain and body: predicting older adult safe street-crossing

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Abstract

Older adult pedestrians are overrepresented in road-related crash fatality statistics. Perceptual, physical, and cognitive decline, in part, explain road-crossing behaviours such as increased time and unsafe decisions (Tournier et al., 2016). However, no studies have investigated whether these factors can predict safe street-crossing skills in an older adult population such as detecting road hazards and identifying a safe gap to cross. This study examines the key predictors of safe street-crossing from a sample of 100 older adults (aged 60+ years). Street-crossing behaviours were measured using a validated virtual reality pedestrian street-crossing task, where a series of 360-degree video clips captured from real-world pedestrian situations were presented. Using correlational and structural equation modelling we examined the key perceptual, physical, and cognitive predictors of safe street-crossing. The outcomes of this study will inform the development of an evidence-based street-crossing training program that will ultimately reduce the number of older adult pedestrian fatalities.

Post on X

Perceptual, cognitive and physical factors predict older adult safe street-crossing behaviours.

Introduction

Safe street-crossing requires a visual search of the environment to identify potential hazards and to determine a safe gap in the flow of traffic. Failing to engage hazard perception and gap acceptance can result in pedestrian crashes. While pedestrian fatalities occur across the lifespan, deaths of adults aged 60 years and older are overrepresented (Rod et al., 2021). Perceptual, physical, and cognitive factors have been shown to have a relationship with a variety of pedestrian safety behaviours (Tournier et al., 2016). Decline in perceptual skills such as vision have been associated with difficulties in perception of both fixed (e.g., objects on a pathway) and moving hazards (e.g., other road users; Tournier et al., 2016). Declining physical capacity results in reduced walking speed (Asher et al., 2012). Additionally, cognitive decline that typically occurs with aging, interferes with hazard perception and gap acceptance, thereby increasing the risk of unsafe street-crossing decisions (Dommes, 2019). Whilst a variety of pedestrian safety behaviours have been examined in older adults (Wilmut & Purcell, 2021), no studies have examined the predictors of the important skill of safe street-crossing in this population, inclusive of both hazard perception and gap acceptance. Understanding the predictors of poor street-crossing in older adults is important for future risk reduction.

Method

Participants and recruitment

A total of 100 older adult participants were recruited for this study. To ensure representativeness of the older adult population, we recruited \sim 50 participants who fell between 60-75 years, and \sim 50 participants who were 75 years and older. An equal gender split between females males was also achieved. To facilitate efficient data collection and to examine a broader representative demographic of Australians, recruitment and testing occurred in NSW and Victoria.

Measures

A feasibility study, completed in February 2024, involved testing a small sample of 14 younger adults (aged 25-45 years) and 14 older adults (aged >65 years), demonstrated the expected pattern of responding and that virtual reality (VR) was tolerated by older adults. For the current study, the participants completed a suite of tasks; *perceptual capacity* measures included visual acuity and contrast sensitivity; *cognitive capacity* was assessed using a battery of tasks that measured task switching, psychomotor speed, visual attention, visuospatial learning, response inhibition, and memory; *physical capacity* tasks included balance, mobility, gait, lower and upper limb strength, and cervical range of motion; *hazard perception and gap acceptance* was measured using the validated VR-PSCT, which presents a series of 360-degree video clips captured from real-world pedestrian situations in a HTC XR Elite virtual reality headset. In the hazard perception condition, participants were asked to respond with a button press to any potential hazards (See Fig. 1). For gap acceptance, participants were asked to step upwards as if planning to cross the street when they felt there was an acceptable gap.



Figure 1. Example clip from the hazard perception condition of the pedestrian VR-PSCT. The red circle depicts a hazard that the participants were asked to respond to.

Procedure

After providing informed consent, the participants completed the visual perceptual tasks, followed by the cognitive tasks and the motor tasks (counterbalanced and randomised across participants) and the VR-PSCT tasks (counterbalanced across participants). The experiment took ~ 2 hours to complete and the participants were reimbursed for their time with a \$50 Coles/Myer voucher. The study was approved by the Human Ethics Research Committee, Australian Catholic University (2023-3255H).

Results

As of mid-June 2024, data has been collected from 91 participants (Age: M = 68.64yrs, SD = 5.21yrs; Sex: 44 female). Preliminary bivariate correlations show that *visual perception* (contrast sensitivity), *cognitive capacity* (attention, executive function, response inhibition, visual search, motor screening, learning and motor reaction time), and *physical capacity* (10m walking speed, timed up and go, cervical range of movement) have significant relationships with *hazard perception reaction time* (Table 1). There was also a significant, positive relationship between lower leg strength (sit to stand) and *gap acceptance reaction time*. Planned analyses will include structural equation modelling where the predictor variables (hazard perception and gap acceptance) will be grouped to examine a predictive model. We will also investigate how this might vary according to the different age categories (60-75 years and 75 years and older).

Table 1. Bivariate correlations between perceptual, cognitive and physical factors, and response times for hazard
perception and gap acceptance and accuracy for hazard perception (N = 91)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 HP RT	-													
2 HP Acc	.14	-												
3 GA RT	.08	.01	-											
4 PR CSC	23*	02	03	-										
5 TMTA	.31**	06	.1	1	-									
6 TMTB	.41**	.04	.15	14	.52**	-								
7 GNG Error	.3**	08	.04	06	.24*	.09	-							
8 MTRSCAM	.22*	15	.28*	16	.29**	.32**	.16	-						
9 PALFAMS	23*	06	.04	.22*	15	17	15	28**	-					
10 PALTEA	.33**	.11	01	22*	.09	.08	.1	9**	88**	-				
11 RTISMRT	.4**	14	.05	14	.23*	.2	.13	.25*	18	.08	-			
12 TUG	.22*	17	.14	01	.16	.18	03	.08	05	.004	.13	-		
13 STSN	17	03	24*	.13	21*	18	06	13	.08	07	006	55**	-	
14 10m Walk	.25*	15	.13	04	.13	.15	.007	.12	16	.13	.1	.68**	48**	-
15 CROM right	25*	.01	08	.18	22*	23*	03	1	.36**	25*	13	12	.14	.22*

Note. HP RT = Hazard Perception Reaction Time; HP Acc = Hazard Perception Accuracy; GA RT = Gap Acceptance Reaction Time; PR CSC = Pelli-Robson Contrast Sensitivity Chart; TMTA = Trail Making Test Part A; TMTB = Trail Making Test Part B; GNG Error = Go-No-Go Error; MTRSCAM = Match to Sample Visual Search Reaction Time; PALFAMS = Paired Associated Learning Memory Score; PALTEA = Paired Associated Learning Total Error Adjusted; RTISMRT = Simple Mean Movement Time; TUG = Timed Up and Go; STS = Sit to Stand Number; CROM = Cervical Range of Motion.

*p < .05; **p < .01, two tailed.

Benefits to road safety

The outcomes of this study will inform the development of an evidence-based street-crossing training program delivered at home via a user-friendly online platform. This is crucial given that the Australian population is ageing due to the increased number of "Baby Boomers" entering this age bracket. The program will be future proof and accessible across Australia to continue to serve older adults. By training all key factors necessary for safe street-crossing together in a comprehensive multi-session program, pedestrian safety in older adults can be substantially improved. By understanding and improving core street-safety skills for older adult pedestrians we can better support their ability to live long, safe, and independent lives. This applies to Target 2030, to halve road deaths, by potentially reducing the number of older adult pedestrian fatalities.

Implications for policy and/or practice

The training program will benefit practice as it will have the capacity to target key populations such as aged care facilities, or perhaps individuals living with dementia. The findings can also be useful more broadly. For example, just by understanding the predictors of safe street-crossing, other groups will be able to better target training (e.g., occupational therapy, physiotherapy, exercise physiology) to improve mobility. Policy will be able to understand why older adult pedestrians are involved in crashes, which could influence how roadways are designed.

Conclusions

This study addresses a gap in the literature by examining the key predictors of safe street-crossing using VR technology. The outcomes will inform a future training program that can be delivered online and in the home environment. This has important implications for improving older adult pedestrian safety especially given that the Australian population is aging.

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Approaches to serious road crash injury data linkage in Queensland

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Abstract

The Serious Road Crash Injury Data Linkage project aims to improve the measurement of non-fatal serious road crash injuries in Queensland through data linkage. This project utilised data from the Queensland Crash Analytics Reporting System (CARS), the Queensland Hospitals Admitted Patients Data Collection (QHAPDC) and the MAIC Compulsory Third Party (CTP) injury claims register. Approximately 380,000 records from these three data sources were linked and paired which resulted in the estimation of over 60,000 serious road crash injuries for the period of January 2015 to December 2021. This project highlights the benefits of linking road crash data with health-related data to better count serious road crash injuries, particularly for the under-reported vulnerable road users such as bicycle and motorcycle riders.

Post on X

A cross-agency team in Queensland conducting a data linkage project to improve the measurement of non-fatal serious road crash injuries in Queensland.

Introduction

It has been established in the past decade that linking road crash data with health-related data from hospitals allows for a more complete understanding of serious road crash injuries (Watson et al., 2015). Health data can be utilised to confirm hospital admission of road crash hospitalised casualties, to capture the under-reporting of some road user types and to provide a better understanding of injury types and outcomes.

The Road Safety Data Bureau (RSDB) is a cross-agency team, funded by the Motor Accident Insurance Commission (MAIC), to consolidate, integrate and analyse road crash-related data from member agencies to inform whole-of-government decision-making and approaches to road safety policy. The RSDB is tasked to undertake the Serious Road Crash Injury Data Linkage project to improve the measurement of non-fatal serious road crash injuries in Queensland through data linkage.

Project description

The project utilises three main data sources: the Queensland Crash Analytics Reporting System (CARS), the Queensland Hospitals Admitted Patients Data Collection (QHAPDC) and the MAIC Compulsory Third Party (CTP) injury claims data. Additional information to supplement the cohort dataset was also obtained from the Emergency Data Collection (EDC), Cause of Death (COD) and Queensland Ambulance Data. Consistent with the National Road Safety Strategy, serious injury in this project is defined as a severe injury that results in hospital admission which also includes those injuries not reported in the crash data.

The objectives of the current project are:

- To develop and implement linking and pairing methodology on Queensland's road crash, hospital and CTP injury claims data (cohort dataset) and link the cohort dataset to Queensland's emergency, cause of death and ambulance data for additional information
- 2) To estimate the number of non-fatal serious road crash injury cases in Queensland for the period of January 2015 to December 2021
- 3) To assess the crash and injury characteristics of non-fatal serious road crash injury cases in Queensland using both linked and non-linked data.

Approach

The person linkage between datasets used in this project has been conducted by the Data Linkage Queensland, Queensland Health. The RSDB conducted further data integration and pairing (congregating pairs of crash, CTP injury claim and hospital records that refer to the same individual and same crash event) to identify unique crash injury cases. Pairing logic and approaches from a previous national study by Harrison et al. (2019) were adopted to establish the estimate number of non-fatal serious road crash injury cases. Several logic adjustments were also implemented to allow for the data to be integrated and paired with CTP injury claims data and the other additional data sources.

Results

Approximately 380,000 records from CARS, QHAPDC and MAIC CTP data were integrated and paired which resulted in the estimation of over 60,000 serious road crash injuries for the period of January 2015 to December 2021. These cases consist of linked crash (C), MAIC injury claim (M) and hospital (H) cases (that is CMH, CH and MH pairs) as well as hospital record only cases (H-only). Overall, approximately 60% of all serious road crash injuries were paired cases and the remaining were H-only cases. The proportion of paired cases fluctuates based on the road user and mode of transport. This proportion is the highest amongst motor vehicle drivers with three-quarters of them being paired cases. Half of motorcycle rider and just over a quarter of bicycle rider serious injuries were paired cases. This is consistent with the findings of the national study (Harrison et al., 2019) and confirms the under-reporting of crashes involving vulnerable road users such as bicycle and motorcycle riders within Queensland.

Implications

Data linkage across government agencies allows better counting of serious road crash injuries, particularly for vulnerable road users such as bicycle and motorcycle riders, which are currently under-reported in road crash data. Further work will be conducted by the RSDB as part of the broader Serious Road Crash Injury Data Linkage project to further explore the impact of road crashes on injury types and outcomes as well as to assess the completeness, concordance, and discordance of each data source.

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Road condition elements influencing road crashes in Kuching, Malaysia

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Abstract

This paper investigates the relationship between pavement surface, geometry, and road environment factors contributing to road crashes in Kuching, Malaysia. Field inspections were conducted on 15 crash-prone roads to assess pavement and road conditions. Four pavement condition indices (PCI) were established for surface distress, roughness, skid, and pavement structure, culminating in the development of the overall pavement condition index (OPCI). An overall road condition index (ORCI) was derived from Start Rating Scores (SRS). Findings indicate that roads with poor conditions experience a higher proportion of crashes, emphasizing the need for prioritized efforts in improving road infrastructure. Bivariate analysis suggests complex dynamics between surface distress, pavement structural condition, and skid resistance, underscoring the multifactorial nature of RTCs. The outcomes advocate for comprehensive approaches that integrate various road condition factors into road safety measures. By prioritizing maintenance based on influential factors identified, stakeholders can reduce crash occurrences and enhance overall road safety.

Post on X

Inadequate road conditions significantly contribute to road traffic crashes; targeted interventions addressing pavement quality and geometry can efficiently reduce crash occurrences, informing resource allocation and infrastructure design for enhanced road safety.

Introduction

Road traffic crashes (RTCs) annually result in 1.25 million fatalities and 20-50 million long-term disabilities globally (World Health Organization, 2015). RTCs stem from a myriad of factors, including human, vehicular, and infrastructure-related elements, with human error predominantly driving crash occurrences (Baskara et al., 2019; Goniewicz et al., 2016; Wangdi et al., 2018). While data on RTC causes are typically available from traffic police records, these often lack crucial technical details concerning road conditions. This deficiency underscores the necessity for field measurements to assess the impact of road condition elements on traffic safety comprehensively. Focusing solely on individual factors may offer an incomplete understanding of the intricate interplay of road condition elements influencing RTCs. Hence, this study concentrates on examining the causes of road crashes attributed to pavement condition characteristics, geometry, and roadside environment.

Methodology

This study concentrated on 15 crash-prone roads in Kuching, pinpointed by the Royal Malaysia Police as hazardous routes. Field inspections were carried out on the road segments to visually evaluate roadway conditions. The study encompassed 15 mid-block sections (535 data points) and 12 signalized intersections (60 data points), totaling to 45.1 km. Most of these roads fell into the arterial and major collector categories, with only one being a local street. The roads featured a total of 1 to 3 through lanes. Data collection included assessments of pavement condition, covering surface distresses, skid resistance, roughness, and structural condition.

The Pavement Condition Index (PCI) survey method was utilized to evaluate surface distress data, encompassing longitudinal and transverse cracks, raveling, potholes, patches, alligator cracks, rutting, bleeding, depression, edge cracking, and corrugations. Skid resistance was quantified using a skid resistance number, while pavement roughness was assessed via the pavement ride quality rating (RQR) method. Pavement structural condition was determined by calculating the percentage of the surface area affected by structural distresses. These four performance indices, namely PCI_{Distress}, PCI_{Roughness}, PCI_{skid}, and PCI_{structural}, were combined to create an Overall Pavement Condition Index (OPCI) using a weighted arithmetic mean formula. Geometric design characteristics data were collected via the international road assessment program (iRAP) survey, comprising lane width, number of through lanes, speed limit, road length, annual average daily traffic (AADT), shoulder width, and median width. Roadside environment condition characteristics included visibility of road signs and markings, safety side barriers, presence of footways, lighting, pedestrian crossing facilities, and distance from roadside objects. Star Ratings Scores (SRS) were generated for vehicle occupants, motorcyclists, pedestrians, and bicyclists, with only vehicle occupants' scores utilized in this study. These SRS scores were subsequently converted to an equivalent scale of the Pavement Condition Index (PCI). An overall road condition index (ORCI) that incorporates both the overall pavement condition and the geometry/roadside environment was developed using the weightage mean approach. The ORCI is important for a more comprehensive, precise, and

focused assessment of road conditions, as it enhances the accuracy of road condition evaluations by considering multiple dimensions. Table 3 provides a complete list of surveyed roads and their details. **Table 3. Study area particulars and the results**

		Longth	Sections	OPCI	Geometry and roadside	ORCI
Code	Road Name	(Km)	Surveyed	$(w_i = 0.25)$	$(w_i = 0.33)$	$(\sum_{i}^{n} \frac{w_{i}x_{i}}{w_{i}})$
R01	Jalan Wan Alwi	1.3	8	69-Fair	60- Fair	64- Fair
R02	Jalan Tun Razak	1.4	8	59-Fair	60- Fair	60- Fair
R03	Jalan Setia Raja	1.6	8	48-Poor	60- Fair	55- Poor
R04	Jalan Batu Lintang	1.6	8	78-Good	60- Fair	68- Fair
R05	Jalan Utama	0.9	6	63-Fair	80- Good	73- Good
R06	Jalan Stutong Baru	2.3	11	63-Fair	40- Poor	50- Poor
R07	Jalan Rock	1	8	83-Good	80- Good	81- Good
R08	Jalan Keruing	1.7	9	68-Fair	60- Fair	63- Fair
R09	Jalan Tun Jugah	2.5	11	59-Fair	60- Fair	60- Fair
R10	Jalan Kulas	1.1	7	74-Good	60- Fair	66- Fair
R11	Jalan Muhibbah	1.5	8	88-Good	80- Good	83- Good
R12	Jalan Lapangan Terbang	1.5	8	45-Poor	60- Fair	54- Poor
R13	Jalan Matang	11.2	10	59-Fair	40- Poor	48- Poor
R14	Jalan Semariang Baru	9.6	10	76-Good	60- Fair	67- Fair
R15	Jalan Sultan Tengah	5.9	10	75-Good	40- Poor	55- Poor

*Good (70-100), Fair (55-70) and Poor (0-55)

Findings

Statistical analyses of the relationship between road condition and RTCs

The Chi-square goodness of fit test revealed that inadequate road condition significantly contributes to the occurrence of road traffic crashes. The majority of crashes (69.4%) occurred on roads with poor condition, followed by roads with fair condition (27.1%), and a small proportion on roads with good condition (3.5%). These findings highlight the critical role of road condition in mitigating crash occurrences, emphasizing the importance of prioritizing efforts to improve road infrastructure conditions for enhancing road safety measures.

The bivariate analysis indicates that as surface distress condition worsens, pavement structural condition deteriorates, resulting in poorer riding quality and moderately reduced skid resistance. However, the correlation between skid index and structural index, as well as roughness index, was not sufficiently strong, suggesting that the road's structural condition and surface irregularities may not directly impact its skid resistance properties. This implies that factors such as pavement texture, tire characteristics, and environmental conditions may play a more significant role in affecting skid resistance. Furthermore, the study found that improvements in pavement condition, geometry, and roadside environment correlate with a decrease in the number of crashes, highlighting the importance of maintaining favorable overall pavement conditions in reducing road crashes.

Sensitivity analysis of road traffic crashes causes

The impact of various road condition characteristics on crash frequency was assessed through a sensitivity analysis using Spearman's Rho rank-order correlation coefficient (ρ). The results revealed that pavement condition variables had different effects on RTCs, with Overall Road Condition Index (ORCI) being the most influential factor, followed by rutting, surface distress (PCI_{Distress}), OPCI, roughness, pavement structural condition (PCI_{Structural}), raveling, and roughness index (PCI_{Roughness}). Conversely, variables like depression, bleeding, potholes, and skid had minimal effects on RTCs, indicated by low ρ values. Similarly, geometry and roadside environment condition characteristics showed varying effects on RTCs, with annual average daily traffic (AADT) being the most influential factor, followed by road length, roadside obstacle distance, and iRAP Star Ratings Score (SRS). Conversely, safety side barriers, road signs, road markings, lane width, number of lanes, and median width had the least effect on RTCs. Figure 6 and Figure 7illustrate the impact of pavement condition variables and geometry/roadside environmental condition characteristics, respectively.

Benefits to road safety and implications for policy and/or practice

By identifying inadequate road conditions as a notable risk factor contributing to the occurrence of RTCs, the study highlights the importance of targeted interventions. Investing in road maintenance and infrastructure improvements to address poor road conditions can directly reduce crash occurrences, thereby enhancing road safety. The findings underscore the importance of considering multiple factors, including pavement condition, geometry, and roadside

environment, in road safety measures and policy decisions. Prioritizing maintenance and improvement efforts based on influential factors identified in the sensitivity analysis can help in effectively reducing crash occurrences.



Figure 6. Sensitivity analysis of pavement condition characteristics causing RTCs



Figure 7. Sensitivity analysis of geometry and roadside environment condition characteristics causing RTCs

Conclusions

The majority of crashes occur on roads with poor conditions, indicating a clear correlation between road condition and crash frequency. Roads with better conditions, including improved pavement condition, geometry, and roadside environment, tend to have fewer crashes. This underscores the importance of prioritizing efforts to improve road infrastructure conditions to enhance road safety.

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Crash protection of modified child restraints for children with disabilities

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Abstract

Many children with disabilities or medical conditions do not fit well in, or receive adequate support from, child restraints designed for typically developing children. Supplementary padding is frequently added to improve postural support and positioning in the restraint. Our study conducted frontal sled crash testing of three different padding materials used on a forward-facing child restraint to recline the restraint and/or support the head, trunk and pelvis of a Q1 anthropometric test device (ATD). We found the use of padding to increase restraint recline, or padding placed behind the head, increased a child's risk of head injury. Tightly rolled towelling around the body had minimal effect on injury risk measures, while firm rigid foam reduced risk of chest injury when used in locations to counteract forward sliding movements of the lower body. Our findings offer a pathway for future clinical practice guidelines on motor vehicle travel for children with disabilities.

Post on X

Crash testing study shows support padding for children with disability that reclines a child restraint or is placed behind the head can increase injury risk in a crash.

Introduction

Children with disabilities represent approximately 7.7% of children in Australia under the age of 15 years (Australian Bureau of Statistics, 2018). Prevalence is similar globally, with UNICEF estimating 10.1% of children aged 0-17 years have a moderate to severe disability (Olusanya et al., 2022). While they are required to use an approved child restraint when travelling in a motor vehicle, traditional standard child restraints are often not suitable for children with disabilities (Downie et al., 2020). Poor postural seated position is a common challenge for children with physical disabilities (Falkmer & Gregersen, 2002; Black et al., 2023), and additional supplementary padding is often added to the restraint to improve support of the child in the seat (O'Neil et al., 2009; Black et al., 2023; Cook et al., 2023). An Australian survey of caregivers of children with disabilities and health professionals working with children with disabilities recently showed 16.7% of caregivers and 71.74% of health professionals have used padding to support children in their child restraint (Cook et al., 2023). This included the use of towelling, soft foam and rigid or firm foam.

Current guidelines, including the Australian/New Zealand Standard 4370: 2013 Restraint of children with disabilities or medical conditions in motor vehicle, and The American Academy of Pediatrics, 2019 provide guidance on the use of padding for positioning on child restraints. However, despite these recommendations, there are no known studies investigating the effect of support padding during a motor vehicle crash. The aim of this study was to investigate the effects of additional padding, as recommended and being used in clinical practice, on injury risk to a child occupant restrained in a forward-facing restraint in simulated frontal crash tests.

Method

Forty frontal sled tests (ΔV =49km/h), on a custom-designed deceleration sled, were conducted to compare injury metrics measured in a Q1 ATD in a forward-facing restraint with and without additional supplementary padding. Tests were conducted as per the standard frontal impact test from AS/NZS 3629.1 (2013). Three padding materials were used including cloth towelling folded into various thicknesses to provide postural support; soft "medium-firm density" cushion foam; and lightweight, rigid expanded polystyrene (EPS). Padding was secured under the child restraint to increase the recline of the restraint or secured onto the shell of the restraint under the cover to support the head, trunk and pelvis.

The effect of the padding on head excursion, peak head acceleration (3ms), HIC15, peak chest acceleration (3ms) and chest deflection were analysed and compared to the restraint with no additional padding (baseline). Repeated measures ANOVA was used to compare each outcome measure between tests with each location and type of padding. Post-hoc Dunnett's test identified which test conditions (location and padding type) were different to baseline. Thickness of padding was measured before and after each crash to determine any crush of the padding.

Results

The location of the supplementary padding had a significant impact on head injury metrics (head excursion (F (7, 24) = 14.83, p < 0.0001; head acceleration (F (7.24) = 11.07, p < 0.0001; HIC 15 (F (7.24) = 40.27, p < 0.0001). The effect of the padding type differed based on where it was applied, showing a significant interaction effect between padding location and type for chest acceleration (F (14, 24) = 4.871, p = 0.0003); and chest deflection (F (14, 24) = 3.867, p = 0.0018). All types of wedge padding were ejected from under the restraint on impact, and this was accompanied by increased peak forward head excursion (average increase 8.36%), head acceleration (average increase 19.7%) and HIC15 (average increase 50.4%). Padding under/behind the pelvis resulted in forward displacement of the pelvis by 20mm post-impact with all types of padding. Combined towelling padding, including behind the head, along the sides of the trunk, behind the pelvis and laterally to the thighs, resulted in bilateral foot contact to the head, with increased head excursion by 10.2% and increases in head acceleration by 13.5% and chest acceleration by 12.6%. Although there was no overall significant interaction between padding type and injury metrics, towelling used in the side wings of the restraint, along the trunk and under the pelvis had lower increases in overall head and chest injury metrics compared to baseline than when soft foam and EPS foam was used in these locations. While towelling was able to be shaped and conform closely to the contours of the restraint and ATD, it had the greatest change in compressibility from pre to postcrash. Rigid EPS foam padding was effective in preventing the ATD from sliding forward when positioned in front of the crotch and beneath the knees.

Comparing our results with the minimum requirements for safety recommendations from the Australian Child Restraint Evaluation Program (CREP), all additions of padding exceeded CREP criteria for head and chest acceleration, indicating the modified restraint would have low safety scores for performance. In contrast, results for head excursion were under CREP reference values, however the increased risk of higher head excursion needs to be carefully weighed against the benefits of the padding.

Benefits to road safety

This is the first study to document that some forms of additional postural support padding used on child restraints for children with disabilities can impact injury risk measures. Avoiding the use of wedge padding to increase the recline of a forward-facing child restraint and avoiding the use of padding placed behind the head reduces the risk of head injuries to children in crashes. If additional postural support is required on child restraints for children, secured firm rigid foam is preferred, or secured tightly rolled towelling around the body can be used for short-term use with minimal effect of injury risk measures.

Survey reports in Australia reflect that 62% of caregivers of children with a disability report unmet vehicle seating needs for their child, with the use of additional padding added to the child restraint being the most frequently used modification (Cook et al., 2023). Our study provides evidence of the impact padding for postural support modifications have on the safety and performance of the child restraint. Our study ensures a pathway forward to ensuring the safety of modifications being used in the real world to transport children with disabilities in motor vehicles.

Implications for policy and/or practice

Our findings provide an evidence-base for practice for clinicians needing to use padding for postural support on child restraints. Padding to increase the recline of a forward-facing restraint or padding behind the head of a child increases injury risks and is not supported in clinical practice. If postural support padding is required to position the child back into the seat, firm rigid EPS foam is the preferred padding type. Tightly rolled or folded towelling may be used around the body of a child, however should not be used behind the child and all padding should be secured to the child restraint under the cover.

Conclusions

The use of additional postural support padding on child restraints can increase injury risks measures when used to recline a forward-facing restraint or used to position the head further forward. Our findings support published standards and guidelines in the Australian/New Zealand Standard 4370:2013 Restraint of children with disabilities or medical conditions in motor vehicle and the American Academy of Pediatrics, to not use foam for postural support that is soft or easily compressed, with firm foam or short-term use of tightly rolled towelling secured under the child restraint cover and not behind the child being supported.

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Safe transportation of children in early education and care settings

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Abstract

Transporting children in early childhood education and care (ECEC) settings carries significant risk of critical injury (NSW Department of Education, 2023). Sadly, children left unsupervised in vehicles for extended periods of time have experienced serious injury or have died. Consequently, National ECEC regulations have been strengthened to protect children when being transported. The *Kids and Traffic* Program, a partnership between Transport for NSW (TfNSW) and Macquarie University, collaborated with the NSW Department of Education (NSWDoE) to develop the *Kids and Traffic* Safe Transport Toolkit. The Toolkit is an impactful outcome of cross-government departmental partnership to address child road trauma. Comprehensive, strategic dissemination of the Toolkit and ongoing ECEC sector support by *Kids and Traffic*, ensures child road safety is prioritised by ECEC services, families, and communities. Collaborations such as this leverage the strengths and influence of government departments and agencies, maximising outcomes, reach and cost effectiveness of road safety interventions.

Post on X

Working together to keep children safe. The Safe Transport Toolkit, developed by the *Kids and Traffic* Program (Transport for NSW and Macquarie University) in partnership with the NSW Department of Education, supports NSW ECEC services to ensure understanding of, and compliance with, mandated safe transport regulations.

Background

In 2019, following a review of the ECEC National Quality Framework, Commonwealth, state and territory education ministers agreed to strengthen regulatory requirements for transporting children as part of service provision. It was recognised that transporting children posed additional risks, and oversight arrangements required bolstering to protect children from harm and hazard (Education Services Australia, 2022). Consequently, three rounds of transport-related regulatory changes were mandated for ECEC services between October 2020 and October 2023. In early 2020, The NSWDoE, as the state regulatory body for ECEC, engaged *Kids and Traffic*, the NSW Early Childhood Road Safety Education Program, to develop a range of resources to guide ECEC services in implementing the new regulations, and achieving best practice in the safe transportation of children. *Kids and Traffic*, funded by TfNSW and delivered in partnership with Macquarie University, is part of an enduring joint-governance collaboration with TfNSW, the NSWDoE, The Association of Independent Schools NSW, and Catholic Schools NSW. The *Kids and Traffic* Program provides professional learning workshops, educational resources, advice, and support to early childhood services.

Project description

Under the new regulations, particular focus is given to ensuring children are restrained in vehicles according to the laws of the jurisdiction and accounting for all children at disembarkation of the vehicle. Sadly, children left unsupervised in vehicles for extended periods of time have experienced serious injury or have died as a result. In addition to addressing in-vehicle related risks, *Kids and Traffic* ensures pedestrian safety considerations also receive focus, including risks to children of low-speed vehicle run over.

The regulatory requirements now require ECEC services to:

- have policies and procedures in place for the safe transportation of children
- undertake and record risk assessment and management processes
- obtain written authorisations for parents or carers prior to transportation
- notify the regulator when starting or ceasing transport
- ensure a staff member (other than the driver) accounts for each child embarking and disembarking the vehicle at the ECEC service
- ensure records are made to demonstrate each child is accounted for as they embark and disembark the vehicle at the ECEC service
- ensure records are made to confirm the inside of the vehicle has been inspected to ensure all children have disembarked (NSW DoE, 2023).

As part of the *Kids and Traffic* Safe Transport Toolkit, a series of six documents was produced for ECEC services to improve understanding of, and compliance with, regulatory requirements under the Education and Care Services National Law and the NSW Road Rules. See Figure 1

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia



Figure 1. Kids and Traffic Safe Transport Toolkit documents

The documents contain regulatory and best practice guidance for transporting and travelling with children. Sample policy, procedures, risk assessments and authorisations are provided to help services make practical improvements to their existing transport and travel-related documentation. Additionally, three practice example videos were created to showcase how featured services considered the safe transportation of children through a quality improvement lens and worked in partnership with stakeholders, including families, communities, and recognised authorities, to safeguard children throughout the transport process (NSWDoE, 2023). See Figure 2.



Figure 2. Kids and Traffic Safe Transport Toolkit sample practice videos

The Safe Transport Toolkit documents and videos are housed on both the NSWDoE and the Kids and Traffic websites.

Results

The *Kids and Traffic* Safe Transport Toolkit documents and videos were, and continue to be, widely promoted to NSW ECEC services by both the NSWDoE and *Kids and Traffic*. Multiple NSWDoE communications promoting the Safe Transport Toolkit have been issued to more than 6000 ECEC services operating in preschool, long day care, family day care, and outside of school hours care settings across NSW. More recently, the Department launched the 'Safe Transport Regulatory Priority Program' to maintain focus on strengthening service knowledge and understanding of safe transport best practice and compliance requirements which will ensure continuous engagement with the *Kids and Traffic* resources (NSWDoE, 2023).

The partnership between *Kids and Traffic* and the NSWDoE also included delivery of three separate live, one hour information sessions via the Department's 'ECE Connect' webinar series, reaching close to 1000 services in NSW and beyond. These sessions were recorded and are housed on the Department's website for viewing or reviewing by services.

Exploration of the Safe Transport Toolkit is included in all *Kids and Traffic* professional development workshops with ECEC educators, TAFE and university students. Between October 2020 and February 2024, this amounted to approximately 650 workshops. Additionally, the NSW Family Day care Association engaged *Kids and Traffic* to partner in a professional development session for their members. The recorded webinar included in the Associations' 'PD in your Pocket' series, is available to all educators via their website (NSW Family Day Care Association Inc., 2024).

At the time of writing, *Kids and Traffic* has undertaken more than 200 unique, safe transport-related policy consultations via phone, online and face-to-face, including consultations with peak ECEC groups such as the Australian Childcare Alliance which supports thousands of private childcare providers across Australia.

Benefits to road safety

By promoting and facilitating implementation of ECEC sector transport-related regulatory changes, *Kids and Traffic* continue to strengthen their advocacy for the safety and well-being of all children. As vulnerable road users, children remain a crucial focus of the NSW Government's Road Safety Action Plan 2026, and in meeting 2030 targets to halve deaths and reduce serious injuries by 30% on NSW roads (TfNSW, 2023). Furthermore, the Safe Transport Toolkit project emphasises the critical importance of ECEC services embedding road safety into their ongoing documentation and practice in their everyday work with children and families in local communities. The responsibility of all adults in children's lives to ensure their safety cannot be underestimated.

Implications for policy/practice

The Safe Transport Toolkit project demonstrates the positive impact of ongoing collaboration between government departments and relevant agencies. *Kids and Traffic*, as a TfNSW funded and supported program, is guided by research, strategy and policy communicated by TfNSW, and informed by the knowledge of the agency's subject experts. This strong collaborative foundation, supported by *Kids and Traffic*'s four-decade history of working in early childhood road safety education, provided the NSWDoE with a reputable, knowledgeable, and trusted partner to ensure children's safety is paramount. Collaborations such as this leverage the strengths and influence of each government department and agency to maximise, not only the reach, but also the cost effectiveness of road safety interventions.

Conclusions

The *Kids and Traffic* Safe Transport Toolkit collaboration is a positive example of impactful cross-government departmental partnership to address child road trauma. The documents and videos developed by *Kids and Traffic*, in consultation with TfNSW and the NSWDoE, support ECEC services throughout NSW to understand, and comply with, transport-related regulations and best practice guidelines which ensure children's safety during transportation and travel. Comprehensive, strategic and ongoing dissemination of the Safe Transport Toolkit resources, and continuing ECEC sector support provided by *Kids and Traffic*, will ensure child road safety remains a priority for ECEC, families and communities.

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Abstract

Last year, 962 men and boys died in road incidents across Australia. Mothers, wives and daughters carry this burden. Bystanders are the keystone, the first link in the 'Trauma Chain of Survival'. Postmortem studies showed potential preventability of death before emergency services arrived, noting that clearing an airway within minutes of a crash may save lives. Such findings provided rationale for research into the key elements of a social impact campaign to activate community members. An online survey of 100 women was undertaken, resulting in positive feedback and indicating that 86% were willing to undertake specific training in incident management. Motivations and barriers for stopping to help, were also listed. This proposes women are well positioned to lead a movement of "prepared bystanders" and contribute to halving lives lost on the roads by 2030. A social impact campaign upskilling community in road incident management is a new approach worth considering.

Post

New approach to post-crash response could reduce fatalities. A new study finds a gap in post-crash response; the first link in the trauma chain of survival could be the keystone to reducing fatalities to half by 2030

Introduction

In 2023, Australia recorded the third consecutive year of increasing fatalities on our roads. This has not happened since 1970. One expert, Dr Milad Haghani, suggested we are at the effect of 'the law of diminishing returns' – that is, "the more improvements you have in a system, the harder it gets to make further improvements" (ABC Radio, 2024, 45:55-46:08 mins). This suggests we need a new approach to tackle a chronic problem.

In 2019 I witnessed a road crash. A 4WD was clipped by a truck and nose-dived into an empty parked car. The bystander heeded my initial request to turn off the engine, put the keys on the dash and pull the handbrake on. While I was on the phone to Triple Zero for all three emergency services, the bystander did not heed my instruction to leave the semi-conscious driver in the car. The air bags had been deployed and so it would have been better for the casualty to stay put. It was then that I realised the public would benefit from training in appropriate road incident management, which is what has led to this research. LeCornu (2014) recognised ten years ago that other than first aid, there were no road safety initiatives preparing road users to act to save lives. The training HLTAID011 Provide First Aid can be undertaken in one day. It might be a high expectation that one or two courses three years apart will be sufficient for a bystander to manage a road crash. While first aid is certainly important (Bakke & Wisborg, 2017); Oliver et al, 2017) it is not the only skill required at a crash. Even so, Heard et al., (2020) reviewed what they called 'the public first-aid training landscape' across 22 countries including Australia. While they reported a high willingness for the public to help in an emergency, they found a low uptake of first aid training. As a community, we expect people will help at a crash, but we also allow the public to extemporize. How different could an incident scene be if bystanders knew what to do?

Australia's post-crash recovery system is one of the world's best and so while it is noted as one of the five pillars of road safety action by WHO (2021), Australia is not currently focusing on this aspect. This could be because our paramedic responses and trauma departments are well equipped. The missing link, however, is before paramedics arrive: the time from when the incident occurs to the time medical aid takes over. While the aim is for zero deaths by 2050, there are still road incidents occurring, mostly daily. It would be valuable to society to consider the *immediate* post-crash perspective.

Method

This study undertook a comprehensive review of reports on bystanders responding to road incidents as well as postmortem findings that looked at the potential survivability of patients who died before the arrival of emergency services.

For the primary research, using an ethnographic model, I conducted an online survey of 100 women aged 40 to 70 with eight questions, three of which were demographic (age, gender and living environment). The women surveyed resided across metropolitan, regional, rural and remote areas of Australia. The questions asked included 1. whether or not they had seen a road incident before emergency services arrived, 2. the likelihood they would stop to help if they did, what 3.

barriers and 4. motivations they think affect people stopping to help, and 5. how many would be interested in undertaking specific training in how to appropriately manage a road incident. This led to establishing the key elements of a successful social impact campaign.

Results

Researchers agree that the bystander, the first person at the scene of an accident, is critical to the outcome of the injured (Bakke & Wisborg, 2017; Oliver et al., 2017; Tannvik et al., 2012; Hussain & Redmond, 1994). Both Oliver et al., (2017) and Husain and Redmond (1994) agree from their post-mortem studies, that lives could be saved: "Training in first aid should be available more widely, and particularly to motorists as many pre-hospital deaths that could be prevented are due to road accidents" (Hussain & Redmond, 1994).

Tannvik et al., (2012) concluded from their studies into bystanders attending road incidents that: "It is probable that laypeople present at the scene of trauma can improve [sic] outcome by providing measures such as a free airway, stopping external bleeding and preventing hypothermia" (p.1222).

Managing a road crash requires more than first aid. The one-day course now offered, as opposed to a four-day course in the 1990's, is questionable regarding the participant's level of confidence to manage one casualty let alone a multicasualty road incident. However, first aid qualifications remain the first step.

Considering the above, this research determined a swift and efficient way to enact "prepared bystanders" would be through a social impact campaign. There is considerable literature on the effectiveness of documentaries and factual-journalistic style media in their ability to change audience behaviour. "Good storytelling in documentary films can ignite powerful emotions and evoke empathy among its audiences. Such an impact facilitates major change in viewpoints and fuels social change" (Das, 2019, p.1).

Ten key elements to a successful social impact campaign were identified. One is to differentiate the target audience. Women aged 40-70 were selected to begin this campaign. Given the statistics indicated males were 76% (962) of lives lost in 2023, women in this selected age group could be said to carry the weight of this burden. It is their partners or husbands, sons, brothers and fathers they are losing. They could be considered stakeholders in the fight to reduce road fatalities. They are also in an age group where people-management skills have been tried and tested in workplaces, with teenagers and with ageing parents. This cohort of women are more confident in their skills and abilities than their younger selves, and leadership in times of crisis can be their strength. The 2021 Census noted 43.8% of women were in part time employment (compared to 22.6% of men) (ABS, 2022) indicating their time may be more fluid for running errands and thus being present on the roads. Compared to women under 40, they are less likely to have smaller children in their car - a potential barrier in stopping to help at an incident. In addition their timeline may not be as rigid as taxi and public transport drivers that WHO suggested could be trained to help at incidents due to the road as their workplace (WHO, 2021, p.17).

The results of the online survey indicated that while 49% respondents said they had seen an incident before emergency services arrived, 100% said they would stop to help; and 86% said they would undertake a training program in managing a road incident. The majority of responses to motivations to stop were categorised into groups of 'desire to help others', 'knowing first aid', 'empathy' and 'reciprocity'. Barriers to stopping to help were grouped according to 'legal or insurance concerns', 'concerns for safety', 'visual or emotional trauma', 'untrained/unskilled to help', 'having passengers in the car', responses consistent with the 'bystander effect' and 'concerns for doing something to make the casualty worse'.

Benefits to road safety

Two main benefits to road safety arise – firstly, more trained first aiders in the community means an increased chance someone involved in a road incident will be appropriately attended to. There are four studies noted in Hall et al., (2013) that found a significantly higher proportion of people willing to provide first aid after completing a first aid qualification (p.5). They also showed an increase of 71% in 'willingness' to stop at a motor vehicle accident after training. Another study they quote found an increase of 26% in 'intentions to undertake CPR' following a cardiac emergency, post training. As such, the responses I garnered above resonate with the findings by Hall et al., (2013).

Secondly, people who have trained in road incident management may be more cautious on the road, as they know the consequences. It was suggested by Larsson et al., (2012) that "intensified first-aid training of the general public could lead to citizens who are more cautious in traffic ..." (p.134).

Post-crash response education and training focused on clearing airways and controlling external bleeding, is at the heart of The Prepared Bystanders Social Impact Campaign. It offers a double win by supporting people impacted at a road incident and educating the community to be more cautious on the roads as they can see firsthand the dire consequences

of fatigue, distracted driving or other reasons. Based on the last three-years of male deaths on Australian roads, 2024 is predicted to reach 1,000. Women at the frontlines as the prepared bystanders could just be the answer to reducing this staggering statistic.

Implications for policy or practice

Senior Australian of the Year 2022, Mrs. Val Dempsey, has been making progress towards legislation that all new drivers hold a first aid certificate. This is a first step. The next step would be to offer all 10-year renewing drivers a discount on the cost to do so if they hold a valid (within 12 months) first aid qualification or have undertaken The Prepared Bystanders training course. It would be a small reward for their community service and an even smaller cost to the economy.

The target audience of women aged 40-70 is the beginning. Ideally, everyone who uses the roads including pedestrians, motorcyclists and delivery drivers/riders feel a reciprocity to their community, that if they were injured, someone would help them and so being prepared to do the same.

Conclusion

'The Prepared Bystanders' as a social impact campaign narrows in on resolving the missing link – those critical minutes between crash and paramedic arrival. This campaign is designed to empower community members to help keep people alive, providing road crash response education and training to individuals and community groups. As demonstrated, this research shows the proposed effectiveness of this campaign, noting previous studies resulting in an increased 'willingness to help' (Hall et al., 2013) and more 'cautious drivers' (Larsson et al., 2012) after completing first-aid training. Prevention is the best management to reduce fatalities and serious injuries, but after a three-year continued increase, it is time to invest in the *immediate* post-crash response by upskilling those first on the scene.

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Automated iRAP encoding using computer vision and deep learning

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Abstract

Addressing the issue of manual encoding inefficiencies in International Road Assessment Program (iRAP) ratings, SmartRAP was conceived as a cost-effective, automated solution. AI-powered automation avoids labour-intensive and error-prone manual encoding, particularly impacting developing countries. Leveraging advanced computer vision techniques, SmartRAP is designed around the U-Net semantic segmentation model, specifically adapted for iRAP's complex encoding criteria. The prototype uses a parallelized convolutional neural network (CNN), effectively automating attribute encodings. It successfully encoded four attributes, Upgrade Cost, Land Use, Area Type, and Road Condition, using low-cost dashcam footage. The results showcase the prototype's success in significantly reducing the cost and time associated with iRAP encoding. This innovative approach offers a scalable and low-cost solution, particularly for low and middle-income countries. The feasibility of SmartRAP shows potential for a solution aligning with the UN's road safety goals for 2030 that enables standardized and cost-effective iRAP assessments worldwide.

Post on X

SmartRAP is a cost-effective, efficient solution for iRAP encoding with computer vision and deep learning. The AIpowered automation eliminates labour-intensive and error-prone manual encoding. The method is particularly beneficial for developing countries and cities with limited funding. #iRAP #RoadSafety #SafeRoads #DeepLearning #ComputerVision

Background

International Road Assessment Program (iRAP) (*IRAP - International Road Assessment Programme*, 2022) is a global charity organization assessing road safety standards using a star rating system. iRAP is a not-for-profit agency dedicated to saving lives by eliminating high-risk roads. Its vision is aligned with the United Nation's Second Decade of Action (74/299. Improving Global Road Safety, 2020) which has set an overarching goal of reducing traffic deaths and injuries by at least 50 percent by 2030. The current Survey Manual and Coding Manual of iRAP specifies 67 road and roadside attributes used as input to the iRAP Star Rating calculation. In addition, the manuals offer details of planning road surveys, some tools available to assist encoding, the criteria for attribute encoding, and guidelines for training and setting up human teams for the encoding process (*IRAP Specification, Manuals and Guides - IRAP*, 2022).

The most labour-intensive component of the current workflow is encoding each 100-meter segment of identified roadways with human encoders. The process is both expensive and error prone. For example, the iRAP Coding Manual states a team of four to six trained encoders will take approximately one month to code a 3,000 km road network. It also recommends keeping a small team (less than 10 encoders) to ensure consistency in coding. (*IRAP Specification, Manuals and Guides - IRAP*, 2022). The costs of training and certifying the encoders, supporting software for human encoders, etc. also add up. Keeping a small team to achieve consistency will extend the timeline for a large road network. Overall, relying on human encoders will require significant upfront costs and recurring costs, despite the issues of fatigue causing errors and inconsistencies across different human encoders.

SmartRAP was conceived as a low-cost, automated solution to leverage advanced computer vision techniques to develop a scalable and low-cost solution to address the issues of costs, extended time required for coding, and possible human errors.

Project Description

SmartRAP was a proof-of-concept prototype developed using advanced computer vision techniques to automate the labour-intensive and error-prone manual encoding of iRAP road attributes. The project completed a successful prototype that was able to encode four iRAP attributes, namely, Upgrade Cost, Land Use, Area Type, and Road Condition, using low-cost dashcam footage.

Custom Image Labeller

The first step was to build a custom image labeller to label dashcam footage by a human user. The labeller could extract image frames from the video footage and supported adding multiple labels simultaneously for all four attributes (Upgrade Cost, Land Use, Area Type, and Road Condition) used for the prototype.
Road Feature Detection using Semantic Segmentation

The second part involved a semantic segmentation model to identify roadside features such as pavement and sidewalks. The computer vision model was trained using the Mapillary datasets (*Mapillary Datasets*, 2022). Further optimization with customized labelling for low-standard, rural roads is planned as future work. **Figure 8** is a clip extracted from the SmartRAP prototype that successfully detected the pavement (orange colour) using low-cost dashcam footage. For the full video, see https://www.youtube.com/watch?v=svPl131AL-I.



Figure 8: Pavement detection using semantic segmentation (Source: https://www.youtube.com/watch?v=svPl131AL-I)

Parallel Encoding using U-Net Based Machine Learning Model

The third step was to use a customized version of a U-Net semantic segmentation model developed for biomedical imaging (Ronneberger et al., 2015) to generate the iRAP encoding. This model was trained using 700+ images labelled using the purpose-built image labeller. **Figure 9** illustrates the high-level architecture of the encoder model that generated the final iRAP attribute encoding file.



Figure 9: Parallel attribute encoder (Source: Author)

Results

The outcome of the prototype was a working machine learning model and the related user interfaces to generate the iRAP encodings. The proof-of-concept successfully confirmed the feasibility of the approach of using dashcam footage to automate the labour-intensive road attribute encoding process.

Figure 10 is a screenshot from the final demo software application. The user can upload dashcam footage and the software will automatically segment the video to *Road Sections* of 100 m in length (the recommended segment length in iRAP) and extract four to five scenes (i.e. *Frames*) for each section. The final coding for a given section is generated based on the individual *frames* extracted for that *section*. A narrated demo of the prototype application is available at <u>https://youtu.be/tWaXX1YaM6E</u>. The cost savings and the efficiency improvements through the elimination of human errors will generate great benefits to cities and road agencies to meet the UN's road safety goals for 2030 which will require standardized and cost-effective iRAP assessments worldwide.

The main aim of this project was to confirm the feasibility of using modern computer vision technology to build an automated system to generate iRAP encoding. Therefore, it did not produce an elaborate comparison to quantitatively estimate the cost savings or improvements in efficiencies. Further work is required to build up on this prototype and execute a pilot project to establish the cost-benefits of this approach.



Figure 10: SmartRAP Auto Encoder Prototype Software

Future Work

The following future work is necessary to convert SmartRAP into a production-ready solution.

- a) Build a dataset specific to the iRAP encoding criteria with targeted classification, especially fine-tuned for road segments from developing countries
- b) Build a CNN model trained using the dataset in (a) above. The model will generate multiple attribute encodings at once, thus behaving like multiple models in parallel operation to improve the efficiency of the encoding process
- c) Use the latest object detection models (i.e., U^2 Net)(Qin et al., 2020) and adopt for iRAP attribute encoding
- d) Build a close-loop reinforcement learning model to benefit from the verification of the samples of semantic segmentation by trained human encoders

Implications

The benefits of an automated, accurate solution for iRAP encoding are enormous for cities and road agencies. With vast expansions of roads, most will struggle to develop and maintain the iRAP ratings for their road networks with human encoders. Based on the iRAP Coding Manual, assume a team of five coders can encode 3,000 km of roads in a month. An automated system can do the same amount of work (if not more) in the same time using one experienced human coder as a secondary validation step for computer-generated encodings. Assuming a monthly salary of \$1,000 (LKR 300,000) for a trained human coder, this amounts to savings of \$4,000 a month. A subscription-model software service can provide a much lower cost-per-license.

There can be further savings in terms of probing vehicles that do not require expensive camera equipment required for human encoders. The prospect of advanced AI-powered systems like SmartRAP in terms of cost savings and effectiveness will impact the road safety of both developed and developing countries alike, helping avoid millions of deaths and injuries that occur on roads worldwide.

Conclusion

SmartRAP prototype successfully confirmed the viability of applying advanced computer vision technology to tackle the serious challenge of developing and maintaining the iRAP ratings for vast expansions of road networks. Its further development to realize a viable production version will offer numerous savings and benefits to cities are road agencies worldwide, especially those of low and middle-income countries.

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Cost-effective crash analysis models using data science and machine learning

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Abstract

Traditionally, road crash analysis used regression and discrete choice models using past data. Since road traffic crashes occur across space and time, numerical approaches fail to provide insights into geospatial regions. Exploratory data analysis, machine learning, and geospatial tools collectively offer a unique opportunity to fill these gaps cost-effectively. This study applied data science and machine learning to build explanatory models to analyze road crashes. Crash analysis algorithms, correlation charts, and gradient-boosted decision trees were developed to relate accident severity with crash data. The visualizations provide crash density maps and interactive maps to focus on hot spots. The algorithms enable repeatable application to new and old datasets with minimal effort. The methods were tested using crash data in Sri Lanka. Future work on integrating sources such as weather and traffic data can achieve near real-time crash prediction. The outcome helps cities and agencies tackle the road safety problem with limited resources.

Post on X

A research on algorithms and explanatory AI models for cost-effective and precise road crash analysis. The insights from the models and interactive visualizations will enable the deployment of resources cost-effectively to tackle road safety challenges. The outcome is especially suited for developing countries or cities with limited funding. #RoadSafety #MachineLearning #ExplanatoryModels #OpenSourceTools

Introduction

Deaths caused by road traffic crashes are a global problem and account for more than 1.3 million fatalities annually worldwide. They are also the eighth leading cause of death and the leading cause of death for young adults aged between 5 and 29 years (Global Status Report on Road Safety 2018, 2018). Fatalities and severe injuries caused by road crashes in Sri Lanka are also major national problems. According to the statistics published by the National Road Safety Council of Sri Lanka, there have been over 3,000 deaths on average per annum between 2016 and 2019 (National Council for Road Safety, Sri Lanka, 2020).

In addition to the loss of lives, the grievances faced by the families of the deceased individuals, and the hardships caused by severe injuries, the cost of road crashes is a massive burden on a country's economy. The Global Road Safety Facility (GRSF) of the World Bank estimates that road crashes drain out as much as 4.9% of Sri Lanka's GDP each year (Sri Lanka's Road Safety Country Profile, 2021). In a statistical analysis of road crash data, economic indices, and per capita health expenditure in Sri Lanka between 1977 and 2016, Thangamani (2019) found that every 1% increase in the fatality index¹ reduces the economic growth rate of the country by 0.79%. The same study also concluded that the health expenditure per capita increased by 0.87% for every 1% increase in the total casualties (Thangamani, 2019).

The objective of this research was to combine the theoretical knowledge from the field of transportation studies and the power of modern data science and machine learning technologies to build programmatic explanatory models. An integrated approach to understanding the causal factors and visualizing crash densities and hotspots using geospatial mapping technologies was developed. Such an approach is crucial to identify the spatial distribution of road crash occurrences thereby focusing the attention of road and enforcement agencies to take effective control and prevention measures. These types of technology-driven solutions will support countries and agencies to address current challenges faced in achieving the United Nation's overarching goal of reducing road traffic deaths and injuries by at least 50 by the year 2030 (74/299. Improving Global Road Safety, 2020).

A crash model typically tries to establish the relationship between crash frequency or severity and the causal factors such as vehicle factors (type of vehicle, safety features), human factors (influence of alcohol, use of safety features such as helmets), and road and environment factors (road condition, weather, light condition). Approaches such as mathematical models (Asalor, 1984), various regression models, discrete choice models, and artificial intelligence (AI) based techniques have been employed in developing crash models (Abdulhafedh, 2017). The numerical nature of such models could be complemented by the powerful geospatial analysis tools and data visualization technologies that have advanced rapidly with the big data revolution. These new developments offer visualization that improves the efficacy of human experts (Shneiderman, 2014). Further, two recent phenomena, namely the exponential growth of available

¹ Fatality Index = (Total Fatalities / Total Casualties X 100) (Thangamani, 2019)

²⁰²⁴ Australasian Road Safety Conference

³⁰ September - 3 October, Hobart, Tasmania, Australia

computation power and the abundance of data to train models, caused this rapid advancement in the AI and machinelearning fields (Haenlein & Kaplan, 2019; Singh, 2017).

The computer programmatic approach enables these to be repeatedly applied to new data sets with minimal changes in the model. The computer science applications are based on leading free and open-source technologies in the industry thus making the approach cost-effective and affordable.

Method

The study used complementary approaches to build explanatory models to analyze and visualize road crash data. The first is exploratory data analysis (EDA) to understand general patterns. Second, a machine-learning model using gradient boosting algorithms was built to provide added explainability from the auto-detected feature importance through the machine-learning (ML) models. The third and final element was static and interactive maps for geospatial analysis.

The Python programming language was used to develop functions and algorithms to programmatically analyze the data set. The ML model development used stable and popular open-source Python libraries to improve the cost-effectiveness of the approach. For visualizations, the crash database GPS data and the geo data of different administrative regions of Sri Lanka (e.g. provinces, divisional secretariats) were combined. Methods were developed to generate static choropleth maps for crash density (i.e., crashes per 100,000 persons) and interactive maps to see crash hotspots and drill down by zooming into very granular levels on geographical regions.

Results

The main outcomes of the study were a set of algorithms, machine learning models, and charting methods that can be repeatedly used for road crash analysis of similar data sets. The application of data science techniques improves the analysis compared to traditional methods. For example, the use of EDA helps generate a complete co-relation analysis for the full data set with a few lines of code. Refer the appendix on **Error! Reference source not found.** for more information.

The use of advanced plotting tools visually emphasized the impact of certain types of crashes which may not be so obvious from numerical data. Figure 11 is an example of how programmatically generated analysis presents multidimensional data in an easy-to-understand format.



H - Heavy Vehicles | L - Light Duty Vehicles | V - Vulnerable Users | X - Uncategorized

Figure 11. Heatmap of fatal crashes with element type vs hour of the day

The ML models revealed certain information that could escape the traditional hand-crafted analysis models. For example, the *feature importance* (a measure of how much each attribute contributes to the model prediction) revealed that Police Station No. is the most prominent feature (Figure 12). Further examination revealed that certain stations have a higher portion of fatal crashes as a percentage of the total crashes (Figure 13).

Interactive crash density maps are another significant outcome that is not possible with traditional numerical analysis methods. Figure 14 illustrates a few examples from the interactive maps prototype at different zoom levels. A detailed video of this prototype is available at <u>https://www.youtube.com/watch?v=pFsDAZwVxso</u>. The study also found inconsistencies and inaccuracies in the existing data-capturing methods and some limitations in the current data collection schemas.



Figure 12. Feature importance in the ML model



Figure 13. Percentage of crash severity by Station No

Benefits to Road Safety

The benefits for road safety include:

- Ability to provide alerts and insights with visualizations in relation to geospatial regions
- Ability to expand the study findings to crash prediction with the incorporation of other real-time data sources
- Low-cost and efficient road crash analysis, particularly benefiting low and middle income countries and cities with limited funding
- Ability to repeat the study outcomes to new and old datasets with minimal effort

Implications to Policy and Practice

The outcomes of the study can be easily applied to build affordable and interactive crash analysis systems. The implications of this approach are beneficial to countries, city councils, and road agencies that struggle to tackle the road safety problem with limited human and financial resources. The study can be expanded to build an online digital platform to provide real-time insights and predictions to minimize road crashes and the resulting social and economic impacts on societies. A high-level technical design for such a platform is illustrated in Figure 15.

Conclusions

The outcomes of the study were tested with crash data from Sri Lanka. The results confirmed the potential to generate new insights about crash factors using machine learning and the power of interactive tools to manage crash data. The integration of the latest explainable AI tools will increase the effectiveness of crash analysis several folds.

The key research contributions from this study are a) the cross-discipline application of computer science knowledge with transportation engineering knowledge, b) the unified analysis provided by multiple techniques, and c) proof of the viability of the latest open-source technologies in building effective and affordable digital systems. The blending of transportation engineering knowledge with the power of computing knowledge and open-source technologies provides a great opportunity for fast and new insights that are not possible with traditional analysis approaches.



Figure 14. Crash hot spots and clusters at different zoom levels





Figure 15 A high level proposal for a digital platform. Source: (De Silva & Perera, 2021)

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Best practices in end-of-queue risk management at roadworks

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Abstract

Traffic queues at roadwork sites pose significant risks to motorists and roadworkers as rear-end crashes at the end-ofqueue (EOQ) location are the most common type of work zone traffic incident. Subsequently, Transport for New South Wales (TfNSW), Deakin University, and iMOVE CRC partnered in a large-scale field trial of EOQ crash and injury reduction treatments. Prior to conducting trials, a three-stage methodology was developed to identify potential treatments and examine which measures are likely to be most feasible and effective in the study area. Methods consisted of a comprehensive review of the literature (stage 1), consultation with international experts (stage 2), and focus groups with roadwork personnel from Australia (stage 3). Results include traditional and simple low-cost measures through relatively sophisticated treatments that rely heavily on emergent technologies and innovative approaches. In many instances, these treatments may be used in combination to maximise the overall EOQ risk reduction benefit.

Post on X

A review of the literature and consultations with international experts and roadwork personnel in Australia have unveiled a promising list of treatments for managing end-of-queue crashes at roadworks, which are being field tested in a large-scale trial in New South Wales.

Introduction

Traffic queues occur frequently at roadwork sites due to changes in site geometry, traffic management controls, and traffic flow characteristics. These queues pose significant risks to motorists and roadworkers as rear-end crashes at the end-of-queue (EOQ) location are common at roadwork sites (Ledger et al., 2021; Ullman et al., 2016; Debnath et al., 2014). To address the risks at roadwork sites, researchers and practitioners have developed and tested various controls and technologies, including Queue Warning Systems (QWS) (Brown & Edara, 2022; Hsieh et al., 2017). A wide range of other measures may be used in conjunction with a QWS, and/or as stand-alone controls to improve work zone safety. These include autonomous and remote-controlled traffic control devices (Finley, 2013; Debnath et al., 2017), enforcement measures (Benekohal et al., 2010), work zone intrusion technologies (Gambatese et al., 2022), among others. With the advancement of technologies, innovation in this space is being made continuously.

To address this important safety issue in Australian roadwork sites, Transport for New South Wales (TfNSW), Deakin University, and iMOVE CRC have partnered in a large-scale field trial of EOQ crash and injury reduction treatments. Despite many research efforts in EOQ risk management internationally, there is limited understanding of EOQ treatment effectiveness in an Australian context. To fill this important gap in the literature and to inform future best practice, this paper aims to identify which traffic control measures are effective in reducing the frequency and/or severity of injuries associated with EOQ crashes at roadworks.

Methodology

To document best practices in EOQ risk management and to identify effective treatments, a three-stage methodology was developed, consisting of a comprehensive review of the literature (stage 1), consultation with international experts (stage 2), and focus groups with roadwork personnel from Australia (stage 3).

In the first stage, a comprehensive review of the literature was undertaken to identify the best practices and solutions for reducing or eliminating EOQ crash and injury risk. The review was international in scope to ensure the capture of all relevant materials. Reports and documents from existing similar studies run in Australia, as identified by the project's steering committee with representation from several jurisdictions in Australia, were also included in this review.

Consultations with international experts (n=6 from the US and Europe), who have undertaken studies related to EOQ crashes and risk management in recent years, were undertaken in Stage 2. These consultations focused on the experts' current understanding of 1) work zone risks and hazards in their respective jurisdictions, and 2) best practices and controls, focused mainly on those used to address EOQ crash and injury risks. These consultations were run in a semi-structured interview format for approximately 60 minutes with each expert.

In the third and final stage, consultations with industry experts from Australia were also undertaken in two parts. First, to capture valuable contextual insights from local conditions, a series of consultations were undertaken with subject matter experts involved in roadwork safety management across Australia. The subject matter experts provided

information on past and current trials of work zone safety treatments in Australia, as well as the preferred safety treatments relevant to EOQ risk management. Second, a series of Focus Group Discussions (FGDs) were undertaken with different groups of roadwork personnel (workers, traffic controllers, safety managers). These FGDs gathered anecdotal information about the likely effectiveness of different EOQ treatment options and messaging content.

Results

Since there are many variables to consider regarding roadwork sites and the different types of treatments available to address EOQ crash risks, including site layout, roadway type, traffic characteristics, nature and duration of works, and treatment costs, among others, best practice must be informed by consideration of frequently occurring factors. Best practices identified in this paper, as presented below, include both traditional and simple low-cost measures as well as relatively sophisticated treatments that rely heavily on emergent technologies and innovative approaches. In many instances these treatments may be used in combination to maximise the overall benefit in terms of EOQ crash risk reduction. The best practices are broadly categorised into five classes: (i) Traditional and electronic signage; (ii) Guidance and perceptual countermeasures; (iii) Enforcement-related measures; (iv) Audible warning messages; and (v) EOQ warning systems and autonomous and remote-controlled traffic control devices.

Traditional (static) signage and variable message (electronic) signs

The literature shows that static signs are effective in reducing speeds and alerting drivers to work zone lane closures. However, their effects can be limited and depend on appropriate placement, message content, and number of signs (more signs do not necessarily improve the effect) (Debnath et al., 2017). Consultation with experts and industry indicates that static work zone signs should continue to be used but should be clear, unambiguous and consistent across sites. It is recommended that static signs have messages that can be translated to clear actions by drivers (e.g., prepare to stop). In reduced visibility conditions, additional enhancement processes (e.g., adding flashing lights) are recommended.

Variable message signs (VMS) are found in many studies to be more effective than traditional static signs, although observed differences are not always substantial (e.g., comparative speed reduction effect). A clear advantage of VMS is the ability to change and customize messages on demand using a combination of text or graphics as required. According to the literature and consultations alike, one of the most effective uses of VMS is in radar-activated (or speed-activated) signs, which display vehicle speeds to drivers, often in combination with the display of positive messages/graphics for compliant behaviour. VMS may also provide critical information regarding queues ahead and may form part of dedicated queue warning systems.

Guidance and perceptual countermeasures

Several forms of guidance and perceptual countermeasures show promise for reducing vehicle speeds in work zones and therefore reducing the occurrence or ameliorating the impacts of EOQ crashes. These include temporary portable rumble strips (TPRS), which have been shown to reduce vehicle speeds and improve driver awareness (Chircop, 2017; Hsieh, 2017), although their effectiveness and feasibility depends on a wide range of implementation factors and the type/s of TPRS used. Another measure in this category to reduce vehicle speeds on approach to work zones is the use of temporarily narrowed lanes or gateway treatments, which may be implemented by linemarking or the use of traffic cones or bollards. While identified in the literature and tentatively supported in consultations, implementation factors are also important with this treatment, such as not impeding the passage of wide loads or causing excessive sudden braking in the traffic stream.

Enforcement-related measures

Active and perceived enforcement and visible police presence have been found to be among the most effective ways to reduce vehicle speeds and encourage compliance at work zones. This is demonstrated in literature (Benekohal et al., 2010; Debnath et al., 2017) and is strongly supported by international experts and industry representatives consulted in the current project. A key limitation of this measure, according to consultations, is the often-limited availability of police to attend work zones for such activities.

Audible warning messages

While the research on effectiveness of UHF radio messages to drivers approaching work zones is limited, heavy vehicles are associated with greater risk in relation to EOQ crashes than other crash types (Ledger et al., 2021). Therefore, more work is needed to establish whether UHF radio messages may be effective for alerting and improving the response of truck drivers approaching EOQ scenarios at work zones.

EOQ warning systems and autonomous and remote-controlled traffic control devices

The literature review showed that the use of high-end EOQ warning systems has produced positive outcomes in reducing EOQ crashes in North America (Brown & Edara, 2022). EOQ warning systems use a combination of speed sensors and VMS to provide dynamic messaging to motorists on approach to stop/slow points and potential queue formations. Consultation with experts in the United States explored the use of such systems, the trial of which was generally endorsed by industry representatives in Australia.

Autonomous and remote-controlled traffic control devices have been found to be effective in reducing the exposure of workers who may be vulnerable in the event of EOQ crashes (Finley, 2013; Debnath et al., 2017). Remote-controlled portable traffic signals may also be linked to upstream VMS to provide motorists with critical information on traffic signal status and/or queue formation ahead, thereby constituting a relatively simple form of a queue warning system.

Current and Future works

Based on the findings on of this research project, the abovementioned EOQ treatments are being trialled at a range of roadwork sites in rural and regional NSW, using rigorous state-of-the-art data collection and analysis methods. In addition to recording driver behaviour through video and speed data collection processes, roadside surveys with drivers are being conducted to understand their perceptions and preferences about the EOQ treatments. While this paper presents best practices based on the evidence available in the literature and anecdotal understanding in the industry, it is expected that these trials will provide quantitative evidence to inform best practices for addressing EOQ crash risk in the context of NSW and Australian work zones. Preliminary results of these trials will be presented at the conference, along with the best practices identified in this paper.

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Comparing vehicle probe speeds with spot and space mean speeds

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Abstract

Travel behaviour analysis has traditionally relied on spot speed and space mean speed data, which usually involve highcost data collection methods. The emergence of new data collection methods (e.g., vehicles with satellite navigation systems acting as a probe in traffic flow) provides opportunities to consider this as an alternative to traditional speed data. However, there is limited research on the suitability and validity of the probe-sourced speed data. To fill this important gap, this paper presents a comprehensive statistical comparison of probe-sourced speed data with spot and space mean speeds, using data from 22 road sections in Victoria. Results showed that probe-sourced data have a better match with the space mean speed data than the spot speed data. The extent of match was greater for high-speed connector roads than for other road types. The findings of this study have strong implications on how the probe-sourced speed data should be used, and the use cases can be improved by undertaking future research on data quality issues.

Post on X

A study of 22 road sections in Victoria shows that vehicle probe-sourced speed data can be a suitable alternative to the traditional space mean speed data, particularly for high-speed connector roads.

Introduction

Road network intelligence and travel behaviour analysis have traditionally relied on spot speed (SS) and space mean speed (SMS) data collected using sensors mounted on infrastructures. The costs of deploying and maintaining these fixed-loop sensors are high compared with the costs of accessing vehicle probe-sourced data (Adu-Gyamfi et al., 2017; Grande et al., 2022). There has accordingly been greater interest in using probe-sourced data for better network coverage under constrained budgets to collect traffic and speed data. The probe-sourced data also offers ready accessibility and availability for road sections over wider areas. However, there is limited understanding in the literature about the suitability and validity of the probe speed (PS) data (Adu-Gyamfi et al., 2017). To fill this important gap in the literature, this paper presents a comprehensive statistical comparison of PS data with SS and SMS data obtained from 22 connector and local road sections in Victoria. These three types of speed data were statistically compared in a spatial and temporal hierarchical framework.

Method

Data description

To compare the validity of PS data, 22 road sections were selected from across Victoria covering different types of roads in the Movement and Place framework: connector roads of 80-90 km/h posted speed limits, connector roads of 100-110 km/h speed limits, local street of 80-90 km/h speed limits, and local streets of 100-110 km/h speed limits. Connectors primarily provide access to state-level, regional-level and municipal-level places while Local Streets are streets within municipalities and local places.

SMS data were collected using Automatic Number Plate Recognition (ANPR) technology by recording the times at which they entered and exited each road section. SS data were collected using pneumatic tubes at two locations within each road section (referred to hereafter as Tube A and Tube B) approximately at the first-quarter and third-quarter of a road section. Two SS data collection points were used to obtain a representative picture of spot speeds over a road section. The PS data, sourced from HERE Technologies, were processed in mean speed values per 5-minute (min) periods on multiple links in each road section of interest. The SMS and SS data were recorded for individual vehicles.

While the PS and SS data were available for 24 hours a day, due to limitations in ANPR technology the SMS data were available for the day hours only (7am-7pm). As such, the SMS data from ANPR technology were compared with the corresponding daytime PS data, whereas the 24-hour SS data from Tubes A and B were compared with the corresponding 24-hour PS data, separately for day, night, AM peak (6-9:29am), Midday (9:30am-3.29pm), and PM peak periods (3:30-6.59pm).

Statistical analysis

To compare the speed datasets, a common time period (i.e., a specific day or multiple days) and data from the same direction of travel were considered in the analysis. This was done to avoid any unobserved effects in the speed datasets due to variations in traffic and environmental characteristics from multiple time periods or travel directions.

A three-stage data analysis compared the PS, SMS, and SS data. In the first stage, the data were examined visually using histograms and descriptive statistics to identify outliers. In the second stage, the normality of all speed data was assessed and t-tests (for normally distributed data) or Mann-Whitney (M-W) U tests (for non-normally distributed data) were used to assess whether the PS data were significantly similar to the reference data (SMS and SS). The third stage complemented the statistical tests with a range of error metrics, such as the Average Absolute Speed Error (AASE) and the Speed Error Bias (SEB), the state-of-the-art techniques for PS data analysis (Gong et al., 2021; Vander Laan & Sharifi, 2021). These metrics were adopted from the methodology developed by the Maryland Transportation Institute of the University of Maryland within the framework of a research project (the I-95 Corridor Coalition Vehicle Probe Project) conducted to validate PS data collected on some freeways and arterial roads in the US States of New Jersey, Pennsylvania, Delaware, Maryland, Virginia and North Carolina (Haghani et al., 2009). The AASE indicates the difference between the PS data and the reference data, and the SEB refers to the tendency of the PS data to over- or under-report speed compared to the reference data. The AASE is a precision metric, and the SEB is a bias metric. Following thresholds of the error metrics used in the literature (Gong et al., 2021; Sharifi et al., 2017) and consultation with industry stakeholders, thresholds of AASE < 10 km/h and -3km/h <= SEB <=3 km/h were used for a set of use cases of the PS data, particularly for the use of PS data at strategic/network level. These thresholds were used to interpret the error metrics in this report; however, it is noted that more conservative thresholds may be used for specific use cases, e.g., in a before-after safety analysis.

Results

The results of the statistical analysis include mean speed difference (MSD), normality test results (M-W test), and AASE and SEB error metrices. Due to space limitations, only a summary of the results is presented here (Table 1). Interested readers are referred to a published research report (Debnath and Soro, 2023) for detailed results.

	PS - SMS				PS - SS (Tube A)			PS - SS (Tube B)				
Level of Analysis (LoA) Site type, Speed limit, Time	MSD	M-W	AASE	SEB	MSD	M-M	AASE	SEB	MSD	M-W	AASE	SEB
All sites, All speed, Day	-1.9	Х	Y	Y	-4.2	Х	X	X	-1.2	Y	Y	Y
All sites, All speed, Night	-	-	-	-	-5.2	Х	Х	X	-1.7	Х	Y	Y
All sites, All speed, AM peak	-2.2	Х	Y	Y	-4.6	Х	X	X	-1.0	Y	Y	Y
All sites, All speed, Midday	-1.8	X	Y	Y	-3.6	Х	X	X	-0.7	Y	Y	Y
All sites, All speed, PM peak	-1.7	X	Y	Y	-5.1	Х	X	X	-2.0	Х	Y	Y
Connector, 80-90, Day	-9.4	X	X	X	-13.3	Х	X	X	-8.4	Х	X	X
Connector, 80-90, Night	-	-	-	-	-14.3	Х	X	X	-9.4	Х	X	X
Connector, 80-90, AM peak	-9.0	X	Y	X	-13.5	Х	X	X	-8.6	Х	X	X
Connector, 80-90, Midday	-9.6	X	X	X	-13.1	Х	X	X	-8.3	Х	X	X
Connector, 80-90, PM peak	-9.2	X	Y	X	-13.4	Х	X	X	-8.5	Х	X	X
Connector, 100-110, Day	-0.1	X	Y	Y	-5.5	Х	Y	X	-1.8	Х	Y	Y
Connector, 100-110, Night	-	-	-	-	-4.1	Х	Y	X	-0.5	Y	Y	Y
Connector, 100-110, AM peak	-0.4	X	Y	Y	-5.9	Х	Y	X	-1.9	Х	Y	Y
Connector, 100-110, Midday	-0.1	X	Y	Y	-4.9	Х	Y	X	-1.3	Y	Y	Y
Connector, 100-110, PM peak	0.3	Y	Y	Y	-6.1	Х	Y	X	-2.4	Х	Y	Y
Local St, 80-90, Day	1.8	X	X	Y	6.8	Х	Х	X	5.4	Х	X	X
Local St, 80-90, Night	-	-	-	-	6.5	Х	Х	X	6.6	Х	X	X
Local St, 80-90, AM peak	0.3	Y	X	Y	10.4	Х	Х	X	9.9	Х	X	X
Local St, 80-90, Midday	2.3	X	X	Y	7.2	Х	Х	X	5.4	Х	X	X
Local St, 80-90, PM peak	2.1	Х	X	Y	3.7	Х	Х	X	2.6	Y	X	Y
Local St, 100-110, Day	0.8	X	X	Y	6.8	Х	Х	X	8.4	Х	X	X
Local St, 100-110, Night	-	-	-	-	0.6	Y	Х	X	1.1	Y	X	X
Local St, 100-110, AM peak	0.2	Y	X	Y	5.1	Х	X	X	7.1	Х	X	X
Local St, 100-110, Midday	1.5	X	X	Y	7.1	Х	X	X	8.8	Х	X	X
Local St, 100-110, PM peak	0.1	Y	Х	Y	6.1	Х	Х	Х	7.4	Х	Х	X

Table 1. Comparison of Probe speed (PS) with Space mean speed (SMS) and Spot speed (SS)

MSD: Mean speed difference (PS – Reference speed), M-W: Mann-Whitney U test results, AASE: Average Absolute Speed Error, SEB: Speed Error Bias, - : not applicable, Y: Two speed datasets are comparable, X: Two speed datasets are different or didn't meet the criteria (AASE<10 km/h, -3<=SEB>=3 km/h)

The MSD values showed that the PS and SMS data were quite similar (differences of 0.1-2.3 km/h) when all sites were considered together, as well as for Connectors with a speed limit of 100-110 km/h, Local Streets with a speed limit of 80-90 km/h and Local Streets with a speed limit of 100-110 km/h, but not for Connectors with a speed limit of 80-90 km/h (differences of 9.0-9.6 km/h). While the M-W test results indicated that the PS and SMS are statistically different, the AASE and SEB error metrics showed that the two speed datasets can be considered similar for the Connectors with a speed limit of 100-110 km/h and when all sites were considered together, for all time periods (AM peak, midday, PM peak) and the selected thresholds. This implies that in these levels of analysis (LoAs), PS data can consistently be used as a proxy for the SMS data for the selected thresholds. Nevertheless, the validation criteria of both metrics were not met for Connectors with a speed limit of 80-90 km/h, Local Streets with a speed limit of 100-110 km/h.

Overall, the differences between PS and SS were larger compared to the differences between PS and SMS, with increased fluctuations between types of roads and observation time periods. Results showed that the PS data do not meet the AASE and SEB validation criteria for both speed measurement points (i.e., Tube A and B) for any of the LoAs. Some LoAs meet the validation criteria for one of the two speed measurement points. The results do not suggest that the PS data can be applied as a proxy for SS data.

Conclusions

Vehicle probe-sourced speed data offers significant benefits regarding data accessibility and reducing data collection time. There has accordingly been growing interest in using this data in travel speed analysis. This paper presented a comprehensive statistical comparison of PS data with two forms of traditional speed data, such as SS and SMS. Results showed PS data has a greater match with SMS data than SS data. The PS data can be used as a proxy for SMS data for the given level of error thresholds at a network level, specifically for Connectors with 100-110 km/h speed limits. In contrast, the results do not provide concrete evidence in favour of using PS data as a proxy for SS data. Future research is recommended to derive further insights on using PS data for all road types and to undertake a sensitivity analysis of the thresholds of error metrics for different use cases in road safety evaluation.

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Evaluation of side road activated signs treatment at rural intersections

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Abstract

Side Road Activated Signs (SRAS) at intersections aim to slow main road vehicles using electronic speed limit signs that are activated by vehicles travelling on the side road and by temporarily reducing the posted speed limits on the main road. While a few studies have investigated the effectiveness of this treatment, an in-depth comprehensive evaluation is lacking in scientific literature, particularly in relation to different types of intersections. This paper presents a comprehensive evaluation of the effectiveness of SRAS at T and cross intersections with wide medians in Victoria. Statistical modelling of the changes in vehicle speed in a Tobit regression framework and analysis of near misses using surrogate safety measures were undertaken at three rural intersections. Results showed that SRAS effectively reduces speeding and near misses with greater levels of effectiveness at single carriageway intersections than intersections with dual carriageways and wide medians. The findings provide evidence to safety practitioners on SRAS performance and the factors associated with its effectiveness.

Post on X

A Victorian evaluation of the Side Road Activated Signs (SRAS) showed that SRAS are effective in reducing vehicle speeds and near misses at intersections, particularly for rural roads with single carriageways.

Introduction

More than 50% of the road fatalities per year in Australia occur in rural areas and 40% of these fatalities occur at intersections (Bureau of Infrastructure and Transport Research Economics, 2023). Treatments such as roundabouts or grade separation are commonly implemented to reduce severe crash risk at intersections. Nevertheless, these treatments may be financially costly and often unsuitable for high-speed and low volume rural unsignalized intersections (Mongiardini et al., 2021). Alternatively, intersection conflict warning systems have been adopted to assist drivers for safe and timely crossings or turning at rural intersections (Huang et al., 2022; Tian et al., 2021). The conflicts warning systems, aka Side Road Activated Signs (SRAS), are intelligent transport systems that aim to reduce crash occurrence and severity at high-risk rural intersections. When installed at an intersection, they aim to slow main road vehicles by temporarily reducing the posted speed limit on main road using electronic speed limit signs when vehicle(s) are present on the side road (Meuleners et al., 2020; Mongiardini et al., 2021).

Driving simulator studies in Western Australia (Meuleners et al., 2020) and the United States (Tian et al., 2021) and field trial studies in New Zealand (Mackie et al., 2017) and South Australia (Mongiardini et al., 2021) showed the capability of conflict warning systems to effectively reduce vehicle speed on main road approach at rural intersections. Despite these studies, there is a significant gap in the literature that the effectiveness of the SRAS treatment is not comprehensively understood for different types of intersections (e.g., T vs cross) and how their effectiveness varies by other factors (e.g., presence of wide medians). In addition, the existing studies ignored the effects of traffic and environmental characteristics on vehicle speeds when evaluating the effects of SRAS. This paper aims to comprehensively evaluate the SRAS treatment in Victoria using a multivariate case-control analysis methodology to assess the safety benefits and performance of SRAS in terms of changes in speeds and near misses.

Method

Data collection

Three rural intersections (denoted hereafter as Sites 1, 2, and 3) were selected as treatment sites, where the SRAS was installed, for this evaluation study. Three other intersections which had geometric and traffic characteristics similar to the treatment sites (denoted hereafter as Sites 1c, 2c and 3c) were selected as control sites in the case-control methodology. The sites were selected by the research team in consultation with the Victoria Department of Transport and Planning (DTP) based on data availability and DTP's plans for SRAS installation. Speed and traffic movement data were collected at all six sites before and after SRAS installation on treatment sites. Site 2 (South Gippsland Hway/Fish Creek-Foster Rd) is a T intersection with single carriageway and painted median. Site 1 (Bass Hway/Soldiers Rd - a T intersection) and Site 3 (Princess Hway/Hendy Main Rd - a cross intersection) have dual carriageways and wide medians with dedicated right turn lanes.

Speed data were collected before and after installation of the SRAS treatment for both directions of travel: Southbound (SB) and Northbound (NB) for Site 1 and Eastbound (EB) and Westbound (WB) for Sites 2 and 3. Data on near misses were gathered by processing video recordings of traffic movements collected from the treatment sites. Speed and video data were collected for at least 7 days for all sites and study conditions (i.e., before and after SRAS installation).

Statistical analysis

The speed and near miss data were analyzed using statistical methods, including multivariate analysis of driver speeds in a Tobit modelling framework. The analysis methods are outlined below for three key evaluation criteria of SRAS: changes in speed, changes in near misses, and changes in driver behaviour.

Changes in speed

The speed profiles for all vehicles at each treatment site and the corresponding control site were examined through descriptive statistics including mean speed, standard deviation (SD), 85th percentile speed, and compliance rates with the posted speed limits. These statistics were computed by direction of travel for both sites before the SRAS installation, for the control sites after the SRAS installation and for the treatment sites when the SRAS was installed and was activated (ON) or deactivated (OFF). Then, the differences and percentages of change in mean and 85th percentile speeds were computed, and the normality of the speed data was assessed. T-tests (for normally distributed data) or Mann-Whitney U tests (for non-normally distributed data) were used to assess whether the SRAS significantly reduced mean speeds for each direction of travel. To account for the effects of other traffic and environmental factors, the changes in speeds were modelled in a Tobit regression framework to compute the probability of speeding and the amount of speed above the posted speed limit (see Debnath et al., 2014 for a description of the framework).

Changes in near misses

The changes in near misses were examined using three surrogate safety measures: gap size, gap acceptance rates, and Post Encroachment Time (PET). These measures were examined using descriptive statistics including mean gap and SD for all vehicles, proportion of accepted or rejected gaps and their mean gap and SD, and the mean PET and SD of the mean. Changes in all mean gap, accepted and rejected mean gaps and proportions of accepted gaps were computed to assess the effects of SRAS on these measures.

Changes in driver behaviour

Using the video recording of traffic movements, driver behaviour on both side road and main road were examined in terms of changes in the positioning of stopped vehicles on side road (i.e., if a vehicle stopped before entering an intersection and where they stopped in relation to the STOP line), and the changes in lane positioning of main road vehicles (i.e., position of a main road vehicle within a lane either centered or left/right aligned).

Results

A summary of the results is presented for the changes in speed (Table 1). Due to space limitation, detailed results of the Tobit regression models are not presented in this paper.

Site	Direction of travel	Change in the amount of speed above posted speed limit (km/h) (before-after^)*	Change in probability of speeding (before- after^)*	Change in mean speed (km/h) (before-after^#)	Change in 85 th percentile speed (km/h) (before-after^#)
1	SB	-1.5	-15.1	-13.0	-7.5
	NB	3.4	34.4	6.4	14.0
2	EB	-2.4	-12.4	-31.1	-22.0
	WB	-1.6	-6.7	-5.1	-9.0
3	EB	0.1	2.5	2.7	12.2
	WB	1.5	27.4	-5.6	2.6

* all results were statistically significant at 95% confidence level; ^ after condition refers to when SRAS was ON; # Change = (mean of control site, before condition – mean of treatment site, before condition) – (mean of control site, after condition – mean of treatment site, after condition when SRAS was ON)

Negative values in Table 1 mean that SRAS had a positive effect on reducing the speeds of main road vehicles when a vehicle was present on the side road. Tobit regression results showed that presence of the SRAS treatment reduced the probability of speeding and the extent of speeding (i.e., amount of speed above posted speed limit). The results were consistent for both directions of travel at Site 2 (T intersection with single carriageway), but mixed results were obtained for each direction of travel at Sites 1 and 3 which had wide medians with dedicated right turn lanes.

Extended Abstract (Researcher)

Results of the surrogate safety measures (Table 2) showed that SRAS had positive effects on reducing gap sizes, gap acceptance rates, and the proportions of critical near misses. Mean gap sizes on the main road reduced in all sites when SRAS was activated, potentially due to lower speeds. Accordingly, the gap acceptance rates reduced in Sites 1 and 2, but an opposite result was found for Site 3. Mean PET values were smaller when SRAS treatment was active than when those were not, however, the proportions of critical conflicts (PET ≤ 1 sec) reduced in all sites when SRAS was active, suggesting the potential of SRAS in reducing high risk near misses.

Site	Mean gap size (sec) (before-after^)	Gap acceptance rate (%) (before-after^)	Mean PET (sec) (before-after^)	Proportion of critical near misses (PET<=1 sec)* (before-after^)
1	-46.8	-36.9	-18.7	Reduced
2	-67.3	-16.2	-58.9	Reduced
3	-23.0	22.7	-12.6	Reduced

* a threshold of 1 second was chosen based on similar studies in the literature; ^ after condition refers to when SRAS was ON

Results of the changes in road user behaviour on main and side roads (detailed results not presented due to space limitation) showed that improvements in the positioning behaviour of stopped vehicles on side road were observed at Sites 1 and 2, but mixed findings were obtained at Site 3. Improvements in the lane positioning of main road vehicles were found at Site 2, but Sites 1 and 3 saw minimal changes, suggesting limited effects of SRAS on this road user behaviour.

Conclusions

This study examined the capability of an intersection conflict warning system (known as SRAS) to reduce the risk of crash severity at rural unsignalized intersections using data collected at three treatment and their corresponding control intersections in Victoria. Results obtained from a case-control analysis including multivariate modelling of speed data showed that SRAS effectively reduced speeding on main road and near misses among main road and side vehicles, with greater levels of effectiveness at single carriageway T intersections (Site 2) than intersections with dual carriageways and wide medians (Sites 1 and 3).

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Australasian Road Safety Conference 2024, 30 September – 3 October 2024, Hobert, Taumania Paper No: 154 Evaluation of Side Road Activated Signs treatment at rural intersections

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BACKGROUND

- More than 50% of the road fatalities per year in Australia occur in rural areas, with 40% occurring at intersections
- Conflict/near miss alert systems are used to improve safety at rural intersections
- Side Road Activated Signs (SRAS) at intersections aim to slow main road vehicles using electronic speed limit signs
- SRAS temporarily reduces the posted speed limits on the main road when side road vehicles are present

AIM

 To comprehensively evaluate the SRAS treatment in Victoria for T and Cross intersections, including at intersections with wide medians

METHOD

- · SRAS was implemented at 3 intersections in Victoria
- Case-control evaluation methodology applied: 3 control sites were chosen by matching their geometric and traffic characteristics with the treatment sites
- · Data collected 'before' and 'after' implementation of SRAS

Evaluatio n criteria	Key Analysis Variables	Related intersection approach	Related data collection technology
Change in	Change in mean speed	Main road	Wi-Fi, Radar/ATC
speed	Change in 85 th percentile speed	Main road	Wi-FL Radar/ATC
	Change in compliance levels with posted speed limits	Main road	WI-FI, Radar/ATC
Change in near	Changes in mean gap size and acceptance status	Main and side roads	Roadside video
misses	Change in mean Post Encroachment Time (PET)	Main and side roads	Roadside video

 In addition to descriptive statistics, Tobit regression models for main-road vehicle speeds were developed

$$Y_i^* = \beta X_i + \varepsilon_p, \quad i = 1, 2, ..., N$$

$$Y_i = Y_i^* \text{ if } Y_i^* > 0$$

$$Y_i = 0 \text{ if } Y_i^* \le 0$$

Yi: dependent variable (excess speed) measured using a latent

variable Y_i for positive values and censored otherwise β : a vector of estimable parameters

 X_i : explanatory variables

 ϵ_i : normally distributed error term (zero mean, constant variance $\sigma^2)$

N: no. of observations

Effects of the treatment (SRAS) were estimated by

- accounting for the effects of other variables, e.g.,
 - Time of day and Day of week
 - Types of vehicles and Types of leader vehicles
 - · Gap between consecutive vehicles
 - Platoon characteristics
 - Traffic volume and composition
 - Extent of speeding in traffic stream

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Site 1

Control site
Site 1c - Bass Highway - McKenzie Road
Site 2c - South Gippsland Hwy / Tarwin Lower Rd
Site 3c - Princess Highway / Considines Road
second product in the second

Site 2

RESULTS - CHANGES IN MAIN-ROAD VEHICLE SPEEDS

Site	Directi on of travel	Change in the amount of speed above posted speed limit (km/h) (before after*)*	Change in probability of speeding (before- after*)*	Change in mean speed (km/h) (before- after*#)	Change in 85 th percentile speed (km/h) (before- after*#)
1	58	-1.5	-15.1	-13.0	-75
	NB	3.4	34.4	6.4	14.0
2	EB	-2.4	-12.4	-31.1	-22.0
	W8	-1.6	-6.7	-5.1	-9.0
3	EB	0.1	2.5	2.7	12.2
	WB	1.5	27.4	-5.6	2.6

* all results were statistically significant at 95% confidence level; ^ after condition: SRAS was ON; # Change = Imean of control site, before condition - mean of treatment site, before condition - (mean of control site, after condition - mean of treatment site, after condition when SRAS was ON).

RESULTS – CHANGES IN NEAR MISSES

Site	Mean gap size (sec) (before- after*)	Gap acceptance rate (%) (before after*)	Mean PET (sec) (before- after*)	Proportion of critical near misses * (before after*)
1	-46.8	-36.9	-18,7	Reduced
2	-67.3	-16.2	-58.9	Reduced
3	-23.0	22.7	-12.6	Reduced

* Critical near misses defined as PET <> 1 sec; ^ after condition: SRAS was ON

CONCLUSIONS

- SRAS effectively reduced
 - speeding on main roads, and
 - near misses among main-road and side-road vehicles
- Greater levels of effectiveness observed at single-carriageway T intersections than at intersections with dual carriageways and wide medians
- Mixed findings obtained on lane positioning of main road vehicles and stopped positions of side road vehicles

ACKNOWLEDGEMENTS

Victoria Department of Transport and Planning

Safe Future Mobility Research Lab



Site 3

DEAKIN

Cannabis and driving – Australian medical practitioner perspectives

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Abstract

We conducted an online survey of Australian doctors, primarily psychiatrists in Western Australia, practitioners shared their knowledge and attitudes towards cannabis use and driving. Data collected included clinician demographics, experiences with cannabis-using patients, perceived knowledge, attitudes toward cannabis and driving safety, and professional development needs. Findings indicated that practitioners' familiarity with legal guidelines led to more frequent safety discussions and less conservative driving advice. Varied stances were noted on tetrahydrocannabinol (THC) and cannabidiol (CBD) blood limits and penalties, but there was consensus on the need for more education and improved educational tools and resources to equip healthcare providers in this evolving legal field.

Post on X

Practitioners have varied stances on driving after recreational and medicinal cannabis use, but agree on the need for more education and improved educational tools and resources to equip healthcare providers in this evolving legal field.

Background

As of 2022, there have been more than 248,000 scripts approved for medicinal cannabis within Australia (MacPhail et al 2022), but the risks associated with driving after using medicinal or recreational cannabis can be difficult to adequately assess (Pearlson et al. 2021; Arkell et al. 2021; McCartney et al. 2021). In a survey of Australians using medical cannabis, 72% of respondents reported that their medical cannabis use does not impair their driving, nor their ability to assess their own fitness to drive (Arkell et al. 2021).

Considering that THC is predominantly administered through inhalation, roadside drug tests (RDT) primarily identify residual oral THC, but this detection method shows minimal correlation with plasma THC levels (Wennberg et al 2023). It is therefore crucial to note that RDTs are not designed to assess impairment, nor to determine potentially impairing THC plasma concentrations. Importantly, a legal medicinal cannabis prescription is not a valid defence against prosecution under RDT laws, and patients face potentially severe penalties for driving with legal THC products in their system. This may be a barrier for patients contemplating or receiving medicinal cannabis treatment, particularly those who live in regional and remote areas who depend on being able to drive for their employment and quality of life.

Epidemiological evidence of crash risk suggests little evidence of an increase in culpability or risk when drivers are found with low levels of blood THC (under \sim 1 ug/L), indicating that cannabis use likely occurred some time before the incident (Rogeberg 2019; White and Burns 2021). While, higher concentrations of blood THC (i.e., $> \sim$ 10 ug/L) are more reliably associated with epidemiological crash risk (Drummer et al. 2020), but a low number of crashes are recorded with this high concentration. Such uncertainty, along with increasing use of medicinal cannabis, has translated to acknowledgement by governmental bodies that the advice and policy surrounding driving following medical cannabis needs to be examined (The Senate Community Affairs References Committee 2020). There is hence a need to better understand the perspectives of medical practitioners and the advice provided to their patients surrounding driving and medicinal (or other) cannabis products.

Aim

Our survey aimed to assess practitioners' awareness of the risks relating to cannabis and driving; of approaches to counselling on safe driving; and to identify educational gaps. We also sought to understand how these factors varied by specialty and experience. We hoped this may contribute to the insights into the consistency and evidence base of road safety advice provided to patients using cannabis.

Methods

The design of the study was a cross-sectional anonymised online survey delivered via Qualtrics to medical practitioners. The study and questionnaire were approved by the North Metropolitan Are Mental Health Service Ethics committee (RGS0000006503) and the University of Western Australia Ethics committee (2023/ET001062). The survey contained predominantly closed-ended questions and was designed to be completed within 15 minutes which was explained to participants in the information/consent page contained within a recruitment email.

The target population consisted of medical practitioners operating within a field wherein they are typically exposed to patients who use recreational and/or medicinal cannabis. The survey employed purposive convenience sampling as

participants were intentionally approached via email based on their clinical work and accessibility. We aimed for a sample size of 100, to allow a relative standard error of at least 10% for most questions in the survey.

Participants were contacted via email distributed through the professional networks of the investigators. The email detailed the survey topic and approach to privacy and confidentiality. Consent was obtained by asking participants to proceed to the survey by ticking an explicit box denoting consent.

Statistical analysis was conducted in Jamovi (version 2.4) and R (version 4.3) and was primarily descriptive, i.e., calculating frequencies and percentages of outcomes. Some inferential statistics were conducted on physician advice (see below). Some qualitative data were obtained, but not analysed here.

The primary outcome measures were:

- 1. Clinician advice to patients
- 2. Clinician knowledge of pharmacology
- 3. Clinician confidence
- 4. Clinician knowledge of legal guidelines

Bland-Altman method of agreement analysis was used examine concordance between advice to drive across different preparations and routes of administration. Relationships between clinician characteristics, knowledge and attitudes with respect to time-to-wait advice were analysed using ordinal logistic regression, with time-to-wait treated as an ordinal dependent variable. Relationships between familiarity with guidelines and agreement with the guidelines were analysed using binary logistic regression, with stated agreement on a specific item treated as the binary outcome variable.

Results and Discussion

Study Sample Characteristics

Participants indicated varied experiences with cannabis-using patients. Most respondents hailed from Western Australia (39.2%), and a significant majority practiced in metropolitan areas (66.2%). Psychiatry was the most represented medical specialty (56.1%), with most respondents being Consultants or Fellows (64.9%).

Practitioner Interactions

Practitioners less frequently interacted with medicinal cannabis users compared to recreational users, with 35.6% encountering less than one medicinal user per week. In contrast, more practitioners met 1-5 recreational users weekly (34.4%). Anxiety management and stress relief were cited as primary reasons for cannabis use, followed by insomnia and sleep disturbances.

Driving and Cannabis Use

Many practitioners estimated a high percentage of their cannabis-using patients also drove (37.2% of physiciancs estimated 51-75% of patients drove). In discussions between practitioners and patients with respect to cannabis use and driving, patient inquiries about the impact of cannabis on driving were uncommon, with 47% of practitioners reporting that patients never raised the question. However, discussions initiated by practitioners were more frequent, with 17% always addressing the issue and 78% bringing the topic up at least sometimes.

Clinician Estimations and Discussions

Clinicians' discussions on driving safety varied, with some reporting a perceived positive impact by patients, while others noted a negative impact. Over 50% of the sample indicated that patients chose not to disclose any information on the impact of cannabis on their driving. Familiarity with legal guidelines increased the likelihood of discussing driving with patients. Those familiar with regulations were also more confident in assessing a patient's fitness to drive. Specialty-wise, psychiatrists felt that guidelines were less clear compared to other fields.

Advice patterns regarding time-to-wait before driving

Practitioners' advice on the time-to-wait before driving post-cannabis use was influenced by the type of cannabis consumed. A cautious approach was recommended for THC containing products, with longer wait times suggested for recreational use. For CBD, which is non-psychoactive, the advice was less conservative. We further explored clinician characteristics, knowledge and attitudes with respect to time-to-wait advice. For inhaled medicinal cannabis products containing THC, the percentage estimate of patients who use cannabis and drive was negatively associated with time-to-wait, while frequency of conversation surrounding driving safety and cannabis was positively associated with time-to-drive advice. The same pattern of results was seen for orally administered medicinal cannabis products and recreational cannabis.

For medicinal CBD products, the percentage estimate of patients who use and drive was negatively associated with time to drive advice, but surprisingly, psychiatric practitioners were more much more likely to suggest increased time-to-drive following CBD products compared to other specialties.

Legal Limits and Penalties

Less familiarity with guidelines was found to be associated with lower agreement with the guidelines. However, with respect to a maximum limit for THC (like for alcohol), those with lower familiarity were more likely to indicate agreement with a maximum limit. Specialty or experience did not influence these findings.

Pathway Forward

As cannabis gains acceptance for medical use in Australia, balancing personal autonomy with public safety becomes crucial, necessitating an informed confluence of scientific evidence, legislative measures, and education. Practitioners themselves expressed a desire for further education on cannabis and driving in this study.

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Introduction

500,000 applications for cannabls products have been registered by the TGA. 72% of Australian medical users do not think their driving is impaired¹.

Crash culpability studies find minimal risk with low levels of THC (under ~1-2 ug/L). Risk emerges more clearly around >2-5 ug/L².

Increasing medical use requires examination of medical advice surrounding driving³.

We surveyed ~85 medical practitioners

· Mostly psychiatrists, cannabis prescribers, and GPs

We asked

- Challenges experienced counselling patients on their use
- Time-to-wait advice before driving after using cannabis

Results



Challenges experienced by discussing cannabis and driving

Practitioners endorsed patient-centric issues, including: resistance by patients to discuss driving impairment and patients' insights into their own impairment from cannabis products.

Practitioners specifically commented on:

- patient autonomy
- patient fears about revealing illegal activity
- procedural justice for cannabis relative to other substances

Pathway forward

Many challenges exist for practitioners advising patients. A desire for further education on cannabis and driving was strongly endorsed.

 High-quality education materials should be made available to support practitioners.



Time to wait advice

Practitioners indicated consistent times to wait for medical or recreational or oral cannabis products, with most indicating a 6-12 hour delay after using.

A shorter time to wait was indicated for CBD-only products, in line with its non-psychoactive properties.

A large number of practitioners indicated long wait times for CBDonly products.

Advice surrounding waiting to drive after using

cannabis is highly variable, reflecting uncertainty in its impairing effects and pharmacokinetics.

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Crash prevention and mitigation: updated evidence from in-depth crash investigations

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Abstract

Trauma from road crashes is a pervasive problem facing Australia. In-depth crash investigations have an important role in building an understanding of crashes and proposing solutions. This paper describes the latest findings of the most recent series of in-depth crash investigations conducted in South Australia, with a focus on the factors that contributed to the crashes occurring, and interventions for crash prevention and mitigation. A total of 255 crash investigations were included in the present analysis. This updates initial results published in 2020 based on the first 116 investigations. It was found that, while the most common contributing factors were human-based, the most common interventions for either prevention or mitigation were related to the road or the vehicle, consistent with the initial results. The top interventions included road infrastructure treatments for intersections, vehicle technologies AEB, ESC and LKA, speed limit reductions, and both centre and roadside barriers.

Post on X

Updated evidence from in-depth crash investigations continues to show that human error is a large part of the problem, but road infrastructure improvements and vehicle technologies are the solution.

Introduction

Trauma from road crashes is a persistent problem facing Australia. In 2022 there were 1,194 deaths due to road crashes, with little change in this number over the last decade (BITRE, 2023). In order to solve the problem of trauma from road crashes the problem itself must be clearly understood. In-depth crash investigations have an important role in building this understanding so that a Safe System can be achieved.

The University of Adelaide has been at the forefront of in-depth crash investigations in Australia, conducting 11 series of crash investigations, beginning in 1962. The most recent series of in-depth crash investigations at University of Adelaide is being conducted by the Centre for Automotive Safety Research (CASR) and began in late 2014. In 2020, the initial results of this series of crash investigations were published, with a focus on contributing factors, and interventions that could have prevented or mitigated the crash (Doecke, Thompson and Stokes, 2020). The purpose of the present paper is to update the results presented in Doecke *et al.* (2020).

Method

The crash investigation team is made up of researchers with engineering, psychology and health backgrounds. CASR is notified of a crash at the same time as the emergency services and immediately attends the crash scene if it is within 100 km of Adelaide. Other criteria for case selection include: at least one participant must be transported to hospital by ambulance, the crash must occur on a public road, and it must include at least one motor vehicle (including motorcycles). Originally, the team would be on-call to immediately attend crashes during between 9am and 9 pm, Monday to Friday. This was extended to 7am to 9pm in October 2019, and some weekend shifts covering similar hours were also introduced. In addition, fatal and life-threatening injury crashes occurring outside of these times, which are attended by the Major Crash Investigation Unit (MCIU) of the South Australian Police, are investigated in the following days, as the evidence is preserved by MCIU. Detailed information is collected on the crash circumstances, the vehicles, the road infrastructure, and injury outcomes. Further information on the methods employed in the investigations is provided in Doecke *et al.* (2020).

All crashes that are investigated at-the-scene are also reviewed by a multi-disciplinary panel comprised of experts in human, road, and vehicle factors. The purpose of these reviews is to obtain an overall understanding of the crash, decide upon the most likely version of events, and then identify the factors that contributed to the crash occurring. In addition, interventions (or treatments) that could have prevented the crash or mitigated the severity of resulting injuries are nominated by the review panel and given a confidence level (high, medium, low) that the intervention would have prevented or mitigated the crash.

All evidence collected over the course of an investigation informs the selection of contributing factors. They cannot be selected based on speculation. A contributing factor can be proposed by any member of the expert review panel. However, the expert in the area that the factor relates to (e.g., human factors) must demonstrate to the panel why that factor is or is not relevant to the crash.

Interventions that could have prevented the crash or mitigated the severity of resulting injuries are also grouped into the categories of human, vehicle, or road-based interventions. Multiple interventions can be selected for each crash but most intervention are considered independently. Some interventions that may be more effective when grouped together can be considered as a group (e.g, audio tactile edge lines with sealed shoulders). The associated confidence level that is selected for a nominated intervention is based on the expert's knowledge of the probability of the intervention being effective under the specific circumstances of the crash. When nominating mitigation interventions, the panel must consider the actual injuries sustained by participants in a crash and the ability of a given intervention to reduce the severity of these injuries or prevent the injuries altogether, thereby reducing the overall severity of the crash.

As of November 2021, 255 of the crashes investigated had undergone a case review to identify contributing factors and interventions, and are included the analysis. This compares to the 116 crashes that were analysed in Doecke *et al.* (2020). Only interventions with a confidence level of medium or high are included in the analysis.

Results

Human factors were the most common contributing factors, with an average of 1.5 per crash, followed by road factors (0.6 per crash) and vehicle factors (0.1 per crash). One or more human factors contributed to 232 (91.0%) of the crashes, while road factors contributed to 113 (44.3%) and vehicle factors to 31 (12.2%). There was insufficient evidence to identify any contributing factors for nine (3.5%) of the 255 reviewed crashes. Table 1 shows the top contributing factors for the crashes investigated.

Contributing factor	Number	Percentage
Human: fail to give way unspecified	37	14.5%
Road: visibility	34	13.3%
Human: exceed speed limit	34	13.3%
Human: speed too high for conditions	28	11.0%
Road: road layout	25	9.8%
Human: recognition failure	23	9.0%
Human: distraction	22	8.6%
Human: alcohol	21	8.2%
Human: competing demands for attention	19	7.5%
Human: drugs	18	7.1%
Vehicle: conspicuity	18	7.1%
Total	255	-

Table 1. Top contributing factors identified through in-depth crash investigations

A total of 746 prevention interventions were selected by the team, with an average of 2.9 per crash. At least one applicable prevention intervention was found for 237 (92.9%) of the 255 crashes. Table 2 shows the top crash prevention interventions. The top three interventions were all infrastructure interventions related to preventing intersection crashes (roundabout, traffic lights, and prevent right turn), as was the fifth most common (grade separated junction). Vehicle technologies also featured prominently as crash prevention strategies. Overall, road interventions were the most common way to prevent crashes, followed by vehicle intervention and human interventions.

Table 2. Top prevention interventions identified through in-depth crash investigations	Table 2.	Тор	prevention	interventions	identified	through	in-depth	crash ii	nvestigations
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Prevention intervention	Number	Percentage
Road: Roundabout	75	29.4%
Road: Traffic lights	55	21.6%
Road: Prevent right turn	52	20.4%
Vehicle: Autonomous Emergency Braking (AEB)	39	15.3%
Road: Grade separated junction	38	14.9%
Vehicle: Electronic Stability Control (ESC)	31	12.2%
Human: Apprehension for drink/drug driving offence	30	11.8%
Road: Speed limit reduction	28	11.0%
Vehicle: Lane Keep Assist (LKA)	27	10.6%
Road: Vertical deflection	20	7.8%
Total	255	-

A total of 260 mitigation interventions were selected. At least one applicable mitigation intervention was found for 109 (42.7%) of the 255 crashes. It should be noted that in some crashes with low injury severity, such as minor bruising, it is difficult to nominate any intervention that could have mitigated the injury with a medium to high level of confidence. Table 3 shows the top mitigation interventions identified in the in-depth crash investigation case reviews. Speed limit

reduction was the most common mitigation intervention, as well as featuring in the most common prevention interventions in Table 2. The other road infrastructure treatments, centre barriers, side barriers, and clearzones, were related to mitigating road or lane departures. Three vehicle-based interventions were in the top ten mitigating interventions, Autonomous Emergency Braking, Intelligent Speed Assist – Limiting, and curtain airbags.

Mitigation intervention	Number	Percentage
Road: Speed limit reduction	37	14.5%
Road: Centre barrier	25	9.8%
Vehicle: Autonomous Emergency Braking	20	7.8%
Road: Side barrier	19	7.5%
Road: Vertical deflection	19	7.5%
Road: Clear zone to guidelines	11	4.3%
Vehicle: Intelligent Speed Assist – Limiting	10	3.9%
Human: Wearing of better protective clothing	10	3.9%
Vehicle: Curtain airbag	9	3.5%
Road: Roundabout	9	3.5%
Total	255	-

Table 5. Top mitigation interventions identified through in-de	eptn	crasn	investi	gations
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Discussion

While the most common contributing factors were human-based, the most common interventions for either prevention or mitigation were related to the road or the vehicle, consistent with Doecke *et al.* (2020). The top three prevention interventions, roundabouts, traffic lights and preventing right turns are all road infrastructure treatments for intersections, and this was also consistent with Doecke *et al.* (2020).

There were three vehicle technologies in the ten most common prevention interventions. While the three vehicle technologies (AEB, ESC, LKA) were consistent with Doecke *et al.* 2020, the percentage of crashes that could be prevented with ESC fell from 17.2 to 12.2%. This is likely related to the increased prevalence of ESC in the vehicle fleet over time.

Speed limit reduction was the intervention that was found to mitigate the injury outcome for the most crashes, consistent with Doecke *et al.* 2020, while also ranking highly as a preventive intervention. Speed limit reductions have been found to be effective in reducing the number of crashes that occur (Mackenzie, Kloeden & Hutchinson, 2015; Elvik, Christensen & Amundsen, 2004). Barriers, either centre or roadside, would have mitigated a total of 17.3% of the crashes. Barriers have been found to be highly effective at reducing the severity of a crash (Zou, Tarko, Chen & Romero, 2014) and are designed to prevent some of the most severe crash types, hit-fixed-object crashes with roadside objects and head-on crashes. They may also prevent rollover crashes.

There are several limitations of this study that should be acknowledged. The main limitation is that investigated crashes are not fully representative of all crashes involving ambulance transport that occur in South Australia due to the lack of a full '24-7' sampling period. When considering interventions, the cost or practicality of the intervention was generally not considered. While this was by design, it does mean that the intervention that would have prevented the most crashes may not be the most cost effective or practical to implement.

Conclusion

The results presented in this paper that were based on the larger sample of crashes were largely consistent with the smaller sample used in Doecke *et al.* 2020. It was found that, while the most common contributing factors were human based, the most common interventions for either prevention or mitigation were related to the road or the vehicle, consistent with Doecke *et al.* 2020. The top interventions, roundabouts, traffic lights, and preventing right turns, were all road infrastructure treatments related to preventing or mitigating crashes at intersections. Vehicle technologies AEB, ESC and LKA were also among the most common interventions for crash prevention and mitigation. Speed limit reductions and barriers (centre and roadside) were found to be important crash mitigation interventions.

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Monitoring Personal Mobility Device emergency department injury presentations and trends

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Abstract

In the more than five years since the first shared e-scooter scheme in Australia began in Brisbane, Queensland, other Australian jurisdictions have gradually allowed their own shared schemes with varying restrictions. Private use on public infrastructure has also become more commonplace with previous bans being lifted over this time. However, evidence from emergency department presentations, injuries and compensation claims, shows it is apparent that as the number of users grows, as does the amount and severity of injuries from e-scooters and other PMD (Personal Mobility Device) types (RACQ, 2023). In November 2022, Queensland introduced new legislation regarding PMD use, decreasing the footpath speed by half and increased fines for breaching the rules (Queensland Government, 2022). As the rules and users mature with PMDs, it is crucial to track changes in injury trends to understand the impacts from safety messaging, regulations and policies.

Post on X

Monitoring PMD emergency department injury presentations to understand and inform changing injury patterns amongst PMD users.

Introduction

Studies have shown increasing numbers of PMD injuries, especially electric scooters, however factors such as the circumstances of injury and injury severity are inconsistently reported (Toofany et al, 2021). To monitor PMD injuries in a timely manner across a wide area, while also obtaining further detailed information on specific injury events, two approaches are being undertaken in the collection of these injury data. The first is a self-completed patient questionnaire and chart review, where those attending Emergency Departments (EDs) across select hospitals in Queensland can complete a survey of their injury event, followed by a chart review performed by facility research staff. While labor intensive, this can provide deep detail on the circumstances of the injury, information about the device, infrastructure, and purpose of travel. The second approach consolidates data from a broader selection of Queensland hospital EDs with less detail, however, can give timely, consistent surface level information on injury presentations.

Method

Data collection has not yet commenced on the patient questionnaire, however the PMD ED injury dashboard has been retrospectively populated with available data from select Queensland public emergency departments from November 2018, when shared scooter schemes began, through to December 2023. A descriptive analysis of patterns and trends is provided from identified PMD related ED presentations.

Results

Figure 16 shows the main PMD dashboard page in PowerBI to present an overall snapshot key ED presentation data.

Between November 2018 and December 2023 there were 4003 PMD related ED presentations across 31 hospitals in Queensland (62.5% male, 37.5% female) with an average patient age of 30. 663 (17%) of ED presentations required admission to hospital. The most common age group overall is 25-34, and the most common age group for males being 25-34, and for females it is 16-24. The most frequent body regions for injuries were the head (31%) and face (21%), followed by upper extremity injuries including forearms (21%) and hands and fingers (21%). The most frequent nature of injuries were fractures (42%), superficial injuries such as minor grazes, bruises, etc (21%), open wounds (17%), sprains and strains (16%) and intracranial injuries (4%).

A dynamic heatmap was generated to identify the most common presentation times and adjusts based on the date range and hospitals selected. The most common time of presentation overall was between 12pm-6pm on a Saturday, followed closely by Sunday 12pm- 6pm. Afternoons, evenings and weekends show the highest number of presentations.

Droder and Tucker



Figure 16 - Main page of PMD injury dashboard







Figure 18 - Day and time of presentation heatmap

Of 4003 ED presentations, only 785 (20%) had specified whether a helmet was worn, of which 483 (12%) stated that a helmet was not worn.

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Table 6 - Helmet use

Helmet Worn	Ν	%
Yes	483	12%
No	302	8%
Unspecified	3218	80%

Alcohol and substance use among the 4003 ED presentations was mostly unreported, with 3567 (89.1%) stated as unspecified, 400 (10%) involving alcohol only, 26 (0.65%) involving both alcohol and substances, and 10 (0.25%) involving only substances.

Table 7 - Alcohol and substance involvement

Alcohol/substance involvement	Ν	%
Alcohol	400	10.0%
Alcohol and substance	26	0.65%
Substance	10	0.25%
Unspecified	3567	89.1%

Benefits to road safety

The data from this dashboard could aid in informing where PMD injuries are occurring and the infrastructure that they are involved in. The patient questionnaire intends to gather detailed information on the type and condition of the infrastructure during an injury event to provide insights into where injuries are most common and interactions with other footpath and road users. The dashboard data can provide timely updates on where safety campaigns could be targeted and to what type of user and circumstance.

Implications for policy and/or practice

The rules and regulations vary between all jurisdictions of Australia, and this is again varied for shared schemes by councils imposing their own restrictions on operators of shared e-scooters. It is hoped that informed access to these data by regulators and policy makers can inform where and when severe injury presentations are occurring.

Conclusions

It is evident that e-scooter/PMD rider injury-related presentations to Queensland EDs have been increasing each year, and that many of these presentations are occurring more frequently in the afternoon and on weekends. With fractures as the leading nature of injury, these presentations are not trivial injuries and occur across a wide age range. Males were more commonly injured than females. A proportion of PMD-related injury cases continue to involve alcohol and non-helmet use, and improving reporting on these aspects will assist the development of more effective safety countermeasures on these issues. Obtaining greater detail regarding PMD-related injuries, treatment circumstances and outcomes will provide a better understanding of the broader impacts of the injuries to our health systems. To address this, we plan to survey patients directly in the ED to gain a greater understanding of PMD use habits, factors that led to presentation, and further details about the devices involved.

These data collection projects provide valuable insights into the common contributing factors and injury outcomes for e-scooter/PMD-related presentations to EDs in Queensland. With the growth of this new transport mode and the recent implementation of policies and regulations to promote safer use of these devices, it is important to be aware of where crashes and injuries are still occurring. These data will assist in development further advocacy and education activities to build on previous efforts and promote safer PMD use in Queensland and across Australia.

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Emerging post-Covid trends in road trauma from New Zealand

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Abstract

Road to Zero sets a target of a 40% reduction in deaths and serious injuries (DSi) by 2030 compared to 2018 levels. Based on a straight-line reduction, achievement of the target requires an annual reduction of approximately 100 DSi. Crash data from 2019 to 2023 showed that New Zealand was ahead of the 40% reduction target from 2019 to 2021; however, fell behind from 2022 onwards. Extensive analysis of recent crash data reveals some emerging trends and patterns in road trauma, the most significant being a shift in where crashes occur on the network. The analysis showed a significant increase in severe road trauma on local rural roads, and particularly on roads where crashes of any severity were rare or completely absent in the preceding years. This presentation shares insights gained from the analysis and details how these insights will be important for addressing road trauma in coming years.

Post on X

Interesting post-covid road trauma trends are emerging in the latest crash data from New Zealand. The most significant change is the distribution in where high severity road trauma is occurring. Come along and find out where the changes are occurring and the factors behind this.

Introduction

The number of people killed in road crashes in New Zealand was higher in 2022 and 2023 than the preceding two years. In and of itself, this is not unsurprising given travel restrictions imposes during the primary Covid pandemic years (2020 and 2021) supressed travel demand and reduced road trauma. Nonetheless, the increased number of deaths in 2022 and 2023 reversed a downward trend in fatalities that had been observed year-on-year since 2018. That increase triggered an investigation into crash data to identify if there were any emerging trends or patterns in road trauma based on location, road user type, causation, road attributes or other contributing factors. The investigation was set against a context of almost every monitoring and evaluation study into road safety initiatives showing moderate to high levels of efficacy in reducing road trauma. So, if the interventions being delivered are so successful, what else has changed that has resulted in an increase in road trauma? That was the question the investigation sought to answer.

Approach

All crashes resulting in fatal or serious injuries were downloaded from the New Zealand Crash Analysis System (CAS) for the period 2014 to 2023 inclusive (10 years). The CAS intersection field was used to identify intersection crashes separately to midblock crashes. The intersection crashes were then attached to an intersection dataset, and midblock crashes were attached to a road centreline dataset that contained a wide array of road attributes, such as functional classification, speed limit, traffic volume, horizontal alignment classification, proactive and reactive risk metrics, and adjacent land use character. The annual number of DSi were tabulated and plotted against different road network attributes that are not recorded in CAS. An example showing the annual number of DSi by functional road classification is shown in Figure 1. An initial screening process was used to identify any plots with an obvious change in DSi trend in the post-covid period of 2022 and 2023. Further investigation was then conducted into each of these.

Summary of Initial Screening Findings

The initial screening identified the following post-covid trends in DSi:

- A noticeable widening between the number of midblock DSi on local roads (flat to increasing) compared to State Highways (decreasing), exacerbated when the road surface is wet and when it is dark.
- An increase in the number of DSi on roads with low traffic volumes (<1,000 vehicles per day) compared to roads with moderate to high volumes where DSi numbers have been flat or reduced.
- A significant shift in the Collective Risk rating of roads where DSi occur. Specifically, the number of DSi on roads with a Low Collective Risk nearly tripled in 2022 and 2023 while DSi on roads with a Low-Medium, Medium, Medium-High and High Collective Risk all decreased.
- A noticeable widening between the number of DSi at intersections on local roads (increasing) compared to State Highways (flat to increasing).
- A noticeable widening between the number of DSi at urban intersections (increasing) compared to rural intersection (flat to increasing).
- A noticeable increase in the number of single-vehicle loss of control crashes at intersections.

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Figure 1. Change in midblock DSi by functional road classification

Results

This extended abstract focuses on one of findings from the initial screening exercise, namely the significant shift in the Collective Risk rating of roads where DSi occurred in 2022 and 2023 (refer Figure 2).



Figure 2. Change in midblock DSi by Collective Risk band

The average percentage change in DSi in 2022 and 2023 relative to the average annual number of DSi in the 2018-2021 period for each Collective Risk band is shown in Table 1.

Collective Risk Band	Average Annual DSi (2018-2021)	Average Annual DSi (2022-2023)	Percentage Change
High	119	86	-28%
Medium-High	274	178	-35%
Medium	543	418	-23%
Low-Medium	572	427	-25%
Low	206	586	+184%
ALL	1,713	1,694	-1%

Table 1.	Comparison of DSi by	v Collective Risk Band in 2018-2021 and 2022-2023 ne	riods
ranc r.	Comparison of Dor by	y Concentre mark Dana in 2010-2021 and 2022-2023 per	ious

It is important to appreciate that the Collective Risk bands were developed using crash data from the 2017-2021 period based on the DSi casualty equivalents approach where severity indices are applied to all injury crashes. From this, we can conclude that a significant proportion of severe road trauma in 2022 and 2023 occurred on roads where road trauma of any severity was rare or absent in the preceding 5-years. Whilst the phenomenon of severe road trauma moving around a road network like lightning strikes is well documented, particularly on lower volume parts of a road network, it is interesting to observe that similar changes were not evident in the years prior to 2017.

What is most interesting about the change in road trauma by Collective Risk band observed in 2022 and 2023 is the consistent reduction in trauma across all Collective Risk bands except for Low Collective Risk roads, which exhibited a dramatic increase. The working hypothesis was that some of these changes reflect the success of road safety interventions, which are predominately introduced on roads with some prior crash history and highlights that roads without such interventions have heightened risk because drivers are becoming increased accustomed to a higher standard of safety. This hypothesis is supported when road trauma changes are investigated in relation to the functional classification of roads. In New Zealand, rural roads are classified as either a 'Interregional Connectors', 'Regional Connectors' or 'Rural Roads'. Interregional Connectors are the highest order rural roads and typically state highways that are designed to a high standard. Regional Connectors include lower order State Highways and important movement corridors on the local government road network. Roads with a lesser movement function are classified as Rural Roads. These roads typically have the least safety features, are often narrow and many are unsealed. Interrogation of the data shows road trauma reduced by 9% on Interregional Connectors and by 4% of Rural Connectors in 2022 and 2023 compared to the preceding 4 years, but increased by 28% on Rural Roads, as shown in Figure 3.



Figure 3. Change in midblock DSi by Functional Classification

Analysis of traffic volumes indicates that some of this change can be explained by a shift in travel patterns. This shows that VKT on Rural Roads increased by 17% on Rural Roads between 2019 and 2023 compared with 4% on Rural Connectors and 3% on Interregional Connectors.

Implications for Road Safety

There are important implications associated these results. The reductions in road trauma on Interregional Connectors and Regional Connectors indicates that road safety interventions (infrastructure and speed management), which are predominantly delivered on these higher order roads, are effective at addressing road trauma. The findings also suggest that the investment in the higher order roads, which is growing the disparity in quality of rural roads by functional classification, may being inadvertently raising the relative risk on the lowest order and lowest standard roads. Analysis shows the relative DSi crash rate (per unit of exposure) on Rural Roads increased by 41% relative to Interregional Connectors and 34% relative to Rural Connectors in 2022/23 compared to the previous 4 years – despite travel increasing significantly more on Rural Roads compared with Rural Connectors and Interregional Connectors. These findings suggest there is an urgent need to prioritise measures that can reduce risk and save lives on our lowest order rural roads. The obvious solution is speed management, and widespread lowering of speed limits to reflect safe and appropriate speeds on these roads. The presentation on these findings will be of interest to state and local government practitioners from New Zealand and Australia, as increasing road trauma outcomes in 2022 and 2023 are not confined to New Zealand.

Google Street View, zero-shot learning for road safety attributes extraction

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Abstract

This study introduces a novel approach to extracting critical attributes for the International Road Assessment Program (iRAP) using street view images combined with zero-shot in-context learning techniques and multimodal large language models (MLLMs). By analyzing about 168 diverse street view images collected from different driving environments, we demonstrate the promising capability of MLLMs to accurately identify and categorize key road safety features without prior direct training on specific iRAP attributes. This methodology reduces the reliance on extensive labelled datasets. The application of zero-shot learning allows for the flexible adaptation of the model to new attributes or changes in assessment criteria with no additional training.

Post on X

MLLMs can identify critical road safety features from street view images enhancing iRAP evaluation process.#MLLM

Introduction

Road safety is a critical concern worldwide, with the iRAP playing a pivotal role in evaluating and improving road conditions to reduce accidents and fatalities (Kačan, 2020). iRAP is the umbrella programme for Road Assessment Programmes (RAPs) worldwide that are working to reduce crashes and save lives using a robust, evidence-based approach to prevent unnecessary deaths and suffering (iRAP, 2024). Traditional assessment methods, however, are labor-intensive and time-consuming. The advent of Google Street View imagery and advances in large language models offer promising alternatives. This research explores the integration of zero-shot in-context learning and MLLMs to automate the extraction of road safety attributes from Google Street View images, providing a scalable and efficient solution for road safety assessments.

Method

This exploration study collected 168 street view images from various driving environments in Brisbane, Queensland, Australia, encompassing multiple road conditions and features. Utilizing zero-shot in-context learning, we prompted gpt-4-vision-preview (a multimodal large language model) to recognize and interpret these images in the context of iRAP safety attributes. This approach allowed the model to generate relevant safety features without explicit prior training on the iRAP dataset, showcasing the potential of MLLMs in understanding complex driving environments and replacing humans in some of the routine inspections.

 Table 1: Description of the Prompt Utilized for Interpreting Google Street View Images within the Eleven Selected

 iRAP Safety Attributes and One Completion Example.

Your role is systematically inspecting an image for various road features.

Road Inspection Checklist

1. Number of Lanes - Count the number of lanes in the direction closest to the camera. Provide the number without additional comment.

- 2. School Zone Warning Inspect for school zone warning signs and select the appropriate option:
 - 1. School zone flashing beacons
 - 2. School zone static signs or road markings
 - 3. No school zone warning
 - 4. Not applicable (no school at the location)
- 3. School Zone Crossing Supervisor Observe for the presence of a school zone crossing supervisor and select one: 1. Supervisor present at school start and finish times
 - 2. Supervisor not present
 - 3. Not applicable (no school at the location)
- 4. Roads that Cars Can Read
 - Inspect the following and provide 'yes', 'no', or applicable comment:
 - Clear and consistent road signage visible and unobstructed.
 - Well-defined road markings, maintained with high contrast for visibility.
- 5. Roadworks Examine the area for roadworks and choose one:
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- 1. No road works
- 2. Minor road works in progress
- 3. Major road works in progress
- 6. Pedestrian Fencing Check for pedestrian fencing (guard rails) and select one:
 - 1. Not present
 - 2. Present
- 7. Vehicle Parking Inspect the area for vehicle parking and select one:
 - 1. None
 - 2. Each road side has at least one parked vehicle
 - 3. At least one vehicle is parked on one side of the road

8. Speed Management / Traffic Calming - Identify any present speed management features such as curb build-outs, speed humps, raised tables, etc.

9. Median Type

- Examine the image and identify any present median type:

- Options include Centre line, Wide centre line, Central hatching, Continuous central turning lane, various physical median widths, safety barriers, etc.

10. Carriageway - Inspect the image and select one:

- 1. Divided carriageway
- 2. Undivided carriageway

11. Quality of curve - Inspect the image to identify any present road Curvature then select one:

- 1.Poor
- 2.Not applicable
- 3. Adequate



Number of Lanes: There are four lanes in the direction closest to the camera.

School Zone Warning: No school zone warning

School Zone Crossing Supervisor: Not applicable (no school at the location)

Roads that Cars Can Read:

Yes, clear and consistent road signage visible and unobstructed.

Yes, well-defined road markings, maintained with high contrast for visibility.

Roadworks: No road works

Pedestrian Fencing: Present, as there is a barrier between the pedestrian walkway and the road.

Vehicle Parking: None

Speed Management / Traffic Calming: No visible speed management features such as curb build-outs, speed humps, raised tables, etc.

Median Type: Safety barriers are present between the opposite lanes of traffic.

Carriageway: Divided carriageway

Quality of Curve: Not applicable, as no significant road curvature is visible in the image provided.

Results

Upon visual inspection of the images and analysis of the model's responses, Figure 1 shows the accuracies of a GPT-4vision-preview model in responding to prompts related to eleven selected iRAP criteria using a zero-shot learning approach. The accuracies are displayed on a scale from 0 to 100. Moreover, the visual inspection revealed several common errors were identified:

- 1. The model frequently misidentifies barriers on highways as pedestrian fencing.
- Emergency bays and shoulders are often mistaken for additional traffic lanes. 2.
- The model struggles with accurately counting lanes, especially when there are more than three. 3.
- 4. Moving vehicles on urban streets are sometimes incorrectly classified as parked cars.
- 5. The model misidentifies the materials of medians.
- It confuses low medians for mere road lines. 6.



Figure 19. Analysis of ChatGPT-4's Zero-Shot Learning in Road Feature Recognition

Conclusions

This study has highlighted the potential of GPT-4-vision-preview in interpreting road safety features from Google Street View images, highlighting its capability for zero-shot learning. However, the common misclassifications identified signal a need for model enhancements, either through few-shot learning or fine-tuning with a specialized iRAP dataset. Future research will explore few-shot in-context learning, employing a small set of example images to teach the model traffic and road safety concepts more effectively. We will also evaluate other multimodal models capable of local execution, refining them through supervised learning to tap into the MLLM's inherent foundational knowledge. By incorporating images that delineate the differences between various iRAP attribute values, our goal is to refine the model's accuracy in extracting attributes, thereby setting the stage for more advanced and detailed road safety evaluations.

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Improving safety on the Midland Highway: key challenges and lessons

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Abstract

The Midland Highway 10 Year Action Plan is a \$565 million investment from the Australian and Tasmanian Governments to improve safety. The planning, design, and delivery of the Action Plan has had numerous challenges, and several key lessons have been learned, and innovations developed. The key challenges, lessons and innovations of the Action Plan were reviewed by representatives from the Tasmanian Department of State Growth and Jacobs Engineering Group. The key findings from the review included the need to balance strategy with early delivery, the advantages of larger and smaller design and construction packages, the value of early investment in stakeholder engagement, and the benefits of supplementing local design industry capacity with interstate and international capability. It is hoped that lessons from the Midland Highway 10 Year Action Plan can be used by other road authorities to better implement their own upgrade programs and improve safety for all road users.

Post on X

Key challenges, lessons, and innovations from the Midland Highway 10 Year Action Plan. Includes discussion on the need to balance strategy with early delivery, benefits of early stakeholder engagement, and advantages of different design and construction procurement models.

Background

The Midland Highway 10 Year Action Plan is a \$565 million investment from the Australian and Tasmanian Governments to improve safety on the transport freight route between Hobart and Launceston. In 2014 the Australian Road Assessment Program assessed the safety of the highway before upgrades, with one star being the least safe and five stars the safest. In this assessment, 86% of the Midland Highway was marked with 1 or 2-stars. The Action Plan is upgrading the identified sections of the highway to a 3-star standard under the Australian Road Assessment Program (Department of State Growth, 2024).

The project uses the principles of the Safe Systems Approach and is aimed at decreasing head on crashes and reducing the severity of loss of control crashes through installation of median flexible safety barriers, reducing roadside hazards, providing sealed shoulders, and improving intersections. So far, the Action Plan has:

- Provided new and safer overtaking opportunities to decrease driver frustration and reduce the potential for head-on crashes from unsafe overtaking
- Installed over 200 km of roadside barriers, reducing the risk of run-off-road crashes
- Installed over 140 km of central median barriers, reducing the risk of head-on crashes
- Widened the highway
- Upgraded junctions
- Improved accesses to properties
- Sealed road shoulders
- Straightened sections of the highway
- Installed audible edge lines

Key Challenges, Innovations and Lessons

The key challenges, lessons and innovations from the planning, design and delivery the Action Plan were workshopped by representatives from the Tasmanian Department of State Growth and Jacobs Engineering Group, including design managers, project managers, and project directors from each organisation. The findings may help other road safety practitioners and road authorities set a pathway to achieving the 2030 target of reducing annual road fatalities by at least 50 per cent and serious injuries by at least 30 per cent.



Figure 1. Example of an Upgraded Section of the Midland Highway Source: Department of State Growth, Tasmania (reproduced with permission)

T	able 1.	Challenges	encoun	tered	and	asso	ciated	innovations	and/or	lessons	learnt
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Challenge	Lessons Learnt or Innovation
Encountered	L $r_{1} = 1$ L $r_{1} = 1$ C $r_{1} = $
Linking the	Lesson Learnt: The first half of the highway upgrades were designed in approximately 10 km
overall safety	sections, generally independent from each other. While each segment was carefully considered,
vision of the	understanding of the proposed upgrades in adjacent project areas was limited (often because other
highway to	areas were not yet designed). The design of the final 50 km of upgrades shifted to a concurrent
individual	approach, where a detailed strategy was developed for overtaking lanes, turn facilities, and
delivery packages	intersections as a first step. The strategy was distilled into simple line diagrams of proposed
	upgrade works for 10-15 km sections of highway. This approach allowed project teams to
	comprehend the interconnected nature of the corridor and provided an understanding of both
	upstream and downstream completed works. In particular, it allowed better planning for dedicated
	overtaking lanes and turn facilities, which are required as a result of the implementation of a
	central median barrier, and important to limit driver irustration (and consequent poor driver
	benaviour). The development of a strategy for the final 50 km of upgrades meant the project
	area might impact the averall Action Dian implementation. The result was that the design of the
	area might impact the overall Action Fian implementation. The result was that the design of the
	and addressed the needs of the entire
Balancing	Lesson Learnt: It is important to recognize that while developing a detailed strategy and
community	implementation plan prior to delivering individual project sites is ideal this is not always possible
expectations of	due to community expectation for action and the realities of funding cycles. Road authorities and
action versus time	design teams for long-term action plans and corridor-wide ungrade programs need to be agile in
spent on strategy	their ability to develop strategy in parallel to delivery of project sites. This creates a number of
speni en suuregy	key benefits including:
	 Sections of highway are upgraded earlier meaning they are safer earlier
	 The public are able to see action
	The construction industry is engaged earlier
Understanding the	Lesson Learnt: The procurement of design services for the Midland Highway 10 Year Action
key benefits of	Plan occurred under two different models. The first half of the highway upgrades were designed
different delivery	in approximately 10 km sections by different consultants, while the final 50 km were undertaken
models in design	by a single design organisation. The key benefits for each design procurement model are listed
	below.
	Separate, smaller design commissions – key benefits:
	• Design packages are quicker to procure and develop (i.e. less than 12 months)
	• Smaller design packages provide more opportunity for large and small design organisations
	to participate, increasing industry engagement and competition
	Larger, corridor wide design commissions – key benefits:
	• A more consistent approach to implementing an upgrade strategy
	Greater knowledge retention of common issues
	• More streamlined communications between the designer and the principal (fewer interfaces)
	• Better opportunity to understand rural property owners, whose interests frequently extend
	beyond smaller (10-15 km) project packages
Understanding the	Lesson Learnt: The construction works were procured under two different models. The initial
key benefits of	project sites were tendered in 10-15 km sections, while the final stages were grouped into larger
Challenge	Lessons Learnt or Innovation
---------------------	---
Encountered	
different delivery	20-30 km sections and included an Early Contractor Involvement process. The key benefits for
models in	each design procurement model are listed below.
construction	Separate, smaller construction packages – key benefits:
	• Smaller works packages allow for a wider range of construction contractors to bid on works,
	Second and the second
	• Smaller packages of work allow faster procurement phases, and works for individual packages are completed sooner, and are therefore safer sooner (i.e. a package is completed
	within 12 months from tender period)
	Longer construction packages and ECI process – key benefits:
	• Securing construction contractors early in tight labour market conditions
	• Construction contractors have a better understanding of the project areas, allowing
	substantial works to commence on site earlier (within 1-2 weeks of formal handover)
	• Better consistency of traffic management across longer lengths of highway
	• Better opportunity for value for money construction and economies of scale (e.g. project management / site set up / mobilisation)
Understanding the	Lesson Learnt: Stakeholder engagement with adjacent property owners continually improved
impacts of the	during the course of the 10 Vear Action Plan implementation, and it was recognised that early
works on adjacent	investment in stakeholder engagement substantially benefited this project. To help understand the
landowners (and	imposts of the safety upgrade works, property owners must be individually visited early in a
reducing impact	project to listen to their local knowledge and understand their interaction with the highway
where possible)	before presenting them with any proposals of the design ungrades. Early and detailed engagement
where possible)	allows a vast amount of important local information to be collected and recorded which helps to
	inform design, and also helps to reduce impact to adjacent property owners where possible
The need for	Innovation: Mobile laser scanning (MIS) data was used to develop a 3D digital point-cloud and
ongoing site	related imagery for planning and investigation, and detailed design purposes. Point cloud data
specific	was shared between all project team members and other departmental and technical stakeholders
information at	The use of 3D point cloud data provided the project team an ability to understand and accurately
remote locations	measure existing site conditions and visualize issues and opportunities which reduced the amount
	of travel and onsite activities adjacent to a high-speed road in remote locations
Local industry	Innovation: The design of the final 50 km of highway ungrades was undertaken by a single
capacity to deliver	design organisation in order to provide a more consistent approach to implementing the upgrade
design	strategy. Due to the quantum of design work, and the canacity of local consultant teams, the
documentation for	design effort was broken into three nackages with each having a dedicated manager and
large upgrade	associated design team all under the guidance of a local project leadership team (Project
nackages	Manager Design Manager and Project Director). One design package team was located in
Pachages	Hobart, another in Adelaide and the third in New Zealand This approach allowed for broader
	technical experience and more resources to deliver the project, whilst still retaining local
	leadership to ensure strong communication with the principal and ensuring Tasmanian design
	practices were incorporated. The delivery model highlighted the ability for road authorities and
	consultants to work and deliver projects across geographical boundaries, and the model was being
	implemented even before the COVID-19 pandemic.

Conclusions, Benefits to Road Safety, and Implications for Practice

The Midland Highway 10 Year Action Plan uses the principles of the Safe Systems Approach to improve safety and decrease head on crashes. The works are a step towards the National Road Safety Strategy 2021-30 target to reduce the annual number of fatalities by at least 50 per cent and serious injuries by at least 30 per cent (The Department of Infrastructure, Transport, Regional Development, Communications and the Arts, 2024). The key findings from the review of project challenges are:

- Developing a detailed strategy of the upgrade works is important so that project teams can comprehend the interconnected nature of a highway corridor, however road authorities and design teams may also need to be agile in their ability to develop strategy in parallel to early delivery of project sites.
- There are numerous benefits to larger and smaller design and construction packages road authorities need to consider the appropriate model for different stages in corridor wide safety upgrade programs.
- Early investment in stakeholder engagement substantially benefited the safety upgrade program. Detailed, and meaningful conversations with adjacent property owners help design teams understand important local knowledge and also the impacts of highway safety upgrade works.
- Local design industry capacity can be successfully supplemented by interstate and international capability, provided that teams are carefully structured, and a local presence maintained.

Throughout Tasmania and Australia, it is expected that similar programs of safety upgrades and installation of central median barrier will be required as a step towards 2030 national road safety targets. It is the authors' hope that other road safety practitioners can use the key lessons and innovations learnt from the Midland Highway 10 Year Action Plan to better implement their own works programs and improve safety for all road users.

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Business case for safety improvements on high-speed local government roads

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Abstract

The local road network in regional Australia presents a significant road safety challenge – it is vast with low traffic volumes, high-speed traffic, roadside hazards and few safety features. Around half of deaths and serious injuries in regional WA occur on local government managed roads, meaning these roads must be improved to deliver 2030 road safety targets. This project involved reviewing up to 10,000km of sealed, high-speed local government roads in WA and identifying cost-effective safety treatments that could be applied. The safety benefits of these treatments were assessed using AusRAP star rating scores and crash reduction factors. 439 local government roads, covering over 8,200km, were prioritised for treatments such as line marking and shoulder sealing, which were modelled to prevent 138 fatalities and 489 serious injuries over a 30-year lifespan. The WA Government supports the business case and has submitted it to Infrastructure Australia for assessment.

Post on X

This project identified cost-effective safety treatments that could be applied to 8,200km of high-speed local government roads in WA to prevent 627 deaths and serious injuries over 30 years and culminated in a robust business case being submitted to Infrastructure Australia.

Background

Regional Western Australia (WA) presents a significant challenge to saving lives and reducing serious injuries on our roads – over five years, more than 500 people have been killed and nearly 2,900 seriously injured on WA's regional roads. Of the 175 fatalities on WA's roads in 2022, over two thirds (or 120 deaths) occurred on regional roads (Road Safety Commission, 2023), despite only 21 per cent of the population living there. This translates to a fatality rate of 18.7 road deaths per 100,000 population in regional WA, which is significantly higher than in other states and territories (except Northern Territory) as well as the regional national average of 10.6 road deaths per 100,000 people in 2022 (Australian Automobile Association, 2023).

Much of the regional road network is unforgiving of mistakes, with high-speed two-way traffic, roadside hazards such as trees and a lack of safety features. Over two thirds of all fatal and serious injury crashes in regional WA were the result of run- off-road or head on crashes (Road Safety Commission, 2024) – deaths and serious injuries that could be avoided through implementation of effective low-cost safety treatments. Infrastructure Australia has identified these as significant issues nationally, highlighting poor quality parts of Australia's regional road network (Infrastructure Australia, 2022), and more specifically single vehicle, run-off road crashes in WA (Infrastructure Australia, 2023). These issues have also been recognised within the WA State Infrastructure Strategy and the national and WA road safety strategies.

WA's Regional Road Safety Program is helping to address this challenge through low-cost safety upgrades (Main Roads WA, 2024), but it is almost entirely focused on the state road network, with just \$35 million invested through the program in local government managed roads. Around half of deaths and serious injuries in regional WA occur on local government managed roads (accounting for approximately 300 deaths and serious injuries (KSIs) each year), meaning that these roads also need to be improved to deliver national and state road safety targets and achieve Vision Zero.

Local governments in WA manage approximately 113,000km of regional road, only around 26,000km of which is sealed (WA LGA, 2023). Due to the nature of local road networks in regional and remote areas, crashes are spread across large areas and there are fewer 'black spot' locations with a significant crash history – improving safety requires a widespread approach. Many of these roads have low traffic volumes when compared to state roads, and would not be eligible for Regional Road Safety Program treatments due to them being unsealed or having a narrow road seal and/or lack of line marking. There is therefore a need for a new low-cost program tailored to local government roads.

In late 2022, a project commenced to review up to 10,000km of sealed, high-speed WA roads managed by local governments and develop a business case to seek funding to improve road safety on these roads by applying (mainly) low-cost treatments. The WA Local Government Association and Main Roads WA were project partners, supporting

the project through: a funding contribution; active participation in the project working group; and a joint commitment to use the project deliverables to improve road safety outcomes.

Approach

Shortlisting roads for assessment

Only sealed local government roads in WA with a speed limit of 90km/h or higher were considered for inclusion. Three sources were used to prioritise up to 10,000km of road for assessment:

- Roads listed in Roads 2040 Regional Strategies for Significant Local Roads (WA LGA, 2022) prioritised based on traffic volumes, midblock crash history, road classification and route continuity
- Peri-urban roads within the Perth metropolitan area prioritised based on traffic volumes and midblock crash history
- Other roads with a history of crashes (two or more midblock KSI crashes or at least five midblock crashes where one was a KSI crash between 2027 and 2021)

Data collection

Data was sourced for the assessed roads for crash history, traffic volume, speed limit and video road survey. This data was used to measure: formation width of the road; seal width; delineation; sealed shoulder width; presence of audio tactile line marking; and presence of hazards. Local government consultation helped to validate data accuracy.

Identifying and allocating road safety treatments

The project team identified potential road safety treatments based on knowledge of road safety treatments, existing and previous Main Roads WA programs and suitability for regional local government networks. To assist in the application of treatments, a decision tree was produced with warrants for each treatment, working through treatments in the following order: lane widening; delineation; shoulder sealing; audio tactile line marking (ATLM); wide centreline treatment (peri-urban roads only); and hazard removal within 1m of traffic lanes. The warrants for each countermeasure were based on existing standards and guidelines. Where the traffic volume on a road was greater than 150 vehicles per day, the decision tree was worked through from top to bottom, with the only restriction being the existing formation width of the road. Where the traffic volume on a road was less than 150 vehicles per day, the decision tree was worked through from top to bottom as far as possible without applying any seal widening.

Calculating AusRAP Star Rating Scores before and after treatment

AusRAP Star Ratings provide an objective measure of the level of safety provided by a road. Roads are assigned Star Rating Scores (SRS) that represent the relative risk of death and serious injury for an individual road user, which are then banded into Star Ratings from 1 to 5 where 1 is the least safe and 5 the safest. Research has found that the cost of crashes is approximately halved for each incremental improvement in Star Rating (IRAP, 2021). Due to the extent of the network being assessed, and the limited data available, it was not feasible as part of the project to conduct comprehensive Star Ratings for each 100m section, so the project team developed stereotypes that allowed continuous sections of road with similar cross-sections to be "grouped" and assessed together. Each road was assessed by dividing it up into homogenous sections which aligned to the attributes that underpinned the road stereotypes. An SRS and Star Rating was calculated for each road first based on its existing road stereotypes (before) and second based on what its road stereotypes would be if the treatments were applied (after).

Calculating Crash Reduction Factors (CRFs)

An analysis was undertaken of the likely crash reduction that would be expected after implementation, utilising Main Roads WA Crash Reduction Factors for fatal and serious injury crashes (Main Roads WA, 2021). For each section of road proposed for treatment, crash reduction factors were applied to the number of fatal and serious injury midblock crashes between 2017 and 2021. This allowed the project team to estimate how many fewer fatalities and serious injuries would occur per year across the treated road network compared with the current network.

Calculating economic benefits and costs

Main Roads WA provided unit rate costs and service lives for the treatments and with crash costs for fatal and serious injuries. This enabled the project team to calculate the capital and operating costs over a 30-year lifespan of implementing the program and to compare these costs against the economic benefits due to reduction in fatal and serious injury crashes.

Results and road safety benefits

The resulting business case recommends applying safety treatments to 439 local government roads across WA. The proposed treatments are in Table 1. The average Star Rating Score across the 8,208km of road assessed was 38.4 before the countermeasures, and this reduced to 29.1 after the countermeasures, which is an average reduction of 24 per cent. A Star Rating improvement was demonstrated for 950km of road and the number of km of road rated 2 Stars or above increased from 1,230km to 2,002km, an increase of approximately 771km (63 per cent).

Table 1. Proposed treatments

Treatment	Length (km)
Lane widening	3,388
Centreline	5,651
Edge lines	4,892
Sealed shoulder	4,359
Audio tactile linemarking	4,159
Wide centreline treatment	39
Hazard removal/protection	38
Total length of road being treated	8,208

Table 2. Star Ratings for treated road lengths

Star Rating	Before (km)	After (km)	Before (%)	After (%)
1 star (SRS 22.5+)	6,978	6,206	85.02%	75.61%
2 star (SRS 12.5 to < 22.5)	809	1,409	9.85%	17.16%
3 star (SRS 5 to < 12.5)	418	583	5.09%	7.10%
4 star (SRS 2.5 to < 5)	4	11	0.04%	0.14%
5 star (SRS 0 to < 2.5)	0	0	0.00%	0.00%
Total	8,208	8,208	100.00%	100.00%

An analysis of Main Roads crash reduction factors estimated a reduction of 138 fatalities and 489 serious injuries based on the treatments proposed for a 30-year lifespan.

Implications for policy and/or practice

The business case estimates that the program would cost \$552m to implement and that the present value of capital and operating costs of the program would be \$738m over a 30-year lifespan and using a discount rate of 7%. The total present value of the benefit due to reduction in fatal and serious injury crashes is estimated at \$669m based on a 30-year life and a discount rate of 7%. The conservative benefit-cost ratio resulting from this is 0.91 and does not account for minor injury or property damage only crashes or additional benefits beyond road safety. This indicates that the program would be economically feasible in WA and therefore a similar type of program would likely be feasible in other states. All 97 local governments who own the roads identified for treatments were consulted and 69 local governments responded to the consultation, all in support of the initiative. The WA Government supports the business case and has submitted it to Infrastructure Australia for assessment.

Conclusions

Safety improvements need to be made to local government roads to deliver 2030 road safety targets. This project demonstrated it is possible to develop a robust business case for safety upgrades to high-speed local government roads across a large network, which will contribute to achieving targets set in the national and state strategies.

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Testing messages to build community support for speed limit reductions

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Abstract

Speed limit reductions are one of the most cost-effective way to prevent deaths and serious injuries on our roads and are key to achieving 2030 road safety targets. However, a major challenge to their implementation is real or perceived lack of public support. Our own research has found a status quo bias whereby people typically believe existing speed limits are appropriate. In addition, people underestimate the benefits of speed limit reductions (due to misconceptions about the relationship between speed and severe crashes) and people overestimate the negative impacts. We conducted qualitative and quantitative research to understand what types of messages are most effective at building community support for speed limit reductions. The research found that the most effective messages focus on the fact that if you or your loved ones are involved in a crash then lower speed limits dramatically reduce the likelihood of someone being killed or seriously injured.

Post on X

Given that real or perceived lack of public support is a major challenge to implementing life-saving speed limit reductions, this research explored what types of messages are most effective at building community support for speed limit reductions.

Background

There is a strong relationship between the average speed of traffic and road safety which has been proven by research across many countries, road types and time periods (Elvik et al., 2019). The extent to which a speed limit reduction leads to a reduction in travel speeds depends on driver compliance with the new speed limit, which is influenced by education, enforcement and the road design and environment (Sadia et al., 2018). However, there is robust evidence that setting speed limits for new and existing roads based on Safe System principles is effective in reducing fatalities and injuries (Global Road Safety Partnership, 2023). Indeed, introducing safe and appropriate speed limits is one of the most cost-effective ways to manage vehicle speeds to save lives and prevent serious injuries (Job & Mbugua, 2020).

The National Road Safety Strategy 2021–30 identifies speed management as an important underpinning of all strategy themes and the National Road Safety Action Plan 2023-25 commits to developing regulatory impact statements on reducing the open road and unsealed road default speed limits. The Western Australian (WA) Government's Driving Change – Road Safety Strategy for Western Australia 2020–2030 targets to reduce deaths and serious injuries by 50-70 per cent rely heavily on reductions to speed limits. For example, during consultation for the WA strategy, modelling a 50 per cent Killed or Seriously Injured (KSI) reduction required (in addition to a significant increase in road safety infrastructure spending) all speed limits between 40km/h and 100km/h being reduced by 10km/h.

A major challenge to the implementation of speed limit reductions is real or perceived lack of public support:

- Qualitative research we conducted in 2022 uncovered widespread misconceptions about the role that speed plays in crashes, including beliefs that severe crashes are due to driver error rather than speed, that good drivers can drive safely at high speeds and that high speed limits are safer when driving long distances (e.g. by reducing fatigue, distraction and exposure time).
- In a 2022 survey of 1,114 respondents, we asked them what they thought was an appropriate speed limit on 11 different road types. This revealed a status quo bias, with for 10 road types the largest proportion of respondents thinking the existing speed limit was appropriate. On major roads, those who did not support the status quo were most likely to believe higher speed limits would be more appropriate, whereas on local roads there was substantial support for lower speed limits.
- In a 2023 survey of 330 respondents, we asked what impact, if any, they thought lowering all speed limits in their local government area by 10km/h would have on a range of factors. Only four per cent of respondents thought it would decrease the number of road crashes a lot (half expected no decrease at all) and only seven per cent thought it would decrease the severity of road crashes a lot (four in ten expected no decrease at all). In contrast, four in ten thought it would increase driver frustration and road rage a lot (eight in ten any increase), three in ten thought it would increase speeding a lot (six in ten any increase) and a quarter thought it would increase journey times a lot (eight in ten any increase).

We conducted qualitative and quantitative research to seek to understand what types of messages are most effective at building community support for speed limit reductions.

Approach

In early 2022, we collaborated with the Brand Agency to develop 14 messages (grouped under five themes) designed to build and shift community attitudes to support speed limit reductions.

In May/June 2022, Painted Dog Research conducted eight online focus groups (three Perth Metro, five Regional WA) on our behalf to test the 14 messages with 67 participants skewed towards those opposed to speed limit reductions.

Based on the focus group findings, the messages were refined, with 12 messages (five with an urban focus and seven with a regional focus) tested through an online survey that 9,892 people were invited to complete in September/October 2022. The survey received 1,114 responses (an 11% response rate), including 221 from regional WA, and data was weighted by lifestage.

Findings

The key findings from the qualitative research were:

- Communications need to address widespread misconceptions about the role that speed plays in crashes, including building community awareness of the impact of speed and benefits of travelling at lower speeds.
- Communications are likely to be more effective if they address specific road types and specific speed limit reductions Even those strongly opposed to speed limit reductions in general could often see benefits of reductions in specific situations e.g. in school zones and entertainment precincts.
- Messages that performed strongly in testing had a human element, used simple and compelling evidence/statistics to support their claims and connected to personal benefits of speed limit reductions.
- Messages that performed poorly in testing drew evidence from, or made comparisons with, other jurisdictions or focused on non-safety benefits of speed limit reductions.
- The best performing messages used a real-life scenario where speed could make all the difference to avoiding being seriously injured by a dangerous hazard (utilising stopping distance or impact speed survival rates) or contrasted the large road safety benefits of reduced speed limits against the small journey time increase.

Of the 12 messages tested in the quantitative research:

- The strongest performing urban message (which also performed best in the focus groups) was "Oliver almost died when he was walking home from school after being struck by a car travelling 30km/h. If he'd been hit at 50km/h his chances of being killed would have been 5 times higher. Lower speed limits reduce the chance of you killing or injuring other people." This message was felt to be most effective because it was personalised, relatable and concerned a particularly vulnerable road user group.
- The strongest performing rural message was "Every day someone is killed or seriously injured on a 110km/h WA road. Every death could be your son, daughter, friend, partner. Reducing the default speed limit from 110km/h to 100km/h would prevent around 75 deaths and serious injuries each year." This message was felt to be most effective because it had impactful statistics and made people think about their loved ones. With revised wording, the message performed better than in the focus groups.
- The poorest performing urban message made comparison with other jurisdictions: "In response to calls from the United Nations and World Health Organisation, many cities around the world are now adopting 30km/h speed limits in areas of high pedestrian activity, including near shopping and entertainment precincts, schools, hospitals and aged care homes. It's time for WA cities to join them."
- The poorest performing rural message referred to the fuel efficiency benefits of lower speed limits: "For most cars, fuel efficiency declines once your speed increases over 80km/h driving a typical petrol vehicle at 100km/h instead of a 110km/h would save you around 10% on fuel costs and reduce your environmental impact.
- Urban and rural travel time messages were rated as believable but not as attention-grabbing or convincing as messages with a stronger safety focus.
- The tested messages generally resonated better with females, 30-44 year olds and light drivers than with males, those age 65+ and heavy drivers.

Benefits to road safety and implications for policy and/or practice

Building community support for speed limit reductions is key to implementing reductions that will reduce fatalities and serious injuries. Based on the research, we developed the following message hierarchy for communications around speed limit reductions:

Overarching theme	If you or your loved ones are involved in a crash then lower speed limits dramatically reduce the likelihood of someone being killed or seriously injured			
Supporting evidence	Impact speed survivability	Reduction in statistical risk	Case studies	Survivor stories
Additional benefits	Less likely to crash (more time to react and brake)	More liveable neighbourhoods (urban)	Promotes active transport. (urban)	Better fuel economy (rural)
Myth busting	Good drivers still have crashes (roads are unpredictable, people make mistakes)	Lower speed limits don't increase travel times by much	Higher speed limits are never safer, even when driving long distances	Safer speeds are one part of a Safe System, complementing safer roads, vehicles and road users



Conclusions

The most effective messages to build community support for speed limit reductions are those focused on the fact that if you or your loved ones are involved in a crash then lower speed limits dramatically reduce the likelihood of someone being killed or seriously injured. The messages need to help members personally relate to an unlikely scenario (being in a crash) and understand how lower speed limits could benefit them in this scenario. Most of the other tested messages still performed reasonably well, so can play a supporting role in communications. For example, messages about journey times are believable but do not make a convincing case in isolation for speed limit reductions. References to international organisations such as the UN and WHO were not well received by a WA audience.

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Serious motorcycle crashes: does criminal and traffic history predict involvement?

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Abstract

Fatal crashes involving motorcycles account for approximately 27 percent of lives lost on Queensland roads since 2022, despite motorcycles comprising approximately four percent of vehicle registrations. Statistics also demonstrate motorcycles are overrepresented in serious injury and fatal crashes where the rider is at fault. By interrogating data from fatal and all serious injury motorcycle crashes investigated by the Queensland Police Service (QPS) Forensic Crash Units (FCU) for calendar years 2022, 2023 and up to 28 February 2024, this study aimed to examine whether there is a nexus between rider criminal history and traffic history and propensity to be at fault in a crash. The findings show at fault riders are more than four times more likely to have pre-existing criminal history, over four times more likely to have both criminal and traffic history and almost four times more likely to be not appropriately licensed than not at fault riders.

Post on X

Are motorcycle riders with criminal and or traffic history more likely to be at fault in a crash than other riders?

Background

The involvement of motorcycles in serious injury and fatal road crashes has historically been over-represented when a comparison of crashes to registered vehicles is undertaken. In Queensland, 27 percent of lives lost on the road network since 1/1/2022 have been motorcyclists, whilst motorcycles make up only approximately four percent of registered vehicles. During 1 January to 31 December 2023, there were 79 motorcycle rider/moped rider and pillion fatalities because of crashes, which represented 28.5% of all fatalities in Queensland. The number of motorcycle rider/moped rider and pillion fatalities increased almost 7% from 2022 to 2023.

Significant work has been conducted over time determining what motorcycles are crashing, why they are crashing, what demographic is crashing, and how they are crashing. However, little has been conducted, to our knowledge, on what type of person (rider) is crashing. This review began with the premise that a rider's propensity to offend criminally and/or on the road may have some impact on the likelihood of their involvement in a motorcycle crash and whether they are more likely to be at fault in that crash.

In a study of speeding offenders, almost one-third of speeding offenders (from a subsample of 1,000) had committed at least one previous criminal offence (across lifetime offending records), with property and drug offences being the most common. This study highlighted that for some riders and drivers, there is a link between traffic offending and other offending behaviours (Watson et al., 2015). These findings are consistent with self-reported research from the United States where driving citations (infringements) were positively associated with criminal behaviour (Sansone et al., 2011).

Approach

Crash information was obtained from QPS Forensic Crash Units (FCU) for each fatal motorcycle crash (N=160) and serious injury crash (N=183) investigated by the FCUs for the period 1/1/2022 to 28/2/2024 (n=324). It was noted that some crashes involved more than one motorcycle, and some included both injury and fatality of a rider.

Information collected and examined during investigation by FCU included, date, rider gender, rider age, rider license status, crash severity, motorcycle model and type, motorcycle learner approved status, helmet status, single or multi-vehicle, at fault attribution, traffic and criminal history of rider, drug/alcohol involvement, vehicle behaviors (crash causes), road speed limit, and prevailing environmental conditions.

Specifically, the criminal and traffic histories of involved riders was examined in addition to their motorcycle license status at the time of crashing. Data was drawn under the following categories to compare at fault riders to not at fault riders:

- Criminal history in the last five years
- Traffic history in the last five years
- Significant traffic history in the last five years (five or more offences)
- Criminal and traffic history in the last five years
- No criminal history in the last five years
- No traffic history in the last five years
- No significant traffic history in the last five years (four or less offences)
- No criminal or traffic history in the last five years
- Was not licensed or appropriately licensed.
- Was appropriately licensed.
- Drug alcohol involvement
- No drug alcohol involvement

In terms of data limitations, raw data obtained from FCU is not cleansed and some key variables are subject to interpretation by investigators. For example, the causes of the crashes were nominated by the investigator following their completed investigation. This FCU data does not consider subsequent Coroner's findings as to cause of death. Additionally, the type and severity criminal behaviour was not available for this study. Nor was information as to what proportion of traffic offending was whilst the individual riders were riding motorcyles.

Following consultation with the Queensland Data Bureau, a comparison was then completed utilising odds ratios to determine if riders with the above attributes are more or less likely to be involved in a fatal or serious crash.

Findings

Table 1 below displays the odds ratio of at fault versus not at fault riders across various measures. Key findings include:

- At fault riders are 4.3 times more likely than not at fault riders to have criminal history in the last 5 years.
- At fault riders are 4.5 times more likely than not at fault riders to have both criminal and traffic history in the last 5 years.
- At fault riders are 3.8 times more likely than not at fault riders to be unlicensed or inappropriately licensed at time of crash.
- At fault riders are 4.9 times more likely to have alcohol or drugs in their bodies at time of crash than not at fault riders.

Table 1. Comparative: At fault motorcycle riders versus not at fault motorcycle riders in fatal and serious injury crashes in Qld 1/1/2022 to 28/2/2024

Measure	Odds ratio
Total Crashes (n=324)	At Fault v Not at Fault
Has criminal History	4.283 : 1
Has traffic History in last 5 years	1.545 : 1
Has significant traffic history in last 5 years (5 or more offences)	1.688 : 1
Criminal and traffic history in last 5 years	4.516 : 1
Was not licensed /appropriately licensed	3.771 : 1
Likely to be involved in fatal crash	1.325 : 1
Has illegal levels of alcohol and / or drugs in body at time of crash (205 tests)	4.897 : 1

Implications for policy

In considering current targets under the *Queensland Road Safety Strategy 2022-31*, the findings suggest the following issues may need further exploration:.

- Should a person's ability to enter the motorcycle licensing system be limited, delayed, or prevented based upon previous criminal and or traffic history?
- Conversely, should increased efforts be made to bring unlicensed or inappropriately licensed riders into the legitimate licensing system?

Whilst effective graduated licensing schemes and motorcycle power to weight limitations are in place, the rate of motorcycle involvement in fatal and serious injury crashes is not declining.

Conclusions

With increasing metropolitan growth comes a necessity to manage traffic congestion. Motorcycling will likely remain a legitimate part of congestion management as well as a sport, past-time, and transport option. If nothing in the motorcycling environment changes however, it will remain a transport option that if undertaken by riders with a prior propensity to offend, may continue to contribute significantly and disproportionately to road trauma. In considering treatments for road related motorcycle trauma, this study points to the Safe Systems approach needing to broaden its parameters to include the social antecedents of riders as it appears these have strong correlations with riding outcomes.

It is recommended that further in-depth research is undertaken examining how criminality (both crime and traffic related) in general, affects driver/rider attitudes and actions within the road safety environment.

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Exploring enhancement of community understanding of safe system speeds

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Abstract

Misperceptions about speeding remain prevalent and community acceptance of the need to reduce speeds to levels consistent with safe system principles has not been achieved. Encouraging speed limit compliance remains a focus in Western Australia, a state with a higher default rural area speed limit (110km/r) than most Australian jurisdictions (100km/h) and many unsealed roads. A literature review identified a variety of evidence-based speed management interventions across these domains: speed limit setting, infrastructure, enforcement, in-vehicle technologies, awareness raising (with enforcement), and behavioural interventions (brief interventions, implementation intentions, incentives/feedback). Importantly, it also identified an opportunity to explore links between safety star-rated roads and community perceptions of appropriate speeds. A scoping review of recent speed-related surveys found this element was lacking. Gauging community mis/perceptions about safe travel speeds on roads with different safety ratings could produce insights to guide future interventions and inform how speed limits are explained to the community.

Post on X

This research explores how to help reduce road trauma caused by speeding and the potential benefit of examining the concept of safety star-rated roads to gauge community acceptance of speeds that are compliant with safe system principles

Background

Safe system principles are not yet fully understood in the general community. Misperceptions about speeding remain prevalent and widespread community acceptance of the need to reduce speeds to levels consistent with safe system principles has not yet been fully achieved in Australia (Fleiter et al., 2016). The National Road Safety Strategy 2021-2030 highlights that a key challenge for embedding the safe system approach is speed management. Across Australia, community attitudinal surveys show good support for speed enforcement and a level of understanding of the link between speed and risks on the road. However, a good understanding of how crash risks compound with even small increases in speed is lacking. The National Strategy recognises that an immediate priority is continuing to change the culture relating to speed in Australia. One pathway to help attain the 2030 target of a 50% reduction in fatal and serious injuries is to find ways to create widespread understanding of the link between travel speed and crash risk.

Western Australian context

Encouraging speed limit compliance remains a key focus area in Western Australia (WA). The Driving Change Road Safety Strategy 2020-2030 notes that many crashes on WA's regional and remote roads involve high speeds. For the period 2015-2019, 1,912 people were killed or seriously injured on 110km/h roads in the state. Speed limit compliance is gradually improving but speeding and inappropriate speeds still cause significant road trauma in the state. Importantly, WA is out of step with most other Australian jurisdictions regarding speed limit setting. A default speed limit allows for the implementation of a speed limit in the absence of a speed limit sign. Two default speed limit categories apply widely in Australia: i) the default urban (built-up) area speed limit is 50km/h, and ii) the default rural (open road) speed limit is 100km/h. However, in WA, the default rural area speed limit is higher, at 110km/h, even though many rural roads are not designed to safely accommodate driver error at such speed. Moreover, several jurisdictions are now working towards lowering their default speed limits further. This includes Tasmania, which has now set a default speed limit of 80km/h on unsealed roads where no specific speed limits are posted, but rather drivers are to 'drive to conditions'. Many roads that extend across and connect WA's regional and remote communities are unsealed and can be affected by extreme weather conditions, making them even more dangerous. As speed limits on rural roads in WA are amongst the highest in the country, there is a critical need to address this issue, including improving community understanding about risks associated with travelling on roads with low safety ratings.

Regular speed surveys conducted across Perth from 2000-2018 have assessed changes in speed compliance rates, proportion of drivers exceeding 10 or more km/h above the speed limit, 85th percentile, and mean speeds (Sultana, 2018). Encouragingly, relative to the rate in 2000, the surveys demonstrated a significant average increase in compliance rates over time. Relative to the compliance rate in 2000 (53% of vehicles travelling at or below the speed limit), there has been a significant average increase in the compliance rate (64.1% in 2015 and 69.5% in 2018), although the poorest compliance was evident on 60km/h roads. The number of drivers travelling at high speeds on Perth's roads, for instance, has also declined to 3.4% in 2018 (a reduction of 73.3% on the figure in 2000). Together, these speed

survey results demonstrate that speeding has become less prevalent among the general driving population in Perth over time. However, approximately 24% of crashes resulting in death or serious injuries on rural roads, and 12% on metropolitan roads, are caused by excessive or inappropriate speeds for the prevailing conditions (Road Safety Commission). Further, no similar analysis of trends in regional areas has been published. As such, more effort is needed to reduce the impact of speeding.

The primary aim of this research was to review interventions to reduce speeds that are applicable to the Western Australian context. A secondary aim was to identify recent surveys implemented in Australia to gauge community understanding and perceptions about speed and speeding, particularly as relative to safe system speed principles and star-rated roads.

Method

Published and grey literature was reviewed to examine interventions available to assist in reducing 'speed' and 'speeding' related road trauma as well as recent 'survey' (or 'questionnaire') research conducted in Australia. Searches were conducted in late 2023-early 2024 and limited where possible to the last 10 years. Databases searched included APA PsychINFO, Scopus, PubMed, Web of Science and Cochrane Database of Systematic Reviews, as well as Google and Google Scholar. Reference lists of all retrieved studies were examined to source additional relevant reports, studies and documents.

Results

Interventions to reduce speeding

A recently updated best practice manual for speed management summarised international evidence to classify interventions according to their level of effectiveness across these categories: speed limit setting, road infrastructure, enforcing speed limits, in-vehicle technologies, and awareness raising (Global Road Safety Partnership, 2023). Overall, the literature review located a variety of evidence-based options available to authorities across each of the primary domains described above. Speed limit setting is critical, but not sufficient to establishing safe travel speeds. Speed enforcement has also proven to be an extremely important intervention to reduce speeding. Infrastructure changes that have been demonstrated to be effective in reducing speeds are Raised intersection platforms, Raised midblock platforms and Raised pedestrian crossings, Road diets, Rest-on-red signals, Curve design and treatment, Wide centreline, Vehicleactivated signs for curves, Vehicle activated signs for intersections, and Gateway treatments. In-vehicle technologies such as Intelligent Speed Adaptation (ISA) and speed limiters also provide important options for reducing speeds. In regards to education, public awareness campaigns that are coupled with enforcement efforts are recommended above all other education options. Behavioural-based interventions were absent from the aforementioned speed management manual. A broad range of behavioural-based interventions offer varying degrees of promise in reducing the prevalence of speeding among repeat offenders and/or the broader driving population. These include: Brief interventions (e.g., Young et al., 2013); Implementation Intentions (a self-regulatory cognitive intervention) (e.g., Brewster et al., 2015); Incentives/rewards/feedback (delivered to drivers in a variety of ways including in-vehicle real-time apps, post-drive web-based, and in-person feedback and coaching) (e.g., Molloy et al., 2023; Meuleners et al., 2023; Reagan et al., 2013); or combinations of the above.

It is important to continue implementing interventions with proven results such as those mentioned above. However, it seems that new approaches are needed for Australia to reach the 2030 target. The literature review also identified a proposed a new long-term strategy to improve and extend compliance with speed limits, including nine recommendations by Johnston & Howard, (2017): 1) publicise that infrastructure can be safety star-rated and demonstrate links between low safety ratings and crash history; 2) transparently relate intense enforcement to lower star-rated roads; 3) consider reducing limits only on blatant sub-standard roads; 4) enhance deterrence through increased cameras across the network to create and sustain the 'anywhere, anytime' principle; 5) ensure all road sections are well signed for speed limits; 6) ensure avenue for appeal against unfair enforcement; 7) ensure all speed infringement fine revenue transparently allocated to infrastructure safety remediation; 8) praise the public for improved compliance. Several recommendations have particular relevance to the WA context in regard to high default speed limits on sub-standard roads and are discussed below relating to examining community perceptions linked to safety star-rated roads.

Community speed surveys

Nine key community surveys conducted recently in Australia were identified, some of which are confidential and not yet published at the time of writing. Only two used representative sampling methods, with others advertised on online platforms or based on certain membership samples. These generally included items exploring personal experiences of speeding and perceptions of prevalence in community (kms over posted limit); perceptions of speed enforcement (prevalence/risk of detection, acceptance, particularly relative to different detection methods) and penalties (points, fines, whether appropriate); perceptions of vehicle speed advisory/adjustment technologies; perceptions of speeding as risky (by speed zone or urban/regional/rural area); views of speed campaigns; and views of safe speeds in relation to photos of depicting certain scenarios, all in good conditions (daytime, clear vision, dry weather, low traffic volume).

None of the surveys directly queried knowledge, understanding or acceptance of default speed limits or support to change these. While it was apparent that some surveys targeted safe system speed principles, there were few overt questions about this topic and there was limited exploration of the common myths about speeding which are considered to underpin lack of community support for speed management. Of note, none of the surveys directly examined perceptions relating to star ratings of roads.

Implications for policy and practice

Is linking the concept of safety star-rated infrastructure with community perceptions of safe travel speeds the pathway forward?

Johnston and Howard (2017) recommended that more can be done to enhance public understanding of the concept of star-rated roads and the literature review identified a gap in this regard. Despite the broad range of effective speed management interventions and surveys of community perceptions identified in the review, there is a gap in our knowledge relating to a potential link between star-rated roads and associated risk, and community understanding of safe travelling speeds on them. There is opportunity to educate people about higher risks associated with lower star-rated roads (including unsealed roads) and the safety benefits of implementing safe system travel speeds on lower star-rated roads. To date, there appears to have been little work done to gauge community engagement might serve as an additional mechanism to help explain crash risk as well as explain the need to reduce speed limits on sub-standard roads. This has particular relevance to WA context described above, where there is a higher default speed limit on rural roads than in most other Australian jurisdictions, even though many rural roads are not designed to safely accommodate error at such speed and because many roads in the state's regional and remote communities are unsealed making them even more dangerous.

Conclusion

Ensuring road users travel at 'safe system speeds' that are consistent with the risk associated with the road environment in which they are travelling, irrespective of the posted speed limit, is a powerful way to improve road safety. However, because safe system principles are not yet widely understood, there is need to gauge community mis/perceptions about safe travelling speeds across roads with different safety ratings and crash histories. The insights gained from asking road users about their perceptions of safe travelling speeds on various roads can guide future interventions and inform the ways in which speed limits are explained to the community. Enhancing road user understanding of why roads have different safety ratings may assist in promoting safer road use through a greater appreciation of risks associated with various travel speeds on different types of roads. Over time, enhanced understanding of risks associated with other behaviours (e.g., drinking driving) has helped reduce their prevalence. To reach the ambitious national fatality and serious injury reduction targets by 2030, finding new pathways to help road users understand the risks they face will be necessary, because current speed management methods have not yet achieved desired compliance results.

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Improving motorcycling and cycling safety at urban intersections

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Abstract

Urban intersections are a common place of injuries and deaths for cyclists and motorcyclists, particularly involving 'right turn against' vehicle movements. Dominion Road, a busy arterial in Auckland was identified as having relatively high harm to motorcyclists and cyclists. Auckland Transport sought to trial two mitigations for reducing risk for these road users at unsignalised intersections. The mitigations were yellow hatching to improve sight lines and driver warning signs of an approaching cyclist/motorcyclist. An evaluation of these interventions was undertaken using video analysis, speed measurement, and focus groups and assessed over 7000 encounters between vulnerable road users and vehicles at four treatment and control sites across baseline, hatching only and hatching + signs. While the effects are small, trends indicate that the countermeasures show promise in reducing risky encounters between 'right turn against' crashes with cyclists and motorcyclists.

Post on X

Installation of yellow hatching and turning driver warning systems showing promise in improving safety for cyclists and motorcyclists at unsignalised intersections

Introduction

In New Zealand, 48% of the motorcycle injury crashes in the urban environment are at intersections, three quarters of all deaths and serious injuries for cyclists in an urban environment occur at intersections, and of these crashes the most common crash movement is right-turn in/out (Ministry of Transport, 2015). Dominion Road in Auckland was identified as a high-risk corridor for motorcyclists as previous research showed that in the five years since a special vehicle lane was added to the road, motorcyclists crashes had increased by 80% (Newcombe and Wilson, 2011).

Internationally, research has shown that when other vehicles are allowed to use special vehicle lanes, crash rates increase, particularly at intersections (Elvik, Vaa et al. 2009, Goh, Currie et al. 2013). Some studies suggest that vehicle speeds in the special vehicle lanes play a part, others that motorists are either not seeing oncoming motorcycles or misjudging the speed of the motorcyclist (Pai 2011, Lee and Sheppard 2017, York, Webster et al. 2008, York, Ball et al. 2010). Interestingly, a few studies have found that riding motorcycles closer to the kerb may make them more visible to motorists (Sager, Yanko et al. 2014). Overall, the research suggests that increasing the conspicuity of cyclists and motorcyclists, reducing speeds, and improving sight angles at unsignalised intersections could reduce crashes between motorcyclists, cyclists and turning vehicles (Sagberg and Sørensen 2012, Schepers, Kroeze et al. 2011, NZ Transport Agency 2013, Prati, Puchades et al. 2018).

The road controlling authority sought to trial on-road interventions at unsignalised intersections on Dominion Road to reduce the risk of a right turn against crash with cyclists and motorists in the special vehicle lane. The trial combined two countermeasures. These were yellow hatching painted on the intersection to improve sight lines, and turning driver warning signals to improve motorcyclist and cyclist conspicuity (Figure 1). Four treatment and four control intersections along Dominion Road, Auckland, were included in the trial.



Figure 1. On road hatching and driver warning sign installed at an intersection on Dominion Road

Project approach

The objectives of the trial were to understand:

- A. *Road user behaviour* the effect of the countermeasures on type, frequency, and context of encounters between vulnerable road users (VRUs) and other road users.
- B. *Environmental conditions for encounters* the effect of the countermeasures on the other conditions that are known to increase risk during encounters between VRUs and vehicles. These included speed of VRUs and the speed of other vehicles, and speed differential between the general vehicle lane and special vehicle lane, assessing road user compliance and non-compliance with hatching and considering the traffic conditions under which encounters are happening.
- C. *Evaluation of road-user's perceptions, understanding, and stated behavioural responses* Examining how conspicuous, legible, understandable, and credible the hatching + signs countermeasures are to road users.

Video data was collected and coded using a six-level scale between 'ordinary encounter' and 'collision' for the intervention and control intersections before treatment (baseline), after hatching was installed (hatching only) and after the active warning signs were installed (hatching + signs). Serious encounters included those that were 'close encounters' (no obvious action taken but evidence of discomfort or close proximity), 'avoidances' (noticeable change in speed or direction by either party), 'near misses' (rapid and evasive action) and collisions. Vehicle speed and volume data was also recorded separately for the general and special vehicle lanes at each intersection studied via pneumatic tubes for each project phase. Focus groups were used to gather road user perceptions, understanding, and likely behavioural responses to the countermeasures.

The intervention was installed in phases, allowing for hatching to first be evaluated alone, before the driver warning signs were added. For the purposes of the evaluation, all encounters between VRUs, including pedestrians, and vehicles at the trial intersections were recorded. Analysis of the number of encounters, their location, and environmental conditions was undertaken in PowerBI.

Results

Over 20,000 VRUs were observed passing through the study intersections throughout the project, and 7,000 encounters between VRUs and other road users were identified. The results show that the combined countermeasures have reduced the proportion of risky right turns in encounters.

When comparing the results from 'hatching only' to baseline (Figure 2), the hatching reduced queuing across intersections, but may have contributed to an increase in avoidance type encounters following the installation of hatching which seems counter-intuitive. It is important to note that while some of these encounters were serious, they did not result in near misses or collisions which could be due to the increased sight distance provided by hatching compliance. The analysis also showed that more risky encounters happen when general traffic is slowed, or queued (e.g., peak conditions). There was also a disproportionate effect at the north most intersection, possibly due to the recent introduction of a special vehicle lane at the location, and also, potential COVID related influences. The Hatching+ sign encounters show an increase on baseline at control sites, and a decrease on baseline at intervention sites (as shown in Figure 2).



Figure 2. Proportion of right turn in encounters which were serious at each project phase, separated by intervention and control

The speed of motorbikes and cyclists in the special vehicle lane, the speed differential between the general vehicle lane and the special vehicle lane, the amount of traffic in the general vehicle lane, and queued traffic across the intersection are all known to be environmental conditions which increase risk for right turn in crashes at unsignalised intersections. The speed of motorbikes and bicycles though the studied intersections were relatively high, which provides turning vehicles with limited time to react to a VRU travelling down the special vehicle lane. The speed differentials between the two lanes (special vehicle lane and general vehicle lane), was also high at times, indicating times where VRUs may be less visible to turning motorists. The analysis clearly shows that the installation of yellow hatching improves compliance with leaving intersections clear, and it appears that, when the hatching is blocked by vehicles not complying with the mitigation, more serious encounters are happening.

The focus group respondents showed good understanding of the meaning and appropriate responses of the yellow hatching, however they were less confident as to the specific meaning of the active warning signs, despite reporting of likely positive behavioural responses (i.e. pause, check, proceed). The analysis also showed participants felt the two countermeasures were more effective together.

Conclusions

While the behavioural effects were subtle, particularly within the context of relatively rare serious interactions, positive trends indicate that yellow hatching and bike warning signs show promise in reducing risky encounters between right turn against vehicles and cyclists and motorcyclists. In the future, it is recommended that, further elements of the countermeasures are considered to enhance performance, such as reliable in-ground studs or mechanisms to slow motorcyclists and cyclists approaching risky situations such as unsignalised intersections with queuing traffic.

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How to reduce pedestrian and pedal cyclist fatalities: Poland demonstrates

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Abstract

Australia's pedestrian and cyclist fatalities have remained fairly constant over the past decade. Pedestrian fatalities have averaged 158 deaths, ranging from a high of 182 in 2016 to 133 in 2021 and then 158 deaths in 2023. Cyclist fatalities have averaged 38 deaths ranging from a high of 50 in 2013 to 29 in 2016 and then 35 deaths in 2023. Any policy efforts to reduce driver aggressivity and speeds on roads frequented by pedestrians and cyclists has an immediate effect on fatalities. This presentation will describe how Poland was able to reduce pedestrian and cyclist fatalities by 30% and 36% respectively over the past three years, by introducing a law that gives pedestrians and cyclists priority at pedestrian crossings and intersections, by reducing the night urban speed limit from 60km/h to 50km/h, and by introducing strong enforcement with large penalties for traffic violations. Australia should consider learnings from this.

Post on X

Poland reduced pedestrian and cyclist fatalities by 30% and 36% respectively over the past three years, by giving pedestrians and cyclists priority along with strong enforcement with large traffic violation penalties and by reducing their 60km/h night urban speed limit to 50km/h. Australia should consider learnings from this.

Introduction

The targets set by Australia's Infrastructure and Transport Ministers in Australia's National Road Safety Strategy 2021-30 is "to reduce the annual number of fatalities by at least 50 per cent (an estimated reduction in the fatality rate per capita of 55 per cent) by 2030 and to reduce the annual number of serious injuries by at least 30 per cent (an estimated reduction in the serious injury rate per capita of 38 per cent) by 2030" (DITRDC, 2021). However, it appears that unless there are some serious road safety policy changes to show regulators a pathway forward to achieving this target, and determined political will to implement the proposed policy changes, it is unlikely these targets will be reached. This presentation aligns with the conference theme 'Target 2030: What's the pathway forward?' showing a potential pathway forward to reducing pedestrian and pedal cyclist fatalities and serious injuries.

There has been relatively little reduction in Australia's pedestrian and cyclist fatalities over the last 10 years. Figure 1 shows that deaths of vulnerable pedestrian and pedal cyclists have largely flat lined over the past decade (BITRE, 2023A, 2024). This is despite various road safety initiatives such as cycling and pedestrian infrastructure and reduced speed limits in urban areas (Corben, 2020).



Figure 1. Australian pedestrian and cyclist fatalities over the past decade (BITRE, 2023, 2024)

Poland on the other hand was one of the worst performers in terms of road safety compared to other European nations over many years, ranking last at 9.3 deaths per 100,000 population. In 2019 it still ranked 3rd last out of 27 European Union countries (EU) countries in terms of the highest numbers of fatalities (7.7) per 100,000 inhabitants. With COVID restrictions taking effect in 2020, road fatalities dropped. However, the Polish government noted that pedestrian fatalities were still very high representing 25% of all road fatalities (EU, 2020; IRTAD, 2021). Hence, the Polish government introduced new laws targeting specifically pedestrian safety as well as driver safety that took effect in June 2021, that appear to have had a dramatic effect helping Poland reduce its road fatalities. Poland's fatality rate per 100,000

population was 5.04 compared to Australia's 4.54 in 2022. This resulted in Poland winning the European Transport Safety's 2023 Road Safety Performance Index (PIN) Award to Poland for the first time (BITRE, 2023B). Poland has cut road deaths (all road users) by 47% between 2012 and 2022, where the EU average reduction was 22%. However, a significant proportion of those fatality reductions for all road users, around 35%, have been gained in the last four years. Poland's population in 2023 was around 41 million compared to Australia's 27 million.

This presentation will describe what fatality reduction counter measures Poland has recently adopted over the past few years and how it has resulted in a significant reduction of pedestrian and cyclist fatalities.

Method

Road fatality data for Australia and Poland was collected through on-line database access (BITRE, 2023A; BITRE 2024; ITS, 2024). Fatality data was analysed using an Excel spreadsheet. Information relating to Australia's and Poland's road laws and road safety policy was accessed via on-line government and grey literature sources.

Results

Figure 2 shows Poland's and Australia's pedestrian and cyclist fatalities per 100,000 populations compared over the last ten years. It should be noted that more than 70 percent of Poles used a bicycle for recreational riding in 2022. More than 40 percent of those surveyed used a bicycle as their daily mode of transportation regardless of the weather, and four in 10 Poles did amateur cycling (Statista, 2023). Australia's cycling participation (riding a bicycle for any purpose) was around 40% in 2021, where the majority of cycling participation was for recreation (82% of 40% \approx 33%) whereas 35% (of 40% \approx 14%) used a bicycle for transportation purposes, i.e. significantly less in terms of crash exposure (Munro, 2021).



Figure 2. Poland's and Australia's pedestrian and pedal cyclist fatalities per 100,000 population compared over the past decade (BITRE, 2023; BITRE, 2024; ITS, 2024)

The fall in fatalities in Poland in 2020 has been attributed to COVID lockdowns. The restrictions affected mobility volumes and patterns where traffic volumes decreased the most in April and May 2020 with most EU countries entering into a lockdown (ITF, 2021). Overall traffic volumes were -12.2% lower in 2020 than in the previous year resulting in an EU average of 19.2% reduction (ITF, 2021). Interestingly many people switched from public transport to bicycles to avoid the risk of infection associated with closed spaces in buses, trams, and trains (ITF, 2021). Hence the fall in fatalities was lower for cyclists than that for pedestrians in 2020. Nevertheless, Figure 2 clearly shows that the rate of decline in pedestrian and pedal cycling deaths is more rapid in Poland and around 19.3 and 4.4 times greater respectively compared to Australia.

	roland	Australia
Pedestrian	Pedestrians have priority regardless of whether	Pedestrians have priority regardless of
Zebra Crossings	they are waiting to cross or already on the	whether they are waiting to cross or already
	crossing. Prior to 2021 drivers were only required	on the crossing. (2014 – Reg 81). Penalty for
	to give way to pedestrians who had already	not giving way \$300 (WA), \$464 (NSW) &
	stepped onto the crossing forcing traffic to stop.	3 demerit points (WA & NSW). 4.5-7% of
	Penalty 327 EUR 1 st offence & 654 EUR 2 nd	average monthly salary (about 1-2 day's
	offence within 2 years & 3 penalty points. 19-	salary)
	38% of average monthly salary (4-8 day's salary)	
Urban Speed	50 km/h at all times of day and night. Before	Default urban speed limit 50 km/h (NT
Limits	2021 it was 60 km/h between 11 p.m. and 5 a.m.	60 km/h). Many sub-arterial urban roads are
		zoned 60 km/h
Alcohol BAC	BAC of 0.02 for all vehicle road users, including	BAC of 0.05 for all motorised vehicle road
limit	cyclist and other mobility devices. No laws for	users.
	pedestrians. BAC of 0.15% or anyone who causes	
	an accident with a BAC of 0.05% will have their	Vague rules for cyclists and no laws for
	vehicle ownership confiscated by the state.	pedestrians.
Mobile phone	Pedestrians fined if they use a mobile phones or	No law to stop pedestrians using their
use	other devices which may impair pedestrians'	phones when crossing.
	vision or other perception while crossing the road.	
Pathway	Significant investment in providing pedestrian	Austroads (2021) guidelines "Guide to Road
Segregation	and cyclist pathways & new design standards in	Design Part 6A: Paths for Walking and
	2021 for pedestrian and cyclist pathways.	Cycling". Investment for any new roads to
		include such pathways.
Pedestrian	2016-2021 Warsaw City conducted Road safety	Road Safety Audits now include assessing
Crossing Audits	audits with a focus on lighting (illumination)	pedestrian and cyclist paths and segregation.
and Upgrades	evaluation for 4500 pedestrian crossings.	

Table 1. Various individual measures taken that have influenced the reduction in pedestrian and cyclist safety

The new laws for pedestrian crossings and giving way to pedestrians at intersections along with increased fines was introduced in 2021. However, many Polish drivers were wary of pedestrian priority prior to this date and often give way to pedestrians as well as cyclists at such road intersections and pedestrian crossings. It is worth noting that Poland's pedestrian fatalities fell from 776 in 2019 to 446 in 2023 and cyclist fatalities fell from 290 in 2018 to 158 in 2023. These are significant reductions. However, Jamroz et al. (2022) indicate that further infrastructure work including safety audits, needs to be carried out along with the refinement of the Polish traffic laws protecting pedestrians still need to be made to further drive down these fatalities.

In Australia, the author recently called for the default speed limit in urban residential streets to be lowered from 50 km/h to 40 km/h (Grzebieta, et al, 2023). A number of permanent 40 km/h speed limits have been introduced throughout NSW and evaluated demonstrating significant casualty reductions (Fry et al, 2018). Moreover, Australia could follow Poland's lead and substantially increase fines related to any violations regarding speed violations and not giving pedestrians priority at crossings, equivalent to at least one to two weeks salary. Under the Australian road rules if the driver is turning left or right or making a U-turn, the driver must also give way to any pedestrian at or near the intersection who is crossing the road, or part of the road, the driver is entering. However, a driver is not required to give way to a pedestrian who is crossing the (e.g. minor) road that the driver is leaving. Changing the law so that pedestrians have priority over cars turning or travelling through intersections on residential streets and minor streets where give way or stop signs are present, would likely reduce fatalities. These changes to speed and pedestrian priority would likely have a casualty reducing effect for pedal cyclist safety.

Benefits to road safety

Poland has shown Australia a pathway forward to the 2030 road safety target. Providing increased priority to pedestrians in road laws, lowering speed limits, and increasing speeding infringement fines to significant amounts that changes driver behaviour not unlike what has transpired in Poland, pedestrian and cyclist safety would increase dramatically resulting in significant falls in fatalities and serious injuries.

Implications for policy and/or practice

By introducing a law that gives pedestrians and cyclists priority on Australia's roads, by reducing the residential night urban speed limit from 50km/h to 40km/h, and by introducing strong enforcement with very large penalties for traffic violations that include speed violations and not giving pedestrians and cyclists priority at crossings and intersections, pedestrian and cycling fatalities will reduce significantly. Unless such dramatic changes are introduced, Australia will have no hope of reaching its 2030 target, and pedestrian and cyclist fatality counts will continue to stall or increase.

Conclusions

Poland's changes to pedestrian priority road laws and major increase in speed violations fines monetary values, have resulted dramatic reductions in pedestrian and cyclist fatalities of the order of 30% and 36% respectively over the past three years. Given Australia reductions in pedestrian and cyclist fatalities have pretty much stalled over the past decade, it is maybe time Australian regulators consider some of the changes needed which Poland introduced, i.e. large increases in speed violation fine amounts, giving pedestrians and cyclists priority at minor street intersections with an arterial road and reductions in urban residential speed limits.

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Vision Zero for pedestrians. What's the pathway?

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Abstract

This paper explores Australia and New Zealand's road safety vision and 2030 targets from the perspective of pedestrian safety. Drawing on modelling and analyses for the Australian and New Zealand context, it examines whether we can get to zero for pedestrians, using know interventions, and if not, what pedestrian safety risks remain unaddressed and why? The paper considers challenges uncovered in addressing pedestrian safety, and provides direction on key areas where we need more to be done to keep people safe when walking.

Post on X

Vision Zero for pedestrians. Will we get there? Does how we get there matter? #PedestrianSafety #VisionZero

Introduction

Australia and New Zealand have both adopted a vision for road safety where no one is killed or seriously injured in road crashes, referred to as Vision Zero (Austroads, 2021). The *Australian National Road Safety Strategy 2021-2030* sets a target to reduce the annual number of fatalities by at least 50 per cent by 2030 and to reduce the annual number of serious injuries by at least 30 per cent by 2030 (Commonwealth of Australia, 2021). *Road to Zero, New Zealand's Road Safety Strategy 2020-2030* sets a target to reduce road deaths and serious injuries on our roads by 40 percent by 2030 (Waka Kotahi, 2021).

While neither strategy has set specific fatality and serious injury (FSI) targets for different modes of travel, this paper considers Vision Zero and the national 2030 targets from the perspective of walking in Australia and New Zealand,

Pedestrians make up a significant share of FSIs in Australia and New Zealand (see Table 1). Pedestrian trauma, on average, for the last 5 years or so, across Australia and New Zealand, has broadly stayed stable, or slightly declined. In the context of Vision Zero and the 2030 targets we would expect to reductions in pedestrian trauma over time. With a growing and ageing population, there is a risk that pedestrian trauma may grow.

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Pedestrian Trauma Measure	Australia	New Zealand	
Fatal Crashes: Pedestrians involved in X% of fatal crashes.	12.5%	10%	
Serious Injury Crashes: Pedestrians accounted for Y% of serious injury crashes.	6.7%	12%	
2021 Data: Pedestrian Deaths, and Death Rate per 1,000,000 population.	133, 9.4	25, 4.9	

Table 1. Australian and New Zealand Pedestrian Fatalities and Injuries (2018-2022)

This paper draws on work undertaken for the *Keeping People Safe When Walking* program. This work while unpublished at the time of writing the abstract will be published by ARSC 2024. Two other conference abstracts report on the programs findings in relation to i) improving pedestrian data, and ii) effective pedestrian safety interventions.

Method

Keeping People Safe When Walking: Data, Evidence and Interventions was delivered in two phases described below.

Phase I: Discovery: Scoping Exercise and Current State Analysis; Data Collation and Analysis; and Emerging Trends and High-Risk Cohorts Analysis. Phase II: Intervention Collection: Review of Pedestrian Safety Strategies and Interventions; Government Engagement and Action Research; Stakeholder Consultation and Strategy Identification; Workshop with Key Stakeholders; Geographic and Contextual Analysis for Interventions; and Emerging Issues and Global Trends Analysis

Addressing pedestrian trauma is considered through the Safe System approach and its interacting "pillars": safe roads, safe speeds, safe vehicles, and safe people. Our focus was on prevention of crashes involving pedestrians, and therefore the Safe System's fifth pillar, post-crash response, was not in scope for this work.

Results

Vision Zero Modelling and Forecasting

Vision Zero modelling and forecasting was utilised to understand the trend of pedestrian fatal and serious injuries in Australia and New Zealand and the effectiveness of a combined Safe System strategy to curb pedestrian trauma. A synthesis of the results is provided below.

The examination of pedestrian fatal and serious injuries (FSIs) in New Zealand and Australia shows significant trends over recent years. New Zealand's official figures from the Crash Analysis System (CAS) for the period between 2012 and 2022 report a varying number of pedestrian FSIs annually, peaking in 2017 with 39 fatalities and 284 serious injuries, translating into 323 FSIs. In contrast, 2022 saw a total of 273 FSIs, comprising 33 fatalities and 240 serious injuries. However, when accounting for under-reporting using a scaling factor of 2.51, the adjusted figure for 2022 rises to 635 FSIs.

Australia's pedestrian FSI data, in the absence of a centralised reporting system, relies on hospitalisations to gauge serious injuries. The number of pedestrian fatalities reported showed a decrease from 174 in 2012 to 162 in 2022. When hospitalisations are factored in to estimate serious injuries, the FSI figures for Australia in 2018 were 2,665 serious injuries combined with 178 fatalities, yielding an estimated 2,839 FSIs.

The combined FSI figures from both countries from 2012 to 2019 illustrate the overall pedestrian safety scenario in Australia and New Zealand. In 2012, Australia recorded 2,846 FSIs, while New Zealand, after adjusting for underreporting, had 668 FSIs, totalling 3,514 FSIs across Australia and New Zealand. By 2019, the combined FSI figure slightly reduced to 3,480. Looking ahead based on historical trends from 2012 to 2019, there is an anticipation of a slow rise in pedestrian FSIs. This trend assumes constant levels of infrastructure investment and no significant advancement in safe system pillars.

Scenarios of implementing different Safe System pillar interventions individually and in combination was used to forecast the potential impact on pedestrian FSIs. For instance, in New Zealand, where over 80% of roads do not meet safe system speed limits, the implementation of lower speed limits is programmed to reduce pedestrian crashes by approximately 12.5%. In terms of vehicle safety technology, technologies like pedestrian detection systems and emergency braking could offer a conservative estimate of a 25% reduction in pedestrian crashes.

In a combined intervention scenario with safe roads, safe speeds and safe vehicle interventions, there is a significant reduction of 73.5% in FSIs, decreasing from approximately 3400 in 2023 to about 900 in 2050.

Pedestrian Trauma Modelling

In-depth trauma modelling was utilised to look at the pedestrian safety problem from a different angle. By synthesising results from previous trauma modelling exercises in Victoria, New South Wales, and New Zealand, and adopting methodologies similar to Sweden's Target Management System, this approach allowed for a comprehensive analysis of systemic risks leading to pedestrian trauma, effective systemic interventions, and the evolution of systemic failures and interventions across different time periods.

The focus was on understanding the components within the Safe System pillars that contribute most to pedestrian serious trauma, recommending systemic interventions to address these risks, and analysing the temporal differences in systemic failures and interventions from now until 2050. This method provided insights into how close we can get to zero harm with current interventions and helped identify areas where additional innovative solutions are needed to eliminate all pedestrian harm.

Systemic Interventions to Prevent Trauma

- Combining infrastructure, speed management, and modern vehicle safety technology, are critical. However, they may not reduce pedestrian trauma to the same extent as car occupant trauma.
- Urban pedestrian trauma can be mitigated with traffic calming and Autonomous Emergency Braking (AEB) for pedestrians. Challenges persist in rural areas in high-speed road environments.
- Despite the availability of effective interventions, the primary issue is implementation. The transformation to a Safe System end state requires a concerted effort to apply these measures.

Temporal Differences in Systemic Failures and Interventions (Now-2030 vs. 2030-2050)

- Planned treatments in action plans of Victoria, New South Wales, and New Zealand are not anticipated to reduce pedestrian trauma proportionally to other road users.
- Residual pedestrian fatalities by 2030 are largely due to unimplemented available treatments. By 2050, remaining pedestrian trauma is expected due to the lack of planned interventions.
- One forecasting scenario indicates that pedestrian trauma could be reduced by more than 90% if there were no constraints on implementation.

Learning from Other Jurisdictions

Pedestrian safety is a critical concern worldwide, and some jurisdictions have been particularly successful in achieving zero pedestrian road deaths, most notably Norway and Switzerland. These jurisdictions provide crucial lessons and strategies that can be applied elsewhere to improve pedestrian safety and significantly reduce trauma.

The program undertook a case study analysis of a sample of global cities that have successfully reduced the number of pedestrian crashes, finding that they often implement a combination of strategies that prioritise pedestrian safety and create an environment that encourages walking as a safe and convenient mode of transportation. Reductions in pedestrian fatalities across these cities of 20% to 70% was reported.

Implications for policy and/or practice

We know that it's possible to make significant gains in pedestrian safety. Many other places globally have made significant gains, a few all the way to zero. Modelling and scenarios tell us that existing safe system interventions, i.e., safe roads, safe speeds, safe vehicles, and safe road users if implemented *without constraint* will get us a long way there. However, on our current plans we're unlikely to achieve either Australia and New Zealand's Vision Zero or 2030 2030 targets for pedestrians. We also know that there are challenging pedestrian safety issues that existing safe system interventions will do little to help. For these areas we don't yet know enough about the problem, or the solutions.

We also know that there are significant equity concerns regarding pedestrian trauma, in some locations indigenous pedestrian trauma is many orders of magnitude greater than non-indigenous pedestrian trauma, and the elderly are significantly over-represented and even more so when falls are considered (Berry et al., 2007; Gálvez-Pérez et al., 2021). There are also concerns that places with lower socioeconomic demographics may have a higher per capita share of pedestrian trauma, however further analysis is required to validate this and to explore any relationship between pedestrian trauma and availability of pedestrian infrastructure (including footpaths and crossing facilities), road speed environments, and public transport availability.

Furthermore, modelling (unpublished) for one Australian jurisdiction indicated that given the implementation of all road safety interventions in the pipeline, reductions in fatalities amongst the vulnerable road user groups (including pedestrians) are expected to be less compared to reductions in fatalities for vehicle occupants. Under this scenario, vulnerable road user fatalities are expected to increase over time as a share of all road user fatalities.

While Australia and New Zealand's road safety vision is necessarily concerned with achieving the greatest reduction in road trauma overall, how we get there matters as much as the destination. Should a principle of equity in safety outcomes also shape our road safety approach to ensure that all people are considered equally, regardless of the mode they travel by, their socioeconomic status, their age or abilities, their indigeneity, or where they live?

Conclusions

Given the striking finding that pedestrian trauma could be reduced by more than 90% if there were no constraints on implementation it is clear that a focus is needed on how to best strengthen institutions and practitioners focus on pedestrian safety and uptake of known interventions is critical.

Critical areas for the Keeping People Safe When Walking program to focus on next include:

- Next steps to close critical data gaps at the national and subnational level necessary for better pedestrian safety risk analysis, monitoring and evaluation of progress on pedestrian safety interventions and outcomes.
- What can be done to strengthen the system within which road and road safety practitioners operate, to progress changes to policy, planning, and investment to realise zero FSIs for pedestrians, including in the areas of guidance, risk analysis methodologies and best practice knowledge base.
- Strengthening the case for interventions that can make the greatest impact on pedestrian trauma for the greatest number of people in the quickest time particularly in the areas of Safer Speeds, and Safer Vehicles.
- Prioritising further research to address knowledge gaps critical to getting to Vision Zero for pedestrians.

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Crash prediction at rural crossroads: did we get it right?

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Abstract

In New Zealand, there were several recent fatal crashes at rural priority-controlled crossroads where a driver failed to observe a Stop or Give Way sign and travelled through the intersection at speed. This prompted the NZ Transport Agency Waka Kotahi to commission an analysis of all rural crossroads in New Zealand to identify those susceptible to this type of crash. A predictive risk model was developed and the risk of over 1,700 rural crossroads across New Zealand was assessed. The predictive model was validated by reviewing similar crashes that occurred in the two years *after* the model was developed. The model was found to be effective, with 95% of straight-through injury crashes occurring at 'High' or 'Medium-High' risk sites. The validation also showed that this type of crash often occurs at locations that have little (or no) prior history of this type of crash.

Post on X

Straight-through crashes at rural priority-controlled crossroads are relatively rare, but often catastrophic. A predictive risk model was developed for this type of crash was found to be highly effective at predicting where these types of crashes might occur in the future.

Background

There were several high-profile, high-severity crashes at rural priority-controlled crossroads in New Zealand in recent years. A common factor among these crashes was a driver failing to observe a Stop or Give Way sign and travelling through the intersection at speed. These crashes often result in multiple fatalities. In 2022, this prompted the NZ Transport Agency Waka Kotahi to review the safety of all rural priority crossroads in New Zealand, and to identify those that are particularly susceptible to this type of 'tunnel vision' crash.

A predictive risk model for rural crossroads

Most rural priority-controlled crossroads in New Zealand have low traffic volumes and straight-through 'tunnel vision' crashes are infrequent. This means that analysing crash data alone is insufficient for identifying potentially high-risk intersections. Instead, a proactive approach to identifying high-risk sites was developed. This involved creating a predictive risk model that considers the physical and operational attributes of each rural crossroad. The NZ Transport Agency also required this model to be implemented at scale, to assess all 1,700+ rural crossroads in New Zealand.

Developing the model

A literature review identified relevant intersection attributes which can cause drivers to overlook priority-controlled crossroads. Factors that also affected the likelihood and/or severity of a straight-through crash were also identified. These factors include the monotony of the road environment, traffic volumes, vehicle speeds, skew angle, horizontal alignment, and vertical alignment. A geospatial methodology was developed to code over 50 different variables for every rural priority-controlled crossroad in New Zealand. These were attributes that could be modelled or attached from existing datasets – making it possible to test multiple road and roadside variables, at scale across the country.

To investigate the relationship between the intersection attributes and crash risk, twenty years of crash data was extracted from the NZ Transport Agency's Crash Analysis System (CAS) and attached to each rural crossroad. The crash query was limited to crashes with a right-angle intersection movement type (code 'HA') with at least one cause code indicating a driver failed to give way or stop. Following crash attachment, it was found that of the 1,719 intersections analysed, only 459 (27%) had at least one of these types of crashes reported in the past 20 years. This reinforced the fact that these types are relatively rare – but when they do occur the consequences can be catastrophic.

A model for predicting crash risk was developed through exploratory statistical analysis and by testing several model forms. The result was a power model that predicts the number of crashes expected over 20 years. The average minor road traffic volume is the primary predictor variable in the model, which is modified by three additional (binary or categorical) explanatory variables:

- average major road traffic volume
- the length of straight road with priority before the intersection (on the minor leg), and
- the angle between the minor approaches.

The additional explanatory variables increase (or reduce) the baseline level of risk in the power model. For example, crash risk increases by 15% if the angle between the minor (side-road) approaches to the intersection is between 165°-180°, but crash risk reduces by about 28% for angles less than 140° degrees.

Application of the predictive risk assessment

The predictive model was applied to every rural crossroad in New Zealand. The crossroads were ranked on their predictive risk score and banded into five risk categories, ranging from 'Low' (bottom 20%) to 'High' risk (top 20%).

A spreadsheet list of risk-rated rural crossroads was provided to every road controlling authority (local council) in New Zealand, in early 2023. Guidance was also provided on suitable treatments for rural crossroads, including low-cost treatments for lower risk sites such as improved maintenance, signage, and line marking. Many councils have since used this list to inform their local roads safety investment programs.

The NZ Transport Agency is also currently updating the Traffic Control Devices Manual (NZ Transport Agency, 2008) to recommend the appropriate level of analysis and treatment of priority-controlled rural crossings, including clarifying where 'minimum' treatments may not be appropriate. This update is due to be published in the first half of 2024. The NZ Transport Agency is also looking at funding models to support local councils with intersection safety improvements.

Validating the predictive model – did we get it right?

The predictive model was developed in 2022 using crash data from 2002 to 2021. To test the predictive capability of the model, injury crashes at rural crossroads in 2022 and 2023 (*after the model was developed*) were reviewed to see how the model classified these sites.

Injury crashes at rural crossroads from January 2022 to December 2023 were exported from CAS using the same query used in the predictive model: a right-angle intersection movement type (HA) and a contributory cause code indicating a failure to give way or stop. The crossroad that each crash occurred at was then reviewed to determine:

- the proactive risk rating for the rural crossroad
- whether any similar crashes had occurred at the same crossroad in the preceding 20 years (2002-2021).

Care was taken to exclude a small number of recent crashes because they happened at newly constructed crossroads or at crossroad that have been upgraded to rural roundabouts.

A total of 134 injury crashes were reported in the two-year period from January 2022 to December 2023. Of these:

- 110 (82%) occurred at crossroads assessed as 'High' risk
- 18 (13%) occurred at crossroads assessed as 'Medium-High' risk
- 4 (3%) occurred at crossroads assessed as 'Medium' risk
- 1 (<1%) occurred at a crossroad assessed as 'Low Medium' risk
- 1 (<1%) occurred at a crossroad assessed as 'Low' risk.

The injury crashes reported in 2022 and 2023 included 8 fatal and 37 serious injury crashes (45 in total). These highseverity crashes were reviewed in more detail (see Table 1). This review demonstrates that most high-severity crashes occurred at 'High' risk rural crossroads (n=38). Considering those crossroads assessed as either 'Medium-High' or 'High' risk, there were:

- 8 (18%) high-severity crashes occurred at rural crossroads with no history of this type of casualty crash in the preceding 20 years.
- 16 (36%) high-severity crashes occurred at rural crossroads where ≤1 similar crashes were reported in the preceding 20 years.

Findings from the validation

The proactive risk model was validated by examining similar crashes that occurred *after* the model was developed. This showed that the model was effective at predicting future crash locations, with 95% of straight-through injury crashes occurring rural crossroads classified as either 'High' or 'Medium-High' risk. The validation also demonstrated that these types of crashes often occur at locations that have little (or no) history of this type of crash. This finding will give road engineers and managers confidence that treatments targeting high-risk rural crossroads are justified, even if the crash history (alone) doesn't indicate there is a problem.

Table 1. Detailed review of actual FSI 'straight-through' crashes at rural crossroads, 2022-2023

Rural crossroad (city/district)	Proactive risk rating	Observed FSI crashes	Observed (all) casualty crashes
Alexandra / Diagonal / Malaran (Matamata Biaka)	Uich	2022-2023	2002-2021
Anglahy Huy / Swamp / Partlatt (Tagman)	High	<u> </u>	3
Arlington / Wohurn / Ngahana (Control Howko's Pou)	High	1	3
Panlay / Graandala (Saluura)	High	1	4
Bealey / Oleendale (Selwyll)	High	1	1
Currache / Newtone (Selware)	High	1	1
Dirton Winton Hyur / Hundred Line Fact (Southland)	Tigli Uiah	1	0
Ellosmoro / Pohinsong (Soluum)	High	1	0
Enesmere / Koolinsons (Selwyn)	Tigli Uiah	1	2
Herberten / Dured (Weinscherfini)	High Ui-h	1	2
Harleston / Broad (waimakariri)	High	1	2
Holland / Marshmeadow / Telephone (Walkato)	High	1	14
Junction / Mangorei (New Plymouth)	High	1	3
Kairanga Bunnythorpe / Gillespies Line (Manawatu)	High	2	5
Kairanga Bunnythorpe / Roberts Line (Palmerston North)	High	l	10
Linwood / Charles / Laing (Auckland)	High	1	1
Longburn Rongotea / No 1 Line (Palmerston North)	High	1	13
Main / Wharerata / Awapuni (Gisborne)	High	1	4
Main South / Walkers / Dunns Crossing (Selwyn)	High	1	5
Mill North / Fairweather / Bainfield (Invercargill)	High	1	7
Moreton / Rutland (Carterton)	High	1	6
No 1 Line / Karere (Manawatū)	High	1	8
Old North / Old Railway (Auckland)	High	1	9
Oteramika / Mill South (Invercargill)	High	1	7
Rangitikei Line / Flygers Line (Palmerston North)	High	2	10
Riccarton West / Bush (Dunedin)	High	1	4
SH 27 / Horrell / No 4 (Matamata-Piako)	High	1	9
SH 30 / Macdonald / Western Drain (Whakatāne)	High	1	0
Shands / Hamptons (Selwyn)	High	1	6
Springs / Robinsons (Selwyn)	High	1	0
Springs / Tancreds (Selwyn)	High	1	0
Te Mata Mangateretere / Waimarama / River (Hastings)	High	1	2
Turuturu / Ohangai (South Taranaki)	High	1	1
Wakanui / Milton South (Ashburton)	High	1	1
Wards / Courtenay (Selwyn)	High	1	1
Winton Lorneville Hwy / Gap West / Gap East (Southland)	High	1	0
Dipton Winton Hwy / Campbell / Lady Barkly (Southland)	Medium High	1	0
Earl / Winchester Hanging Rock (Timaru)	Medium High	1	1
Great South / Pitt (Auckland)	Medium High	1	2
Hill / Masters / Aka Aka Church (Waikato)	Medium High	1	1
Lake / Dawson (Waikato)	Medium High	1	9
School North / Hazlett (Dunedin)	Medium High	1	0
Tinwald Westerfield Mayfiel /Maronan Valetta (Ashburton)	Medium	1	1

Benefits to road safety

This project demonstrates the benefit of a proactive approach to assessing the risk of straight-through crashes at rural crossroads. It shows that relying solely on crash data to identifying high risk sites for this type of crash is flawed, as many high severity straight-through crashes occur at intersections with little, if any, prior history of this type of crash. Although this project was developed in New Zealand, the predictive model can readily be adopted and applied in the Australasian context, especially in jurisdictions with large, relatively low-volume rural road networks.

Reference

NZ Transport Agency (2021). *Traffic Control Devices Manual (TCD Manual)*, <u>https://www.nzta.govt.nz/resources/traffic-control-devices-manual/</u>

Safety of school bus journeys in New Zealand

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Abstract

Buses are the safest form of transport to and from school; however, travelling on a school bus is not entirely without risk. This project involved an extensive review of the state of school bus safety in New Zealand to identify interventions that could enhance the safety of students and bus drivers in and around school buses. The research was undertaken in 2022 and involved reviewing New Zealand and international literature, guidance, policy, and legislation; engaging with stakeholders from a range of government, private sector, and advocacy organisations; and technical analyses to quantify the risks around school bus travel. The research applied a Safe System lens to identify interventions that could improve school bus safety, from route planning to vehicle safety technologies and driver management. The primary recommendation was that a working group be formed to investigate these interventions further and assign responsibilities for implementing safety improvements.

Post on X

School buses are the safest form of transport to school; but travelling on school buses is not entirely without risk. This project reviewed the state of school bus safety in New Zealand and identified how we can make school bus travel safer for bus drivers and students.

Background

The safety of school buses in New Zealand was last examined in Baas et al. in 2010 (NZ Transport Agency research report 408). However recently there was renewed interest in school bus safety, including a call for seatbelts on school buses and changes to the requirements for standing and seating on school buses. This prompted the NZ Transport Agency to undertake a fresh review of school bus safety, considering current evidence and broader safety interventions being implemented under Road to Zero: New Zealand's Road Safety Strategy 2020–2030 (Ministry of Transport, 2019).

Project description

The objectives of this research were:

- to understand current best practice nationally and internationally, including interventions that have been tested
- to assess the operating conditions for school buses and the vehicle fleet used for delivering school bus services
- to review current legislation, guidance, policy, and practices that impact on the safety of school bus travel
- to make recommendations on measures to improve the safety of people travelling on school buses.

The scope of the research covered school bus services funded by the Ministry of Education or contracted by regional councils as part of their public transport contracts. This included daily bus and technology bus services.

Method

The research was undertaken during 2022 and involved:

- 1. undertaking a literature review and engaging with relevant stakeholders to examine school bus safety guidance, research, policy, and practice in New Zealand, and in comparable countries
- 2. undertaking technical analyses to quantify and qualify the safety of school buses, including identifying the types of road environments that school buses travel on
- 3. identifying a range of potential interventions for addressing identified safety risks.

The review of literature, guidance, policy, and practice was extensive. A 'whole of system' lens was applied to all aspects of school bus travel, including:

- route design
- bus stop site selection and assessment
- school bus signage and visibility, and speed limits around buses
- vehicle selection and vehicle safety technologies
- occupant protection including compartmentalisation, seatbelts and standing on buses
- driver management and training
- education and behaviour management
- crash and incident reporting.

The researchers met with or held workshops with a range of representatives from the Ministry of Education, NZ Transport Agency, Ministry of Transport, NZ Police, regional councils, advocacy groups, industry bodies and several school bus operators. These representatives included policy analysts and advisors, commercial vehicle safety experts, route planners, contract managers, fleet managers, school travel advocates and health and safety managers.

The technical analysis stage involved using available data to:

- 1. Quantify the different types of school bus services operating across New Zealand, including the number of trips and equivalent kilometres travelled on council services and Ministry of Education funded services.
- 2. Undertake a review of crash reports from the Crash Analysis System (CAS) and incident reports collated by the Ministry of Education (for the period 2010 to 2021). Patterns and trends in the number of and severity of injuries arising school bus travel were examined in detail.
- 3. Assess the operating conditions of bus routes by analysing the relative risk of school bus routes in different road environments including urban roads, high volume rural roads, and rural roads with 'extreme' operating conditions due to weather, alignment, and roadside hazards (for example, as mapped in Figure 1).



Figure 1. Ministry of Education daily bus routes in the Wellington Region, by risk classification

Finally, the findings from across the research process were collated to identify and categorise a suite of interventions with potential to improve school bus safety in New Zealand.

Findings

Every school day about 10% of school-aged children in New Zealand travel to school on a dedicated school bus service. About 83% of daily school bus services are funded or contracted by the Ministry of Education representing 92% of all school bus travel by passenger kilometres travelled. About 84% of the Ministry of Education's daily bus services (by length) operate on rural roads, whereas most services run by regional councils operate on urban roads (88%, by length).

The review of crashes and incident reports found that bus drivers and passengers were most likely to be injured while travelling on the bus (24.7 injuries per year), with approximately 38% of these injuries caused by non-collision events such as harsh braking. However, the highest rate of death and serious injury to road users occurred around the pick-up and drop-off of students (3.0 deaths or serious injuries per year). Most (75%) of these deaths and serious injuries were pedestrians being struck by other vehicles while crossing the road to or from the bus.

When examining the crash risk (for all road users) on the roads that school buses operate on, it was found that run-off and head-on road crash rates are higher on typical rural routes compared to typical urban routes. The crash rate (per road user) was highest on rural undivided roads with extreme operating conditions: a 'high' infrastructure risk rating, tortuous alignment or where adverse weather and road conditions may be encountered. A range of potential interventions were identified to improve school bus safety. These were grouped into ten focus areas:

- 1. school bus route design
- 2. speed and infrastructure (on roads where school buses operate)
- 3. selection, design, visibility, and operation of pick-up/drop-off locations
- 4. conspicuity of school buses, visibility of school bus routes and speeds around stationary buses
- 5. school bus vehicle safety technologies
- 6. bus occupant protection
- 7. bus driver management
- 8. education and behaviour management
- 9. eligibility for school bus transport from a safety perspective
- 10. data collection, reporting and sharing.

Examples of key interventions across different focus areas include:

- Updating guidance for siting school bus stops to better align with Safe System principles, and to better manage the highest risk activity: children crossing the road to/from the bus.
- Improving signage for school buses to better communicate both the speed limit passing the bus, and when the speed limit applies.
- Investigating options to mandate or incentivise the uptake of vehicle safety technologies in the school bus fleet.
- Progressively prioritising and adopting Australian Design Rules (ADRs) for heavy buses used as school buses: ADR 68/00 for occupant protection (three-point seatbelts for all occupants) and ADR 66/00 (seat strength, seat anchorage strength and padding).
- Developing a national consistent safety education program for school bus users.
- Reviewing eligibility criteria for school bus transport through a safety perspective, with an aim of updating criteria to reduce the distance children must travel on high-risk roads to get to a school or a school bus stop.

A key discovery was uncovering the multitude of groups and individuals that influence school bus safety in some way, including several government departments and agencies, local and regional councils, bus operators, schools, and parents. Because there is no single body with oversight of all areas of school bus operation, gaps formed where responsibilities are unclear – for example, who is responsible for educating students on bus safety. There are also limited opportunities for collaboration across the sector – for example, sharing information on school bus safety trends between the Ministry of Education, bus operators and councils operating school bus services. Finally, because school buses are the safest mode of transport to school, this can result in little motivation among the organisations involved to prioritise interventions that specifically improve school bus safety.

Recommendation

The primary recommendation was that a school bus safety working group should be formed to review the findings of the research, consider how the identified interventions should be progressed, and to assign responsibility for the investigation and delivery of them. There is a precedent for this type of approach to improving bus safety, including the working group that formed the Alpine Code of Practice (for buses) in New Zealand, and the School Bus Safety Community Advisory Committee in New South Wales.

Benefits to road safety

This project applied a Safe System lens to school bus travel to identify the hazards and risk to students and school bus drivers, from the front gate to the school gate. The research draws on examples and literature from New Zealand, Australia, and other comparable countries to identify best practices, as well as gaps in legislation, policy and practice that need to be addressed. While the technical analyses and policy review are unique to the New Zealand environment, many of the learnings and findings are relevant to Australian government bodies and agencies that fund, provide, or otherwise influence the safety of school bus journeys.

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Changing dangerous behaviours through highly targeted digital communication

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Abstract

Persuasive communication has an important role to play in changing road user behaviour and reducing road fatalities by 2030; providing important road safety information, educating road users and helping reduce dangerous behaviours. However, to be effective this communication must reach and resonate with the high-risk road users it's aimed to target. Queensland's Department of Transport and Main Roads' road safety education and engagement program, StreetSmarts, has evolved its digital communication strategy to reach specific at-risk road user groups by using niche digital channels such as Reddit and Twitch, and working with social media influencers whose followers fall into specific high-risk categories to provide road safety messaging directly to their audience. This communication is reinforced through programmatic audio ads on platforms (e.g., Spotify), designed to reach drivers 'in the moment', with targeted messages automatically customised for listeners according to date, time of day, weather conditions and their geographic location.

Post on X

The Queensland Government's road safety education program, StreetSmarts, is successfully using a range of niche digital communication channels to reach specific at-risk road user groups with the aim of changing their risky behaviours and reducing road fatalities.

Introduction

Road safety education is one element of the Queensland Government's Road Safety Strategy which aims to reduce the number of lives lost on the road by 50 per cent and serious injuries by 30 per cent by 2031. Communication and education is part of a holistic integrated approach to reducing road trauma that forms the Safe System. The effectiveness of advertising and communication in road safey is well documented, reducing the number of road incidents by up 9% (Traffic Injury Research Foundation, 2015).

Project Description

The Queensland Government's StreetSmarts Road Safety Education initiative was established in 2018 as an evolution of the 'Join the Drive to Save Lives' program. The aim was to broaden the scope of road safety education with a particular emphasis on new digital communication channels to put road safety at the forefront of people's minds every time they use the road.

The digital always-on program was therefore established as a key element of the StreetSmarts communications initiative, combining a range of digital channels to provide year-round road safety messaging specifically targeting vulnerable road user groups, particularly young Queenslanders aged 17-24. Previously, StreetSmarts had been particularly successful in reaching young people through social media channels such as TikTok and Snapchat (Harrison & Bishop, 2024). However, Queensland has experienced consecutive years of an unacceptably high road toll; 2022 saw 297 lives lost on Queensland Roads while 278 lives were lost in 2023 with a further 8,000 people hospitalised because of serious road crashes. To address this, StreetSmarts digital channels have evolved to provide more targeted communication to reach specific at-risk and vulnerable road users and drive positive behaviour change.



Figure 1. Road Safety Personas

Source: Footprints Research 2020, Road Safety Personas (reproduced with permission)

Extended Abstract (Practitioner)

For the past five years StreetSmarts' digital always on program has used a range of popular social media platforms such as Facebook, X (Twitter), Instagram, TikTok, and YouTube to reach vulnerable road users. Through organic and boosted posts (social media paid adverts) its road safety messages reach between 1 and 2 million road users every month. However, the challenge was to reach specific at-risk groups such as young males aged 17-24, bike riders, and specific categories of drivers and motorbike riders, particularly those classed as 'fast and furious' (a group chiefly made up of males under the age of 40 who enjoy driving and motorbike riding and like to do it fast – see Figure 1 on Previous Page) and 'Concerned Multi-taskers' (a group overrepresented by females under the age of 55 with kids who have a tendency to be in a hurry, and are often stressed and distracted while driving see Figure 1) (Footprints Research, 2020). The aim was to reach these groups with very specific messaging to change their dangerous behaviours.

Approach and Results

To effectively reach young males two new niche social media channels were introduced to the always on social media mix, Twitch and Reddit, while more posts were developed specifically for existing channels popular with young males including Snapchat, TikTok and Instagram Reels. The strategy for these social media channels, particularly Twitch and Reddit, is to create posts and adverts which are 'native' to each specific platform, so they look and feel as if they belong seamlessly on the channel.

Twitch is an American video live streaming service which specialises in video game live streaming with high reach across a younger demographic of gamers. Fifty one percent of Australia's online population (25.8M) are gamers (13.1M). More than a third (35.85%) of Twitch users fall into the 18 to 24 age bracket, while its regular users are heavily skewed toward young males (78.36%) (Essence Mediacom, n.d.). StreetSmarts is reaching this vulnerable road user group through targeted 15 second pre rolls (un-skippable video advertisements that automatically play directly before a featured video) with customised creative to look and feel as if they are part of the Twitch platform.

In December 2023, StreetSmarts reinforced its presence on Twitch by taking over the Queensland site for a day to underline the dangers of speeding during the holiday season. This featured exclusive 'Just one Life IRL (In Real Life)' banner ads on the Twitch home screen supported by a specific pre roll video, created especially for the channel. This video featured Twitch influencer TJ Birrd playing a driving video game, speeding and crashing which filters through to real life, communicating that even though in games you have multiple lives, you only have one in real life. This specific Twitch Initiative delivered strong results and outperformed benchmarks, delivering 119,955 impressions (six times above expectation) and generating 664 clicks to the StreetSmarts web site. The video ad also performed above expectation achieving 400,000 impressions as at the end of January and a CTR (Click Through Rate) of 0.27%, above the 0.05% benchmark with a completion rate of 85.13% (Essence Media, 2024). Using Twitch has enabled StreetSmarts to engage vulnerable young male drivers who are notoriously hard to reach in an environment where they're spending a large portion of screen time (Essence Medicon, n.d.).

Alongside Twitch, StreetSmarts also started strategically placing ads including memes on Reddit to reach a range of high-risk road users. With over 70 million active users worldwide, Reddit is a very specific social media platform designed for group conversations and discussions and encouraging interaction from highly engaged audiences. By promoting relevant road safety content on Reddit, StreetSmarts has been able to generate conversations about high-risk road safety issues among micro communities at minimal cost. StreetSmarts has recorded over 4 million impressions, exceeding the benchmark for reach by 16%. Significantly, Reddit ads have delivered very strong engagement results generating traffic to the StreetSmarts website and recording a \$0.4 CPC (cost per website link click). Topics which have created particularly productive conversations on Reddit have included vehicle modifications, safe sand driving, motor bike safety, bike rider safety, towing and four-wheel driving. For example, a StreetSmarts post on Redditt about how to safely pack your vehicle for a road trip generated 27,737 video views at a cost of just 2c per completed video view (Essence Mediacom, 2024).

The use of Twitch and Redditt has been complemented by the engagement of social media influencers to amplify key road safety messages to their followers and fan base; many people, particularly young people aged 17-24 are more likely to trust social media and social media influencers than government organisations (BBC, n.d.).

A high profile 'Hero' influencer was engaged to reach all Queensland road users while three 'Micro' influencers were engaged to target specific at-risk groups. Queensland Maroons State of Origin coach and Rugby League legend Billy Slater was engaged in early 2024 as StreetSmarts 'Hero' influencer to reach all Queenslanders, particularly the high-risk male audience (Billy Slater has close to 900k followers across Facebook, Instagram and X. Seventy one percent of his followers are aged 17-44 and 62.4% of his followers are male (SFX, 2024). A video about road safety and lives lost on Queensland roads has been produced supported by specific video messaging on each of the fatal five dangerous driving behaviours. These videos, positioning Billy Slater in the role of road safety coach for Queensland, will be promoted on Facebook and Instagram throughout the year, launching in May prior to the 2024 State of Origin Rugby League series (results will be available by August 2024).

Three 'Micro' influencers have also been engaged to reach at-risk road user groups, 'concerned multi-taskers' (busy mums), young Queenslanders aged 17-24 and bicycle riders. The first posts from these micro influencers went live in February 2024 and these posts will continue throughout the year. Initial results have been very encouraging, generating positive engagement from target groups, with the first mum influencer's Instagram post on distractions generating 868 likes, 40 comments and 120 shares (full results will be available by August 2024).

Influencers were carefully chosen to minimise risk and maximise the reach within target at-risk groups. Careful vetting selected influencers with no previous road safety issues while the size and demographic makeup of their followers was assessed to maximise the effectiveness with the target audience. For example, the young person influencer, Jon Wyeth, was chosen not only for the fact that more than half of his 108, 400 TikTok followers are aged 17-24, but also that he has a high number (54%) of male followers (Goat Media, n.d.). The influencer's posts are currently in production and will specifically highlight the danger of speed to his followers.

The third element of the evolution of StreetSmarts' digital strategy was an expansion of programmatic audio messaging on Spotify and iHeart Radio. With programmatic audio, specific road safety messages are crafted to reach drivers 'in the moment', with targeted audio adverts automatically customised by the audio platform for the listener. It was first used by StreetSmarts in 2023 as a test and learn pilot program. This proved particularly successful exceeding the pilot's listener target by 13% and listen through rate by 17.7% with a high level of engagement indicating the dynamic elements of the messaging provided greater attention and recall of the messages (Essence Media, 2024).

In 2024, StreetSmarts expanded the customisable elements of programmatic audio to present listeners with targeted messages according to date, time of day, weather conditions and location. Road safety ads are served 'in car' to drivers asking them to look out for pedestrians, bike riders, heavy vehicles, motorcycles and school children when driving through school zones. Ads are also served 'out of car' targeting people specifically with pedestrian safety messages. There are future plans to match messaging to specific high crash zones on major roads and to complement StreetSmarts outdoor billboard advertising. The new programmatic audio messages were launched in December 2023 and results will be available in the next three months.

Evaluation and Effectiveness

To evaluate the success of its digital strategy, Streetsmarts uses an external market research agency to conduct quarterly face-to-face focus groups and online research with a sample of over 1000 Queensland drivers aged 17-65 years. The new digital strategies employed by StreetSmarts are already having a positive effect on behaviour change with the latest market research showing that 47% of respondents recall at least one Streetsmarts message. Recall rises to 66% for 17–24-year-olds while 66% (Footprints Market Research, 2023) of all respondents who had seen or heard StreetSmarts messaging stated that the messages made them re-think their dangerous driving behaviour.

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The path forward for better interventions to reduce drug driving

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Abstract

There are growing concerns regarding the role of drug driving in road crashes in Australia. Currently, the primary emphasis lies on law enforcement as the predominant countermeasure to deter drug driving, while identifying the contributing factors has received less attention. Our research studies have provided a better understanding of drug driving by demonstrating that: a) there is a need to treat the problematic use of drugs, being a major contributing factor to engaging in drug driving, through health-based programs, b) better access to public transport is a prudent approach towards reducing the instrumental rewards anticipated from drug driving, c) changes to current policing practices and drug driving laws may be required to enhance the effectiveness of drug driving enforcement. The findings suggest that applying a multidisciplinary approach that includes law enforcement, healthcare professionals, government agencies and the wider community may achieve a sustainable reduction in drug driving.

Post on X

The risks of drug driving to road safety can be mitigated by applying a multidisciplinary approach involving law enforcement, healthcare professionals, government agencies and the wider community.

Introduction

Drug use is a major risk factor for road safety, especially when combined with alcohol (Di Ciano et al., 2023). In Australia, an increasing trend in drug driving-related crashes and associated fatalities has been observed (Baldock & Lindsay, 2020; Davey et al., 2020). Deterring this behaviour has been prioritised through enforcement-based strategies, particularly the operation of Roadside Drug Testing (RDT). Through this countermeasure, police can randomly stop any driver to conduct a saliva test that checks for the presence of certain drugs. Drivers who test positive for any of the drugs tested are subject to penalties, such as disqualification from driving, imprisonment or fines. However, a question mark remains as to whether this approach alone is effective in reducing drug driving. Furthermore, while previous research well documents contributing factors to engaging in drink driving, much less is known about those that contribute to drug driving. Therefore, it is of great interest to understand the nature of drug driving and the factors influencing it, so that existing countermeasures can be improved, and new approaches be proposed.

This paper aims to report on a series of studies conducted in Australia that demonstrate the need to adopt additional strategies to reduce drug driving alongside existing enforcement-based strategies (Hasan et al., 2023a, 2023b). Identifying and implementing such strategies should be based on a better understanding of the key factors contributing to the behaviour.

Method

Participants from Queensland, New South Wales, and Victoria completed an online survey in which they self-reported whether they had driven after taking any drugs in the past three months. Participants also self-reported their intention to drive within an hour of taking drugs in the next three months. Since drivers' level of substance dependence influences drug driving, the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST, version 3.1) was used to identify problematic substance use (Humeniuk et al., 2010).

To operationalise the legal and psychosocial variables contributing to drug driving, this research utilised a theoretical framework combining Deterrence Theory and Akers' Social Learning Theory (SLT). Deterrence Theory posits that individuals are deterred from engaging in illegal activities if they fear the consequences of the act, and that these consequences are perceived to be certain, severe, and swift (Homel, 1988). The theory has been extended to include the concept of experiencing or avoiding punishment, either personally or by knowing others who have done so (Stafford & Warr, 1993).

Akers' Social Learning Theory (SLT) assumes that the decision-making process to engage in illegal behaviour represents a balancing act between anticipated social and non-social rewards or punishments, (Akers, 1990). For instance, these include anticipated instrumental rewards (i.e., anticipating that it would be easier to drug drive than to make alternative plans), anticipated non-social rewards (i.e., feeling more relaxed when drug driving), anticipated instrumental punishments (i.e., fear of losing the driver's licence), and anticipated non-social punishments (i.e., feeling

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guilty if drug driving). The theory also covers how attitudes act as an orientation towards particular behaviours (i.e., believing that it is okay to drug drive).

Furthermore, this research utilised the concept of procedural justice, which focuses on individuals' perceptions of how fairly they are treated by authorities such as the police, to predict future drug driving intentions (Murphy et al., 2014). The perceived legitimacy of the police and related laws were also investigated as they have been shown to influence perceptions of procedural justice. Police legitimacy is when people trust and comply with police decisions. The legitimacy of laws is when people view the laws enforced through police operations as fair and appropriately implemented. Decision tree analysis and regression-based techniques were used to analyse the data by using the IBM Statistical Package for the Social Sciences (SPSS, Version 29).

Results

Table 1 shows the factors that were significantly associated with self-reported drug driving and intentions to drug drive in the future. Participants aged 25 years or younger were more likely to report drug driving, while male drivers showed stronger intentions to drive under the influence of drugs in the future. Furthermore, those with problematic drug use were more likely to self-report drug driving. Most drug driving was reported after problematic use of cannabis, and of the drugs listed in the survey, cannabis was the most common drug of problematic use. The majority of participants with problematic drug use indicated being residents of Queensland (52%), followed by New South Wales (28%) and Victoria (20%).

Among the enforcement-related variables, the experience of being tested at RDT was positively associated with intentions to drug drive. In other words, those who had been tested for drugs in the past reported stronger intentions to do so in the future. However, this relationship may not necessarily be causal in nature, but just reflect the tendency for drug drivers to drive at times and places when RDT is more likely to be undertaken. Direct (personal) experience of detection avoidance was also significantly associated with self-reported drug driving, with those who regularly drove after taking drugs without being caught being more likely to report drug driving in the last three months. This suggests that successful evasion might encourage more frequent drug driving and implies that the effectiveness of enforcement is undermined by drivers applying strategies to evade detection and thus avoid punishment. Indeed, the results indicated that drug driving was associated with the frequency of remaining watchful for police vehicles as a strategy to avoid being detected.

Among the psychosocial factors, attitudes were a significant predictor of engaging in drug driving, with participants who agreed that nothing was wrong with drug driving being more likely to engage in this behaviour. Akers' SLT explains that the social environment plays a vital role in shaping favourable personal attitudes toward a particular behaviour and, therefore, encouraging more frequent engagement with that behaviour. Similarly, anticipated instrumental rewards were another significant psychosocial factor, with those who considered drug driving more convenient than using other forms of transport being more likely to engage in this behaviour. Limited access to alternative transport options prompted drivers to choose the more readily accessible option of drug driving.

A positive association was found between intentions to drug drive, police legitimacy, and the legitimacy of drug driving laws, with individuals reporting lower perceptions of the legitimacy of police and related laws exhibiting stronger intentions to drug drive. Controversies over the appropriateness of drug driving laws, such as *zero-tolerance* laws prohibiting any amount of illicit drugs in the system that can be detected by RDT, may have a negative influence on the perceived legitimacy of the police and encourage more drug driving. Procedural justice did not emerge as a significant predictor of intentions to drug drive, but mediation analysis identified that the two legitimacy items fully mediated the relationship between procedural justice and these intentions.

Variable	Self-reported Drug Driving	Intentions to Drug Drive
Aged 25 or younger	✓	
Being a male driver		\checkmark
Holding provisional or probationary licence	✓	
Drug dependence	✓	\checkmark
Being tested for drugs by RDT		\checkmark
Direct experience of punishment/detection avoidance	✓	
Remaining watchful for police vehicles	✓	
Favourable attitudes to drug driving	✓	
Anticipated instrumental rewards from drug driving	✓	
Low perceptions of legitimacy of police		\checkmark
Low perceptions of legitimacy of laws		\checkmark

Table 1. Factors significantly associated with self-reported drug driving and intentions to drug drive *

* All reported associations were positive in nature

Implications for policy and/or practice

The series of studies reported in this paper highlights some important implications for road safety. Given the significant association between problematic drug use and drug driving, greater attention should be paid to health-based approaches, as they are more suitable for addressing drug addiction than sanctions. There is a compelling need for rehabilitation programs that are tailored to the characteristics of drug drivers who struggle with addiction.

The findings showed that the convenience of driving after taking drugs compared with using less convenient modes of transport was a motivation for drivers to engage in drug driving. Coordinating road safety strategies with better public transport, through increasing the frequency and reducing the costs of using buses or taxis at night in entertainment precincts where drug taking is more common, could minimise the anticipated rewards of driving home.

The findings suggest that police enforcement should be as unavoidable as possible to reduce drug drivers' experience of avoiding detection. This can be achieved by increasing the visibility of RDTs while maintaining unpredictability in time and location. Furthermore, authorities need to consider changes to the laws targeting drug driving that will positively impact people's perceptions of legitimacy. Public education is one approach that can help bring a better understanding of the risks associated with engaging in this behaviour and reinforce that drug driving is socially undesirable.

Conclusions

Problematic drug use among drivers highlights the need to treat the problem of drug driving through health-based programs rather than solely relying on enforcement-based measures. This should be accompanied by approaches aimed at reducing psychosocial rewards for drug driving, such as more convenient and economical alternative transport options. Coupling this with public education about the purpose of police practices and related laws, with changes to current policing practices and drug driving laws may be required to reduce the incidence of drug driving and associated injuries and fatalities. To achieve all of these strategies, a multidisciplinary approach is required that includes law enforcement, healthcare professionals, government agencies and the wider community.

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Footpath interactions between delivery and non-delivery bicyclists and pedestrians

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Abstract

The urban traffic mix has changed with the proliferation of food delivery riders. When cyclists do not feel safe on the road, they often choose the footpath although this increases the risk of crashes and near-misses with pedestrians. Pedestrians often feel unsafe when sharing footpaths with cyclists, despite the low objective risk of collision. An observational study conducted in Brisbane identified that more than half of the bicycle riders observed in busy urban restaurant precincts rode on the footpath. Delivery riders rode on the footpath more often than non-delivery cyclists but behaved similarly towards pedestrians. Very few riders opted to use their bell or call out when passing pedestrians. A better understanding of how pedestrians respond to audible warnings is needed to guide policy responses such as mandating warnings or educational campaigns.

Post on X

Delivery riders rode on the footpath more often than non-delivery cyclists but behaved similarly towards pedestrians.

Introduction

When cyclists do not feel safe sharing the road with vehicles, they often choose to ride on the footpath (which is legal except in NSW and Victoria), increasing the risk of crashes and near-misses with pedestrians. Collisions between cyclists and pedestrians on shared infrastructure are rare but can have significant consequences (Tuckel et al., 2014) and the risk of a pedestrian-bicycle collision is of concern to both pedestrians and cyclists (Gkekas et al., 2020). Pedestrians' risk of injury is far greater than cyclists in cyclist-pedestrian collisions (Chong et al., 2010; Short et al., 2007). Of all cyclist collisions, approximately 5-6 percent involve pedestrians (DeRome et al., 2014; Poulos et al., 2015). However, previous research may not accurately reflect the number of cyclist-pedestrian collisions that occur because cyclist-pedestrian collisions are severely under-reported to the police and transport safety research on generally uses data collected from hospitals, medical clinics and police records that are biased towards collisions with serious outcomes (Poulos et al., 2015).

Bicycles are required to be fitted with a device to warn pedestrians. In Queensland, the requirement is for a "working bell, horn or similar warning device". To the authors' knowledge, there is no legal requirement to use the warning device, although it is generally recommended when passing pedestrians (Hatfield & Prabhakharan, 2016). A Queensland survey (Foster et al., 2018), reported that cyclists were more likely to ring their bell (or use their horn) than to call out when passing an "average" pedestrian, but the type of pedestrian influenced which warning behaviour they would adopt. For example, they were less likely to call out if the pedestrian was wearing headphones, and more likely to provide no warning at all when passing skateboarders or rollerbladers. Little research examined pedestrian responses to bell-ringing, with only anecdotal reports of unpredictable behaviours, or calling out by pedestrians. In the past five years, the gig economy workforce has changed the transport mix, particularly with the growth of bicycle riders working as food delivery riders (Lachapelle et al., 2021). There is concern that the time pressures for deliveries may result in delivery riders travelling faster than other riders, including when they are on the footpath in the vicinity of pedestrians. To understand these interactions in greater detail, and to explore differences in behaviours between non-delivery and delivery riders, an observational study was conducted during June 2021 in Brisbane.

Methods

Data collection

Bicycle rider behaviour was observed at five signalized intersections across urban Brisbane (South Brisbane, West End, Newstead, New Farm and Central Brisbane) between 11am-2pm and 5-9 pm on 8 to 17 June 2021 to capture both lunch and dinner delivery times. Precise sites have not been reported to protect the identity of delivery riders at nearby food outlets. There was a painted bicycle lane at one site and a protected bicycle lane at another site. At sites with low rider counts, one observer recorded rider behaviours, while at high volume sites two observers recorded separate riders. Observers recorded the type of bicycle, helmet use, location (footpath or road), rider gender, use of mobile phones, clothing, lights, and if they were a delivery rider or not immediately before they entered the intersection. Non-delivery

riders included riders of privately-owned and rental bicycles, which were not separated in the data. For riders observed to be using the footpath, it was noted whether they passed pedestrians and whether they provided a warning by using their bell or calling out, whether there were pedestrians within 5m and whether passing occurred with 1m (described as "rider could touch the pedestrian if they leaned over and reached out"). Observers received prior training in the observation procedure. Details of the site characteristics and the data collection method are provided in Oviedo-Trespalacios et al. (2022).

Results

The 3401 standard bicycle and e-bike riders observed comprised 1,133 non-delivery and 2,268 delivery riders. Delivery bicycle riders were more likely to be travelling on the footpath than non-delivery riders (43.2% compared to 38.6%; $\chi^2 = 6.57$, p = 0.01). We observed 437 non-delivery and 979 delivery bicycle riders cycling on the footpath, of whom 242 non-delivery and 512 delivery riders interacted with pedestrians (at least one pedestrian was within 5m of the rider). While delivery riders were more likely to be travelling on the footpath, delivery riders were not more likely to interact with pedestrians than non-delivery riders (52.3% compared to 55.4%; $\chi^2 = 1.15$, p = 0.28), nor were they more likely to ride within 1m of a pedestrian (55.3% compared to 62.0%; $\chi^2 = 3.03$, p = 0.08).

When encountering pedestrians on the footpath, riders were more likely to change their riding behaviour (e.g., slow down and/or change position on the footpath) without sounding a bell or calling out, than not making any change or changing and using their bell. Riders were more likely to slow down or change their position on the footpath when they were passing pedestrians within 1m, while riders only used a bell, or called out, in combination with changing riding behaviour when they were passing pedestrian within 1m (Table 1). There were no significant differences between non-delivery and delivery riders when responding to interactions with pedestrians. Riders travelling faster than walking pace were more likely to adjust their riding behaviours and use a bell, or call out, when passing pedestrians with 1m or less or when travelling at faster speeds (see Table 2). No collisions or injuries were reported during the observation period.

	Non-deliver	ry riders (1	N=242)	Delivery riders (N=512)				
	No change in	Chan	ge in riding	No change in	Change in riding			
Passing a pedestrian	riding path/speed	Speed or path	Speed or path + bell or call out	riding path/speed	Speed or path	Speed or path + bell or call out		
At 1-5m distance	26.1	73.9	0.0	29.7	70.3	0.0		
At < 1m	m 12.7 86.7		0.7	11.3	86.2	2.5		

Table 2. Riders' responses to interactions with pedestrians by cyclist travel speed.

	N	on-delivery	riders (N=24	42)	Delivery riders (N=512)					
		Passing a	pedestrian		Passing a pedestrian					
	At 1-5m	distance	At <	<1m	At 1-5m	distance	At < 1m			
	Walking pace (N=40)	Faster than walking pace	FasterWalkingthanpacewalking(N=52)pace		Walking pace (N=82)	Faster than walking pace	Walking pace (N=113)	Faster than walking pace		
		(N=52)		(N=130)		(N=147)		(N=170)		
No change in riding path/speed	22.5	21.1	28.8	8.2	34.1	27.2	10.6	11.8		
Change in riding (speed or path)	77.5	78.8	71.2	90.8	65.9	72.8	86.7	85.9		
Change in riding (speed or path) + bell or call out	0.0	0.0	0.0	1.0	0.0	0.0	2.7	2.4		

Benefits for road safety

This research has identified that more than half of the bicycle riders observed in busy urban restaurant precincts rode on the footpath. During lunch and dinner periods, delivery riders comprised more than two-thirds of the cyclists observed. Thus, the research identifies the need to provide safer infrastructure in such areas to improve both cyclist and pedestrian safety, particularly with the increase in cyclist numbers resulting from the high volumes of delivery riders.

Implications for policy

Bicycle riders who choose to ride on the footpath demonstrate similar behaviours when interacting with pedestrians, regardless of whether they are non-delivery or delivery riders. However, despite fitment of warning devices on bicycles being mandatory, their use does not appear to be legally required and very few riders opt to use their bell or call out when passing pedestrians. The lack of the use of a bell or an alternative warning by bicycles when passing pedestrians may have safety implications for pedestrians and decrease the amenability of footpaths for pedestrians. Further investigations should be undertaken to understand how pedestrians respond to audible warnings before strategies are developed to advocate for increased education or mandating the use of auditory warnings, particularly in those Australian jurisdictions where it is legal for adults to cycle on the footpath.

Conclusions

While riders on footpaths modify their riding speed or position, they seem unwilling to warn pedestrians, either using a bell or calling out, when passing on footpaths. Delivery riders rode on the footpath more often than non-delivery cyclists but behaved similarly towards pedestrians. While it is recommended that cyclists warn pedestrians when passing, further research is required to understand how pedestrians respond to audible warnings before strategies are developed to advocate for increased education or mandating the use of auditory warnings.

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Safe streets for cycling in Tasmania: planning and design guidance

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Abstract

For Tasmania to meet its road safety and emissions reduction targets, expediting the delivery of high-quality on-road cycling infrastructure is imperative. Limited existing infrastructure compounded by the rising use of e-bikes and micromobility devices, presents a significant road safety concern. Through co-design with local government and leveraging national and international best practice, this program has outlined pathways for safe cycling infrastructure in Tasmania. The guidance suite includes the Tactical Infrastructure Guide, the Tasmanian Cycling Design Guide, and Active Transport Planning Guidance. These resources streamline the process to deliver quality on-road cycling infrastructure and help overcome skepticism towards new techniques and owing to hilly terrain. Direct application of this guidance in projects in Glenorchy and Hobart showcase the translation of guidance to practice. The guidance suite aims to hasten the implementation of safer cycling infrastructure, achieving more with less, and at a quicker pace than the approach of mainland Australia.

Post on X

Tried an e-bike? The hills have been flattened! With the highest transport costs in the country, e-bikes are taking off in Tassie. But with barely a bike lane in sight, new riders have no choice but to take on the traffic. In response, WSP have produced guidance for rapid delivery of quality on-road cycling infrastructure in Tasmania.

Background

Since April 2023, the author has been working with the Department of State Growth to produce planning and design guidance for active transport infrastructure for the unique Tasmanian context. The existing provision of on-road cycling infrastructure in Tasmania is very limited. Until now, cycling participation has been low and the opportunity for cycling to serve a significant transport task largely ignored. Tasmania Government policy is seeking to shift this attitude as demonstrated by the release of the Greater Hobart Cycling Plan (2022), Draft Keeping Hobart Moving (2023) and Australia's first e-bike subsidy scheme (2023).

Since relocating to Hobart from Melbourne in late 2023, the author has strengthened his understanding of the local context and appreciation of opportunities and barriers to rapidly introduce cycling infrastructure to improve safety for current and new riders.

Overview

The first guide developed was a Tactical Design and Delivery Guide in 2023. The project lead applied first-hand experience from the City of Melbourne where they worked to deliver an unprecedented 17km of protected bike lanes within 12 months during the pandemic. This intensive period of project design and delivery generated a range of innovations (such as Orca separation kerb, trial approval governance, engagement techniques) and lessons (such as media strategies and installation techniques) which have been drawn upon to develop tactical guidance for Tasmania.

Following this, the project team progressed to create a Cycling Design Guide for Tasmania. The Project Director's experience developing Transport for New South Wales Cycleway Design Toolbox (TfNSW 2021) was insightful to guide this second stage. However, the project also highlighted the unique challenges facing Tasmania including financial constraints, limited practitioner experience and limited data availability. The guide has been developed to overcome these challenges.

Finally, the project team are now progressing new active transport planning guidance for Tasmanian LGAs in both urban and regional contexts. The guidance will provide specific tools to integrate walking and cycling projects, align and leverage tourism economic development, cost-effective analysis techniques.

Across the whole guidance suite, the necessity of collaboration with local government practitioners has been demonstrated to be key to success, by building confidence in the guidance, and integrating application and pilots with the development of the guidance to test and iterate in response to the unique local context.

Results

The guidance suite is now being applied to practice. Examples include:

Collins Street Bikeway, City of Hobart

• This project is directly applying the tactical design and delivery guidance. Planned for delivery in early 2025, the project brings new techniques to Tasmania. The adjustable design allows for accelerated delivery with options to make modifications post-installation if required.

Terry Street bikeway, Glenorchy City Council

• The project team is collaborating with the Department of State Growth and Glenorchy City Council to apply the guidance and develop a tactical cycleway design for Terry Street Glenorchy. This project will extend the existing Peltro Street cycleway which was the first on-road cycleway in Tasmania. The project provides an opportunity to refine and iterate the guidance while working closely with practitioners to upskill in project development and delivery.

Benefits to road safety

Protected cycling infrastructure benefits not just cyclists but all road users, and especially pedestrians (Marshall and Ferenchak, 2019). This has been confirmed by analysis of crashstats on upgraded streets in the City of Melbourne. Increasing the awareness of broader benefits of cycling infrastructure is a priority to build stronger community appreciation and project legitimacy.

Implications for practice

The implications of this work for street design in Tasmania are significant. In particular, the guidance suite provides techniques and legitimacy for practitioners to seek to reallocate road space from motor vehicles in favour of people riding bikes.

The suite also brings an integrated approach to communications, engagement and evaluation. Multidisciplinary teams are required to delivery new cycling infrastructure, and the guidance ensures that practitioners know when to seek the right support from within their respective organisations.

Conclusions

This presentation will bring local experience and policy to the conference. It will elevate the achievements of local practitioners to define pathways to providing safe cycling infrastructure. The author is particularly interested in the political dynamics for street design which exist in Tasmania – and will make the case that the incrementalism which has been a trademark of cycling infrastructure development in Mainland Australia, may not be the pathway which Tasmania will take to get more people riding bikes in the next few years and meet the 2030 road safety target. True to character, the pathway forward for Tasmania looks to be unconventional, innovative and a lot of hard work.

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Paediatric pedestrian injuries in Greater Western New South Wales: 10-Years' insights

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Abstract

Pedestrian safety, especially for children, remains a critical concern in Greater Western New South Wales (NSW Centre for Road Safety, 2024). This retrospective cross-sectional study examined 559 paediatric pedestrian injury cases that met inclusion criteria at the Children's Hospital at Westmead over 10 years between 2013 and 2022, with nearly two-thirds involving males. While no significant age group differences emerged, seasonal variations were observed, with more incidents occurring in Spring and Autumn. There were 12 fatalities in total. Children faced higher risks as pedestrians on school days, especially in the afternoon period from 12 to 6 pm. The most common injury types involved extremities/spine, head with other injuries, and minor injuries like abrasions. No geographic clustering occurred, but the polarisation of incidents between school days and holidays varied yearly. These findings highlight paediatric pedestrian vulnerabilities and the need for targeted safety initiatives considering the increased risks with temporal patterns in the Greater Western NSW.

Post on X

Explore 10 year's data from Children's Hospital at Westmead, unveiling insights on paediatric pedestrian injuries in Greater Western NSW #PedSafety #CHWTraumaResearch

Introduction

Pedestrian safety, particularly among children, remains a critical public health concern in Australia. While New South Wales (NSW) having a lower overall burden of road traffic fatalities, progress in reducing child pedestrian injuries has stagnated, with rates remaining relatively unchanged over the past decade (NSW Centre for Road Safety, 2024; Tiwari, 2020). This lack of improvement raises concerns about the effectiveness of current pedestrian safety measures and interventions, especially given the observed decline in pedestrian travel in Australia (IHME, 2020; Stutts et al., 1996).

Children face distinct vulnerabilities as pedestrians due to their emerging independence coupled with still-developing cognitive, perceptual, and executive functions (Schwebel et al., 2014; Stevenson et al., 2015). Gender disparities exist, with boys experiencing higher pedestrian injury rates, potentially linked to increased impulsivity and outdoor exposure (Desapriya et al., 2011). Socioeconomic factors also contribute inequities, with children from ethnic minorities and low-income families disproportionately affected (Gupta et al., 2015; Laflamme & Diderichsen, 2000).

Between 2018 and 2022, over 66% of fatal pedestrian accidents involving children aged 0-16 in NSW occurred in Greater Western NSW (NSW Centre for Road Safety, 2024). As the region's only dedicated Level 1 Pediatric Trauma Center, the Children's Hospital at Westmead is committed to delivering exceptional acute care following road accidents and conducting surveillance of child pedestrian injury data. Our institution collaborates with stakeholders to enhance neighborhood walkability and prevent injuries.

We conduct annual audits to monitor the epidemiological profile of pedestrian injuries in our primary catchment area of Greater Western NSW. This enables longitudinal assessment of the efficacy of implemented policies and providing invaluable data to relevant institutions. Our goal is to contribute directly to efforts improving pedestrian safety for local children.

Method

This retrospective cross-sectional study collected data from the Trauma Registry the at Westmead. Eligible patients were: 1) aged 16 years and under, 2) survived to hospital within 24 hours of the incident; 3) injured as a pedestrian on a public road by a Motorised vehicle; and 4) admitted through the Westmead Emergency Department between 1st Jan 2013 – 31st Dec 2022. Data were excluded otherwise, e.g., any patient deceased on scene, or was injured on driveway/foot path. Analyses were focused on the demographic variables of the eligible patients (such as place and time of injury), as well as injury characteristics such as injury patterns and injury severity score/ISS as coded according to the AIS05 – 2008 update (AAAM, 2016); Table 1. Three Age groups of 0-5 years, 6-11 years, and 12-16 years were defined according the Munich Age Classification System (MACS (Althammer et al., 2023)). Categorical and continuous variables were summarised as count/proportions (N, %) and medians/ interquartile range (IQR) respectively. Chi-square/binomial tests assessed categorical variables, with year as the grouping variable for longitudinal analyses.

						Year															
		201	13	201	4	201	5	201	6	201	17	201	18	201	19	202	20	202	21	20	22
		Count	%																		
Gender	F	21	35.0	19	32.2	9	19.6	17	37.0	18	38.3	11	21.6	27	46.6	19	33.3	16	27.1	28	36.8
	М	39	65.0	40	67.8	37	80.4	29	63.0	29	61.7	40	78.4	31	53.4	38	66.7	43	72.9	48	63.2
Arrival	00:00-06:00	2	3.3	3	5.1	0	0.0	4	8.7	0	0.0	3	5.9	0	0.0	3	5.3	1	1.7	2	2.6
time_	06:01-12:00	7	11.7	7	11.9	9	19.6	5	10.9	4	8.5	8	15.7	14	24.1	14	24.6	8	13.6	6	7.9
new	12:01-18:00	31	51.7	27	45.8	22	47.8	21	45.7	26	55.3	22	43.1	27	46.6	24	42.1	36	61.0	41	53.9
	18:01-23:59	20	33.3	22	37.3	15	32.6	16	34.8	17	36.2	18	35.3	17	29.3	16	28.1	14	23.7	27	35.5
Season	Autumn	15	25.0	18	30.5	18	39.1	8	17.4	10	21.3	16	31.4	19	32.8	11	19.3	22	37.3	19	25.0
	Spring	17	28.3	16	27.1	14	30.4	17	37.0	15	31.9	15	29.4	18	31.0	17	29.8	11	18.6	20	26.3
	Summer	13	21.7	7	11.9	6	13.0	13	28.3	11	23.4	6	11.8	6	10.3	14	24.6	16	27.1	17	22.4
	Winter	15	25.0	18	30.5	8	17.4	8	17.4	11	23.4	14	27.5	15	25.9	15	26.3	10	16.9	20	26.3
School	N	23	38.3	24	40.7	14	30.4	8	17.4	17	36.2	16	31.4	7	12.1	17	29.8	20	33.9	26	34.2
day	Y	37	61.7	35	59.3	32	69.6	38	82.6	30	63.8	35	68.6	51	87.9	40	70.2	39	66.1	50	65.8
Trauma	Attend	7	11.7	13	22.0	8	17.4	14	30.4	4	8.5	9	17.6	11	19.0	12	21.1	8	13.6	16	21.1
call type	Consult	48	80.0	45	76.3	37	80.4	31	67.4	41	87.2	40	78.4	47	81.0	45	78.9	50	84.7	55	72.4
	No call	5	8.3	1	1.7	1	202	1	202	2	4.3	2	3.9	0	0.0	0	0.0	1	1.7	5	6.6
Injury	Chest and/or abdominal											0	0.0	1	1.7	1	1.8	0	0.0	1	1.3
pattern	injuries only																				
	Extremity and/or spine	9	15.0	8	13.6	10	21.7	7	15.2	8	17.0	8	15.7	12	20.7	6	10.5	9	15.3	15	19.7
	injuries only																				
	Head, and other injuries	6	10.0	8	13.6	7	15.2	8	17.4	5	10.6	10	19.6	13	22.4	7	12.3	8	13.6	17	22.4
	Isolated head injury	5	8.3	4	6.8	0	0.0	2	4.3	5	10.6	1	2.0	0	0.0	2	3.5	8	13.6	1	1.3
	Minor injuries (abrasions	31	51.7	33	55.9	25	54.3	23	50.0	25	53.2	24	47.1	24	41.4	30	52.6	28	47.5	37	48.7
	etc.)																				
	Multiple injuries excl head,	7	11.7	5	8.5	2	4.3	5	10.9	2	4.3	6	11.8	4	6.9	7	12.3	4	6.8	3	3.9
	burns or other																				
	Multiple injuries, burns or											0	0.0	0	0.0	0	0.0	0	0.0	1	1.3
	other									-								-			
	No injuries	2	3.3	1	1.7	2	4.3	1	2.2	2	4.3	2	3.9	4	6.9	4	7.0	2	3.4	1	1.3

Table 1. Key demographic and injury variables of paediatric pedestrian injuries in road traffic (2013-2022)

Results

We excluded 17 cases and analysed a final set of 559 cases that met the inclusion criteria between 2013 and 2022. 66.9% patients were male. While there were slightly fewer cases between 2015-2018, this difference was not statistically significant. The results revealed no strong representations of a specific age group, with children aged 0-5 years accounting for 33.1%, 12-16 years for 29.7%, and 6-11 years for 37.2%. The median hospital length of stay was 1 day, and the median Injury Severity Score was 2. Incidents were dispersed across residential postcodes in Western Sydney and surrounds, with no significant geographic clustering.

Interestingly, there were significantly more incidents in Spring (160, 28.6%) and Autumn (156, 27.9%) compared to Winter (134, 24.0%) and Summer (109, 19.5%), suggesting a seasonal variation (χ^2 (3, n = 559) = 11.8, p = 0.008). Most cases were less severe, with 78.5% requiring limited trauma activation - Trauma Consult - and only 18.2% activating full trauma team attendance – Trauma Attend (χ^2 (2, n = 559) = 532.8, p < 0.001). Our data indicated that children were more likely to be injured as pedestrians during school days (p < 0.001). Additionally, more incidents occurred during the afternoon period between 12:01 and 18:00 (χ^2 (3, n = 559) = 277.5, p < 0.001). The most common types of injury were extremity and/or spine injuries, head with other injuries, and minor injuries like abrasions ((χ^2 (7, n = 559) = 844.1, p < 0.001). Notably, our analyses showed that the school day variable was significantly correlated with years ((χ^2 (9, n = 559) = 19.1, p = 0.024, | φ | = 0.185), with the proportion of incidents between school days and holidays being the most polarised in 2019 (87.9%) occurred on school days) and least so in 2013 and 2014.

Conclusions

The 10-year analysis of paediatric pedestrian injuries at our hospital from 2013-2022 unveils valuable insights to guide prevention efforts. While no specific age group was at the highest risk, nearly two-thirds of patients were male. Seasonal patterns were evident, with more incidents in spring and autumn. Most injuries were relatively minor, but a notable portion required full trauma team involvement.

Crucially, children faced greater pedestrian risks on school days, particularly afternoon periods aligning with commutes, underscoring the need for enhanced safety measures during these times. Injury patterns highlighted extremity/spine and head trauma as priorities for prevention. Although no geographic hotspots manifested, year-to-year variations in the polarisation of incidents between school days and holidays indicates changing circumstances requiring continuous monitoring. These findings emphasise the importance of multifaceted interventions tailored to address temporal risk factors like seasons and school schedules. Ongoing surveillance is vital to detect emerging high-risk demographics and areas. As the region's leading Paediatric Trauma Centre, we aim to leverage this evidence base to maximise community benefit through coordinated population health initiatives and ensuring effective translation of proven safety practices into local policies and infrastructure.

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2024 Australasian Road Safety Conference

30 September - 3 October, Hobart, Tasmania, Australia

Applying technologies in youth empowerment for safer roads

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Abstract

Road crashes disproportionally affect young people from age from 10 to 19 in Vietnam. Due to the absence of reliable data sources and limitation in technology, the decisive governmental actions for road safety investment is impeded. With the aims to support the government stakeholders to effectively allocation the public resources into high-risk locations, the *AI&Me: Empower youth for safer roads* project was piloted in three cities in Vietnam, applying a combination of emerging technologies. Pre and post intervention surveys exposed the improvement in road safety knowledge, attitude and behaviors among students from 55.8% to 82%, 42.1% to 58.6%, and 39.6% to 57.1%, respectively. 106 schools in three project cities was listed as high-risk schools by Big Data Screening. 18,617 YEA pins reported by youth were defined by Star Rating for Schools and then shared on Citizen Portal as reference for local authority to allocate resource into road improvement around schools.

Post on X

AI&Me: Empowering Youth for Safer Roads becomes a reality across Vietnam.

Results and highlights were shared with government stakeholders and partners in Yen Bai, Gia Lai, and Ho Chi Minh City:

- → 106 schools in three project cities was listed as high-risk schools by Big Data Screening.
- → over 1,800 young students were empowered with road safety skills.
- → over 18,000 pins were scored to indicate high-risk areas using the Youth Engagement App
- → 100% of the surveyed government stakeholders found the youth's opinions collected from YEA useful/very useful to identify high-risk locations.

Introduction

Every day, approximately 16,300 children and adolescents under the age of 19 are killed or injured in road crashes (Green, 2023). In Vietnam, road crashes are the leading cause of death and daily adjusted life years (DALYs) among adolescents from 10 to 19 (Atzatzev, 2021). Despite being among the most vulnerable road users, young people are underrepresented in political processes (Thapa, 2021).

Project description

With the aims of support government to allocate public resource and engage with young citizens on road safety, through emerging technologies AIP Foundation, the International Road Assessment Programme and Anditi have piloted the "AI&Me: Empowering youth for safer roads" project in three cities in Vietnam, namely Ho Chi Minh City, Pleiku and Yen Bai, with the support from Fondation Botnar and FIA Foundation.

The project utilized an innovative Big Data Screening Methodology, which integrates evidence-based attributes and big data sources to assess and rank schools based on pedestrian safety risks. In addition to Big Data Screening, the project has developed a digital risk-perception tool known as the Youth Engagement App (YEA). This app empowers youth to designate locations as either "safe" or "unsafe" about the road infrastructure for different commuting means, from walking, cycling to motorized vehicles.

Result

A total of 1,063 schools across the three pilot cities underwent various levels of analysis of Big Data Screening. From this process, 56 schools in Ho Chi Minh City, 25 schools in Yen Bai, and 25 schools in Pleiku were identified as high-risk locations, forming the final list of 106 schools for further detailed assessment in later stages. During the pilot phase, the methodology received support from stakeholders, with 86% of survey respondents acknowledging its utility in identifying high-risk communities and schools.

1800 students were recruited and trained in the use of the YEA, as well as educating them on their roles and responsibilities, the project has significantly increased student awareness of road safety. After the intervention, the percentage of students with good and excellent road safety knowledge grew dramatically from 55.8% to 82%. On a scale of 1 to 5 (where 1 = totally disagree, and 5 = totally agree), students rated their level of agreement with statements about road safety. Following the YEA implementation, 58.6% of all surveyed students demonstrated their agreement with statements about road safety, increasing by 16.5% compared to pre-intervention results (42.1%). In terms of

behaviors, 57.1% of students reported safer behaviors in the post survey, compared to 39.6% in the pre-intervention one. Furthermore, the project has received positive feedback with 100% of the surveyed government stakeholders found the youth's opinions collected from YEA useful/very useful to identify high-risk locations.

Conclusion

The project was successful in amplifying the role of young generation and empowering them as active contributors to road safety policy design. Aside from more than 18,600 pins reported, young students confidently presented their perceptions on potential risks surrounding their schools at youth forums and meetings with the participation of local authorities. Such risk assessments by youth were defined with the Star Rating for School tool, then shared on Citizen Portal as reference for communities and decision-makers for action to upgrade the road infrastructure. With the results obtained, the pilot project provided the evidence for authorities to engage the community in policy making process and will be scaled nationally.

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Craig Hoey

Abstract

Today more than 1200 people are killed and a further 40,000 or so are seriously injured on Australian roads every year. Australia's road safety performance trails leading European nations employing a safe system approach to the problem of road safety. Safe system underpins a strategy of building and operating a safe road transport system, not just relying on improving individual road user behaviour. While the concepts of a 'safe system' approach to road safety have been adopted at a strategy level in Australia, implementation has been patchy and difficult to sustain. I was awarded a Churchill Fellowship for international travel to investigate the factors underpinning the road safety performance of Australia relative to the best performing nations. The ethos of a Churchill is to: learn globally, inspire locally. I will present on the findings of my Churchill Fellowship.

Post on X

Why does Australia's road safety performance continue to fall short of leading countries despite committing to the safe system approach?

Introduction

Today more than 1200 people are killed and a further 40,000 or so are seriously injured on Australian roads every year. Australia's road safety performance at 4.5 deaths per 100,000 population is well behind leading European nations that are achieving less than half that rate. Matching the level of road safety performance of leading nations would dramatically reduce the number of people killed and sustaining long term injury on our roads. Australia's efforts to reduce road trauma have generally focused on reducing the prevalence of high-risk behaviours by road users, such as: speeding, drink driving, and inattention. Research has demonstrated that much of the behaviour contributing to crashes is not irresponsible or negligent but the result of imperfect humans making everyday mistakes (Johnston et al., 2014).

Radical changes in the fundamental conceptual approach to road safety policy and practice originated in Sweden and the Netherlands. In 1997, Sweden adopted a 'Vision Zero' goal for road safety; a vision that, long term, no one would be killed or seriously injured on Swedish roads. Vision Zero underpins a strategy of building and operating a safe road transport system, not just relying on improving individual road user behaviour (Tingvall, 2022). Sustainable Safety, a similar policy, was developed in the early 1990s in the Netherlands to build an inherently safe road transport system (Wegman, et al., 2022). The principles of these policy platforms form the basis of the 'safe system' approach to road safety which underpins strategy at both the national and state level in Australia.

While the concepts of a 'safe system' approach to road safety have been adopted at a strategy level in Australia, implementation has been patchy and difficult to sustain. Scandinavian countries and the Netherlands are among the nations most advanced in safe system implementation. The adoption of Vision Zero is credited with increased levels of road safety performance that Sweden and Norway have experienced over the past decade. Vision Zero has influenced the choice of road safety interventions and has led to a more systematic approach to working on the problem of road safety in those countries (Belin, 2021; Elvik, 2022).

Background

The theme of the Australasian Road Safety Conference for 2024 is *Target 2020: What's the pathway forward?* That is, what can we in Australia and New Zealand do to shift current road safety performance to meet our 2030 target to halve road fatalities and dramatically reduce serious injury. No jurisdiction in Australia has even gotten close in the recent past to achieving its road trauma reduction targets. Indeed, in the last decade, the absolute numbers of road users killed or seriously injured has remained stubbornly resistant to change. The problem is not one of strategic direction. We need to become more effective at safe system implementation (Johnston, et al., 2014; Woolley, et al., 2018).

The safe system approach underpins Australian road safety policy and strategy. The safe system philosophy is based on four principles (Belin et al., 2012):

- I. People should not have to die in traffic. The economic benefit of traffic and mobility to society should not have to take place at the price of people's lives. Our transport system cannot and should not be designed to avoid every crash. But it should keep people alive and in full health.
- II. People make mistakes, so our transport system needs to accommodate human error and unpredictability.
- III. People are fragile. There are physical limits to what the human body can tolerate. Our transport system needs to be forgiving, so that the impact of a crash is not sufficient to cause fatal or lead to long term injury.
- IV. All those with a role in designing, operating, managing, and using our transport system have a responsibility to reduce danger.

We have accepted the ethical imperative that no one should be killed or suffer long term injury through our shared commitment to zero traffic deaths on Australian roads by 2050. The limits to human tolerance to crash energy is also well accepted in our national strategy, which identifies evidence-based measures to manage harmful energy in designing and managing our transport system. However, we still place ultimate responsibility for keeping safe in traffic on the individual road user.

Project description

In 2020 I was awarded a Churchill Fellowship for international travel to Sweden, Norway, Denmark, and the Netherlands to investigate the factors underpinning the road safety performance of these countries relative to Australia. I completed my Churchill travel in the northern hemisphere winter of 2022-23, due to COVID related travel restrictions.

A Churchill Fellowship offers Australian citizens the opportunity to travel overseas for up to eight weeks to learn more about a topic or issue that they are passionate about. The ethos of a Churchill is to: learn globally, inspire locally. Applications are assessed by experts from a range of disciplines with a strong focus on topics that demonstrate community benefit, and that the candidate has exhausted learning within Australia.

As part of my Fellowship travel, I established meetings with more than 50 people working in the field of road safety including senior government advisors, departmental officials, leading road safety academics and researchers, automotive industry researchers, experienced practitioners, and road user advocates. Individual consultation followed a semi structured interview approach involving three areas of investigation on road safety: evolution of policy and strategy; implementation of measures; and long-term performance. I also attended the Vision Zero International Course convened by the Swedish Traffic Administration.

Findings

Nations with low levels of road trauma have in common a governance framework that facilitates a systematic method of working on the problem of road safety. Priority is placed on evidence-based measures and agreed actions have clear lines of accountability. Safe system principles guide the methods to make things happen and underpin road safety interventions, which have influenced the number fatalities and long-term injuries in the road transport system (Belin, 2021). This model is described in figure 1.

Safe system and ways to work



Figure 1. Safe system and ways to work

In Australia significant effort continues to be directed at reducing the prevalence of high-risk behaviours by road users through education, laws, campaigns and enforcement. We frame the problem of road safety through traditional road safety thinking and delegate responsibility to the road user to survive in traffic. This is not a sustainable way to govern road safety from a safe system perspective. The road transport system is a complex social-technical system. We cannot always negotiate such a system safely because, as humans, we are prone to making mistakes.

The transport system is complex and comprises many actors responsible for its design and operation. For example, private businesses, large and small, buy and generate transport services throughout their whole value chains. Effective road safety governance must recognise this fact and engage more broadly. Acceptance of this is growing locally and our national strategy identifies the need to widen the scope beyond traditional road safety stakeholders through a social model approach.

A lead agency model is critical to facilitating and leading improved road safety performance. A lead agency must have the authority to foster collaboration amongst road safety stakeholders. It must also have and be able to influence a broad toolbox of different policy instruments spanning legal, economic, communications and funding. These instruments must create leadership and stimulate responsibility for road safety in as many of the processes that, and amongst as many stakeholders who influence the road transport system.

In summary:

- The traditional road safety leadership and management model is not effective enough.
- Road safety must be integrated in all societal processes influencing the design and use of the road transport system.
- A lead agency is important to facilitate this integration by using a broad array of policy instruments.

Conclusions

Learn globally. Inspire locally.

There is no silver bullet, or quick fix, to cut through the messy and complex problem of road safety.

The problem of road safety requires a systematic method of working. Priority must be given to evidence-based measures and the implementation of agreed actions. These actions must be supported by clear lines of accountability.

The foundations for improved road safety exist in Australia. Our national strategy is based on safe system thinking, it sets targets, includes agreed actions, looks to engage widely through a social model approach, and has a performance framework to monitor progress. And we have a national office of road safety to monitor and coordinate our agreed actions. Much can be learnt from the Scandinavian countries and the Netherlands about effective safe system implementation. First and foremost, we need to honour all principles of safe system thinking and work towards making the road system 'fail-safe' so that human mistakes do not lead to death or long-term injury. With consensus on safe system policy, we can then turn to strengthening our governance model so that we engage road safety stakeholders responsible for the design and operation of the transport system, commit those stakeholders to action, and monitor and report on progress. With this approach to tackling the problem of road safety, it is more likely than not that effective road safety measures will be implemented than if road safety policy and practice lack one or more of those elements (Elvik, 2022).

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Intergovernmental Road Safety Data Sharing Agreement Finalised

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Abstract

The Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) has spearheaded an intergovernmental Data Sharing Agreement (DSA) to exchange road safety data: finalising it was a key action for the Australian Government under the National Road Safety Action Plan 2023-25. The DSA is a non-legally binding administrative document that formalises existing data-sharing arrangements and provides a clear pathway for non-government researchers to request access to road safety data. Increased access to the data will facilitate road safety research and in turn support effective road safety policies and strategies. The DSA is a significant milestone in the improvement of road safety data quality, consistency and availability, achieved through comprehensive collaboration and agreement between states, territories and DITRDCA.

Post

The new Data Sharing Agreement opens up access to crucial Australian road safety data for researchers.

Introduction

Data is central to the development of effective road safety policy and planning.

To date, relevant data is sourced from a range of sources nationally, including state and territory enforcement authorities and road safety agencies. DITRDCA's existing road safety data is collated in two collections describing road fatalities (updated monthly) and road vehicle crashes (updated annually). While some fields such as crash types and vehicle body types are harmonised, it is not yet possible to fully harmonise others such as speed and fatigue, often due to differences in data collection and reporting.

Finalising the DSA was a significant milestone for the Australian Government under the National Road Safety Action Plan 2023-25. The implications of the DSA's implementation are two-fold: it will streamline the collection and improvement of road safety data and provide a mechanism of access to the data for non-government researchers. Consequently, the DSA will support effective road safety policies and strategies.

Industry, academic and private researchers can apply through DITRDCA (as a team where relevant) to access the data shared under the DSA. Decisions regarding access are made by the Road Safety Data Working Group (RSDWG), which is comprised of state and territory representatives and for which DITRDCA provides secretariat support. Data are securely provided to researchers in consistent tabular formats. The DSA explicitly prohibits any monetisation of the data shared under it. There is no set minimum reporting size but the RSDWG decisions regarding applications for access to the data will be made on a case-by-case basis taking into consideration privacy obligations that restrict reidentification of individuals. A condition of access to the data is that research outputs are submitted to the RSDWG for approval before publication.

The DSA builds on DITRDCA's long history of collating and managing road safety data. DITRDCA maintains the Australian Road Deaths Database which was established in 1990, and the National Road Safety Research and Reporting Database (formerly known as the National Crash Database) established in 2011, with data going back to 2008.

Project description

Since July 2021 the Road Safety Data Hub and Analytics team within DITRDCA has worked closely with state and territory road safety data agencies and the respective legal teams to refine the Commonwealth's draft DSA. We undertook extensive consultation with jurisdictional and internal departmental stakeholders including our legal section and carefully considered and implemented feedback received from each state and territory road safety agency, and DITRDCA signed on behalf of the Commonwealth.

Results

The DSA was finalised in early 2024. Shared road safety data is now more accessible to researchers. The community of road safety data custodians has been strengthened and an effective mechanism for sharing national road safety data with researchers has been established.

Benefits to road safety

DITRDCA continues to rely heavily on road safety data as evidence to inform policy. However, the quality and availability of data and subsequent analysis is an enduring limitation. The DSA functions in two ways: to improve the collection of data and to allow researchers the ability to engage more meaningfully with any data that is collected. The contribution of the research community to knowledge and analysis of road safety issues is an obvious benefit to DITRDCA, as published research can complement existing analysis informing policy. Increased engagement with the data also has the complementary benefit of clarifying priority areas for future data collection.

We expect increased engagement with the data will rapidly further our collective understanding of key road safety issues.

Shared road safety data is now more accessible to researchers, which will support effective road safety policy and planning. The data collected under the DSA is used to inform the advice that the Office of Road Safety within DITRDCA provides to the Australian Government concerning road safety measures, and the increased accessibility of the data will enrich road safety data for all Australian jurisdictions. The DSA responds to calls from researchers and other stakeholders for governments to be more open with government data so it can be widely used for research and analysis.

Implications for policy and/or practice

Finalisation of the DSA means greater access to national road safety data, enhanced national datasets and increased evidence-based research to inform road safety policy and practice.

Conclusions

Finalisation of the DSA supports research to improve policy and planning.

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Holtby

Safety effectiveness of the Metropolitan Intersection Program (MIC) in Western Australia

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Abstract

We assessed the effectiveness of the WA State's Metropolitan Intersection Program (MIC) spanning from 2012/13 to 2021/22, focusing on 14 fully and 4 partially funded projects. A before-and-after study with controls on road intersections was conducted to evaluate the impact on all reported crashes, casualty crashes, and fatal or seriously injured (FSI) crashes. Crash data were analysed using negative binomial linear mixed-effects regression models (GLMER-NB). The overall MIC Program demonstrated significant benefits, particularly for higher severity crashes, with incidence rate ratios (IRRs) for FSI crashes ranging from approximately 0.17 to 0.42 (equating to a 58% to 83% reduction), while IRRs for all crashes ranged from approximately 0.5 to 0.7 (a 30% to 50% reduction), and for casualty crashes fell in between at approximately 0.4 to 0.6 (a 40% to 60% reduction). The Program is effective at reducing crashes, especially FSI crashes.

Post on X

New study assesses WA's Metropolitan Intersection Program's efficacy, showing significant reductions in severe crashes from 2012/13 to 2020/21. #RoadSafety #Research

Introduction

Intersections play a critical role in road safety as they are key points where various traffic streams converge, increasing the potential for conflicts and collisions among vehicles, pedestrians, and cyclists (Ray Sarkar et al., 2024). Various factors contribute to crash risk at intersections such as: speed, traffic volume, intersection design/geometric road design, driver behaviour, traffic control devices, environmental conditions, and pedestrian and cyclist presence (Alnawmasi et al., 2024; Mussone et al., 2017; Tamakloe et al., 2022).

In the Western Australian (WA) metropolitan area, 49% of fatal or serious injury (FSI) crashes occur at intersections (Road Safety Commission, 2021). In an attempt to reduce metropolitan FSI crashes in the Perth metropolitan region, several Programs have been initiated at the State and Local Road level. For example, the WA Black Spot Program has treated hundreds of metropolitan intersections over a span of roughly twenty years, resulting in consistent reductions in FSI crashes (Albrecht MA, 2022a, 2022b). A separate program of road safety treatments applied to metropolitan intersection Crash Program" (MIC), a program funded through the Road Trauma Trust Account (RTTA). Commonly, the Program considers treatments that have generally been shown to be effective at signalised intersections, for example signal modifications, grade separation, roundabout installation, adding/extending turning lanes, overhead mast arms, and red-light cameras. Often, treatments are applied in combination, thus the evaluation in this project was of the Program as a whole and was not able to isolate individual treatments.

The aim was to assess the effectiveness of the MIC Program on reducing FSI crashes, casualty crashes, and all reported crashes.

Methods

Study Design

The design was a before and after study with control. We included analysis of all reported crashes, all casualty crashes, and all FSI crashes to determine effectiveness of the interventions.

Sites

Fourteen intersections were fully funded and four were partially funded in the MIC Program from 2012/13 to 2020/21. Main Roads WA provided details on each treated intersection site, including intersection location, treatment descriptions, treatment start and finish dates, treatment costs, and estimated treatment life. For crash reduction evaluation, each site was individually inspected to ascertain the length of each leg to include for crash capture. These lengths depended on the types of treatments applied to the intersections and whether the treatment was judged to have an impact on crashes further upstream of the intersection. To do this, sites were examined using Nearmap (aerial views) and Google Street View (from a driver's perspective) before and after the construction of the treatments.

Extended Abstract (Researcher)

The major road safety improvements for all fully funded sites were: (i) improvement of intersection geometry, (ii) construction of bridges, (iii) installation of traffic signals including overhead mast arms, (iv) installation of red-light cameras, (v) addition and extension of turning pockets, (vi) addition of lane approaching intersection and (vii) improvement of pedestrian facilities. An example intersection located at Wanneroo Road, Green Street and Walcott Street is provided below detailing the types of treatment, crashes recorded within its vicinity, and the rationale behind selecting an appropriate distance from the intersection for analysis.

Table 1. Intersection No. 50690: Wanneroo Road / Green St / Walcott St Intersection (City of Wanneroo)

Types of	Right turn pockets southbound into Green Street,
treatments	• Two new traffic signal mast-arms to improve visibility of the signals, one on Wanneroo
	Road at Walcott Street and one on Charles Street at Green Street
	Installation of mast arms
	Addition of pedestrian crossing
Crashes included	• Wanneroo Rd – 150 m both sides of the intersection.
	• Green street – 150 m
	• Walcott St $-$ 150 m
Justification	• Looking at the extension of the existing turning lane, crashes may have occurred due to a
	queuing effect and high traffic volume; therefore, the length of the treated right-turning
	pocket (around 150 m) was selected to include crashes on the road section







After treatment (14 October 2023)

Figure 20. Intersection No. 50690: Wanneroo Road / Green St / Walcott St intersection (City of Wanneroo) from Nearmap (aerial view)

We selected control sites to be as comparable as possible with treatment sites using road features such as geometry, signalisation, number of carriageways, presence of slip lanes, turning pocket length, speed limit, and traffic volume. Efforts were made to match geographical location as closely as possible to treatment sites. Two control sites per treatment site were included.

Data analysis

We extracted the crash data from the Integrated Road Information System (IRIS), maintained by Main Roads. Crashes that occurred during the construction period were excluded, including the pseudo-treatment periods for control sites. The earliest date of crash inclusion was 1/1/2009 and the latest date was 31/12/2022. Data were imported into R version 4.3.2 (R Core Team 2023) for analysis. Crash data were modelled using a generalized linear mixed-effects regression model with negative binomial (GLMER-NB) link function using the "glmmTMB" library (Brooks et al., 2017). The model included effects of group (treated vs control), period with respect to treatment (pre- post-treatment with control sites assigned the treatment time according to their matched treatment sites), the interaction between group and time with respect to treatment, traffic volume on the primary leg, year (modelled as a restricted cubic spline to account for non-linearity), and the offset included the primary and secondary leg lengths. The random effects variable was the intersection "ID". The primary contrast of interest was the group X period interaction which denotes the treatment specific effect.

Results

Table 2 presents the pre- and post-treatment time exposure, crashes of all severities, casualty crashes, and FSI crashes across the treatment and control groups broken down by the full and partial programs. Despite being twice as many control sites as treatment sites, there were not twice as many crashes in the pre-treatment period for control sites. Indeed, there were lower numbers of FSI crashes for the FSI sites compared to the treatment sites, indicating some selection bias.

	Pre-treat	tment				Post-treatment				
	Mean Months	Mean primary AADT	All crashes	Casualty Crashes	FSI Crashes	Mean Months	Mean primary AADT	All crashes	Casualty Crashes	FSI Crashes
Both Programs										
Control	86.7	29996	4362	830	130	74.3	31933	3050	613	117
Treated	87.5	28834	3318	697	167	74.2	30759	1402	241	41
Fully-funded	program									
Control	90.9	31346	3609	659	107	73.0	33110	2225	418	75
Treated	90.9	32147	2140	487	139	73.0	34186	1183	205	39
Partially-fund	Partially-funded program									
Control	72.0	25270	753	171	23	79.0	27815	825	195	42
Treated	75.5	17238	1178	210	28	78.3	18766	219	36	2

Table 2. Crash counts and time exposures pre- and post-treatment for control and MIC treated sites

The effectiveness of the overall MIC Program, combining both the fully and partially funded projects, is summarised in Table 3. The primary contrast of interest for all analyses is the "Group x Period" interaction contrast, which denotes the effectiveness of the Program relative to both baseline and changes from baseline in the control group. Crash reductions were seen for all crashes across all models, casualty crashes across all models, and FSI crashes across all models. The MIC Program appeared most beneficial for higher severity crashes, with the 95% CI of the IRR for FSI crashes = 0.17 - 0.42 (58% to 83% reduction), while the 95% IRR for all crashes was 0.53 - 0.69 (31% to 47% reduction), and the casualty crash estimate in between 0.39 - 0.6 (40%-61% reduction).

Table 3. Period, Grou	p, and Interaction	effects from the	GLMER-NB mod	els as assessed for all sites
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	All crashes		Casualty C	rashes	FSI Crashes		
Variable	IRR	95% CI	IRR	95% CI	IRR	95% CI	
Period	0.92	0.82-1.04	0.84	0.69-1.02	1.02	0.69-1.53	
Group	1.93	1.37-2.72	2.1	1.56-2.82	3.05	2.14-2.34	
Group x Period	0.6	0.53-0.69	0.48	0.39-0.6	0.27	0.17-0.42	

• IRR = incident rate ratio, CI = confidence interval, FSI = fatal or seriously injured, GLMER-NB = generalized linear mixed-effects regression-negative binomial

Pathway Forward

The MIC Program elicited substantial crash savings, especially to casualty and FSI crashes, indicating the treatment program to be effective. The partial program obtained very strong FSI crash reductions, likely due to the removal of conflict points possessing very high traffic volumes. The findings of this study underscore the program's efficacy in enhancing road safety and mitigating the severity of crashes, thus contributing positively to a reduction in FSI crashes and transportation infrastructure. The program should continue to be monitored and evaluated to track the ongoing effectiveness of intersection interventions. Treatment groupings as applied in the MIC may be considered for individual effectiveness upon a larger roll-out of the program.

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The role of safety in modal choice and shift: a transport users' perspective in Australia

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Abstract

This study explored transport users' perspectives on safety in modal choice and shift through a public survey in Australia. While affirming the safety of public transport, the majority currently favours alternative modes. However, a considerable proportion contemplates a modal shift, showing potential for a move towards public transport. Although participants acknowledge the importance of safety, it ranks low in forced-choice scenarios for modal choice and shift. Priorities like time, journey utilisation, personal safety, and cost prevail in modal choice. While time, convenience, and mode availability dominate modal shift. Intriguingly, more participants prioritize transport safety in modal shift compared to modal choice. Demographic variations influence modal shift preferences, necessitating targeted interventions. In conclusion, despite safety playing a limited role in modal decisions, there is potential for a shift towards public transport and increased awareness of transport safety. Addressing current priorities and concerns may contribute to reducing road fatalities and injuries.

Background

Despite earlier studies affirming the safety superiority of public transport modes over alternatives (Ibrahim, Logan, Koppel, & Fildes, 2022), discussions on modal shifts to enhance safety remain limited within road safety strategies(Litman, 2014). Previous expert interviews have highlighted the minimal role of transport safety in modal choice or shift behaviour (Ibrahim, Logan, Koppel, & Fildes, 2023). In light of this, it becomes crucial to compare expert perspectives with those of transportation users (the public) through a community survey in Australia, seeking insights into their considerations regarding modal choice and modal shift. This study aimed to explore the perspectives of transport users about the role of safety in modal choice and modal shift focusing on identifying opportunities for enhancing safety in transportation decisions and encouraging the use of safer modes.

Method

Participants aged 18 or older, residing in Australia, and travelling at least weekly (excluding professional drivers) were recruited for this study. Their feedback was collected via an internet-based survey consisting of 29 questions, taking 20-40 minutes. 770 eligible participants were surveyed nationwide. The study examined modal choice behaviour, frequency of mode changes, consideration of safety, and its importance compared to other factors. Responses underwent detailed analysis, revealing key perspectives among transport users.

Results

Current modal choice and future modal shift trends

The majority of participants (71%) indicated currently prefer alternative modes. Moreover, a similar percentage, 71% of individuals are contemplating a modal shift at different levels, and indicating an increasing inclination towards public transportation. This shift has the potential to elevate the mode share from 28.3% to 43.53%

The role of safety in modal choice and shift

When asked about the role of safety in modal choice, 75% acknowledge varying importance levels of transport safety in general. However, when forced to choose among other factors for modal choice, it ranks low at the thirteenth position with 1.1%. Top factors for modal choice included time, journey utilization, personal safety, and cost. For modal shift, top factors included time, convenience, and mode availability, with "Transport Safety" ranking seventh and representing 5.5%.

Significant factors related to modal shift

Significant relationships with modal shift were found, including young participants, students, and those on study-related trips being less inclined to prioritize transport safety. Most Students and young people mostly prioritize time, while older people, retired individuals, and the self-employed mostly value convenience. Those with travel needs prioritize certainty and personal safety on board.

Conclusions

The role of safety in the current modal choice process is limited, but it becomes more considerable for future modal shifts, especially with increased user focus on transitioning towards safer public transport modes. This, alongside the

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia overall recognition of transport safety, presents an opportunity to mitigate road injuries through modal shift. However, policymakers need to prioritise improvements to public transport that address crucial factors influencing modal choice, as well as demographic variations, to encourage a shift towards public transport. Targeted interventions aimed at promoting safer transportation modes have the potential to alter travel behaviour, potentially leading to a reduction in road fatalities and serious injuries.

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Analysis of crashes on wirerope sections of TWTL intercity expressways

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Abstract

On Japanese intercity expressways, two-way two-lanes (TWTL) are installed instead of four lanes on sections with low traffic volumes. In the past, rubber poles divided the center line in those sections where head-on collision risk existed due to departures into the opposite direction. Since 2017, wire ropes (WR) have been gradually installed to prevent the collisions. In the summer of 2023, the installation was completed on a total of 776 km of tolled earthwork sections of the intercity expressway. Since its installation, no head-on fatal crashes have occurred. The current challenge is to reduce the incidence of collisions with WRs. When reflective materials, delineators or postcovers were installed to WR with the reflective tape, the crash rate was found to be lower.

Post on X

Wire ropes have been installed on TWTL intercity expressways in Japan. Reducing the incidence of collisions with WRs is a current challenge. The crashes were analyzed from the perspective of road structure and visibility.

Introduction

Provisional TWTL expressways account for nearly 40 % of the total extension of intercity expressway network in Japan. In these sections, curbs and rubber poles were once installed on the center line. However, as crashes involving head-on collisions due to departures from the center line became a social problem, the installation of wire ropes (WR) having the function of restraining departures into the opposite lane has been recommended. The difference between wire ropes and curb plus rubber poles is shown in Fig. 1. Since 2017, WRs have been installed in earthwork sections and on small and medium-sized bridges less than 50 meters in length. Installation was completed in August 2023 on all 776 km of expressways (tolled sections) managed by the three Japanese intercity expressway companies (NEXCO East Japan, NEXCO Central Japan, and NEXCO West Japan), as originally planned.

Since the start of installation, WRs have been effective in preventing fatal head-on crashes caused by departures into the opposite lane (Figure 2). However, many crashes involving contact with WRs that were not apparent when the curbs and rubber poles were in place are now occurring frequently.

It takes an average of 70 minutes to recover from such an crash, with both lanes closed to traffic. This has increased the burden on road operators, and there is a need to reduce the frequency of crashes involving contact with WRs. This study provides an overview of such WR contact crashes that occurred from the start of installation to March 2023, and then reports an analysis of the relationship between road structure and crashes, visibility measures and crashes, as basic data for studying crash countermeasures.



Figure 1. Wire ropes and conventional curbs plus rubber poles



Figure 2. The moment of prevention of head-on collision in a WR section

Findings and Evaluation

Number of crashes on wire ropes

Table1 shows the number of WR contact crashes and total length of WRs. The total number of crashes involving contact with WRs is 3,716. It is proportional to the installation extension. The number of crashes involving departures from the center line has been reduced to 10 in total, and no head-on collisions have occurred. Compared to the 196 head-on collisions that occurred in 2016, prior to the installation of the WRs, this indicates that the system is fully effective in preventing such collisions.

Table 1. Number of WR contact crashes and total length of WRs

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	TOTAL	Before installation (2016)
Number of contact crashes	240	313	391	540	912	1,320	3,716	-
Number of departure crashes	1	3	1	0	3	2	10	196
Installation length (cumulative total)	115km	186km	291km	565km	743km	772km	-	-
Rate of contact crash (per 100 million vehicle-km)	87.5	78.2	60.7	46.1	55.2	69.2	-	-

Road alignment

We analyzed contact crashes by roadway alignment. Horizontal curves, cross slopes, and longitudinal grades were analyzed, but only horizontal curves are shown here. Since WRs are installed in sections where lanes are not separated, the left and right sides of the curve exist in equal proportions. In Japan, vehicles drive on the left side of the road, just like in Australia. Figure 3 shows the ratio of WR contact crashes on horizontal curves. The ratio of crashes is 50% for right curves and 30% for left curves. This indicates that crashes occur more frequently on right curves. There are two possible reasons for this. One is that on right curves, drivers for some reason turn the steering wheel too much, causing a collision with nearby WRs. The other is that may be caused by the strong influence of the curve's cross-slope.





Figure 3. Ratio of WR contact crashes on horizontal curves

Visibility measures

Road operators are taking measures to prevent collisions between WRs and vehicles. The main ideas are to (1) emphasize WRs or posts, and (2) to install rumble strips on the road surface. It's standard for rumble strips is installed on surface. For the purposes of this report, we define (1) as visibility measure. We compared the crash rates of four typical visibility measures for WRs as shown in Figure 4. Figure 5 plots the result. The application of reflective tape has the highest contact crash rate. When reflective materials, delineators or postcovers were added to the reflective tape, the crash rate was found to be lower. This indicates that making drivers aware of the WRs may further reduce the crash rate. However, the age of installation and night-time visibility were not taken into account, and the sample size is small. It is not possible to assure that (4) is the most effective. So further analysis should be considered in the future.



Figure 4. Four typical visibility measures for WRs



Figure 5. WR contact crash rates by visibility measures

Conclusion

This report presents the analysis results of crashes in WR sections installed on provisional TWTL intercity expressways in Japan. Although WRs have the function of restraining departures into the opposite lane, they are placing an increasing burden on road operators as the number of collisions increases greatly. In the future, we would like to propose more effective visibility measures to help reduce contact crashes.

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Multi-Function enforcement solution working towards addressing the Fatal Five

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Abstract

Road traffic crashes are commonly caused by the fatal five behaviours: speeding, impaired driving (drugs and/or alcohol), failure to wear a seatbelt, driver fatigue and distraction – leading to the deaths of 1.19 million people annually across the globe. To address this problem, Acusensus has developed a multi-function enforcement solution, which is an artificial intelligence assisted system that can detect mobile point-to-point (average speed), spot speed, seatbelt non-compliance and distracted driving – addressing three of the fatal five. This system has been trialled in Western Australia, collecting significant informative data. Research and development is currently in progress to add impaired and fatigued driving detection to the Multi-function system, which is a world-first initiative that will allow Multi-function to address all fatal five contributors to road trauma.

Post on X

Multi-function enforcement solution powered by artificial intelligence in development that will eventually address all fatal five behaviours of road trauma, including drugs and alcohol-impaired driving.

Introduction

Road traffic crashes are commonly caused by the fatal five behaviours: speeding, impaired driving (drugs and/or alcohol), failure to wear a seatbelt, driver fatigue and distraction (NRSPP Australia » Easter Road Safety: The Fatal Five, n.d.). These behaviours have led to the deaths of 1.19 million people annually across the globe, with 20 to 50 million more people suffering non-fatal injuries as a result (Road Traffic Injuries, n.d.). If traffic laws on these fatal five behaviours are not enforced, a reduction in road traffic fatalities related to these specific behaviours cannot be reduced. It is important to develop an effective solution that addresses behaviours are stopped and not repeated. Acusensus is working on a multi-function enforcement solution that aims to address all of the fatal five dangerous behaviours. This solution is currently in development – at present, the multi-function device is capable of detecting and addressing three of the fatal five behaviours: mobile point-to-point (average speed), spot speed, seatbelt non-compliance and distracted driving.

Effectiveness of enforcement solutions

The multi-function solution operates as a response to the success of the use of AI-based enforcement solutions in changing dangerous driver behaviour. This is initially proven through the use of the Acusensus 'Heads-Up' solution, which is used by authorities to enforce distracted driving. 'Heads-Up' success is most evident in New South Wales (NSW), with other successful programs established and running in Queensland and the Australian Capital Territory.

In the years before the mobile phone enforcement camera program commenced in NSW, 350 lives were lost each year and 11,000 people were seriously injured in road crashes – at a cost to the community of around \$8 billion (2026 Road Safety Action Plan | Towards Zero, n.d.). The formal Acusensus contract in NSW began operating on 1 December 2019, with warning letters issued instead of fines for the first three months of the contract term. After six months of operation, the rate of mobile phone offences fell steadily to 0.3 percent compared with a rate of 1.2 percent from the January 2019 pilot (Bye, 2020). Since the enforcement program commenced up to the end of 2022, there has been a sixfold reduction in the rate of camera-detected mobile phone offences in NSW compared to the 2019 pilot, along with a decline in road fatalities, with the road toll reducing by 0.9 deaths per 100,000 per annum from 4.4 to 3.5 (Economics, 2024). This represents a strong decline in road fatalities per 100,000 compared to the rest of Australia, where the road fatality rate increased from 4.9 to 5.0 (Economics, 2024).

Multi-function Solution

Given the proven effectiveness of utilising enforcement solutions to reduce distracted driving, Acusensus believes expanding existing artificial intelligence systems to extend its capabilities would help the company further address road safety challenges and save more lives. A system was designed to enable the supply of a single asset and installation that can simultaneously address multiple road safety challenges, addressing three of the fatal five, namely spot and/or average speed, seatbelt non-compliance and distracted driving. This system was created in collaboration between Acusensus and the Western Australia (hereafter WA) Road Safety Commission.

The WA government has committed to a vision of zero deaths and serious injuries by 2050 (Road Safety Commission, 2023). A business unit within the WA Police, the Road Safety Commission strives to improve road safety and reduce road trauma. In 2022 the Commission partnered with Acusensus on a world-first trial of a multi-function mobile enforcement solution, providing authorities with a single tool to address multiple dangerous driving behaviours with a single product on the road network.

Multi-function Technology Trial

The seven-month trial beginning in June 2022 saw WA lead the user case as the world-first to utilise multiple artificial intelligence-powered enforcement capabilities at once. Another key feature of this trial is the use of artificial intelligence to classify heavy and towing vehicles in near real-time to apply a lower speed offence threshold to different vehicle classifications – light vehicles have 110km/h posted speed and heavy and towing vehicles are assigned 100 km/h posted speed.

Using real-world data, Acusensus and WA Road Safety Commission were able to identify and compare behaviours in regional and metropolitan areas, point speed against average speed, the prevalence of repeat offenders and the recording of multiple dangerous behaviours enacted simultaneously.

The trial ran from July 2022 to February 2023 and saw the multi-function system deployed in rural areas of Australia. The focus on rural areas is significant as cellular connection is often unavailable in these locations, making it traditionally difficult to deploy, monitor and address potential road safety behaviours. This allowed Acusensus the opportunity to explore other means of communications in remote locations successfully. In the trial period, the multi-function system made 7,916,963 detections with the following offences:

- 58,350 point-to-point (average) speed offences
- 265,873 spot speed offences
- 66,787 verified mobile phone offences
- 11,426 verified seatbelt offences (driver and front passenger)

An alarming data trend during the trial was simultaneous offences – drivers who were displaying multiple dangerous behaviours simultaneously:

- 1,751 instances of distracted driving and speed
- 479 instances of distracted driving and seatbelt non-compliance
- 226 instances of seatbelt non-compliance and speed
- 17 instances of distracted driving, seatbelt non-compliance and speed.

This trial also tracked repeat offenders – people who offended multiple times:

- Distracted driving 8,121 instances of a person repeat offending
- 187 instances of someone repeat offending while distracted driving, not wearing a seatbelt and speeding.

The trial further paints an image of the severity of dangerous driving behaviours in WA whilst also proving how one system can simultaneously capture multiple dangerous driving behaviours. When enforcement occurs with this system, such behaviours can be addressed to discourage dangerous driving and save lives.

Addressing all of the Fatal Five through Impaired Driving Detection

Acusensus aims to continuously improve its technology to adapt to changing road safety needs. The multi-function solution currently addresses three of the fatal five causes behind road trauma – Acusensus is undergoing the process of upgrading Multi-function to include impaired and fatigued driving detection, addressing all of the fatal five.

Research in the impaired driving space is a work in progress – a large number of research papers have been published about the topic but there is little to no attempt to produce an external fixed solution for drugs and alcohol-impaired driving (Chen & Chen, 2017; Jones et al., 2003). Acusensus recognises the seriousness of the impaired driving problem and believes it is a significant enough problem to invest in the research and development of an impaired driving detection system, which is to be added to our Multi-Function Solution.

Acusensus' internal simulator testing has been conducted to inform a solution capable of detecting behaviours synonymous with impaired driving. In this process, gathering well-calibrated and controlled data from non-impaired and impaired drivers is essential for both simulator and real-life testing. After two successful rounds of simulator testing, a list of promising and quantifiable behaviours of impaired driving are identified: vehicle trajectory patterns, vehicle speed and lateral movements within lanes.

Impaired Project Future

The next steps are to proceed to a real-world trial stage and work with partnered police services to conduct roadside data collection. Feedback from partnered authorities will help determine the most suitable implementation for the project. Real-world data collection is critical as simulator testing outcomes may not effectively translate into real-world situations. Simulator testing has its limits, such as the absence of actual motion, ambient wind noise and the driver's familiarity with their vehicles. Therefore, the results of real-world data collection are essential to verify the accuracy and robustness of the detection algorithm.

Once implementation ideas have been finalised, Acusensus will modify Multi-function with the relevant software and hardware for the real world and data collection. This is expected to include the development of new vehicle tracking algorithms and systems tailored for impaired driving detection, involving sensor technologies such as radar, LiDAR and cameras.

The collected data will be anonymously linked to random breath and drug test results for analysis, which will inform the further development of impaired driving detection strategies. This ambitious project will allow the multi-function solution to address every single, significant cause behind road safety incidents. The detection of impaired driving behaviours will lead to increased discouragement towards this dangerous behaviour whilst providing cost and time-efficiency as random drug testing can be replaced or enhanced with this innovative detection system.

Conclusion

Road trauma is a serious problem as millions of people die or suffer serious injuries as a result of road accidents – this bears a huge economic cost to communities at large. This issue needs to be taken seriously by discouraging dangerous driving behaviours known as the fatal five. Acusensus' multi-function solution aims to address multiple road safety risks and challenges simultaneously following the proven success of using artificial intelligence-powered enforcement tools in reducing road fatalities. It currently addresses three of the fatal five with research and development endeavours in progress to add impaired driving detection, creating a solution that addresses all of the fatal five.

A tool that addresses all of the fatal five will be economically beneficial as it will reduce costs and automatically detect dangerous driver behaviours. The existence of a system such as this one will have the capacity to discourage the behaviours that lead to all the major causes behind road accidents. This can produce real change and save lives that should not end prematurely across the global road network.

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Enhancing Traffic Safety Analysis with Multimodal Data and GPT Models

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Abstract

Traffic safety analysis has traditionally focused on either tabular or textual data, neglecting the potential of a combined multimodal approach. This study introduces a novel Multimodal Data Fusion (MDF) framework that integrates tabular data with textual narratives, utilizing advancements in Large Language Models (LLMs) such as GPT-2, GPT-3.5, and GPT-4.5. Employing few-shot in-context learning with GPT-4, we generated novel labels for a comprehensive traffic crash analysis, including Severity, Driver Fault, Driver Actions, and Crash Factors. Tested on Missouri State Highway Patrol crash data, GPT-4.5 few-shot learning demonstrated remarkable accuracy (98.9% for crash severity and 98.1% for driver fault) and GPT-3.5 achieved significant Jaccard scores (80.2% for driver actions and 89.2% for crash factors). These results highlight the framework's capability to extract actionable insights from fused data, marking a significant advancement in traffic safety analysis and demonstrating the potential for broader applications.

Post on X

"Integrating tabular & textual data with GPT models enhances traffic crash analysis, achieving unparalleled accuracy in severity & fault prediction. #TrafficSafety #DataFusion #GPT"

Introduction

This study explores the integration of tabular data and textual crash narratives through the application of Large Language Models (LLMs) like GPT-2, GPT-3.5, and GPT-4.5, aiming to enhance traffic crash analysis. While tabular data offers essential quantitative insights, it lacks contextual depth, which textual narratives provide through detailed incident descriptions. By fusing these data types, the study seeks to achieve a more comprehensive understanding of crash factors. The research leverages the transformative potential of LLMs, which bridge the gap between quantitative and qualitative data analysis, offering new avenues for in-depth road safety research. Employing methods like few-shot in-context learning, the study demonstrates how LLMs can adapt to new tasks with minimal examples, significantly enhancing the analysis of crash reports without the need for large, annotated datasets. This approach not only facilitates the extraction of actionable insights from crash narratives but also contributes to the development of more effective road safety interventions and policies. The methodology focuses on generating new labels for a nuanced analysis of crash data, validated by domain experts, and examines various training methodologies to optimize the application of these labels in crash report analysis (Mannering & Bhat, 2014; Saket, Endert, & Demiralp, 2018).

Method

Employing a dataset from the Missouri State Highway Patrol, we applied GPT-4's few-shot learning to generate novel labels for traffic crash analysis, including severity, driver fault, driver actions, and crash factors. The study assessed the efficacy of various GPT models across zero-shot, few-shot, and fine-tuning learning approaches, focusing on optimizing model performance for traffic safety analysis (Hegselmann et al., 2023). Table 1 shows model performance per class.

Results

GPT-4.5 few-shot learning exhibited exceptional accuracy in predicting crash severity (98.9%) and identifying driver fault (98.1%). Furthermore, GPT-3.5 in a few-shot setting achieved significant Jaccard scores for extracting driver actions (80.2%) and crash factors (89.2%), demonstrating the models' effectiveness in detailed crash analysis (Olugbade et al., 2022; Haghshenas et al., 2023). The word cloud in Figure 1 reveals stark differences in driver actions in traffic crashes based on fault. "At-fault" crashes are marked by terms like "aggressive" and "drinking," pointing to risky behaviors like speeding and impaired driving as key contributors. In contrast, "not-at-fault" scenarios highlight defensive reactions to unforeseen factors, such as animals on the road, with terms like "avoid" and "swerve." This analysis underscores the need for targeted road safety campaigns and education focusing on preventing aggressive driving behaviors while promoting defensive driving skills to mitigate crash risks effectively.

Class	Best model	Accuracy	Precision	Recall	F1-Score
Non-Fatal	CDT 45 For Shot	000/	98%	100%	99%
Fatal	GP1-4.5 Few-Shot	99%	100%	98%	99%
Not at Fault	CDT 4 5 Easy Shot	080/	97%	86%	92%
At Fault	GP1-4.5 rew-Shot	9870	98%	100%	99%

Table 1. Best Performing Models Summary







(a) (b) Figure 1: Driver Actions when the driver fault is (a) yes, and (b) no.

Benefits to Road Safety

The integration of Multimodal Data Fusion (MDF) with advanced Generative Pre-trained Transformer (GPT) models, as explored in this study, presents significant benefits to road safety. By fusing tabular data with textual narratives, the approach offers a comprehensive analysis of traffic crashes, enabling a deeper understanding of the multifaceted nature of road incidents. The application of GPT models, particularly through few-shot learning, allows for the extraction of nuanced insights from crash narratives, which traditional analysis methods might overlook. This enhanced analysis capability can identify specific risk factors and driver behaviors that contribute to accidents, facilitating the development of targeted interventions. For instance, the ability to accurately predict crash severity and identify driver fault with high precision can inform more effective road safety policies, driver education programs, and preventive measures. Ultimately, this innovative approach contributes to the broader goal of reducing traffic accidents, improving emergency response strategies, and ensuring safer roads for all users, marking a significant advancement in the field of traffic safety research.

Implications for Policy and/or Practice

The findings from this study have profound implications for policy and practice in road safety. By leveraging the capabilities of Large Language Models (LLMs) for enhanced traffic crash analysis, policymakers can gain access to more detailed and accurate insights into crash causality and risk factors. This information is crucial for designing targeted safety interventions, refining driver education programs, and formulating policies that address the specific behaviors leading to accidents. For practitioners, the ability to integrate and analyze multimodal data means more effective deployment of resources towards high-risk areas and situations, potentially leading to a significant reduction in traffic accidents and enhancing overall road safety (Yang et al., 2022).

Conclusions

This study introduces the Multimodal Data Fusion (MDF) framework, which combines tabular and textual data using advanced generative models like GPT-4.5 and GPT-3.5 for traffic crash analysis. Unlike prior models that relied on word frequencies or keywords, this approach captures accurate semantic content without extensive training. The GPT-4.5 model, in particular, demonstrated exceptional performance, achieving up to 98.9% accuracy and 100% precision in identifying crash severity and driver fault. Additionally, GPT-3.5 showed significant improvements in classifying driver actions with a Jaccard score of 80.2%. These results underscore the potential of few-shot, in-context learning for automated text analysis and highlight a robust methodology for enhancing text classification tasks' accuracy and reliability. By providing detailed insights into crash causes and dynamics, the developed model aims to inform targeted safety interventions and policies, contributing to safer roads. Future research will focus on enhancing model interpretability and integrating additional data sources for a more comprehensive traffic incident analysis.

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Is that evidence-based? Practical tips for practitioners

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Abstract

How do you know if a road safety action is an important, evidence-based approach or a shiny new thought bubble? Many of the answers are available in the published literature or from road safety professionals. But how do you access and manage masses of information to find clear answers that can be used to inform effective action? How do you confirm what actions should be avoided? This study identified the evidence for seven research questions generated following a recent Tasmanian Parliamentary Inquiry into road safety. With university access behind paywalls, we conducted rapid systematic literature reviews, interviewed road safety experts, and report on four clear outcomes for action: established evidence (high priority), some evidence (more work is needed to establish good practice), little or no direct evidence (low priority) and evidence is contentious (not advised at this time). We will present practical tips for practitioners.

Post on X

Practical tips on how to tell evidence-based actions from shiny new thought bubbles.

Introduction

Government action is critical to reach road safety targets for 2030 and beyond (Wegman, 2017). But how can governments be certain they're prioritising the right actions? What are the steps needed to identify actions with an established evidence base versus shiny new thought bubbles? Particularly when the thought bubble sounds appealing and has no known benefits – or worse, may make our roads less safe?

The task of identifying evidence from the hundreds of thousands of publications is even more difficult when there are a wide range of unrelated topics being considered. This is particularly the case in unspecified Parliamentary Inquiries into 'road safety' that can generate many recommendations based on submissions from road safety experts, non-expert members of the public and the members of the Parliamentary Committee.

We present as a case study, the recently completed project for the Tasmanian Government. We provided independent advice on seven research questions generated following the Parliamentary Inquiry into Road Safety in Tasmania (2022). In total, 94 written submissions were made to the inquiry. Following analysis of these submissions and evidence from experts, the Committee made 49 recommendations. The aim of this project to provide independent advice on the evidence base for seven research questions to inform the response from the Tasmanian Government on supported recommendations and initiatives. Here we present an overview of the approach taken to create a Priority for Action list that provided clear guidance to the Tasmanian Government about the evidence for each research question and rank the action by the benefit or disbenefit to road safety.

Methods

Seven research questions were posed about a wide variety of road safety topics. Initially, the request was to conduct seven literature reviews. However it was clear that some questions could not be answered by the published literature, particularly for the local context. After consultation with the Tasmanian Government, a mixed method approach was taken and combined three methods: 1) desktop reviews, 2) rapid systematic literature reviews and 3) interviews with road safety experts. While grouped under seven topics, additional sub-questions expanded the project to 13 questions or sub-questions. The questions and sub-questions are summarised below and presented with each method used (Table 1).

Four desktop reviews provided an overview of government activities in all states and territories in Australia. Following the PRISMA systematic search protocol, five rapid systematic literature reviews were conducted to assess the scientific evidence. In total, the titles and abstracts of 12,356 scientific papers were screened and 1,460 full papers were reviewed to identify the evidence base for the topics. Key study characteristics and research findings were extracted and used to create summary tables. Three questions were answered in six interviews with expert practitioners from state and territory governments and leading Australian road safety organisations. The research questions and methods used are presented in Table 1.

Table 1. Research questions, sub-questions (summarised) and methods used

Res	earch question (summarised)	Method				
		Desktop	Rapid systematic	Interview key		
		review	literature review	stakeholders		
1	Government funded school curriculum and in-school driver training programs focused on road safety in Australia	\checkmark				
2	Low-cost treatments with high risk-reduction benefits are being implemented outside of Tasmania	\checkmark				
	 Evidence to support implementing treatments in Tasmania Trial metrics (scale, time and evaluation framework) 		\checkmark			
3	Tourist-focused educational materials and infrastructure treatments are implemented outside of Tasmania	\checkmark				
	Evidence of road safety benefit?Evidence to support implementation in Tasmania		\checkmark			
4	 Defensive driving and/or advanced driving instruction for novice young drivers: What training models benefit road safety outcomes, if any? When and how should they be delivered? Costs versus effectiveness 		~			
5	Evidence to support a mechanism for mandatory road safety infrastructure audits after all road crashes involving a fatality and/or serious injury		~	\checkmark		
	Cost of mechanism versus effectiveness	\checkmark	✓			
6	Evidence to support the Tasmanian Government resourcing the training of professionals to conduct road safety infrastructure audits		~	\checkmark		
7	Approaches to attract and retain road safety specialists in government positions			~		

Results

While there was consensus in some of the topic areas in terms of the scientific evidence and expert insights, the evidenced varied in other topics. Key findings for each of the seven topic areas are summarised below.

- Q1. School curriculum: Federally or state funded school curricula and in-school driver training programs focused on road safety are being conducted in all states and territories. New South Wales is the only jurisdiction with a mandatory in-school curriculum for driver training.
- Q2. Low-cost treatments: There is a 'library' of low-cost treatments that are effective in reducing the risk of crashes. The most effective treatment will depend on the type of crash being prevented. Overall, the most effective treatments include speed reduction, audio tactile line markings and traffic signal phasing.
- Q3. Tourist education: Most jurisdictions have tourist-focused online education material with New Zealand a noted exemplar of information, particularly for the planning stage. Tourist-focused infrastructure focused on access to tourist destinations or scenic routes (e.g., Great Ocean Road in Victoria). Recommendations from expert stakeholders included industry partnerships to reach tourists at key points in time (e.g., on arrival, car rental etc).
- Q4. Defensive/advanced driving: There is a lot of noise in the defensive/advanced driving literature that made it difficult to provide a clear response. There was no consensus on the optimal components of a defensive/advanced driving course and there was wide variation in the quality of evaluations. While there may be some benefits gained from some skills taught in existing courses, there was not an 'off the shelf' option currently available for implementation.
- Q5. Road Safety Audits: Despite an extensive systematic search, there was little in the literature to provide advice on a mechanism for mandatory road safety infrastructure audits. Experts did not support mandatory audits, primarily because the audit alone was considered insufficient and a broader approach that integrated Safe System principles was recommended.
- Q6. Resourcing professionals

Experts were supportive of government staff understanding the process of road safety audits, to enable them to read audit reports. However, experts cautioned against government staff being trained to conduct road safety audits due to concerns about their ability to be independent and the likelihood that they would be defensive of the road safety network managed by their agency. Experts also raised legal concerns over public liability if the audit was conducted by internal staff. Insights from the published literature were limited.

Q7. Attract and retain specialists: Experts identified that attracting and retaining road safety staff is a global issue. Their recommendations were in four categories: value of training and positive work culture, recognition and career development, remuneration and competitiveness with the private sector, and work/life balance.

Priority for action

Priority action based on the evidence presented in this report, ranks the topics in the following order for their benefits to road safety (Table 2).

Tuble 2. Thomy for action by evidence base		
Research question	Evidence	Priority
Q2. Low-cost treatments including speed reduction	Established evidence	High priority
Q1. School curriculum	Some evidence	More work is needed to
Q5. Road Safety Audits		establish good practice
Q6. Resourcing professionals		
Q7. Attract and retain specialists		
Q3. Tourist education	Little or no direct evidence	Low priority
Q4. Defensive/advanced driving	Evidence is contentious	Not advised at this time

Table 2. Priority for action by evidence base

Discussion

When prioritising road safety action, an evidence base is needed at every point of the policy cycle (Talbot et al., 2024). This evidence needs to be a mix of published scientific literature and consultation with road safety experts (Dupont et al, 2012). The success of this project was a result of the collaboration between researchers and the staff at the Tasmanian Government. Regular meetings created opportunities for the government to provide clarification on the emphasis of each question (set-up) and stay informed of progress and discuss any pivoting needed during the project.

Collaboration is critical to ensure the outcome is useful for government. University researchers are trained in conducting systematic literature reviews and can manage and distil thousands of publications into meaningful advice. Critically, through the university libraries, researchers have full access behind the expensive paywalls of the world's scientific literature. Researchers with expertise in qualitative data add further value by triangulating findings in the literature by interviewing and/or surveying practitioners and other experts and provide advice to address gaps or conflicts in the literature.

While the full report for this project provides detailed analysis for all seven research questions and comprehensive summaries of the evidence, the key outcome of this project is provided in Table 2. Table 2 provides an easy to access, unequivocal list of priorities for action and includes an assessment of the evidence and priority level that the government can use with confidence that their actions have a clear evidence base.

A final note on shiny new ideas. Initially all ideas are new and do not have an established evidence base. We are not suggesting that this should stop implementation. Governments have an important role to play in introducing and trialling new ideas. However, the road safety outcome expectations need to be managed with clear before and after measures, appropriate safeguards and testing protocols and share both positive and negative outcomes to help everyone reach our 2030 road safety targets.

Acknowledgements

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Uber insights: getting answers from commercial transport big data

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Abstract

Commercial transport businesses generate petabytes of data about how our road network is used. However, to date, there is no clear pathway for businesses to provide data to governments to inform public policy action and investment. In this project, we used UberEats data to create and test a pathway to provide trip data to the City of Sydney. This pilot study takes the trip data from 2019 and maps where delivery riders are travelling to identify the priority routes that can be used to inform short, medium and long-term investment (e.g., gaps in the network, priority routes for community cycling and bottlenecks). This presentation is of Stage 1 of the study and presents the initial sample data provided by Uber, how we navigated the commercial and technical challenges and the preliminary pathway to provide ongoing data to inform government action to prevent deaths and serious injury on our roads.

Post on X

Commercial transport data can provide governments insights into road network use and inform road safety action. But overcoming significant hurdles is a major first step. We've cleared these hurdles and we'll share how.

Introduction

The road network is the workplace for many industries. These industries generate significant datasets as they monitor the movement of goods, vehicles and staff. Yet there has been limited integration of these datasets with governments in an ongoing partnership to inform government decision making, policies and investment. While occasional relationships have produced rich insights, they are often limited to registered users (e.g. global Strava data)(Strava, n.d.) or a one-off sugar hit of data that is not expanded to other data sources. From a road safety perspective, trip data generated by industry are highly valuable and could provide critical insights into how we use our road networks to improve safety.

However, from the commercial perspective, these are data is highly sensitive. While there are the obvious disincentives to share data, commercial-in-confidence, competitive advantage, confidentiality and privacy, there have also been unforeseen consequences as trip data is weaponised against people. For example, in the United States of America, Google recently announced it would delete location data for visits to abortion clinics to prevent the data being used to prosecute women in the states were abortions are now illegal due to the overturning of Roe vs Wade (Sandvik, 2023).

Despite these challenges, if we are to achieve road safety targets for 2030 and beyond, we need to find ways to integrate commercial data sources to maximise the road safety benefits and provide ongoing inputs from industry.

The aim of this project was to identify ways to access commercial data that could be integrated into governments to inform road safety action, policy and investment. This submission focuses on Stage 1, the process of navigating the requirements to access an initial data set from Uber and the development of a preliminary pathway to establish and ongoing data updates.

Project description

Entering into a legal agreement to access data from Uber took five years from 2019 to 2024. Initial discussions started in 2019 as part of a workshop on bicycle delivery at the International Cycling Safety Conference in Brisbane in November 2019 (Johnson, 2019). The workshop included presentations from UberEats, Domino Pizza and Deliveroo (now defunct). In an open Q&A forum, industry representatives answered questions from conference delegates. After the workshop, there was a shared recognition of the value of the knowledge that could be gained from commercial data. However, there was also acknowledgement that outside the conference environment, the companies were competitors, and it was rare to have a neutral space to share their insights.

Momentum to continue the potential to share data was interrupted by the pandemic. However, at the same time, the pandemic saw consumer demand for individual delivery skyrocket. In 2021, as part of a research grant from the Office of Road Safety, discussions about data sharing were restarted with UberEats, Deliveroo and MilkRun (Thorpe et al., 2021). During the course of that study (2021-2022), both Deliveroo and MilkRun ceased trading and discussions with UberEats stalled with concerns about mishandling data and privacy.

Following the conclusion of the research grants, the authors continued discussions with Uber. We were committed to the value of the data and determined to find a way to address ongoing concerns. In late 2023, we signed a data agreement between Uber and the University of New South Wales (UNSW Sydney) with the intention of finding a

pathway to share the data with governments to inform action for road safety. This work was awarded funding in November 2023 by the James Martin Institute to undertake a pilot study with the City of Sydney based on the data from UberEats delivery riders.

Results

Two major advances were made in Stage 1 of this project. First, the data agreement and negotiations to receiving data from Uber and the second is the mechanism providing these data to government.

A data agreement was signed with Uber mid-2023 and listed the purpose of the data sharing as: 'Uber to provide data on two-wheeled couriers' movement trends to a team of researchers at Institution to support their research study on improving road safety for food delivery cyclists.' The agreement listed a range of data points and negotiations were managed by solicitors and Directors at both Uber and UNSW. However, when it came time for the data to be provided, the agreement lacked the specificities in data description required for the data to be released. The generalities in describing the data, suitable for an agreement at the Director level, were not nuanced enough to provide guidance to the data scientists. This led to lengthy rounds of negotiations to clearly specify the exact data points that could, and could not, be provided.

The first step in providing data was a series of 'dummy data' that provided a sample of the types of data produced by Uber. This gave us the first insights into the proprietary data format (H3 - https://www.uber.com/en-AU/blog/h3/) used by Uber and the complexities of analysing these data within existing non-proprietary systems. Using a hexagonal shape that maps in a honeycomb structure, data from Uber was also anonymised. To ensure individual trips and destinations could not be identified, the minimum trip count needed to be five for data on a section to be provided. In addition, the data resolution is represented number code rather than unit area or dimension, the higher the number, the finer the resolution. Initially, Uber provided data at resolution level 8 (0.73km²), which is too macro and did not provide sufficient detail to understand where delivery cyclists were travelling. With continued discussions and aggregated data with minimum trip counts (min. 5), Uber provided data to resolution level 9 (0.10km²) and 10 (0.01km²) (see Figure 1) (Venkat, 2021).



Figure 1. Examples of data resolution from Uber, resolution 8, 9 and 10 (left to right)

The second key finding from this first stage a preliminary understanding of how the flow of data can work between commercial operators and government. The initial discussions have been between the research team and Uber. In particular, the data scientists have worked closely to build trust in the way the data will be handled and also to find ways to work within the existing parameters to provide the data with the greatest insights for road safety benefits.

At the end of Stage 1, we have developed a preliminary schematic that illustrates the flow of data from the commercial operators to governments. Figure 2, from left to right, shows the flow from the commercial operator to a proxy or trusted partner, in this case, UNSW Sydney that is able to analyse the data, in particular translate the proprietary formats into accessible outputs. Next, the data are presented and discussed with the government, in this case, the City of Sydney. This process allows for time to be taken by the government and the trusted partner to provide feedback and refinement to maximise the type of data needed to inform government action, policy and investment. Then the trusted partner feeds the data back to the commercial operator to extend the data provided as possible within the terms of the data agreement.



Figure 2. Schematic of data flow from commercial operator through trusted partner to government

Discussion

Commercial operators are generating enormous datasets that by enlarge are not being utilised for their road safety potential. The examples from this study are from UberEats delivery riders. Unlike other datasets that are limited to one day a year (e.g., ABS Journey to Work data; Olivier et al., 2018) or specific types of riders (e.g., Strava), or commuters who tend to ride the same trip, UberEats provides trip details on hundreds of riders travelling to unique destinations across the entire network. These data clearly show where delivery cyclists are riding and avoiding. This is particularly important at locations where, despite there being cycling infrastructure, cyclists do not ride. This evidence over hundreds of trips will allow the government to further investigate the likely reasons for avoidance including considering trip segments in context and the potential severance points along and entire trip.

It was a mistake to assume that the signing of a data agreement was enough to provide open access to the data we had requested. In hindsight, there needed to be a discussion between the data scientists from our research team and Uber before the contract was signed. However, there was a reluctance for this discussion to occur without a signed data agreement in place. This circular requirement, a chicken-and-egg style loop of needing an agreement before having the discussion about data but not having the data discussion about the agreement was in place, led to lengthy delays. While we recognise the need for clear communication prior to a data agreement being signed, it's not clear how this could be achieved for other groups seeking their first agreement.

Finally, the data flow is an important consideration. As commercial operators are likely to all use some component of proprietary data and have concerns about data handling, a trusted partner provides data analysis and translation that can be integrated into existing government systems.

Conclusion

In the first stage of this study we have successfully collaborated with one commercial operator to find a way to access commercial-in-confidence data for governments to access to inform road safety action, policy and investment. Further stages of this project will test the data feedback and refinement stages. Future work is planned to clarify how to establish a pathway for more commercial operators to safely and confidently provide their data to boost government work to prevent death and serious injury crashes on our roads.

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Transport is dirty, but is it safe to be clean?

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Abstract

The 2030 targets set by Australian State and Federal Governments in different priority areas can positively or negatively impact each other. For example, addressing barriers to the uptake of active transport can support goals to mitigate climate change, but undermine efforts to improve road safety, and vice versa. Ideally, these goals can be mutually reinforcing. As we shift to a 'movement and place' approach, it is critical that we rethink how space on roads and road-related areas is allocated to support travel options that reduce greenhouse gas emissions from transport, while minimising the risk of harm to road users. In this context, our project examined how existing legal, design, and roads safety regulation is currently impeding better uptake of active transport across areas of 1) design of bicycles and mobility devices, 2) road rules, and 3) road design and the building environment.

Post on X

Australian State and Federal Governments 2030 targets for climate change and road safety need to be achieved by mutually beneficial means. This project examined regulatory options and barriers in law, design and road safety to identify opportunities that support better uptake of active transport.

Introduction

Transport is dirty. In 2022, 19 percent of all greenhouse gas emissions in Australia arose from transport activities, 10 percent from car and light commercial vehicles alone (Australian Government A, n.d.). By 2030, the transport sector is projected to be Australia's largest source of greenhouse gas and noxious emissions (Australian Government, n.d.). Underpinned by increased population density, limited public transport options, fuel mix and the social importance of motor vehicles (Johnston et al., 2024), we know 'the need for rapid decarbonisation is crystal clear' (Beaufoy, 2024, p.1)

In this respect, the transport sector has much to contribute towards achieving 2030 targets to reduce Australia's national greenhouse gas emissions by 43 percent below 2005 levels (Australian Government B, n.d.). However, we also know that transport activities are dangerous, and therefore the Government has set a separate 2030 target to significantly reduce trauma from all transport modes.

As we focus on the road safety targets for 2030, we also need to take into account broader policy targets to ensure road safety gains are not environmental losses. Critical perspectives are often missing from road safety actions, in particular law, environment, urban planning and land use, design and health. Yet these perspectives and transdisciplinary collaborations offer new insights and new allies who can help us achieve road safety targets (Napper et al., 2021).

Transport is a major contributor to greenhouse gas emissions, however, it could also provide a solution. Mode shift to active transport for short trips will reduce greenhouse gas emissions. However, at a neighbourhood level, particularly in the suburbs and in country towns, public roads and spaces have been built to support and encourage an over-reliance on motor vehicles thanks to high speed arterial roads and ample parking (Taylor & van Bemmel-Misrachi, 2017). While active transport, particularly cycling, is a popular leisure activity, this does not translate to cycling for transport. We are a long way from the major mode shift needed to positively impact Australia's greenhouse gas emissions profile, as we are not building spaces for enough people to feel safe to use active transport.

We need governments to prioritise building safe spaces for more people to use active transport, both physically in terms of the road environment, but also by regulating road design, vehicles and road user behaviour in ways that make this form of transport safe. Increased walking and cycling to achieve environmental targets are only acceptable if it does not result in an increase in death or serious injuries. The aim of this work was to examine the regulatory options to maximise the contributions of active transport to deep carbonisation in Australia through the lens of road safety.

Method

In this project we examined the regulatory options required to maximise safe active transport and how this could contribute to deep decarbonisation. The focus was on legal issues that contribute to the regulatory barriers in law, design and road safety that together, impede better uptake of walking and cycling. Specifically, we focused on three key areas:

- regulatory barriers affecting road design and the built environment
- regulatory barriers that impact design for bicycles and other mobility devices
- regulatory barriers with road rules and other laws affecting road user behaviour

Results and Discussion

The legal pathway to deep decarbonisation in Australia should address three key areas to support safe active transport.

Regulatory barriers for road design and the built environment

Unlike motor vehicles, with extensive design standards, regulations and testing, the lack of appropriate design regulation for bicycles and other micromobility devices contributes to the perception that these devices are toys and erodes their legitimacy as transport vehicles. While it might be argued that micromobility devices (e.g. e-scooters) are new technology and developing faster than standards can keep up, this argument does not hold for bicycles. Despite an earlier genesis than motor vehicles, standards for bicycles focus on a minimum safe mechanical standard. Missing from the standards are the wide range of bicycles that provide safe, practical options for active travel. This lack of specific design standards for bicycles is a critical gap in road safety. Without specific design standards, practitioners designing and implementing bike lanes continue to create spaces that fail to fit the range of bicycles available. Figure 1 shows longer wheelbase bicycles that accommodate these bicycle types that support carrying additional load including children (de Groot, 2017).



Figure 1. Examples of bicycles not considered in current standards Longtail and Longtail Mini-Velo

Legal impediments to appropriate design

Design regulation for bicycles is a significant gap and one that continues to lag behind innovation. Harmonisation of standards is needed to ensure that all bicycle types are recognised as a key step required to include the bicycle as a transport vehicle. There also needs to be a clear pathway to keep pace with innovation, in both vehicle design (e.g., electric bikes and e-scooters) and to inform consumers. As purchasing options continue to expand beyond physical retailers, to a global, online market, consumers require clear information about the specifications for legally permitted vehicles, particularly when the active transport option has power assistance.

Legal recognition of different types of bicycles

Legal regulations are also inadequate in relation to riding on footpaths. While riding on footpaths is permitted in some Australian states and both territories, in others such as Victoria and New South Wales, it is restricted to riders aged under 13 years, and to adults who are accompanying or supervising a child rider under 13 years, or who are carrying a child in a bicycle baby seat or on an attachment with pedals. There are other exemptions for a medical reason or riding for employment (e.g., postal worker).

Road rules like these neither cater for different bicycle designs, the attachment and use of accessories nor different uses to which bicycles are being put. According to r 250 of the Victoria Road Rules for example, the rider of a cargo bicycle carrying children, cannot legally ride on the footpath, because these children are carried on the bicycle itself and not in a bicycle baby seat, or on an attachment with pedals. Given that internationally and domestically, cargo bikes are widely used to carry young children to kindergarten and school, rules that force riders onto roads may discourage greater uptake of this form of active transport.

Road design and urban planning

The shift to a 'movement and place' approach in road design and urban planning is a critical policy change that will benefit people using active transport. But it also raises challenges of retrofitting a road network that was designed for motor vehicles. One example of an interim measure to keep cyclists safe in the existing road network is requiring drivers to allow minimum passing distances, however this did not create any new space on the road. This creates new bottlenecks on our roads, especially considering placement of bicycle infrastructure, parked cars and other obstacles. For example, drivers of motor vehicles must allow at least 1m when passing cyclists on road with a speed limit of up to an including 60km/h and 1.5m on roads with a higher speed limit.

If we are to achieve our 2030 road safety targets and rethink our roads and public spaces under the 'movement and place' approach, there needs to be serious reduction in the provision of on-street parallel parking. That space needs to be reallocated to create separated bicycle lanes for people to safely travel by active transport.

Bicvcle lanes

There is an established evidence base that bicycle lanes make it safer to cycle (Marshall & Ferenchak, 2019). However, both in regulation and practice, there are significant gaps that are preventing safe bicycle lanes being built in Australia and this is a major reason why more people do not cycle. In Victoria for example, a 'bicycle lane' is clearly defined in Victorian Road rules r 153 (4) by certain on-road line markings and/or traffic signs. However, in practice, there is substantial variation in the on-road line markings that do not always comply with the above definition, and this can have the perverse effect of making bicycle lane related road rules ineffective. In addition, on-road line markings are often used that are not recognised by the road rules (e.g., sharrows, directional arrows etc.), and thus lack regulatory enforcement.

Regulatory barriers with road rules and other laws affecting road user behaviour **Regulatory confusion over electric scooters**

Recent technology advancement has seen a dramatic increase in the use of e-scooters and other micromobility devices, both privately owned and hired from commercial share schemes. However, until the design of devices and the behaviour of riders is appropriately regulated, the uptake of these devices as a safe means of transport cannot be maximised. The main challenge is that these devices straddle several distinct categories of road user, and thus their use is confusing as a matter of road design and road user behaviour. While used by pedestrians, their speed and power characteristics align e-scooters more closely to bicycles or motor vehicles, notwithstanding the very different characteristics of all three modes. The current pace of the legal pathways and the design standards are failing early adopters of these new transport modes and faster action is required to keep riders safe.

Legal pathways to maximise benefits

There are several options to create legal pathways to maximise the active transport and achieve both targets for both road safety and climate change, for example: 1) amending existing regulations applicable to road and vehicle design and road user behaviour; 2) introducing complementary regulation to incentivise the uptake of active transport, and 3) incentivising active transport by financial mechanisms (e.g., transport carbon price).

Conclusion

We need to build safe spaces for people to walk and cycle if we are to achieve our targets in road safety and the environment. Currently there are regulatory barriers to greater active transport across multiple disciplines including engineering, design and law. Road design, bicycle design and the road rules contribute to the experiences of pedestrians, cyclists and scooter riders and more is needed to ensure climate change and road safety targets for 2030 can both be met by means that are mutually reinforcing.

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Protecting vulnerable road users: A rural citizen science project

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Abstract

Little is known about the impact of road safety on walkability for rural residents. This is important to understand, because road safety is critical for pedestrian safety, particularly vulnerable children, older people, and those living with a disability. This citizen science project sought community perspectives on issues that impact walkability and pedestrian behaviour. It involved working closely with 87 residents in 10 rural Tasmanian towns to audit walkability and discuss key issues and potential solutions at workshops. Road safety was a key theme of qualitative data, particularly traffic speed, changing traffic conditions, and crossing. Simple solutions such as reducing traffic speed, providing safer crossings, and repairs/improvements to footpaths were identified. This project demonstrates how citizen input can be used to prioritise actions that improve road safety for walking. Working with citizens to identify issues and solutions means that modifications will be more acceptable and receive greater support from communities.

Post on X

Working with communities to identify key road safety issues that impact walkability might contribute to reducing deaths and serious injuries to vulnerable road users in rural areas, as well as improving health and community connectedness.

Introduction

Pedestrians are vulnerable road users and are a critical target group for achieving the National Road Safety Strategy 'Target 2030' ambition to reduce road deaths by 50% and serious injuries by 30% (Commonwealth of Australia, 2021). Thirteen per cent of people killed in road crashes in Australia in 2020 were pedestrians, with children and older people particularly vulnerable (Commonwealth of Australia, 2023). There is little evidence of progress in reducing pedestrian fatalities over the past decade (Commonwealth of Australia, 2023). Given the health and sustainability benefits of walking and the vulnerability of pedestrians, understanding pedestrian behaviours and attitudes, and identifying strategies to protect pedestrians, are critical elements of a path towards Target 2030.

Currently only around one fifth of Australian adults meet the recommended amount of physical activity (Australian Bureau of Statistics, 2023) – walking can make an important contribution to overall physical activity levels and associated health benefits. It is also a sustainable form of transport (United Nations, 2015). To meet Sustainable Development Goals 3 (Good Health and Wellbeing) and 11 (Sustainable Cities and Communities), adults are encouraged through health promotion and public health campaigns and guidelines to increase their physical activity by walking to get to and from places.

There is well-established evidence indicating that the way built environments are designed has an important role in shaping walking behaviours (Owen et al., 2004; Saelens & Handy, 2008). Indicators of 'walkability', or the ease of walking for utilitarian purposes, such as residential density, street connectivity, mix of land uses, and safety, have been consistently associated with walking for transport in urban areas. Recently, the 12-country, 5-continent International Physical Environment Network study identified strong positive associations between residential density, land use mix diversity, intersection density, street connectivity, pedestrian infrastructure and safety, park proximity, aesthetics, traffic safety, and crime and the total physical activity levels and/or walking behaviours of adults (Sallis et al., 2020). However, research to date has largely focused on urban settings and large cities, with much less attention devoted to rural and regional areas. While the majority of road deaths in rural and regional areas relate to lane departures, pedestrian deaths and serious injuries are preventable. Elements that contribute to walkability and road safety considerations in rural areas are likely to differ from those in cities and are essential to consider to enable more people to walk more often while protecting pedestrians from potential harm.

The aim of this paper is to explore road safety issues that impact on walkability and potential solutions posed by rural citizen scientists in our Communities for Walkability project.

Method

The Communities for Walkability project was conducted across Tasmania, Australia (68,401 km²; population 541,071; population density 7.9 persons/km²). The Tasmanian population is geographically dispersed, with more than half of its residents living outside the capital city (Hobart), and one fifth of residents living in 92 'small rural towns' ranging in

size from 200 to 6,000 residents. It is the only state in Australia with no 'Major cities' and hence is an entirely regional and rural state (Australian Bureau of Statistics, 2018).

Communities for Walkability used a citizen science approach and developed an online tool for use by communities to assess the walkability of their local environment. We worked with 61 citizens scientists in 10 purposefully selected small rural towns to audit the walkability environment and discussed findings in community workshops with 58 community members to identify key issues and the top three priorities for action, and to develop potential solutions (n=87 unique participants). Citizen scientists were recruited by identifying 'Community Champions' in each area, who then helped to identify community members to participate. Community Champions used the online tool to select meaningful town segments of approximately 1km in length for auditing. The online tool worked through a checklist-like series of closed-ended questions, with opportunities for open-ended comments embedded within each question.

Community workshop transcripts and free text data from open-ended online audit tool questions were compiled and analysed in QSR NVIVO software. Data were analysed using content/thematic analysis, where we systematically classified data using coding to identify and generate the key themes. This was done by one researcher with regular discussion of emerging themes with the broader research team.

Results

Perceived safety related to traffic was identified as a major theme in workshops and open-ended online audit tool questions. Six out of the ten towns listed pedestrian safety (n=5 towns) or safety in general (n=1 town) in their top three priority areas. Key safety sub-themes issues related to traffic that could impact walkability were traffic speed, changing conditions, and crossings. Potential solutions were also proposed.

<u>Traffic speed</u>: Traffic speed had the potential to negatively impact participants' perceptions of a town's walkability. Participants raised concerns about areas where pedestrians had no choice but to walk with their back facing oncoming traffic. Whilst they tried to avoid traffic as far as practicable when walking, this was often deemed impossible due to a lack of footpaths, very narrow sections of road with no verge or option to step out of the way of traffic, or lack of connectivity of chosen walkways.

'Pedestrians must walk on the road. When cars pass by very few slow down or move a safe distance from pedestrians.'

'It is not safe for elderly folks or folks with a pram to walk. They would be required to walk in the line of traffic which could be travelling up to 50km/hr.'

'This section is definitely not suitable for an elderly person or a person walking with pram. There are large sections where there is no footpath at all, sometimes on fairly blind corners.'

'But yeah, I find the motorised vehicles, sometimes they just tear along like, oh my gosh, like they're trying to tear up a new trail, and it's a little bit off-putting.'

<u>Changing conditions:</u> Whilst some participants acknowledged that their town had little traffic, particularly in relation to larger towns, many found that traffic did increase at particular times. School pick up and drop off, and when people were commuting to and from work were highlighted as relatively high-traffic volume periods. As many of the towns are in areas considered very beautiful or with access to beaches, hiking, or mountain bike tracks, the influx of tourists at weekends and during peak holiday time also negatively impacted walkability. Similarly, small towns that regularly hold Sunday markets experience increasing traffic at these times, making walking difficult and potentially unsafe for locals.

'One of the interesting things around that is that when those people [tourists] arrive here the place totally changes. It's just full to the brim. The road that you might've walked along with the occasional car is not like that anymore, it's a procession of boats and four-wheel drives continuously. You can barely move when it's like that around [town].'

'No safe pedestrian access. Highly seasonal traffic as this is a popular tourist area - quite busy in school holidays, quieter at other periods.'

<u>Crossings:</u> Absent, inadequate, and poorly designed road crossings were also named as common issues that made pedestrians feel unsafe. This was often discussed in terms of its impact on vulnerable road-users, including children, the elderly, those living with a disability, parents with prams.

'There are no safe crossings of the main road either at the end of [street] or at the end of [street].' 'Poor connections and abrupt ending of path, multiple crossings to continue on a footpath all decrease walkability.'

'Lack of safe pedestrian crossing spots even the one with flags at the school' 'road crossing - busy road - needs a crossing for children to safely cross and for motorists to be aware that children cross there' <u>Potential solutions:</u> Participants proposed many solutions that they felt would address the traffic safety issues impacting walkability in their towns. While some solutions were larger infrastructure projects (e.g., a pedestrian bridge), many were simple and low-cost improvements.

'There are improvements that could be made to this section of road to make it more walkable. Some SLOW signs, or a lower speed-limit. Road repairs, and a designated pedestrian footpath. Trees for shade.' 'I'm trying to push for the back road to be a one-way road because then it just changes everything. So if the traffic's all coming one way you're not having to dodge two directions of traffic.' 'I think there's quite a big elderly population that take a long time to cross the road, and you need to have

education, traffic calming, a whole lot of indicators to say, "Look, this is a pedestrian area, slow down, chill out, it's only going to take you a minute."

Benefits to Road Safety

Pedestrians in rural areas are an uncommon focus of research, despite their unique needs, population structure, and high vulnerability. Our findings suggest that by ensuring pedestrians and vehicles are not sharing the same infrastructure, the likelihood of pedestrian accidents or near misses in rural towns is reduced. There are relatively simple solutions that could make a large difference for walkability and road safety for rural residents. The identification of these solutions by the community means solutions are likely to be more acceptable to and receive better community support.

Implications for policy and/or practice

This project demonstrates how citizen input can be used to prioritise actions that improve road safety for walking, and that integrated planning approaches instead of business-as-usual decision making by policymakers and practitioners (e.g., planners, engineers) may lead to better outcomes. Citizen-led priorities for improving safety for walkability could be leveraged to create more responsive priorities with more value (especially in regards to health and safety) to and buy-in from the entire community, not just vehicle drivers.

The findings also highlight the critical need for policymakers and practitioners to ensure that rural road development includes consideration of the needs of pedestrians as well as vehicles. Rural residents are often older, and so policymakers and practitioners need to give greater consideration to diversity in rural populations. Age-friendly environments will also support road safety for children and those living with a disability. Investment in road safety considerations in rural areas might support more diverse population to live in and move around rural towns (i.e., young families) and better enable ageing in place, contributing to economic growth.

Finally, traffic calming measures commonly used in urban environments might not be fit-for-purpose and may require adaptation or modifications for rural towns, where in general traffic volumes might be low but there is a need to accommodate fluctuations in traffic where it can be unsafe for community members to walk around their town.

Conclusions

Being able to safely walk places is a fundamental right. In this study, citizen scientists audited their own towns, discussed unique challenges to walkability in rural towns, and suggested simple solutions to improve the ease and safety of walking. Key road safety issues were identified including traffic speed, the impact of changing conditions at different times of the day, week or year, and lack of or inadequate road crossing infrastructure. Road safety risks – whether real or perceived – have a major impact on modal choice, and residents will choose not to walk if they feel unsafe. Fewer people walking will result in increased traffic demands, more greenhouse gas emissions, and poorer health and wellbeing.

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Challenging roundabout safety assumptions on high-speed arterials

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Abstract

Roundabouts have been recognised as a Safe System option for managing traffic at intersections. Some transport planners have questioned this assumption for multilane roundabouts operating on high-speed urban arterials (MLHSR). Safety performance functions based on Victorian sites and crash data were developed and used to compare safety performance of MLHSR against current-design, signalised arterial intersections on similar roads (a non-Safe System alternative). The modelling results showed that the fatal and serious injury (FSI) crash frequencies were no different between MLHSR and signals, given similar traffic flow conditions. Further, MLHSR would generate twice as many all-casualty crashes compared to traffic signals. This suggests that MLHSR may not be the more forgiving option as previously concluded. Further, motorcyclists dominated the FSI crash records for MLHSR. This highlighted the urgency to develop arterial intersection solutions supporting Safe System outcomes for all road users.

Post on X

New research challenges assumptions on roundabout safety! A study comparing multilane roundabouts to signalised intersections reveals surprising findings: similar fatal & serious injury crashes but double the all-casualty crashes at roundabouts. Time for safer alternatives? #RoadSafety #TransportPlanning

Introduction

Roundabouts have been recognised as examples of Safe System infrastructure, with their designs limiting vehiclevehicle impact speeds to survivable levels (Woolley et al. 2018). There has been a general push to select roundabouts for safety reasons. This sometimes resulted in a practitioner push-back on grounds of limited traffic capacity and reduced pedestrian levels of service. Crash data analyses also raised a question if there was a meaningful difference in safety outcomes between traffic signals and roundabouts on high-speed urban arterials where intersections are larger and designed to higher standards.

These safety questions needed to be addressed to inform planning for high-speed urban arterials in time to have a meaningful effect on the 2030 Safe System goal. A research project was undertaken to compare FSI and all-casualty crash performance of MLHSR with current-standard signalised intersections (i.e. controlled right turns², mast arms, slip lanes, medians) on high-speed outer metropolitan arterials. The conclusions could be used to better inform road planning, design practice and to drive innovation towards Safe System outcomes all road users.

Methods

The research goal required:

- Maximising a sample of sites representing MLHSR (n = 81) and current-standard arterial traffic signals (n = 63) sampled from comparable urban arterials in and around Melbourne, Victoria.
- Measuring key design variables such as central island diameters (25 100 m), numbers of approaches (3 vs. 4), approach speed limits (60 100 km/h), etc.
- Obtaining the most recent five-year crash data records and Annual Average Daily Traffic flows (AADT).
- Developing Safety Performance Functions, i.e. crash frequency estimation models with Negative Binomial or Poisson error distributions based on independent, statistically significant design and operational variables. This was conducted using R statistical package.
- Comparing FSI and all-casualty crash model estimates per five years for cross-intersection MLHSR and current-standard traffic signals (control group) under the same traffic flow conditions.
- Analysing and interpreting the results to inform Safe System knowledge and potential infrastructure developments towards the 2030 goal.

The above approach was proven via other similar research is used in modelling safety performance of different road infrastructure, or in evaluating efficacy of road safety interventions (e.g. Islam et al. 2022; Abdel-Aty & Wang, 2006). The cross-sectional study design was deemed appropriate to inform the broad goal. Also, installation dates for sampled intersections were not available to enable a quasi-experimental design.

2024 Australasian Road Safety Conference

² The full-time implementation of turn control could not be verified.

³⁰ September - 3 October, Hobart, Tasmania, Australia

Results

The FSI and all-casualty crash models and their independent variables were statistically significant. Standard errors on mean crash estimates were large due to the small numbers of sites available for both intersection types.

For MLHSR, major and minor road AADTs, number of approaches, and the central island diameter (a proxy for entry and circulating speeds) were statistically significant variables. Increasing any of them increased FSI and all-casualty crash estimates. For standard signalised arterial cross intersections, FSI and all-casualty crashes increased significantly with major and minor road AADTs. Approach speed limits were not found to be significant contributors to crash performance in both samples; majority were 80 km/h. These results echo similar findings by Turner, Roozenburg and Smith (2009) and Al-Marafi et al. (2020).

Figure 1 highlights how FSI crash estimates increase with major road AADT. While the roundabout estimate was similar or higher, this difference was not statistically significant (LHS). The all-casualty crash estimate for roundabouts was about twice as high as for signalised intersections (RHS). This difference was also not a statistically significant (error analysis will be included in a future paper).



Figure 1. Example FSI and all-casualty crash estimates at MLSHR and signalised cross-intersections Note: Minor AADT set to 10,000 vpd; MLSHR diameter set to sample average of 39 m.

A MLHSR central island diameter of 70 m would result in an FSI estimate double that of comparable traffic signals. A minimum diameter of 25 m produced an FSI estimate similar or somewhat lower than that for signals. This suggests that larger roundabout designs could be compromising Safe System design principles (low impact speeds).

Further investigation of crash data presented a possible explanation for the MLHSR models results. Table 1 shows proportions of FSI crashes by road user and crash type category. High-speed multilane roundabouts had three times higher proportion of motorcyclist FSI crashes than standard signalised arterial intersections (the control group). Table 1 highlights specific motorcyclist FSI risk contributions such as intersection crashes (right angles), loss-of-control and same-direction. Loss-of-control crashes were generally over-represented at roundabouts, even for vehicle occupants.

Road Users	Crash types	Signalis	ed	MLHSR	
Car occupants*	Right through	23%		1%	
	Intersection	20%		20%	
	Same direction	27%	770/	10%	570/
	Loss-of-control	5%	//%	20%	5/%
	Head-on	3%		4%	
	Other	0%		1%	
Motorcyclists	Right through	3%		1%	
	Intersection	3%		9%	
	Same direction	6%	120/	17%	410/
	Loss-of-control	1%	13%	13%	41%
	Head-on	0%		0%	
	Other	0%		1%	
Other Vulnerable Road	Pedestrians	7%	100/	1%	10/
Users	Bicyclists	3%	10%	na	1%0

Table 1. Comparison of road user FSI crash types by intersection type

* May include bicyclists at roundabouts.

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Benefits to Road Safety Policy and Practice

Literature search suggested this was the first comparative analysis of safety performance of multilane roundabouts and signalised intersections on high-speed arterials. The research showed that both intersection types had comparable FSI crash performance, and that MLHSR had about double all-casualty crashes, under similar traffic flow. This will be useful in planning of high-speed urban arterial upgrades, e.g. road duplications, especially where motorcyclists are present in high numbers.

Comparatively good safety performance of standard arterial signalised intersections may reflect incremental design safety improvements, such as introduction of fully controlled right turns and overhead displays (Turner et al. 2012).

The findings emphasize that neither multilane roundabouts nor standard signalised intersections achieve Safe System outcomes on high-speed arterials. Further innovation is needed to align intersections with evolving Network Safety Plans. Grade separations, compact roundabouts, signalised roundabouts and raised safety platforms at signalised intersections may offer safer and more integrated alternatives for high-speed, high-volume arterials. Their aim should be to support the 2030 and 2050 Safe System goals for all road users, including for motorcyclists. On the other hand, it is not realistic to address the FSI risks for motorcyclists at all high-speed, high-volume arterial intersections through infrastructure-based solutions by 2030. This highlights the urgency to implement broader Safe System solutions for motorcyclists in the short- and long-term.

The presented results infer broad trends based on a limited sample of sites from Melbourne and its surrounds. A larger study based on sites from Australia and New Zealand may be able to generalise these trends with greater confidence and provide input into future design guidance changes towards Safe System performance. There is a need for dedicated funding streams to support such innovation.

A journal paper will provide full findings. In the meantime, the corresponding author may be contacted for further details of this research.

Conclusions

This Abstract presented new research findings demonstrating that multilane roundabouts and standard signalised intersections on high-speed arterials have comparable FSI crash performance under similar traffic flows. Multilane roundabouts present three-times higher FSI risk for motorcyclists and are likely to generate twice as many injury crashes. These findings could inform technical policies for intersection design, drive refinement of design guidance and drive practitioner-led innovation towards safer outcomes.

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Gravel cyclists' self-reported crash risk factors

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Abstract

Gravel bike riding has become a popular recreational activity in outer metro and rural areas but injury crash risks are poorly understood for this cyclist cohort. Forty-nine gravel riders took part in a survey drawing on their personal crash experiences. Findings show that key crash risks were: gravel road surface conditions, distracting encounters with others on roads (incl. animals) and rider behaviour factors. These findings offer an opportunity for future investigation of injury crash risks and consideration of initiatives to improve rider safety on gravel roads.

Post on X

New survey reveals key crash risks for gravel bike riders: surface conditions, encounters with others including animals, and human factors. Understanding these risks is crucial for improving rider safety on gravel roads. #Cycling #GravelBiking #Roadsafety

Introduction

This paper sought to better understand risk factors contributing to likelihood and severity of cyclist crashes on gravel roads. Gravel cycling provides a more adventurous experience than traditional road cycling. Riders use mostly rural, low-traffic unsealed roads and shared-path regional rail-trails. Little is known about safety of this growing cohort of riders. Use of road and off-road networks makes gravel cycling safety studies more complex, akin to other modes of active transport such as walking or micromobility.

Gravel riding, including bikepacking and touring, has risen in popularity in recent years, especially since the Covid-19 pandemic. Ernst & Young (2023) reported that sales of adult road bikes (incl. gravel and related types) accounted for over a quarter of all bikes sold in Australia in 2022. Dedicated gravel races and riding events have grown in number and in participation according to Giuliani (2022). Such growth was boosted by increasing e-bike sales.

The injury profile of gravel riders is unknown, with only 40% of all serious injury on-road cycling crashes being reported to police (Meuleners et al. 2020). Between 48% and 85% of sampled on-road cyclist hospitalisations resulted from single-bicycle crashes (Beck et al. 2019, Meuleners et al. 2020, Utriainen et al, 2023). The higher value could be more valid for gravel cyclists given infrequent intersections and vehicular traffic on unsealed roads.

Gravel rider crash risks have not been sufficiently reported in research, and thus little evidence-based guidance on safety could be provided to the growing gravel rider community, especially those new to the activity. This abstract sought to address this through an online survey of gravel riders reporting on their historical crashes.

Methods

Forty-nine gravel riders from several dedicated Victorian online communities agreed to provide information via an online focus group, chat and a follow up online discussion (40 male, 9 female). All riders were adults and considered at least 'somewhat experienced' in gravel riding as this was requested by the facilitator.

Individuals were asked to identify multiple factors present in their own past crashes while gravel riding. These potential risk factors were then grouped into similar types, categorised, and ranked by frequency of their mentions. Injury levels were not specifically reported, however, follow-up inputs suggested that most resulted in at least minor injuries with some requiring prolonged treatment such as physiotherapy.

Results

The participants' responses related almost exclusively to single-bicycle crashes, i.e. loss of control leading to falls, lending credibility to the higher end of the reported injury proportions being applicable to gravel riding. The finding was consistent with infrequent vehicular traffic on gravel riding roads.

In all, 75 different crash-related risks were mentioned. Figure 1 presents the breakdown of the leading crash risk categories drawn from these reported risks.



Figure 1. Gravel riding crash risk categories

'Surface Conditions' of gravel roads were the leading crash risk category (24 mentions) with the following specific risk factors being noted:

- Washouts, water-filled and hidden ruts (7)
- Loose sand / gravel patches (7)
- Slippery surfaces after rain (4)
- Fallen trees and debris (4)
- Corrugated gravel roads (2)

These risks were often mentioned in connection with high speeds, downhill road sections and turns, leading to loss of front wheel control and falls.

The next highest risk category of 'Others on Road' (18 mentions) was led by the risk factor of 'Animals on road' (11), followed by 'Encounters with other road users' (7). The respondents noted animals as posing a significant distraction leading to loss of control, specifically mentioning stray dogs, magpies, kangaroos, snakes, echidnas, and wombats. 'Encounters with other road users' (7) were of similar nature, adding 'near misses' and 'being driven off the road', mainly noting drivers of four-wheel-drives and trail-bike riders.

'Rider Behaviour' (15) and 'Rider Human Factors' (12) would be the highest risk category if considered together. As expected, these categories contained many specific risk factors with the leading being:

Rider Behaviour:

- Excessive downhill speed (5)
- Overconfidence in a group (4)
- Overconfidence solo (2)
- Insufficient route reconnaissance (2)
- Alcohol (2)

Rider Human Factors:

- Lack of riding skills / inexperience (5)
- Distraction / loss of concentration (5)
- Dehydration, overheating and exhaustion (1)
- Underlying conditions, e.g. injuries, health (1).

'Bike Equipment and Setup' category was mentioned less frequently (6 times). Upon further enquires, the 'Improper bicycle setup' (4) related to reduced bicycle control caused by incorrect tyre selection and pressure, high seat position, or clip-in pedals settings. 'Inappropriate bike choice' was mentioned as a risk factor only twice. These crash risk factors may be the easiest to control by experienced riders, and thus may have been already addressed by those participating in the survey, leading in low mentions. This risk category could rate differently for novice riders.

Figure 2 suggests that the leading specific risk factors were not under direct control of gravel riders. This leads to a question if crash risks on gravel roads could be addressed by improved management of unsealed roads. Some lesser risk factors could be addressed by safer rider behaviour and training.

Benefits to Road Safety with Implications for Policy and Practice

This research focussed on risk factors directly contributing to gravel riding crashes. Rider safety also depends on noncrash factors such a running out of water, exposure to elements, technical and health emergencies enroute. These were noted for future, more comprehensive analysis.



Figure 2. The leading self-reported crash risk factors for gravel riders

The findings suggest that targeted maintenance improvements to well-known gravel routes could help to address some of the main crash factors, such as more frequent road grading, shared-path sweeping, drainage and roadside vegetation management. Encouragement of safer cycling behaviour could be linked with promotion of leading gravel routes which seeking to boost regional tourism.

It is noted that self-reported information could bias certain risk factors and cannot provide a comprehensive picture of crash causation. Nonetheless, some of the above results are consistent with similar studies based on hospitalisation injuries of general road cyclists, (e.g. Heesch et al., 2011; Meuleners et al., 2020). Some of the safety interventions suggested by these sources matched the ones presented above.

The findings provide a glimpse of crash risk factors for this fast-growing road user group. The findings could inform further research, rural and remote road safety policies, targeted unsealed road maintenance, and development of guidance for novice gravel riders.

Conclusions

This exploratory research highlights that adverse road surface conditions, distracting encounters with others on roads and rider factors play key roles in gravel riding crash risk. These findings offer an opportunity for future investigation of gravel rider injury crash causation, and identification of targeted safety initiatives.

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Road Intersection Risk Assessment in Western Australia

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Abstract

The "Rural Intersection Risk Assessment" ranked 5141 rural unsignalized 3-leg and 4-leg intersections in Western Australia (WA) according to their potential for crashes, ranging from high to low risk. This Assessment addressed the challenge of assessing potential crash risks accurately at unsignalized rural intersections within WA's rural road network. Derived from Turner & Gardener's (2013) Rural Intersection Risk Assessment Tool developed for the New Zealand Rural Road Network, road traffic volume, speed, and geometry were considered crucial components contributing to safety risk at intersections. The risk ranking established from the model was successfully validated using historical crash data and road user surveys. This evidence-based and proactive approach enables strategic resource allocation for addressing safety risks at unsignalized three leg and four leg intersections by identifying crash risks before they occur within Western Australia's rural road networks.

Post on X

The Rural Intersection Risk Assessment ranked 5141 unsignalised rural 3-leg and 4-leg intersections in Western Australia from high to low crash potential. The resulting index aids strategic resource allocation in road safety.

Background

Main Roads Western Australia currently utilises ROSMA (Road Safety Management System) as its primary tool for prioritising intersection safety improvements. ROSMA assesses intersections based on the history of casualty crashes occurred over the immediate 5 years. ROSMA categorises them under 4 risk levels: Black, Red, Amber, and Green, where Black carries the highest safety risk. Rural areas present distinct road safety challenges, especially regarding priority control intersection crashes. Unlike urban settings, rural environments with low traffic volume often experience more severe crashes that occur randomly. Typically, these incidents involve 1 or 2 crashes at each intersection over a 5-year or longer period, making it difficult to identify consistent trends or patterns when assessing rural intersections.

Moreover, ROSMA's assessment is constrained by the fact that only 30-40% of total intersections in the rural road network experience casualty crashes within a 5-year period. Consequently, a significant portion of intersections in the rural road network remain unaccounted for in terms of safety assessment, exacerbating the challenge of identifying and addressing potential crash risks. Given these complexities, there is a pressing need to develop additional tools and approaches to comprehensively address intersection safety in rural areas. Solely relying on ROSMA may not suffice in identifying and ranking high-risk locations or predicting future crash occurrences. The objective of this project was to create a rural intersection safety index to further assist in the prioritisation of rural intersection safety improvements. By considering crash exposure, such as traffic volume, and crash likelihood factors such as speed and geometry, 3-leg and 4-leg unsignalised intersections were systematically ranked from those with a high potential for crashes to those with a low potential for crashes.

Methodology

The project examined 5141 unsignalized 3-leg and 4-leg intersections on rural state roads in WA by using a safety model by S. Turner and R. Gardner from New Zealand (2013). The Safety Index (SI) was calculated as SI = BM crash prediction * (1+ sum (risk factor values)), by considering exposure and risk measures for crash risk assessment. Base Model (BM) evaluates crash potential based on traffic volume and operating speed under the conditions of,

- a) The 85% tile speed on the priority road is 110km/hr
- b) It has a stop or give-way control, with well positioned single sign
- c) Sight distances in both directions meet or exceed the Austroads requirements
- d) It is located on a straight section of road or one with a radius exceeding 1500m
- e) It is not on a crest curve and has no approaches with gradients exceeding 4.5%
- f) Localized shoulder widening is provided, but no right turn or left turn lanes
- g) There are no raised or painted islands, including splitter islands on side-road
- h) The pavement condition is excellent, and road marking is in good condition.
- i) There are no major hazards within 15m of the Intersection on all corners of a cross-road, and 'top of the T' at 3 -leg intersections
- j) Full lighting is not provided (flag lighting may be provided)

The calculated crash risk for 3-leg intersections is represented as $BM = b_0 x \text{ Qmajor}^{0.2} x \text{ Qminor}^{0.54}$, and for four-leg intersections as $BM = b_0 x \text{ Qmajor}^{0.37} x \text{ Qminor}^{0.63}$. Here, b_0 represents the main road speed, with its values listed in Table 1. These values vary based on the 85th percentile speed on the major road.

85th Percentile	b0 (T junctions)	b0 (X-Roads)
Speed (km/h		
110	7.14x10 ⁻⁴	3.97x10 ⁻⁶
100	5.7x10 ⁻⁴	3.15x10 ⁻⁶
90	4.4x10 ⁻⁴	2.45x10 ⁻⁶
80	3.32x10 ⁻⁴	1.85x10 ⁻⁶
70	2.41x10 ⁻⁴	1.34x10 ⁻⁶
60	1.67x10 ⁻⁴	9.26x10 ⁻⁷
50	1.0x10 ⁻⁴	5.98x10 ⁻⁷
40	6.3x10 ⁻⁵	3.5x10 ⁻⁷

Table 1. Speed Factors

Source: Adapted from "Rural Intersection Risk Assessment Tool," by Turner and Gardener (2013), *Note.* Speed factor values were adjusted to align with road speed values in WA.

The risk measure (1+sum of risk factors) enhances the base model by considering important road and operating features. Eight risk factors were developed for the important road operating features at a rural intersection, considering the existing resources to extract the data.

- 1. Intersection provided with right-turning Bay
- Intersection provided with Basic right turn (BAR) (BAR treatment is used frequently in low volume on two-lane highways across the state road network in WA. A feature of the BAR turn treatment is a widened shoulder on the major road that allows through vehicles, having slowed, to pass turning vehicles.)
- 3. Splitter Island on the Minor Road Approach
- 4. Intersecting with skew angle
- 5. No shoulder widening
- 6. Intersections on horizontal Curves
- 7. Intersections located in close proximity to a horizontal curve
- 8. Vertical slope of the major road where intersection located

The benefits and disbenefits of each factor are summarised in Table 2 below.

Table	2.	Risk	Factors
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Risk Type	Risk Factor	Source
Intersecting angle<70°	+7.5% per arm x roads	Turner (2005) / Montella
	+15% for T intersections	
Horizontal alignment	+35%	Montella (adjusted)
Up to 500m R inside		
800m R	+17%	
Horizontal alignment	+35%	Montella (adjusted)
Up to 400m outside		
800m R	+17	
Vertical Gradient >5%	+17%	Elvik and Vaa
Right turn bay on 3 leg intersections	-30%	Montella (adjusted)
Right turn bay on 4 leg intersections	-15%	Montella (adjusted)
BAR Treatment	-20%	MRWA safety forums
No shoulder widening T	+15%	Beca
No shoulder widening X	+15%	Beca
Splitter islands on side-roads of T-	-35%	NZTA Smartmovez
junctions (with extra signs)		
Splitter islands on side-roads of X-	-50%	Adjusted Hughes (2008)
Roads (with extra signs)		
Intersections located in close proximity	+15%	MRWA safety forums
to a horizontal curve		

Source: Adapted from "Rural Intersection Risk Assessment Tool," by S. Turner and R. Gardener, 2013, IPENZ Transportation Group Conference, Dunedin, New Zealand.

Note. Risk factor values were adjusted to align with road/intersection features in the rural road network in WA.

The safety index for 5114 unsignalized 3-leg and 4-leg intersections was established by incorporating both crash exposure and risk measures values.

Data Collection

Data collection involved accessing Main Roads' IRIS database and utilizing online resources (Google Maps). Traffic volume data for minor roads were obtained from 108 rural councils across WA. The collected data underwent thorough review, cross-checking, and validation against other sources to ensure accuracy and reliability.

Project Outcome

The Safety Index was computed for 5141 rural road 3-leg and 4-leg unsignalized intersections in WA. Based on the distribution of the safety index, intersections were grouped into five risk categories: Very High, High, Medium, and Low, with Very High indicating the highest risk index value. Of the 5141 intersections analysed under the project, 324 received ROSMA rankings based on casualty crashes. Of this, only 67 intersections were categorised as Black or Red. The graph below shows the ROSMA Red and Black distribution on the safety index rankings. This supports the validity of the rural intersection risk assessment's categorisation.



Figure 1. Distribution of ROSMA Black and Red on Rural Intersection Assessment Risk Categories

Further, the rural intersection risk assessment was validated against the annual RAC WA Road User Survey (2022), where intersections most nominated as risky by road users aligned with the current rural intersection risk assessment's safety index. Table 3 shows the distribution of RAC Survey's top 10 intersections against RIRA risk categories.

RAC's Ranking	Rural Intersection Assessment Ranking			
1. Albany Hwy & South Coast Hwy	Not Assessed			
2. Bussell Hwy & Capel Dr	High to Medium			
3. Forrest Hwy & Raymond Rd	Not Assessed			
4. Forrest Hwy & Pinjarra Rd	Not Assessed			
5. Forrest Hwy & Binningup Rd	Not Assessed			
6. Caves Rd & Yallingup Beach Rd	Very High			
7. Bussell Hwy & Memorial Dr	High			
8. East Hyden Bin Rd & Hyden Lake Kind Rd	High to Medium			
9. Bussell Hwy & Sues Rd	High			
10. South Coast Hwy & Strickland St	High to Medium			

Benefits to Road Safety

By prioritising interventions according to potential risks identified through analysis, decision-makers can strategically allocate resources, effectively addressing safety concerns in rural unsignalised 3-leg and 4-leg intersections. This evidence-based approach guarantees that safety enhancements are directed where they are most crucial, reducing the probability of future crashes and enhancing overall road safety outcomes.

Conclusion

The Rural Intersection Risk Assessment aimed to develop a safety index that identifies and ranks the safety risk of rural unsignalised 3-leg and 4-leg intersections across the rural state network. The safety index was developed by considering the intersection's crash exposure, risk factors, and then ranking them from high to low potential for crashes. The resulting index was compared against crash statistics, annual customer survey results for high-risk intersections. The comparison provided strong evidence to support that the risk ranking is valid, meaning that risk ranking does reflect safety risk at intersections to a high degree.

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Advancing Heavy Vehicle Fatigue Risk Management: Evidence-Based Insights from Technology

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Abstract

Regulatory bodies and fleet managers implement various strategies to mitigate fatigued driving risks such as limiting the driving hours for heavy vehicle (HV) operators, stipulating maximum driving limits and mandatory rest breaks. Although various rules, regulations, and guidelines have been implemented to address fatigued driving, there is limited analysis on the compliance with and effectiveness of these measures. This study investigates fatigue noncompliance among HV operators using Automatic Number Plate Recognition (ANPR) camera data. It investigates patterns and trends in fatigue driving, focusing on working journeys exceeding 11 hours. The analysis reveals a downward trend in fatigue noncompliant journeys since 2018. The study highlights areas for future research, such as the fatigue-prone area, relationship between speeding and fatigue noncompliance, and the effectiveness of Electronic Work Diaries in reducing fatigue noncompliance.

Post on X

Exploring fatigue noncompliance in heavy-vehicle drivers using ANPR cameras to enhance road safety.

Introduction

In the past decade, the landscape of road transport in Australia has witnessed a notable surge in the number of registered Heavy Vehicles (HVs) signalling a rise in the presence of HVs on national roads (Australian Bureau of Statistics, 2021). Injuries from crashes involving HVs are often much more severe compared to those from crashes involving other types of vehicles. The critical nature of this scenario is underscored by recent statistics by the Bureau of Infrastructure, Transport and Regional Economics (2024), highlighting within the year leading to the end of March 2024, crashes involving HVs resulted in 151 fatalities in Australia. This data underscores the need for focused safety measures in the HVs sector. In Australia, fatigue ranks among the top five road safety priorities, commonly referred to as the 'fatal five'; which also includes concerns like seatbelt use, speeding, drug and alcohol impairment, and distraction (Thomas et al., 2021). This focus on fatigue is further emphasised in the National Road Safety Strategy 2021-2030 (2021) by the Australian Government, highlighting its continued importance in road safety efforts across Australian states and territories. This issue is particularly crucial in the context of HV operation. The existing scientific literature indicates that fatigue contributes to between 2% and 16% of road crashes (Thomas et al., 2021) and is a factor in nearly 20% of fatal road crashes in Australia (Ren et al., 2023). Studies focusing on the physiological and psychological aspects of fatigue have linked it to key performance impairments such as delayed reactions, lapses in attention, and compromised decision-making (Board et al., 2012; Du et al., 2015). These impairments can lead to an increased risk of unsafe behaviours like lane drifting and inconsistent speed control (Philip et al., 2005). Regulatory bodies and fleet managers implement various strategies to mitigate Fatigued Driving (FD) risks, such as regulations on work scheduling and hours, including limitations on active duty, mandatory rest periods, and work diary maintenance (Hartley et al., 2000). While various regulations, guidelines, and codes of practice have been implemented to address FD, their effectiveness is often hampered by noncompliance. There is limited analysis on the compliance of fatigue regulations, so this study aims to analyse the noncompliance trend to the FD regulations leveraging ANPR cameras data.

Methodology

In this research, ANPR camera data is utilised to assess the compliance of HV operators with fatigue regulations. The data has been methodically processed to identify distinct journeys. This is done by inferring what types of activities a vehicle has been involved in between a pair of consecutive sightings by the ANPR camera network. The total population of the ANPR data utilised for the analysis, along with the percentage of journeys based on origin-to-destination, organised by state, are illustrated in Figure 21(a) and (b), respectively.

There are three distinct categories of activities, namely work, recovery rest breaks and reset rest breaks (NHVR 2024). The analysis focuses on working journeys exceeding 11 hours, which can be a proxy to fatigued driving. Fatigue noncompliance is expressed as a ratio, considering total journeys, given by:

Noncompliance ratio[%] = $100 \times \frac{\text{Total Fatigue Noncompliance Journeys}}{\text{Total Journeys}}$



Figure 21: (a) The distribution of ANPR cameras across Australia (b) Percentage of journeys for origin to destination, organised by states

Results

(a)

Figure 22 (a) illustrates the trend analysis for different jurisdictions since 2018. The overall non-compliance ratio among all jurisdictions, follows a downward trend. **Figure 22** (b) presents an analysis of the origins and destinations in relation to non-compliant journeys in 2023. The figure highlights the roads responsible for a large portion of non-compliant journeys across different jurisdictions.





Figure 23 shows an analysis of the distribution of non-compliance ratios across different travel routes within Australia in 2023 using box plots. Each data point is the noncompliance ratio for a specific route with the same origin and destination. The box plots show the interquartile range, which covers the middle 50% of the non-compliance ratios for journeys between specific state pairs. The median of the distribution is indicated by the central line within each box, providing a measure of the central tendency of fatigue non-compliance for each pairing of states. These outliers are also significant as they identify specific instances of non-compliance that are markedly different from the general trend and may signify potential areas which need further investigation on fatigue non-compliance journeys or interception by Safety and Compliance Officers (SCO).

Conclusion

In this research, an effort is made to approximate fatigue non-compliance using ANPR camera data. Our primary focus was on analysing working journeys exceeding a duration of 11 hours, aligning with the Solo drivers regulatory guidelines by NHVR (2024). This approach is premised on the assumption that such lengthy journeys are indicative of driver fatigue. Due to the inherent limitations in the resolution of the data, our analysis is constrained and does not extend to the examination of shorter rest breaks. This limitation in data granularity impacts our capacity to conduct a comprehensive analysis of all rest break durations. In future work, extending this analysis to include Human Movement Data may provide the level of granularity required to overcome these limitations. Findings from our analysis highlight a downward trend in non-compliant journeys since 2018. The origin-destination analysis provided insights into the geographical patterns of non-compliant journeys.



Figure 23: Origin-destination based non-compliance journeys for each state in 2023

The project opens several avenues for future research that are critical for enhancing our understanding of fatigue and non-compliance in HV operations. One key area is the statistical analysis of actual on-road enforcement and trends from ANPR data. The current research solely focused on the trends in ANPR data. Further investigation is needed to examine the relationship between ANPR data observations and actions such as education, offences, and infringements to assess the effectiveness of new policies on fatigued driving. Additionally, investigating the potential correlation between speeding and fatigue non-compliance journeys is an important aspect. Exploring the link between non-compliance journeys and crash rates could help identify patterns and develop targeted interventions. Pinpointing specific locations that are hotspots for fatigued driving, known as fatigue-prone areas, could aid in implementing location-based safety measures. Utilising crowdsourced data, such as telematics data from HVs, would be another future work for this project to overcome the resolution limitations of ANPR data.

While the study provides valuable insights, it is important to acknowledge its limitations. The reliance on ANPR data inherently restricts the analysis to what can be inferred from vehicle sightings. The geographical placement of these cameras is restricted to specific locations along the road network, resulting in a partial coverage that does not encompass the entire network. It should be noted that the National Heavy Vehicle Regulator (NHVR) is expanding the use of mobile cameras to assist in capturing data on strategic routes, which will enhance the coverage of road network. The study assumes solo driving, which may not always be the case. Additionally, the low resolution of the data means that it is not possible to extrapolate whether the required 15-minute rest breaks have occurred within any journey.

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Improving road safety outcomes with Māori: a community centric approach to building relationships

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Abstract

Improving road safety outcomes with Māori project is a key initiative within New Zealand's road safety strategy, as we want to achieve better road safety outcomes with Māori. In this project, New Zealand Transport Agency (NZTA) is partnering with iwi Māori (Māori people) to co-design approaches to improve road safety outcomes for Māori. We are taking a 'listen first' and relationship building approach. As relationships develop and strengthen, NZTA and iwi Māori are co-designing a format of holistic and culturally relevant interventions. Early examples include using of Māori language and images of iwi Māori to directly engage with Māori communities. The co-design of the program also ensures the way iwi Māori are included in road safety campaigns is culturally sensitive and accepted by community. Māori continue to be overrepresented in traffic related deaths and serious injuries, mortality rates are between 60% - 200% higher for Māori compared to non-Māori. We continue to look for opportunities to collaborate with Māori, other government agencies, road safety providers and advocates to improve these outcomes.

Post on X

Improving road safety with Māori. Let's get more people home safe and sound to their whānau, hapu and iwi (family, people, and tribe).

Introduction

Improving road safety outcomes with Māori project is a key initiative within New Zealand's Road Safety Strategy 2020-2030, Road to Zero, (the strategy), as we want to achieve better road safety outcomes with Māori (New Zealand Government 2019). Specifically, that in New Zealand, our data is currently incomplete and that 'The limited evidence we do have suggests that Māori are at greater risk when travelling on our roads than the rest of the population at all ages' (New Zealand Government, 2019, p 55). Sadly, since 2013 the number of people dying or being seriously injured (DSI) on Aotearoa New Zealand roads has increased from 2014 to 2017, the DSI rates for Māori were 60-200% higher compared to non-Māori.

The strategy calls out that more work is needed to understand the relatively high levels of road trauma for Māori. We are working with our Road Safety partners to commence this work and will be partnering with Māori to co-design activities that reduce road trauma and support Māori.

Efforts to improve Māori road safety outcomes cannot be undertaken without acknowledging historical trauma and disparities. These disparities now involve a complex mix of socioeconomic and lifestyle factors, difficulties accessing healthcare, structural barriers and systemic racism. However, over recent decades, a resurgence of cultural revitalisation, demand for equitable outcomes and an increased mandate for greater Māori autonomy has highlighted the resilience of Māori to contest, adapt and evolve their endeavours to achieve better outcomes. This provides a strong foundation for us to work from, in partnership with Māori.

Method

We are taking a 'listen first' and relationship building approach. We are connecting and partnering with iwi Māori, other government agencies, road safety partners and advocates, to continue to look for opportunities to collaborate, leverage resources and learnings that contribute to Māori-centric road safety and wellbeing initiatives to:

- > Identify and undertake further analysis and research as required and/or,
- > Co-design Māori-centric Road Safety interventions to address specific issues.

Results

The results are ongoing, as we gain insights and learnings into a te ao Māori lens on road safety. Approaches and samples we have that are working to date and can be replicated are:

- > Listen first and relationship building
- \rightarrow By Māori for Māori (By the community for the community)
- > Sell not tell
- > Change through conversation
- > Creating a road safety movement with Māori
- > Creating road safety images using images of iwi Māori (Figure 1)
- > Working with leaders in the community to create their own Road Safety Strategy

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia Ongoing collaborative relationship building and engagement, that contribute to improving road safety initiatives work. For example, information gathered from 46 Māori males, was able to be used by NZTA Education and Marketing team when developing a new campaign, to encourage people to wear seatbelts. There will be a national approach, as well as looking into specific solutions for Te Tai Tokerau, which NZTA is working on, with the Far North Rural Education Activities Programme (REAP) and the Northland Transportation Alliance to develop.

Solutions led with Māori in their own communities are likely to have the most impact E.g. Matariki Event where road safety was weaved in, not only acknowledge lives lost since the last Matariki New Year (Māori New Year) but celebrated the present and looking to the future and learning from these losses with a holistic approach to road safety. This was the first event of its kind and the community showed up, so looking forward to supporting more annual events. https://fb.watch/mqAQKD9thf/ (Figure 2)



Figure 1. Images of iwi Māori created as part of the road safety co-design work



Figure 2. Matariki Event, to watch click: https://fb.watch/mqAQKD9thf/

Benefits to road safety

To gain understanding and insights to work towards reducing road trauma and support Māori.

The savings in deaths and serious injuries if the DSI rates for Māori where the same non-Māori. Opportunity for New Zealand to reduce its trauma levels. In 2023 NZ had 341 deaths and 2428 serious injuries, a social cost of \$7,746 Million. If this could be halved, that is a saving of \$3,873 Million.

Implications for policy and practice

The literature, research and data tell us Māori are overrepresented in death and serious injuries, as a result of road crashes. Trends suggest this is increasing. It is imperative that we partner with Māori and local government, as well as central government across a broad range of sectors, to help us understand the contextual and systemic issues that contribute to these outcomes. NZ Transport Agency and our road safety partners need to continue to explore the contributing factors to road trauma for Māori.

Gathering evidence and insights will help towards furthering and widening this project and give opportunity to wider potential research topics into transport aspirations for Māori e.g. (Urban areas, Ethnicity, Regional differences, Detailed investigation into the factors contributing to Māori DSI in Auckland, Waikato and Northland Regions, which would provide a clearer understanding of where and how best to focus efforts of addressing road safety outcomes for Māori.

The key for us is to have some form of metric that tells us how we are going / what we are aiming for as a target and this should be directly influenced by things we are doing. We also want to supplement these with stories on what we are doing well to showcase ways of working / partnering with Māori and how and where we are driving positive outcomes for Māori. For example: Gather case studies to celebrate achievement and understand what is working well and what is not working well. Gather feedback from Māori on their experience working with NZ Transport Agency and gain insights, learnings and any, improvements that maybe needed. Create action plans for reducing road-related deaths and serious injuries to address the over representation for Māori. Build trusted relationships, where Māori are engaged and report feeling safer in their communities. Additional attitude and behavioural surveys. Comparisons stats before and after we have worked in a location and compare other locations, along with monitoring our outcomes and having quality Māori data to be available to inform road safety initiatives.

Conclusions

It is too early in the programme to draw conclusions and Māori continue to experience poorer road safety outcomes than non-Māori which manifests in higher rates of DSIs in road crashes. Through building relationships, we can work together to co-design culturally relevant road safety initiatives based on communities' wishes and needs. Once we have an agreed way forward, we can then look at how we can support Iwi to introduce and maintain the initiatives in their communities.

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Seat me safely: professional development for caseworkers transporting vulnerable children

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Abstract

Kidsafe NSW conducts Child Car Seat Professional Development workshops for community and justice caseworkers whose role requires them to transport vulnerable children, often in emergency situations. Designed as a direct response to the feedback received from participants and based around the principles of adult learning, Kidsafe NSW has customised these workshops to meet the needs of an extremely diverse and geographically dispersed group of professionals. Initially, the professional development sessions consisted of a 2.5 hour, face-to-face, theory-based, demonstration workshop. The staff indicated that they required a hands-on practical component to be confident to install, adjust and check child car seats every child, every trip. The workshops continue to evolve to include a combination of current theory and practice. The final phase (see Approach Four) is designed to improve knowledge and service delivery by incorporating a customised online theory component available any time prior to practical workshops or as a refresher.

Post on X

Kidsafe NSW conducts Child Car Seat Professional Development workshops, incorporating both theory and practical sessions, customised for caseworkers whose role requires them to transport vulnerable children.

Background

In New South Wales (NSW) road trauma is the second leading cause of death due to injury to children (NSW Child Death Review Team, 2023). Road trauma is also the second leading cause of injury to children (AIHW, 2023). Moreover, children in regional and remote areas have a higher rate of transport-related injury than those living in major cities (NSW Child Death Review Team, 2023). While child car seats are being used, upon inspection, it is found that in the majority of cases they are not being used correctly (Brown et al., 2022).

Caseworkers build relationships with children, young people, and their families and carers to influence change and bring about support and protection in families to create a safe environment for children. One caseworker reaches many families each week. Every year, around 1 in 33 NSW children aged under 18 years come into contact with the child protection system (AIHW, 2023).

Educating caseworkers in road safety, especially on correct selection and use of child car seats, not only ensures these caseworkers are equipped with the skills and knowledge to safely transport children in their care, but also enables them to share this information with families and carers, improving the safety of young, vulnerable children throughout NSW. In addition, as employees, the caseworkers are provided with work related training to reinforce work, health and safety knowledge and compliance.

Due to the high rates of child injury and death on NSW roads, particularly in regional and remote areas, combined with the high rate of out-of-home care and the need for child car seat information, Kidsafe NSW developed, adapted, and continuously improved a professional development workshop for caseworkers transporting children on a regular basis in the Hunter and Central Coast regions of NSW.

Project Description

This project addresses the conference theme by creating pathways, in partnership with agencies, to support vulnerable communities to continuously improve knowledge and skills around the safe transport of children through needs-based workforce training.

Transport for NSW (TfNSW) contacted Kidsafe NSW about the possibility of training a large number of caseworkers from the Department of Communities and Justice (DCJ) on child car seats in the Hunter and Central Coast Regions of NSW. This is an extremely diverse and geographically dispersed group of professionals with restricted timeframes and availability, working with communities often with complex needs.

To ensure the workshops were available to the greatest number of people and were economically viable, TfNSW with DCJ decided to provide several face-to-face professional development sessions conducted by Kidsafe NSW. Other options for consideration included a webinar which could cater to an unlimited number of people, or a one-day

nationally recognised training course which could be offered to approximately 12 senior caseworkers per session. Neither of these would satisfy the unmet demand for sound knowledge and hands-on practice with qualified instructors and/or mentors.

The evolution of these workshops is outlined below. Combining the principles of adult learning with action research, these workshops have been updated, customised and improved to suit the unique needs of this group of professionals (Hill et al., 2015).

Approach One

Over two months, Kidsafe NSW conducted six professional development sessions throughout the Hunter and Central Coast Regions of NSW to approximately 90 caseworkers. The professional development sessions were designed to give a general overview of child car seats and the issues around the safe transport of children. The sessions covered:

- 1. Laws for transporting children
- 2. Types of child car seats
- 3. Features of child car seats including ISOFIX
- 4. Common misuse issues

- 5. Accessories
- 6. Purchasing child car seats
- 7. Installation of child car seats
- 8. Demonstration of an installation of a child car seat

<u>Evaluation</u>: TfNSW surveyed participants after the session and based on the feedback decided that, although the presentation was informative, participants had an expectation of a practical hands-on session to increase confidence and competence in checking, adjusting, and installing child car seats (refer to Approach Two).

Approach Two

To support the request for a practical session on child car seats and to ensure the needs of TfNSW and DCJ staff were met, Kidsafe NSW made some service delivery modifications. Three practical sessions were conducted for approximately 40 staff who had already completed the professional development sessions or had completed a DCJ online module on child car seat safety. They were provided hands-on experience in checking, adjusting, and installing child car seats, including rear-facing car seats, forward-facing car seats, and booster seats.

Kidsafe NSW identified that a practical session would only be beneficial if participants had prior knowledge about child car seats. Based on informal conversations during the practical sessions, it was determined that only half of the participants had completed any pre-learning on child car seats prior to this session. This meant that the learning experience was not optimal.

<u>Evaluation</u>: An online evaluation survey was developed for participants following the practical sessions. 54% of participants completed the evaluation, 95% strongly agreed or agreed that they were satisfied with the practical session. However, participants and senior team leaders indicated that the existing DCJ online module did not adequately address the knowledge and skills required for transporting children safely.

Approach Three

Applying the principles of adult learning, Kidsafe NSW continued to adapt the sessions to ensure the best possible learning environment and outcomes for participants (Hill et al., 2015). Kidsafe NSW developed a session which incorporated an interactive one-hour theory component and two-hour practical session. TfNSW organised and promoted four of these sessions which were conducted over a two-day period for over 60 people from DCJ and other NGOs.

This element of the delivery model, i.e. face-to-face, proved to be effective as participants gained basicknowledge and understanding around child car seats and the issues of safely transporting children, as well as the hands-on experience of checking, adjusting and installing different child car seats. Following the success of the combined theory/practical approach, TfNSW has secured funding to deliver more of these sessions in 2024 across the Hunter Central Coast Region.

Evaluation: Following these sessions, participants were asked to complete an online evaluation andthere was an eve higher response rate of 84% of participants completing the online evaluation. Results showed participants were extremely satisfied with the sessions with 98% strongly agreeing or agreeing that they benefitted from the workshop. This was also evident in testimonials received after the workshop, "awesome presenters, knew what they were talking about and answered all questions. Loved being able to do the fitting on the spot," "the instructors were very helpful and knowledgeable."

However, the existing online information could not be formally assessed by Kidsafe NSW as access was not available to non-Departmental personnel. But based on the professional opinion of senior Departmental personnel and the extent

of information needed and questions asked, pre-existing knowledge appeared to be basic, variable and not necessarily current. Based on this qualitative assessment of the pre-reading online module, Approach Four was incorporated into the project development.

Approach Four

The next phase aims to incorporate a customised online theory component. The final resource will be available any time prior to practical workshops or accessed following the workshops as a refresher. The online component will cover relevant child car seat information and will include knowledge assessments.

<u>Evaluation Plan:</u> As the Child Car Seat Professional Development program progresses it will allow for ongoing refinement and improvement based on participant feedback and emerging best practices ensuring the effectiveness and sustainability of the program in the long term. This approach has commenced and the planned evaluation phases include:

- Research available, comparable modules and compare content to information needs of caseworker cohort
- Modify content and produce draft module text to be assessed by Kidsafe and DCJ Caseworkers
- Test compliance with pre-reading and assessment protocol
- Produce pilot version to be tested with representative sample, and modify
- Develop approved branding and partner agreements
- Test the professional development that incorporates pre-learning online module and assessment in conjunction with face-to-face practical session. This will be an important element to establish the value of the integrated, multi-mode adult learning elements in meeting the learning needs of the caseworkers as well as meeting the expected level of professional knowledge and skills.

Conclusion

To date, approximately 200 caseworkers from DCJ in the Hunter and Central Coast regions have completed a version of the Kidsafe NSW Child Car Seat Professional Development program. Kidsafe NSW has a mission to engage with communities across NSW to prevent child injury by recognising the importance of cultural and regional diversity and self-determination. Kidsafe NSW delivers training, education and programs ensuring accessible and equitable service delivery.

The continued roll-out of these Child Car Seat Professional Development workshops to educate caseworkers is important as children in regional and remote areas face unique challenges and risks due to geographical isolation and limited access to services. Equitable access to professional development ensures caseworkers can confidently and competently safely transport children in their care throughout NSW.

The success of these professional development workshops has been due to the collaboration and client relationships between agencies such as DCJ, TfNSW and Kidsafe, and the flexibility of Kidsafe NSW to adapt and customise the sessions as needed. This has ensured that the skills and knowledge being taught is adequate and that these agencies are receiving a unique product suited to their needs.

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A Corridor-level approach for demarcation of pedestrian vulnerability

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Abstract

Globally, pedestrians are the most vulnerable group in road crashes, accounting for 23% of reported fatalities among road user types. The South Indian State, of Kerala witnessed more than 5100 pedestrian fatalities corresponding to 26.5% of total fatalities during the period 2018 to 2022. The present paper explains a corridor-based approach to identify pedestrian vulnerable locations, which refers to specific sections of roads posing increased risks and safety concerns for pedestrians. A total of 400 such corridors, ranging from 200 to 4000 metres in length, have been identified, with fatalities ranging from 2 to 24 within each corridor. Cluster analysis was carried out using K-Means Clustering to categorize the corridors using parametres like length of section, road type, facilities available and area type. The proposed approach will help the policymakers in formulating measures to improve pedestrian safety on a corridor level, unlike the point level.

Post on X

#Let's make every step safer! #PedestrianSafety #KeralaRoads #ARSC #RoadSafety

Introduction

Road crashes pose a significant public health concern worldwide, leading to substantial loss of life and economic costs, necessitating urgent measures to improve road safety. Road crashes rank as the 12th leading cause of death for persons of all ages and the first leading cause of death for people aged 5-29 years. Additionally, more than half of these fatalities are among pedestrians, motorcyclists, and cyclists (WHO 2023). Globally, an estimated 1.19 million road traffic deaths occurred in the year 2021, equating to 15 road traffic deaths per 100,000 population. In India, a total of 4,61,312 road crashes were reported by States and Union Territories in 2022, resulting in 1,68,491 fatalities and injuring 4,43,366 individuals, averaging 1,264 crashes and 462 deaths per day or 53 crashes and 19 deaths per hour nationwide(MoRTH, 2022). The South Indian State, Kerala ranked 3rd among the states in India for the total number of crashes in the year 2022. According to the Road Crash Statistics by the State Crime Records Bureau (SCRB), Kerala Police, 19,468 people died, and 211,534 people were injured in 186,375 crashes in Kerala during the five calendar years from 2018 to 2022. Out of this, 37,749 pedestrian-involved crashes were reported, resulting in 5,151 pedestrian fatalities, accounting for 26.5% of total fatalities (Police, 2023).

The spatial pattern of crashes tends to concentrate along specific corridors rather than occurring randomly. The corridor-level analysis provides a better understanding of the factors contributing to pedestrian and bicyclist crashes, allowing for the development of effective countermeasures to improve safety (Al-Mahameed et al., 2019). Pedestrian-vulnerable corridors are characterized by the conditions that increase the potential hazards and thereby, the likelihood of pedestrian-related crashes. Identifying and addressing the issues of vulnerable pedestrian road corridors will aid in the implementation of appropriate measures to improve pedestrian safety. Leonardi et al., (2020) identified four clusters of elderly pedestrians, proposing solutions such as sidewalk adaptations, enhanced lighting, pedestrian-vulnerable corridors across Kerala and to categorize these vulnerable corridors through clustering based on corridor length, availability of pedestrian facilities, and the number of fatalities. The study addresses the need to improve pedestrian safety in Kerala by identifying corridors that have a higher concentration of pedestrian fatalities.

Methodology

The study objective was achieved through crash data collection from secondary sources, data preprocessing, demarcation of corridors in GIS, computation of corridor-wise pedestrian fatalities & further categorization of pedestrian-vulnerable corridors. The requisite crash data for the study was collected for the years 2018, 2019 and 2022 from the SCRB. Crash data for the years 2020 and 2021 were excluded considering the impact of the COVID-19 pandemic. The sliding window method is used to identify the pedestrian vulnerable corridors. As the window slides, if two adjacent fatal crash locations in a same type of road falls within a distance of 500 m from each other, the road segment between them will form a vulnerable corridor. This process is repeated till the distance between two fatal crash locations is more than 500m. The distance from the initial crash location to the final location within the same road type and having the inter-distance between adjacent locations not more than 500m, is considered as the length of the corridor. The number of pedestrian fatalities were then attributed to each corridor for determining its severity.

Pedestrian Vulnerable Corridors were categorized through K-Means Clustering (Abiodun et al., 2023), considering parameters including corridor length, availability of pedestrian facilities, and the number of fatalities.

Results and Discussion

The analysis of pedestrian crash data revealed that a total of 3613 pedestrian fatalities were reported in 11807 pedestrian-involved road crashes during the study period, which involved 1450 fatal crashes, and 10,357 injury crashes. Pedestrian involved crashes in the study area were mapped and the vulnerable corridors for pedestrians were identified using GIS, which is shown in Figure 24.



Figure 24. a) Crashes imported to QGIS b) Demarcation of Corridors

A total of 400 pedestrian-vulnerable corridors with an overall length of 555.81 kilometres were demarcated across the State. These corridors witnessed 1548 pedestrian fatalities out of the total 3613 fatalities that occurred during the analysis period. The highest number of corridors was observed in Thiruvananthapuram (54 corridors) followed by Thrissur (48 corridors), and Kozhikode (46 corridors), as illustrated in

Table 8. The number of fatalities on these corridors ranged from 2 to 24, with corridor lengths varying between 200 metres and 4000 metres.

District	No. of corridors	No. of fatalities	Length (m)
Thiruvananthapuram	54	214	45584
Kollam	31	132	45633
Alappuzha	41	213	60608
Pathanamthitta	5	19	8093
Kottayam	13	40	11362
Idukki	5	19	7817
Ernakulam	35	144	40135
Thrissur	48	230	81906
Palakkad	31	114	41812
Malappuram	28	94	38862
Kozhikode	46	155	79590
Wayanad	10	17	3620
Kannur	38	134	75787
Kasaragod	15	23	15001
Total	400	1548	555810

Table 8. District-wise number of corridors

Out of the 400 demarcated corridors, 262 belonged to rural areas, while the remaining 138 were in urban areas. The information on the availability of pedestrian facilities shows that 247 corridors have no facility while 153 have some kind of facility like zebra crossing, footpath, foot over bridge etc. A total of 163 corridors were part of the National Highway, followed by 137 sections in the other roads category and 100 corridors in the State Highway Category. Since there was wide variation in the characteristics of the corridors, the demarcated pedestrian vulnerable corridors were categorized into 5 clusters based on the Scree Plot obtained through hierarchical clustering followed by K-Means Clustering. The final cluster centres and average fatality rate per km are shown in Cluster 1 includes 40 corridors, with the least presence of pedestrian facilities, having an average length of 3700m, in which, an average of 7 pedestrian fatalities occurred during the analysis period. Cluster 2 represents the most vulnerable one constituting 118 sections with an average number of fatalities of 2.40 and having the least average length of 457 m only. Cluster 3 comprises 52 corridors, which are characterized by minimal pedestrian facilities, have an average length of 2784 metres and an average length of 4, with corridors having an average length of

1940 metres without considerable pedestrian facilities. In the case of Cluster 5, there exists an average fatality of 3.7, with corridors extending an average length of 1053 metres, and notably limited pedestrian facilities. **Table 9. Results of cluster analysis**

	Clusters				
Parameters	1	2	3	4	5
Fatalities, Nos	6.93	2.4	5.65	4.14	3.7
Length, m	3709.85	457.74	2783.94	1940.64	1052.91
Pedestrian Facility (Yes = 1 , No = 0)	0.28	0.47	0.35	0.32	0.38
Road Type (NH=1, SH=2, Other = 3)	1.58	2.19	1.75	1.82	1.97
Number of Corridors	40	118	52	84	106
Fatality rate per km	1.87	5.24	2.03	2.13	3.51

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Table 9. Results of cluster analysis

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Number of Corridors	40	118	52	84	106
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While considering the fatality rate per kilometre length, Cluster 2 and Cluster 5 emerge as the most critical, with an average fatality rate of 5.24 and 3.51, respectively. The other three clusters have an average fatality rate of 1.87, 2.03 and 2.13. Despite the presence of adequate pedestrian facilities in Cluster 2, it exhibits a higher vulnerability, potentially attributed to the inadequate functioning of these facilities or the lower compliance level. This calls for a more detailed investigation into the compliance as well as the operational aspects of the facilities.

Benefits to road safety

Every journey starts and ends with a walking trip. Identifying pedestrian vulnerable road corridors is crucial for targeted safety interventions, leading to a significant reduction in pedestrian crashes and injuries. This study demarcated the pedestrian vulnerable corridors in Kerala, which helps to allocate the optimum allocation of scarce resources. Through targeted safety interventions a significant reduction in pedestrian crashes and injuries can be achieved. This study demarcated the pedestrian vulnerable corridors in Kerala, which helps to allocate the optimum allocation of scarce resources. This study demarcated the pedestrian vulnerable corridors in Kerala, which helps to allocate the optimum allocation of scarce resources. This study demarcated the pedestrian vulnerable corridors in Kerala, which helps to allocate the optimum allocation of scarce resources. This approach not only enhances pedestrian safety but also promotes a safe environment for all road users, ultimately fostering a safer road environment for everyone.

Implications for policy and/or practice

This study aligns with the Australasian College of Road Safety Policy Principles by emphasizing the prioritization and equitable implementation of pedestrian safety measures, ensuring individuals of diverse backgrounds, ages, and abilities can navigate the road network without facing disproportionate risks of injury or fatality. The study also complies with the Safe System Approach, the Safe Roads and Safe User, in the Global Plan for the Decade of Action for Road Safety 2021-2030 developed by the World Health Organization and the United Nations Regional Commissions. The study can throw light on the critical corridors requiring infrastructure improvements that can enhance Pedestrian Safety and thereby achieve better star ratings as envisaged by the Global Plan (Target 3).

Conclusions

The spatial analysis of pedestrian crash data in Kerala during the study period revealed disturbing statistics, with a total of 3,613 pedestrian fatalities in 11,807 pedestrian-involved road crashes. Through spatial analysis, the study demarcated 400 pedestrian-vulnerable corridors across the Kerala state, spanning 555.81 km. The number of fatalities in these corridors ranged from 2 to 24, with lengths varying between 200 metres and 4000 metres. These corridors witnessed 1,548 pedestrian fatalities during the analysis period, warranting an urgent need for safety interventions. Out of the total corridors analyzed, 62% lack pedestrian facilities, while the remaining 38% have some form of facilities such as zebra

crossings, footpaths, foot-over bridges, etc. Detailed investigations are required to bring out the effects of these factors in increasing the safety of pedestrians. Through Cluster analysis, the identified pedestrian vulnerable corridors were categorized into five clusters, with Cluster 2 and Cluster 5 emerging as the most critical due to their high fatality rates of 5.24 and 3.51, respectively per kilometre.

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Workplace road safety education – truck safety and blind spots awareness project

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Abstract

Promoting road safety within our organization of 1800 employees is a paramount. Through comprehensive workplace education efforts, we embed a culture of safety, cultivating heightened awareness among employees and encouraging responsible behavior on the roads, thus mitigating the risk of work-related incidents. This initiative is designed for long-term impact, with a focus on continually reinforcing safety practices and adapting content to address current road safety issues. By tailoring education to the specific needs of our employees, we intent to also extend the benefits of road safety awareness to the broader community, acknowledging their integral role within families and networks. The aim is that increasing road safety awareness not only benefits our employees but also contributes to safer roads in the community in general.

Post on X:

Promoting road safety among Council staff and wider community through education and awareness initiatives, making roads safer for all needs to be an ongoing work on many levels. #RoadSafety #CommunityAwareness

Background

Every day, people in the community interact with trucks on roads. With about 1800 staff members our organization is one of the biggest employers in the area. As most of workers also live in the Beaches area, they're not just employees but also active community members with families and friends. Council believes in making roads safer by educating its staff, knowing that this knowledge will also benefit the wider community. As identified by Road Safety Team this project would be beneficial for the additional education for staff. This initiative aims to spread important road safety messages effectively and to enhance safety awareness to road users in our community. Initially, the program was created as a Pilot targeting the staff at a particular worksite where 70 workers participated in the one day workshop. Due to its positive impact and popularity there is already scheduled another Truck Safety and Blind spots awareness workshop at another Council worksite and there are plans for more of them.

Details of the work that was completed

This was a One-day Road Safety Educational Workshop for Council staff at one of the worksites - promoting truck safety and blind spots awareness with relevant information and resources also provided. There was 70 participants in the workshop.

The aim of the workplace activity: To raise awareness of the truck blind spots and to provide education to staff around truck safety in general.

Staff were also able to check the interactive displays available, talk to a truck driver about all things 'truck safety', also able to get inside of the truck to check mirrors and what is possible to see and what is not visible from the truck cabin. Peer education provided as the Truck driver, experienced employees with over 40 years of work experience as driver, was able to talk to staff about the experiences from their daily routine of sharing roads with pedestrians, bicycles, etc, also the issues with any truck blind spots and how difficult it can be viewing from the vehicle if not enough distance is left between the truck, other vehicles or pedestrian.

Objectives of this Road safety education at workplace project are:

- To improve staff awareness about truck blind spots by providing education and enabling opportunities for learning.
- Also to enable peer education exchanging experiences and learning directly from a colleague experienced truck driver
- To promote a general message from Transport for NSW about Road safety and truck safety awareness
- To contribute to the implementation of the Council's Road Safety Plan's strategic goals towards safer community.

Outcome of the work

The expected benefits and/or outcomes of the event/project are:

- Staff being more aware of truck blind spots ٠
- Increase in awareness of the road rules relating to trucks
- Direct and indirect education enabled Education to the staff directly indirectly to some other community • members as staff will be spreading messages to colleagues, family and friends' networks resulting in more awareness and a safer community
- Safer roads and environment for road users •

Evaluation and Effectiveness:

There were 70 employees attending the workshop. Evaluation forms completed by 66 employees (Male 33 & Female 33 coincidentally) 53% of all attendees were 50 years old and over (with long driving experience) Awareness increase reported by 95% of workshop attendees.



Figure 1. Gender of workshop participants



Figure 3. Awareness increase reported

Benefits to the Road Safety

By educating its staff, knowing that this knowledge will also benefit the wider community. As identified by Road Safety Team this project would be beneficial for the additional education for staff. This initiative aims to spread important road safety messages effectively and to enhance safety awareness to road users in our community. Initially, the program was created as a Pilot targeting the staff at the a particular worksite, with the intention to extend to other Council worksites.

Implications for policy and/or procedure

This workshop was endorsed by the organization WHS team and it contributes to their work on updating of relevant policies.

Conclusions

In conclusion, workplace-based road safety education is not only sustainable but also efficient way to enhance road safety awareness. Its ongoing nature and tailored content contribute to a safer road environment, aligning with the broader goals of workplace safety and community well-being. This conference poster will elaborate on the impactful aspects and outcomes of our road safety education initiative in the workplace.

Small projects are encouraged by our organizations as they can create direct and positive impact to the community. These are sustainable and cost efficient. Northern Beaches Council Road Safety Team is continuing with workplace road education and the next workshop on Truck safety is scheduled on 24th of April at a another Council worksite.

The conference theme this year is 'Target 2030: What's the pathway forward? This project is relatively a small step in road safety, however projects of this type enable direct community engagement and direct education to road users. Evaluation is available instantly and feedback is direct. It contributes to our major goal "Towards Zero"





Figure 4. Photos of trucks on display



Figure 5. Workplace poster



Figure 6. Lens cleaning cloth merchandise

TRUCK SAFETY AND BLIND SPOTS AWARENESS PROJECT

Workplace education: Be aware of truck blind spots and stay safe Pavica Kupcak, Northern Beaches Council



PROMOTING ROAD SAFETY IS OUR PRIORITY.

We are committed to fostering a culture of safety and heightened awareness of responsible behaviour on the road among our 1,800+ employees. "The Truck Safety and Blind Spots Awareness Project" for Northern Beaches Council employees is organised by the Council's Road Safety Team. The simulation activity involves a parked truck surrounded by stationary objects to demonstrate the very real blind spots for truck drivers. The project gives every staff member the opportunity to sit in the truck and experience the blind spots from the truck driver's seat.

PROJECT ADVANTAGES:

- · participants experience truck blind spots in a safe and controlled environment
- participants gain a new understanding and new perspective on how their road behaviours can impact and benefit others
- · easity replicated in similar environments and workplaces

By tailoring education to specific needs of employees, we also intended to extend the benefits of road safety awareness to the broader community acknowledging their integral role within families and community networks. Increasing road safety awareness at workplace also contributes to safer roads in the community in general. TRUCKS HAVE FOUR BLIND SPOTS, MARKED IN ORANGE.

AWARENESS OF WORKSHOP ATTENDEES INCREASED:


Effectiveness of chevron speed reduction marking

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Abstract

One strategy for mitigating speeding-related crashes involves implementing speed control measures, such as Speed Reduction Markings. This study aims to evaluate the effectiveness of chevron speed reduction markings installed at two locations along the Trans Java toll road. The first marking covers a 500-meter stretch along the shoulder lane, followed by a second set placed in the median lane, also spanning 500 meters. Analysis revealed a significant decrease in vehicle speed at these marking locations, with both areas experiencing an average speed reduction of 9% and 13%, respectively, alongside an 11% decrease in the 85th-percentile speed. These findings were validated by t-test results for paired samples and one-way ANOVA test results, confirming the reductions were significant at 95% confidence level. Additionally, the markings demonstrated potential effectiveness in reducing crashes, as indicated by the results of a before-and-after study, conducted two years before and two years after the markers were installed.

Post on X

Chevron speed reduction markings may be able to decrease average speeds by 9% to13% and 85th-percentile speed by 11%. The markings also demonstrated potential effectiveness in reducing FI crashes thereby contributing to the Global Road Safety Targets 2030.

Introduction

Toll roads are designed to accommodate high-speed vehicles, with a primary focus on providing comfort, smoothness, and safety for road users. However, the occurrence of speeding-related crashes that occur on Indonesian toll roads remains notably high, often attributed to the straight and smooth road conditions. Many light vehicle drivers exceed the designated speed limit of 100 km/h when traversing the Trans Java Toll Road, as discovered in research conducted by Phahlevi et al. (2023). The research also highlighted that this aggressive driving behavior is influenced by the toll road's monotonous and low-traffic conditions, which can lead drivers to feel drowsy. One intervention aimed at reducing vehicle speeds on toll roads involves strategically placing speed controlling measures. Transverse speed reduction markings are among these measures, designed to increase driver awareness of potential risks through perceptual optical effects, thus prompting a decrease in vehicle speed (Martindale and Urlich, 2010). Moreover, these perceptual markings have the added potential to create an illusion, causing drivers to perceive that they are traveling faster than their actual speed, thereby enhancing overall road safety. Some markings also provide vibration effects which causes drivers a feeling of accelerating. However, the effectiveness of these perceptual markings is not well understood, as there is currently limited research available that evaluates their effectiveness in reducing speed as well as crashes.

Gates et al. (2008) conducted a study evaluating the impact of experimental transverse pavement markings on vehicle speeds at curve locations. Their findings indicated that these markings were effective in reducing vehicle speeds, particularly shortly after installation. Furthermore, the study revealed that transverse markings were most effective in reducing speeds when placed in the shoulder and middle lanes. Hunter et al. (2010) conducted an investigation into the effectiveness of chevron markings in reducing vehicle speeds on two-lane freeway-to-freeway directional ramps. Their study concluded that these markings had a minimal effect on vehicle speeds, as drivers tended to readjust back to their previous speeds once they became accustomed to the treatment. They also found that the effect of the chevron markings was more pronounced shortly after installation. Li et al. (2013) concluded that perceptual markings may reduce speed by 5 to 10 km/h and provide warnings for drivers, nevertheless they cannot reduce speed more than 10 km/h. Nagami et al. (2019) conducted an experimental and simulation study focusing on three types of transverse pavement markings and three types of colored pavement to assess their impact on drivers' perceptions of speed, danger, and disturbance. The study revealed that chevron markings induced the highest sense of speed among drivers, while the optical dot markings generated the highest sense of disturbance. Additionally, the colored pavement did not significantly affect drivers' perception of speed; however, the red stripe pavement elicited the highest sense of danger and disturbance among drivers.

The purpose of this study is to evaluate the effectiveness of chevron speed reduction marking installed at two locations along the Trans Java toll road in reducing light vehicle speed as well as reducing crashes. These markings are characterized by a series of chevron-shaped lines, each 200 mm wide and forming a 45-degree angle, with 8290 mm spacing between chevrons, spanning a length of 500 meters, strategically placed alternately in the shoulder lane and the median lane. It is envisaged that the result of this study can provide decision makers with viable options for reducing crashes and enhancing safety on Indonesian toll roads.

Method

The speed survey was conducted in early 2023 during three off-peak hours by extracting data from nearby CCTV and camera recordings. The time duration required for a vehicle to traverse the 500-meter segment with chevron markings and the preceding segment, both in shoulder lane and median lane, was recorded to calculate the speed. The layout of the marking sites and the observation points a, b, c, and d are depicted in Figure 1. It can be seen that the first chevron markings is positioned on the shoulder lane for a length of 500 meters. After this section, the chevron markings continue on the median lane for the same length.



Figure 1. Layout of the marking sites and observation points

The number of samples for the speed survey was calculated using the following formulae:

 $N = ((z \times s)/\varepsilon)^2 \qquad \dots (1)$

Where N is the required number of samples, s is the standard deviation, ε is the allowable error, and Z is the value of the normal distribution parameter, according to the confidence level used. A pilot speed survey was conducted with limited samples to estimate the sample standard deviation, which then resulted in a standard deviation of 18 km/h to be used to estimate the minimum required number of samples. By taking allowable error of 2 km/h and 95% confidence level, the minimum number of samples required were 311 samples. A paired sample t-test and a one-way ANOVA test were performed to compare the mean speed before and when traversing the chevron markings.

Crash data from two years before and three years after the installation of chevron markings in late December 2020 were gathered from the toll road operator for eight 1-km segments of the Trans Java toll road installed with chevron markings in shoulder and median lanes. Contingency tables were then developed to conduct before-after studies using the chi-square test and log-ratio test, with control sites selected as segments 1-km before and after the segments with chevron markings. This analysis aimed to evaluate whether there was an effect of the chevron treatment in enhancing safety.

Results

During the 3-hour survey period, a total of 341 and 542 vehicles were observed in the shoulder lane and median lane, respectively. Speed data of all the vehicles were calculated, and the results are presented below.

Attribute	Shoulder	Lane	Median Lane			
	Before the marker	At the marker	Before the marker	At the marker		
Number of vehicles	341		542			
Max speed (km/h)	164	138	164	150		
Min speed (km/h)	67	60	86	67		
Average speed (km/h)	107	97	125	109		
Standard deviation (km/h)	21	18	18	17		
Mode (km/h)	120	90	129	120		
Median (km/h)	116	102	121	116		
85 percentile speed (km/h)	129	114	140	125		

Table 1. Descriptive statistics of the speed data

It can be seen that there were reductions in both average speeds and 85th percentile speeds at both marker sites. For the marker located in the shoulder lane, the average speed decreased from 107 km/h to 97 km/h, while the 85th percentile speed decreased from 129 km/h to 114 km/h. Similarly, for the marker positioned in the median lane, the average speed decreased from 125 km/h to 109 km/h, with the 85th percentile speed decreasing from 140 km/h to 125 km/h. The t-test for paired samples and one-way ANOVA test were then carried out at 95% confidence level, with null hypothesis (Ho) indicating there is no significant difference between mean speed before and at the marker site. The results of the tests are presented in Table 2.

Table 2. Descriptive statistics of the speed data

Marker location	t-tes	t for paired san	nples	One-way ANOVA test			
	t-stat	t-critical	Decision	F-stat	F-critical	Decision	
Shoulder lane	20.012	1.963	Reject Ho	404.424	3.855	Reject Ho	
Median lane	17.884	1.962	Reject Ho	319.849	3.850	Reject Ho	

Both t-test and one-way ANOVA test show that the null hypothesis is rejected, which means that there were significant reduction in mean speeds at the segments with chevron reduction marker compared to 500 meters preceeding the marker. The fatal-injury (FI) crash data on the before and after periods is presented in Table 3.

Table 3. Before-after crash data

	Fatal-Injury (FI) Crash Data									
	Cumulative Before period (2 year)	Cumulative 1-year after	Cumulative Total 2-year after	Cumulative Total 3-year after						
Treatment sites	29	10	18	41						
Control sites	39	23	48	70						

A remarkable decrease in the number of FI crashes was observed at the treatment segments one year after implementation. After two years, the cumulative total number of FI crashes was 18 in two years, averaging 9 crashes per year, which implies that the number of annual crashes remained relatively constant compared to the first year. However, after three years, the cumulative total number of FI crashes rose to 41, averaging nearly 14 crashes per year. This increase brought the average annual FI crashes close to the numbers before the chevron markings were installed, possibly due to drivers becoming accustomed to the markings and thus not maintaining heightened awareness while driving. Despite these trends, the results of chi-square test indicated that the chevron markings did not significantly affect safety, but the log ratio test results suggested that the chevron markings did improve safety condition.

Benefits to Road Safety

This research provides insight that the installation of chevron speed reduction markers on toll roads may have an impact in reducing vehicle speeds and FI crashes.

Implications for policy and/or practice

The findings of this research may offer decision makers with viable options to reduce road traffic crashes and injuries on Indonesian toll roads, thereby contributing to the Global Road Safety Targets 2030.

Conclusions

The chevron speed reduction marking had been shown to be effective in reducing both average speeds and 85th percentile speeds. For the marker located in the shoulder lane, the average speed decreased from 107 km/h to 97 km/h, while the 85th percentile speed decreased from 129 km/h to 114 km/h. Similarly, for the marker positioned in the median lane, the average speed decreased from 125 km/h to 109 km/h, with the 85th percentile speed decreasing from 140 km/h to 125 km/h. Both t-test and one-way ANOVA test results showed significant reduction in mean speeds at the segments with chevron marking compared to the 500 metres preceeding the marking. Moreover, the log ratio test indicated that the marking improved safety conditions that it reduced the number of FI crashes after implementation.

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Developing a driving simulator assessment scenario for impaired research

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Abstract

Driving simulators are valuable tools for studying driving impairment, which is overrepresented in the Australian road serious injuries and fatalities, as apparent from the proportion of fataly injured drivers with an illegal BAC (21%) or drugs (18%) in Australia in 2022 (Office of Road Safety, 2024). However, most studies currently use simple driving environments, limiting the ability to identify driving performance metrics to determine when someone is impaired. We developed a driving simulator assessment scenario inspired by the Q-SAFE driving test. The scenario has been piloted with healthy participants to obtain baseline driving performance benchmarks. This extended abstract presents the preliminary benchmarks obtained for a subset of events occurring during the drive. This research will be applied to different conditions (alcohol, medicinal cannabis, fatigue). Scoring based on machine learning techniques will be developed to detect different types of impairment.

Post on X

We developed a new driving simulator assessment scenario for studying impaired driving and tested it with healthy participants.

Introduction

Five critical factors – the "Fatal Five"– represent primary contributors to serious injuries and fatalities on Australian roads. Drink and drug driving and fatigue are two of these factors and are related to impaired driving. Further research on impaired driving is therefore necessary to attain the objectives of Vision Zero. Such research requires a a safe, ethical, and cost-effective environment in which impaired driving can be examined, making driving simulators valuable tools for studying this behaviour. (Espié et al., 2005). They also allow researchers to objectively assess a large range of driving performance metrics under controlled conditions (Mullen et al., 2011).

In the context of impaired driving, several studies have used driving simulators to investigate the effects of alcohol and drug impairment on driving performance. Studies have shown the relative validity of simulators when comparing the impaired driving behaviour observed in the simulator to real-world impaired driving outcomes (e.g., Helland et al., 2013; Veldstra et al., 2015) or when focusing on dose-response relationships, usually different blood alcohol concentration (BAC) levels (e.g., Helland et al., 2013; Lenné et al., 2010; Veldstra et al., 2015; Yadav & Velaga, 2019). The literature has identified a range of driving performance metrics that are affected by alcohol – particularly at BAC levels higher than the legal limit – including lane-keeping, headways, average speed, reaction times, and collision avoidance (Helland et al., 2013; Lenné et al., 2010; Veldstra et al., 2011; Yadav & Velaga, 2019). Such performance metrics can therefore be used as the basis for impairment driving research. However, a recent systematic review shows consistent evidence that several cognitive processes crucial for driving are negatively affected by alcohol (Garrisson et al., 2021). Further, driving performance may be impacted differently by various impairing conditions, and therefore a broader range of metrics should be considered when investigating impaired driving.

Most of the current driving simulations are conducted on simple road networks, such as motorways, resulting in a limited assessment of the possible effects of impairment. It is therefore necessary to develop more complex driving scenario assessments in simulated environments to gain a deeper understanding of the effects of impairment on driving performance within driving simulation research, given the challenges of conducting such research on roads. This research aims to develop such a simulator assessment scenario that can be used when investigating impairment under different conditions. The developed scenario, based on Queensland's Q-SAFE practical driving test, has been piloted with healthy participants to obtain baseline driving performance benchmarks.

Method

The driving simulator assessment scenario is inspired by Queensland's Q-SAFE practical driving test for C (car) and LR (Light rigid) licences. It replicates the duration of the practical driving test as well as the driving situations that must be incorporated into every test route. Discussions with Transport and Main Roads allowed for the identification of the type of roads and itineraries used for driving tests, as well as the specific driving situations included.

The road environment was recreated based on example Q-SAFE routes employed on the Sunshine Coast (Figure 1). The road geometry and topography were first recreated in the virtual environment by importing roads from OpenStreetMaps

and terrain elevations from GoogleMaps. The selected roads were then driven with the RSRC's vehicle equipped with a camera and a smartphone to record GPS coordinates. YOLO (You Look Only Once) version 4 was used in Matlab to automatically analyse (post-processing) the video recordings and detect road signs. Visual inspections were completed to ensure accurate sign detections and GPS coordinates for each video frame with a road sign extracted. The signs were then replicated (texture) and loaded in the simulator. GPS coordinates were mapped to the driving simulator coordinates and signs were placed at the appropriate location in the virtual environment. The number of road lanes and horizontal markings were also extracted from the videos and replicated in the virtual environment. The videos were also used to recreate the traffic environment, representative of an off-peak period. Traffic was mainly found on arterial roads, while other roads were characterised by a significant number of parked vehicles, which were also recreated in the virtual environment.

A 20-minute driving loop was recreated in the virtual environment, and a range of frequently occurring events were scripted. The events were also designed to investigate the speed and accuracy of more complex cognitive processes, as they are negatively affected even at BAC levels lower than the legal limit, unlike what is found for simpler tasks (Garrisson et al., 2021). The events include decisions at intersections with traffic lights; gap acceptance at intersections; interactions with cyclists, a motorcycle on a narrow road with parked vehicles, and a bus pulling out from a bus stop; merging on a motorway; navigating through a traffic calming zone; giving way to traffic; and detecting a road changing from one-way to two-way.

Thirty-eight healthy participants (22 females, mean age 48.76 years (SD=10.90), range: 18 - 60 years) were recruited. Twenty-six completed the urban driving simulator assessment scenario and were included for analysis.



Figure 1. Screenshot of the participant's view of the road environment

Results

Driving simulator data have been analysed for a subset of the events that occur in the driving assessment scenario. Table 1 presents the benchmarks that were obtained from the participants. The current analysis includes first how participants merged into the motorway in terms of location (when allowed or not), speed and use of indicators. It also provides the distribution for gap acceptance at an intersection that participants had to cross while side traffic was present (both sides). Participants' detection of the change from a one-way to a two-way section is inferred from the position of the car at the following intersection with a stop sign. Participants' decision to stop when an amber light is activated 3.5 seconds before the participant reaches the light is also detailed in Table 1. The interaction with the on-coming motorbike on the narrow road with parked cars is analysed in terms of speed and minimum distance when passing the motorbike. Finally, speed in the traffic calming zone and overspeeding statistics are reported.

Conclusions

This study has piloted the concept of a more realistic and complex driving assessment scenario in a driving simulator. It provides benchmarks for driving performance metrics in our simulator, allowing future impaired research to be contextualised when providing recommendations to road safety practitioners and policy makers. Future work will consist of using the scenario with impaired drivers, starting with alcohol at different BAC limits, followed by medicinal cannabis patients. Driving metrics will be extracted from the simulator data, and the latest machine-learning techniques will be developed to score the drive in terms of impairment. Such a driving assessment tool can be used in the future to develop in-vehicle monitoring tools detecting impairment, or could be used as a training platform for learner drivers to learn basic driving skills before taking to an on-road environment.

Table 1. Results for a sub-selection of events occurring in the driving assessment scenario

Scenario e	vent	N	%	Mean	SD	Ν	%
Motorway	merging						•
				Speed at n	nerging	Indica	ator use
Merging	Zebra	3	11.5%	94.5	12.9	2	66.7%
location	Solid line	3	11.5%	98.2	7.6	3	100.0%
Ì	When allowed	20	76.9%	88.5	11.3	18	90.0%
Corssing an	n intersection with side traffic						•
Gap	Third gap (4s)	1	3.8%				
_	Fourth gap (5s)	4	15.4%				
	Last gap (>5s)	21	80.8%				
Stop sign a	fter the road changed from one-way	y to two-way	7				
Lane	Corrected lane	21	80.8%				
selected	Partially on the wrong lane	3	11.5%				
	On wrong lane	2	7.7%				
Traffic ligh	nt at T intersectin changes to green,	and remains	red for left				
Decision	Remained stopped [correct]	23	92.0%				
	Proceeded [wrong]	2	8.0%				
Amber ligh	nt activated 3.5 seconds before the c	lriver reache	s the interac	tion			
Decision	Stopped	8	36.4%				
	Drove through	14	63.6%				
Interaction	with motorcycle						
				Passing dist	ance (m)		
Speed	Less than 30 km/h	2	7.7%	1.09	0.14		
_	30 to 40 km/h	9	34.6%	1.52	0.46		
Ì	40 to 50 km/h	9	34.6%	1.52	0.30		
	More than 50 km/h	6	23.1%	1.63	0.34		
Traffic calı	ning zone (40 km/h)						
Speed	Average			43.7	4.3		
	Min]		53.6	5.7		
	85 th percentile]		50.0	5.1		
	Max]		32.8	5.9		
Speeding (time percentage)						
		0 km/h	5 km/h	10 km/h			
		and over	and over	and over			
Speed	50	32.9%	1.4%	0.2%			
limit	60	18.1%	0.4%	0.0%			
	100	24.0%	0.0%	0.0%			

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Evaluation of messaging strategies to reinforce 'good' road safety behaviours

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Abstract

Informed by the tenets of learning theory, improving driver behaviour could be achieved by not only reducing the extent that individuals engage in illegal and risky behaviours but also by increasing their engagement in positive, safe behaviours. Although both options reflect viable behaviour change strategies, fewer studies have examined the determinants of positive, safe road user behaviour and how these behaviours may be better encouraged. This project examined the effectiveness of positive road safety campaigns, with 'positive' conceptualised as prosocial driving behaviours. It comprised three studies; a desktop review to identify positive campaigns, a focus group to assess the applicability of identified campaigns, and an online survey to evaluate the campaigns from a behaviour change perspective. This project provides evidence-base regarding the potential effectiveness of road safety campaigns that encourage individuals' engagement in more positive, prosocial driving behaviours as a component of overall campaign approaches.

Post on X

Evaluating the effectiveness of positive, prosocial messaging in encouraging positive, safe driving behaviours.

Introduction

Positive, prosocial road safety campaigns are not new, with examples existing from as far back as decades ago within Australia; however, relatively speaking, such campaigns have been implemented much less than campaigns which have sought to reduce and prevent risky and illegal behaviours. Recognising that finite resources are available for devising and implementing road safety interventions, the argument against the use of more positive campaigns has tended to be that with factors such as speeding and distraction, as risky and illegal behaviours, continuing to represent major contributors to road trauma, campaigns must seek to reduce and prevent such behaviour. We agree that focus must remain on reducing and preventing such behaviours; however, given the complex, multimedia landscape that road safety messaging must now exist within, arguably, there is need to consider different types of campaign approaches that may help in efforts to ultimately improve driver behaviour. Thus, for example, a positive, prosocial campaign which encourages a driver to be mindful of others they are sharing the road with may have road safety benefits by having them slow down and adopt a more patient mindset when behind the wheel. According to Bierhoff (2002), prosocial behaviour is when an individual does something that is intended to benefit another while altruistic behaviour is when the focus is on the needs of another rather than oneself. In this study, such behaviours were conceptualised as positive, prosocial driving behaviours. Kaye et al. (2022) revealed a growing number of studies examining the motivators of prosocial driving behaviours. The evident next step is to evaluate the extent to which interventions, such as advertising campaigns, can increase drivers' engagement in such behaviours. The current study addressed this key next step.

Method

Overall, the project comprised three studies. Study 1 involved a desktop review of road safety campaigns from national and international jurisdictions. The review sought to identify examples of campaigns that met the criterion of a messaging strategy that encouraged individuals' engagement in more positive, prosocial road user behaviours and, thus, terms of this nature were used in the search phase of the desktop review. This definition was intentionally broad with respect to the behaviours that may have featured in a campaign as prosocial. This approach enabled the researchers to identify potentially more rather than less campaigns as it was unknown how many relatively recent campaigns may have adopted such an approach, and it was anticipated that there may not be too many available.

Study 2 involved a focus group to confirm whether the researchers' classification of campaigns as approaches that encouraged more positive, prosocial behaviours was indeed how others, namely, licensed drivers also classified such campaigns. Additionally, the study explored how effective participants considered the campaigns to be in promoting individuals' engagement in positive, prosocial road user behaviours. The outcomes of Study 2 informed the selection of campaigns to be evaluated in the third and final study of this project.

Study 3 as the messaging evaluation study, comprised a between-groups design in which licensed drivers responded to an online survey in which they were randomly allocated to view and respond to questions about one of the campaigns being examined and, thus, were assigned to the intervention group. Some participants were assigned to a control group and thus did not view any campaign. The constructs measured were informed by Lewis et al.'s (2016) Step approach to

Message Design and Testing which has been applied extensively in evaluating road safety campaigns (Lewis et al., 2021). Key outcome measures assessed included general and specific intentions. General intentions related to the extent that participants reported intentions to behave in a prosocial manner while specific intentions related to the extent that participants reported intentions to slow down and be considerate of others sharing the road (and thus in a manner consistent with key prosocial behaviours highlighted in the messages being tested).

Prior to data collection commencing for any of the three studies, the project gained Ethical approval from the authors' university.

Results

The desktop review identified five campaigns. Table 1 provides a brief outline of the campaigns.

Campaign title	Summary	Link to media	Selected for Study 3
West Aussie Wave	Produced in 2021 by the Government of Western	West Aussie wave Jul Sep	Y
	Australia to encourage courtesy and tolerance	<u> 30sec - YouTube</u>	
	between all road users.		
Travel like you	Made in 2022 by the Department for Transport,	https://youtu.be/HDEalkgJLE8	Y
know them	UK encouraging positive behaviour and		
	protecting those more at risk.		
Be smart, drive	Part of an awareness-raising campaign about	<u>"Mr. Rhodes/Driver" – Be</u>	Y
smart	one's own unsafe driving habits. Produced by	Safe. Drive Smart YouTube	
	the Texas Dep. of Transportation. Date unknown.		
Enjoy the ride	A 2011 campaign by the Government of Western	Speed "Enjoy The Ride" Road	Y
	Australia encourages drivers to slow down on the	Safety Council WA Australia -	
	roads as well as life in general to decrease stress	<u>YouTube</u>	
	and improve wellbeing. This advertisement was		
	started at 1 minute to keep more consistent with		
	the shorter times of each other.		
Legend	Produced by the New Zealand Transport Agency	Legend (Ghost Chips) - Road	Ν
	in 2011. Uses humour to get the message across	Safety Commercial NZ On	
	of stopping a mate driving drunk.	Screen	

Table 1. The campaigns identified in Study 1, subsequently discussed in Study 2, and those which were evaluated in Study 3

N = 6 licensed drivers (4 Females; Mean age = 54.33 years, SD = 17.78; Range = 26 -70 years) who participated in Study 2. Participants all had open licenses and most reported driving daily or almost every day (n = 5). Participants agreed that four of the campaigns in particular represented positive, prosocial messaging and that they thought would be effective options in encouraging individuals' greater engagement in positive, prosocial driving behaviours. The final column of Table 1 shows these four campaigns which were to be evaluated in Study 3.

For Study 3, a market researcher, Farron, was used to assist with participant recruitment. A total of 234 responses were received of which 21 were removed due to >5% missing data. The final sample comprised N = 213 who were aged 24 to 87 years (M = 54.0 years, SD = 15.1 years) with 48.8% identifying as female. Among some of the overall results (with further to be outlined in our presentation), it was found that, within the intervention group, intentions to behave pro-socially on the road significantly increased following exposure to the prosocial campaigns with post-campaign scores higher than pre-campaign scores on measures of both general and specific intentions (see Table 2).

Table 2. Descriptive statistics and paired sample t test results comparing intervention group mean scores of)n
general and specific intentions before and after exposure to a prosocial campaign	

Scale	Ν	Mean (SD)	Ν	Mean (SD)	t	df	р	d
	P	re-campaign	Post-campaign					
		exposure		exposure				
General Intentions	172	5.86 (1.26)	172	6.03 (1.28)	-3.06	171	.003	23
Specific Intentions	172	5.91 (1.20)	172	6.03 (1.16)	-2.15	171	.033	01
\mathbf{N} to the 1 1 1	6.0	<u> </u>	· C	1 1 C 1	, 1			

Note. t = t value; df = degrees of freedom; p = significance value; d = Cohen's d

When comparing the intervention group (comprising each of the four campaigns being tested) with the control group, the results indicated that the intervention group's post-campaign scores for both general as well as specific intentions to behave pro-socially were higher in all message conditions compared with the mean scores of the control group (the only exception was with general intention mean scores of Campaign 4 and the control group where the control group was higher); however, none of these differences were statistically significant (F(4,208) = 0.54, p = .705 [general intentions];

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F(4,208) = 0.59, p = .673 [specific intentions]). Table 3 shows the descriptive statistics of the intervention group (based on the four campaigns) and control group for general and specific intentions to behave pro-socially. Overall, it is also apparent that intentions to behave pro-socially were high given the 7-point measurement scale.

Table 3. Descriptive statistics (M, SD) of the intervention (based on the four campaign conditions) and contr	ol
groups of the general and specific intentions scores	

Intervention/	General Intentions				Specific Intentions				
Control group						_			
		n	M	SD		n	M	SD	
Intervention group	Campaign 1	44	6.26	0.83	Campaign 1	44	6.14	0.90	
	Campaign 2	44	6.00	1.43	Campaign 2	44	6.10	1.18	
	Campaign 3	41	5.96	1.28	Campaign 3	41	5.94	1.21	
	Campaign 4	43	5.91	1.49	Campaign 4	43	5.94	1.33	
Control group	No Campaign	41	5.93	1.31	No Campaign	41	5.80	1.09	

Mean scores based on Likert-scale of 1-7 where 7 indicated stronger intentions to behave pro-socially.

Implications for policy and practice

This project provides evidence regarding the option of improving drivers' behaviour through advertising campaigns that encourage individuals' engagement in positive, prosocial behaviours. The evidence is intended to prompt discussion and consideration of innovative approaches to road safety advertising campaigns. The findings (of the desktop review) suggest that such campaigns are available currently but are less frequently implemented than campaigns that address risky and illegal behaviours. Licensed drivers considered such approaches as effective at increasing individuals' engagement in prosocial driving (Study 2), with a robust evaluation offering further insights into the campaign's effects. The insights suggested that those who were shown any campaign about prosocial driving behaviour increased intentions to engage in prosocial driving behaviours. The results suggest that campaigns that promote prosocial driving behaviours may offer an additional and alternative means of ultimately encouraging safer, less risky driving behaviour on our roads.

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Nudging to improve driver behaviour

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Abstract

Under Queensland's Road Safety Action Plan 2022–24, the Department of Transport and Main Roads (TMR) funded a trial of new roadside technology which detects dangerous driving behaviours and provides real time feedback to drivers. This paper outlines Study 1 of a program of research that developed and tested message concepts for use in Study 2, on-road trials. The trial comprised roadside cameras, variable message signs (VMSs), and machine learning to identify motorists engaging or not engaging in this behaviour and to provide a targeted message. Focus groups were conducted with licensed drivers in Queensland to pilot message concepts addressing two behaviours - phone use while driving and tailgating. At the time of preparing this abstract, the on-road trials (i.e., Study 2) had not yet commenced but it is anticipated that preliminary findings may be shared from the on-road trials as part of the presentation later in 2024.

Post on X

Evaluating the effectiveness of innovative roadside technology to deliver targeted, real-time messaging to drivers to nudge behaviour change for phone use and following too closely.

Background

Australian road crash statistics reveal increasing trends in the numbers of serious crashes and fatalities in recent years (BITRE, 2021). Road safety advertising represents a long-standing component within Governments' investment in road safety strategies each year. One method of advertising, namely, roadside variable message signs (VMS), can play a key role in improving motorists' behaviour. VMSs can be used to display information about traffic-related matters (e.g., crashes, roadwork, and road closures), as well as safety communications to change immediate driving behaviour (e.g., speeding) and inform future strategic driving choices (e.g., drink driving, fatigued driving). VMSs include permanent overhead gantry-style infrastructure through to temporary, roadside verge/median strip trailers. Past studies have demonstrated the effectiveness of roadside advertising including portable VMSs in reducing dangerous behaviours (e.g., Glendon & Lewis, 2022; Tay & de Barros, 2010).

TMR committed to testing emerging roadside technology comprising cameras and machine learning that detects a driver's engagement (or not) in dangerous driving behaviours and subsequently provides targeted messaging in real-time with an aim to change the behaviours (or, conversely, reinforce safe driving behaviours). To design messages and evaluate their effectiveness, TMR partnered with the Centre for Accident Research and Road Safety – Queensland (CARRS-Q).

The messages in this study were devised and tested utilising the Step approach to Message Design and Testing (SatMDT; Lewis, Watson, & White, 2016; Figure 1). The SatMDT has been used to aid the development and/or evaluation of messages addressing a range of risky driving behaviours (Lewis et al., 2021). Message concept development was also guided by nudge theory which posits the value of individuals choosing an option. Specifically, nudge theory maintains that governments should nudge individuals to make better decisions rather than solely relying on efforts to force them to comply and, in doing so, respect their freedom of choice (Thaler & Sunstein, 2009; Egan, 2017). Nudge theory believes in achieving change through indirect encouragement and enablement of positive behaviours.

Method

Study 1 comprised two separate rounds of focus groups each consisting of N = 30 licensed drivers in Queensland to pilot test various message concepts; one round focused upon messaging for phone use (Figures 2 and 3) and the other on tailgating (Figures 4 and 5). Figures 2 to 5 show that messages comprised various options including text-only, pictograms, and a combination of text and pictograms. Message content including character count and pictogram style were required to comply with the specifications of the digital sign to be implemented in the on-road trial.

Consistent with the SatMDT regarding message testing protocols, participants first completed a brief survey to assess their immediate responses to each of the messages prior to engaging in the group discussion about its effectiveness.

Study 2 comprised the on-road trials of the technology at metropolitan (i.e., Brisbane) and regional (in Townsville) locations where drivers' objective, behavioural responses prior to and after the messaging were recorded by camera.

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STE Pre-ex Indiv charact	P 1 listing ldual eristics		STEP 2 Message-related characteristics		STEP 3 Individual responses		STEP 4 Message outcome	5
Identify	Elicit		Focus & Content		Emotional & Cognitive	8	Acceptance Rejection	1 & I
Gender / Age + Extent & nature of involvement involvement behaviour	Salerit bellefs + Strategies for avoiding behaviour (response efficacy)	Methodology Step 1 Plict work	Focus of Message Challerge perceived benefits And/Or Highlight perceived disadvantages Key content: • Emotional appeal type (e.g., fear- based, humour based) • Modelling of behaviour • Strategies	Methodology Step 2 Message Exposure	Emotional responses (anticipate emotion elicited?) * Cognitive responses (e.g. perceptions of response efficacy, involvement)	Methodology Step 3 incept testing and Message checks	Intentions to adopt message and/or definal, defensive avoidance reactions	Persuasive effects measured over time

Figure 1. The Step approach to Message Design and Testing (Lewis et al., 2016)



Figure 2. Messages tested for use when drivers' phone use behaviour was detected





Figure 4. Messages tested for use when drivers detected as following too closely

Message A Sovers 1 Sovers 2 So



Figure 5. Messages tested for use when drivers detected as not following too closely

Results

Study 1 was completed in November 2023 and February 2024 for the phone use and tailgating message testing, respectively. The results of Study 1 informed the selection of messaging to be used in Study 2. Thus, from Figures 2 to 5, one final option from each figure was identified as the most effective (as per SatMDT message testing protocols). Specifically, the results identified Message C (Figure 2), Message C (Figure 3), Message F (Figure 4), and Message F (Figure 5), for the on-phone, not-on-phone, tailgating, and not tailgating messages, respectively. There were some minor adaptions made to message content based on piloting feedback. First, for Message C (Figure 3), the text was altered to read, "Not on Phone" and accompanied by "Thank you" with uppercase "T" only. The reference to "No phone" only was perceived by some participants as potentially mocking that someone did not have a phone. Thus, to ensure the definitiveness of the message, this was changed to "Not on phone" as presented in other messages where this statement had functioned well. The use of title case rather than all upper case was supported to avoid the perception that the message was essentially 'shouting' at motorists. Of note, Message D (Figure 3) was identified as another potentially effective option if a one-screen option was to be preferred. Regarding Message F (Figure 5), the word "distance" had to ultimately be changed to "gap" as in "safe gap" as the dimensions of the digital sign meant the font size required to include the word "distance" was too small and may have impacted readability on-road. Consequently, use of the word "gap" was deemed the better option. This decision was supported in the testing with the word "gap" and "distance" being used interchangeably when talking about what constituted a safe (or unsafe) distance or gap between vehicles.

To inform the on-road trials, the team has undertaken two user acceptance testing days on a closed-road circuit at the RACQ Mobility Centre. The presentation will include overview of this process in terms of stages involved in designing and implementing an innovative roadside technology for on-road application.

Implications for policy and/or practice and conclusion

The study exemplifies collaboration in terms of academic and government partners working together to implement robust methods to support evidenced-based decision making to contribute to enhancing the safety of Queensland roads for all.

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Transport for children with disabilities: evaluation of health professionals' experience

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Abstract

Children with disabilities are at an increased risk of being inappropriately and inadequately restrained in vehicle restraint systems, placing them at additional risk of injury or fatality when travelling. Health professionals play a vital role in supporting children with disabilities and their families to travel safely on our roads, however limited research exploring the knowledge and challenges of allied health professionals exists. To gain deeper insight into the experiences and perspectives of health professionals involved in the safe transportation of children with disabilities and to evaluate the impact of MACA's Commonwealth grant activity, MACA engaged Curtin University to undertake a large-scale national baseline evaluation. Results revealed significant challenges faced by health professionals, and low knowledge, skills, and confidence in this area of practice. The presentation will outline key findings and the interventions MACA has implemented to close the gaps and improve road safety outcomes for children with disabilities and their families.

Social media post

Large-scale evaluation survey of Australian health professionals reveals significant challenges in meeting the needs of children with disabilities as passengers in motor vehicles.

Introduction

Over the last twenty years, there has been little improvement in the way children with disabilities are transported in motor vehicles – they 'continue to be inappropriately restrained in vehicles, constituting an ongoing road safety problem' (Downie et al. 2019).

Australian families of children with disabilities and medical conditions (disabilities) have reported significant concerns about their child's safety during transport and that their transport situation restricts their child's participation. These include having to pull over to reposition their child, becoming distracted because of their child becoming upset or distressed, and having difficulty physically getting their child in and out of the car.

Over half of parents reported their child was getting out of their child restraint or vehicle seatbelt whilst the vehicle was moving and ten per cent reported their child had got out of the vehicle and into the road environment (Black et al. 2023). Research conducted in America shows even higher rates of child elopement from transportation vehicles, with 58% of parents of children with autism spectrum disorder reporting this behaviour (Plummer et al. 2021). The higher rates in the American study may be attributed to the fact that only parents of children with autism spectrum disorder were surveyed, whereas parents of children with any disability or medical condition were eligible to participate in the Australian survey.

Further, over two thirds of Australian parents reported never receiving information about how to safely transport their child and nearly half reported that their child was missing out on participating in everyday life (Black et al. 2023). If we are to meet the road safety targets set out in Australia's National Road Safety Strategy by 2030, the road safety needs of our most vulnerable road users must be addressed. MACA was established in 2019 to advance the rights of children (under 16 years) with disabilities to safe and equitable transport. MACA's approach to eliminating road deaths and serious injuries for children with disabilities and their families is based on the social model approach to road safety, in line with the National Road Safety Strategy.

MACA is leading an unprecedented research and development agenda to address the systemic gaps in Australian policy, research and practice impacting on the safe transport of children with disabilities. MACA's work program includes an Australian Government Department of Social Service's Information Linkages and Capacity (ILC) National Information Program grant (2019-24). This activity includes the development of a national website and training courses for key professionals supporting children's motor vehicle transport needs.

MACA has also established the world leading Australian Safety Assessment Program, with funding from the Transport Accident Commission and in-kind support from Britax Childcare and Neuroscience Research Australia's Transurban Road Safety Centre. AuSAP assesses, and sled crash tests restraint types used by children with disabilities and medical conditions. This enables the development of resources and training to improve safety, advice and information for families, allied health professionals, suppliers, funding agencies and government. Children with disabilities often require special consideration when being transported in vehicles and are often not able to travel in regular child restraint systems (Downie et al. 2019). Allied health professionals assess and prescribe for the motor vehicle transport needs of children with disabilities. They play a vital role in supporting families to transport their children safely in motor vehicles and are the preferred source of information for parents on safe transport (Black et al. 2013).

However, Australian occupational therapists have a limited understanding of relevant standards and face challenges in making recommendations to support the safe transportation of children with disabilities (Baker et al. 2012). They may be expected to make recommendations to families about their child's transport needs, despite having little or no training in the field of child passenger safety. Such recommendations may lead to inappropriate selection or misuse of child restraint systems. This area of injury prevention is not addressed adequately by health care professionals, largely because of a lack of education regarding interventions to address the problem (Yonkman et al. 2013).

Despite the important role of allied health professionals, little is known about their perceived knowledge and confidence in supporting families, and where and how they are obtaining information to underpin clinical decisions (Black et al. 2024).

Study Aim

MACA engaged Curtin University to undertake a large-scale national baseline evaluation to:

- gain insight into the experiences and perspectives of health professionals involved in the safe transportation of children with disabilities (under 16 years)
- evaluate the impact of MACA's Commonwealth grant activity.

Method

The survey comprised 28 items regarding assessment, prescribing practices, knowledge and beliefs, challenges in addressing seating needs, and accessing information. It was distributed online via the online survey platform, Qualtrics (2005), and data collection was completed between July 2020 and May 2021.

Data was exported from Qualtrics and imported into SPSS Statistical software (IBM Corporation, 2020) for data cleaning and analysis, using descriptive statistics and frequencies, with medians (MDN) and IQR presented for Likert-scale data, which provided a measure of central tendency and variability. Health professionals' postcodes were used to provide a measure of practice area socio-economic status (Black et al. 2024).

Results

Of the 234 health professionals who completed the national survey, the majority were occupational therapists (65.4%), followed by physiotherapists (12.4%). Health professionals worked with children with a variety of disabilities and medical conditions, the most common being cerebral palsy (25.3%), followed by autism spectrum disorder (19.1%) and global developmental delay or intellectual disability (16.4%). Health professionals most frequently reported addressing the vehicle transport needs of children with disabilities and medical conditions occasionally (39.8%) or monthly (30.6%), followed by weekly (17.3%). Most health professionals reported always assessing vehicle transport needs in an initial assessment (25.3%), almost always (29.5%), usually (17.8%) or sometimes (18.2%), with 8.4 percent and 0.9 percent reporting doing it almost never, and never, respectively.

Specialty harnesses/vests were the most commonly prescribed or recommended device (68.2%), followed by special purpose car seats (63.2%), mainstream (off-the-shelf) child restraints (60.1%) and buckle covers (57%). Chest cross straps (40.8%), additional padding (39.5%) and head support (36.8%) were also commonly recommended or prescribed by health professionals.

While 16.4 percent of health professionals believed that they had considerable knowledge and skill in addressing the motor vehicle needs of children with disabilities and medical conditions, health professionals most frequently believed that they had some (47%) or a little knowledge or skill (31.5%).

Health professionals most frequently reported obtaining their knowledge and skills about addressing car seat and travel needs for clients (under 16 years) with disability/medical conditions from other health professionals (81.7%), followed by reading standards and guidelines (66.7%). Over half reported learning from a disability product supplier (57.7%), while 39.4 percent reported learning through trial and error.

When asked where they would like to receive information on the safe transport of children with disabilities and medical conditions, they endorsed a range of approaches including online training (84.7%), websites (78.9%), and short courses or professional development events (77.5%).

Most health professionals reported that they had experienced challenges when recommending or prescribing car seating for children with disabilities and medical conditions (92.4%). Over half reported that a lack of appropriate training and professional supports, a lack of specialised knowledge, and a lack of appropriate seating options were challenges (Black et al. 2024).

Implications for policy and/or practice

This is the first national research exploring the experiences, perspectives and knowledge of health professionals relating to their work in supporting the motor vehicle transport needs of children with disabilities. The findings suggest that health professionals may benefit from additional training, professional development, and easy access to resources to better meet the needs of their young clients (Black et al. 2024).

In response to this research, MACA has developed a range of information resources including a website published in 2021. This is the first central source of best practice information supporting the safe transport of children with disabilities and medical conditions in Australia. MACA has also developed online training and prescribing resources for health professionals, aimed at improving their knowledge, confidence, and capability, and embedding transport planning in their day-to-day practice.

A national follow up evaluation survey was conducted in 2023 to evaluate the effectiveness of MACA's interventions and to highlight where more work needs to be done. The results are currently being analysed by Curtin University, with preliminary data indicating that health professionals' knowledge and confidence in addressing children's motor vehicle transport needs has improved. The data also reveals a higher percentage of parents had received information about how to safely transport their child with disability.

Conclusions

This presentation will reflect on how investing in interventions for our most vulnerable road users can contribute to meeting our 2030 road safety targets as well as promoting inclusive equality, family wellbeing and community participation for children with disabilities and their families.

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Road Safety Audit in and around construction sites using nearMiss

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Abstract

This paper presents an evaluative study focused on the deployment of the NearMiss system at the North-East-Link construction site in Victoria, showcasing its effectiveness in proactively identifying and mitigating road safety hazards. To give context to anyone unfamiliar with the project, The North East Link Tunnels project is a major infrastructure initiative aimed at significantly enhancing Melbourne's transport network by constructing a 6.5km tunnel to Watsonia and additional tunnel sections, removing 15,000 trucks from local roads daily and reducing travel times by up to 35 minutes. The implementation of market available NearMiss technology serves as a pivotal real-world example, highlighting the system's capability to enhance road safety in construction zones. Additionally, the research examines mobile monitoring units (standalone fixtures), which are autonomously powered by solar panels and batteries, and are specifically designed for quick installation and high mobility. These features allow for rapid deployment across varied terrains, making them exceptionally suitable for diverse construction settings. Mitigation of potential accidents and timely interventions at high-risk intersections were notably achieved. The units' capabilities, including real-time data collection utilising cameras, AI-powered analytics, and NearMiss incident detection, are discussed. This research aims to contribute significantly to the dialogue on improving road safety standards and practices in and around construction sites as we strive for target 2030.

Post on X

Our study explores the NearMiss system's significant impact on improving road safety at Victoria's North-East-Link site, demonstrating how advanced monitoring and AI analytics can proactively prevent accidents in and around construction sites.

Introduction

During construction, road conditions are often altered or left in suboptimal states, leading to a heightened risk of accidents and near-miss incidents. Despite these changes, safety levels must remain paramount, consistent with standards applied to fully operational roads. This necessity is underscored by alarming statistics: in 2022, vehicle incidents constituted 42% of work-related fatalities, with a notable percentage occurring in environments undergoing construction (Safe Work Australia, 2023).

Our research proposes the adoption of the NearMiss system to address these safety challenges head-on. NearMiss technology uses advanced computer vision and machine learning algorithms to analyse video footage from traffic cameras. By detecting near-miss incidents and understanding their causative factors, we can enact timely and informed changes, thereby preventing potential accidents before they transpire. This initiative is crucial for upholding safety standards during the transitional period of road construction, ensuring that roads remain safe for all users, irrespective of their current state of development.

Approach

This project is dedicated to improving road safety in construction zones through the strategic implementation of the NearMiss system. Here's a brief explanation of how it works:

- Video Data Collection: Cameras are set up at various locations to continuously capture traffic footage.
- AI and Machine Learning: The video data is fed into an AI model that has been trained to recognise different types of vehicles and pedestrian movements. The model can classify these entities and track their trajectories. Primary metrics that are collected are: Speed, volume, classification, user path, TTC (time to collision) and PET (post encroachment time).
- **Risk Analysis:** The AI analyses the movements to identify instances where collisions are narrowly avoided, this is generally determined by utilising PET. This measures the time difference between the departure of one vehicle and the arrival of another vehicle at a potential collision point. Essentially, the lower the PET value, the closer to an incident.

• **Data Reporting**: The system records detailed information about each NearMiss event, including the time, location, involved parties, and potential causes. As well as this, the data is assessed utilising a risk matrix, based on speed and the relevant DCA code to determine the risk rating for each NearMiss.

Dashboard Integration: This data is then moved from its raw format (CSV) and visualised on a dashboard, allowing traffic analysts to review and understand the circumstances of NearMiss incidents. This helps in identifying high-risk areas and developing strategies to improve road safety.

Some additional requirements for the specific project included:

- unexpected driving behaviour including wrong-way travel, erratic swerving, and breakdown;
- classify types of road users;
- road user's turn path;
- speed of travel to determine the potential impact in the event of a collision;
- not allow for identification of a person or vehicle license plate; and
- operating at night and in all weather conditions.

Results

The deployment of the NearMiss system in the North East Link construction zone led to a measurable improvement in safety outcomes. Notably, there was a significant reduction in the risk and severity of incidents, transitioning from severe to low in the evaluated period. This improvement is attributed to enhanced detection and mitigation strategies informed by the system's real-time data.



Figure 1. Construction site access during audit

- 1. Vehicles can complete U-turns on the main road and right turns out of the driveway.
- 2. The line of sight when turning out of the driveway is minimal due to the recent construction of a bridge which curves around the bend.



Figure 2. Construction site access after audit result.

1. U-turns on the main road and right turns out of the driveway have both been restricted.

Findings

Analysis from the NearMiss system unveiled critical insights into the primary causes of near-miss incidents, notably identifying issues such as insufficient signage, ambiguous lane markings, and inefficient management of traffic during peak construction periods. The application of targeted interventions, informed by these insights, resulted in a marked decrease in the number and severity of near-miss incidents, enhancing overall safety within the construction zone.

Evaluation and Effectiveness

The project's success was measured through a comprehensive evaluation process, incorporating data analytics, stakeholder feedback, and a review of safety records pre and post-implementation. The substantial decrease in incident severity and risk underscores the effectiveness of the NearMiss system and the implemented safety measures. Feedback passed on by NEL from site workers and road users further validated the perceived enhancements in safety and navigability around the construction site.

The outcome of this project highlights the critical role of advanced monitoring systems and data-driven approaches in improving safety standards in construction zones. The results advocate for the expanded use of such technologies in managing and mitigating road safety risks, particularly in environments with significant construction activity, thereby supporting broader national efforts to reduce work-related road traffic incidents and enhance public safety.

Conclusions and Implications for Policy/Practise

The successful implementation of the NearMiss system at the North East Link construction zone has significant implications for road safety policy and practice, especially in construction settings.

Scalable Rollout: The project's data-driven insights and safety improvements support a scalable rollout of the NearMiss system across various construction sites in Victoria and nationally.

Integration into Standard Practice: The findings advocate for incorporating advanced monitoring systems like NearMiss into regular safety audits and planning processes. This preventive approach can significantly reduce accidents and near-misses, aligning with the 2030 safety targets.

Policy Development: The results should inform the development of comprehensive road safety policies that prioritise real-time monitoring and data analysis.

The NearMiss system's deployment at the North East Link site has significantly advanced construction zone road safety. Through detailed analysis and proactive measures, the risk and severity of incidents have decreased, transforming potentially severe situations into manageable low-risk events. The technology also provides:

- Greater insights due to rich information
- Comparisons of crash data with factors observable in incident videos
- Earlier detection and addressing of problems
- Shortened feedback loops for evaluating treatment effectiveness

This research extends beyond the North East Link site, offering a scalable model for national and global adoption. It suggests a new paradigm in road safety management that prioritises pre-emptive measures and technological innovation. The insights gained from this project contribute to a safer future for all road users, setting a new standard for construction zone safety and continuous improvement in road safety practices worldwide.

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Utilising Artificial Intelligence to improve safety at school crossings

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Abstract

This paper presents a study on the implementation of Camera-based AI safety technology at various school crossings, showcasing the system's effectiveness in identifying and mitigating road safety hazards for schoolchildren. Commissioned by the Department of Transport Planning (DTP), deployment began of high-resolution cameras and AI technologies to analyse pedestrian and vehicular dynamics at crossings. This initiative aims to provide detailed insights into pedestrian demographics and vehicle behaviour, thus significantly contributing to the proactive prevention of nearmiss incidents and enhancing overall safety in school zones. The study delves into the system's capabilities, including data collection, advanced analytics, and privacy-compliant monitoring, under different environmental conditions. The findings and methodologies of this research aspire to influence future safety standards and practices, particularly in school crossing areas, aligning with the Target 2030 road safety goals.

Post on X

Discover how AI-powered Pedestrian Safety System is setting new standards in school crossing safety, turning data into actionable insights to protect our children.

Introduction

Initiatives aimed at bolstering pedestrian safety driven by the Department of Transport and Planning (DTP), particularly at school crossings, is a pivotal and essential shift in transport investment. School crossing safety is a concern increasingly highlighted by recent data and unfortunate events. The AAMI Crash Index underscores this issue, revealing that a considerable portion of road incidents occur during school dismissal hours, thereby marking these times as particularly hazardous for schoolchildren and their guardians (Guthrie, 2020). Furthermore, the recent tragic event in Wodonga, Victoria, where a school crossing supervisor was fatally struck, has brought to light the critical safety challenges faced by school zones.

The project, utilising video data with artificial intelligence and computer vision technologies, aims not only to analyse the dynamics between pedestrians and vehicles but also to proactively identify and mitigate potential risks. By doing so, it seeks to significantly enhance the safety measures in school zones, ensuring that children, parents, and crossing supervisors are safeguarded against potential hazards. This initiative is in direct response to the escalating need for safer school environments, reflecting our commitment to prevent accidents and near-miss incidents, thus contributing to the creation of a safer, more secure community for our children.

Overview

Traditional road safety measures, reliant on historical accident data, fall short in addressing the immediacy of school zone hazards. This outdated approach fails to capture the full spectrum of traffic interactions and undetected near-miss events, creating a gap in effective safety planning and implementation. A shift towards pro-active data-driven insights is essential for developing more responsive and preventive safety measures in school environments.

Addressing the shortcomings of conventional safety evaluation methods, this study introduces a new paradigm with pedestrian safety detection through artificial intelligence driven computer vision. By transcending the limitations of traditional traffic data collection methodologies, the system employs advanced computer vision to accurately detect and analyse complex dynamics at school crossings such at near misses, drive-through events (non-compliant), and vehicle speed profile, offering a more nuanced understanding of safety risks before they escalate.



Figure 1. AI detecting pedestrian at a school crossing



Figure 2. Extract of AI processing traffic data at a school crossing

Approach

The AI-Pedestrian Safety System leverages state-of-the-art computer vision and artificial intelligence to provide a multifaceted analysis of school crossing areas. The system's capabilities include detecting erratic driving behaviours, classifying road users, tracking movement paths, and assessing the potential impact of collisions—all while ensuring user privacy and adaptability to various conditions. The specific project requirements are as follows:

- Camera based
- Traffic flow recognition in either direction
- Vehicle counting for upstream and downstream traffic
- Identifying vehicles stopping within 40m of a crossing
- Vehicle classification as per the Austroads Extended Vehicle Classification Scheme
- Pedestrian counting and classification into age-related categories. (Preschool, Primary, Secondary, Adult)
- Minimum frame rate of 25FPS for video recording
- Average accuracy rates of 95 percent for vehicle and pedestrian counts and speed
- Analysis of pedestrian and driver behaviour
- Including automatic extraction of video clips of predefined safety risk situations
- De-identification of individuals and vehicles in captured video for privacy compliance
- Detection of pedestrian dwell time at crossings
- Identification and counting of drive-through and near drive-through events at crossings

Privacy concerns were addressed through the use of automatic blurring, encrypted storage devices and the use of encrypted Amazon Web Services cloud storage and processing. This comprehensive approach allows for an unprecedented level of insight into the factors contributing to school zone hazards.

Results

The project is at the deployment phase comprehensive finding and learnings will be available later in the year. However, it is anticipated that the deployment of the AI-Pedestrian Safety System across 3000 school crossings will feed the data and insights into a network-wide risk assessment platform to then objectively prioritise treatments at highest risk sites. By facilitating a deeper understanding of pedestrian and vehicle interactions, this approach will enable the identification and mitigation of high-risk conditions, thereby reducing the likelihood and severity of potential accidents.

Implications for Policy and Practice

The success of the data collection AI-Pedestrian Safety System underscores the importance of integrating advanced monitoring technologies into regular safety evaluations and urban planning processes. This project stands as a milestone for utilising camera-based AI technology to enhance and revolutionise traditional data collection methods and outputs. This project serves as a model for future safety initiatives, advocating for a technological and proactive approach to protecting vulnerable road users, particularly in school zones. As well as this, the project offers insight into the management of privacy concerns, specifically the sensitive nature of the data being collected.

Conclusion

The implementation of the AI-Pedestrian Safety System at school crossings represents a significant step forward in road safety. The project's outcomes will not only demonstrate the potential for technology-driven solutions to mitigate risks but also set a new benchmark for proactive safety measures. As we move towards the Target 2030 objectives, this research offers valuable insights and practical implications for enhancing pedestrian safety in school environments and beyond.

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Challenges in child seat legislation enforcement in the Philippines

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Abstract

Sustainable law enforcement is important. The Philippine government deferred the implementation of the Child Safety in Motor Vehicles Act in 2021 because of the economic shock brought by the COVID-19 pandemic. Now that the pandemic is over and the country's economy is recovering, it is imperative to unveil new challenges that may prevent its enforcement. Looking through the same laws at countries of similar financial stature as the present and the future Philippines, this paper shows that child seat prices, its compatibility with existing cars, and its perceived effectiveness, will continue to avert its application soonest.

Post on X

Find out what the challenges are in the implementation of child seat laws low- and middle-income countries like the Philippines. After their law's implementation was put on hold during the pandemic, it seems that there remains barriers which need to be addressed first.

Introduction

Sufficient legislation is paramount in ensuring road safety. However, its outcomes are not achieved by the laws alone. The World Health Organization (WHO, 2017) asserts that "appropriate" implementation of the law is key, including continuous enforcement, which will result in reduced road crashes and trauma associated with them. Through a pilot legislation, the Philippines acknowledges child safety while inside motorized vehicles are corollary to their rights for proper care and special protection from all forms of neglect, abuse, and other conditions prejudicial to their development (Child Safety in Motor Vehicles Act, 2019). This law was set to be fully operationalized on February 2021 but was deferred by now former President Rodrigo Duterte due to the current economic conditions of families exacerbated by the COVID-19 pandemic (Gita-Carlos, 2021). As a result, no Filipino with a car and a child is technically mandated to equip their car with a child seat, not until any new development on the implementation status of the law is established.

In May 2023, the WHO officially declared the end of the COVID-19 pandemic. This marks the start of the economic recovery process of all countries all over the world, including the Philippines. The Asian Development Bank (ADB, 2023) expects that the Philippine economy will continue to grow by 6.0 percent in 2023 and further increase by another 6.2 percent in 2024. The ADB attributes the current and anticipated growth to domestic recovery in employment and retail trade, development in the manufacturing sector, and the ever-continuous rise of public infrastructure spending. Despite the optimism, the regional development bank also emphasizes the external risks from highly anticipated slowdown of other larger economies, ensuing geopolitical tensions, and inflation, which can gravely affect the economic outlook estimates for the country. Apart from these developments, the Philippines has transitioned to a new administration in 2022. President Ferdinand Marcos, Jr., was elected.

With the end of the pandemic, a promising economic outlook, and a new leadership, it is apparent that conversations will resume regarding the implementation of the child seat legislation in the Philippines. However, it is exceedingly possible that the enforcement of the law is still premature based on the underlying factors beyond the recovery of the nation from economic shocks due to the COVID-19 pandemic. Through an anticipatory approach, this paper will provide an overview of the Child Safety in Motor Vehicles Act of the Philippines and explore the expected benefits from its implementation based on the salient features of the law. It will then deduce the possible challenges underpinning the financing aspects that initially delayed its execution. These will arise from the various findings of published road safety papers which cover other low and middle-income countries. It will also assess other considerations based on the case in China, a country considered an upper middle-income country (UMIC) where parental support for child seat in Nanjing was studied.

Dissecting the Law

Former President Rodrigo Duterte signed into law the Republic Act No. 11229 or "an act providing for the special protection of child passengers in motor vehicles and appropriating funds therefore". This law aims to prevent traffic-related deaths and injuries in children. It recognizes that it is imperative to "adequately, consistently, and objectively" pursue the requirement, regulation, promotion, and communication of the use of child seats in motor vehicles. It likewise stresses that this legal measure considers the purchasing power of Filipinos by ensuring their access to "safe, appropriate, quality, and affordable" child seats compliant with the standards prescribed by the United Nations (Child Safety in Motor Vehicles Act, 2019).

The policy declares that it is considered unlawful for a child, specifically aged 12 years and below to be seated on the car seat. The driver must always secure the child with the child seat unless the child is at least 150 centimeters in height. Exceptions include situations when there is a passenger requiring immediate emergency medical care whether it is the child or not and other situations (Child Safety in Motor Vehicles Act, 2019). The law is expected to take effect in following the approval of the implementing rules and regulations (IRR).

Formulated by various government and non-government stakeholders led by the Department of Transportation, the IRR is provided detailed enforcement mechanisms of the law. It outlines the product safety standards compliant to the United Nations Regulation Nos. 44 and 129, use and installation of the child seat in a motor vehicle, law enforcement and adjudication, consumer protection, and penalties. Fines on erring drivers who do not equip their cars with a car seat or who use substandard or expired car seats starts at PHP1,000 and can go up to PHP5,000 with the suspension of the driver's license for one year. Manufacturers up to the sellers may also be penalized with fines ranging from PHP50,000 to PHP100,000 for violations of tampering, alteration, forgery, and imitation of the authenticity mark or sticker of the child seat, as well as acts of deception in sales (Implementing Rules and Regulations, 2019).

This legislation entails an added cost to a typical Filipino family with a car and a child to spend at least PHP6,500 to PHP28,000. The prices of these seats are expected to be fluid and has the potential to rise given the external economic risks the Philippines presented by the ADB (2023). Though it is already considered a huge cost, the singular but paramount benefit is that the risk of road crash death is reduced by at least 70 percent for infants and 47-54 percent for children aged one to four years. Despite the benefits, it must be admitted that the unforeseen disruption of the economy due to the COVID-19 pandemic had serious consequences in the financial standing of Filipinos, in general. With the IRR ready in December 2019, the law is set to take effect in February 2021. However, acknowledging the difficulties in the pandemic, the government deferred its implementation indefinitely (Gita-Carlos, 2021).

Fleiter et al. (2023) are among the experts consulted by the Philippines in the formulation of the IRR of the Child Safety in Motor Vehicles Act. They assert that legislative changes are imperative to improve traffic law enforcement capacity. They also highlight the value of evidence-based traffic laws and admit its inadequacy if there is no sustained enforcement. Conversely, in the case of the Philippines, the pandemic stalled the success of what they allege as a sustainable model for low- and middle-income country (LMIC) contexts.

The Context of Lower Middle-Income Countries

The WHO (2017) indicates that a mere 11 of the 150 LMICs have child seat policies. The attention for LMICs in road safety cannot be underestimated as 90 percent of road crash fatalities occur within them. Michael Paine (2020) published in the Journal for Road Safety implies that many child deaths from traffic in LMICs can be prevented by child seats. The author identifies two key action points for a successful child seat use in LMICs: first is to equip vehicles with child seats, and second is to assist families in the acquisition and use of child seats. Consequently, for child seat laws to accomplish its desired outcomes, it should consider the financial constraints experienced by families in LMICs whether there is a pandemic or not. While Fleiter et al. (2023) insists that the implementation of the law requires sustained enforcement, they overlooked the economic condition of the Philippines as an LMIC. The law and the IRR mostly covered only consumer protection to ensure authenticity and quality of child seats as well as the penalties for non-compliance with or violating the law. This poses a challenge that may extend the deferment of the Child Safety in Motor Vehicles Act even beyond the pandemic and other emerging economic challenges.

In addition, Paine (2020) considers the fact that the LMICs may have a wide range of vehicles in terms of age that can have compatibility issues with the installation of child seats. Typically, child seats are attached with the use of existing seatbelts in a motor vehicle. In the law, private vehicles regardless of age, function, or ownership are required to be equipped with child seats when there are child passengers. In the case of public utility vehicles such as jeepneys and buses, the Department of Transportation has another year after implementation to study the feasibility of requiring use of child seats. If the study finds it not feasible, they will recommend to the Congress necessary legislative measures for safe and secure transportation of children (Implementing Rules and Regulations, 2019).

Becoming an Upper-Middle Income Country

The Philippines as an LMIC may not be for long as it is predicted to outgrow this status in the coming years. Its public infrastructure spending contributes highly to its economic expansion through the projects built that connect communities with markets and public services and the resulting jobs and livelihoods created (ADB, 2023). Rapid urbanization, increasing middle class, and a large, young population provides a steady potential for the country to become a UMIC in the near term (The World Bank, 2023). Towards this context, reaching a higher income classification can contribute towards the implementation of the law as illustrated by a case study in China, a country classified as a UMIC.

Extended Abstract (Researcher)

The factors influencing the support of parents for a child seat legislation in Nanjing, China was studied by a group of transportation experts in 2021. Li et al. (2022) confirm that legislation is important to increase the use of child seats in motor vehicles. However, their study found that parents still had low support for the law mandating the installation of child seats with 5.83 percent opposing the measure and over 40 percent being neutral instead of a supportive attitude. They also underscore the need of time and influence of income status to have at least a majority to support the use of child seats. For instance, the United States which passed its child seat legislation as early as 1977 has child seat use exceed 60 percent (Weatherwax et al., 2016 as cited by Li et al., 2022) as compared to 13 percent in Iran, a developing country (Tavakoli et al., 2019 as cited by Li et al., 2022).

In an earlier study of on the role of traffic law enforcement by Solmazer et al. (2016), it also acknowledges that law enforcement must be undertaken by the government to decrease road crash fatality rates, but it also entails a long time. With these considered, the economic status of the Philippines may not necessarily influence the expected outcome of the child seat law. Applying the case study in China, its UMIC classification may not guarantee full support of the Filipinos and other examples cited also meant that the legislation will see its positive results in terms of child seat use in the long term instead of the short term. This implies that Fleiter et al. (2023) were correct to say that the government should be persistent and should sustain enforcement even if there are no significant results in the first few years of implementation.

Conclusion

The delay in the implementation of the Philippine Child Safety in Motor Vehicles Act is not yet over even after the COVID-19 pandemic and its economic aftershocks start to diminish. Several challenges remain at bay and must be considered before any decision is made pertaining its enforcement. The first consideration is the cost of the child seats which can increase with inflation induced by economic slowdown and geopolitical tensions. Although the Philippines has the potential to become a UMIC, it does not mean that the child seats will be cheaper or that the purchasing power of a Filipino can permit them to easily acquire a child seat.

Second, the various types of vehicles in the country which also range widely in terms of manufacturing year leads to compatibility issues for older cars. The IRR of the law focused on the mandatory use of child seats for private vehicles but not with public utility vehicles wherein the installation of child seats is yet to be studied. Should there be issues, the Congress will have to amend the existing policy or create an entirely new law for other types of vehicles other than the private vehicles already covered.

Finally, the outcome of reduced road crash fatality may not be quantified right away can negatively impact the perceived effectiveness of the policy measure in the near term. It was common ground among the various transport experts that it will need a sustained enforcement for a long period of time to increase support and compliance with the law. Furthermore, the improvement in economic status of the Philippines whether in the long term or short term does not have a sufficient guarantee on the level of compliance for the policy.

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²⁰²⁴ Australasian Road Safety Conference

³⁰ September – 3 October, Hobart, Tasmania, Australia

Frequency analysis of crashes involving heavy vehicles

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Abstract

Literature about Heavy Vehicles (HV) safety is limited; to the best of our knowledge, no study has analysed various Fatal and Serious Injury (FSI) crash types including head-on, rear-end, single-vehicle, and sideswipe involving Rigid Trucks and Buses (RTBs), Articulated Trucks (ARTs) and Multi-Combination Vehicles (MCVs) in Australia. A retrospective analysis was conducted, encompassing HV crashes that resulted in at least one fatality or serious injury. Traffic volumes, roadway types and geometric features were considered as potential explanatory variables. Given the distribution characteristics of the data, a Poisson regression model was chosen as the appropriate analytical framework. Our analysis revealed that, although likely contributing factors vary among crash types, they remain fairly consistent for all vehicle classes. Addressing these factors can be used to develop targeted countermeasures, enhancing safety for all road users.

Post on X

Unveiling key insights into heavy vehicle crash dynamics in Australia, an analysis of diverse crash types, advocating for targeted safety measures.

Introduction

The freight and logistics sector is essential for national financial systems, where Heavy Vehicles (HV) play a pivotal role. In Australia, road freight has seen consistent growth, with projections of an average annual growth rate of 1.9 per cent (BITRE, 2022). However, this rise in road freight volume is expected to lead to an increase in the number of HVs and related crashes, highlighting the need for improved safety measures. In the United States, large truck-involved fatalities rose by 17% from 2020 to 2021 (NHTSA, 2023), and in Australia, despite HVs only accounting for 2.4% of vehicle registrations, they are involved in 16% of road fatalities (BITRE, 2017). This study focuses on identifying likely contributing factors to Fatal and Serious Injury (FSI) crashes involving RTBs, ARTs and MCVs across diverse crash types. Employing Poisson regression analysis, the research aims to offer insights into specific likely contributing factors, assisting in the development of specific safety improvements aligned with the National Road Safety Strategy's goals of substantially reducing fatalities and serious injuries.

Background

Various studies have sought to evaluate factors influencing HV-related crashes by applying a broad range of methodological tools, mainly analysing injury severity while less frequently assessing crash frequency. Much of the existing research is based in the US, Europe, and Asia, with a notable scarcity of studies within the Australian context. Most of these studies have concentrated on specific variables, crash types, or vehicle categories. Factors such as human (e.g., fatigue, reckless driving, age, alcohol use), environmental characteristics, and temporal impacts have been widely explored. However, the scope of management by transport agencies typically centres on the road infrastructure and operations, highlighting a gap in understanding the impact of traffic and roadway features on HV crashes. While previous investigations have identified various likely contributing factors for crashes involving HVs, there remains a gap in the literature regarding the identification of unique factors affecting different crash types involving Rigid Trucks and Buses (RTBs), Articulated Trucks (ARTs) and Multi-Combination Vehicles (MCVs). Moreover, this research presents findings from analyses involving diverse crash types and different HVs operating on Australian roads.

Data

The dataset included roadway and traffic characteristics for 29,841 road segments within Queensland's state-controlled road network, ranging from 0.5km to 1.0km in length. It includes attributes such as Annual Average Daily Traffic (AADT), road type and functional classification, speed limits, terrain, and the types and proportions of curvature, among others. The FSI crash data involving RTBs, ARTs and MCVs for the same domain and 5-year period (2012- 2016) was linked to the main dataset. After the exclusion of road segments with incomplete or inconsistent information and segments not permitted for HVs (non-gazetted), the analysis focused on 26,625 segments.

In this study, RTBs correspond to buses and trucks with two to four axles and lengths between six to 13 metres. ARTs are heavy freight vehicles with three to six axles, with lengths ranging from six to 21 meters. MCVs are B-doubles and double road trains equipped with seven or more axles and lengths exceeding 21 meters. During the 5 years, 480 RTB- related, 480 ART-related and 224 MCV-related FSI crashes occurred on the considered road segments. Figure 1 shows the number of FSI crashes by crash type for each vehicle category. The limited occurrence of crashes resulting in death or severe injury in certain crash types presents challenges in the modelling process, such as a lack of significant variables or computational issues. For example, only 15 or fewer FSI crashes happened at merging locations, single vehicle turns, and involving bicycles and miscellaneous. The five most prevalent crash types are head-on, rear-end, single-vehicle, intersection, and sideswipe, representing together over 85% of total crashes.



Figure 1. Number of Fatal and Serious Injury crashes by crash type

Methodology

A stepwise approach outlined by Arndt (2003) was adopted to analyse FSI crashes involving RTBs, ARTs, and MCVs on gazetted roads. Initially, 45 characteristics were considered. The product of the road segment's length and the analysis period was included as an offset in the crash model. Suitable relationships between the response variable (crashes) and independent variables were identified. Both Negative Binomial (NB) and Poisson regression were initially considered, however, for most crash types, the data indicates equidispersion and the NB model's dispersion parameter was not significant. Thus, the Poisson regression model was selected as the preferred approach for performing statistical analyses to achieve statistically significant and reasonable results.

Model specifications

Poisson models are extensively used for crash frequency analysis. In its formulation, Y_i represents FSI crashes on i^{th} road segment, and **Y** the vector of observations. Assuming Y_i follows a Poisson distribution with λ_i being the expected number of crashes on the i^{th} road segment, the probability of observing crashes can be estimated using Equation (1)

$$Prob(Y_i = y_i | \lambda_i) = Poisson(y_i; \lambda_i) = \frac{exp(-\lambda_i) \lambda_{ij}^{y_i}}{y_i!}$$
(1)

The mean (λ_i) of FSI crashes is formulated as shown in Equation (2) respectively. where X_i is the vector of roadway and traffic attributes; *Ei* crash exposure parameters, α_o , α_1 , and vector β are the parameters

$$\lambda_i = \alpha_o E_i^{\alpha_1} \exp(X_i \beta) \qquad (2)$$

to be estimated (Behara et al., 2021). Bayesian methods and Maximum likelihood are the most prevalent for the estimation of crash frequency models. In this study, the log-likelihood, AIC and BIC were used as goodness of fit measures.

Results and Discussion

The models revealed likely contributing factors for each crash and vehicle type. All results and models provided consistent and expected signs of the key determinants. Likely contributing factors fluctuate across crash types, yet they are moderately uniform across all HV classes. Due to space limitations in this extended abstract, Table 1 presents the estimated results for one specific crash type as a representative example. The effects of explanatory variables included in the parsimonious model are discussed in the following:

- **Traffic characteristics:** AADT, RTB traffic, ART traffic, MCV traffic, and the interactions between AADT and the volumes of each HV category were tested as exposure variables. The analysis indicated a significant positive relationship between the frequency of FSI crashes and the traffic volumes of RTB, ART and MCV respectively for all crash types. This finding aligns with expectations and is consistent with previous studies that have also observed an increase in crash counts when heavy vehicle traffic increases (Balakrishnan, 2017; Dong et al., 2017). For intersection and sideswipe FSI crashes, the products of total AADT and RTB, ART or MCV volume, accordingly, emerged as a predominant significant factor, in line with previous investigations.
- **Roadway types and speed limits:** Rural single-carriageway with medium speed limits was found to increase the likelihood of head-on and overtaking crashes involving RTBs, while urban single-carriageway with medium speed limits has a positive relationship with the occurrence of pedestrian crashes involving RTBs and intersection crashes for all HVs. Rural dual carriageway shows a positive association with ART-related shoulder crashes, while urban dual carriageway exhibits a positive relation with RTB rear-end crashes and with all HV-

related intersection crashes and crashes involving pedestrians.

• **Roadway features:** Some of the key findings from our analysis reveal that an increase in the number of lanes decreases head-on FSI crash counts for all HVs, as well as overtaking crashes involving RTBs and ARTs, but it raises the single- vehicle turn crash frequency for RTBs and ARTs. Mountainous terrain heightens the risk of rear-end crashes involving ARTs and MCVs, as well as single-vehicle crashes involving RTBs and ART-related overtaking crashes. An increase in the shoulder width on the passenger side reduces the likelihood of single-vehicle crashes involving ARTs, alongside shoulder and hit-object crashes involving RTBs. Moreover, sharp curvature significantly increases the frequency of single-vehicle crashes for both ARTs and MCVs.

RHEAD-ON FSI Crashes	Rigid Tr	ucks & I	Buses	Articul	Articulated Trucks			Multi-Combination		
Explanatory Variables	Coef.	Std Error	P (> z)	Coef.	Std Error	P (> z)	Coef.	Std Error	P (> z)	
Constant	-20.74***	0.79	< 0.0001	-11.34***	2.60	< 0.0001	-18.12***	1.32	< 0.0001	
Log(AADT*AADT of RTBs)	0.57***	0.07	< 0.0001							
Log(AADT of ARTs)				1.60***	0.14	< 0.0001				
Log(AADT of MCVs)							1.49***	0.17	< 0.0001	
Rural single carriageway with medium speed limit (50-100 km/h)	0.88**	0.45	0.04							
Number of lanes	-0.56***	0.17	0.0009	-1.36***	0.24	< 0.0001	-1.63***	0.55	0.003	
Lane width				-2.11***	0.80	0.008				
Audio tactile lane marking on driver side				-0.78*	0.42	0.07				
No. of parameters (K)		4			5			3		
Log Likelihood		-311			-423			-262		
AIC		630			856			530		
BIC		663			897			554		
Note: ***, **, and * imply level	of significa	nce at 19	%, 5%, and	10%, respe	ectively.					

Table 1	Head-on	FSI	crashes	model	estimates
	IICau-UII	LOI	U asiles	mouci	commates

Conclusion

This study provided extensive statistical analyses of crash data involving RTBs, ARTs and MCVs to determine the effects of volume, speed, and various roadway characteristics on the frequency of crashes resulting in severe injury or fatality. Likely contributing factors revealed by the models differ across FSI crash types. Results indicate that the logarithm of HV volume is the predominant variable with significant influence in all HV-related crashes, regardless of the crash type. The models developed in this study can be used to propose targeted safety countermeasures and treatments, including but not limited to vehicle restrictions, median implementation, and speed management. Future research can include additional data such as human and environmental factors for further investigation and testing of advanced statistical methods.

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Attitudes and behaviours towards driving under the influence of drugs

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Abstract

Methamphetamine-affected drivers continue to be overrepresented in road trauma; yet a clear intoxication-impairment matrix remains elusive. Therefore, exploring intrapersonal factors may provide insight into behavioural antecedents that increase risk for harm. This study examined whether attitudes toward drug driving predicts dangerous driving behaviour in individuals who use methamphetamine and how this may differ to individuals with no history of substance use. A multigroup regression analysis indicated that individuals who use methamphetamine generally report more favourable attitudes toward drug driving predicted greater engagement in dangerous driving behaviour, whereas more favourable attitudes to sanctions predicted less dangerous driving behaviour. Among those with no history of substance use, favourable peer attitudes toward drug driving predicted dangerous driving behaviour. Targeted campaigns aimed specifically at reducing methamphetamine-related road trauma should focus on the risks and dangers of such behaviour, rather than the sanctions and influence of peers.

Post on X

National survey of Australian drivers who currently use #methamphetamine suggests that more favourable attitudes towards drug-driving predicts greater engagement in dangerous driving behaviour. Challenging #attitudes towards perceived risks and dangers may help reduce harm.

Introduction

Methamphetamine is the most frequently detected substance among drivers injured or killed due to road trauma (DiRago et al., 2019; Schumann et al., 2021). Attitudes and beliefs towards driving under the influence of drugs may indirectly or directly influence driving behaviour based on perceived risk, and this is likely to differ among individuals who do or do not use substances. This study builds on previous research that has linked drink driving attitudes and driving behaviour (Davey et al., 2004) by seeking to understand the relationship between drug driving attitudes and dangerous driving behaviour in individuals who use methamphetamine.

Method

Australian drivers aged 18-50 years who regularly consumed methamphetamine and individuals who reported no recreational drug use were recruited through flyers distributed in the community, advertisements on social media platforms (Facebook and Twitter), and via targeted patient databases at Turning Point (Eastern Health), a clinical addiction treatment centre in metropolitan Melbourne. Participants completed a forced entry, branched logic anonymised online survey that included a validated measure on self-reported dangerous driving behaviour and an adapted, validated measure assessing drink driving attitudes for drug driving. The survey was open for responses between 27 January 2021 and 27 September 2022.

Attitudes towards drug driving were measured using the scale developed by Davey et al (2004). Total dangerous driving score was modelled against three factors of drug driving attitudes (favourable attitudes toward risks, unfavourable attitudes toward sanctions, and favourable peer attitudes) in a multi-group analysis model with substance use as grouping variable.

Results

A total of 125 participants, comprising people who use methamphetamine (n = 53) and individuals with no history of substance usage (n = 72) were assessed. Table 1 shows the breakdown of age and gender by substance use group. Participants who use methamphetamine demonstrated more favourable attitudes toward drug driving and more unfavourable attitudes towards sanctions compared to participants with no substance use history (Figure 1) and demonstrated significantly higher levels of self-reported dangerous driving behaviour (M = 66, SD = 15 vs M = 55, SD = 14; t(110) = -4.38, p < .001).

Multigroup analyses indicated that all three drug driving attitude factors varied significantly in their relationship to dangerous driving behaviour between the two groups. Among individuals who use methamphetamine, favourable attitudes toward risk were associated with higher scores on measures of dangerous driving behaviour (t = 3.19, p = .002) and unfavourable attitudes toward sanctions were negatively associated with dangerous driving behaviour (t = -3.41, p = .001). Peer attitudes were not significantly associated with dangerous driving behaviour among this group. Among individuals with no history of substance usage, peer attitudes toward risk and attitudes toward sanctions were not.

Table 1. Age and Gender by Substance Use Group

Characteristic	Ma Group	Non-Drug Group	p-value ¹
Age Mean (SD)	30.8 (7.0)	28.3 (6.2)	0.051
Sex	-	-	0.092
Male	33.0 (62.3%)	33.0 (45.8%)	-
Female	20.0 (37.7%)	37.0 (51.4%)	-
Prefer not to say	0.0 (0.0%)	2.0 (2.8%)	-

¹Wilcoxon rank sum test; Fisher's exact test



Figure 1. DUID Attitude Factor Scores (Median, IQR) Between Groups

Benefits to Road Safety

Driving while intoxicated by alcohol or drugs is a known risk factor for injury and death on our roads. While much clinical and epidemiological work has examined how acute intoxication may impact crash risk, no research has yet focussed on factors that contribute to elevated road safety risk among people who regularly consume illicit substances. Thus, identifying and understanding which relevant person-level factors may contribute to increased propensity for harm will help to inform policies and procedure to improve road safety for this vulnerable group, as well as all road users.

Implications for policy and/or practice

Campaigns that are targeted at drivers who use illicit substances such as methamphetamine may benefit from direct messages related to the *risks* associated with such behaviour, and providing greater education and information around the imposed sanctions may help to deter drug driving behaviour among this cohort.

Conclusions

Drug driving attitudes, and their relationship to dangerous driving behaviour differs between those who use methamphetamine and those who do not have a history of substance usage. Among those who use methamphetamine, a more favourable attitude toward the risks of drug driving predicts higher engagement in dangerous driving behaviour, while more unfavourable attitudes toward sanctions for drug driving (i.e., beliefs that the laws and punishment for drug driving are too harsh) predict lower engagement. Targeted road safety messages should thus highlight the inherent safety risks of engaging in such behaviour, rather than just the sanctions or attitudes of peers among people who use methamphetamine.

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Assessing road infrastructure for compatibility with ADAS

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Abstract

Advanced driver assistance systems (ADAS) comprise various innovative vehicle technologies that have great potential to reduce fatalities and serious injuries. The effectiveness of some ADAS is reliant on features of the road network such as line markings and signage to enable proper functioning of technologies like lane departure warning or intelligent speed adaptation. This project involved driving an instrumented vehicle along major roads within the ACT to assess and record the compatibility of the road infrastructure with ADAS. The data collection occurred over five days with over 1,349 km of roadway being assessed and 1,963 speed limit signs being detected. Using this data, high-resolution maps were generated that show how well ADAS is able to interpret the infrastructure across the ACT road network. Overall, it was found that ADAS is likely to operate effectively across the majority of the roads that were assessed.

Post on X

Obtaining an understanding of how well ADAS interprets road infrastructure can give us confidence that modern vehicle technologies will work effectively to keep us safe.

Introduction

Advanced Driver Assistance Systems (ADAS) have been found to greatly reduce the occurrence of crashes. These systems include intelligent speed assistance (ISA) and lane support systems like lane departure warning (LDW) or lane keep assist (LKA). A UK based study (Lai et al, 2012) concluded ISA could result in crash reductions of between 3% and 12%. A study conducted in Sweden (Sternlund et al., 2017) found that vehicles equipped with LDW/LKA systems were 53% less likely to be involved in a lane departure casualty crash.

While this evidence for effectiveness is encouraging, ADAS manufacturers primarily develop their systems for the European or North American market and thus their systems may not be designed to operate optimally in the unique Australian road environment. In 2014, a study on emerging vehicle safety technologies interviewed road safety experts from Australia who acknowledged the immense potential benefits of ADAS, but expressed an opinion that Australian road infrastructure may not be optimal for effective use of some technologies (Searson et al., 2015). Indeed, to function properly, ISA systems must be able to detect the posted speed limit on the road being driven and LDW/LKA systems require line markings that are clear and well maintained. It is therefore important to establish whether our Australian road systems, and maintenance programs, are compatible with Advanced Driver Assistance Systems that have the potential to reduce crashes and prevent road trauma.

Through support from the ACT Road Safety Fund Community Grants Program, this study sought to assess the compatibility of ADAS across the ACT road network.

Method

It was not feasible to assess the entire ACT road network for ADAS suitability. As such, there was a need to identify and prioritise the roads which could be covered in the time available (five days). To achieve this, several road infrastructure stakeholders in the ACT were contacted to request feedback via a consultation.

Four organisations agreed to take part in a consultation. During the consultations the background and goals of the study were explained, and a discussion was held to seek each organisation's opinion on an appropriate method to prioritise the roads that would be assessed. An opportunity was also provided for each organisation to nominate any roads that they felt should be assessed because they were examples of either bad or good infrastructure.

As a result of the stakeholder consultation, a prioritised plan for data collection was developed. The first item in this plan was to cover all ACT highways in their entirety. Next was to cover a reasonable proportion of the urban and rural arterial road network, followed by a sample of urban and rural distributor roads. Finally, a small sample of local residential streets would be covered, as well as any of the specific roads nominated. Further details of the roads that were selected, along with map can be found in Mackenzie et al. (2024).

An instrumented vehicle was utilised for data collection. The vehicle, a 2014 Subaru Outback, was fitted with a Mobileye dev-kit system as well as a RaceLogic Vbox Video HD2 system. In tandem, these systems enable the collection of ADAS data regarding line markings and signage at a frequency of 10 times a second, along with

synchronised GPS location and video of the forward driving scene. Images and further details regarding the setup of the instrumented vehicle can be found in Mackenzie et al. (2024).

Mobileye is a commercially available ADAS that views the driving scene via a single forward-facing camera and applies machine vision algorithms in real time to detect important road and traffic features such as line markings, the location of other road users, and the details of roadside signs. The system is also connected to the vehicle's controller area network (CAN) bus which provides information such as current vehicle travel speed, use of turn-signal indicators, and application of the brake pedal. Based on the video and CAN bus data, the Mobileye system can provide safety information to the driver, such as the current posted speed limit or headway to the vehicle in front, via a small in-cabin display unit. When a crucial safety event is detected, such as an unexpected lane departure, the system provides an audio alert to the driver. Mobileye has also been installed as original equipment in over 100 million vehicles worldwide by multiple manufacturers. When installed as original equipment, the system's safety alerts can trigger safety features such as autonomous emergency braking or lane keep assist. As such, the Mobileye system can be considered a suitable example of modern, commercial-grade ADAS.

The Mobileye "dev-kit" is a specialist version of the system that is usually provided to developers or manufacturers and provides access to all the features being detected by the Mobileye system in real-time. This access is gained via connection to a CAN output from the Mobileye system along with corresponding knowledge regarding how the CAN messages should be decoded. The CAN data from the Mobileye is fed to a Vbox Video HD2 system which is able to capture, decode, and record the CAN messages along with GPS data and video from two cameras. The HD2 system records the CAN and GPS data synchronously at a frequency of 10 Hz.

Two researchers travelled to the ACT and collected data (during daylight hours) with the instrumented vehicle for a total of five days in June 2022. Because this work involved a video camera that was recording the public roadway and road users, there was the possibility that personally identifying information, such as people's faces and vehicle registration plates, could be recorded. As such, an ethics approval for the activities being undertaken was obtained from the Office of Research Ethics, Compliance and Integrity at the University of Adelaide (Ethics Approval No: H-2018-102).

Data collection was focussed on the roads recommended by the consulted stakeholders, as described above. During data collection, one researcher navigated and operated the data collection equipment, while the other researcher was solely responsible for driving. For roads with more than one lane, attempts were made to drive along each lane in multiple passes as well as in each direction of travel.

Analysis of the collected data was conducted in three phases. The first phase consisted of removing any irrelevant data points (e.g. outside the area of interest or where travel speed was less than 20 km/h) and a process of matching the remaining points to the Open Street Map (OSM) network. The second phase focussed on exploring what information the Mobileye system was able to collect on line markings and the third explored what the system was able to detect regarding speed signage.

Results

Over 70% of the detected line markings were found to have been rated as "good" quality by the Mobileye system with a further 19% rated as "satisfactory". These two ratings indicate where the system had sufficient confidence in the line marking to enable ADAS features such as lane departure warning. Only 1% of line markings were rated as "poor". Around 10% of the line markings were rated as "undetectable", but this is likely to include locations were there was no line marking present.

A high-resolution digital map was generated that shows the quality of line markings across the various parts of ACT road network that were assessed (see an example depicted in Figure 1). The interpretation of this map is best conducted with knowledge about the specific infrastructure present in the sections of interest, but generally it appears that line markings are well recognised by the Mobileye system. It was observed that there were limitations in the ability of the system to recognise line markings at roundabouts and through intersections. However, it is likely that this is because there are no line markings present in these locations.

Despite the generally good recognition of line markings, there were still many instances of mid-block road segments where line marking recognition was found to be poor. These locations have the potential to be incompatible with ADAS and thus present potential safety gaps in the road network.

There were 1,963 speed limit signs detected in the recorded data. A high-resolution map showing the location of the signs was generated. The detected sign speed limits were also compared to the reported speed limit in the associated OSM roadway section. For signs detected as showing a speed limit of 70, 80, 90 or 100 km/h there was a fairly good correlation (70% - 90%) with the associated OSM road segment speed limit.



Figure 1. Sample of high-resolution map showing line quality on road segments where data collection occurred

However, there was little correlation between signs detected with a speed limit of 40 km/h or 50 km/h and the associated OSM road segment speed limit. The majority of these signs were detected on roads that were tagged with a speed limit of 80 km/h or 60 km/h in the OSM road network. Only three signs were detected as displaying a speed limit of 110 km/h and these were all found to be on road segments tagged with an OSM speed limit of 100 km/h.

It was not practical to perform an exhaustive investigation into every instance of a mismatch between the detected sign speed limit and the OSM road segment speed limit. However, an ad-hoc check of some of the most common instances of a mismatch was conducted by viewing the videos that were recorded at the time the speed limit signs were detected. There were three instances where a temporary speed limit sign was detected within, or on the approach to, a road works site. There were four instances where the detected sign was an official speed limit sign, indicating that the mismatch was due to an error in the OSM data.

It should be noted that OSM data is predominately crowd-sourced and thus there is no guarantee of the accuracy. It was therefore not surprising that some mismatch between the detected data and the OSM data was identified. However, no alternative sources of speed zone of speed limit sign data (that were also comprehensive and authoritative) could be identified.

Conclusions

Overall, this study was able to present a good overview of how well ADAS is able to understand the relevant areas of the ACT road network. The results provide confidence that existing Advance Driver Assistance Systems are likely to have good compatibility with the infrastructure on ACT roads. However, the results also identified many sections of roadway where compatibility was poor and this will provide a useful tool in prioritising maintenance or upgrade works, particularly in locations where there is a history of crashes.

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Showcasing impact in road policing funding agreements

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Abstract

New Zealand's new Road Policing Investment Programme (RPIP) 2024-27 showcases the vital importance of road policing activities in making our roads safer. The programme represents the formal agreement to fund road policing in New Zealand from 2024-27, providing a significant investment in road policing and enforcement in recognition that it is one of the most important tools for improving road safety. It contributes to the Government's overarching goal for transport of an effective, efficient, and safe transport system that supports economic growth to deliver greater prosperity, security and opportunities for all New Zealanders. It has been collaboratively developed by three key road safety stakeholders: the New Zealand Transport Agency, NZ Police, and the Ministry of Transport. Importantly, a new outcomes framework demonstrates the value of investing in road policing for road safety through linking activity to intermediate outcomes and through to long-term outcomes.

Post on X

New Zealand's new Road Policing Investment Programme 2024-27 showcases the importance of road policing activities in making our roads safer.

Background

On average, one person is killed every day on New Zealand roads, and another seven are seriously injured. In 2022 this meant that 374 people died and 2,541 more were seriously injured on our roads. New Zealand's rate of road fatalities is amongst the worst in the OECD. In addition to being devastating for those involved, their families and communities, these deaths and injuries also burden our health system, cause disruptions and delays on our roads, and have a significant financial cost. The Social Cost of the 2,915 deaths and serious injuries in 2022 was estimated to be around \$8B.

Road deaths and injuries are predictable and preventable, and road policing plays an important part in reducing harm on our roads through promoting good driving practices, road safety education, and effective enforcement to deter people from undertaking unsafe behaviours. In recognition of the value of these activities, the RPIP provides a significant investment over 2024-27 in road policing.

The Programme

The programme outlines seven key operational priorities for activity in based on areas of highest risk and harm, with an outcome's framework (see below) detailing the road policing activities critical to making our roads safer and linking these to outcomes via intermediate term measures. These seven operational priorities build on the areas for investment from the programme's predecessor, the Road Safety Partnership Programme (RSPP) 2021-24, and are based on international best practice and evidence. They are:

- 1. Impairment (including from alcohol, drugs and fatigue)
- 2. Speed (including speed management and roads and roadsides)
- 3. Restraints (including seatbelts and child restraints)
- 4. Distraction (especially mobile phone use)
- 5. High-risk drivers (including recidivist and high-end risk-taking behaviours)
- 6. Commercial vehicles (including light and heavy vehicle safety and compliance)
- 7. Other on-road prevention and enforcement activities (including general enforcement of road user rules, referrals to driving and licensing programmes, crash attendance, and network maintenance and efficiency)

The RPIP 2024-27 has been developed in accordance with the Land Transport Management Act 2003 and the Government Policy Statement on Land Transport (GPS). As such, it contributes to the government's overarching goal for transport, which is: an effective, efficient, safe, secure, accessible and resilient transport system that supports the growth of our country's economy to deliver greater prosperity, security and opportunities for all New Zealanders. Under the GPS, funding for road safety is focused on safer roads, safer drivers, and safer vehicles, and the significant investment in road policing and enforcement recognises that it is one of the most important tools for improving safety on New Zealand's roads.

Building on previous activities

The RPIP builds on the recent strong delivery of road policing activities from the 2021-24 Road Safety Partnership, with changes to:

- Increase activity levels of some measures, setting expectations of sustained delivery (e.g., 3.3 million passive breath tests) towards a desired level of 3.5 million
- Add measures where road policing activities were not previously measured (e.g., 50,000 Commercial Vehicle Inspection Reports) or to better target risk (e.g., 2.145 million passive breath tests to be undertaken in high and extreme alcohol risk times)
- Specify targets rather than percentages for risk-targeting activities, ensuring that there is clarity on the level of activity required (e.g., officer-issued speed offences on open roads)
- Remove some past measures which were not as strongly linked to impact or evidence (e.g., number of RIDS operations which is better measured through existing measures).

Measuring success

Governance of the RPIP is designed to strengthen delivery of road safety outcomes and provide assurance around the significant NLTF investment. This governance is provided at different levels to provide senior level strategic oversight and appropriate performance and programme management (including monitoring and reporting). RPIP governance exists in an ecosystem of other governance groups, including for the government's road safety strategy.

Assurance and reporting of the RPIP 2024-27 aims to monitor the efficiency and effectiveness of the NLTF investment into road policing. A range of regular reports provide information on the delivery of road policing activities along with the impact of these activities, as set out in the outcome's framework, as mentioned above. Importantly, assurance reporting is designed to address assurance requirements (e.g., for the Land Transport Management Act and the New Zealand Transport Agency Waka Kotahi Board) and maintain investment confidence by demonstrating that delivery maximises road safety outcomes.

Importantly, achieving the intermediate and long-term outcomes and making our roads safer requires a range of wider Safe System interventions beyond road policing activities, including safer vehicles and roading infrastructure (such as median barriers).

The Outcomes Framework

Key to measuring success is the RPIP 2024-27 outcomes framework. This framework details the key road policing activities considered to be critical to making our roads safer (intervention indicators), linking these to intermediate term (safety performance indicators) and to long-term (outcome indicators) measures.

Measures are set for the key road policing activities (Intervention indicators) at levels which target the biggest areas of risk of harm on our roads. They also provide network-wide general deterrence. Some activity levels are set higher than for the 2021-24 programme (the Road Safety Partnership Programme, the RPIP's predecessor) in the expectation that Police sustain the recent improvements they made and continue to deliver to strong levels. Some of these measures target activity to risky times or locations, for example a majority of alcohol breath tests are is required to be done at the times when most of these serious and deadly crashes occur, and a majority of speed infringements are to be issued on the roads where the majority of serious and deadly crashes occur (open roads, or those rural roads with speed limits of 80km/h or above).

All these measures are set as minimum delivery levels, recognising that any activity delivered above this makes our roads even safer. Some activities (Intervention indicators) are 'monitored for operational purposes only', where it is important to monitor trends but setting a level of activity won't contribute to achieving road safety goals so these, or where a new measure is being introduced and an appropriate level of activity is yet to be determined. Safety Performance Indicators and Outcome Indicators are monitored for trend only (up/down, using 2018 as a baseline year where possible) rather than setting a specific level to be met. This is because they are affected by a wide range of activities beyond those delivered through the RPIP 2024-27, including multiple Safe System activities, human behaviours, and other drivers (such as fuel prices).

Conclusion

New Zealand's new Road Policing Investment Programme (RPIP) 2024-27 showcases the vital importance of road policing activities in making our roads safer. The programme represents the formal agreement to fund road policing in New Zealand from 2024-27, providing a significant investment in road policing and enforcement in recognition that it is one of the most important tools for improving road safety. It contributes to the Government's overarching goal for
transport of an effective, efficient, and safe transport system that supports economic growth to deliver greater prosperity, security and opportunities for all New Zealanders.

Road safety improvements for rural local roads in Western Australia

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Abstract

Local Government, responsible for a substantial portion of the road network, plays a pivotal role in our pursuit of Target 2030. However, they must not shoulder this burden alone; a multifaceted approach is essential to support Local Government on this critical road safety journey. In Western Australia, the majority of road fatalities occur on regional or rural roads, with many of these roads managed by Local Government. Despite this, a recent review highlighted the absence of context-specific guidance for low-cost road safety improvements on rural local roads. To address this, the Local Government Transport and Roads Research and Innovation Program developed a Practitioners Guideline. This guideline equips Local Government practitioners with vital information on cost-effective treatments and engineering solutions, streamlining the implementation of road safety improvements. Its ultimate goal is to reduce fatalities and serious injuries on rural local roads, reinforcing our collective commitment to safer roads for all.

Post on X

We need to take a multi-faceted approach to support Local Government towards Target 2030. See how our Practitioners Guideline provides WA Local Governments with context-specific tools to better implement low-cost road safety improvements on rural roads.

Background

The low-cost road safety improvements for rural Local Government roads in Western Australia (WA) project emerges from a collaboration between the Western Australian Local Government Association (WALGA), the National Transport Research Organisation (NTRO), and Main Roads Western Australia (MRWA), facilitated under the banner of the Local Government Transport and Roads Research and Innovation Program (LG TRRIP).

LG TRRIP is a dedicated initiative addressing the unique transport challenges faced by Local Governments in WA. Its primary mission is to enhance the capabilities of Local Governments by fostering collaborative projects that introduce advanced technologies and cost-effective solutions to road and transport issues across the state.

The development of guidance relating to low-cost road safety improvements highlights the program's commitment to improving road safety outcomes on local roads. By providing practical guidance and solutions, Local Governments are empowered to identify and implement the most effective measures to enhance road safety within their jurisdictions.

Between 2018 and 2022, a staggering 61% of road fatalities in WA took place on regional roads. This alarming statistic translates to 501 out of the 819 total fatalities recorded on WA roads over this five-year period (Road Safety Commission 2024). The Local Government road network in WA is a vital component of the state's public infrastructure, accounting for 87.2% of the total road network, spanning over 127,336 km (Western Australian Local Government Association 2021).

This stark reality highlights the urgent need for Local Governments to proactively address road safety and implement low-cost solutions tailored to rural areas. Without the concerted efforts of Local Governments, achieving the State Road Safety Strategy target of a 50-70% reduction in fatalities and serious injuries by 2030 will remain an uphill battle (Road Safety Commission 2020).

Approach

Review of current guidelines and research

The review concentrated on identifying low-cost road safety treatments applicable to rural roads in Western Australia (WA). A range of sources were examined, including existing guidelines, research papers, reports, and other pertinent publications, to gather insights into the treatment effectiveness, costs vs benefits, and best practices for these treatments.

The treatments identified and included in the review were shoulder sealing, lane widening, longitudinal linemarking, audio-tactile linemarking, speed limit review and zoning, guide posts, curve warning signs, intersection warning signs, advisory speed signs, guide signs (i.e. curve alignment markers), vehicles activated signs, RRPMs, surface corrections, road safety barriers, skid resistance and flag lighting.

Consultation and stakeholder engagement

To ensure the project's relevance and practicality, the project team engaged in extensive consultations with representatives from various Local Governments across WA. Their operational expertise in road construction and maintenance was instrumental in ensuring the accuracy and reliability of the information, particularly regarding cost rates.

Feedback was then solicited on the specific needs, challenges, and priorities of rural Local Government roads. This collaborative effort facilitated the development of cost estimates for implementing low-cost road safety treatments, enabling Local Governments to budget effectively and allocate resources efficiently.

Practitioners Guideline

The primary output of this project is the Practitioners Guideline, which provides practical guidance on low-cost safety treatments to mitigate crash risks on rural roads. This Guideline includes a matrix for treatment selection, best practice design and implementation guidance, and illustrative case studies.

The Practitioners Guideline equips Local Governments with context-specific tools to make informed decisions. Additional implementation opportunities, including community engagement and education in road safety, foster a culture of safety and encourage safer road behaviours among users.

While the Practitioners Guideline reflects the best available knowledge, it acknowledges that local road contexts and new materials and technologies will evolve. Periodic updates will ensure the information remains current.

Treatment Selection Matrix

A comprehensive matrix has been developed to facilitate the selection of optimal low-cost safety treatments for rural roads with low traffic volumes (see Table 1 for an extract). This matrix offers a systematic approach to treatment selection based on road type, location, and cost considerations, with effectiveness in reducing specific crash types highlighted as green (highly effective), yellow (moderately effective), and red (less effective).

		Longitudinal linemarking	RRPMs	Guide posts	Curve warning signs	Intersection warning	Advisory speed
Treatment						signs	signs
Cost		Low	Low	Low	Low	Low	Low
Road	Sealed	ü	ü	ü	ü	ü	ü
	Unsealed	û	û	ü	ü	ü	û
Location	Mid-block	ü	ü	ü	ü	û	ü
	Intersection	ü	ü	ü	û	ü	û
Hierarchy	Change road user behaviour	û	ü	ü	ü	ü	ü
	Reduce the risk	ü	û	û	û	û	û
Crash	Head on						
type	Hit animal						
	Hit object						
	Hit pedestrian						
	Non-collision						
	Off carriageway						
	Other						
	Rear end						
	Right angle						
	Right turn thru						
	Sideswipe						
Crash Reduction Factor		10-25%	15%	10-25%	10-30%	10-30%	30%

Table 1. Treatment selection table

This structured framework enables stakeholders to identify treatments that effectively target specific crash risks while evaluating their cost-effectiveness. This approach prioritises interventions with the greatest potential to improve road safety outcomes within a budget.

By using this matrix, Local Governments can tailor decisions to their unique circumstances and infrastructure challenges, ensuring resources are allocated for maximum impact.

Treatment Factsheets

The Practitioners Guideline includes concise and practical factsheets on 16 low-cost safety treatments, detailing their benefits, implementation considerations, and case studies of their effectiveness.

Each factsheet provides a detailed description of the safety treatment, its purpose, and application. This information is crucial for practitioners to understand the nature and intended impact of each treatment in improving road safety.

Additionally, the factsheets highlight the benefits of each treatment, such as estimated crash rate reductions, improved road user behaviour, and enhanced road infrastructure. Implementation considerations, including installation requirements, maintenance needs, and cost estimates, are also addressed.

Case studies

The Practitioners Guideline features a compilation of case studies showcasing existing low-cost safety treatments on rural Local Government roads in WA. Each case study offers an analysis of the effectiveness and success of these treatments, challenges encountered during implementation, and a high-level before-and-after crash summary.

These case studies provide valuable insights into real-world scenarios where low-cost safety treatments have successfully improved road safety outcomes. By examining these initiatives, readers can gain practical knowledge of their application and impact in rural settings.

Conclusion

The Practitioners Guideline delivers powerful, actionable recommendations for deploying low-cost safety treatments to tackle road safety challenges on rural Local Government roads in WA. Recognising the ever-changing landscape of road safety, the guideline will undergo periodic updates to remain relevant with evolving local contexts and technological advancements. Implementing these cost-effective safety measures on Local Government roads dramatically enhances road safety outcomes, optimising limited resources and reducing crash risks.

This comprehensive guideline empowers Local Governments with practical guidance, essential resources, and a steadfast commitment to ongoing improvement. It enables informed decision-making and the implementation of effective interventions that substantially improve road safety. By integrating low-cost safety treatments with robust community engagement and education initiatives, Local Governments can drastically lower the incidence of crashes, particularly fatalities and serious injuries, thereby fostering safer road environments for all users.

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Development of Road Safety Assessment Framework in Nepal

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Abstract

It is crucial to effectively utilize Nepal's limited resources to address the increasingly concerning road safety issues. This study aimed to develop a Nepal Road Safety Assessment Program (NeRSAP) for evaluating relative risks on roads or road section in the country which uses limited road risk attributes than iRAP. Data pertaining to road attribute data (land use, carriageway, presence of medians, road type, number of lanes in each direction, length of homogenous section of road), road risk attributes (horizontal alignment, vertical alignment, lane width, roadside hazards, pavement surface, private access, number of intersections, number of interchanges, on street parking and traffic data (Average Daily Traffic (ADT), pedestrian exposure, cyclist's exposure) were collected from either primary or secondary sources wherever available. The results of NeRSAP were validated through a case study conducted on the Kamala Dhalkebar Pathalaiya and Naghdhunga Naubise Mugling sections of the country's two national highways. NeRSAP star rating based on limited risk attributes has been found to be well aligned with the iRAP star rating which requires extensive input data which demonstrates that NeRSAP can offer a promising "quick and dirty" risk assessment tool in a constrained resource environment of LMICs like Nepal.

Post on X

Development of Nepal Road Safety Assessment Program (NeRSAP)

Introduction

Nepal with current local road network of more than 63,500 km (Economic survey 2020/21, Ministry Finance, Government of Nepal) and national highway of more than 14,000 km (Statistics of National Highway 2020/21, Department of Roads) is expanding its road network to meet the people's desire of movement. Both percentage of GDP allocated for roads and the share of road budget to capital budget dropped slightly last year but still remain 2.84 percent of the GDP and 28.35 percent respectively which is substantial if compared with other countries of similar economy (Thapa, 2021). Still there are one district head-quarter and 21 municipal centers not connected by roads. Therefore, more roads are being planned and will be constructed in the future. There is now ongoing debate on constructing quality roads rather than focusing on the quantity of the roads which obviously requires more emphasis on road safety aspect.

The road traffic deaths around the globe reached its peak number of 1.35 million in 2016. The population-based death rate is quite stable (18 deaths per 100,000 population) and motor vehicle-based death rate has declined (from 135 to 64 deaths per 100,000 motor vehicles from year 2000 to 2016) over the years (Global Status Report on Road Safety, 2018, WHO). The United Nations (UN) first decade of action for road safety (2011-2020) initiated with the target of halving road fatalities was not successful in meeting its objective and hence UN General Assembly resolution 74/299 declared second decade of action for road safety 2021-2030 with the target to reduce the road traffic deaths and injuries by at least 50 percent during that period (Global Plan, Decade of Action for Road Safety 2021-2030).

The crash history of Nepal indicates that there is an increase in 1264 number of crashes per year in an average. The data from July 2007 to July 2023 suggests that the number of crashes increased at the rate of 12.2 percent on an average annually whereas the fatality and serious injury increased with average rate of 5.8 percent and 6.4 percent respectively (Data source: Traffic Police Directorate). The increase in vehicle registration during the same period of time is near about 14 percent per annum (Data source: Department of Transport Management). There is a growing concern on road safety both from government and non-governmental sectors. Nepal being one of the signatory countries of Stockholm declaration on road safety is yet to endorse the road safety action plan in line with the UN Global Plan of Action for the Decade of Action for Road Safety 2021-2030. The newly drafted road safety bill 2017 is yet to be enacted by the parliament and national transport policy 2018 is yet to be adopted by the Government. The draft baseline report of Nepal's Sustainable Development Goals (National Planning Commission, Government of Nepal, June 2017) has highlighted the 2030 target for SDG 11 as to make at least 50 percent of urban roads safe from global standard.

Research Needs

The road safety scenario in Nepal in worsening despite the efforts put to improve it. Nepal's investment need in road safety is USD 879 million over the coming decade to achieve the Sustainable Development Goal 3.6 target of a 50 percent reduction in national road crash fatalities (The World Bank Group, 2020). The allocated budget to road sector is mainly for construction and maintenance rather than for improving the safety scenario which is merely around USD 4 million (Shakya & Marsani, 2020). The already constructed roads should vigorously undergo checks on road safety deficiencies whereas newly planned, designed and under construction roads should undergo different stages of road

safety audits. Though some road safety notes are published by Department of Roads including road safety audit manual, the road safety audit process is not well followed at its different stages. Road safety audits of existing roads are being conducted on roads selected in an ad hoc basis but the implemented measures are not so widely visible. Most of the roads especially local roads are unaudited roads. It will be hard for government agencies to prioritize road sections even for safety audit without any prescreening criteria as it cannot conduct audits and implement recommended measures in all of its roads. Most of the previous researches on road safety in Nepal were more focused on crash prediction models (Thapa, 2015; Joshi, 2015; Dahal & Marsani, 2019) using crash records. But the use of the crash records obtained from Traffic Police of Nepal has its own limitations as it is not georeferenced. This makes it hard to exactly locate the crash site and hence relate to road attributes. Approximately 400 kilometers of roads in Nepal underwent star rating through the Asian Development Bank South Asia Road Safety Program. However, the specifics of these ratings are not accessible on the iRAP website. Similarly, about 1457 kilometers of Nepal's strategic road network were evaluated for star ratings by iRAP for the World Bank, yet these ratings are also not publicly accessible (IRAP, 2022). In a resource constraint environment like in Nepal, it will be very hard to implement such a detailed safety inspection where majority of road lengths are with minimum design standards. Therefore, development of a quantitative risk assessment framework without using the crash data and with use of minimum data input to support prioritized safety audits is the current need in the context of Nepal and also is the focus of this research. This research study developed quantitative road safety assessment framework named Nepal Road Safety Assessment Program (NeRSAP) that will facilitate ranking of road sections in Nepal in terms of relative risk scores. NeRSAP was developed following analysis of multiple road safety risk assessment tools used globally and focusing mainly on three widely used infrastructure risk assessment tools: International Road Assessment Program (iRAP) star rating, Road Risk Score (RSS), Canada and Infrastructure Risk Rating (IRR), New Zealand, Australia. These tools were reviewed in detail and some of the risk attributes used in these tools were taken into consideration to develop the NeRSAP. This simplified model will help government agencies to focus on high-risk road sections without using crash data at the same time avoiding the use of extensive data input to further conduct proactive road safety audits and prioritize road network for road safety interventions so that limited available resources could be best utilized.

Research Objective

The overall objective of the research is to estimate the relative risks of roads or road sections so as to prioritize further actions needed. The specific objectives are:

- a) To calculate the relative risk based on risk attributes (geometric and non-geometric attributes)
- b) To compare and validate the relative risk ranking with iRAP star rating result

Research Methodology

The proposed research was conducted based on the methodology depicted in Figure 1.



Figure 1: Methodological Flow Chart

1. Preparatory works

Though the overall study area of this research is whole Nepal the study focused on two sections of national highway namely Kamala-Dhalkebar-Pathalaiya section, Nagdhunga-Naubise-Mugling sections of National Highway. For data collection purpose, the selected road sections were divided into different sections taking into account of homogeneity of road attributes like land use, carriageway type, number of lanes as well as design speed.

2. Data Collection

For each homogeneous road section, different data required for the study (11 road risk attributes) were collected from primary or secondary sources which includes

- a. Road attribute data
 - This class of data collected from the field includes the land use, carriageway, presence of medians, road type, number of lanes in each direction, length of homogenous section of road
- Road risk attributes
 The road risk attributes like horizontal alignment, vertical alignment, lane width, roadside hazards, pavement surface, private access, number of intersections, number of interchanges, on street parking, etc. These data were collected from the field survey
- c. Traffic data

This include, the Average Daily Traffic (ADT), pedestrian exposure, cyclist's exposure and were collected from secondary sources wherever available and were validated while conducting field survey.

3. Data Analysis and Risk Score Calculation

For each of the road risk attributes, a risk level that matches prevailing conditions need to be determined. The risk level was categorized into 3 levels (3-high, 2-medium and 1-low). The weighing factors for each risk attributes were determined not only based on road risk attributes but also non geometric attributes so as to calculate risk score in automated spreadsheet.

4. Result Validation and Discussion

After assessing the risk score for each homogeneous section of the road, they were arranged in descending order, with those scoring higher indicating the most hazardous sections along the length of the road under consideration. This outcome was then juxtaposed with the iRAP star rating evaluation of corresponding road sections. Sections rated with five stars demonstrate superior safety performance, while those with one star exhibit the lowest safety standards, aligning well with the findings of the NeRSAP assessment with iRAP star ratings.

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A data-led approach to pedestrian safety

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Abstract

"Keeping People Safe While Walking" is an ongoing program aimed at reducing the risks faced by pedestrians in the road transport system. This comprehensive program involves multiple components, such as analysing data on pedestrian-related accidents, evaluating existing interventions, creating guidelines, and developing plans to eliminate pedestrian fatalities and serious injuries. This abstract focuses on the pedestrian data-related aspects of the program. A key factor in mitigating pedestrian risk is implementing effective countermeasures in specific locations. However, identifying these locations can be challenging. Relying solely on crash data is not enough, especially when dealing with specific types of incidents, such as those involving pedestrians. This presentation highlights the pedestrian data frameworks and the important datasets needed to understand pedestrian risks. It also provides recommendations for improving data collection to help Australasian Road Controlling Jurisdictions adopt a proactive approach to pedestrian safety.

Post

Find out more about how the "Keeping People Safe While Walking" Research Project is changing the way we approach pedestrian data.

Introduction

Enhancing pedestrian safety is paramount in achieving the ambitious goal of reducing New Zealand's and Australia's road fatalities and serious injuries to zero by 2050. Pedestrian deaths and serious injuries in New Zealand's and Australia are showing no significant reduction. Taking into account underreporting, we estimate between 3,200 to 3,500 deaths and serious injuries occur in Australia every year. These are not just numbers but mothers, fathers, daughters, sons, ppartners friends, teammates and colleagues. A paradigm shift is needed to address the systemic underlying factors.

The "keeping People Safe When Walking" project has a holistic focus including what can done through the Safe System pillars of safe roads, vehicles, road users, and speeds, as well as what can be done through Road System Management. The program acknowledges that implementing the right countermeasure at the right location is key to addressing pedestrian risk. There is a catch though. To target risk, you need to know where it is. Pedestrian risk is not simple. A complex road user, Pedestrians take many shapes and forms from the school child who doesn't understand when to give way, to the elderly pedestrian who has a reduced walking speed and limited vision. Compounding this difficulty is the fact that, for many places there is little or no data on pedestrian trips. While most roads in Australasia have an estimate of the number of vehicles that travel them, this is not the case of pedestrians, leaving road safety practitioners and decision makers to rely on outdated and inaccurate reactive approaches. So, what is needed?

To understand the complex nature of pedestrian fatal and serious crashes across our road network, there is a need to collect and analysis various data sources. Historically, there has been a shortage of pedestrian related data, compared with motor vehicles data. Also, where it is available, the industry has limited understanding of pedestrian datasets and the strengths and weaknesses of the various datasets (Alavi, 2013). Hence safety-related decisions are often made in the absence of suitable data (e.g. volume of pedestrians on a route or at an intersection) or using inferior quality data. Monitoring of safety performance at route or network levels are also impacted by limited access to suitable data.

This presentation focuses on pedestrian data frameworks and the key data sets needed to understand pedestrian risk, such as speed, land use, population density and public transport hub locations. It discusses how to effectively use these datasets in conjunction with one another to understand where pedestrians are, what is the risk to pedestrians.

Approach

This research employed a multistage methodology to investigate pedestrian safety, incorporating rigorous stakeholder engagement, exhaustive literature review, and advanced data-driven analyses. Figure 1 outlines this process.

The stages of stakeholder engagement were diverse, encompassing in-depth interactions through focus groups, interviews, and an expansive online survey that garnered over one-hundred expert responses. These engagements delved into nuanced insights at the national, state, and local government levels.

A review of literature was carried out, followed by the detailed gathering and analysis of relevant data sources. At the same time, the study aimed to create a modern framework for pedestrian data, taking into account the latest insights from international pedestrian data sources. These efforts helped identify shortcomings in pedestrian data from Australasia and provided recommendations for addressing them.



Figure 25 Pedestrian research approach

Pedestrian framework

First, it is essential to understand that Pedestrian data is far more comprehensive than simply pedestrian crash data. Our team has developed a framework to address the intricacies involved in different pedestrian datasets, which carry varying degrees of significance. This framework systematically catalogues diverse data sources, delineates their significance, and specifies the recommended level of granularity, including whether geospatial linkage is necessary.

At the site level, the highest level of data granularity is essential. Relying solely on a reactive crash-based methodology for prioritizing safety interventions is inadequate. A proactive, data-driven approach is necessary because crashes happen randomly, leading to an inaccurate portrayal of risk solely based on crash occurrences during analysis periods. For example, some sites may have no recorded crashes at all, while others may experience a high frequency of incidents, skewing the assessment of underlying risks (Ali et al., 2023).

Our framework serves as a self-assessment tool for road controlling organisations, enabling them to comprehensively identify and address specific gaps in pedestrian data. Key pedestrian data examples include land use, pedestrian crash data, pedestrian volumes, traffic volumes, and vehicle mass. Evidence elucidating the importance of these elements is presented in Table 10 below. In the presentation, case studies will be used to show how international organisation have adopted this data-led pedestrian data approach to create pedestrian risk prediction models using a range of these pedestrian data sources.

Pedestrian data examples	Evidence from Literature
Land use	Understanding the land use around road and streets is important for estimating the
	exposure and severity of pedestrian crashes (Almasi et al, 2021). Land use plays a
	large part in the pedestrian demand for a given location, with malls and shopping
	centres likely to create more crossing demand than rural or urban industrial land use.
Pedestrian volumes	Pedestrian volumes have a strong positive correlation with vehicle-pedestrian crashes
	(Almasi et al, 2021; Sandt, 2016). Research shows that these pedestrian exposure
	models can even be conducted over a large network. For example, Lilasathapornkit
	(2022) explores network-wide pedestrian assignment models.
Traffic volumes	Alongside pedestrian volumes, traffic volumes are also important (Almasi et al, 2021).
	This is the other key element required by pedestrian volumes to understand the number
	of possible conflicts between pedestrians and cars.
Population density	Population data can also be used to give an indication of the urban density of an
	environment and thus the pedestrian movements within and through that environment.
	This combined with travel demand data can be used to help estimate pedestrian
	exposure (Liu et al., 2021).

Table 10. Pedestrian data examples

Recommendations

After conducting gap analyses and gathering valuable insights from stakeholder engagements and group workshops, we formulated recommendations aimed at enhancing pedestrian safety. These recommendations cover a wide range of areas crucial for pedestrian safety and mobility, including actions such as adopting unified definitions for pedestrian safety terms, improving pedestrian data systems, and developing action plans for pedestrian data enhancement.

This presentation highlights the urgent need for a collaborative, multi-tiered effort involving federal, state, and local governments, along with road safety partners across jurisdictions, to effectively implement these recommendations. The joint endeavor not only addresses identified gaps but also aims to leverage emerging technologies and innovative approaches for enhancing pedestrian safety. The key pedestrian data recommendation are:

- 1. Adopt the key definitions of Pedestrian, Pedestrian Crash, Pedestrian Safety Risk, and Exposure to Pedestrian Safety Risk from the related research report: Pedestrian Safety Problem and Project Methodology
- 2. Adopt the Pedestrian Data Needs Framework from the related research report: Pedestrian Safety Problem and Project Methodology and tailor it to the needs of respective jurisdictions
- 3. Utilising the current and improved pedestrian data systems and develop specific pedestrian safety data requirements to understand pedestrian safety inequity across modes (for example, pedestrian safety compared to vehicle occupant safety) and across cohorts (for example, the safety of child, elderly, female, and First Nation pedestrians).
- 4. To accurately measure pedestrian risk and exposure, consider three levels of approach: strategic, tactical, and intervention. At the strategic level, use population data. At the tactical level, use specific walking data (walking trips' length or duration). At the intervention level, use pedestrian crossing counts.
- 5. Develop predictive pedestrian exposure models to estimate pedestrian crossing counts or aggregate walking distance or duration estimates based on land use, socio-demographic characteristics, vehicular and public transport characteristics, and other characteristics of the road transport system.
- 6. Develop pedestrian risk maps at the network level, based on detailed pedestrian crashes and injuries, and pedestrian exposure data.
- 7. Develop a linked dataset between police data and hospital data to understand the magnitude and characteristics of pedestrian crashes and injuries more fully. Utilise the findings of the in-depth trauma modelling and Vision Zero backcasting modelling in this project to inform the data requirement and in-depth pedestrian safety modelling data needs for such linked datasets.
- 8. Develop a pedestrian data improvement action plan and roadmap, based on the recommendations of this report, and tailored to the needs and requirements of respective jurisdictions.
- 9. Develop pedestrian safety appraisal, evaluation and monitoring programs based on the key pedestrian data, Safety Performance Indicators, and pedestrian deaths and serious injuries recommended in this report.

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A Safe System aligned fatal crash reporting management system

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Abstract

New Zealand's Fatal Crash investigation process is inconsistent, and unaligned to the proactive Safe System approach. Generally overfocusing on operational deficiencies and not capturing failures in the transport system that could save lives. This abstract covers a Safe System-aligned fatal crash reporting process, utilising a gap analysis methodology. This helps users make network wide decisions to reduce these gaps and iterate towards a Safe System, often through mass action programs dealing with common factors. Thus shifting the approach from reacting to fatal crashes as they occur, and instead, looking at gaps from the Safe System allowing fatal crashes to happen. The system is also a fatal crash reporting interface and management system, covering fatal crash trend analysis, automated report generation, and report tracking capabilities. We believe the reporting interface and management system has potential to revolutionise Australasia's Fatal Crash reporting and help put us on the road to zero!

Post

Find out more about the Fatal Crash Reporting System and its ability to identify reoccurring factors in fatal crashes, monitor safety interventions and ultimately support practitioners proactively reduce future high severity crashes.

Introduction

This abstract covers a Safe System-aligned fatal crash reporting process, utilising a gap analysis methodology. This helps users make network wide decisions to reduce these gaps and iterate towards a Safe System, often through mass action programs dealing with common factors. Thus shifting the approach from reacting to fatal crashes as they occur, and instead, looking at gaps from the Safe System allowing fatal crashes to happen. The system is also a fatal crash reporting interface and management system, covering fatal crash trend analysis, automated report generation, and report tracking capabilities.

We believe the reporting interface and management system has potential to revolutionise Australasia's Fatal Crash reporting and help put us on the road to zero!

Background

New Zealand's Fatal Crash investigation process is inconsistent, and unaligned to the Safe System approach. Generally overfocusing on operational deficiencies and not capturing failures in the transport system that could save lives.

Nearly every day, a fatal crash occurs on New Zealand's roads. For these fatal crashes, many Road Controlling Authorities (RCAs) undertake investigations, often alongside the New Zealand police serious crash unit. Going beyond what is captured in Crash Analysis System (CAS) and serious crash unit experts, who don't have road design experience, these investigations delve into why the crash occurred. Ultimately, the investigations develop site specific and network wide safety implementations, targeted at reducing future high severity crashes.

The problem is, many fatal crash reports nationally are not aligned to the Safe System; moreover, until now, the findings from these fatal crash reports weren't aggregated across reports. Vital fatal crash trends aren't captured and potential safety improvements, which would address these trends, are overlooked. The evidence underscores the necessity of addressing systemic issues with a comprehensive treatment approach, much like the ongoing upgrades to level crossings over the years. For instance, the implementation of "look both ways" signs at these crossings signifies a proactive step. Moreover, historical design faults resulting in fatal crashes, should inform policy and guidance documents, thereby influencing future actions.

Updated Fatal Crash Reporting content

The approach breaks down the elements of the system into their respective Safe System pillars. Starting by stepping through the ideal Safe System state, the investigator then identifies the gap between the safe system and the current state. Appropriate recommendations to close these gaps and create a safe system are then determined. While not all of these interventions may be implemented and all the gaps closed, the tool takes a proactive approach by analysing the repeated gaps to better understand networkwide deficiencies.

Proactive approach

Crashes can occur randomly, even in areas with no history of previous crashes. This randomness highlights the importance of taking a proactive approach to road safety. The Fatal Crash process recognizes this and focuses on identifying trends across all crashes, not just addressing the specific crash location. Thus, preventing future crashes of a similar nature.

Fatal Crash management System

Figure 26 shows the home interface to the AT Fatal Crash Reporting Management System. There are several different aspects to the system. The input stage, where all data is entered into the tool, is perhaps the most important. Capture all data wholly at this stage removes the risk of multiple conflicting sources of truth. All other stages read from this database. Analysing, aggregating and displaying the input data in an easily digestible manner.



Figure 26. AT FCR User Interface

Reporting and Tracking

The aggregated data within the Fatal Crash Reporting process is captured for two distinct reasons. The first is to capture important gaps and trends in fatal crashes.

When it comes to capture important gaps and trends in fatal crashes, **Error! Reference source not found.** shows how several different safety aspects are analysed across reports. The information reflected in the figures is artificial data, to protect the sensitive information held within the tool. Real examples will be provided at the conference.

Taking alcohol involved or suspect as an example. This element fits within the Safe Road User Pillar. In the artificial data, a high proportion of the fatal crashes were reported as alcohol related or suspect. Depending on a comparison to the other metrics, this might help identify alcohol related crashes as a significant issue in fatal crashes, and encourage the road controlling organisation to direct their efforts to decreasing drunk driving in the future.

The various pie charts are all linked together and can be filtered based on several metrics including the crash year, the author of the report, and whether the report has been submitted to the police.



Figure 27. FCR Safe System analysis

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia In addition to this analysis, we also have a year-by-year analysis of the data. This reporting feature displays the same metrics as the static analysis, enabling comparisons across different years. Figure 3 depicts the interface for this particular aspect of the tool, which will be further elaborated on in the presentation.



Figure 28. FCR Year-to-year analysis

The final crash data analysis is a geospacial analysis. This maps all the crashes across the network symbolizing them by the selected safety element (e.g. vehicle star rating, alcohol involved, restraints and helmets used, etc).

The second purpose of the system is to ensure the organization is meeting its fatal crash reporting deadlines. Since the implementation of the tool, fatal crash reporting times have significantly decreased. This is critical to achieve these deadlines as they ensures that any immediate safety risks that could contribute to future fatal crashes are address.

Conclusion

The Fatal Crash Reporting System streamlines fatal crash report production, creates a single point of entry for fatal crash information, and enables the effective communication of aggregated fatal crash information to various stakeholders. Moreover, it assists engineers achieve a consistent, Safe System aligned Fatal Crash investigation process. Most importantly, it allows insights to be drawn regarding safety initiatives to see if it is having effects on fatal crash metrics.

The Fatal Crash Reporting System has been well received and has potential to assist other councils and national road controlling authorities.

Future safeguards for enforcement and emergency workers on the roads

Rachael Mason and <u>Peter McKennie</u> NZ Police

Abstract

Road safety enforcement, prevention and emergency response activities are critical components of a safe system. They intervene to address immediate risks arising from unsafe behaviours, influence decision making of road users and strive to minimise the extent of death and injury following crash events. When a Traffic Camera Operator (TCO) received serious injuries after a driver intentionally crashed into the mobile speed camera (MSC) van, NZ Police ceased deployment of MSCs to all camera sites with a speed limit greater than 70 km/h unless the camera van could be situated behind a road safety barrier, as an interim risk management measure. The enquiry highlighted that Police and road safety partners have collaborative responsibilities for factors that have a bearing on the safety of the road as a workplace for enforcement and emergency workers, including road and roadside engineering, speed limits, and legislation to inform and influence driver behaviours.

Background

The vision of New Zealand Police is to be the safest country. To achieve this, we adopt a Prevention First approach 'taking every opportunity to prevent harm' and 'to ensure everybody can be safe and feel safe'. As part of delivering this vision on our roads, MSCs and Police officers are deployed on our roads to help people get through their journeys safely.

Most state highways and other rural roads in New Zealand do not have road safety barriers, often carry high traffic volumes, and operate with speed limits which are high by recognised international standards for the engineering and use of the roads. When something goes wrong, regardless of why, these roads are unforgiving, and the consequences are often tragic due to the impact forces associated with the speed of travel and absence of protective infrastructure. Unsurprisingly, approximately 73% of road deaths in NZ occur on un-barriered rural roads.

When a TCO received serious injuries after a driver intentionally crashed into the MSC van, it caused NZ Police implement an interim risk management measure of ceasing deployment of MSCs to all camera sites with a speed limit greater than 70 km/h unless the camera van could be situated behind a road safety barrier. This meant reduced levels of speed enforcement were being conducted on these high outcome-risk roads. With MSCs being an important tool for safe roads, it was critical that NZ Police could maintain effective deployment of these assets whilst ensuring the safety of employees.

A wide-ranging review of the policy, procedure and practice was required to ensure TCOs' safety before deployment of MSCs to un-barriered, higher speed roads could be resumed. This work drew attention to harm risk exposure for all Police personnel conducting enforcement and prevention activities on and adjacent to the roads, and for Police and other emergency services during crash or other incident response.

Outcomes

A holistic review of road safety outcome risks highlighted the need to ensure that the pathway forward is safe for all operators while engaging in tasks on our roads and roadsides. One major change was development and introduction of an overarching Critical Risk and Assurance Framework that now sits across multiple Police functions. Its purpose is to reduce points of failure in identifying risks, implement robust controls and provide assurance regarding compliance with controls. Recognising policing's many competing and changing demands for service, the Police Executive has set clear expectations for these staff safety activities being maintained as a priority and is actively monitoring progress and compliance.

Lessons learned for NZ Police included a requirement to regularly review policies, procedures and practices, to ensure robust mechanisms were in place to provide assurance regarding consistent policy compliance, and to be vigilant for changing circumstances in the dynamic roading environments that impact the risk assessments and the currency of risk control mechanisms.

NZ Police identified that staff operate on the roads and at the roadside in many different prevention, enforcement, and emergency situations, including the operation of MSCs. In conjunction with categorising roadside operations as a critical risk for the organisation, a wide review of risk assessment, education and learning was initiated. Changes were also initiated that have both enabled and placed limitations on enforcement and prevention activity.

Whilst MSCs can again be deployed to higher speed roads due to the implementation of Police change initiatives, they can only do so if individual site risk assessments determine that it is safe and appropriate. Some previous MSC sites are no longer used as the risks could not be sufficiently addressed, or they have limitations regarding the circumstances in which they can be used, such as time of day. The Police Commercial Vehicle Safety Team has stopped or significantly restricted the use of a large number of weigh stations on the state highway network due to unacceptable exposure to passing high-speed traffic at close proximity. This has significantly reduced opportunities to weigh and inspect heavy commercial vehicles.

Enforcement, prevention and response are critical elements to support a safe road transport system. Alongside the internal Police activities, these is a need to strategically collaborate with partners regarding safe system opportunities, whilst also recognising fiscal, political and other challenges for those agencies. Complimentary platforms need to be in place to enable the greatest benefit realisation from road safety activities to be delivered effectively and safely. Examples include a platform of safe speed limits for the engineering and use of the roads and penalties that influence decision making that aligns to safety. It also requires engineering solutions which incorporate safe locations and conditions for enforcement and emergency situations to be conducted and managed safely, for general road users and emergency services personnel. For example, the weigh station sites are the responsibility of the NZ Transport Agency and collaboration is underway regarding the installation of road safety barriers to enable the sites to be safely used.

Challenges and Future directions

Consideration is underway concerning where and how Police officers deploy on high-speed roads for speed and other enforcement and prevention activities. This incorporates the Government's recently announced intention to consult on introducing 120km/h speed limits. To protect them from harm, there is potential for restrictions to be placed on officer enforcement in some environments, such as motorways and expressways that have no facilities to safely park Police vehicles or stop offending vehicles.

As the operation of speed cameras within New Zealand is scheduled to be migrated to the NZ Transport Agency, there is a unique opportunity for multi-agency collaboration to share and learn together, including how officer and camera enforcement technologies and methods can complement each other in the network for greatest road safety outcome benefit. For example, technology such as average speed cameras could provide an effective speed management solution on roads where it is not safe for officer deployment.

Across New Zealand there are different risk profiles based on population, vehicles, and ratio of urban to rural roads. The design and engineering of these roads, together with operational control methods applied for the conditions and situations as they exist at any point in time, play fundamental roles in the safety of people working within the road system. This will ensure that the pathway forward is safe for all operators while engaging in tasks on our roads and roadsides.

Safety of Police staff conducting road safety enforcement

Rachael Mason and <u>Peter McKennie</u> NZ Police

Abstract

In 2021 the unthinkable happened. A Traffic Camera Operator (TCO) was seriously injured when the mobile speed camera (MSC) van was deliberately crashed into by a motivated offender in another vehicle. This was the first time any crash of this nature happened involving a TCO and MSC in New Zealand or Australia. Post-event, NZ Police, in conjunction with WorkSafe and other stakeholders, worked to identify risks which compromised the safety of the TCOs. This then expanded to any other vehicle crash-related risks that Police Officers face when undertaking road safety enforcement and prevention activities. A major part of the lessons learned would be influencing the cultural and behavioural changes for the TCOs, their supervisors and managers. With us all needing to ensure the safety of our people while engaging in tasks to reduce trauma on and adjacent to the roads, lessons can be of benefit to all Australasian jurisdictions.

Background

Mobile speed cameras were introduced in NZ in 1993. The number of operating hours has varied over time, with some years having over 100,000 operating hours. The earliest records available suggest approximately 55,000 MSC operating hours were undertaken per annum in 2004 and 63,000 hours in the 12 months to August 2023. This equates to approximately two million mobile camera deployment hours in the past 30 years. This does not include the hours TCOs spend travelling to the MSC sites and camera set up. MSCs are highly efficient in terms of offence detection per hour of operation. Previous New Zealand assessments found covertly operated MSCs to be effective in reducing speeds on rural roads, reducing casualties by 31% within camera sites, and by 19% generally (Keall et al., 2002).

MSCs are particularly effective road safety tools as they can both be operated with relatively high intensity and deployed in an unpredictable fashion. However, in August 2021, the unthinkable happened; a motivated offender in a vehicle deliberately crashed into a mobile speed camera van, seriously injuring the TCO. This incident was followed by significant restrictions being placed on the deployment of MSCs, including removing them from operating on the roads with the greatest excess speed-related crash risks whilst reviews were undertaken.

How could NZ Police keep our staff safe while maintaining deployment of a key enforcement tool in locations where they are most beneficial in preventing death and injury? Were there opportunities to do things differently to manage safety risks to an acceptable level, and what challenges were there to implementing changes? Could NZ Police identify beneficial opportunities, overcome barriers, and implement changes that provided a platform to redeploy MSCs on roads where they can more effectively, and more safely, contribute to safety outcome benefits?

Overview

The interim risk management response to the crash was to cease deployment of MSCs to all camera sites with a speed limit greater than 70 km/h unless the camera van could be protected behind a road safety barrier. This meant that MSCs could not operate in locations where the speed-related road safety outcome risks are greatest – high speed roads without barriers. Following the crash, Police stood-up a national project with the aim of enhancing the safety of TCOs when deploying MSCs.

Method

The consultation began with a health and safety investigation incorporating crash analysis by the Police Serious Crash Investigators, participation in a WorkSafe investigation, and a root cause analysis of all factors contributing to this crash, and any that may harm a TCO at work. The national project considered input from stakeholders including TCOs, their supervisors and managers, senior road policing subject matter experts, and Police health and safety, organisational assurance, and policy groups. External consultation included the Police Association (Union), WorkSafe and the NZ Transport Agency. The project, which is still running, has senior Executive level governance and WorkSafe oversight.

Through a joint approach of senior executive level governance and WorkSafe oversight, the project sought considerations from TCOs, their supervisors and managers, senior road policing subject matter experts, Police health and safety, organisational assurance, and policy groups.

A broad range of options were considered and consulted, leading to the development of recommendations for policy, procedural and practice changes for Executive approval consideration. This was followed by managed implementation

of initiatives, incorporating communication strategies to overcome change resistance and ensure a shared understanding of Executive expectations for delivery.

Findings

Whilst policies and procedures for the operation of MSCS were in place at the time of the crash, they did not adequately provide for the circumstances of this motivated offender deliberately crashing into a parked MSC at high speed. At the time there were no formal processes in place to provide assurance that policies, including risk control measures, were consistently being complied with.

Additional to the site location risks, the project identified other workplace safety risks. As many TCOs were very set in their ways, many were accustomed to self-selecting deployment locations and deployment durations. Additionally, a past modification to a risk which addressed muscle discomfort meant the TCO was sitting in an ergonomic seat, but in the unprotected cargo area. Also, the deployment to lower speed roads increased TCOs' exposure to a risk more evident in urban locations, that being personal confrontation with members of the public.

It was clear that road safety outcome benefit realisation of MSC investment was not being fully realised with the postcrash deployment restrictions, and that improvements were required to address other workplace safety risks.

Policy Changes and Implications

Some managers and supervisors of TCOs took a little while to prioritise their assurance responsibilities amongst other operational priorities, however clear communication of Police Executive expectations alleviated that issue. The priority for the project team was to identify and successfully implement changes that would support more flexible and effective MSC deployment whilst managing risks to an acceptable level. Policy and related initiatives to support this included:

- a comprehensive and mandatory online training package for TCOs,
- requiring them to sit in the front of vehicles with a seatbelt on during deployments unless parked behind a road safety barrier,
- limiting deployment duration to minimise muscular skeletal strain risks,
- individual site risk assessments and risk controls recorded on a consistent risk template,
- active supervisor and manager deployment decisions,
- regular supervisor assurance and compliance checks with TCOs during deployments, and
- templates to record assurance checks and support auditing.

The MSCs are now being deployed with fewer restrictions, but in a more controlled and safer manner than was the case prior to the incident which gave rise to the investigation and project initiation. The lessons learned are also being applied to other road and roadside activities of NZ Police. The project activities also include sharing lessons learned for the benefit of others in the industry.

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Exploring crashes involving light rail vehicles in Canberra

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Abstract

Light Rail Vehicle (LRV) services commenced operation in Canberra in 2019. Since then, crashes have occurred involving LRVs and other road users, specifically motor vehicles, pedestrians and cyclists. 'Target 2030' aims to reduce the number of crash-related deaths and serious injuries by 50%, with the Safe System approach key to achieving this target. The Safe System approach highlights that humans make mistakes, but these mistakes should not lead to serious injuries or deaths. Recognising this, the current research examined the circumstances surrounding 18 crashes involving LRVs in Canberra, identifying a series of potential countermeasures that could be considered to prevent similar incidents in the future. These potential countermeasures included: changes to traffic light design and timing, speed of LRVs and preventing pedestrians crossing at undesignated locations. The results have value in providing important information to be considered when developing Light Rail systems, and importantly a pathway toward achieving 'Target 2030'.

Post on X

Analysis of previous crashes and identification of potential countermeasures is key to enhancing road safety around Canberra's Light Rail network and to reaching 'Target 2030'

Introduction

Light Rail systems have been found to reduce the use of car transportation for those living in close proximity to services (Cao & Ermagun, 2017). Indeed, in a study undertaken by Fageda (2021), it was highlighted that cities with Light Rail services observe lowered levels of traffic congestion and pollution, as well as shorter travel times. To achieve these potential benefits, it is essential the community perceives Light Rail as safe means of transportation. One important component of safety relates to the interactions between Light Rail Vehicles (LRVs) and other vehicles and road users, including the incidence of crashes.

Stage 1 Light Rail services commenced operations in Canberra in April 2019, with one line, 12 km in length, running in the centre of the road, from Alinga Street in the Canberra city centre, to the northern suburb of Gungahlin. Since services commenced, LRVs have been involved in crashes with motor vehicles, pedestrians and cyclists. Studying crashes that have occurred involving LRVs in Canberra is important to understand both the factors underlying these crashes, and to inform the development of potential countermeasures to minimise the risk of similar incidents in the future. Further, works are currently underway in Canberra to expand Light Rail services. As this work continues, it is essential that any areas of concern in the existing network are identified, such that the infrastructure that will be implemented into new sections of Light Rail is developed with these concerns in mind.

Method

A two-phase approach was used to examine crashes involving LRVs in Canberra. First, incident reports, detailing the circumstances of crashes, were obtained from CMET, the company responsible for operating and maintaining Light Rail services in Canberra. A total of 18 incident reports were received, for the period from commencement of operations to May 2023. No selection criteria were applied, with all incident reports included in the analysis.

Second, site visits to each of the 18 incident locations were conducted. In addition to the specific focus on individual crashes, the site visits allowed for general observations to be made in relation to Canberra's Light Rail, to identify if there were other potential issues of concern that present a heightened risk to road users, including Light Rail passengers.

Results

Analysis of incident reports

Year crash incidents involving LRVs occurred

In 2019, five incidents occurred; in 2020, three incidents occurred; in 2021, one incident occurred; in 2022, six incidents occurred; in 2023 (to May), three incidents occurred. It was somewhat concerning to see that, despite Light Rail services only commencing operations in April 2019, there were five incidents in that year. This was only second to 2022, where six incidents occurred. These findings could be due to a number of factors. A possible explanation is that the introduction of Light Rail in Canberra was unfamiliar, and therefore there was a higher number of incidents as people adapted to changes in traffic conditions in 2019. In 2020 and 2021, it is possible the decline came as a result of

COVID-19 restrictions, and the trend for working from home. In 2022, as people gradually returned to offices and social events, the increase may have been a result of greater movement in Canberra.

Road user types involved in crashes with LRVs

Motor vehicles made up the majority (12 of 18, 67%) of incidents with a LRVs. Five (28%) incidents involved a pedestrian, and one incident involved a cyclist. Motor vehicles represent the most common form of transportation on the road, and therefore it is to be expected they were involved in the greatest proportion of traffic incidents with LRVs. **Factors that contributed to crashes involving Light Rail Vehicles**

Motor vehicle drivers failing to obey a red light was overwhelmingly the factor that led to the majority of the incidents involving LRVs, accounting for ten of the twelve incidents involving motor vehicles (83%). In these incidents, drivers tended to be making right hand turns, and proceeded into the path of an LRV, either colliding with the side of an LRV, or alternatively, having an LRV collide with the side of their motor vehicle. Undertaking a U-turn at a location where a U-turn was not permitted, and failing to give-way to the LRV when undertaking this U-turn was the factor that led to the remaining two incidents involving motor vehicles and LRVs. In these cases, a green light was likely displayed for traffic travelling straight through an intersection, with drivers seeing this green signal and potentially assuming it was also safe to undertake a U-turn. Failing to obey a red light was also a factor amongst the pedestrian incidents, as was crossing the tracks at an undesignated location.

Light Rail site visit

The site visit undertaken to examine crash sites along Canberra's Light Rail network allowed some characteristics that may potentially have contributed to the crashes to be identified, and importantly, potential countermeasures that could prevent similar incidents in the future to be proposed. Some of these are outlined below.

Traffic light design

At some locations, signals for LRVs were found to be mounted directly alongside signals for motor vehicles (See Figure 1). It is possible this may increase the risk that drivers will observe a signal change, and mistakenly believe it applies to them, proceeding to undertake a right-hand turn when a LRV is moving through the intersection. A potential countermeasure identified, to avoid the risk of confusion between LRV signals and motor vehicle signals, would be to, where possible, mount the Light Rail signals separately from motor vehicle signals. In such instances, drivers are only required to focus on the signals for motor vehicles, minimising the risk that a change in the Light Rail signals will be mistaken for a change in the signals for motor vehicle drivers.

Traffic light timing

Signal timing is potentially another factor that may have contributed to crashes between motor vehicles making righthand turns and LRV. Observations showed that when an LRV approaches an intersection, while they slow, there is rarely a need for them to come to a stop, with the signals apparently designed to change as they approach, for efficiency reasons. On approach, in many instances, the right-hand turning signal is on green, turning to amber and then red as the LRV gets closer, to allow the LRV to proceed. It may be that drivers are 'racing' the lights, and proceeding through the intersection when the signal has just turned red, with collisions resulting from this driving behaviour. This may be an issue of signal timing. The gap between which the right turn signal goes to red, and the LRV receiving a proceed aspect may be too short, providing little buffer for drivers who fail to obey the signal, and enter the intersection. A potential countermeasure identified is to increase the time between signals changing. This would, in most cases see drivers who proceeded through the light on red at the end of the traffic sequence already moved off the Light Rail tracks by the time the LRV is presented with the proceed signal and moves through the intersection.

Speed of LRVs through intersections as they depart stops

The speed limit for LRVs when they depart and approach stops is 30km/h, with very good speed compliance observed. However, when an LRV departs a stop, the immediate surrounding area can be busy, with passengers leaving the area. Like in all high pedestrian areas, people can be distracted or make poor choices, such as crossing against a red signal, or crossing at undesignated locations. Observations showed that departing LRVs built up speed quickly. Given the size of Light Rail Vehicles, and the distance it takes these vehicles to come to a complete stop, a potential countermeasure identified is to reduce the speed limit to 20km/h when LRVs are travelling near a stop. Lower speeds would provide LRVs more opportunity to respond to pedestrians in their path and, in the event of a collision, reduce the severity of injuries.

Pedestrians crossing at undesignated locations

Pedestrians crossing at undesignated locations is another factor in incidents involving LRVs. Along Canberra's Light Rail corridor, there are landscaped garden beds. Pedestrians are able to cross these garden beds, crossing both the road and Light Rail tracks at uncontrolled locations (See Figure 2), therefore posing a risk of being struck by LRVs or motor vehicles. Potential countermeasures that could be given consideration are to ensure there are fewer gaps between plants in garden beds, to discourage pedestrians from crossing. Further, at locations where it is possible, and where it is more common for pedestrians to cross the tracks and garden beds at undesignated locations, consideration could be given to making access difficult, such as through the use of raised kerbs, or flexible wire rope barriers, which would have the additional benefit of minimising the severity of crashes involving motor vehicles should they leave the carriageway.



Figure 1: Image of LRV and motor vehicle traffic signals alongside one another



Figure 2: Image of a garden bed with a gap between plants that may encourage crossing at an undesignated location

Benefits to road safety

Studies such as the one described here offer a pathway towards achieving 'Target 2030', by identifying ways to improve safety within segments of the road network, specifically Canberra's Light Rail network, and the interactions of LRVs with other vehicles and road users. By pinpointing areas where countermeasures could be implemented, it is possible to maximize opportunities to create a safe environment for all road users, including Light Rail passengers, pedestrians, cyclists, and motor vehicle occupants.

Implications for policy and practice

The Safe System approach to road safety highlights that humans make mistakes, but that these mistakes should not lead to serious injuries or fatalities (United Nations Road Safety Collaboration, 2021). Recognising this, the current research has presented several countermeasures, targeted at improving safety on Canberra's Light Rail network. Such research is important in providing information for road safety professionals designing and developing road and Light Rail systems, to create a safe environment for all road users.

Conclusions

The results of this study provide an overview of crashes that have occurred involving LRVs on Canberra's Stage 1 Light Rail Network, and importantly identifies opportunities for improvement to the network. While the observations showed a generally well designed and operated network, there are still areas that could be improved. The countermeasures provided throughout this abstract provide some options for consideration, in looking forward to 'Target 2030' and the reduction of road deaths and serious injuries by 50%.

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Validation of a Virtual-Reality Pedestrian Street-Crossing Task

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Abstract

As vulnerable road users, pedestrians are required to make effective street-crossing decisions to navigate roadways safely. Current literature investigating pedestrian street-crossing behaviour is limited as tasks often lack ecological validity or have been developed without following established procedures. The current study used established test creation principles used for the development of driver hazard perception tasks to validate a virtual-reality pedestrian street-crossing task (VR-PSCT). Un-staged street-crossing scenarios were filmed using 360-degree video cameras at locations across Sydney and Melbourne. Sixteen hazard perception and 17 gap acceptance scenarios were tested with 32 children (M = 9.48, SD = 1.31 years) and 44 adult (M = 23.45, SD = 3.46 years) participants. After following established test creation principles, the final VR-PSCT comprised 13 hazard perception and 11 gap acceptance scenarios across. Adults responded significantly faster and more accurately than children, therefore demonstrating appropriate validity of the task for use in future research.

Post on X

A principled approach to the development of a virtual reality test of pedestrian street-crossing behaviour.

Introduction

Pedestrians are vulnerable road users who lack protection in the event of a crash. Approximately 23% of road fatalities involve pedestrians, and pedestrians are at fault for approximately 30% of crashes (Dommes & Cavallo, 2011; Haleem et al., 2015). Consequently, understanding pedestrian street-crossing behaviour is an important step in reducing road fatalities in the future. Street-crossing behaviour involves three stages: an initial stage (before crossing), a middle stage (initiation of crossing), and a final stage (completion of crossing). The initial and middle stages are seen as particularly important as these involve the decision-making process while standing at the side of the road. During these stages, pedestrians will explore the roadway environment and determine a safe gap in the traffic to cross the road, which involves two related but distinct behaviours. Hazard perception (HP) encompasses the identification, interpretation, and subsequent response to a hazard during the initial stage of a road crossing (Rosenbloom et al., 2015). Gap acceptance (GA) is the point at which a pedestrian will judge that there is a sufficient gap in the flow of traffic in which they can safely cross the road (Oxley et al., 2005).

Research investigating street-crossing behaviours has used a range of different methods including questionnaires, static pictures, roadside crossing tasks, computer-based tasks, simulators, virtual reality (VR), and 360-degree video footage, however, the validity of some of these methods is questionable. For example, questionnaires and static pictures lack ecological validity (Shen et al., 2023), and computer-based tasks do not elicit representative exploratory behaviours (e.g., head movement; Deb et al., 2017). The use of VR headsets to examine street-crossing behaviours is becoming more common as the technology enables more realistic representation of the complexity of the roadway environment and enables participants the freedom to explore the 360-degree roadway environment (Tapiro et al., 2020). Despite the promise of using VR headsets to assess pedestrian street-crossing behaviour, studies do not always complete adequate validation of the street-crossing tasks which they developed (Shen et al., 2023).

There are well established principles for test validation that are used for driver HP test development (Moran et al., 2019). The primary assumption made in the development of HP tests is that younger more inexperienced drivers will perform more poorly on HP tests than older more experienced drivers (Wetton et al., 2011). Defining inexperience as a pedestrian is more challenging than for drivers because people interact with the roadway on foot from a young age and there is no licensing requirement to gauge experience among pedestrians. Comparative studies have consistently shown that children under the age of 13 years have slower HP response times than middle-aged adults aged 18-54 years, and the latter out-perform older adults (aged above 65 years; Rosenbloom et al., 2015). Following methods used in driving research, comparison between children under the age of 13 years (or inexperienced pedestrians) and adults in middle-adulthood (experienced pedestrians) could index the validity of a pedestrian street-crossing task. In addition, Wetton et al. (2011) outline five principles of HP test creation that should be used when validating a pedestrian street-crossing task.

Aim

The aim of the current study was to validate a VR pedestrian street-crossing task (VR-PSCT) which examines critical pedestrian safety behaviours of HP and GA by following the established principles used for driver HP test development.

Method

The validation process involved a detailed three stage process, including clip development, clip selection, and testing with participants.

Stage 1: clip development:

A thorough review of the literature was conducted by four authors to canvas the types of roadway environments which should be included in the VR-PSCT. This literature review aimed to identify the environments and roadway situations which have been linked to increased crash rates in pedestrians across the lifespan. Discussion on the findings of the literature were had with all authors until consensus on the environments to film was reached. The list was also presented to an independent expert who works in a government road safety research role for review.

The list included 12 roadway environments for filming. For each roadway environment, clips were filmed at both a cluttered and uncluttered location, and clips were filmed for both HP and GA tasks. All clips were un-staged, and were filmed with two INSTA360 X3 360-degree video cameras, one set at the average Australian adult height (1.71m) and one set at the average Australian child height (1.32m). Clips were filmed at a variety of locations across Sydney and Melbourne during daylight hours with consistent weather conditions.

The footage from each roadway environment was rewatched by two lead authors and possible HP or GA scenarios were selected for editing. This resulted in 36 possible HP clips and 41 possible GA clips being created. The same scenarios were used for both the child and adult clips. These clips were edited using Adobe Premiere Pro and exported as 5760x2880 H.264 video files at 30 fps using Adobe Media Encoder.

Stage 2: clip selection

Every clip was reviewed by three authors to select appropriate clips and to determine the associated response windows for each clip. Each author watched the clips independently and were required to identify the hazard or gap window start and finish in seconds from the start of the clip. For HP clips, authors also identified the hazard present in the clip. The HP window start times were defined as the initial emergence of a potential hazard, and the HP window end was defined as the point in which the hazard was directly in line with the path that the participant would have taken to cross the road. The GA window start times were defined as the initial emergence of a safe gap to cross the road, and the GA window end time was defined as the point in which it would no longer be safe to start crossing the road.

The two lead authors reviewed the clips and window times. Clips that did not have consensus on the potential hazard, clips with large discrepancies in the window start or end time, and clips which had large discrepancies in window times between the children and adult clips were excluded. This process resulted in 20 clips for testing in the HP task: two practice clips, 16 clips with a hazard, and two clips that did not contain a hazard to assess acquiescent responding. For the GA task, 21 clips remained: two practice clips, 17 clips featuring a gap, and two clips showcasing a continuous flow of traffic to assess acquiescent responding.

Stage 3: testing with participants

Participants

Participants consisted of 32 children, ranging in age from 7 to 11 years (M = 9.48, SD = 1.31, 75.2% male), and 44 adults ranging in age from 18 to 36 years (M = 23.45, SD = 3.46, 48% male). Participants were recruited from the community in both Melbourne and Sydney through a combination of word of mouth and snowball sampling. All participants were offered a \$15 shopping voucher as compensation. The study received institutional human research ethics committee approval before commencing.

VR-PSCT

Participants completed the pedestrian street crossing task using a head-mounted HTC VivePro Eye headset powered by an Alienware X17 laptop. Block presentation of the HP and GA tasks was counterbalanced across participants to prevent order effects, and clips within blocks were randomised. Response time was the primary outcome used to measure performance in both tasks. Participants were instructed to pull the controller trigger to indicate when they first identified a hazard (for HP trials) or when they felt it would be safe to cross the road (for GA trials). The time at which the participant pulled the controller trigger was recorded by the custom designed software. Response time (in seconds) was calculated as the time between the window start and the point at which the participants pulled the controller trigger. Faster response times indicated better HP and GA skill. Following each HP clip, participants were asked to name the hazard they responded to.

Results

Analysis of response windows

An analysis of the percentage of participants responding more than once for each clip was conducted. Children made multiple responses at a higher frequency than adults. The median number of responses was two, with further analysis demonstrating that these responses often occurred in quick succession, suggesting participants were ensuring they recorded a response rather than being evidence of multiple hazards/gaps. To examine erroneous responding we identified participants that responded more than 10 times within a single clip. These participants' responses were removed from subsequent analysis. An analysis of the pattern of responses relative to the response windows (before, during, and after) was conducted. Children to have a higher proportion of responses outside the response windows than adults. For HP clips, the response window was modified based on participant responding for four clips. No changes to response windows were made for GA clips, however, one clip was removed due to confusion in the clip which could not be removed by adjusting the response window.

Comparison of performance between children and adults

A comparison of performance for each clip between children and adults was conducted. HP and GA response times that fell within the adjusted windows were included. No response and responses outside response windows were deemed to be legitimate attempts at completing the task and therefore scores for these participants were imputed with the maximum acceptable response time (i.e., window end time). Participants who demonstrated erroneous responding on an individual clip were excluded from the analysis.

For the HP clips, adults performed significantly faster than children on 13 of the 16 clips, with effect sizes ranging from medium to large. For the GA clips, adults performed significantly faster than children on 11 of the 16 clips, with effect sizes ranging from small to large. Clips that did not demonstrate a significant difference between groups were excluded from the VR-PSCT.

Final VR-PSCT

The final VR-PSCT comprised 13 hazard perception and 11 gap acceptance clips. For GA tasks, internal consistency was acceptable (Cronbach's $\alpha = 0.77$) and for HP tasks internal consistency was excellent (Cronbach's $\alpha = 0.91$). Non-significant weak positive relationships were found between HP and GA response times for both children (r = .13, p = .489) and adults (r = .26, p = .139), suggesting that HP and GA are distinct pedestrian skills. Independent t-tests indicate that children have significantly slower overall response times compared to adults for both the HP and GA tasks, and children were significantly less accurate on the HP task (Table 1).

	Child M (SD)	Adult M (SD)	t-test	Cohen's d
HP Response Times (s)	8.23 (2.88)	5.57 (2.12)	t(49.7) = 4.32, p < .001	1.08
GA Response Times (s)	4.56 (1.10)	2.75 (0.76)	t(51.8) = 8.02, p < .001	1.97
HP Accuracy	11.7 (1.26)	12.41 (0.76)	t(43.2) = -2.76, p = .009	-0.71

Table 1. Descriptive statistics and t-tests for VR-PSCT overall scores.

Benefits to road safety

To meet the goal of halving road fatalities by 2030, we need to understand behaviours of all road users. Pedestrian fault accounts for approximately 30% of crashes involving pedestrians, and therefore it is imperative to use pedestrian streetcrossing tests that are ecologically valid and have been designed using established principles, as this will support our best understanding of pedestrian street-crossing behaviour. The current research establishes principles for the appropriate development of pedestrian street-crossing tasks, which can inform future research. It is further expected that this VR-PSCT will be used in future road safety research to provide measures of pedestrian hazard perception and gap acceptance performance, for example as a pre-post measure to evaluate the effectiveness of intervention programs.

Implications for policy and/or practice

Going forward, it is important that research and practice make use of validated assessment tools when measuring pedestrian and driver hazard perception and gap acceptance skill. In doing so, we can be more confident in findings and interventions can be designed to target the appropriate outcomes to reduce road fatalities.

Conclusions

The current research has established the validity of the VR-PSCT by using established principles of test development for driver hazard perception. In doing so, the test items have strong discriminant, internal, face validity. This work can be extended upon by assessing other psychometric aspects of the test items, in particular the concurrent, predictive, and external validity. It is recommended that future research use appropriately validated tasks or clearly demonstrate the procedures that have been used to validate new tasks. It is also advisable that future work account for familiarity with test equipment, such as relative experience with using a virtual reality headset.

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Injury and fatality risk by transport mode: a systematic review

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Abstract

Safety concerns can deter people from using active modes of transport, however, differences in data collection and reporting of transport injuries across modes makes quantifying safety by mode difficult. We undertook a systematic review to investigate injury and fatality rates across different land-based transportation modes. We included studies that used travel related denominators to examine how travel injury and fatality rates vary by mode of transport. Findings indicated disparities in injury and fatality rates, dependent on the combination of mode and exposure measures - including kilometres travelled, hours spent commuting or number of trips made. The research provides valuable insights into injury and fatality rates associated with various transportation modes. It offers a foundation for evidence-based decision-making, enabling policymakers, researchers, and practitioners to design contextually relevant interventions, including infrastructure investment; ultimately fostering safer transportation environments and saving lives.

Post on X

What's the safest way to travel? PT often has lowest rates and motorcycles often have highest rates of injury and fatality. Beyond that it's hard to say - with considerable variation in results across studies.

Background

Transport injuries and fatalities remain a substantial global health burden (WHO, 2023). At the same time, there are efforts worldwide to improve population health and environmental sustainability through promotion of active travel (Giles-Corti et al., 2016). Injury and fatality risk, and perceptions of risk travelling by different modes can influence travel behaviour and investment in road safety measures. In particular, perceived risk of injury can deter people from cycling (Sanders, 2015). However, comparison of rates of injury and fatality by different modes is not straightforward. Use of inappropriate denominators, such as population size can mean that comparisons of safety risk by different modes are distorted (Mindell et al., 2012), especially when comparing geographical areas with different underlying rates of travel by different modes. Mindell et al. (2012) propose that time-based exposure measures are most appropriate for comparing between modes as they account for differences in average travel speed by different modes. Therefore, we undertook a systematic review of the literature to understand how injury and fatality rates vary by mode of transport, and variations according to age, sex and socioeconomic status and/or area deprivation.

Method

We undertook a comprehensive, systematic search of the medical, health sciences and transport research literature using a combination of keywords and MeSH terms in the following databases: Ovid (MEDLINE, EMBASE, PsycINFO, Emcare, Nursing Database, CINAHL, TRID and Web of Science. We used three concepts to guide the keyword search: 1. Transport, for example, all modes of land transport; 2. Injury, for example, injuries, fatalities, accidents; 3. Exposure rates, for example, per distance, per trip, per time.

We completed backward and forward citation scanning to identify additional relevant articles. We included studies published since 2000 that used travel related exposures (denominators). Papers using only population based or vehicle ownership denominators were not included. We only included articles that compared at least two modes of transport, due to challenges in comparing rates across studies.

The review was registered in PROSPERO (CRD42023406522). We used the PRISMA reporting protocol and COVIDENCE software for data extraction and management. **Error! Reference source not found.** shows our PRISMA flow chart. One author conducted the database search. 542 citations were exported to Endnote and 245 duplicates removed. Two authors screened 294 studies for inclusion by reading the journal article title and abstract. 147 were removed at this stage. 147 full text studies were assessed for eligibility by one author with 10% (n=14) checked by another author. At this stage, 118 studies were excluded. Twenty-nine studies were included in the final review.

Results

We report injury and fatality rates for three travel related denominators (per billion km, per 100 million trips and per million hours). Table 11 shows the number of studies that reported fatal and non-fatal injuries for each denominator.



Figure 1. Systematic Review PRISMA Flowchart

Table 11. Number of studies reporting fatal or non-fatal rates by exposure denominator type

Denominator	Fatal	Injuries (non-fatal)	
Distance	23	10	
Time	11	10	
Trip	9	7	

Fatalities and injuries per billion km travelled

Distance was the most commonly used travel exposure denominator. Twenty-three studies reported fatalities by distance. Twenty of these included motor vehicles (MV), 22 included cyclists, and 21 pedestrians. Two included public transport and three powered two-wheelers. The lowest fatality rate per distance travelled is for public transport. After this, the lowest fatality rate was for MV, except for three studies that focused on urban areas specifically. The results were more mixed for pedestrians and cyclists, with the pedestrian fatality rate higher than cyclist rate in 12 studies and the cyclist fatality rate higher than pedestrian rate in 7 studies (Figure 2). Powered two-wheelers had the highest fatality rate overall.

Ten studies reported non-fatal injuries by distance. Seven of these reported injury for MV. All ten reported cyclist and pedestrian injuries. Two reported public transport, and two reported powered two-wheeler injuries. In all studies rates of injury by distance travelled were lowest for public transport and highest for powered two-wheelers. Cyclists had a higher injury rate than pedestrians in all 10 studies. MV had a lower injury rate than pedestrians or cyclists in all ten studies. There were considerable variations in the extent of difference in injury rate amongst modes (Figure 2).

Fatalities and injuries per 100 million hours travelled

Eleven studies reported fatalities using a time-based denominator. All reported cyclist and MV fatalities and 10 reported pedestrian fatalities. Two studies reported public transport and four powered two-wheelers fatalities. Public transport had the lowest fatality rate, and powered two-wheelers the highest. Cyclist fatality rates were higher in 10/11 studies and pedestrians higher in one study. The pedestrian fatality rate was lower than for MV in 5/10 studies. Ten studies reported injuries using a time-based denominator. All reported cyclist injuries. Nine reported pedestrian injuries, eight reported MV injuries, four reported public transport and four reported powered two-wheelers injuries. Public transport had the lowest injury rate, and powered two-wheelers the highest. Cyclists had a higher injury rate than pedestrians or MV in all studies. MV had a lower injury rate than pedestrians and cyclists in 4/8 studies.

Fatalities and injuries per 100 million trips

Nine studies reported fatalities using a trip-based denominator. All of these reported pedestrian and cyclist fatalities, six reported MV, one public transport and three powered two-wheeler fatalities. Public transport had the lowest fatality rate, and powered two-wheelers the highest. Cyclist fatalities were higher than pedestrians in 8/9 studies. MV fatality rates were higher than pedestrians in 3/6 studies, and higher than cyclists in one study. Seven studies reported injuries

Extended Abstract (Researcher)

using a trip-based denominator, all reported pedestrian, cyclist and MV injuries. Four reported public transport and two reported injury rates for powered two-wheelers. Public transport had the lowest injury rate, and powered two-wheelers the highest. Amongst cyclist, pedestrians and MVs, the injury rate was highest for cyclists in five studies, highest for pedestrians in one study and highest for MV in one study.



Figure 2 – Fatality (left) and injury (right) rates per billion km travelled

Socio-demographic variations

Eight studies reported breakdowns of injury and fatality rates according to sex. Males had a higher rate of pedestrian fatalities and injuries across all studies and all exposures. Females had a higher rate of injury for cycling and MV across all three exposure types in one study, and for MV using trip-based exposure in another study. Only two studies considered ethnicity, and both used trip-based exposure. Black, Hispanic and American Indian people had higher injury or fatality rates across all modes of transport. Eight studies reported injury and/or fatality by age. These showed variable and inconsistent results, though typically higher rates of injury/fatality among younger drivers, and older pedestrians, especially where falls were included as pedestrian injuries.

Conclusions

The review reveals disparities in injury and fatality rates, with results dependent upon the travel-related exposure measure used. These variable findings highlight the methodological challenges in trying to quantify risk. The development and use of standardised metrics needs to be considered, together with improved data collection methods for the exposure data. Results are very different, especially for distance-based denominators when the focus is on a metropolitan area rather than a whole country rate. Few studies reported socio-demographic breakdowns, yet variation across age groups has been shown to have considerable impact on headline rates (Mindell et al., 2012). It is therefore important that greater consideration is given to what is driving overall rates by considering the population and environmental context. These improvements would facilitate accurate cross-modal comparisons and between jurisdictions, resulting in improved understanding of the risks posed by different modes and for quantifying benefits of infrastructure and policy initiatives to reduce burden; ultimately fostering safer transport environments and saving lives.

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Safer speeds on rural roads

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Abstract

Mornington Peninsula Shire implemented 80 km/h speed limits on 33 Shire-managed high-risk high-speed rural sealed roads in December 2019. The objectives of the trial were to better match the speed limit with the characteristics of the rural roads to reduce the likelihood of crashes occurring, and also reduce the risk of vehicle occupants being seriously injured or killed if a crash does occur. The Victorian Department of Transport has coordinated a comprehensive evaluation of the trial. In summary, the 80 km/h speed limits have been successful, achieving a high level of community support, average vehicle speeds reduced and road trauma significantly reduced. Speed limit corrections are a critical element of road safety and reducing road trauma, particularly on council-managed roads. With this project and evaluation breaking new ground, there's potential for other road managers to replicate the systemic batch approach to achieve significant road trauma reductions.

Post on X (

Mornington Peninsula Shire's speed limit correction to 80 km/h on 33 rural roads has been successful, achieving a high level of community support, average vehicle speeds reduced and road trauma significantly reduced.

Background

The Mornington Peninsula has a long history of unacceptable levels of road trauma. This was further highlighted in 2019, with 12 people losing their lives and 200 people seriously injured.

Mornington Peninsula Shire's 33 high-speed sealed rural roads, with a total length of 110 kilometres (refer to Figure 1), were identified as high-risk, with 90 km/h and 100 km/h speed limits putting road users at increased risk of death or serious injury, and therefore not representing an appropriate speed limit for these roads. Over the past 20 years, 32 people have been killed, 280 people severely injured, and 487 people sustaining minor on these roads. Six of the 32 deaths were in 2019 alone.



Figure 1. Mornington Peninsula Shire's Safer Speeds Trial roads locations Source: Mornington Peninsula Shire

Safer speed limits

Setting appropriate speed limits is an essential element in reducing risk to road users with evidence showing that speed strongly influences both the chances of a crash occurring and the severity of trauma, should a crash occur (Woolley, Stokes, Turner & Jurewicz, 2018).

However, widespread and significant implementation of appropriate speed limits to improve road safety has been very limited, primarily due to the perceived likelihood of community objection.

Project description

An innovative approach to speed limit reductions is to identify types of roads with high systemic risk (such as highspeed rural roads), then implement an appropriate speed limit on all roads of this type to reduce the systemic risk across all of these roads. However, this type of systemic batch approach to speed limit changes, has generally not been supported by State speed limit approval agencies.

Nevertheless, Mornington Peninsula Shire decided to pursue this approach for speed limit changes on our 33 high-speed rural roads, thereby preventing the possibility of many deaths and serious injuries during the many years it would take to achieve appropriate speed limits with the traditional road-by-road approach.

The Victorian Government approved a two-year Safer Speeds trial of 80 km/h speed limits on the 33 Shire-managed high-risk rural roads, and agreed to coordinate an evaluation of the trial. The 80 km/h speed limits were implemented in December 2019. It is understood that it has been the largest Local Government led speed limit project to ever occur in Victoria, and possibly Australia.

Findings

The Victorian Department of Transport has coordinated a comprehensive evaluation of the Safer Speeds Trial. The evaluation was completed in mid-2022 and analysed detailed information such as community views, recorded vehicle speeds and road trauma statistics over the two-year period.

Community sentiment

A large scale and comprehensive community sentiment survey was undertaken approximately 12 months after implementation of the 80 km/h speed limits to understand residents' views about the 80 km/h speed limits. Survey participants were a randomly selected demographically diverse sample of Shire residents.

This survey was considered a key research aspect of the trial evaluation as the results have the potential to debunk the common perception by road agencies, politicians and road safety practitioners that the implementation of appropriate speed limits that match the road environment may be viewed negatively by the broader community.

It was also an innovative approach as community engagement for speed limit changes is almost exclusively undertaken prior to a change in speed limit. For the Safer Speeds project, views after the implementation of the change of speed limits were sought, once respondents have experienced the new speed limits and can provide an informed opinion.

There were 1,059 respondents to the survey which is considered a robust sample size, with the results representative of the Shire's population. A study of this size and methodology has never before been undertaken in Victoria following a speed limit change.

The community sentiment survey report has shown significant community support for the reduction of speed limits to match the road environment. Some key findings include:

- Residents were nearly three times as likely to support the reduction of the speed limits (59%) than they were to oppose them (22%), while 20% took a neutral stance.
- Among the 59% supporting the trial, reasons for supporting the trial include that it is 'safer due to less accidents' (31%), that 'safer roads/slower speeds are safer' (27%) and that it is 'safer due to poor road condition/design' (18%).

Vehicle speeds

'Before' and 'after' traffic counts were undertaken on all 33 trial roads as well as comparable 'control' roads in other municipalities.

The 80 km/h speed limits have been effective in reducing vehicle speeds based on various metrics relative to the previous 90 km/h and 100 km/h speed limits. In summary, statistically significant average control-corrected mean speed reductions of 3.4 km/h and 5 km/h were recorded on the roads that had 90 km/h and 100 km/h speed limits respectively. Anticipated reductions in road trauma were also estimated from the Nilsson Power Model (Nilsson, 2004) to be 20% and 15% for the roads that previously had 100 km/h and 90 km/h speed limits respectively, with some former 100 km/h routes showing estimated reductions as high as 39%.

There were higher reductions in mean speed observed on higher volume roads (7 km/h on average) and roads that had the highest 'before' speeds (up to 10 km/h reduction). There is also now a significantly higher proportion of drivers travelling below the safer 80 km/h target speed.

As of early 2024, connected vehicle data indicates that the lower vehicle speeds on the 33 roads have been maintained or reduced further since the late-2021 traffic counts.

Road trauma

Crash statistics since the implementation of the 80 km/h speed limits have been compared to the two years prior to the implementation of the 80 km/h speed limit. Annual fatal and serious injury (FSI) crashes reduced from 19 per year to six per year (a 68% reduction) during the trial. This is a 20% net reduction relative to unchanged comparable control roads in other municipalities.

In addition, there have not been any road deaths on any of the 33 roads since the beginning of the trial, relative to six deaths along their length or at intersections in 2019 alone, and 32 deaths over the past 20 years.

Implications for practice

Mornington Peninsula Shire's Safer Speeds project has demonstrated that a systemic batch approach to speed limit changes can be achieved despite it not currently being the norm.

The success of the trial reinforces that wide scale speed limit corrections on high-speed roads to match the speed limit to the characteristics of each road should be vigorously pursued across Australia to save lives and reduce the number of people killed or seriously injured.

In particular, speed limit corrections are critical for Local Governments in the current cost-constrained environment as they are effective and cost-efficient road safety improvements. Councils manage long lengths of road and a significant proportion of deaths and serious injuries occur on council-managed roads (35% in Victoria, source: Victorian crash database). State and National road trauma reduction targets are unlikely to be met without a significant reduction in road trauma on Council-managed roads.

Conclusions

In November 2022, Mornington Peninsula Shire's Councillors resolved to apply to the Victorian Department of Transport for the 80 km/h speed limits on the 33 roads to become permanent.

Road safety, vehicle speeds and road trauma will continue to be monitored on the 33 Safer Speeds roads.

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Optimising fixed automated road safety enforcement

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Abstract

The method of selecting fixed camera location sites in Victoria currently considers primarily site crash history, with broader traffic engineering and road infrastructure factors not taken into account. This Ph.D. research proposes to improve the camera site selection process in Victoria by developing an understanding of the risks stemming from road design, traffic violations, and other factors to include these in the camera site selection criteria. An interview study with those involved in the safety camera selection process revealed that current practice only considers aggregate risk at a site rather than being able to isolate the element of risk associated with traffic violations. Interviewes generally supported an expanded evidence-based approach to be adopted for site selection process, while providing contrasting views on the range of criteria to be involved and indicating the need for a proactive process that considers traffic exposure and road engineering aspects.

Post on X

Developing a theoretical basis for the optimization of fixed automated traffic enforcement systems deployed on Victorian roads, by developing a guideline for the site selection process, with a particular focus on the role that road infrastructure characteristics play in enforcement effectiveness.

Introduction

Research has extensively examined the relationship between speed and road safety. High driving speeds are associated with a higher crash rate and with a greater likelihood of more severe outcomes (Aarts & Van Schagen, 2006). Automated speed enforcement has been deployed to ensure better adherence to speed limits and therefore improved road safety. It is widely accepted that appropriate speed limits and their enforcement are effective road safety measures (Elvik et al., 2019). Automated enforcement has been used on Victorian roads since 1983, with the introduction of the red-light camera program at signalized intersections. Since then, the camera program has grown to include fixed spot and point-to-point speed cameras, combined speed and red light cameras, and mobile speed cameras (Pearson, 2011).

Previous studies have focused on evaluating the road safety outcomes of speed enforcement technologies. Research showed that speed cameras reduce motor vehicle speeds and crashes by affecting positive behaviour change through general and specific deterrence (Cameron & Delaney, 2008). Moreover, fixed cameras were found to be an effective way to manage driver behaviour and thereby improve road safety (Kloeden et al., 2019). However, no previous research has examined broadly the rationale and limitations of camera deployment, including the criteria by which sites are selected for camera placement, limitations in site selection, and the measures required to overcome them. One of the major limitations of speed camera deployment is the absence of clear site selection guidelines for fixed camera placement based on scientific evidence. Although there is no definitive best practice for selecting safety camera locations in the literature, frequently used criteria mostly rely on crash data.

As part of its 2006 performance audit, *Making Travel Safer: Victoria's speed enforcement program*, the Victorian Auditor-General's Office (VAGO) found that guidelines for selecting fixed camera sites were insufficiently justified and it recommended that more detailed site selection criteria be developed. In his audit report, Pearson (2011) mentioned that determining the location for fixed speed cameras was the responsibility of Victoria Police and the other Victorian road safety agencies. In its speed camera site selection criteria document (*Speed camera site selection criteria*, 2006), Victoria Police stated broadly that site selection for fixed cameras should consider traffic volume and whether the risk of high trauma at the site was speed related. In response, in 2007 Victoria Police and the then-Department of Justice (DoJ) established the Fixed Camera Site Selection Committee (the Committee) to address the VAGO recommendations. The Committee's terms of reference included developing and implementing more detailed site selection guidelines for fixed cameras. As of early 2024, this project had not yet been undertaken.

For intersection sites, the current selection of camera sites is undertaken with the assistance of a formula developed by Monash University Accident Research Centre in collaboration with Department of Justice and Community Safety (DJCS). The formula ranks intersection sites for camera placement based on a weighted average of medium and long-term crash history. A limitation of this approach is that intersection sites were not considered until a longer-term crash problem had arisen (Pearson, 2011). The Committee acknowledged this limitation and recommended developing a predictive model that incorporated factors such as traffic volumes, road geometry, and traffic manoeuvres to proactively treat high-risk intersections before crashes occur (Pearson, 2011).

This Ph.D. program aims to develop a comprehensive process for fixed traffic camera site selection that considers the full range of crash risk factors at an intersection to determine the role played by non-compliance with speed limits and red lights. Results of the initial stages of the work are presented here, documenting current processes for fixed camera site selection.

Method

Five key studies are planned to be completed in this thesis, contributing to the development of a theoretical framework. This abstract presents the second of these studies, which reviews and documents current practice for automated enforcement deployment including technology and site selection, operational deployment practice, and operational policies, and compare these against evidence of best practice identified in a literature review. A structured interview was administered with representatives from DJCS, the Department of Transport and Planning (DTP) and the Victorian Road Safety Camera Commissioner (RSCC) (Monash Human Research Ethics Committee - MUHREC project number 36752). Interviews were recorded and transcribed and NVivo was used to assist in the identification of themes. The findings were benchmarked against the current practice international systems and best practice from a review of the literature. The focus of the interview was on identifying the gaps in the current practice and exploring the available data and data collection methods at DJCS and other Victorian government agencies relevant to automated traffic enforcement and documenting how these are used to inform current practice.

Results

The conducted interviews have compiled various information and opinions from three Victorian Government agencies working in collaboration to improve road safety enforcement on the Victorian road network. In total, 8 interviews were conducted. Participants were: 5 representatives from the DJCS, 2 representatives from DTP, and 1 representative from the RSCC. The major themes that arose from the interviews were related to describing the agencies' perceptions on the current process, the main limitations and challenges, data availability and limitations, opportunities and improvements . The main findings from the interview study are aligned with the VAGO conclusion, stating that the guidelines for selecting fixed camera sites need to be more detailed (Pearson, 2011). Interviewees agreed that the current decisions are heavily reliant on historical data with an approach based on analysis of historical crash data using a scientific evidence-based approach with limited scope. Interviewees supported an expanded evidence-based approach to be adopted where broader criteria related to road infrastructure, including traffic volumes, traffic signals, signal phasing and speed zoning, are considered rather than just crash statistics. The interviewees expressed the need for an increase in harmonisation among the decision-makers from the various stakeholders by developing a standardised methodology based on defined severity indices by using a combination of weighting factors such as operating speed, traffic volumes and crash history. The interviewees recommended that the role of the committee becomes more strategic in improving road safety by acting proactively in terms of making informed decisions based on a more detailed site selection criteria.

Benefits to road safety

The road safety benefits of automated speed enforcement have been extensively studied. Generally, the aim of evaluating the efficacy of such technologies has been to assess road safety outcomes at an aggregate or program level. Evaluations have not focused on the differential effectiveness of cameras at different sites and the factors associated with these differences. Since the available research does not identify all the potential factors associated with optimal safety camera benefits, it is impossible to assess whether current automated enforcement systems are operating optimally. While best estimates of injury crash reductions attributable to fixed camera systems fall in the range of 20% to 25% at treated locations as evidenced in Thomas et al. (2008), it is possible that the measured effectiveness is constrained by site selection practice. Incorporating a more comprehensive range of factors than currently used, particularly relating to the road and road infrastructure has the potential to improve both the effectiveness of individual sites, as well as the effectiveness of fixed camera programs overall.

Implications for policy and/or practice

Reflecting VAGO's conclusion that the guidelines for selecting fixed camera sites need to be more detailed, the interview component of the study confirms the VAGO findings and provides a basis on which to develop a more comprehensive site selection protocol. This research will establish optimum site selection protocols, with a particular focus on the role that road infrastructure characteristics play in enforcement effectiveness. It will also consider optimum deployment principles and consider the learnings in the context of the development of an optimization framework for the Victorian Road Safety Camera Program.

Next steps

The next step is to develop a data conceptual framework to inform and guide the systematic, and comprehensive collection of data to underpin the generation of an evidence base to optimize fixed-speed and red-light camera site selection. It is hoped to achieve a full understanding of the risks stemming from road elements, traffic violations and other factors to focus camera site selection on the area of risk best able to be addressed by the camera.

The approach used to define the data conceptual framework referred to previous research that tackled this field of road safety, including research conducted by Angelo D'Elia "A data conceptual framework for injury prevention" (D'ELIA, 2019). Moreover, the key concepts identified for the development of this framework include an evaluation study conducted by Budd et al. (2011) titled "Evaluation of the crash effects of Victoria's fixed digital speed and red-light cameras". In addition, the development of this data framework has considered research that was identified in the literature review (i.e. (Martin, 2002), (Golob & Recker, 2003), (Kononov et al., 2008) and (Wang et al., 2013)) that studied the impact of road infrastructure and traffic characteristics on intersection crash risk. The integration of the above-mentioned studies defines a conceptual basis for the systematic and comprehensive approach to the collection of data and the development of a data conceptual framework to be applied for locating fixed cameras in Victoria. This study will consider assessing the impact of traffic volume, traffic congestion, road curvature, road geometry (number of lanes, lane width, right turn lanes) and signalization (signal phasing and control) on the effectiveness of fixed-speed enforcement in Victoria along with the speed profile, crash stats and infringement data.

The first key step of the data analysis consists of reproducing the study of Budd et al. (2011) with a wider camera population and over a longer period and to measure heterogeneity between road safety benefits at different installations. The second key step is to relate the heterogeneity of effectiveness measured in the 1st key step to road and traffic attributes identified in the data framework and highlighted as being important in the literature review. This method will allow direct measurement of the intersection attributes for which intersection camera enforcement works best. Drawing on the outcomes of the planned analysis, the planned final steps of the research program are defined below:

- Data analysis interpretation: Interpreting the results of the data analysis in Study 3 to identify the road / traffic / behavioural conditions in which fixed cameras will produce the greatest road safety gains
- Data analysis translation: Use these factors to determine a site ranking and selection process for fixed cameras
- Practical application: Apply this to data from currently unenforced signalised intersection in Victoria to demonstrate the proof of concept of the new ranking system
- Implementation: Define the ongoing data collection and methods required to allow the application of this methodology of site selection by the government in the future.

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How does training affect 'different types' of drivers' speed compliance?

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Abstract

Speeding remains the leading cause of road fatalities and injuries each year. In Australia, young drivers between the ages of 17 to 25 years are greatly over-represented in road accidents. The main aim of this research was to examine the effect of a cognitive-based training intervention on young drivers' speed management compliance in ACT. In addition, the focus of research was investigating the effectiveness of training on different types of drivers (i.e., based on their attitude and perception). Forty young novice drivers between the ages of 18 to 25 were randomly allocated to one of two groups (control group, or training intervention group). Ultimately, the results of this study showed promise that the training intervention was effective for all types of drivers. This knowledge is valuable in contributing to the development of a new training program to improve speed compliance for young novice drivers.

Introduction

Speeding is the leading cause for road fatalities and injuries, with an estimate of 1.25 million fatalities across the globe each year (World Health Organisation, 2017). This is because exceeding the speed limit reduces a drivers' reaction time to avoid a potential crash and increases a vehicle's stopping distance. Studies indicate that speeding only 5km/h over the speed limit is enough to double the likelihood of a casualty crash (Department of Transport and Main Roads, 2023). In Australia specifically, there were a total of 1,116 road fatalities in 2021 (Bureau of Infrastructure, Transport and Regional Economics - BITRE, 2023). As a result, speed management has been recognized as a central theme in the Australian Government's National Road Safety Strategy for 2021-2030. The primary aim of this research was to investigate the effect of a cognitive-based training intervention on the speed management behavior of young novice drivers. This study provides valuable background for policy makers, and future researchers in understanding how a training intervention can be tailored or targeted towards young drivers.

The primary aim of this research was to investigate the effect of a cognitive-based training intervention on the speed management behaviour of young novice drivers. The secondary aim of the research was to address how this training intervention influences different categories of drivers. The objective of the study was to address a research gap in current literature, by exploring the effect of training on different driver types, using objective data. This study provides valuable background for policy makers, and future researchers in understanding how a training intervention can be tailored or targeted towards the varying attitudes of drivers. The research questions that this study sought to address were:

- a. What is the effect of a training intervention on young novice drivers' speed compliance in low (i.e., 50km/h) and high (i.e., 80km/h) speed zones?
- b. How does a training intervention influence different types of young novice drivers' (i.e., conformers, deterred, manipulators, defiers) speed compliance?

Method

A total of 40 voluntary participants (31 males) took part in a driving simulator study (UC-win/Road Drive Simulator version 16 (Forum8, 2023). All participants were 18-25 years of age (M = 20.6, SD = 1.04), and all participants held a valid Australian provisional license (32 Provisional 2 drivers). Provisional drivers are considered licensed drivers who are authorized to drive under some specific restriction (i.e., limited speed limit, number of passengers in the car, use of mobile phone, etc.). Provisional 1 drivers' license is obtained after completing the driving test and after driving on learner's license for at least 12 months. Provisional 2 driver's license is issued after passing a hazard perception test and being driving for 1-2 years on Provisional 1 license. The average age that participants started driving was 16 years and 5 months (SD = 0.76), indicating that participants had a mean of 4 years, 2 months driving experience. Participants spent an average of 7.5 hours driving per week (SD = 4.45), with 87.5% reporting that they drive mostly city/suburban routes most often. On average, participants had spent 109.25 hours driving under supervision on their Learner license (SD = 25.73), and 512.7 hours driving without supervision (SD = 373.26). Of the 40 young drivers, 17 reported that they had received a speeding infringement. Of these 17 participants, five reported that their infringement was for travelling more than 15km/h over the speed limit, whilst the remainder reported their infringement was for speeding less than 15km/h over the limit.

The driving simulator was comprised of both software and hardware components. The software used in the experiment was UC-win/Road Drive Simulator version 16 (Forum8, 2023). The hardware included a Samsung S9 49inch 120Hz

Curved VA Ultrawide QLED DQHD monitor, a Logitech G920 Driving Force Racing Wheel, and a three-pedal set (accelerator, brake and clutch), as illustrated in Fig. 1. The UC-win/Road software was configured to automatically log all relevant time, speed, and distance data at 0.1 second intervals.

Training Intervention

The designed training intervention incorporated two key methods: (1) self-explanation, and (2) combined feedback. The self-explanation component required the participant to answer a series of questions, which were developed based on previous research by (Molloy et al., 2018a). All participants then received combined feedback, relating to their performance, and financial and safety implications. To produce accurate feedback on the individual's baseline performance, a MATLAB script was generated, which took the corresponding UC-win/Road CSV file as the input, and produced a series of statistics, plots, and graphs (related to performance, finance, and safety). The printed statistics were used to deliver the verbal feedback component, whilst the plots were shown, and explained to the participant graphically.

Results

Analysis

Complete, descriptive statistics including mean, median, and standard deviation were obtained for each data set. All data was cleaned using the median and interquartile range to identify outliers and transform them to reduce their impact on the study. Statistical testing was then applied to the cleaned data, including a 2x2 mixed repeated measures analysis of variance (ANOVA) for the maximum speed outputs. In these tests, the between-groups independent variable was training, consisting of two levels (control, training); and the repeated measures independent variable was time, consisting of two levels (baseline, test). Next, participants were categorised into different types based on their responses to the line of questioning within the post-drive survey (Blincoe et al., 2006).

Participants responses were then used to categorise the drivers as either conformers, deterred drivers, manipulators, or defiers, as per the typology derived by Blincoe et al. (2006). The demographic of participant responses is illustrated in Figure 1.

Summary of Speed Management Performance

The aim of this research was to investigate the effect of a training intervention on different types of young novice drivers' speed compliance. In terms of maximum speed in the 50 km/h speed zone, the mixed repeated measures ANOVA showed a statistically significant interaction between time and training (F (4,79) = 5.48, $\rho < 0.05$). In the 80km/h speed zone, the maximum speed interaction was significant (F (4,79) = 5.60, $\rho < 0.05$). In both speed zones, further analysis using independent t-tests showed a statistically significant difference between groups (control vs training). The results showed that the most significant difference was found for the maximum speed for conformers (t(7) = 2.50, p = 0.04) and manipulators (t(5) = 3.13, p = 0.03), whereas there was a trend in lowering maximum speed for all types of drivers.



Figure 1. Maximum speed comparison between each category of drivers: a) in the 50 k/h speed zones; b) in the 80 km/h speed zone.

Discussion

From a theoretical perspective, the statistically significant results achieved in this research indicate that a single session, cognitive-based training intervention can influence the speed management behaviors of young novice drivers. The effectiveness of such training is supported by a variety of other research (Molesworth et al., 2011; Molloy et al., 2018) investigated various training methods and concluded that self-explanation coupled with combined feedback was the

most promising improvement in speed compliance (particularly in lower speed zones) for young novice drivers. Additionally, the results of this research clearly demonstrated that greater speeding violations occurred in the lower speed zone (50km/h) compared to the higher speed zone (80km/h). This aligns with previous research studies, which have indicated that lower speed zones are perceived as more difficult for young novice drivers to control their speeding behavior, compared to higher speed zones (Krasnova et al., 2015; Molloy et al., 2023).

From an applied perspective, the results of this study are valuable as they provide objective evidence that a training intervention is promising in improving the speeding behaviors of young novice drivers. This particular conclusion aligns with previous research, which also indicates promise in the use of cognitive training for speed compliance (Krasnova et al., 2015; Molloy et al., 2023).

Conclusion

In summary, this study investigated the effect of a training intervention on the speeding behaviours of young novice drivers; the research then further investigated the effect of this training on different types of young drivers based on their attitudes towards speeding. The results showed statistically significant findings for conformer and manipulator drivers in relation to maximum speed. However, consistent trends indicated that a reduction in speeding behaviour was present for all categories of driver, with the exception of defiers. This research also highlighted that speed compliance is a significantly greater issue for young novice drivers in lower speed zones (i.e. 50km/h) as opposed to higher speed zones (i.e. 80 km/h) - this trend aligned closely with findings from previous research. From an applied perspective, these findings indicated that policy makers should focus primarily on improving speed compliance in lower speed zones, in suburban areas, as opposed to highways in urban areas. It is recommended that further research should investigate how different types of training interventions are accepted by different types of drivers, and how the training could be tailored to enhance its effectiveness.

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A body of knowledge for road safety engineers

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Abstract

This paper discusses what body of knowledge should be acquired by anyone wishing to call themselves a road safety engineering professional. Based on recent activity in the area of occupational health and safety, this is the first part of a three part approach which includes accreditation of professional education providers and certification of professionals. The need for a body of knowledge is illustrated. This body of knowledge will include a general understanding of the scope of road safety, together with specific training in road safety engineering. It is proposed to be a stepped process, with the higher levels increasingly focusing on human factors knowledge and specific technical expertise.

Post on X

Effective physical road safety improvements require design and traffic management professionals to have a body of road safety engineering knowledge. What should that be and how should training be structured and provided?

Introduction

This paper discusses what body of knowledge should be acquired by anyone wishing to call themselves a road safety engineering professional. After discussing the topic of a body of knowledge for road safety professionals generally, the paper focusses on the knowledge required by road safety engineers. The attainment of levels of expertise will need to be a stepped process. At the highest level, the knowledge will include specific areas of specialist expertise. This paper expands on ideas originally put forward by Prof Ann Williamson, President of the Australasian College of Road Safety in a keynote address to the 2023 ACRS road safety conference in Cairns, focusing here on road safety engineering.

The demand for a body of knowledge

In 1999, eminent Canadian road safety researcher, (now Emeritus) Professor Ezra Hauer made the following comment in his introduction to a road safety guide aimed at traffic engineers:

The profession and its institutions seem to be content to let loose on the road system engineers who have not received training in road safety at undergraduate level, and allow them to build roads and control traffic without requiring the acquisition of knowledge in road safety during their career. If knowledge is not in demand, it will not come into being. (Hauer, 1999)

No one would feel safe knowing that a bridge they have to travel over had been designed by an engineer with no structural expertise. So perhaps we should question why we continue to allow, for example:

- urban road networks to be established by engineers and town planners who do not understand the road safety consequences of road planning and town planning options,
- signing schemes to be designed by traffic engineers with no traffic signing expertise,
- traffic crash problems to be assessed by engineers with no crash investigation experience, and
- road safety audits to be carried out by engineers who have no road safety engineering expertise.

Figure 1 shows a recent direction sign that is too complicated (it takes too long to decipher), too close to the intersection (it can't be read in time to act safely) and on the wrong side of the road (it is likely to be hidden by traffic or otherwise missed). It was part of a major project. It was designed by professionals, road safety audited by professionals, and yet ... Evidently, the project office had no specific professional or technical demands of those involved, or felt no obligation to adopt legitimate advice. This will only change if a demand comes from within road safety.

A Body of Knowledge: Road Safety in General

Road safety involves many disciplines, including (but not limited to):

- Engineering (including road design, traffic engineering, road safety engineering and mechanical engineering)
- Behavioural sciences, human factors
- Social sciences, town planning, transport planning
- Research, systems theory and practice

- Post-crash management
- Information management
- Legislation and legal issues
- Policing and other enforcement, and
- Government policy (including areas not directly relating to road safety)

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Figure 1. A direction sign: too complicated, too close to the intersection and on the wrong side of the road (Image © the author)

The best approaches to reducing road trauma are usually multi-disciplinary. Both the details and a broad appreciation are important. Professionals need to become increasingly knowledgeable in their own specific areas of expertise, yet also have a strong appreciation of how their area(s) of expertise fit in with the broad range of other disciplines. Currently, it is more likely that professionals who can influence road safety are working in their own isolated technical 'silos' with little appreciation of the broader influences. Figure 1 provides a very simple illustration of this.

A Way Ahead for Road Safety Engineering

As discussed by Prof Ann Williamson at the 2023 ACRS Conference, recent activity in the area of occupational health and safety points to a possible way ahead. That activity has involved three tasks:

- the development and publication of a Body of Knowledge (see ohsbok.org.au),
- the accreditation of those providing professional education, and
- the certification of generalist professionals.

This model from occupational health and safety is the road ahead that road safety engineering needs to take. Once it is taken, all road design, traffic engineering design and traffic management will be able to benefit from all the elements of that Body of Knowledge, relevant to the particular project.

A general body of knowledge

An understanding of a general 'body of knowledge' about road safety is the first part of a layered certification process, designed to improve engineering outcomes in road safety (see Table 1). This general understanding will create a sound base, so a road designer or traffic engineer can see how her or his area fits in with other disciplines.

A road safety engineering body of knowledge

Beyond that general or broad understanding there will need to be professional development and certification for more specific road safety-related engineering tasks. For example, the process of certification would establish who can call themselves a road safety engineer and who can, for example, undertake and sign off a road safety investigation and who can receive, respond to and sign off on a road safety audit report. Returning to Figure 1 as a simple example, the process will need to specify who can prepare a traffic signing scheme and who can road safety audit such a scheme.

Certificate course content and delivery

The proposal is for a sequential series of postgraduate certificates. Consideration was given to inclusion of Level 2 learnings (see Table 1) into undergraduate courses, but inclusion of similar material into already crowded curricula has previously proven to be difficult or impossible. Graduate certificate courses will be more equitable and accessible. This model assumes graduate engineers will have had no, or minimal, exposure to road safety topics in their undergraduate course. At Level 1 they are designated as 'uncertified' in terms of road safety knowledge. Their work can involve investigations, designs, etc., but they will not be able to assert they have any recognised understanding of road safety.

Each Certificate course in Table 1 would be delivered online and in-person (in block mode) by a host university with a highly internationally-ranked School of Civil Engineering, preferably with an existing stream in transport engineering. The course curriculum would be developed by that university in consultation with government, industry, relevant other universities, the Australasian College of Road Safety, Engineers Australia and other relevant stakeholders. Lecturers with relevant knowledge and expertise would teach each course (primarily remotely). They would come from the host university, as well as other universities, government and industry.

A precedent exists for the provision by Australian universities of graduate certificates in specialty areas. A graduate certificate is an Australian Qualifications Framework (AQF) Level 8 postgraduate coursework qualification that usually requires six months of full-time enrolment (or equivalent) to complete. Completion of both Levels 2 and 3 of the

proposed sequence of courses (see Table 1) would lead to granting of the *Certificate of Road Safety Engineering: General*, with completion of Level 2 (*Certificate of Road Safety*) being a pre-requisite for advancement to Level 3. It is only at Level 3 that a person would be able to call themselves a Certified road safety engineer. These Level 2 and Level 3 certificates would be conferred and granted by the host university.

Level	Title	Qualifications (sequential)	Example areas included
Level 1	Uncertified road	Graduate engineering degree	Civil engineering,
Cadet Level	designer;		Mechanical engineering
$\mathbf{\Lambda}$	engineer		(Multiple course options)
Level 2 Professional Level	Road safety-certified road designer; Road safety-certified traffic engineer	Postgraduate Certificate of Road Safety. Certified through an accredited postgraduate course in road safety (Same course to be available to non-engineers)	A course covering a wide range of road safety topics and disciplines.
Level 3	Certified road safety	Postgraduate Certificate of Road	Road safety engineering:
General	engineer	Safety Engineering: General.	Road design essentials
Expert Level		Certified in road safety engineering	• Traffic engineering essentials
		through an accredited postgraduate	Road safety engineering
		course.	Statistical analysis
		Includes Level 1 Human Factors	Road safety auditing
		certification.	Crash investigation Human Factors Level 1
1			(One approved course)
Level 4	Certified road safety	Postgraduate Certificate of Road	Human Factors Level 2, plus a
Specific	engineering expert	Safety Engineering: Specialist.	specific area, such as:
Expert Level	(for which the technical	Certified in a specific area through	Traffic sign design
	area is specified, e.g.	an accredited postgraduate course.	• Traffic planning
	engineering expert.	Includes Level 2 Human Factors	• Traffic management
	Traffic planning')	certification.	Koadwork signing Dedestrien sefety
	1 07		(Multiple specific courses)

Table	1	Levels	of Road	Safety	Engine	ering F	vnertise
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At Level 4 there would also be course delivery online and in-person (in block mode) by a host university. However, given the importance of being able to apply these specialisations in a practical way, certification would be conferred upon completion of a major practical project, in the specific area chosen. This will allow the candidate to illustrate how their knowledge and skills acquired at Levels 2, 3 and 4 can be effectively applied in practice. As capability is the combination of skills, knowledge and *experience*, the practical project will also allow the candidate to apply their increasing experience. Certification at Level 4 would be conferred by a professional association, such as the Australasian College of Road Safety or Engineers Australia. It is envisaged that engineers will undertake several of these Level 4 courses over time, to enable them to call themselves a certified expert in particular road safety engineering-related fields. To initiate discussion, it is suggested that a road safety audit team would need to include one or more Level 4 experts, depending on the nature of the project; while someone in a project office who responds to a road safety audit would need to have at least Level 3 certification in road safety engineering.

Table 1 shows that at Level 3 and Level 4 the courses include learning about human factors. So much to do with effective road safety engineering relies on an understanding of human factors: the interactions of humans with the various elements of the traffic system, including other road users. How are road users likely to behave in a particular situation? What ranges of capabilities do they have? What limitations? What information do they need to make safe decisions – and when do they need it? How might road users adapt their behaviour in response to a design?

It is these types of understandings that are missing in the example in Figure 1, yet they are vital if new projects and the road system in general are to operate safely. Achieving safe outcomes during the design and management of the road system starts with practitioners having the necessary body of knowledge, gained through accredited training – as well as through personal hands-on experience – and through road authorities requiring that professionals are suitably certified.

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The lost art of crash investigation

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Abstract

Austroads' original *Treatment of Crash Locations* guide in 2004 made the point that crash countermeasures are not general; each one needs to target a specific type of contributing factor or crash cause. This understanding is now largely lost. The site of Victoria's first side-road-activated reduced speed limit signs is investigated. This treatment's aim of reducing crash severities was not achieved. The author's investigation concludes the main reason for this is that the likely crash causes were not identified. An alternative, low-cost treatment for the intersection is described. It is concluded that the most effective way to reduce crash severities can simply be to eliminate the crash causes.

Post on X

A case study crash investigation shows that if the causes of crashes are not identified, there is a risk that a treatment focusing directly on reducing crash severities will not be effective.

Introduction

Austroads' original crash investigation guide advised "Remember, countermeasures are not 'general': each one is known from experience to be able to address a specific type of contributing accident factor." (Austroads, 2004, section 8.1). In the most recent variation of this guide (Austroads, 2021a) this point is no longer included.

The Safe System approach is proactive, being to "Proactively target and treat risk" (ITF, 2016, Table 2.1). This table advises that the pre-Safe System 'traditional' approach was "Reactive to incidents". Austroads (2021b, Table 2.2) expresses this as the "conventional" approach having had a "Bias towards pre-existing crash history, understanding crash causes and likelihood" while the Safe System focuses on "Risk analysis based on network design attributes supplemented by crash data, understanding crash consequences". However, the ability to be proactive relies on prior experience gained through 'reactive' crash investigations and crash studies. This understanding is now largely lost.

Case study

The site of the first side-road-activated reduced speed limit electronic signs in Victoria is the cross intersection of the B160 Glenelg Highway with the C178 Penshurst-Dunkeld Road and the C188 Dunkeld-Cavendish Road, some 3 km west of Dunkeld. In 2015 a right angle crash occurred at this crossroad. A truck travelling west on the 100 km/h highway collided with a car travelling north on the C178 side road which has an 80 km/h speed limit. The car had Queensland number plates, from which it is concluded the driver was unfamiliar with the intersection. Both side roads are controlled by a Give Way sign. Three people were seriously injured.

In response, side-road-activated reduced speed limit electronic signs were installed on the highway in 2019. In the absence of intersecting traffic, the highway speed limit is 100 km/h. When a vehicle approaches from either side road, or a vehicle enters the right turn lanes on the highway, a 70 km/h speed limit is activated on the highway using a pair of variable speed limit signs on each approach (see Figure 1). Table 1 shows the reported crash history.



Figure 1. Looking west on the Glenelg Highway to the C178 intersection

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No.	Date (DD.MM.YYYY),	Serious	Crash type	Vehicles and directions	Conditions						
	day, time	injuries									
1.	17.07.2015, Fri., 14:28	0	All = DCA	Car to west. Car to north	Daylight, wet road						
2.	11.11.2015, Wed., 13:05	3	110: right	Truck to west. Car to north	Daylight, dry road						
3.	19.03.2020, Thu., 11:10	3	angle	Car to east. Car to north	Daylight, dry road						

Table 1. Reported Intersection Casualty Crashes 1.1.2010 to 31.12.2020

Crash information courtesy of Department of Transport and Planning, Victoria

The crash that prompted the treatment (No. 2 in Table 1) was assessed by Peiris et al (2018). The authors make no mention of any investigations into the causes of the crash. Rather, they offer four treatment options intended to reduce the injury severity of such a crash, by reducing the impact speeds. These four options were a roundabout, rumble strips on both approaches, an 80 km/h speed limit on the highway, and the latter two options in combination. The potential severity reductions from these four options were assessed using simulation software. The authors' comment:

Based on these findings, intersection designs that require drivers to reduce speed are likely to bring significant road safety benefits. We note that subject to community acceptance, a localised reduction in the speed limit represents the single most cost-effective intervention of those examined here, with added benefit from the addition of rumble strips to the point that the collision studied would likely be avoided entirely.

However, contrary to the predictions by Peiris et al about the safety benefits of localised speed reductions, Table 1 shows that the reduced speed limit treatment installed in 2019 has neither eliminated crashes nor reduced crash severity.

The selection of an ineffective treatment can be directly tied to the causes of the crashes not being identified. All the crashes in Table 1 are right angle crashes involving a vehicle approaching from the south (i.e. travelling to the north), which was required to give way. This suggests that there is some critical issue on this approach. A site inspection by this author in early 2022 identified the following issues relevant to northbound drivers approaching the intersection:

- The intersection is 40 m after a railway level crossing with flashing lights.
- On this approach, there is a major direction sign and a diagrammatic 'Give Way sign Ahead' warning sign. The latter sign is 350 m from the intersection. This is two to three times the recommended distance in the 'MUTCD', the Manual of uniform traffic control devices. From a human factors perspective, having this sign located so far ahead of the intersection and before the warning for the level crossing means it could easily be misunderstood as applying to the level crossing, or simply be forgotten (lost from short term memory) after the other signs had been passed.
- The only item at the intersection to tell minor road drivers that they need to give way is a single, minimum size Give Way sign located on a median island. For the 80 km/h approach speed, VicRoads guidelines require a larger sign.

The human factors issues of perception and expectancy explain how, if a traffic sign says one thing and all the other environmental cues say something else, then some unfamiliar drivers are likely to fail to notice the sign and will instead misread a situation in potentially unsafe ways. At this site it was evident that without the small Give Way sign the road looks like it continues through, albeit on a left hand curve. The only visual cue to counter the distraction of the level crossing and the misleading appearance that the road continues on is one inadequate sign. Therefore it is concluded that the drivers on the south approach did not appreciate there was a give way condition applying to them at the highway.

Approaches to reducing crash severities

In this author's view, the most effective way to reduce the number of fatal and serious injuries on roads is to:

- Firstly, seek to eliminate/avoid/prevent crashes that might have severe outcomes, and
- Secondly, where elimination cannot be achieved or is unlikely, take action to reduce crash severities.

Elimination requires an understanding of crash causes at a site: eliminate the causes and all crashes of that type will be eliminated, including the severe ones. Hence, reducing fatal and serious injuries is not only achievable by directly addressing severities (e.g. as at this case study site by seeking to reduce speeds), but can be done by eliminated all crashes (of all severities) of the particular type. But to do this requires carrying out crash investigations, the 'traditional' approach that is "reactive to incidents". As this case study example shows, not attending to the first dot point, and instead relying on the second dot point risks not achieving any reduction in crash severities.

Relying on direct severity reduction techniques also assumes that all crashes are inevitable. Williamson (2021) challenges the view that error and crashes are inevitable. "Where Safe System treats error as inevitable, the potentially important strategy of reducing road-user error is ignored or at least discounted." Her conclusion is: "A first step must be to amend the concept of Safe System for road safety and expand it to include prevention of road-user error through better human-user centred system design." The case study example supports this conclusion.

Fitzharris et al (2022) describe an updated 'integrated safety chain' (ISC) model. A simplified representation of this model (by this author) is provided in Figure 2. If, due to the misleading and inadequate arrangement of signs at the case

study site, a driver approaching on the south leg is driving 'normally' (Phase 2) but is oblivious of the need to give way, then within the ICS model there is no deviation from normal driving (Phase 3), yet a situation is emerging (Phase 4) which becomes critical (Phase 5) if a vehicle approaches on the highway at the same time. In this situation the implemented speed reduction treatment (a Phase 6 treatment) is all there is to protect vehicle occupants from serious injury. But that treatment has failed. Now consider the inadequate and misleading signs. They are a Phase 1 issue (Threats to normal driving), i.e. a crash-inducing factor that is in place before the journey starts. Eliminate that factor through an effective road safety engineering treatment and the crash is avoided altogether.



Figure 2. A simplified representation of the updated 'Integrated Safety Chain' model in Fitzharris et al (2022)

An effective case study site treatment

To target the likely contributing factors (the Phase 1 Threats to normal driving), the recommended treatments are:

- Replace the single sub-standard Give Way sign on the median island with a pair of larger Give Way signs, one on the left and one on the island. Include a square, contrast-colour backing board behind each. This will make the give way requirement and its position more obvious and help counter the distraction of the level crossing.
- Remove the 'Give Way sign Ahead' warning sign located 350 m before the intersection.
- 120 m before the intersection (i.e. 80 m before the level crossing), install a pair of larger 'Give Way sign Ahead' warning signs. Beneath them install a supplementary sign with the legend 'AFTER RAILWAY' or 'X-ROAD AFTER RAILWAY'. This will be the primary counter to the distraction of the level crossing.

With the crash problem eliminated at Phase 1 (see Figure 2) there is no need for the Phase 6 side road-activated 70 km/h signing on the highway. It should be decommissioned and used elsewhere, at a site where it can have good effect.

The future of crash investigation

Speed reduction has its place in the range of treatments available to reduce road trauma. But if the causes of crashes are not correctly identified, speed reduction is not guaranteed to reduce crash occurrences or crash severities. It simply becomes a general solution based on a theoretical "risk analysis based on network design attributes" and an "understanding of crash consequences", to quote Austroads (2021b, Table 2.2). This ignores the particular circumstances at each particular site. Taking this approach also engenders the view that crash information is only of marginal value, and assessing crash causes or contributing factors does not matter. Williamson (2021) has identified a significant hole in the Safe System: assuming road user errors and crashes are inevitable. Once that assumption is corrected, crash investigation (in order to identify crash causes) will need to be restored, as a vital road safety tool.

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Reducing WA's rural unzoned speed limit to achieve 2030 target

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Abstract

Over 77% of Western Australia 132,000km rural road are unsigned and subject to the unzoned 110km/h speed limit and are of a low standard for safe travel at 110 km/h. Research indicates a strong relationship between speed and the number of crashes, where higher speed is accompanied by a higher number of crashes and a higher degree of severity. This research has been lived out on Western Australian unzoned 110km/h rural roads, where on average, 127 people are killed or seriously injured each year. This project investigates the impact and benefits of reducing the unzoned 110km/h speed limit to 100km/h speed limit. The outcome of this project indicates that a reduction of the unzoned 110km/h speed limit to 100km/h speed limit will save 19 killed and serious injury crashes annually. Such a speed reduction policy will have little impact on travel time and can be implemented at very little cost.

Post on X

Reducing Western Australia's unzoned rural speed limit from 110km/h to 100km/h speed limit will have nonsignificant impact on the population and travel time but will save about 19 killed and serious injury crashes every year.

Introduction

Vehicle speed is one of the most significant parts of the Safe System and an important determinant of road crashes (Cascetta, et al., 2011). Speed affects both the number of crashes and injury severity (Elvik, et. al., 2009). Evidence from research indicate that a lower speed limit is correlated with fewer crashes (Warner & Åberg, 2008), and in environments where speed limits were not Safe System compliant, speed limit reductions have been effective in reducing the number of crashes and injury severity. It is therefore vital to set speed limits that are safe, consistent, and reasonable.

Speed limits can either be posted or unzoned (formerly referred to as default). An unzoned speed limit defines the maximum speed limit applicable to a non-speed zoned road. In Western Australia, majority of the over 132,000km rural road have unzoned 110km/h speed limit. Of this 132,000km of unzoned speed limit roads, 101,000 km are of low standard for safe travel at 110 km/h. This 110km/h low standard network has resulted in an average of 127 people fatality or seriously injured (FSI) each year. An internal assessment of these roads concluded that the state would require a massive \$100 billion to bring these roads to a standard that will align with the Safe System principles. This means, assuming using the entire Main Roads WA's total yearly budget, it would take the equivalent of 43 years to align these roads to the safe system principle.

Changing the current unzoned speed limit of 110 km/h on these low standard rural roads to 100km/h will cost the community little to no cost but will deliver a crash savings of about 19 deaths and serious injury per year. This will also stop the 'migration' of road users to low standard roads. This research investigates the benefits and need to change the 110km/h unzoned speed limit on Western Australian low standard rural road network to align with the safe system principle.

Approach to the Project

The project was approached in two stages. The first stage was to compare the magnitude of Western Australia's crash problem on unzoned rural roads with the crashes on unzoned rural speed limit roads across the various Australian State and Territories. The second stage was to investigate the impact of reducing the unzoned 110km/h speed limit to a 100km/h speed limit. Using Nilsson's power model, the impact on crashes was assessed. Two other impacts, namely the proportion of the population that could be affected if this speed limit reduction policy is implemented and the potential impact on travel time delays when such a policy is implemented were also investigated.

Outcome of the Work

Comparison Across Australia

A comparison of fatalities per 100,000 population by states/territories and based on the environment (metro/regional) was conducted. Apart from Northern Territory, no other State or Territory has an unzoned speed limit over 100km/h. The fatality rate (per 100,000) indicates that regional Western Australia has almost twice the rate of regional areas of all other states/territories apart from Northern Territory. Although Western Australia is the home for only 10% of Australian population and 11% of Australian vehicle km travelled, Western Australia has on the average 50% of Australian fatalities on 110km/h roads per year.



Figure 1: (left) a comparison of WA's fatalities with other Australian states/territories, (right) population that will be affected by a reduction in the speed limit

Impact on population

As of 30th June 2023, the population of Western Australia was about 2.88 million (ABS, 2023). Out of this number, approximately 80% of the population live in Perth/Peel regions and 18% in the South West corner. Only 2% of the population covers the remainder of Western Australia. Majority of these unzoned 110km/h rural low standard roads that will be affected by the speed limit reduction are mostly located outside the Perth/Peel regions and the South West corner of Western Australia.

Our analysis indicates that, although state roads make up 18% of the total most travel rural roads, they carry more than double the total traffic on these roads than local government roads which make up 82% of these most travelled rural roads. Also, considering that heavy vehicles contribute to 25% of all the rural travel, and that these vehicles are already subject to 100 km/h by their license, plus all the vehicles towing trailers and caravans, a change to the unzoned state speed limit would only affect a small proportion of the travelling public on a regular basis. That is approximately 95% of WA's population would not be affected on a regular basis if the unzoned 110km/h speed limit was changed to 100km/h.

Benefits or Impact on road safety/trauma

Using Nilsson's Power model, and Western Australian crash data from 2017-2021, the 95% confidence was estimated for the effect a change in speed limits will have on road trauma. A reduction of speed limit from the unzoned 110km/h to 100km/h will save ~19 FSI's per year, with an almost insignificant cost. If the reduction in the speed limit from 110km to 100km/h is extended to current posted 110km/h low standard speed zoned roads such as low volume roads, this will deliver an additional FSI reduction of ~13 per year. In all, Western Australia could save ~32 people from serious road trauma and death and reduce the pain that flows from this trauma. All these crash savings translate to a Benefit Cost Ratio of 1400:1 (5 years).

Impact on Travel Time

Analysis was done to understand the travel time difference between the current unzoned 110km/h and the proposed unzoned 100km/h between towns with a population of over 1,000 people (Figure 2) which accounts for 91% of the state's population. The result indicates that the maximum delay due to the reduction in speed limit with a new unzoned speed limit of 100km/h between a combination of towns with a population greater 1,000 will be 13 minutes. For example, a reduction in speed limit from 110km/h to 100km/h will only increase travel time from Dongarra to Kalgoorlie (a journey that takes about 8 hours 45 minutes) by 13 minutes. However, the average delay will be about 2 minutes. This is an interesting result for road safety as a reduction in speed limit will have very little impact on travel time, and in some instances these delays are unnoticeable.

Conclusion

The current unzoned 110km/h speed limit of rural Western Australian roads does not align with the safe system principle and is not in agreement with rural unzoned speed limit across Australia. A reduction of the unzoned 110km/h speed limit to 100km/h will save several lives at very little cost to the State. The unzoned speed limit reduction will impact on 5% of WA's population and very insignificant impact (delay) in travel time.

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Figure 2. Travel time difference between the current unzoned 110km/h and the proposed unzoned 100km/h

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Developing targeted safety performance indicators for rural networks

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Abstract

To assist in the development of local road controlling authority (RCA) road safety strategies and improvement programmes, interactive web maps have been developed to evaluate key road safety indicators for current and future years on the RCA's network. These tools provide a clear picture of existing and future safety performance of a network down to individual intersections and mid-block sections. It has been found that applying the same approach to say a predominantly higher volume urban network versus a lower volume rural network has resulted in lack of granularity in the results between present and future time periods for the more rural, remote networks. We will explore the variability in the road safety metrics and investigate how we can gain meaningful road safety outcomes for all RCAs so they can target deficient areas, including emerging locations, and reduce DSIs on their networks despite ever changing government policy and priorities.

Post on X

In this time of change, how can we help road controlling authorities with predominantly rural road networks demonstrate the need for safety investment.

Background

With the recently released draft of the New Zealand Government Policy Statement Land Transport 2024-34 (GPS) there are significant changes proposed with the Road to Zero road safety strategy being removed, yet no replacement vision for road safety has been offered in its place. This affects all transport asset owners with local road controlling authorities (RCAs) having either updated existing or prepared new road safety strategies for their transportation networks. Despite the ever changing political environment, trauma on our transport networks will continue to occur and our lower volume rural networks are most susceptible to under investment and lack of tangible road safety outcomes.

Looking ahead to 2030 and beyond, given that we have had local and international targets to eliminate road trauma by 2050, we need to develop tools that can assist with identifying emerging risk areas on our networks so RCAs can programme interventions to prevent trauma on our roads.

Implications

To complement RCA road safety strategies and developing their annual and long term plans, interactive web map tools have been developed so the RCA can view their road network and the factors which have an influence on road safety. Additionally, the information can be provided via an interactive dashboard for simplified and targeted analysis/metrics of road safety performance for current and future years. This assists with providing an evidence base for long term planning and investment funding applications.

The interactive web maps use spatial data which is collected from various sources including RAMM[™], together with the reported crash history extracted from NZ Transport Agency Waka Kotahi's Crash Analysis System (CAS) database. Current and future modelled year network volumes for mid-blocks and intersections were extracted from transportation models together with crash prediction models (NZ Transport Agency Waka Kotahi, 2016), for the individual elements on the networks broken into urban and rural mid-blocks and intersections. These data blocks were utilised to evaluate key road safety indicators for current and future years.

These tools have provided a clear picture of existing and future safety performance of a network down to individual intersections and mid-blocks and assists the RCAs to identify known and emerging areas where crash rates are increasing or emerging allowing them to programme their future safety projects in long term plans based upon this robust analysis.

The evaluated key road safety performance indicators ((NZ Transport Agency Waka Kotahi, 2011) and (NZ Transport Agency Waka Kotahi, 2013)) that are adjusted by future volume predictions include:

- Deaths and Serious injuries (DSIs)
- Personal Risk
- Collective Risk
- Infrastructure Risk Rating (IRR)

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia These safety performance indicators when applied to an urban network with higher volumes, provide a clear understanding of where the future crash pressures will be in relation to key intersections and along certain corridors, when presented in the web map. The safety performance can be seen graphically and tracked over stepped time block intervals from the existing year to future modelled years.

However, when the same approach is applied to lower volume rural networks, this has resulted in lack of granularity in the results between the time periods modelled for the safety performance measures. This is due to the lower crash reporting rates in remote rural areas, the low traffic volumes that these networks carry and the lower growth rates for the future years where there is minimal change in the land use. Therefore, instead of using mid-block and intersection volumes at each modelled time period, converting the volumes to vehicle kilometres travelled (VKT) to determine whether this provided a more pronounced difference in the resulting DSIs and other safety performance measures at the modelled years was tested.

Next Steps

With the expansion of peri-urban areas as a result of development growth, the tool can allow for the identification of key routes and intersections that either currently perform poorly, or with the predicted growth, will result in an unacceptable level of crash risk. In response to this, our team investigated modifying the tool to evaluate the networks using VKT to provide the additional level of detail at each modelled time period and to better identify emerging areas of crash risk for lower volume rural networks.

This presentation will discuss the variability in the road safety indicator results found and investigate how we can gain meaningful outcomes for all RCAs to reduce DSIs on their networks and work towards the future targets of eliminating road trauma. Examples will be provided together with a proposal to improve the granularity of the reporting for lower volume rural transportation networks and refine the interactive web map tool.

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Aligning Perspectives for Safer Shared Spaces

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Abstract

Achieving safe roads requires collaboration between different experts: researchers, practitioners, and policymakers. This workshop fosters dialogue between these groups, bridging the gap between theory and practice to enhance safety in *shared spaces*. We'll explore challenges to the existing car-centric network and the shift toward safely accommodating all road users. Drawing on a specific focus on cycling safety, participants from diverse backgrounds will share insights and collectively categorize different shared space designs based on safety levels. This workshop directly supports the conference theme "Target 2030: What's the pathway forward?" by offering a collaborative space to identify tangible actions and strategies for achieving safer, more sustainable roads especially for cyclists.

Post on X

Seeking a safer, sustainable road system? Discuss the transition from car-centric design to shared spaces, with a focus on cycling.

Introduction

Road safety demands a collaborative effort from researchers, practitioners, and policy makers. Each group brings essential insights, yet perspectives can differ: researchers may prioritize innovation and data, practitioners favor immediate action, and policymakers must balance short-term solutions with long-term visions, often within budgetary and public opinion constraints. A crucial step toward eliminating road deaths and injuries is aligning these diverse approaches to pave a sustainable path forward.

Similar to bringing people of different backgrounds with the same goal together, a *shared space* brings together different types of road users with the same goal of traveling from an origin to a destination. The existing car-centric road system has proven unsustainable and unsafe. A shift is needed away from automobile-oriented roads towards spaces safely accommodating all road users. However, spatial or cost restrictions prevent some locations from adopting this ideal design. A discussion is needed on how to align the goals of different road safety experts and transportation modes to maximize safety for everyone.

With a particular focus on cycling safety, all participants are engaged to discuss their backgrounds and their approach to improving road safety, in order to collectively categorise different cyclist-proving shared spaces into different safety levels.

Facilitator

Dr. Matin Nabavi Niaki has a background in transportation engineering and has worked as a researcher in the field of road safety over the past decade. She has lead other workshops such as one at the International Cycling Safety Conference 2023 in The Hague, where she led a similar discussion bringing together researchers and practitioners with different road safety experiences to communicate and align their ideas on improving safety for all road users by identifying the most important actions that need to be taken collectively.

Workshop leaders

Dr. Michael Nieuwesteeg leads Austroads' Road Safety & Design Program, focused on eliminating road deaths and serious injuries. His extensive background includes leading Victoria's Safe System Road Infrastructure Program, and managing road safety research for the Transport Accident Commission.

Dr. Lars Ekman is a road safety expert at the Swedish Transport Administration with special emphasis on road safety countermeasures. He has a background as researcher at Lund University. The research focused on road safety evaluation applied on pedestrians and bicyclists. Dr. Ekman has also for a long time been involved in international collaboration in the field of road safety both in Europe and worldwide.

Interactive Workshop format

- Presentation by Matin Nabavi Niaki on international shared space design and safety evaluation studies
- Participant introductions including online survey (how many participants are as researchers, practitioners, or policymakers; experience working on shared spaces
- Presentation by Lars Ekman on challenges of achieving "shared speed" on roadways, particularly when considering vulnerable road users. It will be argued that prioritising safety for all users, as envisioned by Vision Zero, may necessitate speeds slower than what is typically currently allowed in shared spaces.
- Interactive activity of 9 different shared space images. Audience will rank shared spaces from safest to least safe (example shown in Figure 1).
 - Group discussion of safety rankings including the challenges they faced and strategies they employed when collectively evaluating and prioritising safety of the shared spaces. Suggestions on how road safety experts can work together to apply the safety ranking criteria as real world solutions will be discussed.
- Participants will be encouraged to share contact details to further discuss the ways to collaboratively improve the safety of roads.
- Closing remarks by Matin Nabavi Niaki



Figure 1. Example from Luxembourg, Luxembourg (Google, 2022; Ville de Luxembourg, n.d.).

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Lessons from road user trajectories

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Abstract

The purpose of this research is to explore additional applications of road user trajectory data in safety evaluation that go beyond conventional safety assessments. This is demonstrated by cyclist trajectories collected from an experimental setup. The evaluation of vulnerable road user safety is often hampered by limited data. Advances in computer vision has allowed the extraction of road user trajectories from video, enabling the computation of Surrogate Measures of Safety (SMoS). While trajectories are widely used to calculate SMoS, few studies examine how different *trajectory patterns* impact safety. Our research extends the value of trajectory data beyond generalised safety calculations. By clustering similar cyclist trajectories, we reveal preferred cyclist movement patterns that offer insights into infrastructure safety. The comparison of speed and SMoS severity variations within each trajectory pattern, specific unsafe movements can be pinpointed. Ultimately, this movement-based safety evaluation enhances understanding of risk and informs road design improvements.

Post on X

Unlock deeper safety insights from your trajectory data! Use computer vision to isolate high-risk movement patterns and gain a nuanced understanding of road user behaviour to target the root causes.

Introduction

Vulnerable road users (VRUs), such as pedestrians and cyclists, are disproportionately affected by traffic accidents. Traditional safety evaluations are often limited by insufficient data, hindering proactive safety measures. The rise of computer vision techniques offers a powerful tool, enabling detailed analysis of traffic footage. Road users can be automatically detected, and their trajectories extracted, which is used to compute surrogate measures of safety (SMoS) such as time-to-collision (TTC). Many studies have used video data to extract trajectories and compute SMoS to evaluate safety (Bamrungwong & Kronprasert, 2022; Moylana et al., 2022). Although the general number and severity of SMoS provides insight into safety, the relationship between *trajectory patterns* and safety remains underexplored. This study addresses this gap by employing a trajectory clustering algorithm (also used in Nabavi-Niaki et al. (2019)) to group similar trajectory patterns and assess the speed and SMoS variation between different trajectory patterns. This method highlights the importance of using trajectory data to not only compute SMoS, but to also identify road user behaviour and specific safety issues. This method can be used to answer more detailed safety questions, for example, considering interactions between turning and through movements, are sharp turn trajectories leading to more conflicts?

Method

This methodology for video-based trajectory analysis and clustering begins with a preprocessing stage. To ensure accurate spatial measurements, video footage is undistorted, and 2D image coordinates are converted to real-world coordinates using appropriate scaling and calibration factors. Next, computer vision techniques are used for image processing to detect and extract individual road user trajectory. A clustering algorithm, such as the Longest Common Subsequence method (Morris & Trivedi, 2009), then calculates similarities between trajectories based on distance and a predefined similarity threshold (Mohamed & Saunier, 2015). Trajectories exhibiting sufficient similarity are grouped into *trajectory pattern* clusters, representing typical motion patterns. Finally, each trajectory pattern will indicate the proportion of road users following that movement, the mean speed of road users performing that movement, and the SMoS related to each movement. In Figure 1, an example of the results of this method can be seen. The top image shows a plot of all cyclist trajectories traveling through an experimental setup. The bottom image shows the trajectory patterns and the percentage of cyclists performing that movement.

Results

The results of applying this method are shown in Table 1. Looking at the movement behaviour of cyclists, 82% of them keep either to the right shown as trajectory C (41%) or to the left (41%) side of the lane as shown in trajectory A. 14% of cyclists travelled along the centre of the lane (trajectory B), and 3% changed lanes from the right side to the left side as they arrived at the intersection point, shown as trajectory D.

Looking at the speed of cyclists in each trajectory pattern, cyclists to the far left (trajectory A) have the highest speed, which is reasonable since they are less affected by the right-turning cyclists. The cyclists travelling in the centre and

closer to the right side of the lane (trajectories B and C) have a lower average speed. Finally, the speed is lowest for those changing lanes (trajectory D) possibly slowing down to avoid conflicts with right-turning cyclists.



Figure 1. Plot of all cyclist trajectories



Figure 2. Plot of trajectory patterns and percentage of cyclists belonging to that movement

Direction	Trajectory	Number and percen per trajectory patter	tage of cyclists rn	Mean speed per trajectory pattern	Rate of unsafe interactions per
	pattern	Number	Percentage	(km/h)	trajectory pattern
Through	A	149	41%	12.0	1.4
cyclists	В	52	14%	9.5	3.9
	C	149	41%	9.1	1.0
	D	12	3%	7.9	41.7
Turning	E	41	16%	11.4	7.3
cyclists	F	46	18%	11.7	15.2
	G	171	66%	10.3	-

Table 1. Cyclist movements

The safety summary provides interesting insight. Cyclists keeping to the right or left (trajectory pattern A and B) have a lower rate of unsafe interactions (TTC below 1.5s). Cyclists travelling in the centre of the lane have slightly higher levels of unsafety, while the most unsafe interactions were observed with trajectory pattern D where the cyclists are changing lanes, possibly to avoid a collision with right-turning cyclists. This knowledge is crucial in improving the safety, as it indicates exactly which movement should be changed/eliminated. Solution that come from this knowledge will nudge cyclists to perform the safer movements.

Looking at the right-turning cyclist behaviour, cyclists made either a wide turn, a sharp turn, or a manoeuvre in between. Cyclists performing a sharp right turn did not have any conflicts with through-travelling cyclists. Cyclists making a wider turn or turning in the middle of the lane had more conflicts with through-cyclists.

It is interesting to see that the safest movements were the ones most performed by road users (82% through-cyclists, and 66% right-turning cyclists), which may indicate that cyclists consciously or subconsciously follow the safest movement. The trajectory patterns that were most unsafe indicated to us that a small proportion of cyclists will make manoeuvres that are likely to lead to a crash. The focus can now be on eliminating those unsafe manoeuvres and restricting them from making the unsafe movement.

Benefits to road safety

This work offers significant benefits to road safety by transforming how we understand and address risks. By analysing road user trajectories, it uncovers the specific movement patterns that are most likely to lead to crashes. This allows us to go beyond counting near-misses and directly target the behaviours and situations that contribute to unsafe conditions. The result is a proactive, data-driven approach that supports targeted infrastructure improvements designed to prevent conflict-inducing movements. This methodology has a particular advantage for vulnerable road users, as it offers crucial insights into their specific risks. Ultimately, this work paves the way for road environments that are designed to protect all road users, leading to a reduction in crashes and serious injuries.

Implications for policy and practice

This work has significant implications for policy and practice in road safety. It calls for a shift away from reactive measures that address crashes after the fact, and towards a proactive approach focused on preventing incidents. By understanding high-risk movement patterns, policymakers can develop targeted regulations and guidelines that promote safer road user behaviour. Practitioners can leverage this knowledge to design infrastructure that physically discourages unsafe movements while encouraging patterns that enhance safety. Furthermore, trajectory data can be used to evaluate the effectiveness of existing infrastructure and prioritize areas for improvement. This methodology can help align investment with demonstrated safety needs, optimizing resource allocation and leading to measurable reductions in crashes and injuries.

Conclusion

This study addresses the limitations of traditional road safety assessments by leveraging the power of computer vision and trajectory analysis. The applied clustering algorithm reveals common movement patterns, providing insights beyond mere conflict counts. The results demonstrate that specific movements, such as lane changes or centre-lane turns, are more likely to lead to safety risks. By understanding these high-risk behaviours, this work has significant implications for the design of safer infrastructure. It promotes a targeted, data-driven approach that can proactively prevent crashes and protect the most vulnerable on our roads.

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Route-level cycling safety: a sustainable safety approach

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Abstract

This paper addresses a gap in cycling safety assessments: the lack of emphasis on route-level safety evaluations. Existing literature focuses heavily on network- and road-level studies. To address this deficiency, we propose using the Dutch principles of Sustainable Safety as a foundation for creating route-level safety indicators for cyclists. Sustainable Safety's *Functionality* and *(Bio)mechanics* principles are particularly relevant in designing safe cycling routes. Detailed functional requirements are derived based on these principles and translated into seven core safety evaluation rules, plus an additional rule to consider the protection of vulnerable road users (pedestrians, children, elderly cyclists) from high volumes of high-speed, heavy bicycle traffic. This study offers a novel framework to enhance cycling safety assessments, ensuring safer route choices for cyclists.

Post on X

New research addresses a critical gap in cycling safety assessments – the route-level perspective. Sustainable Safety principles offer a framework for safer route evaluation.

Introduction

Cycling offers numerous benefits, ranging from improved personal health and reduced environmental impact to decreased traffic congestion. However, safety concerns remain a significant barrier to widespread adoption. Cycling safety evaluations can be carried out at three different levels: network, route, and road. Comprehensive safety assessments require understanding and improving safety at all three levels. Current research focuses heavily on network-wide cycling safety analyses (Kamel & Sayed, 2020, Zhang et al., 2015, Callister & Lowry, 2013, Winters et al. 2013) and safety assessments of individual road sections or intersections (Kaplan, Vavatsoulas, & Prato 2014, Osama & Sayed, 2016, Teschke et al. 2012). This emphasis leaves a crucial gap: the route-level perspective. Cyclists rarely travel solely on one road segment or through a single intersection; their journeys involve a sequence of connected infrastructure elements. Evaluating the safety and comfort of an entire route offers a more practical and user-centric approach for planning, design, and improvements. Unfortunately, much of the existing literature labeled as "route safety" does not truly address the safety of routes as a whole. Therefore, a clear and systematic framework for defining and evaluating cycling route safety is crucial. Although network- and road-level evaluations are valuable, route-level focuses on elements such as the time and distance the cyclists travel as well as the level of separation from traffic throughout their entire journey, which affect their level of risk. This study addresses this critical gap by applying the Sustainable Safety approach to develop a comprehensive set of cyclist route-level safety indicators. Sustainable Safety is a Dutch road design approach, focused on preventing crashes entirely, or if they occur, minimizing the severity of injuries by adapting road infrastructure to the limits and vulnerabilities of human road users. The Sustainable Safety principles are categorized into Functionality, (Bio)mechanics, Psychology, Responsibility, and Learning and Innovating. These indicators offer a structured approach, enabling a more holistic and proactive approach to ensuring cyclists' safety.

Method

To address the gap in route-level cycling safety knowledge, we can utilize Sustainable Safety principles. From a Sustainable Safety perspective *Functionality* and *(Bio)mechanics* are the most important principles for the safety of cycling routes and are defined as (SWOV, 2018):

- <u>Functionality</u>: Road sections and intersections have only one function for all modes of transport (monofunctionality): a traffic *flow function* or an *exchange function*. The road network shows a hierarchical structure of these functions.
- (Bio)mechanics: Traffic flows and transport modes are compatible with respect to speed, direction, mass, size, and degree of protection. This is supported by the design of the road, the road environment, the vehicle, and, where necessary, additional protective devices. For two-wheeled modes, it is important that the road and the road environment contribute to the stability of the rider.

For the first principle, the road *Functionality* are traditionally defined for cars (access roads, distributor roads and through roads), however, these functions can also be applied to cycling routes. The two functions related to cyclists are flow and exchange. The flow function is accommodated through main roads and dedicated cycling facilities where cyclists can have higher speeds. The exchange function can be assigned to local roads where cyclists can have lower

speeds and perform different movements (Weijermars, 2013). For the second principle, the difference in mass and speed between bicycles and motorized vehicles is clear. Similarly, bicycles and other users of bicycle facilities may also differ in speed, mass, and direction. The principle of separating heavy and fast bicycle traffic from slower and light bicycle traffic may mean that different types of cyclists, separated based on speed and/or mass, must use different types of bicycle facilities.

Results

To address the limited research on route-level cycling safety, our study aimed to define route-level indicators based on the mentioned Sustainable Safety principles, which have been defined mainly for cars. The following rules are proposed to evaluate the safety of a cycling route:

- 1. The route travel distance must be as short as possible while avoiding hills and steep gradients:
 - The shorter the distance of a route, the less risk a cyclist is exposed to.
- 2. Travel time as short as possible:
- Similar to travel distance.Low intersection density, especially concerning intersections with higher speeds and high traffic volume roads:
 - The number of intersections on a route should be limited as they are seen as potential conflict points for cyclists. Especially (at-grade) intersections with distributor/arterial roads should be avoided as much as possible as they are the least safe for cyclists. Moreover, when two routes are equally safe based on other requirements, the following order of intersection types with distributor roads should be followed to choose the safest route:
 - a) Well designed and regulated roundabouts are preferred over priority or signalised intersections.
 - b) Priority intersections are preferred over intersections with traffic lights.
 - c) Signalised intersections are the least preferred. This indicator is justified by the literature on the unsafety of intersections and safety of roundabouts amongst intersection types (Osama & Sayed, 2016).
- 4. Wherever possible, cyclists should follow exclusive bicycle tracks:
 - Exclusive bicycle tracks are only accessible for cyclists. This makes them safer compared to roads shared with motor vehicles (SWOV, 2018).
- 5. Wherever possible, the use of 50km/h distributor roads without separate bicycle tracks should be avoided:
 - When speeds are higher than 30km/h, conflicts between motorised traffic and cyclists should be prevented. Therefore, roads with a 50 km/h speed limit or higher should have a separated bicycle track. This is justified by literature on the safety of bicycle tracks (Kullgren et al., 2019; van Petegem, Schepers & Wijlhuizen, 2021).
- 6. As few left-turns (against oncoming traffic i.e. in right-side driving countries) in as possible:
 - Left turns at intersections are known to be a risky manoeuvre for cyclists. They should therefore be as few as possible along a route (Kaplan, Vavatsoulas & Prato, 2014).
- 7. As few transitions and discontinuities as possible:
 - Transitions between and discontinuities of cycling infrastructure led to increased risk of having a crash and result in increased levels of discomfort for the cyclist (Nabavi Niaki, Saunier & Miranda-Moreno, 2018). Transitions and discontinuities should therefore be avoided as much as possible.

As a potential 8th indicator, in addition to the need to protect cyclists from motorised vehicles, it may also be desired to protect vulnerable road users from large volumes of fast-flowing bicycle through-traffic and other potential users of bicycle facilities. Vulnerable road users in this respect include pedestrians and vulnerable cyclists (children and seniors on bicycles). This is related to the *(Bio)mechanics* principle of Sustainable Safety as applied to bicycle traffic. An additional indicator dealing with this issue is therefore:

- 8. Wherever possible, fast-flowing and possibly heavy bicycle through-traffic should be separated from slow speed and vulnerable bicycle traffic:
 - This additional indicator aims to minimise serious conflicts between the most vulnerable road users and potentially high speed and/or heavy two-wheelers. It's important to consider traffic volume when designing cycling infrastructure. High-volume routes, particularly those connecting major origins and destinations, may benefit from separation from other cycling paths. Ideally, a dedicated corridor, such as an exclusive bicycle track, could be implemented to accommodate high-speed cycling and heavy traffic flow. This would help to prioritize safety for vulnerable cyclists, such as children and older adults, who might primarily use cycling paths in residential areas. Separating high-volume through-traffic from these areas is especially important during peak hours. In situations where separation isn't feasible, the design of the cycling facilities should prioritize the safe interaction between different traffic types.

Since route analysis is comparative, and is usually carried out in comparison to shortest-route, or preferred route, these indicators will be used to compare the level of route safety. This means that the shortest route (time and distance) should be the same as the safest route for cyclists: least number of intersections, travel the entire route (as much as possible) on an exclusive bicycle track, lowest speed limit (below 50 km/h), least number of left-turns to be taken from

origin to destination, least number of transitions/discontinuities, and most homogeneous cycling traffic (speed and flow), compared to all other possible routes.

Benefits to road safety

Although network- and road-level safety evaluations are valuable, the choice a cyclist makes to follow a route is partly based on the level of safety that route provides. This highlights the importance of carrying out route-level studies to identify origin-destination pairs and evaluate the level of safety they provide based on the proposed indicators. The benefits of this work to road safety can be summarized as follows:

- **Reduced crashes and injuries:** By creating route-level safety indicators based on Sustainable Safety, routes can be designed or modified to minimize conflict points between cyclists and motorized vehicles. This directly translates into a reduction in crashes and the severity of injuries for cyclists.
- **Increased cyclist confidence:** Knowing that safety considerations have gone into route selection gives cyclists greater peace of mind. This encourages more people to consider cycling for commuting and leisure, promoting healthier lifestyles and reducing traffic congestion.
- **Improved route efficiency:** This work prioritizes shorter, more direct routes and minimizes potential hazards. This translates to faster commutes and less exposure to risk for cyclists.
- **Guidance for infrastructure:** The indicators developed here provide city planners and transportation engineers with concrete guidelines on how to prioritize safety when designing/upgrading cycling routes.
- Focus on vulnerable cyclists: The potential 8th indicator specifically addresses the safety of children, seniors, and other cyclists who may be more vulnerable to collisions with fast-moving or heavier bicycles. This creates a safer environment for everyone using cycling infrastructure.

This work contributes to a more holistic approach to road safety. Focusing on the route-level helps ensure cyclists have safe, efficient, and comfortable options, making cycling a more attractive transportation mode for everyone.

Implications for policy

The policy implications include improving cycling safety and promoting cycling as a sustainable mode. Additionally:

- **Funding Allocation:** The safety indicators could be used to justify increased funding for cycling infrastructure projects. This could include creating new routes or improving existing ones.
- **Revision of Infrastructure Standards:** Existing design standards for roads and cycling facilities may need to be revised based on this research. For example, policies could be put in place that stipulate the need for dedicated bicycle tracks along roads with higher speed limits instead of just painted cycle lanes.
- Network Planning Guidance: This work can inform the creation of cycling network plans. Policies could encourage a focus on route-level design in addition to overall network connectivity, ensuring that every route within the network prioritizes cyclist safety.
- **Data Collection:** This work highlights the need for better data collection on cycling routes and cyclist behaviour. Policies could support the development of more sophisticated data systems to track route usage, crashes, and near-misses, allowing for continuous evaluation and improvement of cycling safety.

In general, the policy implications of this work centre around creating a regulatory and funding environment that prioritizes cyclist safety on specific routes. This will enhance the overall network and make cycling a more viable and attractive choice for transportation.

Conclusions

This work fills a gap in cyclist route-safety studies and demonstrates the value of a route-level perspective in cycling safety assessments. By applying Sustainable Safety's principles of *Functionality* and *(Bio)mechanics*, the indicators help in evaluating and improving route safety for cyclists. The seven core rules, along with the potential eighth rule, provide a framework for planners, cyclists, and policymakers. Prioritizing these indicators in future safety studies and infrastructure design will result in safer, more efficient, and more appealing cycling routes. This, in turn, has the potential to increase cycling as a sustainable transportation mode, promoting healthier lifestyles, reducing traffic congestion, and improving overall road safety for all users.

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Identifying six bicycle journey types for a path forward

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Abstract

What is a bicycle trip? Some research indicates that we might classify them as either transport or recreation, but the nuances in different trips – and the impact of those nuances – have a profound impact on road safety. By carrying out an exploratory literature review, this research synthesises sources from scientific literature and the popular press to determine six interrelated bicycle trip purposes. Trips for recreation, commuting, tasks and errands, passenger, work and sport are identified as having unique characteristics and impact on road safety and are presented in a typology. Trip characteristics of interest to road safety include vehicle type, application of the road rules, matters of choice for example time of day, speed, distraction and exposure time. The typology provides an organised method of asking whether a road safety scenario has been considered with different users in mind. This extended abstract is based on previously published work (Napper 2023).

Post on X

If we understand what people are doing on bicycles, we have a better chance at making cycling safer. Recreation, commuting, tasks and errands, passenger, work and sport trips are carried out in diverse ways by diverse cyclists. They use different bikes and even the road rules apply differently depending on what you're doing.

Introduction

Bicycles are used for a variety of trips. They are versatile, range from cheap to expensive, can be repaired and adapted to different uses by their owner (Napper 2020), and provide a range of benefits to society such as low emissions and opportunities for exercise (Garrard et al. 2012, Massink et al. 2011). Although everyday experience may tell us that the bicycle is used for a variety of purposes, a systematic understanding of this variety is lacking in mobility research. Trip purposes, such as shopping, are identified in the literature as well as popular guides on "how to" cycle, but are not the subject of analysis. Rather, they are used to illustrate examples. Much of cycling research relies on classification by fear (Dill and McNeil 2013), and while useful this may not help us to understand that the same rider may have different fears when undertaking different trips.

In this research I propose to organise information: much like Professor Medeleev's periodic table of 1869. While the impact of a cycling typology will not be as great as the periodic table, it is hoped that this pure research will facilitate better understanding and therefore give us a new approach to information. In the case of road safety, a better understanding of the purposes someone is cycling for may provide us with rich detail on factors such as speed, exposure, time of day, choice (or lack thereof), vehicle types, and the demographics of riders.

Method

This research is carried out in two stages. First is an exploratory literature review, in itself a response to an initial literature search that returned few results. A systematic search returned so few results as to be unworkable, with the resulting outcome indicating that trip purposes are not studied as a subject in their own right – rather they are used to illustrate other studies. As an alternative to this, a snowballing approach was used to mine references from highly cited papers on cycling, as well as highly cited popular guidebooks on cycling.

Taking the results from the exploratory literature review I synthesised them into categories, aiming to balance the need for precision on one hand, while avoiding gross generalisation on the other. In doing so I formed six categories as shown in table 1. I then organised the six categories into adjacent places on a wheel to illustrate close relationships between some, for example sport and recreation.

Results

Table 1 shows the categories found in the review and the synthesis into six categories. Each of the trip types contains characteristics which will affect the road user's own safety.

Recreation trips are undertaken for pleasure, and make up a large component of cycling in Australia (Austroads 2019) – where relatively few trips are undertaken by bike overall. Some key characteristics of recreation are that the trip is discretionary: there are few dependent factors on the trip happening, and at a particular time. If the conditions are not ideal for cycling, such as wet or dark, the tri may be deferred. Similarly, discretion may be exercised over route – if a rider feels that one route is more appropriate or safe they may choose it over an alternative. Recreation includes trips for

purposes of play which is a method of learning to cycle. People of all ages and abilities would be found undertaking recreational trips.

Commuting concerns the journey to work or study. Different to recreation, these trips can be more frequent, and connect an origin with a destination in a time-bound fashion. While the rider may exercise some choice over route and to some extent timing, it isn't as flexible or adaptable as other trip purposes. This means that riders may find themselves in less-than-ideal situations such as cycling in the dark, on poorly equipped roads, or in inclement weather and poor visibility. Further to this there may be social or workplace ideals on the riders clothing, a factor that interacts with visibility.

Journey types from literature	Proposed Aggregate Journey Type
Social, recreation	Recreation
Exercise	
Dining out	
Journey to work	Commute
School/Education	
Utilitarian or transportation	
Carrying cargo	Tasks & errands
Shopping	
Personal business	
Dining out	
Carrying passengers	Passenger
Carrying Cargo	Work
Competitive sport	Sport

Table 1	1. Journey	types fo	und in t	he literature,	and aggregation.

Tasks and errands contains many trip types of varying length and purpose. Trips to the doctor, to shops, social engagements or events fall into this category, and it excludes trips undertaken in the line of work, which are allocated to that separate category. The Tasks and errands category includes the movement of people and objects over short and long distances. It reminds us that there may be a trip of only one kilometre with five stops on the way, highlighting the increased proportion of parking tasks in that trip. Walking and riding around parking facilities shared with cars reversing means that a rider will need to be aware of situations with poor visibility.

Passenger trips involve carrying or chaperoning other people – often children, and inclusive of bicycles designed to carry passengers in wheelchairs or onboard a tandem. Bicycles designed for taking passengers can be modified from more basic bikes, or purpose designed "cargo bikes" such as longer vehicles. The Australian Model Road Rules allow an adult to ride on a footpath when they are accompanying children or carrying a passenger in a "baby seat", however interestingly the same person riding home from dropping a child at school would not be allowed on the footpath in most jurisdictions.



Figure 1. The typology Source: Authors artwork Work trips are those undertaken in one's duties as a contractor or employee. They include food delivery riders, couriers, as well as people riding a bicycle to an appointment such as a meeting. Food delivery work is undertaken on bikes and greatly increases the riders exposure time on the road – as well as placing them under time pressure with little flexibility in route or conditions. A professional athlete in training is carrying out their work, which may involve riding for a certain time at a certain power level, maybe in a group.

Sport trips are similar to work in some ways if the rider is a professional athlete, and similar to recreational in others. Recreational riders may engage in amateur sport over a closed route in an organised event, but may also undertake competitive sport on an informal basis with other riders. The professional athlete will reach high speeds in sport trips and the design of roads, paths and other "ways" should account for this, as well as group size.

Organising the trip types in a wheel suggests adjacency between some of the trip purposes, and indeed it is possible that trips may include more than one purpose. In a similar way to the Periodic Table's grouping of elements with common characteristics, it may be helpful to practitioners to consider the adjacent journey type when considering road safety for only one purpose.

Benefits to road safety

The literature review and resulting typology provide stronger representation for different bicycle trips than a binary of sport or transport. For road safety this means a better understanding of the factors leading to crashes. Designing better roads, road rules and vehicles for these purposes could help to reduce fatal and serious injury. For example, if we understand that a food delivery rider is working late nights in the rain because there are opportunities for work at that time, and that they've been on the road for many hours, we might have a stronger case to intersections with cycle lanes to separate riders from large motor vehicles when we know they're fatigued, have less traction, and are under time pressure. Likewise the recreational rider may be very young or an infrequent cyclist and therefore require a wider path as they (re)learn the interaction between balance and steering (CROW 2010).

Implications for policy and practice

If policymakers and practitioners, researchers and even bicycle shop employees understand the different types of trip purpose possible by bike, and set about their work with consideration of this diversity, the implication for road safety could be that we take a strong step towards a safer system for cycling in Australasia.

Conclusions

Through this research I've developed the cycling typology to provide the practitioner with six journey types. The typology provides a rich, and additional way of understanding why people ride bicycles and the conditions and circumstances they find themselves in. Further to this, it illustrates how one person may be many different types of rider depending on their needs, route, and variables such as skill, passengers, cargo or simply if they're in a rush.

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ROBBIE NAPPER

What is a bicycle trip? Some research indicates that we might classify them as either transport or recreation, but the nuances in different trips – and the impact of those nuances – have a profound impact on road safety.

By carrying out an exploratory literature review, this research synthesises sources from scientific literature and the popular press to determine six interrelated bicycle trip purposes.

Trips for recreation, commuting, tasks and errands, passenger, work and sport are identified as having unique characteristics and impact on road safety and are presented in a typology. Trip characteristics of interest to road safety include vehicle type, application of the road rules, matters of choice for example time of day, speed, distraction and exposure time. The typology provides an organised method of asking whether a road safety scenario has been considered with different users in mind.

This extended abstract is based on previously published work (Napper 2023).



Learner Driver First Aid eLearning Program: A pre-post evaluation

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Abstract

Mandatory first aid training for learner drivers has been introduced in some European countries but no such requirements are in effect in Australia. This study delivered and evaluated a pilot first aid eLearning program for learner drivers in Australia. A total of 103 participants responded to an online survey immediately before and two weeks after completing the program. Participants showed significant pre-post program improvements in first aid self-efficacy (SE) and first aid knowledge; however, there were no significant changes in first aid attitudes. The findings provide preliminary support for the efficacy of online first aid training for Australian learner drivers.

Post

This study delivered and evaluated a pilot first aid eLearning program for learner drivers in Australia. The findings provide preliminary support for the efficacy of online first aid training for Australian learner drivers.

Background

Approximately 1.35 million people worldwide are killed in road accidents every year. Bystanders play an important role in responding to road incidents prior to the arrival of emergency services (Eftekhari et al., 2019). For example, medical intervention by a first aid trained person in the immediate period following a road crash can prevent death and lessen the impact of injuries (e.g., Arbon et al., 2011) and first aid training can increase bystander willingness and confidence to intervene (e.g., Larsson et al., 2002). Unfortunately, however, many people lack the skills and training to adequately respond in emergencies (e.g., Heard et al., 2020). Subsequently, the World Health Organization emphasised the importance of training drivers in first aid (Racioppi et al., 2004). First aid training can improve road user first aid knowledge, though few studies have focused on learner drivers specifically (Ufashingabire et al., 2023). Mandatory first aid training for learner drivers has been introduced in some European countries. However, no Australian jurisdiction mandates or delivers learner driver first aid training. To address this, St John Ambulance Australia developed the Learner Driver First Aid program (<u>https://driverfirstaid.org.au</u>), a free 30-minute online course teaching first aid skills to be applied before emergency services arrive. The current pilot study aimed to deliver and evaluate the Learner Driver First Aid program in Australia. Evaluation of the program included assessment of first aid knowledge, self efficacy, and attitudes. It was hypothesised that participants would show pre- to post-program improvements in first aid knowledge, SE, and attitudes.

Method

A total of 103 participants responded to an online survey immediately before and two weeks after completing the program. Australian residents with a current learner class driving license (n=103) were recruited for this study. Approximately half were women (52.4%), drove in the city (49.5%), and had prior first aid training (51.5%). They ranged between 16 and 48 years of age (M = 20.57, SD = 5.02), had obtained their learner license between 1 and 84 months previously (M = 13.59, SD = 17.41), and drove between 0 and 40 hours per week (M = 8.21; SD = 7.31). Participants were recruited through social media advertisements, the university Participate in Research webpage, and/ or driving schools. Participants were offered a \$50 e-voucher following completion of the study.

Self-efficacy (SE) was measured using a 5-item Self Efficacy scale (Bandura, 2006) to assess participants' confidence to perform first aid skills taught in the program. Participants rated how confident they were to a) provide first aid, b) provide basic life support, c) place someone in the recovery position, d) manage external injuries, and e) manage internal bleeding on a Likert scale ranging from 0 (cannot do at all) to 100 (highly certain can do). Scores were averaged and higher scores indicated higher SE.

Positive first aid attitudes were measured using a 4-item scale (Duut et al., 2022) with items adapted to suit the roadside context. Participants rated their degree of agreement with each statement on a 5-point Likert scale ranging from 0 (strongly disagree) to 5 (strongly agree). Scores were averaged and higher scores indicated more positive first aid attitudes.

A 10-item multiple choice quiz was created to assess first aid knowledge. Items were based on prior research and the Australian and New Zealand Committee on Resuscitation (ANZCOR) first aid guidelines (Australian and New Zealand Committee on Resuscitation, 2023). Only questions relevant to program content were included and questions were

modified to ensure they did not replicate questions asked within the program. Responses were rated as correct (1 point) or incorrect (0 points) and points were summed to get an overall knowledge score ranging from 0-10.

Results

A series of paired samples t-tests assessed whether participants showed pre- to post-program improvements in their first aid SE, knowledge, and attitudes. As shown in Table 1 and Figures 1-3, paired samples t-tests showed significant improvements in total first aid SE and first aid knowledge, but not in first aid attitudes. Note. Error bars represent standard error.

Table 1. Paired sample t-tests showing change in first aid SE, first aid attitudes, and first aid knowledge

Variable/ item	T1 M	T2 M	t	df	95% CI	Р	d
Self efficacy.	44.76	71.83	-13.80	102	[-30.96, -	<.001*	0.95
·					23.18]		
First aid attitudes	4.33	4.43	-2.24	102	[-0.20, -	.028	0.19
					0.01]		
First aid knowledge.	8.45	9.33	-6.37	97	[-1.15, -	<.001*	0.64
e					0.601		

Note. T1 = time 1 (pre-intervention). T2 = time 2 (post-intervention). * survived Bonferroni correction (.05/12 = .004).



Figure 1: Average Pre- and Post-Intervention Total First Aid SE Scores



Figure 2: Average Pre- and Post-Intervention First Aid Knowledge Scores



Figure 3: Average Pre- and Post-Intervention First Attitude Scores

Conclusion

The Learner Driver First Aid program is the first of its kind in Australia and this pilot program provides preliminary evidence for its effectiveness in significantly improving learner driver first aid SE and first aid knowledge. The current study provides preliminary evidence that knowledge can be retained for up to two weeks and that online delivery can be an effective method of knowledge dissemination. Contrary to previous research (e.g., Breckwoldt et al., 2015), the current study did not find significant post-program improvements in first aid attitudes. However, there was evidence of a ceiling effect as participants had high attitude scores at baseline making it difficult to detect improvements at follow-up. It is suggested the program be further refined and rolled out on a larger scale to the Australian public. Future research should use more rigorous designs to further explore the effect of first aid training on learner driver first aid knowledge, skills, and willingness to intervene at roadside accidents, and subsequently explore whether first aid training for learner drivers can reduce road accident mortality rates.

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Safety benefits of new roads (bypasses)

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Abstract

Improving road safety is a key reason for building new roads but what difference do these new roads actually make? The benefits of retrofitting existing roads with standard safety interventions is well documented¹ however this project is the first known study in New Zealand to quantify the benefits of new roads while retaining the old. Eight bypasses constructed from 2009 to 2016 were analysed. "Areas of interest" for each were considered with before (old road) and after (old road and new road) crash statistics compared to the surrounding district (control area). The study found the bypasses have reduced injury crashes by 22.5%, resulting in a 29% reduction in minor injuries and a 37% reduction in deaths and serious injuries (DSIs). Most notably, the largest reduction in DSIs were from loss of control and head-on crashes both at curves (57%) and straights (40%).

Post on X

Safety Benefits of New Roads (Bypasses) indicates new roads (bypasses) result in significant reductions in head on, loss of control and crossing/turning type crashes when compared to the pre-bypass road network.

Introduction

The purpose of this study was to investigate eight new bypasses constructed in New Zealand between January 2009 and December 2016 to understand the safety benefits that may have resulted from investing in these new roads. The bypasses investigated were:

- Northern Gateway (Auckland)
 Ruby Bay (Tasman)
 East Taupo (Waikato)

- 4. Tauranga Eastern Link (Western Bay of Plenty)
- 5. MacKays to Peka Peka (Wellington)
- 6. Te Rapa & Ngāruawāhia (Waikato)
- 7. Cambridge (Waikato).

The bypasses were all designed with high-speed alignments and have posted speed limits of 100km/h or 110km/h. Apart from Ruby Bay and East Taupo, a median barrier was provided for all locations. Some bypasses were multi-lane with additional side barriers present. Traffic volumes varied amongst the sites and surrounding districts. The analysis involved:

- An investigation of the crash and injury outcomes resulting from each of the bypasses. •
- A separate analysis of DSI outcomes. •
- A comparison of the crash data trend from each of the bypasses against the wider district (control area). •
- An investigation of the types of crash and resulting injury reduction. •

Method

The study method involved:

- Identifying an area of interest containing only the new and old roads (see Figure 1 for a depiction of the study method used).
- Extracting data from the Waka Kotahi Crash Analysis System (CAS) for the area of interest and surrounding • district, before and after the provision of the bypass.
- Observing the change in crashes within the area of interest relative to the surrounding district. The surrounding district was the control area for each bypass.

Excluding data from 2020-2021 (impacted by national/regional lockdowns resulting from the COVID-19 pandemic) and 2022 (impacted by CAS processing times). The exception being MacKays to Peka Peka (Wellington) where two analyses were undertaken due to the limited after period if COVID periods were excluded.

Results

In Figures 2, 3 and 4, a ratio of less than 1 indicates there are fewer crashes or crash outcomes following the provision of the bypass. Figure 2 shows that in all cases, the bypass has resulted in an injury crash reduction relative to the surrounding district. Figure 3 shows that in all cases, the bypass resulted in an injury reduction relative to the surrounding district.

¹Waka Kotahi Standard Safety Intervention Toolkit - https://www.nzta.govt.nz/assets/resources/standard-safetyintervention-toolkit/standard-safety-intervention-toolkit.pdf

Extended Abstract (Practitioner)



Figure 1. Depiction of the Area of Interest and Surrounding District



Figure 2. Ratio After/Before Injury Crashes (Total for all sites (excluding 2020-2021): Surrounding District n=36,944 After/38,822 Before); Area of Interest n=645 After/832Before)



Figure 3. Ratio After/Before Injuries (Total for all sites (excluding 2020-2021): Surrounding District n=49,541 After/48,847 Before); Area of Interest n=872 After/1,231 Before)

Figure 4 shows that apart from East Taupo, the bypass resulted in an even greater reduction in DSIs relative to the surrounding district. Because the reductions seen in Figures 3 and 4 is greater than the reductions seen in Figure 2, we can also conclude (following provision of a bypass), there are:

- Fewer injuries per injury crash.
- Fewer DSIs per injury crash.

Figure 5 shows the DSI reduction by crash movement type.

Extended Abstract (Practitioner)

Newsome



Figure 4. Ratio After/Before DSIs (Total for all sites (excluding 2020-2021): Surrounding District n=7,953 After/8,372 Before); Area of Interest n=153 After/244 Before)



Figure 5. Deaths and Serious Injuries by Movement Type

Limitations

Traffic volume was not measured in this study. However, the bypasses are generally located in areas of rapid growth. Therefore, the safety benefits are likely to be conservative, as there is likely to be higher volumes (resulting in more crashes) in the after period than in the before period. Other than the consideration of trends observed in the Area of Interest relative to the Surrounding District, this study has not adjusted the crash rates for growth.

There is a base level of crashes (owing to local trips on the old road) that are unaffected by the provision of the new road (i.e. these trips would continue to be made on the old road regardless of the provision of the new road). These should be the same in the before and after periods meaning the absolute reduction in crashes and injuries within the area of interest can be directly attributed to the new road (assuming no other safety improvements were carried out on the old road). The percent reduction is likely to have been understated because of this base level of crashes.

Conclusions

- The study concluded that the construction of the new bypasses has resulted in:A 17.6% relative reduction and 22.5% absolute reduction in injury crashes for all sites (excluding 2020-2021). A chi-square test of independence confirmed the relation between injuries crashes and provision of bypass as being significant, X2 (1, N = 77,243) = 15.0308, p < .001.
- A 30.6% relative reduction and 29.2% absolute reduction in injuries for all sites (excluding 2020-2021). A chisquare test of independence confirmed the relation between injuries sustained and provision of bypass as being significant, X2 (1, N = 100,491) = 65.0636, p < .001.
- A 32.3% relative reduction and 37.3% absolute reduction in deaths and serious injuries for all sites (excluding 2020-2021). A chi-square test of independence confirmed the relation between injuries sustained and provision of bypass as being significant, X2 (1, N = 16,722) = 16.0737, p < .001.
- Reductions in injury crashes, total injuries sustained, and deaths and serious injuries sustained within the area of interest for the main movement groups.
- Relative to their surrounding districts, the worst performing bypasses for deaths and serious injury reduction were East Taupo and Ruby Bay. These were the only sites that didn't have a continuous median barrier provided as part of the bypass.

More detail can be found in the published research report at <u>https://www.aa.co.nz/assets/about/Research-Foundation/Safety-benefits-of-new-roads/AARF-report-Safety-Benefits-of-New-Roads.pdf?m=1680149096%22%20class=%22type:{pdf}%20size:{2%20MB}%20file.</u>

Utilisation of social media on road safety campaigns in LMICs

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Abstract

Social networks are a communication trend that has grown strongly in recent years. The application of social media campaigns in traffic safety offers the prospect of saving costs and increasing the audience exposed to media messages. This is extremely significant for low- and middle-income countries where the burden of road safety injuries and deaths is highest. Through social media campaigns in two road safety projects implemented in Thailand and Vietnam in recent years, it is promising to be able to replicate and develop this mass communication method to raise public awareness of traffic safety laws and encourage them to comply with them.

Post on X

Social media in road safety communication programs brings positive effects in raising community awareness at a low cost and saves the lives of a large number of target audiences.

Background

In Thailand and Vietnam, more than 35,400 people are killed on the road each year; this corresponds to a rate of 21 road traffic deaths per 100,000 population and higher than the worldwide figure of 15 deaths per 100,000 people (WHO, 2023). Mass media campaigns, whether social media, through the distribution of road safety information are some of the important elements of all road safety strategies (WHO, 2019). An estimated 72% and 83% of Internet users in Thailand and Vietnam, respectively, report using social networks in 2023, of which Facebook has the highest usage in both countries (Kemp, 2023; Digital Landscape, 2023). In this context, a series of media campaigns has been implemented about road safety across two outstanding projects targeting the community, especially students and young adults nationwide in the two countries.

Approach

With the aim of raising road safety awareness among target groups to address high-risk road behaviors and advocate for impactful legislative change to promote road behaviors with the highest potential to save lives, "*Safety Delivered phase III*" project has been conducted in Thailand and Vietnam from 2021 to 2023. Another project that also widely applies social media campaigns in its communication strategy to increase road safety knowledge among students and stakeholders in Thailand is the "*Street Wise*" project from 2022 to 2023.

Based on the interests and needs assessment of target audiences, the most popular social platforms including Facebook, Instagram, Twitter, TikTok were identified as the main channels for conveying information and attracting attention from youth, community members, civil society, and governments.

Techniques to estimate the number of people reached, interacted and engaged calculated on each social media platform, then eliminating possible duplicates in the same target population.

Results

Communication activities via social media channels have achieved their set goals in reaching and engaging target audiences and contributing to the overall success of the projects. Between 2021 and 2023, these projects were covered by 162 posts on social platforms presenting in a variety of content formats in both countries.

In "*Safety Delivered phase III*" project, Facebook and Instagram campaigns were launched to raise awareness of road safety in Thailand. These campaigns have directly reached 2,392,051 million individuals and 9,809,925 million indirectly. The posts included road safety awareness ads, road safety videos, and social media cards featuring quotes from local celebrities, officials, and citizens encouraging safe road practices on the roads. The "*Safety Delivered*" Vietnam Facebook fan page "*Hanh Trang An Toan*" has reached over 13,215,644 people via informative posts educating viewers on safe road and helmet practices.

Total number of people reached through all social media platforms on *"Street Wise"* activities (2022-2023) was 1,317,243. Notably, the TikTok Challenges nationwide has shown remarkable success in attracting the attention and participation of students from grades 1 to 12 across Thailand. From April to October 2023, this campaign reached about 900,000 people.

Along with other project activities, communication activities have contributed to changing the rate of helmet-wearing among students by an average of 26% to 55%. The rate of students with excellent road safety knowledge raised by 31% to 54%.

Implications for policy and/or practice

Engaging the local stakeholders from different departments of transportation, education, communications, partners and experts across the implementing countries played a crucial part in the success of the media campaigns. It helps to select the most suitable and cost-effective channels to reach the target beneficiaries in the local context. Stakeholders also have their knowledge enhanced and strengthened, creating favorable conditions for lobbying for changes in laws and policies related to local road safety.

Conclusions

The presentation shares some of the lessons learned and experiences in running a regional public awareness campaign using social media as part of broader efforts to increase public awareness of road safety laws in low- and middle-income countries.

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Vehicle factors explaining sex differences in crash outcomes: scoping review

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Abstract

Female drivers are more likely to be hospitalized, seriously injured, and die after being in a crash compared to male drivers. The vehicles driven by females may contribute to these sex inequities however, the extent to which this has been studied is unknown. This scoping review aims to examine what vehicle factors and features have been explored to explain differences in crash outcomes between male and female drivers. Four electronic databases were searched from their inception to January 2024. After screening, 665 studies were found to report on sex differences in various crash outcomes. However, only 10% of these examined vehicle features as potential explanatory factors, and even fewer looked specifically at crash avoidance safety technologies. The results highlight the need for additional research necessary to address this significant gap to provide policymakers and industry with evidence required to reduce sex inequities in crash outcomes.

Post on X

Women are more likely to be hospitalized, seriously injured, or die after a crash than men, however research considering vehicle features as potential explanatory factors for this inequity has been overlooked.

Introduction

The burden of serious road trauma is not evenly shared. Male drivers, no matter their age or geographic location, have been consistently shown in the literature to be involved in more crashes than female drivers. However, once a crash occurs, females drivers are more like to be hospitalized, seriously injured, or die compared to males. Despite male drivers having higher rates of crashes involving a single vehicle, on a street with a speed limit of at least 80 km per hour, in wet conditions, and in the dark, a recent Australian study found that they were still 0.73 times less likely to be hospitalized after a crash compared to females (Cullen et al., 2021). Another study in the United Kingdom found greater decreases in casualty rates from 2005 to 2015 amongst young adult male drivers than young adult females (young adult males: rate decreased by 6.2 times; young adult females: rate decreased by 2.7 times) (Jones, 2017). This is supported by another study from the United States which found mortality in male drivers involved in T-bone crashes to be 0.76 times lower than female drivers involved in the same type of crash (Crandall, 2003). Female drivers also sustain different patterns of injury in a crash compared to male drivers involved in the same type of crash. For example, when compared to front passenger position, female drivers have a 2.5 times higher risk of getting whiplash injuries from a rear-end crash while males only had a 1.4 times higher risk (Jonsson, Tingvall, Krafft, & Bjornstig, 2013). Literature has attempted to explain these differences by exploring the driving patterns and behind the wheel behaviours of male and female drivers. However, a key factor which might also contribute to crash outcomes involves the types of vehicles being driven, and the safety technologies included in these vehicles. The extent to which vehicle factors and features have been explored to possibly explain these sex differences is unknown. Given the rapid rise in vehicle safety technologies focused on crash avoidance and autonomous vehicles, this gap in knowledge needs to be addressed. This paper reports on a scoping review to address this question and shed more light on how vehicles may be protecting male and female drivers differently. These results will play a vital role in creating a safer fleet for all and increasing the uptake of safer vehicles by 2030; goals outlined in Australia's National Road Safety Strategy 2021-30.

Method

This scoping review is reported using the PRISMA-ScR guidelines (Tricco et al., 2018). An electronic database search of PubMed, Scopus, EMBASE (Ovid), and TRID was conducted from their inception to January 2024 for Englishlanguage studies only and with no geographic exclusions. The inclusion and exclusion criteria for this review are described in Table 1. Briefly, the population of focus was drivers of all ages driving four-wheeled motorized vehicles. As the authors predict that a substantial amount of the literature in this area of road safety will be in the grey literature, government reports and conference proceeding articles were also included. The outcomes of interest were crash outcomes defined as crash involvement rates and/or risk, injury risk and severity measured through injury severity scales such as the maximum abbreviated injury scale, and crash fatality rates and/or risk. Studies were included if they reported on any difference between male and female drivers in one or more of the crash outcomes of interest. No studies using driving simulations were included. Similarly, studies describing interventions such as driver education programs were excluded.

Table 1. Study inclusion and exclusion criteria

usion
rature reviews, narrative systematic reviews [‡] ,
mentaries, dissertations, editorials, case reports,
c chapters
ventional studies on driver education programs,
er training programs or licencing systems
ies using driving simulators, crash-labs, crash sled
or crash dummies.
ies on drivers with mental or behavioural conditions,
ity, or other impairments in cognition, vision, and
ical health.
ies focused on pregnant women as comparisons are
nally done between pregnant and non-pregnant
nen and not men.
ies on work-related crashes.

*This criteria is used to screen abstract and title ONLY.

†This criteria is used to screen full-text ONLY.

[‡]The reference list will be reviewed to capture any studies that may have been missed during the database searches.

All titles, abstracts and full-texts were reviewed independently by two investigators using Rayyan; a web-based platform that assists with the management and screening process of reviews and synthesis projects (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016). The criterion for full-text screening was slightly altered from the one used for title and abstract screening. Whilst any study reporting on sex differences in at least one of the crash outcomes were accepted during title and abstract screening, only studies that looked at any vehicle factors and/or features as a possible variable to explain differences between female and male drivers were included after full-text review. This decision allowed the authors to clearly see what the literature is currently focused on and if vehicle features and factors were being considered equally. Data extraction was completed independently by two reviewers using data extraction forms adapted from the Joanna Briggs Institute templates (Tricco et al., 2018). Data extracted from the studies included design, setting, participant characteristics, what vehicle feature and factors and crash outcomes were explored, and relevant effect measures describing differences found between male and female drivers. All studies were narratively summarised.

Results

From the electronic database search, 5719 studies were identified for title and abstract screening after 1754 duplicates were removed. After title and abstract screening, 665 studies were found to report on sex differences in at least one of the crash outcomes. However, after full-text review only ~10% of the studies were found to explore vehicle features and factors as possible explanatory factors for differences between male and female driver outcomes. To account for differences in crash outcomes between males and females, much of the literature focused on behind the wheel driver behaviour and patterns, such as distracted driving, driving under the influence, risk-taking and day vs. night driving, and physiological differences in height and weight variables between males and females. For the studies which did consider the vehicle as an explanatory factor, the most common features investigated were airbags and seat belts, followed by the vehicle age, type, curb weight, wheelbase, and safety rating. However, only a small proportion (<15%) of these studies looked at how crash avoidance technologies, such as electronic stability control, impact sex differences in crash outcomes.

Approximately 50% of the studies that investigated vehicle-related features as potential explanatory factors focused on their impact on injury risk and severity. Roughly a third explored fatality risk while the remaining examined risk and rate of crash involvement. Briefly, results on seat belt use and airbag deployment were mixed. Most of these studies reported female drivers to have lower risk of serious injuries or fatalities compared to males, however not all were significant. Studies that did report higher risks for females using seatbelts or airbags were published over 20 years ago therefore not accounting for modern designs that may better protect females. New, heavy vehicles were more protective for female than male drivers, however larger vehicles with longer wheelbases increased the risk of neck pain in rear-end crashes for females. Electronic stability control did significantly lower odds of single-vehicle crashes for female compared to male drivers in one study; however, results in the same direction from other studies were not significant. With the limited data on electronic stability control and other crash avoidance technologies, it is difficult to confidently conclude whether these safety technologies are influencing sex differences in crash outcomes.

Benefits to road safety

The advantages to road safety provided by this scoping review lies in its potential to increase understanding of how crash avoidance technologies might influence differences in crash outcomes between male and female drivers. This review highlights that there is limited evidence to conclude whether crash protective technologies, especially the more advanced technologies available in newer vehicles, contribute to higher crash rates or injury and fatality risk amongst females compared to males. Crash avoidance technologies have been around for many years yet their ability to protect all drivers, no matter their sex, has not been thoroughly covered. This must be addressed for policies aimed at creating safer vehicles for all to be successful.

Implication for policy and/or practice

This scoping review has implications for future policies responsible for designing and upgrading vehicle safety technologies focused on crash avoidance. There is a gap in the literature looking at how these technologies may explain differences in crash outcomes between male and female drivers. The review demonstrates the need for high-quality evidence in this area to allow development of future policies on how these technologies are designed, performance tested, and commercially rolled out in the vehicle fleet.

Conclusion

This scoping review demonstrates a clear gap in research examining differences in crash outcomes between male and female drivers and a distinct lack of research examining vehicle features as possible explanatory factors for these sex differences. Further, the current focus of the few studies currently available is primarily on crash protective technologies like seat belts and airbags, rather than crash avoidance systems. With features like lane-keeping assist and blind-spot warnings becoming increasingly standard in all new cars, an important pathway towards achieving the National Road Safety Strategy's vehicle safety priority goals by 2030 involves increasing the understanding on whether these technologies are protecting all drivers the same way.

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Developing an integrated safety camera network to 2030

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Abstract

Automated enforcement is internationally recognized as an important intervention to deliver improved road safety outcomes. The project outlines the development of a Safety Camera Network Framework and strategic program, which defines an approach to delivering an integrated safety camera network to improve road safety for all New Zealanders. This presentation examines potential approaches to proactively integrate safety camera sinto wider road safety investment, utilizing increasing data availability and evidence to develop safety camera expansion and operations through to 2030. This includes defining safety camera principles, modelling safety camera locations across the transport network and defining the role of engagement and education alongside enforcement to optimize safety outcomes.

Post on X

Presenting an approach to an integrated safety camera network framework, that outlines key principles and methods to the role safety cameras play in targeting risk in the transport system with the right interventions at appropriate locations.

Introduction

Safety cameras in New Zealand have historically been operated and managed by NZ Police. In 2019 the NZ Government's Tackling Unsafe Speeds program initiated the transfer of safety camera operations and future expansion of the safety camera network to the New Zealand Transport Agency, Waka Kotahi (NZTA). This was to incorporate investment and transition of safety cameras into NZTA's broader planning supporting speed management and road safety outcomes.

The framework utilizes findings outlined in determining the readiness for safety cameras and wider automated enforcement (Job, 2020) on the key requirements for a safety camera network. The project has developed an approach to determining key principles to align safety cameras with speed management, infrastructure investment and officer-led NZ Police enforcement. This allows a holistic approach to be enabled that proactively defines the risk being targeted through safety cameras and the integration of safety cameras to a wider safety portfolio.

It is anticipated that the sharing of work undertaken by practitioners in New Zealand on a strategy for integration with wider portfolio aspirations can inform wider conversations on the on-going and expanding use of automated enforcement to 2030.

Details of the work undertaken

The framework sets out the key principles that focus on delivering road safety outcomes, aligning to NZTAs Tū ake, Tū māia, regulatory Strategy and considering partnership approaches and road safety equity. It looks at the alignment between automated enforcement and police officer-based enforcement, operational challenges, the balance between enforcement, engagement, education, and the equity of outcomes related to safety cameras within a safe system approach. The framework focuses on how engagement and education can support safety camera enforcement, noting the increased road safety benefits that can be achieved between effective co-ordination of enforcement activity with well communicated engagement/awareness of increased enforcement (Job, 2023).

The project used a combination of risk-based metrics (Death and Serious Injury equivalent densities) alongside speed probe data at a network level in a consistent manner with other road safety investments. Allowances were made for differences between probe data with conventional speed surveys using data from trials conducted by NZTA, this allowed some calibration to be applied to the model. This was coupled with the One Network Framework, which defines a movement and place-based approach to define the transport network into road and street types. This allows consideration of the strategic function of our roads and streets. These inputs can then be modelled to determine suitable candidate sites.

This provides an initial overview of the most suitable locations for safety cameras as a compliance-based tool to deliver road safety outcomes. The model combines findings related to mean speed reductions derived from international studies on safety cameras to anticipate the potential safety benefits (Aronsson, 2009; Ragnøy, 2011). This is supported by data from early phases of the safety camera expansion completed in New Zealand. A comparison of the data from relative international studies and from safety cameras in New Zealand is provided in Figure 1. It builds on the variance in safety camera effectiveness found in international research and levels of non-compliance as a key consideration for such

occurrences (Job, 2023). The assumptions within the model of this relationship between potential mean speed reductions and site selection are part of the wider development of an evaluation and monitoring plan to test the strategic modelling assumptions as well as measure specific road safety benefits post implementation.



Figure 1. Summary of findings on the change in mean speeds related to safety camera installations in research compared with New Zealand evaluation studies

Taking the inputs from the model, criteria was applied to determine the appropriate initial camera type recommendation as outlined in Figure 2. For mobile speed cameras, this was further defined with a secondary criteria list related to a priority rating relative to the dosage allowing for lower dosage locations, that don't meet the criteria in Figure 2. This allows the list of potential locations to be expanded through partnership approaches that would increase geographical presence and be more responsive to communities and stakeholders whilst retaining focus on the higher benefit locations identified in the modelling.

Safety Camera	Criteria
Average Speed Safety Cameras (Point to Point Safety Cameras)	Collective Risk is not Low or Low Medium Corridor midblock DSI/ Corridor DSI ratio > 0.6
	Corridor is longer than 1km
	 Mean speed or free flow speed to posted speed limit ratio is > 0.95
	 Corridors with no mid segment roundabouts/ signalised intersections
Static Spot Speed Cameras	Collective Risk is not Low or Low Medium
	 Corridor Length ≥ 0.5km if Urban (<80km/hr) or ≥ 1km if Rural (≥80km/hr
	 ONF is not Local Streets or Civic Spaces
	Mean speed or free flow speed to posted speed limit ratio is > 0.95
Mobile Safety Cameras*	 Mean speed or free flow speed to posted speed limit ratio is >0.95
	Personal or Collective Risk is not Low or Low Medium

*Mobile safety cameras are part of a network level enforcement and site selection criteria form the initial priority list Figure 2. Table outlining model selection criteria for different safety camera types (Source: Abley, 2023)

Outcome of the work and Benefits to Road Safety

The framework allows NZTA to consider a means to integrate model outputs with wider road safety investments such as, infrastructure improvements, speed management, future technologies, and enforcement activities. Integration follows a defined safe system treatment philosophy relative to risk profiles. For corridors identified for safe system transformation in long-term modelling an interim or supporting approach is considered depending on the likely delivery timeframes and the anticipated level of non-compliance following transformational changes. Expressways and motorways known to have operational challenges for officer-based or mobile speed enforcement can also be identified to ensure that enforcement of multi-lane roads with higher safety infrastructure are considered. This forms a baseline potential strategic program to 2030, the outputs of which are shown in Table 1.

Type of Camera	Number of	Effective Network	Estimated annual DSI
	Cameras	Coverage (kms)/ Hours	reduction
Average Speed	300 (89 corridors)	1709	81
Spot Speed	218	337	12
Intersection (Red light/ Speed)	108		20
Sub Total (Fixed cameras)	625	2046 (2% of network)	113
Mobile Cameras	94	140,000 hours	47
Total	719		160

Table 1. Summary of modelling a potential strategic safety camera program in New Zealand

The baseline program forms a starting point for future consultation with partners and stakeholders to ensure that local knowledge and operational considerations can be input into the process to ensure that any final safety camera network meets the intent of the framework and delivery approaches can be optimized to ensure effective investment and value for money. On this basis the program has been split into both regional views for engagement with RCAs and district views to align with NZ Police officer-led enforcement.

The framework evaluation focuses on lead indicators for consideration of the impact of safety cameras as a single intervention due to the probability of overlap with other interventions in an integrated approach to increase the effectiveness of reducing DSIs. Studies presented on research in Sweden have shown that combination effectiveness vastly improves safety outcomes. A 62% reduction in fatalities on roads where safety cameras were coordinated with speed limit reductions from 90kmh-80kmh was found compared with decreases of 39% for roads that retained original speed limits (Vadeby, 2022). It is therefore important that evaluations of the safety camera network can be articulated to stakeholders and communities within the broader safety investment narrative, as well as for specific locations. Table 1 reflects anticipated DSI reductions accounting for other interventions that have previously been implemented or that are already programmed to prevent double counting as a means of outlining an expected contribution to national targets.

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What, where and now – safe routes to a local school

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Abstract

Australia has seen a significant decline in the proportion of children walking and cycling to school in recent decades. Road safety is a key factor influencing these trips. Previous research has identified a need to better understand minimal infrastructure requirements for the full spectrum of active transport users including children. In this project a spatial engagement survey of parents at a local primary school was used to understand where safer infrastructure was needed, and what type of treatments would be suitable. The project identified and prioritised 19 road safety interventions. Subsequently three raised crossings, one signalised pedestrian crossing and one low-cost, speed reduction treatment was installed to support safe routes to school. This project may help to inform broader infrastructure decisions about where and what types of treatments are needed to create safe routes to school and planning processes for how they can be identified.

Post on X

Using spatial engagement surveys of parent communities to capture data that drives investment in road safety interventions for safe routes to school.

Introduction

The purpose of this study was to recommend road safety improvements to support active transport to a local primary school. Key challenges included identifying where and what types of interventions were most needed and justifying investment with a robust identification and prioritisation process. These types of challenges have previously been identified as research priorities for advancing active transport in Australia (Bolten et al. 2022).

Australia has seen a significant decline in the proportion of children walking and cycling to school over the last three decades (Schoeppe 2016). Parents and children identify road safety as a key barrier to these trips (Amiour et al 2022; Swaine et al 2023). The most common road safety interventions for school children include reduced speed limits and school crossings. These treatments are generally focused on the boundary or within 200m of schools (TMR, 2022). Previous projects have also identified specific interventions on routes to school based on investigations by engineers (Smith et al. 2022).

To provide for active travel to school, broader changes to the built environment that consider road safety interventions between schools, homes and other destinations used by children are needed. Deciding where and what interventions are needed can be complex, as there are often significant deficiencies in networks, large areas to consider, limited data to support decisions and limited budgets to work with. Reinforcing the need for better data in this area, a previous study identified the following research priorities in Australia:

'What infrastructure is needed to make neighbourhoods safe for children to walk and cycle and move independently?' 'How can the barriers of the use of active transport to school be overcome?'

'What are the minimal levels (quality and amount of infrastructure required to provide safety and meet the needs of all active transport users' (Bolten et al. 2022)

Approach

The methodology for this project is described in Figure 1. It draws on similar work undertaken in the Sunshine Coast (Author, 2022; Swaine et al. 2023). The methodology defines four stages; find, define and prioritise, scope or plan, design and build. At the start of the process, an electronic survey is distributed through school communication channels and decision making is led by parent, carer, and community input. Engineering input follows and leads the final phases.



Figure 1. Methodology used to identify and rectify barriers in active transport networks around schools

The electronic survey included spatial engagement A total of 77 responses were received. The survey was designed to capture localised and specific information including:

- Where are safer crossings needed (map question)?
- How concerned are parents about children they care for using specific types of crossings?
- Other suggestions to make it easier and safer for children to walk or cycle to school?

Findings

Respondents could identify up to 10 sites when answering 'where are safer crossings needed?' 179 mapped responses were recorded, identifying approximately 14 sites. Results are shown in Figure 2 and include:

- refuge crossings at several mid-block sites and roundabouts
- untreated side roads of local streets
- an existing at grade zebra crossing



Figure 2. Responses to question 'where are safer crossings needed?' with aerial photograph of several sites

Survey participants were provided with photograph examples of various crossing types and asked 'how concerned are you about children you care for using the following types of crossings (see Figure 3)?' At least 9 out of 10 respondents indicated they were 'somewhat concerned' or 'very concerned' with children using untreated crossings, untreated crossings at side roads, refuges at roundabouts and refuge crossings. Approximately 2 out of 10 parents were 'somewhat concerned' with children using raised zebra crossings, and the remainder were 'not concerned'.



Figure 3. Parent responses to question 'How concerned are you about children you care for using the following crossings?' and images used in the survey

In response to an open-ended question, respondents offered the following comments about uncontrolled crossings.

'My children need to cross the road at a refuge crossing on [controlled distributor] street which I find to be very dangerous as I am never sure that my children are going to stop in the middle, even when I always accompany them.'

'It needs to be safer for children crossing the [side road near to school] I have found [it] is unsafe to walk or ride as there is cars everywhere.'

'More crossing at busy roads especially at ... roundabout,'

'Paths on both sides of the roads - especially along full lengths of [controlled distributor] as it's generally not safe to cross the road to get to the current path. Need to be able to ride along either side until you reach a safe crossing.'

'Raised speed bumps BEFORE a zebra crossing would force cars to slow down and actually stop when needed.'

'Please add a zebra crossing into the existing refuge crossing on Cars are flying there.'

Evaluation of effectiveness

The data sets that emerged from the crossing survey questions enabled practitioners to identify sites for safety interventions up to 1km from the school. This helped simplify the problem of knowing where to provide interventions. The data that emerged from concerns around different crossing types demonstrated that parents have low levels of confidence in crossings at refuges, side roads, roundabouts and mid-blocks. Whilst they had high levels of confidence in refuge crossings. The map-based data further reinforced this finding.

Infrastructure planning projects have been undertaken for schools at the Sunshine Coast for more than 10 years. The original methodology engaged with the school administration but not parents. This made it difficult to prioritise investments and there was also a lack of evidence available to support more complex projects such as crossings. In 2019 the process was modified to engage with parental using a spatial survey. This methodology has made it simpler to prioritise investments and the evidence base has supported more complex interventions, such as crossings.

Following the completion of the study, Sunshine Coast Council improved six crossings up to 500m from the school. A selection of these improvements is shown below and includes; replacing refuge crossings with raised or signalised crossings, providing raised crossings at side roads, and installing speed cushions at approaches to an existing crossing.



Figure 4. Before and after images of sites where crossings were improved

Conclusions

This project allowed practitioners to confidently identify refuge crossings, untreated side roads and untreated mid-block crossings as below the minimum standards that parents and carers require to confidently let children walk or ride to school. This information could help to inform the question posed by previous research about minimal levels of infrastructure required to meet safety needs of all users (Bolten et al 2022).

Spatial engagement surveys are a fast and effective way to collect data and evidence about where road safety interventions are needed. The methodology for planning investments around schools could also be repeated, as it provides a fast, low-cost approach for identifying sites for improvement with enough confidence to support investment.

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Hiding in plain sight: unlicenced motorcycle riders in Victoria

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Abstract

Motorcycle rider deaths make up around 17% of lives lost on the road in Victoria, with more than 400 motorcyclists killed on Victorian roads over the last ten years. During 2022 and 2023, this increased to more than 50 motorcycle rider deaths per year. An investigation into factors that may have contributed to this increase showed there had been an increase in the number of unlicenced motorcycle riders over this two year period. In-depth interviews (n=10) were conducted with Victorians who ride motorcycles (including on-road bikes, dirt bikes and scooters) without a licence. The interviews explored the circumstances under which the participants were riding unlicenced and sought to understand the barriers to and motivations for getting a motorcycle licence. All participants described taking safety seriously when riding and considered themselves to be competent riders.

Post on X

Unlicenced motorcycle riders might not be who you think.

Introduction

Motorcycle rider deaths have been increasing over the last several years, with 228 riders killed in the last five years. Around a third of these deceased riders are not licenced to ride a motorcycle. An interrogation of fatality data showed that while historically, around 15 deceased motorcycle riders each year were not correctly licenced to ride a motorcycle, the number of unlicenced riders killed has increased in the last two years to more than 20 each year.

As part of the Transport Accident Commission's (TAC) broader social research program, regular research is conducted with people who hold a current motorcycle licence and/or a current motorcycle registration. The Motorcycle Monitor has been running continuously since 2012, and during 2023, surveyed N=962 current and former riders about their riding activities and attitudes and behaviours about motorcycle related road safety. From the Motorcycle Monitor (IPSOS, 2023), most riders surveyed hold a valid motorcycle licence (98%), and most riders will abide by the road rules most of the time, with only 3% self-reporting drink-riding, and 53% saying they would never intentionally ride over the speed limit (compared to 64% of car drivers (Wallis, 2023). Additionally, 90% of riders state they have never been pulled over by police while riding (IPSOS, 2023).

The unlicenced rider cohort is not sufficiently represented in a larger research program like the Motorcycle Monitor, with N=18 people insufficient for quantitative analysis. A brief review of available research showed there was minimal to no existing research that engaged directly with people who rode unlicenced. In order to gain insights into this cohort, it would be necessary to conduct exploratory qualitative research with people who say they ride unlicenced. This work was commissioned with an external research provider (IPSOS, the current provider of the Motorcycle Monitor research) in order to conduct in-depth, one-on-one interviews with Victorians who ride unlicenced to explore and understand the attitudes and perceptions of unlicenced riders.

Approach

Because of the expected difficulty in finding people who would admit to an illegal behaviour, and readily talk about it, coupled with overall perceptions of who in fact was an unlicenced rider, it was decided that the most appropriate approach to this research was to conduct individual interviews with research participants. Sample specifications were set as broadly as possible, with a goal of conducting eight to ten interviews with people who ride unlicenced. At a more specific level, Victorians, aged 18+ who ride a motorcycle unlicenced at least some of the time, and off road motorcycle riders who may ride on gazetted roads were considered to be in scope. There were no other requirements relating to demographic criteria. N=10 online depth interviews were conducted in January of 2024. As per the matrix below (Table 1), interviews were conducted with a broad range of people who ride unlicenced.

Results

Learning to ride: Most participants learned to ride at an early age (under 15), and were taught to ride by family and friends in Australia and overseas. Some rode overseas as adults, but did not transfer their motorcycle licence when they came to Australia. A key reason for continuing to ride was linked to a sense of adventure and freedom they did not have in other areas of their lives. Some riders experienced being chased by police when they were younger, but saw that experience as "naughty" and a bit of fun.

From the Motorcycle Monitor – Most licenced riders learned to ride when they were under 15.

Table 2 Research Participants

Gender	Three female
	Seven male
Age	Two aged in their twenties
	Four aged in their thirties
	Three aged in their forties
	One aged in their fifties
Main type of motorcycle	Three on road motorcycle
ridden	Three scooter riders
	Four off road motorcycle (one also rode a road bike)
Frequency of use	Ranged from at least once a month to 3-4 times a week
Reason for riding	Recreational, local trips and longer trips, commuting
Holds any licence	Ten hold current driver licenses
	One participant successfully obtained a motorcycle licence in the past but let
	it lapse
Lived	Melbourne – some rode regularly in other locations
Occupation	Professional/semi-professional

Riding unlicenced: Everyone who participated in the research had been riding regularly for a long time (at least ten years), and all considered themselves to be experienced, competent and confident riders. Despite the length of time they had all been riding, there was a sense of inertia in relation to actually getting their licences, it (getting licenced) was something they had not gotten around to in the past.

Safety considerations: While a few participants described themselves as having been more daring and risk-taking with regards to motorcycle riding in the past, everyone who took part in the research placed a great deal of value on being a "safe rider". All participants were quite genuine in their belief that it was prudent and responsible to ride as safely as possible, but at the same time, it should also be noted that these "safety" strategies would minimise the likelihood that they would receive attention from police – in effect, "hiding in plain sight".

Riding in a sensible fashion	Not being reckless with speed or riding in a way that could cause accidents.
Protective gear	All reported wearing helmets and those not on scooters reported wearing
_	proper jackets and gloves and usually riding pants too.
Riding in good conditions	Preferably in good weather and daylight
Riding a motorcycle with	Most wouldn't consider riding a high (or higher) powered motorcycle
"suitable" power	
Riding on "suitable" roads	A preference for riding on back streets, rather than congested or busier
_	roads

Table 3 Safety strategies used by participants

From the Motorcycle Monitor – riders were less likely to speed than car drivers, most riders wore gloves (83%) and jackets (72%) every time they rode.

General behaviour: Participants were also asked about whether riding unlicenced was 'typical' for their character – most respondents stated that riding unlicenced was definitely the "worst thing" that they did and pointed out that their riding style (safety consciousness, not speeding, never drinking and riding) confirmed they were actually very compliant. Many of the participants had friends and family who also rode unlicenced, which in part confirmed their decision to ride unlicenced. Others had friends and family who were at most mildly disapproving of their actions, and it was not something they were likely to share more broadly.

Barriers to getting a licence: All of the participants had at some point considered getting a motorcycle licence, but all had concluded that the disadvantages did not outweigh the advantages to being licenced. They all firmly believed they were unlikely to get caught – due to mitigating their riding behaviour generally. All participants believed that it was expensive and time consuming to actually get their licence. When they were asked what they knew about the licensing process, they stated the cost ran into thousands of dollars, that courses only ran during business hours, and were not suitable for their needs. Predominately for off-road riders, the graduated licensing system (MGLS) operating in Victoria participants felt the MGLS did not seem to cater to their very specific skills and needs and minimal time spent actually riding on roads. On-road riders believed their skills were already adequate for the task and did not see any benefit from actually getting their licence.

Motivators to get a licence: To some extent, peace of mind for the off chance of getting caught could be a potential motivator but would only come to front of mind if the person was to start riding more frequently. Pressure from family

and friends would also only potentially encourage the unlicenced rider to obtain their licence. Insurance coverage was mentioned in passing, but again was not seen to be a great incentive to obtain a licence.

Impact on Road Safety

Between 2019 and 2023, 228 motorcycle riders were killed. Of those, 84 were unlicenced. Using the broad participant criteria from the current piece of research, it was decided to further interrogate data relating to unlicenced deceased riders. This was done to determine whether the cohort of unlicenced riders captured in this research was reflected overall in killed unlicenced riders. The majority of deceased unlicenced riders fell into the same age categories as the research participants, and roughly one in three deceased were riding off-road motorcycles, meaning at a high level, the research participants were generally similar to those killed unlicenced riders. When considering car licence status, most deceased unlicenced riders held a current car licence at the time of their death, and a further 9% held a car learner permit. This potentially indicates that a reasonable proportion of deceased unlicenced riders may in fact be similar to those who participated in this research, and that unlicenced riders are not necessarily inexperienced.

Conclusions

Overall, riders in this small study were not taking a moral stance against licencing in general, as evidenced by all of them holding a current driver licence, and their adherence to the majority of road rules. Nor did they take abject pleasure in breaking the law by riding unlicenced. In fact, most of the participants would probably get a licence if they didn't think it was an arduous and expensive process, and that the benefits of having would outweigh these costs. This cohort could see few disadvantages to being unlicenced, and firmly believed their approach of riding as safely as possible would mitigate any risk of being caught. All of the participants in this research valued their car licence as a vital and necessary tool, yet none were aware of the potential consequences to their driver licence if they were caught riding unlicenced. Additionally, off-road riders were put off gaining a licence due to the complexity of the current licencing process, particularly as their motorcycles, while recreational registered, were not road compliant. Interestingly, the more complex graduated licencing process commenced in October of 2014, and all riders in this study were riding long before the introduction of the MGLS, meaning that if they wanted to, they would have been licenced relatively easily in the past.

Limitations of this research

It is important to note that this research was a very small scale study, talking to N=10 people. The key strength of this approach was that the issue of unlicenced riding was able to be discussed in detail and in depth enabling researchers to investigate more fully the nuances of this particular hard to find cohort. While findings cannot strictly be generalised to a larger population, this work has given insight into Victorians that ride unlicenced that was not available via other research methods.

Further research

Before the completion of this study, there was a high degree of uncertainty as to whether the target of 8-10 interviews would be achievable due to uncertainty about the willingness of this cohort to participate in research. It may be possible in the future to conduct a larger piece of research, using the same methodology, with this cohort to potentially gauge the extent of unlicenced riding among motorcycle riders.

Further interrogation of fatality and serious injury data comparing unlicenced motorcycle riders to licenced riders would also be of value to assess relative risk associated with riding unlicenced compared to riding when appropriately licenced.

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Characterising motorcycle rider anthropometry for better understanding of injury mechanisms

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Abstract

Contact between the pelvis and the fuel tank is the primary source of pelvic injury for riders and influences overall rider kinematics in a crash. Understanding how differences in riding postures may influence the initial loading condition at the pelvis-fuel tank interface is important for accurate motorcycle crash simulation. A male and female rider approximating the 50th percentile were seated on four motorcycle types – Naked, Sports, Tourer and Adventure. 3-D scanning wase used to calculate anatomical joint angles for each rider. The results demonstrate significant differences in pelvis orientation, knee flexion and ankle dorsiflexion among the bike types, and hip flexion between the males and female riders. These findings indicate the need for more accurate representation of pelvic geometries relative to the fuel tank in motorcycle rider dummies and computer models. More broadly, the results from this preliminary study are being used to develop a standardized seating rig to characterize population variation in anthropometry with motorcycle design.

Post on X

Motorcycle fuel tanks are the initial source of loading in motorcycle crashes. Different motorcycles induce different riding postures which influence this initial loading condition. Understanding how this varies is critical for accurate simulation of motorcycle crashes.

Introduction

Motorcyclists are the most vulnerable road users worldwide (WHO, 2018). In Australia, motorcycles make up less than 6% of all registered vehicles but account for about 24% of all traffic hospitalisations and 18% of all traffic deaths (AIHW, 2023). Motorcycle use is increasing rapidly worldwide and yet there has been very little progress in the safety of motorcycles (Carroll et al., 2023). Motorcycle fuel tanks influence overall rider kinematics and are the primary source of pelvic injuries to riders (Carroll et al., 2023; Meredith et al., 2016). Different motorcycle types (sports, tourers, naked, etc.) induce different riding posture that differently orient the pelvis of the rider to the fuel tank. Pelvic position and orientation in relation to the motorcycle fuel tank is currently and how this differs across different gender, motorcycle types, and rider anthropometry is currently unknown. Yet this understanding is critical for accurate simulation of motorcycle crashes. The inability to accurately simulate motorcycle crashes physically and computationally is inhibiting advancement in development and evaluation of new motorcycle safety technologies. This study is the first step in a larger program of work aimed at addressing this gap by characterising population variation in male and female rider anatomical positioning across different motorcycle types. This paper presents results from this preliminary study demonstrating how rider anthropometry varies by motorcycle type and collecting data on which a standardised seating rig for studying population level anthropometric variation can be built.

Method

Data has been collected from one male (height: 172cm; weight: 75kg) and female (height: 165cm; weight: 51 kg) control rider approximating the 50th percentile seated on 4 motorcycles of each type - Standard/Naked, Cruiser/Touring, Sports, and Adventure. According to anthropometric surveys the height and weight of the 50th percentile male and female is ~176cm (78kg) and ~163cm (62kg) respectively (Gordon et al., 1989). Volunteers were recruited through social media to bring their motorcycle to the lab. The motorcycles were secured using a front wheel chock, rear wheel stand and tether straps. Trained researchers located external bony landmarks (as recommended by VICON) and placed 25mm black Styrofoam balls on these landmarks on the control riders. Markers were also placed on medial femoral condyle and medial malleolus for both legs to calculate knee and ankle joint centers. The control riders were instructed to assume normal riding position on the restrained bike. Each bike was scanned with and without the control riders using a handheld 3-D scanner (EinScan HX). The scans were processed using software (MeshMixer). MeshLab was used to acquire location of markers in 3-D space (Figure 1). These 3-D coordinates were processed in MATLAB to generate joint angles using joint kinematic calculations. Data collection will continue until the anthropometry of the standard riders has been collected from 10 motorcycle of each type.

A detailed set of measurements characterising variation in design features across motorcycle types were also collected.

²⁰²⁴ Australasian Road Safety Conference

³⁰ September – 3 October, Hobart, Tasmania, Australia

Once data has been collected this will be used together with the anthropometric data from the control riders in a principal components analysis to develop specifications for a standardised motorcycle seating rig. This rig will be used in later studies in Australia and North America to characterise population variation in rider anthropometry induced by different motorcycle types.



Figure 1. Pelvic Tilt, Bike type and gender

Results

Pelvic tilt angle was maximum for both the controls (male and female) on the sports bike showing an anterior pelvic tilt (forward tilt) while a posterior pelvic tilt was observed for the other three bike types (Figure 2). The female control showed similar posterior tilt for adventure, naked and the tourer (~ -17 deg). The male showed similar posterior tilt for naked and the tourer (~ -17 deg). The male showed similar posterior tilt for adventure, naked and the tourer (~ -17 deg). The male showed similar posterior tilt for naked and tourer (~ -10 deg) while showing the maximum posterior tilt of the pelvis on the adventure bike (-21.3 deg). There was a significant difference in average hip flexion between the male and the female control for all four bike types (p < 0.05). Hip flexion, hip abduction, knee flexion and ankle dorsiflexion were maximum for the sports bike and the least for the adventure bike. However, there was a significant difference in average knee flexion and ankle dorsiflexion among all four motorcycle types (p < 0.05). Data collected from the control riders across the full set of ten motorcycles of each type and an example of how this will be used to design a standardised seating rig will be presented.

Benefits to Road Safety

Correct orientation of pelvic and lower body geometries is critical to accurate simulation of motorcycle crashes using either crash test dummies or finite element modes, as this influences the initial loading condition and overall kinematics of the rider. Development and evaluation of emerging motorcycle safety technologies depend on this accurate representation. The findings of this study are a critical first step towards more accurate representation of the rider/fuel tank interface. These preliminary findings also highlight inherent differences in male and female riders, and riders of different bike types may be critical to consider when considering motorcycle crash simulation.

Implications for Policy and/or Practice

Findings of this study are useful for those developing physical and computational methods for evaluating emerging motorcycle technologies.

Conclusion

Findings indicate that different motorcycle types induce different riding postures as seen from the difference in joint angles across the four motorcycle types, and that these vary between male and female riders. Data collection is ongoing for another 36 motorcycles (10 motorcycles of each type) which will be scanned with the controls and the data will be presented at the conference for a holistic viewpoint. Ultimately this study will inform the design of a standardised seating rig that will be used in a later study in Australia and North America to characterise population variation in anthropometry induced by different motorcycles design. The outcomes of this work will then be used to improve initial static positioning of motorcycle rider human body models.

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Revisiting desired headway to estimate rear-end crash risk

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Abstract

Driver capability is a potential metric for integrating driver-level heterogeneity in crash risk assessment. However, it is challenging to evaluate due to the impact of various unobservable elements. In car-following (CF) events, a link between driver capability and desired headway exists, but it is difficult to estimate from the traffic data because the desired headway needs to be observed in steady-state CF. This study proposes a methodology for reliably estimating desired headway to estimate rear-end crash risks by developing suitable conditions for acceleration range and relative speed with a time window of sustenance. Results show that 3.5 seconds of sustenance time window with an acceleration range of ± 0.75 m/s² and a relative speed of ± 1.52 m/s is required to observe the steady-state car-following event to measure desired headway. Any headway shorter than the desired headway for a driver would create an extreme event, which could be further utilized to estimate rear-end crash risks in car-following interactions.

Post on X

Desired headway in car-following events can be utilized as a measure of driver capability and to estimate associated rear-end crash risks.

Introduction

Traffic conflict-based crash risk assessment methods have proven useful for proactive safety evaluations. However, adopting the same critical threshold for all drivers to differentiate between safe and risky events results in a homogeneous technique. Driver capability is a potential metric for integrating driver-level heterogeneity. The Task Capability Interface (TCI) model (Fuller, 2000) explains how to utilize driver capability and the prevailing demand for safety understanding.

According to the TCI model, the driver will be at risk if demand breaches the capability limit. However, because of the influence of several unobservable factors, evaluating driver capability is difficult. Nonetheless, prior research on car-following (CF) interactions has demonstrated a connection between driver's competency and temporal headway selections through desired headway (Saifuzzaman et al., 2015). Driver capability and desired headway are inversely related, and they are related to rear-end crash risk potential.

Desired headway is typically defined as the time available to the driver to provide an appropriate braking response in case the leader vehicle decelerates. For quantification, it has been anticipated that each driver has a preferred time headway to maintain in steady-state CF interactions (Heino et al., 1992; Winsum & Heino, 1996). From the perspective of CF driver capability, this looks like an oversimplification of the desired headway quantification, that each time headway (TH) observation in the steady-state CF would reflect the desired headway. Steady-state car-following (CF) interactions are typically determined using a relative speed threshold (Bham & Benekohal, 2004). This approach quantifies the desired headway as the average time headway (TH) a driver maintains with the leading vehicle while adhering to a specified relative speed threshold. By considering this threshold, drivers can react to significant changes in the leading vehicle's speed while maintaining a steady relative speed. However, perceiving the preferred headway under these conditions can be challenging, particularly when drivers must respond to rapid accelerations or decelerations by the leading vehicle while maintaining a relative speed-based steady state. In such cases, one can observe sporadic and transient steady-state interactions and corresponding headway observations, leading to unreliable desired headway estimates. Utilizing such an estimate of driver capability to examine crash risk in CF interactions may mislead the actual risk involved.

This study proposes a methodology to reliably extract the desired headway from car-following events so that rear-end crashes can be estimated. The TCI model can be utilised for rear-end crash risk evaluation in which the driver will be at risk if the prevailing headway breaches the desired headway limit.

Method and Data

Within the relative speed threshold of ± 1.52 m/s, to mitigate the above-discussed issues, this study tested a range of acceleration thresholds (± 0.50 m/s², ± 0.75 m/s², ± 1 m/s²). The sustenance time windows range from 1.5 to 5 seconds are observed for the discussed relative speed and acceleration thresholds. The study investigated the relationship between space headway and speed variations to observe the linearity strength for all acceleration thresholds and sustenance

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windows. Pearson correlation coefficients (r) are also observed to understand the change in linearity strength quantitatively. The goal is to identify the time window of sustenance of steady-state within a threshold of acceleration and relative speed that best correlates with the capabilities of CF drivers, thereby enhancing the accuracy of desired headway estimation.

A data set with the possibility for steady-state CF interactions throughout a continuous speed range is needed to evaluate the proposed method for extracting steady-state for desired headway estimation. The 15-minute dataset (4:00 to 4:15 p.m., April 13, 2005) from NGSIM I80 data, reconstructed (removing most of the noise and inconsistencies from the original data) by Montanino and Punzo, 2013 is used in this investigation. The length of observation is around 500 meters; it includes six lanes and one extra on-ramp lane that is not physically separated from the neighboring lane. Out of the six, a lane is dedicated to high occupancy vehicles (HOVs). To preserve homogeneity, this research solely considers the four regular lanes, excluding the HOV lane and lanes that have the effect of merging or diverging.

Result

Figure 1(a) depicts the variation of the correlation coefficient between space headway and speed (for $\pm 0.75 \text{ m/s}^2$ with the relative speed of $\pm 1.52 \text{ m/s}$) for each sustenance time window considered. Figure 1(b) demonstrates the variation of space headway with speed for steady state CF (for $\pm 0.75 \text{ m/s}^2$ with the relative speed of $\pm 1.52 \text{ m/s}$) without a sustenance window and with 3.5 seconds of sustenance window. Besides, the linear fit line is plotted to visualize the nearness of variation to the linear fit line.

Results suggest that for an acceleration threshold of $\pm 0.75 \text{ m/s}^2$ with a relative velocity of $\pm 1.52 \text{ m/s}$, the sustenance window of 3.5 seconds shows the highest linearity strength for space-headway and speed relation (r = 0.556). Besides, in the acceleration range of $\pm 0.75 \text{ m/s}^2$ with a relative speed threshold of $\pm 1.52 \text{ m/s}$, it is observed that the correlation coefficient (r) of the linear relationship of space headway and speed gradually increased until 3.5 seconds of sustenance window (r = 0.556), as shown in Figure 1(a). This finding demonstrates that the linear relationship between space headway and speed steadily develops until the 3.5 seconds sustenance time window. Note that the connection strength for sustenance of 4 seconds appears similar to that of the 3.5 seconds, however, at the expense of missing data for 80 leader-follower pairs (compared to the number of leader-follower pairings in 3.5 seconds sustenance). Similarly, connection strength grows for 5 seconds from 4.5 seconds, but more than 300 leader-follower pairings have been lost (relative to the 3.5 seconds sustenance).



(a) Strength of space-speed relationship
 (b) Space headway variation with speed
 Figure 1. Strength of space-speed relationship with a time window of sustenance of steady state CF & space-speed variation in steady-state CF with (3.5 seconds) and without sustenance window.

Figure 1(b) suggests that the variation of space headway with speed diminishes towards the linear fit line when a sustenance window of 3.5 seconds is considered. Note that dispersion is much reduced from the outer perimeter, i.e., high and extremely low space headways at a given speed level. Furthermore, steady-state measurements tend to drop at higher speeds (see for speeds greater than 40 km/h). Therefore, the lost space headway observations may be unintentional, fleeting observations in steady-state CF. These are the observations that would mislead the desired headway estimate.

Conclusions and Discussion

The findings suggest that headway observations of simplistic relative speed-based steady-state CF interactions may incorporate unintentional, fleeting observations, resulting in inaccurate estimates of desired headway. For reliable desired headway estimate, this study demonstrates the extraction of steady-state CF interactions through three conditions: (a) ± 1.52 m/s relative speed threshold, (b) ± 0.75 m/s² of acceleration range, to ensure that drivers do not

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia exceed an acceleration level where they cannot perceive their desired headway, and (c) both the conditions must sustain for a time window of 3.5 seconds.

From the driver's point of view, the TCI model explains risk through the interaction between the driver's capability and prevailing task demand. According to the TCI model, the driver will be at risk if demand breaches the capability limit. However, due to the complexity of quantifying the driver capability, the crash risk based on TCI has not yet been investigated. Recently, Saifuzzaman et al., 2015 demonstrated the integration of driver behavior in car-following models utilizing desired headway as a metric of capability in car-following interactions (due to its link with human factors). However, they assumed a diverse distribution of desired headway among drivers for simplicity. For evaluating rear-end crash risk with d river-level heterogeneity, a reliable estimate of desired headway (driver capability interactions) can be used in the TCI model to quantify crash risks across various road traffic conditions.

Acknowledgments

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Revisiting desired headway to estimate rear-end crash risk

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Background:	Method:
 Traffic Conflict based crash risk assessment: Homogenous technique Driver capability is a potential metric for integrating driver-level heterogeneity in crash risk assessment. However, it is challenging to evaluate due to the impact of various unobservable elements. In car- following events: a link between driver capability and desired headway exists. But it is difficult to estimate from the traffic data because the desired headway needs to be observed in steady- state car-following. 	 This study tested a range of acceleration thresholds (±0.50 m/s², ±0.75 m/s², ±1 m/s²) within thresholds of relative speed (±1.52 m/s). In addition, to determine the optimal time window for sustaining a steady-state, this study investigates time windows ranging from 1.5 to 5 seconds, with increments of 0.5 seconds. The goal is to identify the time window that best correlates with the capabilities of drivers, thereby enhancing the accuracy of desired headway estimation.
Aim:	Data:
 To propose a methodology to estimate rear-end crash risk by utilizing desired beadway as a capability metric in 	 Next Generation SIMulation Interstate 80: the 15-minute reconstructed vehicle trajectory dataset (4:00 to 4:15)

car-following interactions.

p.m., April 13, 2005)

Results:

 The study drew the relationship between space headway and speed variations to observe the linearity strength for all acceleration thresholds and sustenance windows. Correlation coefficients were also investigated to understand the change in linearity strength quantitatively.



Conclusion and Scope:

 Results show that 3.5 seconds of sustenance time window with an acceleration range of ±0.75 m/s² and a relative speed of ±1.52 m/s is required to observe the steady-state car-following event to measure desired headway.

 Any headway shorter than the desired headway for a driver would create a safety-critical event, which could further be utilized to estimate rear-end crash risks in car-following interactions.

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Smart Transport Safety Research Lab

Enhancing road safety: Vietnam's safe school zones advocacy journey

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Abstract

In Vietnam, road crashes rank as the second leading cause of death among children and youth aged 0-19, claiming 2,315 young lives in 2019. The absence of safe school zones significantly contributes to this statistic. This abstract explores the progression of the development and advocacy of a comprehensive policy framework aimed at enhancing road safety around school zones at the national level. The AIP Foundation has collaborated with Vietnam's Ministry of Transport (MOT) develop the Safe School Zone Guide to enhance the safety of school zones nationwide. Endorsed as a legal reference document, this guide has garnered widespread interest and recognition from governments at various levels, marking a significant milestone in enhancing road safety around school zones nationwide. Ongoing efforts are underway to scale up its implementation further to solidify its evidence base to support legislation establishing a legal school zone definition in Vietnam.

Post on X

Protect vulnerable road users and children in particular, by improving the policy and procedure framework for school zones in Vietnam

Background

In recent years, road safety for children has been a great concern of the Vietnamese government(Government Directive 31/CT-TTG, 2023). Children are more vulnerable to road crashes due to increased exposure to road traffic hazards as pedestrians and cyclists in their daily commutes to and from school zones. In Vietnam, road crashes stand as the second leading cause of death among children and youth aged 0-19, claiming 2,315 young lives in 2019(GBD, 2019). One major contributor to this statistic is the lack of safe school zone standards across the country – which results in a significant number of schools being built with insufficient pedestrian-friendly infrastructure and other speed-calming measures.

Project description

In response to this pressing issue, AIP Foundation has partnered with Vietnam's Ministry of Transport (MOT) to develop a comprehensive policy framework to enhance school zones' safety at the national level. The progression towards advocating for school zone definition includes the following crucial steps:

- Development of a nationwide Safe School Zone Guide (SSZG), delineating engineering parameters and necessary steps for establishing safe school zones across the country.
- Pilot implementation of SSZG in three provinces to assess its effectiveness and make necessary adjustments based on real-world outcomes.
- Adjustment and finalization of SSZG, incorporating insights gained from the pilot phase and feedback from key government stakeholders.
- Training workshop for Department of Transport officials from all 63 provinces in Vietnam to effectively utilize the SSZG.
- Implementation of the SSZG to upgrade infrastructure around school zones in targeted provinces, thereby expanding its adoption and garnering support from provincial governments
- Organization of an experimental study tour in Melbourne with government stakeholders to secure their endorsement for the school zone definition and enhance their capacity to advocate for effective legislation while fostering coordination among decision-makers.
- Enactment of a national legal school zone definition, including speed reduction

Results

The Safe School Zone Guide was developed in consultation with local and international stakeholders that incorporates international best practices on school zone infrastructure into Vietnam's road safety context. Following its development, the SSZG underwent a pilot phase encompassing six schools across Hanoi, Nghe An, and Soc Trang provinces, representing diverse geographic regions within Vietnam. Pre- and post-intervention assessments demonstrated the substantial impact of the SSZG on reducing traffic risks for students, evidenced by reductions in school zone crashes, decreased traffic conflicts between pedestrians and vehicles, and overall improvements in road infrastructure conditions (schools were upgraded from 1 or 2 stars before intervention to 4 or 5 stars after intervention based on the Star Rating for School tool). Furthermore, SSZG received widespread support from students, parents, teachers, and communities. After multiple adjustments and revisions, the SSZG reached a significant milestone with the MOT issuing the first edition of the Guide as a legal reference document – thereby allowing it to serve as a government-endorsed resource for local authorities to assess and implement solutions to improve traffic safety conditions in school zones.

The effectiveness of the SSZG in enhancing school zone safety has garnered significant attention and active participation from governmental entities. Provincial authorities in various regions, including Hai Duong and Gia Lai, have proactively taken action to upgrade road infrastructure around school zones within these provinces, based on SSZG recommendations. Additionally, the Vietnam Road Administration has underscored its recognition and endorsement by consistently urging all provincial Departments of Transportation and related organizations across the country to adopt SSZG to optimize traffic management in school zones and guide the construction of new schools. As a result, numerous provinces are actively conducting school zone assessments and developing action plans to enhance safety in school zones based on SSZG recommendations.

Conclusion

The widespread attention and recognition from communities and governmental bodies, coupled with endorsed SSZG as government reference documents, marks a significant milestone in paving the way for enhancing road safety measures around school zones nationwide. Moving forward, SSZG will continue to scale up its implementation, further solidifying its evidence base to support legislative endeavors aimed at a legal school definition across Vietnam.

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Serious Road Crash Injury Data Linkage: Spatial analysis preliminary findings

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Abstract

The Serious Road Crash Injury Data Linkage project aims to improve the measurement of non-fatal serious road crash injuries in Queensland through data linkage. This project utilised data from the Queensland Crash Analytics Reporting System (CARS) from Transport and Main Roads (TMR), the Queensland Hospitals Admitted Patients Data Collection (QHAPDC) and the MAIC Compulsory Third Party (CTP) injury claims register. Approximately 39,000 distinct road crash injury cases from paired dataset containing records from both CARS and QHAPDC for the period of January 2015 to December 2021 were included in the geospatial analysis. The analysis investigated the road crash and hospital locations as well as residential locations where known. The analyses were conducted on various geographical boundaries including Remoteness Areas, Australian Bureau of Statistics (ABS) Statistical Area Levels (SA2, SA3 and SA4), TMR and Queensland Police Services (QPS) regions, districts, and areas.

Post on X

A preliminary spatial analysis that uses the linked road crash and hospital admissions data to extract the distance between crash and hospital locations as well as residential location when known.

Introduction

It has been established in the past decade that linking road crash data with health-related data from hospitals allows for a more complete understanding of serious road crash injuries (Watson et al., 2015). Health data can be utilised to confirm hospital admission of road crash hospitalised casualties, to capture the under-reporting of some road user types and to provide a better understanding of injury types and outcomes.

The Road Safety Data Bureau (RSDB) is a cross-agency team, funded by the Motor Accident Insurance Commission (MAIC), to consolidate, integrate and analyse road crash-related data from member agencies to inform whole-of-government decision-making and approaches to road safety policy. The RSDB is tasked to undertake the Serious Road Crash Injury Data Linkage project to improve the measurement of non-fatal serious road crash injuries in Queensland through data linkage.

Project description

The cohort dataset for this project utilises three main data sources: the Queensland Crash Analytics Reporting System (CARS), the Queensland Hospitals Admitted Patients Data Collection (QHAPDC) and the MAIC Compulsory Third Party (CTP) injury claims data. Additional information to supplement the cohort dataset was also obtained from Transport Registration and Integrated Licensing System (TRAILS) data. For the purposes of this study, serious road crash injury cases are defined as an that results in hospital admission which includes those injuries not reported or recorded in the crash data. Using linked data, the RSDB was able to extract geospatial data from the crash location and residential addresses (CARS and TRAILS data) and hospital location where the injured person was admitted to (QHAPDC data).

The objectives of current geospatial analysis are to:

- Measure the distance between crash location and hospital locations where the injured person was admitted to after the crash and assess the similarities and differences in these locations based on various geographical boundaries.
- 2) Measure the distance between crash location and residential address of the injured person and assess the similarities and differences in these locations based on various geographical boundaries.

Approach

The crash records from CARS were linked to the hospital data from QHAPDC and geographical data from both sources were transformed into geospatial information. GNAF data was used to transform addresses into latitude and longitude to allow for distances between locations to be measured. Geographical data were also transformed into various geographical boundaries including Remoteness Areas, Australian Bureau of Statistics (ABS) Statistical Area Levels (SA2, SA3 and SA4), TMR and Queensland Police Services (QPS) regions, districts, and areas. The private hospitals were not identified in the linked data, therefore were excluded from the analysis.

Results

Approximately 39,000 distinct crash cases from paired dataset containing records from both CARS and QHAPDC for the period of January 2015 to December 2021. The following are the preliminary findings from the analysis conducted:

- Investigating the distances between crash location and hospital locations, the findings show that for 81% of cases, the distance was less than 20km and 14% of cases fall into 20-50 km range.
- Investigating the distance between crash location and residential SA2 centroid, the findings show that for 65% of cases, the distance was less than 20km, 19% of cases fall into 20-50 km range, and 5% of cases the crash location was more than 200km away from the residential SA2 centroid.
- Comparing the residential address point and SA2 centroids, 87% of cases sit inside 0-20 km range and 7% in 20-50 km range.
- Comparing the SA2s for crash and hospital locations, only 10% of casualties admitted in a hospital are located in the same SA2.
- Comparing the SA2s for crash and residential locations, 76% of crashes occurred in the same SA2 as the residential address.
- Considering the Remoteness Areas (RAs) for crash and hospital locations, table below shows the relations between these two factors:

Crash	Hospital Location RA						
Location RA	Inner Regional	Major Cities	Outer Regional	Remote	Very Remote		
Inner Regional	56%	44%	0%	0%	0%		
Major Cities	0%	100%	0%	0%	0%		
Outer Regional	23%	4%	73%	0%	0%		
Remote	21%	2%	47%	30%	1%		
Very Remote	4%	2%	26%	17%	51%		

Data limitations

The analysis conducted is subject to data limitations as outlined below:

- The residential address is not known for all records.
- The private hospital names were not identified in the linked data.
- There are some records that the residential address is not matching with GNAF data file. Therefore, the Latitude and Longitude are not defined.

Conclusion

This preliminary analysis provides an insight into the relation between geographical boundaries for crash, hospital and residential locations. The findings can be used for the cases when there are no matched records between data sources (QHAPDC, CARS and MAIC). The relativeness between locations will lead us to find an estimation/proxy location for crash location in the case when there is no matched road crash record. On the other hand, for any road crash record when there is no linked record in hospital dataset, the results of this analysis might provide some information about the casualty residential SA2 or hospital location.

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Enhancing road Safety: Improving Injury Severity Assessment and Post-Crash Care Analysis

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Abstract

Various measures can be used to define a 'serious injury' resulting from a road crash. These range from police reported data on whether a road crash participant was admitted to hospital, to in-depth detailed coding of each individual injury sustained by a person in a road crash using the Abbreviated Injury Scale (AIS). The latter is often reduced to a single value, indicating the maximal level of injury sustained (MAIS) by an injured person. MAIS greater than three is commonly used as a serious injury indicator, and the European Commission have adopted this definition. However, this definition diminishes the influence of multiple less severe injuries that may increase both overall injury as well as extended hospital stay. This research explores the various injury measures as well as post-crash recovery time spent in hospital, and which measure might give a better indication of serious injury.

Post on X

Is it time to rethink what we classify as serious injury?

Introduction

When a person is involved in a road crash, they may sustain an injury. The extent of any injuries (and hence crash severity) can be documented and reported in several ways. For statistical and road safety performance indicators, 'serious injuries' and 'fatalities' are the types of injuries of most concern. The definition of a fatality is clear, but the definition of serious injury, and hence a serious crash, is more difficult to define.

In some jurisdictions, a serious injury for statistical purposes (coded by police) is recorded when a crash participant requires admission to hospital with overnight stay in a hospital ward. From a public health perspective, a hospital admission might include instances where an injured person spends four hours or more in the emergency department (ED), which includes time spent in extended-care critical units, where injured people can be monitored for 24 hours without being admitted to a hospital ward. The fundamental issue with a police injury reporting system is that there is a lack of objective measure of injury severity, as the injury outcome of a road crash participant is ranked by level of hospitalization (admitted or treated). Additionally, there may be discrepancies between whether an injured party was in fact, admitted to hospital or merely treated at hospital due to administrative issues. This results in some hospital admissions being "administratively" serious but without an objective injury measure.

More objective ways to measure injury severity involve the coding of individual injuries sustained by crash participants using the Abbreviated Injury Scale (AIS) defined by the Association for the Advancement of Automotive Medicine (2005). Trained medical professionals code specific injuries and their severity for various body regions. The coding is an internationally agreed upon measure of severity or threat-to-life on a six-point scale, ranging from AIS 1 to AIS 6 (where 1 is minor, 2 moderate, 3 serious, 4 severe, 5 critical and 6 maximal) for each specific injury sustained on six specific body regions (Abdomen, Chest, External (skin), Extremities [limbs], Face, Head/Neck).

There can be multiple injuries to individual body regions, and these can vary in severity. For an individual crash participant, the maximum AIS (MAIS) is recorded as the highest AIS coded for that person. this MAIS can be used to rank the overall injury or crash severity. In road crashes, a person sustaining an injury of MAIS 3 or greater is often reported as having a serious injury, and the European Commission have adopted this definition (European Commission, 2015). However, the MIAS definition does not account for the number of injuries sustained.

To better reflect the extent of injury, and alternate measure called the Injury Severity Score (ISS) can be used. The ISS uses the (sum of the squared) highest three AIS values by unique body region. While this injury metric is a better descriptor of injury, it may dilute overall injury severity (Osler et al., 1997) as the score is dominated by the highest AIS value by unique body region. The New Injury Severity Score (NISS) corrects this bias by using (the sum of the squared) of the three highest AIS values, regardless of body region. This gives a better overall indicator of an individual's injury level, as it captures the most severe or traumatic injuries sustained which may be confined to a particular body area, rather than being influenced by more frequently observed superficial/minor injuries sustained on alternate unique body areas. A final measure of injury severity is length of stay in hospital; more seriously injured people would spend longer durations in hospital.

The purpose of the present research was to examine a cohort of hospital presentations and observe the different injury measures assigned to each presentation and explores the use of NISS as a more representative method for summarising road crash injury severity, in particular a NISS threshold of nine as a serious injury. NISS \geq 9 captures injured people sustaining at least one AIS 3 injury (as per the current accepted definition) and also considers combinations of less serious injuries that may contribute to a greater overall injury severity that is currently disregarded as a serious injury. Additionally, this research compares the coded injury measures to post-crash hospital recovery time and explores whether post-crash recovery time alone can be used to define serious injury.

Method

Data containing casualty injury information from crashes that occurred between 2014 and 2017 were obtained from a major trauma centre in an Australian capital city. The data included descriptive medical and injury details, as well as objective injury coding (Abbreviated Injury Scales), that were matched to police reported crash records. The data set included 2,072 drivers, motorcycle riders, cyclists and pedestrians who were admitted to the trauma centre and met the public health operational definition for a serious injury.

Results

All 2,072 presentations had an AIS coding, but only 85% (1,763 presentations) could be matched to police reported data. Only 37% (656 people) of the police report matched presentations were classified as having been admitted to hospital, the police operation definition of serious injury. Table 1 shows the cross tabulations of the police reported injury severities compared to the coded injury severities for the cohort in this study. There were more NISS 9+ injuries compared to

police reported serious injuries but fewer MAIS 3+ injuries.

Police Reported	MAIS 2 or less	MAIS 3+	NISS <8	NISS 9+	Total
Fatal	21	59	10	70	80
Admitted	382	274	229	427	656
Treated	804	144	657	291	948
Private Doctor	3	2	3	2	5
No injury	68	6	61	13	74
Total	1278	485	960	803	1763

 Table 4. Police reported injury severities compared to the coded injury severities

Table 2 shows the time distribution of post-crash recovery time in hospital (for surviving presentations only) for the respective injury measures. As can be seen, overall, there were significant discrepancies between the each of the injury measures, with more NISS 9+ injuries (733) compared to police serious injuries (656) and again fewer MAIS3+ injuries (426) compared to police injuries. Table 3 shows cumulative time in hospital for each of the injury measures. Again, there are significant discrepancies between the different injury measures by cumulative time in hospital, however for 8 days or more in hospital a comparatively smaller difference was observed between the hospital definition of serious injury (392) and NISS 9+ (351). This maybe suggestive of a relationship between NISS 9+ injury and extended hospitalisation.

Table 5. Injury severities compared to duration of hospital stay

Hospital Stay	Police Serious Injury	MAIS 2 or less	MAIS 3+	NISS <8	NISS 9+	Total
Less than 1 day	101	627	14	605	36	641
1 day	42	125	12	99	38	137
2 to 7 days	254	367	146	205	308	513
8 to 13 days	102	84	95	27	152	179
14 days	157	54	159	14	199	213
Total	656	1257	426	950	733	1683

Table 6. Injury severities compared to the cumulative duration of hospital stay

Time in hospital	Hospital Serious Injury	Police Serious Injury	MAIS 3+	NISS 9+
1 day or more	1042	555	412	697
2 days or more	905	513	400	659

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8 days or more	392	259	254	351

Average NISS was plotted against duration of hospital stay and there appears to be a power relationship between the two injury measures $y = 0.0152x^{2.3375}$ (R² = 0.7039), with an average NISS of 9 resulting in around 3 days in hospital, while an average NISS of 14 resulting in around 8 days in hospital.



Figure 1. Average NISS plotted against duration of Hospital Stay

Discussion

To ensure there are sound baselines for injury performance indicators in road safety policy frameworks, an accurate and consistent method for crash injury severity reporting is necessary. While police provide a high-level injury outcome in road crashes, injury information from hospitals that provide a more detailed level of injury severity is critical in understanding the true nature of road crash injury outcomes. This research proposes that NISS ≥ 9 is perhaps a better injury severity threshold for road safety research as even those injured in road crashes with what might be considered minor injuries (MAIS 2 or less) under the commonly accepted definition, MAIS 2 injuries can still result long duration post-crash care in hospital. However, while injury coding may still be too detailed and complex for mass crash data collection, perhaps a more appropriate middle ground to explore further is length of post-crash care, as this appears to be a sound indicator of road crash injury severity and indeed consumption of public health resources as a burden of injury. Further research is needed to better understand, or account for the length of post-crash care in hospital to ensure they are not artifacts of age, road user type, frailty, pre-existing medical conditions and complications, or other reasons beyond the injury mechanisms from road crash involvement. Additionally, with further research and improved injury modelling, a better relationship between NISS and post-crash hospital care might be produced so both policy makers and researchers can develop further insights into serious injuries.

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Measuring the Safe System approach: a validated scale

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Abstract

While the Safe System approach is widely used by policy makers and practitioners around Australia, a valid and reliable mechanism to measure perceptions of this approach are limited. This paper addresses this gap by demonstrating how the Safe System Scale, a measure of the shared perceptions about whether the road transport system can accommodate human mistakes, was validated. The Safe System Scale, consisting of six items, and two other measures used to assess convergent and discriminant validity were administered to 615 participants. The results indicated that the scale is both reliable and valid. The use of this scale will allow more effective measurement of the Safe System approach and thus enable practitioners and policy makers to assess the effectiveness of interventions and strategically plan programs of work.

Post

New validated Safe System Scale, a measure of shared perceptions of whether a road transport system can effectively accommodate human mistakes, to inform road safety policy and practitioner work in Australia.

Introduction

The Safe System approach, which is widely used as a basis for road safety policy within Australia, promotes that it is unacceptable for people to be killed or seriously injured on the road. It suggests that humans will make mistakes and therefore the road system should be designed to prevent deaths and injuries (Green et al., 2023). The Safe System approach originally had four pillars (roads, vehicles, people and speeds) with post-crash care more recently being added as fifth pillar (Green et al., 2022).

The underlying premise of the Safe System approach is the "shared responsibility between all parties (road users, road practitioners, transport authorities and enforcement agencies), which acknowledges that mistakes may occur, but blame should not solely rest with the road user" (International Transport Forum cited in Green et al., 2024: 84). Research suggests that the Safe System approach is not as widely used as it could be. Research with Victorian practitioners found that only two-thirds of participants identified that they used this framework in their last project or program (Green et al., 2024) despite it being seen as the overarching approach within the road safety policy development process (Green et al., 2023).

However, despite this focus, there is no known tool to measure perceptions about the Safe System approach. Furthermore, there is currently no way to identify any misalignment between the perceived changes in road safety across the system between road safety practitioners and road users. Thus, as part of a larger project to understand community perceptions and beliefs regarding safety within the road system, this paper introduces the Safe System Scale. This Scale is a novel way to measure shared perceptions about developing a road transport system that can more effectively accommodate human mistakes. As well as presenting the results from the validation of the Scale, this paper discusses the benefits to road safety and the implications for practitioners, particularly those working in a policy, monitoring or evaluation perspective.

Method

The Safe System Scale

As part of a scale to understand changes in community perceptions and beliefs regarding safety on the road environment, the Safe System Scale was developed. The Safe System Scale measures shared perceptions about developing a road transport system that can more effectively accommodate human mistakes. The development of the Scale followed the 7 steps outlined by Hinkin et al. (1997; see Table 1). This paper focuses on the construct validity of the Scale in Step 6. The previous steps had been undertaken in an earlier phase of the project.

Convergent and Discriminant validity

The Scale consists of six items. Given the novelty of the Safe System Scale, it was not possible to identify a similar scale that could be used to measure convergent validity. After considering a number of approaches such as asking for qualitative assessment of validity, six items that had been rejected during the development of the original Scale were used to assess convergent validity. Discriminant validity was assessed using the violations and aggressive violations subscales of the Driver Behaviour Questionnaire (see Table 2).

Table 7. Guidennes for scale development	and analysis
Step 1: Item generation Create	items
Step 2: Content adequacy assessment Test for	or conceptual consistency of items
Step 3: Questionnaire administration Determ	nine the scale for items
Deterr	nine an adequate sample size
Admir	ister questions with other established measures
Step 4: Factor analysis Explor	atory to reduce to the set of items
Confir	matory to test the significance of the scale
Step 5: Internal consistency assessment Determ	nine the reliability of the scale
Step 6: Construct validity Determ	nine the convergent and criterion-related validity
Step 7: Replication Repea	the scale-testing process with a new data set

Source: (Hinkin et al., 1997)

able 2. Sale System Scale items and convergent and discriminant valuity items				
Safe System Scale	Convergent validity items	Discriminant validity items		
(1) strongly disagree to (5) (1) strongly disagree to (5)		(1) never (3) occasionally (5) nearly all the time		
strongly agree	strongly agree			
1. If there is a	6. If I crash on the	Violations		
crash on the road, the	road, I am unlikely to be	1. Disregard the speed limit on a		
people involved are	seriously injured	residential road		
unlikely to be killed	7. If there is a	2. Disregard the speed limit on a		
2. The way the	crash on the road, the people	freeway or rural highway		
roads are built mean that	involved are unlikely to be	3. Drive so close to the car in front		
people are able to have a	killed	that it would be difficult to stop in an emergency		
crash without serious injury	8. The way the	4. Overtake a slow driver on the left		
3. The way	roads are built mean that people	5. Stay in a lane that you know will		
vehicles are built mean that	are able to have a crash without	be closed ahead until the last minute before		
people are able to have a	being killed	forcing your way into the other lane		
crash without being killed	9. The way	6. Drive even though you suspect		
4. The speed	vehicles are built mean that	you are over the legal BAC limit		
that people travel on the	people are able to have a crash	Aggressive violations		
roads means that they are	without being killed	7. Use your horn to indicate your		
able to have a crash without	10. The speed that	annoyance to another road user		
serious injury	people travel on the roads	8. Get angry at a certain type of		
5. People use	means that they are able to	driver and express your anger any way you can		
the road in such a way that	have a crash without being	9. Become angry at another driver		
they are able to have a crash	killed	and chase them with the intention of showing		
without serious injury	11. People use the	them how angry you are		
	road in such a way that they are			
	able to have a crash without			
	being killed			

Table 2.	Safe System Scale items and convergent and discriminant validity items
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While the Spearman's *rho* coefficient has traditionally been used for ordinal data, Likert scales, which were adopted for the survey applied in this testing phase, are treated as continuous data to allow the application of a greater range of statistical tools. Therefore, Pearson's correlation coefficient (r) was selected as the appropriate statistical test for the following analyses. The variance (\mathbb{R}^2) is also presented.

Sample

A private research company was used to recruit participants, administer the scale via an online survey and collect the data. Participation was voluntary and anonymous. The final sample consisted of 615 participants with half female (50.2%) and ages ranging from 17 years to more than 80. The largest proportion of the sample came from South East Queensland (72.9%).

Results

The mean of the Safe System Scale was 3.0 (sd = .9) and the Cronhbach's alpha was .91. This is consistent with the administration of the Scale when it was first developed (M = 2.63, sd = .9, Ca = .92). The mean of the Scale suggests that participants were neutral in their perception of the road system protecting users from being killed or seriously injured.

The mean for the violations and aggressive violations subscales of the Driver Behaviour Questionnaire, used for discriminant validity, was 1.79 (sd = .8; C α = .92). The mean of the rejected items from the development of the Safe System Scale, used for convergent validity, was 1.79 (sd = .85; C α = .88).

Construct validity

While the Spearman's *rho* coefficient has traditionally been used for ordinal data, Likert Scales, which were adopted for the survey applied in this testing phase, are treated as continuous data to allow the application of a greater range of statistical tools. Therefore, Pearson's correlation coefficient (*r*) was selected as the appropriate statistical test for the following analyses. The variance (\mathbb{R}^2) was also calculated. The Safe System Scale displays an appropriate level of convergent validity ($\mathbf{r} = .722$, $\mathbf{p} > .01$; $\mathbb{R}2 = 52.13\%$) and discriminant validity ($\mathbf{r} = .383$, $\mathbf{p} > .01$; $\mathbb{R}2 = 14.67\%$).

Benefits to road safety

This work has a number of benefits for road safety. Firstly, it allows effective measurement of the Safe System approach upon which much of the road safety policy within Australia is based. Given that inferences made on inaccurate scales are meaningless, it is critical that scales used within the policy context are validated.

Secondly, when administered longitudinally, the use of this Scale will provide an understanding of whether or not perceptions regarding the safety of the system are improving. This information can be used to inform and prioritise the program of work that practitioners undertake. For instance, the current sample indicated that they were neutral in their perceptions of the system protecting them from death or serious injury. If administered again, as a post test after the introduction of an intervention, the Scale will provide an indication regarding whether these perceptions have changed.

Thirdly, this Scale can be administered in conjunction with other scales to understand specific road safety issues. While these other scales may not be validated because they are focused on a particular policy issue, the inclusion of a validated scale will add scientific rigour to the results. Finally, the use of a validated scale will enable more accurate comparisons of results across differing Australian jurisdictions.

Implications for policy and/or practice

Policy makers and practitioners within road safety use the Safe System approach to underpin their work (Green et al., 2024). This is despite the concept being relatively abstract. It is difficult to know if this occurring effectively if we are unable to measure this construct in a meaningful way. The creation of a validated Safe System Scale enables policy makers to effectively identify if the work that they are undertaking affects individuals' perceptions of the Safe System approach. Furthermore, from a practitioner perspective, a measurement tool enables the identification of areas where additional support for the Safe System needs to be gained, for example, across enforcement agencies, transport authorities or road safety researchers.

Policy makers and practitioners can use the Scale in a number of ways to meaningfully assess the impact of their work. Firstly, the Scale can be administered regularly to a representative sample of community members. By doing so, policy makers will gain an understanding of changes in these share perceptions over time. Secondly, the Scale can be administered to a sample of professionals. This will provide an indication of how professionals perceive the system. Thirdly, the Scale could be administered in a pre- and post- test design to identify if a particular intervention affects perceptions of safety. In all cases, the Scale can be administered with additional scales or items that more directly measure the phenomena under consideration (e.g., drink driving interventions or automated vehicle features).

Conclusions

The Safe System approach is a widely used framework within the Australian road safety context. However, there has been no effective tool to measure perceptions of the Safe System. This paper has demonstrated that the Safe System Scale is valid and reliable. The understanding provided by the Safe System Scale is fundamental to support the continuous improvement of, and communication about, road safety initiatives. Thus, practitioners and policy makers can use the Safe System Scale to enhance and inform their development of individual initiatives and their broader programs of work.

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An iterative approach for the use of administrative crash datasets

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Abstract

A significant output of a national road safety research partnership is an annual report providing insights into hazards faced by heavy vehicle operators within Australia. The report and relevant materials utilise administrative insurance datasets to determine key hazards that affect the heavy vehicle industry in order to inform intervention and education initiatives improving road safety. With these opportunities come challenges in meeting quantitative research design standards and scientific rigour. The current study aimed to outline a procedural method for working with operators to identify and acknowledge data limitations, report findings with a high level of confidence and feedback on improved methods of data collection and structure to operators to improve outcomes. To minimise the limitations of working with current administrative datasets has been proposed. The iterative approach proposes to identify and acknowledge data limitations, improve confidence in findings and feedback improved data collection methods to industry partners. The formalised iterative approach for administrative datasets has led to a thorough understanding of the benefits and limitations of the contained variables, a higher level of confidence in reported findings and a value proposition returned to the industry partners improving collection practices.

Post on X

Road safety data has historically focused on government and regulatory datasets. Expanding the scope of business data can add depth and scale, but it is not without difficulty. This study examined the journey into using administrative data, including its challenges and opportunities.

Introduction

Opportunities

A large insurer specialising in heavy vehicle motor insurance previously provided insights into its claims data by releasing its own report series. These reports were produced independently of any established academic or research structures. To grow the initiative's impact and reach, while also bringing additional rigour, a partnership was established with a key university research centre and an industry engagement program.

Privately held datasets created through the processing of crash insurance claims, known as administrative datasets, have traditionally seen limited utilisation in road safety research and policy setting. Several factors contribute to this including but not limited to; a lack of existing relationships between corporate data holders and road safety practitioners, a lack of an articulated benefit back to the data holders, an inability to pre-determine a hypothesis without prior knowledge of data variables and the subjectivity of variables created for operational purposes (Hyman, 2015).

Benefits

The availability of administrative datasets provides improvements in some facets of research design robustness and scientific rigour. The data set in this partnership has greater sensitivity/ availability of variables not present in governmental/ publicly available datasets. For example, the administrative dataset includes national crash incidents that would either not be captured in police or state road crash datasets as external property damage, third-party injury or loss of life were not reported or would require going to each state reporting body individually. There may be untapped potential for further research on factors impacting the effectiveness of safe system approaches by virtue of the closer relationship between insurers and transport operators, such as vehicle specifications (safer vehicles), hiring and training practices (safer road users) or journey planning and compliance assurance (safer speeds). Additionally, the financial impact of crash incidents was captured within the administrative dataset and can therefore be measured and reported. To capture these variables at the large sample sizes available within the administrative dataset would come with significant financial expense and time investment to a research group (Hyman, 2015). The large sample sizes available within administrative datasets increase the likelihood that they are representative of the study population, reduce selection bias and enhance the potential for generalisability.

Challenges

With the opportunity and benefit of using administrative datasets, there are challenges to be managed. Within an administrative dataset, the data collection process lacks control by the researcher for the requirements demanded by rigour. This can lead to missing, inconsistent, misleading and, at times unreliable variables. Administrative datasets can also suffer from subjectivity and organisational bias in the classification and coding of variables as the data is focused

on operational needs and not those required to inform a research hypothesis. There is an inability to pre-determine a hypothesis without prior knowledge of the containing variables and form a working understanding of the data's blind spots. Such as selection bias: a sample doesn't truly represent the general population of interest, and confounding: an unmeasured variable that influences both cause and effect (Hyman, 2015).

Method

A collaborative partnership program hosted by a university research centre was approached by a heavy vehicle motor insurer to potentially produce their major incidents report and improve on findings by providing more in-depth independent analysis. Once the partnership model and principles were agreed under the program a partnership agreement was reached, data was de-identified by the insurer, ethical use of the data was approved by the Human Research Ethics Committee (40958) and data was transferred to the university research centre. A key enabler for the process under the agreement was the establishment a Governance Board to provide oversight of the management and use of data and the public release of content/findings.

A collaborative process of discussion, data exploration and preliminary analysis between the research group and industry partner was held. This involved importing the dataset into a dataframe using python and data-cleaning including fixing inconsistent labelling, checking for misclassifications and relabeling incorrect entries. Following this, was the creation of subset-data variable visualisations which were presented for discussion. Through the collaborative process it was agreed that the partnership would benefit from a formalised procedure in working with the current administrative datasets and those that would be used in the future. The procedure was based on a collaborative method of improving the dataset to meet the requirements and align with the scientific paradigm for qualitative research.

The procedure would use assumptions that underpin the scientific paradigm to guide it, those being; there is one singular reality, and to the best of its ability the data is objective, impartial and representative of the study population (Davies & Fisher, 2018). The methodological approach utilises a predetermined hypothesis and maintains control to minimise any factors influencing findings. For research to be robust and rigorous, the research design process must be formal: well thought out, planned and recorded, objective: free from subjectivity or bias, reliable: able to be tested and/or observed with consistency, generalisable: the sample size to be representative of the studied population, and repeatable: with clearly stated methods that can be reproduced (Bloomfield & Fisher, 2019).

Results

A step-by-step formal process was created that walks through the process of identifying, acknowledging and improving administrative datasets for use in reporting, educating and intervening in the heavy vehicle road safety space. The process was called an iterative approach. The iterative approach for the use of administrative crash datasets (Figure 1) within the partnership has been developed to include five (5) steps:

Step 1. Identify challenges to research design robustness and scientific rigour

Step one involved a literature review of published works involving the use of administrative datasets by the university researcher to determine the opportunities, benefits and challenges. There was also consultation with colleagues of the university research group with prior experience in working with administrative datasets on the challenges they can present.

Step 2. Working collaboratively with the supplying operator to acknowledge data subjectivity, bias and unreliability

In step two the university researcher and a heavy vehicle insurance subject matter expert (SME) began with a period of consultation between the two parties. This involved discussions of past works and possible issues with the dataset meeting scientific rigour. Challenges that were identified in the administrative dataset were a lack of predetermined hypothesis; the research questions presented was broad and lacked focus, variable subjectivity and inconsistency; classification of some variables was determined via a 'best fit' approach, the entry database allowed for manual inputs that created inconsistent labelling and some variables contained missing data.

Step 3. Discuss and implement ways to improve on limitations

Step three involved the discussion of practical ways to improve the historical dataset. This comprised of data cleaning by the university researcher to identify misspelt entries, fixing inconsistent labelling (i.e., inconsistent letter case), checking for misclassifications and relabeling incorrect entries. Additionally, dataset entries that needed to be corrected that were linked to identifiable data were improved by the heavy vehicle insurance SME.

Step 4. Focus on reporting around high-confidence data fields

Step three involved focusing on variables with high confidence once data cleaning was complete, these included variables that were reliable, consistent, objective, repeatable and represented a good sample size. Additionally, exposure rate was included as a scaling factor in reporting historical time series trends to account for growth in the heavy vehicle insurers portfolio.

Step 5. Feedback information to supplying operators to improve collection procedures

Step five involved working with the supplying operator, providing information of where the data can be improved and methods for improving on the challenging factors. This included improving inconsistency and reliability by providing

methods for disallowing misclassified or mislabeled data and putting thresholds in place on numerical data that was bounded. To address subjectivity and inconsistency documentation has been developed to guide variable classification at the point of data input.

The iterative approach led to adaptions to the way the annual report represented data. This included the creation of more defined and scalable visualisations, greater depth in the exploration of the data variables and the inclusion of referenceable literature to support findings. Working through these steps improved collaboration, increased the understanding of subjectivity & bias, enhanced open discussion, provided feedback to improve data collection and structure and informed expanded road safety reporting, research and initiatives from the administrative datasets.



Figure 3. The iterative approach feedback loop for use with administrative datasets.

Conclusions

The implementation of the iterative approach is ongoing, the historical administrative datasets have been improved, and as time goes on, the collection and refinement of ongoing datasets will continually progress. The iterative approach is in the process of being applied to other administrative datasets and with improved objectivity and reliability. Additionally, the improved data has been used in initiatives that enhance communication, readability and usability of data and reduce the risk of misinterpretation. With these new structures in place the capability exists to enhance the administrative data collection process to align with and inform Safe System approaches. The collaborative nature of the iterative approach has the added benefit of strengthening relationships between industry operators and academic researchers with the partnership. The outgoing reports and materials from the partnership administrative datasets have been used to inform and lead heavy vehicle road safety research, educational workshops, webinars and crash intervention initiatives.

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Cyclist clearance times at signalised dual left turn intersections

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Abstract

Locally in Queensland, some cyclists have asserted anecdotally that the existing guidelines inadequately consider the time required for cyclists to navigate intersections, potentially exposing them to conflicts with other traffic movements. This study seeks to understand and assess the likelihood of cyclists safely navigating Dual Left Turn slip lanes (DLT) within specified signal clearance times. This study includes a survey conducted in five South East Queensland locations over 24 hours at intersections with DLTs, varied layouts, and high cyclist usage. Two incidents of interest occurred during the video survey suggesting that there is a genuine threat of traffic-cyclist collisions at sites where cyclists cross intersections with active DLTs. Results show that at the sites surveyed, 2.7% of cyclists could be crossing a DLT while a conflicting movement is released. To mitigate risk, suggested measures include minimising DLT separation, extending inter-green times in cyclist-heavy areas, and implementing cyclist detectors at bike lane stop lines.

Post on X

Studying potential for conflicts involving bicycles at signalised dual left turn slip lanes intersections.

Background

The clearance times for cyclists at intersections with signalised DLT have consistently been a raised issue. These slip lanes have historically designed with low entry angles into the adjoining road, creating large intersections with long clearance distances (over 100m). It is important to design clearance times at intersections based on the slowest vehicle, which includes bicycles unless they are explicitly prohibited. Large speed differentials between cyclists and motor vehicles at intersections result in noticeably long all-red phases, regardless of whether cyclists are crossing the intersection or not (Shladover et al., 2011). Cyclist speeds also vary significantly based on user types, experience, and environmental conditions such as wind speed and gradient (Haworth and Schramm, 2011). This wide range of possible speeds has raised concerns for practitioners when determining the appropriate design speed for these sites.

The purpose of the investigation is to understand the circumstances and likelihood of whether a cyclist can safely clear a DLT within the clearance time provided in the signal phasing and, if not, the probability of a cyclist being in a potential collision zone with a motorised vehicle turning left from the DLT. Figure 1 demonstrates scenarios of potential conflict issue for cyclist movements at an intersection with a signalised DLT.



Signal phase changes from green to yellow just as the cyclist enters the intersection

DLT goes green and a vehicle (assuming right of way with the green light) moves into a zone where the cyclist is entering

Figure 1. Example Scenarios of Cyclists at signalised DLT Intersections

Survey Site selection

The candidate sites were selected using a combination of reviewing aerial imagery (Google Maps and Nearmap) and local knowledge. A total of 12 candidate sites were initially identified, which were subsequently shortlisted to five locations. These locations encompass a broad geographic spread across South East Queensland, a range of intersection layout types, the potential for high cyclist usage, and at least one signalised DLT slip lane on the State Controlled road network. Intersection signal data were reviewed during the survey days and cross-referenced with video footage.

Survey Procedure

On-site video survey was undertaken on Thursday 27th of April 2023. Key survey details included:

- Data collection occurred from 00:00 to 24:00
 - Three (3) cameras were placed at each DLT intersection:
 - Camera 1 captured the DLT traffic lights and the DLT vehicle movements.
 - Camera 2 captured the traffic lights and the vehicles/bicycles for the movement conflicting with the DLT movement.
 - $\circ \quad \ \ {\rm Camera} \ {\rm 3 \ captured \ footage \ right \ at \ the \ conflict \ point}$
- Where required additional cameras were supplied to capture intersection with multiple DLTs.

Results and Analysis

The key movement data and potential DLT conflict data ('incidents') that were collected from the surveyed sites is summarised in the table below. Incidents are defined as instances where a cyclist crosses in front of a 'Green' DLT leg.

Site No	Site Name	Number of DLTs	Daily Volumes across DLT Movements		Number of
			Vehicle Volumes ²	Cyclist Volumes	Incidents
1	Southport-Burleigh Road / Christine Avenue intersection	1 (north-west corner)	17,957	1	0
2	Olsen Avenue / Smith Street Off-Ramp EB / Smith Street On-Ramp EB intersection	1 (north-west corner)	14,834	17	1
3	Old Pacific Highway / Foxwell Road / Whitewater Way intersection	2 (north-east and south- east corners)	19,382	4	01
4	Anzac Avenue/Deception Bay Road intersection	3 (north, south, and west corners)	13,787	18	1
5	Depot Road/Braun Street/Gateway on- off ramp/Board Street intersection	1 (south corner)	8,242	32	0
Total		8	74,202	72	2

Table 1. Key Movement and Conflict Data

1. An incident was noted within the data, however, was the result of an illegal right turn of cyclist and has been excluded from analysis 2. Total vehicle volumes crossing a DLT (e.g., through and right turning movements).

The recorded data indicates consistently high vehicle volumes for all DLT movements. The sites experienced a combination of dry and wet weather conditions. The light weather conditions did not appear to affect cyclist movement numbers. Signal cycle times at the surveyed intersections varied between 70s and 160s, with an average of 110s. Cyclist volumes crossing a DLT ranged from 0.5% to 0.01% of total traffic. Notably, two potential incidents were observed: one at Intersection 2 (Olsen Avenue/Smith Street) at 7:58 PM with a signal cycle time of 75s, and the other at Intersection 4 (Anzac Avenue/Deception Bay Road) at 4:58 AM with a signal cycle time of 110s. Results show that at the sites surveyed, 2.7% of cyclists (2 incidents over 72 total cyclists) could be crossing a DLT while a conflicting movement is released.

Cyclist Conflict Probability Calculation

A probability of a conflict has been primarily determined using the following.

- Average cycle times Total time divided by the number of complete cycles in a day. Note that the average cycle time does not take into account variance over a time period as the number of occurrences remains the same.
- DLT Green Phases Considers the number of times within a signal cycle that a cyclist movement can cross the DLT green phase, as well as the number of DLT phases within a signal cycle.
- 'Number of incidents' Number of surveyed occurrences of a cyclist crossing a green DLT signal.

The calculation of conflict probability, based on survey data from this assessment, is the product of the 'risk rate' by the likelihood that a cyclist will cross the intersection prior to a DLT green phase;

 $\frac{\text{Incidents}}{\text{Total Surveyed Cyclists}} * \frac{\text{Total Cyclists at Intersections}}{\text{Number of DLT Green Phases}} = \frac{2}{72} * \frac{72}{(60*60*24*5)/110} = \frac{1}{2160}$

Where 'DLT Green Phases' is the total number of times a DLT green occurred over the survey period. Applying the surveyed number of instances (2), the total number of cyclists (72), average signal cycle time (110s – based on 1 DLT green per cycle), and a 24-hr survey period across 5 intersections:

The resulting likelihood of a conflict occurring is approximately 1 in 2160 per intersection over a 24- hour period of operations. This would result in the likelihood of a conflict occurring being approximately 1 in 6 per intersection within over a year of typical operations (assuming the intersection is both a DLT and provides on-road cycle facilities).

Benefits to road safety

The project improves road safety by highlighting the need for enhanced intersection designs for cyclists, identifying potential conflict scenarios with left-turning drivers, and emphasising the importance of adequate signal phasing at signalised DLT intersections. These measures collectively contribute to an overall enhancement of cyclist's safety at intersections and across the road network.

Implications for practice

The study's results provide guidance, particularly for practitioners involved in intersection operations, to enhance signal phasing and improve cyclist safety at signalised DLT intersections.

Conclusion

The research aimed to investigate a perceived and anecdotal threat of conflict. Acknowledging the results as a temporal snapshot, encompassing two incidents observed in a twenty-four-hour period across five different locations with relatively low overall bicycle traffic, the findings suggest that the identified risk is genuine and potentially consequential. To reduce risk, recommended measures include minimising DLT separation from through lanes, extending inter-green times in high-cyclist areas, and implementing cyclist detectors at preceding bike lane stop lines. However, future work entails collecting more data from additional intersections with DLT treatments to bolster confidence in risk probabilities across all intersections. Integrating video analytics techniques may also offer further insights.

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Effectiveness of Raised Safety Platforms: a systematic review

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Abstract

Raised safety platforms (RSPs) can provide benefits such as speed and crash reduction as well as potential drawbacks including but not limited to riding discomfort and dangerous manoeuvres. This study conducted a comprehensive literature review on RSPs to develop design considerations and offer insights to enhance safety and comfort. Results indicate that RSPs are an effective Safe System treatment for reducing speeds at intersections, roundabouts, midblock pedestrian crossings, and slip-lanes. The results suggest that well-designed RSPs at signalised intersections offer an effective and sustainable solution within the Safe System framework. The most effective RSP design for reducing speed is a trapezoid shape, which includes crosswalk markings on local streets. Moreover, the effectiveness and usefulness of raised safety platforms may vary based on factors such as design, location, and local traffic conditions.

Post on X

🊧 Enhancing Road Safety with Raised Safety Platforms (RSPs) 参オ 💡

Enhancing road safety with Raised Safety Platforms (RSPs): These vertical deflection structures reduce speed, improve visibility for pedestrians and cyclists, and promote inclusivity. While they improve safety, careful design considerations are needed to address potential drawbacks. #RoadSafety #RSPs

Introduction

In Australia, of the 1,136 people killed in road crashes in 2018, 191 (17%) were motorcyclists, and 213 (19%) were pedestrians and cyclists. International studies show that speeds of 30 km/h or less reduce the likelihood of severe injuries in areas where pedestrians, cyclists, and other non-motorised users interact with motorised vehicles (Austroads, 2020). Numerous studies have emphasized the benefits of maintaining lower speeds in urban areas and have called on policymakers to implement 30 km/h speed limits on streets (e.g., Gitelman et al., 2017). However, adopting a 30 km/h speed limit for an entire city area can be challenging due to its significant deviation from existing speed limits on urban and rural roads. Various speed-calming measures have demonstrated effectiveness by significantly reducing vehicle speeds on road networks (Jateikiene et al., 2016) including RSPs.

Raised Safety Platforms

RSPs can serve as an effective speed-calming approach to create a safer road. They are particularly effective at intersections, roundabouts, midblock pedestrian crossings, and slip-lanes (Austroads, 2020; Jateikienė et al., 2016; Loprencipe et al., 2019). The presence of RSPs in urban and rural areas can have various effects on the safety of road users, including non-motorised such as pedestrians and cyclists, as well as motorised such as drivers and motorcycles. RSPs include to vertical deflection structures that are increasingly being utilized to reduce the maximum comfortable operating speeds of vehicles (Jateikienė et al., 2016; Pease & Hall, 2023). Numerous studies have revealed that RSPs enhance the visibility of pedestrians, cyclists, and individuals with disabilities within the driver's field of vision (Gitelman et al., 2017). In addition, its approach ramps may reduce vehicle speed and boost driver yielding. The overall results indicate that RSPs effectively improve road safety on urban roads (Gitelman et al., 2017), with the improvements varying based on the type of platform used (Jateikienė et al., 2016; Loprencipe et al., 2019). Literature on the functioning of RSPs in rural areas is limited. However, some studies have indicated that appropriate types of RSPs can effectively reduce speed in residential areas (Smith et al., 2002) and highways located in mountainous regions (Jianbo et al., 2010), and consequently reduce traffic crashes.

While RSPs offer several advantages and benefits, they could also have several drawbacks. These include potential for vertical acceleration and riding discomfort, which may require modifications if located on bus or freight routes (Loprencipe et al., 2019). Other drawbacks include concerns about heavy vehicle stability, increased traffic noise levels resulting from vibrations (Austroads, 2020), drainage issues (Austroads, 2020), higher costs compared to standard pedestrian crossings (such as Zebra crossings), additional difficulties for cyclists, an increased risk of rear-end collisions (Gitelman et al., 2017), increased traffic diversions to avoid congestion, potential vehicle damage and safety issues due to contact with raised pavement, increased vehicle operation costs, deterioration of pavement condition near ramps (Abdel-Wahed & Hashim, 2017), sudden deceleration, increased travel time, impacts on traffic flow and the ability of different road users to navigate the section, the need for additional information for pedestrians who are blind, and unsuitability for locations with frequent snow removal such as streets in Canada and the USA.

Aim and Objectives

This study aims to evaluate the effects of different dimensions of RSPs to provide valuable insights for improving design considerations. The research question for this study was as follows: What are the RSP design considerations and practices suitable for rural and urban roads to enhance the safety of motorised and non-motorised users? This review seeks to clarify the design requirements for the installation of RSPs and deepen our understanding of leading international practices across various performance aspects. The scope of this study is to present valuable and relevant information for the geometric design of RSPs to enhance user safety and passenger comfort.

Method

We employed a systematic review approach to identify relevant original research papers and other sources of pertinent information. We completed a search of databases, screening of papers, article extraction, and research synthesis according to listed items from guidelines about systematic review. The entire procedure used during this systematic review is depicted in Fig. 1. The goal was to gather and consolidate all existing information that has correlation with using RSPs to improve safety for motorized and non-motorized users. Articles were eligible if they had the selected keywords within the title, author keywords, or abstract and were published with the full text in English from 2000 to January 2024.



Figure 4. PRISMA 2020 flow diagram of the included studies

Results

Mohammadipour et al. (2020) explored the impact of geometric characteristics on speed reduction for RSPs. They developed a model for predicting speed reduction and provided insights into the geometric design of speed control measures. Additionally, Loprencipe et al. (2019) highlight the significance of considering comfort and safety in the design of RSPs, specifically emphasising compliance with international standards. These studies collectively emphasise the importance of careful design and dimensioning to ensure the effectiveness of traffic calming measures in enhancing road safety.

Designing optimal speed humps involves a delicate balance between prompting speed reduction and avoiding excessive elevation. Long speed humps offer a smoother ride and discourage undesirable driving behaviours. Considerations like slope, width, and spacing are crucial for minimising jarring effects and maintaining traffic flow. Clear markings and signage inform drivers about speed humps, and the design is nuanced based on road functionality and classification, adapting to specific characteristics and speed limits.

Designing appropriate RSPs while taking into account the safety of motorcyclists, as well as pedestrians and cyclists, is one of the most crucial considerations (Lav et al., 2018). Poorly-designed RSPs can pose serious hazards and have often been fatal for motorcyclists. Shwaly et al. (2018) created regression models to explore the associations between the operating speeds (V85%) for motorcycle and three variables: hump length, hump height, and the spacing between successive speed humps. The predicted crossing speed (V85%) for motorcycles was estimated based on the characteristics of the humps. These relationships can serve as valuable tools for highway and traffic practitioners, as well as field engineers, in designing hump elements for specific speed limits or estimating the hump-crossing speed based on the characteristics of the speed humps.

Conclusion

Through this review, we learned about design requirements, examined international practices, and summarized proposed RSP dimensions for user safety and comfort. By thoroughly examining 52 research papers, we uncovered invaluable results that shed light on significant challenges and areas that necessitate further investigation. The review emphasizes the importance of addressing these challenges and filling the identified gaps. Additionally, our descriptive and bibliometrics analysis demonstrated a growing interest in this field, with an increasing number of publications. Notably, articles focusing on themes such as speed, road safety, and speed management have emerged as prominent topics in recent years, suggesting a promising outlook for future growth. Moreover, the key findings suggest that:

- Implementing well-designed RSPs at signalized intersections is an effective and sustainable approach for constructing a safe system (Pease and Hall, 2023).
- The main objective of implementing a RSP is to improve road safety by enhancing the visibility of pedestrians crossing. However, it should be noted that RSPs may have limited effectiveness in areas where crashes mainly occur during congested, low-speed situations.
- The implementation of a trapezoid-shaped RSP with crosswalk markings is the most effective approach for reducing vehicle speed on local streets.
- While not all traffic calming devices consistently slowed down traffic, researchers estimated that most drivers responded to RSPs by reducing their speed. It was observed that as the width of the platform increased, the magnitude of speed reduction decreased.
- Proper planning, signage, and maintenance are key to maximise the benefits of RSP and ensure their effective addition to road safety efforts.
- Increased speed limits may require the implementation of more noticeable vertical deflection measures, while reduced speed limits may permit the use of smaller and less forceful speed humps.
- There is evidence from Egypt about the impact of various speed hump geometric characteristics on different vehicle types including motorcycles. Details are available in Shwaly et al. (2018).

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Advanced Driver Assistance Systems in Driver Testing and Consumer Awareness

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Abstract

Advanced Driver Assistance Systems (ADAS) are now found in many Australian vehicles. Active technology presents complex challenges to regulators and driver assessors. Regardless of ADAS operation, drivers must still demonstrate the ability to operate a vehicle safely and show a maintained awareness of other road users and hazards in the road environment. Variations in system interfaces, operational characteristics and manufacturer terminology each provide an additional layer of complexity to policy development. Research has begun to describe the road safety value of ADAS, but the consumer landscape provides little information for drivers, fleet operators and other stakeholders. Two Austroads projects provide policy leadership in addressing these issues in Australia. The first produced two guides; one providing guidance on the use of ADAS in driver assessment, the other a plain English, brand neutral consumer guide to ADAS functions. A second project is developing an education strategy based on the consumer guide.

Post on X

How can ADAS be used to assist the assessment of safe drivers? Do you know what ADAS are in your car, what they do and how they can make driving safer? #Austroads is leading the development of safe vehicles policy and consumer education.

Introduction

The proposed presentation will describe two major projects on the management of live ADAS functions during on-road driver testing and the development of driver education resources and an associated communications strategy. It aims to introduce delegates to the complex issue of management of ADAS in the driver assessment context, provide insight into the broad range of ADAS functions now available in mass market vehicles, their use and limitations and connect these to the potential road safety impacts of better consumer understanding of these functions and their value in a safe system context. It will also encourage engagement with the policy and practice challenges posed by increasing deployment of in-vehicle technology and encourage research into its safety impact.

ADAS are becoming increasingly ubiquitous in new vehicle sales. Once limited to high-end luxury vehicles, ADAS are now available in a broad range of vehicles at all price points. Early estimates suggested that even at a slow uptake rate, vehicles with ADAS will represent 30% of the vehicle fleet by 2030. Fleet penetration could be as high as 50% by 2030, if uptake is more rapid. More recent estimates put the penetration of ADAS in new car sales as high as 70% by 2030.

Vehicles classified by SAEJ3016 (a standard produced by SAE International) as levels 0 to 2 (no, low and partial automation) include technologies that are classified broadly as Advanced Driver Assistance Systems (ADAS). While these technologies can perform elements of the driving task, the human driver always remains in control. The driver is responsible for the entire driving task, including monitoring and responding to the ADAS. ADAS include, for example:

- Blind spot warning (level 0) detects when another vehicle is adjacent to or near the rear of the vehicle and provides a warning to the driver;
- Adaptive cruise control (level 1) allows the driver to set a maximum speed for vehicles and automatically slows the speed of the car when traffic is sensed in front of the vehicle; and
- Highway 'autopilot' (level 2) a combination of lane centering and adaptive cruise control at the same time.

Earlier Austroads' work on the driving impact of increasing in vehicle technology concluded that:

- as ADAS become increasingly ubiquitous, the knowledge, skills and behaviours required for drivers to safely operate vehicles are changing,
- there is an education and training gap associated with ADAS but that there is no need to substantively review or change driver licensing frameworks at this time, and

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia • given the lack of standardisation across ADAS technologies, the ability of governments to fill this education and training gap is unclear and opportunities for industry collaboration should be investigated.

Recommendations from that work included:

- development of a standardised set of terms for ADAS,
- development of education material for drivers on the safe use of generic types of ADAS technologies,
- the inclusion in public education programs content on safety benefits and limitations of ADAS and
- the identification of ADAS that may be permitted to be turned on during practical driver licence testing without compromising test validity.

Project Outputs

Completed in 2022, Austroads project '*Incorporating ADAS into Driver Licensing, Education and Training Practices*' addressed those recommendations, working with Australian licensing agencies, to produce two detailed guides. The first established a policy framework to assist licensing authorities to set operational parameters around permitting certain ADAS functions to be live during on road driver testing without diluting the assessment of driver skills in controlling the vehicle and responding appropriately to other road users and events in the road environment. The second guide provided a high level plain English and brand neutral description of most common ADAS functions, their operational characteristics, strengths and limitations and, where available, an indication of research showing their road safety impact.

The project was generously informed by previous policy work undertaken by the American Association of Motor Vehicle Administrators (AAMVA) and *Clearing the Confusion* a brand neutral ADAS taxonomy developed collaboratively by the US National Safety Council, Consumer Reports, the American Automobile Association, J.D.Power and SAE International. ANCAP Safety and the Federated Chamber of Automotive Industries (FCAI).

Publication of the *Driver Education Guide* in 2022 was accompanied by a recommendation for the development of a communications strategy and associated driver education material based on the Guide. A second project is now underway to give effect to that recommendation.

ADAS functions offer great safety potential, but drivers are often confused or unaware of these functions and how to use them. Vehicle manufacturers use various definitions and descriptions, adding to this confusion. ADAS technology and the terminology describing it is rapidly advancing so that guidance quickly loses currency. The benefits of this project include:

- encouraging safe and informed use of ADAS functions and enhancing the contribution they make to improving road safety
- supporting driver licensing authorities to maintain relevant driver testing regimes
- training material for driver assessors to keep them up to date with the development and deployment of ADAS technologies
- advance standardisation of ADAS terminology.

This project will produce the following deliverables:

- Communications Strategy
- Stakeholder Engagement Strategy
- Website and associated communication and educational resources
- Processes and tools for monitoring:
 - Changes to jurisdictional driver license testing processes to incorporate ADAS
 - Uptake of guides, website usage and associated resources including SEO optimisation and user feedback.
 - Research new/emerging changes to ADAS

The communications strategy will focus on a safety behaviour change approach built on four key steps, providing the best chance of achieving the project goals of raising awareness and having a positive and desired impact that is sustained beyond the life of the project.

- Educate: Build awareness and accurate understanding of the issue and the target behaviour with the audience
- Motivate: Create desire and willingness among the audience to change their behaviour
- **Facilitate**: Make it easy for the audience to change their behaviour by removing barriers and prompting them in relevant situations and environments

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• Sustain: Once achieved, ensure the target behaviour is sustained and becomes habitual. A further stage will consider options for evaluation and monitoring of strategic impact including web access feedback and research liaison. Collection of reliable data on the safety impact of ADAS systems is a longer term prospect requiring liaison with external researchers. However the collection of data on behaviour and attitude change after exposure to educational materials might provide a more immediate proxy indicator of changing attitudes to safety through informed vehicle purchasing decisions.

Benefits to road safety

The road safety impact of ADAS deployment is gradually emerging in the research literature. The greatest benefits for active safety features appear to be for forward collision avoidance. This is most likely to be due to the high proportions of metropolitan, intersection, multi-vehicle and rear-end collisions in Australia and New Zealand.

As an example, Monash University Accident Research Centre studies have estimated Automatic (Advanced) Emergency Braking to have the potential to avoid or reduce the severity of up to 70% of the trauma incidents occurring in light vehicle crashes (Newstead et al, 2020). In addition, Blind Spot Warning has been estimated to reduce lane-change collisions by 14% (Insurance Institute for Highway Safety and Highway Loss Data Institute, 2020). The benefits of recent safety technologies extend beyond collision reduction. Some emerging technologies contribute to:

- more efficient emergency braking
- decreased speeding
- increased visibility
- decreased impact in the case of a collision
- improved reaction times and general awareness
- more efficient traffic flow and better fuel efficiency, therefore reducing pollution and emissions.

In addition, functions which reduce vehicle collisions reduce the need for resources to be used to transport and repair vehicles, transport and care for those injured in a collision and the impact of fuel spillage and debris at collision sites. The use of GPS, finding the most direct route to a destination, has the potential to reduce fuel consumption and vehicle emissions, wear on tyres and the vehicle in general, and reduce travel time. This is particularly evident on vehicle with GPS based map systems that include advice on the least congested route even if it is not the most direct. These may have an indirect positive impact on crash frequency and seriousness of outcome.

Anecdotal reports suggest that for some drivers, lack of familiarity with ADAS functions, benefits and limitations can have negative consequences including disabling warning functions or over reliance on their operation and effectiveness. Improved information and systems understanding is intended to overcome these negative impacts, provide support for safer vehicle choices, awareness of the safety impact of ADAS and more effective engagement with available systems.

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Decoding the brain's perception of crash risks: pilot results

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Abstract

Risk perception models are reliable indicators of comprehension/prediction of future behaviour and are crucial in influencing decision-making. The neural mechanisms underlying risk perception are poorly understood. Advances in Generative Artificial Intelligence (AI), brain imaging techniques/analysis such as functional magnetic resonance imaging (fMRI) and psychology-based self-assessments offer a radically new proactive approach to diagnosing maladaptive risk perception by creating a machine-learning model that expresses the neural foundation of human risk perception functions. Modelling the neural mechanisms affecting human risk perception in different risky situations provides quicker and safer evidence-based grounds to design and test tailored interventions to reduce maladaptive risk perception from fMRI scans. It presents the preliminary results of a large research program assessing human risk perception from a neuroscientific perspective with fMRI controlling for environmental ambiguity and individual differences.

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Seeing the brain's perception of crash risk.

Introduction

Road transport is a key enabler of every economy on the planet and, simultaneously, through road crashes an enormous source of both social and economic losses. Road traffic crashes result in approximately 1.3 million fatalities and 50 million yearly injuries. Most of these crashes stem from driving behaviour influenced by interactions with the road environment and are preventable. Although proactive road safety approaches such as the use of surrogate measures of crashes (e.g. near misses) to predict crashes are growing; current approaches to developing and improving road safety policy still rely largely on historical crash data and psychosocial measures for understanding risk-taking. Consequently, not only road users must be injured or killed before a lagging reactive safety policy is deployed but it is also difficult to design safe driving environments adequate for future transport landscape. Furthermore, the road safety community is of the view that the current approaches have achieved an asymptote in their efficacy. Hence the urgency of the new approach to deliver Vision Zero.

There are many theories related to risk perception, such as Protection Motivation Theory, Risk Homeostasis, Habituated Action Theory and Social Action Theory. Not all road users perceive the same risk in a situation or understand their own ability to manage it. Theoretically, hazard perception and risk perception are two related but different processes. Hazard perception is a skill about real-time hazard identification, whilst risk perception is the ability of an individual to discern a certain amount of risk. It is related to the likelihood of a crash and the severity outcomes of the crash. Risk perception is the first layer of situation awareness (1A-SA). The relationship between risk perception, driver behaviour and road crashes is well-established (Danso et al., 2022; Jing et al., 2022). The inability to accurately perceive risk, also called maladaptive risk perception, may lead to higher risk tolerance leading to high-risk behaviour. Maladaptive risk perception is associated with risky driving behaviours that can result in crashes. Risk perception involves a long and complex learning process related to the probability, characteristics, severity, consequence and ways of dealing with hazards. It is influenced by a wide array of psychological, social, institutional, and cultural factors and is a well-established research field in its own right.

There has been little research that has examined the brain mechanisms underlying the risk perception process accounting for individual variability of road users in fluid, complex and uncertain driving situations. Non-invasive neuroimaging techniques such as fMRI are pivotal in studying the brain activity associated with risk perception. fMRI studies, including resting-state and task-based imaging, allow researchers to compare brain activity under different conditions. By examining these patterns, scientists can identify the neural correlates of risk perception. This understanding is crucial for developing interventions to enhance driver safety. This paper is part of a larger research program targeting a step change in fundamental neuroscience understanding of risk perception and road safety management by creating a novel Artificial Intelligence (AI)-enabled model for diagnosing "maladaptive" human risk perception.

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Methods

A pilot study was conducted at the Herston Imaging Research Facility (HIRF) within the Royal Brisbane and Women's Hospital. Given the exploratory nature of this study, we recruited six participants for MRI scanning using a 3T Siemens PRISMA scanner (Siemens Heathineers, Erlangen). During a 45-minute session, participants were presented with video footage of driving scenarios displayed on a computer monitor, encompassing both risky and no-risky situations, following the completion of seeking and risk-taking questionnaires.

The Blood Oxygen Level Dependent (BOLD) signal was measured, reflecting changes in the magnetic properties of blood resulting from fluctuations in the ratio of oxyhemoglobin to deoxyhemoglobin. This signal serves as an indirect indicator of neuronal activity in the brain. A voxel is a 3D unit in brain scans, representing a small, discrete volume (typically 3mm³) used in fMRI analysis to measure changes in blood oxygenation levels and infer neural activity. The BOLD signal is measured within each voxel. By analysing the signals within voxels, we localised neural responses to risk exposure. Data analysis involved the examination of time series variations BOLD signal through voxel-wise analysis, a commonly utilised approach for analysing task-based fMRI data and localising regions of activation associated with the experimental paradigm. Z-scores were employed as the primary statistical metric for evaluating the significance of BOLD signal changes. Z-scores denote the number of standard deviations a data point (voxel) deviates from the mean of a normal distribution.

Furthermore, multivariate pattern analysis techniques were applied to fMRI recordings and questionnaire responses to discern neural markers that distinguished individual risk perception. Region of interest and seed-to-voxel analyses were conducted to investigate experience-related changes in functional connectivity during the visualisation of risky and no-risky scenarios.

Results

After a stimulus is presented to a participant, the parts of the brain activated by the stimulus exhibit an increase in the BOLD signal, which can be represented by a Gamma Distribution known as the Hemodynamic Response Function (HRF). BOLD signals underwent pre-processing using the fmriprep Python package, including co-registration, motion correction, spatial normalisation.

Individual level analysis (Level 1)

We performed a first-level analysis for each participant by fitting a General Linear Model (GLM) to the BOLD response of each voxel using event-related regressors and confounds. The model includes three main regressors: Risk, NoRisk, and Control. Each regressor represents an ideal time series where a Hemodynamic Response Function (HRF) is placed at each onset corresponding to the specific trial type. We fitted the model to find the coefficients for each regressor and computed the contrast as the difference between the Risk and NoRisk conditions. We computed the Z-scores for this contrast to assess the statistical significance of the differences between the conditions and plotted the activation maps. In these maps, a high positive Z-score in a specific brain region indicates that, for the contrast being studied (here "Risk" minus "NoRisk"), brain activity is significantly higher in the "Risk" condition compared to the "NoRisk" condition, and vice versa for a high negative Z-score.

Group level analysis (Level 2)

We performed a second-level analysis to examine group-level effects by combining the individual Z-maps from the first- level analysis. We defined the contrast to test whether the average z-score across all participants is significantly different from zero, answering the question of whether, on average, there is a significant difference between the Risk and NoRisk conditions across participants. This resulted in a group-level Z-map highlighting regions where brain activity significantly differs between the Risk and NoRisk conditions.

As before, high positive Z-scores indicate that brain activity is significantly higher in the Risk condition, while high negative Z-scores indicate higher activity in the NoRisk condition. By applying statistical thresholds, we identified the brain regions showing significant activation differences, providing insights into the neural mechanisms underlying these conditions across our population.

Figure 1 illustrates the Z-score of an individual participant, while Figure 2 illustrates the combined (level 2) score of all six participants with a Z threshold of 1.96. This suggests greater activation (increased blood oxygen concentration) during risky videos compared to no-risky videos.



Figure 1. Individual Z score of BOLD activation of Risk vs No-Risk of a participant



Figure 2. Group level (N=6) Z score of BOLD activation of Risk vs No-Risk

Conclusions

This pilot project employs new methodology that models the neural underpinnings of human risk perception to enhance road safety. The brain regions activated during high-risk footage are the bilateral anterior insula (aINS), thalamus, dorsomedial prefrontal cortex (DMPFC), and right dorsolateral prefrontal cortex (DLPFC). The fMRI BOLD activation patterns in these regions exhibited distinct differences between exposure to risky and no-risky visual stimuli. As this was a pilot experiment, only six participants were recruited. Currently, we are exploring the relationship between brain BOLD patterns and driving scenario images displayed during fMRI experiments using Generative AI, building upon prior work (Shen et al., 2019; Chen et al., 2022). Understanding changes in brain patterns during risk perception could pave the way for new avenues in fundamental and applied research aimed at mitigating risk exposure. This research will contribute novel theoretical and methodological insights to road safety through experimental and computational approaches. This finding represents a foundational step towards objectively identifying perceived risk via the brain's neural signature, paving the way for potential interventions to mitigate risk and improve road safety. The ultimate goal is to develop a new generative AI model that can reconstruct human vision from brain activity, enabling reliable comprehension and prediction of risk perception. This would provide evidence for policymakers to formulate policies that effectively reduce road crashes.

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Attitudes and behaviours of NSW motorcycle riders towards road safety

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Abstract

Motorcyclists are overrepresented in NSW road trauma, accounting for 18.6% of all fatalities and 21.6% of all serious injuries in NSW in 2018-2022. A recent mixed-methods study explored motorcycle riders' attitudes towards road safety and risk-taking, and passenger and driver attitudes towards motorcyclist safety. The study revealed that riding is integral to riders' social identities. Both riders and drivers acknowledged shared responsibility for safety, highlighting concerns such as driver inattention and motorcyclist visibility. Risk perception varied, with riders demonstrating a greater inclination to take risks in perceived lower-risk situations. Distinct segments of riders were identified based on risk profiles, emphasising the need for targeted safety messaging. While ownership and usage of protective gear were high, cost and comfort barriers existed. The findings inform future campaigns and policy initiatives aimed at harnessing riders' sense of responsibility, reframing risk perceptions, and improving awareness of rating and assessment programs for protective gear.

Post on X

NSW motorcyclists, passengers and drivers reveal their current attitudes towards motorcyclist road safety in a new survey, with implications for how motorcyclist road trauma can be addressed.

Background

Motorcyclists remain overrepresented in road trauma in Australia, with a fatality rate of more than 30 times higher than vehicle occupants per kilometres travelled (BITRE, 2023). They are also more likely to experience more severe postcrash injuries and longer hospital stays compared to vehicle occupants, because they are less physically protected in a crash (Sharwood et al., 2021).

In NSW, motorcyclists accounted for 18.6% of all road fatalities from 2018 to 2022 despite motorcycles only making up 4.4% per cent of all registered motor vehicles over this period, highlighting the need to continue to develop effective countermeasures. Under the 2026 Road Safety Action Plan the NSW government has committed to ensuring the safety of vulnerable and at-risk road users, including motorcyclists (Transport for NSW, 2022). The focus on vulnerable road users is one of five priority areas to halve deaths and reduce serious injuries by 30 per cent, from 2018-20 levels, by 2030.

Understanding rider attitudes towards road safety, risk-taking behaviours, and awareness of existing motorcycle safety initiatives is critical to inform new road safety initiatives, communication strategies and education campaigns, as well as to identify high-risk subgroups of riders. Research has shown that riders who wore more protective gear were less likely to be involved in a crash, suggesting that attitudes to riding and risk-taking are likely to be associated with crash risk (Brown et al., 2015).

Attitudinal research on a representative sample of NSW motorcyclists was last conducted in 2012. The motorcycle landscape has changed significantly over the last 10 years with an increase in motorcycle registrations, introduction of new road safety initiatives such as the Motorcycle Clothing Assessment Program (MotoCAP), advancements in vehicle technology, and changes in rider demographics. Therefore, new research was needed to gain an up-to-date understanding of motorcyclist attitudes and behaviours, and of passengers and drivers towards motorcyclist safety, to inform effective design and implementation of targeted road safety initiatives to reduce motorcycle road trauma.

Overview

The primary aim of this research was to investigate motorcycle riders' attitudes to road safety and self-reported riding behaviours, and a secondary aim was to understand the attitudes of passengers and drivers towards motorcyclist safety. The research involved a mixed-methods approach with two phases.

Phase 1 was a qualitative research phase involving six focus groups with riders, and two focus groups with drivers, with 6-8 participants per group. Focus groups were 1.5 hours in duration and were conducted either in-person or online. The focus group findings informed the development of a survey instrument used in Phase 2.

Phase 2 was a quantitative research phase involving an online survey of motorcycle riders (n = 912), motorcycle passengers (n = 161), and drivers (n = 948). All survey respondents had to reside in NSW and be at least 18 years of age to participate. To be eligible, riders had to have ridden a motorcycle or moped/scooter in the last 6 months. Passengers had to have been a passenger (pillion) on a motorcycle or moped/scooter in the last 6 months, and not qualify as a rider. Drivers had to have driven a car or truck in the last 6 months, and not qualify as a rider. The rider, passenger and driver samples were sourced from an online panel provider with a nationally representative sample. The rider sample included an additional 417 respondents sourced from an open link distributed through the Motorcycle Council of NSW in order to increase sample size and obtain a broader perspective of riders. Weighting was applied to the rider sample to ensure sample representativeness.

Riders were asked questions about their motorcycle use, attitudes and beliefs about riding, riding habits, attitudes towards road safety, crash history, ownership and use of protective gear, motorcycle purchasing decisions, awareness of NSW motorcycle safety initiatives, and demographic characteristics. Passengers were asked a subset of questions from the rider survey. Drivers were asked questions about their attitudes and beliefs about motorcyclists, concerns about sharing the road with motorcyclists, crash history and demographic characteristics.

Findings

Attitudes towards riding and road safety

Riding was seen by motorcyclists to be a strong part of their social identity, and more than just a form of transport, with the top reason for riding being 'because I enjoy the feeling of riding' (endorsed by 72% of riders), with the majority of riders agreeing that they 'would be devasted if they could never ride again' (79%). Riders were also concerned about how they were perceived by other road users, with 79% agreeing that 'there are certain groups of riders who give us all a bad reputation' and 53% agreeing that 'riders have a bad reputation amongst drivers'.

Riders and drivers were matched on their belief that the responsibility for motorcyclist safety was shared between motorcyclists (approximately 55% of total responsibility), drivers (approximately 30%) and the government (approximately 15%). Riders' top three safety concerns were the inattention of other drivers (69%), aggressive behaviour of other drivers (68%), and other road users not seeing motorcyclists (63%). Drivers' top three safety concerns were motorcyclists changing/weaving between lanes (74%), high speeds of motorcyclists (64%) and not seeing motorcyclists (58%).

Risk-tasking and safety behaviours

Both riders and drivers agreed that riding is risky, and the majority of riders agreed that 'as a rider I am always the most vulnerable on the road' (72%). Perception of risk and behaviours differed for certain types of rides, with local known roads, short trips, and minimal traffic seen as lower risk. Riders reported being more likely to ride wearing less protective gear in situations they perceived to be lower risk.

Riders perceived the lowest levels of confidence with riding: under the influence of drugs (83% not at all/not very confident), under the influence of alcohol (81%), or without a helmet (77%). Despite speeding being the biggest contributor to serious motorcyclist road trauma, it was viewed as lower risk compared to other illegal behaviours, with 74% of riders reporting that they were somewhat/very confident riding 5-10 km/h over the speed limit. A significant minority of riders agreed that they tend to ride faster than the speed limit when they are sure they won't get caught (25%). Novice riders with 0-2 years of experience were more likely to overestimate their skill level relative to riding experience, reflecting overconfidence and a higher risk appetite.

The research also identified five segments of motorcyclists based on their attitudes, beliefs, behaviours and propensity for risk taking, with distinct crash history profiles. The highest risk segment was 'risky riders', characterised by their relaxed attitudes towards risk, overconfidence, and thrill-seeking, and more permissible attitudes towards speeding and riding under the influence of drugs and alcohol. Compared to the total sample, this segment comprised a higher proportions of: younger riders aged 18-34 years; CALD riders; First Nations riders; and inexperienced and novice riders on Ls and Ps.

Protective gear

Regarding protective gear, self-reported ownership and usage were both high, particularly for helmets, owned by 98% of riders, and with 95% reporting they wore their helmet 'most or all of the time'. The top barrier to owning more protective gear was cost (37%). The top barriers to wearing protective gear related to comfort including getting too hot (27%) and finding it uncomfortable/restrictive (21%). Riders assumed helmets, protective gear and motorcycles sold in Australia meet quality and safety standards, even though standards exist only for helmets. Only about half of riders

were aware of current NSW initiatives to support consumer choice of safe protective gear (MotoCAP and the Consumer Rating & Assessment of Safety Helmets, CRASH).

Benefits to road safety

The current research findings will be used to inform future campaigns and communications to the NSW rider community. In addition, the research will inform delivery of motorcyclist initiatives under the 2026 Road Safety Action Plan to advance progress towards Target 2030. These include developing enhancements to the Motorcycle Graduated Licensing Scheme to better align with best practice; assessing the feasibility of an incentive program to increase the use of motorcycle protective equipment measures; assessing the feasibility of mandating the use of protective boots and gloves for novice riders, and working with retailers to increase uptake of the safest motorcycle protective clothing and helmets.

Implications for policy and/or practice

One key finding was that riding was a pivotal part of riders' personal identity. Education and safety campaigns that focus on riders' desire to uphold a positive reputation for the riding community are likely to be engaging. Second, this research identified that some riding situations (e.g., familiar roads) and behaviours (e.g., speeding) were perceived by riders as lower risk than other behaviours (e.g., unfamiliar conditions, drink riding). Further, riders reported changed their riding behaviours (e.g., how much protective gear to wear) based on their perceptions of risk for upcoming rides. There is therefore an opportunity to reframe and realign risk perceptions of certain high-risk behaviours such as speeding. Interventions and communications that draw attention to the disconnect between perceptions of speeding as low risk and the actual risks associated may be effective in changing rider attitudes. Third, the research identified five distinct segments of motorcyclists based on their risk profiles, highlighting the need to ensure that safety messaging will resonate with highest risk subpopulations. Fourth, the research found that riders incorrectly assumed that all protective gear and motorcycles sold in Australia meet a certain standard of quality and safety, even though standards exist only for helmets. There is an opportunity to improve NSW riders' awareness of assessment programs like MotoCAP and CRASH to support safer purchasing choices for gear. Finally, riders were largely supportive of introducing incentive programs to increase the uptake of protective gear, and of introducing mandates for wearing protective gear other than helmets, and requiring additional vehicle safety features for novice drivers. These findings highlight that policy changes to improve rider safety are likely to be viewed as acceptable to the community.

Conclusions

This project provides rich insights into NSW riders' current attitudes and behaviours towards road safety using a robust mixed-methods approach. The findings have several implications for policy and practice in NSW and Australia, and have highlighted opportunities to develop and target effective communication approaches to reduce risk-taking behaviour as well as other interventions to improve protective gear ownership and usage.

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Assessing Fitness to Drive – prioritising health professional education

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Abstract

Managing the risks associated with driver impairment due to medical conditions and treatments is vital for road safety and an important aspect of planning towards our shared 2030 goal. Now in its second year, the Austroads Implementation Strategy for *Assessing Fitness to Drive (AFTD)* seeks to address the barriers to consistent and appropriate application of the standards that guide licensing decisions and medical management of drivers throughout Australia. A significant barrier is lack of systematic education for health professionals and this is being addressed as a priority in order to better equip health professionals to apply the standards and provide support to their patients. The approach involves developing a foundation level module for general practitioners, as well as activities to promote training opportunities more broadly and encourage stakeholders to deliver targeted training to medical specialists and other health professionals.

Post on X

Medical fitness to drive is important for road safety. Health professionals have an essential role in advising patients and licensing authorities about the impacts of medical conditions on fitness to drive. #Austroads is responding to the need for health professional education through our Assessing Fitness to Drive Implementation Strategy.

Background

The national Assessing Fitness to Drive (AFTD) standards provide the basis for nationally consistent licensing decisions and medical management of drivers with health conditions that may affect their fitness to drive. The success of the standards in addressing the road safety risks associated with medical conditions relies on achieving consistent application by health professionals, which in turn relies on achieving widespread awareness and building appropriate knowledge and skills.

With this in mind, the Austroads AFTD Implementation Strategy, launched in 2022, identified health professional education as a high priority, noting in particular the need for educational opportunities for general practitioners, who are commonly in a position to consider the road safety risks of patients' medical conditions. A major obstacle is the insufficient systematic education for health professionals. Resolving this issue has become a priority to ensure that health professionals are better equipped to apply the standards and provide optimal support to their patients.

In addressing health professional education, Austroads is seeking to embed education and training in relation to AFTD at various levels (undergraduate, post-graduate and continuing professional development) for a range of health professionals. This will be achieved through (refer Table 1):

- Advocating for delivery of fitness to drive education and training by professional bodies and other agencies.
- Facilitating delivery of fitness to drive education and training by partnering with stakeholders.
- **Promoting** existing education and training through Austroads communication channels.

These approaches are enabled through the extensive stakeholder network established in the first year of the Strategy and the building of a 'community of practice' with shared goals for achieving consistency and fairness in the application of fitness to drive.

A priority in 2024 is the development of a foundation level module for general practitioners.

The module aims to achieve understanding in the following areas:

- The importance of driver health for road safety.
- The underlying principle and key clinical practice considerations.
- The clinical and licensing processes, including the roles and responsibilities of health professionals, drivers and licensing authorities.
- How to support patients to manage their health in relation to driving case examples and practice tips.

The underlying principle to be communicated is that of *keeping people driving for as long as it is safe to do so*. This reflects the need to consider the impact of health conditions in the context of people's driving needs and the nature of their driving task.

Health professional education strategy							
Activities and Interventions	Specific processes to measure	Short-term outcomes and measures					
ADVOCATE for delivery of fitness to drive education by professional bodies and other agencies through stakeholder engagement.	Education offerings and opportunities are monitored and mapped. Educational needs and priorities are identified and inform specific education projects.	Health professional bodies across all main target groups including general practice, medical specialties and allied health are engaged with respect to the need for FTD education. Undergraduate schools are engaged in discussions about FTD content.					
FACILITATE delivery of fitness to drive education by partnering with stakeholders and providing expertise and other support.	 Partnerships are established and specific projects facilitated/delivered including: Baseline online module for GPs Specific education for commercial vehicle driver fitness for duty Driver information pack for health professionals Others as identified 	Health professional peak bodies and other relevant organisations engage in projects to improve education for FTD. Commercial driver stakeholders commit to involvement in education specific to fitness for duty assessment and management					
PROMOTE relevant education and training through Austroads and stakeholder communication channels.	Education is promoted to health professionals through various channels Reach of Austroads communications is actively developed through promotion of the newsletter subscriber base	Existing education resources are identified and promoted, and authors are engaged in the AFTD community of practice.					



Figure 2. Underlying principle guides approach to GP education

Key messages for clinical practice have been identified and are currently being tested with general practitioners:

- Gain an understanding of your patients' driving needs and their specific driving task, including changing needs over time.
- Consider driving early in the management of relevant conditions and as patients get older.
- Discuss the impacts of health conditions on driving and licensing with your patients normalise conversations about driving and embed them into existing clinical processes and preventative activities.
- Facilitate approaches to maintaining driving including through conditional licenses (include regular monitoring), driving restrictions, self-regulation and driver rehabilitation.
- Normalise and support the change or transition to non-driving, including through alternative transport options.
- Take a whole-of-practice approach to ensure consistency and to optimise opportunities for conversations, understanding and support.

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2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia

Year 2 of the WA observational study of eRiders

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Abstract

The behaviour of eRiders and cyclists was observed at sites around metropolitan Perth, 7 days a week, from 8am – 11am and from 3pm – 6pm, for the same two-week window in 2022 and then again in 2023. The information recorded included, the type of device being ridden, helmet use, rider gender, location (road, footpath, bike path), speed, and inappropriate maneuvers. E-riders demonstrated more risky behaviour than cyclists, with helmet non-use, travelling too fast and inappropriate maneuvers being significantly greater than cyclists. The rate of travelling too fast and inappropriate maneuvers decreased across time for e-scooter riders but the rate of helmet noncompliance increased for those same riders. The increase in availability of hire e-scooters from 2022 to 2023 may explain the increase in helmet noncompliance.

Post on X

E-scooter riders are riskier than cyclists, but that risk may decrease over time.

Background

Reflecting global trends, small electric rideable devices ('eRideables') continue to grow in popularity. On 4 December 2021, new eRideables regulations, that introduced size/weight restrictions, speed limits for eRideable devices, and minimum age and helmet requirements for riders, came into effect in Western Australia (WA). As the popularity and usage of eRideables has increased, paramedics have reported attending more e-Rideable incidents. Although there is good data from other states (e.g. Haworth, Schramm & Twisk, 2021), until recently there had been little empirical research in WA on eRider safety behaviour.

To address this knowledge vacuum a program of research was initiated in WA to document safety-relevent behaviours of eRiders in Perth. The current study represents the second year in this program of research and compares the most recent data to the previous years data. Continuous monitoring of eRider behaviour is important for several reasons, including being able to assess the effectiveness of public education and to monitor the impact of changes in the eRideable fleet. For example, in WA, since the 2022 data collection, there has been an increase in availability of hire esconters.

Method

For the first two weeks in December in both 2022 and 2023, ten research assistants observed and recorded aspects of eRider and cyclist behaviour at 10 sites around metropolitan Perth. Cyclists could be riding either a conventional bicycle or an ebike and no attempt was made to distinguish these. eRideable device types were categorized as either e-scooters, e-skateboards, e-wheels, hoverboards, e-unicycles or e-skates. The sites and times were chosen to ensure that they captured both commuter and recreational riders. Observations were made 7 days a week, from 8am – 11am and from 3pm – 6pm. The information recorded included the type of device being ridden, helmet use, rider gender, location (road, footpath, bike path), hire versus private, judged as travelling too fast and/or inappropriate maneuvers for the conditions.

Results

In 2022, over the two-week observation period, information relating to 24,960 eRideables and bicycles was recorded. Approximately 80% were bicycles (or e-bikes), 19% e-scooters, and 1% e-skateboards. There were also small numbers of e-unicycles (37) and e-wheels (25). The most common location for riders was a bike path (57%), followed by a footpath (25%) and the road (17%). Approximately 80% of all riders were male.

In 2023, the volume of riders recorded rose to 29,806. Contrary to expectations the volume of eRideables remained relatively constant across the two years with the increase in the total volume explained almost entirely by an increase in the number of cyclists recorded. Consistent with the greater availability of hire e-scooters, in 2023 the proportion of e-scooters that were hire scooters more than doubled compared to 2022 (from 8.4% to 18.6%). In 2023, the proportion of footpath and road riding increased (to 32% and 23% respectively), and bike path riding decreased (to 44%). This was the case across all device types. Again, approximately 80% of all riders were male.

As in 2022, while, on average, 90% of all riders were helmeted, this varied across rider groups. Helmet non-use was significantly greater for e-scooters compared to cyclists in 2022, and this difference was further exacerbated in 2023

with e-scooter riders' helmet compliance deteriorating (p < .05) by around 5%, with no change in cyclist's helmet compliance.

In 2022, escooters were observed to travel too fast for the conditions and to make more inappropriate maneuvers significantly more that cyclists. This effect persisted in 2023 but the rate of these behaviours approximately halved (p < .05).

Conclusions

While it is clear that infrastructure factors contribute to eRider crashes (see e.g., Shah, Aryal, & Cherry, 2021; Yang, Ma, Wang, Cai, Xie, & Yang (2020), it is also clear that risky behaviour contributes to eRider crashes. For example, Hennocq, Schouman & Khonsari (2020) administered a questionnaire to 125 patients who presented with injuries associated with e-scooter use and found that risky behaviours were present in 87% of cases.

The current study compared eRiders with cyclists in the same locations and time windows across a 12-month interval. As in 2022, in 2023 risky behaviours were over-represented in eRiders compared to cyclists. Interestingly, while this over-representation decreased for travelling too fast and inappropriate maneuvers, from 2022 to 2023, it increased for helmet noncompliance over the same period. While it is unknown why helmet compliance for e-scooter riders has deteriorated, one possibility relates to the increased availability of hire e-scooters in 2023. Anecdotally people are less likely to use a shared helmet and indeed, while the number of escooter riders has stayed relatively constant from 2022 to 2023, the number of people riding hire scooters unhelmeted has approximately doubled.

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A pathway for Metro Manila-Enhanced Road Safety by 2030

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Abstract

Road safety is a pressing issue in the Philippines, particularly in Metro Manila, where traffic congestion and road traffic incidents are prevalent. There have been an increasing number of road traffic crashes and deaths in Metro Manila over the past few years. 52% of the total road incidents involved vehicles. This was followed by motorcycle accidents, which accounted for about 23 percent. Metro Manila becomes unsafe for road users. It emphasizes the need for a comprehensive Metro Manila Road Safety Action Plan guided by the Safe System approach and the Philippine Road Safety Action Plan 2023-2028. The proposed plan, led by the MMDA and supported by the Department of Transportation, and other key national government agencies and NGOs, WHO Philippines and the Center for Policy Studies aims to reduce road traffic deaths, enhance road infrastructure, and improve enforcement of traffic laws, contributing to safer roads by 2030.

Post

Exciting days! Metro Manila-Enhanced Road Safety via the Road Safety Action Plan 2024-2028 is here.

Introduction

There are over 12,000 road traffic fatalities annually in the Philippines, which has a population of over 117 million. The Philippine Statistics Authority (PSA) reports that between 2011 and 2021, the number of road traffic deaths increased by 39%, from 7,398 in 2011 to 11,096 in 2021. Regions IV, III, XI, NCR, and VI account for the majority of road traffic fatalities, according to ONEISS data.

Metro Manila has a total of 14 million people living in 17 cities, and around 57,179 road crashes have been recorded in 2022, or an average rate of 156.65 cases daily, according to the data of the Metropolitan Manila Development Authority (MMDA) via the Metro Manila Accident Reporting and Analysis System (MMARAS), which began in 2005. Approximately 52% of all vehicle-related traffic events in the nation were reported in Metro Manila in 2022, likely due to the city's fast development and burgeoning motorization. Motorbike crashes comprise about 23% of all vehicle crash occurrences in the region.

As the major metropolis in the country, the risks of crashes, injuries, and deaths on its roads affect not only its residents but also visitors and those travelling from other areas. If nothing is done, the situation will get worse and the number of road traffic fatalities and injuries will rise. This has economic cost as well to the individuals and families affected, as well as to the regional and national economy, owing to medical and non-medical costs that will ensue.

To address the above issue, it is imperative to assess the road safety situation and develop the Road Safety Action Plan for Metro Manila, one that is aligned with the Philippine Road Safety Action Plan 2023–2028 and the UN Decade of Action for Road Safety 2021-2030. The Metropolitan Manila Development Authority (MMDA) lead this process, in close collaboration with the 17 NCR cities and with technical assistance from relevant stakeholders including the Department of Transportation, the Department of Health, and the World Health Organization - Philippines. The Policy Center (TPC) will assist the MMDA in this endeavor.

Program Description

The program started with the identification and engagement of various stakeholders. These included the 17 cities of the National Capital Region (NCR), collectively known as the local government units (LGUs). Each LGU played a crucial role in understanding and addressing the unique road safety challenges within their jurisdictions. The initial phase involved conducting comprehensive desk reviews related to the road safety situation in Metro Manila. This included analyzing existing reports, data, and studies from the MMDA, PSA, ONEISS, and WHO. The purpose was to gain a detailed understanding of the current road safety landscape and identify key issues and trends. A questionnaire was developed to gather primary data on road safety from various stakeholders. This survey aimed to capture detailed insights into road safety perceptions, incidents, and potential solutions from those directly affected by or involved in road safety management. To supplement the survey data, key informant interviews (KIIs) and focus group discussions (FGDs) were conducted. These activities involved in-depth discussions with experts and stakeholders, providing qualitative data that offered deeper insights into road safety issues and potential interventions. A technical working group (TWG) was organized, consisting of key technical personnel from the MMDA, the Department of Transportation, the Policy Center, and WHO Philippines. This group was responsible for overseeing the technical aspects of the project, ensuring that the methodologies and strategies employed were robust and effective. Stakeholders were brought together

in a series of workshops and planning meetings to assess the current road safety situation in Metro Manila. During these sessions, participants collaboratively developed, validated, and refined the Metro Manila Road Safety Action Plan using the Safe System Approach. This approach emphasizes safe roads, safe speeds, safe vehicles, and safe road users, and is aligned with the Philippine Road Safety Action Plan 2023-2028 and the UN Decade of Action for Road Safety 2021-2030.

Outcome of the work

The Road Safety Action Plan for Metro Manila was created by the 17 NCR cities in response to various sector needs. It is in line with the UN Decade of Action for Road Safety 2021-2030 and places road users at the center of the five pillars of road safety. To encourage road safety in Metro Manila, a plan for a road safety communication strategy was also created. Additionally, it was able to provide traffic safety resources that were suited for various target groups and coherent across all communication channels. It created awareness, influenced behavior, and enhanced the organization's image.

The Road Safety Action Plan provided a means for the 17 NCR cities to work together, communicate more, exchange information, and create a system that is in line with existing road safety implementation organizations. It evolved into a means of guaranteeing the continued support and advancement of road safety advocacy and campaigns. Benefits to Road Safety

The 17 NCR cities were given the chance to cooperate and work together on road safety through the creation of the Road Safety Action Plan for Metro Manila. It gave people a forum to talk about statistics on traffic fatalities and collisions and to collaborate as a group to get Metro Manila's Road conditions better. It turned into a means by which we could share best practices and learn from one another. Local government organizations were able to enhance their road safety knowledge and exchange programs and services with the project's assistance. Ultimately, the objective is to make a positive impact on the country, Metro Manila, and the UN Decade of Action for Road Safety 2021–2030 by lowering the number of injuries and fatalities.

Implications for policy and/or practice

Road safety units will be established in Metro Manila and the 17 NCR cities as a result of this project, which will have an impact on national policy. The goal of this road safety plan is to reduce the number of traffic accidents and fatalities in Metro Manila and to support the UN Decade of Action for Road Safety (2021–2030) and the Philippine Road Safety Action Plan (2023–2028) by collaborating with academic institutions, NGOs, civil society, and road users, in addition to the 17 NCR cities.

Conclusions

The dangerous road conditions have taught us that we must work together to develop creative solutions with the communities and local authorities in order to prevent more collisions and fatalities. If we want to see a shift and create a safer road environment for everyone, particularly in Metro Manila, we must take the time to prepare ahead for road safety. Although urbanization and motorization will only grow, we still have the ability to make things better, create more sustainable roadways, and boost road traffic safety. The Road Safety Action Plan, which was created by the people, for the people, offers a path toward greater road safety in Metro Manila, Philippines, by 2030! This is a joint endeavor amongst the 17 NCR cities, spearheaded by MMDA with backing from WHO Philippines.

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AFTER IMPACT: reaching young drivers through serious injury videos

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Abstract

Road safety is very focused on road death statistics; yet far less time is given to the very significant statistic of those people seriously injured in road trauma. A staggering 40,000+ people a year fall into that category. That's more than 110 per day. Serious injury from road trauma was our focus in developing video content featuring seven survivors living with lifelong injuries. A 1-hour documentary, *AFTER IMPACT*, was subsequently produced. Broadcast on primetime television across the NT in December 2023 and nationally in May 2024, with the aim of reaching younger drivers and their influencers. Seven stand-alone videos featuring each injury survivor are currently being produced as educational tools for injury awareness and prevention and road safety programs targeting high school students, addressing the serious impact of road trauma. The schools' presentations are designed to reach young drivers about to get, or already with, their L or P plates.

Post on X

After Impact looks at the consequences of serious lifelong injuries resulting from road trauma. 7 injury survivors were filmed for this project. A TV documentary and individual case videos were produced for injury awareness and prevention programs targeting high school students.

Introduction

Road safety is often spoken about in numbers and statistics (e.g. last year, 1,266 people died on Australian roads).

We believe our submission directly addresses the conference theme of *TARGET 2030 – What's The Pathway Forward?* – because it offers one of many potential pathways forward through a different approach.

Our rationale for this is that we often talk about the number of people who lose their lives each year on our roads. Yet this number has continued to rise for the past few years. This doesn't mean we should stop the dialogue.

Maybe another angle needs to be considered – the plight of those we rarely hear about who have been seriously injured as a result of road crashes, and who are subsequently left living with life-changing injuries. Most of us know someone who has suffered serious injuries from road trauma. We strongly believe this needs to be more of a focus in terms of reaching younger drivers – as well as their family, friends, and other influencers. The numbers around serious injuries are astronomical – more than 40,000 per year Australia-wide.

In addition to the obvious road safety issues that are recognised Australia-wide, the Northern Territory (NT) has a number of unique challenges in achieving improved road safety outcomes for road users. Some of these include the vast road network and unsealed roads, extreme climates and seasons, the widely dispersed Territory population and a combination of socioeconomic issues that affect some of the Territory's most vulnerable road users.

The project – *After Impact* – was designed to deliver a range of content for ongoing educational use across the Northern Territory and was a collaboration between three agencies:

- Road Safety Northern Territory (RSNT) which sits within the Department of Infrastructure, Planning and Logistics (DIPL) in the NT Government and is responsible for the effective delivery and provision of advice in relation to school, community and workplace road safety education programs.
- RADD Recording Artists, Actors & Athletes Against Dumb Driving. RADD has been a partner of RSNT for 15 year, and is a not-for-profit organisation. RADD launched in Australia in 2004, and a sole focus on drink driving. Today it covers most road safety issues. RADD has the support of some 2,000 celebrities and highprofile international, national and grassroots talent who have donated their time to record messages for radio and occasionally video/TV.
- Prevent Alcohol and Risk-related Trauma in Youth (P.A.R.T.Y.) Program an injury prevention and awareness program run by the Royal Darwin Hospital Trauma Service. P.A.R.T.Y. program exposes teenagers to the tragic consequences of risk taking behavior. The program has a strong focus on road safety and is offered in all Australian states and territories. Senior students from across Northern Territory High Schools are invited to participate and follow the journey of the trauma patient. Students learn through vivid and emotional experience what happens when young people make a decision that changes their life forever.

Approach

Road safety in the public sphere is often defined by the number of deaths on our roads, but rarely includes the number of people who are seriously injured. To gain the attention of the general public, Road Safety NT, the P.A.R.T.Y Program NT and RADD worked together to look at a different approach. We believe future road safety statistics should reflect both deaths AND serious injuries.

The recent statistics provide good evidence for this:

- in 2023, 1,266 people died on Australian roads;
- in 2022, around 43,000 people were seriously injured. That's 118 people every single day of the year.

With a view to the 'Towards Zero Road Safety Action Plan' and possible pathways forward, we believe this approach should be seriously considered.

One of the hardest-to-reach demographics in terms of road safety are young male drivers, especially those who exhibit risk-taking behaviour. Many of them are in the 15 to 18 age group and are senior high school/secondary school students.

Road Safety NT, the P.A.R.T.Y. Program NT, and RADD decided to utilise visual storytelling of real case studies to produce meaningful content that has a multiplicity of uses:

- videos for use in road safety education delivery to senior school students
- a television documentary
- online and social media assets
- content for radio
- short videos for medical centres and doctors' waiting rooms
- possibly even roadside billboards

In the production of this project, we filmed interviews with seven case studies/survivors all living with lifelong injuries from road crashes. We also interviewed others close to them – family, friends, and therapists, as well as road safety, health and trauma experts.

The range and diversity of content allowed us to produce a 60-minute television documentary. Titled *After Impact*, the program explored the consequences of living with serious lifelong injuries sustained in road crashes ... things like acquired brain injury, loss of limbs, quadriplegia, and facial reconstruction. The interweaving format of the seven individual stories took viewers on an emotional rollercoaster, but was able to conclude in a positive and uplifting manner. The important and life-changing consequences of each crash were closely examined, including the physical, mental, social, financial and functional costs to each.

Presented by Ally Langdon ('A Current Affair'), *After Impact* was broadcast on Nine Darwin and Imparja (Central) on Monday 4 December 2023, at 7:30pm and via the OnDemand streaming app 9Now. It was subsequently broadcast across the entire Nine Network and its affiliate rural and regional stations on Saturday 4 May to coincide with National Road Safety Week. To date, the documentary has reached over 65,000 views in 5 weeks on YouTube (unboosted), and has attracted some excellent comments.



Figure 1: Screenshot from the After Impact documentary depicting presenter Ally Langdon and the seven serious road injury survivors

Source: Recording Artists, Actors and Athletes Against Dumb Driving (reproduced with permission)

Benefits to road safety education practice

The single biggest legacy of filming the content is that we are also able to produce individual stand-alone videos with each of the seven survivors. Running between 12 and 15 minutes in length, these videos are now being used across the Northern Territory by Road Safety NT and P.A.R.T.Y. as part of their education delivery to senior school students. It has been exceedingly difficult for these education presentations to have survivors come and speak to school students on an ongoing basis; for some, they just want to move forward with their lives; for others, the trauma keeps resurfacing. This provides an asset that will not only includes a video about each person, but also those around them (family, friends, therapists). It shows photos and videos of life BEFORE the moment that shattered everything, and how they've had to change and adapt to the way they now live. Here's a link to Will's Story online – <u>Will</u>. Her's one of the 7 survivors.

Research has shown that educational and behavioural strategies and multifaceted programs are effective in reducing road trauma among youth (Malekpoura, et al., 2024), however research also shows that there is need for continued engagement and enforcement of road safety educational programs to support long term improvements in the road safety behaviours of youth (Francis, et al., 2022) and (Gunn, et al., 2018). The development of the standalone videos is supporting the continued engagement of PARTY Program participants who then participate in school based education sessions conducted by RSNT, or view the promotional material online or on social media.

Conclusion

We are proposing that a long oral presentation be included in the Australasian Road Safety Conference program, taking the format of a Q & A panel session. It will be structured to be engaging and emotive with some excellent – and different – educational angles. We understand this is not necessarily a normal format for this conference, but it offers the audience a unique chance to see and understand how and why the project came together, and the benefits to be derived from such a venture. It also highlights the strengths of different organisations working together to create something new that has the potential to engage with a range of audiences.

The proposed presentation will look at a different way of engaging with young people who are at the pointy end of getting their L plates or P plates. The session will also demonstrate an approach that has wider relevance – think: parents, relatives, friends, other influencers. Video clips will be shown. The three partnering organisations that collaborated on this project will be panellists, as well as one (Francis, et al., 2022) of the case studies who has severe acquired brain injury.

Peter Rubinstein, RADD's National Director, will facilitate a panel discussion with the following 3 individuals:

- Pantelitsa (Litsa) Rigas Manager, Road Safety NT, Department of Infrastructure, Planning and Logistics
- Belinda Nolan Trauma Program Manager, Royal Darwin Hospital Trauma Services, and P.A.R.T.Y. Program Coordinator NT
- Eli Murn a serious road crash survivor living with severe acquired brain injury. His story is featured in both the documentary and a self-contained segment for schools' presentations.

The 15-minute presentation will be structured as follows:

- Setting the scene: screening of a 2-minute promotional spot on AFTER IMPACT that provides a succinct, powerful insight into the project.
- Project overview: Peter to provide a brief overview into the production of the AFTER IMPACT project, including RADD's role in facilitating collaboration between the key stakeholders, and how it was decided to focus on serious road injury.
- Q & A: Peter to facilitate a Q & A with Litsa, Belinda and Eli.

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A road user safety-field theory for estimating pedestrian crash risks

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Abstract

Pedestrians are a vulnerable road user group, and assessing pedestrian crash risk at critical locations such as signalised intersections is crucial to developing targeted countermeasures to improve pedestrian safety. While traffic conflict techniques are becoming popular for estimating crash risks, the current conflict measures do not take into account road user heterogeneities. This study proposes a safety field theory, which encompasses such heterogeneity by modelling safety-perceived pedestrian-vehicle interaction and deriving risk force as a measure of nearness to collision. Generalised extreme value distribution with the block maxima approach is used to model risk forces obtained from 72 hours of video data from three signalised intersections in Queensland, Australia. Results indicate that safety-field-derived risk forces provide a reasonable estimate of pedestrian crashes compared with historical crash records. The proposed framework has a strong potential for proactive road safety analysis.

Post on X

Introducing a novel theory for estimating pedestrian safety by applying AI-based video analytics.

Introduction

Intersections are considered major crash-prone locations as they are susceptible to conflicting movements of road users from different directions. In Australia, the majority of vehicle-pedestrian interactions occur at signalised intersections. Pedestrian fatalities have shown slight improvement over the past decade, and intersections accounted for 27 % of these fatalities in 2020 in Australia (National-Road-Safety-Strategy-2021-30, 2021). Thus, estimating pedestrian crash risk at such a location is crucial to improving pedestrian safety and achieving the bigger goal of zero road fatalities.

Traditionally, pedestrian crash risk is estimated by the reactive approach. This approach utilises the crash data to estimate crashes, which first requires the occurrence of an infrequent large number of crashes. Further, in the majority of the cases, the utilised data is police-reported crash data, which is susceptible to facing various shortcomings of under-reporting and limited information. In another approach, proactive safety assessment estimates the crash risk using traffic conflict techniques that depend on the traffic conflicts that are precursors of the crash events and share a similar mechanism (Chang et al., 2017).

Proactive safety assessment is a non-crash-based analysis that, in a recent development, utilises the video processing data to estimate near-ness-to-collision measure post-encroachment time (PET) for vehicle-pedestrian interaction at signalised intersections (Ali et al., 2023b). The near-ness to collision measures in literature are also referred to as traffic conflict indicators or surrogate safety measures and are used to identify potential collisions or conflicts between different road users, near-misses events, and the safety performance of the traffic system. However, present nearness-to-collision measures suffer from the serious drawback of exclusion of one or more context-dependent factors for traffic conflicts, such as road traffic environment, road user and vehicle characteristics. Road user factors include user-specific reaction time and vehicle factors such as braking and steering capacity. Near-ness to collision measures such as risk force, which derives from safety field theory, is promising in overcoming the existing drawbacks by including road, user and vehicle heterogeneity within its modelling (Arun et al., 2021a).

The concept of a safety field theory involves measuring the perceived potential safe field around a road user. Moreover, the perception of risk and conflict situations is created when one user interacts with another road user within the perceived safety field (Li et al., 2022). However, in the literature, the application of safety field theory with real-world conflict data for crash risk assessment is limited (Arun et al., 2023) and, specifically for pedestrian safety, very rare. Thus, given the advantage of the proactive approach, the promising context of safety field theory and the limited research with it, this study aims to propose applying novel road user safety field theory to measure the vehicle-pedestrian conflicts and estimate pedestrian crash risk at signalised intersections.

Methodology

In the modelling framework, video analytics is first performed over the recorded video data to extract road user trajectories and conflicts. A total of 72 hours of video data is used for the analysis, recorded from the three intersections

Extended Abstract (Researcher)

with high pedestrian activity in Queensland, Australia (see Table 1). These videos are processed using an artificial intelligence-based automated video analytics platform (see Figure 1). Then, for a conflict between a pair of road users (pedestrian and vehicle), the extracted user trajectory information is used to estimate the risk force derived from safety field theory. Further, given the advantage of Extreme value theory (EVT) in estimating crash risk from observable to rare events(Ali et al., 2023a), it is used in the modelling to estimate the crash risk from the risk force values. Generalised extreme value (GEV) distribution and the block maxima approach are used to model the extremes of the identified risk force where blocks are created based on the traffic signal cycle level.

Intersection		Duration			
	Camera 1	Camera 2	Camera 3	Camera 4	
Vulture Street	28/10/2016	28/10/2016	12/12/2016	12/12/2016	12 h (6 am-6 pm)
	29/10/2016	29/10/2016	13/12/2016	13/12/2016	12 h (6 am-6 pm)
Mccullough Street	09/12/2016	09/12/2016	09/12/2016	09/12/2016	12 h (6 am-6 pm)
	10/12/2016	10/12/2016	10/12/2016	10/12/2016	12 h (6 am-6 pm)
Turbot Street	04/11/2016	04/11/2016	05/12/2016	05/12/2016	12 h (6 am-6 pm)
	05/11/2016	05/11/2016	06/12/2016	06/12/2016	12 h (6 am-6 pm)

Table 8. The data collection schedule for the study sites



Figure 5. Automated video analysis through artificial intelligence

Results

To check the robustness of risk force to estimate the crash risk, a stationary generalised extreme value model is estimated, and the model performance is analysed by comparing with the observed crash count between 2014-2018 and the crash frequency estimate from the PET (conflict; PET ≤ 3.0 sec, commonly used threshold across studies for signalised intersections (Arun et al., 2021b).) (see Figure 2). The crash data is obtained from the Department of Transport and Main Roads, Queensland Government. The mean crash frequency estimate from the risk force is 4.61, which is closer to the observed (4) and has better accuracy than the crash frequency estimate from the PET (5.33). To quantify the uncertainty associated with crash estimates from risk force and PET, 50,000 simulations are performed and compared with a 95 % Poisson confidence interval of the observed crash as performed in the literature (Hussain et al., 2022; Songchitruksa et al., 2006). The precision level of crash frequency estimate from risk force (10.14-0.77 = 9.37) is closer to observed (10.24-1.09 = 9.15) than that from PET (11.37-1.01 = 10.36). Overall, crash estimates from risk force are close to the observed crash count and are more accurate and precise than estimates from PET.



Figure 6. Comparing crash estimates with observed crashes

Benefits to road safety

Utilising the safety field theory in traffic conflict techniques to estimate crash risk advances the scientific knowledge of estimating pedestrian crash risks properly by considering the heterogeneity of road users and traffic environment. Such a framework will help evaluate the impact of interventions and technologies (e.g., connected and Autonomous vehicles (CAVs)) on pedestrian safety as the CAVs are capable of capturing these heterogeneities.

Conclusion

This study models the application of safety field theory in estimating pedestrian crash risk using extreme value modelling. Risk force is derived as near-ness to collision measures that identify the cash risk with good accuracy and precision level compared with traditionally used indicator PET for vehicle-pedestrian conflicts. The proposed model of safety field theory incorporates various heterogeneities, including environment, vehicle and road user characteristics. The risk force providing better crash estimates suggests the inclusion of macroscopic parameters which can affect safety-relevant decisions taken by road users. Therefore, the study motivate further extensive research and application of safety field theory in road safety assessment with inclusion of various microscopic parameters.

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Novice drivers' perceptions of on-road policing and procedural justice

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Abstract

Globally, novice drivers are highly vulnerable to road trauma. One strategy for improving novices' road safety focuses on fostering greater adherence to road rules by cultivating positive relationships with police through applying procedural justice practices during interactions in Learner Driver Mentoring Programs (LDMPs). This qualitative study explored the perceptions of disadvantaged novice drivers regarding police and procedural justice. Participants were enrolled in an LDMP administered by Police Citizens Youth Clubs (PCYC)-Queensland called Braking the Cycle (BTC). BTC operating within PCYC clubs ensures a police presence at every location. Findings showed that BTCs daily operations offered opportunities for police to strengthen relationships with novice drivers enrolled in the program. Participants emphasised the benefits of continuous positive interactions with police to build respect. The potential for sustained positive engagement exists at every BTC location, offering an opportunity to enhance relationships between disadvantaged novice drivers and police officers, and additionally, contributing to road safety's Target 2030.

Social Media Post

Improving novice road safety: Disadvantaged novice drivers seek procedural justice, wanting connection, neutrality, respect, trustworthy motives, and a voice from police both on and off-road. #RoadSafety #NoviceDrivers #ProceduralJustice #CommunitySafety

Introduction

Understanding the factors influencing public trust and confidence is crucial for enhancing police-community relationships and perceptions of police legitimacy (Tyler, 2014). Legitimacy involves individuals recognising an authority's right to govern their actions, and this recognition can impact voluntary compliance, even if individuals perceive certain laws as unjust (Murphy, 2017). A legitimacy-based model is strengthened by community involvement in policing policies and practices that affect them (Tyler & Nobo, 2022). Public confidence in police intentions and actions, combined with acceptance of their authority and belief in the moral justification of their actions, signifies police legitimacy (Tyler, 2014).

Procedural justice supports police legitimacy by emphasising the quality of decision-making and interactions between authorities and the public (Murphy, 2017). Procedural justice is a supportive pathway to legitimacy (Murphy & Tyler, 2017). Based on empirical studies, procedural justice rests on four pillars: neutrality, respect, trustworthy motives, and voice (Murphy & Tyler, 2017). Implementing procedural justice pillars in policing practices could effectively encourage increased novice driver compliance with traffic laws (Bates et al., 2021).

People assess police officers' intentions and character by interpreting their communication cues, gauging the trustworthiness of their motives (Tyler, 2014). The perception of 'neutrality' stems from officers consistently applying legal principles, and prioritising transparency in decision-making processes (Tyler, 2014). 'Respect' entails fair and dignified treatment, characterised by adherence to laws and procedures by authorities (Murphy, 2017). Police convey 'trustworthy motives' by listening to citizens' accounts, then explaining and justifying the law enforcement perspective in a considerate manner that addresses individual concerns (Murphy & Tyler, 2017). Voice' refers to allowing individuals the opportunity to voice their concerns before decisions affecting them are made by police, and ensuring consideration of those concerns fosters procedural justice. (Murphy, 2017).

Novice drivers, typically young adults, exhibit diverse opinions on perceptions of police legitimacy, faith in procedural justice, and compliance with the law. This study examines the perspectives of LDMP disadvantaged novice drivers concerning on-road policing, procedural justice, and exposure to police within the confines of the BTC program. BTC is a PCYC facilitated, community-based LDMP that has the goal of aiding disadvantaged learner drivers to meet their 100-hours of supervised driving practice to be eligible for the provisional licence test in Queensland. BTC provides driving mentors and a vehicle for supervised learner driving practice and ensures mentor competence via thorough comprehensive training. Learners not only receive driving instruction but also participate in road safety workshops with police officers and emergency personnel. Some BTC coordinators and mentors are retired or active police officers, and each PCYC site has a full-time officer overseeing operations.

LDMPs such as BTC have the potential to positively influence perceptions of police legitimacy. With BTC operating in 51 out of 56 PCYC clubs, primarily located in low socio-economic regions, and a significant portion in high-needs communities, it offers a unique opportunity to explore disadvantaged novice drivers' perspectives of police interactions both on-road and within BTC sites. Unlike typical learner drivers who may have few interactions with police, participants in BTC are presented with opportunities to encounter a favourable police presence during program activities, which could lead to changes in their perceptions of law enforcement, fostering a more community-focused perspective. Despite limited research on the role of police in novice driver education, investigating the impact of police involvement in BTC is essential for understanding its benefits for the LDMP cohort. Hence, this study aims to enhance existing knowledge and evaluate the influence of police engagement in BTC on participant perceptions of police and procedural justice.

Method

Eight semi-structured focus groups were facilitated by the researcher at BTC sites in southeast Queensland. Focus groups were attended by 34 participants who were either active or recent BTC graduates and held a learner or provisional licence. Novices completed a brief demographic survey and engaged in discussions exploring their perceptions of police and procedural justice about both in-club and on-road interactions. These discussions, lasted approximately one hour each, were audio recorded and subsequently transcribed. Participants were from three regions in Queensland: Major cities (C1), Cities, and major regional areas (C2), and Regional and other areas (C3), with ages ranging from 16 to 35 years. Focus group comments are referenced with C1, C2, or C3 for the region, For example, C3/G2-m4 indicates the participant is the fourth speaker and a male in group 2 and they attended BTC operating in a regional (or other) area.

Results

Novices' experiences within the procedural justice pillar of neutrality unveiled a perception of bias from police towards novice drivers, with instances of negative bias, both overt and subconscious, impacting judgments and interactions, leading to tension and anxiety. With novices saying it is "pretty evident that there's a general bias in among you know, officers there, so that could definitely influence how they treat different people" (C1/G5-m5). Police bias could be identified in "the way they carry themselves or the way they have the conversation", and that bias was evident in "the way they talk to you, the manner they talk to you" (C1/G5-m5). However, police bias might not be conscious, but "subconsciously, they could still have bias, humans have biases", but an "officer having bias could definitely affect your judgement" (C1/G5-m5).

Novices felt targeted in specific situations, believing "if a police officer is driving down the road and they see a Pplater, they're a little more observant, they'll just kind of follow" (C1/G5-m5). Contributing to an overall perception of bias, including biases related to cultural backgrounds, disabilities, and personal attributes, a participant stated, "I'm very wary around cops and I am more privileged than a lot of people" but there was a noticeable "difference in the way that they treat me versus the way they treat my best friend who's indigenous" (C2/G8-f3). However, some participants recognised instances of neutral treatment, identifying the importance of fairness and non-judgmental attitudes from police officers. One novice stated:

"I think they're just checking up to make sure they're aware of the rules and stuff like that to make sure they're safe on the road. They're keeping others safe on the road. They pull them over because they want to make sure everything's okay. I think that in general, they're just doing their job at the end of the day" (C1/G4-m3).

Participants' negative biases against the police were influenced by past experiences and media narratives. One participant felt that "even one bad interaction can make you suspicious of all police" (C1/G5-m5). Negative media portrayal of police, including instances of misconduct, played a significant role in shaping biases, such as "when the audio recordings came out about police and their, you know, racist remarks" (C1/G5-m5). Nevertheless, despite recognising negative biases, many participants remained hopeful that procedurally just interactions could alter perceptions and cultivate positive relations with police. Even minimal positive interactions were seen as capable of reshaping attitudes towards law enforcement. Participants conveyed a repeated sentiment that police officers had "to protect and serve" (C2/G1-m9) and "at the end of the day, they're just people doing a job like everyone else" (C2/G1-f2), with "a bit more responsibility put on their shoulders" (C2/G1-m8).

Discussing 'respect', novices highlighted the positive impact of respectful police behaviour on stress management during interactions. Instances of calm and respectful approaches from officers, especially during licence checks, reduced their experience of anxiety. "So long as they're just calm and not aggressive, that's basically it, like then everybody's sort of not scared, not as scared" (C1/G5-f6). Community-based policing programs were additionally seen as beneficial in promoting respect for law enforcement with one participant commenting "some of them are polite, like they're really nice to the high school children" (C2/G1- f2).

Related to 'trustworthy motives', participants appreciated officers with comprehensive legislative knowledge because it improved their understanding of the situation. One participant noted that if an officer "said I'll just Google that and get back to you, you know, you'd be concerned" (C1/G5-m1). Concerns about perceived untrustworthiness and unpredictability were expressed. It was stated that "it's like 50-50, some are, some aren't and it makes it difficult for some of us young people because it's like which one are, which sort of one are we going to get, like good cop, bad cop, sort of situation" (C2/G1-f2). The findings highlighted the intricate interpersonal dynamics shaping novices' perceptions of police behaviours within the community.

Discussions around 'voice' revealed instances where participants valued opportunities to speak and be heard during challenging situations. However, nuances were recognised, with varying officer receptiveness and the subjective nature of willingness to hear novices' voices. One participant highlighted an uncertainty in the police's approach, noting:

"They're taking into consideration your situation for what they pulled you over for but not really paying attention to excuses. Yeah, kind of like, they, like, you can tell them what happened, but very rarely does it change the outcome" (C1/G5-m5).

Benefits to Road Safety

Improving respect for law enforcement, reducing traffic violations, and preventing road crashes are vital for achieving road safety Target 2030 goals. This study highlights that fostering procedurally just interactions between police officers and novice drivers has the potential to lead to positive outcomes for road safety. Novice drivers benefit from procedurally just exchanges with police, during roadside encounters and community-based programs. Novice drivers are receptive to fair interactions with police, and police are equipped with the skills to incorporate procedural justice practices into their community engagement efforts.

Implications for Practice

While positive on-road encounters with police were reported, there was limited engagement within the PCYC club and BTC setting, suggesting an area for to enhance interactions between novice drivers and police. Given that each club has a full-time officer overseeing operations and that traffic police interact with participants during road safety workshops, along with retired officers serving as coordinators and active police as driving mentors at some LDMP sites, there exists an opportunity to improve relations and exposure between police and disadvantaged novice drivers.

Conclusion

In conclusion, this study shows that BTC focus group participants experienced a range of positive and negative interactions with police on the road and the type of interaction they experience is important for their perceptions of procedural justice. Initiatives involving police, LDMPs, and other community-based programs tailored to this cohort have the potential to reshape novice drivers' perceptions of law enforcement, and empower them to contribute positively to improved road safety by 2030.

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Victorian Road Safety Linked Dataset: 13 years of Road Trauma

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Abstract

Following the success of the one-year 2014/15 pilot linkage project, the Road Safety Partnership has now established a 13-year linked dataset. The dataset covers all levels of road trauma from fatal through to minor injury. As we continue to implement countermeasures and shift away from focusing on just fatalities to incorporate injury severity in road safety strategy, policy and countermeasures, it is becoming increasingly important to understand the broader road trauma picture. The pilot project provided insights into the under-reporting of road trauma and established the value of a range of injury severity metrics. The addition of new datasets into the 13-year linked dataset will allow enhanced analytics; ensuring more complete and accurate data on crash circumstances, accident location, seatbelt/helmet wearing and injury severity metrics.

Post on X

The power of data linkage: the development of one of the most sophisticated road safety databases in the world.

Background

Following the Victorian Parliamentary Road Safety Committee's Inquiry into Serious Injury, a Technical Working Group was established to investigate how injuries can be better understood and used in Victoria.

The Victorian Road Safety Data Linkage Pilot Project established a one-year linked dataset containing Hospital data², Victoria Police reported crash data³ and TAC Claims data for the period 2014/15. The pilot provided valuable insights into linkage rates across datasets, under-reporting of road trauma, and demonstrated the feasibility of calculating additional injury severity metrics than previously available (Ziekemijjer & McIntyre, 2018).

Subsequently, the Victorian Road Safety Partnership recommended the establishment of an ongoing data linkage program, presented here.

Project Description

The Victorian Road Safety partnership, with the Centre for Victorian Data Linkage (CVDL) has sourced and linked thirteen years of road trauma data (2008 to 2020). In addition to the datasets linked in the pilot, data from Ambulance Victoria (AV)⁴, Department of Transport and Planning (DTP) ⁵, and Births, Deaths and Marriages (BDM) have been included. The data is housed in CVDLs secure online platform Virtual data Access Linkage Trust (VALT).

The focus of this next phase of the project involves:

- Cleaning and consolidation of data such that each record has best available information for crash circumstances, person demographics, vehicle specifications, crash location and injury severity metrics;
- Establishing if having the data housed in the VALT meets use cases;
- Analysis focusing on road user groups and capturing the full road trauma picture, to understand admissions, emergency department presentations and ambulance attendance cases previously unknown;
- Calculating, analysing and comparing injury severity metrics within road trauma data;
 - $\circ \quad \text{hospital admission status and length of hospital stay,} \\$
 - \circ level of impairment,
 - o lifetime injury costs,
 - Abbreviated Injury Scale (AIS) based metrics,
 - ICD-based Injury Severity Score (ICISS),
 - Years Lost due to Disability (YLD) component of the Disability-Adjusted Life Years (DALY)
 - o Risk of Permanent Medical Impairment; and,
- Establishing a process for maintaining an ongoing linked dataset.

² Department of Health (DoH) Victorian Admited Episodes Dataset and Victorian Emergency Minimum Dataset.

³ Victoria Police Traffic Incident System Data.

⁴ Ambulance Victoria Road Traffic Accident and Emergency Services Telecommunications Authority (ESTA) Datasets.

⁵ Department of Transport and Planning Road Crash Information System (RCIS) and Driver Licensing System (DLS)

Insights from new data sources yield benefits above what is already known:

- AV data enhances the completeness of crash location, on/off road coding, crash date, and seatbelt/helmet wearing, where not available from police data.
- DTP's data provides enhanced and validated crash circumstance information for police reported cases, and contributes driver licensing information.
- BDM data gathers accurate dates of deaths that may otherwise not be reported, and will assist with calculating the YLD component of DALY.

Work towards these goals have begun and an up-to-date progress report will be presented.

Conclusion

The linkage of road safety data with hospital data enables a more comprehensive view of the true scope of road trauma in Victoria and illustrates the magnitude of under-reporting. An ongoing data linkage program will enable a more comprehensive understanding of road trauma than previously possible; informing countermeasures and policy and to evaluate programs and monitor progress.

Acknowledgements

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Driver licensing access challenges for neurodivergent young adults

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Abstract

Given Australia's vast rural areas, access to community, social and economic opportunities is often dependent on private transport. A driver licence can be critical for young adults to access education and employment. This project explored the barriers and challenges experienced by neurodivergent young adults in relation to driver licensing systems and processes. Interviews were conducted with 18 young adults with diagnoses of autism and/or ADHD. All reported lack of accommodations in the licensing process. These commonly resulted in test failures, not due to lack of driving knowledge or skills, but because of assessment approaches. They suggested several actionable and practical accommodations to address the current challenges. Improvements are needed to ensure licensing processes are fair and equitable for all licence applicants towards a future more inclusive licensing process.

Post on X

Neurodivergent young adults report lack of driver licensing accommodations to truly test their driving knowledge and skills and propose practical and actionable accommodations of potential benefit to all licence applicants towards future more inclusive licensing.

Introduction

A driver licence can be critical for daily needs, especially in countries with vast rural areas lacking public transport alternatives. While there have been considerable advances in increasing access to licensing services and supports for diverse applicant groups in Australia, attention to neurodivergent young adults is limited. To ensure safe and appropriate driver licensing and avoid unintended consequences (such as diverting potentially licence-worthy drivers to unlicensed driving), it is important to ensure that licence testing protocols are fair and inclusive.

Approximately 1 in 100-150 Australians has an autism diagnosis (AIHW, 2017) and 5% an Attention Deficit Hyperactivity Disorder (ADHD) diagnosis (ADHD Australia, 2023). Autism is characterised by differences and difficulties in social communication and interaction, by patterns of repetitive, highly intense or focused activities, behaviours and interests and by sensory sensitivities (APA, 2022). ADHD is broadly characterised by developmentally inconsistent levels of inattention, hyperactivity and impulsivity (APA, 2022). While a few studies have explored relationships between autism and/or ADHD traits and characteristics and driving, seemingly little attention has been paid to implications for the processes required to gain a driver licence.

This research sought to learn from autistic and/or ADHD young adults about their driver licensing experiences. Of particular focus were the assessment requirements: the knowledge test for learner licensure, and the hazard perception and practical driving tests for provisional licensure.

Method

Eighteen young adults in Western Australia aged 18-to-24 years (10F, 7M, 1 non-binary) with autism and/or ADHD diagnoses responded to an advertisement on a university recruitment website for psychology students and the general community, to take part in an interview study about their driver licensing experiences. Participants were interviewed in person or online. Questions focused on test attempts, whether they disclosed their diagnoses to assessors, and if any particular supports were offered or useful. Interview transcripts were coded applying framework analysis (structured subtype of thematic analysis), conducted by the first three authors and reviewed by the fourth author to agreement. Quotes reported in the text are followed by identifiers of their gender (M/F/NB), age (years), and licence type: no (N), learner (L), provisional (P) or open (O) licence.

Results and Conclusions

Four overarching themes resulted. A first theme, *Heightened emotions*, was commonly reported by both autistic and ADHD participants, generally reflecting driving or test anxiety:

"I think I just made stupid mistakes because of the anxiety" [F, 24, O].

A second theme, *Driving performance challenges*, included general challenges with divided attention across participants, but also included prioritisation-sequencing challenges specific to ADHD participants:

"I find that it's hard to give proper attention to directions being given to me while also giving proper attention to the road that I'm driving on" [M, 18, P].

Mostly reported by autistic participants was the theme *Navigating ambiguities*, either in relation to directions from instructors or in the driving environment generally:

"I would find it so stressful if a driver was angry or beeping or swearing at me. And I know my whole life I have struggled with understanding and reacting to those sorts of behaviours or social cues" [F, 20, N].

All participants reported on *Strategies-Accommodations*: ways to better navigate the driver licensing process, particularly test conditions, which they either applied when driving or would have preferred for assessments. For example, unlike in some other Australian jurisdictions, in Western Australia only the examiner and candidate are in the vehicle for the practical driving test. One participant shared:

"...even if my instructor sat in the back quietly, then I'd feel like a sense of, I guess, ease, without having that other complete stranger judging me. There's at least some sense of familiarity" [M, 20, L].

While some themes reflected known challenges for learner drivers generally, others presented as more specific to or relevant for neurodivergent applicants. These included examples of test failures, such as taking online tests in crowded noisy service centres or asking instructors to repeat questions "too many times", which reflected inflexible assessment processes rather than not demonstrating driving related knowledge or skills per se.

To ensure licensing assessments are fair and equitable, greater accommodations are needed to support neurodivergent applicants. These include what appear to be relatively simple, feasible accommodations to address anxiety – common across all test-takers – such as allowing for quiet conditions for computerised tests, and repeated questions during practical testing, as well as the presence of a familiar instructor/other. Such inclusive practices will ensure that licence candidates are assessed on their driving skills and abilities, rather than on challenges navigating test conditions. This wilk ensure the path towards 'Target 2030' is a safer, equitable path for neurodivergent road users.

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Road Safety Incident Investigation Camera in varied settings

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Abstract

The Road Safety Technology team at Transport for NSW extended its use of Artificial Intelligence (AI) to enhance the capabilities of a mobile safety incident investigation tool. It was deployed in various road settings, including a roundabout, a high-speed highway and urban locations with vulnerable road users and light rail. The technology was tested to understand its capabilities and limitations at each location, including at night in the absence of street lighting. The Road Safety Incident Investigation Camera (ROSIICAM) used AI to detect near-misses. Video footage of events was captured and displayed on a dashboard. The technology also identified other features of the events, including road user-type, movements and speed. Examining near-misses is a proactive approach used to understand crash risk. This technology can assist in the development of customised and effective road safety treatments at specific locations to help reduce road fatalities and achieve vision zero.

Post on X

Transport for NSW has extended its use of Artificial Intelligence technology to enhance the capabilities of a mobile safety incident investigation tool across a range of road settings, including a roundabout, a highway and urban locations with vulnerable road users and light rail

Background

The NSW 2026 Road Safety Action Plan (2022) aims to halve deaths and reduce serious injuries by 30% on NSW roads by 2030 whilst the Towards Zero vision strives for zero fatalities and serious injuries on our roads by 2056. ROSIICAM offers a practical, proactive approach to help achieve these goals. Investigating 'near-misses' can help predict crash risk. Such a technique complements traditional approaches that rely on historical lag indicators, like hospital and crash data, which can take years to collect.

The richness of video footage can assist road safety practitioners understand a particular intersection in almost real time, as video footage becomes available, providing earlier detection of potential problems. This reduced time lag may be beneficial when evaluating the effectiveness of a treatment after it has been implemented.

Near-misses are usually not reported; however, more information about these incidents can aid better policy, planning and design. Following the initial trial of ROSIICAM at two intersections in 2022, the technology was tested further at eight more locations in various road settings.

Method

Eight standalone portable solar-powered cameras were placed at various locations throughout NSW in 2023 (See Figure 1).



Figure 1. ROSIICAM at a busy urban marked pedestrian crossing

Seven cameras collected video footage for four weeks and one for seven weeks. Sites were chosen based on community correspondence or road safety practitioners' concerns; however, crash data showed there were no or few actual crashes in recent years at these locations.

Cameras were placed at the following locations:

- Two cameras were simultaneously placed at a complex seagull intersection on a highway
- One at a large roundabout
- One at a busy urban marked pedestrian crossing
- One at an urban intersection with light rail, vehicles, and vulnerable road users
- One at a rural location with no streetlighting to test video capture in low light
- One at a 4-way intersection where signals were being considered as a treatment
- One at an intersection with an acute angle of approach

Road users' privacy was protected as identifiable features, including faces and number plates, were automatically blurred by the system.

Artificial intelligence was used to analyse the video footage. The system used 'Post Encroachment Time' (PET) to detect potential near-miss events. PET is the time difference between two vehicles occupying the same space. Events were classified according to severity based on PET, road user movement and vehicle speed.

In addition to the ability to view video footage of an event, other information could also be extracted, including:

- Direction of travel
- Time of day
- Visibility
- Speed
- Road user type
- Road user movement (RUM)

A dashboard was created where practitioners could filter events by severity, location, RUM and time of day. Traffic counts for all lanes and movements, broken down by vehicle type and time of day, were also provided.

The accuracy of the technology in identifying near-misses was assessed by manually reviewing the video footage of each event and by manually reviewing 3-hour samples of footage from each location.

Results

Preliminary results suggest that the technology was able to detect and classify vehicles, measure vehicle speeds, and record video of near-misses.

The system automatically detected 446 events, ranging from 37 events at one of the urban locations to 104 at the rural location with low lighting (where the camera was in place for seven weeks).

Events were classified as 'light' (n=64), 'moderate' (n=162), 'severe' (n=203) or 'unknown' (n=17). The severity rating was a function of PET, travel speeds and Road User Movement code.

Figure 2 shows an example of a near-miss event between a cyclist and a pedestrian captured at a busy marked urban pedestrian crossing. The algorithm classified this event as 'severe'. The dashboard indicated the PET score for this event was 0.13. The maximum speed that the bicycle was travelling at was 15.1 km/h and the maximum speed the pedestrian was travelling at was 4.3 km/h.



Figure 2. Near-miss of a cyclist and a pedestrian detected by ROSIICAM

The system seemed to be more adept at detecting near-misses at some types of locations than others. Notably, this type of technology is deemed to not be particularly suited to a multi-lane roundabout, due to the flowing nature of movements, speeds and interactions at this type of intersection. The distance of the camera from the intersection, the ambient lighting and the viewing angle all appear to influence accuracy.

Road safety practitioners reviewed the videos of identified events. The review suggested that the majority of detected events were deemed to be accurately identified as near-misses. There was a low number of false positives. However, the severity ratings scale classifying events as either 'severe', 'moderate' or 'light' requires ongoing refinement.

In addition, for each location, three hours of video footage was viewed by the researchers to detect any missed events. At most locations, none were found; however, in the urban locations, there were many. For example, a review of a three-hour sample of video footage of an 80km/h highway found no events. At a busy marked pedestrian crossing with a large number of pedestrians and cyclists, seven additional events were manually detected during the three-hour validation period. No events were automatically detected during that three-hour period and 41 events were detected during the four-week period. At another busy urban location with many pedestrians, cyclists, vehicles and light rail, seven events were manually detected during the three-hour validation sample. An additional near-miss was also manually included that was reported by the light rail driver as a near-miss during the trial period, but was not automatically detected. By way of comparison, no events were automatically detected during the three-hour period and 37 near-miss events were automatically detected by the system at that intersection during the four weeks of data collection.

Whilst the system did detect many near-misses amongst pedestrians and cyclists, the low speeds and subsequent high PET scores meant that the system missed incidents where road users took evasive measures. Furthermore, PET scores do not consider harsh braking events, which is a different type of near-miss not automatically detected by the current algorithms. More in-depth analysis is currently underway to further explore potential refinements that could help overcome these limitations.

Conclusion

There is evidence that ROSIICAM can support road safety analysts to gain an in-depth understanding about the number and nature of incidents at certain location types. Further studies may consider other measures to determine a near-miss, in addition to PET, like change in velocity, or at other location types, including a rail level crossing.

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Estimating pedestrian crash risks using autonomous vehicle sensor data

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Abstract

Traditionally, modelling pedestrian crash risk at corridor or network levels has been challenging due to limitations in data collection techniques, hindering the capture of detailed pedestrian interactions. The advent of autonomous vehicles (AVs) generating extensive datasets provides an opportunity for network-wide safety analysis, yet its utilisation remains limited. This study proposes an extreme value theory (EVT) framework to estimate network-wide pedestrian crash risks using AV sensor data. Two Bayesian models were developed within this framework: a Generalized Extreme Value (GEV) model (block-maxima approach) and a Generalized Pareto (GP) model (peak-over-threshold approach). Utilising a subset of the Argoverse dataset on a Miami arterial corridor, pedestrian and vehicle trajectories were extracted, and conflicts were measured using post-encroachment time. The models successfully estimated historical pedestrian crash frequencies, with the GEV model demonstrating higher accuracy than the GP model. This research underscores the potential of AV data for network-wide safety analysis.

Post on X

Autonomous vehicles provide rich information about surrounding road users, which can be used to estimate pedestrian crash risks in a road network by applying traffic conflict techniques.

Introduction

The pedestrian crash risk in car-dominated environments presents a significant safety concern, necessitating accurate modelling methods. Traditional approaches reliant on historical crash data encounter data quality and coverage limitations for comprehensive pedestrian safety analysis. This study addresses these challenges by proposing a framework that leverages autonomous vehicle (AV) sensor data to conduct network-wide safety analysis, offering a novel approach to pedestrian risk estimation.

By integrating EVT modelling with traffic conflict techniques, this study uses AV sensor data to assess pedestrian crash risks at the corridor level. Utilising a subset of the Argoverse II Motion Forecast dataset (Wilson et al., 2023) on a 19 km-long urban corridor in Miami, Florida, the study demonstrates the efficacy of the proposed framework. Importantly, it utilises AV sensor data, offering detailed behavioural insights into vehicle-pedestrian interactions often lacking in conventional safety studies. The study's innovative approach not only overcomes the limitations of traditional data collection methods but also contributes to advancing the understanding of pedestrian safety on a corridor scale, thus filling a crucial research gap in the traffic engineering literature.

Dataset

AV sensor data

The study utilises the Argoverse II Motion Forecast dataset. This dataset comprises 250,000 episodes collected in 2021, capturing object trajectories through LiDAR sensors and high-resolution cameras mounted on the vehicles. Each episode provides 11 seconds of bird's-eye-view data tracked at 10 Hz, enabling detailed analysis of vehicle and pedestrian movements. Figure 1 illustrates the AV sensor setup and data samples from various sensors.



(a) LiDAR Data

(b) Argoverse AV sensor setup

(c) Camera Data

Traffic conflict extraction

The study employs an algorithm to filter inconsistencies in trajectories within the dataset. Object annotation irregularities were particularly evident in vehicles engaged in roadside parking manoeuvres or traversing mixed-use areas such as parking lots and driveways, resulting in unrealistic trajectories. To mitigate such discrepancies, the algorithm utilised map-context layers to delineate drivable areas and pedestrian crossing boundaries. Vehicle-pedestrian conflicts were measured using the post-encroachment time conflict measure. The final processed dataset had 581 pedestrian-vehicle conflicts. Furthermore, pedestrian crash data from the Florida DoT provides validation data for the final models.

Model development

The framework utilises two prevalent sampling methods. (1) The block maxima approach involves fixed time or space block samples, with block interval selection pivotal for model accuracy. This study adopts a block maxima approach at episode level, treating each block's maximum value as extreme. Mathematically, the GEV function can be expressed as:

$$G(x) = \exp\left\{-\left[1 + \xi\left(\frac{x-\mu}{\sigma}\right)\right]^{-1/\xi}\right\}$$

where μ , σ , and ξ are the location, scale, and shape parameters. (2) The peak-over threshold method samples observations exceeding a predetermined threshold, with the threshold identification crucial for the model accuracy. For x_1 , x_2 ... x_n independent identically distributed random observations, the cumulative distribution function of exceedances X over the threshold u can be approximated as GP distribution for a sufficiently high value of threshold as:

$$G(y) = 1 - \left(1 + \frac{\xi y}{\sigma}\right)^{-1/\xi}, \qquad \xi \neq 0$$

where σ and ξ are the scale and shape parameters. For a detailed understanding of EVT models, refer to Coles (2001).

Various covariates were incorporated to address the non-stationarity of traffic conflict extremes and capture the effect of various traffic determinants. Bayesian method was used for parameter estimation. The model's goodness-of-fit is evaluated using the deviance information criterion and confidence intervals for observed and modelled crash frequencies. Additionally, mean crash estimates and confidence intervals are utilised to assess global model performance, comparing estimated crash frequencies with observed data. Confidence intervals for observed and modelled crash frequencies are computed using appropriate statistical methods, providing insights into the uncertainty surrounding crash risk estimates.

Model results

Results from the models estimated in the study are summarised in Table 1. A brief discussion follows.

Model Model		Domonoston	Location				Scale		Shape	DIC		
Туре	ype	Parameter	μ_0	μ_{PC}	μ_{VC}	μ_{PS}	μ_{VS}	Øo	ϕ_{PC}	Ø _{VC}	ξ_0	
	Stationary	mean	-3.803			—		0.102	—		-0.295	3967
GEV		s.d.	0.149	_	—	—		0.036	—	—	0.059	
		sig. lev.	5%	_	—	—		5%	—	—	5%	
	Location parametrisation	mean	-3.074	-0.098	-0.022	-0.076	0.175	0.081	—	—	-0.276	3850
		s.d.	0.443	0.062	0.022	0.042	0.138	0.036		—	0.054	
		sig. lev.	5%	5%	5%	5%	5%	5%	—	_	5%	
	Scale and location parameterisation	mean	-3.389	-0.101		-0.07	0.17	0.366	—	-0.014	-0.282	3860
		s.d.	0.404	0.059	_	0.044	0.137	0.182	—	0.012	0.055	
		sig. lev.	5%	5%		5%	5%	5%	—	5%	5%	
GP F v	Stationary	mean	NA				-0.064	—		-0.209	605	
		s.d.					0.027	—	_	0.158		
		sig. lev.					5%	—	_	5%		
	Pedestrian and	mean					0.455	-0.056	-0.033	-0.322	565	
	vehicle volume	s.d.					0.42	0.071	0.027	0.155		
	parameterisation	sig. lev.						5%	5%	5%	5%	

Table 9. Summary of the GEV and GP model results

Abbreviation: PC = pedestrian volume; VC = vehicle volume; PS = average pedestrian speed; VS = average vehicle speed; DIC = Deviance Information Criterion; s.d. = standard deviation; NA = not applicable; sig. lev. = significance level.

Several GEV and GP models were estimated in the Bayesian framework. Two chains with 100,000 iterations were run, and the first 50,000 were discarded as burn-ins. The remaining were used for the posterior distributions of the model parameters. The model convergence assessment highlighted well-mixed trace plot chains and the Gelman-Rubin statistic value for each parameter to be less than 1.1, reflecting model convergence. Table 1 presents the deviance information criterion values used for comparing the models. All non-stationary models with location/scale parameters

gave a better fit than the stationarity model. Incorporating covariates in model estimation captures the variation in the data better, provides more insights into vehicle-pedestrian interactions, and thereby improves model goodness-of-fit.



Figure 8 GEV model goodness-of-fit diagnostics

Figure 2 shows the goodness-of-fit of the selected model. The model is well-fitted to the observed data as the observations lie along the line of equality (Figure 6(a)), and the modelled and observed curves (Figure 6(b)) are close.

Model validation

The developed models were applied to estimate crashes and compared with historical crash records. Results, outlined in Table 2, indicate superior performance of the block maxima over the peak-over threshold sampling-based model. The mean annual crash estimate using the block maxima approach was 8.1, with a relative error of 15%, while the peak-over threshold approach yielded a mean estimate of 13.3, with a 90% relative error. Confidence intervals for both models were wider than the observed data, likely due to the relatively small dataset size. However, the block maxima approach exhibited narrower confidence intervals compared to the peak-over threshold approach. Further discussion comparing the models' performance is provided in the subsequent section.

Model	Annual crashes	Confidence interval	Relative crash error (against observed)	Crash confidence interval comparison (against observed)
Observed Crashes	7	(2.81, 14.42)	-	-
Block maxima	8.1	(0, 116.1)	15%	10 times observed
Peak-over threshold	13.3	(0, 406.0)	90%	35 times observed

Table 10. Estimation of crash frequencies by the developed extreme value models

Discussion and conclusion

The results from two sampling approaches employed within the EVT framework indicate that the block maxima approach yielded mean predicted crashes close to observed crashes, albeit with wide confidence intervals due to limited sample size. Contrastingly, the peak-over threshold approach produced significantly wider confidence intervals, reflecting a higher level of uncertainty. Prior studies have reported mixed findings regarding the performance of these sampling approaches, suggesting that the choice may be contingent upon dataset characteristics (Bücher & Zhou, 2021). Nonetheless, this study's findings suggest a relative advantage for the block maxima approach under the assumption of independent identically distributed scenarios, which aligns with previous research. Furthermore, the study explores the incorporation of covariates in capturing the non-stationarity of EVT models. Covariates related to vehicle and pedestrian volumes, as well as average vehicle and pedestrian speed, were found to influence model performance positively, with the block maxima approach demonstrating superiority in local and global goodness-of-fit measures. These findings are consistent with prior research, which underscores the significance of considering covariates in modelling crash risks. Notably, pedestrian volume and speed exhibited a negative association with pedestrian crash risk, indicative of the safety-in-numbers phenomenon (Islam et al., 2022) and increased exposure time for slow-walking pedestrians. Also, vehicle volume showed a negative association with pedestrian crash risk, reflecting lower opportunities for pedestrians to jaywalk. Conversely, average vehicle speed was positively correlated with crash risk, emphasising the impact of vehicle speed on crash likelihood (Hague & Washington, 2015). These findings contribute to a deeper understanding of the factors influencing pedestrian crash risks in urban environments.

In conclusion, the study presents a Bayesian EVT modelling framework leveraging autonomous vehicle sensor data for corridor-wide pedestrian crash risk estimation. The study successfully developed a combined safety model for intersections and mid-block sections, which typically required separate models in past research. Results demonstrate the framework's efficacy in estimating pedestrian crashes with reasonable accuracy along a corridor in Miami City. The study underscores the potential of autonomous vehicle sensor data in addressing data sparsity issues and facilitating comprehensive safety analyses. Overall, as autonomous vehicle penetration rates increase, the wealth of data collected by autonomous vehicles holds promise for advancing road safety research and informing effective safety interventions.

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Hazardous location identification for head-on collisions with roadside objects

Amolika Sinha, Macgregor Buckley, <u>Trevor Wang</u>, Sepehr Dehkordi, Charles Karl NTRO

Abstract

This study presents a deep learning approach proof of concept (PoC) for identifying hazardous locations prone to headon collisions with roadside assets and objects, particularly "killer trees." Utilising the Digital Video Road (DVR) data from the Department of Transport and Main Roads (TMR), we developed an end-to-end model that employs transfer learning and mask region-based convolutional neural networks (R-CNN) to detect and classify roadside objects such as killer trees. Our model demonstrates promising results in accurately identifying killer trees, with an overall accuracy of 96% in tree trunk detection and high sensitivity and specificity in hazardous tree detection. Integrating this model into road safety management systems can significantly enhance the monitoring of gradually changing roadside assets and contribute to reducing road fatalities. Further research is required to scale up the model for broader network coverage and to develop a semi-automated data annotation framework for efficient data processing. Given the increasing integration of data-driven approaches in decision-making and policy formulation, our work focuses on proactive decision-making. In line with this year's theme the pathway of using this technology is to predict hazardous locations in advance, enhancing the ability to mitigate potential risks.

Post on X

Developed a deep learning model to identify hazardous roadside trees, achieving 96% accuracy in detection and enhancing road safety monitoring. #RoadSafety #DeepLearning #AI

Introduction

The TMR Spatial Labs tasked the National Transport Research Organisation (NTRO) to create an AI and ML-based model for detecting road hazards, specifically "killer trees," which significantly contribute to road fatalities in Australia. This innovative approach aims to enable faster, cost-effective, and automated monitoring of road safety by identifying hazardous vegetation and facilitating its management. Addressing challenges such as high costs, time constraints, and manual data processing inefficiencies, this project seeks to revolutionise the way road safety and asset management are approached.

DVR data, collected annually by ARRB for Queensland's state-controlled roads, consists of spatial video and navigational (NVG) files. Spatial videos capture images from seven directions at 10 m intervals, while NVG files provide calibration metadata and GIS information for each video frame, including road name, GPS coordinates, and frame numbers, collected at both 10 m and 5 m intervals for enhanced detail. This comprehensive data was used for this research work.

Methodology

The project proposed that by using the front view camera's DVR image data, a custom model could be trained to detect killer trees and report the geographical location. An overview of the development process is described in this article, with Figure 9(a) below depicting the block diagram for the proposed methodology.



Figure 9. (a) Proposed methodology, Example of annotated (b) tree trunks, (c) road segmentation using CVAT

The data preparation involved dividing data into training and testing sets, with a focus on annotating tree trunks and drivable paths using OpenVINO's CVAT for precision. Tree trunks were annotated with polygon coordinates for accurate distance estimation, while the same detection pipeline was employed for road segmentation, facilitating model training with precisely labelled roads and objects, as shown in Figure 9 (b) and 1(c).

Detection Model, algorithms and architectures

To conserve time and resources, the project employed transfer learning, leveraging a pre-trained mask R-CNN with a ResNet101 backbone and feature pyramid networks, originally trained on the MS COCO dataset (Lin et al. 2015). Transfer learning approach allowed for efficient tree trunk detection by retraining the model's last layer with just 180 annotated images, demonstrating the method's efficacy in learning from a related task (Soria et al. 2009). The models are discussed in detail in Table 11.

Summary	Figures
Tree trunk detection Training data was exported with the polygon coordinates, and the final layer of the model was then trained on the small tree trunk dataset. Error! Reference source not found. shows tree trunk detection results when bounding boxes or polygons were used for data annotation. The result shows that the trunks' edge detection using polygons outperforms the bounding boxes, thus the project progressed with polygon annotation.	Figure 2. The impact of bounding boxes and palagene annetation on truth datastion.
Road segmentation	polygons annotation on trunk detection
For road segmentation, an off-the-shelf MobileNet (Howard et al. 2017) model trained on the CityScapes dataset (Cityscapes Dataset 2022) was identified for use in the project. However, the available model, wasn't deemed precise enough due to the inclusion of the road shoulder and gravel paths in its mask Error! Reference source not found To overcome this, a small data set was labelled and used to train the available model based on polygons with outside road lines in the labelling. This allowed the model to identify the drivable path of the road without including the shoulder. This was theorised to have	Figure 10. An example of using the shelf semantic segmentation on the DVR data usin MobileNet (Howard et al. 2017)
better precision in road width estimation, allowing the width of any given road segment to be assumed as 7 m, based upon an average two-lane road. Error! Reference source not found. shows the successful road segmentation and tree trunk detection using the proposed model.	Figure 11. Road segmentation and tree trunk detection using proposed transfer learning
Hazard distance estimation model	detection using proposed dansier rearrange
The technique calculates a tree's distance from the road using a pixel-distance ratio, assuming a standard two-lane road width of 7 meters. By measuring pixel differences between the tree (P and Q) and road edges (T and U), it determines the tree's proximity and width as shown in Error! Reference source not found. iRAP ratings (iRAP 2021) classify trees as hazardous based on proximity, with trunks over 10 cm in diameter within 1 meter of the road deemed most dangerous. This system categorizes trees into three hazard levels based on distance, incorporating a 15% measurement margin of error. Outputs include tree locations, danger categories, and survey dates, with examples for areas with and without high-risk trees.	Figure 12. Image showing the distance estimation procedure

Evaluation result and discussion

The proposed model's performance was assessed through a confusion matrix, highlighting its accuracy in predicting true conditions. Performance metrics like sensitivity (true positive rate) and specificity (true negative rate), ranging from

Extended Abstract (Practitioner)

zero to one, indicate the model's efficacy in accurately detecting killer trees and correctly identifying non-killer trees, respectively. To evaluate the proposed algorithm, reported crash data from TMR and ARRB's road survey repository were leveraged to identify locations with prevalent trees and a type of crash identified as an "off-carriageway hit object". From this, Mt Cotton was selected as a control site, and route No. 414_1 was selected as a 'hazardous tree in the driving scene' use case. To avoid biased outcomes, the model had not seen the evaluation data before. A total of 135 scenes were manually annotated using visual observation and binary decision-making to find a trunk and decide on the killer tree potential of the object in each image.

Figure 13 shows the qualitative results of the proposed detection model on sequential images of a test road. The result indicates a consistent detection from one frame to the next. It is also observable that signs, bars or pillars are sometimes detected as a tree trunk. These false detections do not pose significant issues for the proposed end-to-end model due to size, height and dimension. The manual annotation shows that TP=89 and FP=7 for the selected samples shows the 96% accuracy of tree trunk detection using Mask-RCNN.

Figure 13. Qualitative result on road segmentation (purple) and tree trunk detection (green) while driving. (a) to (i) are sequential video frames



Table 12: Performance evaluation of the proposed model for (a) Mt Cotton and (b) Route No. 414_1 use cases.

(a)		Predicted condition		(b)		Predicted condition	
Actual condition	Total population = $P+N = 62 + 34$	Positive	Negative	Actual condition	Total population = $P+N=19+20$	Positive	Negativ
	Positive (P)	TP = 52	FN = 10		Positive (P)	TP = 13	FN = 0
	Negative (N)	FP = 3	TN = 31		Negative (N)	FP = 5	TN = 1

The overall performance of the proposed method on the control and use case sites was evaluated to give an accuracy of 86% and 72%, respectively, both acceptable performance levels. Overall, the proposed system was noted to have a high sensitivity and specificity, justifying the proposed model approach in detecting killer trees. The evaluation results for the selected use cases are provided in Table 12.

Conclusions

By utilising deep learning algorithms, a proof-of-concept end-to-end model for detecting and classifying killer trees was developed with promising evaluation results. To scale up the proposed model to cover entire road networks and maintain quality datasets on killer trees, further evaluation would be required. The system would also need to be trained using more meaningful/larger datasets. Future research relies on more efficient data annotation. Although only 180 samples were used and achieved acceptable results (96% in detecting tree trunks), data annotation is still an extensive task. Aggregating reported incident data with DVR is a complex task, and proper data ingestion is required to integrate the proposed model into current safety datasets. As such, generating a data ingestion framework to undertake data annotation semi-automatedly would be more appropriate for large-scale deployment. Additionally, the proposed data engine could be used to detect other assets, such as signs, barriers, lane markings and traffic signs, to generate an inventory system.

Acknowledgment

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Self-perceptions of driving safety while hungover: seminaturalistic randomised controlled trial

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Abstract

Alcohol hangover is one of the most common mental states on the road resulting from recreational use of a pharmacological agent. Hangovers are associated with not just the classic hangover symptoms and experiences, but also impairments across cognitive domains. We tested the effect of a hangover on subjective perceptions of driving safety as a prelude to better understanding the impact of hangover on driving safety and risk. 29 participants were recruited in a semi-naturalistic randomised cross-over trial of previous-day drinking (hangover state) versus control (previous-day sobriety). Subjective perceptions of on-road driving skills and safety were assessed using visual analogue scales. When participants were "hungover", they estimated a higher crash risk, but not a lower level of safety. We failed to find an effect on self-rated driving skill or the prediction of traffic conflicts (i.e., hazard perception skill). These perceptions will be followed-up with more objective measures of hazard perception skill.

Post on X

Hungover drivers believe themselves to be at a higher crash risk, but not necessarily more impaired compared to when sober.

Background

Alcohol is the most commonly used drug affecting driving performance. Following alcohol consumption, a state of "hangover" can be experienced with varying levels of severity. Given the blood alcohol concentration will usually be 0 or nearly 0 during the hangover state (Verster et al., 2020), it is legal to drive while hungover (assuming BAC < 0.05) and may be believed to be relatively low-risk. Therefore, driving while hungover is one of the most common altered psychopharmacological states on the road arising from recreational drug use. The extent of hungover driving is difficult to fully assess as there is no biomarker for hangover state and whether hangover impairs driving and crash risk is unclear.

The hangover state has been shown to impair cognitive performance on a range of tasks important for driving (but not all; see Gunn et al., 2018). Simulator research has demonstrated impairments in driving performance measured by standard deviation of lane position (SDLP) and slower response times, more attentional lapses, poorer driving control, and higher traffic violations (Alford et al., 2020; Verster et al., 2014), suggesting the hangover state increases driving risk. Hungover participants also reported feeling more tense and needing to exert more effort to complete the task. This could be due to the presence of hangover symptoms such as headache and nausea (Verster et al., 2013). Thus, subjective and motivational impacts of the hangover may be important for risk.

Aim

There is a need to better characterize the hangover state and whether there are associated road safety risks. As a prelude to an in-depth and objective investigation of driver hazard perception in the hangover state, we aimed to first investigate whether hangover alters perceptions of driving skills and safety (including crash risk). Answering this question would inform the extent to which self-regulation of driving behaviour could occur.

We anticipated that participants in the day-after drinking condition (hungover state) would rate their driving skills and safety as being poorer than when they had not been drinking the day before.

Methods

Participants

29 participants were recruited (age: M = 33.3, SD = 19.7; female = 19). Inclusion criteria: over 18 years old, to drink alcohol, probationary or full driver's license, and participate without driving themselves to the lab on the hangover testing day. All participants provided informed consent. Approval granted by UWA Human Ethics (ET2023/000004).

Design

The study implemented a semi-naturalistic randomised repeated-measures cross-over design. "*Naturalistic*" in that participants identified a day they were likely to drink alcohol and were advised to not change their usual drinking behaviour, i.e., to engage in drinking as they usually would outside of the lab in-the-wild. At the same time, participants

underwent both states of previous-day drinking and abstinence in a random order and crossed-over to the other state on the second session (hence *semi*-naturalistic, because we are directing the order they come in for formal testing in the laboratory). Testing sessions occurred at least one week apart between 8 am and 12 pm. The previous day drinking session was designated as the "hangover" day. Note, participants were not necessarily "hungover" just that they had drunk alcohol the previous day. Analysis was supplemented with subjective measures of hangover severity.

Primary variables

Independent variables included self-reported alcohol consumption, hangover severity and sleep duration (see Accessory Instruments). The dependent variables were subjective belief questions about their on-road driving skills and safety (adapted from Horswill et al., 2013), which were assessed using visual analogue scales (VAS) with the stem, "If you were driving right now, how would you compare to other Western Australian drivers (0 = worst driver, 50 = typical driver, 100 = best driver) for each of the following?". Participants were asked to rate themselves on "predicting traffic conflicts" (i.e., hazard perception skill), "overall driving skill", "overall driving safety" and "crash risk".

Accessory Instruments

Demographic survey: Age, gender, height, weight, ethnicity, driving experience, alcohol and drug consumption. *Consensus Sleep Diary (CSD)*: Abbreviated 8-item CSD assessed sleep quality and duration of previous night of sleep (Carney et al., 2012).

Blood Alcohol Concentration (BAC): Protech QM7320 fuel cell breathalyser to ensure a zero BAC before testing. *Alcohol Hangover Severity Scale (AHSS)*: Self-reported symptoms using 15 items measured on a VAS ranging from zero to 100 with zero being absent and 100 being extreme. The scale was adapted from Penning et al. (2013). Hangover symptoms included fatigue, thirst, concentration problems, and others (Verster et al., 2020).

Analysis

Data for the driving tasks were analysed using linear mixed-effects regression (LMER) to account for both fixed-effects (i.e., state [sober or hungover] and session [second testing session or first testing session]) and random-effects (participant-level intercepts to account for dependence across measurements within participants).

Results and Discussion

Hangover severity

As expected, participants were more hungover during the previous-day drinking session compared to the sober day. Figure 1 presents the hangover symptom scores. Previous-day drinking increased symptom ratings by ~14 VAS points (/100) on the single item scale (95% CI = 5.8 - 22.6), and by ~8.4 points on the combined scale (95% CI = 3.4 - 13.6).



Hangover Scale Item

Figure 1. Hangover severity of the participants in the sober and hungover states for each hangover symptom measured and the single item hangover scale measure (n = 29). N.B. is expected that some hangover symptoms will be experienced in the sober condition because they are not necessarily specific to the hangover state.

Subjective evaluation of driving ability and risk

Figure 1 presents participants' self-rated driving ability and risk for the four assessed subjective measures. There was a significant increase in self-assessed crash risk in participants who were hungover, indicating a reduction of ~11 points on the VAS scale (95% CI = 2.0 - 19.8). Interestingly, despite rating themselves as being more of a risk, the three other



Figure 2. Subjective evaluation of driving ability and risk in the hangover and sober states

Hangover symptom severity and sleep disturbance effects on self-perceptions

To determine whether the effect of hangover was more related to the hangover state, hangover symptoms themselves, or sleep disruption, we ran a series of multivariable regressions including hangover symptom severity, sleep duration, and hangover state. Neither symptom severity nor sleep duration predicted self-reported driving ability or risk.

Discussion

The selective responding indicating an increase in "Crash Risk" beliefs while hungover may reflect more the beliefs of the participants about such a state. However, this needs to be considered within the context of an absence of participants' beliefs about effects on driving skills and other aspects of hazard perception. The divergence could also suggest that the increase in crash risk is not a strongly held belief and may more reflect that the participant feels the researchers may desire such an increase in responding.

Pathway Forward

Hangover is an exceptionally common psychopharmacological state and requires more research to better understand if any heightening of crash risk may exist. Objective measures of driving skills (e.g., hazard perception skill) and risktaking behaviours (e.g., speeding propensity) that correlate with crash risk will be necessary to compare with the subjective measures. If a clear hangover deficit is observed on objective measures, this may also provide a target for behavioural interventions dissuading driving. We are recruiting more participants to analyse hazard perception skill performance (using a validated hazard perception test) and objective measures of driving-related risk-taking behaviours.

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Smith et al.



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Introduction

Alcohol hangover is one of the most common mental states on the road resulting from recreational use of a drug.

Important to identify possible:

- Impairments across cognitive domains
- Driving skill impairments
- Mismatch between subjective assessment of skill and ability

Results



Hangover symptom scores

While the number of drinks consumed was on average relatively low, participants rated hangover symptoms as higher on the hangover day across the range of items

Pathway forward

Participants self-rated their driving skills as lower while hungover.

Objective measures of driving skills and risk-taking behaviours that correlate with crash risk will be necessary to compare with the subjective measures. We recruited 49 participants:

 Semi-naturalistic cross-over design, 1^{er} session randomised to:

- . "Hungover" had a drink the previous night
- · "Sober" did not drink the previous night

Asked participants to rate:

 Subjective perceptions of on-road driving skills and safety



Self-rated driving skill

Participants were more likely to rate the following as lower when hungover:

- Conflict Prediction: OR' lower score = 1.9. Cl = 0.92 4.4. p = 0.051
- Driving Skilt: OR lower score = 2.4, Cl = 1.1 5.1, p = 0.01
- Driving Safety: OR lower score = 1.5. CI = 0.7 3.4. p = 0.15
- Crash Risk: OR lower score = 1.8. Cl = 0.8 3.7. p = 0.07
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If a clear deficit is observed on objective measures, this may provide a target for behavioural interventions dissuading driving.

A more severe hangover state may be necessary for more robust differences.

The Shaanxi Mountain Road Safety Demonstration Project

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Abstract

The \$344 million Shaanxi Mountain Road Safety Demonstration Project in China was completed in 2020 and upgraded 850km of roads, trained more than 200 professionals, and 2,400 students, teachers, parents and residents participated in evidence-based education activities. As a result of the project deaths decreased by 33% and injuries by 53%, saving 32 lives and 868 injuries annually. This coincided with a 22% increase in household travel and was achieved by increasing the roads rated 3-stars or better by 52%. Apart from making safety the primary focus of the large-scale investment, it also introduced several innovations. It was an early use of the iRAP methodology at the design and post-construction stages to set and monitor quantitative infrastructure safety targets and indicators, and it used new guidance on safety treatments to create an enabling environment for designers to embed safety in the project.

Post on X

The Shaanxi Mountain Road Safety Demonstration project in China upgraded 850km of roads, increased the roads rated 3-stars or better by 52% and reduced deaths by 33% and injuries by 53%, saving 32 lives and 868 injuries annually.

Introduction

The Shaanxi Mountain Road Safety Demonstration Project in China aimed to improve road safety by:

- 1. Upgrading and introducing safety treatments on trunk and rural roads in the hazardous Qinba Mountains area of southeast Shaanxi.
- 2. Implementing a crash reduction program for road safety treatments on other hazardous rural roads.
- 3. Strengthening road safety design and management practices while introducing road safety education and community awareness programs.

More broadly, the project was designed to contribute to poverty reduction by reducing fatalities and serious injuries, lowering transport costs, and enabling economic activity. The project was aligned with China's national development priorities outlined in the Twelfth Five-Year Plan (2011–2015) by providing safe and sustainable transport services and reducing poverty in Qinba Mountain area. The project also reflected Shaanxi Municipal Government's priorities of strengthening transport infrastructure and reducing poverty in southern Shaanxi. The project started in March 2016 and was completed in December 2020. The project was implemented by the Shaanxi Department of Transport and costed US\$344.43 million, comprising a loan of US\$200 million from the Asian Development Bank (ADB) and US\$144.43 million government funding.



Figure 1. Location of the project (left) and example of the mountainous roads (right)

Methodology

Research showed that road fatality and injury rates in Ankang and Shangluo counties in the Qinba Mountains were four times the national average for roads of similar class in China. An analysis of some 1,000 kilometres (km) of roads in the area found that road fatalities and injuries cost \$84 million (0.3% of Shaanxi's gross domestic product) per year from

Extended Abstract (Practitioner)

2007 to 2011 and highlighted the urgent need to improve road safety and connectivity in the project area. The road network included a combination "Trunk", "Additional" and "Rural" roads. According to Ministry of Public Security (MPS) data, about 21% of the roads (by length) accounted for about half (46%) of the crash costs, with the higher-class Trunk roads, which carried the largest flows, typically accounting for the highest numbers of crashes. Since the road network is largely in mountainous areas, and there were very few pedestrians and bicyclists apart from in villages. An analysis MPS data available indicated that the main crash types were: run-off (~42%); head-on crashes (~40%); pedestrian crashes (~9%).

Prior to the project, road networks had also been assessed by the ChinaRAP and iRAP teams using the iRAP methodology and with support from the World Bank Global Road Safety Facility (GRSF) and Bloomberg Philanthropies. This showed significant opportunities for safety improvements. The project also drew on evidence on road safety education and awareness, using human-centered design principles.

The project was innovative in several ways:

- It positioned road safety as the primary focus, including recognising the role safety has to play in reducing poverty, and prioritising safety ahead of travel speeds and vehicle operating costs.
- It was ADB's first application of the star rating assessments using the iRAP methodology at design stage and post-construction, including to set quantitative infrastructure safety targets and indicators (see Table 1).
- It used the iRAP methodology to explicitly include road safety costs and benefits in the economic evaluation.
- It made use of new guidance on acceptable safety treatments that enhanced design standards, developed as part of the national 'Highway Safety to Cherish Life' program.
- It implemented an innovative approach to road safety education and awareness, using human-centered design principles, codesigning and developing meaningful engagement with students and other road users in the community.
- It demonstrated the value of combining infrastructure with behaviour change interventions to drive sustainable road safety improvements. It was the first program in the PRC to successfully coordinate between transport bureaus, traffic police, and schools to ensure traffic safety for children commuting between school and home.

	Length (km)		Vehicle kilometres travelled (vkt)		
Road user	Existing	Design	Existing	Design	
Vehicle occupants	16%	41%	27%	59%	
Motorcyclists	7%	22%	15%	42%	
Pedestrians*	43%	52%	56%	67%	
Bicyclists*	55%	80%	69%	89%	

Table 1. Star Ratings by road user for existing roads and final designs

* Only sections of road where pedestrians and bicyclists are likely to be present were rated

Results

The project successfully improved the safety and efficiency of roads in southeast Shaanxi Province, raised public awareness of road traffic safety, and contributed to poverty reduction. In particular, the project delivered the following outputs:

- 850km of roads were upgraded with improved road safety star ratings. Improvements included: realignments, paved shoulders, safety barriers, reduced speed limits and traffic calming and pedestrian crossings.
- 206 people participated in road infrastructure safety training. 48 person-days of international and 670 persondays of national training were provided to the executing and implementing agency staff on road safety policies, strategies, management, innovation, and technologies.
- A safety awareness campaign in three schools was implemented. A total of 2,400 students, teachers, parents and residents participated in the safety education activities. This education model has been replicated throughout Shaanxi Province and in other parts of the PRC.

During the project, local police also took an active interest in the project and engaged in the initiative by performing target enforcement activities on the project roads. This resulted in 56 enforcement campaign operations being implemented and 61,310 violations issued. This enforcement was a factor in ensuring vehicle operating speeds were in compliance with speed limits, and contributed to the final outcome where star ratings exceed those expected in the designs.

An evaluation of the project found it to be highly successful, being highly relevant, highly effective, highly efficient, and likely sustainable. The envisaged performance targets and indicators for outcomes were achieved or exceeded. Road safety improved significantly while at the same time travel frequency increased. In particular:

• Monthly travel frequency of rural households in the project area increased from 16.4 times per month in 2014 to 21.6 by 2020, exceeding the target of 20 times per month.

- Overall, the percentage of three-star rated rural roads rose from 27% to 79% by 2020, exceeding the 59% target.
- For the Trunk Roads, which accounted for a large percentage of travel and crashes on the project roads, the final star ratings were: vehicle occupants: 80.3% 3-star or better; motorcyclists: 68.6% 3-star or better; pedestrians: 71.5% 3-star or better; and Bicyclists: 83.3% 3-star or better.
- Analysis of crash data from the Ministry of Public Security (MPS) comparing figures in 2019 with 2011 indicated that crashes were reduced by 52.2%, fatalities by 33.3%, and injuries by 53.1%, far exceeding the target of a 25.0% reduction from the 2011 baseline.



Figure 2. Example of Star Ratings for existing network and design (left) and examples of safety treatments installed (right)

Conclusions

The project demonstrated the significant safety improvements that are possible on rural roads. Each of the partners made a strong commitment to the project, illustrated in large part by the significant financial commitments. Staff of the government project management office, implementing agencies, and project implementation units actively participated in the trainings and workshops, learning about ADB's policies and guidelines, project management, contract management, sustainable urban transport management, and operation of the facilities.

The project benefited from the government project management office building effective relationships with key stakeholders in the road safety ecosystem, including traffic police and education bureaus. Had the agencies not committed fully to the project and not cooperated with the project management office, effectiveness of the project and safe system approach would have been reduced.

The project was a replicable demonstration of road safety for rural, and especially mountainous, areas and supported PRC objectives on innovative design and using performance-tracking tools. By demonstrating the combination of infrastructure and "soft" interventions, the project has long term-impacts within and beyond the project area. The approach has been replicated in other projects such as the Xiangtan Low-Carbon Transformation Sector Development Program and Heilongjiang Green Transformation Demonstration Project. The ChinaRAP team has developed strong capability and has supported many subsequent road infrastructure projects throughout China and globally. The project is a model for other countries to adapt and implement.

The safety treatments implemented are long-lasting, often with service lives running into decades. The project significantly strengthened the capacity of local agencies by providing relevant training in: safety management, implementation, and enforcement; the use of safety equipment and software; and public awareness. The project built sustainable public awareness through an education and awareness campaign that led to guardian teams being established by volunteer parents. These teams promote safety in front of the schools every morning and ensure project lessons are sustained. The project also strengthened coordination and cooperation between traffic police and schools, institutionalizing systems-thinking for road safety improvement.

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Evaluating impact of 30 km/h speed limit trial

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Abstract

In 2018, Yarra City Council conducted a trial to lower the speed limit in a specific network segment to 30 km/h, backed by funding from the Transport Accident Commission (TAC) and support from the Department of Transport and Planning (DTP) and the Victoria State Government. An evaluation by Monash University Accident Research Centre showed a minor decrease in mean speed and lower chances of surpassing speed thresholds of 40 km/h and 50 km/h. However, no notable difference was found in exceeding the 30 km/h limit. This study highlights the results of an additional investigation, which revealed a significant 67.6% drop in severe injuries post-speed limit reduction. Noteworthy reductions were also observed in injuries among pedestrians and bicyclists. These findings emphasize the effectiveness of implementing a 30 km/h speed limit in mitigating road trauma in urban areas, as evidenced by the Yarra City Council trial.

Post on X

Discover the impact of Yarra City Council's 30 km/h speed limit trial on urban safety. Significant reductions in injuries observed! #RoadSafety #UrbanSafety

Background

In 2018, Yarra City Council conducted a trial to reduce the speed limit of a section of its network to 30 km/h. This trial aimed to reduce the risk of severe injuries to Vulnerable Road Users by introducing a 30 km/h speed limit in a local residential area as part of the Towards Zero initiative. The treated area was bordered by Johnston Street to the south, Nicolson Street to the west, Hoddle Street to the east, and Alexander Parade to the north. Notably, Brunswick Street and Smith Street were excluded from this trial. Figure 1(a) depicts the trial location. This initiative was funded by the Transport Accident Commission (TAC) and supported by the Department of Transport and Planning and the Victoria State Government. The implementation was carried out by the Yarra City Council.



Figure 1. (a) The area treated by 30 km/h speed limit, (b) The treated and control areas

The Monash University Accident Research Centre conducted an evaluation to assess the impact of this treatment on mean speed and the likelihood of exceeding speed thresholds of 30 km/h, 40 km/h, and 50 km/h in the treated area (Lawrence et al. 2020). To ensure control over external factors influencing speed measures, they also selected a control area (see Figure 1(b)). The study findings revealed the following results (Lawrence et al. 2020):

- \circ Mean speed decreased by 1.1% in the treated area and by 2.7% in the control area.
- The odds of exceeding speed limits of 40 km/h and 50 km/h decreased by 11% and 25%, respectively.
- However, the study did not demonstrate a statistically significant difference in the odds of exceeding the 30 km/h speed limit following this reduction.

In summary, the outcomes of the shorter-term evaluation did not indicate a notable enhancement in speed measures. This article presents a complementary study which was conducted to delve into the Victoria Road Crash Data to investigate the effects of reducing the speed limit to 30 km/h.

Study approach

This study examines the effectiveness of reducing the speed limit to 30 km/h at the network level, considering the constraints of available data and the study area's size. It encompasses the entire network, including all intersections and mid-blocks, with a focus on serious injuries among pedestrians and bicyclists. No fatalities occurred within the network during the study period.

Data

This study employed Victoria Road Crash Data for its analysis. This dataset comprises police-reported crash data, validated through collaboration with the TAC, DTP and health authorities. This validation process ensures a high level of accuracy, particularly regarding reported serious injuries within the Victoria Road network.

Analysis approach

For this assessment, we conducted a before-after study with a control area (Figure 1 (b)). The chosen control area closely resembles the treated area in terms of land use behaviour and road environment characteristics. It was also utilised as a control area in the study by Lawrence et al. (2020), enabling comparisons between short and long-term evaluation results.

Our analysis utilised four years of data, spanning periods before and after the implementation of the speed limit reduction. The before period ranged from calendar years 2014 to 2017, while the after period encompassed calendar years 2019 to 2022. We excluded 2018 because that's when the treatment was implemented, and data collection began the following year to allow road users sufficient time to adapt to the speed limit change.

Analysis process

The analysis progressed through three stages:

- <u>Descriptive Analysis:</u> Initially, a descriptive analysis illustrated changes in the number and proportion of serious injuries before and after the trial.
- <u>Poisson Log-Linear Model</u>: Next, we developed a Poisson Log-Linear Model to assess the effect of the speed limit reduction across the entire network. In this phase, we utilised a Quasi-Experimental approach to organise serious injury data for different road users at intersections and mid-blocks in the matched treated and control areas.
- <u>Matched Intersections and Mid-blocks:</u> In the third stage, comparable intersections and mid-blocks in treated and control areas were matched for analysis. Once again, the Poisson Log-Linear Model was employed, ensuring consistency in the modelling approach. Similar to the second stage, a Quasi-Experimental approach was used for data arrangement in this stage.



Figure 3. Distribution of serious injuries in treated and control areas

Addressing the effect of regression to the mean

The analysis approach does not directly address the effect of regression to the mean. However, a time series analysis of serious injuries from calendar years 2012 to 2022 was conducted. The results indicate that the selected before period for this analysis is characterised by a lower mean of serious injuries compared to the period before that. While this finding suggests that the potential impact of regression to the mean could be minimal, it is important to note that this evidence is not considered highly robust.

Results

Figure 3 illustrates the distribution of serious injuries among various road user categories in both the treated and control areas. Table 1 summarises the findings of the Poisson log-linear model for both the second and third stages of the analysis.

Socious Injunios	Stage 2 Analysis		Stage 3 Analysis		
Serious Injuries	Reduction (95% CI)	Significance	Reduction (95% CI)	Significance	
All network	-67.6% (-60.8% to -73.2%)	Yes	-91.0% (-70.4% to -97.2%)	Yes	
Intersections	-54.6% (-29.6% to -70.7%)	Yes	-86.1% (-56.9% to -95.6%)	Yes	
Mid-blocks	-63.2% (-50.4% to -72.7%)	Yes	-82.7% (+60.1% to -98.1%)	No	
Pedestrians	-71.3% (-53.1% to -82.4%)	Yes	-88.9% (-35.5% to -98.1%)	Yes	
Bicyclists	-49.0% (-30.1% to -62.8%)	Yes	-80.9% (-18.0% to -95.5%)	Yes	

Table 1. Findings of the Poisson log-linear models

The outcomes from Stage 2 and Stage 3 of the analysis unveiled a notable decrease in the incidence of serious injuries across the entire network, encompassing intersections, pedestrians, and bicyclists, subsequent to the implementation of the 30 km/h speed limit reduction. However, there was a discrepancy regarding the statistical significance of the reduction in serious injuries at mid-blocks. While Stage 2 displayed a statistically significant decline, the Stage 3 analysis failed to validate this outcome. The absence of statistical significance in the reduction of serious injuries at mid-blocks in Stage 3 suggests that the observed decrease may not be statistically significant.

Furthermore, considering the aggregated figures at the network level, the magnitude of change in Stage 2 is deemed more reliable. Wider confidence intervals in the Stage 3 results further confirm this. It is imperative for readers to consider the reduced numbers of serious injuries found in Stage 2 of the analysis as more reliable, while approaching the findings of reduced serious injuries in Stage 3 with caution. Additionally, it is important to refrain from generalising these findings as a crash reduction factor for this treatment, given the relatively small size of the study area. Further studies are warranted to establish a robust crash reduction factor value for this treatment.

Benefits to road safety

The results of this study highlight several benefits to road safety stemming from the implementation of a 30 km/h speed limit reduction. The significant decrease in the number of serious injuries across various road user categories, including pedestrians and bicyclists, underscores the effectiveness of this intervention in mitigating road trauma. By reducing vehicle speeds, particularly in urban areas, this measure enhances safety for all road users and contributes to the overall improvement of road safety outcomes.

Implications for policy and/or practice

The findings of this study hold significant implications for policy and practice in urban safety initiatives. The observed reduction in serious injuries following the implementation of the 30 km/h speed limit reduction underscores the effectiveness of such measures in enhancing road safety within urban environments. Policymakers and urban planners can use these results to advocate for the similar speed limit reductions.

Conclusion

In conclusion, the analysis findings presented a remarkable reduction in serious injuries across various road user categories. The substantial decrease of 67.6% in serious injuries, alongside observed reductions at mid-blocks and intersections by 63.2% and 54.6% respectively, underscores the effectiveness of the 30 km/h speed limit reduction. Moreover, the notable reductions of 71.3% and 49% in serious injuries among pedestrians and bicyclists further emphasize the positive impact of this intervention on road safety outcomes. These findings highlight the importance of implementing such measures to enhance overall road safety and mitigate road trauma in urban settings.

The absence of a significant speed reduction during the short-term trial evaluation may be attributed to road users needing time to adapt to the new speed limit. Immediate effects on speed distribution and extreme behaviours may not be apparent in the short term. Future research could delve deeper into these factors for a better understanding of the short-term impacts. However, it's important to note the lack of data to determine if speeds have further decreased since the short-term evaluation. As a result, uncertainty remains regarding whether the initial modest speed reductions lead to substantial reductions in trauma or if it's the larger reductions observed five years later that drive the trauma reductions.

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The impact of navigation application enforcement alerts on road safety

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Abstract

Road trauma remains a significant global public health issue. While enforcement of illegal and high-risk driving behaviours has been associated with significant reductions in associated trauma, technological advances and behavioural adaptation among motorists continue to present barriers to enforcement efforts. A number of navigation applications provide users with the ability to receive alerts and share information on locations of speed enforcement and other police activity, potentially impacting road safety by undermining road rules, facilitating punishment avoidance, and encouraging mobile phone use while driving. Qualitative interviews with 28 Queensland drivers, who self-reported as regular speeders, showed that more than half (57.1%) reported using navigation applications for the specific purpose of receiving alerts about speed enforcement locations. This paper discusses the impact such alerts have on speeding behaviour, attitudes and punishment avoidance. Recommendations for policy and future research are also discussed.

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"It's not foolproof, but it's pretty close". Do alerts in navigation apps about enforcement locations undermine road safety? New qualitative data suggests they do, by aiding punishment avoidance and giving some drivers a sense they can speed with relative impunity.

Introduction

Road trauma remains a significant global public health issue, with an estimated 1.2 million people killed in traffic crashes worldwide in 2021 (World Health Organization, 2023). In line with the Safe Systems approach, a wide range of interventions have been implemented to address this problem, aimed at improving the safety of the road environment, vehicles and road users. One of the most effective approaches is evidence-based enforcement and sanctions targeting illegal and high-risk driving behaviours. Indeed, enforcement of speeding, red-light infractions, impaired driving, seat belt use and using a mobile phone while driving, have consistently been found to be associated with significant reductions in associated road trauma (Bates, et al., 2012). Unfortunately, technological advances and behavioural adaptation among motorists continue to present barriers to enforcement and challenges as to how enforcement must similarly adapt to ensure road safety is preserved.

In recent years, there has been a proliferation of smartphone applications aimed at assisting motorists to avoid detection by automated enforcement, such as speed and red-light cameras, by providing data and real-time alerts regarding the location of enforcement (Truelove, et al., 2023). Indeed, popular navigation applications (i.e., Google Maps, Apple Maps and Waze) have brought these alerts into the mainstream, providing users with information on locations where speed enforcement and other policing activities are being conducted. Typically, this data is acquired, or at least maintained, through user-generated content (UGC), whereby motorists share real-time information regarding their direct experiences with the enforcement activity they encounter on the road.

Road safety practitioners have expressed concern that including alerts and information about the locations of traffic enforcement in navigation applications has the potential to negatively impact road safety in a number of important ways (Oviedo-Trespalacios & Watson, 2021). Specifically, such alerts facilitate punishment avoidance, undermining the legitimacy of road rules and enforcement efforts, and subsequently reducing the perceived risk of detection and diminishing the deterrent effect of enforcement. Such alerts can also contribute to social norms that legitimise negative attitudes towards enforcement and lower perceptions of risk associated with particular high-risk driving behaviours. In addition, the reliance on UGC data – often instructing users to report and/or confirm enforcement locations in real-time – actively encourages potentially illegal and dangerous mobile phone use while driving. However, limited research has been conducted quantifying the scope of this problem.

Method

This research involved 28 one-on-one interviews with motorists from Queensland, including regional and remote areas, who self-reported as regular speeders. Interviews lasted up to 30 minutes and were conducted by the same facilitator. Interview questions included the use and perceived effectiveness of a range of punishment avoidance strategies, as well as the context and reasons for using such strategies. This paper focuses on results related to discussions of the use of

navigation applications for the specific purpose of receiving alerts and information about speed enforcement locations. A thematic content analysis was performed on the data, aimed at identifying and exploring key themes, how they relate to one another, and quantifying common concepts within the data where feasible.

Results

A total of 28 participants were interviewed. The sample included an equal number of male and female participants (n=14), with a mean age of 40 years (SD = 14.9 years, range = 19-63 years). The majority were from south-east Queensland (67.9% or n=19), while the remainder were from regional Queensland (32.1% or n=9), with most holding an Open licence (92.9% or n=26). With regards to self-reported speeding behaviour, 42.9% (n=12) were categorised as low-level speeders, reporting they only ever exceed the speed limit by up to 10 km/h. Conversely, 28.6% (n=8) of participants were categorised as moderate speeders, such that they occasionally exceeded the speed limit by more than 10 km/h, with a further 28.6% (n=8) categorised as excessive speeders, reporting they exceeded the speed limit by more than 10 km/h regularly or most of the time.

More than half of all participants (57.1% or n=16) reported using navigation applications for the specific purpose of receiving alerts and information about speed enforcement locations. That is, they expressly stated that receiving speed enforcement location notifications was a primary reason for using the application. Males were more likely to report using navigation applications for this purpose compared to females (71.4% vs 42.9%), as were participants from southeast Queensland when compared to those from regional areas (63.2% vs 44.4%), and drivers aged 18-39 years when compared to those aged 40 years and older (64.3% vs 50.0%).

Among the 16 participants who reported using navigation applications for the specific purpose of receiving speed enforcement location alerts, Google Maps was the most popular application (50.0% or n=8), followed closely by Waze (43.8% or n=7). While Google Maps and Waze had relatively similar rates of use, participants expressed particularly positive attitudes towards, and experiences with, the Waze app. Many participants expressed they used these applications on almost every trip, viewing it as a relatively integral part of the driving experience: "*I use the Waze app religiously … sometimes for the navigation but mostly purely for that [speed enforcement alerts] … it's a money saver; I love it … I also share locations on the Waze app too*" (Male, aged 63 years, Brisbane).

Receiving alerts about speed camera locations from these navigation applications appeared to have a negative impact on behaviour, whereby participants only reduced their speed in the vicinity of the camera. As one participant stated: "*The maps that I use on my phone … it automatically tells you that there's a camera up ahead, so you just slow down to 60 K and then you go through it*" (Male, aged 57 years, Gold Coast). This temporary impact of speeding behaviour may result in some participants developing a sense that they can otherwise speed with relative impunity, particularly when they consciously link avoiding detection to the speed enforcement location alerts.

This conscious link to punishment avoidance and positive reinforcement of speeding behaviour was further exacerbated when considering the confidence many participants have in the information provided by navigation applications regarding the location of speed enforcement. Indeed, as one participant said in relation to using Waze: "*It's not foolproof, but it is pretty close*" (Male, aged 59 years, Brisbane). That said, participants noted that experiences with false positives (receiving an alert when there is no enforcement) and false negatives (not receiving an alert when there is enforcement) could quickly erode confidence in the information provided, with false negatives being particularly impactful. However, while such experiences might induce caution upon relying too heavily on the information, it typically did not result in discontinued use of the applications for receiving these alerts.

Overall, most participants seemed aware the information about speed enforcement locations was based on real-time UGC. As one participant noted in relation to Waze: "*There's so many users, and someone will mark – multiple people will mark – 'there is a police camera there'. As you are driving past, it asks every user that is using the map, 'Is it still there?' ... it is getting live information from thousands of drivers ... [asked how confident they are with the information] Very confident. It's always been spot on" (Female, aged 39 years, Sunshine Coast). For some, this community of users providing real-time data served to increase the confidence they had in the accuracy and reliability of the information.*

Benefits to road safety

Technological advances have undoubtedly led to significant improvements in vehicle safety. However, the proliferation of smartphone use and its clear impact on reducing safety while driving through distraction, presents a challenge for road safety practitioners. While some smartphone applications, such as those used for collision warning, voice control, texting prevention and in-vehicle data recording, can play a role in improving safety (Albert, et al., 2016), applications that provide users with the ability to receive and share information on locations of traffic enforcement are likely to erode road safety efforts, by undermining road rules, facilitating punishment avoidance, and increasing the use of mobile phones while driving. This study, which is the first phase in a broader program of research that will also include a quantitative survey of self-reported speeders, provides much-needed data showing the scope of the problem and how

it influences driving behaviour and attitudes. Such information is critical for developing evidence-based policy recommendations aimed at addressing the road safety issues associated with such applications.

Implications for policy

The research highlights that navigation applications are used by some motorists for the specific purpose of receiving alerts and information related to speed enforcement locations in order to circumvent detection when speeding. The prevalence of this behaviour is likely to be underpinned by perceptions of low risk associated with low-level speeding and a subsequent desire to not be sanctioned for such behaviour. Attempts to modify these perceptions and attitudes should continue, through education and awareness campaigns demonstrating the risks associated with speeding. In addition, policy discussions should identify whether regulations can be developed that prevent the inclusion of such alerts and information in navigation applications in the Australian market. Finally, it is imperative that speed enforcement adapts to the threat to road safety posed by these applications.

This research also highlighted high rates of other punishment avoidance strategies. This included site-learning and device-learning (i.e., looking out for and slowing down in the immediate vicinity of known or suspected enforcement locations, or in the vicinity of vehicles or other devices suspected of conducting speed enforcement), as well as driving to a de facto speed limit (i.e., above the speed limit, but not more than the perceived enforcement tolerance) and sharing information about enforcement locations through social media groups. Thus, there are concerted efforts by speeding motorists to avoid punishment. Enforcement policy and practice must adapt to reduce the likelihood that traffic enforcement locations can be confidently identified by motorists, including more covert operations and innovative technology (e.g., in-vehicle roaming speed cameras), or approaches whereby location knowledge would have limited impact on the effectiveness of enforcement, such as fixed and mobile point-to-point camera systems. Research highlighting the use of social media groups to identify roadside drug and alcohol testing (Mills & Truelove, 2024) also suggests it is only a matter of time before such alerts, disguised under the vague umbrella of "police-activity", begin to enable substance-impaired drivers to avoid enforcement efforts, which would further erode road safety initiatives.

Conclusions

Navigation applications that provide users with real-time information and alerts on locations of traffic enforcement have numerous potential negative impacts on road safety, by undermining road rules, facilitating punishment avoidance, and increasing mobile phone use while driving. This research highlights that such applications are used by motorists for the specific purpose of receiving alerts and information related to speed enforcement locations in order to circumvent detection when speeding, producing negative impacts on driving behaviour and attitudes. Enforcement policy and practice must adapt to this threat, by increasing covert operations and trialling and implementing innovative technology that reduces the ability or effectiveness of identifying enforcement locations. Finally, a broader social discussion is required regarding the unique social norms expressed toward speeding, such that speed camera alerts are largely socially accepted, but there would likely be significant public backlash if navigation applications explicitly provided users with advanced warnings of the location of roadside drug and alcohol testing sites. Such disparity highlights the relative indifference many motorists have towards the dangers of speeding.

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Multi-sectoral metropolitan Road Safety Action Plan: case study from Chennai

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Abstract

Road crashes took 168,491 lives in India in 2022. A third of these fatalities occurred in urban areas, highlighting the need for metropolitan safety. In 2023, the Chennai Unified Metropolitan Transport Authority (CUMTA) adopted a Chennai Road Safety Action Plan (CRSAP) with a vision of "Safe Chennai Roads, free from fatal and serious injury". It aims to sustainably reduce road crash deaths in the Chennai Metropolitan Area by 25 percent and 50 percent by 2026 and 2030 respectively, in line with the UNSDG target. This paper describes the development of the CRSAP, a multi-sectoral action plan concretely tied to a-priori defined targets under the safe system approach, with potential for replication in other Indian metros. Key lessons include the need to build robust institutions for road safety management, data-driven decision making, speed management in high pedestrian areas and proactive assessment of roads.

Post on X

The Chennai Road Safety Action Plan - a unique template for city road safety management with a-priori defined targets and multi-sectoral interventions under the safe system approach – for Indian metropolitan cities.

Introduction

Safety is at the heart of the sustainable mobility agenda and is part of the UN Sustainable Development Goals (SDGs) 3 and 11. Road crashes are a global public health problem, particularly in fast-growing cities in developing countries. Road crashes in India took 168,491 lives in India in 2022, causing immense social, physical and financial distress to individuals, families and society. 54,230 (33 percent) of these fatalities occurred in urban areas, with 17,089 (11 percent) recorded in the 51 cities with a population over a million (TRW, 2022). Rising urbanization, disposable incomes and aspirations, coupled with the low cost of motorcycles and lack of viable public transport options, has led to rapid motorization: Between 2009 and 2019, motorization in India increased by 159% and road fatalities increased by 20%. Key underlying issues are: (i) rapid motorization combined with a vehicle-first mindset that prioritizes vehicle movement over the safety of vulnerable road users (VRUs), and (ii) dispersed institutional arrangements for road safety with limited accountability for delivery of results at the city-level. Chennai's road safety situation typifies that of other large cities in India in terms of a growing population, high levels of urbanization and motorization and high number of fatalities. At first glance, the road safety situation in Chennai seems to have improved over time (Figure 1). However, while the number of road crashes and injuries in the Chennai Metropolitan Area (CMA) has nearly halved in the last decade, the number of fatalities has held steady, with an average of 1,150 fatalities in the same period. The severity of crashes and likelihood of death has in fact, risen over time, highlighting the urgent need to tackle the road safety challenge systematically.



Figure 14. Chennai Metropolitan Area crash statistics 2013-22 (Source: Road accidents in India, TRW, MORTH, GOI, 2022)

It is not all bad news: some Indian cities have successfully reversed their road crash situation through concerted action. Mumbai and New Delhi have reduced their fatalities by 26% and 20% respectively between 2013 and 2022. Cities worldwide are increasingly adopting the Safe System approach, which looks beyond road user behavior and the safety of motorized vehicles to inclusiveness and every major element of the road traffic system, to improve urban safety. It is particularly relevant in Indian cities where road safety issues abound, as do opportunities, levers and the drive to

improve the situation. This paper puts forth a systematic approach to tackle rising road crash fatalities in Indian cities based on safe system principles, and describes the relevance of Road Safety Action Plans to align stakeholders and impel action on road safety. It is based on the Chennai Road Safety Action Plan (CRSAP), a first-of-its-kind city-level road safety plan in India, adopted by the Chennai Unified Metropolitan Transport Authority (CUMTA) in 2023 with a vision of "Safe Chennai Roads, free from fatal and serious injury".

Approach

Recognizing the impact of annual city road fatalities, the CUMTA initiated the development of the CRSAP in September 2020⁶. Key issues and deficits under each of infrastructure, institutions, enforcement and user behaviors were identified through a thorough analysis of available crash and non-crash data. Analyses revealed that VRUs are most at risk of death from road crashes in Chennai: Motorcyclists made up 57 percent of all fatalities, with pedestrians accounting for another third. Speeding was a contributing factor in 75 percent of all road crash fatalities, whereas non-wearing of helmets was a contributing factor in 48 percent of fatalities. Most pedestrian fatalities were due to collisions with motorcyclists. Observational surveys revealed that nearly 40 percent of vehicles exceeded posted speed limits in the city, and that 32 percent of two-wheeler riders and 97 percent of pillion riders did not wear helmets. 89 percent, 70 percent and 26 percent of roads are rated 1 or 2-star under the IRAP methodology, for pedestrians, cyclists and motorcyclists respectively. All these pointed to a need for safer infrastructure, speed calming measures, enforcement against speeding and non-wearing of helmets. These were systematically categorized and analyzed through a combination of International Road Assessment Program (IRAP) star rating methodology and crash rates to prioritize road corridors for safety improvements (Figure 2).



Figure 15: Methodology for prioritizing roads for safety improvements in Chennai (Source. Review and Findings Report 2, Consultancy Services for preparing RSAP for CMA, DIMTS, April 2022)

A total of 469 km of riskiest corridors were prioritized for treatments. Analysis indicated that a combination of infrastructure measures such as mass action and capital intensive treatments⁷ on the prioritized roads and junctions, reduction of average vehicle speeds by 2.5 kmph and full compliance to helmet-wearing would result in a savings of 818 fatalities a year (or a 58 per cent reduction from current year fatalities). The benefit-cost ratio of the infrastructure improvements alone was 15:1, indicating a high return for an investment of just \$75 million in mass action treatments.

Key elements of CRSAP

The CRSAP comprises the following four key elements:

- A) <u>Safety outcomes and performance targets:</u> To achieve its vision, the CRSAP has set Safety Performance Targets (SPT) to 2030 targeting some of the factors contributing to road crashes (Figure 3).
- B) <u>Institutional arrangements:</u> Chennai has taken meaningful steps to reduce institutional fragmentation and improve road safety governance recently. The CUMTA has established a Road Safety Cell (RSC)⁸ with the following responsibilities oversight, interagency coordination, monitoring, evaluation and reporting of road safety interventions, outputs, and outcomes. A Road Safety and Non-Motorized Transport Sub-committee has also been set up to oversee implementation of the CRSAP and related road safety initiatives in the CMA.
- C) <u>Interventions:</u> Measures need to be targeted to tackle the key contributing factors for crashes in Indian cities. The top four priorities that Chennai has prioritized to reduce its road fatalities are:

⁶ https://www.dtnext.in/city/2020/09/27/road-safety-action-plan-to-bring-down-accidents-fatalities-in-chennai-suburbs

⁷ Comprising segregated on-road motorcycle and bicycle lanes, footpath improvements, pedestrian fencing, raised pedestrian crossings and refuge islands, signalized pedestrian crossings, curve and junction delineation, lighting, school zone treatments, traffic calming/speed management measures, crash barriers and removal of roadside hazards

⁸ https://timesofindia.indiatimes.com/city/chennai/chennai-corporation-plans-road-safety-cell-to-study-accidents/articleshow/80162998.cms

- <u>Rationally set speed limits</u>: In November 2023, the Greater Chennai Traffic Police (GCTP) mandated a uniform speed limit of 30 kmph in all residential areas in Chennai, differential speed limits for different vehicle classes and a maximum speed limit of 60 kmph for light motor vehicles in the city.
- <u>Enforce speeds</u>: The GCTP has already procured and installed Traffic Regulation Observation Zones on several city roads with Automatic Number Plate Recognition (ANPR) technology, Red Light Violation and Speed Dome cameras at junctions to automate monitoring of traffic violations, and minimize human interaction and errors in their issue. It is also planning enhanced general deterrence using both fixed and mobile cameras.
- <u>Enforce helmet-wearing:</u> Strict enforcement of helmet-wearing by GCTP has yielded good outcomes: a survey conducted under a World Bank study revealed that helmet compliance in Chennai improved from ~20% in 2019 to ~65% in 2022, resulting in a ~48% reduction in 2-wheeler fatalities between 2019 and 2022. However, about 78% of the pillion riders still do not wear helmets, and 36% of all riders do not fasten their chin clips. Of women pillion riders, more than more than 90% don't wear helmets. Strict enforcement of the helmets for pillion including women would help reduce 2-W fatalities further.
- <u>Improve pedestrian facilities:</u> CUMTA has proposed mass action and geometric treatments pelican signals, speed humps/cushions and traffic calming measures, tabletops and refuge islands, road narrowing, speed tables, signalized pedestrian crossings, school zone and gateway treatments at high crash risk locations to reduce pedestrian facilities. Systematic templates for what conditions warrant each type of measure have also been developed for city-wide replication.

Fatalities	 50% reduction in fetalities by 2030 25% reduction in fetalities by 2026
Reads	At least a 3-star infrastructure star rating (#AP) for all road users by 2030
Speeds	 50% reduction in vehicles exceeding the posted speed limit by 2030 25% reduction in vehicles exceeding the posted speed limit by 2026
C. Halmata	 100% of motorcycle riders correctly using helmets by 2030 60% of motorcycle riders correctly using helmets by 2026
Seatbalts	 100% of all vehicle occupants correctly using seatbelts by 2030 60% of all vehicle occupants correctly using seatbelts by 2026
() Drunk	 S0% reduction in drivers testing above the legal alcohol limit by 2030 25% reduction in drivers testing above the legal alcohol limit by 2026

Figure 16. CRSAP road safety performance targets (Source: CRSAP, February 2023)

D) <u>Reporting, monitoring and evaluation arrangements:</u> Chennai has set up a robust monitoring and evaluation program to help implement and evaluate the strategy, performance and delivery of actions by each responsible agency.

Lessons for other cities/metropolitan regions

- <u>Robust institutions:</u> Arrangements in the form of either a dedicated lead agency or committees at high level executive and operational levels are vital for coordination, management and delivery of all city road safety activities.
- <u>Data-driven decision making</u>: Accurate data on incidence and type of crashes along with a detailed analysis and understanding of the crash contributory factors are essential for policy decisions, prioritizing public health issues, identifying interventions, monitoring trends and assessing intervention programs in cities.
- <u>Forgiving roads and roadsides:</u> Cities should aim to develop a road transport system which accommodates human error and reduces human exposure to motor vehicle speeds/crash forces that may result in death or serious injury.
- <u>Speed management</u>: Safety needs to be directly provided for in cities by significantly reducing motor vehicle speeds in high pedestrian areas, and indirectly by supporting safe motor vehicle movements on high-volume corridors.
- <u>Systematic, proactive assessment of roads:</u> Cities with highways passing through them should identify and prioritize mass action road safety treatments especially where crashes are dispersed across the road network.

Conclusion

Formulation, adoption and implementation of a city road safety action plan is an essential first step for metropolitan cities in low and middle income countries to reduce their road death tolls. The plan should be premised on a thorough analysis of crash data to understand key issues and contributing factors. It should comprise targeted safety performance targets and interventions under each road safety pillar/theme, related institutional and governance arrangements, high-priority projects (both infrastructure and non-infrastructure) and accountable agencies along with timelines and

monitoring and evaluation arrangements. The CRSAP is a unique example of an action plan that is concretely tied to apriori defined targets using multi-sectoral interventions, with potential for replication in other metros across India.

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Seniors' opinions on fitness to drive assessments: a qualitative study

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Abstract

This qualitative study explored older adults' experiences and opinions regarding fitness to drive assessments, with a particular emphasis on the assessment of cognitive function and how it relates to driving. A total of 34 (14 females) older adults aged 60 years and over (Mage = 73 years, SD = 9, range = 60-93) were included in this study, and underwent a 20-minute anonymous interview via telephone. The data will be analysed using Braun and Clark's (2022) thematic analysis. Preliminary themes include: (1) seniors would prefer to undertake an on-road driving test as cognitive tests lack face validity, (2) fitness to drive assessments require improvement, (3) there is inconsistency in how fitness to drive assessments are performed and (4) mixed opinions exist as to whether an independent assessor should conduct the assessment.

Post on X

This qualitative study explored older adults' opinions and experiences regarding fitness to drive assessments. A total of 34 participants underwent an anonymous 20-minute interview via telephone.

Background

As the ageing population continues to increase via improvements in modern medicine, a greater number of older adults are able to maintain their licence for a longer period of time. However, increasing age can lead to the development of various age-related health conditions such as vascular disease, mild cognitive impairment and dementia, all of which may affect cognitive functions that are important for driving safely (Wadley et al., 2009; Rashid et al., 2020; Stefanidis et al., 2019). The emergence of such changes highlights the need for ongoing assessment and monitoring of cognitive deterioration or decline in other driving-related functions (e.g., visual or motor abilities) which may ultimately hinder driving capability. However, despite their importance, fitness to drive assessments can be considered stressful or confronting for older adults. A driver's licence represents a sense of freedom and independence, both of which are needed for high quality of life and personal wellbeing (Jalenques et al., 2020; Oxley & Whelan 2008). This study aimed to gain a deeper insight into how older adults perceive fitness to drive assessments, including the assessment of cognitive function with respect to driving.

Method

A total of 34 older adults (14 females) aged between 60-93 years (M = 73, SD = 9) took part in this study. Participants were eligible for inclusion if they were aged 60 years and over and held a current Queensland driver's licence. Informed consent was obtained online as well as verbally before the commencement of the interview. In addition, participants provided consent in writing and verbally for their interview to be recorded for transcribing purposes. Ethics approval for this project was granted by the University [name here] Human Research Ethics Committee (A211678). All interviews were conducted via telephone, with each interview lasting approximately 15-30 minutes, depending on the length of responses. Questions pertained to their personal experiences and concerns regarding fitness to drive assessments, the assessment of cognitive function and how it relates to their driving ability, as well as their recommendations for improving such assessments. For example, questions included: 'If you had concerns about your cognitive functioning (e.g., memory, attention) and your driving abilities, who would you discuss these concerns with?' 'What are your current thoughts and opinions regarding the assessment of driving ability in older adults?' 'What factors do you think GPs and other health professionals need to take into account when assessing fitness to drive?'

Results

Participants reported holding a driver's licence for 54 years on average (SD = 9 years) and spent approximately 6.5 hours driving per week (SD = 5.45; with one participant reporting not driving all during this time). Health conditions reported in the sample included vision problems (n = 1, 2.9%), hearing problems (n = 2, 5.9%), previous cardiac illness (n = 3, 8.8%), high blood pressure (n = 2, 5.9%), diabetes (n = 4, 11.8%), sleep apnoea (n = 1, 2.9%), arthritis (n = 1, 2.9%), and diagnosed mental illness (n = 1, 2.9%). One participant reported having very mild cognitive impairment, which did not affect their driving. A total of 18 (53%) participants had experience with fitness to drive assessments as part of their annual medical assessment due to a health condition or being over the age of 75 years. The remaining participants expressed their opinions based on what they had experienced with their parents or heard from others, such as their peers.

The data from this study will be analysed using Thematic Analysis (Braun & Clark, 2022). Preliminary themes identified include: (1) seniors would prefer to undertake an actual driving test as cognitive tests lack face validity, (2) fitness to drive assessments require improvement, (3) there is inconsistency in how fitness to drive assessments are performed and (4) mixed opinions exist as to whether an independent assessor should conduct the assessment.

Benefits to road safety/implications for policy and/or practice

Fitness to drive assessments can represent a difficult and confronting experience for older adults. Maintaining a licence is critically important for their capacity to undertake activities of daily living, as well as for their mobility and independence. Maintaining their licence is thus critical for their overall wellbeing and quality of life (Jalenques et al., 2020; Oxley & Whelan 2008). As such, knowledge of the challenges and experiences they face with respect to fitness to drive assessments (including the assessment of cognitive fitness to drive) can guide the development of intervention strategies or support mechanisms to better prepare older adults for fitness to drive assessments as well as driving cessation. In addition, knowledge of their experiences with these assessments is useful in designing assessment tools and measures of fitness to drive, with greater face validity for older adults.

Conclusion

In conclusion, this study will provide a deeper insight into how older adults perceive fitness to drive assessments and highlight potential ways in which they believe they should be improved.

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Vision Zero Planning for Road Safety in New Zealand

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Abstract

New Zealand Transport Agency has undertaken a project with the main purpose to identify a roadmap for setting interim targets on the way toward zero road deaths and serious injuries by 2050 and a 40% reduction by 2030. A Vision Zero Planning approach was used to envision and quantify the gap to a desirable Safe System End State. Case-by-case trauma modelling of fatal crashes was then used to estimate the benefit of three different scenarios to transform the road network to a Safe System End State by 2050. The most ambitious scenario was estimated to reduce fatalities by 55% to 2030 and 89% to 2050. While this shows that New Zealand can get close to zero by 2050 with today's available road safety interventions, more effort is needed to find new ways of protecting vulnerable road users in general and motorcyclists specifically to eliminate road trauma.

Post on X

Vision Zero Planning and case-by-case trauma modelling shows how it is possible to achieve zero fatalities by 2050 in New Zealand.

Introduction

New Zealand's previous Road to Zero Strategy aimed to reduce death and serious injury on the country's road by 40 per cent over the decade to 2030 (New Zealand Government, 2019). To better understand the extent to which existing trauma can be prevented and to chart a pathway to zero fatalities by 2050, the New Zealand Transport Agency (NZTA) commissioned a project with the following key objectives:

- To understand the extent to which existing trauma will be prevented in the future by current and planned measures.
- To identify the combination of interventions likely to eliminate and/or reduce future road trauma.
- To identify a roadmap for setting interim targets on the way toward zero road deaths and serious injuries by 2050 and a 40% reduction by 2030.

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Approach

World-leading countries such as Sweden apply a system of 'Management by Objectives' to manage road safety performance. This involves agreeing an overall target for trauma reduction by a specified date and based on this target, developing interim targets.

The Vision Zero Planning approach in this project used backcasting to envision and quantify a desirable future state. It then works back in time to the present asking: What will need to occur in order to bring about the desired future state? The steps undertaken in this project and presented here involves to:

- 1. Specify the vision, define and validate the Safe System End State
- 2. Gap-analysis to compare current and future end state
- 3. Trauma modelling to develop baseline trends and strategic responses to get to zero by 2050.

The Safe System End State was built based on the knowledge of human biomechanical tolerance in combination with future vehicle performance for crash protection and crash avoidance summaries in Rizzi et al. (2023). Infrastructure requirements where specified for different movement classifications and road functions in the One Network Framework (NZTA, 2024). Trauma modelling used case-by-case counterfactual analysis on current and future trauma and system performance can assist with this process and provide a roadmap to prioritise future road safety system changes, interventions and target setting. This approach involves a systematic and detailed analysis of serious crashes that considers information about safety features of the road environment and vehicles involved in each crash, as well as best available information, evidence and scenarios about long-term benefits of likely future safety measures. This allows understanding of whether current trauma would be prevented through the safety features we know will exist in future and identification of the combination of these and additional interventions.

The dataset used for trauma modelling included all 353 fatalities in 2019 extracted from the NZTA crash data system CAS. Crash Analysis Reports from New Zealand Police was used to gain more details on the crash circumstances. This

dataset was then enriched using MegaMaps with information on whether and when the crash location would be subject to any future road safety treatments.

Results

Safe System End State Validation

The case-by-case analysis resulted in an estimated 87% reduction of fatalities with the full implementation of the Safe System End State (Figure 1). Further analysis of the residual 44 (13%) fatalities showed that the majority were vulnerable road users and 50% of the residual were made up of motorcycles.



Figure 1. Validation of the Safe System End State and residuals by road user group.

An analysis of the residual trauma in 2030 and 2050 showed that the major reason for fatalities being in the residual in 2030 was due to slow implementation time. That is, there was an available and effective measure that could have prevented the fatality, however, there were no plans in place to implement the measure or the lead time for implementation was too slow such that it won't have a safety impact in 2030. But by 2050, where vehicle safety measures were assumed to be rolled out, the number of residuals due to slow implementation reduced dramatically. There were only a small number of fatalities that were 'true' residuals in that there are currently no relevant interventions or specified interventions that could effectively address the fatalities. This category calls for new innovative treatments and initiatives to truly get close to zero fatalities.

Gap Analysis

The gap analysis quantified the gap, per midblock and intersection category, between the current road network and the Safe System End State. In summary, the state road network gap was 2,443 km of full barrier containment and 62,387 km of speed management and mass action treatment. In addition to the full barrier containment, 2,734 km of high movement corridors were concluded to be in the need of mid- and roadside barrier treatments in the end state, but with the understanding that the interim solutions on the pathway to 2050 would likely include less costly targeted treatment types. The intersection gap analysis categories each intersection into acceptable or not acceptable combinations of speed and intersection type combinations. It was concluded that 70% (57,496) were acceptable and 30% (25,598) not acceptable. To facilitate the development of a strategic response to close this gap, intersection risk ratings were introduced to understand the collective risk for each intersections (rated as Low Medium to High risk) accounted for 72% of all death and serious injuries (DSI). Also, 500 (0.6%) Medium High and High-Risk intersections accounted for 18% of all DSI.

Strategic response scenarios

Three strategic response scenarios were to investigate the potential trauma savings to 2050 over and above the baseline as per Table 1. Scenario 3 was developed as a Vision Zero 2050 unconstrained scenario.

Table 1. Strategic response scenarios to achieve interim targets to 2030 and zero fatalities by 205	50.
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	Scenario 1	Scenario 2	Scenario 3
Speed and infrastructure	100% delivery of the speed and infrastructure outputs as forecast by SIP in the pipeline delivery programme up to and including NLTP 3, i.e. excludes NLTP 4+ (i.e. ~550km median barrier, ~ 600 SST intersections and ~30,000 speed management)	Based on the SIP Strategic Model rollout up to 2030 (i.e. 1,000km median barrier, 1,400 SST intersections, 10,000kms speed management). Between 2040 and 2050 the rollout was based on Scenario 3.	2,500 km median barrier, 2,176 intersections, 20,000kms speed management in 2020- 2030. 5,200 km median barrier, 25,000 intersections, 48,000 km speed management in 2020-2050.
Vehicles	Regulatory (standards) programme slow/delayed. Assumed minimal regulatory changes by 2030 under this scenario.	Optimistic view of vehicle safety features/technology uptake - noting RTZ assumes equivalent to removal of 1 and 2 star vehicles (2018 baseline rating) by 2030	As Scenario 2
Road policing	No change to current levels (currently ~60% of Road to Zero targets)	Road policing levels increase to 100% of Road to Zero targets	As Scenario 2
Safety cameras	50% of the proposed equivalent of 600-800 cameras by 2030	100% of the proposed equivalent of 600-800 cameras by 2030	As Scenario 2

The result of modelling the three scenarios showed for Scenario 1, 2 and 3 an estimated fatality reduction to 2030 by 26%, 37% and 55% respectively, and a reduction to 2050 with 58%, 89% and 89% respectively. Scenario 1 was estimated to cumulatively save 400 lives compared to the baseline, and Scenario 2 and 3 were estimated saved an additional 2,494 and 2,909 lives, respectively to 2050.

Benefits to road safety

Using a backcasting approach by targeting zero fatalities in 2050 in New Zealand enabled a gap-analysis to be undertaken, based on the current road network performance compared to a Safe System End State. By doing this one can identify additional programs and innovation needed to achieve zero and understand how to optimise the pathway to zero to 2050. Close to zero road trauma by 2050 would translate into an approximate 50% reduction per decade and scenarios were developed to make this pathway more tangible and thereby more likely to get operationalised.

Conclusion

Three scenarios were developed to investigate future trauma reductions to 2050 in New Zealand. Two of them were developed to align with a Vision Zero Planning approach to translate the road network into a defined Safe System End State. This end state was estimated through case-by-case trauma modelling to reduce fatalities by 87%. After accounting for traffic growth and general improvements from speed management and enforcement, this resulted in an 89% reduction overall. While this shows that New Zealand can get close to zero with today's available road safety interventions, more effort is needed to find new ways of protecting vulnerable road users in general and motorcyclists specifically.

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AI-based video analytics for estimating pedestrian crash risks in real-time

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Abstract

Vehicle-pedestrian crashes are generally severe due to the vulnerability of pedestrians. While traffic conflict techniques have been tested for vehicular crashes, their suitability for estimating pedestrian crash risk by severity levels remains underexplored. This study utilises a non-stationary bivariate extreme value (EVT) model to jointly model Post Encroachment Time and Delta-V for estimating real-time pedestrian crash risk by severity at individual signal cycles of signalised intersections. Vehicle-pedestrian conflicts were extracted from 144 hours of video data of three signalised intersections in Queensland, Australia, by applying artificial intelligence (AI)-based video analytics. The developed model was found to reliably predict severe and non-severe pedestrian crashes compared to the historical crash records. Results suggest that the frequency of pedestrian conflicts per signal cycle and average pedestrian speed are associated with real-time pedestrian crash risks. The proposed proactive estimation of pedestrian crash risk by severity levels can help design time-sensitive countermeasures for pedestrians.

Post on X

A new technique for proactively estimating pedestrian crash risks by severity levels in real-time. #RoadSafety #PedestrianSafety #AIforRoadSafety

Introduction

The dilemma associated with crash-based safety evaluation is that road users must experience the unfortunate circumstances of crashes over many years at transportation facilities before they are identified as locations warranting potential improvements. Advancements in statistical and econometric modelling tackle this moral dilemma by utilising conflict-based safety evaluations based on traffic conflicts extracted from video cameras. However, unlike the estimation of crash frequency by severity in crash-based safety evaluations (Tahir et al., 2024), conflict-based safety assessments to date mainly assess overall crash risks at the transportation facility, mostly overlooking the severity component of the crash risk. In this regard, Arun et al. (2021) pioneered the estimation of crash risk by severity levels by applying traffic conflict techniques. While the proposed framework by Arun et al. (2021) estimated the crash risk by severity, it was only applicable for rear-end interactions and did not take into account time-varying exogenous variables to address the non-stationarity of conflicts in extreme value theory models.

Vulnerable road users are a less studied topic among traffic conflict-based safety assessments. In particular, Guo et al. (2020) conducted a before-after safety evaluation of leading pedestrian intervals. Alozi and Hussein (2022) evaluated the crash risk associated with autonomous vehicle-pedestrian interactions. Arun et al. (2023) evaluated the effectiveness of leading pedestrian intervals, focusing on vehicle-pedestrian and vehicle-vehicle crash risks. Among the studies mentioned above, only Ali et al. (2023) estimated pedestrian crash risks at individual signal cycles for real-time crash risk estimation. However, the models developed by the aforementioned studies are not capable of estimating pedestrian crash risks by injury severity levels. Motivated by this limitation, this study proposes a framework for estimating real-time pedestrian crash risks by injury severity levels at the signal cycle level.

Method

This study utilised three signalised intersections in Queensland, Australia: (a) Vulture Street – Dock Street Intersection, (b) McCullough Street – Sunny Park Intersection, and (c) Turbot Street – Wharf Street Intersection. The selected intersections generally had high pedestrian activities. At least two camera poles were employed at each intersection, each equipped with two cameras to record all possible road user interactions for two days from 6 am to 6 pm.

This study developed a bivariate extreme value modelling framework based on Artificial Intelligence (AI)-based video analytics to estimate real-time pedestrian crash risk by injury severity levels. The proposed framework selects suitable traffic conflict measures for vehicle-pedestrian crash frequency and severity. Traffic conflicts were extracted from the video data collected from roadside closed-circuit television (CCTV) cameras, which were processed using Artificial Intelligence-based algorithms. The steps of Artificial Intelligence-based algorithms are shown in Figure 1. Next, the three data sources (road users' trajectories, vehicle-pedestrian conflicts, and signal cycles) were fused to form a comprehensive database. The framework then requires sampling of extreme traffic conflicts. This study used the block maxima approach to sample traffic conflict extremes. These extreme conflicts at the signal cycle level were then used to jointly model the Post Encroachment Time and Delta-V using a non-stationary bivariate extreme value theory model. Subsequently, real-time pedestrian crash risk estimation was performed by injury severity levels at the signal cycle level.

Extended Abstract (Researcher)

This study defines a vehicle-pedestrian crash occurrence when the negated Post Encroachment Time exceeds zero (Ali et al., 2023). Moreover, based on the recommendations of Jurewicz et al. (2016), this study assumes that the critical impact speed of vehicle-pedestrian crashes of 5.56 m/s (20 km/h) at a 10% probability of Maximum Abbreviated Injury Scale value ≥ 3 to be used as a Delta-V threshold to define severe injury crash risk of pedestrian crashes.





Object detection and tracking



Results

Table 1 presents the result of the non-stationary bivariate extreme value model for jointly modelling the crash frequency component (Post Encroachment Time) and crash severity component (Delta-V). The parameters, including pedestrian conflicts per cycle and average pedestrian speed per cycle, were found to be significant in the location parameter of the crash frequency component. Moreover, the shape parameters of both margins are greater than -0.5, implying that maximum likelihood estimators are regular. Furthermore, the bivariate dependence is 0.999, which shows a weak dependence between the crash frequency and crash severity margins for very high quantiles.

Table 1. Bivariate non-stationar	v extreme value	e model for crash	h risk by severit	v estimation
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	Parameters	Estimates (Std Err)	95% Confidence Interval (CI)	
	Location			
Crash	Constant	-5.337 (0.097)	[-5.526, -5.148]	
	Pedestrian conflicts per cycle	0.676 (0.037)	[0.603, 0.748]	
(DET)	Average Pedestrian speed per cycle	0.240 (0.085)	[0.073, 0.406]	
(FEI)	Scale	0.901 (0.019)	[0.864, 0.939]	
	Shape	-0.139 (0.017)	[-0.172, -0.106]	
Crash	Location	14.451 (0.186)	[14.087, 14.815]	
Severity Scale		6.157 (0.123)	[5.916, 6.398]	
(Delta-V)	Shape	-0.284 (0.016)	[-0.315, -0.252]	
Bi-variate dependence	Dependence	0.999 (0.000002)	[0.99921, 0.99922]	
Data fit	Log-likelihood	-6369.483		
Data IIt	Akaike Information Criterion	12756.966		
Validation	Crash severity of vehicle-pedestrian	Estimated crashes [95%	Observed grashes [05% CI]	
Validation	crashes	CI]	Observed crashes [95% CI]	
crashes	Severe injury crashes per year	0.751 [0.000, 2.487]	0.800 [0.218, 2.048]	
crasnes	Non-severe injury crashes per year	0.202 [0.000, 0.819]	0.200 [0.000, 1.114]	

The estimated crash frequencies for severe and non-severe injury crashes from the non-stationary bivariate extreme value model are also presented in Table 1Error! Reference source not found.. It was found that the estimated means of severe and non-severe injury crashes are 3.754 and 1.009, respectively. At the same time, the observed means of

Extended Abstract (Researcher)

severe and non-severe injury crashes are 4 and 1, respectively. It suggests that the estimated crash frequencies by severity levels by the bivariate extreme value models are close to the observed frequencies.

Figure 2 presents the fitted generalised extreme value distributions of Post Encroachment Time and Delta-V for two representative signal cycles for a typical day. The red dotted lines in the figures represent the thresholds for the negated Post Encroachment Time and Delta-V. A positive crash risk cycle is identified in the Vulture Street – Dock Street Intersection during the morning peak hour since the tail of the distribution of negated Post Encroachment Time exceeded the threshold of 0 s. Furthermore, the distribution of Delta-V indicated more probability of a severe injury crash. On the contrary, during the off-peak hour, a safe cycle was identified in the McCullough Street – Sunny Park Intersection.



Figure 2. Real-time estimation of crash risk by severity at signalised intersections

Conclusions

Two parameters, including 'pedestrian conflicts per cycle' and 'average pedestrian speed per cycle', were found to significantly affect the location parameter of the crash frequency component. The developed bivariate model has been found to reasonably predict the mean severe and non-severe pedestrian crash frequencies compared with the historical crash records for severe and non-severe pedestrian crash frequencies at the studied intersections. Moreover, the developed framework can proactively estimate the pedestrian crash risk by severity at the signal cycle level. This framework is readily implementable at intersections and can help develop time-sensitive countermeasures (e.g., lead pedestrian interval signals for pedestrians) to improve pedestrian safety.

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Multimodal large language model framework for safety-critical event detection

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Abstract

Integrating crowd-sourced Naturalistic Driving Data (CSNDS) collected via dash cams with Multimodal Large Language Models (MLLMs) capabilities presents a transformative approach to analyzing driving behavior and identifying safety-critical events. This study harnesses the innovative potential of MLLMs like Gemin-pro-vision 1.0 and Llava, which blend textual and visual data, to automate detection, significantly reducing time and financial resources typically expended in manual video review. Our framework's application of context-specific prompts enhances the models' reasoning, yielding reliable and actionable insights for early hazard identification. Preliminary findings indicate promising zero-shot learning capabilities and precise event detection, setting a benchmark for future expansion and validation on broader datasets. This research highlights the emergent role of MLLMs in streamlining video analysis and extracting relevant events for comprehensive downstream investigation.

Post on X

A new MLLM framework offers reliable safety-critical event detection and hazard identification.#DriveSafe #MLLM.

Introduction

Recent advancements in MLLMs are enhancing autonomous driving (Cui et al., 2024), focusing on textual and multimodal analyses to interpret complex driving environments. These technologies are promising for understanding dynamic road conditions and offering early hazard warnings. Despite their potential, a gap exists in applying these models to safety-critical event analysis. Our contribution addresses this gap with an MLLM framework tailored for analyzing safety-critical events in driving, combining text and image analyses to provide nuanced insights. Our framework automates data reduction, extracting relevant information from vast video data efficiently. This automation streamlines processes, allowing for precise event identification and facilitating a quicker response to critical research questions. This step forward in technology represents a significant advancement in achieving safer driving solutions.

Method

The framework in Figure 1 is designed for detecting safety-critical events, utilizing a multi-stage Question-Answer (Q/A) approach with MLLM. The process initiates with "Frame Extraction," where the system automatically collects video frames from the ego vehicle's camera at regular intervals (every second). These frames are subjected to a "Hazard Detection" phase, where the model assesses the scene for potential dangers. Upon identifying a hazard, the framework employs a tripartite categorization strategy to probe the nature of the threat further, using "What," "Which," and "Where" queries to delve into object-level details. In the "What" phase, the MLLM classifies the entities detected by the camera, whereas the "Which" stage involves the MLLM identifying specific features and attributes of these agents, and the final "Where" phase tasks the MLLM with determining the spatial location and distance of the hazard agents. To evaluate the framework, human experts first assessed ground truth data before it was used with the MLLM. The sample included 20 videos from the YouTube channel "Dash Cam Owners Australia," offering diverse scenarios for testing. Comparative analysis measured the model's performance against this data to determine its accuracy in hazard detection and categorization. Although the initial results are promising, the LLMs were not fine-tuned for this task. Future research will focus on fine-tuning the MLLM, particularly the Llava model, to improve accuracy and reliability.

Data Reduction Strategy

To enhance the efficiency of the proposed framework, two distinct methodologies were experimented with for reducing the volume of vehicle video data thereby optimizing processing speed and accuracy in detecting safety-critical events.

Sliding Window Frame Capture

The first methodology employs a sliding window approach to systematically capture and analyze subsets of video frames. This technique involves defining a window that slides over the video timeline, capturing a specific range of frames from t_i to t_{i+n} where t_i represents the initial frame in the window and n is a configurable variable that determines the number of frames included in each window. The mathematical representation of this method is:

(1)

$$Window(t_i) = \{Frame(t_i), Frame(t_{i+1}), \dots, Frame(t_{i+n-1})\}$$

This strategy allows for the dynamic adjustment of the window size based on the specific requirements of the analysis, enabling the system to balance between data comprehensiveness and processing efficiency.



Figure 1. Multi-Stage Framework for Safety-Critical Event Hazard Detection Using an MLLM

Textual Context Representation

The second methodology integrates the MLLM to convert past visual frames into a textual context representation. This approach leverages the MLLM's capability to succinctly describe visual data in text form, encapsulating the essential elements and their interactions within the frame. Once a textual context representation is generated, it is combined with a sequence of frames captured using the sliding window method described above. The combined data then serves as input for predicting safety-critical events. The process can be mathematically represented as

(2)

$$Context(t_i) = MLLM(Frame(t_{i-n}), ..., Frame(t_{i-1}))$$

$$Predicition = MLLM(Context(t_i), Window(t_i))$$
(3)

where $Context(t_i)$ is the textual representation of the frames from t_{i-n} to t_{i-1} as generated by MLLM and $Window(t_i)$ includes the frames from t_i to t_{i+n} . The Prediction in equation (3) is the output of combining these inputs into MLLM.

Results

The work presented in this extended abstract demonstrates the potential of leveraging the capabilities of MLLM in analyzing safety-critical event scenarios using multi-modal data integration and dynamic contextual data reduction for guiding the model's output. The prediction illustrated in Figure 2 showcases the proficiency of Gemini-pro-vision 1.0 in zero-shot learning scenarios. To conclude the effectiveness of the proposed framework, a series of experiments were carried out utilizing two distinct base models: Gemini-pro-vision 1.0 by Google (Anil et al., 2023) and Llava-7B 1.5 (Liu et al., 2023). The findings, as detailed in Table 1 underscore the promising capabilities of Gemini-pro-vision 1.0 in various question-answering stages. Gemini-pro-vision's outstanding performance can be attributed to its larger size and the extensive dataset it was trained on, providing it with a broader understanding and a more nuanced ability to interpret

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and answer questions across different stages. On the other hand, Llava-7B 1.5 has shown notable potential, especially when considering its results in certain Q/A stages. While its overall scores were lower, it's probably with fine-tuning datasets more closely related to safety-critical event driving scenarios, Llava-7B 1.5's effectiveness could improve significantly.



Figure 2. Output from Gemini-pro-vision Analysis with Sliding Window (n=2)

	Sliding Window Reduction (n=2)		Textual Context Representation		Gemini-pro- video 1.0
	Gemini-pro-vision 1.0 Llava-7B		Gemini-pro-vision	Llava-7B	
		1.5	1.0	1.5	
Q/A Stage					
Risk	62.4%	53%	55%	46%	75%
Scene	93.7%	81%	90%	76%	100%
What	100%	75%	83%	71%	66%
Which	95%	63%	87%	59%	66%
Where	80%	60%	61%	49%	66%
Recommended Action	71%	56%	55%	51%	75%
Overall	83.68%	64.6%	71.8%	58.6%	74.67%

 Table 1. Comparative Performance Analysis of Q/A Frameworks Using Sliding Window Reduction and Textual Context Representation

Conclusions

The proposed framework aims to enhance the efficiency of processing naturalistic driving dash cam data, ultimately improving the detection of safety-critical events using an MLLM-empowered model. The integration of sliding window techniques and textual context representation for data reduction has shown significant potential in preliminary tests. However, there remains a necessity to evaluate our proposed framework on larger datasets encompassing a broader spectrum of scenarios. Such comprehensive testing is critical for establishing robust evidence of the framework's effectiveness and reliability. Future research will focus on expanding the dataset and scenario range to further validate our innovative approach to driving safety.

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Modelling The Impact of Anti-lock Braking System For LAMS

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Abstract

A backcasting model was developed to understand the effect of mandatory Anti-lock Braking System (ABS) and Traction Control System (TCS) on novice riders' Fatal and Serious Injury (FSI) crashes. The model indicates that if ABS was mandated for all newly purchased Learner Approved Motorcycle Scheme (LAMS) motorcycles in 2025, there would be a 28% reduction in novice rider FSI crashes and a 22% reduction if mandated in 2030 compared to the baseline. Additionally, if LAMS ABS + TCS is mandated for all newly purchased LAMS motorcycles in 2025, it would result in a 31% reduction in novice rider injuries and serious injuries and a 32% reduction in novice rider fatalities compared to the baseline. The study recommends mandating ABS on all LAMS motorcycles by 2025 and to consider mandating TCS in addition to ABS shortly thereafter.

Post on X

We can reduce novice motorcycle rider fatal and serious injury crashes by up to 28% if ABS is made mandatory for learner approved motorcycles.

Introduction

The current Learner Approved Motorcycle Scheme (LAMS) was introduced in NSW in 2002 to replace the 250 cc engine capacity limit for novice riders (i.e., those on Learner and Provisional licenses) as race replica 250 cc motorcycles were over-represented in Fatal and Serious Injury (FSI) crashes. It was subsequently adopted by VIC, QLD, SA, NT, WA, TAS, and New Zealand, with some amendments in some jurisdiction. Since then, no changes to LAMS has been made despite advances in motorcycle safety technology such as Anti-lock Braking System (ABS) and Traction Control System (TCS).

In 2021, the Australian Government mandated that all new motorcycles sold must be fitted with ABS except for enduro, trail, and motorcycles with an engine capacity of 125 cc or less. However, the propagation of ABS throughout the motorcycle fleet will take time. As such, a backcasting model was developed with the aim of understanding the effects on motorcycle FSI crashes amongst novice riders if ABS and TCS were mandated for all LAMS motorcycles.

Methodology

Back casting is a method that starts with defining a desired future state and then working backwards to identify gaps to be addressed in the present and future for the desired future state to be achieved. In this case the desired future state for New South Wales is a 50% reduction in fatalities and 30% reduction in serious injuries by 2030 compared to 2020 crashes (TfNSW, 2022), which aligns with the National Road Safety Strategy 2021-2030 (DITRDC, 2021) Additionally, the longer-term aim is for zero fatalities and serious injuries by 2050.

The back casting model for this project was built with ten years (2011 to 2020, inclusive) of crash data from New South Wales. This data enabled the baseline for the model to be established. It is noted that the baseline for backcasting models projects into the future assuming a 'business as usual' case. Road and transport safety initiatives are then added to the baseline to determine the effect they have on crash rates.

Once the baseline was established, then effectiveness of ABS and TCS data was introduced to the model. The following information was used in the model for ABS:

- 1. ABS is 39% effective in reducing serious injury motorcycle crashes in Australia (Fildes et al, 2015)
- 2. ABS is applicable to crashes that do not involve a head-on crash, crashes occurring while manoeuvring a motorcycle, and some overtaking crashes (Fildes et al, 2015)
- 3. The estimated propagation rate of ABS through the motorcycle fleet was that provided by TfNSW (Personal communications between TfNSW and Johan Strandroth, 2020-2022).

ABS was added to the baseline first due to ABS already being mandatory on most new motorcycles, it can be relatively easily extended to speed up ABS uptake amongst LAMS motorcycles and has shown to be effective in reducing crashes in the real world.

The following information was used in the model for TCS:

1. TCS is 5% effective in reducing serious injury crashes (Transportstylrelsen, 2013)

2. The estimated propagation rate of TCS through the motorcycle fleet was based on that of the ABS propagation rates.

TCS was added to the model after ABS as TCS' real-world effectiveness has not been well studied and it is currently not mandatory for new motorcycles to be equipped with TCS. Thus, introducing mandatory TCS on new motorcycles, especially that of LAMS motorcycles, would require a reasonable amount of effort by both the states and federal government.

The data from the study published by The Swedish Transport Administration were selected for use in this project as it is one of few that has studied TCS effectiveness in the real world. It is also noted that the 5% effectiveness data is a conservative estimate of TCS effectiveness.

Results

The results from the backcasting model and associated recommendations are:

- If LAMS ABS were introduced in 2025 for all newly purchased LAMS motorcycles in NSW it would achieve a 28% reduction for all novice rider injuries, fatalities, and serious injuries compared to the aforementioned baseline. If LAMS ABS were introduced in 2030 for all newly purchased LAMS motorcycles, a 22% reduction for all novice rider injuries and serious injuries and 21% reduction in novice rider fatalities can be achieved compared to the aforementioned baseline. The most conservative BCR for ABS is 3.1. Thus, the earlier LAMS ABS is introduced or faster uptake is encouraged, the more lives can be saved from fatal and serious injuries.
- If LAMS ABS + TCS is introduced in 2025 for all newly purchased LAMS motorcycles in NSW it would achieve a 31% reduction for all novice rider injuries and serious injuries and a 32% reduction in novice rider fatalities compared to the aforementioned baseline. The crash rates for ABS + TCS being introduced in 2025 is the same as that of 2030.

The BCR for TCS is above 1.0 thus, TCS should also be given consideration in addition to ABS.

Figure 1 and 2 below represent the Novice Rider FSI projections under different scnarios using the backcasting model.



Figure 1. Novice Riders FSI vs LAMS ABS + TCS Introduction Year

Conclusion

The model indicates that if ABS was mandated for all newly purchased LAMS motorcycles in 2025, there would be a 28% reduction in novice rider FSI crashes and a 22% reduction if mandated in 2030 compared to the baseline. If LAMS ABS + TCS is mandated in 2025 for all newly purchased LAMS motorcycles, it would result in a 31% reduction in novice rider injuries and serious injuries and a 32% reduction in novice rider fatalities compared to the baseline. The findings support the introduction of ABS for all LAMS motorcycles to reduce FSI crashes amongst novice riders and to contribute to the 2030 aims of a 50% reduction in fatalities and 30% reduction in serious injuries.

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Estimating pedestrian crash frequencies from conflicts by applying video analytics

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Abstract

The current state-of-the-art offers traffic conflict-based extreme value models to estimate crash frequency for proactive safety assessment. Block maxima (BM) based generalised extreme value (GEV) modelling often tends to fit the data in type-II or type-III extreme value distributions with uncertainty in the tail behaviour. In this regard, the appropriateness of the type-I extreme value distribution with restricted tail behaviour in predicting low-frequency crashes, such as pedestrian crashes, remained unexplored. This study investigates the appropriateness of the type-I extreme value model for estimating pedestrian crash frequencies from traffic conflicts captured through video analytics. A comprehensive sensitivity analysis was conducted to observe the crash risk variations with different block sizes (time intervals) and conflict thresholds. The study results provide insights into the choice of type-I extreme value distribution type and reduce the subjective selection of block size and conflict threshold to improve the traffic conflict-based crash estimation models to evaluate pedestrian safety at signalised intersections.

Post on X

Traffic conflicts extracted from AI-based video analytics can reliably predict pedestrian crashes with a proper econometric model

Background

Traffic conflict-based extreme value modelling to predict long-term crash frequency has been a promising approach to evaluating the safety of various roadway facilities. The conventional sampling techniques for extreme value modelling include the block maxima and peak-over threshold approaches. The maxima/minima from block maxima sampling converge to a variable with a distribution from one of the three extreme value families - type-I extreme value distribution with unbounded light tail ($\xi = 0$), type-II extreme value distribution with unbounded heavy tail ($\xi > 0$) and type-III extreme value distribution with bounded light tail ($\xi < 0$), widely known as Gumbel, Fréchet, and Weibull distribution families, respectively (Coles et al., 2001). Here, ξ is the shape parameter of the distribution ($-\infty < \xi <$ ∞). These three distributions are unified into a single family – generalised extreme value (GEV) distribution. The inference on $\boldsymbol{\xi}$ determines the possible tail behaviour of the distribution. Block size (time interval) selection in block maxima (BM) based extreme value modelling is crucial as it requires a trade-off between bias and variance of extreme conflict data (Ali et al., 2023a). Significant biases were found considering small block sizes (5 min and 10 min) for leftturn vehicle crashes at signalised intersections from the sensitivity analysis with different block sizes in developing extreme value models with a 4s conflict threshold (Zheng & Sayed, 2019). Subjective choice of block size and conflict threshold often tends to fit the data in type-II and type-III extreme value distributions out of the three types of extreme value distribution families, ignoring the competence of type-I extreme value distribution. Type-II extreme value distribution with the heavy tail can be considered a safe choice in crash risk modelling, whereas type-II extreme value model with the light tail may underestimate the crash risks. It is also evident that type-I extreme value distribution generates narrower confidence intervals than the other two types of distributions, implying less uncertainties are involved in the crash estimates (Borsos et al., 2020). To this end, the type-I extreme value model can be a better choice for low-frequency pedestrian crashes. Therefore, this study examines the effects of conflict thresholds and block sizes within extreme value models to estimate pedestrian crashes from traffic conflicts.

Method

The road-user trajectories from two signalised intersections, namely, 1) McCullough Street-Sunny Park and 2) Turbot Street-Wharf Street, were used to extract the pedestrian conflict data. These intersections were identified with approach roads that have crossings carrying a large volume of pedestrians and traffic movements by the Brisbane City Council (BCC). Traffic movements for a total of 48 hours on weekdays in November and December 2016 were captured by four overhead video cameras mounted on camera trailers at each intersection. The road user trajectory data was extracted by an artificial intelligence-based video analysis system (Ali et al., 2023b) developed at the Queensland University of Technology (QUT).

An extensive sensitivity analysis was performed to observe the pedestrian crash risk variations with different block sizes and conflict thresholds. Post encroachment time (PET) is used as a measure of pedestrian-vehicle conflicts considering the crossing road-user trajectories at the signalised intersections (Arun et al., 2021). In the event of a

pedestrian-vehicle conflict, PET can be defined as the time difference between the moment of an "offending" pedestrian leaving the potential collision point and a "conflicted" vehicle reaching the point, or vice versa. Temporal proximitybased PET poses a clear boundary between crash and non-crash events, as $PET \le 0$ denotes a crash occurrence. The threshold range was selected with PET threshold values of 3s, 3.5s, 4s and 5s, which were considered to examine the effect of conflict thresholds in predicting pedestrian crashes. This threshold range ensures a sufficient number of conflicts that will provide adequate information by excluding normal traffic events and a sufficient number of extreme conflicts; for instance, it is assumed that PET > 5s is a normal traffic encounter. The extreme value with the block maxima sampling approach requires blocks to sample extreme conflicts. To understand the effect of block sizes and their subsequent effect on extreme value distributions, a range of block sizes with 1-minute, 5-minute, 10-minute, 15minute, 20-minute, 30-minute and 1-hour blocks were considered in this study. The discussed PET threshold and block size ranges were used to develop generalised extreme value (GEV) models and type-I extreme value (EV) models. For the goodness-of-fit tests, analytical methods were used along with graphical methods to consider the deviations in the tail of the distributions. Parameters were estimated by applying the maximum likelihood method. Different timedependent traffic flow variables - pedestrian volume, turning vehicle volume, pedestrian average speed, and vehicle average speed, were included in the univariate non-stationary extreme value models to observe the temporal variation of pedestrian crash risks. Crash estimates were compared with historical crash records from 2014 to 2018 from the Department of Transport and Main Roads (TMR), Queensland.

Results

The crash estimates from the well-fitted stationary GEV models and stationary type-1 EV models for different conflict thresholds and block sizes are presented in Table 1. The estimated mean crashes are found to vary for different conflict thresholds and block sizes. The mean crashes are decreasing with the increasing block sizes and PET thresholds. However, none of the stationary GEV models performed well in predicting crashes since all the models underestimated the observed mean crashes. It is expected that the number of minor conflicts (for instance, PET > 3.5s) decreases as the block size increases from 10-minute to 1-hour, hence shifting the mean of the maximums to lower PET values, i.e., higher negated PET values. Accordingly, the distributions tend to yield sharper decay (type-III EVM) and result in an end of the distribution before zero negated PET value, inferring zero probability of crashes, which differs from the historical record. On the contrary, it is also apparent that the standard deviation of the conflict data increases as the sample size decreases (with increasing block size), leading to slower distribution decay (type-II EVM), indicating higher crash risks. Similar behaviour holds for the increasing conflict thresholds from 3s to 4s. Therefore, the interpretation of the simultaneous influence of conflict threshold and block sizes is not straightforward, and the overall effect can be found from the estimated mean crash frequencies.

	Post encroachment time (PET) Threshold									
	3s	3s		3.5s			4s			
NoEstimated annualofpedestrian crashBlockObs.frequencySize(95%CI)		NoEstimated annualofpedestrian crashObsfrequency.(95%CI)		No of Obs.	NoEstimated annualofpedestrian crashObs.frequency(95%CI)		Observed annual pedestrian			
		GEVM	Type-I EVM $(\xi = 0)$		GEVM	Type-I EVM $(\xi = 0)$		GEVM	Type-I EVM $(\xi = 0)$	(95% CI)
10mi n	124			187	0.452 (0, 24.77)		213	0.063 (0, 22.51)	0.30 (0, 11.53)	
15mi n	106			142	0.289 (0, 25.80)	0.25 (0, 10.61)	158	0.051 (0, 24.71)	0.473 (0, 13.99)	
20mi n	91			118	0.276 (0, 26.17)	0.31 (0, 11.790)	125	0.031 (0, 24.37)	0.59 (0, 14.74)	0.8 (0.25, 3.69)
30mi n	71	0.371 (0, 28.80)	0.34 (0, 12.4)	84	0.077 (0, 26.70)	0.59 (0, 15.11)	87	0.01 (0, 25.58)	0.86 (0, 17.48)	
1hr	45	0.026 (0, 27.36)	0.78 (0, 16.93)	46	0.011 (0, 27.32)	0.91 (0, 17.74)	46	0.011 (0, 27.32)	0.91 (0, 17.74)	
Abbre	Abbreviation: GEVM=generalised extreme value model, EVM=extreme value model, Obs=Observations,									

Table 1. Comparison of stationary extreme value models to predict pedestrian crashes

CI=Confidence Intervals, min=minute, hr=hour

bFor further investigation, the uncertainty of the shape parameter of the fitted GEV distributions is considered. It is the most critical parameter that influences how the extrapolation to the higher quantiles, the crash risk, behaves. The 95% confidence intervals of the shape parameter (ξ) of the several models include zero. So, for these data sets, type-I extreme value distribution ($\xi = 0$) is a plausible case. All the well-fitted extreme PETs were tested with $\xi = 0$. The results (Table 1) indicate that the predicted mean crashes increase as the block size and conflict thresholds increase, unlike the results from the GEV models. Even though the mean decreases and standard deviation increases in a similar trend for GEV models, the mean crash risk increases for the type-I EV with increasing thresholds. Possibly, the inclusion of the uncertainty of the shape parameter (ξ) by setting it as zero involving less uncertainties. The type-I EV model with 4s threshold-30-minute block, 3s threshold-1-hour block and 3.5s threshold-1-hour block (same as 4s threshold-1-hour block) yield the small mean absolute deviations from the observed crashes compared to the other models. The confidence intervals are also relatively similar and much less than GEV models, indicating prediction accuracy. The model fit diagnostics for well-performed 4s threshold and 30-minute block is presented in **Figure 1**.



Figure 1. Type-I stationary extreme value model goodness-of-fit diagnostics for 4s threshold-30-minute block

The tested traffic variables were not statistically significant for the models with poor fit from the stationary modelling. Pedestrian crash risks were significantly related to the pedestrian volume and turning vehicle volume individually for these block sizes. The inclusion of both variables in the model did not yield better results. The parsimonious non-stationary model results with pedestrian volume as a covariate in the location parameter are reported in **Table 2**. Although the crash prediction underestimates the observed crashes, the non-stationary type-I EV model with a 4s threshold and 30-minute block size performed better than other non-stationary models with a narrower confidence interval, indicating a reduction in uncertainty in the prediction and better model fit, capturing better variation of pedestrian crash risks.

	Post encroachment time (PET) Threshold						
	3s		3.5s		4s		
	Estimated a	Estimated annual		innual	Estimated a		
	pedestrian	crash	pedestrian o	erash	pedestrian c	Observed	
Block	frequency (95%CI)		frequency		frequency		annual
Size			(95%CI)		(95%CI)		crashes
		Tune LEVM		Type-I		Type-I	(05% CI)
	GEVM	$(\xi - 0)$	GEVM	EVM	GEVM	EVM	(9570 CI)
		$(\boldsymbol{\varsigma} = \boldsymbol{U})$		$(\boldsymbol{\xi} = \boldsymbol{0})$		$(\boldsymbol{\xi} = \boldsymbol{0})$	
30-			0.54	0.46	0.07	0.63	0.8
minute			(0, 25.20)	(0, 10.86)	(0, 23.01)	(0, 12.09)	(0.25, 2.60)
1 hour	0.34	0.41	0.47	0.40	0.47	0.43	(0.23, 5.09)
1-110u1	(0, 12.16)	(0, 10.82)	(0, 25.90)	(0, 11.08)	(0, 25.90)	(0, 11.30)	

 Table 2. Comparison of non-stationary (pedestrian volume as a covariate) extreme value models

 Dest encode showert time (DET) Threshold

Abbreviation: GEVM=generalised extreme value model, EVM=extreme value model

Conclusions

This study performed a sensitivity analysis on the effects of block size and conflict threshold within an extreme value modelling framework to estimate pedestrian crashes from conflicts. Results indicate that type-I extreme value model with a 4s threshold and 30-minute block size performs the best to predict pedestrian crashes. The findings imply that the type-I extreme value model can be a good choice for pedestrian crash risk estimation. This study will reduce the subjective choice of the block size and conflict threshold in developing extreme value models for estimating pedestrian crashes.

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Retrofit Advanced Driver Assistance Systems (R-ADAS) in Australia

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Abstract

The rise in vehicle quality since the 1990s has predated the rise in technologically led active safety systems, which only started to proliferate from about 2015. Vehicles that were sold in Australia during this period have effective service lives of up to 25 years from delivery. However, these older cars do not have any active safety features and will continue to be a road safety problem until they are removed from service. Retrofit Advanced Driver Assistance Systems (R-ADAS) may be an opportunity to increase the safety of these vehicles. A desktop study was conducted on the claimed capabilities of Retrofit ADAS products available to Australian consumers in 2023, developing frameworks for classifying ADAS, scanning relevant literature and suppliers, and developing a shortlist of specific products that show promise for Australian deployment. The study focused on locally available products that show the greatest promise in contributing towards improved road trauma outcomes and recommended a forward-looking camera-based solution.

Post on X

Well-built older cars with lots of life remaining but without any active safety systems could be made safer with retrofit active safety upgrades. A study on the feasibility of Retrofit ADAS products available in Australia focuses on those that contribute towards improved road trauma outcomes.

Background

The rise in vehicle quality since the 1990s has predated the rise in technologically led active safety systems over the past decade, resulting in a cohort of vehicles with good longevity and reliability, but without the latest in active safety features.

Recent developments in vehicle sensor (e.g., radar, lidar, camera, etc.) and processing capability, and decrease in cost for these items have seen a sharp rise in the mass adoption of these technologies to improve vehicle safety in new cars. These technologies are now widely installed in new vehicles to enable active safety features that can intervene in the driving task with the aim of preventing or mitigating the impact in a multitude of crash types.

Older vehicles continue to be used, possibly as cheap/second/third cars, but at an elevated road trauma risk to the occupants and other road users, when compared to newer vehicles fitted with more advanced technology. Indeed, the average age of all vehicles in Australia has increased from 10.6 years in 2021 (Australian Bureau of Statistics, 2021) to 11.2 years in 2024 (IBISWorld, 2024).

While it is generally accepted that newer cars are safer cars, there remains a proportion of drivers who are unwilling or unable to afford the latest models which are fitted with active safety features. Retrofit ADAS (R-ADAS) is one way for drivers to either retain their existing car or buy an older car and equip it with some of the technology of the latest models.

With global environmental concerns also becoming more significant, fully utilising the remaining life of an already manufactured car instead of creating demand for new cars can be beneficial, especially if the driver can be assured that the car they are driving is made to be as safe as it can be.

Project Description

Objectives

The objectives of this study were as follows:

- 1. Review the context and background of R-ADAS.
- 2. Desktop evaluation of available R-ADAS products locally and overseas, and summarise the market scan in accordance with common ADAS capabilities (e.g. Forward Collision Warning, Lane Departure Warning, etc.).
- 3. Comment on trends and upcoming developments in R-ADAS, if any.
- 4. Build on the existing body of knowledge towards broader deployment of R-ADAS within the Australian light vehicle fleet.

Components

The study was structured with the following components:

- 1. Review of relevant literature.
- 2. Classification of ADAS into functional classes, installation classes and by target market. This step provided some context into the considerations required to be taken under any proposal to deploy R-ADAS broadly.
- 3. Having laid the framework for understanding the characteristics and factors around ADAS in the previous components, the study considered individual products and their classes, making recommendations for deployment. Specific products were recommended where the author was satisfied that one product is sufficiently distinguished from its competition, although the competing products were listed for completeness.
- 4. Identification of further research opportunities arising from a deployment of R-ADAS paired with a telematics platform.

Findings

Literature review

The study identified five literature sources that were considered relevant. Two of them are outlined below.

A study by Scholliers, et al. (2020) was commissioned by the European Commission Director-General for Mobility and Transport and provided a detailed look at the technical feasibility of retrofitting multiple classes of ADAS, a Europe-centric fleet analysis of the uptake of factory-fit ADAS, and a comprehensive cost-benefit analysis including several layers of sensitivity analysis.

This study provided validation of our methodology, as the motivations, thought processes and study structures are very similar, covering the following pertinent points:

- The average age of vehicles in the fleet is more than 10 years, so it will take many years for the latest ADAS features to percolate naturally.
- R-ADAS may have a role in filling this gap.
- The study focuses on ADAS included in EU Regulation 2019/2144 known as the General Safety Regulation 2 (GSR2).
- Vehicle manufacturers are generally unwilling to provide access to vehicle actuators, hence the scope of R-ADAS studied is limited to warning/advisory types that do not interfere with vehicle control.

The New South Wales State Insurance Regulatory Authority (SIRA) conducted the Young Drivers Telematics Trial (YDTT) in 2018 to investigate the effectiveness of telematics use on young drivers (NSW State Insurance Regulatory Authority, 2019). The YDTT analysed 1.8 million km and 33,279 hours of driving data recorded by more than 700 young drivers aged 17-24 across NSW over a six-month period. While the technology deployed in the YDTT is seen as complimentary to ADAS, leveraging both ADAS and telematics streams can yield benefits that are greater than the sum of their individual parts.

ADAS Classification Frameworks

ADAS is a broad term that encompasses a growing range of systems designed to increase the safety of drivers, passengers and other road users by reducing the severity and likelihood of automotive crashes. This study considered the following classification systems to aid with understanding the various systems' intended function, and market positioning:

- Functional types what is the system intended to do?
- Supplier/installation types factory fit, permanent aftermarket or removable?
- Target market who is the target customer?

For the purposes of an Australian deployment, an ADAS device with the following characteristics was recommended:

- Primary function: collision avoidance/deviation from intended path warnings
- Secondary function: telematics
- Installation type: permanent retrofit/aftermarket
- Target market: light vehicles, privately owned or very small fleets

Market Scan

With the recommended characteristics decided above, a scan of available products yielded a number of solutions available globally. Depending on further constraints that will be specific to any given proponent of R-ADAS, a single best product can be identified. Contemporaneous solutions were:

- Mobileye 8 Connect
- Movon
- Momenta Autoring
- ADAS One
- Trakpro

The study noted that assessments of local installation partners would need to be updated for any given deployment, as the market for R-ADAS was not considered to be stable or mature, and some development on the supply-side would be required.

Benefits to Road Safety

The Literature review found the following quantifiable benefits to road safety:

- Assuming complete fleet penetration, the bundle of FCW (Forward Collision Warning), SLI (Speed Limit Information) and LDW (Lane Departure Warning) could reduce fatalities by 12.9-27.2% and injury crashes by 8.4-23.4%. This bundle is commonly available in a single forward-facing camera unit, and exhibited the highest safety potential of all the ADAS types included in the study. (Scholliers, et al., 2020)
- As part of the Young Driver Telematics Trial, economic modelling of in-car telematics and driver feedback was conducted, estimating that a wide-scale rollout would result in a net annual reduction of 2 fatal crashes, 59 serious injury crashes, 57 moderate injury crashes, 41 minor injury crashes and 83 non-casualty towaway crashes across NSW. The resulting estimated yearly community saving was modelled to be between \$38.2m to \$59.9m. Using this estimated saving amount to fund 90,000 telematics devices per year for newly licensed drivers gives a breakeven price of \$424 to \$666 per device, which exceeds the \$149 per device purchase price. (NSW State Insurance Regulatory Authority, 2019)

Further benefits to Road Safety may be pursued as one of the objectives a future study of Australian R-ADAS deployment.

Implications for Policy/Practice

This study highlights the potential for R-ADAS to assist with the goal of Target 2030 by reducing the length of time for ADAS features to spread across the Australian vehicle fleet. This enables the benefits of Lane Departure Warning and Forward Collision Warning systems to be delivered ahead of the usual fleet adoption rate, independently of the vehicle's original equipment specification.

Vehicle safety policy has a long lead time, not just in the implementation of regulations such as Australian Design Rules which apply to new cars, but in the time it takes for the safety feature to percolate its way into the Australian vehicle fleet once it becomes mandatory.

A further societal benefit is that with global environmental concerns also becoming more significant, and the growing culture of minimising waste, fully utilising the remaining life of an already manufactured car instead of creating demand for new cars can be attractive, especially if the occupants can be assured that the car they are in is made to be as safe as it can be.

The implementation of government-funded ADAS technology into the broader vehicle fleet also raises opportunities for rich data collection, which can form the basis for future research and insights development.

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Safe child restraint use: urgent change to Australian Road Rules

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Abstract

Kidsafe requests urgent changes to Part 16 of the Model Australian Road Rules (ARR). Several sections of *Rule 266 - Wearing of seatbelts by passengers under 16 years old* are outdated, and no longer align with key national and international best practice guidelines and evidence-based recommendations about safe child restraint use, when a child can travel in the front seat, and children using the adult seatbelt. There is also a disconnect between the requirements in the ARR and the child restraints sold on the Australian market, which further adds to customer confusion. Kidsafe petitioned the National Transport Commission requesting changes to Part 16 of the ARR and has been advised a revision will be put on the agenda. Changes to the ARR could take years. Meanwhile there is widespread confusion and babies and children are travelling dangerously.

Post on X

The ARR need urgent revision to prevent unnecessary serious or fatal injury to babies and children travelling unsafely in motor vehicles.

Background

In 2021/22 transport injuries resulted in around 61,500 hospitalisations and 1400 deaths. Transport was the top cause of fatalities in the 0-9 years age group (AIHW, 2023). Errors in the way restraints are used reduce the effectiveness of a restraint system in providing protection to an occupant in a crash (Bilston et al., 2007). Professional fitters from Kidsafe Qld have fitted and/or checked over 6,000 seats for free from 1 July 2020 to 1 March 2024, due to funding from Transurban. Fitting faults were detected in four out of every five. Nearly half of these seats had more than 1 fitting fault. Alarmingly, of the seats checked, many needed to be re-installed in the rear-facing mode due to the baby not reaching the forward-facing height marker (Table 1).

Table 1. Wrost common fitting faults (70 of an seats checked)								
Fitting fault	Site 1	Site 2	Site 3	Total				
Tether issues	40%	44%	64%	56%				
Harness issues	22%	40%	40%	37%				
Seatbelt / Isofix not securely fitted	14%	26%	38%	31%				
Rear facing issues	8%	19%	19%	17%				
Incorrect use of accessories	10%	2%	9%	8%				

Table 1. Most common fitting faults (% of all seats checked)

There is a disconnect between the requirements in the Australian Road Rules and the child restraints sold on the Australian market, which is confusing for customers.

As currently written, Rule 266 puts children at increased risk for serious injuries in the event of a crash in four ways:

- (2) and (2A) allow and encourage children to be moved to a forward facing position at 6 months old
- (2B) says that children older than four but less than 7 must be forward facing
- (3A), (a) and (b) allow a child over 4 years to sit in the front row of a motor vehicle under certain conditions, and
- (4) allows and encourages children to move into an adult seatbelt at the age of 7.

These child transportation laws came into effect in 2009, at a national level, and at that time age was used as a guide because it was easy to understand.

Further, in 2007 a paper published in the MJA (Reeve et al., 2007) concluded: High levels of overall restraint use in Australia indicate that parents are motivated to protect their children, yet inadequate knowledge of what constitutes optimal restraint is placing children at unnecessary risk. Education campaigns, strong advocacy, and legislation play important roles in injury prevention. The safety benefits of child restraint use should be reflected in adequately disseminated policy. Key recommendations including levels of evidence: Children are safest travelling in dedicated child restraints; Children are safest travelling in the rear seat of a vehicle; Size is more important than age in deciding when to graduate to another restraint type; Graduation to an adult seatbelt should only occur when a child is 145 cm tall; Appropriate legislation, education and awareness campaigns are needed to improve the use of optimal restraints; and Health professionals are well placed to provide information on child restraints and advocate for changes in legislation.

However, a lot has changed since 2007/2009, and the introduction of features such as shoulder height markers through the periodic review of the *Australian and New Zealand Standard for Child Restraints for use in child restraints* (AS/NZS 1754) has been a key step to determining if a child is using the correct restraint for their size and, these height markers determine a baby of six months is too small to be forward facing. AS/NZS1754 appears to be dictating a higher level of safety for child car restraint occupants.

Approach

Kidsafe in each state and territory wrote to its State Road Safety / Transport Ministers advocating for changes to sections (2), (2A), (2B), (3A) and (4) of Rule 266.

The Kidsafe National President wrote to the Chair of the National Transport Commission advocating for changes to Rule 266 citing evidence on lack of alignment with key national and international best practice guidelines and evidence-based recommendations about safe child restraint use, when a child can travel in the front seat and children using the adult seatbelt.

Results

Kidsafe Qld and Vic received letters from the relevant State Minister (Vic) and Director General (Qld) informing us that the National Transport Minister's Meeting 6 December 2023 agreed to conduct a review of the Child Restraint Rules within the National Road Rules. The review will commence in the 2024-2025 financial year. There was no comment on the expected time any reviews would take nor when any updates would take effect. The changes in legislation are urgent.

What is the Pathway forward?

While this commitment for review is a great start, the numbers of children suffering serious or fatal injuries due to being incorrectly fitted or used child car restraints is inacceptable. To protect our children the review and update to the ARR needs to be expedited. Each State Government can, while the ARR review is ongoing, make these changes to its Road Rules Part 16 immediately:

- (2) If the passenger is less than 12 months old, he she must be restrained in a suitable and properly fastened and adjusted rearward facing approved child restraint.
 - (2A) if the passenger is 12 months or older, but is less than 4 years old, he or she must be restrained in a suitable and properly fasted and adjusted:
 - (a) Rearward facing approved child restraint; or
 - (b) Forward facing approved child restraint that has an inbuilt harness.
 - (2B) If the passenger is 4 years old or older, but is less than 7 years old, he or she must:
 - (c) be restrained in a suitable and properly fastened and adjusted forward facing approved child restraint that has an inbuilt harness; or
 - (d) be placed on a properly positioned approved booster seat and be restrained by either a suitable lap and sash type approved seatbelt that is properly adjusted and fastened or by a suitable approved child safety harness that is properly adjusted and fastened; or ...
- (4) If the passenger is 7 years old or older but under 16 years old:
 - (a) he or she must be restrained in a suitable approved child restraint that is properly adjusted and fastened; or...
 - (b) when he or she passes the 5-Step Test:
 - (i) must occupy a seating position that is fitted with a suitable approved seatbelt; and...

Benefits to road safety / Conclusions

The benefits are multi-faceted – less confusion leading to carers and parents making safer choices in how to use child car restraints to transport their children and a reduction in the number and severity of injuries to babies and children travelling in motor vehicles.

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Addressing Victoria's seatbelt non-compliance

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Abstract

Following a three-month advisory period, the Victorian Government commenced the enforcement of new distracted driver and seatbelt (DDS) cameras on 1 July 2023. The DDS cameras were introduced in response to rising trends in driver distraction — a known contributor to road crashes, with mobile devices being a main source of distraction for drivers. The roll-out of the new DDS cameras has revealed an unexpected level of seatbelt non-compliance amongst Victorian drivers and passengers. In addition, seatbelt non-compliance was a significant contributor to road fatalities in 2023, a devastating year on Victorian roads. Despite the statistics presented, there has been an increase in the number of challenges to infringements issued in relation to seatbelt non-compliance. This presentation outlines the response by the Victorian Road Safety Partnership to the seatbelt non-compliance issues identified through the deployment of the DDS camera system.

Post on X

In detecting distraction, the new Distracted Driver and Seatbelt (DDS) cameras have revealed an unexpectedly high level of seatbelt non-compliance. The presentation outlines the Victorian Road Safety Partnership response to seatbelt non-compliance issues identified by the DDS cameras.

Background

Through the Road Safety Strategy Action Plan 2021-2023, the Victorian Government allocated \$33.72 million to establish a Distracted Driver and Seatbelt (DDS) automated enforcement program in Victoria to support the Victorian State Government in achieving the potential to prevent up to 95 casualty crashes per year.

Distracted driving is a serious challenge to road safety. Mobile phone use and other illegal distractions cause drivers to take their eyes and concentration off the road ahead — with research showing that taking your eyes off the road for two seconds can double the risk of being in a crash — increasing risks of collision, trauma and death. Similarly, fatalities where distraction is a factor have increased and may be attributed to the prevalence of smartphones and portable devices. The magnitude of the problem of distracted driving from mobile phones was identified in the outcomes of the Victorian Government's Distracted Driving Pilot undertaken in July to October 2020. The pilot showed that approximately 2.40 per cent of vehicles screened by the camera systems showed mobile phones either being held in the hand of drivers (1.43 per cent) or on drivers' laps (0.97 per cent), both being illegal in Victoria.

In addition to detecting portable device use, the DDS cameras also detect the incorrect wearing of seatbelts for drivers and front-seat passengers. Wearing a seatbelt reduces the risk of injury and death by up to 50 per cent. Despite seatbelt wearing being compulsory in Victoria for over 50 years, around 26 car occupants are still killed each year in the last five years from not wearing a seatbelt.

During the first six months of DDS operations (Advisory Letter period of 31 March to 30 June and Enforcement from 1 July to 30 September 2023), a total of 11,048 advisory letters and 24,933 infringement notices have been issued to the registered operators of vehicles that were detected committing portable device or seatbelt offences, of these:

- 18,122 (51 per cent) were issued for portable device offences
- 13,144 (37 per cent) were issued for driver seatbelt non-compliance
- 4,361 (12 per cent) were issued for passenger seatbelt non-compliance.

Project Overview

Data from the first six months of deployment has shown an unexpected level of driver and front-seat passenger seatbelt non-compliance (approximately 45% of infringements issued by the DDS cameras). In Victoria, seatbelt compliance is governed by the Road Rule 263A of the Road Safety Road Rules 2017, which states:

Requirement that seatbelt etc. be properly adjusted and fastened

1) In this Part, a requirement that a person wear or be restrained in or by a seatbelt, child restraint or child safety harness is not met unless the seatbelt, child restraint or child safety harness is properly adjusted and fastened.

Since enforcement commenced, Victoria Police has reported seeing a high proportion of challenges on seatbelt compliance infringements — primarily citing that seatbelts were being worn correctly, as the belt was buckled/clipped in. However, merely having the belt buckled/clipped in does not necessarily constitute '*properly adjusted and fastened*' as required by the legislation.

In response to the high volume of seatbelt non-compliance detections, and the subsequent challenges to infringements, the Victorian Road Safety Partnership is investigating ways in which to increase compliance and bring about further positive behaviour change amongst drivers and passengers. To do so, the Road Safety Partnership aims to address issues that have arisen as a result of the DDS camera system deployment — in particular, in relation to improving the clarity of the legislative requirement around seatbelt compliance, and improving the public's understanding of correct seatbelt wearing.

Approach

After the initial stages of investigation on seatbelt non-compliance issues that have arisen, the Road Safety Partnership, has agreed to explore three options to improve the level of seatbelt compliance in Victoria:

- 1. Increasing awareness amongst the Victorian community of the correct and safe ways to wear a seatbelt;
- 2. Reviewing the wording of Road Rule 263A to clarify what is meant by 'properly adjusted and fastened'; and
- 3. Reviewing penalties for offences under Road Rule 263A.

Further investigation outcomes of the Road Safety Partnership's exploration of these three options will be presented at the ARSC.

Benefits to Road Safety

The DDS camera systems were introduced and deployed to bring about positive behavioural change in drivers. As the experience from Victoria shows, there is still an unacceptable level of non-compliance in relation to seatbelt wearing. Furthermore, the challenges to infringements that Victoria Police is encountering reveals that there may be a lack of understanding amongst the Victorian community on how seatbelts should be worn correctly.

Seatbelt non-compliance has contributed significantly to road trauma. By investigating these options to increase the level of seatbelt compliance, the Victorian Road Safety Partnership aims to bring about the reduction of road trauma caused by seatbelt offences. Importantly, the options being investigated attempt to address different countermeasure perspectives, including:

- 1. Providing communications and awareness to the public in relation to the correct and safe ways to wear a seatbelt;
- 2. Ensuring that the road rules are clear and easily able to be understood, so as to increase the level of understanding of the rule and limit the number of challenges to infringements; and
- 3. Assessing whether penalties are currently sufficient to incentivise compliance.

Implications for Policy and/or Practice

The investigation will improve public awareness of the law and how seatbelts should be worn correctly and safely. In addition, considerations will be made as part of the process to ensure the wording of the law on seatbelt compliance is clear, easily understood, and enforceable. These activities will enable the Victorian community to more easily understand, and consequently comply with, seatbelt wearing rules.

Finally, a review of the effectiveness of the current level of penalties imposed on registered owners of vehicles where drivers or front-seat passengers fail to comply with seatbelt rules will ensure that penalties are up-to-date, and that they adequately incentivise compliance without being unfair or onerous.

Conclusion

Since their deployment, the DDS camera systems have revealed an unexpected level of seatbelt non-compliance amongst drivers and front-seat passengers. In order to bring about positive behaviour change in road users, activities that complement enforcement must be explored. The investigation being undertaken by the Victorian Road Safety Partnership in response to what the DDS camera deployment data has so far revealed will not only aim to increase compliance amongst road users, but will also equip Victoria to achieving road safety objectives set for 2030.

Deterrence and technology that notifies drivers of enforcement locations

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Abstract

Technology that has the ability to notify drivers of enforcement locations during a drive is growing exponentially. However, drivers' experiences using this technology and the ways in which this can impact deterrence for road rule violations has been largely unexplored. As such, the present study aimed to explore how this technology is used while driving and how it influences perceptions of deterrence for road rule violations. Focus groups with 58 Queensland drivers were conducted. Reflexive thematic analysis was used to analyse the data and 8 themes were identified. The findings highlight the complexity of this topic, identifying the different ways that deterrence can either be strengthened or weakened as a result of this technology. For example, the use of the technology can help some drivers better regulate their speed, yet drivers also use it to avoid being caught breaking road rule violations.

Post on X

Technology that notifies drivers of enforcement can both weaken and strengthen deterrence, depending on how it is used.

Introduction

A large proportion of resources are being dedicated to road rule enforcement, as this countermeasure has been demonstrated to significantly reduce engagement in road rule violations and subsequent road trauma rates (e.g., Delavary Foroutaghe et al., 2020; Rezapour Mashhadi et al., 2017). Deterrence theory underpins the use of these enforcement methods. This theory stipulates that a potential offender would be deterred from committing an offence provided they have a high perceived chance of being caught and they believe the punishment would be severe and delivered swiftly (Homel, 1988). There are two types of deterrence: general deterrence and specific deterrence (Stafford & Warr, 1993). General deterrence refers to deterring the general public from committing an offence while specific deterrence refers to deterring those who have already been caught and punished from committing a further offence. With evolving technology, enforcement has improved in an attempt to increase the deterrent effect, such as with the introduction of mobile phone detection cameras. However, technology that notifies drivers of traffic enforcement has also been evolving. For example, a recent content analysis identified 73 applications that have this ability (Truelove et al., 2023). Further, some vehicles come equipped with a system that notifies them of speed camera locations, and there is a multitude of social media sites where users post enforcement locations. The extent to which this technology impacts enforcement is currently unknown. As such, this study aims to explore how drivers are using this type of technology and how the technology impacts deterrence for road rule violations.

Theoretically, technology that notifies drivers of traffic enforcement locations could be suggested to increase the general deterrent effect. That is, drivers may be more exposed to enforcement via the technology than they would be without the technology. In contrast, the use of the technology may contribute to drivers experiencing punishment avoidance (engaging in offending behaviour and not being caught), which can lower their perceived certainty of being caught (Stafford & Warr, 1993). The way in which the technology impacts the deterrent effect may also differ depending on the type of road rule violation. Broadly, there are two categories of road rule violations: transient and fixed (Scott-Parker & Proffitt, 2015). Transient road rule violations are those that can be stopped and started on the one trip, such as speeding and using a phone while driving. Fixed road rule violations are those that cannot be changed during the trip, such as drink and drug driving. For fixed road rule violations, research has found that drivers who view Facebook police location communities related to drug driving enforcement are likely to check these sites and either delay driving or take a back route when they have drugs in their system (Mills et al., 2024). For transient road rule violations, a preliminary study found that those who used applications that display enforcement locations were significantly more likely to speed, but not significantly more likely to use a phone while driving, compared to those who do not use these applications (Truelove et al., 2023). This is likely a reflection of speed camera locations being more prevalent on the applications. Currently, the extent to which drivers are using this type of technology, and how it is impacting deterrence related perceptions needs to be explored in more detail. No study has qualitatively examined the use of technology that notifies individuals of enforcement locations during a drive to provide a deeper understanding of the topic. As such, a qualitative focus group was conducted to answer the below research questions:

Research question 1: What type of technology that notifies individuals of enforcement location while driving is used and how is it used?

Research question 2: How does drivers' use of the technology influence deterrence for road rule violations?

Method

Ethics approval was granted by the University Human Research Ethics Committee (A211542). Participants were recruited if they were aged 17 years and older, held a valid Queensland driver's licence and were using technology that notified them of traffic enforcement locations during a drive. Participants were recruited through Facebook advertising and university recruitment. Consenting participants were contacted via email to organise an appropriate time for a zoom interview. Participants were asked to choose an alias name and keep their camera off for anonymity. Focus groups were organised based on participants ages (17-25 years, 26-49 years and 50+ years), considering road rule violations and deterrence perception can differ among age groups. This study was part of a larger project on the use of the technology that notifies drivers of enforcement locations. Participants were asked to complete a short survey to provide contextual information on the sample along with their use of the technology. Structured interview questions were developed for the focus groups that asked participant general questions on their use of the technology, as well as questions that focussed on the application of deterrence theory to their use of the technology. Data was analysed using reflexive thematic analysis based on Braun and Clarke (2022). Two themes were created for research question 1 and 6 themes were created for research question 2.

Results

A total of 58 participants participated in the focus groups. Table 1 displays the technology that was used by participants, with 32 participants reportedly using more than 1 application.

Android Auto (on phone)1 (2%)Android Auto (in-vehicle)2 (4%)Apple Car Play11 (20%)
Android Auto (in-vehicle)2 (4%)Apple Car Play11 (20%)
Apple Car Play 11 (20%)
Google Maps 42 (78%)
GPS Attachment 3 (6%)
In-vehicle Display 5 (9%)
Other applications 3 (6%)
Radar detection devices 1 (2%)
Waze 27 (50%)

Table 1. Technology that notifies individuals of traffic enforcement locations during a drive used by participants

The themes created for each research questions are summarised in Table 2. The results highlight the different ways that the technology is used and can impact deterrence perceptions for different types of road rule violations. For example, the use of the technology helped some drivers be more compliant with the speed limit by helping them improve their regulation of the behaviour. In contrast, the use of the technology helped some drivers avoid being caught and punished for all types of road rule violations. Drivers' response to viewing road rule enforcement on the technology varied depending on if they were engaging in a transient or fixed road rule violation.

Benefits to Road Safety

This study identified ways in which technology that notifies individuals of enforcement locations are used and can influence deterrence related perceptions. Road rule violations are the leading cause of road trauma and enforcement is the primary method used to prevent these behaviours. Technology that displays enforcement locations is understudied and have the potential to both undermine the deterrent effect but also have some road safety benefits. For example, this study highlighted how the technology will only assist drivers in being more rule compliant if this was in line with their beliefs. However, this was specific to regulating speeding behaviour. In contrast, the technology helped road rule offenders engage in these violations more frequently. A comprehensive understanding of the multifaceted impacts of this technology is required to determine how to increase the deterrent effect for road rule violations and subsequently decrease crashes that are caused by these violations.

 Table 2. Theme names identified for each research question

Research question 1 themes	Research question 2 themes
The technology is primarily used for navigation	The technology influenced some drivers to be more road
purposes, with avoiding enforcement a secondary	rule compliant
purpose	
The extent to which individuals interact with the	Some drivers use the technology to help them engage in
technology varies among drivers	road rule violations and not get caught
	Drivers engaging in transient road rule violations are
	likely to stop their behaviour (either temporarily or
	permanently) if they see enforcement locations coming
	up on the technology
	Drivers engaging in fixed road rule violations would
	likely change their route while driving when using the
	technology or check the technology to plan their route to
	avoid detection before they drive
	Participants were more likely to use the technology to
	avoid enforcement if the penalty for a road rule violation
	they were engaging in was high
	Some drivers are more likely to use the technology to
	avoid enforcement with the introduction of mobile phone
	detection cameras

Implications for Policy and Practice

The findings illuminate the complex interplay between technology that notifies drivers of enforcement locations, the deterrent effect and the principles of responsible innovation. Transparent dialogues with stakeholders are required to assess the risks and benefits of the technology, ensuring that it contributes to positive social well-being instead of encouraging harmful behaviours. The impacts of this technology on road safety need to continue to be monitored to ensure technological innovations are used to strengthen road safety and comply with ethical standards.

Conclusions

The findings from this research highlight the different ways in which the deterrent effect can be strengthened or weakened as a result of individuals using technology that notifies them of enforcement locations during the drive. This effect was also likely to differ between transient and fixed road rule violations. As the way in which the technology impacted a driver's behaviour depended on pre-existing individual differences, such as intentions to violate the road rules and levels of internalised self-regulatory processes, it is necessary for future research to further understand how to influence these factors. The findings also have important implications for effective enforcement of road rule violations.

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Tram crashes involving pedestrians and cyclists: a severity analysis

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Abstract

This study uses data from Melbourne's tram networks to explore the severity of tram crashes and the effects of pedestrian and cyclist involvement on tram crash severity. Among 639 tram crashes between 2012 and 2023, 196 involved pedestrians and 40 involved cyclists. Results from binary logistic regression modelling showed that tram crashes involving pedestrians or cyclists were more than twice as likely to be fatal or seriously injured. The impacts of crash-level variables such as speed limit and area-wide variables such as population density, tram stop density and commercial land use on tram crash severity were also evident. The findings suggest a critical need to improve the safety of pedestrians and cyclists around tram routes.

Post on X

New research in Melbourne showed that tram crashes involving pedestrians or cyclists are more than twice as likely to be fatal or seriously injured.

Introduction

Trams, also known as streetcars, constitute a vital part of the public transport systems in many cities like Zurich, Berlin, Vienna, Prague, Toronto and Melbourne. Tram systems can help reduce not only traffic congestion but also overall traffic crashes by reducing car traffic (Aftabuzzaman et al., 2010; Truong & Currie, 2019). However, trams often operate in mixed traffic and thus frequently interact with other road users, leading to tram crashes. Most tram crashes involve vehicles, followed by vulnerable road users such as pedestrians and cyclists (Marti et al., 2016; Mitra et al., 2010). Travelling near tram tracks is challenging for bicyclists with issues such as track skidding; consequently, tram tracks are often cited as a significant risk factor for bicycle crashes (Beck et al., 2019; Teschke et al., 2016). Trampedestrian crashes are a known pedestrian safety issue (Lackner et al., 2022), especially around tram stops (Currie & Reynolds, 2010; Naznin et al., 2016). While much research has investigated bicycle crashes on tram tracks, little is known about tram crashes involving cyclists. Bhuiyan et al. (2023) suggested that tram-bike collisions accounted for about 4% of all bicycle crashes relating to trams in Melbourne. Furthermore, there is a lack of research investigating the severity of tram crashes involving pedestrians and cyclists.

This study aims to explore the severity of tram crashes and the effects of pedestrian and cyclist involvement on tram crash severity. Melbourne is selected as a case study, given the city's operation of one of the world's largest tram networks.

Method

Police-reported crash data in Melbourne between 2012 and 2023 was used in this research. It is noted that this data included casualty crashes only. Tram crashes were extracted using the details of vehicles involved in the crash records. The involvement of pedestrians and cyclists in these crashes was identified using person and vehicle details. Traffic information, such as traffic volume and the proportion of heavy vehicles, was obtained by linking with the traffic volume data. Area-wide variables (such as population density, proportion of commercial, residential, and industrial land uses, tram stop density, and intersection density) based on traffic analysis zones where the crash occurred were also integrated for the analysis. All data were obtained from data.vic.gov.au and census. Bivariate analyses were first conducted using the Chi-squared test. Logistic regression was then employed to explore the effects of explanatory variables, especially pedestrian and cyclist involvement, on tram crash severity. Data processing and analysis were conducted using the R statistical package.

Results

Between 2012 and 2023, there were 639 tram crashes in Melbourne, including seven fatal crashes, 286 serious injury crashes, and 346 other injury crashes. Given the relatively small number of fatal crashes, fatal and serious injury levels are combined into a severity level, that is, fatal or serious injury (FSI). All seven fatal crashes were tram-pedestrian crashes. **Figure 17** illustrates the distribution of tram crashes in Melbourne, clustered along tram routes in inner and middle suburbs. **Figure 18** shows tram-pedestrian and tram-cyclist crashes in Melbourne.

There were 196 tram-pedestrian crashes, of which 112 were FSI and 84 were other injury crashes. Approximately 47% of tram-pedestrian crashes occurred at mid-block locations. Bivariate analysis showed that tram crashes involving

pedestrians were more severe than crashes not involving pedestrians (Chi-squared = 13.87, df = 1, p<0.001). During the 2012-2023 period, 40 tram-cyclist crashes occurred, including 23 FSI and 17 other injury crashes. About 45% of tramcyclist crashes occurred at mid-block locations. While tram crashes involving cyclists appear more severe than those not involving cyclists, this relationship was insignificant (Chi-squared = 1.86, df = 1. p = 0.17).



Figure 17 Tram crashes in Melbourne (2012 - 2023)



a) Tram-pedestrian crashes

b) Tram-cyclist crashes Figure 18 Tram-pedestrian and tram-cyclist crashes in Melbourne (2012-2023)

Table 1 summarises the estimated results of the final binary logistic model for FSI versus other injury levels. Only significant variables were included in the final model, which was selected using the Akaike information criterion (AIC). According to the likelihood ratio test, the model was statistically significant at p < 0.001 (Chi-squared = 37.68, df = 6). This final model only included statistically significant variables. Given the relatively low number of explanatory variables in the final model, robust standard errors were computed to account for potential model misspecifications.

Three crash-level variables were significant, including speed limit, pedestrian involvement and cyclist involvement. As expected, tram crashes in a higher speed zone were more severe. In particular, crashes in zones with a speed limit of 60km/h or more were about 1.6 times more likely to be fatal or seriously injured. Tram crashes involving pedestrians were nearly 2.4 times more likely to be fatal or seriously injured. Similarly, cyclist involvement in tram crashes increased the likelihood of being fatal or seriously injured by about 2.2 times. It can be argued that vulnerable road users such as pedestrians and cyclists are more prone to impact in tram crashes when compared to other road users and, thus, severe injury.

The effects of area-wide variables on tram crash severity were evident. It was found that tram crashes were more severe in areas with a higher population density but less severe in areas with a higher proportion of commercial land use. These findings suggest that tram crashes would be more severe in residential areas. Regarding infrastructure, it was evident that tram crashes in areas with a higher tram stop density were more likely to be fatal or seriously injured.

Variables	Coefficient	Standard Error	p-value	Adjusted Odds Ratio		
Intercept	-0.900	0.205	0.000			
Speed limit \geq 60 km/h (binary)	0.479	0.191	0.012	1.615		
Pedestrian involved (binary)	0.860	0.184	< 0.001	2.364		
Cyclist involved (binary)	0.799	0.361	0.027	2.224		
Tram stop density (stop/km ²)	0.011	0.005	0.035	1.012		
Population density (10,000/km ²)	0.246	0.123	0.046	1.279		
Proportion of commercial land use	-0.767	0.321	0.017	0.465		
Log-likelihood (intercept only)	-440.72					
Log-likelihood	-421.88					
Sample size	639					

Table	13 Results	of the binary	logistic r	egression	model for tram	a crash seve	rity (FS	I versus o	other inju	ury)

Conclusions

This research has explored the severity of tram crashes in Melbourne and associated factors. The results of both bivariate and logistic regression confirmed that tram crashes involving pedestrians were more than twice as likely to be fatal or seriously injured. The logistic regression results also showed that cyclist involvement in tram crashes increased the likelihood of being fatal or seriously injured more than two times. That cyclist involvement was significant in the logistic regression, but insignificant in bivariate analysis highlighted the importance of considering area-wide factors in understanding tram crash severity. The findings suggest a critical need to improve the safety of pedestrians and cyclists around tram routes in order to achieve the 2030 road safety targets.

A limitation of this research is that the data does not include non-casualty crashes. Thus, it was not possible to consider the distinction between casualty and non-casualty tram crashes. In addition, the range of crash-level and area-wide variables could have been more extensive. Future work should extend the analysis with additional explanatory variables concerning street design (such as number of lanes and lane width) and the presence of tram safety features (such as safety zones and tram lanes).

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Setting safe speed limits: is our current approach fatally flawed?

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Abstract

Different methods are used around the world to set speed limits, but most use a traditional road classification approach as a starting point. There are some significant issues with traditional approaches to speed limit setting based on road classification. These typically focus on motorised traffic flow without considering other road users, the land-use or communities roads pass through. This paper outlines the safety issues in detail, highlighting how previous application has led to speed limits that are unsafe, especially <u>for</u> vulnerable road users. A new approach based on Safe System as well as Movement and Place principles can be used to address these issues. This paper provides guidance using principles, and it is recommended that this new approach is used to ensure speed limits that are safe for all road users.

Post on X

Speed limits need to be set so they are safe for all road users present. Our current approach using road classification is flawed, but a new approach based on the Movement and Place philosophy can help us to ensure speeds are consistent with Safe System objectives to eliminate severe injuries for all road users.

Background

Inappropriate speed, whether travelling too fast for the conditions, or exceeding the speed limit, is a leading cause of road crash fatalities and serious injuries. Estimates have indicated that speed is a factor in 30% of fatal crashes (e.g., ERSO, 2021), but the contribution is likely to be double this (e.g., Job & Brodie, 2022). This is true for high-income countries like Australia and New Zealand, but also for low- and middle-income countries (LMICs) where the vast majority of the world's road deaths and injuries occur. A key approach for addressing inappropriate speed is to set speed limits that are safe for all road users, and to ensure that there is good compliance with these limits. This paper focuses on the first part of this approach – the setting of safe speed limits. Although speed limit setting has evolved over time, most countries still apply outdated approaches that mainly consider motorised transport and do not consider Safe System or Movement and Place principles. This paper explores the current approach used in most countries and outlines a new approach that addresses many of the flaws in the current speed limit setting system.

Problem Statement

There are many approaches to setting speed limits. However, most approaches use a traditional road classification system (or road hierarchy) as the initial basis for selecting a speed limit (Forbes et al., 2012), an approach that is also used in Australia (Austroads, 2021). The most basic classification is one that separates roads into 'urban' and 'rural' classes, applying a default speed limit for each (e.g. 50 km/h for urban; 100 km/h for rural). Most road classification systems are slightly more complex than this, especially for urban roads. In this situation, there may be a classification based on traffic use that includes a distinction between urban local and urban arterial roads. In Australia and New Zealand (and many other countries) this has typically led to a situation where there is a default speed limit of 50 km/h for rural roads (ranging from 60-80 km/h); and a speed of 100 km/h for rural roads (although this varies between 100 - 130 km/h in Australia).

In addition, there may be provision for adjustment to these default speed limits, with the ability to raise or lower speeds based on different factors. Historically, the 85th percentile speed was used to modify the speed limit (Forbes et al., 2012). This approach has been discredited (Austroads, 2021; GRSP, 2023), and has not been recommended for use in Australasia for several decades, although it is still in use in some countries. This approach is based on the speed at which 85 percent of motorists are travelling at or below (i.e., only 15% of vehicles exceed this speed). It assumes that drivers are capable of selecting a speed that is safe. In fact, drivers' subjective assessments of their own and other road users' risks, and the relationship between speed and risk, are commonly found to be inaccurate (Hatfield et al., 2013; Job, 2000). Thus, the speed selected by most drivers is often not safe in any sense, not for them and not for other, often vulnerable road users.

Other factors have increasingly been used in Australasia to select safe speed limits including crash risk based on crash data, road design elements or road use. Where risk is high, speed limits may be lowered. Whatever the approach, the establishment of a position within the road classification system is typically the starting point for speed limits, and adjustments (if they are permitted) can only occur within the bounds of that type of road.

In many countries the road classification systems were developed at a time where the main focus was on motorisation and on fast and efficient motorised transport of people and goods. In this context, classification systems were not established with speed limits or road safety at their core. As examples, the classification often corresponds to road ownership or administration, or the initial purpose of the road even if usage has changed and it may indicate traffic and freight priority routes, levels of service or others.

There are significant flaws with using a traditional classification when setting speed limits (World Bank, 2024). These flaws manifest in the setting of speed limits that are often too high for safe road use, and include the following:

- 1. Road classification is typically based on motorised traffic, neglecting the safety of the most vulnerable road users (VRUs). Because classification systems are set for many purposes, they have strongly favored motorised traffic. The predominant objective is often to move this traffic quickly at the expense of safety. When VRUs are present they are often ignored, or at best, some limited infrastructure is applied to provide a measure of safety. However, so that motorised traffic is able to move quickly, there is strong reluctance to reduce speed limits.
- 2. Related to this point, classifications and hierarchies are often linked to other purposes, such as freight plans, funding, and traffic growth. If safety is a consideration, it is often a minor one, and often seen as competing objective. This leads to compromise, usually at the expense of safety, especially for VRUs.
- 3. There is a strong reluctance to change the function of the road based on its position in the classification system, even if localised activity along the road changes. This is most clearly demonstrated in LMICs, where roads classified as 'highways' maintain their 'designated' high speeds, even when passing through urbanised areas such as villages or a linear settlement with many VRUs present. However, there are also many examples in Australia where the designation of a highway prevents a 50 km/h or lower limit being applied, even though the road is urban with mixed use.
- 4. There is a tendency to focus on a whole corridor, rather than addressing risk at specific locations. The use of roads changes at different locations along a road corridor, often quickly. Use may even change at different times of the day (e.g., start and end of school). There is a strong reluctance to make localised changes to the road classification system based on this activity, meaning that whole sections may retain inappropriate speeds despite the risk.
- 5. Classifications tend to be historically based and change to the original intended purpose of the road when built is often resisted. Such changes are common over time, especially in areas of rapid development. This includes changes in land use that are 'planned' (such as newly developed commercial areas) or unplanned (such as 'illegal' housing and roadside business development in city outskirts in LMICs).

The outcome from these limitations is that speed limits are often not able to be changed to reflect the risk present (World Bank, 2024). Where change does occur, this is often slow. It also means that demands from local communities for improved safety are often overlooked (World Bank, 2024).

The current approach to countering these limitations is a long-term, structured approach that tries to match road use, speed limits, and road design elements. Implementing such a comprehensive classification system for speed limit setting requires a vision, a long implementation period, and adequate funding as protection for all types of road users should be provided through adequate design on all types of roads. The speed limit setting approach used in the Netherlands is often highlighted as a sophisticated and successful example of this approach. This system includes categories for 'Through roads' (outside of urban areas), 'Distributor roads' (50-70 in urban; up to 80 in rural) and 'Access roads' (15-30 in urban, and up to 60 in rural area). Infrastructure is provided to reinforce the type of road within this framework. As an example, gateway treatments utilising traffic calming measures are often used at transition points where the speed limit changes. This system has been in place for many years, and the Dutch road agencies have been working to clearly define the network and support the selected speed with adequate infrastructure provision ever since.

It is necessary to have a vision for a road system that is arranged to move people and goods safely. The ultimate goal of road safety and speed management should be to create clear classes of roads that provide protection for all types of road users through adequate design. However, such a system is not yet in place in any country. As the Dutch example shows, further refinement is still needed, especially in situations where there is mixed traffic. Other countries have followed a similar path, but for many, especially those in LMICs, such an approach is aspirational. The conversion of the whole road system including all the necessary changes in infrastructure requires time and considerable financial investments. Although such a system is highly desirable, immediate change is required to address the significant road safety issues caused by inappropriate speeds.

A revised approach

New thinking is needed in the setting of speed limits. An approach is required that:

• sets speed limits with the protection of VRUs in mind, consistent with Safe System survivable impact speeds (ITF, 2016), and with road user vulnerability at the core;

- varies the speed limit for each section of any road depending on the context, or how the road is being used at that specific location. Where this results in excessive complexity with too many changes in speed limit in a short distance, continuation of the lower speed limit is required for safety, not continuation of the higher limit;
- has community wellbeing and livability in mind (prioritising equity, health, and environment).

Such an approach is the newly developed Roads-for-Life (R4L) framework (World Bank, 2024), which is based on Movement and Place principles (e.g., Victorian Department of Transport, 2019), and integrates Safe System survivable impact speeds. This approach has also been applied as the basis for the New Zealand speed strategy (Waka Kotahi, 2022). This approach recognises that roads both move people and goods and serve as destinations in their own right, and that these two demands are often in conflict. Rather than try to segment roads into specific categories, it uses the variety of road functions and uses to classify roads. Unlike traditional road classification approaches the R4L framework takes into account not only the movement of motorised traffic but also the activity needs of VRUs such as pedestrians and cyclists using the road, children playing or people shopping in markets on the roadside. It also goes beyond traditional road classification approaches by considering the following factors:

- The presence of VRUs, road characteristics and conditions, such as land use and surrounding activities;
- Specific spatial functions (e.g., schools, hospitals, transit stations, markets);
- Current (and future) types of road users and traffic;
- Road and roadside infrastructure quality and design.

Roads can be categorised based on the type of demand that is dominant. However, when these demands compete, the safety of vulnerable road users should be prioritised. This means:

- Roads or road sections with many VRUs must have limited movement and be oriented to pedestrians and other VRUs, especially children and/or the elderly. Speeds should be set at a maximum of 30 km/h. This is true for most roads in urban areas.
- On roads or road sections that need to accommodate both VRUs and the (motorised) movement of people and goods, priority should always be given to VRUs and speeds should therefore often be lowered to 30 km/h. Still, such roads can reach a maximum of 50 km/h where VRUs are protected from motorised traffic by safe and signalised crossing facilities in addition to adequate sidewalks and cycling lanes.
- Where the primary need is to move people and goods, and virtually no VRUs are present, roads must still be designed to move all vehicles and occupants safely and to prevent access by VRUs. VRUs should be separated from motorised traffic and diverted to an attractive and safe alternative route which is not substantially longer.

This relatively simple categorisation is broadly applicable, practical to apply and provides the basis for the R4L framework to assist with balancing the competing demands on a certain road or road section. It can be used on new or existing roads on a network-wide scale, as well as on a specific road or road section.

A road classification system for managing roads is useful, and a long-term vision to design roads around this, including to improve road safety outcomes is also important. Such a plan will help decide where it is best to move freight, or where to build schools. However, we cannot wait for such a plan to be fully implemented. Speed limits should be based on road users present, and not road function. Changes are needed to how we set speed limits, and a system used that takes account of actual road use involving all road users. It is recommended that speed limit classification systems are revised to embed these principles.

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Network Safety Plan Process - Bundaberg Regional Council

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Abstract

NTRO and Bundaberg Regional Council have developed a Network Safety Plan (NSP) to prioritise road safety actions on Council's road network. Since the process of developing an NSP is new and largely untested in Australia, this paper seeks to share the experience gained in developing the NSP and serve as a potential model for other councils to apply. The project started with a Movement and Place assessment of Council roads and a review of Council's road hierarchy, with the purpose of integrating these complimentary frameworks to establish a holistic reimagining of road infrastructure to deliver 3-Star or better outcomes for all road users. An assessment of existing network road safety risk and review of Council's standard road cross sections provided a Star Rating Score to compare and identify gaps between current infrastructure standards and the desired end state. Infrastructure investment scenarios included practical and financial constraints, as well as a challenge to achieve a 3-Star or better outcome across the network.

Post on X

See how a Network Safety Plan was developed for a Queensland Council, building on their Movement and Place assessment and taking a fresh look at their road classifications using AusRAP assessments to develop a prioritised multi-year Infrastructure Safety Program.

Background

Network Safety Plans (NSP) are a new and largely untested process in Australia. NSP's are referenced in the Australian Government's National Road Safety Strategy 2021-30 (NRSS) (Commonwealth of Australia, 2021) and fit-for-purpose network risk assessments for local governments (developed as part of NSP's) are contained in the National Road Safety Action Plan 2023-25 (Commonwealth of Australia, 2023). Both aimed to support the local government contribution toward 2030 targets and 2050's Vision Zero set out in both the National and state/territory strategies.

An NSP is a proactive approach to road safety by highlighting areas of highest risk, developing a program to address these, and prioritising the program to meet the available budgets. An NSP will allow Councils to identify the type and scope of improvements to the network required to contribute to the National and state/territory targets of 50% reduction in fatalities and 30% reduction in serious injuries by 2031 and is in line with the Austroads goal to achieve at least 80% of travel on 3-Star or better roads by 2030 (Austroads, 2024).

Achieving these targets will require a sustained investment in road infrastructure. However, Councils have limited budgets and resources, so actions need to be prioritised to address the highest risk factors that lead to crashes and the most serious casualty outcomes. This is what an NSP aims to do.

NTRO and Bundaberg Regional Council (BRC) collaborated to develop a Network Safety Plan (NSP) in parallel with a whole-of-network Movement and Place Assessment and a Road Hierarchy Review. Infrastructure risk assessments are a proactive analysis of risk across a network allowing high risk locations to be identified. Having recently completed AusRAP (Australian Road Assessment Program) and ANRAM (Australian National Risk Assessment Model) assessments of Council roads, BRC sought to utilise the understanding of road infrastructure risk on their network to identify priority actions for saving lives and reducing serious injuries.

The NRSS has introduced the NSP concept, however, a framework and practical guidance for developing and delivering them is not available. Demonstrating an industry leading approach, BRC worked with NTRO to apply national best practice concepts to develop an NSP, for their local government area. This paper will outline the approach applied to deliver the Bundaberg Regional Council NSP and how integration of the Movement and Place Assessment and holistic review of their engineering-based road hierarchy was able to value-add the development of a prioritised program of road infrastructure improvements.

Approach

The collaborative approach between BRC and NTRO to develop an NSP was structured into components that combined the Movement and Place assessment with a comprehensive review of Council's road hierarchy to ensure a minimum 3-Star Rating for all new roads; this provided a foundation for the analysis required to identify gaps in existing road infrastructure based on identified risk, and the infrastructure deficiencies that contribute to increased risk of fatalities and serious injuries. In turn this was referenced in developing the NSP to provide Council with a prioritised program of road infrastructure works to mitigate road safety risk. The four-step model NTRO has adopted in developing an NSP are shown in the figure below.



Figure 1. NTRO's Network Safety Plan Model

Phase 1 - Integrated Movement and Place Assessment and Road Hierarchy Review

Like most Councils, BRC had in place a well-established road hierarchy that consisted of 14 different road classes across rural and urban environments. The structure of the hierarchy reflected a traditional engineering specification format and was referenced when determining conditions of consent and planning road infrastructure improvements; it often required variation on the ground due to site and cost constraints. To align with modern urban planning and design approaches, BRC adopted a Movement and Place framework and applied it across the entire road network.

A key element of the network safety plan project was to first align the road hierarchy and Movement and Place frameworks and then assign the resulting categories to Council's road network. This provided an opportunity to first review the road hierarchy to develop a simpler classification structure.

The result of the review and alignment is shown in Figure 2 and provided a reference framework to describe the design form and engineering specification of each road type. This reference framework was visually represented in GIS showing the new road hierarchy classification overlaid with the Movement and Place assignment for all of Council's roads. Each hierarchy was assessed using AusRAP Star Ratings and changes iteratively applied to ensure that the design of the road, and the adopted speed limit, would lead to safe outcomes – that is, a minimum 3-Star Rating.



Figure 2. Movement and Place matrix overlayed with road classifications

Phase 2 - Developing a Council Network Safety Plan

In the absence of a national framework or other relevant guidance, BRC and NTRO drew from national best practice for the planned, prioritised delivery of safer road infrastructure to develop the process depicted in Figure 3. As outlined earlier, Council wanted to connect three key elements for improving safety on their network, 1) a network wide assessment of road infrastructure risk; 2) a new approach to imagining road infrastructure considerate of form and function; and 3) resetting their established road engineering approach to provide safe, fit-for-purpose road environments that cater for all road users. Referencing these three inputs in the network safety plan process, Council gained insight to the current level of road safety risk on their network and the crash types that contribute most to this risk as well as the distribution of risk across their network.

Considering the national and Queensland road safety contexts, Council determined what would be achievable as appropriate road safety targets and adopted a benchmark of 3-Star or better for 80% of all vehicle kilometers travelled; this guided the development of new stereotypical road cross-sections to define the "desired end state" for their road network. Modelling the new road stereotypes on Council's network permitted a comparison against the existing road safety risk assessments; this gave an understanding of the safety gap between the existing and the desired end state networks which led to the development of an initial infrastructure safety program to close these gaps (Step 4). This was accompanied by an analysis to understand the change in AusRAP Star Rating and the likely reduction in FSI crashes using ANRAM due to the infrastructure improvements.



Figure 3: Bundaberg Regional Council Network Safety Plan process

NTRO included treatment costs from BRC to develop costed mass-action programs of work covering:

- Delineation (including lines, lane markers, hazard markers, guideposts, delineators, road studs and road signage)
- Shoulder sealing/widening, lane widening
- Roadside clearing/protection
- Maintenance (skid resistance, road surface rehabilitation)
- Speed management (for low volume roads or roads where the posted speed limit is higher than the aspirational speed limit).
- Identification of highest risk intersections

Throughout the project, it became apparent that Council required the flexibility to refine and re-prioritise the infrastructure program based on unique funding criteria and changes to funding levels. For this reason, NTRO developed a program that can continue to be filtered and re-prioritised by Council after project completion, with variations prioritised according to risk reduction (Star Rating Scores), FSI's saved, cost per FSI saved (as a Safety Performance Indicator), by VKT (highest travelled roads) and Benefit Cost Ratio (BCR).

The concept of the network safety plan is still under development in Australia and there are few, if any, peer councils to learn from in how to go about preparing one. With no established guidance or framework for BRC to refer to in developing their NSP, to 'go first' demonstrates a progressive commitment to road safety for their community. The process shown in Figure 3 was refined as the network safety plan was developed, and while there will be alternate pathways to deliver the outcome required, the approach applied illustrates the key inputs and steps to achieve an outcome that will guide Council's pathway towards 2030 targets and provides a case study for how network safety plans can be developed and deployed by local governments across Australia.

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Evaluation of the NSW combined drink and drug driving offence

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Abstract

The Combined Drink and Drug Driving Offence commenced in NSW on 28 June 2021. The combined offence was introduced to address the significant risk posed by drivers who combine alcohol and illicit drug use before driving, which can increase the risk of a fatal crash. In 2022, Transport for NSW commissioned an independent review of the combined offence to address evaluation questions about the early implementation of the offence and identify successes, challenges, and areas where implementation could be improved. The review found the combined offence has been implemented efficiently and effectively, a significant achievement given tight delivery timelines, working with multiple partner agencies and new implementation processes. There have been some challenges including uncertainty how the offence is applied to lower range drink driving offences. Transport will share the evaluative process, findings and recommendations and provide insights into the pathway towards 2030.

Post on X

Transport for NSW will share the findings of an independent review of the Combined Drink and Drug Driving Offence. The review addressed questions about early implementation of the offence to understand what was working well, key challenges and areas to enhance implementation.

Introduction

The Combined Drink and Drug Driving Offence (the combined offence) was announced as part of the Saving Lives Accelerated Package on 19 November 2020 and came into effect on 28 June 2021.

The combined offence is intended to address the significant risk posed by drivers who combine alcohol and drug use before driving, which can increase the risk of a fatal crash by 23 times (Li et al., 2013). Of all NSW fatalities between 2017 and 2019, 17 per cent involved illegal levels of alcohol, 21 per cent involved illicit drug presence, and 6 per cent involved a combination of illicit drugs and alcohol.

The combined offence was designed to deter this high-risk behaviour, with higher penalties than for standalone offences. It aims to send a clear message to drivers that they are putting themselves and others at significant risk when driving while affected by a combination of alcohol and illicit drugs. The combined offence is aimed to target the highest risk, so it applies to any driver (or supervising driver) detected with either:

- a middle or high range prescribed concentration of alcohol (PCA) combined with the presence of a prescribed illicit drug/s (first offence and second or subsequent offence within the past 5 years); or
- a lower range PCA (including low, novice, and special range) combined with the presence of a prescribed illicit drug/s, only if the driver committed a <u>previous combined</u> drink and drug driving offence in the past 5 years.

The introduction of the combined offence in NSW supports our pathway to 2030 by deterring unsafe and illegal drink and drug driving behaviours through Police enforcement and associated penalties. This paper can provide insights into policy development and implementation and the benefits of conducting an early evaluation review to identify areas for early changes.

This early review is the first in a series of evaluations that will be undertaken for the Combined Offence; future evaluation work focused on process and outcomes will consider both this offence introduced in 2021, and other drink and drug driving related policies introduced under the 2018 NSW Drink and Drug Driving Reforms.

Approach

In May 2022, Transport for NSW (Transport) commissioned an independent review of the combined offence that was conducted by ARTD Consultants. The purpose of the review was to provide early insight into implementation of the combined offence, working in partnership with other agencies and departments to identify strengths and opportunities to improve delivery. Conducting the implementation review early in the delivery of the combined offence presented an opportunity to adjust implementation approaches, if required.

The review set out to answer the following evaluation questions:

- To what extent is the new combined offence being implemented efficiently and effectively?
- Are all the elements of implementation of the combined offence working efficiently?
- What has worked well? What are the key challenges?
- What issues need to be addressed to improve implementation?

The evaluation used a mixed methods approach, including:

- semi-structured interviews with 15 stakeholders from Transport, NSW Police, magistrates and the Department of Communities and Justice.
- a review of background documents, communications materials and communications data, including media coverage, social media metrics and web analytics.
- analysis of administrative data relating to the combined offence, including driver testing, charges, convictions, and penalties.

Findings

The review found that overall, the combined offence has been implemented efficiently and effectively, and practices and procedures are operating mostly as intended. The success of implementation is a significant achievement given the context of tight implementation timelines, involvement of multiple partner agencies, and the need to develop new implementation processes that are unique to the combined offence in NSW.

Processes to implement the combined offence have been efficiently and effectively put into practice, including Police implementation of the roadside process, access to relevant information by the courts, and magistrate interpretation of the new rules.

Communication to partners and targeted delivery stakeholders was found to be a strength of implementation of the combined offence. Transport engaged broadly with key stakeholders and addressed their different perspectives during the initial consultation and planning phase. Key stakeholders reported good knowledge and understanding of the combined offence, and that communication to partner agencies and stakeholders was effective. This was a critical part of bringing delivery partners along for journey and to ensure the combined offence is successful in being enforced and changing road user behaviours.

The administrative data show that the charging and court process has progressed as expected (Figure 1). Few drivers were proceeded against in the first few months (July to September 2021). Numbers increased from October to December 2021, then fluctuated between January and June 2022. The review noted that a number of factors relating to the delivery of the random breath testing and mobile drug testing programs are likely to have an impact on the enforcement of the combined offence. The most common combined offence charge so far is a first offence for driving with mid-range PCA and illicit drug presence. Additional data can be presented to the conference to provide updated statistics on offences.



Figure 1. Persons proceeded against from July 2021 for all combined offences Source: New South Wales Police

The review identified three key challenges in implementation of the combined offence: uncertainty about the application of the offence for lower range offences, inconsistency of drug testing for drivers that return a mid or high range alcohol reading, and the complexity of the administration processes.

During the early stages of implementation of the combined offence, there were a small number of wrongful convictions for a first combined offence of lower range drink driving combined with the presence of illicit drugs (noting that lower range combined offences are only applicable following a previous combined offence). These convictions were corrected once identified and relevant stakeholders were supported by renewed communications given the complexity of the combined offence.

Some processes in applying the combined offence were noted to be cumbersome by some stakeholders. For example, they felt it was inefficient to lay two charges at the outset—a drink driving charge and a combined offence charge. However, the legislation does not allow for an immediate licence suspension based on the combined offence charge due to not having confirmatory evidence of illicit drug presence at the roadside.

Recommendations

Sense making workshops were held with key combined offence stakeholders to present the findings of the review and to review recommendations regarding the combined offence.

Overall, the combined offence has been implemented efficiently and effectively. Most of the elements of implementation are working smoothly. To improve implementation of the combined drink and drug driving offence, the review recommended that:

- Transport renews stakeholder engagement to foster further information sharing about the combined offence within and between partner agencies. This might include:
 - \circ sharing the results of the review and acknowledging implementation success
 - better communicating the policy rationale for not including lower range drink driving and illicit drug presence first offences in the combined offence, and for charging with two offences at the outset
 - establishing a process for ongoing monitoring and data sharing between agencies.
- NSW Police reviews the combined offence training for operational police with the aim to clarify the application of the combined offence to lower range drink driving and reinforce police understanding of processes.
- NSW Police investigates the distribution of drug tests consumables ensuring adequate supplies are available across NSW for operational police. This will improve detection of combined drink and drug driving offences and balance other road safety priorities.
- Transport investigates the prevalence of combined drink and drug driving in NSW in the next phase of evaluation, in order to provide a benchmark for estimating the rate of detection and changes over time.

Conclusions

This paper will present insights into the early evaluation of the NSW Combined Drink and Drug Driving Offence, including findings relating to the policy development and implementation, enforcement and policing and initial impacts on road user behaviour. It will provide road safety stakeholders with insights into the benefits of early evaluation of policy changes to identify areas of success, key challenges and areas for improvement and support stakeholders in navigating a pathway to reduced trauma by 2030.

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Understanding high-risk traffic offenders using infringement, debt, and crash data

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Abstract

Recidivist offenders are over-represented in Queensland road crash statistics, and the fact that they are recidivists suggests that they are largely undeterred by current road safety countermeasures. This study used data on traffic offence histories, crash involvement, and debt recovery to examine the profiles of different recidivist traffic offender groups. Results showed that all of the recidivist offender groups have higher rates of crash involvement compared to the general licensed driving population. The results highlight the importance of not treating recidivists as a homogenous group and acknowledging that there is no 'one size fits all' solution for repeat traffic offenders. There are opportunities for a more focused and bespoke approach to be taken to traffic offence management and prevention. Novel interventions need to be investigated including using offence profiles to communicate with offenders about potential programs and develop other approaches to behaviour change.

Post on X

Recidivist offenders are over-represented in Queensland road crash statistics. The results highlight there is no 'one size fits all' solution. There are opportunities for a more focused and bespoke approach to be taken to traffic offence management and prevention.

Introduction

Recidivist offenders are over-represented in Queensland road crash statistics, and the fact that they are recidivist offenders suggests that they are largely undeterred by current road safety countermeasures; including debt recovery processes undertaken by the State Penalty Enforcement Register (SPER). Research is needed to understand more about this high-risk cohort regarding the various factors that may contribute to recidivist offending including demographic and psychosocial factors as well as personal, social, and environmental factors. Increasing understanding of such contributing factors to recidivist offending and its relationship to other types of offending behaviour will help to inform the development of effective, targeted countermeasures as well as assist with identifying potentially opportune times for early intervention.

Method

Sample

The sample included all individuals with at least one traffic offence and/or at least one traffic offence related debt in Queensland between 1 January 2009 and 31 December 2018.

Data sources

Data were supplied by Queensland's Department of Transport and Main Roads relating to traffic offence histories, drivers' licence histories, vehicle registration histories, crash involvement histories. Data were supplied by Queensland's SPER relating to details about all debts referred (including non-traffic debt), payment details and arrangements, and enforcement action.

Selections and coding

Recidivist offenders were identified based on having at least two traffic offences in any combination of speeding, drink driving, or unlicensed driving. These individuals were then categorised into groups based on their offence profile.

- Low-range speeding specialists: multiple 13km/hr or less speeding offences and no mid- or high-range speeding, no drink driving, and no unlicensed driving.
- Mid-range speeding specialists: multiple mid- and high-range speeding offences and no low-range speeding, no drink driving, and no unlicensed driving.
- Drink driving specialists: multiple drink driving offences and no speeding and no unlicensed driving.
- Unlicensed specialists: multiple unlicensed driving offences and no speeding and no drink driving.
- Generalists (all): multiple of all three offence types.

Analysis

Profiles were produced for each offender group for demographic, offence histories, crash involvement, and debt history (SPER). The frequency distributions for the offender groups were then compared with the overall recidivist population using Chi-square distribution tests. The alpha level was reduced to account for any family wise error. As a result, P-values of below .01 were considered statistically significant.

Crash rates for each offender group were also compared to the general driving population to account for different lengths of time in each period for offenders (exposure/opportunity to crash). The total number of individuals involved in crashes in each group was calculated for the period 1 January 2009 to 31 December 2018. Also, the total number of drivers and motorcycle riders involved in crashes for the same period was calculated for the Queensland driving population comparison. To account for differing exposure levels, proxy denominators were calculated based on 1,000 person-years of holding a licence in the period (sum of all eligible offenders' licence years in the period/1000). In order to test the differences in rates for each offending group compared to the driving population, rate ratios were calculated.

Results

There were 11,860,220 traffic offences between 1 January 2009 and 31 December 2018 in Queensland. These offences were committed by 3,483,181 individuals. Of these individuals, 968,700 were recidivist offenders by the study definition (had at least two traffic offences in any combination of speeding, drink driving, or unlicensed driving). There were 1,477,061 individuals with at least one traffic offence-related debt in the period with 645,779 individuals being traffic recidivists (representing 66.7% of all traffic recidivists).

Table 1 shows the distribution of characteristics for each recidivist offender group. Statistically significant differences compared to the profile of all recidivists using Chi-square distribution tests are bolded.

Offender group	All	Low-	Mid- high-	Drink	Unlicensed	Generalist
	recidivists	range	range	driving	driving	(all three
		speeding	speeding	specialists	specialists	offences)
		specialists	specialists			
Number of offenders	968,700	343,607	153,248	5,642	11,029	5,923
Gender				_		
Male	61%	54%	62%	80%	71%	85%
Female	39%	46%	38%	20%	29%	15%
Age group						
16-24 years	15%	12%	20%	17%	41%	28%
25-29 years	12%	10%	13%	13%	18%	23%
30-39 years	23%	20%	21%	25%	23%	32%
40-49 years	22%	22%	19%	23%	12%	13%
50-59 years	15%	18%	15%	15%	5%	3%
60-69 years	9%	12%	8%	5%	1%	1%
70 and older	4%	6%	3%	2%	0%	0%
SEIFA quintile						
Most disadvantaged	17%	14%	18%	22%	26%	18%
2	17%	16%	19%	20%	23%	20%
3	22%	21%	23%	24%	21%	23%
4	23%	24%	22%	21%	19%	25%
Least disadvantaged	21%	25%	18%	13%	11%	14%
Remoteness Area						
Major Cities	49%	56%	37%	34%	47%	40%
Inner and Outer Regional	46%	40%	56%	54%	44%	55%
Remote and Very Remote	5%	4%	7%	11%	9%	5%
Crash involved	19%	14%	6%	11%	5%	19%
Crash rate ratio (compared to all	2.0	2.0	2.1	3.8	1.9	5.5
Queensland licensed drivers)						
Other traffic offence (any)	41%	26%	32%	45%	68%	90%
Drug driving	2%	<1%	1%	3%	11%	18%

Table 1. Characteristics	(demographic	offence crash	and debts) of each	recidivist (offender groun
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Offender group	All recidivists	Low- range speeding specialists	Mid- high- range speeding specialists	Drink driving specialists	Unlicensed driving specialists	Generalist (all three offences)
Seatbelt	5%	2%	4%	8%	12%	24%
Mobile phone	9%	5%	7%	3%	3%	18%
Unregistered	15%	6%	8%	20%	49%	61%
Follow too closely	2%	<1%	1%	2%	10%	10%
Disobey road rules	28%	18%	21%	30%	35%	68%
SPER Debt	67%	17%	75%	57%	72%	46%
Debt for non-traffic offences	40%	8%	26%	33%	57%	43%
Parking	23%	5%	13%	9%	10%	25%
Tolls	20%	4%	9%	7%	11%	23%
Drug Offences	6%	<1%	2%	8%	25%	18%
Offences Against Property	5%	<1%	2%	7%	24%	16%
Fail to Vote	12%	2%	7%	10%	15%	15%
Domestic Violence	2%	<1%	1%	7%	12%	9%
Fare Evasion	3%	<1%	1%	4%	14%	8%
Other Offences Against Persons	2%	<1%	1%	4%	9%	6%
Total traffic debt	\$231M	\$31M	\$67M	\$3M	\$4M	\$990k
Total non-traffic debt	\$1.17B	\$76M	\$98M	\$9M	\$42M	\$32M
Debt amount per debtor	\$4.6k	\$2k	\$1.4k	\$4k	\$6k	\$12k

All of the recidivist offender groups have higher rates of crash involvement compared to the general licensed driving population, however, generalists (5.5 times) and drink driving specialists (3.8 times) have the highest rates of crash involvement. The generalists and unlicensed specialists had the most involvement in non-traffic offending. It is important to note that the non-traffic debt is substantially higher than the traffic debt, particularly for some offender groups.

One quarter of the unlicensed specialists had drug offences and offences against property. For the generalists of all offence types, about 1/5 had drug offences and offences against property. However, unlike the unlicensed specialists the highest proportion of 'other offence' were parking and toll evasion.

A higher proportion of drink driving specialists and unlicensed specialists are from regional and remote areas compared to other offender types. The unlicensed specialists and generalists for all offence types had an over-representation of individuals from most disadvantaged areas.

Conclusion

This work has shown the importance of bringing data from multiple sources together to give a more comprehensive picture of recidivist offending. It has also highlighted the importance of not treating recidivists as a homogenous group and acknowledging that there is no 'one size fits all' solution for repeat traffic offenders. The issues and concerns for road safety and other domains are wide and varied and need to be captured and understood.

Much of the reason for fines and associated penalties is to deter further offending and ultimately improve road safety. However, if these penalties are being overshadowed by financial stress, social disadvantage, other criminal behaviour, lack of resource and access to services, and a 'mountain of debt' for non-traffic related offences, it is not that surprising that these offenders are so resistant to change.

There are opportunities here for a more focused and bespoke approach to be taken to traffic offence management and prevention. Novel interventions need to be investigated including using offence profiles to communicate with offenders about potential programs, identify opportunities for early intervention, and develop other approaches to behaviour change.

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Tasmania's graduated licensing system enhancements: perspectives three years on

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Abstract

Graduated licensing systems (GLS) have been introduced across Australia with evidence showing success in reducing the crash risk of young novice drivers. In 2020, Tasmania enhanced their GLS to be more in line with best practices. To assess the effectiveness of these changes, a seven-year evaluation commenced in 2020. This included online surveys disseminated at baseline (B) in 2020 and followed up (F) in 2023 to young people of eligible licensing age (n = 510 [B], 264 [F]) and parents of young people of eligible licensing age (n = 120 [B], 179 [F]). Survey questions focused on accessibility to licensing, perceptions of the licensing changes including measures of agreeance, adequacy, and safety. Changes to the learner and provisional licence were generally perceived more favourably at follow-up by young people and parents, including the increase to 80 hours from 50 hours of supervised driving practice and greater restrictions on peer passengers.

Post on X

Three years on and young people and parents view the 2020 enhancements to Tasmania's graduated licensing system as more favourable compared to when first introduced, including increased learner driver supervised practice hours and peer passenger restrictions.

Background

Young drivers are over-represented in road trauma and generally at least four times at greater risk of a crash than a more experienced driver. To address this, Graduated Licensing Systems (GLS) have been implemented, and mandate a staged approach to novice driver licensing. This includes an extended learning phase with required supervised practice driving hours and restrictions at each licensing phase that allows novice drivers to be gradually exposed to known driving risks with the aim to reduce young driver crash risk (Senserrick & Williams, 2015).

Research has shown that GLS reduces the crash risk of young novice drivers with evidence of a reduction in fatal crashes (Masten et al., 2013). A learner phase of between nine and twelve months has been shown to be more effective than shorter time periods, and passenger restrictions over no passenger restrictions have also contributed to the reduction in crashes (Masten et al., 2013).

GLS is generally well accepted by parents and young people eligible for licensure (Naz & Scott-Parker, 2017). Parental acceptance is important given the extensive role they play as a driving supervisor throughout the learner phase. Furthermore, parents continued involvement beyond this phase has been found to be protective of young driver crash risk.

Tasmania introduced GLS in 2009 with enhancements made in December 2020. These changes included:

- reducing two learner phases to one,
- an increase in mandated supervised driving practice for learners from 50 hours to 80 hours, including 15 hours of night driving,
- a peer passenger restriction during the first provisional licence (P1) stage only one passenger (aged 16-21 years) for drivers aged <25 years (with exemptions to passengers that are family members, travelling for education or employment, and for medical or hardship purposes),
- no phone use while driving for learner and P1 drivers,
- increased maximum speed restrictions of 90 km/h for learners and 100 km/h for P1s,
- introduction of an automated Safe Driver Reward (free 3-year full licence) when P1 and P2 provisional phases are offence-free, and
- introduction of a hazard perception test before learners are eligible to attempt the practical driving assessment to progress to the provisional licensing phase (commenced in March 2022).

Study aims

The current study aimed to understand changes in the perceptions of young people and parents of young people eligible for licensing between prior to the full implementation of the enhancements to GLS and three years after the enhancements were implemented.

Method

Young people (n = 510 [B], 264 [F]) of eligible licensing age and parents of young people of eligible licensing age (n = 120 [B], 179 [F]) were recruited to complete an online survey at baseline (November 2020) and three years after the GLS enhancements (November 2023). The mean age of young people in the baseline and follow-up surveys was 21 years, while the mean age of parents in both surveys was 51 years.

Both young people and the parent samples reflected an overrepresentation of female participants with 63% female (B) and 58% (F) in the young people sample and 69% female (B) and 75% (F) in the parent sample. Of the young participants, 5.7% identified as Aboriginal and/or Torres Strait Islander in the follow-up survey and 3.5% in the baseline survey. Additionally, 14.4% of the young participants in the follow-up survey and 21% in the baseline survey reported speaking a language other than English in the home. For parents, 3.3% (B) and 5% (F) identified as Aboriginal and/or Torres Strait Island while 5% (B) and 0.6% (F) reported speaking a language other than English at home.

The surveys focused on understanding the perceived accessibility to licensure, perceptions of the GLS changes, and the specific perceptions of participants reporting low socio-economic status and/or belonging to minority groups. The surveys took approximately 15 minutes to complete and there was an opportunity to win a \$100 gift card. The studies were approved by Queensland University of Technology (QUT) Human Research Ethics Committee (Approval numbers 2000000894 [B] and 7349 [F]).

Results

Table 1 provides a summary of the mean scores for young people and parents of young people concerning accessibility, agreement with changes to GLS, perceived adequacy of the changes, and perceived safety of the changes.

Young people

Regarding licence accessibility in the follow-up survey, young people scored on average 2.86 compared to 2.82 at baseline, on a 5-point scale (1 = very easy, 5 = very difficult). This means accessibility overall is somewhere in between easy and difficult and there was no significant change across the two timepoints. Being able to access the knowledge test was the only item that reflected a significant increase between baseline and follow-up. However, the mean score remained at 2, suggesting that the knowledge test was still easy to access for young people.

Table 1. Mean scores for young people and parents of young people on key variables assessing the perceived success of GLS changes

Baseline M(SD)	Follow up M(SD)
2.82(0.72)	2.86(0.74)
3.40(0.61)	3.55(0.57)
2.93(0.82)	3.11(0.81)
3.55(0.74)	3.65(0.70)
2.39(0.82)	2.61(0.90)
3.73(0.57)	3.84(0.54)
3.10(0.99)	3.14(0.96)
3.84(0.69)	4.00(0.66)
	Baseline M(SD) 2.82(0.72) 3.40(0.61) 2.93(0.82) 3.55(0.74) 2.39(0.82) 3.73(0.57) 3.10(0.99) 3.84(0.69)

Note. M = mean; SD = standard deviation.

Constructs were measured on 5-point scales. a 1 = very easy, 5 = very difficult; b 1 = strongly disagree, 5 = strongly agree

Regarding the level of agreement with the changes to GLS, the mean scores at baseline and follow-up were not significantly different and the scores suggested neutral to positive agreement. At an item level, scores were significantly higher (more positive) at follow-up on the increase to the required 80 hours supervised driving practice, the removal of the assessment during the learning phase (there were two learner phases with an assessment between), and restricted peer passengers to one aged 16-21 years (with exemptions such as employment and education).

Three years after the enhancements, young people were less accepting of completing 15 hours of night driving during the learner phase, finding it difficult to achieve. There was also a significant and positive change regarding the perception of stricter peer passenger limits contributing to safety. Overall, compared to the baseline findings, the follow-up survey showed more positive perceptions towards agreeance, adequacy, and safety concerning the GLS enhancements.

Parents

Parents' attitudes towards the GLS enhancements were generally positive at baseline and remained so over the three years post implementation of changes. Concerning accessibility, there was a significant increase from baseline to follow-up perceiving access to professional lessons (not the cost) and reaching minimum logbook hours to be more

difficult. However, the mean scores for these items remained at the mid-point of 3 on the scale from very easy to very difficult.

Similar to the young people, parents reported stronger agreement in the follow-up survey to the restrictions in place for young people driving with peer passengers. Parents also had a stronger positive response to the safety value of not allowing hands-free mobile phone use and the peer passenger restriction. Additionally, there was a stronger safety value expressed for having a consistent maximum speed limit for Learners and Provisional drivers.

Benefits to Road Safety

GLS has known positive impacts on the crash risk of young novice drivers. Novice driver and parent acceptance of GLS requirements is important to ensure compliance and enhance young driver safety. Increasing the accessibility of licensing for young people is a recognised way to reduce social and economic disadvantage. Thus, understanding the effectiveness of changes made specific to Tasmania ensures that enhancements in line with best practice are also effective in Tasmania.

Implications for Policy

The details of the evaluation and associated findings provide critical information for driving jurisdictions considering enhancements to existing GLS or implementing GLS as a new approach to licensing. In particular, these findings provide insights about how acceptance of GLS may change over the long-term, from the initial implementation onwards. Tasmania conducted extensive community engagement and communication of the changes and implemented support systems to assist individuals. Therefore, it is important for jurisdictions to understand the success of Tasmania's enhanced GLS system is within the context of early and extensive communications.

Conclusions

These findings will be triangulated with stakeholder consultations and focus groups involving young people of licensing eligibility and parents of young people of licensing eligibility. The current findings suggest that over time young people and parents have become more agreeable with most of the changes made to Tasmania's graduated licensing system. In particular, more positive responses were made concerning the restrictions on peer passengers by both young people and parents. These findings will assist other driving jurisdictions in a pathway forward for improving licensing and reducing the overrepresentation of young novice drivers in crashes.

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The impact of test anxiety on practical driving test performance

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Abstract

The practical driving test has been designed as a measure of driving competency that, when passed, allows a learner driver to progress to independent driving. The reliability of this test was questioned from the notion that test anxiety is known to negatively impact performance on a test. This study examined the relationship between driving test anxiety and the quantity and types of errors made by young learner drivers who were aged 17-27 years (M = 18.7 years, 81% female). Novice drivers (n = 133) who had attempted their practical driving test in the previous 3 years completed an online survey. In a regression analysis, the state anxiety dimensions of cognitive interference and worry significantly predicted more driving test errors. Understanding the nuances of anxiety and the dimensions that uniquely contribute to reduced performance on the practical driving test allow for targeted interventions, such as programs for driving instructors and parents to deliver to young learners impacted by test anxiety.

Post on X

Driving test anxiety has been found to negatively impact performance on the practical driving test. This supports the notion that the practical driving test is not an accurate measure of how competent or safe a driver is, yet it continues to be a measure of such.

Background

Licensure for young drivers is important for their development as they transition into independent young adults (Fylan & Caveney, 2018). It is well known that transport accessibility can improve education, employment, and health outcomes. In most Australian states, under graduated licensing systems, a young driver is required to undertake a set number of supervised practice driving hours with the intention to develop driving skills that allow them to be safe enough independent drivers. The key milestone in this transition to independent driving is the practical driving test. This test is intended to determine whether a young person is ready and competent to drive independently. However, the reliability of a test to measure competency can be diminished when an individual is subject to anxiety.

It has been reported that 30% of Australian learner drivers aged 18-24 years who attempt the practical driving test, fail on their first attempt (Budget Direct, 2021). Some of these drivers may be experiencing test anxiety and not exhibit their optimal performance. Test anxiety is defined as experiencing apprehension and nervousness reflected in cognitive and physical symptoms prior to and during a test (Lazarus, 1991). Test anxiety can negatively impact decision making, attentional control, and self-regulatory capabilities (Miller & Taubman-Ben-Ari, 2010; Von der Embse et al., 2021). Experienced during the practical driving test, test anxiety may contribute to increased driving errors and possible test failure. Furthermore, failure can contribute to increased test anxiety for subsequent attempts. Despite the implications for young people's independence limited research has examined the impact of test anxiety on driving test performance.

Study aims

This research aimed to understand how test anxiety influences driving test performance in a sample of Queensland young novice drivers. Trait anxiety, defined as a stable personality trait that impacts how threatening situations are perceived, and state anxiety, a situation-specific emotional reaction, were examined in relation to driving test errors.

Method

Provisionally licensed young drivers aged 17-27 years (M = 18.7 years, SD = 2.0) who had attempted the practical driving test within the previous three years (2020-2023) were recruited to complete an online survey. Of the 133 participants included in the study, 81% were female, 72% held an automatic licence, 44% had taken the driving test in 2023 and 27% in 2022. The average number of times the practical driving test had been attempted was 1.5 with an average of 2 errors made on the test.

State anxiety was measured on five dimensions including social concerns, cognitive interference, worry, physiological hyperarousal, and task irrelevant behaviours. The Kessler-10 Anxiety Scale was used to measure trait anxiety (Kessler et al., 2002). The survey also included questions concerning age, gender, licence class, year of Provisional licensure, and the number and type of driving errors made on the practical driving test.

Despite the study requiring a retrospective perspective of anxiety before and during the test, much research has concluded that emotional arousal can consolidate long-term memories and enhance memory recollection (Kensinger &

Ford, 2020; McGaugh, 2015). Therefore, given the practical driving test can be stressful, it was anticipated that, while not 100% accurate, the memory of the test would be sufficient for this study.

The survey took approximately 30 minutes to complete, and a prize draw entry was offered to participants (\$50 e-gift card). This study was approved by the Queensland University of Technology (QUT) Human Research Ethics Committee (Application Number: 6914).

Results

The mean score for trait anxiety (5.05 where the maximum score was 10) suggested that participants experienced anxiety some of the time. Of the state anxiety dimensions, worry had the highest mean score of 3.15 on a 4-point scale suggesting worry was experienced by most participants. Cognitive interference had the lowest mean score of 2.20, just below the mid-point.

In examination of the correlations, the number of driving errors was significantly associated with worry, cognitive interference, physiological hyperarousal, and task-irrelevant behaviours. This meant self-reported greater state anxiety on these dimensions was associated with more driving errors made on the test. Although trait anxiety showed low to moderate significant positive correlations with all five state anxiety dimensions, there was no significant association between trait anxiety and test errors.

A hierarchical regression analysis was conducted to investigate whether the dimensions of state anxiety predicted the number of driving test errors while controlling for age, gender, licence class, and trait anxiety. The final model accounted for 16.5% of the variance in driving errors with worry and cognitive interference significant positive predictors of the number of driving test errors.

Benefits to Road Safety

This study highlights that the driving test is not equitable in assessing a driver's competence to be safe enough to drive independently. As the milestone to independent driving, it is critical that the practical driving test is equitable and a reliable measure of safe and competent drivers. This study is one step towards identifying that the practical driving test may require an innovative upgrade to provide benefit to young driver road safety.

Implications for Practice

The insights gained from this study can contribute to the development of programs that address test anxiety that could be delivered by driving instructors and potentially parents for those young drivers who are impacted by test anxiety.

Conclusions

This study was one of the first to examine the effects of state and trait anxiety on practical driving test performance. In the analysis, although two of the state anxiety dimensions were found to predict driving test errors, the amount of variance accounted for was small. This suggests the driving test is complex with other possible variables contributing to performance such as the test route, examiner subjectivity, and the quality of training received during the learner phase.

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We need to talk about handsfree: changing roads policing practice

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Abstract

Drawing on UK research focused on the policing of mobile phone use by drivers, this paper explores officer understandings of the dangers of distracted driving, and specifically the risks of using a phone handsfree (the legal, but unsafe, alternative form of phone use). Despite robust evidence of these risks, they are generally less commonly understood and accepted. Via the results of our survey and interviews with UK officers, we show that 71% of officers consider that handsfree is safer than handheld use and that 82% recommend to driver that they switch to handsfree use in future. As such, officers are giving dangerous advice to drivers which is likely to contribute to levels of distracted driving. We then present our findings in relation to officer engagement with an interactive intervention designed to change their attitudes to handsfree phone use and, in turn, the advice they give drivers at the roadside.

Post on X

#WeNeedToTalkAboutHandsfree: Police officers are giving dangerous advice to drivers which puts lives at risk. Can completing an interactive intervention change their attitudes and roadside practice?

Introduction

Research outlining the negative consequences of handheld and handsfree phone use by drivers, including failure to detect hazards, longer reaction times, and increased crash risk (Caird et al., 2008; Dingus et al., 2016) is emphatic. Nevertheless, increasing numbers of drivers use their mobile phones, contributing to increased injuries and deaths (WHO, 2021). Many countries ban *handheld* phone-use by drivers, with several recently tightening legislation and increasing penalties imposed on offenders (e.g. UK, 2017, 2022; France, 2020; Victoria, Australia, 2023).

However, handheld phone use, and laws proscribing it, represents only part of the problem. Research emphatically shows that phone-use causes cognitive distraction which leads to deteriorated driving performance, irrespective of whether the phone is handheld or handsfree. Drivers using a handheld or handsfree phone are four times more likely to crash; often fail to notice hazards, and take significantly longer to react to any they do see; demonstrate decreased situational awareness; and can look directly at hazards yet fail to see them. Phone-using drivers look around the driving scene far less, often failing to monitor items in the peripheral areas and, in the absence of any collision or salient event, are largely unaware of aspects of the driving situation that they have missed (see the summary in Wells et al, 2021). Despite this, handsfree phone use remains legal in most countries

Those who self-report handsfree phone-use while driving are more likely to do so regularly (once a day or more) than handheld mobile phone-users (Sullman et al, 2018). Hence, focusing on the enforcement of mobile phone law represents a partial – and possibly counterproductive – endeavour. A focus simply on more effective enforcement of the law, or on deterrence based on the threat of penalties, may (theoretically) eradicate illegal phone-use whilst achieving no success in relation to distraction-related collisions more generally. It may simply cause a displacement effect onto handsfree phone-use (the often legal, yet unsafe alternative). A recent survey (Briggs et al, 2023) has, indeed, shown that many drivers detected using their phone illegally intend to switch from handheld to handsfree use, with only 30% of those surveyed saying that they would cease phone-use whilst driving.

Project description/Overview/Approach

This paper reports on the findings of a project which set out to explore the issue of a potential displacement effect from handheld to handsfree phone use, police officer understanding of the dangers of handsfree phone use, and how this understanding impacted on their interactions with drivers observed using their mobile phone. The scope included measuring officer attitudes to phone use and their behaviour with offenders, both before and after receiving some education on the dangers of handsfree phone use.

A total of 411 Police officers from across England and Wales were recruited to participate in an online survey which measured their attitude and experiences relating to both handheld and handsfree mobile phone use by drivers. Having completed the survey, officers were asked to complete an <u>evidence-based interactive activity</u> (Open University, 2023) which positioned them as a driver for a recorded drive, during which they were required to complete a task conveyed via a handsfree call. At the end of the interactive, officers completed a quiz about what they remembered of the task and what they observed about the drive. They were then surveyed again, to enable a comparison of attitude measures pre-and post- exposure to education. In addition to the online survey, a further group of 10 officers completed in-person

interviews with a member of the research team. Interviews followed the same approach as the survey, in that they asked officers about their attitudes towards, and understanding of, mobile phone use by drivers, saw them complete the interactive task, and then engaged in further interview questions.

Results, Findings, Evaluation and effectiveness

Analysis of both the quantitative survey data and the qualitative interview data revealed key differences in attitude following exposure to education. Key themes in the data revealed that prior to education many officers considered that the main issue with phone use is the manual and visual distraction it imposes, and that more than two-thirds believed handsfree phone use to be a safe alternative to illegal phone use. Data also revealed that officers felt discretion is needed when considering prosecution due to feelings of fairness, the type of phone use witnessed and future potential police-public interactions. Finally, data indicated that officers were in support of greater education for drivers regarding phone use (both at the roadside and elsewhere), but that officers themselves largely felt they did not need such further education themselves.

Quantitative data showed strong support from officers in enforcing mobile phone law with a view to improving road safety. However, over 80% of officers reported that they routinely offer roadside education to offenders, including a recommendation to use handsfree in future, based on the view that handsfree phone use is safer than handheld use.

After exposure to the interactive education, which provides personalised feedback on the user's own multitasking ability, attitudes relating to the safety of handsfree phone use changed significantly. Officers changed their views on the seriousness/danger of handsfree phone use, and phone use while stationary in traffic. They further reported the intention to use their education in practice, including explaining the dangers of *all* phone use to offenders in future, recommending avoiding handsfree use and explaining specifically why handsfree phone use is dangerous. Some officers further suggested they would change their own phone use both at work and outside of work following experiencing the education, while others considered their own expertise and capability made such changes unnecessary.

In light of the effectiveness of education in changing officer attitudes and potential future practice, we have created a set of recommendations for wider application of education and specific guidance on officer-offender interactions. This includes a directive to not promote handsfree use as a safe alternative to illegal phone use, to target follow up education to address issues of consistency in applying the law (given views on discretion and context) and to provide policespecific education on the dangers of their own phone use. Further to this, we have produced a set of resources which have been shared with UK forces for them to use to support a national operation focused on mobile phone use by drivers in early 2024. This included social media posts, posters, infographics, and handouts for use in respect of both police and public audiences, and was very well received by frontline and strategic police partners.

The paper therefore tells the story of the project and the journey from identifying a road safety problem, to isolating a critical operational encounter, to testing an innovative educational tool, to assessing its effectiveness, exploring a pathway to impact and pursuing meaningful dissemination of the key messages.

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Older adults' driving self-regulation patterns over time

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Abstract

Aim: This paper examines trajectories of driving self-regulation among older adults and investigates patterns by gender and birth cohort. Method: Self-reported data from four waves of NZPATHS longitudinal cohort study of drivers (65y+). Change in self-regulation across time was estimated using group-based trajectory models (GBTM). Differences by gender and birth cohort were investigated using random effect (Poisson) models. Results: GBTM showed three distinct driver groups, Group1 (25.9% participants) had a zero self-regulation score on average; Group2 (52.7%) had at least one driving avoidance on average over the period, increasing over time; Group3 (21.4%) had higher total driving avoidance than Group2 over time. Conclusions: Self-regulation may assist drivers to maintain independent mobility and improve safety by reducing exposure to situations which can increase crash risk. These findings show the development of self-regulation over-time in a cohort of ageing drivers. Next steps are to ascertain factors associated with the different patterns.

Post on X

Older drivers report different self-regulation patterns over time, evidenced by New Zealand Prospective Older Adult Transport and Health Study.

Background

Older adults (aged 65+) are the fastest growing sector of population in most OECD (Organization for Economic Cooperation and Development) member countries (Shope et al., 2019). In Aotearoa New Zealand (NZ), more than one in five will be over age 65 years by 2034, and the number of Māori (Indigenous people of NZ) over 65 years is expected to more than double (Butler et al., 2020). Older drivers can have an increased likelihood of crash involvement because of declining vision and health (Charlton et al., 2019). To mitigate this risk, older drivers have been encouraged to self-regulate their driving, avoiding certain challenging driving situations (Feng et al., 2021; Molnar et al., 2015). This study aimed to examine trajectories of self-regulation in older adult drivers from 2016 to 2023 and whether patterns of self-regulation differ by gender and birth cohort.

Methods

New Zealand Prospective Older Adult Transport and Health Study (NZPATHS) is a nationwide prospective cohort study of older drivers, aged 65+ years at baseline (2016). There have been four waves of data collection, with telephone interviews completed in 2016, 2019, 2021, and 2023. Interviews have collected data on driving practices including self-regulation of driving. Self-regulation is the intentional avoidance of driving situations and was measured by 14 driving avoidance questions (Molnar et al., 2013). These include avoidance of driving at night, avoidance of intersections without traffic lights, and avoidance of roundabouts, for example. Group Based Trajectory Model (GBTM) was used to estimate self-regulation trajectory groups using a Zero Inflated Poisson (ZIP) model; number of groups was determined based on Bayesian Information Criterion (BIC); the polynomial shape was chosen based on p-value < 0.05 (Nagin, 1999). Differences by gender and birth cohort were investigated using random effect (Poisson) models. Analyses were limited to participants who were still driving and who completed all four surveys and responded to the self-reported driving avoidance questions.

Results

There were 2,508 observations from 627 participants in final analyses after exclusion criteria applied. We found that avoiding driving at night, driving in inclement weather (in general and at night), and increasing following distances were the most common situations reported over time by the participants (Figure 1).

The GBTM showed three distinct groups with each trajectory quadratic in shape, except Group 1 (Figure 2). Group 1 (25.9% of participants) is characterised by having no avoidance behaviour on average over time; Group 2 (52.7%), is characterised by having one or two avoidance behaviours on average, increasing over time; Group 3 (21.4%) is characterised by having three or more avoidance behaviours on average, with increasing total counts that are higher than Group 2. Using Poisson models, we found these trajectories were different by gender (p < 0.001) and birth cohort (p < 0.001). Figure 3 displays the interaction effects for driving self-regulation by gender and birth cohort.

Conclusions

Finding show that self-regulation of driving is not a homogeneous behaviour amongst older drivers. In this cohort one in four did not report any avoidance behaviours; however, the remainder reported avoidance behaviours, and for one in four these increased over time. Longitudinal analysis shows that the increase in driving avoidance counts over the period was being driven by oldest older drivers' (born in 1920s – 1930s), who have a higher counts of avoidance behaviours than those in younger cohorts. These were also differences by gender – female drivers self-regulate more than male drivers in the latest survey year. The findings give us some insight into self-regulation behaviour but do not explain why the pattern of self-regulation is different. Further analysis is planned to explore the broader range of factors associated with self-regulation. We will also explore the role of self-regulation in driving cessation and the association of self-regulation patterns with safety and crash risk.



Figure 1. Prevalence of each driving avoidance behaviour due to self-regulation from 2016 to 2023



Figure 2. Estimated self-regulation trajectories (solid lines) of older drivers from the group-based trajectory model by survey year (dotted grey lines – Confidence Interval), with observed group counts at each survey year (dot). Group percentages in the figure legend



Figure 3. Self-regulation of older drivers per trajectory group by gender (left) and birth cohort (right)

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Overlength vehicle detection and classification using tracking radar

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Abstract

Accurate vehicle length measurement and classification is essential for road safety and traffic management policy implementation. This is especially true where heavy vehicles are concerned, as restrictions on their movement may be limited only to certain lengths or classes. Heavy vehicle classification schemes rely on resolving their length, the number of axles, the axle groupings and spacing between these groups. In this paper, we describe a University of Melbourne PhD project sponsored by Sensys Gatso Australia and iMOVE to research and develop a non-invasive axlebased vehicle classification system using tracking radar technology. The system can be pole mounted at the side of the road, without requiring any physical contact or modification to the road surface. This has the potential to improve road safety by easing installation and maintenance, whilst providing real-time traffic data (including speed and class) in situations where this was not previously viable using traditional invasive sensor technology.

Post on X

Sensys Gatso Australia and iMOVE has sponsored a University of Melbourne PhD project to research and develop a non-invasive axle-based vehicle classification system using tracking radar technology. The system can be used to detect overlength and/or prohibited vehicle classes.

Introduction

Road operators are increasingly demanding the use of non-invasive vehicle classification technology. Systems requiring in-road sensors or infrastructure are considered invasive, as they need to be installed under its surface. Typically, invasive vehicle sensors require road closures and extensive traffic management in order to be safely installed. They cannot reliably detect and classify overlength vehicles that need to traverse the road network, nor can they be installed on unsealed roads, such as interstate routes or on mining sites, where significant road safety issues may exist.

Any new solution must be suitable for temporary or permanent pole mounting beside the road. As well as simplifying installation and maintenance access, it also enables use on over-size vehicle routes, where passage under gantries or bridges would be impossible. This arrangement will allow road authorities to monitor the passage of over-size vehicles at key points in the road network, e.g. bridges and flyovers, to ensure that they are traversing in the middle of the road and hence distributing their load in the safest fashion. In this paper, we propose a novel non-invasive axle-based vehicle classification system using tracking radar that can overcome the limitations of existing technology.

Method

The solution has been developed using a Sensys Gatso RT4 Frequency Modulated Continuous Wave (FMCW) phased array tracking radar. The unit is pole mounted at the side of the Federal Highway in the ACT at a height of 450cm. A local embedded controller captures and processes the radar data.

Also installed at the same location is an existing ACT Roads heavy vehicle monitoring system, which is operated on behalf of the National Heavy Vehicle Regulator (NHVR). This system employs invasive sensor technology and provides classification data in accordance with the Austroads scheme (Austroads, 2020). It acts as a reference system by providing ground truth data used to verify the accuracy of the tracking radar algorithms – both during development and when compiling the test results below.

The existing RT4 solution provides enforcement grade speed measurement and length data for passing vehicles. In order to develop new radar algorithms, the raw RT4 radar detections are logged using the roadside controller. This data has been processed and analysed by taking advantage of the micro-Doppler generated by the rotational motion of the wheels on passing vehicles. By means of time and frequency analysis, we were able to extract the axle configuration and the length of a vehicle. These characteristics were then fed into a classifier to provide the vehicle classification (Deville et al., 2022).

Figure 1 illustrates the whole process, from the collection of a vehicle's radar detections through to its classification according to the AUSTROADS scheme. Figure 2 illustrates a new method to more accurately estimate a vehicle's length. This process is less computationally intensive and is ideally suited where overlength vehicle detection is required, but without the need for AUSTROADS classification.

Extended Abstract (Practitioner)

Wiggins and Deville



Figure 1. Radar Automatic Vehicle Classification Algorithm – Process Overview



Figure 2. Radar Data Pre-processing for Vehicle Length Estimation

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia

Results

An initial version of the classification algorithm was developed using radar data collected under limited conditions. The algorithm excluded data from vehicles with a low signal to noise ratio micro-Doppler signal, resulting in a reduced capture rate. The accuracy of the classification was also compromised due to miscounting of axles.

Improvements to the algorithms are continuing. This process has included the development of a radar data simulation, which helps cater for the presence of noise and interference in the captured signals.

An enhanced version of the algorithm has been developed based on the signal direction of arrival. This has improved the vehicle feature estimation accuracy, including both length and axle-configuration. It also resulted in the detection rate increasing by 0.2% and the AUSTROADS classification accuracy increasing by 6%.

The vehicle length estimation is in accordance with Queensland Department of Transport's Class C sensor accuracy standards, which require a 10% accuracy (Queensland Government, 2022).

Conclusion

This project has demonstrated that side fired tracking radar can be used to accurately measure the length of vehicles and classify them in accordance with the AUSTROADS scheme. The new solution enables authorities to improve road safety through monitoring and enforcing the movement of over-sized and heavy vehicles at locations where this was not previously possible with existing technology.

Unlike invasive sensors, that only provide traffic data at a single point on the road network, the new tracking radar solution continually tracks vehicle movements over a distance exceeding 100m, with an estimated classification range of 40m. This enables road operators to not only detect over-size vehicles, but also ensure that they are correctly traversing the section of road being monitored.

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Local Government Network uniting council road safety practitioners

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Abstract

Collectively local governments across Australia and New Zealand manage over 80% of the road network. They are key players in the 2030 road safety targets. The formation of the Australasian College of Road Safety's (ACRS) Local Government Network (LGN) provides a fertile opportunity for knowledge sharing across jurisdictions and connects practitioners with people and ideas they may not have otherwise encountered. Since its inception in 2022, the LGN has continued to grow, attract members and deliver high quality monthly events. At the beginning of 2024 the LGN has just over 100 members. The LGN has delivered 13 events since its inception and has had close to 1,000 people attend and engage in these events. The ability to coordinate local government's interest across jurisdictions also provides an excellent opportunity to advocate for meaningful change via a united platform that is well supported by the overarching ACRS.

Post on X

Local governments across Australia and New Zealand play a pivotal role in achieving the 2030 road safety targets. The ACRS Local Government Network helps to unite local government practitioners to share solutions, learn new approaches, celebrate success and advocate for change.

Background

There are 615 local governments across Australia and New Zealand - 537 in Australia and 78 in New Zealand. Collectively local government manages approximately 82% of the Australian and 88% of the New Zealand road networks by length (Austroads, 2020). They are key players in the 2030 road safety targets of reducing fatalities by 50% and serious injuries by 30% (compared to a baseline of the averages experienced between 2018 - 2020) that has been adopted across Australia (Commonwealth of Australia, 2021).

In recent years, there has been an increase in the number of fatalities that have occurred on local roads, especially in regional and remote areas.

The road safety work being undertaken by local governments is vast - covering road maintenance, infrastructure upgrades, education and engagement activities, safe driving policies and much more.

The Australasian College of Road Safety's (ACRS) Local Government Network (LGN) was formed to allow local government road safety practitioners throughout Australia and New Zealand to connect and share their stories and experiences, celebrate success, network, learn new approaches and advocate for change through a united platform.

Given the change in emphasis by the new government in New Zealand with regards to road safety, the LGN will be important to provide local practitioners with a professional network to consult and learn from. Changes occurring within Australian local government practice means that council practitioners have a greater role in delivering on the 2030 targets and ultimately the Vision Zero objective. The sharing of road safety activity being undertaken by practitioners via the LGN assists local governments throughout both Australia and New Zealand.

Overview

From humble beginnings in 2022, the LGN has continued to grow, attract members and deliver high quality monthly events. At the beginning of 2024 the LGN has just over 100 members. The LGN has delivered 13 events since its inception and has had close to 1,000 people attend and engage in these events.

The LGN has an active committee comprised of local government practitioners from across Australia and New Zealand.

Monthly online events include webinars, deep dive meetings and open mic sessions.

Webinars involve up to four speakers who are invited to present on projects and research related to local government road safety and focusing on a particular topic. In 2023 the LGN webinars focused on road safety strategic plans, award winning local government road safety projects, speed management for safety and Australia's National Road Safety Action Plan.

The webinars are followed the next month by deep dive meetings where the topics covered during the webinar are discussed in further detail, and where participants can select a discipline themed break-out room to have discussions with like-minded practitioners.

Open mic sessions provide an opportunity for members to pose questions to the group of participants about how to solve problems and address road safety challenges.

The LGN also hosted a pre-conference workshop at the 2023 Australasian Road Safety Conference where invited participants included the Australian Local Government Association (ALGA), the Australian Government's Department of Infrastructure, Transport, Regional Development, Cities and the Arts (DITRDCA) and Waka Kothai New Zealand Transport Agency.

The diversity of local governments across New Zealand and Australia's states and territories provides a fertile opportunity for knowledge sharing across jurisdictions. The LGN offers members the opportunity to establish and build relationships with other road safety practitioners and hear ideas from guest speakers that they may not have otherwise met, engaged with or heard about. However, a lack of coordination and awareness of the success being achieved elsewhere can be a significant barrier, resulting in efforts and discovery needlessly being duplicated in isolation.



Figure 1. Members of the Local Government Network Committee in attendance at the 2023 Australasian Road Safety Conference in Cairns, Queensland

Source: Australasian College of Road Safety (reproduced with permission)

Outcomes

A few success stories:

- Following an LGN webinar presentation from the City of Onkaparinga in South Australia on a proposal to
 install an innovative compact rural roundabout, a practitioner from Victoria's Mornington Peninsula Shire
 reached out to the presenter from Onkaparinga to offer their council's experience having recently constructed
 examples of this treatment. This interaction was instrumental in reducing the cost of Onkaparinga's
 roundabout by orders of magnitude through sharing of the design approach adopted by Mornington Peninsula.
- 2. Bundaberg Regional Council have committed to develop a Network Safety Plan of their road network following the LGN webinar on the same topic.
- 3. Members representing the LGN were invited by DITRDCA to attend and contribute to a national roundtable meeting alongside ALGA, state and territory based local government representative bodies and other representatives from ACRS to discuss significant upcoming changes to the Commonwealth's Targeted Infrastructure Program for road safety treatments including Roads to Recovery, Black Spot and Safer Local Roads and Infrastructure funding programs.

Implications for practice

The LGN has incredible potential to contribute towards achieving Target 2030 by providing a platform for local government road safety practitioners to network with colleagues they would otherwise have had no opportunity to connect with. Communication through webinars and online meetings results in a more inclusive approach that connects people across Australia and New Zealand in both metropolitan and regional councils.

Individual councils are then empowered to change policies and procedures and implement new solutions based on what they learn from networking in the LGN. The ability to coordinate local government's interest across jurisdictions also provides an excellent opportunity to advocate for meaningful change via a united platform that is well supported by the overarching ACRS.

Conclusions

As the LGN continues to grow and offer practitioners a place where they can learn and find solutions, we encourage more local government staff to join and share their knowledge. This would then build upon the richness and robustness of the conversation about local road safety problems and how to achieve the 2030 targets.

But local government needs more support to counter the lack of funding and fewer staff dedicated to road safety when compared to their state and national counterparts (Austroads, 2020). To achieve our shared road safety vision, the pathway forward requires a coordinated effort where local government works together regardless of jurisdiction. The LGN has already demonstrated in its short history that it is capable of informing and influencing practitioners across the broad spectrum of local governments, as well as higher levels of authority.

Acknowledgement

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Managing periurban local roads by setting safer speed limits

Brett Williams City of Onkaparinga

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Abstract

Periurban local roads present complex road safety challenges, differing from typical rural roads due to higher number of driveways, intersections, and residences. Our council implemented evidence-based speed limit reductions on an 18.7km network of periurban roads involving a coordinated communications strategy. After the reductions were implemented 85th percentile speeds decreased by 2.8-20.2% on treated roads versus 2.9-5.0% on untreated controls, along with an estimated reduction of fatal crashes by 15-70% and serious injury crashes by 11-59%. While the speed limit reductions provided safety benefits, complementary road engineering treatments are still needed as the lowered limits alone did not improve AiRAP assessed road safety star ratings. The project demonstrated how local governments can enhance road safety on periurban networks through speed management, contributing progress towards Vision Zero targets. However, a coordinated approach that addresses all components and participants of our road system is required to achieve our 2030 targets.

Post on X

Can our 2030 Vision Zero targets be met? Our project to reduce speed limits on over 18km of periurban roads shows it can certainly help, but more needs to be done! The pathway forward requires a systems-based, coordinated effort that supports the local government sector.

Background

Setting appropriate speed limits that match the roadside environment with the safe operating speeds of vehicles is one of the single most effective ways to reduce death and serious injury on our roads. Speed is the single greatest influence on the forces experienced in a crash, and its management is crucial for a safe road network. Research shows that even small decreases in travel speeds lead to significant reductions in crashes and trauma due to the improved stopping distances, reduced impact speeds and less kinetic energy transferred to vehicle occupants (Austroads, 2021).

Periurban local roads are complex to manage and understand, as evidenced by the lack of guidance provided in practitioner policy. The NSW Movement and Place framework is one useful resource, which defines these areas as "peripheral urban environments ... between built-up suburbs and rural landscapes" with "a diversity of uses, from residential to light industrial and agricultural and a sparse network of local streets" (Transport for NSW, n.d.). Local roads in periurban areas were often constructed prior to modern geometric design standards, aligned between existing properties, or following informal tracks. Safety is compounded by rural-residential development resulting in higher population densities for the rural landscape, more driveways and intersections, and higher traffic volumes than experienced on typical rural roads. Contrasted against highways where minor roads tend to feed off a major arterial road, periurban roads often experience broader network dispersal and increased conflict due to vehicles travelling at different speeds such as trucks, agricultural vehicles and visitors who are unfamiliar with the area. The presence of cyclists, pedestrians, horse riders, roadside hazards such as trees, and lack of safety barriers also increases risks.

Upgrading these roads to match existing speed limits is often cost-prohibitive for local governments, often requiring removal of roadside vegetation and property acquisition. As speed limits have traditionally been adopted with little understanding of safety, the resulting legacy is a community of road users who have been conditioned to accept speed limits that are not aligned with injury reduction (Austroads, 2018). Vehicle operators often have existing expectations of perceived acceptable travel speeds based on prevailing speed limit setting conventions, and reducing existing speed limits to levels that consider the Safe System approach can therefore provoke strong, negative responses from some members of the community.

Project Description

Our council hosts a network of periurban roads in the Adelaide Hills carrying significant through-traffic volumes beyond their original design capacity, resulting in high crash rates. Responding to resident requests for safer speeds, the council sought changes to speed limits on eight roads totalling 18.7km, all with 80km/h speed limits. In preparation for an anticipated negative response from sections of the community, this project commenced with a coordinated communications strategy, starting with general "drive safe" messaging for Christmas 2022, then a message about the general risk of speeding for National Road Safety Week in May 2023. Throughout the whole process council's elected members were kept informed of the proposed speed limit changes and invited to provide feedback.

To support the proposed speed limit changes, a detailed Traffic Impact Statement was prepared and submitted to South Australia's Department for Infrastructure and Transport (DIT), who are responsible for setting speed limits in South Australia. DIT subsequently approved speed limit reductions on these roads in September 2023. In October 2023, information was provided on the upcoming specific speed limit changes via social media, a community engagement website, and news articles. The new lower limits became operational on November 30, 2023.

Evaluation

Gaining strong support from elected council members was vital by providing ongoing briefings on the technical analysis, approval process, and community engagement. To evaluate the impacts, probe speed data using the Compass IoT platform was obtained to assess before and after travel speeds. Probe data is derived from persons or vehicles carrying devices that report time and location and can have several advantages compared traditional data gathering methods (Austroads, 2020). The results presented in Table 1 show 85th percentile point-to-point speeds reported in December 2022-February 2023 (before) and December 2023-February 2024 (after implementation). Results showed that control sites with no speed limit changes had speed reductions of 2.9-5.0%. The sites where speed limits were lowered had speed reductions of 2.8-20.2%.

To complement the speed analysis, the Global Road Safety Facility's "Speed Impact Tool" was used to estimate the change in fatal and serious injury crashes relating to the speed reductions reported by the probe data (Global Road Safety Facility, n.d.). This spreadsheet-based tool provides broad guidance that considers the exponential relationship between crash risk and speed, and recommends that results are applied using engineering judgement. Results showed that control sites with no speed limit changes had reductions of 15-27% for fatal crashes and 11-21% for serious injury crashes. The sites where speed limits were lowered had reductions of 15-70% for fatal crashes and 11-59% for serious injury crashes.

Separately, a trial using AiRAP (Accelerated Intelligent Road Assessment Program) was conducted on 32km of periurban roads collected by vehicle-mounted mobile LiDAR scanning in March 2023 (International Road Assessment Programme, n.d.). This assessment included some of the sites where speed limits were reduced on 30 November 2023. Whist reduced speed limits will have improved the risk ratings, the AiRAP data showed the lowered speed limits alone did not improve the "star rating" bands for any of the roads. This indicates that while reducing speed limits is beneficial, other complementary treatments are still needed to improve road safety.

Conclusions

Local government manages 75.3% of the Australian Road Network (Commonwealth of Australia, 2023), and it is simply impossible to invest in engineering measures to upgrade these roads where existing speed limits are not safe. Time is running out to meet our nation's Vision Zero targets for 2030, which aims for a reduction in fatalities by at least 50% and casualties by 30% from a baseline of the averages experienced between 2018-2020 (Commonwealth of Australia, 2021). Our project provides an example of how a coordinated and evidence-based approach can result in improving a network of roads with safer speeds and with minimal financial outlay. Implementing safer speed limits on all of our nation's rural and periurban roads has the potential for significant contribution towards achieving our shared Vision Zero targets. Speed limit reduction in isolation however will not be enough to meet the rapidly approaching 2030 target. Our pathway forward will require a coordinated effort that supports the local government sector by considering the interactions of all components and participants within the road traffic system (ACRS, 2023).

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Road Name	Section	New Speed Limit (km/h)	Direction of Travel	V85 Speeds Before (km/h)	V85 Speeds After (km/h)	Speed Change (km/h)	Fatal Crash Reduction	Serious Injury Crash Reduction
Daing Daad	Piggott Range Road to Knox	70	Eastbound	84.0	77.4	-6.6 (7.9%)	43%	34%
Bains Road	Drive	70	Westbound	85.0	76.6	-8.4 (9.9%)	47%	38%
Cove Hill Dood	Panalatinga Road to Emu	70	Eastbound	79.6	70.0	-9.6 (12.1%)	55%	45%
	Creek Lane	70	Westbound	79.6	75.0	-4.6 (5.8%)	33%	26%
Faston Road	Piggott Range Road to Grants	70	Eastbound	79.4	77.0	-2.4 (3.0%)	15%	11%
Easton Road	Gully Road	70	Westbound	77.8	75.1	-2.7 (3.5%)	21%	16%
Education Road	Piggott Range Road to Singer	70	Northbound	79.1	71.8	-7.3 (9.2%)	43%	34%
Education Road	Drive	/0	Southbound	75.0	64.2	-10.8 (14.4%)	59%	48%
Oskridge Road	Main Road to 720m east of Homestead Drive	60	Eastbound	73.2	64.9	-8.3 (11.3%)	47%	38%
Oakiluge Road			Westbound	67.9	64.9	-3.0 (4.4%)	21%	16%
Piggott Range Road Grants Gully Road to Bain Road	Grants Gully Road to Bains	70	Northbound	82.9	76.5	-6.4 (7.7%)	38%	30%
	Road		Southbound	81.9	73.1	-8.8 (10.7%)	51%	42%
Potter Road	Clarendon Road to Grants	60	Northbound	79.5	75.2	-4.3 (5.4%)	33%	26%
Totter Road	Gully Road	00	Southbound	72.7	70.7	-2.0 (2.8%)	15%	11%
Upper Penneys Hill	Piggott Range Road to Craig	60	Eastbound	69.9	65.6	-4.3 (5.4%)	27%	21%
Road	Road		Westbound	73.9	59.0	-14.9 (20.2%)	70%	59%
Kangarilla Road	Bakers Gully Road to	80	Northbound	82.2	79.8	-2.4 (2.9%)	15%	11%
(80km/h control site)	Douglas Gully Road	(no change)	Southbound	80.5	77.2	-3.3 (4.1%)	27%	21%
Cherry Gardens Road	Hicks Hill Road to Dorset	70	Eastbound	77.2	74.8	-2.4 (3.1%)	15%	11%
(70km/h control site)	Vale Road	(no change)	Westbound	77.3	73.4	-3.9 (5.0%)	27%	21%

Table 1. Results and evaluation of reported 85th Percentile point-to-point speeds both before and after speed limit change from previous 80km/h limit

Target 2030: global learnings for safer Australasian roads

Judy Williams and Rob McInerney International Road Assessment Programme (iRAP)

Abstract

Using the International Road Assessment Programme (iRAP) methodology, road safety infrastructure changes and safer speeds have prevented almost 700,000 deaths and serious injuries in 74 countries since 2016, according to Johns Hopkins University research published in *PLOS One*. iRAP partnerships span the globe connecting governments, mobility clubs, development banks, industry and road safety NGOs with free tools and training to make their roads safe. 3.6 million kilometres and 1,356 schools have been assessed in 126 countries, informing the safety of USD\$101 billion of infrastructure investment. 69,000 people have been trained and practitioners accredited to deliver assessments aligned to the global infrastructure standard recognised by the UN and WHO. Inspirational partnerships, programs and projects are transforming the safety of roads worldwide and AusRAP is achieving significant success... Best practice case studies from Brazil, Saudi Arabia, Tanzania, Vietnam, UK, India, Thailand and more, offer insights for safer Australasian roads.

Post on X

#RoadSafety research in PLOS One shows 700,000 deaths and injuries have been prevented on safer roads informed by the @iRAPSavingLives methodology and tools. iRAP partnerships are creating safer roads in >125 countries, & learnings from Brazil, Tanzania, Vietnam, UK + are helping shape safer Australasian roads. #AusRAP

Background

An estimated 1.19 million people die on the world's roads each year, making it the leading cause of death for young people. UN Member States have agreed on 12 Global Road Safety Performance Targets to drive action across the world. All countries are challenged to meet UN Targets 3 and 4 which include ensuring all new roads are built to a 3-star or better standard for all road users (Target 3), and more than 75% of travel is on the equivalent of 3-star or better roads for all road users by 2030 (Target 4). Based on evidence-based research, Star Ratings for pedestrians, cyclists, motorcyclists and vehicle occupants provide an objective measure of the likelihood of a crash occurring and its severity. A 1-star road is the least safe and a 5-star road is the safest. A person's risk of death or serious injury is approximately halved for each incremental improvement in star rating (ITF OECD, 2016)¹.

Description

iRAP partnerships span the globe connecting governments, mobility clubs, development banks, industry and road safety NGOs with the free Star Rating Methodology, tools and training to make their roads safe. Recent research by Johns Hopkins University, published in the respected journal PLOS One², shows road safety infrastructure changes and safer speeds informed by the iRAP Methodology and tools have prevented almost 700,000 deaths and serious injuries in 74 countries since 2016 (Li & Bradford, 2024). The findings validate the lifesaving benefit of safe road infrastructure and the pathway forward to save lives in Australasia.

Outcome / Results

Inspirational partnerships, programs and projects are transforming the safety of roads in many, many countries and provide compelling case studies for safer roads in Australasia. 3.6 million kilometres and 1,356 schools have been assessed using the iRAP Methodology in 126 countries, informing the safety of USD\$101 billion of infrastructure investment for pedestrians, bicyclists, motorcyclists and vehicle occupants. 69,000 people have been trained and practitioners accredited in 49 countries to deliver assessments aligned to the global infrastructure safety standard recognised in the UN Targets 3 and 4, and by the WHO and leading stakeholders. 76 national strategies include iRAP targets for infrastructure including for Australia, New Zealand, Vietnam, Indonesia, Thailand, Malaysia, Lao PDR, Croatia, Georgia, Greece, Slovenia, UK, Brazil, Cayman Islands, Saudi Arabia, Pakistan, Gambia, Uganda and Malawi.

In the last 12 months, large assessments in the Kingdom of Saudi Arabia (73,000km), Colombia (22,000km), and Thailand (15,000km), are shaping evidence-based upgrades and investment. The results of the 54,500km assessment in Brazil are shaping investment which is estimated will prevent more than 150,000 serious injuries and fatalities over a 20-year period with an economic benefit of BRL 45 billion. United Kingdom RAP and partners in Spain risk map 54,000km and 30,000km of their networks respectively every year, helping to performance track investment in safety measures. This includes the recent announcement of a £47.5 million investment on England's local road network to prevent deaths and serious injuries. More than 50,000km has been assessed in Australia, including the world's largest AiRAP assessment in Western Australia which is leading global innovation for AI in road safety.

The Star Rating for Schools (SR4S) programme continues to inspire across the world. 1,356 schools have been assessed across 70 countries, impacting the safety of an estimated 418,914 students. A USD\$2 million Google.org grant to iRAP is now underway to leverage Artificial Intelligence (AI), SR4S and AiRAP partnerships to scale up 3-star or better school journeys in Vietnam and the world. The integration of a Youth Engagement App (YEA) is capturing supplementary youth perceptions of risk.

Partnership projects are being supported worldwide helping to make roads safer in countries Some notable multinational collaborations include: a transformative UNESCAP project, funded by the UN Road Safety Fund, to improve road design standards across Central Asia Regional Economic Cooperation (CAREC) countries; the Ten Step Approach for Safer Road Infrastructure which launched TanRAP for Tanzania; the long-term support partnership underway between iRAP and the Millennium Challenge Corporation (MCC) to stimulate safer roads progress in low- and middleincome countries; the EU-funded project PHOEBE to develop an integrated, human-centred, predictive safety assessment framework for vulnerable road users in urban areas; the ELABORATOR project for designing sustainable urban mobility towards climate neutral cities in Europe; and the GRSF and iRAP's Target 3 Project to evaluate countries' progress in achieving UN Target 3 for all new roads by 2030.

The iRAP Innovation Framework is supporting 111 partners worldwide in projects and initiatives to pioneer global and local tools for road safety. Examples include AiRAP, Star Rating for Designs, the integration of iRAP in the ORIS platform to optimise the safety and climate resilience of road designs,, and CycleRAP, a model transforming cyclist and light mobility user safety.

Before and after road upgrade assessments are providing the evidence-base of lives and injuries saved informed by iRAP assessments and Safer Road Investment Plans. For example³, in Karnataka, India, deaths reduced by 54% and injuries by 42% on a 62km section of the Belagavi - Yaragatti Highway; in Victoria, Australia, deaths fell by 77% and hospital bed days reduced by 74% on 1,730km of key highways; zero fatalities and an 89% fall in injuries on a section of Highway 4028 in Thailand; in Shaanxi, China, road deaths fell 33% and injuries more than halved (53%) on 850km of roads; in Albania, road deaths fell 23% following treatment on 1,335km of the nation's busiest primary and secondary roads; in England, deaths fell by 54% on more than 7,000km of strategic network roads; and in Bogota, Colombia, speed limit reductions informed by iRAP assessments resulted in a 22% reduction in fatalities.

Benefits / Implications

Ensuring that 75% of travel is on the equivalent of 3-star or better roads for all road users worldwide by 2030 stands to save more than 450,000 lives and 100 million deaths and serious injuries over the 20 year life of treatments. This presentation will illuminate best practice examples and insights from countries around the world as a guide for life-saving Australasian road infrastructure management, policy and practice.

Conclusions

iRAP partnerships in more than 120 countries are saving lives and serious injuries on 3-star or better safer road infrastructure. Global iRAP case studies of success provide valuable insights for achieving Global Plan Targets to halve road deaths and injuries by 2030 on safer Australasian roads.

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Preliminary impact evaluation of penalty increases for high-risk driving offences

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Abstract

In response to the high number of lives lost and seriously injured road users resulting from speeding, red-light and seatbelt offending, the Queensland Department of Transport and Mains Roads (TMR) undertook a review of the appropriateness of penalties for these dangerous driving behaviours. As a result of the review, a key action in the Queensland Road Safety Action Plan 2022-24, was to introduce new penalties targeting these high-risk driving offences. The Queensland Government increased the penalties for these offence types. This presentation gives an overview of the early analysis of the potential impacts of these penalty increases in Queensland. The preliminary analysis found there has been an overall notable decrease in the number of speeding, red light, and seatbelt offences since the penalties came into effect.

Post on X

Preliminary impact evaluation of the penalty increases for high-risk driving offences in Queensland shows promising results for road safety, with reductions observed for speeding, red-light, and seatbelt offending after penalties increased.

Background

In the five-year period 2016-2020, there were 287 lives lost, around one quarter of all fatalities on Queensland roads, as a result of speeding. During this same period, there were 24 lives were lost as a result of a crash involving a traffic light violation, and 151 people were killed in a crash where they were not wearing a seatbelt. In addition to the fatalities, speeding, red-light, and seatbelt offending together contributed to over 4,000 people being hospitalised as a result of a crash between 2016 and 2020.

In response to the high number of lives lost and seriously injured road users resulting from speeding, red-light and seatbelt offending, the Queensland Department of Transport and Mains Roads (TMR) undertook a review of the appropriateness of penalties for these high risk-driving offences (HRO). Effective and salient penalties are essential to deterring dangerous high-risk driving behaviours, and previous research has shown that increasing fixed fines are associated with a reduction in the rate of offences (Elvik, 2016). As a result of the review, a key action in the Queensland Road Safety Action Plan 2022-24, was to introduce new penalties targeting HRO, including speeding, seatbelts and red-light violations. The Queensland Government increased the penalties for these HRO from 1 July 2022 (Table 1), supported by an extensive targeted public education campaign in the lead up to the penalty increases.

In addition, there was an adjustment to the range of speeding offences which fall into the lower two ranges. On 1 July 2022, bracket 1 offences changed from 1-12km/hr above the limit to 1-10km/hr above the limit, and Bracket 2 offences changed from 13-20km/hr above the limit to 11-20km/hr above the limit.

Table 1. Changes to the penalties for high-risk driving offences (HRO) from 1 July 2022 in Queensland.

Offence type	Penalty units change	Fine amount change ¹	Demerit points ²
		(1 July 2022)	
Speeding 1-10 km/h over posted limit	1 ¹ / ₃ to 2	\$183 to \$287	1 (no change)
Speeding 11-20 km/h over posted limit	2 to 3	\$275 to \$431	3 (no change)
Speeding 21-30 km/h over posted limit	3 ¹ / ₃ to 4 ¹ / ₂	\$459 to \$646	4 (no change)
Speeding 31-40 km/h over posted limit	4 ² / ₃ to 7 ¹ / ₂	\$643 to \$1,078	6 (no change)
Speeding > 40 km/h over posted limit	9 ¹ / ₃ to 11 ¹ / ₂	\$1,286 to \$1,653	8 (no change)
Fail to wear, or incorrectly wear, seatbelt	3 to 7½	\$413 to \$1,078	3 to 4
Fail to stop at a red traffic light or arrow	3 to 4	\$413 to \$575	3 (no change)

Note: 1 = Organisations pay five times the monetary fine if they do not nominate the individual who committed the offence. 2 = Double demerit points apply if more than one > 20 km/h over the posted limit speeding offence incurred within 12 months.

Project description

Early analysis of the potential impacts of the penalty increases was undertaken once 12 months of post-implementation infringement data was available. The analysis undertaken compared the number of each offence type post-penalty increases to the corresponding period prior to the penalty increases. For speeding and red light offences, this was done

on a 12-month basis, Financial Year (FY) 2021-22, and also compared to the 5-year FY average prior to the penalty increases (5-year average FY2017-18 to FY2021-22). The number of speeding and red light offences were also compared to the corresponding 12-month period prior to the beginning of COVID-19 disruptions (FY2018-19).

For the seatbelt offences, due to the major change in enforcement method for non-wearing and incorrect wearing of seatbelts for front seat passengers (mobile phone and seatbelt cameras) which came into effect on 1 November 2021, seatbelt offences were examined and compared from periods in which the mobile phone and seatbelt cameras were operational. The cameras became operational on 1 November 2021, representing an 8-month period in 2021-22 financial year and were operational for a full 12 months in the following financial year. As such, the comparison of seatbelt infringements was undertaken for the same 8-month period in 2022-23 after the increased penalties came into effect (1 November to 30 June). Due to the major change in the enforcement method for non-wearing and incorrect wearing of seatbelts for front seat passengers, the number of seatbelt offences after the penalty increase were not compared to the previous 5-year average before the penalty increase.

The analysis focussed on the HRO committed by individuals; that is, where the driver details were known. Offences committed in vehicles registered to organisations, where the organisation had not subsequently nominated the driver responsible for the offence, have not been included in this preliminary analysis. The data used in this project came from internal TMR sources. Due to the preliminary nature of this analysis, other data sources, such as measures of driving exposure and road crash data, have been omitted. Such data sources will be included in a future evaluation, once sufficient data is available.

Findings

Speeding offences

Following the penalty increases, there was an overall 18% decrease in speeding offences in comparison to the previous 12 months (see Figure 1(a)). In comparison to the five-year average, there was an overall 19% decrease in speeding offences in FY22-23. Compared to the corresponding 12-month period prior to the beginning of COVID-19 disruptions (FY2018-19), speeding offences overall decreased by 25%.

The comparison of the number of speeding offences was further separated and examined by the range (bracket) of speeding offences, to determine whether there were differential effects across the five speeding brackets. Some of the observed reduction in the first bracket offences was due to the 11km/h and 12km/h offences having moved from this lowest bracket into the next highest bracket as part of the changes to the speeding brackets. Due to this change, the first (1-10km/h over the speed limit) and second (11-20 km/h over the speed limit) bracket offences were analysed together (see Table 2).

	1 1 2	2-25 (1 0st penat	1 1 21-22	(FY 17-18 to 21- 22)	
Speeding offences	Number of Offences	% difference FY21-22	% difference 5yr AVG (FV 17 22)	Number of Offences	Number of Offences
Speeding Brackets 1 and 2 combined	712,541	-18%	-20%	871,261	887,552
Speeding Bracket 3	34,967	-17%	-17%	42,101	42,184
Speeding Bracket 4	6,964	-17%	-13%	8,363	7,962
Speeding Bracket 5	3,261	-8%	-2%	3,540	3,335

Table 2. Number of Speeding Offences in FY22-23, FY21-22 and the five-year average for FY17-18 to FY21-22.FY22-23 (Post penalty increases)FY21-225vr Avg.

The analysis of the combined first and second brackets showed there was an 18% decrease in the observed number of offences for the lower two speeding brackets when compared to the 12 months prior to the penalty increase, and a 20% decrease compared to the previous five-year average.

For the highest severity speeding offences (> 40km/h over the posted limit), the decrease in number of offences was less, implying those committing the highest level speed offences are less influenced by the higher penalties. In Queensland, this level of dangerous driving behaviour also results in an automatic 6-month driver licence suspension.

Red light offences

Comparing the 12 months prior to the increases, red light offences decreased by 17% after the penalty increases (see Figure 1(b)). In comparison to the five-year average prior to implementation, the number of red light offences decreased

by 18%. Compared to the corresponding 12-month period prior to the beginning of COVID-19 disruptions (FY2018-19), red light offences decreased by 11%.

Seatbelt offences

Seatbelt infringements were compared for the same 8-month period (1 November to 30 June) pre and post penalty increases. The number of seatbelt offences decreased by 34% (see Figure 1(c)) when compared to the same 8-month period in 2021-22. It is expected that the relatively large reduction observed for seatbelt offences is due to a combination of the increased penalty and the change in the enforcement method.



Figure 1. Number of (a) speeding offences, (b) red light offences, and (c) seatbelt offences pre and post penalty increase

Payment of fines

Effective penalties are essential to deterring dangerous high-risk driving behaviours. One aspect that may reduce the impact is if offenders are able to dodge paying the fine they have incurred. The number of HRO infringement notices that were paid upfront (within the 28-day infringement notice period) after the penalty increases came into effect were compared to the number that were paid upfront before the changes. During FY2022-23, 55.2% of all HRO infringement notices were paid upfront within 28 days of receiving the infringement notice. This was lower than the 12-months pre penalty increase period (67.2%, FY21-22) and lower than the 5-year pre increase average (67.7%). This finding must be considered in the context of the macro-economic conditions during 2022-23 (high CPI and interest rate rises). The proportion of all HRO infringement notices that were challenged in court was slightly higher than the 12-month period pre penalty increases (0.70% vs. 0.63%), with increases observed for red light offences and bracket 3 and 4 speeding offences.

In Queensland, all offences not paid by the due date, and not challenged in court, are referred to the State Penalties Enforcement Registry (SPER), who are responsible for managing unpaid fines and debt on behalf of the Queensland Government. Those offenders unable to pay fines can access hardship measures via SPER, including options to pay in small instalments as well as the ability to pay down fines via unpaid work, treatment or counselling, and educational, vocational or life skills programs.

Benefits to road safety

The preliminary analysis of the impact of the increased penalties for HRO has shown there has been an overall notable decrease in the number of HRO since the penalties came into effect. This has been observed across speeding, red light, and seatbelt offences, which may well be an early indication that drivers have changed their behaviour, which will result in positive outcomes for road safety in Queensland. Encouragingly, the overall levels of camera-based enforcement, the primary enforcement tools used in Queensland for speeding, red-light, and seatbelt offending, have either generally remained static, or have increased, over the period considered in this analysis.

Conclusions

While the findings from this preliminary analysis are encouraging, the impact of the increase in penalties continues to be examined and monitored by TMR as more data becomes available. The results of an interim, independent impact evaluation will be available in the second half of 2024. This initial phase of the independent evaluation will focus on assessing the impact of the increase in penalties. Once sufficient data is collected, including the number of fatalities and serious injuries from crashes where speeding, red-light, or seatbelt offending was a contributing circumstance, an outcome evaluation will be undertaken. The independent evaluation will also consider the camera-based enforcement mix to determine whether changes made to the enforcement types being operated have contributed to the observed decrease in the number of HRO since the increased penalties came into effect.

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Victorian schools survey to understand road safety knowledge and practice

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Abstract

Detailed baseline surveys were undertaken among Victorian Primary and Secondary Schools in 2023 to measure road safety knowledge and practice. The purpose of obtaining this baseline data is to assist the Victorian Government Road Safety agencies in identifying areas where they can further support schools in increasing road safety education and improving road safety within and beyond the school gate. The surveys also provide a baseline measure to enable future evaluations to assess the impact of a suite of new measures being implemented progressively across both Primary and Secondary schools. As part of a new "Whole of School Community" (WoSC) approach, a range of evidence-informed programs, resources, and support activities will be implemented to enable school communities to have a clearer pathway forward to be more proactive in their road safety practices.

Post

Surveys across Vic Primary & Secondary schools found most believe road safety is a priority. While over 2/3 had used a road safety program or resource in the past 5 years, only about half included road safety in their curriculum. Less than 1 in 10 had a road safety policy.

Background

The Victorian Government's first Road Safety Action Plan 2021-2023 included a commitment to develop a new strategic approach to delivering best practice education programs for children, young people, families, and the general community. The Victorian Government Road Safety Partners, which includes the Transport Accident Commission (TAC), Department of Transport and Planning (DTP), Public Transport Victoria (PTV), and Victoria Police (VicPol), have developed a "Whole of School Community" (WoSC) approach to road safety education. This evidence-informed approach will involve the progressive development of a range of programs, resources and support activities to enable school communities to develop and foster sound road safety knowledge and practices.

The Victorian Government Road Safety Partners will provide educational programs and resources spanning all education settings, from Early Childhood to Year 12 and all audiences – young and novice drivers, families, local government authorities, and the general community. Programs and resources delivered through the WoSC approach will include free curriculum-based resources, road safety programs, policy templates, curriculum-linked lesson plans, and professional development for educators.

Project Overview

A program logic model was developed to outline the expected short, medium and long-term impacts and outcomes of the WoSC approach. The program logic model informed the development of an evaluation framework that will monitor the outcomes of the approach over the next four years. The first step in implementing the evaluation framework is the collection of baseline data across all Victorian educational settings. The purpose of obtaining this baseline understanding is to assist the Victorian Government Road Safety Partners in identifying how they can support schools to increase road safety education and improve road safety within and beyond the school gate.

The objective of the surveys is to provide an assessment of Victorian schools across the following six areas:

- 1. The current approach to incorporating road safety into the curriculum.
- 2. Inclusion of road safety in school policy.
- 3. Prioritisation of road safety issues and education.
- 4. Local road safety issues and infrastructure.
- 5. Engagement with external stakeholders regarding road safety.
- 6. Prevalence and promotion of active transport.

A baseline survey was developed for the Secondary School setting and then adapted for the Primary School setting. The survey questions were developed with input from key stakeholders, including school leaders, teachers, the Victorian Road Safety Partners and curriculum experts. Question themes included the current uptake of road safety education programs, policy, advocacy, and communication within the community regarding road safety. The survey underwent cognitive testing before finalisation. Approvals from each school jurisdiction administrator were received before recruitment began.

2024 Australasian Road Safety Conference 30 September – 3 October, Hobart, Tasmania, Australia Schools were approached by letter, email and telephone to participate between July and December 2023. 588 Secondary Schools and 1792 Primary Schools were invited to participate. The most appropriate staff member at each school completed the survey as nominated by the school. In some cases, multiple staff members contributed to the survey response on behalf of their school. Specialist Schools and Early Childhood Services will be invited to participate in a baseline survey in 2024. Follow-up surveys will be conducted four years following the baseline data collection.

Benefits to road safety

The project is a large-scale baseline survey open to all Primary and Secondary Schools in Victoria to gain an in-depth understanding of the current state of road safety knowledge and practices. Baseline data has provided valuable insights into how road safety is currently being addressed and the key issues and priorities within and around Victorian schools. Data will be used to inform the Victorian Government Road Safety Partners in developing effective interventions that will improve road safety and contribute to a reduction in road trauma. Additional benefits may include increasing knowledge regarding best practice road safety and motivating schools to improve road safety within and beyond their school boundaries.

Results

The surveys achieved relatively high response rates [primary schools: n=497 (27.7%); secondary schools: n=139 (23.6%)]. Combined key findings from the Primary and Secondary School surveys show that there is an opportunity to improve road safety education and the road environment across school sectors.

While schools often state that road safety is a priority (primary: 63%; secondary: 56%), as shown in Table 1, evidence suggests considerable room for improved practices. For example, most schools do not have a stand-alone road safety policy (primary schools: 81%; secondary schools: 82%). At present, where road safety topics are covered, they tend to be incorporated into other policies. Topics most commonly included related to school drop off, traffic management, parking, and safe transportation of students. However, only about half of schools mentioned having coverage of these topics in policies.

While some schools incorporate road safety topics in their curriculum (primary: 48%; secondary: 45%), this area could be improved substantially. Including road safety in the curriculum is most common in the early years of primary school and the middle years of secondary school. A summary of the road safety activities undertaken is shown in Table 2.

Table 1. Road safety as a priority in Victorian schools

Focusing on road safety is	Primary Schools (n=497)	Secondary Schools (n=139)
Essential or a high priority for school	63%	56%
Medium or low priority for school	36%	42%
Unsure	1%	2%

Table 2. Road safety activities undertaken by Victorian schools

Road safety activity	Primary Schools	Secondary
	(n=497)	Schools (n=139)
Participated in a road safety program or used road safety resources	67%	77%
Use road safety content in the curriculum	48%	45%
Have a stand-alone road safety policy	8%	11%

Schools tend to focus on obvious road safety issues, such as school pick-up and drop-off. (primary: 98%; secondary: 96% communicated with parents about driving behaviour at pick up and drop off locations). Communication about planning safe routes to school, public transport and student driving was less common.

Schools were asked to rate how risky they perceived a range of potential issues in the environment around their schools to the safety of their students. The findings, shown in Table 3, indicate congestion and parking concerns were perceived as the highest risk to students, followed by driver behaviour, presence of heavy vehicles and speed settings.

Table 3. Schools perceptions of risk in school environment

Average rating of potential risks to students in the school	Primary Schools	Secondary
environment	(n=497)	Schools (n=139)
Parking and congestion at school drop off and pick up	4.0	3.7
Drivers speeding	3.7	3.5
Driver behaviour around crossings	3.7	3.2
No. of heavy vehicles around school	3.0	2.8
Speed setting not appropriate	2.7	2.3
Location or routes to PT stops	2.4	2.5
Lack of footpaths	2.4	2.2
Safety of railway crossings in the area	1.7	2.1

* Prompted question using rating scale 1=Not a risk, 5= Very high risk

Conclusion

Key survey findings reveal opportunities to increase road safety education and improve the road environment around Victorian schools. Baseline data shows that most schools do not have a stand-alone road safety policy and that only approximately half incorporate road safety topics in their curriculum. The data from these surveys provides a baseline measure for follow-up surveys that will be undertaken in approximately four years to measure change and the impact of new initiatives. Importantly, insights from the surveys have also identified opportunities to assist schools to focus on the safety of their school environments to improve road safety and contribute to a reduction in road trauma.

Identifying the contribution of fatigue to injury crashes

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Abstract

Fatigue is widely recognised as an important factor contributing to road crash risk but estimates of its involvement in crashes varies considerably. This study examines the contribution of fatigue to police-reported injury crashes and investigates whether these data capture the true contribution of fatigue. Analyses indicated that the injury crash data under-represented fatigue by 37% in fatal crashes and 6% in injury crashes (at a minimum). To guide investment in driver fatigue measures, the characteristics of these crashes and road users were investigated. Fatigue crashes were predominantly on roads with high-speed limits, in regional areas, occurred at midblock locations and were single vehicle crashes. They occurred most frequently in the afternoon and in the early morning hours. Fatigued road users were made to improve the ongoing identification and reporting of fatigue crashes.

Post on X

Driver fatigue plays a significant role in crashes, yet our understanding remains incomplete due to the lack of accurate data. It's time to bridge this gap and prioritise research and data collection to understand its extent and impact. #DriverFatigue #RoadSafety #DataAccuracy

Introduction

Fatigue is widely acknowledged as an important factor contributing to road crash risk. A fatigued driver may fall asleep or experience deficits in their cognitive functioning (e.g., vigilance, reaction time and alertness) and driving performance (e.g., increased lane deviation, poor speed control and increased distraction). However, estimates of the extent to which fatigue contributes to crashes vary considerably from 2 to 16% in Australia (Thomas et al, 2021). The wide variation in estimates of fatigue involvement in crashes is caused by difficulties in defining fatigue (as it is an internal psychological state), objectively measuring it, and determining whether it was involved in a crash (Dawson et al., 2018; Filtness et al., 2017; Palamara, 2016; Thomas et al., 2021). The lack of a mechanism to detect fatigued driving is a significant impediment to identifying fatigue as a contributing factor in crashes and for enforcement.

The purpose of this program of research was primarily to explore the best means for identifying the involvement of fatigue in crashes. In the first phase of the driver fatigue program of research, the contribution of driver fatigue to injury and fatal crashes in South Australia was investigated using in-depth at-the-scene investigations of injury crashes (2014-2019) and Coroner's reports on fatal crashes (2014-2015). The study found fatigue contributed to 4.3% (11/254) of injury crashes and 11.5% (18/156) of fatal crashes in South Australia (Thompson & Wundersitz, 2023). These estimates were conservative due to the stringent criteria of clear evidence of fatigue contributing to the crash (and limitations in the hours and coverage of the in-depth investigations of injury crashes).

This study aims to examine the contribution of fatigue to crashes in police-reported crash data in South Australia (Traffic Accident Reporting System, TARS) and investigate whether these data capture the true contribution of fatigue, or at least a good estimate. The characteristics of these crashes are then investigated to explore whether there are any defining attributes that could enhance the accurate identification of fatigue crashes. Consideration will be given as to how to improve the ongoing identification and reporting of fatigue crashes. While based in South Australia, this study also has implications for the optimal identification of fatigue in crashes in a broader context and provides guidance for investment in driver fatigue measures.

Method

This analysis consisted of 547 fatal and injury crashes in South Australia recorded in the Traffic Accident Reporting System (TARS) from 2017 to 2021 in which fatigue/fell asleep was checked by police as a contributing factor (more than one factor can be checked for a crash). Completion of this field was based on the judgement by investigating police. Injury severity was categorised as fatal, serious (admitted to hospital) and minor (treated at hospital or by a private doctor).

The characteristics of fatigue related injury crashes were examined in comparison to non-fatigue related injury crashes occurring within the same time frame (n=23,053). The characteristics of fatigued road users (n=547) (drivers, riders, pedestrians) were also compared with the characteristics of non-fatigued road users (n=48,541) involved in crashes during the same time frame.

Results

Prevalence of fatigue in injury crashes

Over the five-year period (2017-2021), on average, 2.4% of injury crashes were identified as fatigue related. On average, 5% of fatal crashes were fatigue related compared to 3.7% of serious injury crashes and 2.1% of minor injury crashes.

To determine whether police-reported injury crash data, as recorded in TARS, reflected the actual contribution of fatigue related crashes, we compared the number of fatigue crashes to those reported in the previous study (Thompson & Wundersitz, 2023) which used in-depth crash investigation data for injury crashes and Coroner's file data for fatal crashes over a similar time period. It was assumed that the previous study identified the true contribution of fatigue to fatal (11.5%) and injury (2.8%, weighted by injury severity level) crashes, although this would be an underestimate as these were only the crashes that were identified as definitely involving fatigue using stringent criteria. Consequently, the estimates calculated here reflect the minimum proportion of crashes for which fatigue may have been a contributing factor. This simple analysis estimated that the police-reported injury crash data under-represented the contribution of fatigue by 37% in fatal crashes and 6% in injury crashes, at a minimum.

Characteristics of fatigue crashes and fatigued road users

The characteristics of police-reported fatigue injury crashes were then compared to crashes occurring during the same time period that were not deemed as fatigue related (see Table 1). Fatigue crashes were predominantly on roads with high-speed limits (80km/h and over), in rural areas, occurred at midblock locations and consisted of single vehicle crashes (e.g., hitting a fixed object) or head on collisions. Fatigue crashes occurred most frequently in the afternoon from 3pm to 5pm and in the early hours of the morning from midnight to 6am. These times coincide with low periods of alertness associated with circadian rhythms.

Characteristic	Fatigue (N=547)	Non-fatigue (N=23,053)
Time of day: 12am-6am**	20.1%	4.0%
Speed limit: 80-110 km/h**	66.3%	24.0%
Rural location**	64.4%	21.5%
Road layout: Midblock**	88.1%	51.3%
Single vehicle**	74.2%	35.4%
Crash type: Hit fixed object	58.1%	14.1%

Table 1.	Summary	of	characteristics	of	fatique	crashes
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Statistically significant *p<.05, ** p<.001

Mapping of the crashes indicated that fatigue fatal crashes were mostly outside the Adelaide metropolitan area while serious and minor injury crashes were spread throughout the road network. Analysis of the distance of the fatigue crash (all injury crash severities) from a state maintained roadside rest stop indicated that 55.8% were 10km or less from a rest stop and 92.7% were 20km or less from a rest stop.

Analysis by road users (see Table 2) indicated that fatigued road users were 2.4 times more likely than non-fatigued road users to test positive for an illicit drug (methamphetamine was the most common drug detected) and more likely to be unlicensed. There was no difference by BAC status. While males were generally involved in more crashes, a greater proportion of fatigued road users were male than non-fatigued road users. There was little variation in fatigue status by age.

Table 2.	Summary	of characteristics	of fatigued	road users
	•			

Characteristic	Fatigue (N=547)	Non-fatigue (N=23,053)
Illicit drugs (positive)**	18.8%	8.0%
Illegal BAC	8.6%	7.6%
Unlicensed*	4.2%	2.6%
Sex - Male**	69.4%	58.7%

Statistically significant *p<.05, ** p<.001

Discussion (Benefits to Road Safety)

This study confirmed the contribution of fatigue is under-represented in police-reported injury crash data and this was most evident in fatal crashes. While this finding for fatal crashes is initially surprising as they are investigated more thoroughly than lower severity crashes, it is possible that the findings on contributing factors from major crash investigators and the Coroner, which can take some time to finalise when charges are laid, are not updated in the crash database. Generally, the under-representation may be due, at least partially, to variability in the reporting of fatigue as a contributing factor. One of the limitations of these data is that they rely on police consistently and accurately identifying fatigue as a contributing factor.

While there is limited research on the location of fatigue crashes and the road users at higher risk, the findings regarding fatigue-related crashes and road user characteristics are broadly consistent with characteristics reported in research from Australia and in other countries (e.g., Filtness et al, 2017; Philips & Sagberg 2013). Identifying such risk factors is important for the targeting of future fatigue management education campaigns (i.e., early morning trips, males, drug drivers, rural areas) and infrastructure.

An interesting finding that has received little attention in the literature, was that fatigued road users were 2.4 times more likely than non-fatigued road users to test positive for an illicit drug, with methamphetamine the most common drug detected. Drivers may take methamphetamines (a stimulant) to stay alert but this will likely only mask the underlying fatigue once the effects wear off. Additionally, the effects of withdrawal or 'coming down' following methamphetamine use include fatigue and hypersomnia (e.g., Logan, 1996). Further research is needed to explore the relationship between drug use and fatigue in the general driving population.

With respect to the location of crashes, fatigue crashes were 2.9 times more likely than non-fatigue crashes to be outside metropolitan Adelaide. Further analysis indicated that over half (56-58%) of the fatigue crashes occurred within 10km of a roadside rest stop and around 90% within 20km. Rest areas can provide a break from driving during long-distance journeys. However, while rest stops may have been present, many people often do not choose to stop during a trip. The type and quality of facilities available at rest stops can be variable and it is possible that people feel unsafe using them. Improvements to rest stop facilities may result in greater use.

Implications for policy and/or practice

While the contributing factor field offered a means of identifying fatigue crashes, the utility and accuracy of such an identifier is strongly dependent on the quality of input from police. This study showed that current methods used to report fatigue related crashes are underestimating the prevalence. A systematic approach is needed to proactively determine whether fatigue might be a factor in a crash. Such an approach should involve appropriate training for police to identify evidence that fatigue contributed to the crash error (see Dawson et al., 2018). A lack of appropriate police training to identify driver fatigue has been reported in other countries signifying that this is not unique to South Australia (Radun et al, 2013). Importantly, to maintain a systematic approach, a standard set of questions should be developed for police to ask crash participants and witnesses concerning the involvement of fatigue, with responses recorded in the crash reporting system.

Conclusions

A pathway forward has been suggested so that fatigue crashes can be more accurately identified and reported in policereported crash databases leading to more reliable quantification of the contribution of fatigue to crashes in South Australia. Ultimately, accurate information about fatigue crashes will assist in future investment in more targeted driver fatigue education campaigns and appropriate infrastructure to prevent road trauma.

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Abstract

As part of a larger study, the current study conducted an intercept survey of eRiders and non-eRiders (pedestrians and cyclists) in Perth to gain insight into peoples' adherence to and awareness of current eRideable regulations. Other safety-related behaviours such as helmet compliance and eRideable speed were also assessed. Interestingly, while the results show that the majority of eRiders in Perth claim to have a good understanding of eRideable regulations, eRiders continue to flout these regulations and engage in risky behaviours that have the potential to cause injuries. When asked for their perspective on what could improve safety measures for eRiders and non-eRiders, many voiced the need for improved infrastructure. In addition, there was also some support for stricter enforcement of eRideable regulations and harsher penalties, as well as more widespread education about current eRideable regulations in Western Australia (WA).

Post on X

Are eRiders in Perth aware of safety regulations? This intercept survey gives us the answers.

Background

In recent years, eRideable devices⁹ such as eScooters, have gained popularity as a mode of personal transport. The introduction of eRideables have since brought about advantages including saving time in traffic, decreasing transport costs, and encouraging more people to adopt more active lifestyles. However, the newfound popularity of eRideable devices has also given rise to safety concerns about the usage of such devices in WA. Although the Road Safety Commission of WA has introduced eRideable regulations (Road Safety Commission, 2024), such rules may not be stringently enforced, and the public may not be aware of these regulations.

As part of a larger study, the current study comprised an intercept survey to understand the public's compliance and awareness of eRideable regulations, as well as assessing other safety-related behaviours of eRiders in Perth. The study aims to shed light on the current state of eRideable safety practices and provide valuable insights for policymakers and stakeholders to enhance safety measures and promote responsible eRideable usage. The findings of our study can help mitigate safety concerns, potentially encouraging more widespread adoption of eRideable devices as an eco-friendly mode of transportation, and ultimately contributing to the reduction of environmental pollution.

Method

For the first two weeks of December 2023, 10 research assistants were allocated to 10 different sites to hand out business cards to eRiders and non-eRiders. eRiders were people who used eRideable devices such as eScooters, eSkateboards, eWheels, eUnicycles, hoverboards and eSkates. Non-eRiders were pedestrians and cyclists. These business cards contained a QR code that linked to a Qualtrics survey for the respondent to fill out. Each research assistant handed out cards for 14 days, covering two Saturdays and two Sundays; and for six hours each day, from 8am to 11am and from 3pm to 6pm.

⁹ According to the Road safety Commission website, an eRideable device is an electric rideable device that:

- Has at least one wheel
- Is designed for one person
- Doesn't go faster than 25km/h on level ground
- Weighs 25kg or less
- Is no more than 125cm long, 70cm wide and 135cm high
- Examples include eScooters, eSkateboards, hoverboards, eSkates and eUnicycles.
- Refer to Figure 1 examples of eRideable.
- 2024 Australasian Road Safety Conference

³⁰ September - 3 October, Hobart, Tasmania, Australia

eScooter	Hoverboard	eSkateboard
-	Š	Ţ.
eSkate	eUnicycles	eWheel

Figure 1. Examples of eRideables

Results

A total of 42 eRider responses and 223 non-eRider responses were received. For both groups, respondents were mostly aged 17 to 34, (35% of eRiders and 31% of non-eRiders) and male (60% of eRiders and 53% of non-eRiders. The most common mode of transport amongst both groups of respondents is by driving in a car (42% of eRiders and 53% of non-eRiders). When asked how long the eRiders had owned their devices for, 43% of respondents said that they owned their devices for less than six months, and the main reasons were to save money and avoid traffic. Contrastingly, 41% of non-eRiders raised safety concerns as the main reason why they avoided using an eRideable device, and 26% of non-eRiders mentioned purchase cost as a barrier to eRideable use.

A large proportion (77%) of non-eRiders have witnessed eRiders engaging in risky behaviours such as not wearing a helmet, and 73% of non-eRiders have witnessed eRiders going too fast¹⁰. Correspondingly, 52% of eRiders have also admitted to speeding on their devices, and 48% of eRiders role on a road with a speed limit of greater than 50km/h (which is illegal in WA).

While around 37% of eRiders reported not having experienced any negative events, in contrast, 56% of non-eRiders have witnessed or experienced near misses with eRideable users. For both groups of respondents, around 20% have witnessed or experienced a non-injury crash incident with an eRideable device. When asked who was responsible for such occurrences of negative events, 22% of eRiders and 75% of non-eRiders blamed other eRideable users, and 22% of eRiders also faulted pedestrians.

When asked for a rating of their awareness of the rules of eRideable use in WA, the majority (53%) of eRiders claimed to have a clear understanding of the rules. However, more than half (55%) of non-eRiders claimed to have heard of the rules but were unsure what they were. Both groups of respondents mentioned similar factors that would improve the safety of eRideable use in WA, especially better infrastructure to support eRiders, e.g. more dedicated paths and lanes for eRideables users. ERiders and non-eRiders often expressed the necessity for enhanced law enforcement and improved education regarding eRideable regulations.

¹⁰ We define 'Going too fast' as going too fast for the comfort of non-eRiders.

²⁰²⁴ Australasian Road Safety Conference

³⁰ September - 3 October, Hobart, Tasmania, Australia

Conclusions

Despite a majority of eRiders claiming to be familiar with eRideable rules, many still engage in risky behaviors such as neglecting helmet use and speeding. This suggests that eRiders tend to underestimate the dangers of using these devices, increasing the likelihood of crashes and resulting injuries to themselves and others.

Both eRiders and non-eRiders expressed a need for enhanced infrastructure to support responsible eRideable use and mitigate conflicts between road user groups. Furthermore, there seems to be some consensus for more rigorous law enforcement with harsher penalties, and greater emphasis on educating the public about eRideable regulations.

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Modelling KSI reductions of potential lower speed limits in WA

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Abstract

This project aimed to support efforts to meet 2030 road safety strategy targets by identifying countermeasures that would significantly reduce the number of people Killed or Seriously Injured (KSI) on Western Australian (WA) roads within the next 5-10 years, with a focus on speed limit reductions. A literature review was conducted to identify promising countermeasures and then modelling was undertaken to quantify their impact on KSIs. The literature indicated a well-established relationship between travel speed reductions and improvements in road safety outcomes, with speed limit reductions more effective if accompanied by supporting infrastructure, enforcement, and education. Modelling found that reducing speed limits by 10 km/h could prevent thousands of KSIs over a 9-year period, with the single reduction likely to prevent the most KSIs being 60 km/h to 50 km/h. However, the real or perceived lack of community support is a primary challenge to implementation.

Post on X

Lowering speed limits by 10 km/h could prevent more than 4,000 deaths and serious injuries in WA by 2030.

Introduction

The National Road Safety Strategy 2021–30 sets challenging targets of reducing fatalities by 50 per cent and serious injuries by 30% by 2030 and identifies speed management as an important underpinning of all strategy themes. The National Road Safety Action Plan 2023-25 commits to developing regulatory impact statements on reducing the open road and unsealed road default speed limits. The Western Australian (WA) Government's Driving Change – Road Safety Strategy for Western Australia 2020–2030 targets to reduce deaths and serious injuries by 50-70 per cent rely heavily on reductions in speed limits. For example, during consultation for the WA strategy, modelling a 50 per cent Killed or Seriously Injured (KSI) reduction required all speed limits between 40km/h and 100km/h being reduced by 10km/h in addition to a significant increase in spending on road safety infrastructure (Road Safety Commission, 2019).

The purpose of this project was to identify road safety countermeasures that would significantly reduce the number of KSIs on WA roads within the next 5-10 years, with a focus on speed limit reductions. Once potential countermeasures were identified, it was then necessary to quantify the impact of these countermeasures on KSIs to guide prioritisation. In addition, key enablers and barriers to implementation were identified, including any potential negative externalities.

Method

The research was undertaken in three stages. Firstly, a literature review was conducted to identify road safety countermeasures (including a range of potential speed limit reductions) and to determine their effectiveness based on crash reduction factors reported in evaluations. In March 2022, the TRID, PubMed, ProQuest, ScienceDirect, Informit, and SafetyLit databases were searched for publications after January 2000 relevant to this topic. Publication repositories of major Australian road safety research bodies (MUARC, CASR and CARRS-Q) were also searched. The review included documents published in English from all countries, in rural and urban settings. In addition, the reference lists of identified documents were searched to identify other relevant documents.

Secondly, WA crash data was used to develop crash severity (CS) models for motor vehicle occupants, motorcyclists and cyclists/pedestrians to understand which crash characteristics (for example which speed limits) are more strongly associated with KSIs. The process of analysis using CS models is presented in Figure 1.

Thirdly, the reductions in KSIs for 2016-2021 for the relevant policy actions were computed using two different approaches:

- 1. KSIs reduction factors were computed by applying the elasticities from the models to the reductions in number of KSIs for the targeted policy action, and
- 2. The KSIs reduction factor identified from the literature were used to estimate the reduction in the number of KSIs for the targeted policy actions.



Figure 1. Crash Severity (CS) Analysis Procedure

Results

Literature review findings

The relationship between travel speed reductions and improvements in road safety outcomes is well-established (Elvik et al., 2019). However, there is a real or perceived lack of community support (van Souwe et al., 2018). The extent to which speed limit reductions result in reduced travel speeds depends on supporting infrastructure, enforcement, and education (Sadia et al., 2018). Point-to-point speed enforcement holds promise for major routes where vehicle volumes are higher (Cameron, 2008). Consideration should be given to combining speed limit reductions and infrastructure improvements near regional towns, where traffic volumes, community support and enforcement availability may be greater than away from towns.

Safety improvements resulting from speed limit reductions

The crash severity modelling demonstrated that vehicle occupants and motorcyclists are more likely to be KSI when involved in a crash on higher speed roads. Widespread speed limit reductions had the greatest impact on KSIs in Western Australia, ahead of infrastructure improvements such as the Regional Road Safety Program and vehicle safety improvements such as reducing the age of the fleet. The predicted effects of the identified speed limit reductions are presented in Table 1. Where there is a single number presented, these predictions are based on the percentage reduction for that change from the literature review. Where the prediction is presented as a range, the first value is based on the percentage reduction derived from the crash severity modelling and the second value is derived from the literature review.

Table 1. Predicted cumulative reductions in KSI for targeted crashes.

	From 2022 to end 2025		From 2022 to er	nd 2030
	KSI reductions	KSI cost savings	KSI	KSI cost savings
		(\$millions)	reductions	(\$millions)
10 km/h reduction to all speed limits	2469	4225.07	4065	6929.21
greater than 40 km/h*				
70 km/h to 60 km/h	152 - 363	249.00 - 433.60	328 - 597	364.96 - 711.24
60 km/h to 50 km/h	675 - 698	709.82 - 1104.59	1109-1424	1165.33 - 1642.58
50 km/h to 40 km/h	321	444.75	528	731.8
110 km/h to 100 km/h on regional roads	113 - 347	195.99 - 940.77	248-569	284.96-1544.48
Maximum speed limit of 60 km/h on	13 – 25	16.95 - 55.38	25-41	24.74 - 90.3
metropolitan roads used by pedestrians				
and cyclists (Benefit for these users only				
shown)				

* prediction based on percentage reduction obtained from literature review. Greater than the sum of other measures in the table because 100-90 km/h, 90-80 km/h, 80-70 km/h also included. Open and unsealed roads are also included.

Benefits to road safety

The modelling demonstrates that lowering all speed limits by 10 km/h could prevent over 4,000 serious injuries and fatalities resulting from road traffic crashes between 2022 and 2030 in Western Australia. Reducing 60 km/h speed limits to 50 km/h has the greatest single reduction of all road speed limits, with a reduction of all speed limits demonstrating KSI benefits (see Table 1).

Implications for policy and practice

There is a well-proven, consistent relationship between travel speed reductions and a reduction in the likelihood and severity of crashes. The observed reductions in mean travel speeds are often only a fraction of the posted speed limit reduction. Nevertheless, a substantial drop in KSIs is still observed, with a 10km/h speed limit reduction typically reducing KSIs by 20 per cent. The impact of speed limit reductions on mean travel speeds and therefore on KSIs can be strengthened with supporting infrastructure, education and enforcement (see Figure 2). The use of modelling to identify countermeasures that could have the largest impact on KSIs enables funding to be targeted towards countermeasures which offer the greatest overall benefit.



Figure 2. Policy actions to support speed reductions

Conclusions

Speed limit reductions offer great potential for helping governments achieve their 2030 road safety strategy targets. A substantial reduction in fatal and serious injury crashes is observed even with modest speed limit reductions. Modelling found that reducing speed limits by just 10 km/h could prevent thousands of KSIs over a 9-year period, while the single speed limit reduction likely to prevent the most KSIs is reducing 60 km/h speed limits to 50 km/h. Speed limit reductions may be more effective if implemented alongside supporting infrastructure such as raised platforms, gateway treatments, vehicle-activated signage, transverse rumble strips and self-explaining roads. Real or perceived lack of community support, as well as the cost of supporting measures, are key implementation challenges for speed limit reductions. These challenges can be overcome by combining speed limit reductions and infrastructure improvements near regional towns, where traffic volumes are sufficient to justify investment in enforcement and infrastructure.

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MotoCAP program enhances motorcycle clothing safety in Australasia

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Abstract

Since the commencement of the MotoCAP program, numerous products, including jackets, pants, and gloves, have undergone testing. This research analysed jackets and pants tested by MotoCAP, revealing trends in impact protection over a seven-year database. This included assessing presentation and the protection level of the impact protectors in the garments. The findings indicate that an increased number of garments attach the armours and the protection levels have been improved compared to the earlier stages. Notably, the MotoCAP program has exerted positive influences on the motorcycle clothing markets. Specifically, the MotoCAP program has played an important role in quality supervision for promoting market development , by encouraging manufacturers to meet higher standards, and incentivizing them to enhance the quality of their products. This collective effort contributes to enhancing overall safety within the motorcycle community.

Post on X

This project provides the positive influences of MotoCAP program on the impact protection of Australasian motorcycle clothing.

Background

It has been acknowledged that motorcyclists in Australia face a significantly higher risk of serious injury or fatal road crashes compared to other road users (de Rome, 2022; Government, 2021). Wearing protective gear while riding a motorcycle proves to be an effective means of minimizing the severity of injuries during a crash (de Rome et al., 2011; de Rome et al., 2012). Quality protective gear, encompassing helmets, jackets, pants, gloves, and boots, forms a vital defence for riders. Engineered to absorb impact and guard against abrasion, these items significantly enhance overall rider safety. Researching impact armour products is essential for improving the protective capabilities of motorcycle garments.

MotoCAP enhances access to climate-specific protective gear for motorcyclists (Hurren et al., 2022). The new star rating system evaluates and guides the selection of high-quality motorcycle clothing based on rigorous testing for protective capabilities and breathability (MRJ Baldock, 2022). The program focuses on evaluating market products, ensuring reliable and representative results from randomly selected items. This is achieved by comprehensively covering a wide range of stores, including both physical and online stores, across Australia and New Zealand.

This project analysed more than 400 jackets and 200 pants through 7 years tested by MotoCAP. The limited 43 data groups are available for the contract year 2023-2024, as ongoing testing and rating processes are still in progress for bulk samples. This research on the trends in product changes is reflecting a dynamic and evolving landscape in the motorcycle clothing market, serving as indicators for the overall industry development, providing valuable insights and guiding manufacturers toward potential development directions.

Results

As analysis of the quantities of individual MotoCAP test impact protectors, the trends have been shown in Figure 1. Despite the hip consistently having the lowest presence of armours over the past seven years, it's essential to note a significant rise in the hip position. In contrast, there is only a minor increase observed for the elbow, shoulder, and knee positions.

Figure 2 illustrates impact results—mean force in kilonewtons (kN)—reflecting the average force transmitted through each impact protector type. A lower mean force signifies superior protection. The data reveals decreasing trends in mean force for all four protector types (elbow, shoulder, knee, and hip) from 2017 to 2023, indicating an enhancement in impact protection. It's highlighting that there is a noticeable increase in the protective capabilities of armours for the knee position compared to those for other positions. This observation is supported by the column graph in Figure 3, which emphasizes a significant rise in the application of level 2 armours for the knee regions. European Standard EN 1621-1:2012 (Standard, 2012) defines two levels of performance for CE approved protectors. Level 1 represents that less than 35 kiloNewtons (kN) are transferred through the armour part, while Level 2 indicates that less than 20 kN are transferred. In theory, CE Level 2 offers superior protection compared to Level 1. Therefore, a higher proportion of Level 2 application in knee area results in its increased protection.



Figure 1. Percentage trend of garments with armours from 2017 to 2024



Figure 2. Impact protector mean force of individual protector (the dash lines show the fit linear trendline)



Figure 3. Percentage of CE levels application for knee impact protector across different years (the dash lines show the fit linear trendline)

Extended Abstract (Researcher)

In addition to the change in CE level, various enhancements in armour design contribute to the positive trend in impact protection outcomes. Figure 4 shows the brief developmental history of armours, where the initial black ones (a) and (b) were used for a decade before being replaced by the yellow variant (c), offering improved protection. Recently, there has been a shift towards structural designs (d) as well as thinner and more flexible armours (e) and (f), gaining popularity for their increased breathability compared to (c). Manufacturers are encouraged to continue enhancing the quality of their products by improving the material properties and refining structural designs, aiming for greater flexibility, comfort and heightened protection.



Figure 4. Images of armours

Conclusions

MotoCAP aims to enhance safety standards and reduce the risks associated with motorcycle riding, evident in positive market development reflected in tested data. The project highlights increased armoured garments and improved impact protection, indicating heightened manufacturer awareness of safety concerns, especially the insufficient protection in numerous products. This translates to substantial benefits for riders, contributing to enhanced safety and well-being. The findings anticipate a continued positive trend in protective measures, potentially saving riders costs by avoiding inadequate garments and improving rider safety. We acknowledge the MotoCAP program for the use of these test results.

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