



Journal of the **Australasian College of Road Safety**

Formerly RoadWise – Australia's First Road Safety Journal



Special Issue - Road Safety Research, Policing and Education

Peer-reviewed papers

- Investigating the factors influencing cyclist awareness and behaviour: an on-road study of cyclist situation awareness
- Evaluating the use of rural-urban gateway treatments in New Zealand
- Human body modelling of motorcyclist impacts with guardrail posts
- Age and gender differences in perceptions of traffic risk and safety for older pedestrians in metropolitan Sydney

Contributed articles

- Road to Respect roadshow
- Evaluating a package of interventions to improve young driver safety
- The Transportation of Children and Youth with Additional Needs (TOCAN) partnership
- 2020 Vision Zero: to share or not to share the way

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Contents

From the President.....	3
Diary.....	3
Guest Editor.....	4
College news.....	5
Welcome to new corporate members.....	5
Chapter reports.....	5
Other news.....	5
Peer-reviewed papers	
Investigating the factors influencing cyclist awareness and behaviour: an on-road study of cyclist situation awareness - PM Salmon, MG Lenné, GH Walker and A Filtness.....	7
Evaluating the use of rural-urban gateway treatments in New Zealand - T Makwasha and B Turner.....	14
Human body modelling of motorcyclist impacts with guardrail posts - MR Bambach and RH Grzebieta.....	20
Age and gender differences in perceptions of traffic risk and safety for older pedestrians in metropolitan Sydney - CA Gorrie, LG Larsen and PME Waite.....	28
Contributed articles	
Road to Respect roadshow - P Frauenfelder.....	37
Evaluating a package of interventions to improve young driver safety - P Graham.....	46
The Transportation of Children and Youth with Additional Needs (TOCAN) - H Lindner.....	54
2020 Vision Zero: to share or not to share the way - G Grossbard, R Atkinson, D Cass, J Woolley, B Corben and M Whear.....	57
Poster	
Travelwise School – Road Safety Poster Award for the best poster - C Dixon.....	61



Cover image

Driving simulators can replicate a range of road conditions and driver responses. Image provided by Warrington Photography.

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From the President



Dear ACRS members,

In our last Journal I commented that road safety management in public policy is something of a moving feast.

That has now been reinforced with the swearing in of a new Australian government. There is no specific

road safety minister, but this government has quite a specific national road safety policy.

Collaboration is a key focus of this policy, a policy which I hope will also help us across the region and internationally. We look forward to working with the new government, and all those encompassed within the community, to ensure the goals of the National Road Safety Strategy 2011-2020 are achieved.

In this edition of the ACRS journal you can read of developments from the Royal Australasian College of

Surgeons Trauma Seminar, “2020 Vision Zero: to share or not to share the way”, and also from the well-attended Australasian Road Safety Research, Policing and Education Conference held in August in Brisbane.

A timely article is the report on the TOCAN project, winner of the 2012 3M-ACRS Road Safety Award last year - timely as we are coming around to the presentation of the 2013 3M-ACRS Award at our conference in Adelaide in November. These awards recognise innovation in road safety projects, demonstrating that there are opportunities for new ideas to improve road safety results and reduce unnecessary trauma.

This year’s ACRS conference contains a special stream on what factors influence the public perception of road safety. This theme in particular will encourage us to focus our areas of impact to hasten reductions in road trauma over the next decade.

I look forward to seeing many of you at the conference in Adelaide.

*Lauchlan McIntosh AM FACRS
ACRS President*

Diary

6 – 8 November 2013

ACRS Conference
National Wine Centre of Australia
Adelaide
<http://acrs.org.au/conference/>

10 November

Sutho Cops and Rodders Road Safety and Car Show
Boys Town Playing Fields, Woronora Road, Engadine, NSW
www.police.nsw.gov.au/community_issues/sutho_cops_and_rodgers_road_safety_and_car_show

11 – 13 November 2013

11th Australasian Injury Prevention and Safety Promotion Conference
The Esplanade Hotel, Fremantle, Western Australia
<http://www.injuryprevention2013.com.au/>

12 – 14 November 2013

National Local Roads and Transport Congress
Alice Springs Convention Centre, Alice Springs, Northern Territory
<http://alga.asn.au>

20 – 21 November 2013

Cycling Safety Conference
Helmond, The Netherlands
<http://icsc2013.blogspot.nl/>

25 – 27 November 2013

Low Volume Roads Symposium, QLD 2013
Cairns Hilton Hotel, Cairns QLD
www.arrb.com.au/LowVolumeRoadsSymposium2013

7 May 2014

Fifth International Speed Congress
IMEchE, One Birdcage Walk, London
<http://speedcongress.com>

Guest Editor

Dr Nerida Leal

Principal Behavioural Scientist
Department of Transport and Main Roads, Queensland

The Department of Transport and Main Roads (TMR), Queensland, hosted more than 400 delegates at the Australasian Road Safety Research, Policing and Education Conference in Brisbane from August 28 to 30, 2013. This conference is the premier annual road safety conference in Australasia and brought together leading researchers, practitioners and policy-makers from Australasia and overseas to share knowledge about best practice in road safety.

The conference program included three keynote presentations touching on each element of the conference theme of “**vision, action, results**”; as well as 36 concurrent presentation sessions that focussed on the evidence currently available, and how everyone with an interest in road safety can work together to achieve the targeted reduction in serious casualties. The conference website (available until the end of 2013) can be found at www.rsrpe2013.com.au.

The Australasian College of Road Safety (ACRS) had a trade display at the conference and have published the

conference papers on the ACRS website: <http://acrs.org.au/publications/conference-papers/database/>.

I have been offered the privilege of serving as Guest Editor of this edition of the Journal of the Australasian College of Road Safety, which includes the papers and poster of winners of the conference awards:

- **Paul Salmon** – Peter Vulcan Award for the best research paper;
- **Tariro Makwasha** – John Kirby Award for the best paper by a new researcher;
- **Peter Frauenfelder** – Road Safety Practitioner’s Award, sponsored by the Australasian College of Road Safety, for the best practitioner paper;
- **Paul Graham** – Conference Theme Award, which similar to the award presented at the 2012 conference, recognises the conference paper that best fit the theme of “vision, action, results”; and
- **Claire Dixon** – Road Safety Poster Award for the best poster.

I hope you will enjoy reading the award winning papers and poster as much as the conference delegates enjoyed these presentations. Please also visit the ACRS website to read the rest of the great conference papers we received. I look forward to catching up with you at future conferences.



Paul Salmon



Tariro Makwasha



Peter Frauenfelder



Paul Graham



Claire Dixon

College news

Corporate members

The College welcomes the following new corporate members:

Ingal Civil Products
Pitt and Sherry

Chapter reports

New South Wales (Sydney) Chapter

September ushered in a new experience for the NSW (Sydney) Chapter: our first joint remote seminar with the Queensland Chapter, thanks to access to technology available through Queensland University of Technology and The George Institute for Global Health, Sydney. We collaborated with the Queensland Chapter to link into a presentation by Mr Dan Mayhew, Senior Vice President of the Traffic Injury Research Foundation, Canada, entitled *Young and Older Drivers: High Risk for Different Reasons*. The Sydney venue had two screens displaying real-time footage: one of the Queensland venue podium and one of the presentation slides. The seminar was interactive with the audience in Sydney able to ask questions of the presenter. In addition, those unable to attend in person were able to

watch via a video link, which even included one person in New Zealand. This was also recorded and is now available for all to access at: www.carrsq.qut.edu.au/community/events.jsp. The presentation was very informative with lots of practical tips and I think a valuable resource for Members.

Clearly, I believe this event was a great success and I hope it becomes the first of many collaborative and interactive seminars between Chapters, and especially would like to be able to facilitate such access for Members in regional areas. I invite Members to let me or your local Executive Committee know if you have facilities available, as well as key seminar topics that are especially important for your region.

Looking forward, we have a further opportunistic seminar planned for December 4 this year. We will join with Neuroscience Research Australia (NeuRA) and Engineers Australia to host *Vehicle Safety: Bringing up the Rear*. This follows from research suggesting that while historically rear seats have been the safest in cars this might no longer be the case. NRMA will also be sponsoring an international guest speaker for this event. Look out for further details in the Weekly Alert.

***A/Prof Teresa Senserrick,
NSW (Sydney) Chapter Chair and Representative
on the Australasian ACRS Executive Committee***

Other news

2013 ARSRPE Conference papers now online: available on ACRS website

The College has received many enquiries from those interested in reading various papers presented at the ARSRPE conference and are pleased to report these are now available online on the ACRS website.

Papers can be downloaded from the Publications section of the ACRS website at the following address: <http://acrs.org.au/publications/conference-papers/database/>

Driver distraction conference papers now available

Professor Mike Regan, from TARS at the University of NSW and Professor Trent Victor, from Volvo Technology in Sweden, ran the Third International Conference on Driver Distraction and Inattention in Gothenburg, Sweden, between 4-6 September 2013. The conference attracted 145 delegates from 24 countries.

Peer-reviewed papers and PowerPoint presentations from the conference can be downloaded for free from the Conference Website at <http://www.distractionconference.com>

Austroads publication: assessing fitness to drive for commercial and private vehicle drivers

The publication *Assessing Fitness to Drive* contains medical standards to provide guidance to health professionals and driver licencing bodies on the health assessment of private and commercial drivers of heavy vehicles, light vehicles and motorbikes.

As a joint NTC and Austroads publication, the NTC has led the revision of the standards, including undertaking extensive consultation with medical professionals, driver licensing authorities, industry and drivers. The document is available at:

<https://www.onlinepublications.austroads.com.au/items/AP-G56-13>

US research reports on younger drivers and vehicle age


The NIOSH Center for Motor Vehicle Safety has released two new fact sheets to help young drivers stay safe on the job. These fact sheets, one for employers and the other for parents and young workers, present case reports and provide learning points and crash prevention recommendations for young drivers, parents and employers. Information on federal and state laws is also provided, as well as additional resources.

The new fact sheets are available on the NIOSH website: <http://www.cdc.gov/niosh/docs/2013-152/> (parent/young worker fact sheet).

<http://www.cdc.gov/niosh/docs/2013-153/> (employer fact sheet).

In addition, NHTSA's report on age and model year of vehicles involved in fatal crashes can be found at: <http://www-nrd.nhtsa.dot.gov/Pubs/811825.pdf>

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Peer-reviewed papers

Investigating the factors influencing cyclist awareness and behaviour: an on-road study of cyclist situation awareness

by Paul M Salmon¹, Michael G Lenné², Guy H Walker³ and Ashleigh Filtness⁴

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⁴ Centre for Accident Research and Road Safety Queensland, QUT, QLD

Winner of the Peter Vulcan Award for the best research paper, this peer reviewed paper was originally presented at the Australasian Road Safety Research, Policing and Education Conference held at Brisbane, Queensland, 28-30 August 2013.

Abstract

Situation awareness, one's understanding of 'what is going on', is a critical commodity for road users. Although the concept has received much attention in the driving context, situation awareness in vulnerable road users, such as cyclists, remains unexplored. This paper presents the findings from an exploratory on-road study of cyclist situation awareness, the aim of which was to explore how cyclists develop situation awareness, what their situation awareness comprises, and what the causes of degraded cyclist situation awareness may be. Twenty participants cycled a pre-defined urban on-road study route. A range of data were collected, including verbal protocols, forward scene video and rear video, and a network analysis procedure was used to describe and assess cyclist situation awareness. The analysis produced a number of key findings regarding cyclist situation awareness, including the potential for cyclists' awareness of other road users to be degraded due to additional situation awareness and decision making requirements that are placed on them in certain road situations. Strategies for improving cyclists' situation awareness are discussed.

Keywords

Cyclists, Road safety, Schemata, Situation awareness.

Introduction

Crashes involving different forms of road user colliding with one another (e.g. drivers and cyclists) represent a long standing intractable road safety problem [1]. The issue is particularly problematic when one of the road users is a vulnerable road user, such as a cyclist. In the case of cyclists, although an increased uptake in cycling for transport has many environmental, physical and psychological health benefits, there are concerns that it will create more trauma derived from crashes involving vehicles and bicycles. It has previously been estimated, for example, that the risk of death when cycling is 12 times higher than when driving a car [Pucher and Dijkstra, 2003; cited in 2]. Further, a comparison of exposure rates to crash rates reveals that cyclists have a greater exposure to injury and fatal crashes per time or distance than do drivers [3].

Although road safety researchers have examined cyclist crashes, the majority of the research in the area has focussed on overall crash and injury rates or crash characteristics (e.g. time of day) and risk factors (e.g. impairment, helmet use) [2]. To date there has been little research examining cyclist cognition and the influence of the road environment on cyclist cognition and behaviour. This leaves many questions unanswered. For example, Boufous et al. [2] reported that the majority of the cyclist crashes in Victoria, Australia during 2004 and 2008 occurred at intersections. Important avenues for further research then include how cyclist cognition and behaviour contributed to the crashes at intersections and further whether the design of the intersections themselves are shaping road user behaviour in a manner that creates collisions between cyclists and drivers.

When these issues are coupled with the fact that road environments have traditionally not been designed specifically to cater for cyclists' needs, understanding cyclist cognition and behaviour represents a pressing requirement for road safety research. In particular, how to support safe cyclist cognition, behaviour, and interactions with drivers through road design is an important line of inquiry for future road safety efforts.

It is argued in this paper that the ubiquitous human factors concept of situation awareness has a key role to play in understanding road user behaviour and preventing collisions between different road users. Situation awareness refers to how humans develop and maintain an understanding of 'what is going on' [4] and incorporates both the process of acquiring awareness and the product of awareness itself. In the road context, situation awareness has been defined as activated knowledge, regarding road user tasks, at a specific point in time [5]. This knowledge encompasses the relationships between road user goals and behaviours, vehicles, other road users, and the road environment and infrastructure. Despite being a critical commodity for cyclists, there has been no empirical research undertaken to understand what cyclist situation awareness comprises or whether current road environments support or hinder cyclists in their attempts to acquire and maintain an appropriate level of situation awareness for safe and efficient cycling.

This paper presents the findings from an exploratory on-road study of cyclist situation awareness in different road environments. The study involved assessing situation awareness across twenty participants whilst they negotiated an urban study route incorporating intersections, arterial roads and a shopping strip. The aim of the study was to explore what cyclist situation awareness comprised in terms of information derived from the road environment and the resulting 'activated knowledge', to examine differences in situation awareness across the different road environments studied, and to identify issues leading to degraded cyclist situation awareness.

Assessing situation awareness during on-road studies

The study used a network analysis-based approach to describe and assess cyclist situation awareness. This approach involves constructing situation awareness networks using data derived from the Verbal Protocol Analysis (VPA) method, which involves participants 'thinking aloud' as they cycle. The networks depict the information or concepts underlying awareness (nodes) and the relationships between the different concepts (links between nodes). For example, from the verbal transcript line, 'There is a parked car on the left' the resulting nodes and links are presented in Figure 1. This represents situation awareness since the cyclist is aware that there is a parked car on the left in the road ahead.

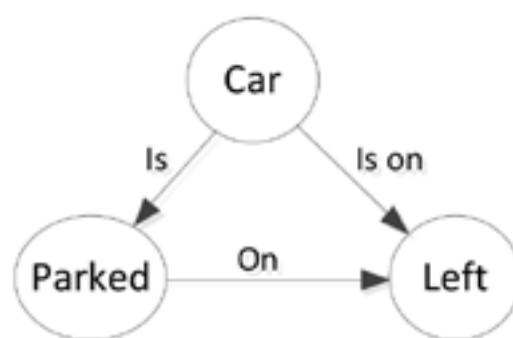


Figure 1. Example of situation awareness nodes and links

Analysis of the verbal transcripts provided by participants enables situation awareness networks to be constructed for different road environments and events. Once the networks are constructed, network analysis metrics are used to interrogate the content and structure of the networks. This enables comparison of situation awareness across different participants and scenarios.

Method

Design

The study was an on-road study in which participants cycled around a pre-defined urban route in the South East suburbs of Melbourne, Victoria. All participants provided concurrent verbal protocols as they negotiated the route. For each participant, situation awareness networks were constructed for three distinct road environments along the route: intersections (15 in total), arterial roads (approximately 6.2kms) and a shopping strip (approximately 0.5kms).

Participants

Twenty participants (15 male, 5 female) aged 18 – 58 years (mean = 32.4, SD = 10.42) took part in the study. The participants were experienced cyclists and at the time of the study cycled on average 6.85 hours per week (SD = 5.23). Participants were recruited through a weekly on-line university newsletter and were compensated for their time and expenses. Prior to commencing the study ethics approval was formally granted by the Monash Human Ethics Committee.

Materials

A demographic questionnaire was completed using pen and paper. A desktop driving simulator was used to provide training in providing concurrent verbal protocols. A 15km urban route was used for the on-road study component. The route comprised a mix of arterial roads (50, 60 and 80km/h speed limits), residential roads (50km/h speed

limit), and university campus private roads (40km/h speed limit). Participants cycled the route using their own bicycles. To record the cycling visual scene and the cyclist verbal protocols, the ATC9K portable camera was fitted to the cyclists' helmets, and cyclists wore Imaging HD video cycling glasses. In addition, an experimenter fitted with an ATC9K portable camera cycled behind each participant to record the cycling scene from the rear. A Dictaphone was fitted to the cyclists clothing to record the verbal protocols. All verbal protocols were transcribed using Microsoft Word. For data analysis, the Leximancer™ content analysis software and Agna™ network analysis software were used.

Procedure

In order to control for traffic conditions, all trials took place at the same pre-defined times on weekdays (10am or 2pm Monday to Friday). These times were subject to pilot testing prior to the study in order to confirm the presence of similar traffic conditions. Upon completion of an informed consent form and demographic questionnaire, participants were briefed on the research and its aims. Following this they were given VPA training in which they received a description of the VPA method and instructions on how to provide concurrent verbal protocols. They were then asked to complete a test drive on a desktop driving simulator whilst providing a verbal protocol and received feedback from an experimenter. This process continued until the experimenter felt that they were capable of providing an appropriate verbal protocol during the cycle. Whilst the participants were practicing verbal protocols the ATC9K camera was fitted to their own bicycle helmet by a technician. Once the VPA training was complete, participants were shown the study route and were given time to memorise it. Participants were then taken to their bicycle and asked to prepare themselves for the test. They were advised to cycle as they would normally cycle and to not modify their normal behaviour in any way during the study. Following this, the experimenter instructed the participant to begin negotiating the study route. An experimenter followed behind on a bicycle to record the cycling scene and to intervene if the participants strayed off route.

Participants' verbal protocols were transcribed verbatim using Microsoft Word. For data reduction purposes, extracts of each participant's verbal transcript for each route section (intersections, arterial roads, shopping strip) were taken from the overall transcript. The extracts were taken based on the video data and pre-defined points in the road environment (e.g. beginning and end of arterial roads). The verbal transcripts were then analysed using the Leximancer content analysis software which auto creates situation awareness networks. The networks were then entered into the Agna network analysis software program for content and structural analysis purposes.

Results

Two different forms of situation awareness network were constructed. First, overall situation awareness networks for all participants in each road environment were constructed in order to derive a generic overview of cyclist situation awareness at intersections and along the arterial roads and shopping strip. This led to the creation of three *overall* cyclist situation awareness networks. Second, individual participant situation awareness networks were constructed for each participant in each of the three environments studied. This led to the creation of 60 *individual* cyclist situation awareness networks.

Overall situation awareness networks

The overall situation awareness networks for each road environment studied are presented in Figures 2, 3 and 4.

The overall situation awareness network presented in Figure 2 gives a generic summary of the composition of cyclist situation awareness at the intersections along the route. The network shows that there is a focus on traffic (e.g. 'cars') and its location and behaviour (e.g. 'behind', 'coming', 'turning'), on checking the traffic situation (e.g. 'check'), on the lights and their status (e.g. 'lights', 'green', 'red', 'arrow') and on the road environment (e.g. 'road', 'lane'). Notable concepts within the intersection network



Figure 2. Overall cyclist situation awareness network for intersections

are 'service', which represents the service lane, 'lane', and 'crossing' which represents pedestrian crossings in and around the intersections. Further exploration of the verbal transcripts revealed that these concepts are derived from a major decision that cyclists face on approach to intersections regarding which path through the intersection they should take. Depending on traffic conditions, the intersection itself, and the perceived level of risk, cyclists can either turn right on the road within the flow of traffic, turn right via the pedestrian crossings and along the footpath, or turn right using a 'hook' turn whereby they proceed straight on through the intersection, join the traffic queue to the left hand side, and then wait for a green light and proceed straight through the intersection (achieving the originally desired right hand turn). Deciding which way to proceed through the intersection in the present study formed a major decision point for cyclists and incurred the need to assess the intersection itself, the traffic situation, and the level of perceived risk associated with each path through. Cyclist situation awareness on approach to intersections was found to be heavily focussed on information gathering for this decision. Notably, all three ways of passing through intersections for cyclists were observed during the study.



Figure 3. Overall cyclist situation awareness network for arterial roads

The overall situation awareness network presented in Figure 3 gives a generic summary of the composition of cyclist situation awareness along the arterial roads. Broadly the arterial road network comprises concepts similar to those found in the intersection network; however, there are notable differences. For example, the concepts 'parked' and related concepts 'cars' and 'room' relate to the potential hazard of parked cars on the side of the road and the cyclists being concerned as to whether there is room for them to pass the parked cars without coming into conflict with moving traffic on the road. In addition, the concepts 'service' and 'lane' derive from the cyclists deciding whether or not to enter the perceived safety of the service lane or to stay on the main road in the normal flow of traffic.

The overall situation awareness network presented in Figure 4 gives a generic summary of the composition of cyclist situation awareness along the shopping strip. The network shows that the cyclists' situation awareness along the shopping strip was markedly different to the intersections and arterial roads. Interesting features of situation awareness along the shopping strip include the presence of concepts relating to parked cars and their doors (e.g. 'parked', 'doors'), which derives from the cyclists constant monitoring of the threat of car doors being opened directly in front of them, and also the presence of pedestrian-related concepts derived from their constant monitoring of pedestrians in and around the shopping strip.

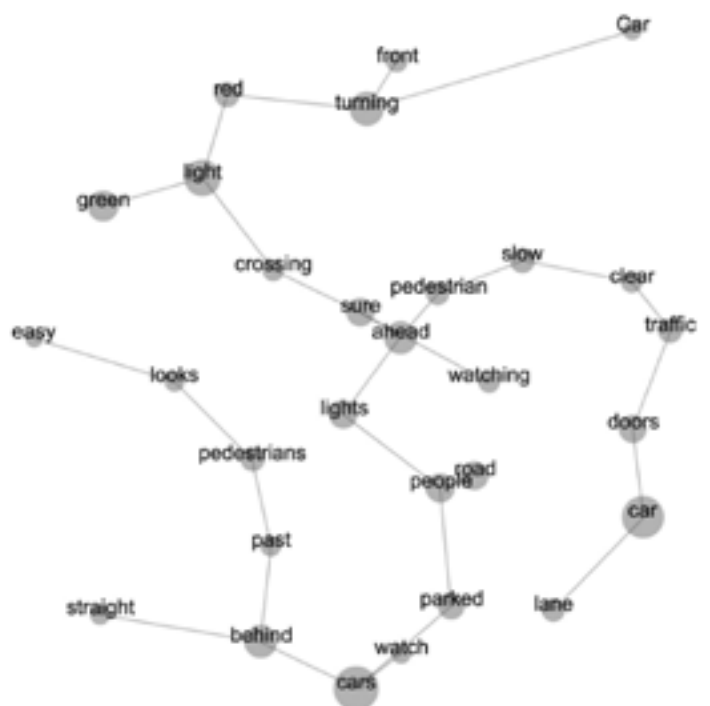


Figure 4. Overall cyclist situation awareness network for the shopping strip

Individual situation awareness networks

The 60 individual networks were further examined by coding the concepts into concept categories. The categories included physical and cognitive actions, infrastructure (e.g. lights), locations on the road (e.g. front, behind), time, risk, traffic etc. For example, the concept category ‘lights’ refers to all concepts related to traffic lights along the route, such as ‘lights’, ‘red’, ‘green’ etc. Frequency counts of the concepts within each category were then conducted. Percentages referring to the total percentage of concepts within each category expressed as a proportion of the total number of concepts for that road environment were then calculated.

The findings from this process were subsequently used to create generic cyclist phenotype schemata for each road environment. Stanton et al. [6] used Neisser’s perceptual cycle model to describe the schema driven nature of situation awareness, arguing that genotype and phenotype schemata drive, and determine the content of, situation awareness. For example, in the road traffic context, cyclists possess genotype ‘intersection’ schemata that become triggered upon encountering intersections. The task-activated phenotype schemata direct and guide cyclists’ interaction with the intersection and perception of it (what their expectations are, where they look, how they interpret information) and how they behave (whether they brake, change lanes, or accelerate through the intersection). The resulting interaction then modifies or confirms the genotype intersection schema which in turn influences behaviour at the next intersection and so on.

Generating generic cyclist phenotype schemata for the three road environments involved mapping the concept classifications onto Neisser’s perceptual cycle model. This was achieved by considering the concepts relating to *locomotion and action* and the *actual environment* to represent phenotype schema. The physical and cognitive action concepts (e.g. checking, looking, thinking, moving) were mapped onto the ‘locomotion and action’ and ‘perceptual exploration’ component of the perceptual cycle, whilst concepts classified as relating to parts of the road environment (e.g. Traffic, Traffic lights, Locations, Conditions) were mapped onto the ‘actual environment’ and ‘environmental information’ component of the perceptual cycle. This process resulted in a generic phenotype schemata representation for cyclists at each road environment (see Figure 5).

Overall, the phenotype classifications demonstrate that, regardless of road environment, the composition of cyclist situation broadly comprises activated knowledge related to cyclists own and other road users’ physical actions (i.e. what the cyclist and other traffic are doing), other traffic generally (e.g. drivers, pedestrians), cognitive actions (e.g. checking, looking), locations in the road (e.g. in front,

behind, to the sides, lanes), important road infrastructure and environment features (e.g. the traffic lights, road, road names), the conditions (e.g. wet, busy, slippery), time, level of risk, and communications (e.g. other road users communicating intentions). A notable finding from the analysis is that cyclist situation awareness includes a threat assessment component and a safest path component whereby they are constantly on the lookout for the safest path through different road environments (e.g. which path to take through intersections, whether or not to use the service lane or footpath, assessment of door threats).

Differences in phenotype schema were identified across the three road environments. At the intersections, a quarter of all situation awareness concepts related to physical actions (e.g. ‘riding’, ‘cycling’, ‘turning’, ‘stopping’, ‘clipping in’) and around 15% related each to traffic lights and their status and other traffic (e.g. ‘cars’, ‘pedestrians’). Road environment related concepts (e.g. ‘intersection’, ‘road’, 9%) and cognitive actions (e.g. ‘checking’, ‘deciding’, 8%) were the next most common concepts, followed by concepts relating to lane, areas (e.g. ‘front’, ‘behind’), conditions, risk, and time.

The arterial road networks produced a similar spread of concepts; however, traffic light-related concepts dropped to 8% and cognitive action-related concepts increased to 11%. Other concepts achieved similar percentages; however, notable inclusions in the arterial road networks included concepts relating to the footpath and service lane (3%), space (as in ‘is there enough space to get past, 2%), and the doors of parked cars.

More differences are present in the shopping strip phenotype. Here concepts relating to other traffic were the most prominent (23%), with physical actions dropping to 20%. Notably, concepts relating to space (6%), doors (4%) and the area behind the cyclist (6%) were more frequent along the shopping strip networks. In addition, a new category of concepts relates to the ‘shops’ along the strip (shops, 1%).

Discussion

The aim of this paper was to present the findings from an exploratory study of cyclist situation awareness. The findings reveal interesting features of cyclist situation awareness along with issues that could be adversely influencing cyclist situation awareness, behaviour, and ultimately cyclist safety.

Cyclist situation awareness

First, the analysis revealed that broadly, cyclist situation awareness comprises activated knowledge related to cyclists’ own and other road users’ physical actions, other traffic, cognitive actions, locations in the road, road

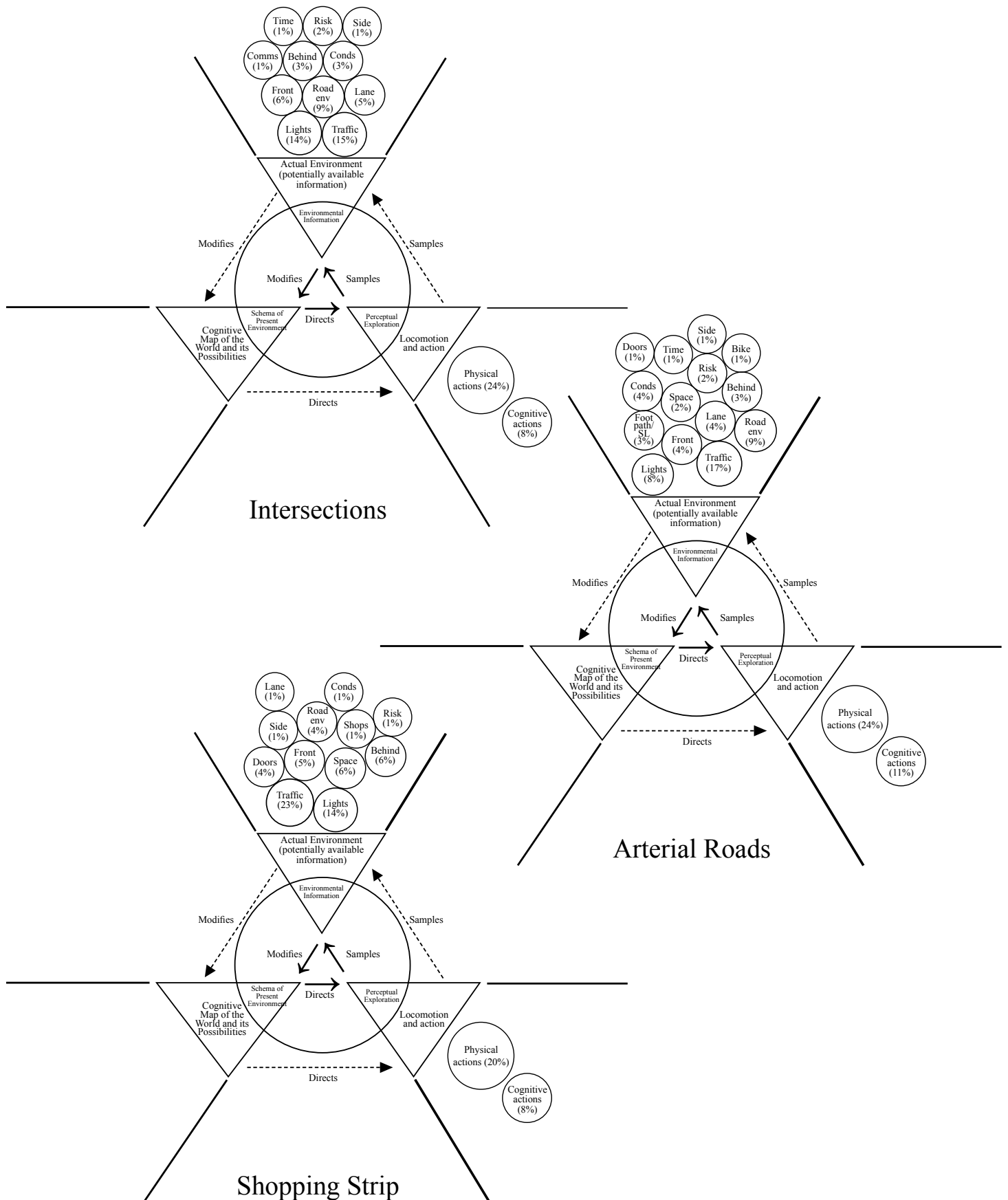


Figure 5. Summary of concepts within individual cyclist situation awareness networks. Number of concepts in each category are expressed as a percentage of the total number of concepts for each road environment

infrastructure and environment features, the conditions, time, level of risk, and communications. Whilst this is not groundbreaking, it reveals the generic make up of cyclist situation awareness and potentially provides a template for training novel cyclists in acquiring appropriate levels of situation awareness during on-road cycling. In addition, this information could be used in design efforts designed to support cyclist situation awareness. For example, the analysis highlights the importance for cyclists to engage in a continual risk assessment process including assessing the risk imposed by elements of the traffic situation including other traffic and the conditions (e.g. road surface, weather). The introduction of novel technologies or road design features to support this process would therefore likely be beneficial.

Second, the analysis indicates that cyclist situation awareness includes some notable features that require both further investigation and support through road design. For example, concepts relating to assessment of risk and threats were found across the different road environments, suggesting that threat assessment forms an important part of cyclist situation awareness (e.g. continual assessment of parked car doors). Further, a safest path component was also identified, relating to the process of assessing and selecting the safest path through different road environments (e.g. which path to take through intersections, whether or not to use the service lane or footpath along arterial roads). These features are interesting both in that they represent an additional level of workload over and above what other road users (e.g. drivers) experience and because they make cyclists unpredictable to other road users, since they have a range of paths that they may take at any given time. At intersections for example, they have a range of paths through (i.e. hook turn, in normal flow of traffic, filtering, on the footpath and via pedestrian crossings) and the timing of path selection is highly variable (ranging from a significant distance prior to the intersection to immediately before the intersection to at the intersection itself). Also notable is that these path decisions often take place in high traffic and complex situations in which there are a number of other important and safety critical situation awareness requirements. Finally, it is also notable that these features of cyclist situation awareness are design induced in that the way in which road environments are designed creates the additional workload and decision requirements. For example, the presence of parking in close proximity to cycle lanes brings with it the requirement to constantly monitor parked car doors and predict when doors might be opened by unaware drivers. The role of road design in supporting, rather than inhibiting cyclist situation awareness is therefore put forward as a key area for further research. Consideration of cyclists' situation awareness during road design efforts is also recommended as a key requirement for future road design efforts.

System redesign

One of the aims of the analysis presented was to identify opportunities to create interventions designed to support cyclist situation awareness, behaviour and safety. Although the study was exploratory in nature, the findings suggest that there are various avenues that can be pursued. The level of flexibility afforded to cyclists on roads is a key issue as it creates a decision load in already complex road environments (e.g. intersections) and makes them unpredictable to other road users. Supporting cyclists thus involves aiding the decision making process, reducing their unpredictability in high risk areas such as intersections, and/or making other road users aware of their range of possible behaviours. For example, the use of continuous and dedicated cycling lanes through intersections could potentially support cyclists in choosing their path through the intersection early and would also increase the likelihood that they would stick with their choice throughout the intersection. It would seem also that measures should be taken to make other road users (pedestrians, drivers) more expectant of cyclists' range of behaviours. At intersections, for example, drivers need to appreciate that cyclists may make major manoeuvres in close proximity to the intersection, in some cases even from the footpath or service lane along three lanes of traffic into right hand turn lanes. The use of cross mode training has previously been raised as a way of developing anticipatory schema that supports perception of other distinct road users [e.g., 7-8]. Cross mode training incorporating both cyclist and motorcyclist training for drivers is likely to increase their expectancy levels regarding cyclist and motorcyclist behaviours at intersections. Study of drivers with high levels of cycling experience may represent a first step in this process as they may reveal that driver-cyclists demonstrate an expectancy for different cyclist manoeuvres and the range of possible cyclist behaviours. There is also a clear role for road design, with dedicated cycling lanes (on the road and on the footpath) and signage warning drivers of the presence of cyclists and the likelihood that they will make major manoeuvres in different road environments such as intersections. In addition to the interventions proposed, testing of new training initiatives and road designs for their effects on cyclist situation awareness and behaviour are recommended.

As an exploratory study the analysis had some notable limitations. First, the study used a small participant sample size. Caution is urged, therefore, before the results are generalised to the overall road user population. Second, the use of advanced data collection platforms such as eye tracking devices would enable more robust assessments of cyclist situation awareness. Future studies incorporating eye tracking devices are planned by the research team.

Acknowledgements

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Evaluating the use of rural-urban gateway treatments in New Zealand

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Abstract

Speed has been widely identified as a leading factor in crash occurrence and severity. On rural networks, a key problem is speeding where vehicles transition from a high speed to low speed environment. Research has identified rural-urban gateway/threshold treatments as a speed reducing measure in transition zones. Gateways include the use of signs, road markings and lane narrowing to lower vehicle speeds and improve road safety. Although gateways have been used extensively, e.g. UK and New Zealand, there has been no comprehensive evaluation on their effectiveness in Australia or New Zealand. The main objective of this research was to assess the changes in crash frequency and severity attributable to the implementation of gateways over time. The study involved a before and after comparison

of crashes at treatment sites after gateways were installed compared to the general trend at similar sites across New Zealand over the same period. The study was designed as a non-equivalent quasi-experiment using 102 treated and 62 control sites. The results showed that gateways, particularly pinch point gateways, were effective in lowering crashes at rural urban transition zones in the New Zealand context.

Keywords

Crash modification factors, gateway effectiveness, gateway evaluation, New Zealand gateways.

Introduction and background

Speed has been identified as a leading factor in crash occurrence and severity, including on rural roads [1]. Although speed management techniques for urban roads are well documented, less has been done for rural roads. To this end, Austroads commissioned research to identify effective speed management measures for rural roads including the management of speed at transition zones. Transition zones

refer to road sections where vehicles move from high speed to low speed environments. Rural-urban gateway/threshold treatments were identified as a possible speed management measure at the transition zones.

Gateways are defined as a combination of traditional and non-traditional traffic calming measures designed to slow traffic entering low speed environments [2-3]. Treatments include the use of lighting, murals, signage, wall and fence structures, lane narrowings, surface markings, median treatments and vegetation to mark road sections where the speed environment changes or alert road users of changing road and traffic conditions (Figure 1). The type of treatment used depends on general guidelines, installation costs and availability of funds, road geometry, underlying concerns and, in some instances, public opinion. Although gateways have been used extensively, e.g. UK and New Zealand, there has been no evaluation on their effectiveness in Australia or New Zealand.

The broader aims of the research involved evaluating the effectiveness of gateways in lowering crashes and speeds as well as determining the economic viability of the treatment. This paper focuses on the effectiveness of gateways in lowering crashes.

Method

Gateway effectiveness was evaluated through a controlled retrospective before and after analysis of crash data at treatment sites across New Zealand. Given that other major

road safety campaigns and treatments were underway during the gateway implementation period, a comparison of crashes before and after gateway installations alone would not have accurately reflected the full effect of the treatment on safety outcomes. Consequently, the analysis was set up as a non-equivalent control group quasi experimental design as the sites were not randomly assigned to either treatment or control group and the probability of a site belonging to either group was not equal.

The analysis involved 102 treatment sites and 62 control sites across New Zealand's road network. The treatment sites included sites where gateways were implemented while the control sites were selected from comparable sites across New Zealand. The process involved matching town/township population sizes to those in the treatment group and ensuring that the selected sites had no existing gateways in place. Limiting the population size allowed for comparable road use estimates at both control and treatment sites, reducing the selection threat inherent in this type of experimental design.

Installation dates and gateway features in the control group were assigned using proportionate stratification. The number of control sites allocated to an installation year was proportionate to the number of treatment sites installed per year. Once the distribution of installation dates within the control group was determined, the dates were randomly allocated to the control sites. Using the same approach, it was possible to determine the distribution of gateway types within the control group. Gateway types and features were



Figure 1. Gateway treatment [4]

then randomly assigned to the control sites. This was done in order to reduce bias and systematic errors as well as provide a more consistent comparison basis.

Crash data

Crash data for the before and after periods was extracted from the New Zealand Crash Analysis System (CAS). The analysis periods covered five years both before and after the gateways were installed. This period took into consideration seasonal variations and was long enough to capture the habituation effect. The before period consisted of five full years of data for all locations while the after period ranged from one to five years of data, depending on the installation year. To counter these differences, the analysis was undertaken using crashes per year as the dependent variable rather than the number of crashes per site.

Earlier research on the effectiveness of gateways found significant speed reductions around the gateways dissipated about 250m downstream from the treatment [5]. With this in mind, the study covered road segments 100m in advance of the gateways, and through the full extent of the township for which the sign applied.

As the majority of treatment sites in this study, with the exception of three, were not selected on the basis of crash history but excessive speed, regression to the mean was not expected to be a significant problem.

To measure the effectiveness of gateway treatments, crash modification factors (CMFs) were developed. CMFs are estimates of changes in crashes due to the implementation of the treatment. They are derived from changes in crashes at treatment sites relative to expected crashes. Expected crashes are a function of the trend at control sites. They represent crashes that would have been observed had the treatment not been present.

Statistical analysis

The aim of the statistical analysis was to determine whether gateways significantly impacted crash frequency and severity and whether the scale and significance of the effect differed by gateway type and feature.

A log-linear model (primarily, a Poisson regression model with unequal time periods) would have been the preferred test for this type of exercise as it would allow the examination of conditional and interaction effects. However, data screening negated the use of a log-linear model due to insufficient expected crash counts in some of the cross tabulation cells from which the log-linear model is evaluated. Statistical testing was therefore undertaken using chi-square tests in SPSS (IBM Statistical Package for Social Sciences 21).

The p-value produced by this test and reported in the results represents the probability of the observed difference between crashes and expected crashes occurring in the absence of any treatment effect. Given the multiple levels of significance tests undertaken, the data was adjusted for type I error. Type I error involves accepting the null hypothesis when it is false. The significance tests in this study were adjusted for type I error using the Bonferroni correction indicated in Equation 1.

$$\alpha = \text{Target } p \text{ value} / n^1$$

where

n^1 = Number of significance tests undertaken

α = New alpha level

Analysis stratification

The data analysis was carried out in the following stages:

1. All sites where gateways were installed. This was an overall measure of gateway effects on crash frequency and severity. This stage included crashes at all sites, regardless of direction of travel and an additional analysis for relevant/affected direction of travel.
2. Sites where pinch point and sign only gateways were installed. All gateways were categorised into one of two broad groups; pinch point and sign only gateways. This level of evaluation measured the general impacts by gateway type.
3. Individual gateway type or configuration. This stage measured the impact of gateway features, e.g. a combination of flush median and solid island or hatched edges and flush median, on crash frequency and severity (see Figure 2).
4. Supplementary analysis. This level measured the magnitude of changes in crash frequency and severity by road type (arterial, collector, local and state highway), crash cause factors (vehicle movements) and rural urban transition speeds.

Results

The evaluation of before and after crashes at treatment and control sites showed an overall crash modification factor (CMF) of 0.74. This indicates a 26% reduction in crashes as a result of gateway implementation across New Zealand. The crash reduction was statistically significant at $\alpha = 0.0167$ significance level ($p = 0.002$)². The results discussed in this report are for both directions of study and so provide a conservative measure of the expected effect.

¹ $n = k(k-1)/2$ where k is the level of significance tests

² p values in this section are Bonferroni corrected. The Bonferroni correction is a multiple-comparison correction used when testing several dependent and/or independent variables simultaneously.

A comparison of crash severity before and after gateway implementation is outlined in Table 1. The results show reductions in serious and minor injury crashes of 32% and 27% respectively (CMFs of 0.68 and 0.73). The results also show an increase in fatal crashes of 79%. The results indicate an increase in the relative risk of fatal crashes and reductions for all other crash types with serious injury crashes having the lowest risk levels. The changes were statistically significant for minor and serious injury crashes but not for fatal crashes. In keeping with the Safe System approach, an analysis of the combined changes in fatal and serious crashes was also undertaken. There was a 23% statistically significant reduction in these severe outcome crashes.

Table 1. Crash frequency and severity analysis

Severity	Control		Treatment		CMF
	Before	After	Before	After	
Fatal and serious	26	24	25	18	0.77
Fatal	4	2	3	3	1.79 ^a
Serious	22	21	22	14	0.68
Minor	64	66	66	50	0.73
Overall	90	90	91	67	0.74

Bold indicates result was statistically significant at $\alpha = 0.008$ significance level

^a Net increase in crashes

Analysing the crashes by gateway type (pinch point and sign only gateways) showed an increase of 3% in crashes at sign only gateways and a 35% reduction at pinch point gateways (CMFs of 1.03 and 0.65 respectively). The changes were statistically significant for pinch points but not for sign only gateways as outlined in Table 2. The results also show the impact of gateways on crash severity by gateway type. There were non statistically significant increases in all injury crash types at sign only gateway sites as well as fatal crashes at pinch point gateways. On the other hand, the crash reductions at pinch point gateways were 51% and 33% for serious and minor injury crashes respectively.

Table 3 shows overall reductions in crashes for the different gateway features. The lowest risk levels were observed at coloured surface gateways (CMF of 0.20). However, these sites also had the least number of crashes.

Secondary objectives of this analysis included determining whether gateway effectiveness varied by road type and the rural-urban transition speed as well as differences by road type.

Figure 3 shows the expected and observed crashes for selected transition zones. There were statistically significant crash reductions of 17% and 29% for the 100-80 km/h zone 100-70 km/h respectively. On the other hand, non statistically significant increases of 1% and 68% in crashes were observed for 100-50 km/h and 70-50 km/h transition zones respectively.



Figure 2. Gateway classifications for analysis (Source: New Zealand Transport Agency)

Table 2. Crash frequency and severity by gateway type

Gateway type	Severity	Control		Treatment		CMF
		Before	After	Before	After	
Sign only	Fatal	1.2	1.0	0.4	0.5	1.35
	Serious	8.2	5.2	4.0	4.2	1.66
	Minor	28.2	27.6	13.4	11.9	0.91
	Fatal and serious	9.4	6.2	4.4	4.7	1.16
	Total	37.6	33.8	17.8	16.6	1.03
Pinch point	Fatal	2.4	1.4	2.2	2.7	2.06
	Serious	14.2	16.1	18.4	10.2	0.49
	Minor	36.0	38.3	52.8	37.8	0.67
	Fatal and serious	16.6	17.5	20.6	12.9	0.59
	Total	52.6	55.8	73.4	50.6	0.65

Bold indicates result was statistically significant at $\alpha = 0.005$ significance level

Table 3. Crash frequencies by gateway features

Gateway	Control		Treatment		CMF
	Before	After	Before	After	
Flush median	12.2	11.2	15.2	5.8	0.42
Solid island	1.2	1.4	8.6	7.9	0.78
Coloured surface	0.4	2.0	1.4	1.4	0.20
Flush median and solid island	4.8	4.8	10.0	6.2	0.62
Flush median and hatched edges	6.8	5.7	21.6	12.9	0.72
Solid island and hatched edges	5.0	5.8	7.4	9.8	1.14

Bold indicates result was statistically significant at $\alpha = 0.005$ significance level

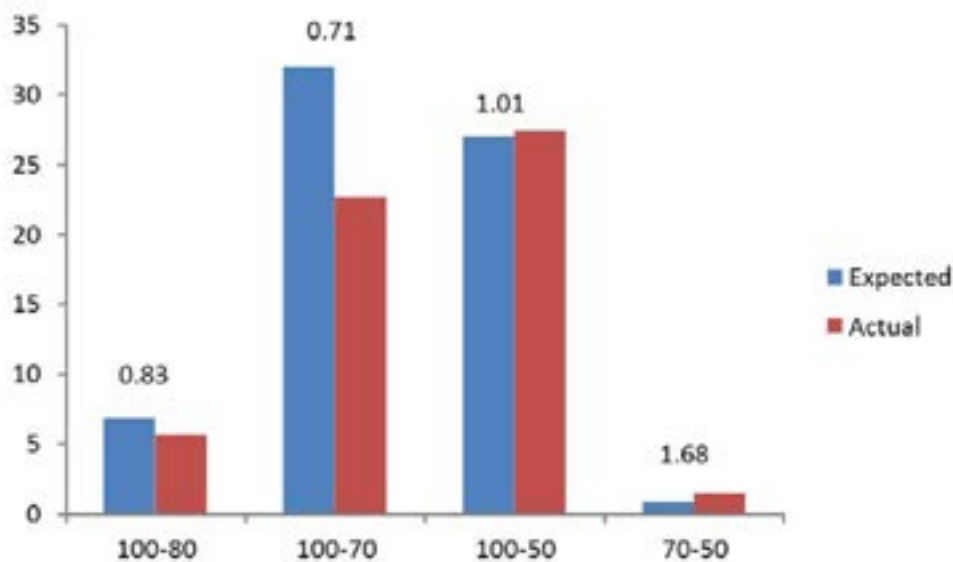
**Figure 3. Crash frequency by transition zones**

Table 4 shows changes in crashes for the different rural urban speed zones by gateway type. The results indicate increases of 218% and 59% at the 100-80 km/h and 70-50 km/h with pinch point gateways respectively. At the same time, there were overall increases for the sign only gateway transitions except for the 100-80 km/h transition. A comparison of crash changes at the 100-70 km/h transitions for both pinch point and sign only gateways showed significantly higher reductions at pinch point gateways.

Further analysis of before and after crashes by selected vehicle movements was undertaken. The main interests from this sub analysis were pedestrian and speed related movements. The results for the specified movements are outlined in Table 5. There were non statistically significant increases in head on crashes at pinch point gateways and pedestrian related crashes at sign only gateways. The highest crash reductions were in head-on crashes at sign only gateways and pedestrian related crashes at pinch point gateway sites, both of which were statistically significant.

Analysing crashes by road classifications and gateway types illustrated increases of 2% and 108% on state highways and arterial and collector roads with sign only gateways and 113% on arterial and collector roads with pinch point gateways respectively. The crash reduction was highest on arterial roads and state highways with pinch points (CMFs of 0.32 and 0.12 respectively). The crash reductions on arterial roads were statistically significant.

Discussion and conclusion

This study was a retrospective before and after analysis of gateways at 102 treatment sites across New Zealand's road network with a control group consisting of 62 sites. The aim of the analysis was to determine the impact, magnitude and statistical significance of rural urban gateways on crash frequency and severity and whether the effect differed by gateway type and feature.

The analysed crash data covered five years before gateways were installed. This provided detailed information on the

Table 4. Crash frequency by rural-urban transition speeds

Gateway type	Rural urban transition speed (km/h)	Control		Treated		CMF
		Before	After	Before	After	
Sign only	100 80	0.6	1.8	1.2	1.2	0.33
	100 70	18.4	14.5	9.4	8.3	1.12
	100 50	18.6	17.5	4.4	4.2	1.01
Pinch point	100 80	1.6	0.4	5.6	4.5	3.18
	100 70	8.8	11.0	24.8	14.4	0.47
	100 50	33.6	38.0	21	23.2	0.98
	80 50	1.2	2.4	2.4	0.0	0
	70 50	7.4	4.0	1.4	1.2	1.59

Bold indicates result was statistically significant at $\alpha = 0.005$ significance level

Table 5. Crash frequencies by vehicle movements and gateway type

Gateway	Crash cause	Control		Treatment		CMF
		Before	After	Before	After	
Sign only	Head on	3.4	2.9	1.4	0.5	0.38
	Lost control or off road	4.8	6.4	1.6	1.2	0.54
	Pedestrians crossing road	6.6	1.4	1.0	1.0	4.71
	Pedestrians other	1.0	0.2	-	0.2	-
Pinch point	Head on	6.6	4.2	4.2	5.1	1.89
	Lost control or off road	7.6	8.5	7.0	7.5	0.96
	Pedestrians crossing road	3.6	4.8	4.8	1.8	0.28
	Pedestrians other	0.6	1.4	0.6	0.5	0.32

Bold indicates result was statistically significant at $\alpha = 0.005$ significance level

crash trends in the before period. However, the after period consisted of different numbers of years. The analysis indicated crash reductions at the treatment sites in the before after analysis.

The findings are consistent with past research on the effectiveness of gateways in lowering crashes. In a study on the effectiveness of traffic calming measures in lowering crashes, Taylor and Wheeler found that gateways (without downstream traffic calming) led to a 43% reduction in fatal and serious crashes while minor crashes increased by 5%. On the other hand, fatal and serious crashes fell by 70% and minor injuries by about 30% with an overall reduction of 45% where downstream traffic calming was also implemented [6].

This study found that gateways led to a 26% reduction in all crashes and 23% reduction in fatal and serious crashes. There was a 35% reduction in all crashes at pinch point gateways with fatal and serious crashes falling by 41%. This indicates that gateways, particularly pinch point gateways, are a useful measure for addressing crash reductions at transition zones.

This evaluation was part of a larger Austroads research project on effective speed management techniques on rural roads (engineering treatments). The information in this paper provides one possible solution for managing speed at rural urban transition zones. Further information on other evaluated treatments is outlined in the project report [7].

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Human body modelling of motorcyclist impacts with guardrail posts

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Abstract

Recent research into motorcyclist collisions with roadside barriers has indicated that while they are infrequent events, they often result in severe injury outcomes. Impacts with steel guardrail (W-beam) barrier posts have been identified as significant contributors to such injuries. Thoracic injury has been revealed as the body region most frequently seriously injured (AIS 3+), amongst fatal and non-fatal collisions. One approach to help reduce such trauma is to perform numerical simulations of motorcyclist-barrier collisions, and to develop and assess barrier types and barrier modifications and their impact on injury outcomes.

The aim of the present study is to validate a human FEM model of a motorcyclist impact with a guardrail post, specifically focusing on the incidence and severity of thoracic injuries. Field-observed cases of motorcyclist-barrier collisions in Australia are identified, where a collision of a motorcyclist sliding into a steel guardrail barrier was fully reconstructed. A numerical model of the THUMS human body model sliding into a steel guardrail barrier is developed using LSDYNA. The biomechanical response of the THUMS model is validated against cadaver experiments of blunt anterior-posterior and lateral impacts to the chest, and against the field-observed collisions. The validated model will be a useful tool to develop and assess

barriers and barrier modifications designed to improve the safety of roadsides for motorcyclists.

Keywords

Motorcyclist, guardrail, thoracic injury, FEM, computer simulation

Introduction

Motorcyclist serious injuries and fatalities contribute significantly to road trauma in Australia and internationally. Per distance travelled, Australian motorcyclists are 30 times more likely to be killed and 37 times more likely to be seriously injured than car occupants [6]. While motorcycle collisions with barriers are rare events (5.4% of motorcyclist fatalities in Australasia), they often result in serious and fatal injuries to motorcyclists [8, 10]. The MAIDS study [14] identified 60 injuries resulting from barrier collisions, while Peldschus et al. [17] reported injury profiles from a European study of motorcyclist collisions with roadway infrastructure including roadside barriers. More recently, Bambach et al. [3] and Bambach et al. [4] described injuries resulting from single-vehicle motorcycle-barrier collisions in Australasia for fatal and non-fatal cases, respectively, while Daniello and Gabler [5] reported non-fatal cases in the United States. These studies have indicated that motorcycle collisions with roadside barriers can result in severe injuries and fatalities, and present a considerable injury risk to motorcyclists.

Of particular concern raised in these motorcycle-barrier collision studies was the incidence of serious thoracic injury (AIS severity 3 or greater, AAAM 2005). Bambach et al. [3] found that amongst motorcyclists fatally injured in single-vehicle collisions with roadside barriers, the thorax was the body region with the highest incidence of serious injury (81% of motorcyclists), and the highest incidence of maximum injury (50% of motorcyclists). This study also highlighted the substantial injury potential provided by the posts of steel W-beam barriers, as have other studies [17]. For non-fatal collisions with barriers, Bambach et al. [4] also found the torso (thorax and abdomen) had the highest incidence of serious injury (42% of motorcyclist casualties). Daniello and Gabler [5] also found that the thorax was the most frequently seriously injured body region following motorcyclist single-vehicle collisions with barriers.

The provision of a safe road environment for all road users, including motorcyclists, is an objective of all road authorities and is the basis of the Safe Systems approach recently adopted in Australia [2]. Therefore, there is a need to address the injury potential of roadside barriers to motorcyclists, and in particular, the most harmful injury mechanism of thoracic injury. There is also a need to assess barrier modifications and their efficacy in reducing the injury potential of barriers to motorcyclists. This is especially true for roadways that form popular motorcycling routes.

One approach to help reduce such trauma is to perform crash tests and/or numerical simulations of motorcyclist-barrier collisions. Currently there is no established procedure in Australia for the testing of motorcyclist collisions with roadside barriers, while there exists a European technical specification for such crash tests [19]. However, the European specification does not prescribe injury assessment methods for thoracic injury, which severely limits its applicability to Australian conditions. Additionally, there are significant cost implications associated with performing crash tests.

The present approach adopted to assess thoracic injury in such collisions was to develop a human body model of a motorcyclist impacting a barrier. A valid finite element method (FEM) numerical model of such collisions may be used to assess different barrier types (such as steel W-beam, concrete and wire-rope barriers) and barrier modifications (such as rub-rails, protectors and post paddings), and their impact on injury outcomes. The specific aim of the present study is to validate a human FEM model of a motorcyclist impact with a guardrail post, focusing on the incidence and severity of thoracic injuries.

Methods

Motorcyclist-barrier collision crash cases

In a previous study by the authors Bambach et al. [3], 78 fatal motorcyclist-barrier collisions were identified that occurred in Australia and New Zealand during the period 2001 to 2009 (inclusive). The full Coronial case files were collected from the various Coroners Courts; being the documents relating to the inquest held to formally establish the cause of death. These files typically contained a police report (including a reconstruction of the crash scene and events as determined by the on-scene investigating police), an autopsy, a toxicology report and a mechanical inspection report.

For the purposes of the present study, cases were identified that involved a motorcyclist colliding with a steel W-beam barrier (guardrail) in the sliding posture, and for which a full reconstruction of the crash scene was available, including the approach angle, sliding distance, pre-crash speed and final resting position of the motorcyclist. The injuries sustained by the motorcyclist were coded to the Abbreviated Injury Scale [1] and only serious injuries were coded (AIS 3+). The sliding posture involves the motorcyclist impacting the roadway prior to contact with the barrier, then sliding along the road surface into the barrier.

Cases were identified where the motorcyclist was likely to have collided with the post of the guardrail. These were identified as when either: a witness saw the motorcyclist impact a post; the motorcyclist was found lying in contact

with a post; or the motorcyclist was found immediately adjacent to a post. Motorcyclists that were redirected along or away from the barrier and were found lying in the roadway were assumed to have impacted the W-beam of the barrier rather than a post (redirected) and were excluded from the study. The post-collision cases with serious thoracic injury were assumed to have impacted the post in the thorax-leading orientation. Two thorax-leading impact scenarios were considered, where the motorcyclist was assumed to impact the guardrail post with the thorax laterally or frontally, as shown in Figure 1a and 1b, respectively. Cases where the thoracic injuries occurred predominantly unilaterally were assumed to have resulted from impact with a post in the lateral orientation, and those occurring bilaterally were assumed in the frontal orientation.

The post impact speed was determined from the pre-crash speed and the measured distance the motorcyclist slid on the roadway. Several authors have determined drag coefficients for humans sliding on roadways, with values ranging from 0.37 to 0.75 [18, 7, 16, 21]. A mean value of 0.6 was used in the present analysis, and standard equations for velocity changes occurring from sliding distances were employed.

FEM model development

The Total Human Model for Safety (THUMS) average size male (50th percentile - AM50) FEM model was used to simulate the human body, developed by Toyota Motor Corporation [9]. The THUMS model simulates human body kinematics and injury responses in crashes. High-resolution CT scans were used to digitise the interior of the body and to generate precise geometrical data for the bones, organs, tissues, ligaments, muscles, skin etc. The FE mesh consists of around 2,000,000 elements representing the components of the human body.

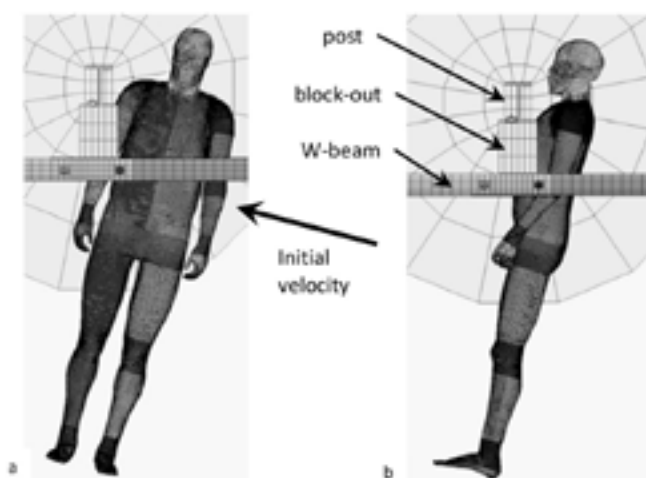


Figure 1. FEM model of THUMS impacting a guardrail post in the thorax-leading orientation; a) lateral impact, b) frontal impact

The steel W-beam barrier FEM model developed by the National Crash Analysis Centre (NCAC) at George Washington University in the United States [15] was used to simulate the barrier. The barrier model consists of steel posts set into the ground, wooden blockouts and steel W-beams (Figure 1). The FEM mesh consists of around 125,000 elements and is used extensively for vehicle-barrier collision modelling. In Australia, guardrail posts are typically 150mm deep steel C-sections. The steel post in the FEM model is a 150mm deep I-section, thus the use of this model assumes the motorcyclist impacted the open face side of a C-section post. The impact position of the thorax on the post was assumed to be the same in all cases, and was determined by sliding the THUMS model into the barrier at an angle of 15 degrees (the average angle of all 78 cases in Bambach et al. [3]), such that the head did not contact the preceding post.

Validation of the thorax of the human body model with cadaver tests

The biofidelity of the THUMS model was validated against experiments on cadavers subjected to blunt anterior-posterior and lateral impacts to the chest. The anterior-posterior thoracic impacts [12, 13] were generated with a six inch diameter unpadded impactor of varying mass (3.6 to 52 pounds) propelled at varying velocities (11 to 32 mph). The lateral thoracic impacts [20] were generated with a 150mm diameter unpadded impactor with a mass of 23.4kg propelled at varying velocities (4.5 to 9.4 m/s). The experimental setup and impact conditions were modelled with THUMS. The force-deflection response corridors of the impactors in the cadaver experiments were compared with those obtained with the THUMS model.

Validation of the motorcyclist-barrier collision model with collision crash cases

The numerical model of the motorcyclist-guardrail collision was validated against the field-observed motorcyclist-barrier collisions. For each crash case, the initial crash conditions were input into the model (impact speed, angle and frontal/lateral orientation). In the cadaver studies [12, 13, 20] the incidence and severity of thoracic injuries were found to be closely associated with the normalised thoracic compression, being the thoracic deflection divided by the thoracic diameter. The thoracic diameter is the width of the thorax measured along the direction of the applied impact load. The normalised thoracic compression was used to compare the motorcyclist-guardrail collision model results with the field-observed crashes.

Results

Motorcyclist-barrier collision crash cases

A total of nine cases were identified from the motorcyclist-barrier collision crash cases in the sliding posture, where the motorcyclist was likely to have collided with the post of the guardrail in the thorax-leading orientation. These cases are summarised in Table 1. The assumed impact orientation is tabulated in Table 1, where three cases were assumed to have occurred laterally with the remaining six frontally. The calculated post impact speeds varied between 25.9km/h and 76.2km/h, and the impact angles varied between 5 and 32 degrees. The maximum AIS severity levels of the thoracic injuries (MAIS) were generally quite severe, ranging from AIS3 to AIS6 with five cases of critical injury (AIS5+), which is to be expected considering the high impact speeds and the fact that the crashes were fatal.

Validation of the thorax of the human body model with cadaver tests

A variety of impactor mass and speed combinations were modelled for frontal and lateral thoracic impacts and the THUMS model generally performed well, with the force-deflection curves lying approximately within the response corridors. Some examples are presented in Figure 2.

Validation of the motorcyclist-barrier collision model with collision crash cases

The crash mechanics of the motorcyclist-barrier post collision numerical model is presented in Figure 3 for the thorax-leading lateral orientation. The frontal orientation results were similar, where the majority of the motorcyclist kinetic energy is expended upon impact with the rigid post, and the motorcyclist body wraps around the post.

Table 1. Motorcyclist-barrier collision crash cases with guardrail post impacts in the thorax-leading orientation

Assumed impact orientation	Thoracic injuries determined from autopsy	MAIS thorax	Post impact speed ^a (km/h)	Impact angle (degrees)	Thoracic deflection/thoracic diameter
Frontal	L ribs #1-4 fx, R rib #2 fx, ruptured pericardial membrane, perforated R heart ventricle, L lung collapse, R lung oedema, R lung contusions, L haemothorax	6	75	21	0.562
Frontal	Multiple bilateral rib fx with flail chest, transected sternum, multiple heart lacerations with rupture, bilateral haemothorax	5	63	16	0.539
Frontal	Bilateral lung collapse, bilateral haemopneumothoraces, posterior subparietal pleural haemorrhages, transverse fx at T1-T2 with partial cord transection	4	26	19	0.423
Frontal	Tension pneumothorax, multiple bilateral rib fx	5	76	16	0.592
Lateral	L lung contusions and lacerations, L haemothorax, L ribs #3-8 fx (parasternal), R ribs #5-8 fx (lateral)	3	29	18	0.393
Frontal	Bilateral collapsed lungs, L ribs #1-12 fx (anterolateral), R ribs #1-6 fx (anterior), flail chest with sternum fx, bilateral haemothoraces, pericardium and heart lacerations, aorta transection	6	63	16	0.534
Lateral	L flail chest with ribs #5-11 fx (posterolateral), L lung contusions and lacerations, L lung collapsed, L haemopneumothorax, diaphragm lacerations	4	39	28	0.527
Lateral	L ribs #2-6 fx (parasternal)	3	30	32	0.417
Frontal	R ribs #3-5 fx, L ribs #3-5 fx, sternum fx, bilateral haemothoraces, R ventricle and L atrium ruptures, T3 fx with cord transection	6	72	5	0.566

L = left, R = right, fx = fracture

^a calculated from the pre-crash speed estimate and measured sliding distance

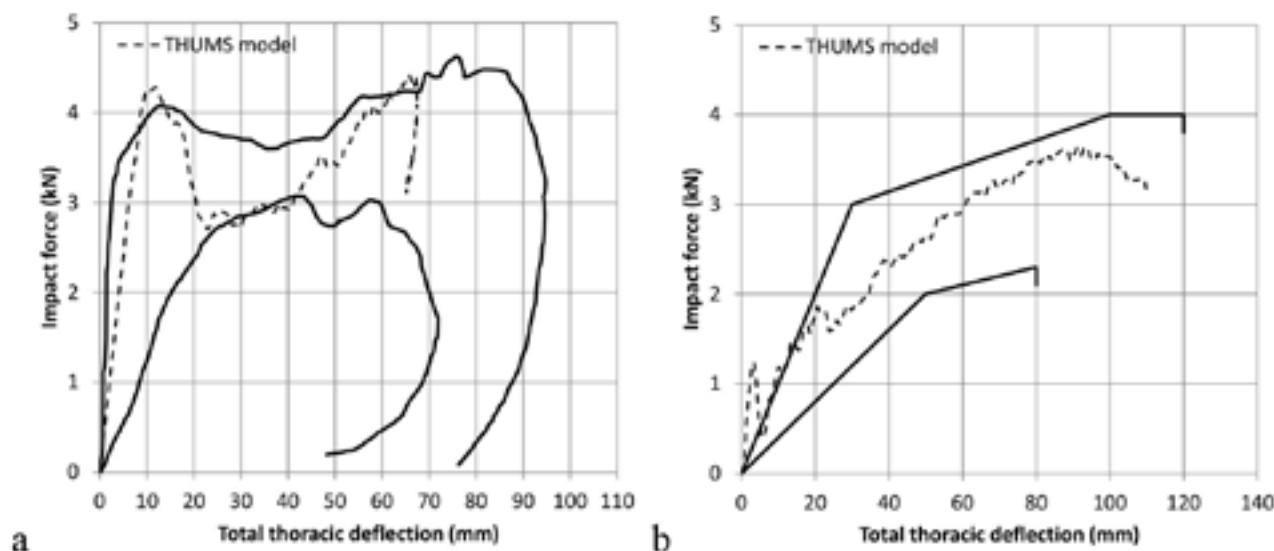


Figure 2. Force-deflection response of the THUMS model compared with the cadaver response corridors; a) frontal thoracic impact with a 23.1kg impactor at 7.2m/s (Kroell et al 1974), b) lateral thoracic impact with a 23.4kg impactor at 6.7m/s (Viano et al 1989)

The response of the thoracic bony structures and internal organs to lateral impact is presented in Figure 4. The impact is somewhat dampened by the presence of the upper arm (not shown), however significant lateral compression of the thorax results as the leading side of the thorax stops against the post and the inertia of the torso compresses the ribs and internal organs.

The biomechanical response of the THUMS model to thorax-leading impact with a guardrail post in the frontal and lateral orientations is expressed as the normalised thoracic deflection from the model. The FEM normalised thoracic deflection results are tabulated in Table 1, and plotted in Figure 5 against the MAIS of the field-observed injuries. The thoracic FEM normalised deflection and MAIS values are compared with those determined experimentally with cadavers [13, 20] in Figure 5. The full results for the variety of initial impact conditions tested in the cadaver experiments are presented.

Discussion

Notwithstanding the large variability in the cadaver experiments with respect to age, gender, physiological condition and experimental variability [12, 13, 20], the results in Figure 2 suggest that the THUMS thorax model is a biomechanically valid representation of the human thorax of an average size male. The THUMS thorax typically unloaded at a lower deflection than in the cadaver tests under frontal impact. However, in the majority of cases subjected to the impact conditions in Figure 2 (12 of 13 cadavers), the cadavers sustained multiple rib fractures. Rib fractures were not explicitly modelled with THUMS, thus the THUMS model could be expected to be stiffer than the cadavers subsequent to rib fracture.

The results of the THUMS impact with a guardrail post in the thorax-leading orientation, shown in Figures 3 and 4 for lateral impact, are generally in agreement with the field-observed collisions of direct impacts with a guardrail post, where the majority of the motorcyclist kinetic energy is dissipated during the impact and the motorcyclist resting position was against or adjacent to the post.

The biomechanical response of the THUMS thorax in response to the guardrail post impact is generally in agreement with that derived from cadaver experiments [12, 13, 20], where increasing kinetic energy results in increasing thoracic compression, which in turn results in increasing thoracic injury severity. However, the comparisons in Figure 5 indicate that the numerical predictions of thoracic compression for the motorcyclists tend to over-estimate those determined from the cadaver experiments. That is, for a motorcyclist that sustained a thoracic injury of a particular AIS severity, the numerical model of the motorcyclist impacting the guardrail post predicted thoracic compression greater than that observed in cadavers with the same AIS severity. Assuming that the THUMS model is a reasonable representation of an average size male thorax under impact (Figure 2), the over-estimation of the thoracic compression in the guardrail post impact numerical models may therefore be attributed to: the idealisation of the post impact orientation and impact surface; and/or uncertainties in establishing the initial post impact conditions; and/or physiological differences between the cadavers and the motorcyclists. These issues are discussed further below, and should be considered as limitations to the numerical modelling approach used in this study.

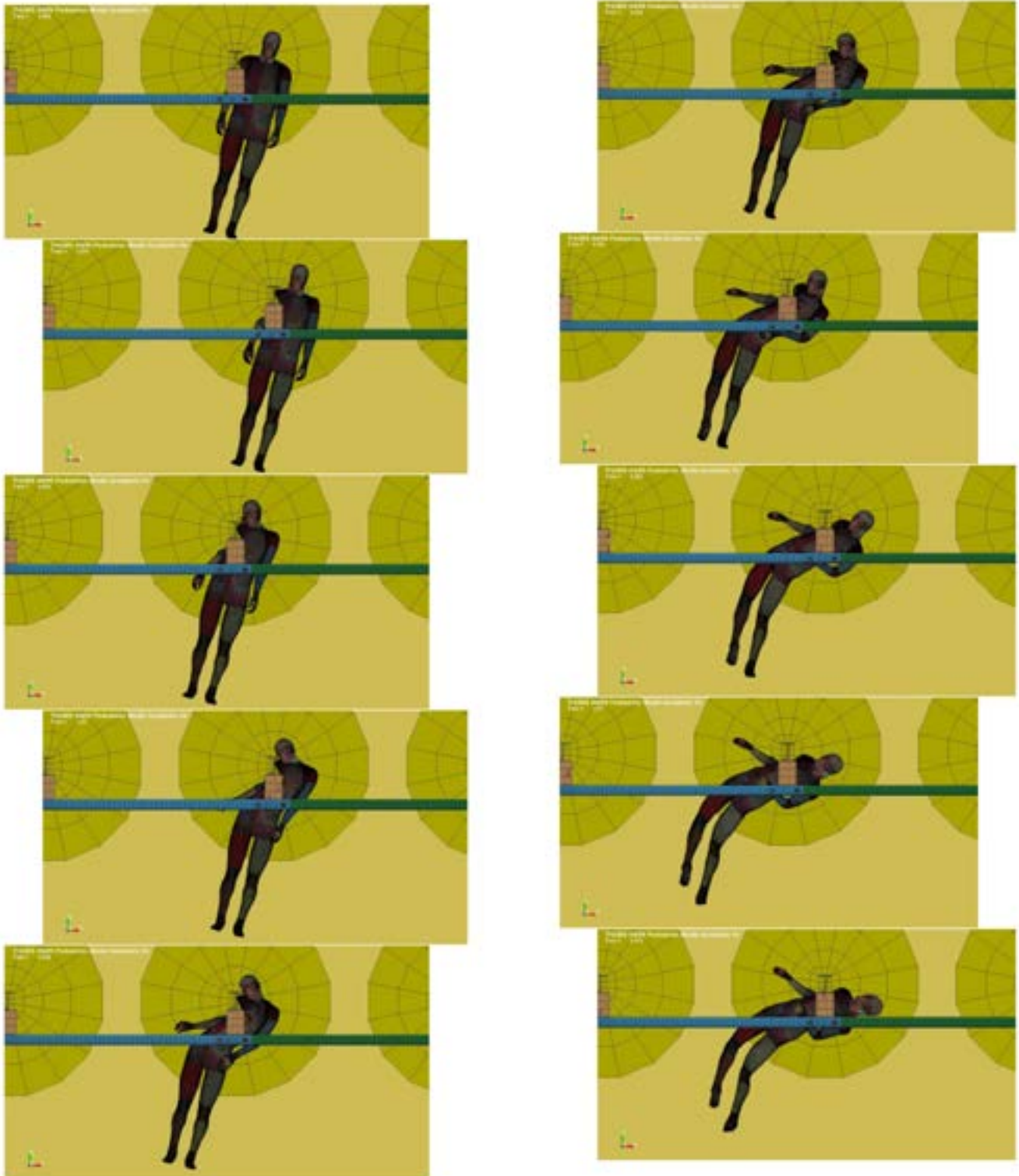


Figure 3. THUMS impact with a guardrail post in the thorax-leading lateral orientation at 40km/h. Each frame represents 0.008ms.

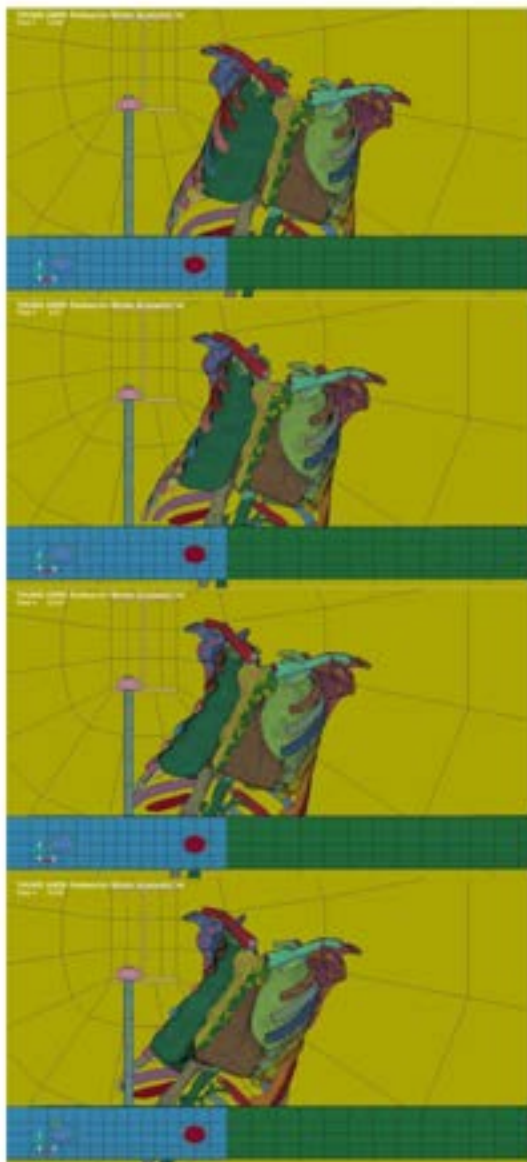


Figure 4. Deformation of the thoracic structures during the THUMS impact with a guardrail post in the thorax-leading lateral orientation at 40km/h. Each frame represents 0.004ms.

It is likely that in the motorcycle crashes the motorcyclist underwent substantial tumbling in addition to sliding along the surface of the roadway prior to impact with the barrier, thus the motorcyclist may not have impacted the barrier post in either the idealised orientation or position that was assumed in the numerical models (ie position of the thorax relative to the post). Indeed the fact that the motorcyclist directly impacted the post was inferred from the on-scene police investigation reports and was not known for certain, except in one case where there was a witness to the crash. The direct thorax impact assumed in the numerical model may over-represent the severity of the impact, which may have led to an over-estimation of the thoracic compression.

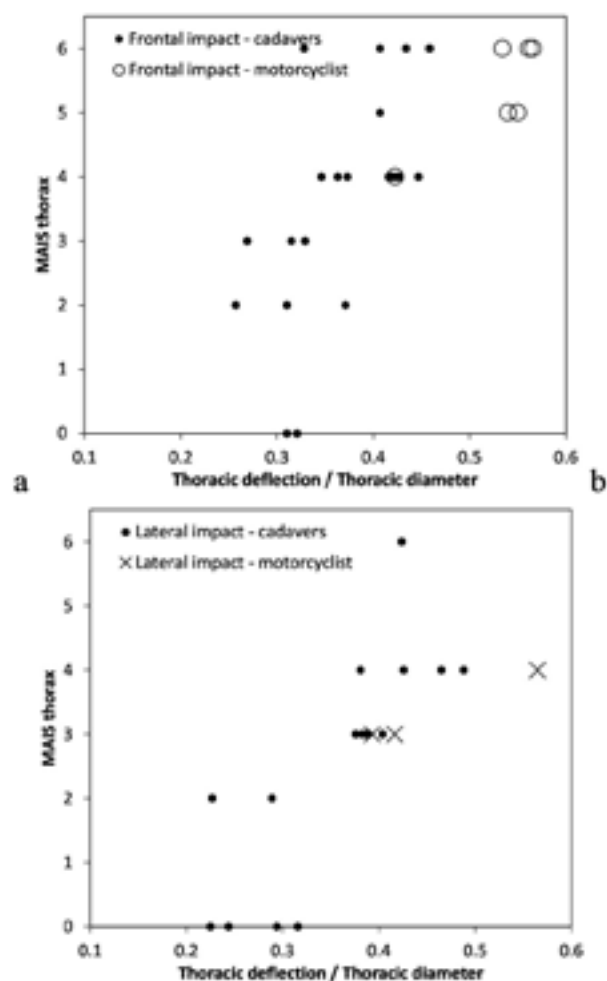


Figure 5. Comparison of the thoracic FEM normalised deflection and field-observed MAIS values from motorcyclist collisions with a guardrail post, with cadaver responses; a) frontal thoracic impact (Kroell et al 1974), b) lateral thoracic impact (Viano et al 1989)

Additionally, the impact surfaces were different between the motorcyclists and the cadavers, where the former consisted of the leading edge of an I-section post, while the latter was a comparatively large surface area of diameter 150mm. For the lateral-post orientation, the upper arm directly contacted the leading edge of the post which distributed the impact load to the thorax. The use of an I-section post FE model assumed that the motorcyclist impacted the open side of the C-section post. Different impact surfaces may lead to different load concentrations, which might result in different relationships between local maximum deflection and injury severity. Analysis of the crash scene photographs and reconstructions indicated that the motorcyclists were facing the open side of the C-section posts in one of the three lateral-post impacts and four of the six frontal-post impacts. The FE models were modified to close the face of the I-section post such that it presents the same shape as the closed face of a C-section post. This made negligible difference to the lateral-post impacts, due to the load

spreading influence of the upper arm. An average decrease in thoracic compression of 3.7% resulted for the frontal-post impacts, which is nearly negligible due to the fact that the leading corner of the post contacts high on the rib cage at the third rib (Figure 1), thus the presence of the closed face of the post above this point had little influence on the thoracic response.

Similarly, there is substantial uncertainty in the initial impact conditions, where the pre-crash speed is a police-reconstructed estimate and the coefficient of sliding friction is a mean value from a wide range of values reported in the literature. However, the impact angle and sliding distance were relatively well established from careful measurements of the markings on the roadway by on-scene police. The pre-crash speed may have been over-estimated by police and/or the sliding friction value may have under-estimated the real friction of the roadway, which may have led to an over-estimation of the severity of the impact and consequently the thoracic compression.

A further limitation of the study is that there were substantial physiological differences between the cadavers and the motorcyclists. The cadaver ages ranged from 19 to 81 years with a mean of 59 years, and 79% were male. The motorcyclist ages ranged from 21 to 70 years with a mean of 37 years, and all were male. It is possible that the THUMS average size male model predicted a relatively accurate magnitude of thoracic compression and that the motorcyclists did indeed undergo such a compression, however for physiological reasons such compression magnitudes did not result in as severe injuries in the motorcyclists as those that occurred in the cadavers. It is well known that thoracic injury severity, particularly that resulting from rib fractures and concomitant organ injuries, is closely associated with age [11]. For example at a normalised frontal thoracic deflection of around 0.3, the probability of sustaining more than six rib fractures is around 10% for a 30 year old while around 40% for a 70 year old.

Conclusions

Notwithstanding the rather substantial uncertainties associated with human body modelling of cadaver experiments and field-observed motorcyclist crashes, the numerical results are generally in agreement with the experimental and crash cases with regards to thoracic injury mechanisms and injury severity. The numerical model of a motorcyclist collision with a guardrail post in the thorax-leading orientation may therefore be considered a valid representation of an average size male motorcyclist subjected to such impacts. The validated model will be a useful tool to develop and assess barrier types and barrier modifications designed to improve the safety of roadsides for motorcyclists, with regards to the most frequent and serious injury mechanism of thoracic injury. Work is

ongoing in this area, as are numerical validation studies of the next most frequently occurring serious injuries of injuries to the head and neck.

Acknowledgements

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Age and gender differences in perceptions of traffic risk and safety for older pedestrians in metropolitan Sydney

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Keywords

Aged, Behaviour, Perception, Risk, Safety, Survey,
Traffic Crashes

Abstract

Older pedestrians are over represented in serious injury and fatality statistics compared to younger age groups and are considered to be at fault in over 72% of pedestrian-motor vehicle crashes. This study sought to investigate the perceptions of risk and safety in the local traffic environment as reported by older people in the course of everyday pedestrian journeys by asking them to complete a kerb-side survey. The majority of the older pedestrians interviewed (475 women: 265 men) considered that they

engaged in safe pedestrian activity and that their own behaviour did not make them vulnerable road users. Perceptions of risk were predominantly associated with external factors such as motorist behaviour and traffic speed. Men tended to be more confident of their own abilities in traffic situations, reported less difficulty crossing roads and paid less attention to route selection than women. Increasing age (65 to 95 years) did not appear to change these perceptions. This is an important consideration for caregivers and medical practitioners when discussing road safety issues with older people, and a critical concern for professionals involved in the planning and implementation of traffic awareness and road safety campaigns for older people.

Introduction

Pedestrians account for 13% of all road deaths in the state of New South Wales, Australia [1]. In 2008, 45% of the pedestrians killed in New South Wales were aged 60 years or more, although people in this age group make up only 19% of the population [1]. This over representation of older people in pedestrian fatalities common to most westernised countries [2] has led to speculation that there is an ‘older pedestrian problem’. While this is of concern, it does not necessarily mean older people are less capable pedestrians than younger people. Given that older people do not survive injuries as well as younger people following an impact of similar force [3], there will always be higher fatality rates for the older age groups for the same number of crashes. Older people also tend to have more complications from injury, so they encounter longer hospitalisation and recuperation times [4].

As in most westernised countries the ageing population in Australia is increasing and older people are expected to be more active and live longer than earlier generations. Older people regularly make walking trips, as a principal form of travel or as part of a journey in association with other types of transport, especially for shopping, entertainment and other personal reasons [5, 6]. It is expected that an increase in the proportion of older people in the community will be associated with a corresponding increase in the number of pedestrian collisions. There are known age-related declines in vision, hearing, mobility and cognition that may affect road safety [7], but there is little empirical data directly linking these declines to increased pedestrian accident risk. Crash data show that older (> 65 years) pedestrian fatalities occur mainly in daylight, on weekdays, close to home, in urban areas and in <60km speed zones [5, 8, 9]. This suggests most collisions happen in the course of normal walking trips in the local area. Several studies have highlighted road crossing as a particularly high-risk situation for older pedestrians [6, 7, 10, 11]. In a previous study of 52 older pedestrian fatalities in Sydney it was found that 81% of the pedestrians were killed while crossing the road [12]. A high proportion of these people were killed while on zebra crossings (12%), at traffic lights (16%) and within 100m of a designated crossing facility (31%). A recent study about older pedestrian views on crossing roads showed that the main areas of concern for older pedestrians are their own confidence, particularly a fear of falls, other road user behaviour and an apparent contradiction in beliefs versus behaviour of older pedestrians themselves [13].

The current study investigates how older pedestrians perceive their own safety in the road environment, with emphasis on road crossing behaviour. Previous studies addressing older pedestrian safety issues have relied on retrospective interviews [6, 14]. We felt it was important to question older people while they were engaged in their

normal pedestrian activities, in order to refer to actual recent and specific road crossings and reduce inaccuracies in retrospective self-reporting. We compared the responses for men and women, and people in four age ranges to determine if perceptions of road safety vary between these groups and if there are older pedestrian issues that warrant targeted attention.

Methods

Older people (60 years and older) were approached to participate in a kerb-side questionnaire about pedestrian safety. The study was briefly explained to them and they were given an information statement with further details. This study was approved by the Human Research Ethics Committee (HREC) of the University of New South Wales (Ethics approval No: 03096). Agreement to be interviewed was considered as consent to participate. The questionnaire was designed specifically for this study to include questions about the current walking route and specific crossing locations.

Questionnaires were conducted from 8.00am to 6.00pm, Monday to Saturday, in each season of the year, and in three different local government areas in Sydney that have been highlighted as having high pedestrian fatality rates; Rockdale, Randwick and Marrickville [15]. The questionnaire took about 10-15 minutes to complete and there was seating available in all interview locations. One interviewer conducted all interviews. The interviews were not conducted in adverse or unusual weather conditions.

The structured questionnaire (available on request to corresponding author) consisted of four parts.

- A) Questions about walking behaviour and perceptions of road safety and risk
- B) Questions about the current walking trip (a one way trip from their point of origin to the interview location), including the most recent road crossing location and a map outlining the walking route taken.
- C) Demographic information about the participant
- D) Interviewer observations about each participant

All recorded data was entered into a database (Filemaker Pro). Respondents were grouped into four age bands (60-64, 65-74, 75-84, 85-96). Age and gender differences were examined using Chi squared tests or Fisher’s exact test for nominal data and ANOVA or t-tests for continuous data. A p-value of less than 0.05 was considered significant.

Results

Sample

The final sample group for analysis included 740 people (475 women: 265 men) aged between 60 and 96 years of age. Table 1 shows the percentages of respondents by age, gender, suburb, day of the week and season of the year. Participants were familiar with the interview area, with 98.6% frequenting the interview location at least once or twice a week, and most had lived in the area for lengthy periods (71% more than 10 years, 25% 1-10 years). Of the people interviewed, 62% reported that they walked for 30 to 60 minutes per trip, 79% walked for more than five hours per week and 87.5% walked at least once a day. From maps drawn showing pedestrian routes we were able to calculate that this sample of older people walked on average 896m a trip (ranging from 50m-6km).

Medical conditions

About half (53.6%) of people interviewed were wearing glasses and there were no differences with age or gender in the way these people responded to any of the questions asked about their experiences in the traffic environment.

While 21.4% of people interviewed had an obvious physical problem many more volunteered information about an existing medical condition. The most frequent medical conditions were arthritis (28.4%) and leg, hip or knee conditions (28.4%), often involving a joint replacement. Bad backs or necks were also common (11.3%). Other medical complaints included Alzheimer's disease, stroke, Parkinson's disease, diabetes and gout. There was an increase in the number of medical problems with age ($p < 0.0001$), with only 8.9% of those aged 60-64 years reporting medical conditions compared to 51.5% of those aged 85-96 years. Compared to those with no health problems, people with medical conditions reported spending less time walking per week ($p < 0.0001$), making fewer individual walking trips in a week ($p < 0.0001$) and that crossing roads were more difficult ($p < 0.0001$).

Perceptions of pedestrian safety

Over 84% of respondents reported feeling safe at zebra crossings or traffic lights. A total of 84% agreed it is not safe to cross the road where there is no designated pedestrian crossing, however in this study 22% of respondents indicated they did not cross the last road at a designated crossing, mainly because there was none or it was more than 100 metres away. A small proportion of these (3.6%) indicated that a designated crossing located 10-100 metres was too far away, and 10.2% chose to cross the road where they did because it was convenient to do so, regardless of where a designated crossing was located.

The majority of these pedestrians (over 60%) reported they did not have difficulty judging the speed of traffic, selecting gaps in the traffic, seeing approaching vehicles, or finding designated crossing locations. When asked about what factors contributed to the safety of a crossing location the presence of traffic lights and good visibility were rated highest. Only 4% rated pedestrian behaviour as a contributing factor to pedestrian safety.

Most of the people interviewed (80%) thought that older pedestrians should be given special attention, even though only 40% thought they were more likely than a younger person to be involved in an crash. A small number of older pedestrians interviewed offered strategies to improve their personal safety such as looking both ways, crossing in groups, making eye contact with drivers and waiting for vehicles to pass before crossing.

Even though, at the time of the survey there were at least three separate safety strategies in place in the local area, 95% of those surveyed were not aware of any. These safety campaigns included banners highlighting the need for pedestrians to cross at traffic lights, advertisements in local newspapers and local council road safety awareness signage.

Perceptions of pedestrian risk

Questions pertaining to non-designated crossing locations and pedestrian refuges elicited varying responses. A total of 84% of people interviewed reported that it was not generally safe to cross the road where there was no designated crossing and when questioned about a recent road crossing at a non-designated crossing location over half thought they had crossed in a safe manner. While 62% of older people generally agreed pedestrian refuges were safe places to cross the road only 30% responded positively when asked about a recent experience crossing the road at a pedestrian refuge. Over 60% of respondents reported turning vehicles and vehicles not stopping as difficulties encountered when crossing roads. Busy streets, turning vehicles and speed of traffic rated highest as factors contributing to risk. Pedestrians also expressed concerns about right of way at traffic controlled intersections. For example, in some intersections vehicles proceeding with a green light are permitted to turn left but must give way to pedestrians, who are also facing a green walk signal, however respondents felt this was not always clear, or obeyed by vehicles. Over half (56%) of respondents did not think "walk signals" allowed enough time for them to cross the road and 85% of respondents thought drivers were too impatient and many older pedestrians reported drivers "honking", verbal abuse or vehicles "creeping forward" while they were crossing the road at designated crossing locations. The risk of falling was highlighted as an area of concern and 6 of 17 pedestrian collisions reported by respondents for the last five years involved falls. These falls

were blamed on poorly maintained or sloping surfaces. All other respondents involved in collisions indicated that the driver was at fault.

Age differences

With increasing age there were significant declines in the time spent walking each week and in the number of individual trips taken each week (Table 2) but no differences in the overall distance travelled on an individual walking trip. The number of roads crossed per trip decreased from an average of 3.1 to for 60-64 year olds to 2.3 for 85-96 year olds but this was not statistically significant ($p = 0.11$).

There was less reliance on driving oneself and more on other forms of public transport with increasing age. When asked about why a particular route was chosen, those in younger age groups showed a preference for routes that were more direct or quicker but there were no differences between the age groups for other factors (Table 2).

When asked about the safety of traffic crossing locations and road user behaviour (Table 3) there were few differences between the age groups. Those in the youngest

age group (60-64 years) were more confident about crossing at non-designated crossing locations and agreed more often that drivers were considerate compared to those in the older age groups. This age group (60-64 years) was less likely to agree that younger people (than themselves) would be more likely to be involved in a pedestrian collision when compared to the older age groups. There were some age differences in what factors were perceived to be difficult when crossing roads (Table 4). The older age groups expressed more difficulty with judging the speed of traffic, crossing in time at traffic lights, the height of kerbs and finding crossings.

Gender differences

There were no differences in the proportion of men and women who reported physical, medical or visual conditions. Men reported making more walking trips per day than women (Table 2) but there were no significant differences in the hours walked per week or in the length of an individual walking trip. Men crossed more roads (3.05) in the course of an individual walking trip than women (2.7) ($p < 0.05$).

Men reported they drove themselves more often than women, whereas women were driven or used buses more often than men (Table 2). This is likely to be due to a cohort effect relating to driving practices for these generations where a higher percentage of men were licensed drivers compared to women [16]. The gender divide was much smaller for the youngest (<65 years) group. Compared to men, women consistently reported that route selection was important ($p < 0.0005$). When deciding on a walking route women took into account the directness of a route, how attractive it was, the type of road and the location of crossings (Table 2).

When asked about safe traffic crossing locations both men and women agreed equally that traffic lights are safe places to cross the road. There were significant differences ($p < 0.0005$) between men and women in their responses about the safety of other road crossing locations (Table 3). Women felt less safe than men crossing at zebra crossings, pedestrian refuges and at non-designated crossing locations. When asked about driver and pedestrian behaviour, more women than men thought older pedestrians should be given special attention, whereas more men agreed that younger people are more likely to have a crash and that drivers are considerate. Women also reported more difficulty in crossing roads than men ($p < 0.0001$). Factors such as judging the speed of traffic, crossing in time, selecting gaps in the traffic and height of kerbs presented more difficulty for the women interviewed (Table 4). The women also thought vehicle behaviour, such as cars not stopping and turning cars, added to the difficulty of crossing the road more often than men did.

Table 1
The number and percentage of older pedestrians interviewed by gender, age, suburb, day of the week and season of the year

	Group	Number	Percentage of sample
Gender	Male	265	35.8
	Female	475	64.2
Age	60-64	116	15.7
	65-74	327	44.2
	75-84	264	35.7
	85-96	33	4.5
Suburb	Rockdale	221	29.9
	Randwick	266	36.0
	Marrickville	252	34.1
Day	Monday	111	15.0
	Tuesday	127	17.1
	Wednesday	126	17.0
	Thursday	140	18.9
	Friday	134	18.1
	Saturday	103	13.9
Season	Spring	172	23.3
	Winter	171	23.1
	Autumn	202	27.3
	Summer	195	26.3

Table 2

Responses of participants about time spent walking and modes of transport other than walking. Percentage of participants who responded with ‘important’ or ‘very important’ when asked about aspects of route selection, shown for age and gender. All values are shown as percentages.

		Age					Gender		
		60-64	65-74	75-84	85-96	P value	Male	Female	P value
Time spent walking	> 5hrs week	84.3	85.1	72.8	55.9	<0.0001	82.3	77.5	0.11
	One or more trips per day	94.8	93.6	79.6	66.7	<0.0001	91.3	85.5	<0.0001
Mode of transport	Drive themselves	52.6	36.4	26.4	14.7	<0.0001	48.3	26.5	<0.0001
	Driven by others	8.7	13.4	15.8	17.6	0.28	6	18.1	<0.0001
	Bus	57	76.9	74.7	73.5	<0.0005	58.8	80.8	<0.0001
	Train	46.5	35.5	27.5	11.7	<0.0001	33.2	33.2	0.98
Route selection	Quick/direct	79.8	75.3	66	64.7	0.01	64.1	76.6	<0.0003
	Attractive	65.7	65.1	60.7	51.5	0.3	48.5	71.1	<0.0001
	Type of road	57.9	53.5	62.2	58.8	0.2	43.7	65.3	<0.0001
	Location of crossings	78.7	81.5	85.5	77.4	0.3	68.8	89.9	<0.0001

p values: Age, chi-squared test; Gender, Fisher's exact test.

Discussion

This study sought to ask older pedestrians about their walking patterns and to identify factors in the traffic environment that they considered to be important to their safety. We were particularly interested in perceptions of safety involved in crossing roads. Participants were interviewed in the course of a normal walking trip so that accurate data could be collected about the distance walked, the number of road crossings in the course of their journey and where they could refer to a recent road crossing experience. In a previous study of older pedestrian walking trips, delays in reporting of only four days were shown to affect the accuracy of the detail about the trip [17]. The aim of this study was to use a current walking trip to investigate what perceptions are held about road safety in this older age range and whether there are differences with increasing age or between men and women.

We deliberately choose to interview older people while on a walking trip for the reasons listed above, however

this did introduce some important limitations to the study. Firstly, all the people interviewed might be particularly healthy and confident pedestrians, who may not represent those with greatest crash risk, although there was a fairly large range of mobility issues within this sample. Secondly, it is difficult to achieve high participation rates when approaching individuals on the street. The 740 people who participated represented about one in five of the older pedestrians approached. Observations about those that did not participate showed no significant difference in age, gender or physical disability. The most common reasons for not participating were “I don’t speak English” and “I don’t have time”. This highlights a serious problem in data collection for this type of study. Older non-English speaking pedestrians in Australia may be one of the most vulnerable groups of road users, and one that the least is known about. The addition of a written version of this survey targeted specifically to local community groups, with appropriate translations, may improve this situation, but was outside the scope of the current study. Additionally,

Table 3

Percentage of participants who responded with ‘agree’ or ‘strongly agree’ to statements relating to road crossing locations and pedestrian and driver behaviour, shown for age and gender

Theme	Statement	Age				p value	Gender		p value
		60-64	65-74	75-84	85-96		Male	Female	
Crossing locations	You feel safe crossing at traffic lights	91.5	94.2	97	97.1	0.1237	96.2	94.2	0.1446
	It is easier to cross one way streets than two way streets	88.9	95.7	90.6	88	0.021	91.7	92.7	0.7842
	You feel safe crossing at zebra crossings	77.1	85.5	85	76.5	0.093	90.3	79.9	0.0002
	There are enough safe road crossing locations	57.6	69.5	72.3	67.6	0.049	68.5	68.5	0.9719
	You feel safe crossing at pedestrian refuges	65.3	60.7	65.2	58.8	0.0829	70.8	55.9	< 0.0001
	‘walk’ signals are long enough for you to cross	51.7	42.6	41.9	44.1	0.3196	44.9	43.3	0.627
	It is safe to cross where there is no marked crossing	28.8	14.5	12.3	17.6	0.0005	27.3	9.9	< 0.0001
Pedestrian behaviour	Older pedestrians should be given special attention	83.1	84.3	76.4	85.3	0.2699	72.7	84.1	0.0003
	Younger pedestrians are more likely to have a crash	46.1	58.6	65.2	58.8	0.0047	70.8	52.4	< 0.0001
	Older people are careful pedestrians	51.7	51.9	54.8	67.6	0.3454	51.8	54.6	0.4612
	Pedestrians are usually at fault in crashes	39.8	32.3	30.3	35.3	0.2349	31.4	33.7	0.5151
Driver behaviour	Drivers are too impatient	83.9	85.8	84.3	88.2	0.8535	86.9	84.1	0.2441
	Drivers are considerate of pedestrians	43.4	85.5	56.2	61.8	< 0.0001	59.9	53	0.059

p values: Age, chi-squared test; Gender, Fisher’s exact test.

it would be very useful to compare these findings to cohorts of younger pedestrians, or to older pedestrians in suburban or rural areas.

We sought to interview older pedestrians in the course of a normal walking journey in metropolitan areas of Sydney. This is an extensive population and therefore a convenience sample [18, 19] was selected by approaching older subjects in three metropolitan areas that have been reported to have high numbers of pedestrian fatalities. All interviews were conducted at locations near shopping thoroughfares and therefore had sufficiently high older pedestrian numbers to recruit a sample large enough for statistical analysis. Interviews were conducted in daylight hours on Monday

to Saturday as this is when most older pedestrian fatalities occur [5, 8, 9]. Our findings should be interpreted in context as the convenience sampling method used means that the results are not necessarily generalisable to the entire older metropolitan pedestrian population. However there is no reason to expect that the views expressed by the older pedestrians in the areas sampled would necessarily be any different in other similar metropolitan areas. It is not our intention to establish any relationship between subjective assessment and possible future accident risk, but rather to investigate if there are different perceptions expressed by sub-sets within this group of older pedestrians that may be preferentially targeted in road safety campaigns.

Table 4

Percentage of participants who responded with ‘somewhat difficult’ or ‘very difficult’ when asked about factors relating to crossing roads, for age and gender

	Age				p value	Gender		p value
	60-64	65-74	75-84	85-96		Male	Female	
Crossing roads (generally)	50.8	48.0	52.4	50.0	0.7591	39.3	56.1	< 0.0001
Judging the speed of traffic	30.0	47.4	40.1	47.1	0.008	27.3	50.1	< 0.0001
Crossing in time at lights	31.7	38.0	51.7	47.1	0.0004	34.5	46.6	0.0015
Selecting gaps in the traffic	32.5	34.3	30.0	17.6	0.674	27.3	34.2	0.0016
Finding crossings	23.3	11.2	6.4	14.7	< 0.0001	10.9	12.0	0.7212
Cars not stopping	71.7	65.7	61.0	58.8	0.1909	54.7	70.2	< 0.0001
Seeing cars	14.2	13.7	16.1	35.3	0.0116	12.4	17.4	0.074
Two way traffic	38.3	28.3	32.2	38.2	0.1917	25.1	35.4	0.0032
Turning cars	64.2	62.9	61.0	52.9	0.6495	51.7	67.7	< 0.0001
Height of kerbs	20.8	14.6	31.5	50.0	< 0.0001	18.7	25.7	0.0375

p values: Age, chi-squared test; Gender, Fisher's exact test.

In general, this sample of older people considered themselves to engage in safe pedestrian behaviour and felt that designated road crossing locations provide them with a safe place to cross the road. There were clear gender differences but not age differences in the responses by the participants in this study.

There were some obvious inconsistencies in our findings about road safety from the older pedestrian perspective which could have resulted from optimism bias. While the majority of older people believed themselves to engage in safe pedestrian behaviour, just over half did not think older pedestrians in general were safe pedestrians. This is consistent with the findings from Shaw et al 2012, where there was a perception of ‘other’ older people being either more careless or overcautious in their road crossing behaviours. Even though statistics clearly show older people are over-represented in vehicle-pedestrian crashes and are considered to be at fault in 72.2% of these collisions [8], 60% of those interviewed thought a younger person was more likely to have a vehicle-pedestrian collision than an older person and 66% thought the driver would be at fault in any crash. Overwhelmingly, the people interviewed stated that when they crossed at a pedestrian crossing

they did so directly on the crossing, and did not deviate. This is in contrast to earlier studies that show that 6-12% of older pedestrians deviate from a marked crossing and 10-15% cross near but not directly on the crossing [20]. Observations made by the interviewer in our study suggest that, for respondents seen crossing a road, in reality many people also started crossing at an angle and veered off towards the end of their traverse, although this was not reported. Also of interest is the finding that of the people who did not cross the road at a designated pedestrian crossing, a small proportion indicated that a designated crossing located 10-100 metres away was too far to walk. In a previous autopsy study examining older pedestrian deaths, 31% of those killed crossing a road were within 100 metres of a designated pedestrian crossing including 8 (19%) who were within 50 metres [12]. Many of the older people in our study referred to ambiguity about traffic rules and right of way issues, a theme also highlighted in other studies about walking patterns of older pedestrians [13, 21]. Some of these issues could be addressed with better education for both drivers and pedestrians, and where this conflict is high, a separation of pedestrians and vehicle movements could be considered by altering sequencing at signalised crossings. In the current study, no single intersection was identified as presenting more problems than any other.

Additionally, five of the 15 people who were injured as pedestrians in the previous five years suggested this was due to a trip or fall, blamed on uneven surfaces rather than a collision with a vehicle. It should be noted that many older pedestrian crash statistics fail to include older pedestrian injuries resulting from ‘falls on the footpath’ and therefore the high proportion of injuries resulting from ‘crossing roads’ may be largely artificial.

Age differences

There were few differences in the perceptions of risk reported for different age groups. The younger (60-64 years) group tended to report somewhat differently when compared to the older age groups. With increasing age, from 65 to over 85 years, the time spent walking decreased as expected [22] and there was a shift away from driving. Of interest was the fact that the oldest people reported the most difficulty judging the speed of traffic and the least difficulty selecting gaps in the traffic in which to cross. Changes in depth perception, cognition and higher executive processing are all common age related changes in older people and contribute to a poorer ability to judge speed. Oxley et al., 2005 [23] showed that when under time constraints older people (>75 years) make poor choices about safe gap selection in traffic and this increased with the speed of an approaching vehicle. In contradiction to these findings Lobjois and Cavallo, (2007) [24] found that, without time constraints, elderly pedestrians (60-80 years) selected larger time gaps than younger ones, enabling them to compensate for their longer crossing times and that this compensatory behaviour resulted in similar safety margins to that of younger pedestrians. The oldest participants in our study might be cognisant of their difficulty in judging the speed of traffic and therefore may have waited for much greater time gaps in which to cross the road regardless of vehicle speed, having an overall effect of reducing the difficulty of this activity. Walking speed decreases linearly with age from about 1.3m/s at 60 years to 0.73 m/s at 89 years [25] and therefore it could be expected that the oldest participants in our study would have the most difficulty having time to cross the road at traffic lights. Certainly the youngest age group (60-64 years) expressed the least difficulty but there was no clear trend for the older groups. Also of interest were the findings for route selection. The oldest pedestrians were the least concerned about speed/directness or the attractiveness of the route.

Gender differences

Our survey clearly demonstrated that older female pedestrians paid more attention to and were more aware of risk factors in the traffic environment than men. They also reported having more difficulty crossing roads than men. Holland and Hill, 2010 [26] report that with increased age women tend to make more unsafe crossing decisions, to leave small safety margins and to become poorer at

estimating their walking speed. However, women of all ages tend to be more careful in their pedestrian behaviour than men, their perception of risk is higher, their perception of their susceptibility to a crash resulting from an unsafe crossing is higher and they are less likely to intend to cross in unsafe situations when compared to men [27-29]. If these risk factors are recognised by women and addressed while in the road environment it might be supposed that this would result in safer pedestrian behaviour and an overall reduction in involvement in older female pedestrian crashes. A comprehensive review of the literature by Department of Transport, London [30] showed that per-population, older male pedestrians have higher overall casualty and fatality rates than older female pedestrians, supporting this view. However this does not take into account possible differences in exposure such as distance walked or roads crossed. When exposure is included in accident and fatality rates, the rates for men and women differ, with women having higher accident rates for some age groups [9, 14]. Unlike previous studies [22, 31, 32] we found no differences in the total distance walked by the men and women in our study but men did cross more roads than women, thus increasing their exposure.

Conclusions

There were significant gender differences but not age differences in the way the older people in this survey perceived their own safety and risk while walking and crossing roads. Men appear to think they are safer and more in control than they actually are, whereas women appear to recognise the risks, yet still have trouble negotiating traffic environments. It is important to recognise that ‘older pedestrians’ are not a single homogenous group. Men and women in this group have quite differing views on the traffic environment and their own interactions with it. This is an important consideration for caregivers and medical practitioners when discussing road safety issues with older people, and a critical concern for professionals involved in the planning and implementation of traffic awareness and road safety campaigns for older people. We would recommend that road safety campaigns address the apparent discrepancy between what older people perceive about themselves and what actual behaviours are putting them at risk in the traffic environment and, wherever possible, highlight gender differences. Concrete solutions such as more considered placement of crossings in areas frequented by older people, and both driver and pedestrian training about right of way, would also be beneficial.

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Contributed articles

Road to Respect roadshow

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Winner of the Road Safety Practitioner's Award, sponsored by the Australasian College of Road Safety, for the best practitioner paper, this contributed article was originally presented at the Australasian Road Safety Research, Policing and Education Conference held at Brisbane, Queensland, 28-30 August 2013.

Abstract

In 2012 VicRoads developed and delivered a road safety campaign to educate truck and car drivers about sharing the road safely. The educational campaign arose out of two key determinants:

- research predicting Victorian road freight to grow by 50 per cent by 2020 and,
- studies which found that roads users, other than the truck driver, were responsible for the majority of multi-vehicle crashes that involved a truck.

The campaign's centrepiece was the Road to Respect Roadshow – an interactive truck that travelled to ten selected locations across metropolitan and regional Victoria. The aim was to give thousands of Victorians an opportunity to experience the road from a truck driver's perspective and remind truck drivers of their road safety responsibilities. VicRoads research found that the most likely way to influence driver behaviour was to allow drivers to experience the road from another driver's perspective. VicRoads engaged a consultant, Icon. Inc, to develop a campaign based on this experiential approach to learning which became the central theme of the campaign, to show, rather than tell, drivers how to share the road respectfully. Key results include:

- 12,000 people visited the roadshow
- The website attracted 3,100 page views
- 27,000 people saw activity on Facebook
- 75% of visitors rated the exhibit eight or more out of 10

- 78% responded that they would change the way they drive around trucks (the most common response was 10 out of 10).

Keywords

Community attitudes to road freight vehicles, Community engagement, Crash causation, Driver behaviour, Education campaign, Key road safety messages, Road to respect roadshow, Social media.

Background and methodology

In 2012 VicRoads developed and implemented a road safety campaign to educate truck and car drivers about sharing the road safely. Studies into multi-vehicle crashes involving trucks and passenger cars indicate the car driver to be the responsible party in the majority of crashes. In addition, Victorian freight is predicted to grow by 50 per cent by 2020 and that freight moving around Melbourne by road will almost double by 2030 [1]. The demand on all drivers to share the road safely will increase with a growing freight task. Managing this situation by reminding and educating the driving public to share the road safely became the impetus for this road safety campaign.

Crashes, causes and who is responsible

The Large Truck Crash Causation Study (LTCCS) examined a representative sample of 967 fatal and injury crashes in the US in the period 2001 to 2003. The aim of the project was to increase knowledge of the factors that contribute to heavy vehicle crashes. Data were collected examining up to 1,000 factors in each crash. The study examined data on 1,127 large trucks, 959 non-heavy vehicles, 251 fatalities and 1,408 injuries [2]. The LTCCS reported that in two-vehicle crashes involving a large truck and a passenger vehicle, the passenger vehicle was responsible in 56 percent of the crashes and the large truck in 44 percent of the crashes examined.

The European Commission (EC) and the International Road Transport Union (IRU) recently published findings of their joint study, the European Truck Accident Causation (ETAC) study. The aim of the study was to identify the main causes of crashes involving trucks in seven European countries. Figure 1 shows the distribution of crashes categorised as human error, mechanical failure of the vehicle, infrastructure and weather conditions. The study investigated 624 truck crashes from 1 April 2004 through to 30 September 2006. The analysis indicated that in 85.2% of the 624 crashes, human error was the cause of the crash. However, of these 75% were deemed to be caused by the road user, other than the truck driver.

Identifying the issue

In 2005, Austroads published a study titled *Community Attitudes to Road Freight Vehicles*. The report indicates that in regard to road freight issues, 55 per cent of those surveyed believe that truck drivers are more tolerant and less aggressive than car drivers and 81 per cent agree that trucks are important for the Australian economy, echoing the transport industry's maxim that 'without trucks, Australia stops'. One quarter of interviewees reported observing car drivers driving in an unsafe manner around trucks. However 55 per cent reported that sharing the road with large trucks makes them feel uneasy. When asked how the situation could be improved, 93 per cent of interviewees believed that car drivers needed to be better educated about how to drive around trucks [4].

The Victorian Road Freight Advisory Council (VRFAC) advises VicRoads on the development, planning, regulation and operation of road freight services in Victoria. The council receives comments on issues of concern to the transport industry. One commonly raised issue was the perceived lack of understanding by road users about the operational requirements of heavy vehicles. The VRFAC commissioned a report that, among other things found

"there was the need for more forceful education in relation to the risks while driving near heavy vehicles and ... [better] ... knowledge of the challenges facing truck drivers on the road [5]. In addition, the attitudinal research found that 'the most important single step [in creating a successful communications strategy] would be to create a perception that truck drivers have a sense of responsibility towards other road users'.

Responding to the issue

Studies confirm human factors remain the most significant contributor in all crashes. They also show that the community acknowledge that a thriving economy is dependent upon road transport to move goods throughout the state. While the driving community identify a discomfort when sharing the road with trucks, there is a body of evidence to show that a significant percentage of crashes are a direct result of the driving behaviour of car drivers. Reminding and educating drivers on appropriate driving behaviours around trucks is an essential factor towards improved road safety outcomes.

In 2012 VicRoads engaged ICON.Inc, a consulting firm specialising in blending the skills of public relations and education and advertising campaigns, to develop a campaign to excite and engage the Victorian driving public. The *Road to Respect Roadshow – Share the Road Safely* campaign was the result.

Detailed results

The campaign

VicRoads and ICON.Inc developed a campaign to remind and educate all drivers of their responsibility to one another when sharing the road. Rather than telling truck and car drivers how to drive, the campaign centred on working with drivers to consider how they drive and to look at ways to

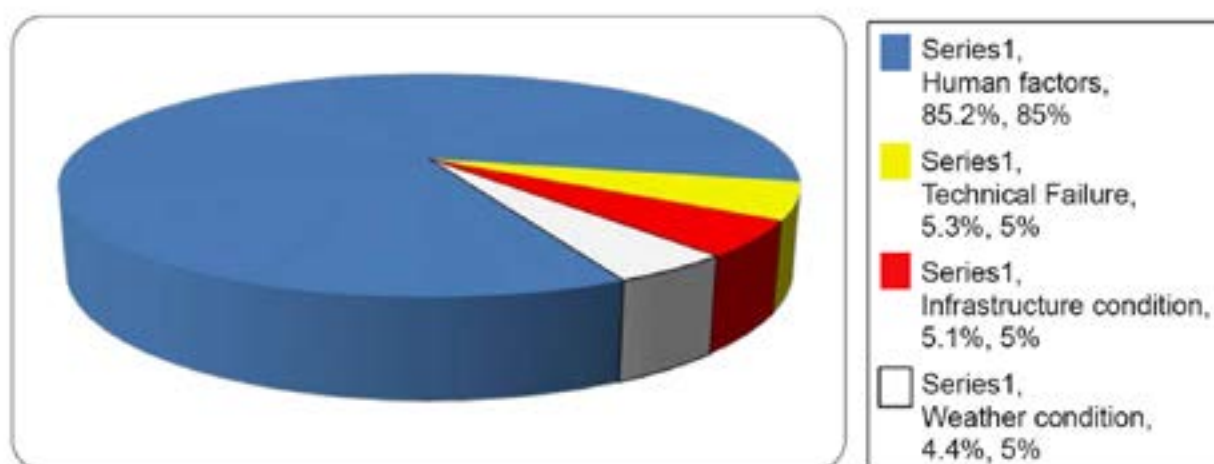


Figure 1. Categories of crash causation for all road users ETAC [3]

improve their driving around one another. This demands of the driver a level of awareness and respect for each other's needs. In addition, a central criterion for the campaign was that it should be experiential.

The aim was to give Victorians the opportunity to experience the road from a truck driver's perspective first-hand by developing an awareness of the driving challenges facing truck drivers and to remind truck drivers of the concern car drivers experience when sharing the road.

Many options were considered before the campaign settled on a roadshow; a truck to carry the message across the state and deliver it to drivers face-to-face. ICON.Inc negotiated with the Australian Trucking Association (ATA) on behalf of VicRoads to lease their interactive, educational semi-trailer. The truck was re-skinned with the campaign's unique branding and key messages. This enabled VicRoads to deliver an experiential roadshow using a multi-million dollar trailer reaching thousands of Victorian drivers, with specific messages targeting all drivers.

The roadshow truck and all supporting communications material carried a unique brand for the Road to Respect roadshow campaign, to complement VicRoads' corporate brand. This brand was tested at focus groups and received a positive response before being finalised and implemented throughout the campaign across the truck, banners, signage, presenter uniforms and digital materials.

A theme to carry the campaign message was devised. It centred on the premise that truck and car drivers and other road users should respect one another. Neither truck nor car driver was to be the villain or the victim. Hence, driver respect for one another became the glue of the campaign.

The campaign was themed "The Road to Respect Roadshow" – aimed at complementing and extending VicRoads' Safe System approach to managing the road network.

Encouraging respect between all road users, particularly trucks and cars, is the first step towards achieving greater awareness of road sharing and enhanced road safety. In turn the campaign aimed to help reduce deaths and serious injury on Victorian roads. The positive nature of the "Road to Respect" theme was designed to appeal to both car and truck driver audiences.

The truck

The truck came pre-fitted with a series of video screens, interactive games and education messages. Icon's design team produced a new campaign for deployment throughout the truck and managed the installation and decommissioning process.

Internal and external skins were created, with key messages and videos leading visitors on a journey through the truck. Print and video messages combined with interactive and hands-on video games to engage visitors. Simple and colourful external graphics were used to attract attention and create a friendly and approachable feel to the truck. An interactive stopping distance game was developed by VicRoads and installed in the truck. The game encouraged users to guess the stopping distances of cars and trucks travelling at different speeds. It also opened a communication with visitors about refraining from 'cutting in' into the path of trucks. Users were asked to place a branded stress ball – a 'squishy car' – on the table and then press a button to reveal actual stopping distances. They could then take the squishy car home as a reminder of the message behind the interactive game on correct stopping distances. The stopping game was a popular component of the truck experience, with exit polls highlighting this message as the most memorable. The stress ball cars proved extremely useful and effective when demonstrating the game. They also worked to gain interest among passers-by, encouraging them to visit the truck and engage with the materials.



Figure 2. Branding used in the Road to Respect campaign

Key messages were displayed throughout the truck as punchy text panels and information graphics. They included information on blind spots, stopping distances, overtaking, tailgating, speed, sharing the road safely, and turning trucks.

Car drivers were able to experience the size and visual limitations of trucks first-hand, with truck drivers included in the discussion rather than targeted for dangerous behaviours. The core theme of “mutual respect” was reinforced through neutral messages, safety tips, and face-to-face interactions.

Road safety messages

The following road safety messages were drafted, tested during market research and refined to make them as simple and memorable as possible to both car and truck drivers. The messages were displayed in the truck and became the focal point for all communications used in the campaign.

- Truck blind spots are large. Know where they are and make sure the driver can see your vehicle in the truck’s mirrors.
- Trucks take longer to stop. Don’t drive in the gap that is required for a truck to stop safely.
- When overtaking a truck, be patient and wait for a safe opportunity. Look and allow enough time and distance to overtake.
- Don’t drive too closely to the vehicle in front. Always be respectful of other road users.
- Drive at or below the speed limit. Be aware of the conditions and travel at an appropriate speed.
- Don’t overtake or travel beside a turning truck. Trucks use more road space to turn.
- All road users have a right to use the road. You have a responsibility to play your part.

The Roadshow

The Road to Respect roadshow included ten stops across metropolitan and regional Victoria, attracting almost 12,000 visitors through the exhibit over the course of two months between 4 September and 3 November 2012. It is worth noting that this attendance figure did not include sightings of the truck and engagement with the external video, which greatly enhanced the exposure of the campaign and its key messages.

Snapshot of the roadshow

Unlike many road safety education campaigns, the roadshow was designed to show rather than tell drivers how to share the road safely through interactive games

and educational videos. The busiest events were the Royal Melbourne Show and Royal Geelong Show respectively, with the quietest event being Chadstone Shopping Centre.

The Royal Geelong Show was highlighted as one of the most successful events, which was attributed to its regional setting and size. The regional setting meant the demographic at the event was a captive audience that was interested and engaged with the exhibit, while the size of the event ensured significant numbers through the exhibit.

The feedback captured through exit interviews and in conversations with exhibit staff demonstrated the campaign was positively received in the community and helped to increase awareness about sharing the road safely with trucks.

The roadshow was particularly well received in regional towns and several event organisers from other towns asked for the Road to Respect to visit their events in the future.

The roadshow truck experience was well received, with the most effective exhibits in the truck being the stopping distances demonstration and ‘risky driving’ video. The majority of people engaged with the stopping distances table, with many underestimating the braking distances required for trucks to stop. The ‘risky driving’ video content proved interesting for a significant proportion of people with many people taking time to watch the video in its entirety.

The games console in the centre of the truck was similarly a popular attraction with almost everyone passing through the truck engaging with the games on some level, showing a general willingness to participate in the truck experience. However, these games were part of the pre-delivery set up of the truck and were in some instances a step away from the campaign’s key messages; an irritation in overlaying one education campaign over another. The campaign’s key messages were displayed on the internal walls of the exhibit.

Stakeholder relations

The Road to Respect roadshow involved many stakeholders and project partners, including the office of the Minister for Transport. A key measure of success for the campaign was the involvement of the Minister for Transport and his staff. The Minister availed himself twice during the campaign to engage with visitors and media at roadshow events. Representatives from the three levels of government showed support for the roadshow with some expressing disappointment that the roadshow was not scheduled to visit their towns. Engagement and support from policy makers at the highest level ensured a successful campaign. The Australian Trucking Association (ATA), the Victorian Transport Association (VTA), Victoria Police, BP, Volvo, National Transport Insurance (NTI), the Royal Automobile



The Road to Respect Roadshow at the Royal Melbourne Show

Club of Victoria (RACV), 3M, Rambler, Rice Graphics, local councils, agricultural societies and various trucking operators, including Oxford Cold Storage, contributed in many varied ways to promote and assist the campaign.

Regular communication with the ATA and associated stakeholders, as well as with local councils and agricultural societies associated with each event, helped ensure the campaign's success.

Digital presence

Digital media was utilised to support the campaign. It became a secondary means to engage with potential visitors and to those unable to visit the truck. It provided stimulus to the campaign and a virtual 'home', but it was not intended to be a significant component in the campaign.

The website

The consultant, ICON.Inc, developed a campaign microsite hosted on VicRoads' website to provide information about the campaign and the Road to Respect roadshow. Over the course of the campaign, the website attracted more than 3,100 page views.

The microsite also hosted a campaign competition, generating positive engagement with the campaign and attracting several hundred entries.

Social media

ICON.Inc developed a campaign Facebook page to help drive consumer awareness and engagement with the Road to Respect roadshow and act as the "social home" of the campaign, supported by Twitter and to a lesser extent YouTube.

While the Facebook page was a valuable element of the campaign, it was a supporting aspect to the overarching behavioural change campaign and was used to document and capture activity from the roadshow.

Over the course of the campaign, 27,227 people saw activity from the Facebook page, with 1,894 people engaging with (clicking on) the page. There were 237 people who 'liked' the page and at the end of the campaign, 136 people were talking about the page. Page visitors spent an average of one minute and 13 seconds per visit.

The most popular pages were:

- Home page
- Competition
- About the campaign
- Roadshow map
- Inside the truck

Campaign collateral

The focus group deemed campaign collateral such as flyers and stickers would not offer the reminders required to ensure the messaging had a level of longevity, whereas a tangible object could fulfil this requirement.

Campaign branded stress ball cars were produced to help visitors engage with the stopping distances game and also act as an item to take home, a reminder of the visitors' 'connection' with the campaign messages. The stress ball car was also intended as a prompt to elicit discussion with family and friends, thus spreading the road safety messages.

This display was the most effective activity in the truck, borne out by the campaign's evaluation which found three out of four visitors to the truck said they learned about stopping distances in an unprompted exit interview question. The stress ball cars were also an effective tool to attract, reward and remind exhibition attendees of their experience.



Figure 3. Road to Respect Roadshow Campaign Locations

Media relations

The launch event with the Minister for Roads and representatives of VicRoads and Victoria Police generated positive coverage across TV, radio and trade media outlets. The launch event received substantial coverage comprising print, online, television and radio mediums. Most notably 3AW's Neil Mitchell conducted an interview with VicRoads about the Road to Respect roadshow. In addition, the launch received coverage on Channel 10's 5pm news bulletin, Channel 9's 6pm news bulletin, and was featured regionally on WIN Television's evening news. Myriad online trade (Fully Loaded, Owner Driver) and marketing and communications publications (B&T, Mumbrella) covered the launch event.

The Road to Respect campaign was supported by a major media push across print, television, radio and online outlets in metropolitan Melbourne and discrete media networks across regional Victoria. ICON.Inc handled all follow-up media requests, developed and distributed media releases, and worked to coordinate interviews and

photo opportunities with various media outlets providing background information on the campaign and talking points for the interviewee.

The campaign generated significant metropolitan and regional media interest with 42 articles across all channels (television, print, radio and digital) published over a nine week period. Most articles contained at least three key campaign messages, with the most prominent being the need for both car drivers and truck drivers to show greater respect to each other on Victorian roads. Advertising equivalent calculations across available television, print, radio and online coverage exceeded \$100,000. The Road to Respect campaign was also promoted on various local council and other organisations' websites and Facebook pages.

Additional information associated with the Road to Respect roadshow

Throughout the media relations, stakeholder relations, campaign branding, online and social media and the roadshow, the following information was conveyed:

- There are more than 122,000 trucks and more than four million cars registered in Victoria.
- Due to strong population growth [6] and increasing consumption, the freight moving around Melbourne is estimated to double by 2030 [1].
- Freight plays an important role in society and is an inevitable part of our daily lives. The Road to Respect campaign aims to educate car drivers and truck drivers how to share the road safely and acknowledges that all road users deserve respect on the roads.
- VicRoads is taking a fresh approach to improving road safety, showing rather than telling Victorian road users what it is like to be behind the wheel of a truck through a state-of-the art, interactive and educational travelling exhibition.
- The Road to Respect campaign is not about apportioning blame. Rather it is about encouraging all road users to respect and understand one another so we can all share the road safely.
- The Road to Respect roadshow gives car drivers an opportunity to experience the road from a truck driver's perspective, helping them to understand the physical limitations of heavy vehicles and respect truck drivers on the road.
- Major support for the Road to Respect campaign was provided by the Australian Trucking Association, Volvo, BP and the NTI, with further support from the Victorian Transport Association and various transport companies.
- Victoria's roads are for all road users, big or small, whether they are travelling to and from work, visiting friends and family or transporting goods across the state.
- Road safety is the shared responsibility of car drivers, truck drivers and all other road users.
- Car drivers and truck drivers each have a responsibility to be respectful and share the road safely.

The Road to Respect roadshow competition

The Road to Respect roadshow involved an online competition where people were encouraged to write a slogan for a series of road sign posters that conveyed the campaign's key messages. There were four rounds to the competition with a winner announced each fortnight and a grand prize awarded to the author of the overall best poster.

The fortnightly prizes were \$200 custom plate vouchers supplied by VicRoads. The competition sponsor, RACV, provided the grand prize – a \$500 RACV voucher. The

competition was promoted to the public through Facebook, flyers, QR code and event staff. The competition attracted a total of 216 entries. The winning taglines were announced through Facebook, with an image of the completed road sign.

Winning slogans

- Open your eyes to blind spots (grand prize winner).
- Be an ace. Leave some space.
- Turning trucks take up space. It's not a race.
- Treat you road neighbour as you would like to be treated.

Evaluation

Pre and post campaign research

In July 2012, BDC Market Intelligence conducted pre campaign research utilising an online methodology to establish Victorian drivers' attitudes and behaviours in sharing the road with trucks.

The research was to be used as a benchmark to test the effectiveness of the Road to Respect roadshow. The same 200 respondents were surveyed post-campaign.

The key learning from the research was that although awareness of the campaign was low, almost two-thirds (63%) of respondents were interested in attending once they were shown a communication piece detailing the campaign. More importantly, there was a significant shift in terms of driver behaviour when sharing the road with trucks post-campaign:

- the number of respondents who said they would never or seldom 'drive in the blind spot of a truck driver' jumped from 62% pre-campaign to 84% post-campaign;
- the number of respondents who said they would mostly or always 'be patient and wait for a safe opportunity when overtaking a truck' rose by almost 50% post-campaign.

Given the Road to Respect campaign was purely a public relations campaign (i.e. not supported by advertising), and that the majority of activity took place at regional events, it is not unexpected that the BDC research, with its metro-centric sample size of 200, found low levels of awareness. To engage a broader metropolitan audience in future, it is worth considering attending university and TAFE campuses and Melbourne high schools targeting years 11 and 12. This would effectively support similar messages directed at this cohort of drivers to develop a greater awareness of how to respectfully and safely share roads with trucks.

At the post campaign de-brief it was concluded that market research was not the most effective measure for a purely PR-focused campaign such as the Road to Respect roadshow. A future campaign may see greater allocation of resources to facilitate extensive exit interviews, which are more likely to provide an accurate reflection of the impact of the campaign on driver attitudes. Collection of visitor contact details during the exit interview process to follow up some time after the campaign would inform of the longevity of the messages. Over the course of the roadshow, ICON.Inc conducted 358 exit interviews compared to the research sample size of 200. With additional resources, more comprehensive exit interviews and follow up interviews could be conducted.

Exit interviews

The findings from 358 exit interviews were overwhelmingly positive. Most importantly, almost 85% of those surveyed said they were more aware of the challenges facing truck drivers on the road after experiencing the exhibit. The vast majority of those who answered 'no' to this question were truck drivers who were already aware of the issue.

Other key findings included:

- 80% said visiting the roadshow would make them more likely to maintain a safe stopping distance
- 80% said visiting the roadshow would make them more likely to stay out of a truck's blind spot
- 76% said visiting the roadshow would make them more likely to give trucks room to turn
- 75% rated the exhibit eight out of 10 or above
- 75% said they learned about stopping distances (unprompted)
- 72% said visiting the roadshow would make them more likely to overtake safely
- 60% answered 8, 9 or 10 out of 10 as to whether they would be likely to change the way they drive around trucks (the most common response was 10 out of 10)
- 51% said they learned about blind spots (unprompted)
- 43% said they learned about overtaking (unprompted)
- 40% said they learned about turning trucks (unprompted)
- 36% said they learned about tailgating (unprompted)

The exit interviews showed that while 75 per cent of participants learned about stopping distances, only 50 per cent learned about blind spots and less than 50 per cent learned about overtaking, tailgating and turning trucks.

While this finding appears to indicate many of the key messages did not get through to participants, it is believed that the results are, in part, reflective of way the question was asked, that is: "What did you learn from the roadshow exhibit today?" The question was unprompted and did not ask participants to state more than one learning, so it is reasonable to assume participants would state their key learning rather than reeling off a list of key messages.

The videos were also effective in conveying the key messages, as shown by conversations between the event staff and visitors to the truck who often expressed surprise and shock at the video footage. But because the videos were more informative as opposed to an interactive educational display, participants were less likely to specify what they had learned as a key message. In addition, recall of an interactive display is likely to be more memorable than a didactic one-way communication stream.

Possibly a better outcome is to align key messages with an experiential opportunity. The number of key messages should also be limited to a maximum of four to allow stronger focus and greater recall.

Key observations

An analysis of the roadshow highlights some key observations:

- More people visited the exhibit at the regional agricultural shows than metropolitan events.
- Regional agricultural shows were also more likely to draw an audience that had the time and the desire to explore the exhibit.
- Roadshow stops linked to a pre-existing event were far more successful than stand-alone events such as Chadstone Shopping Centre or the Hargreaves Mall in Bendigo. In part this was due to the fact that the pre-existing event's marketing and communications materials could be leveraged to raise public and media awareness of the roadshow.
- A greater number of staff to support the campaign driver and travel with the campaign may have enhanced the experience for the visitor.
- The stopping display and stress ball cars were the most well received activities in the truck. They enabled visitors of all ages to participate and it was a clear, simple message that had strong impact. The videos were also well received and effective at conveying the campaign's key messages.
- Where possible, key messages should be aligned with an experiential opportunity. The number of key messages should also be limited to a maximum of four to allow stronger focus and greater recall.

The truck

Some constraints exist with refitting a vehicle used for a different purpose. These include the configuration of the vehicle to manoeuvre visitors through the exhibit and converting existing materials to reflect the theme of the campaign. A purpose built vehicle would offer the opportunity to overcome these limitations however this would prove to be an expensive option. The fact that the exhibit itself was a truck and that it was visually striking worked as a strong draw card for audiences, particularly heavy vehicle drivers who were curious about the truck. The presence of the truck and face to face engagement with the campaign's truck driver and exhibit staff enabled valuable conversations on the driving challenges faced by truck drivers.

A final word

Finally, it should be noted that through a collaborative relationship, VicRoads with ICON.Inc, developed and delivered a highly successful campaign to remind and educate roads users of their responsibility to share the road safely. Weekly formal meetings and regular open contact was a formula for success. The professionalism and dedication of ICON.Inc to the task was unwavering and enabled VicRoads to deliver this important road safety education campaign.

To finish – quotes on the Road to Respect roadshow from members of the driving public, their families and friends.

- A father in his fifties was so impressed with the truck exhibition that he drove home, collected his three young drivers and returned to the truck. Each young driver acknowledged they had learnt something new.
- One man who had been driving for 15 years didn't realise that trucks have such large blindspots. He was very appreciative of the tip to stay back from the truck so that he had a clear view of the truck driver and in turn, the truck driver had a clear view of him.
- "This is a great idea – it should have been done 20 years ago, but it's great they're doing it now."
- "It's definitely made me more aware of sharing the road with trucks."
- "It's a great idea. There's nothing like this in Queensland – they should take it all across Australia." – A heavy vehicle driver in his 40s.
- "I've been driving for more than 40 years but everyone can always learn how to become a better driver." – A car driver in her 60s.
- "They need to introduce tougher laws for drivers but education is just as important as enforcement so this is a good initiative." – A car driver and cyclist in his 50s.
- "It's about time they did something for trucks. I'm used to country driving but in the city everyone just cuts in. I hope the message gets through." – middle-aged female.
- (After watching the video where a car gets clipped by a turning truck): "That same thing happened to me the other day at a roundabout. It's great you're doing this because otherwise people wouldn't know what can happen when you drive next to trucks unless they have a bad experience." – male in his 30s.
- "I didn't know truck blind spots were so large. My husband nearly got bumped by a truck the other day and it must have been because the driver couldn't see him." – female in her 30s.
- "The video footage is the most effective. The games are good for kids but it would be great to see more graphic video footage like the VicRoads Truck Rollover video." – male in his 60s.
- The model table was popular, with many people shocked at the differences in stopping distances between trucks and cars.
- Several truck drivers and ex-truck drivers said that the examples provided in the video and key messages of the campaign were indeed the most common problems that they were faced with on the road, in their experiences.
- A middle-aged woman took quite a bit of time going through all the messages and took some flyers for her sons who are on their P-Plates, saying that the Road to Respect was a great campaign – "it's good to have these messages reinforced".
- "These materials are great – they should be included in the stuff you get when you go for your licence." – a middle-aged man.
- A male heavy vehicle driver in his 50's said, "It's good you're doing this. Anything to cut the road toll is a good thing. I have a 19 year old son and it makes you nervous when they're on the road."
- A male heavy vehicle driver in his 40s said the campaign is a great idea and that, "even if you change one person's behaviour then that might be one less serious accident on the road."
- A man in his 70's and heavy vehicle driver said the campaign is a good idea stating, "Be aware and share is exactly right. People don't have any idea about turning trucks. Hopefully the message gets through."
- "It's really good you're here. Thank you." – male in 40s.

- “This is great. My friend told me to come check it out.” – female in 50s.
 - “Is this the same thing that was on ABC radio this morning? I heard the guy talking and it’s exactly right. People are in too much of a hurry. This is really good – respect is a great word for it actually.” – female in 60s.
 - “Never overtake or travel beside a turning truck!” – said by a five year old boy to his parents as he was exiting the truck.
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Evaluating a package of interventions to improve young driver safety

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Winner of the Conference Theme Award, which recognises the conference paper that best fit the theme of “vision, action, results, this contributed article was originally presented at the Australasian Road Safety Research, Policing and Education Conference held at Brisbane, Queensland, 28-30 August 2013.

Abstract

Young driver safety is a high priority in New Zealand’s 10 year road safety strategy, *Safer Journeys*. A target has been set to reduce the rate of fatalities among young people in New Zealand from 21 per 100,000 to a level closer to Australia’s 13 per 100,000 (2008 figures). Under this strategy a number of changes have already been implemented: the licensing age was raised to 16 and the licensing test toughened, a zero alcohol limit for under 20-year olds was introduced in 2011, and policing has been targeted to ensure more young people are driving within their licence conditions. Education and advertising initiatives have also been developed to support these changes, and to encourage more parental involvement and safer vehicle choices. The effects of these legislative, enforcement and education interventions have been

monitored and evaluated through changes in road crash patterns, audience reactions to the advertising messages, licence offences committed by young drivers, and surveys of driver knowledge and attitudes. Since the changes have been made, the number of drink-driving offences by teenagers decreased by more than 50%, reported crashes involving young drivers decreased by one-third, and some parents have shown an increased intention to remain part of their teenagers’ driving supervision beyond the restricted test. The relationships between these interventions and the results achieved so far will be discussed in this paper.

Keywords

Advertising, Licensing age, Parental supervision, Road policing, Young drivers, Youth alcohol limit.

Introduction

New Zealand’s road safety strategy to 2020, *Safer Journeys* [1], has as one of its goals a reduction in the fatality rate of young people. In 2007/08, the fatality rate for young New Zealanders in road crashes was 21 per 100,000 population. Half of these fatalities were drivers. By comparison, the

equivalent rate in Australia was 13 per 100,000 population. As part of the strategy to reduce fatality rates among young people, a number of interventions have since been put in place aimed at young drivers:

- the age at which people can apply for a licence was raised to 16 years in August 2011
- the licence test for restricted drivers was made significantly longer and more difficult, requiring a higher level of driving ability than previously
- young driver safety was included as a specific activity in the 2012-2015 Road Policing Programme [2], aiming to ensure that “more young people are driving within their licence conditions”
- a mass media advertising campaign began in 2011 to encourage parents to stay involved with their teenagers after they gain their restricted licence
- the alcohol limit for drivers under the age of 20 years was reduced to zero in August 2011.

New Zealand has had a graduated driver licensing scheme (GDLS) in place since 1987. Prior to August 2011, a person was able to apply for a learner licence when they turned 15 years of age, and start learning to drive. After six months on a learner licence, they could undertake a test to gain their restricted licence. Drivers became eligible for a full licence after a further 18 months, or 12 months if they completed an approved advanced driving course.

The learner phase of the GDLS remains relatively safe, as drivers are required to be supervised while driving. The highest risk of crash involvement is during the first six months of driving solo in the restricted phase. Most of the new interventions address this restricted phase.

New Zealand’s road safety strategy is founded on a safe system approach, which focuses attention on programmes, measures and interventions designed to reduce fatal and serious injuries. Although the goal of the strategy for young driver safety is based on overall fatality rates for young people in crashes, this paper will take the safe system approach of discussing trends and results in terms of fatal and serious injuries. Serious injuries in New Zealand crash reports are defined as fractures, concussion, internal injuries, crushings, severe cuts and lacerations, severe general shock necessitating medical treatment, and any other injury involving removal to and detention in hospital.

Advertising

In 2010, an advertising campaign was developed with the aim of increasing the awareness of the high risks that young drivers face on the roads in New Zealand. The campaign was targeted at parents and caregivers, demonstrating the

importance of continued supervision once their teenager begins driving solo, and encouraging both the parents and novice drivers to use the **safe teen driver** education website.

Advertising messages have been placed in multiple media to promote young driver safety, by targeting the parents and caregivers of young drivers who have recently graduated from a learner licence and gained their restricted licence. The intention of the advertising was to promote the idea to parents that they need to remain part of their young driver’s training. The advertising needed to dispel the perception that the restricted licence is an opportunity for parents to end their involvement.

Further details of the advertising campaign itself can be found on the campaign website [3].

The performance of the advertising campaign is monitored by means of a continuous online survey. This survey, conducted throughout the year and averaging 55 participants per week, is used to monitor audience reactions to all the NZ Transport Agency’s advertising campaigns. Survey questions of interest to this paper include:

- recall, relevance, likeability and message takeout
- attitudes to driving and road safety issues
- demographic information.

The survey sample is structured to provide sufficient numbers of males, young people, rural people and Maori for these groups to be analysed separately. Males and young people are therefore over-sampled to enable these analyses. The survey data include weightings to standardise the sample to a normal demographic distribution, to permit analyses of the whole sample (see Table 1).

The Young Driver campaign launched in June 2010, led by the television (TV) advertisement “Don’t Bail Out” and was supported by print, radio and online advertisements. The TV advertisement had good awareness, with over 90% of the target audience being aware of the campaign when prompted. Relevance of the advertising was, pleasingly, highest for couples with children, males (reflecting the lead characters in the TV advertisement), people aged 40–54 years, and higher household incomes (\$60,000 and higher).

Of the key messages reported by the target audience, 40% are in the right territory, from the point of view of the campaign, of “keep supervising” or “the job isn’t over”. Figures 1 and 2 illustrate that the level of message takeout, and awareness of the advertising, both stabilise after 8 – 9 months.

As for an awareness of risk, only around 10% of the target audience responded with the key message “young drivers are most at risk when they are on their restricted licence”.

However 87% of the target audience agreed to a statement that the first six months of driving solo after passing the restricted licence test, is when their teen is most at risk of having a crash where someone gets injured or killed [4].

Enforcement

As part of the 2010–2020 *Safer Journeys* strategy, young driver safety is included as a specific activity within the 2012–2015 Road Policing Programme. The Road Policing Programme is an agreement between the Minister of Transport and the NZ Police for the delivery of road policing services. The desired outcome for this policing activity is that “more young people are driving within their licence conditions” [2].

Road policing is expected to contribute significantly to two strategic outcomes: (1) a reduction in the number of young drivers on graduated licences who are at fault in fatal/serious crashes, and (2) an increased percentage of youth surveyed who believe they will be stopped for non-alcohol/speed offences. Police report their level of enforcement activity each quarter to the Minister and the NZTA.

Table 1. Advertising survey sample structure (3 months, N=720)

	Sample structure	Population structure
Males	60%	50%
Females	40%	50%
16-24 year olds	45%	17%
Rural/provincial	20%	27%
Maori	14%	16%

The road policing contribution is delivered primarily by enforcement of the licence provisions under the GDLS, such as not driving between 10pm and 5am, or carrying passengers without the supervision of a licensed driver. From 2011 onwards, offending decreased nearly 30% from a steady level of around 50,000 detected offences per year during 2005–2010, to around 35,000 offences in 2012 (see Figure 3). An overall decrease in detected offences by 15–19 year old drivers has occurred since 2008, which only accentuates the later change in GDL offending in more recent years.

Driver knowledge and attitudes

Two sources of information were used to monitor any changes in the attitudes of young drivers. The NZ Ministry of Transport conducts an annual survey of public attitudes to road safety, through one-on-one interviews with approximately 1600 people each year [5]. Approximately 300 people in the survey are aged 15–24 years, and their responses have been used in this paper. Questions pertinent to recent interventions designed to improve young driver safety included:

- How likely are you to be stopped for other traffic offences (not drink-driving or speeding)?
- Have you driven while slightly intoxicated in last 12 months?
- Do you agree most people caught driving under influence are just unlucky?
- Do you agree it's difficult to go easy when drinking with friends?

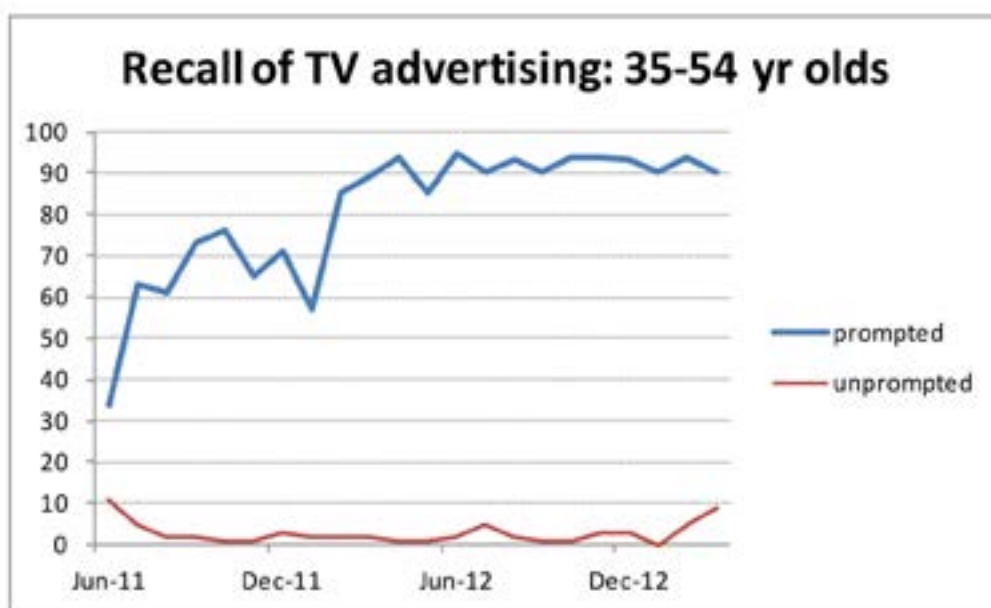


Figure 1. Percentage of surveyed audience who recalled the TV advertisement “Don’t Bail Out”

Table 2 show the shifts in these attitude statements since 2003, by young people aged 15–24 years and by all people in the survey. Typically, attitudes are slow to change. However, one of the success measures for the road policing contribution to young driver safety - the percentage of youth surveyed who believe they will be stopped for non-alcohol/speed offences - has shown a steady improvement since 2006 (see Figure 4).

As part of the continuous monitoring survey for the New Zealand road safety advertising programme, described above, respondents are asked a short set of attitudinal questions about road safety issues. The responses are collected into quarterly or annual summaries. Two questions of interest to this paper from the advertising monitoring survey are:

- What things do you think can make driving on New Zealand roads unsafe?
- How many drinks would you normally have and still consider driving?

Among the usual features that are considered to make driving unsafe, such as drink-driving, speeding, the condition of the road and the weather, “inexperienced drivers” is mentioned by 8% of respondents. Although the percentages are small, from a survey sample of 240 young respondents each quarter, and 360 older respondents, the trend may indicate an increasing awareness of the risks associated with young drivers (see Figure 5).

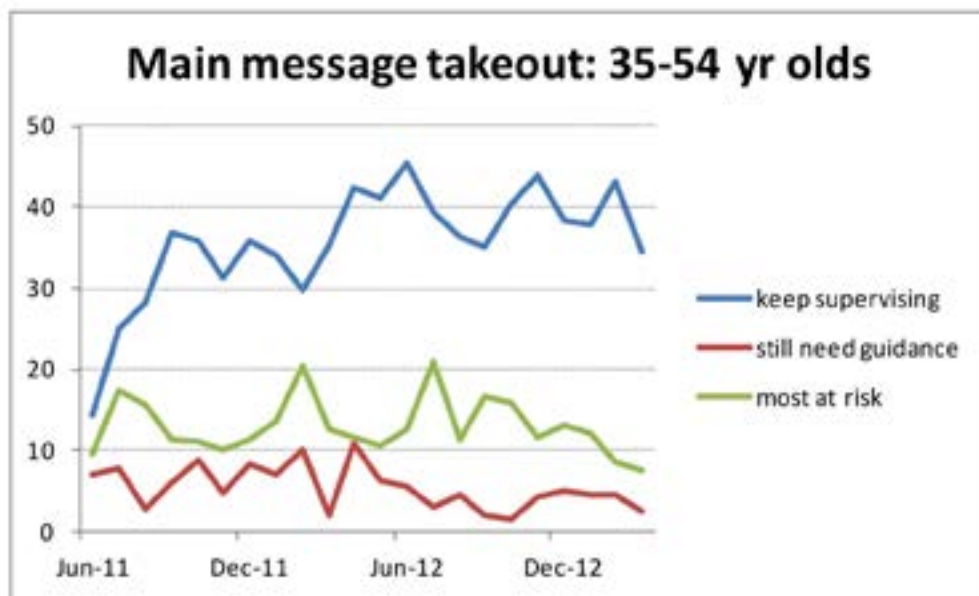


Figure 2. Percentage of surveyed audience who reply with key main messages to the question “What do you think the advertiser is saying to you in this advertisement?”

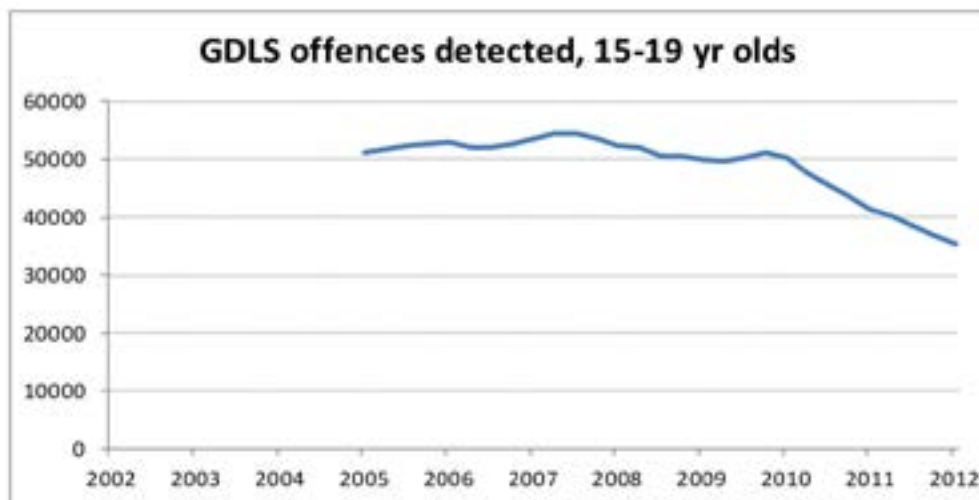


Figure 3. Offence notices issued for graduated driver licence offences by 15-19 year old drivers (rolling 12 month totals)

The second question in the advertising monitoring survey has been introduced into the survey only recently, and the numbers are not yet sufficient for the results to be disaggregated for young and older drivers to show any effect from the recent zero alcohol limit for drivers under 20 years of age. Data from the first three quarters have shown a consistent response level of close to 90% who say they would consider driving after 0, 1 or 2 drinks. Only 1% say they would consider driving after more than four drinks.

Crash patterns

Road crashes and injuries involving young drivers have been extracted from the NZ Crash Analysis System for the period from 2002, prior to these interventions, and up until March of this year. Crash factors of interest to this paper have been the driver's age, licence status and alcohol level, the severity of the crash, and whether the driver is at fault.

Between 2002 and 2009, approximately 1000 drivers aged 15–24 years were involved in fatal or serious injury crashes in New Zealand each year (see Figure 6). After 2009, this number decreased by approximately 100 each year, so that by the end of 2012 the total had fallen to 650 young drivers per year in fatal or serious injury crashes. Sixty-one young people were killed in road crashes in 2012 (9.5 per 100,000 population), compared to 117 in 2008.

The downward trend is more remarkable because it is particular to young drivers. On a per capita basis, a sharp decrease in driver crash involvement per 100,000 population is apparent after 2009 for young drivers, but not for the larger population of drivers 25 years and over (see Figure 7).

A more detailed investigation of the crash records reveals that the decrease in young drivers in crashes is most apparent for those on restricted licences. After 2007, the number of drivers aged 15–19 years who were involved in fatal or serious injury crashes halved from approximately 200 per year to 100 per year by the end of 2012 (see Figure 8). A similar reduction, in percentage terms, occurred for drivers on learner licences, but two years later.

Alcohol as a contributing factor in young driver crashes also decreased after 2007. From that time, the involvement of alcohol-affected, 15–19 year old drivers decreased from approximately 120 per year to 60 per year by the end of 2012 (see Figure 9). By comparison, the decrease in alcohol-affected drivers in fatal or serious injury crashes among the wider driving population was much less pronounced. This is shown in Figure 9 with a time series indexed to 100 in 2002, to allow a straightforward comparison with the younger driver time series.

Discussion and conclusions

This paper draws together the results of Police enforcement activity, a mass media advertising campaign, public attitude surveys and crash reports in an attempt to demonstrate the effects of changes in New Zealand's strategic emphasis on young driver safety. Regulatory changes have also been part of the strategy, raising the age at which new drivers can learn to drive, increasing the difficulty of the restricted driving test, and reducing the driver alcohol limit to zero for persons under 20 years of age.

Table 2. Results from annual survey of public attitudes to road safety

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Percentage of drivers who agree they are likely to be stopped for non alcohol/speed offences										
15-24 yr olds	44	41	34	28	39	35	41	44	39	42
all people	32	36	33	32	34	37	36	41	38	37
Percentage of drivers who say they have driven while slightly intoxicated in last 12 months										
15-24 yr olds	26	26	15	27	28	27	26	28	26	25
all people	24	20	21	24	23	23	21	20	21	20
Percentage of people who agree it is difficult to go easy when drinking with friends										
15-24 yr olds	47	35	45	44	47	48	32	41	50	39
all people	35	31	35	35	37	39	34	35	38	35
Percentage who agree most people caught driving under influence are just unlucky										
15-24 yr olds	28	18	18	23	26	28	16	16	17	16
all people	20	17	17	19	17	19	17	16	16	16

Since the changes have been made, the number of drink-driving offences by teenagers decreased by more than 50%, reported crashes involving young drivers decreased by one-third, and some parents have shown an increased intention to remain part of their teenagers' driving supervision beyond the restricted test.

The timeframe for some of these results has varied. The number of crashes involving young, 15-24 year old, drivers began to decrease from 2009. More particularly, crashes and offending involving teenage drivers began to decrease

substantially after 2010, coinciding with the introduction of licensing changes and a zero alcohol limit for these drivers.

Interventions relating to young drivers were therefore beginning to have an effect even before the regulatory changes in 2011. These latter changes helped to dramatically reduce overall fatalities and serious injuries among young people and young drivers, and to move the fatality rate towards its goal. By the end of 2012 the fatality rate for young New Zealanders in road crashes had decreased to 10 per 100,000 population.

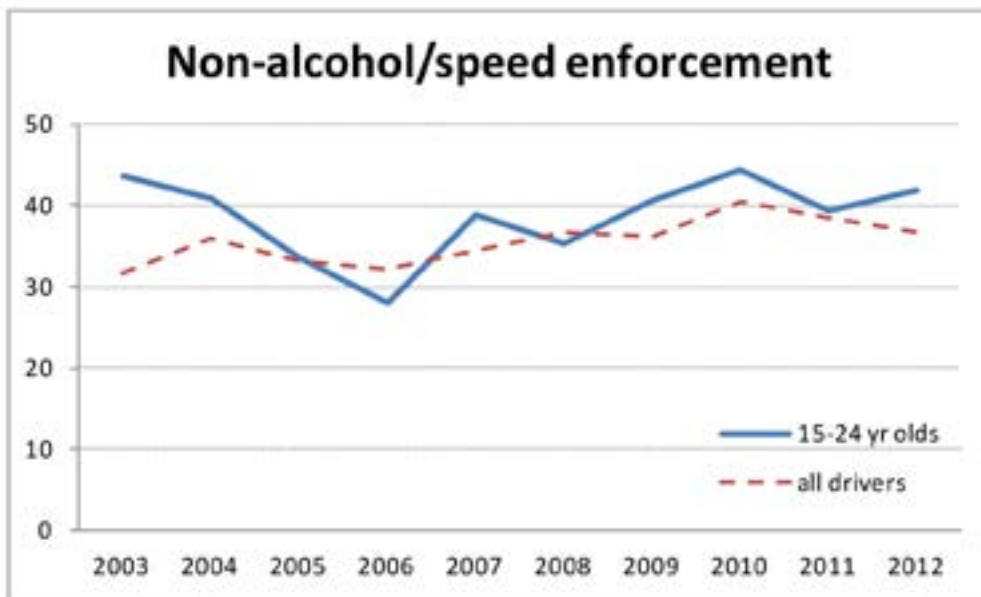


Figure 4. Percentage of surveyed drivers who agree they are likely to be stopped by Police for offences other than drink-driving or speeding



Figure 5. Percentage of surveyed people who consider "inexperienced drivers" make driving on New Zealand roads unsafe

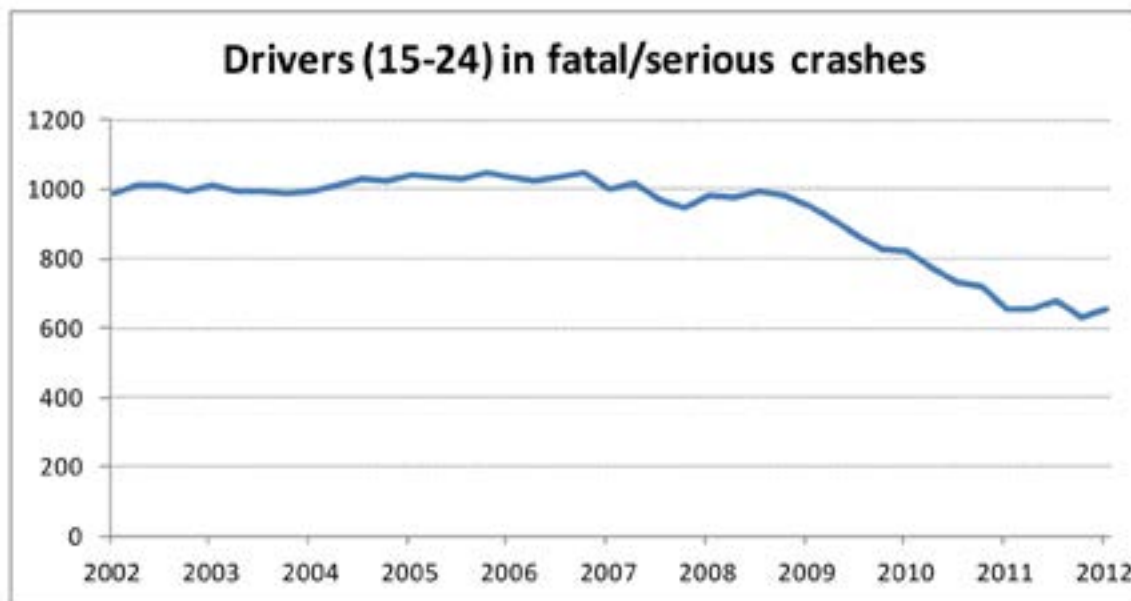


Figure 6. Young drivers (15-24 years) in fatal or serious injury crashes (rolling 12 month totals)

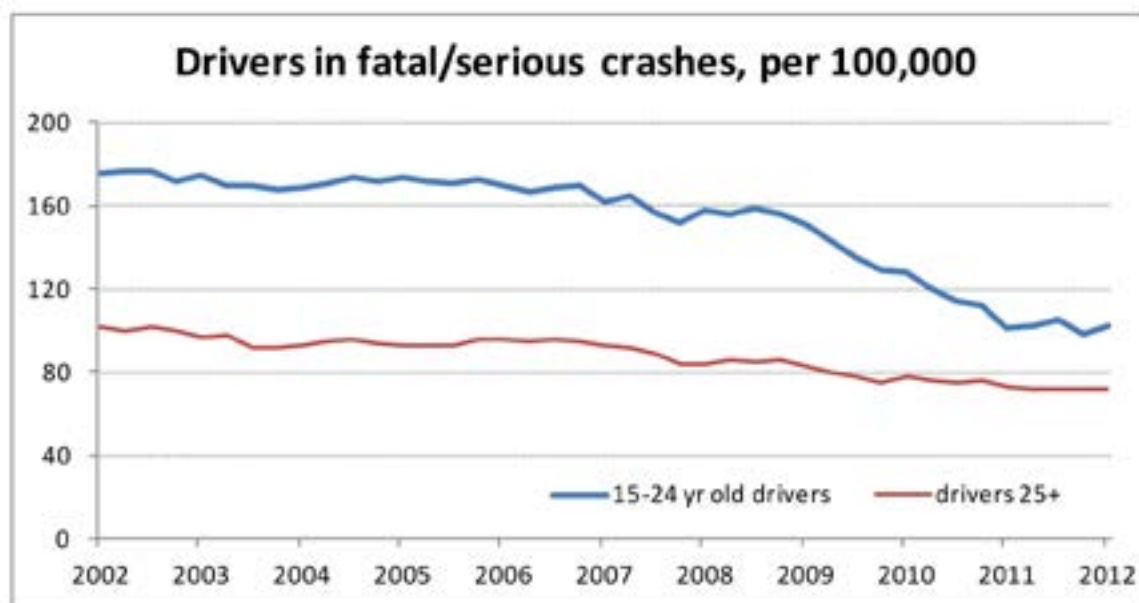


Figure 7. Drivers in fatal or serious injury crashes, per 100,000 population, by age group (rolling 12 month totals)

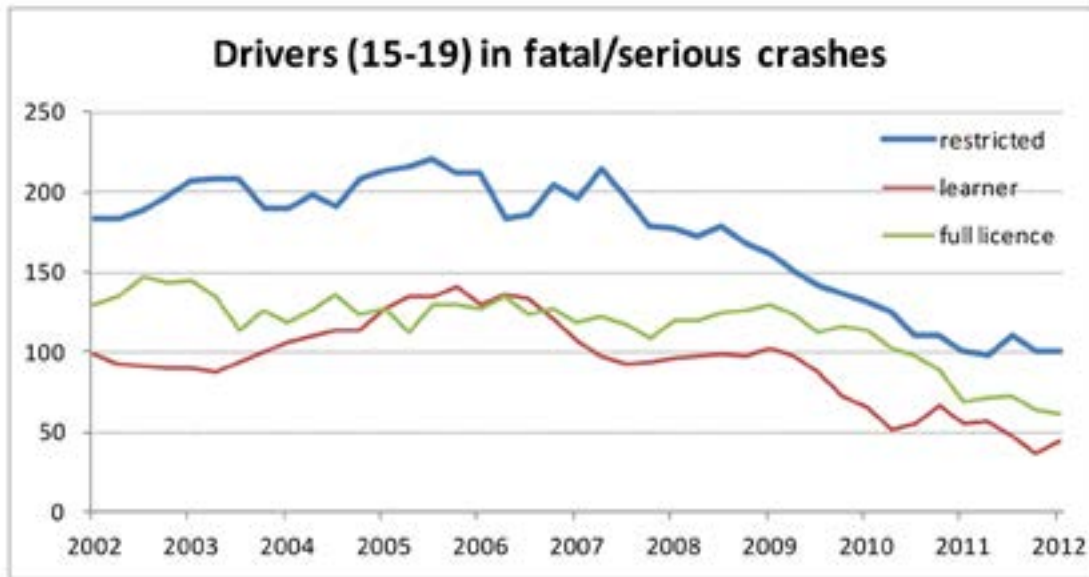


Figure 8. Drivers in fatal or serious injury crashes, by licence status (rolling 12 month totals)

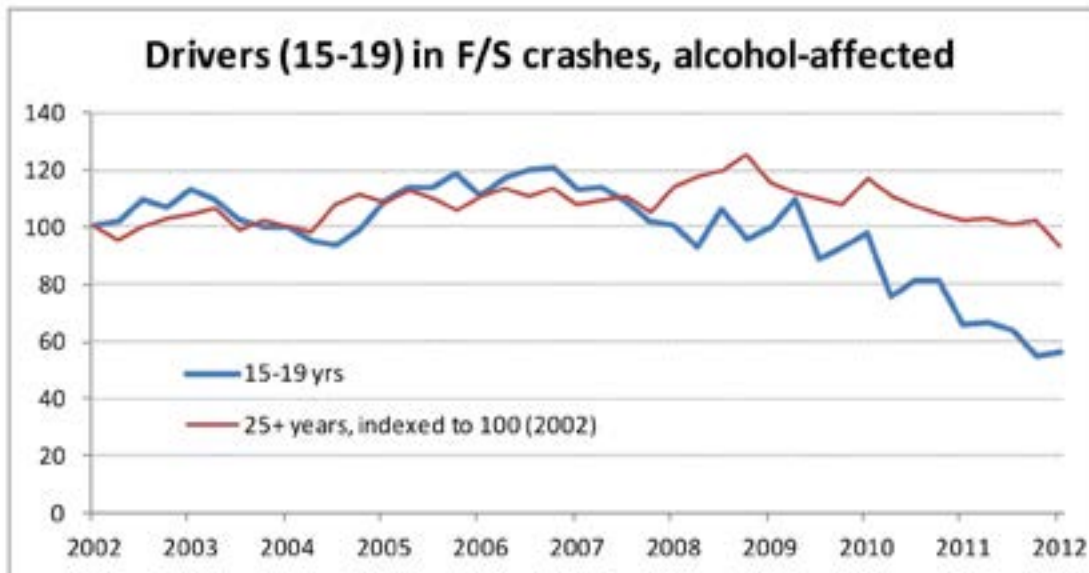


Figure 9. Alcohol-affected drivers in fatal or serious injury crashes, by age group, 25+ year olds indexed to 2002=100 (rolling 12 month totals)

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The Transportation of Children and Youth with Additional Needs (TOCAN)

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TOCAN members today include The Royal Children's Hospital, VicRoads, Britax, the Royal Automobile Club of Victoria, the Australian Child Restraint Resource Initiative, Murdoch Children's Research Institute, Amaze (formerly Autism Victoria), and the Association for Children with a Disability.

The Transportation of Children and Youth with Additional Needs (TOCAN) partnership, as reflected in Australia's National Road Safety Strategy 2011-2020, recognises that road safety progress today is dependent on coordinating strong road safety partnerships effectively across all sectors – government, business, industry and community. The TOCAN partnership is creating foundations that will have a lasting impact on the road safety outcomes for children with additional needs in our communities.

Background

Motor vehicle crashes remain one of the leading causes of death and injury among infants and children in Australia. All children need to be able to travel safely and comfortably in a motor vehicle to enable them to be transported to and from kindergarten, school, leisure activities and medical appointments.

Death and serious injury of children has been associated with the use of suboptimal restraints, that is, using a restraint that is not the most size-appropriate or when the restraint is not being used as it was designed to be used.

Children with a disability, due to a medical condition or challenging behaviour, often require special consideration when being transported in motor vehicles. Children with a permanent disability require long term solutions that need to be reassessed as the child grows, while children with a temporary disability require short term solutions.

Physical conditions and disorders range from head and trunk control problems (e.g. cerebral palsy, muscular dystrophy), to connective tissue disorders and to spinal deformities which present challenges for safe and comfortable seating [1]. Children with behavioural disorders such as autism present challenges in keeping restraints fastened and maintaining the safety of all passengers.

In Australia in 2009, 7% of Australian children (or 288,300) aged 0-14 years were estimated to have a disability. Of this 7%, over half had profound or severe core activity limitations. The prevalence of severe disability was highest among children aged 5-9 years (5.8%) [2].

Although parents and carers of typically developing children have access to evidence based support and advice, and easy access to an extensive range of Australian Standard child restraints, this is not the case for parents/carers and allied health professionals caring for and working with children with additional needs. The Victorian Road Safety Road Rules (2009) provide definitions for *approved* restraints – the definitions only include child restraint systems that comply with the Australian/New Zealand Standard 1754 *Child restraint systems for use in motor vehicles* (AS/NZS 1754). However, there are child restraints used by children with additional needs, known as special purpose child restraints, which do not comply with AS/NZS 1754.

Establishment of the Transportation of Children and Youth with Additional Needs (TOCAN) partnership

The Royal Children's Hospital (RCH) in Melbourne has played a leading role in providing advice, and developing and distributing resource materials relating to child restraints for children with additional needs. However, parents and carers regularly request advice from health practitioners and other organisations which often leads to confusion.

In 2009, Victoria commenced a marketing campaign supporting the introduction of National Child Restraint Road Rules. This awareness raising resulted in an increase in enquiries relating to the transportation of children with additional needs. To respond to the need for coordinated, informed and timely support for families, the Royal

Children's Hospital (Melbourne) together with other agencies established the Transportation of Children and Youth with Additional Needs (TOCAN) partnership in October 2009. TOCAN members recognised the potential to increase community awareness and support through this combined approach. This partnership provides a regular forum for learning, discussing and solving issues relating to the transportation of children with additional needs.

The National Road Safety Strategy (2011-2020) has the vision that no person should be killed or seriously injured on Australia's roads, and Victoria's Road Safety Strategy (2012-2022) vision is to achieve zero deaths and zero serious injuries on our roads. TOCAN is challenged to explore the compatibility of these visions with the transportation of children with additional needs. It has been noted that the basic assumption in 'Vision Zero' is that the transport system should be designed to suit the least tolerant person using the system, however research [3] has found that children with disabilities face an increased risk of injuries and fatalities in the event of an impact in comparison with other children. [4] TOCAN is responding to such challenges and within just three years have provided the leadership for research, action and advocacy with national and international significance contributing to improved knowledge, policy, education and resources supporting the safe travel of children with additional needs.

Some examples of TOCAN's achievements:

Review of AS/NZS 4370: restraint of children with disabilities in motor vehicles

The Australian/New Zealand Standard 4370: *Restraint of children with disabilities in motor vehicles* (AS/NZS 4370) sets out guidelines and procedures for prescribers (e.g. occupational therapists, physiotherapists, medical practitioners) responsible for assessing a child's needs and recommending the way in which a child with a disability or medical condition, should be transported in a motor vehicle. TOCAN members instigated and led the review of this standard. AS/NZS 4370:2013 was published by Standards Australia on May 15, 2013.

Research

The Murdoch Children's Research Institute (MCRI) undertook a research project to understand the knowledge of and challenges faced by paediatric occupational therapists when making recommendations regarding the restraint of children with additional needs in motor vehicles in Victoria. The MCRI survey was completed by 107 paediatric occupational therapists (prescribers). The research identified that:

- 61% of prescribers did not have access to AS/NZS 4370

- 30.5% of prescribers were unaware that AS/NZS 4370 existed, and prescribers reported that they did not feel confident in knowing what child restraints were available that met AS/NZS 1754
- 25% of families did not purchase the child restraints recommended by therapists and continued to transport their child in a way that is considered to be unsafe
- on average it took 1-3 months for families to be able to self-fund the purchase.

A follow up project is currently being implemented with parents and carers of children with additional needs, and aims to understand the needs and challenges of finding appropriate vehicle restraints. It is anticipated that information from this project will be used to inform development of parent and carer resources to support knowledge and decision making around safe car travel for children with additional needs.

Review of child restraints for children with a disability (2011)

VicRoads, supported by the Department of Human Services (DHS), undertook a review to address concerns about the compatibility of restraints for children with a disability with motor vehicles in Australia, and compliance with Australian Standards. The review identified nine special purpose child restraints available for hire or purchase in Victoria. Not one of the special purpose child restraints comply with the Australian Standard for child restraints (AS/NZS 1754). As an interim guide, desktop review criteria was applied to the nine child restraints to assess the compatibility of each child restraint with motor vehicles in Australia; and to assess whether each child restraint is likely to meet the intent of AS/NZS 1754. The Department of Human Services (Victoria) temporarily suspended funding towards child restraints for children with a disability whilst this review was being undertaken. DHS reinstated funding for special purpose child restraints following this review.

Dynamic testing of child restraints for children with a disability (2012/13)

VicRoads and the Transport for New South Wales undertook crash testing of special purpose child restraints. This review aimed to measure how well the desktop review criteria used in the VicRoads (2011) *Child restraints for children with a disability* reflects actual performance in dynamic child restraint tests. The result of this work was presented at the 23rd International Technical Conference on the Enhanced Safety of Vehicles in Korea in May 2013. This work will be of national and international interest.

Other TOCAN activities

The Royal Children's Hospital has hosted two workshops aimed at providing support and guidance for health practitioners relating to the transportation of children with additional needs. The workshops have been well attended by health practitioners, as well as government and community representatives from across Australia.

TOCAN members have also presented papers at conferences in Australia and internationally, and published articles in industry journals and magazines. TOCAN was also the recipient of the Kidsafe 2011 National Kidsafe Day Award, and a 2012 Transport Accident Commission community road safety grant to develop an online resource for allied health professionals, parents and carers and government agencies supporting the safe transportation of children with additional needs.

TOCAN is looking forward to developing a strategic plan in 2013 to inform future interventions and to guide engagement with other jurisdictions and organisations that can contribute to building community support for the transportation of children with additional needs. Later this year TOCAN will launch a website for parents, carers, allied health professionals and the community. For more information about TOCAN contact safety.centre@rch.org.au or Tel: 03 9345 5085.

See the website below for more information and a Question and Answer interview with Helen Lindner from TOCAN: http://www.3mreflective.com.au/TSS/NEWS_14MAY13_-_Q%26A_WITH_2012_3M-ACRS_Award_Winner.html

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2020 Vision Zero: to share or not to share the way

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In November 2012, the Royal Australasian College of Surgeons facilitated the symposium and workshop *2020 Vision Zero: to share or not to share the way* which attracted a wide range of participants and experts in road safety. The workshop reviewed, discussed and evaluated ideas to eliminate death and injury as a result of interactions between various road users – pedestrians, cyclists, motorcyclists, cars and trucks. Speakers included international road safety experts such as Professor Fred Wegman from the Netherlands, politicians, researchers, traffic engineers and representatives of road user groups. At the end of the day, participants agreed to the following resolutions that it is hoped will assist our governments to set some road safety priorities. These resolutions complement the RACS position statements on these matters.

General resolutions

The meeting supports the vision of zero deaths and serious injuries on our road system and believes that governments should adopt this vision with respect to the design and operation of the road system. We strongly maintain this vision is the only moral approach to the carnage on our roads and should constitute the basis of all future infrastructure planning, design and management. It is noted that not all road safety strategies in Australia explicitly endorse this vision. Worldwide there now exists sufficient understanding of road system management to enable the progressive eradication of death and serious injury.

This vision has a strong ethical basis and has been adopted by those countries that lead the world in road safety:

- Economic gain should not be traded for community life and health
- There exists a professional duty of care
- There is nothing inevitable about road trauma – it is foreseeable and, therefore, avoidable
- Everyone has the right to use roads and streets without risking life or health (Tylösand Declaration, 2007)
- There is a responsibility not to pass on our traffic safety problems to the next generation.

One of the major determinants of road trauma is the kinetic energy in the system and, as such, speed management plays a crucial role in road safety strategies. The RACS supports measures by governments which reduce vehicle travelling speeds to levels more likely to minimise death and serious injury.

New technologies have the potential to enhance the safety of road systems and the RACS supports the rapid adoption of proven technologies. In some circumstances, these technologies have greater potential to be effective if made mandatory.

The RACS believes that shared paths should only be used simultaneously by pedestrians and cyclists when it is safe to do so. This generally entails low travelling speeds and sound geometric path design. Where these two cannot be achieved, segregation should be implemented. While cognisant of fiscal constraints at any point in time, the meeting nonetheless maintains that shared spaces, in which cars mix at low speed with pedestrians and other unprotected road users, should only exist under conditions where low risk can be achieved.

The meeting believes there should be a national point of reference for road safety issues which is accessible to all groups involved in road management. This group should address the concerns of the various road and pathway users and, by its composite nature, facilitate solutions with regard to the interests of all parties. This body may also be involved in the education of the various road users, highlighting their concerns and promoting a culture of understanding between these groups. This could be achieved by means of both formal education programs and media discussion.

Specific resolutions

Speed Control

The meeting acknowledges that speed is an ever present factor in deaths and injuries on our roads. It can, however, be measured, legislated and enforced. Evidence indicates that as speed increases so does the mortality rate, and as speed decreases, mortality diminishes. The meeting supports a speed that is safe for the prevailing conditions, in terms of human tolerance to injury and the protection offered by vehicles.

Specifically:

- The introduction of point to point speed cameras for all vehicle types was supported.
- The greater vulnerability of older people should be recognised and any measures to manage speed and consequent risk in the road system would benefit this group significantly.
- Speed limits should be adjusted to take into account areas of high pedestrian activity and in some situations be as low as 30 km/h for all vehicles. A more rational and location-specific system of speed limits is required, based on threshold of injury.
- Where collisions between pedestrians and cyclists are foreseeable, travel speeds of 10 km/h are considered necessary. If this cannot be achieved, the environment should contain design elements that reduce speeds to low collision-risk levels.
- The introduction of ‘black box’ technology (ie. Similar to flight data recorders which record speed, altitude etc at the time of a crash) may also be helpful in enforcement of speed limits.
- The greater use of demerit point penalties rather than monetary penalties might be more effective in achieving community support for road safety laws and should be explored further.
- The meeting expressed dismay at the proposal by the new Northern Territory government to repeal speed limits on their main highways and unanimously agreed that current speed limits should not be raised.

Application of available technology

It is acknowledged that where there is a human element in any activity there is a risk of error. If the human element can be minimised by reliable technology, then the risk of error diminishes. This meeting therefore supports the development of any technology proven to enhance road safety.

This meeting notes that multiple technologies are available but until now their application has been fragmented and largely optional.

- The compulsory introduction of ‘black box’ technology to both heavy vehicles and motor cars may act as a deterrent to unsafe driving practices, particularly with respect to heavy vehicle drivers. In addition to enabling the enforcement of regulations, the technology can be useful in the analysis of crashes, facilitating the understanding of crash and injury risk factors and mechanisms.

- The fitting of detection devices to all cars and trucks will enhance driver awareness of the presence of other road users, particularly motorcyclists, cyclists and pedestrians, in blind spots and at junctions.
- The introduction of countdown signals for pedestrian crossings might be effective in discouraging pedestrians from crossing roads against traffic. This should be investigated further to determine if their widespread use is likely to be effective in Australian cities and towns.
- Pedestrian-only crossing phases at major intersections are supported because, by design, they eliminate the potential for high-risk conflict with vehicular traffic.
- Moderate to heavy tinting on vehicle windows should not be allowed as it impedes visual communication between road users, particularly at intersections at night. Windscreen tinting also reduces the ability of drivers to see pedestrians at night or in low daytime light.
- All new vehicles should be fitted with rear vision cameras.

All these technologies are already available. We believe the universal application of these technologies will decrease the cost of their installation, as has occurred with devices such as electronic stability control, which is now standard in most new vehicles.

It is acknowledged that the slow turnover of the Australian vehicle fleet means it will be some time before many of these technologies penetrate the fleet, however any measures to encourage early or compulsory adoption of the technologies is supported.

Segregation

This meeting believes that where a low speed environment between road users cannot be achieved, separation is essential. The meeting acknowledged that this criterion is not presently being applied in current road and pathway systems and a further review of the provision of segregated facilities in infrastructure design and management is required. Whilst the option of differential surfaces for bicycles and pedestrians was discussed, the meeting did not support this as an adequate degree of separation and there was a view that physical barriers such as fences should also be used.

The separation of bicycles from motor cars was supported and separate bicycle lanes are recommended. These lanes should not be adjacent to parked cars but rather separated from parked cars by a strip of at least 1.5 metres in width.

Opportunities to segregate heavy vehicles from other traffic and road users should be explored and heavy vehicle

operating speeds reduced where conflicts in the road system are foreseeable.

The meeting noted recent controversy relating to at-grade rail level crossings and supported the progressive reduction in the overall number of such crossings.

It is acknowledged that whilst segregation is desirable, it is not always feasible and should this be the case, it is vital that efforts are made to control the speed environment.

Conclusion

It is noted that in spite of legislation and advanced technology, the culture on our roads is one of complacency. This meeting supports any initiative that encourages personal or community ownership of behaviour on our roads and views this as a key to overcoming complacency.

Whilst achieving the elimination of road crash injuries and deaths would require major expenditure, it was noted the measures discussed in the meeting utilise existing technology or practices.

There are some measures that can be highly effective, at a low cost. As an example, speed management has been proven to be highly effective in reducing death and severe injuries on the road system at a relatively low cost. It can be implemented quickly and its benefits realised immediately. This contrasts with infrastructure and vehicle based measures which can take more than a decade to realise a significant level of their potential benefits. Lower travel speeds also have the potential to reduce transport energy

use, harmful emissions and noise. They enhance public health by enabling active travel to take place at low risk, and facilitate social connection, especially among young, ageing and other Australians with restricted mobility.

The thoughtful rearrangement of what is essentially existing infrastructure was considered achievable but required a coordinated system involving all road users. We believe the adaptation and reorganisation of much of the existing infrastructure would represent good value for money. This should be viewed as an investment, not simply a cost. It is money well spent, not only on the alleviation of human grief and suffering but also to achieve the economic savings made possible by the reduced incidence of road crashes and the improved health and liveability of Australian cities and towns.

The resolutions are supported by the College's existing positions on road trauma that address topics such as – licensing, speed, motor cycling, pedal cycling, vehicle safety, quad bikes and alcohol and drugs. These positions have informed the work of road safety advocacy groups and can be found on the College website.

The authors acknowledge the support of the Royal Australasian College of Surgeons, the RACS Trauma Committee, the National Critical Care and Trauma Response Centre and the Transport Accident Commission.

The ACRS Journal needs you!

Have you thought about contributing to the journal? All readers are encouraged to help make the journal more valuable to our members and to the road safety community.

By writing for the journal, you have the opportunity to contribute to the important exchange of views and information on road safety. Articles on any aspect of road safety are welcome and may be submitted as papers for the peer-reviewed section of the journal or as contributed articles. Articles are now invited for issues in 2014.

When preparing articles for submission, authors are asked to download and follow the ACRS Instructions for authors, available at <http://acrs.org.au/publications/journals/author-guidelines>.

Please contact the Managing Editor for further information, and for publication dates and deadlines.

Letters to the Editor and items for the News section will also be considered for publication; feedback or suggestions about journal content are also welcome. Please submit all articles/contributions to the Managing Editor at journaleditor@acrs.org.au.

The next issue of the Journal v25 No. 1 will be a Special Issue showcasing a selection of the best papers presented at the 2013 ACRS Conference in Adelaide from 6-8 November. The conference theme is "A Safe System: the road safety discussion". Articles are invited on this theme or other road safety related issues to be published in February 2014.

Auckland's School Transport Programme: Changing travel habits and enhancing road safety

Winner of the Road Safety Poster Award for the best poster
at the Australasian Road Safety Research,
Policing and Education Conference in Brisbane
from August 28 to 30, 2013 was Claire Dixon from Auckland Transport.

Auckland Transport's School Transport Programme (Travelwise)
is delivered in partnership with NZ Police,
New Zealand Transport Agency and school communities.
The vision delivers a 'Safe System' approach to road safety around schools,
increasing participation in active modes of transport and reducing congestion.

Travelwise School

WHOLE SCHOOL APPROACH

VISION

Provide **safer routes** to school and decrease the number of private vehicle journeys to and from school using an integrated "Whole of School" approach, involving curriculum, parents and community partnerships.



ACTION

Providing a **Safe School Travel Plan** in the Auckland region to over

335 SCHOOLS
(165,000 STUDENTS)

Cycle training to

9,429
STUDENTS

Walking School Bus has

1,500
CHILDREN PARTICIPATING

SUCCESS

Active participation of students in Travelwise activities using the "Whole of School" approach in 2012.

95,204
STUDENTS

The number of reported crashes around schools with a **Safe School Travel Plan** reduced by

58%

Safe School Travel Plans have helped reduce morning peak traffic by

11,097

VEHICLES

Vehicles in the morning peak in 2012, which means approximately

18%
DECREASE

in total car use in the past year.



WHOLE SCHOOL APPROACH

VISION

Auckland Transport works in partnership with school communities, including students, parents/whānau, school staff, key stakeholders including NZTA, Auckland Council and NZ Police, community and local organisations to promote and encourage the use of safe alternatives to private vehicle trips to and from school.

The Auckland Transport Travelwise programme delivers a 'Whole School Approach' to improving road safety and reducing congestion around schools.

- A Whole School Approach to road safety means that a school will incorporate teaching and learning on road safety not only through their curriculum, but also through community and stakeholder involvement, integrated governance and long-term planning.
- The three Travelwise Whole School Approach segments (Parents and Community, Ethos and Organisation and Curriculum) are interdependent and mutually reinforcing.
- The Travelwise Whole School Approach segments act as a guide for 'best practice' road safety education in schools.

The school transport programme contributes to Auckland Transport's overarching outcome: "Auckland's transport system is effective and efficient, and provides for the region's social, economic, environmental and cultural wellbeing" and specifically to the target of the number of morning peak (7-9am) car trips avoided through travel planning initiatives.

Curriculum

- Embed road safety and active transport education programmes within a curriculum framework
- School management supports staff to implement roadsafety education
- Use student-centred, interactive strategies
- Actively engage students in skill development
- Help students to influence their peers as safe road users

Ethos and Organisation

- Consult the wider school community when developing and reviewing road safety and active transport plans, policies and procedures
- School management actively promotes and supports road safety and active transport
- School staff model appropriate road safety behaviours and attitudes
- Review the school traffic environment

Parents and Community

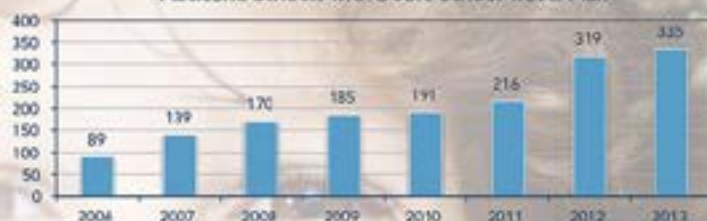
- Provide parents with information to reinforce road safety and active transport messages and skills
- Consult the school community to reinforce safety and active transport messages and skills
- Collaborate with other school programme stakeholders to complement school road safety programmes
- Encourage road safety and active transport through community events and projects
- Network and work with other Auckland schools to promote road safety and active transport



ACTION

Auckland Transport is working with 335 schools across the Auckland region to develop and implement an individualised Safe School Travel Plan for their school. Across the Auckland region, 165,000 school aged students attend schools with Safe School Travel Plans, or 63% of all Auckland students. Since the formation of Auckland Transport there has been a more regionally consistent focus to the Safe School Travel Plan programme, this is particularly notable in the south of the region where there have been 37 new schools joining the programme in the 2012 school year.

Auckland Schools with a Safe School Travel Plan



In the 2012/13 financial year a total of \$12m was invested in the development and implementation of SSTPs delivering road safety and congestion initiatives, walking school buses, cycle training, road safety infrastructure and pedestrian improvements around schools. Engineering improvements such as pedestrian crossings were delivered to streets around 35 schools and 17 schools received electronic warning signs or 40 km speed zone restrictions.


SUCCESS

In the 2012 school year, 95,204 students participated in Travelwise activities at their school. Growth in the transport initiatives delivered at schools has resulted in over 9,000 students in 92 schools receiving cycle training and 3,900 children using 348 walking school bus routes. Additional initiatives that have been offered to students in 2012 include scooter training, curriculum activities incorporating road safety and a Travelwise student leadership programme delivered to 21 intermediate and secondary schools.

The results of the 2012 school year evaluation has resulted in an 18% decrease in car use from 2011 which provides a reduction of 11,097 vehicles in the morning peak. This equates to approximately 2.5% of all traffic movements across Auckland in the morning peak. The continued delivery of the school transport programme has resulted in a benefit cost ratio as calculated by NZTA economic evaluation manual of 6.9 with school aged road users fatal and series crashes in Auckland reducing by 14%. At Travelwise schools in 2012, there was an estimated annual reduction of 3.54 million vehicle kilometres, leading to an annual reduction in CO₂ emissions of 1,150 tonnes. Safe School Travel Plans have a relationship with road user safety, and there is an improved level of safety surrounding a school once a Safe School Travel Plan has been implemented. In 2013, a comparative study was undertaken to test this hypothesis. 60 schools across the region were assessed using crash data (500m of the school), providing an annual average crash rate prior to the implementation of actions and activities of a STP and an annual average crash rate after that time. From this data, it was concluded that the number of reported crashes around schools with Safe School Travel Plans have reduced by 58%, and Control schools showed a 20% reduction in the number of reported crashes.

For more information please contact:
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A man with a prosthetic leg is sitting in a chair. He is wearing a grey t-shirt and black shorts. He has a serious expression. The room has a wall covered in many small photographs. A refrigerator is visible on the left.

I wish I wasn't in this ad.
I wish I hadn't put my family through this.
I wish I had both legs.
I wish I wasn't in pain all day. And night.
I wish I could sleep.
I wish I wasn't going to end up in a wheelchair.
I wish I hadn't been going so fast.

James Archer, speed crash survivor, May 1996.
Two months in hospital, three months in
physical rehab, a lifetime of pain.

We wish we didn't
have to show these ads.
Don't rush.

An initiative of your local council as part of the Local Government Road Safety Program.





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