Austroads

Research Report
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Review of the National Road Safety Strategy

Review of the National Road Safety Strategy

Prepared by

Mary Lydon, Jeremy Woolley, Martin Small, James Harrison, Trevor Bailey and Daniel Searson

Project Manager

Olivia Sherwood and John Goldsworthy

Abstract

This report details the results of a review of the 2011 Australian National Road Safety Strategy (NRSS) designed to identify new countermeasures or changes in trauma patterns that would support changes to priorities in the next Action Plan.

The project was commissioned as part of the first review of the NRSS.

The project included a targeted literature review including strategies from successful countries, consultation with a wide range of stakeholders, a review of the level of implementation of the NRSS and data analysis including fatal crash data, hospital separations data, speed surveys, vehicle kilometres travelled and properties of the vehicle fleet.

Increased emphasis was recommended for 13 priority areas including developing a Safe System for vulnerable road users, improving safety for older road users and better understanding serious injuries. It was also recommended that more support be provided for the introduction of new technology for vehicles and infrastructure.

Keywords

road safety, Safe System, road trauma, road fatalities

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Austroads Ltd.
Level 9, 287 Elizabeth Street
Sydney NSW 2000 Australia
Phone: +61 2 9264 7088
austroads@austroads.com.au
www.austroads.com.au

About Austroads

Austroads' purpose is to:

- promote improved Australian and New Zealand transport outcomes
- provide expert technical input to national policy development on road and road transport issues
- promote improved practice and capability by road agencies
- promote consistency in road and road agency operations.

Austroads membership comprises the six state and two territory road transport and traffic authorities, the Commonwealth Department of Infrastructure and Regional Development, the Australian Local Government Association, and NZ Transport Agency. Austroads is governed by a Board consisting of the chief executive officer (or an alternative senior executive officer) of each of its eleven member organisations:

- Roads and Maritime Services New South Wales
- Roads Corporation Victoria
- Department of Transport and Main Roads Queensland
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure South Australia
- Department of State Growth Tasmania
- Department of Transport Northern Territory
- Territory and Municipal Services Directorate, Australian Capital Territory
- Commonwealth Department of Infrastructure and Regional Development
- Australian Local Government Association
- New Zealand Transport Agency.

The success of Austroads is derived from the collaboration of member organisations and others in the road industry. It aims to be the Australasian leader in providing high quality information, advice and fostering research in the road transport sector.

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Summary

The NRSS 2011-20

The National Road Safety Strategy (NRSS) was released in May 2011 and is based firmly on Safe System principles. At its core is the aspiration that no one should be seriously injured or killed as a result of using the road system. The strategy provides a guide for road safety directions, priorities and initiatives until 2020 and was initially supported by an action plan (the “First Steps” agenda) covering the years 2011-13.

The strategy included a requirement for a review in 2014 of progress in implementing the “First Steps” agenda and further consideration of the implementation of the other proposed initiatives.

In January 2014 an Austroads project was awarded to undertake research to assist the first review of the strategy. The review was not expected to suggest major changes to the philosophy, aspirations or initiatives contained in the strategy. Its role was to provide decision makers with an assessment of progress and to identify a limited number of new or enhanced initiatives, or potential areas for more focussed implementation.

This Executive Summary outlines the work undertaken and the major results of this research project.

Project Aim

The aim of the project was to assist the Austroads Safety Task Force (ASTF) to carry out an objective review of the NRSS and to provide evidence to help identify any necessary changes to priorities and initiatives to help develop the next three-year action plan.

Method

The project included a targeted literature review, consultation with members of the ASTF and a wider range of stakeholders, a review of the level of implementation of the NRSS, data analysis including an examination of hospital separations data and the identification of priority areas.

Targeted Literature Review

The literature review was mainly restricted to documents published between 2011 and 2014, although some earlier work was included if considered relevant. Additional unpublished reports were also sourced where possible. The initial literature search identified that new information was available for a limited number of areas including vulnerable road users, older drivers, road safety communication, vehicle technology, and post crash response. The major findings are summarised below.

The review found recent research has demonstrated the need to direct increased effort to countermeasures aimed at vulnerable road users. These road users are not receiving the same benefits as vehicle occupants from safer vehicles and exposure is believed to be increasing for motorcyclists and cyclists. The review identified a range of infrastructure based countermeasures and suggested research is required to better understand what constitutes a Safe System for vulnerable road users.

National and international research has also shown that older drivers are driving longer and further than in previous years and that countermeasures beyond ensuring fitness to drive will be required. Matching infrastructure and vehicles to the needs of older drivers will become increasingly important.

Considerable literature on road safety communication was found, particularly exploring the role of social media in both road safety education and raising awareness of road trauma, but it is clear this is still a developing area. More work is required to understand how best to take advantage of the opportunities provided by new communication methods.

Vehicle technology has already produced considerable road safety benefits. For the remainder of the period of the NRSS, additional benefits from vehicle technology will come from ongoing improvements in crashworthiness as newer, safer vehicles filter into the fleet, however benefits from the new technologies will mainly be achieved in the following decade. The most promising of these new vehicle technologies in the medium and long term are Autonomous Emergency Braking (AEB), Vehicle to Vehicle Communication (V2V) and Vehicle to Infrastructure Communication (V2I).

The review of a considerable amount of literature discussing post crash response was inconclusive. It is unclear if improvements to post crash response can deliver significant benefits and enhancements to data collection systems and further research is required.

Consultation with Members of the ASTF

An initial consultation with the members of the ASTF was carried out. The discussions covered identification of road safety initiatives at the state and national level, the role of national leadership, proposal of new road safety initiatives, the acceptance of Safe System principles in key organisations and new methods of monitoring road trauma.

There was widespread support for the broad direction of the NRSS and all respondents identified several positive developments associated with the strategy since 2011. However, there was some concern that the strategy is insufficiently focussed to produce real change and that more activity is required at the national level.

Consultation with Stakeholders

Seventeen national road safety stakeholder organisations were consulted to obtain their perspectives on the NRSS and identify issues that need to be addressed in future. The stakeholders were chosen to represent the full range of road safety interests.

The conversations were guided by six questions circulated ahead of time, covering: major contributions to road safety by stakeholder organisations, major achievements at the national level, partners, acceptance of the Safe System, candidates for national priority actions and barriers to progress.

There was support for the directions of the NRSS but concerns were expressed about limited engagement with stakeholders in the implementation of the NRSS and a perceived lack of national leadership.

Implementation Review

The implementation review assessed progress against the “First Steps” agenda and against items identified in the initial modelling used to guide the targets set for the NRSS. The implementation review drew heavily on the Implementation Status Report published by the Transport and Infrastructure Council together with information obtained from the ASTF and the stakeholder consultation and objective evidence from the data analysis. The review explored implementation issues as far as possible however, some of the fifty-nine actions in the “First Steps” agenda were couched in general language and had no obvious measure of success and others involved major changes to funding or legislation and so would not have been expected to be completed in the relatively short time since the strategy was released.

It was agreed most success had been achieved in the Safe Vehicles area, with some new Australian Design Rules (ADRs) already achieved and others in progress, harmonisation of some ADRs with Global Technical Regulations (GTRs), ongoing support for the Australasian New Car Assessment Program (ANCAP) and evidence of the improved safety of new vehicles.

There have also been successes in Safe Speeds, with most capital cities introducing 40 km/h in selected areas and some limited reductions in rural speed limits. The large-scale implementation of lower speed limits is progressing slower than anticipated by the strategy.

The major achievements in the Safe People area were identified as the strengthening of graduated licensing scheme (GLS) provisions in many states and the extension of alcohol interlock programs.

In the Safe Roads area there have been a number of major infrastructure projects. Major investment of $1 billion by the Transport Accident Commission (TAC) in Victoria and $100 million by the Motor Accident Commission (MAC) in South Australia were considered major achievements.

A number of Austroads research projects have been carried out to support implementation of the “First Steps” agenda. There has been some progress in adopting willingness to pay values in investment decisions.

Progress Towards Targets

Results for the main performance indicators to 2012 show ongoing improvement in most areas, with the exception of serious injuries (discussed under the next heading).

National fatal crash and fatality data was obtained from the Bureau of Infrastructure, Transport, and Regional Economics (BITRE). Complete data is only available for 2011 and 2012 with some items available for 2013. Given this short period no statistical testing could be usefully carried out.

The main indicators for the three years before the strategy and the two years of the strategy show that fatalities, fatal crashes and deaths per 100,000 population are all falling with fatalities reducing from 1,277 in 2011 to 1,193 in 2013. There was evidence that motorcyclist and cyclist fatalities have not decreased at the same rate as those of vehicle occupants in the years since the strategy was released. Fatalities of older road users are not reducing at the same rate as shown for young road users and this effect is still present when deaths per 100,000 population are considered.

An examination of Australian Bureau of Statistics (ABS) exposure data showed that even with a slow-down in growth in 2008 and 2009, vehicle kilometres travelled by passenger vehicles and light commercials grew between 2005 and 2012. Vehicle kilometres travelled by motorcycles grew at a faster rate than for other vehicle types.

ABS data shows the number of registered vehicles in Australia has risen from 15 million in 2008 to 17 million in 2013. There has been little change in the age of the vehicle fleet, with the average age staying at about 10 years for passenger vehicles, 11 years for commercial vehicles and nine years for motorcycles.

There has been an ongoing improvement in the safety of new vehicles, with 80% of new passenger vehicles sold in 2013 having a five-star ANCAP rating. The improvement was most marked for commercial vehicles.

Speed survey data was obtained from Western Australia and South Australia. Although it is not possible to present a national picture, it is worth noting that speeds are gradually reducing in both states.

Exploration of Hospital Injury Data

This analysis uses data from the National Hospital Morbidity Database (NHMD), which is operated by the Australian Institute of Health and Welfare (AIHW) and includes records concerning nearly all episodes of admitted patient care in Australia for ten calendar years ending with 2010. The focus was on looking at how trends in road related injuries have changed in recent years and how they differ from trends in road related fatalities.

Rates of hospitalised serious traffic injury rose by about 10% from the level in 2001 then returned to it, while road death rates fell by almost one-third. Analysis of the hospital data showed the rise in serious injuries was largely due to substantial increases in the numbers of injured motorcyclists and cyclists. Although the numbers of drivers injured also rose, the absolute increase for drivers was smaller than for motorcyclists or cyclists, and the percentage rise was much smaller than for those types.

Further analysis showed that the upward trend of motorcyclist and cyclist cases was especially steep for men aged 45 to 64 years, and that the rise was much more marked for cases that occurred in traffic (on road) than for non-traffic cases. The rise in the rate of cyclist cases was more marked for residents of major cities than for people who lived elsewhere.

Priority Areas

Thirteen priority areas were identified for which more emphasis is recommended because of changing crash patterns or a real or perceived lack of activity. The priority areas are not intended to replace the content of the 2011 strategy but are aimed at supplementing both the strategy commentary and associated action agendas.

Vulnerable Road Users

The Safe System philosophy for vulnerable road users is not as well developed as for vehicle occupants. This has been found to be true nationally and internationally, with even leading countries such as Sweden increasing their focus on vulnerable road users. The main finding of the recent review of road safety from the International Transport Forum was that vulnerable road users are receiving smaller benefits from recent road safety improvements than vehicle occupants.

The analysis of fatal crashes in Australia from 2008-13 showed the same pattern as internationally, with vehicle occupants accounting for most of the reduction in fatalities. There was almost no change in total fatalities involving vulnerable road users, with fatalities of motorcyclists and cyclists rising over the period. The analysis of hospital separations data found a much higher proportion of road-related injuries involving motorcycling and cycling than shown by the police-collected data. It also showed that injury cases among these road user types are increasing.

Motorcycling exposure has grown since 2008 with a sharp increase in vehicle kilometres travelled relative to other motorised vehicles. Cycling exposure is also thought to be increasing rapidly although there is no reliable measure. These relative increases in exposure would be expected to account for some of the difference between road user types, together with cyclists and motorcyclists not gaining the benefit from increased vehicle crashworthiness.

The “First Steps” and “Future Steps” agendas include some actions to assist vulnerable road users including improved infrastructure, lower speed limits, vehicle regulations and the development of a GLS for motorcyclists. These could be expanded and strengthened in the next action plan.

A number of infrastructure improvements have been shown to improve safety for vulnerable road users; these include improved pedestrian crossings, cyclist friendly intersection design, separation of bicycles and motor vehicles and improved road surfaces. There is also evidence that pedestrian safety would be enhanced by the rapid introduction of forward collision avoidance systems such as Autonomous Emergency Braking (AEB).

With the encouragement of active travel modes it is expected that walking and cycling will continue to increase. Both the safety and amenity provided to cyclists could be improved by better cooperation between road safety professionals and urban planners.

There is also a need for research to better understand what constitutes a Safe System for vulnerable road users. Although pedestrians, cyclists and motorcyclists are often grouped together as vulnerable road users, the three modes demonstrate different crash patterns and have different requirements of a Safe System.

Older Road Users

Fatalities of older road users are reducing at a slower rate than road user fatalities overall and particularly compared with younger road users. This is true for the total number of deaths and deaths per 100,000 people. The differences are likely to be related, in some part at least, to changing driving patterns of older people, with research showing people are driving further and into older ages and that this is increasingly applying to both males and females. It is also possible that the difference between older and younger drivers is related to road safety measures such as enhanced GLS systems that have targeted younger drivers. The vehicles driven by the different groups could also be a factor, as younger drivers, who generally drive older cars, would have only recently started to benefit from the improvements in crashworthiness that began over 15 years ago.

The current First and Future Steps agendas, which concentrate on understanding fitness to drive and alternative mobility options, need to continue and be complemented by measures to make the road system safer for older road users.

Research indicates that older drivers can benefit from receiving better information regarding vehicle choice, and a range of infrastructure changes has been recommended to assist older drivers. These changes address basic failures to provide a Safe System and so will be of benefit to all drivers.

Indigenous Road Users

While various initiatives have been undertaken to address the disproportionate risk faced by Indigenous Australians on the road, there is continued concern about inequitable outcomes. A relatively large proportion of Indigenous Australians live in remote and very remote regions, and so the overall impact of the higher rates experienced by residents of remote areas is greater for Indigenous than other Australians.

Patterns of road injury events differ between Indigenous and non-Indigenous road users including higher rates of injury as a motor vehicle passenger (not a driver) and as a pedestrian.

Institutions such as Aboriginal community-controlled health services may be appropriate avenues for road safety interventions specifically directed to Indigenous individuals and communities.

National Indigenous Road Safety Forums were held every two years from 2002 to 2010. The five forums were convened by the Commonwealth Department of Infrastructure and Regional Development. Re-establishing the Forums would provide a valuable opportunity for the limited number of people working in this area to consult and share experiences.

The 2010 Indigenous Road Safety Forum recommended a fund for Indigenous road safety projects that produce measurable change, sustainability and capacity for replication in other settings.

Speed Management

Speed management is a core component of a Safe System and remains the best opportunity for a rapid reduction in road trauma. Since 2011 some attempts at implementing safer speed limits have been made, however only limited progress has been made on major urban and rural arterial roads. The critical role of speed in the Safe System was recognised by the strategy and Safe Speeds was treated as a cornerstone area.

The stakeholder consultation suggested further exploration of technological solutions to speed management, including extending the use of Intelligent Speed Adaption (ISA). It was also suggested that national approaches to speed management and speed-related media campaigns be adopted. These items were also listed in the “First Steps” agenda.

The actions from the First and Future Steps agendas could be pursued more vigorously on rural arterial roads and also address reducing speed limits on rural local government roads.

Remote Areas

The data analysis has shown that deaths are reducing at a slower rate on rural and remote roads than in urban areas. Remote areas present a particular challenge; low volumes mean investment in infrastructure on these roads is always going to be given a low priority by traditional assessment methods and traditional enforcement is unlikely to be effective given the vast distances, extremely limited enforcement resources and infrequency of vehicles.

In time, vehicle safety technology may be the most effective countermeasure for remote areas where single vehicle road departures are a significant issue. The increasing use of Electronic Stability Control (ESC), for example, would be expected to result in a reduction in loss of control crashes in these areas. Unfortunately new technology takes considerable time to be taken up by the majority of the fleet, and those most at risk, such as young drivers in remote areas, are likely to be amongst the last to receive the benefits.

Stakeholders suggested development of a separate remote area strategy following the Western Australian model from 2009. This would need to include the potential of vehicle technologies and low cost infrastructure solutions that address core Safe System issues. As a first step, the challenges of remote area road safety need to be acknowledged in the action plan.

Vehicle Safety

Improvements to vehicles have been a major contributor to trauma reductions for over 15 years through developments in crashworthiness and occupant protection. These improvements will continue to deliver trauma reductions throughout the life of the strategy as more and more new vehicles achieve high safety standards and the older vehicles driven by the most at risk drivers improve over time.

New technologies are now being developed to assist in crash avoidance as well as occupant protection but these are likely to have most impact in trauma reductions as part of the next national road safety strategy. AEB holds the most potential and will also benefit vulnerable road users.

ISA appears to have the second highest potential to prevent crashes after AEB. The availability of accurate and reliable digital speed maps remains a challenge for the deployment of ISA in Australia, although in 2014 New South Wales made their map available via a smartphone application.

A rapid take up of technologies into the vehicle fleet will bring forward the benefits of these technologies. The Australian automotive market is characterised by low entry barriers and a high level of competition. The resultant strong competition means that regulation, plus good, easily understood consumer information is vital to ensure the safety of vehicles and to promote vehicle choice based on issues other than price.

Cooperative ITS

There have been considerable developments in Intelligent Transport Systems (ITS) since 2011. Most significant has been the imminent feasibility of connected vehicle solutions, otherwise known as Cooperative Intelligent Transport Systems (C-ITS), which have the potential to significantly improve road safety. Research and technical capacity exists within Australia but there is no clear path to implementation and a variety of approaches and operation scenarios are possible.

There is a high level of confidence that V2V and V2I technologies can deliver considerable safety benefits. While V2V has no dependence on the surrounding infrastructure, it requires both vehicles to have the technology in order to avoid the crash.

Although ITS was mentioned in the NRSS, the rapid changes since 2011 mean that the area needs to be revisited. The action plan needs to be aligned with the Austroads C-ITS Strategic Plan to ensure that a safety perspective guides major policy positions. Given the potential paradigm shift in traffic management possible with C-ITS, it would be a missed opportunity if solutions were primarily based on traffic efficiency.

Communication Strategies

Communication of road safety messages is essential in gaining support for road safety initiatives. All jurisdictions face similar challenges in communicating Safe System principles and shifting community perceptions in favour of interventions that will work. The literature review found some innovative and promising communication campaigns, reflecting a variety of approaches. The cooperative development of resources and guidelines to assist jurisdictions in communication activities could be part of the action plan.

Monitoring Serious Injuries and Crashes

Road safety has long relied upon road fatality counts as the main outcome indicator. It has been recognised that this provides an incomplete basis for planning and monitoring because initiatives directed at reducing deaths are not necessarily effective at reducing other harm, particularly persisting disability.

Measurement of serious road injury is necessary because of the large numbers of cases, the substantial burden of disability resulting from many of the cases, and the differences in trends and other aspects of the data between fatalities and serious injuries.

The measurement and monitoring of serious injuries is a complex issue, and improving the availability and reliability of data needs to be a priority of the next action plan. The Road Safety Committee of the Parliament of Victoria has recently published the report of its extensive investigation into measuring serious road injury. The findings and recommendations provide guidance on the steps needed to establish useful measures of serious road related injuries.

Infrastructure Investment

There is support for both increased infrastructure investment and modified targeting of the available funds, including increased investment to address trauma on country roads, and trauma facing vulnerable road users on urban roads. The analytical tools Australian Road Assessment Program (AusRAP) and Australian National Risk Assessment Model (ANRAM) offer considerable potential to provide a better focus for investment.

The “First Steps” agenda includes recommendations to increase safety related funding and change the priorities for infrastructure investment. The “Future Steps” agenda is focussed on more specific infrastructure treatments, such as facilities to assist cyclists and motorcyclists and low cost treatments on rural roads. These actions are still relevant to the new action plan and a study to establish best safety management practices and processes for prioritising and developing infrastructure projects may be useful in completing some of these actions. There has been support for resetting the socioeconomic value used in the appraisal of transport projects to better reflect community demand for road safety, through the Willingness to Pay (WTP) approach adopted by many countries around the world. The New South Wales WTP measure still represents the most appropriate national measure until a full national study is conducted. It is noted that the Victorian Parliamentary Road Safety Committee, in the report on its Inquiry into Serious Injury, did not support the step towards applying WTP values. The Victorian Government has yet to respond to this report.

Coordination with Urban Planning

Although fatal crashes are reducing in urban areas there is still a major problem with serious injury crashes. The planning context within which towns and cities are managed will play an important role in determining the extent to which these injuries are reduced, particularly in relation to encouraging active travel and injuries to vulnerable road users.

The recent Victorian Parliamentary Road Safety Committee Inquiry into Serious Injury highlighted the issue of bringing together urban planning and road safety. That committee noted the absence of a link to road safety in city plans and to urban planning in road safety strategies. The report considered active engagement of road safety with planning to be essential in encouraging increased use of active transport modes. The inquiry also endorsed the Organisation for Economic Co-operation and Development (OECD) recommendation that a functional road hierarchy catering for all modes is fundamental to producing a Safe System urban design.

There are clear indications of the need for engagement between safety, transport planning and urban design professionals but there has been limited success in making this happen. The Dutch Sustainable Safety approach has had some success and this is being extended, with regional governments in the Netherlands providing specific resources to make sure this engagement happens with transport policy and urban planning professionals.

Workplace Road Safety

Work-related road crashes in Australia account for about half of all occupational fatalities and a significant proportion of all road-related fatalities. Despite the road being the dominant setting for occupational fatalities, not all government agencies with occupational safety and health responsibilities identify work-related road trauma as an occupational safety priority.

Employers and fleet managers have a pivotal role in the composition of the vehicle fleet and influence the safety of very high volumes of trips each day, therefore playing an important role in the safety of the road transport system as a whole.

Workplace road safety was identified as an issue to be addressed in the way forward for the National Road Safety Strategy but was not specifically included in the First or Future Steps agendas.

Engagement with occupational safety and health agencies is important and could build on the progress of the National Road Safety Partnership Program (NRSPP). There is still an unclear picture of the scale of work-related road trauma. Incorporating purpose of trip data in crash reports could be considered to provide a more complete picture of this significant issue.

National Leadership

Internationally, road safety management is a growing focus of attention as various institutions and jurisdictions recognise that the limits to improved road safety performance are, in part, shaped by the capacity of the road safety management system operating in a country.

Many stakeholders thought that the accountability for road safety is unclear and does not assist the leadership task. Improvement in institutional structures, capacities and delivery arrangements at a national level were identified as part of the “First Steps” agenda. Governance arrangements for road safety under the Transport and Infrastructure Council have been modified in the last two years to improve national oversight and coordination of the NRSS and provision of policy advice to Commonwealth, state and territory governments.

A review of governance and management arrangements for road safety could be considered to assist subsequent decision-making. Internationally, a common tool for addressing these matters is a road safety management capacity review and this methodology (or aspects of it) would be useful.

There was also concern about a lack of engagement in the implementation of the NRSS. Many of the non-government stakeholders referred to a lack of engagement on the national road safety issue. Consideration could be given to establishing and formalising a strong stakeholder engagement process.

Recommendations

In addition to the priority areas, the consultation helped identify a number of broader suggestions for consideration in the development of a new action plan. These recommendations are summarised below:

- The next action plan be developed taking into account the identified priority areas and the current First and Future Steps agendas
- A clearer statement of implementation and parameters of success for each identified action be included in the next action plan
- The next action plan be written to clearly delineate each action as the primary responsibility of the Commonwealth, the Transport and Infrastructure Council, Austroads or individual States and Territories
- The separation of responsible and irresponsible in the road user section be removed from the next action plan
- A method for engaging with other government and non-government agencies in the ongoing implementation of the strategy be included in the next action plan
- A priority activity to develop a method for measuring serious injuries be part of the next action plan
- The importance of modelling the effects of countermeasures and monitoring the strategy be recognised in the next action plan
- The importance of ongoing research and development to achieving continuing improvements in road safety be recognised in the next action plan.

Glossary

AAA	Australian Automobile Association
ABS	Anti-lock Braking System
ACC	Adaptive Cruise Control
ACN	Automatic Collision Notification
ACRS	Australasian College of Road Safety
ADAS	Advanced Driver Assistance System
ADR	Australian Design Rules
AEB	Autonomous Emergency Braking
AIHW	Australian Institute of Health and Welfare
AMC	Australian Motorcycle Council
ANCAP	Australasian New Car Assessment Program
ANRAM	Australian National Risk Assessment Model
ANZPAA	Australia New Zealand Policing Advisory Agency
ASEAN NCAP	New Car Assessment Program for Southeast Asia
ASTF	Austroads Safety Task Force
ATA	Australian Trucking Association
ATSB	Australian Transport Safety Bureau
AusRAP	Australian Road Assessment Program
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BSD	Blind Spot Detection
CASR	Centre for Automotive Safety Research
C-ITS	Cooperative Intelligent Transport System
CITI	Cooperative Intelligent Transport Initiative
ESC	Electronic Stability Control
ETSC	European Transport Safety Council
FCAI	Federal Chamber of Automotive Industries
FDW	Following Distance Warning

GLS	Graduated Licensing Scheme
GTR	Global Technical Regulation
HTTL	High Threat To Life
ICD	International Classification of Disease
ICISS	ICD based Injury Severity Scale
IIHS	Insurance Institute for Highway Safety (USA)
ISA	Intelligent Speed Adaptation
ISO	International Standards Organisation
ITS	Intelligent Transport Systems
LCA	Lane Change Assist
LDW	Lane Departure Warning
MAC	Motor Accident Commission
MUARC	Monash University Accident Research Centre
NCAP	New Car Assessment Program
NCD	National Crash Database
NHMD	National Hospital Monitoring Database
NHMRC	National Health and Medical Research Collaboration
NHTSA	National Highway Traffic Safety Administration (USA)
NRSC	National Road Safety Council
NRSPP	National Road Safety Partnership Program
NRSS	National Road Safety Strategy
NTC	National Transport Commission
OECD	Organisation for Economic Co-operation and Development
SVSEG	Strategic Vehicle Safety and Environment Group
TAC	Transport Accident Commission
TISOC	Transport and Infrastructure Senior Officials' Committee
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
WTP	Willingness to Pay

Contents

1. Introduction

1.1 The NRSS 2011-20

The National Road Safety Strategy (NRSS) was released in May 2011 and is based firmly on Safe System principles. At its core is the aspiration that no one should be seriously injured or killed as a result of using the road system. The NRSS provides a guide for road safety directions, priorities and initiatives until 2020 and was initially supported by an action plan (the "First Steps" agenda) covering the years 2011-13.

The NRSS is overseen by the Transport and Infrastructure Council.. In May 2013 the Transport and Infrastructure Council included in its communiqué a statement that "all jurisdictions would strengthen their efforts to implement the priority actions in the National Road Safety Strategy 2011–2020. While considerable activity has been undertaken in the two years since the release of the NRSS, the Transport and Infrastructure Council recently noted that progress remains limited in a number of key areas".

The NRSS included a requirement for a review in 2014 of progress in implementing the "First Steps" agenda and further consideration of the implementation of the other proposed initiatives.

In January 2014 an Austroads project was awarded to undertake research to assist the first review of the NRSS. A parallel exercise is being undertaken by the Bureau of Infrastructure, Transport and Regional Economics (BITRE) to estimate the costs of road trauma and identify the costs and benefits of different countermeasures. Available results from this study will also be considered in reviewing the NRSS.

1.2 Scope of Project

The aim of the project was to assist the Austroads Safety Task Force (ASTF) to carry out an objective review of the NRSS and to provide evidence to help identify any necessary changes to priorities and initiatives to help develop the next three year action plan.

The project included a number of components:

- A targeted review of recent literature to identify new road safety priorities and innovative countermeasures
- Consultation with the members of the ASTF and a wider stakeholder group to explore the level of implementation, identify the influence of the NRSS and identify changes in road safety priorities since 2011
- An examination of the level of implementation of the NRSS, particularly the "First Steps" agenda identified in the 2011 document
- An analysis of road trauma data and related measures such as travel speed, vehicle safety, composition of the Australian fleet and exposure, to determine whether the NRSS targets are likely to be achieved by 2020
- An examination of hospital separations using the Australian Institute of Health and Welfare (AIHW) National Hospital Morbidity Database (NHMD) to understand patterns of serious injury and recommend a method for future monitoring of the NRSS
- A brief examination of alternative modelling approaches to assist in understanding progress towards the targets and assist in future monitoring.

The review was not expected to suggest major changes to the philosophy, aspirations or initiatives contained in the NRSS. Its role was to provide decision makers with an assessment of progress and to identify a limited number of new or enhanced initiatives, or potential areas for more focussed implementation.

1.3 Report Outline

This report provides an overview of the work undertaken including the literature review, the data analysis and the results of the stakeholder consultation. The results of the review are then presented as an implementation analysis, a discussion of identified priority areas and recommendations for consideration by Austroads. The data sources used are listed in Appendix A.

2. Targeted Literature Review

The literature review was mainly restricted to documents published between 2011 and 2014, although some earlier work was included if considered relevant. Additional unpublished reports were also sourced where possible. The initial literature search identified that new information was available for a limited number of areas and these became the focus of the review.

2.1 Vulnerable Road Users

The recent report from the International Transport Forum (ITF 2014) identified that vulnerable road users are not benefiting to the same extent as vehicle occupants from recent improvements in road safety. A detailed review of recent developments in safety for these road users was therefore considered a high priority for the NRSS review.

2.1.1 Pedestrians

Pedestrians have one of the highest rates of death and serious injury yet receive little attention in the NRSS (2011). Toroyan, Khayesi and Peden (2013) contend that greater prioritisation should be accorded to safe walking in transport policy and planning, not simply because over 270,000 pedestrians a year are killed on the world's roads, but because proven pedestrian safety facilities are not installed as often as they could be. Pulugurtha, Vasudevan, Nambisan and Dangeti (2012) conducted an evaluation of the effectiveness of specific road infrastructure interventions at eight sites in the United States: high-visibility cross-walks, median refuges, Danish offset and pedestrian channelisation in enhancing pedestrian safety.

High-visibility cross-walks typically use highly visible painted markings on road surfaces to enhance visibility and to minimise inappropriate perceptions between pedestrians and motorists. They also aim to encourage pedestrians to use cross-walks when crossing the road. As well as addressing issues of pedestrian inconspicuity, these cross-walks reduce problems with motorists and pedestrians failing to give way to each other. In Pulugurtha et al's study, the researchers' field observations and statistical analyses showed that high-visibility cross-walks helped improve both motorist and pedestrian behaviours as well as their safety. This countermeasure was also one of the most economical.

Median refuges are raised barriers in the centres of streets that serve as places of refuge for pedestrians who cross a street at midblock locations or at intersections (including roundabouts). The refuges can be deployed in combination with high visibility cross-walks. Typically, they assist crossing pedestrians trapped in the middle of a street by busy traffic. However, refuges also serve to reduce the speeds of approaching vehicles and address the issue of motorists who fail to give way to crossing pedestrians. The researchers found a statistically significant increase in the proportion of pedestrians who, in using refuges, looked for vehicles before beginning to cross the street. There were also significant increases in not only the proportions of drivers who gave way to pedestrians at the refuges, but also increases in the distances before a refuge in which the drivers stopped or gave way (Pulugurtha et al, 2012).

Danish offsets are a larger form of median refuge in which a pedestrian who has crossed a road to reach the refuge can only complete the crossing if they walk to the right or left along the refuge before attempting to continue with the road crossing. The second crossing location from the refuge is offset from the location of the first crossing. While the trials showed that Danish offsets did not increase the proportion of pedestrians who looked out for vehicles, pedestrians were more likely to select the offset configuration to cross the road and to obey the offset configuration. At the same time, drivers were more likely to increase the distance at which they stopped or gave way before the offset (ibid).

In pedestrian channelisation, safety barriers such as fences separate pedestrians from vehicles and force pedestrians to use a particular route to cross a road. However, data from the trials was inconclusive (ibid).

Specific pedestrian infrastructure treatments have also been evaluated at eight sites in New Zealand, including signalised pedestrian crossings, raised zebra crossings controlled by a warning light system or a school patrol, and refuge islands with and without kerb extensions (Turner, Singh, Quinn & Allatt, 2011). Pedestrian counts before and after installation of the treatments showed that increased pedestrian usage occurred at seven out of the eight sites, ranging from 7% at a signalised pedestrian crossing to 90% for a refuge with kerb extensions. Overall, refuges with kerb extensions resulted in the largest increases in pedestrian usage. Factors affecting the strength of the increases included safety, delayed time and route directness. However, while safety was the most important consideration reported by pedestrians who used the facilities, increases in perceived levels of safety did not necessarily translate into increased pedestrian usage of the facilities. In its conclusion, the study team noted a paucity of research internationally into before and after effects of installing pedestrian facilities. They also called for crash prediction models for identifying sites likely to have high crash rates involving pedestrians and predicting reductions in crash risk following implementation of certain kinds of facilities.

In Australia, Candappa, Stephan, Fotheringham, Lenné and Corben (2014) evaluated raised pedestrian crosswalks located on the actual entrances to roundabouts, rather than at a car length back. Their case study found reduced vehicle speeds on both approaching the roundabout and immediately prior to the crosswalks. There was also a marked reduction in proportions of vehicles travelling at speeds that could elevate the risk to pedestrians. As well, there were reductions in pedestrian waiting times and increased compliance in using the crosswalks. Candappa et al called for a larger study to substantiate their findings.

Concerned that a quarter of its pedestrian crashes occur at pedestrian crossings, the Greater London Authority (GLA)'s (2014) investigations found that 'green man' crossing times had been reduced in the interests of achieving a smooth flow of vehicular traffic. However, this was having the effect of encouraging some pedestrians to take greater risks and discouraging some older and disabled pedestrians from using particular crossings altogether. The GLA recommended increasing the implementation of cameras that can detect the numbers of pedestrians at a crossing and their speed of crossing and adjust the signal phase accordingly.

In addition to inadequate road infrastructure, key risk factors for pedestrians include vehicle speed, alcohol use by drivers and pedestrians, and poor pedestrian visibility; hence a comprehensive, holistic approach is needed involving vehicle design, road infrastructure, traffic controls such as speed limits and enforcement of traffic laws (Toroyan et al, 2013). For example, Freiberg in Germany has designed 90% of its streets for a vehicle operating speed of 30 km/h while also providing car-free residential areas. The result of this approach is that 24% of town trips occur on foot, 28% on bicycles, 20% by public transport and 28% by cars (Whitelegg, 2012, in Toroyan et al, 2013). Toroyan et al consider that Freiberg's comprehensive approach, in which the same low vehicle speed limit predominates, is more effective than a fragmented approach involving varied speed limits. This is because the approach incorporates road design features, interventions to encourage safe walking, and implementing traffic calming measures that include strict enforcement of the speed limit.

Vehicle technology is a key component of any holistic approach to improving traffic safety. The United States National Highway Traffic Safety Administration (NHTSA) (2013) places importance on developing technological capability in vehicles to detect the presence of pedestrians and avoid collisions with them. The NHTSA also recognises the problems caused to pedestrians by quieter vehicles such as electric cars and hybrid models.

A holistic perspective was also pursued by Dumbaugh and Li (2011) who contend that crashes, including those involving pedestrians (and cyclists), are the product of systematic patterns of behaviour associated with the built environment rather than merely the result of errors by drivers. Using vehicle miles of travel as a proxy for random error by drivers, their regression analyses found a weak association of driver error with crashes involving motorists and pedestrians. However, stronger associations were found between crashes and system error characteristics of the built environment. Dumbaugh and Li considered that the factors associated with a vehicle crashing into a pedestrian (or into a cyclist) are largely the same as those resulting in a crash with another vehicle. Consequently, they believe their results suggest that improvements to urban traffic safety require designers to balance the 'inherent tension between safety and traffic conflicts, rather than simply designing roadways to be forgiving' of human error (ibid, p. 69).

The NRSS (2011), under 'Safer Roads', does not use the word 'forgiving' in relation to infrastructure, merely saying that road and roadside treatments are important for preventing crashes or minimising crash consequences. However, this coverage is one step removed from Dumbaugh and Li's assertion that the real focus should be on addressing the tension between safety and traffic conflicts brought about by the built environment. A prime example of such tension given by Dumbaugh and Li is that the spatial distribution of pedestrian crashes shows that they cluster around urban arterial roads, which are typically designed for higher vehicle speeds and to enhance motorist safety by being forgiving of driver error. This often results in pedestrian (and cyclist) advocates calling for design features that reduce driver speeds and which buffer pedestrians (and cyclists) from oncoming traffic. However, while these approaches serve to reduce the opportunities for conflicts between motorists, pedestrians and cyclists, they do not focus on addressing the causes of those conflicts that Dumbaugh and Li contend stem from system error in the built environment rather than from human error. Note that, in their conclusion, Dumbaugh and Li point out that the correlations they found are not proof of causation and research is needed into how drivers and other road users adapt their behaviours in response to the built environment and how those behaviours may affect their exposure to crash risk.

2.1.2 Cyclists

As with its pedestrian coverage, the NRSS (2011) provides little more than passing references to cyclists as vulnerable road users. This minimal coverage was noted by Shaw, Poulos, Rissel and Hatfield (2012) who added that, while the NRSS sees the Safe System approach as underpinning the entire NRSS, it is essentially applied to motorists rather than vulnerable road users. Shaw et al also pointed out that while major cycling documents such as the National Cycling Strategy 2011-2016 and Austroads guides relevant to cycling state that the Safe System approach is relevant to cyclist (and pedestrian) infrastructure, these documents tend to focus on the cyclist and offer few suggestions as to how to apply Safe System principles to promote cycling safety in the broader context of the transport system.

Dumbaugh and Li's (2011) call for research into how drivers and other road users adapt their behaviours in response to the built environment seems to have been heeded by Salmon, Lenné, Walker and Filtness (2013). This team found that, while drivers, motorcyclists and cyclists develop markedly different situational understandings even when operating in the same road environments, these differences are likely to be compatible in the case of arterial road travel, for example. However, their different situational awareness can create conflicts between these types of road user at intersections. For example, at intersections, drivers commonly focus their situation awareness on traffic lights, the lights' status and the area in front of their vehicle, whereas motorcyclists' and cyclists' situational awareness is strongly oriented towards other traffic and the behaviour of other road users. This could contribute to conflicts when riders manoeuvre themselves around intersections in areas that drivers do not focus on, such as the left and right sides of their vehicle. Likewise, drivers may not become aware of riders until they are just ahead of their vehicle. Overall, Salmon et al concluded that situation awareness is heavily related to the road environment in which the road users are operating, and that road and infrastructure design has a critical role in supporting situation awareness across different road users and in enabling different types of road user to relate to each other better.

In their review of literature on infrastructure and cycling, Reid and Adams (2011) also partly foreshadowed Dumbaugh and Li (2011) because, while they noted that cyclist casualties are primarily consequences of human behaviour, they pointed out that they occur in a context formed by infrastructure, law, culture and the behaviours of other road users. Significant infrastructure-related risk factors for cyclists in single-vehicle incidents appear to be slippery surfaces and poor or defective road surfaces. For multi-vehicle collisions, the risk factors appear to be the prevailing speed limit and encounters with other road users at junctions and intersections (Reid & Adams, 2011).

Similarly to Dumbaugh and Li's (2011) position, Reid and Adams (2011) also pointed out that large roundabouts are effective at maximising motorised vehicle traffic speed and flow through intersections, and in reducing the chances of severe crashes for motorists, however, roundabouts remain especially hazardous for cyclists. Some cyclist-specific infrastructure treatments, such as painted cycle lanes and cycle advanced stop lines (or boxes) have shown only limited effectiveness in improving cyclist safety. Moreover, while providing segregated paths for cyclists has had some success in reducing cycling risks, this tends not to be the case where the segregated paths intersect with roads. Indeed, there is evidence that the risk to cyclists at such locations is not offset by the safety benefits of segregating them from motorised road users (ibid). Overall, Reid and Adams (2011) considered that the best approach to improving cyclist safety is to reduce motorised traffic speeds in conjunction with segregated pathways. However, this approach, in Dumbaugh and Li's (2011) view, would not address the more fundamental issue: the tension between cyclist safety and traffic conflicts where the road environment allows cyclist pathways and motorised traffic to intersect.

Traffic conflicts involving cyclists were recently studied in the Netherlands by Schepers (2013). He found that more collisions occur at intersections where the cyclist has right of way, but that the crash probability can be reduced if there are raised bicycle crossings at the intersection and if the cycle path approaches to an intersection are deflected between 2 and 5 metres away from the road. Schepers also found that cyclist-only crashes in which a cyclist rode off a road or hit a bollard were more likely to occur where any bicycle facilities or infrastructure were poorly visible.

Cyclist crashes at intersections were also studied recently in Canada. Harris et al (2013) found that intersections of two local streets had much lower risks than intersections between two major streets, but risks to cyclists were increased where roundabouts existed. They noted that the increased risks could be attributed to the greater number of traffic conflict points attendant on roundabouts, with the two main types of crashes at roundabouts in their study being due to collisions with motor vehicles where the cyclist was not seen, and single cycle crashes where the cyclist collided with infrastructure such as the kerb. The study also found that cyclists entering an intersection where motor vehicle speeds were below 30 km/h faced reduced collision risk.

Harris et al (2013) also investigated infrastructure interventions at non-intersection sites such as dedicated cycle paths. They found that cycle tracks alongside major streets but physically separated from motorised traffic reduced collision risk. On local streets cycle tracks were safer when there was infrastructure that tended to divert motorised traffic away from using the streets having cycle tracks. In California, Nuworsoo, Cooper, Cushing and Jud (2012) reported that other cycle track infrastructure such as cycle parking, route directness of the track, wide lanes for passing each other and traffic light phases for cyclists crossing a road are likely to increase usage of cycle tracks, thereby removing cyclists from regular roads and reducing the incidence of cycle/motor vehicle crashes. Increased usage of dedicated cycle tracks following enhancement of facilities was also demonstrated in Portland, Oregon (Monsere, McNeil & Dill, 2012). In that study, both motorists and cyclists liked the separation of road user types, with cyclists particularly reporting greater perceptions of safety, although motorists were more likely to attribute travel delays to the cycle paths. Pedestrians also appreciated cyclists' separation from traffic, but had concerns about interactions with cyclists when crossing the track.

Khan and Langlois (2011) reported that accommodating cyclists in the transportation system requires infrastructure ranging from common-use traffic lanes to separate, dedicated, barrier-protected lanes. However, they considered that risk-analysis methods need to be developed to characterise and evaluate suitable lane designs to support decision making. Desirably, such methods will estimate potential collisions when they are applied to defined lengths of travel lane and take into account variables such as the aerodynamic forces when motorised traffic passes cyclists, the wide variety of large vehicle types and sizes, evolution and variety in bicycle design and variability in cycling proficiency.

While the NRSS (2011) advocates providing more cycling infrastructure, the document nonetheless concedes that limits need to be placed on infrastructure expenditure per kilometre of Australia's lengthy road network. The NRSS encourages Willingness to Pay (WTP) approaches to inform road investment decisions. Recent research in Ireland (Laird, Page & Shen, 2013) shows that WTP estimates from potential users of proposed cycling infrastructure installations on rural roads indicate rural installations represent value for money. Research in Auckland (Raith, Nataraj, Ehrgott, Miller & Pauw, 2011) notes that cost-benefit estimates for proposed infrastructure projects need to be prioritised, allow for the infrastructure to be phased in over time, based on user demand forecasts and be informed by estimated usage over the life of the cycling infrastructure. Raith et al have developed a user demand forecast model to inform project selection and prioritisation in benefit-cost calculations. This model carries the advantage that benefit-costs of infrastructure installations are calculated across a whole road network rather than applied on an individual project basis. In this context, Raith et al noted that it may be beneficial to prioritise construction of a low benefit-cost ratio project in order to increase connectivity across the whole cycling network.

2.1.3 Motorcyclists

Compared to its coverage of pedestrian and cyclist safety, the NRSS (2011) provides much more detail for motorcyclist safety. This may be because, as the NRSS states, motorcyclist deaths have increased by 17% over the past decade, reflecting in part the increased usage of motorcycles over this time. However, while the NRSS says it recommends infrastructure treatments in response to these trends, it provides little further detail.

Allen, Day, Lenné, Symmons, Newstead, Hillard and McClure (2013) noted that the most recent case-control study of motorcycle crashes in Australia occurred fifteen years ago. Mindful of the above trends and substantial changes in the road environment since then, Allen et al conducted a contemporary analysis. The most common crash scenario reported in the 75 cases studied was another vehicle turning into the path of a rider. Moreover, half of the crashes occurred at intersections and a fifth occurred on a curve or bend, while in 27% of cases it was calculated the rider was exceeding the speed limit. Allen et al are currently completing the case-control component of their study and they anticipate being able to make evidence-based recommendations for countermeasures in the key areas of the Safe System approach.

A recent national scan of motorcyclist safety in the USA (Schaffer, Heuer, Bents, Foglietta, Wieder, Jordan & Tiwari, 2011) identified the following infrastructure issues and suggestions as among those relevant for countermeasure development:

- Communicating motorcycle-relevant information about road conditions and various hazards (including road curves), such as by signage containing a standard motorcycle and rider symbol' and/or by portable electronic message boards containing messages for riders
- Recessing into the road surface the heavy steel plates used to cover temporary excavations and other road works, thus minimising the jolting of riders travelling over them
- Using road surface crack sealants and road marking paints that are not slippery for motorcycle tyres
- Using painted cues at the locations of traffic signal detector loops placed under the road, so that riders can trigger them more readily when they are the only vehicle stopped at the traffic lights
- Including wedges when sealing road shoulders so that if a rider loses control and leaves the road, the rider experiences a gradual drop rather than a vertical drop, and vice versa if the rider steers back on to the road.

In addition, Schaffer et al noted that rural road design, especially road camber and drainage configurations, presents unique challenges to motorcyclists when they are stopping, turning, or slowing down (because uneven and non-level road surfaces can catch a rider off-guard, potentially leading to loss of control).

Although the scan by Schaeffer et al was aimed more at making infrastructure more forgiving than reducing traffic conflicts involving motorcyclists, the team identified the above issues and suggestions chiefly through a consultation process involving a range of highway design specialists as well as various motorcycle rider groups committed to improving motorcyclist safety. A similar consultation process was employed in a European scan by Nicol et al (2012) who identified several issues specifically relevant to motorcyclists travelling near roadwork zones, but added:

- The design and placement of traffic control devices and signs to be more forgiving of motorcyclists (e.g. use of flexible bollards instead of post-mounted directional delineators) and more accommodating of motorcyclists (e.g. use of advance stop lines for riders similar to 'bicycle boxes)
- Leaving gaps in road surface markings so that riders can travel through the gaps without encountering changes in surface friction (e.g. painted 'zebra' style crossings that contain gaps having no paint markings).

Nicol et al (2012) provided an expanded discussion on the development of motorcycle-friendly road barriers, noting recent developments such as France and Spain each establishing standards for the design and performance of dummies used in motorcycle barrier crash-tests. German data suggests that in many barrier crashes motorcyclists slide along the top of the rail, and this has led to a re-designing of barriers to include a cap along the top to prevent upper body injuries caused when crashed riders slide along the rail top (ibid).

The performance of roadside and median barriers in protecting motorcyclists has been further researched in Australia recently. For example, the work of Bambach, Grzebieta and McIntosh (2013) supports the inclusion of an upright posture component in barrier crash-test trials, as is commensurate with such a standard in those trials occurring in France and Germany, and for a thorax injury criterion to be included (see also, Grzebieta, Bambach and McIntosh (2013)).

Bambach et al (2013) considered that national design guides for roadsides in both the USA and Australia do not consider motorcyclists in the risk-based decision process for barrier deployment because the severity indices for barriers and other fixed hazards were originally developed for passenger vehicles. However, Bambach et al subsequently showed that those indices are nonetheless applicable to both vehicle occupants and motorcyclists.

Trials of a Spanish flexible motorcycle barrier system are underway at selected South Australian sites, such as on dangerous curves and other locations with high risk of motorcycle crashes, with a view towards continuing to invest in this system. The initial trials are showing encouraging results (Anderson, Dua & Sapkota, 2012).

In a multi-stage project over 2008-2012, Austroads evaluated a full range of roadside treatments with respect to their suitability for addressing road crashes and run-off road crashes in particular, and for various road environment configurations and circumstances (Jurewicz, Steinmetz, Phillips, Cairney, Veith & McLean, 2014). The work recognised that motorcyclist collisions with roadside and median barriers constitute a significant crash problem and Jurewicz et al extensively reviewed the research literature into the effects of various types of barriers on the injury levels of the motorcyclists who crash into them. Tables 5.22 and 5.23 in this work list the common roadside infrastructure treatments according to where they need to be installed, the crash types they are meant to address and the predicted crash and/or injury level effects found in the literature.

2.1.4 Vulnerable Road Users and Urban Planning

A major international study is currently being carried out by Monash University Accident Research Centre (MUARC) (M. Stevenson, personal communication, April 2014) to examine the overall public health gains that can be achieved by linking urban planning and road safety objectives. The initial findings demonstrate that policies encouraging optimal land-use for active transport can be combined with the provision of infrastructure that reduces the risk of serious injury for vulnerable road users to produce considerable population health benefits across both chronic disease and road trauma.

2.1.5 Recent Strategies

Leading countries such as Sweden are recognising the need to put more emphasis on vulnerable road users in the development of strategies and road safety countermeasures (Tingvall et al 2013). This has been reflected by a number of Australian states in the development of new targeted strategies.

Transport for New South Wales have recently published new action plans for cyclist and pedestrian safety (Transport for NSW 2014a, 2014b). These demonstrate the growing understanding of the need for more emphasis on the safety of vulnerable road users and particularly to cater for safe active travel.

Both action plans were developed in consultation with user groups. The cycling plan emphasises the need for corridors rather than isolated facilities, the needs of cyclists on high-speed roads, and the need for a review of the road rules as they apply to cyclists, together with appropriate education. The pedestrian strategy includes consistent application of reduced speed limits in pedestrian areas, infrastructure improvements including increased walk time for crossings and encouraging new vehicle technology. Both plans discuss the importance of involving the community and local government in solutions and the importance of further research to better understand how to provide a Safe System for pedestrians and cyclists.

Western Australia has also recently published a bicycle network plan that also emphasises the need for a network of bicycle facilities rather than isolated links.

2.2 Older Drivers

The NRSS (2011) acknowledges that the relative fragility of the elderly makes older drivers more likely to be seriously injured or killed in a crash, and that older driver numbers are expected to grow substantially as Australia's population ages. The main NRSS countermeasures stated are improved fitness to drive assessment processes and promotion of alternative mobility options.

2.2.1 The Ageing Population and Older Driver Crash Patterns

In a study of older driver crashes and injuries, Koppel, Bohensky, Langford and Taranto (2011) identified that, compared with middle-aged drivers, older drivers are statistically significantly more likely to collide with fixed objects and to crash in 50 to 60 km/h speed zones, with intersections being particularly troublesome for older drivers due to the amount of visual information requiring rapid driver interpretation (see also Institute for Road Safety Research, 2012a). Koppel et al also found that older drivers are less likely to sustain neck injuries than middle-aged drivers, but more likely to sustain thoracic injuries, with this pattern likely being due to differences in older drivers' crash types and the speeds involved. Chest injuries, such as from restraint system pressures, are a special concern for older people due to weaker capacity of the lungs to recover. Koppel et al concluded that this injury susceptibility has implications for vehicle safety features as well as highway design.

Research in Germany (Jänsch, Otte & Pund, 2013) identified that older drivers are more likely to be at fault in the crashes they are in, are more likely to crash between 9 and 11am (corresponding to the time of day they are most likely to be driving), and to experience visual defects. They are also more likely to be involved in turning crashes requiring giving way to oncoming vehicles or cyclists, and in crashes requiring giving way to traffic when entering an intersection. Problems with interpreting information (e.g. a misjudgement) appeared to be more prevalent in turning crashes than entering intersection crashes (ibid).

In Queensland, Rakotonirainy, Steinhardt, Delhomme, Darvell and Schramm (2012) also reported that older drivers are more likely to be at fault in crashes, particularly at intersections, and are increasingly more likely to be found at fault the older the driver age. Older drivers are also more likely to be found at fault where intersections are controlled by give way or stop signs, which require the driver to make quick but accurate traffic gap decisions. Unfortunately, older drivers tend to drive on local, congested roads rather than highways, and are thus more likely to encounter intersections (ibid).

Such crash trends tend to reinforce a common negative stereotyping of all older drivers as incompetent and hence unsafe, when it should be recognised this is true only for a portion of older drivers. The investigations by Jänsch et al (2013) indicate a need to counter or break down this stereotyping, not just among the general public, but also among older drivers themselves, politicians, policy developers and medical practitioners when assessing fitness to drive. Breaking down such stereotypes will be important if for no other reason than emergent research is now questioning the former wisdom on which the NRSS bases its older driver coverage.

The Insurance Institute for Highway Safety (IIHS) (Karush, 2012) is finding that older drivers are not only proportionally causing fewer crashes than they used to (due to improved vehicle and road infrastructure safety) but they are no longer dying more often than others when they do crash (due to medical advances). Also, this declining crash trend for older drivers applies across fatal, injury and property damage only crashes (Cheung & McCartt, 2011). However, since 2012, the crash rate decline for older drivers has slowed, possibly due to the US recession over that time (Cicchino & McCartt, 2014). Nonetheless, the IIHS (Karush, 2014) reports that in the US older drivers increased their overall mileage from 1997-2012, possibly indicating that they are remaining physically and mentally comfortable with driving tasks which, in turn, may be contributing to the declining crash patterns. In fact, the IIHS's predictions towards 2030 are that its insurance claim frequency among older drivers will be lower compared to 2010 (Karush, 2012).

Staplin and Freund (2013), however, provide a note of caution on the declining crash pattern. A wide range of factors affect America's road toll over the years (for example, between 2005 and 2010, twelve additional states implemented compulsory seatbelt laws). Staplin and Freund assert that a continuing steady decline in the US toll for older drivers cannot be assumed because, while 2009 to 2010 saw a 2.7% decrease in total road fatalities, over the same period the previously steadily declining proportion of total fatalities involving drivers aged 70+ rose by 2.0%. In fact, there has been a persistent upturn in the percentage of fatalities accounted for by crashes involving drivers aged 70+ (from 10.7% in 2006 to 12.3% in 2010) (ibid). Staplin and Freund rightly query whether this trend is merely a reflection of the growing number and proportion of older drivers on US roads, or rather an increasing prevalence of decline in fitness to drive capabilities. As more and more older people continue to drive and for longer, it is inevitable that the number and proportion of individuals who are unfit to drive will increase (ibid).

Nonetheless, reducing crash patterns among older drivers are also being noticed in Great Britain. The recent analyses of Mitchell (2013) revealed that car drivers aged up to 75 or 80 are no more likely to be involved in a slight injury crash than younger drivers on the basis of casualties per driving licence per year. Moreover, car drivers aged 60+ kill many fewer pedestrians than younger drivers. Further, the number of older drivers killed has been reducing since 2004, despite increasing numbers of older drivers (with the fatality rate reductions occurring among drivers aged 70-79 and also those aged 80+). As with the IIHS study, numbers of older driver fatalities in Britain are forecast to continue to fall. Mitchell concluded (p.740):

'While there are undoubtedly some older drivers who should stop driving for safety reasons, these results suggest that the safety of older drivers in Britain is currently being managed in a way that should be sustainable for at least the next twenty years.'

2.2.2 Future Policy, Strategy and Research Concerning Older Drivers

Sustainable management of older driver safety is likely to include assisting their information processing by making infrastructure treatments stand out with good road lighting and clear road markings, intelligent in-vehicle technologies, and better planning of alternative transport modes, particularly in rural areas. At the same time, fitness to drive assessment processes need to focus more on those older drivers who pose the greater safety risks (Institute for Road Safety Research, 2012a). While it has long been appreciated that vision is critical to driving performance and that visual abilities decline with age, there is a need to develop more comprehensive screening tools for testing driver vision with respect to aspects such as acuity, visual field, depth perception and contrast sensitivity, which are not always tested by licence agencies (Desapriya et al, 2011; see also Staplin & Freund, 2013).

Oxley, Langford, Koppel and Charlton (2013) note that there is increasing international recognition of the benefits of education and training to improve the driving practices of older drivers. For example, if older people adopt safer driving practices, then this will have a protective effect on crash risk and there will be less need for them to have to submit to periodic testing. In researching how to enhance an existing older driver training package, Oxley et al note that past evaluations of such programs have tended to be beset with methodological difficulties (particularly selection bias and heterogeneity within samples) often yielding conflicting or inconclusive results about even similar education programs. Moreover, such education initiatives are often implemented as stand-alones. Oxley et al quote the recognition by Korner-Bitensky, Kua, Derosiers, von Zwek and van Bentham (2009) that the research direction should instead be in a more holistic context (Korner-Bitensky et al, 2009, p.110; in Oxley et al, 2013):

Interestingly, what has as yet not been explored fully is the benefit of a multi-faceted intervention that includes education, motor, sensory, cognitive and behavioural aspects, all of which have been shown to be important components of safe driving. Given that the task of driving involves a complex interplay of all of these, the need for such studies is clear.

Recent research has found older driver safety appears to be boosted from an unexpected source. Braitman, Chaudhary and McCartt (2014) found that, based on 2002-2009 USA road fatality data, drivers aged 65-74 had a 43% reduced chance of a fatal crash if they carried one or more passengers with a 38% reduction for drivers aged 75+. Moreover, the reductions occurred for nearly all passenger age and gender combinations. Notably, the passenger benefits were greater at non-intersection sites than at intersections. Possibly passengers pose a greater distraction threat at intersections. Braitman et al concluded it was unclear whether presence of passengers lowers crash risk or whether safer older drivers tend to carry passengers.

A fuller range of the circumstances of older driver crashes (such as that found by Braitman et al, 2013) should be explored. This is not just because of the increasing proportions of older people in the coming decades, but also with the increasing proportions of those older people who are/will be licensed to drive (and who will be driving for many more years due to trends in living longer, and due to advances in road and vehicle safety). Such thinking led the NHTSA (2013) to develop a 5-year traffic safety plan for older people. In the plan, the NHTSA called for upgrading the country's crash databases and database linkages to incorporate various additional capabilities for complex research questions, including by:

- Recording a range of vehicle and environmental risk factors for a crash, rather than simply level of driver culpability (e.g. this could include any adaptive equipment in a crashed vehicle such as pedal extenders that may have contributed to pedal misapplication, as well as presence of driver assistance technologies that could have distracted a driver)
- Developing means to use such data to identify high-risk sub populations of older drivers and vehicle (and infrastructure) properties that are either risky or protective for older occupants
- Making provisions in the databases to include data on driveway and parking lot crashes as, while these locations are not part of the formal road network, many older drivers have crashes (including fatal crashes) on such sites.

2.2.3 Vehicle Safety and the Older Driver

With advances in technological innovation, the extent to which new forms of in-vehicle technological assistance to drivers actually assist or hinder drivers, and older drivers particularly, continues to be a major research direction. For example, Mehler (2013) evaluated the use of parking assistance technology and a crossing traffic alert system with a sample of 42 drivers ranging in age from 20 to 69. He measured their stress reactions to using the aids by heart rate monitoring and self-report ratings. After providing time to become familiar with using the technologies, the parking assist system was found to produce significantly lower self-report stress ratings, as well as lower heart rates, than when not using the aids. These findings were consistent across all driver age groups, although some individuals experienced issues in using the devices. The crossing traffic alert system also reduced stress for all driver ages, although that difference was not significant. However, drivers using this system were found to be more likely to stop and give way to approaching vehicles, when required to do so.

Mindful of the problematic nature of intersections for older drivers in relation to crashes, Dotzauer, Caljouw, de Waard and Brouwer (2013) evaluated an Advanced Driver Assistance System (ADAS) specially figured to support older drivers crossing intersections. In the small-scale study, older drivers used the ADAS in conjunction with a driving simulator. It was found that the drivers, when using the ADAS, devoted more of their attention to the centre of the intersection (where traffic conflicts are highly likely to occur); they also crossed the intersection safely in shorter times and with greater time-to-collision allowances. However, Dotzauer et al were not sure to what extent the older drivers might have benefited from using the ADAS because they were a sample that could already drive safely. They plan to repeat the study while making comparisons with younger drivers and older drivers who have impairments.

The University of Iowa (2014) is embarking on a project to identify, rate and rank current and future technologies that affect the safety of older drivers and to gauge their acceptance of those technologies. The researchers intend to establish a safety system ranking composed of a safety rating for each in-vehicle technology and comparing it to the crash risk and the potential safety benefits of other available technologies. Older driver acceptance of the technologies will be explored using focus groups and surveys that factor in an overall safety score. The project is expected to be completed by the end of 2014.

Another way of gauging how well older drivers adapt to new safety technologies is to explore their purchasing decisions when buying new cars. Using focus groups of drivers aged 70-90 in Ontario, Zhan and Vrkljan (2011) found that drivers were aware of traditional safety features such as airbags, power steering and reliable brakes, but newer technologies such as telematics that might distract a driver were viewed as less important than a driver's own skill set. Moreover, safety was a lesser consideration than other factors when purchasing a newer vehicle, particularly price and running costs. This was seen as due to a variety of factors, such as low driver opinion of a vehicle's safety features, stressful dealer-customer interactions (particularly for older females) and lack of congruity in available safety information. However, visibility of the road from the driver's seat was seen as important by the drivers. The authors recommended the creation of new car purchasing information aids for older drivers.

In Australia, Koppel, Clark, Hoareau, Charlton and Newstead (2013) also explored how important vehicle safety is for older people buying newer vehicles. Their findings were similar to those of Zhan and Vrkljan (2011) and also previous research they cited on this topic. In particular, Koppel et al noted that older drivers buying a newer car rarely sought definitive safety information such as crash test results. Moreover, older consumers with annual incomes higher than $50,000 were significantly less likely to rate safety features highly in their purchase decisions than those with incomes less than that amount.

In its 5-year plan, the NHTSA (2013) made a number of vehicle safety recommendations that were particularly attuned to the needs of older drivers, such as conducting vehicle crash tests with crash dummies appropriate to the biomechanics of older persons, developing occupant restraint systems more attuned to the needs of frail older persons (e.g. those wearing pacemakers), and determining the feasibility of a 'Silver Car Rating' stream relevant to older drivers within the national crash test program, New Car Assessment Program (NCAP). Recent work by Monash University has identified a safe car list for older drivers purchasing new cars (Budd, Scully, Newstead & Watson, 2012).

A year earlier, Eby and Molnar (2012) took the NHTSA's silver car rating concept to a broader plane by exploring whether there is now a need to design and produce an 'older driver vehicle'. Eby and Molnar examined the broader context of older driver issues across the ageing population, exposure and crash trends, to functional declines in older people, self-regulation of driving and cessation. They then looked at various adaptive devices and technologies currently available, as well as critical aspects of vehicle design such as getting in and out of a vehicle, seating, the driver's view of the road, and dashboard controls. This led them to conclude there is a need for an 'older driver vehicle', but that such a concept would benefit drivers of any age. However, they emphasised that the concept should be developed with a holistic approach taking into consideration all the above background factors. Moreover, as there is a high degree of heterogeneity among older drivers, design strategies should allow for options and customisation of specific safety features to suit individual needs, although such a capacity to customise should not be marketed as being only for seniors or those with disabilities. Eby and Molnar note that, with advances in intelligent technology, it will soon be possible for new safety features to automatically adjust themselves to suit a driver's characteristics. At the same time, they caution it will be necessary to improve education efforts about the new technologies, vehicle features and crash avoidance systems, otherwise the benefits of the new designs may not be achieved and safety may be compromised.

2.2.4 Road Infrastructure and the Older Driver

With respect to road infrastructure that benefits older drivers, best practice policies and approaches such as improved sign visibility and intersection design enhancements were established well over a decade ago and, as Staplin and Freund (2013) note, have been shown to result in more stable and confident driving manoeuvres by not just older drivers but drivers of all ages. However, Staplin and Freund consider that, over the years, updates and additions to the initial standards for older driver friendly highway design, in America at least, have been expressed as 'practices that "may" be used, subject to engineering judgment' (p.213). Staplin and Freund call for bodies like the NHTSA and the Federal Highway Administration (FHWA) to steer the fast-tracking of 'optional [best] practices' into national standards to ensure their widespread application and acceptance by planners, designers and engineers.

Staplin and Freund (2013) also address the issue of alternative transport modes for older people who are not drivers. Noting that traditional mass (public) transportation was never built for people who reach the advanced ages of today's elders, they explore options for using private sector resources to meet older people's transportation needs (for example, use of volunteer drivers and car sharing). They recommended a review of US state policies that either create incentives or remove barriers to use of such private resources.

The issue of providing alternative transport modes for those no longer driving reflects the much broader scenario of balancing safety and mobility, which Marottoli and Coughlin (2011) see as often producing a seesaw effect where favouring one side results in decrements in the other. Rather than perceiving safety and mobility as conflicting or polarised needs for the elderly, they advocate a more holistic approach looking at a continuum of resources that optimise both safety and mobility regardless of driving status. These resources apply inclusively to areas such as driver health, licensing regulation, personal decision making and planning, community and transport systems construction, and vehicle design (ibid).

A similar perspective on older people in transport was identified by Ball, Ross, Eby, Molnar and Meuser (2013) who advise that, despite any attempts at a more holistic approach, there remains substantial unmet demand for alternative transport systems able to keep pace with the increasingly ageing population, including those ageing out of driving. Ball et al (2013) echo Staplin and Freund's (2013) call for policies that remove barriers or create incentives for the use of private resources (such as volunteer drivers) for 'sustainable senior mobility, pointing to a whole array of opportunities that can help people take care of themselves (p.138).'

Ball et al (2013) went on to report on the international Emerging Issues in Safe and Sustainable Mobility for Older Persons Conference held in Washington DC in the latter half of 2011. Key change areas identified at the conference were:

- Changing demographics associated with ageing. For example,
- increasing numbers of very old persons
- increasing preferences to live independently within local communities rather than in aged 'enclaves', and
- increased preferences for using private rather than public resources for transportation
- Recognition of a subgroup of older persons whose frailty when using alternative transport modes constitutes a salient safety issue and the broader implications of this, e.g. for vehicle design in both public and private passenger transport
- Issues experienced by caregivers in meeting the transport needs of the elderly
- Emerging research on how brain health and physical fitness (e.g. cognitive training and exercise programs) can improve and maintain fitness to drive
- Increasing numbers of older women choosing to drive.

While general cognitive training programs have been found to benefit the performance of older drivers, a series of structured sessions in which older drivers use a driving simulator have been found to improve on-road driving performance, compared to a control group and a group receiving general cognitive training involving vigilance and selective attention (Casutt, Theill, Keller & Jäncke, 2014).

On the last point, there is emerging research on different error types made by older female versus male drivers, as noted by Classen, Wang, Crizzle, Winter and Lanford (2013), whose own study found that gender differences in driver performance can widen with increasing older driver age.

2.3 Communication Approaches

The NRSS (2011) contains no coverage of communication approaches for road safety messages, such as the potential afforded by social media. Yet, there have recently been some innovative and promising communication campaigns reflecting a variety of approaches, such as social media websites and targeted text messages to mobile phones (Faulks, 2011).

2.3.1 The Road Safety Message

A number of researchers have discussed the importance of changing the road safety message and this was the focus of the 2013 Australasian College of Road Safety (ACRS) Conference. The keynote speaker (Willis 2013) stressed the importance of professionals being in the conversation and not allowing the media to be dominated by “myths”. The importance of having a two-way discussion and using new forms of media in addition to the traditional outlets was also considered to be important.

Much of the discussion at the conference concerned the issue of speed. Mooren, Grzebieta and Job (2013) discussed why it is so difficult to present the facts and dispel the myths about speed, speeding and crash risk. Mooren et al agreed that social media provide an opportunity to have a two way conversation with the community but also considered it to be important to first understand the reasoning behind the anti- speed enforcement and speed limits positions.

Two recent Australian projects sought to assist in this understanding. Ipsos Social Research Institute (2013) undertook an Austroads project to measure driver attitudes to speed enforcement. They found that while most people agreed speeding was unsafe, they mainly defined unsafe speeding as driving faster than they themselves would. Driving slightly over the speed limit was considered normal and safe. Raftery, Kloeden and Royals (2013) carried out a project funded by the former National Road Safety Council to identify speed education resources that address the common myths and misconceptions about speeding.

At the 2013 ACRS conference there was general agreement that a new approach was needed to engage the community in addressing road safety. It was felt that new forms of media provided new opportunities and so these are the main focus of the remainder of this section of the literature review.

2.3.2 Using Social Media

Apatu, Alperin, Miner and Wiljer (2013) consider that, as Facebook™ is used by adults of all ages, this form of social media has high potential to convey messages about safe driving. Their study involving 85 individuals (including some aged over 55) found that over half reported changing their driving behaviours as a result of driving safely information posted within their various Facebook™ groups. Moreover, many survey respondents aged 25 or younger were likely to report Facebook™ or YouTube™ as an effective medium for driving safety promotion. Apatu et al considered their study worth replicating with a larger sample to provide more definitive findings.

One of Facebook’s™ key features is the ability to establish online groups of common interest or of people in similar circumstances, thus allowing safety messages to be tailored to the group (Automotive Fleet, 2011). A fleet manager, for example, could post a safety related message to employees joined up on their company’s Facebook™ page, or via LinkedIn™, an digital social network similar to Facebook™ but aimed at professionals and business people. The message could, for example, relate to using a mobile phone while driving for work, or fatigue for employees going on holiday (ibid).

However, a successful campaign using social media involves much more than someone simply posting a road safety advertisement or message on a medium (Prince, 2012). The various social media formats provide online tools to facilitate users engaging in and contributing to ongoing discussions or dialogues about the message and/or creating further allied content to share, which can lead to unintended but beneficial consequences. Prince illustrates this view using two recent examples from New Zealand. One involved a television advertisement with the message that young drink drivers tend to be good people, but they make bad choices about drinking and then driving, in contrast to previously aired confrontational "you're a bloody-idiot" themed advertisements. After its launch, the new advertisement was placed on YouTube™, resulting in over 1.5 million "hits", plus over 150 Facebook™ pages being created by independent viewers, and spinning off into production of a music video by a Kiwi rap group, and merchandise such as T-shirts and rugby costumes being created (ibid). Initial fears that components of the message would be diluted, distorted or mocked proved unfounded and the New Zealand Transport Authority (NZTA) had to employ a person to monitor the social media outcomes and to respond with new information relevant to the theme (ibid).

Prince's other example concerned a scenario advertisement about a passenger becoming aware that their driver is affected by drugs. The scenario was aired on YouTube™, Facebook™, web forums and a stationary billboard. Through all of these channels, the audience was able to interact, post comments and opinions and vote on selected poll questions associated with the scenario. Overall, the responses indicated that, despite there being clear clashes of opinion on several aspects, drug driving was considered a serious issue. Prince concluded by pointing out that, while social media can work as effectively as traditional forms of media, particularly with regard to certain road safety messages, it may not always be the most appropriate media channel in all cases, and its cost-effectiveness needs to be fully investigated.

2.3.3 Message Content

Along with type of transmission medium, road safety message content has also been a recent research focus. Redshaw (2011) found that focus groups composed of young adults tended to consider car sales advertising that focussed on the speed, power and driving style of new cars filmed in off-road sporty situations to be applicable to regular on-road driving. She noted that the more such aggressive styles of driving are employed in car sales advertising, the more it suggests to audiences that these are acceptable ways to use a car. The focus-group members both implicitly and explicitly connected the off-road driving scenes to on-road driving, with Redshaw noting this is particularly problematic for young people in country areas where off-road driving is common. She concluded that the enthusiasm for cars by young males in particular needs to be managed in ways that clearly separate motor racing and risky, dangerous driving from everyday driving on the road. She suggested that emphasis on social themes of cooperation and consideration in advertising that actually allow roads to function in relatively safe ways could be used more creatively to present alternatives to the themes of car sales advertising and which reinforce meanings that are part of safe driving practice. Similar conclusions were reached by Faulks (2011), who advocated advertising approaches that prioritise the safety of one's family, peers and the broader community, while encouraging behaviours that reduce the likelihood of illegal and risky events.

Also in relation to young drivers, Papakosmas and Noble (2011) considered utilising in safety messages the value young people attach to gaining a driving licence. Whereas many young people maladaptively associate the freedom, independence and maturity of gaining a licence with risky driving choices such as speeding, social marketing campaigns could, instead, link the independence and maturity of a licence with adopting socially responsible attitudes and behaviours on the road. The If You Lose Your Licence, You're Screwed campaign directed at young South Australian drivers was a step in this direction, despite being set in a negative context. The campaign, which employed a variety of media formats including social media, humorously projected the consequences of losing a licence, such as a parent having to pick you up from a pub, not being able to keep a new job, or not going out on dates (Boehm, de Roos & Blackwell, 2013).

A related form of message development, common in social marketing circles, is to communicate desired positive social norms. For example, with respect to changing behaviour around household energy use, the approach involves communicating what 'the neighbours" or "everyone else" is doing for energy efficiency. Research has found the social norm communication approach in this context to be more effective than appealing to people's concern for the environment, or the well-being of future generations (Johnson, Gaudry & Katz, 2013; see also Graham, 2013).

Yet another new approach to message content is to allow drivers to experience the road from the perspective of a different road user, such as a car driver experiencing what a motorcyclist experiences. Frauenfelder (2013) describes an approach used in Victoria to allow car drivers to experience the road from the perspective of a truck driver, with the aim of showing car drivers how they can more safely share the road with trucks.

2.3.4 Type of Audience

Road safety communication approaches are also being analysed with respect to audience sub-groups. In studying anti-speeding message development, Lewis, Watson, White, Elliott, Thompson and Cockfield (2012) found that, when responding to the possibility of being caught, males were significantly more likely than females to report that, if caught, they would consider they were nevertheless still driving safely. In contrast, females were significantly more likely to report thinking that their driving was unsafe and that they should not have been speeding. Females were also significantly more likely to report feeling embarrassed to tell others they had received a speeding infringement. Lewis et al also found significant gender differences in how males and females define the speeds that constitute speeding. They concluded that such qualitative differences warrant ensuring that anti-speeding message content appropriately identifies and challenges such different reactions by male and female drivers.

Papakosmas and Noble (2011) found that parents supervising their children learning to drive often modelled negative behaviours that conflicted with the safe driving habits they were attempting to inculcate in their children, and that this aspect is frequently overlooked in road safety advertising aimed at changing attitude and behaviour among young drivers. Papakosmas and Noble conceded it is likely to be too late to try to change the attitudes and behaviours of the current parent-young driver cohort. Instead, they said, it may be better to focus on a long-term approach targeting inappropriate driving behaviours of parents of much younger children with the message that their children are watching and taking notice of their driving behaviour from a very young age, and that this may influence the driving behaviour of the children years later when they start to drive.

2.3.5 Future Directions in Communications Approaches

After examining various social media communication approaches in the public health area, including in road safety, Murray and Lewis (2011) made a number of suggestions for future research and practice. First, empirically-based evidence on the effectiveness of social media approaches is needed, along with clear definitions of what social media is in relation to specific circumstances and purposes of use. This will enable comparisons to be made with other forms of campaign to afford comprehensive understanding of how particular features of the social media campaigns have functioned. For example, numbers of “hits” on websites are often used to quantify extent of response, but outcomes of practical significance such as behaviour change are important.

Second, there is a need to determine what kinds of safety messages and audience target groups are best suited to the use of which kinds of social media channels. For example, while Twitter™ is highly popular, it limits messages to 140 or fewer characters at a time. Third, models need to be developed for conducting reliable and valid evaluations of campaigns that use social media. Fourth, there is a need to explore how social media approaches can work independently, but also usefully complement the traditional approaches to road safety advertising (ibid).

A paper by Graham (2013) showed how social media approaches were used in New Zealand to complement traditional communications about speed. Noting that previous messages from safety agencies tended to be ‘disconnected’ from the audience views, the approach adopted used social media to ‘engage with the driving public in the same conversational space that they themselves talk and think about speed’. Graham also shows how social media can be used to evaluate the effectiveness of traditional methods of road safety advertising. In South Australia, Dua, Anderson, Cartwright and Holmes (2013) used social media in conjunction with traditional approaches in communicating to the public a reduction from 110 km/h to 100 km/h of the speed limit on selected rural roads in that State. Social media were also employed in evaluating the multi-faceted campaign which found, similar to previous research by Monash University, that while people strongly believe reduced speeds effectively reduce injury severity, they are less likely to believe reduced speeds lead to reduced crash numbers.

2.4 Developments in Vehicle Technology

Recent and future developments in vehicle technologies may bring about significant safety benefits. This section considers technologies that have been introduced into new vehicles during the last five years, technologies that exist but are not commonly found, and technologies that may be introduced in the longer-term future.

2.4.1 Current Emerging Vehicle Technologies

During the last five years, a number of technologies have begun emerging into the vehicle fleet that may bring significant safety benefits. These technologies are focussed on crash prevention, either through providing warnings to the driver or through automatic braking and steering interventions. The most promising of these technologies is Autonomous Emergency Braking (AEB), however there are some other related technologies that might also have some beneficial effect.

AEB uses a sensor system (typically radar or video) to detect objects in front of the vehicle and automatically apply the brakes if a collision is about to occur. Early international studies of AEB effectiveness suggested a potential 20% reduction in the number of crashes (Jermakian, 2011; Highway Loss Data Institute, 2011; Hummel, Kühn, Bende, & Lang, 2011). Locally, Anderson, Doecke, Mackenzie and Ponte (2012) simulated South Australian crashes that had been investigated in-depth and found a potential 20-30% reduction in fatalities and a 30-40% reduction in injuries with AEB, depending on the performance of the AEB system.

AEB may be particularly important for preventing crashes with vulnerable road users: Rosén et al. (2010) simulated German pedestrian crashes and suggested that 40% of pedestrian fatalities and 25% of pedestrian injuries could be prevented with AEB.

These earlier studies of AEB effectiveness may be optimistic. Recent studies of real-world AEB systems have shown that performance can vary significantly between different vehicle models, and that some systems may only work reliably at low speeds (Hulshof, Knight, Edwards, Avery, & Grover, 2013; Ando and Tanaka, 2013; Euro NCAP, 2013). Despite the limitations in performance that might exist at this stage, AEB remains a very promising technology for the near future. Even if crashes are not completely prevented by AEB, the cumulative effect of reductions in speed across a large number of crashes might lead to significant overall benefits.

There are other emerging technologies that use similar sensor technology to AEB. Adaptive Cruise Control (ACC) is a technology used to maintain a constant safe gap to the vehicle in front while driving, and Following Distance Warning (FDW) is a technology used to warn drivers if this gap is too small. Paine, Healy, Passmore, Truong and Faulks (2008) judged that FDW might lead to a trauma reduction of 2% in Australia, as well as estimating a 1.5% reduction for ACC. Murray et al. (2009) suggested that 20% of rear end crashes involving heavy vehicles may be prevented by a combination of FDW and ACC. Also related are Lane Change Assist (LCA) and Blind Spot Detection (BSD) systems, which use similar sensors to detect other road users to the sides of the vehicle. The potential effectiveness of LCA and BSD is relatively small, with early estimates ranging from a 0.5% to 1.0% reduction in trauma (Paine et al. 2008; Gottselig, Eis, Wey, & Sferco, 2008). Anderson et al. (2011) estimated fatality reductions of 1% (35 fatalities) and 4288 non-fatal injury reductions for LCA.

Lane Departure Warning (LDW) systems have also been introduced into vehicles in the last five years. These systems use a camera to monitor the position of the vehicle within the lane, and also monitor steering wheel and indicator use. If the vehicle is determined to be unintentionally deviating from the lane the driver is notified via audible, visual and/or tactile warnings. Some systems may automatically steer the vehicle back into the lane. Paine et al. (2008) suggested that a 2% reduction in trauma in Australia is possible with LDW. Anderson, Hutchinson, Linke and Ponte (2011) estimated fatality reductions of 7% (100 fatalities) and a reduction of 4,177 non-fatal injuries in Australia for LDW.

Fatigue warning systems have also begun to appear in some vehicles. The intention of fatigue warning systems is to monitor and assess a driver's level of alertness and give warning when this is determined to have degraded beyond a threshold. Mercedes-Benz introduced a system called 'Attention Assist' that is based on steering wheel movements, and Subaru have a similar system that monitors steering (Daimler, 2014; Subaru, 2014). Other fatigue warning systems may work by using a camera to monitor driver eyelid movements (with longer blinks being associated with greater levels of fatigue). Euro NCAP (2011) suggest that "… even modest assumptions regarding the numbers who are likely to respond [to a warning and take appropriate action] leads to an estimation that a system like Attention Assist could prevent 1,875 injury accidents involving a passenger car every year in Europe." Paine et al. (2008) judged that this technology might lead to a road trauma reduction of 2% in Australia.

Finally, another emerging technology is Intelligent Speed Adaptation (ISA). ISA is a technology that uses Global Positioning System (GPS), paired with accurate speed zone maps, to determine the current speed limit. Depending on the type of ISA, the system may provide a warning if the speed limit is exceeded (known as advisory ISA), or not allow the vehicle to exceed the speed limit via electronic control of the engine (known as limiting ISA). One of the significant challenges in deploying an ISA system is in generating accurate and reliable maps of speed zones (Creef et al. 2011). This challenge has recently been overcome in New South Wales, with Transport for NSW releasing a free smartphone application in February 2014 that provides advisory ISA (Transport for NSW, 2014c).

The potential benefits of ISA are significant, and stem from the relationship between travelling speed and crash risk. A field trial conducted in New South Wales of over 110 vehicles suggested that advisory ISA reduces speeding and might reduce fatalities by 8% and injuries by 6% (Creef et al., 2011). Doecke and Woolley (2011) used Australian mass crash data to estimate a 7.7% reduction in injury crashes with advisory ISA, which is in line with the estimate of Creef et al. Doecke and Woolley (2011) estimated approximately a 25% reduction in injury crashes for limiting ISA. A recent study in New Zealand estimated that an advisory ISA system might prevent 22% of fatalities and serious injuries on urban roads, and 5% of fatalities and serious injuries on rural roads (Waibl et al., 2013 p. 132). A UK field trial conducted with 80 drivers suggested that advisory ISA, at 100% deployment, would prevent 2.7% of crashes, but a limiting ISA system could prevent 29% (Lai, Carsten, & Tate, 2012). The UK results suggested that a limiting ISA system that could be disabled by the driver could prevent 12% of crashes. A recent European Transport Safety Council (ETSC) report identified ISA as the most effective driver assist technology (Vaa, Assum, & Elvik, 2014).

2.4.2 Existing Technologies Not Yet Being Adopted

There are some safety technologies that already exist, and may be quite beneficial, but are not currently being adopted into the vehicle fleet. They may require government intervention in order to find their way into new vehicles. Three such existing technologies are examined below: Automatic Collision Notification (ACN), seat belt interlocks and alcohol interlocks.

ACN describes a system that automatically notifies emergency services after a crash has occurred. These systems transmit information including location and crash severity, and can reduce the time it takes for emergency services to reach a crash scene. Some vehicles in the mid-2000s were equipped with ACN systems but since then ACN has become uncommon. A number of studies have examined the potential effectiveness of ACN. Clarke and Cushing (2002) estimated fatality reductions in the US of between 1.5% and 6%; most recently Wu, Subramanian, Craig, Starnes, and Longthorne (2013) found there would be a 1.8% fatality reduction in the US with earlier crash notification. Sihvola, Luoma, Schirokoff, Salo, and Karkola (2009) estimated that 3.6% of all fatalities or 4.4% of vehicle occupant fatalities in Finland would probably have been avoided with eCall (European equivalent of ACN). Chauvel and Haviotte (2011) estimated that eCall could have resulted in a 2.8% reduction in fatalities in France. In South Australia for the period 2008-2009, Ponte, Anderson and Ryan (2013) estimated that an effective fully deployed ACN system may have resulted in a reduction in all fatalities of around 2.2% or a reduction of 2.8% for passenger vehicle occupant fatalities.

Seat belt interlocks are a technology that does not allow the vehicle to be started unless all seated occupants have fastened their seat belt (as opposed to seat belt reminders, which only provide an audible warning). Seat belt interlocks were first introduced in the United States (US) in 1974, and were mandatory for all light vehicles manufactured in 1974 in the US. Despite initial studies that had predicted acceptance of interlocks by vehicle users, there was significant public backlash and the law requiring their installation was repealed the following year (Perel and Ziegler, 1971; Robertson, 1975). Whilst a seat belt interlock system is effective at increasing seat belt use, lack of public acceptance of enforced behaviour has caused vehicle manufacturers to widely adopt less intrusive seat belt reminders (Regan et al. 2006; Williams, Wells & Farmer (2002). Despite this, a significant number of road users are killed or injured while not wearing a seat belt.

Since the US experience of 1974, few studies have tried to evaluate the effectiveness of seat belt interlocks. Van Houten, Louis Malenfant, Austin and Lebbon (2005) showed increased rates of seat belt wearing in a small sample of five van drivers that did not habitually wear seat belts. Turbell et al. (1996) suggested a strong benefit of seat belt interlocks, with a benefit-cost ratio of 100:1. An analysis by Searson and Anderson (2013) suggested that fatality rates in South Australia could be reduced by 2% and serious injuries by 7% by 2030 if seat belt reminders were made mandatory from 2015 onwards. Searson and Anderson did not account for the increasing prevalence of seat belt reminders over time, which may provide some of these benefits in the absence of a complete interlock system.

Alcohol interlocks use a breath testing device to prevent a vehicle from being started if the driver has been drinking alcohol. In Australia, alcohol interlocks are currently used in vehicles of drink driving offenders under alcohol interlock schemes. In order to reduce drink driving in the general population, alcohol interlocks could be installed in a wider number of vehicles across the fleet.

Some studies have suggested that mandatory alcohol interlocks may bring about significant benefits. Regan, Mitsopoulos, Haworth and Young (2002) identified the alcohol interlock as being most beneficial out of several in-vehicle technologies, although this was on the assumption that the interlock would be 96% effective at preventing crashes where Blood Alcohol Content (BAC) exceeds .05. A presentation by Coxon (2005) was also optimistic about the benefits from having all vehicles fitted with interlocks. Recommendation 20 of the Inquiry into National Road Safety by the (Australian) House of Representatives Standing Committee on Transport and Regional Services (2004) was that an Australian Design Rule (ADR) be introduced requiring alcohol interlocks on all new vehicles. More recently, there has been discussion by Bailey, Lindsay and Royals (2013, p. 5) and Radun et al. (2014) regarding the broader application of alcohol interlocks in new vehicles. Indeed, according to Radun et al. (2014), “More and more stakeholders, including the industry and politicians, directly or indirectly support an interlock as standard equipment”.

2.4.3 Communication ITS

There are a number of safety technologies that are in development and may begin appearing in vehicles in the near future. The overwhelming trend in these technologies is towards greater communication, both for vehicles communicating with each other, and for vehicles communicating with the surrounding infrastructure.

The term ‘connected vehicles’ generally encompasses both Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communications. V2V systems allow vehicles to send messages to one another regarding their position and speed, and potentially any emergency information. V2I systems allow the infrastructure on the road to send messages to nearby vehicles regarding traffic signals, intersections, stop signs, and possibly traffic flow. The US Department of Transportation announced early in 2014 a commitment to taking steps to enable V2V communication technology for light vehicles, a decision enabled in part by the early results of a connected vehicles pilot study in Michigan (NHTSA, 2014).

A number of large-scale field trials have taken place for connected vehicles. The above-mentioned US pilot study in Michigan included around 3000 vehicles, 21 signalised intersections and five freeways (Rakouth et al. 2013; UMTRI 2014). The study concluded in early 2014, and full results are yet to be published. Another large-scale connected vehicles trial named 'Drive-C2X' is currently underway in Europe, with results due to be published in July 2014 (Drive-C2X, 2014). An early field trial of V2I in Japan involved 2000 vehicles and showed an increased rate of stopping at stop signs and slowing for intersections for vehicles equipped with V2I (Fukushima, 2011). In Australia, the Cooperative Intelligent Transport Initiative (CITI) project in New South Wales aims to trial V2I technologies in heavy vehicles that regularly travel a particular freight corridor (Wall, 2013).

The potential of connected vehicles in Australia appears to be high. Taranto, Young and Logan (2011) conducted an analysis based on Australian crash data and suggested that annual serious casualties could be reduced by 25-35% if connected vehicle technologies were implemented across the entire vehicle fleet. This estimate was made based on technologies that provided a warning only (with no automatic intervention) and were made in the absence of AEB, which may prevent some of these crashes from occurring regardless. Doecke and Anderson (2012) used computer simulations to recreate South Australian crashes that had been investigated in-depth, taking into account the potential effects of V2V technology that can intervene. Their effectiveness estimates for V2V were slightly higher than those of Taranto et al. with up to 55% of injuries and 35% of fatalities being prevented by V2V systems on their own. Doecke and Anderson also examined V2V in addition to AEB, in which case the marginal benefit provided by V2V was lower (up to 20% of injuries and 17% of fatalities).

Some benefit-cost analyses have been conducted for connected vehicles, with results generally suggesting that the benefits would outweigh the costs. RITA (2008) suggested a benefit-cost ratio of 1.6 for V2I in the USA, but this value was sensitive to estimates regarding efficacy. Leudeke et al. (2010) suggested a benefit-cost ratio of 1 to 1.1 for V2V in Europe, and 0.21 to 0.36 for V2I, at fleet penetrations of around 5-10%. Leudeke et al. suggested that higher fleet penetrations and targeted installations of V2I would increase the benefit-cost ratio to above one for V2I. Kompfner (2010) gave figures that would imply a benefit-cost ratio of around 1.5 for connected vehicles in Europe.

User acceptance of connected vehicles has been shown to be high in both the USA and Europe (Lukuc, 2012; Malone & Rech, 2013). Francano et al (2010) surveyed 1800 European drivers and found that most would find connected vehicles useful and would be willing to pay €150-350 for an entire connected vehicles system. In the US, Lukuc (2012) found that most drivers would be willing to pay US$250 extra for V2V to be installed.

On the whole, while there are yet to be results published from any large-scale V2V and V2I field studies, there appears to be an overall high level of confidence in the potential safety benefits of these technologies.

2.4.4 Vehicle Technologies

In early 2014, the Centre for Automotive Safety Research (CASR) conducted a review of emerging vehicle technologies (Searson, Ponte, Hutchinson, Anderson, & Lydon 2014). The study included interviewing sixteen experts in the field of road safety technologies (nine from Australia and seven from overseas). The responses of the experts suggested that AEB is the most promising technology for the short-term future, and connected vehicles the most important in the long-term future. This is supported by the literature described in this section and the estimated potential effectiveness of these two technologies.

Searson et al. (2014) also examined potential rates of uptake of AEB and V2V technologies. If AEB were introduced rapidly over a five year period starting in 2015 (as might happen if it were made mandatory) then by 2030, 72% of vehicles in the Australian fleet would have AEB. Under a slower scenario where AEB gradually filters into the fleet from 2015 to 2030, then only 45% of vehicles would have AEB by 2030. In the first scenario, AEB may prevent 24% of injuries and 20% of fatalities by 2030, whereas in the second, only 15% of injuries and 13% of fatalities would be prevented. Similar results were found for V2V in addition to AEB. Thus, timely and rapid introduction of AEB (and connected vehicles) has the potential to bring about significant casualty reductions.

In the short term, the most important goal might be to increase the uptake of AEB. The experts interviewed by Searson et al. (2014) suggested that the most rapid way to encourage uptake would be through government regulation that mandates AEB. There have been recent efforts by insurance companies to reduce premiums for vehicles with AEB, and these should be encouraged and marketed to consumers. The Australasian New Car Assessment Program (ANCAP) has begun giving concessions to vehicles equipped with AEB, and will soon require AEB in order to achieve a five-star rating.

Of the other emerging technologies considered, ISA appears to have the second-highest potential to prevent crashes. This is true particularly for limiting ISA systems that prevent the driver from speeding through control of the engine. Lai, Carsten and Tate (2012) suggested that, in the UK, encouraging ISA uptake through vehicle regulation could prevent twice as many accidents compared to a market-driven approach.

For the longer term, the potential benefits of connected vehicles in Australia suggest that this technology should be further developed and progress in this area should be kept in line with international efforts.

For potentially highly effective vehicle technologies such as AEB and connected vehicles, strong policy intervention might be justifiable. For a given technology that is 20% effective at preventing deaths and injuries, every year of delay in its introduction will cost, over the lifetime of vehicles sold in that year, 20% of annual crash costs. Crash costs in Australia are roughly $25B per year (ATC, 2011, p. 4), and thus each year of delay in introducing such a technology costs around $5 billion dollars. While only a rough calculation, (and it must be acknowledged that the 20% effectiveness will be for a subset of all crashes in Australia and that there is a cost to the vehicle fleet in fitting the technologies) this demonstrates the significant crash cost savings that are possible from AEB and connected vehicles, which are likely to have an effectiveness of at least 20%.

2.5 Post- crash Response

The post-crash phase is rarely mentioned in many government road safety strategy documents and, when there is coverage, it is often limited in detail. This may be because the post-crash phase is largely seen as a health or emergency services portfolio responsibility instead of as a transport or road safety one, and because the notion of the post-crash phase does not fit readily within current Safe System models for road safety. The earlier discussion on ACN may also contribute to improvements in post-crash response.

Al-Shaqsi (2010) has summarised two distinct approaches to emergency care management. One involves a ‘stay and stabilise’ emphasis, in which specialised trauma personnel with technological equipment attend an incident. These staff have authority to make complex clinical judgments and administer appropriate emergency treatment, often bypassing the emergency department once a patient reaches hospital. The other approach emphasises ‘scoop and run’, in which the aim is to bring patients rapidly to hospital emergency departments with few pre-hospital interventions. Al-Shaqsi discusses how these approaches resemble the dichotomy of Advanced Life Support (ALS) systems versus Basic Life Support (BLS). For example BLS has a ‘load and go’ philosophy involving non-invasive basic interventions and rapid transport to a health care facility, whereas ALS fits more with the ‘stay and stabilise’ approach, which includes all BLS features with the addition of a range of invasive procedures such as intravenous line placement and needle-chest decompression. However, various studies of ALS have not shown it to be superior to BLS in terms of patient outcome (Al-Shaqsi, 2010; Elvik, Vaa, Hoyle & Sorensen, 2009; Jayaraman & Sethi, 2010).

Studies comparing emergency response capability across jurisdictions, typically in international contexts, have proved problematic for a range of reasons including:

- Differences in physical geography and demographics
- Different approaches to structuring and equipping emergency response services
- Differences in types of emergency response data that are, or are not, collected
- Human error in the information recorded by those involved in providing an emergency response.

The current focus is on developing a core set of Emergency Service (EMS) performance criteria, such as that by Gitelman (2008), which consists of:

- The number of EMS stations per area
- The number of EMS transportation units per road length
- The number of EMS transportation units per citizens
- Percentage of physicians and paramedics out of the total EMS staff
- Percentage of highly-equipped transportation units out of the total
- The demand for response time
- Average response time of EMS
- Percentage of EMS responses meeting the demand
- The number of trauma care beds per citizens.

2.6 Summary

The major findings of the literature review were:

- Recent reports have recognised the need to direct increased effort to countermeasures aimed at vulnerable road users and to focus on reducing injuries as well as deaths
- High-visibility road crossing markings and locations significantly improve motorist behaviour in slowing down/stopping for a pedestrian, and pedestrian behaviour in using a crossing to cross the road. This effect is stronger when the crossings have pedestrian refuge and/or kerb extension combinations
- Reducing ‘green man’ crossing times in the interests of keeping traffic flowing smoothly is resulting in some pedestrians taking extra risks and others avoiding using crossings altogether
- There is agreement about the importance of adopting a Safe System approach to cycling safety
- Drivers, cyclists and motorcyclists have quite different situational awareness at intersections (especially roundabouts), and these differences are heavily related to the environmental configuration of the intersection
- Dedicated cycling tracks (especially with separation barriers from motorised traffic) are popular among cyclists and reduce the chances of collisions with drivers
- National and international research has shown older drivers are driving longer and further than in previous years and countermeasures beyond ensuring fitness to drive will be required
- There is a need to develop information resources especially designed to encourage older drivers to purchase safer vehicles. In the US a “silver fleet” NCAP rating has been suggested
- Practices to design road infrastructure that benefits older drivers in areas such as improved sign visibility and enhanced intersection design have been established for many years and have been shown to result in more stable and confident driving manoeuvres, not just by older drivers but drivers of all ages
- The development of mobility options for older people will remain important but research suggests a different approach is needed to provide a continuum of resources that optimise both safety and mobility regardless of driving status
- For the remainder of the period of the NRSS, significant benefits from vehicle technology will come from ongoing improvements in crashworthiness as newer, safer vehicles filter into the fleet
- The most promising new vehicle technologies in the medium and longer term are AEB, V2V communication and V2I communication

- Major road trauma reductions could result from an accelerated take up of new technologies. These benefits will largely accrue in the next decade but action will need to be taken now to maximise this impact
- All forms of ISA have the potential to produce significant benefits, and with support these could be realised earlier because of the possibility of retrofitting ISA to existing vehicles
- There is a growing body of literature on the role of social media in both road safety education and raising awareness of road trauma, but this is still a developing area
- There is a need to better manage the road safety message. This is likely to include engaging in a two-way conversation with the community and using both new and traditional forms of media
- It is unclear if improvements to post crash response can deliver significant benefits and enhancements to data collection systems and further research is required.

3. Consultation with Members of the ASTF

An initial consultation with the members of the ASTF was carried out, covering identification of road safety initiatives at the state and national level, the role of national leadership, proposal of new road safety initiatives, the acceptance of Safe System principles in key organisations and new methods of monitoring road trauma.

The reviewers held telephone conversations with road safety leaders in the Commonwealth, state and territory governments, with the exception of a face-to-face conversation with the South Australian Department of Planning, Transport and Infrastructure.

The conversations were generally 30-45 minutes long, and were guided by five main questions. The questions were circulated ahead of time and sought to explore achievements at both a State/Territory and a National level that related to the NRSS, including acceptance of Safe System principles and improved monitoring. The responses are summarised below, and some overall observations are made. The questions are listed in Appendix B.

The purpose of this process was to gain some additional insight into the implementation of the National Road Safety Strategy 2011-2020, and into the most important aspects that may need investigation during the review process. The summary is not intended to provide a comprehensive picture of all that has occurred in various states.

What do you think have been the three major initiatives implemented in your jurisdiction since 2011?

A series of interventions were cited by jurisdictions, as well as the preparation of a statewide strategy and action plan in New South Wales, and a strategic multi-year action plan in Queensland allied with a major new community engagement approach. The NRSS was regarded as important in validating these strategy level initiatives, and also in facilitating discussion in jurisdictions about specific interventions.

There were regular mentions about graduated licensing initiatives that have continued to be applied since 2011. In South Australia, the latest set of initiatives were about to come into force in July and in ACT a whole new policy project is underway looking at ways of improving the safety effect of their Graduated Licensing Scheme (GLS) for young and novice drivers.

The more widespread application through the law of alcohol interlocks for drink driving offenders in most jurisdictions was another notable change relating to safe use of the road. In Victoria, stronger vehicle impoundment penalties for extreme behaviours and a ban on mobile phone use for all provisional licence holders were noted.

A change to the traffic policing management structure and additional traffic police were regarded as critical changes in New South Wales. This has resulted in significant increases in high visibility enforcement operations and has led to stronger operational partnerships between transport and police. Speed enforcement was usually referenced, with additional camera investments noted in Western Australia, South Australia, Queensland and Australian Capital Territory. In Queensland, where a stronger police relationship was also noted, this was backed up by a police decision to lower the speed enforcement tolerance. Growing investment, installation and planning of point-to-point speed enforcement took place during this period.

Greater public information and transparency regarding camera programs were a feature in some jurisdictions, with Victoria and New South Wales going through substantial review processes regarding the effect and placement of cameras, and Victoria establishing an independent commissioner for the safety camera program.

Major reviews of speed limits were conducted in several states, with probably the most notable safety improvements in South Australia where a large volume of regional roads around Adelaide had speed limits reduced, and in Tasmania where an extensive review process resulted in a reduction of the default limit on unsealed roads to 80 km/h.

In relation to roads and roadsides, the standout feature was the $1 billion commitment over 10 years to Victoria's Safer Road Infrastructure program. Significant developments were also referenced in New South Wales; in Queensland, where 20% of the Bruce Highway has shifted to a wide median treatment; in Western Australia, where $36m was hypothecated from fine revenue to treatment of single vehicle run off road crashes; and in Tasmania, where 2+1 designs have been implemented. The allocation of Commonwealth funding to road blackspot projects and to major road and public transport projects was also referenced. The NSW Community Safety Fund (hypothecated camera funds) currently allocates in excess of $60m through its "Safer Roads Engineering Program" for targeted road safety infrastructure treatments and Black Spots.

Vehicle safety was regularly mentioned, each of the core Commonwealth regulatory commitments having been either fully met, such as Australia's global leadership of the pole side impact standard, or at least well advanced, such as the preparation of a Regulatory Impact Statement for Anti-lock Braking Systems (ABS) on motorcycles. Victoria's requirement in 2011 for Electronic Stability Control (ESC) at registration was referenced by more than one jurisdiction as being a nationally significant action.

The significance of consumer information and fleet purchasing programs was regularly referenced, including the commitment of additional support for ANCAP through the Commonwealth and through the provision of vehicles by manufacturers. As well, several jurisdictions referenced the shift to five-star safety rated cars and four-star safety rated light commercials in their respective government fleet purchasing policies.

The Northern Territory highlighted its considerable change in momentum regarding road safety reform since the handing down of 21 recommendations from a Cabinet road safety committee in 2006. Highlights included a significant remote area licensing program and the development of a community consultation forum based on the model applied in the development of the WA strategy.

Nationally, the responses to this question demonstrated a full range of interventions, with significant safety steps being taken in relation to roads and roadsides, speed, vehicles and users. All of the road safety managers were very well aware of what it was they had been focussing on, and what other managers were able to progress in other jurisdictions.

What do you consider to be the three major road safety achievements at the national level since 2011?

Almost all respondents directly nominated vehicle safety as the major national road safety achievement since 2011. Those that did not refer to this area more broadly referred to specific vehicle related initiatives, such as Cooperative Intelligent Transport Systems (C-ITS) and alcohol interlocks. Commonwealth, state and territory road safety managers alike referenced a full range of critical vehicle safety activity: new vehicle safety regulation; government fleet purchasing policies; and support for ANCAP. Actions by the Commonwealth were regarded by state and territory managers as key elements in what is seen as an increasingly important safety arena.

There was also a sense that national engagement had been an important contributor to improvements in graduated licensing and alcohol interlock laws, and to more point-to-point speed enforcement systems in States and Territories.

Beyond these areas, there were few, if any, common responses regarding major national initiatives. “Trying to think of initiatives” and “problematic outside vehicles” were indicative of the responses. Other national initiatives that were referenced by individual managers were:

- The Australian National Risk Assessment Model (ANRAM)
- The establishment of the National Heavy Vehicle Regulator (although this was not regarded as a safety achievement by some other respondents)
- Collaboration around C-ITS, and the 5.9 GHz band
- Commonwealth contribution to the Global Road Safety Facility.

Two respondents specifically raised strategy/management issues – one referring to good buy-in from Ministers, and another referring to improvements in how safety is being managed across jurisdictions with the merging of the National Road Safety Executive Group into the ASTF.

Answers to this question often turned to other matters relating to the NRSS as a whole and the engagement of the Commonwealth and state and territory governments on road safety. One respondent noted that it is much more difficult to distinguish between specific national achievements and state and territory achievements that are contributing to national objectives. This is not to say that respondents did not wish to engage on national matters. The difficulty was identifying high value national initiatives that were not simply the responsibility of the Commonwealth, or state and territory governments.

What role has national leadership or cooperation played in these achievements?

The NRSS was widely regarded in and of itself as having provided important strategic support and mandate for jurisdictions. It has provided context and direction for road safety strategies, or at the least strategically oriented action plans, to be advanced within States and Territories. The broad national commitment amongst Ministers and Governments that is embodied in the NRSS has been used to positive effect, with a number of instances reported where jurisdictions have picked particular items from the long list of actions set out in the NRSS and begun taking action on them.

Again, the new vehicle safety area was regarded as a highlight. This was assisted by the Commonwealth having a clear mandate within the NRSS, accountability for delivery of specific legislative initiatives, and preparedness to lead a broader national agenda in cooperation with States and Territories. The establishment by the Commonwealth of the Strategic Vehicle Safety and Environment Group, which assumed responsibility for the vehicle safety “First Steps” and “Future Steps”, presaged a more generalised management approach to the NRSS, in which different state and territory managers have taken responsibility for other areas of activity within the NRSS. The Commonwealth has also continued to promote better data for serious injuries, with significant research into hospitalisation arising from road traffic crashes at a national level, and there has been a clear emphasis given to this by States and Territories, as noted below. This stands in contrast to other areas, with frustration expressed about the extent to which the Commonwealth has “stepped back” from road safety over the course of the NRSS.

The National Transport Commission’s (NTC) engagement with corporate Australia on road safety and establishment of the National Road Safety Partnership Program (NRSPP) was marked out as a particular national success. The establishment and abolition of the NRSC was marked out as a particular national failure. The two National Road Safety Forums that had been held were noted for bringing a wide range of parties together.

National governance and management issues came to the fore in this part of the discussion with road safety managers. The engagement and sharing of ideas and perspectives across jurisdictions through the National Road Safety Executive Group were highly valued, and the administrative changes that merged this group with the ASTF were particularly welcomed, especially by the smaller jurisdictions. There is now a single national body with responsibility for overseeing implementation of the NRSS and for directing the available national resources through the Austroads program. The allocation of responsibilities with the Task Force for teams working on vehicles, roads and roadsides, speed, users and management issues was seen as being a good structure.

That said, one respondent considered that insufficient focus has been given to governance matters. Another noted the part-time nature of the national leadership function. The new Austroads-based mechanism is an improvement, but that model relies on committed executives and senior managers taking on additional duties to their day job. There was some difference expressed between managers about the extent of the road safety profile within the Transport and Infrastructure Senior Officials Committee (TISOC) and the Transport and Infrastructure Council – one respondent noted that Ministers were engaged whenever safety issues were raised, while another pointed to the absence of road safety in these national structures or indeed their agenda.

One jurisdiction highlighted the significant contribution by the NRSC towards the remote area licensing program in the Northern Territory as an extraordinary and positive act. However, the lost potential of the NRSC left at least one respondent frustrated with the level of support and leadership that can be provided at a national level. Several respondents noted that there is plenty of opportunity for road safety to be advanced at a national level, and additional resources were required to realise this opportunity. Some explicitly noted the importance of this review process to identify the areas of national leadership, and by implication the structural and financial means to demonstrate it.

What is your impression of the acceptance of Safe System principles at different levels of your organisation and in your partner agencies?

Several jurisdictions said that there was quite wide acceptance of the Safe System approach, amongst people in their organisation working in the transport field, amongst senior staff, and amongst partner agencies. Generally, however, there was a mixed response, with a number of road safety managers outlining ways in which they had been promoting Safe System principles, and succeeding in this, though they also recognised that there is a long way to go with their colleagues in sharing those principles. Colleagues are likely to know some basic elements, but are less likely or inclined to take action to apply them. The lack of buy in on the concept with previous Ministers was also noted in two jurisdictions.

A wide range of measures was being taken, sometimes relying on key inputs from individual leaders within organisations. This included an opportunistic response in Queensland to the major network rebuild and rehabilitation required as a result of the 2011 floods. Senior staff with strong safety and engineering credentials were able to directly influence key project teams at an early stage, which resulted in safety being much better addressed as the network was put back together. The role of successive Managing Directors in Main Roads Western Australia in mandating progressive safety approaches was seen as an important development that means Safe System issues are being picked up by key people outside of the Office of Road Safety.

There was acknowledgement that much more needs to be done, both within roads and traffic authorities and particularly in relation to local government. In some jurisdictions there is some continued resistance to change in how safety is managed by road agencies, however several agencies are putting deliberate capacity building programs in place, within the extended lead agency itself and also with partners in Police and in local government. For example, a series of Safe System workshops have recently been run in New South Wales. VicRoads has been sending senior staff to the MUARC/CASR leadership program, and is looking at a tailored program for a much wider group of their executive. Commonwealth respondents noted that most of the people they engage with understand Safe System principles, but recognised that there has not been much progress with other relevant arms within the transport portfolio, such as those responsible for infrastructure funding.

What, if any, changes have been made to methods of monitoring crashes, injuries and related behaviours since 2011?

The feature of responses to changes on monitoring crashes, injuries and related behaviours since 2011 is the effort that has gone into understanding more about serious injuries, with most jurisdictions having initiated significant work in the area. Major data linking exercises between health and police reported incidents have been undertaken in New South Wales and Western Australia, and are being trialled in Victoria. In New South Wales, a sustained linkage program is being developed which will address the historical gap in serious injury reporting. While high quality Police investigation and reporting were regarded as critical, it was recognised that health based reporting provides a more comprehensive picture of injury outcomes.

It was noted that progress had stalled on developing a common approach to reporting of serious injuries across Australia, although one respondent questioned whether this would be useful anyway. Some frustration was also expressed regarding the different processes in fatal data recording between jurisdictions. However, there was also recognition that road crash data sources in Australia compared very well internationally. Respondents discussed monitoring and data systems as an important area of attention. The Victorian Parliament held a recent enquiry into understanding serious injury. Further developments are expected as a result of this enquiry and a major crash investigation study is being launched with the support of the Transport Accident Commission (TAC). More online reporting of crashes in Western Australia and redesign of crash report forms in Queensland are further examples of attempts to better understand changes on serious injuries.

In terms of core performance monitoring, Western Australia is undertaking more detailed investigation of crashes in order to develop interim targets ahead of 2020, and began reporting performance indicators in 2012. South Australia's quarterly report on key outputs, intermediate outcomes and final outcomes remains notable. Almost all jurisdictions are preparing specific reports to their respective Parliaments regarding road safety performance.

BITRE is developing a database with States and Territories to facilitate better monitoring of the NRSS.

Open question to allow discussion of other items nominated by the ASTF members.

One respondent noted that the Commonwealth was regarded as being unique in terms of the amount of resources it can bring to bear on transport and safety issues, and their jurisdiction wanted Commonwealth resources stepped up in road safety. Another respondent noted that in terms of infrastructure funding, far more could be done with the tools that are available, or becoming available through ANRAM. One generally expressed concern among States and Territories was the limited extent of Commonwealth engagement in road safety. The Commonwealth was regarded as having pushed hard towards a national strategy, but what resulted was more of a collaborative process than a national agenda.

Across the board, there was concern about the all-encompassing nature of the national strategy. It is clearly neither a Commonwealth strategy, nor a state or territory strategy. It is a national strategy that addresses almost all aspects of road safety, but with few specifics about what will be advanced at a national level. The long list of "First Steps" and "Future Steps" that were integrated into the NRSS allowed everyone to have their say, but are not effective as a national agenda. The term "kitchen sink" was used by one respondent, and a number of respondents saw a pressing need to define national priorities, establish appropriate decision-making and accountability processes, allocate the necessary funding, and deliver on the priorities. One jurisdiction commented that the "one size fits all" nature of the NRSS made it less applicable in remote areas and further acknowledgement and understanding of remote area issues was required before any progress could be made in those areas.

Several respondents identified candidates for new or enhanced national priorities:

- An aggressive approach to address the trauma on country roads
- An aggressive approach to address the trauma facing vulnerable road users
- Using ANRAM to support safety outcomes in road infrastructure projects and programs

- A stronger consumer-oriented approach to vehicle safety promotion and regulation in response to the imminent closure of Australia's car manufacturing industry
- Cooperative intelligent transport systems
- Blending outcomes within the transport sector, and better integration between the transport and health sectors
- Addressing base equity issues faced by Aboriginal road users, including the flow on effects associated with rates of attaining and retaining driver licences
- Addressing heavy vehicle transport from a safety and not just the predominantly regulatory and/or productivity perspective
- Consistency in approach to speed management issues, and to laws associated with speeding and drink driving
- Using model legislation as a mechanism for introducing good practice legislation across the country
- Building on the progress in the NRSPP to generate corporate, non-government involvement in road safety nationally
- Distraction, drug driving, fatigue and older drivers also received mention, amongst other issues
- National evaluation of major programs and strategies (this review is regarded as an important example)
- Progress in developing serious injury analysis
- Engagement with national stakeholders and the development of complementary promotions and communications activity
- Governance management and resourcing of road safety at a national level
- A better informed focus on remote area road safety issues and potential countermeasures.

A list of candidates for national road safety priorities can easily become quite long quite quickly, and may suffer in itself from a lack of focus. It will be important to consider the precise nature of what could be achieved in the "national" arena, who will be responsible for it, and how it will be resourced. (High performance vehicle regulation for novice drivers was cited by one respondent as an example of when individual jurisdictions have made joint decisions.) One respondent noted that the use of national model law has potential where legislative priorities are established, but also noted that this is not a universal view. It is also worth noting that one respondent who sought change in the scale of investment and decision making at a national level also recognised that the NRSS is not broken. It does however need additional focus and effort.

3.1 Some Observations

There is widespread support for the broad direction of the NRSS, but frustration in how effectively it is being and can be implemented. There was support amongst all jurisdictions for the preparation of a results focussed and funded action plan that identified key national priorities and delivered on them. It was notable that in response to the first two questions just one respondent referred directly to pages and paragraphs in the NRSS and talked the interviewers through the specific deliverables that had been met.

The chances of success in developing and implementing a results-focussed action plan will be enhanced by analysing the specific levers that can be used at a national level to strengthen safety results in specific areas. The chances of success will also be enhanced by specific and sustained discussion about what implementation responsibilities will lie with the Commonwealth, as the Commonwealth is the only jurisdiction which has powers to act at a national level. The States and Territories do not have these powers. They can collaborate, but collaboration within and between governments is costly and difficult without effective accountability mechanisms. Strategically oriented safety-positive national decisions by Commonwealth, state and territory Ministers responsible for road safety were not mentioned by any respondents, with the exception of one respondent referencing the National Heavy Vehicle Regulator.

The existence of the NRSS cannot be taken for granted, and all respondents pointed easily to several positive developments associated with the NRSS since 2011. Neither can the breadth and depth of road safety management experience and expertise throughout jurisdictions be taken for granted. Each of the respondents were clearly engaged in leading their own jurisdiction or taking responsibility in their own areas for achieving better road safety results, and they seek greater contributions from others as they do so.

4. Consultation with Stakeholders

The reviewers held a combination of face to face and telephone conversations with national road safety stakeholders. The purpose of this process was to gain a national stakeholder perspective on the implementation of the National Road Safety Strategy 2011-2020, and the most important issues that may need to be addressed in future.

The list of stakeholders was agreed with the Austroads project managers. One stakeholder did not take up the invitation to contribute to the process. The stakeholder organisations who contributed to the review comprised two injury insurance corporations (Transport Accident Commission (TAC) and the Motor Accident Commission (MAC)), representatives of pedestrian, cyclist, motorcyclist, motorist user groups (Pedestrian Council of Australia, Amy Gillett Foundation, Australian Bicycle Council, Australian Motorcycle Council (AMC), Australian Automobile Association (AAA)), as well as several sector groups (Australian Trucking Association (ATA), Australasian New Car Assessment Program (ANCAP), Federal Chamber of Automotive Industries (FCAI), New South Wales Local Government Association) professional groups (Australasian College of Road Safety (ACRS), Road Safety Education Reference Group Australasia, Royal Australasian College of Surgeons), and two national agencies (Australia New Zealand Policing Advisory Agency (ANZPAA) and the National Transport Commission (NTC)).

The conversations were generally 30-45 minutes long, and were guided by six main questions. The questions were circulated ahead of time, and sought to explore the stakeholders' relationship with the NRSS, major achievements related to the NRSS, issues that need to be addressed at the national level and barriers to this. The responses are summarised below, and some overall observations are made. The questions used and a list of stakeholders are given as Appendix C and D. The stakeholders were also given the opportunity to submit a short statement in response to the summary stakeholder consultation report.

How does your organisation contribute to road safety? Can you nominate any initiatives undertaken by your organisation towards improving road safety since 2011?

There were a wide variety of contributions made by the stakeholders. Some of these groups have statutory roles to play in improving road safety. Many of the organisations have an explicit advocacy role, in some cases exclusively for road safety, and for some as part of a much wider industry, sector or user brief. Two of them are peak organisations for private sector interests which play a critical role in road safety. One organisation is an inter-governmental agency charged with improving the productivity, safety and environmental performance of Australia's road, rail and intermodal transport system.

All of the stakeholders could point directly to actions they had taken since 2011 to improve road safety, although they varied greatly in nature and scale. Highlights of this activity included:

A $1 billion investment in safer road infrastructure in Victoria by the TAC, on top of a sustained program of significant activity geared to supporting the vision zero approach, such as road safety publicity campaigns, support for enforcement activity and school road safety activity and a large research program (including a new $8 million in-depth crash investigation study in serious injury crashes).

The MAC also pointed to increases in expenditure for road safety promotion and a $100 million commitment to safer road infrastructure in South Australia, as well as insurance scheme reform to introduce no-fault claims for children and for people who are severely incapacitated.

The NTC pointed to their initiation and development and then the formal establishment of the NRSPP, which involves a number of large corporates in an industry knowledge sharing network to reduce organisational and community risk on the road.

ANCAP pointed to the substantial increase in the proportion of five-star safety rated vehicles being purchased in Australia over the last three years, and much greater commitment from fleet managers to set this as organisational purchasing or leasing policy. The number of five-star commercial vehicles has also increased significantly.

AAA pointed to the ongoing support of their members to ANCAP, and the 2013 Australian Road Assessment Program (AusRAP) report which provides road authorities and road users alike with objective star rating information regarding the safety of the Australian national highway network. The completion of this work contributed to AAA's major Demand Better Roads campaign.

Within the advocacy sphere, many stakeholders referred to safety positive contributions they were making in the media, and the Amy Gillett Foundation referred to their 2012 cycle safety manifesto that aims to create a safer cycling environment in Australia.

The ATA highlighted their advocacy for vehicle safety technology, as well as promoting truck safety issues throughout the country. The FCAI pointed to the significant safety benefits arising from the products manufactured and sold by their members. The AMC highlighted their advocacy for infrastructure solutions with road authorities across Australia and the increasing adoption of motorcycle-friendly crash barriers.

A number of the stakeholders saw that they have a critical role in to play in road safety in Australia and matched that role with the core business of their organisation, and the capacity of the organisation to contribute. This meant that they were quite regularly developing resources, or distributing resources which promoted road safety. There were a mix of responses to suggest a combination of preventive actions, and actions that responded to incidents in a way that reinforced the importance of road safety.

What do you consider to be the three major road safety achievements at the national level since 2011?

Several stakeholder answers to this question were very short – they indicated that they could not identify major road safety achievements at the national level, either in terms of their own particular interests, or more generally. Other responses referred only generally to incremental improvement in the quality of roads, vehicles and human behaviours.

A number of stakeholders referred to a greater degree of alignment with the Safe System approach which is articulated by the NRSS and providing strong direction in this regard. One stakeholder questioned the extent to which Ministers, possibly new to the portfolio, had actually taken on this approach.

It is notable that there was some cross referencing of the contribution from other stakeholders when stakeholders referred to major road safety initiatives at the national level: TAC's notable and significant investment in Safe System projects in Victoria; NTC's leadership with the corporate sector in establishing the NRSPP; and ANCAP's significant contribution to promoting the market expansion of five-star safety rated vehicles. The global decision by BHP to set a five-star safety rated light and light commercial vehicle purchasing policy was referenced by a number of stakeholders.

A series of policy improvements within the heavy vehicle sector were referenced, including the national heavy vehicle legislation, new laws relating to fatigue, dangerous goods transport, and the application of chain of responsibility law to mass, dimension and loading. Other items referenced were: lower speed limits being applied in CBD areas, with the Melbourne move to 40 km/h regarded as the "best news in years"; greater use of road risk analysis through AusRAP, and the development of ANRAM were also referenced; the pre-election road safety policy of the current Commonwealth government was identified as a major achievement; and the Road Safety Research Framework established by the ACRS and the National Health and Medical Research Collaboration (NHMRC).

One stakeholder referred to the integration of national road safety responsibilities under Austroads. A number of stakeholders noted however that they could not say whether or not this was a good thing because there was no visibility of how such mechanisms were actually working at a national level. There were several references to negative impacts at the national level, such as the abolition of the NRSC and the lack of response to the Northern Territory decision to increase speed limits.

Who are your key road safety partners?

All stakeholders recognised the significance of their partnerships in road safety, with a diverse set of relationships which may not be exclusively safety-related, but had significant safety implications.

Many stakeholders referred directly to the roads and traffic authorities and the other government agencies in jurisdictions such as police and injury insurance corporations. Occasionally, the reference to these state and territory entities expanded to include other government agencies responsible for justice, health and education. The Commonwealth was identified by several stakeholders – mainly with responsibility for transport and infrastructure, but one stakeholder referenced health and environment agencies. Another referred to the parliamentarians in their own jurisdiction as being an important partner.

Some of these partnerships were based on delivery of paid or commercial services, but the key partners who were identified extended well beyond government entities. Motoring clubs, both the AAA and its member organisations, were a key reference point for many of the stakeholders, as were the road safety research units around the country. International partners were noted for ANCAP such as the International Road Assessment Programme (iRAP) and the linkages provided to help establish the New Car Assessment Program for Southeast Asia (ASEAN NCAP).

Private sector partners were identified in a variety of ways. This included one stakeholder working with a major transport and logistics corporation to help promote their specific and common safety interests. The members of the National Road Safety Partnership Program were key partners for one of the stakeholders. Another was engaging directly with major corporates in the resources, energy and healthcare to help advance their strategic safety goals. The vehicle manufacturers active in the Australian market were also identified as major partners.

A number of stakeholders directly referenced their own membership which when aggregated across all members covers many different organisations from many different sectors, and with many different interests within an overall commitment to road safety. This includes a wide range of: state, territory and Commonwealth government agencies; non-government agencies delivering a range of professional, research and development, advocacy, advisory, educational, health and other social services; and private sector corporations including major national and international entities producing many different goods and services including essential transport services.

Are you familiar with the Safe System framework for road safety? If so, what is your impression of the acceptance of Safe System principles within your organisation and amongst your road safety partners?

There was the greatest variation possible to this response – from the stakeholder not being familiar with the Safe System framework, through to the framework being used by the stakeholder to align itself with other partners, and to the framework encapsulating the very essence of how the stakeholder approaches its work. This variation was also apparent in how stakeholders referred to acceptance of Safe System principles within their organisation and across their partners.

Some gaps noted by stakeholders included road safety being essentially an orphan topic in health research, and there being insufficient capacity within local government to fully implement the Safe Systems approach. A number of stakeholders identified the need to breach the significant gap between understanding and acceptance of the Safe Systems approach and the practical application of agreed safety principles. Closing this gap is a particular focus for several of the stakeholders, for example the TAC and MAC infrastructure investment and ANCAP's consumer program.

A number of stakeholders see that they have made a significant contribution in their own way to promoting the Safe System approach which is well aligned with their own philosophy and direction. This includes major user and industry representatives as well as government agencies. One stakeholder noted the considerable uptake and application of Safe System principles by significant corporate partners – examples include the reorganisation of travel to and from work, and good practice fleet management practices emerging more consistently.

One stakeholder saw the Safe System approach as gaining increasing acceptance within the general public, which responds well to less emphasis on blaming the driver, and more emphasis on the protective systems through roads and vehicles. The specification of speed as one of four intervention sets, which is different to the way the Safe System has been articulated internationally, including by the United Nations, was considered by one stakeholder as not being helpful.

What road safety issues, if any, do you think need to be addressed at the national level?

The need for improved serious injury data was the most common response. Better estimation of the cost of road trauma to the community was also mentioned by one stakeholder, and several stakeholders identified the need for better and/or much greater investment in research and development projects. In this area, reference was made to the large scale research projects attracting commitment in the United States into significant technology issues, including V2V and V2I C-ITS.

A number of stakeholders began their response by identifying national leadership as an issue which needs to be addressed. One said that road safety was not on the national radar, and there were no national debates. One stakeholder asked who was the face of road safety, and another asked who "owned" road safety. Better alignment between the NRSS and state and territory strategies was sought by one stakeholder. Another pointed to the need for greater ambition for road safety. The lack of an ongoing collaborative engagement with stakeholders outside of the responsible state and territory and Commonwealth agencies was noted by many and regarded as illustrative of the lack of national leadership.

More and better infrastructure investment was identified as an issue that needed to be addressed by a number of stakeholders. One suggested that the fuel excise indexation should be reinstated and allocated to road safety, and another felt that commonwealth expenditure for road safety was an issue that often received lip service. The quality of current expenditure by the Commonwealth was criticised by several stakeholders who said it seemed to be dominated by very conventional expenditures and was poorly aligned with Safe System principles. Reference was made in contrast to the efforts made by TAC and MAC to use its infrastructure safety investment as a key means of demonstrating these principles in practice.

Continued improvement in the vehicles arena was regularly mentioned. A couple of stakeholders said there needed to be another big push in this area which was seen as consistent with the industry change that is occurring. There were some differences in the area, with one stakeholder lamenting the much larger number of vehicle manufacturers present in the Australian market than the United States market. Another stakeholder was clear that there needed to be more consistent alignment and harmonisation between the ADR and the United Nations regulations. There were also however areas of significant agreement, with several stakeholders expressing concern over the possibility of change in used vehicle importation which was considered to be a possible threat to safety. Increasing the adoption of five-star safety rating fleet policies, for example by local government, and a review of the luxury car tax were specific suggestions, as was possibly mandating event data recorders. Work in C-ITS and investment in infrastructure to support highly intelligent vehicle fleet was also identified as a need at the national level.

Pedestrian and cyclist safety was mentioned regularly by stakeholders, with one observing that there does not seem to have been any response from government to the surge in cyclist injury, and another noting the same for motorcycle injuries. The sharing of spaces between pedestrians, cyclists and motor vehicles was identified as a particular issue, as was greater separation of pedestrians and cyclists from motor vehicles, and consistency in safety messages relating to pedestrian and cyclist safety. More support for proven cycling programs was sought by one stakeholder in addition to ensuring that the next generation of cyclists obtain better cycling skills. A review of the Australian Road Rules from a cyclist and pedestrian perspective was proposed.

Heavy vehicle (predominantly freight) safety issues were raised by several stakeholders. A local government representative identified issues on local roads in relation to negative community perceptions of heavy vehicles, access and road maintenance. Fleet purchasing and vehicle safety standards were mentioned, including autonomous emergency braking, and mandatory stability control for dangerous goods vehicles. The extension of chain of responsibility laws to vehicle maintenance was proposed by one stakeholder, as was a greater focus on customers by compliance agencies. A specific proposal was for the establishment of a no-blame investigation capability for truck crashes within the Australian Transport Safety Bureau (ATSB).

Other issues referred to by several stakeholders were:

- Speed, including school zones, and potential for developing national speed limit guidelines which avoid ministerial decision making in individual cases
- Fatigue, driver distraction, drug driving, and other enforcement and behaviour change options
- Better individual incentivisation through insurance policies
- Greater consistency in licensing and road rules between states and across borders
- Collaboration over mass media campaigns and more broadly a national communications plan geared towards communication of Safe System principles and practices promoted within the NRSS
- Addressing road safety as a major occupational safety issue through workplace safety programs
- Better integration of safety within infrastructure planning through road hierarchies, and urban planning through connecting safety issues with active transport and public transport issues
- The importance of addressing equity issues faced by Indigenous communities
- Harmonisation of traffic law (e.g. licencing age, GLS, speed limits)
- National approach to drug driving enforcement
- The establishment of major trauma centres in each state.

What barriers, if any, do you think exist to addressing these issues?

The most common set of barriers identified by many of the stakeholders related to governance, management and leadership of road safety at a national level. Two stakeholders referenced the abolition of the NRSC, and another pointed to senior executive responsibilities within the Commonwealth being dispersed. The loss of a road safety portfolio responsibility within the Commonwealth was also noted. One stakeholder highlighted that these developments had left them with a limited opportunity to engage on road safety issues. The recent establishment of a Friends of Road Safety group within the Commonwealth Parliament was seen as a positive move, but insufficient.

Rhetorical questions such as “who is in charge?” and “who is accountable for road safety in Australia?” were typical of this discussion. Generally, the stakeholders wanted to be more involved in the NRSS and the very low level of stakeholder engagement on national road safety was identified as a barrier to this. The former National Road Safety Strategy Panel established under the previous national strategy was referred to as being problematic in terms of the level of discussion, but being of value as a forum for bringing government, industry, health, academia, advocacy and professional groups together to consider and discuss national issues.

The lack of funding for management of the NRSS was seen as being a particular barrier for one stakeholder. Another stakeholder dismissed the public accountability for and reporting on the implementation of the national strategy as being anywhere near adequate – contributions outside of Austroads membership are inadequately acknowledged. Another couple of stakeholders noted that they could not really comment on whether new arrangements within Austroads were or were likely to be effective because they simply did not know what was happening.

A lack of safety funding at a national level was identified as a barrier, with one stakeholder referencing this particularly in relation to local government, which also has specific capacity issues in relation to road safety. One stakeholder referred to competition for funds for expenditure on different user safety issues such as cycling. Another stakeholder noted that nobody seemed to be concerned about maximising safety from available funding.

Some stakeholders referred to a lack of political will. One stakeholder considered the key barrier being an expectation of fatality within the road transport system, and that decisions were not being made within an expectation that fatality or serious injury should be eliminated from the system. Another stakeholder identified a barrier associated with using crash rates rather than absolute numbers, and the lack of public acknowledgement of the mistakes that users make.

The parochial nature of Australia was noted as a barrier by one stakeholder, and the ability of advocacy groups to hijack issues by another stakeholder. Some stakeholders referred to silos within the safety arena as being a barrier, with one noting that activity sometimes ends up being left out on its own. One stakeholder noted that the level of independent activity sometimes meant that the inability to generate scale in some activities was a barrier. An example given was the independent development of educational programs by many agencies and private organisations.

Open question to allow discussion of other items nominated by the participants.

One stakeholder suggested that if there is really a commitment to the Safe System approach, an action plan is needed to drive achievement of this. Another commented that there was too much business as usual activity in the "First Steps" activity of the NRSS – and proposed a stronger hand from the Department of Foreign Affairs and Trade was needed to support vehicle safety initiatives, significantly more safety investment was needed in the infrastructure, and a national driver licence should be established in a manner that lifts safety across the country.

More research and evidence building on issues such as mobile phone use and drug driving risk were considered important by one stakeholder, and another referred to the need to develop better knowledge on small cohorts – for example, children with attention deficit hyperactivity disorder have four times the injury rate of others.

One stakeholder used the opportunity to stress the importance the national function in relation to vehicles to avoid individual state and territory action. A national policy statement on how the interface on road and vehicle technology will be managed was also regarded as potentially useful. One stakeholder used the opportunity to express concern about any introduction of black boxes for trucks, as they are not associated with safe or unsafe operators. Another stakeholder emphasised the importance of market mechanisms as opposed to regulatory mechanisms for vehicle safety in the future. Frustration with the lack of progress regarding motorcycle ABS was referred to by two stakeholders.

One stakeholder acknowledged that road safety enforcement activity was occasionally nationally coordinated however much more could be done in relation to the sharing of information and the use of scale.

4.1 Some Observations

This group of stakeholders includes important road safety stakeholders with a keen interest in road safety strategy at the national level. Some of the group are delivering substantial safety programs that are directly improving the safety experienced by road users in Australia, or are engaged in advocacy and promotion work that is aimed at promoting a climate that is supportive of road safety. Some of the group are among the most active and vocal champions of the Safe System approach to road safety and play an important role in communicating this to their own stakeholders.

Some of the stakeholders are less actively engaged in safety issues than others, but many talked easily about their own road safety networks and partners, and clearly assume some responsibility for road safety in Australia. Many are concerned at the lack of national leadership regarding road safety, whether that is in relation to the perceived attention afforded the issue by the Commonwealth, or the transparency of processes under Austroads' leadership of the implementation of the NRSS.

Based on the discussions, stakeholders on the whole recognise that many different aspects of road safety are the responsibility of individual States and Territories, but also regard the situation of road safety leadership in Australia being separated into nine jurisdictional units as being unsatisfactory. The establishment of a national leadership function for road safety and an ongoing engagement process with stakeholders at a national level is something that could be expected to be well received, and regarded as an important step if the NRSS is to succeed.

5. Monitoring the NRSS

5.1 Introduction

The aims of this section are to document the progress of the NRSS against the agreed performance indicators and to determine if there have been any changes in crash patterns or other indicators to suggest any changes in emphasis for the next action plan.

Results for the main performance indicators to 2012 were included in the Implementation Status Report published by the Transport and Infrastructure Council in 2013 and where possible these have been continued to include results for 2013. The indicators available are shown in Appendix E. Values shown in red are additions to the table in the 2013 report. There are some small variations between the tables and graphs provided in this section and Appendices E, F and G. These arise from the detailed analysis being undertaken using the interim crash data provided by BITRE in June 2014 and the overall fatality number using the Annual Report on Road Deaths released by the Department for Infrastructure and Regional Development in August 2014 (BITRE 2014).

5.2 Police Fatal Crash Data

National fatal crash and fatality data was obtained from BITRE using the Australian Road Deaths Database and the National Crash Database (NCD). The data provides numbers of fatal crashes and fatalities by road user type, crash type and speed limit for 2005 - 2013 and numbers by a more extensive list of variables for the years 2008-12.

Analyses were carried out to continue the series used in the MUARC background modelling and in the introduction and background sections of the NRSS. Data issues, including the lack of BAC data from Victoria from 2011 onwards and the large number of cases where restraint use is not known meant that not all series could be continued. Complete data is only available for 2011 and 2012 with some items available for 2013. Given this short period no statistical testing could be usefully carried out.

Figure 5.1 shows the number of fatalities from 2005 to 2013 demonstrating a continuing decrease over these years. The main indicators for the three years before the NRSS and the two years of the NRSS are shown in Table 5.1.

Figure 5.1: Total number of fatalities by year, 2005-2013

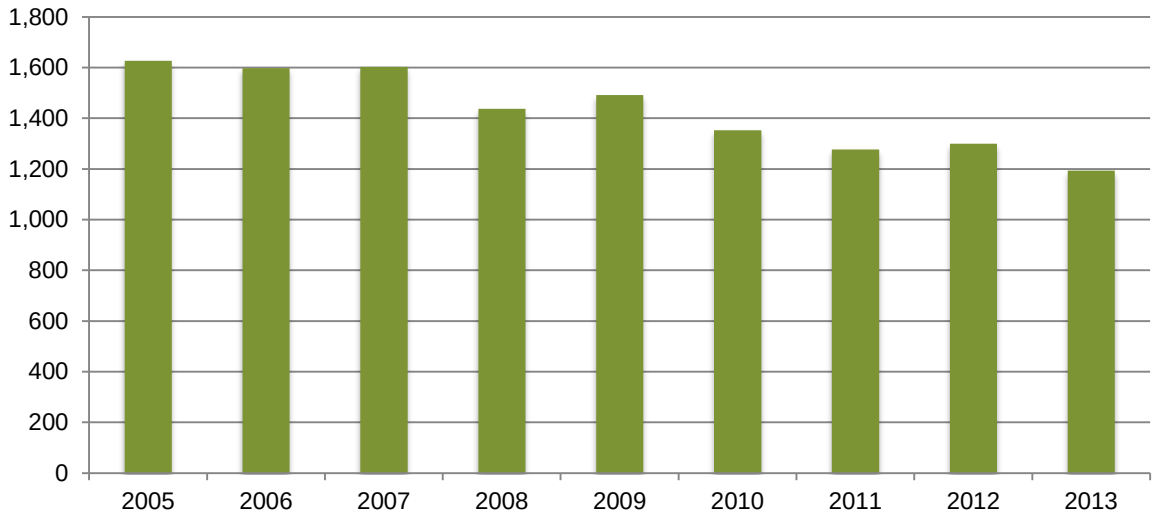


Table 5.1: Indicators 2008-2013

	2008-10	2012	2013
Number of deaths from road crashes	1,427	1,299	1,193
Number of crashes resulting in death	1,298	1,189	1,106
Number of deaths per 100,000 population	6.5	5.7	5.2
Number of deaths per 100 million vehicle kilometres travelled	0.65	0.56	0.56
Number of deaths per 10,000 registered vehicles	0.91	0.76	0.70

A more detailed examination of the fatal crash and fatalities data showed mostly similar patterns to the crash information used in development of the NRSS. More details about the data are provided in Appendix F. There were two areas where possible changes were indicated; cyclists and motorcyclist fatalities and older driver fatalities.

Motorcyclist and cyclist fatalities

Figure 5.2 and Table 5.2 show fatalities by road user type for the years 2005-2013. It can be seen that for the years of the strategy (2011-13) fatalities of motorcyclists and cyclists have not decreased at the same rate as fatalities of vehicle occupants. This can probably be explained in part by increases in exposure for these modes.

Figure 5.2: Fatalities by road user type 2005-2013

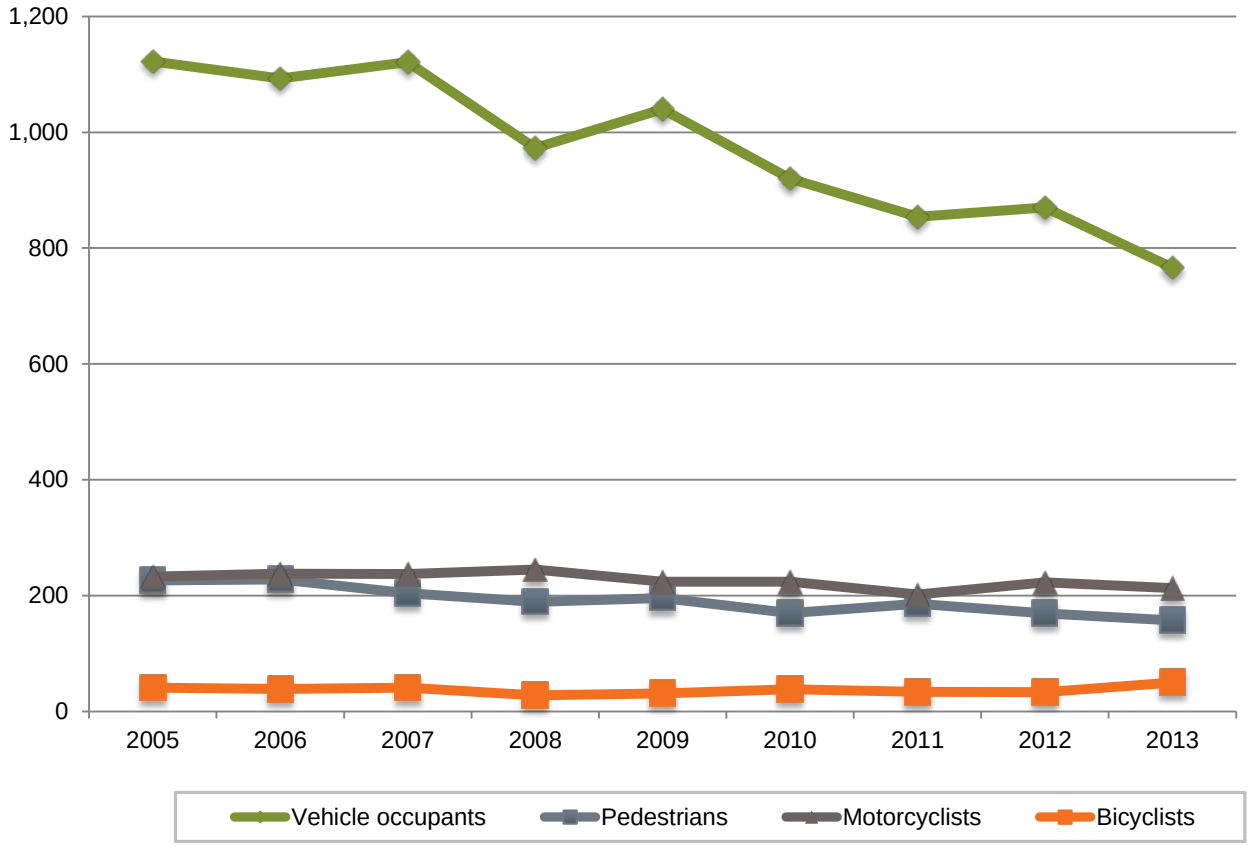


Table 5.2: Fatalities by road user type, 2005-2013

	Average 2005-2008	2009	2010	2011	2012	2013
Number of vehicle occupant fatalities	1078	1040	920	854	870	766
Number of pedestrian fatalities	212	196	170	186	169	157
Number of motorcyclist fatalities	238	224	224	202	223	213
Number of bicyclist fatalities	37	31	38	34	33	50

Older road user fatalities

Fatalities of older road users are not reducing at the same rate as shown for young road users (Figure 5.3) and this effect is still present when deaths per 100,000 population are considered (see Figure 5.4).

Figure 5.3: Fatalities by age 2005-2013

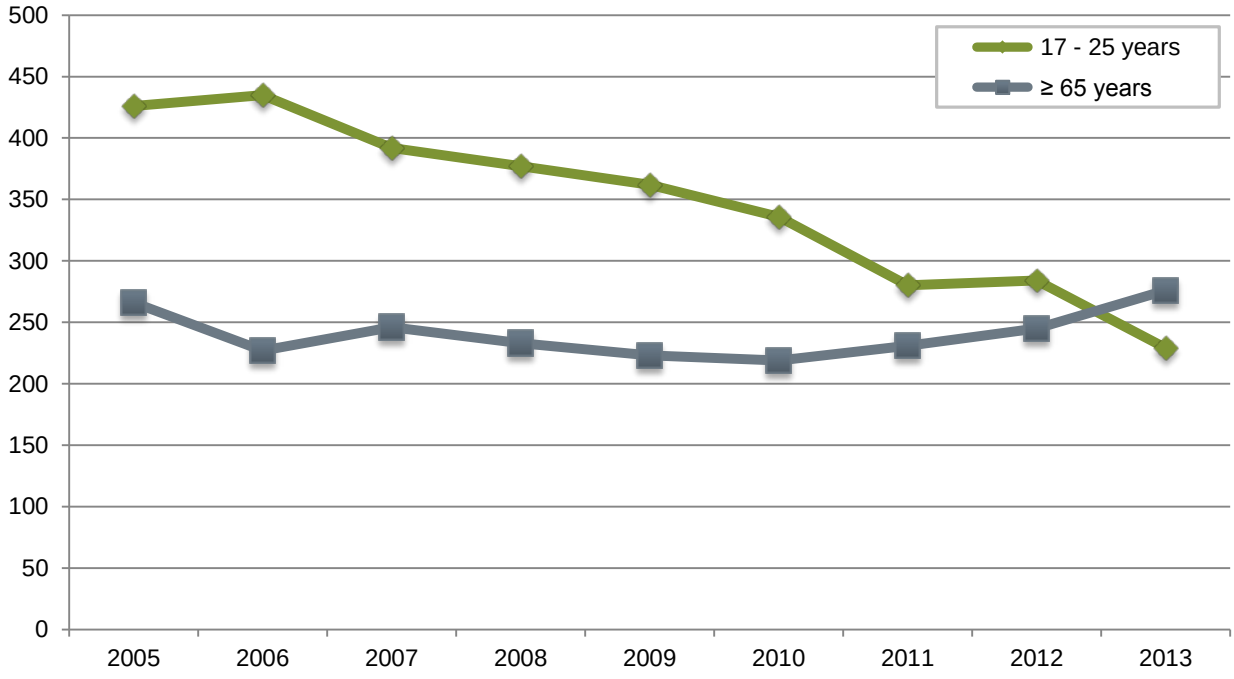
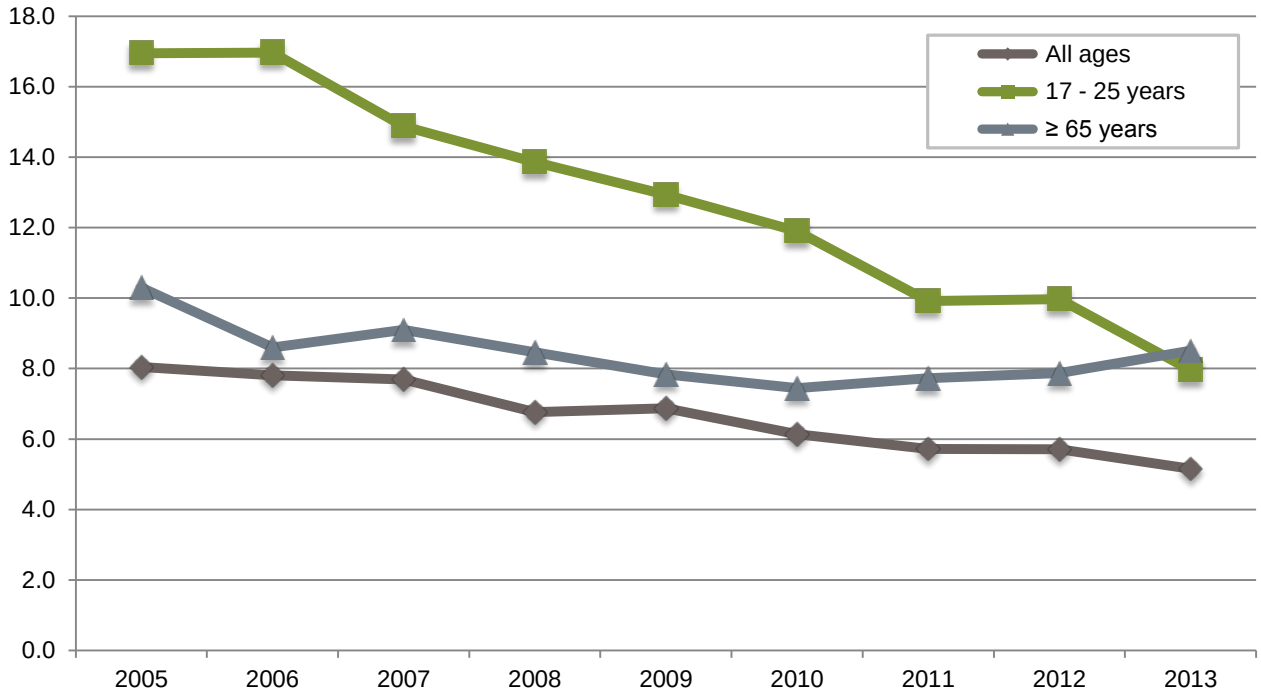


Figure 5.4: Fatalities per 100,000 population 2005-2013



Regional Areas

There is some indication that fatalities in regional areas are reducing at a slower rate than in metropolitan areas (Figure 5.5 and Table 5.3). Since 2008 fatalities have reduced by 19% in metropolitan areas and by 4% in regional areas.

Figure 5.5: Number of fatalities by location 2008-2012

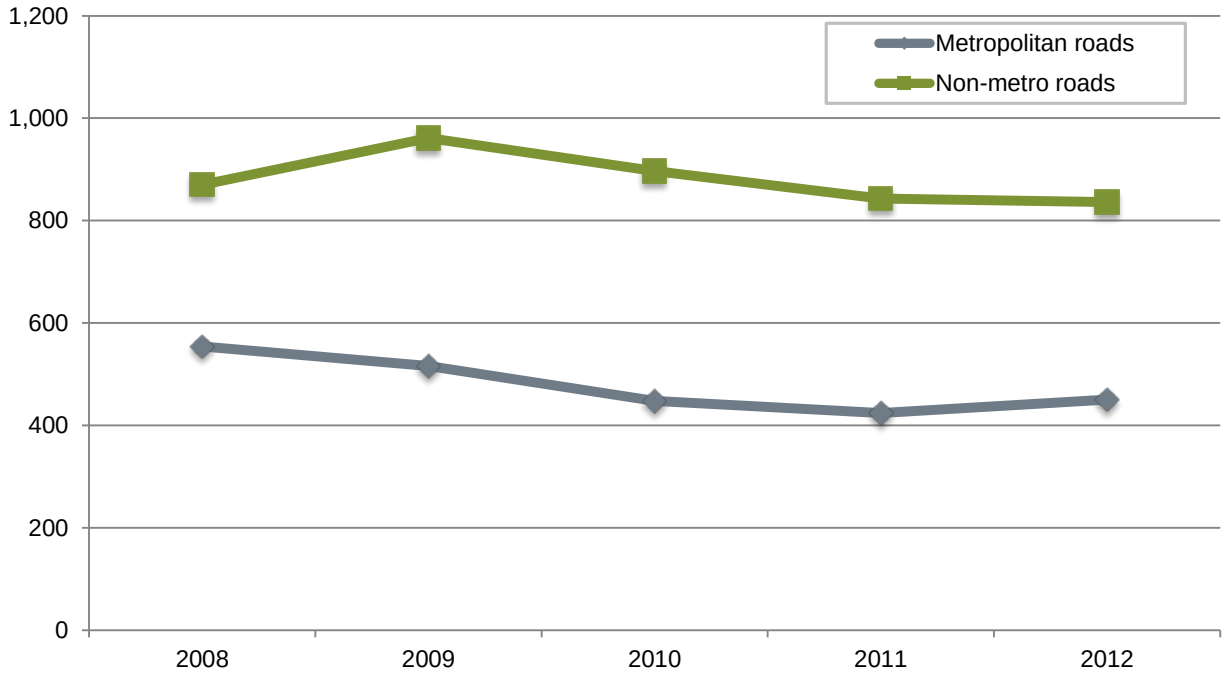


Table 5.3: Number of fatalities by location 2008-2012

	2008	2009	2010	2011	2012
Non-metro roads	870	961	897	843	836
Metropolitan roads	554	516	448	424	450

5.3 Police Serious Injury and All Injury Data

Serious injury and injury data were obtained from BITRE for 2008-2012. The differences between states and changes in reporting procedures during the period meant it was difficult to combine even the “all injury” data to obtain a reliable national figure. Summaries of the “all injury” data from the NCD are provided in Appendix F and suggest there has been a reduction in the number of injuries but this was not confirmed by the hospital data. There were also issues in using data for the individual states, as practices changed from year to year.

5.4 Exposure Data

An examination of the exposure data showed that even with a slow-down in growth in 2008 and 2009, vehicle kilometres travelled by passenger vehicles and light commercials grew by 4% between 2010 and 2012 and by 7% between 2005 and 2012. In contrast, vehicle kilometres travelled by motorcycles grew by 12% between 2010 and 2012 and by 72% between 2005 and 2012. Of course, motorcycling still represents a very small part of total travel, rising from 0.8% in 2005 to 1.3% in 2012. More details about changes in exposure are given in Appendix G.

Anecdotally bicycle riding is said to be rising at a faster rate than motorcycling but no reliable measures of cycling exposure are available.

5.5 Speed Data

Speed data was obtained from Western Australia and South Australia. Although it is not possible to present a national picture, it is worth noting that speeds are gradually reducing in both states, although this is a clearer trend for urban areas (see Tables 5.4 to 5.7). More results from the speed surveys are given in Appendix H.

Table 5.4: Mean speed South Australian roads

	Road type	2008	2009	2010	2011	2012	2013
Metro	50 km/h local	44.23	44.54	43.88	43.98	43.55	42.77
	50 km/h collector	49.94	49.84	49.65	49.94	49.34	48.93
	60 km/h arterial	56.61	56.40	56.08	56.14	56.24	55.57
Rural	50 km/h local	42.67	42.02	42.25	42.59	42.35	42.31
	60 km/h arterial	58.37	57.88	57.77	57.88	58.27	57.86
	100 km/h arterial	97.21	97.30	97.05	97.64	96.80	97.42
	110 km/h arterial	103.55	103.55	103.22	103.79	102.22	102.35

Table 5.5: % of drivers travelling 10+km/h above the speed limits on SA roads

	Road type	2008	2009	2010	2011	2012	2013
Metro	50 km/h local	5.12	5.08	4.68	4.58	4.45	4.21
	50 km/h collector	8.01	7.59	7.46	7.64	6.50	5.73
	60 km/h arterial	1.56	1.40	1.18	1.18	1.02	0.74
Rural	50 km/h local	3.26	3.26	3.26	3.26	2.78	2.78
	60 km/h arterial	3.35	3.01	2.76	2.53	2.72	2.29
	100 km/h arterial	10.36	10.01	9.36	9.76	8.20	8.71
	110 km/h arterial	4.29	4.11	3.82	4.05	2.93	2.94

Table 5.6: Mean speed Western Australian roads

	Road type	2008	2009	2010	2011	2012
Metro	60 km/h	57.7	-	58.4	59.1	58.2
	100 km/h	95.1	-	88.6	95.6	89.4
Rural	60 km/h	58.5	57.2	-	56.8	58.0
	100 km/h	96.4	98.2	-	97.4	89.3
	110 km/h	101.6	102.3	-	99.3	102.5

Table 5.7: % of drivers travelling 10+km/h above the speed limits on WA roads

	Road type	2008	2009	2010	2011	2012
Metro	60 km/h	8.2	-	7.1	6.7	5.4
	100 km/h	4.2	-	3.3	4.4	3.0
Rural	60 km/h	6.3	6.2	-	6.8	5.6
	100 km/h	9.0	12.3	-	7.0	3.8
	110 km/h	4.9	5.6	-	5.0	6.8

5.6 Safety of New Vehicles in Vehicle Fleet

The number of registered vehicles in Australia has risen from 15 million in 2008 to 17 million in 2013. There has been little change in the age of the vehicle fleet, with the average age staying at about 10 years for passenger vehicles, 11 years for commercial vehicles and nine years for motorcycles.

There has been an ongoing improvement in the safety of new vehicles with 80% of new passenger vehicles sold in 2013 having a five-star ANCAP rating. The improvement was most marked for commercial vehicles with the percentage of new vehicles with a four- or five-star rating rising from 40% in 2010 to over 65% in 2013 (Table 5.8). More details about the vehicle fleet are given in Appendix I.

Table 5.8: New vehicle safety improvement 2010-2013

	2010	2012	2013
Average age of the Australian vehicle fleet	9.96	10	10
Percentage of new vehicles sold with a 5-star ANCAP rating	40.26	56.67	64.98
Percentage of new passenger vehicles sold with a 5-star ANCAP rating	49.50	75.56	80.23
Percentage of new commercial vehicles sold with a 4 or 5-star ANCAP rating	40.69	61.03	67.24
Percentage of new vehicles sold with key safety features			
ESC	57.2	78.7	93
Pre-collision safety system	1.3	2.5	5.2

Figure 5.6: Passenger vehicles sold with 4 or 5 star rating 2010-2013

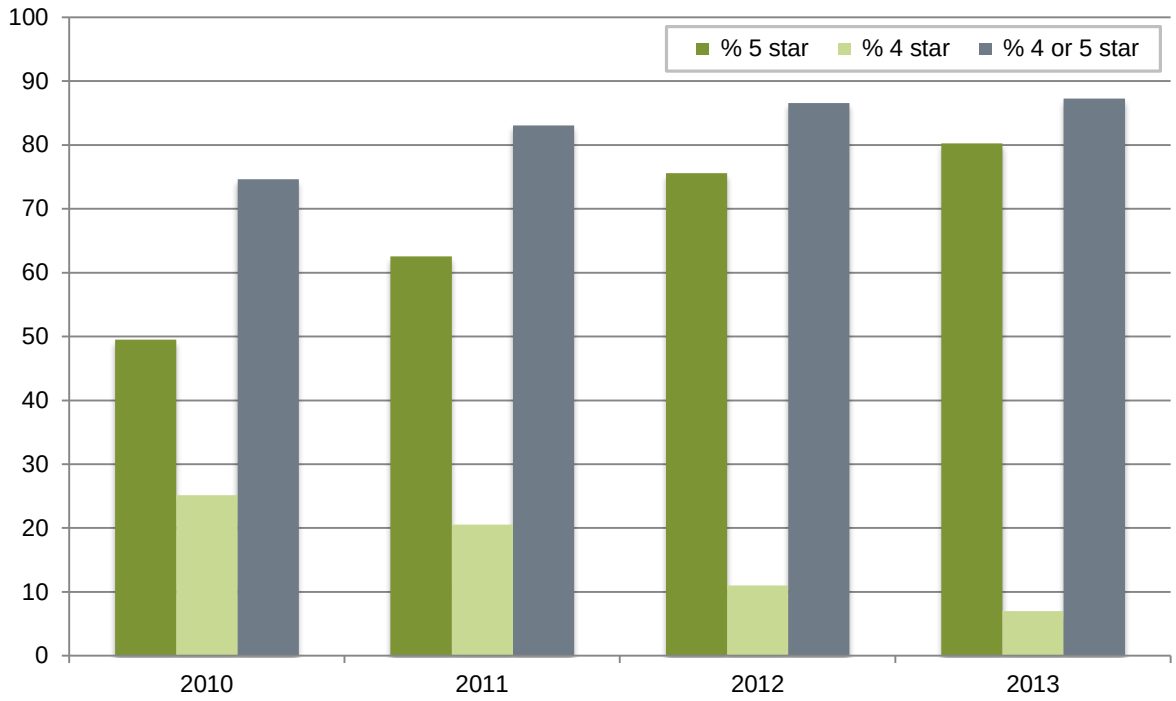
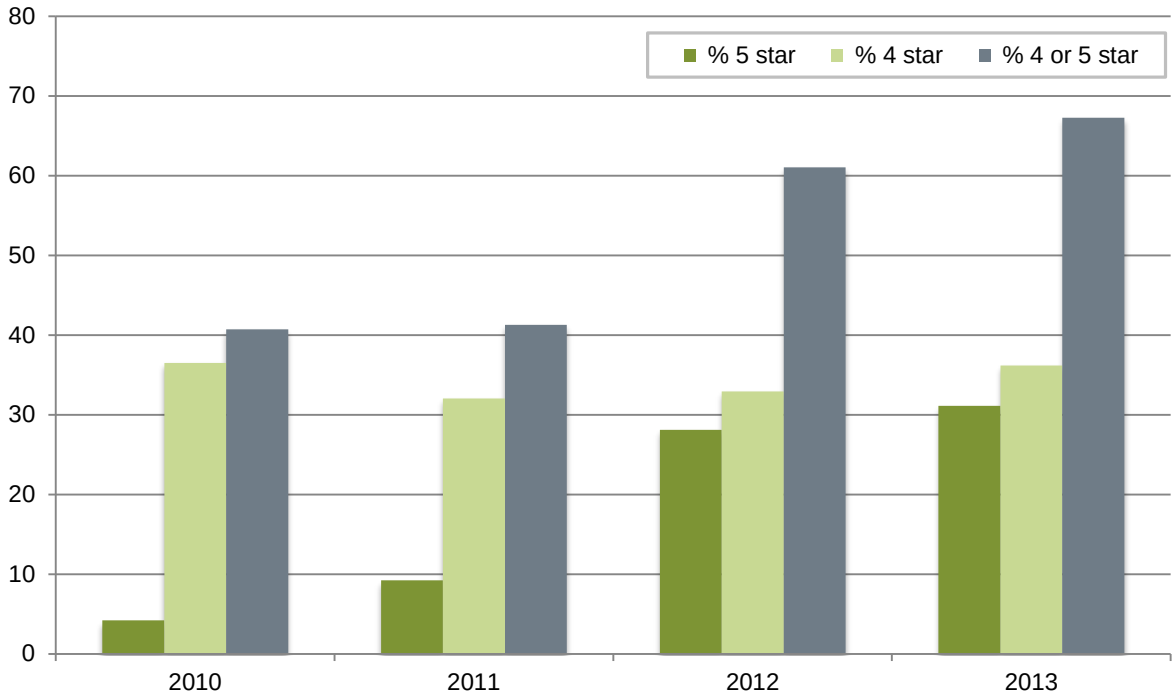


Figure 5.7: Commercial vehicles sold with 4 or 5 star rating 2010-2013



The data shows the success of the inclusion of ESC in the requirements for a five-star rating and the subsequent regulation in achieving rapid uptake, compared to the slow uptake of forward collision avoidance systems.

Figure 5.8: Vehicles with traction or stability control as standard feature 2008-2013

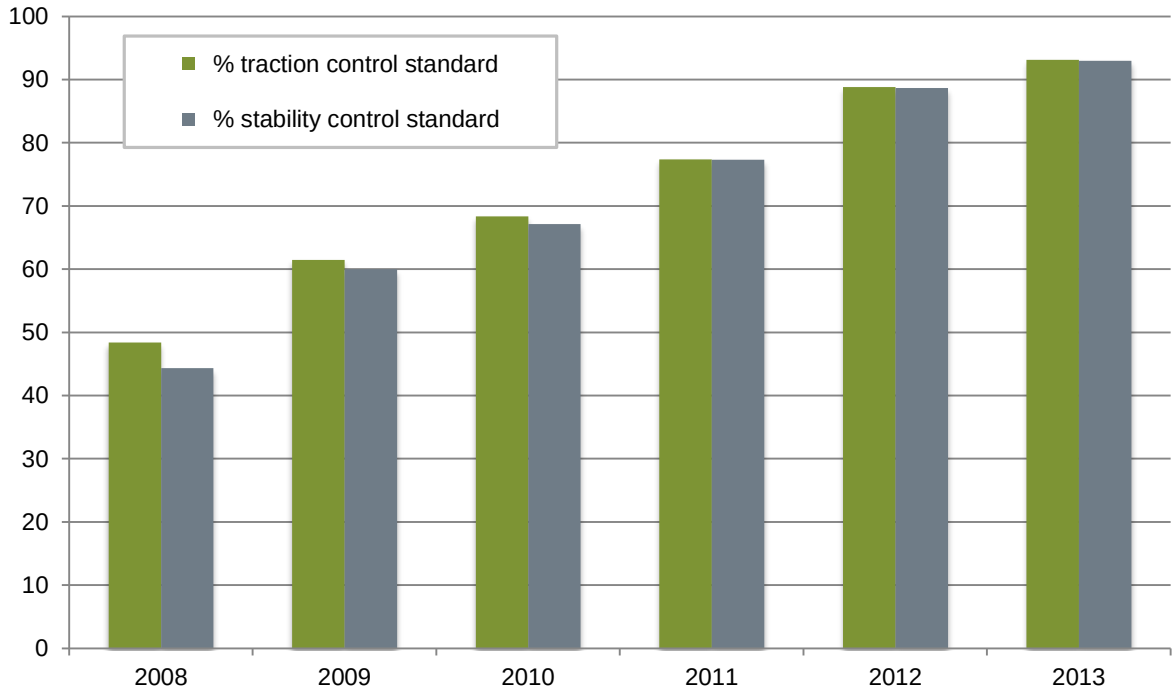
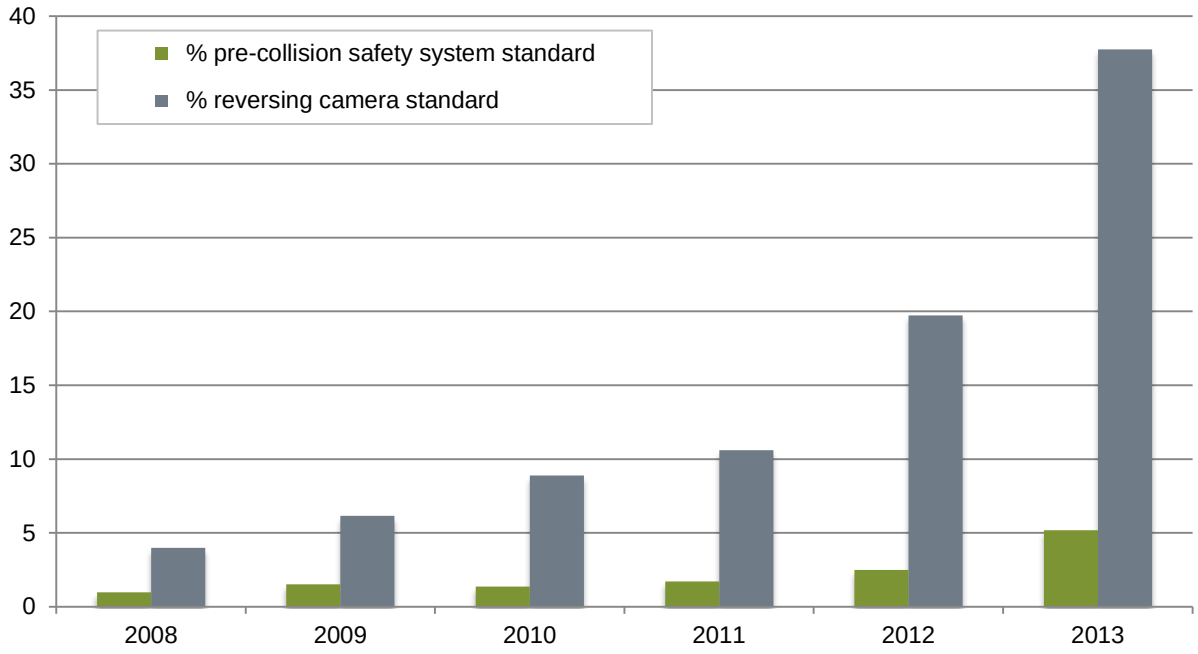


Figure 5.9: Vehicles with new technologies fitted standard 2008-2013



6. Exploration of Hospital Data

This section provides a brief summary and commentary concerning a statistical examination of whether there have been changes in trauma patterns which may warrant consideration of a change in priorities or emphasis for the NRSS. Appendix J provides additional findings and a description of the data sources and methods.

The analysis is based mainly on nationally compiled hospital inpatient data for ten calendar years ending with 2010. The case data are from the NHMD, which is operated by the AIHW and includes records concerning nearly all episodes of admitted patient care in Australia. While the AIHW made the NHMD data available, the authors are responsible for the use made of the data in this report.

Estimated numbers of two types of road injury cases were the main subject of analysis: all admitted cases ('serious injury'; over 30.000 per year), and a High Threat To Life (HTTL) subset (about one-quarter as many). Cases were categorised according to the broad type of road user who sustained injury: drivers of motor vehicles (other than motorcycles); passengers in such vehicles (including people riding on the outside); motorcyclists, cyclists, and pedestrians. Most of the analysis was restricted to cases where injury was recorded as having occurred 'in traffic', which is approximately equivalent to 'on road'. Non-traffic cases were also reported for comparison, at some points.

The main part of the analysis describes change over time in rates that take account of population by year, age, sex, and remoteness zone of residence.

6.1 Summary of Findings

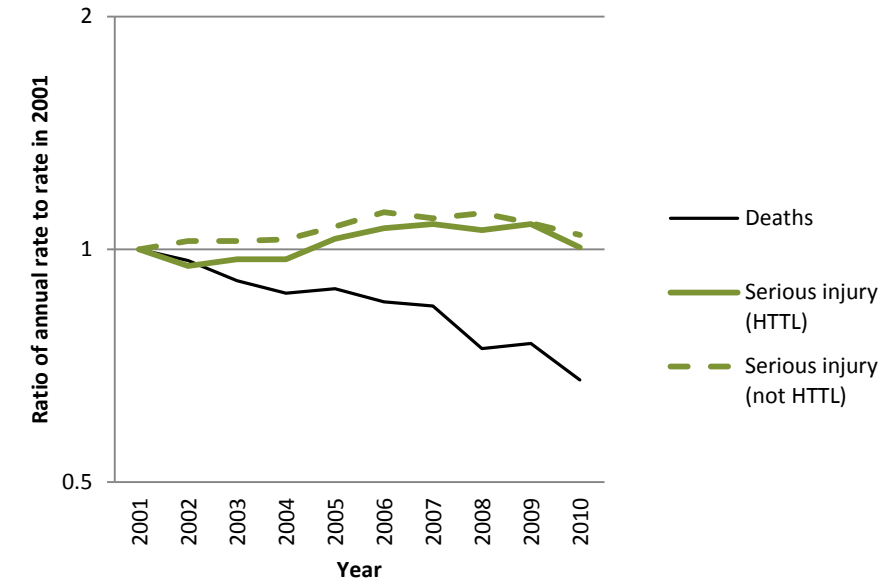
6.1.1 Overview of Cases

Serious injury land transport cases recorded as occurring 'in traffic' rose from 27,343 in 2001 to 32,775 in 2010. About two-thirds of the cases are males and in about one-quarter of the cases, the injuries sustained meet a conventional definition of HTTL. Five case types account for about 95% of traffic cases: drivers, passengers, pedestrians, motorcyclists and cyclists.

6.1.2 Road Deaths Declined While Serious Injuries Did Not

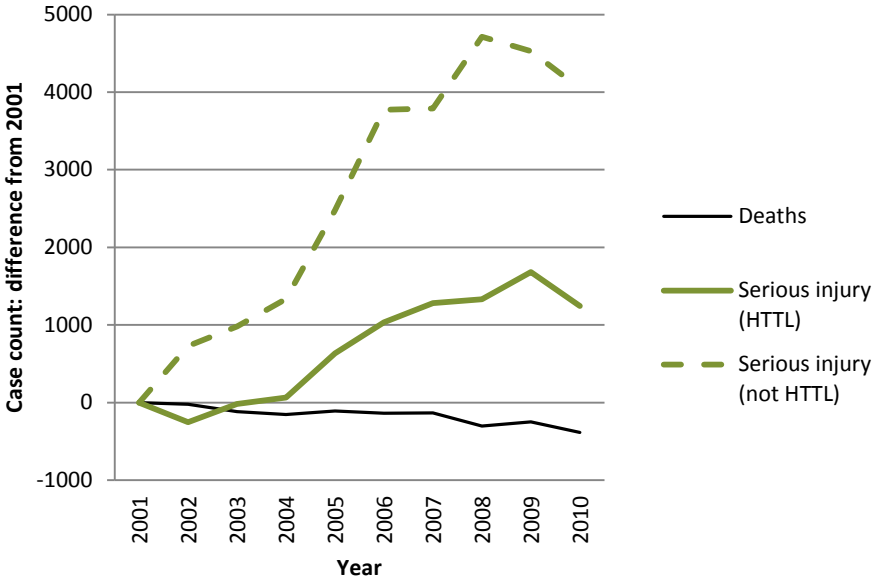
Rates of hospitalised road related serious injury rose by about 10% from the level in 2001 then returned to it, while road death rates fell by almost one-third. Trends in rates of hospitalised injury were similar for the HTTL subset of cases and for the less severe majority of cases. The values show population-based rates for each year as a ratio of the population-based rate in the first year.

Figure 6.1: Ratio of annual population-based rate to the rate in 2001



While the percentage decline in deaths was greater than the percentage rise in serious injury, the absolute number of additional serious injury cases was much larger than the absolute number of the decline in deaths. Hence, the decline in deaths does not account for the rise in serious cases.

Figure 6.2: Case count: difference from 2001



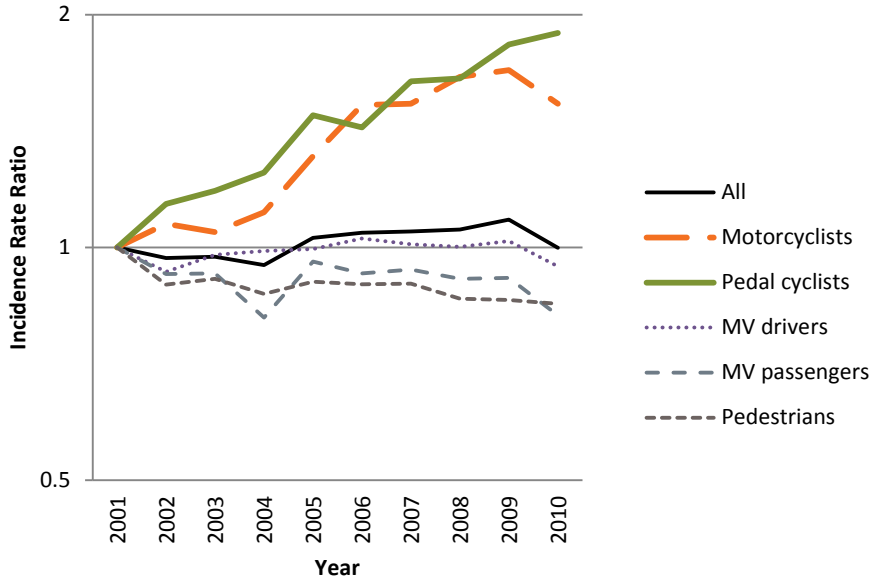
6.1.3 Motorcyclists and Cyclists Account for the Rise in Serious Injury

Annual case-counts of traffic cases for two of the user types rose substantially: motorcycle riders and cyclists. The absolute rise in annual case numbers was somewhat larger for motorcyclists than for cyclists. However, the relative rise was larger for cyclists, and the upward trend in the second half of the period was larger for cyclists than for motorcyclists. These two types accounted for 29% of serious injury traffic cases in 2001, rising to 38% in 2010. The equivalent proportion of HTTL cases rose from 22% to 34%.

Annual case-counts of motor vehicle driver traffic cases also rose. However, the absolute increase in case numbers was smaller than for motorcyclists or cyclists, and the percentage rise was much smaller than for those types. Annual case-counts for the other main types of traffic cases, involving motor vehicle passengers and pedestrians, declined a little during the decade.

Analysis taking account of year, age, sex and remoteness zone of residence, showed no consistent trend of population-based rates of driver cases, gradual decline of rates of other occupant cases and pedestrian cases but steep increases in rates of motorcyclist and cyclist cases. (Data for HTTL cases are shown here, but the pattern was similar for all serious injury cases.)

Figure 6.3: Incidence Rate Ratio



Further analysis showed that the upward trend of motorcyclist and cyclist cases was especially steep for men aged 45 to 64 years, and that the rise was much more marked for cases that occurred in traffic (on road) than for non-traffic cases. The rise in the rate of cyclist cases was more marked for residents of major cities than for people who lived elsewhere.

6.1.4 Commentary

Why have trends for deaths and serious injury rates moved in opposite directions?

As shown above, stratification by road user type reveals that two road-user types, motorcyclists and cyclists, accounted for the rise in the rates of hospitalised serious cases. Further analysis shows that the rise in rates for these case types was particularly marked for middle-aged males and (especially for cyclist cases) for residents of major cities.

It is important to note that the absolute increase in hospitalised cases was many times larger than the absolute decline in fatal cases.

It was beyond the scope of this analysis to undertake a deeper investigation of patterns of case severity, but these findings suggest that it might be fruitful to do so. As an indication of this, in-hospital mortality of serious injury traffic cases overall fell from about 1.2% to about 0.8% during the decade. While better treatment might have contributed to this, it is likely that the mix of cases became less severe over time. Notably, cyclist cases were relatively unlikely to die in hospital (fatal cases ranging from 0.2% to 0.3% per year), and the proportion of serious injury cases that were cyclists rose over time.

7. Implementation Review

The implementation review assessed progress against the “First Steps” agenda and also considered the strategic areas used in the initial modelling performed by MUARC (Corben, Logan, Capper, Hoareau & Devlin, 2011) to support the development of the NRSS.

7.1 Implementation of the First Steps Agenda

A review of the extent to which the NRSS “First Steps” agenda has been implemented was considered a necessary step in the review of the strategy. The following sections summarise the available information but it has not been possible to perform a detailed review of the individual actions.

There were two main barriers to a complete review; firstly many of the fifty-nine actions in the “First Steps” agenda were couched in general language and had no obvious measure of success and secondly some of the actions involved major changes to funding or legislation and would not be expected to be completed in the relatively short time since the strategy was released.

In the Implementation Status report published by the Transport and Infrastructure Council (2013), most items were coded “yellow” meaning “action has commenced and is being progressed”. The following sections summarise the major action that has been taken, under the headings used in the strategy. These actions were identified using reviews of progress prepared by the Department of Infrastructure and Regional Development, consultation with ASTF members and other stakeholders, a search of changes to legislation and a search of announcements of road safety initiatives. The sections do not include all activities taken or in progress to implement the strategy but concentrate on those nominated in the consultations or where an outcome can be identified.

7.1.1 Safe Roads

A number of road safety related infrastructure projects were identified from press releases and websites but it was not clear if these represented an increase in investment. Major investment of $1 billion in safe roads by TAC in Victoria and $100 million by MAC in South Australia were major achievements. Significant infrastructure upgrades including wide median treatment on 20% of the Bruce Highway in Queensland, and $36 million in hypothecated funds from fine revenue towards addressing single vehicle run off road crashes in WA, were noted. The recent Queensland Road Safety Action Plan (Department of Transport and Main Roads QLD, 2013) also included $82m per year to fast track road engineering treatments. The NSW Community Safety Fund (hypothecated camera funds) currently allocates in excess of $60m through its “Safer Roads Engineering Program” for targeted road safety infrastructure treatments and Black Spots.

Austroads reports were published to assist in the allocation of road funding including the completion of ANRAM and also to assist in developing Safe System compliant design solutions.

There has been some progress towards the adoption of willingness to pay values in project evaluation. An Austroads report reviewing willingness to pay methods has been completed.

7.1.2 Safe Speeds

Rural speed limits have been reduced on identified roads in South Australia and on unsealed roads in Tasmania. 40 km/h limits have been introduced into areas of Melbourne, Hobart, Canberra and Adelaide and will be expanded in Sydney late in 2014. The large scale implementation of lower speed limits is progressing slower than anticipated by the strategy.

Austroads projects have been completed to develop guidelines for speed limit setting and speed management. Reports on community attitudes to speed have been released by Austroads and the Department of Infrastructure and Regional Development.

Work is being undertaken by a number of states to improve the effectiveness of speed enforcement including working towards combined fixed and point-to-point cameras and reviewing penalties.

Speed survey results from Western Australia and South Australia show small improvements in compliance with speed limits and small reductions in mean speed. It will be necessary to monitor speeds over a longer period to determine if these are real effects and there appear to be differing effects in rural and metropolitan areas.

7.1.3 Safe Vehicles

The vehicles area was considered the major success area of the strategy by both ASTF members and the wider stakeholders interviewed although it was noted that some of the actions had commenced before the release of the strategy.

Successes in the vehicles area were demonstrated by the properties of the new vehicle fleet. Between 2010 and 2013 the percentage of new vehicles sold with a five-star rating increased from 49% to 80% for passenger vehicles and from 40% to 70% for all vehicles. There was a considerable improvement for light commercial vehicles with the percentage of five-star vehicles rising from 4% to 31%, whilst the four-star percentage stayed constant at 36%. During the same period the percentage of new vehicles equipped with ESC rose from 67% to 93%. This is in contrast to the take up of forward collision avoidance systems, which were fitted to 1% of new vehicles in 2010 and 4% in 2013.

Major activities during the strategy period have included:

- Harmonising the ADR process with UNECE and GTR regulations for many ADRs with the aim of extending to all ADRs over time
- New ADRs for seat belt warnings, ISOFIX child seats, BAS for light passenger and commercial vehicles, ESC for light commercial vehicles and ABS for heavy vehicles
- Regulation Impact Statements are under development to consider ADRs on pole side impact protection for light passenger and commercial vehicles, ABS for motorcycles and ESC for heavy vehicles
- Ongoing financial support has been provided to ANCAP
- The “Stars on Cars” program has been successfully rolled out in most jurisdictions
- Work has been undertaken with the NTC, state agencies and the corporate sector to develop and implement safe fleet buying policies.

The above list only includes the major areas, with a number of other achievements recognised in the review of progress and by stakeholders involved in the consultation.

7.1.4 Safe People

The major achievements in the Safe People area were identified as the strengthening of GLS provisions in many states and the extension of alcohol interlock programs. Austroads research projects on GLS for both drivers and motorcycle riders have been completed, and a project is underway to develop a policy framework for an Australian GLS.

Some work has been done on Indigenous licensing and a major trial is underway in the Northern Territory. There is also a current Austroads project addressing the issue.

A number of jurisdictions are working with the police to strengthen enforcement practices.

An Austroads project has been completed on methods to discourage unlicensed and disqualified driving.

7.1.5 Making it Happen

A review of national governance arrangements resulted in the cessation of the National Road Safety Council, with TISOC taking on a greater role in overseeing the delivery of the NRSS. The new arrangements also saw the functions of the former National Road Safety Executive Group transferred to the ATSF, which assumed responsibility for advising and supporting TISOC on national road safety policy matters.

National engagement with police on road safety strategy was bolstered with the establishment of formal links between the ASTF and the Australia New Zealand Policing Advisory Agency (ANZPAA).

Austroads has commissioned a project to promote safety management systems for road authorities, based on ISO 39001.

The Strategic Vehicle Safety and Environment Group provided a mechanism to support engagement with the motor vehicle industry. A number of stakeholders mentioned the governance of the strategy and mentioned the commitment to the strategy at the political level.

Some actions have been undertaken to engage with key road safety organisations but most of the stakeholders interviewed felt that there were insufficient opportunities for engagement and involvement in the strategy. The stakeholders felt that the introduction of the National Road Safety Forum was a positive step.

To assist in monitoring trauma at the national level, BITRE has established the National Crash Database (NCD), in cooperation with the states and territories.

7.2 Strategic Areas Identified in the Original MUARC Modelling

During the development of the NRSS, data modelling was carried out by the Monash University Accident Research Centre (MUARC) to assist the target-setting process (Corben et al 2011). This was informed by a review of Australian and overseas research on the effectiveness of a number of road safety interventions. A macro-modelling approach was used to estimate the reductions in people killed or seriously injured that would result from a range of possible road safety interventions, during the ten year life of the strategy. Only a limited set of initiatives were modelled, in an attempt to identify the areas of greatest potential gain during the life of the strategy and to illustrate the broad degree of intervention (at a national level) that would be required in each area.

To provide an additional perspective on NRSS progress in the first three years, the level of implementation was examined for some of the specific initiatives modelled by MUARC.

7.2.1 Safe Roads

Increases in road infrastructure investment

The search of websites revealed no major changes in funding so far, however the ASTF members identified major new investments in Victoria, New South Wales, Queensland, Western Australia and Tasmania.

7.2.2 Safe Speed

Reductions in speed limits on all urban roads and on significant portions of rural and remote roads

The most significant programs of changed speed limits to be identified so far are changes in South Australia and Tasmania. In South Australia the speed limit was reduced to 100 km/h on 723 km of arterial roads within 100 km of Adelaide and on Yorke Peninsula, whilst in Tasmania the speed limit was reduced to 80 km/h on all unsealed roads. Most states have introduced 40 km/h on chosen metropolitan roads.

7.2.3 Safe Vehicles

Mandatory installation of Electronic Stability Control (ESC) from 2012 in new passenger vehicles

This was achieved firstly by ANCAP requiring ESC to achieve a 5 star rating and then by regulation. Polk data for 2013 shows 93% of new vehicles sold were fitted with ESC.

Increase in light commercial vehicles with ESC and side and thorax airbags to 75% of new sales by 2020

The Polk data on ANCAP ratings confirms the increase in safety for light commercial vehicles. Between 2008 and 2013 the percentage of new light commercial vehicles with a five-star rating rose from 4% to 31%, during the same period the percentage of light commercial vehicles with a four-star rating remained static at around 36%.

Expected further development of ISA technologies and their deployment in vehicles to 6% of new passenger vehicles by 2020

No information could be found on the level of take up of ISA in new vehicles.

7.2.4 Safe People

Reduction in the BAC limit of young drivers aged 21-24 and/or all drivers

There appears to have been no movement in this area. Most states have zero limits as part of the GLS and for some types of commercial drivers but there has been no movement to extend to the general population.

Reduction of mean speeds of 1% or 2% in all metropolitan areas and on roads in regional and rural areas comprising 20% serious casualties

Speed surveys from Western Australia and South Australia suggest mean travel speeds are reducing slightly. Statistical analysis is required to determine whether the small change is significant.

8. Priority Areas

8.1 Introduction

The priority areas identified in this section are intended to highlight strategies, road user groups and countermeasures for which more emphasis is recommended because of changing crash patterns or a real or perceived lack of activity.

The areas discussed here are not intended to replace the content of the National Road Safety Strategy 2011-2020 but are aimed at supplementing both the NRSS commentary and associated action agendas. A brief review of the continued relevance of the “First Steps” and “Future Steps” agendas is provided as Appendix K.

This section presents 12 priority areas for consideration. The nature of the areas means that there is some overlap between them and they cannot all be presented in a uniform manner. The first seven cover specific road users or countermeasures, the eighth area is the monitoring of serious injuries and the final four cover the strategic issues of infrastructure investment, coordination with planning, workplace safety and national leadership.

8.2 Vulnerable Road Users

8.2.1 Background

The literature review identified that the implementation of the Safe System philosophy for vulnerable road users is not as well developed as for vehicle occupants. This has been found to be true nationally and internationally, with even leading countries such as Sweden increasing their focus on vulnerable road users (Tingvall et al 2013). The main finding of the recent review of road safety from the International Transport Forum was that vulnerable road users are receiving smaller benefits from recent road safety improvements than vehicle occupants.

The analysis of fatal crashes in Australia from 2008-13 showed the same pattern as internationally, with vehicle occupants accounting for most of the reduction in fatalities. There was almost no change in total fatalities involving vulnerable road users, with fatalities of motorcyclists and cyclists rising over the period.

Analysis of hospital separations data found that a much higher proportion of road-related injuries involve motorcycling and cycling than shown by the police-collected data. It also showed that injury cases among these road user types are increasing.

Motorcycling exposure has grown since 2008 with a sharp increase in vehicle kilometres travelled relative to other motorised vehicles. Cycling exposure is also thought to be increasing rapidly although there is no reliable measure. These relative increases in exposure would be expected to account for some of the difference between road user types, together with cyclists and motorcyclists not gaining the benefit from increased vehicle crashworthiness.

8.2.2 Relationship to the NRSS

The NRSS (2011) acknowledges pedestrians as having one of the highest rates of death and injury among vulnerable road users as a group, yet pedestrians receive no dedicated coverage in the NRSS apart from a short mention that they benefit from lower vehicle speeds and certain infrastructure treatments. It also provides only limited specific mention of cyclists.

The “First Steps” agenda does include some actions to assist vulnerable road users including improved infrastructure, lower speed limits, vehicle regulations and the development of a GLS for motorcyclists. Implementation has been most successful in the vehicles area with progress towards an ADR mandating ABS for motorcycles and in the Safe Speeds area with the introduction of 40 km/h zones in a number of capital cities.

The needs of vulnerable road users are also acknowledged in the “Future Steps” agenda with the emphasis on improved infrastructure for cycling and motorcycling and further improvements in vehicle technology for motorcyclists.

8.2.3 Potential Actions

It is clear from the literature that work is required to better understand what constitutes a Safe System for vulnerable road users. Although pedestrians, cyclists and motorcyclists are often grouped together as vulnerable road users, the three modes demonstrate different crash patterns and have different requirements of a Safe System. Therefore it is recommended that research be undertaken to review and clarify these issues. This review should take into account research from the United States that suggests that to cater for vulnerable road users, the focus of the Safe System needs to extend from providing a forgiving system to, in some circumstances, providing a system that eliminates the potential for conflict between road users.

There is evidence that pedestrian safety in particular would be enhanced by the rapid introduction of forward collision avoidance systems such as AEB. There are a range of measures that can be used to accelerate take up of vehicle technology and it is recommended a program of measures including education, consumer testing, regulation and financial incentives be developed to replicate the success achieved for ESC.

The literature identified a range of infrastructure changes expected to assist vulnerable road users. These included:

- A review of pedestrian signal timings to prioritise the safety of pedestrians over reducing delay to vehicles
- Surface improvements to provide better stability and road holding for cyclists and motorcyclists
- Further work on the development and implementation of more appropriate intersection designs to cater for cyclists
- Programs to provide separation of vehicles and bicycles including safe intersection design.

With the encouragement of active travel modes it is expected that walking and cycling will continue to increase. Both the safety and amenity provided to cyclists could be improved by better cooperation between road safety professionals and urban planners. It is recommended that ways to achieve closer cooperation be explored.

A number of stakeholders considered that the road rules concerning pedestrians and cyclists are confusing and not well known and this view is supported by the New South Wales 2014-16 Cycling Action Plan (Transport for New South Wales 2014a). A review of the appropriateness of the road rules as they affect pedestrians and cyclists, together with suitable public education, could be considered.

8.3 Older Drivers

8.3.1 Background

Older driver fatalities are reducing at a slower rate than road user fatalities overall and particularly compared with younger road users. This is not simply due to increases in population as deaths per 100,000 people also show a marked difference by age group. There is some indication that the difference between age groups is mainly accounted for by drivers and passengers, although small numbers of fatalities makes this uncertain.

The differences are likely to be related, in some part at least, to changing driving patterns of older drivers, with research showing people are driving further and into older ages and that this is increasingly applying to both males and females. It is also possible that the difference between older and younger drivers is related to road safety measures such as enhanced GLS systems that have targeted younger drivers. The vehicles driven by the different groups could also be a factor, as younger drivers, who generally drive older cars, would have only recently begun to benefit from the improvements in crashworthiness that began over 15 years ago.

8.3.2 Relationship to the NRSS

The “First Steps” and “Future Steps” agendas acknowledge the issue of older road users but are heavily focussed on Fitness to Drive and providing alternative mobility options so that older drivers will be more accepting of stopping driving. Although these measures remain important, international research suggests that emphasis should also be placed on providing a Safe System for older road users that includes drivers.

8.3.3 Potential Actions

International and Australian research indicates that older drivers can benefit from receiving better information regarding vehicle choice. Older drivers have been shown to give safety a low rating in their vehicle choice and targeted information could assist in changing this outcome. The development of an education campaign designed specifically for older drivers is recommended. The campaign would explain the importance of vehicle choice and the use of ANCAP ratings and Used Car Safety Ratings to assist in choosing a safer car.

To further assist older drivers in their vehicle choice, NHTSA has recommended working with NCAP to determine the feasibility of a ‘Silver Car Rating’ stream relevant for older drivers. Discussions could be held with ANCAP to determine if such an approach is feasible in Australia.

Research from the US has also suggested that vehicle crashworthiness and active safety assessment procedures need to be modified to assess their relevance to older drivers. It is recommended that international developments in this area be monitored.

Infrastructure changes recommended to assist older drivers are likely to be of benefit to all drivers, as they include conventional safety improvements such as improved signing, simplified intersection design and the removal of filter right turns. Consideration could be given to the inclusion of issues known to cause difficulty to older drivers in the guidelines and checklists for road safety audits.

Alternative mobility options will continue to be important but recent research suggests these should be considered as part of providing safe mobility options for older people regardless of driving status. There is an unmet demand for mobility options and, as already acknowledged in the "Future Steps" agenda, innovative ways to provide services need to be developed and encouraged in close cooperation with local communities.

8.4 Indigenous Road Users

8.4.1 Background

While various initiatives have been undertaken to address the disproportionate risk faced by Indigenous Australians on the road, there is continued concern about inequitable outcomes, including the wider socio-economic effects of low rates of attaining and retaining driver licences.

As is the case for the general population, rates of fatal and serious road related injury of Aboriginal and Torres Strait Islander Australians increase greatly with the remoteness of place of residence. However, a relatively large proportion of Indigenous Australians live in remote and very remote regions, and so the overall impact of the higher rates experienced by residents of remote areas is greater for Indigenous than other Australians.

In 2005–06 to 2009–10, 52% of fatal land transport cases recorded as injuring an Indigenous person, and 35% of serious injury cases relating to road transport, involved residents of remote and very remote parts of Australia. In contrast, only 4% of fatal and serious cases injuring persons not identified as Indigenous involved residents of the remote regions. It is thus likely that measures to reduce risk of fatal and serious road injury in the more remote parts of Australia will contribute to a reduction of cases involving Indigenous people.

However, initiatives directed specifically to Indigenous individuals and communities are also required, for several reasons. Firstly, patterns of road injury events differ between Indigenous and other people. For example, injury as a motor vehicle passenger (not a driver) and as a pedestrian, are more prominent among cases involving Indigenous people than other cases. Secondly, social and demographic factors differ between Indigenous and other residents in ways that may influence injury risk and determine appropriate avenues for intervention. For example, English is not the first language of many Indigenous people, particularly those who live in remote areas.

Institutions such as Aboriginal community-controlled health services may be appropriate avenues for road safety interventions specifically directed to Indigenous individuals and communities. Efforts to achieve changes judged desirable by road safety planners and authorities are more likely to be effective if developed and implemented in consultation with such institutions. Planning for general safety promotion in this population segment may be useful in the context of road safety (e.g. the National Aboriginal and Torres Strait Islander Safety Promotion Strategy).

A prominent example of a program in place is the Northern Territory Drive Safe Remote trial. However, further work is required to develop and trial programs in this area. As is highlighted in documentation of the Drive Safe Remote project, the aims of enabling more Indigenous people to acquire and keep licenses extend beyond improved road safety, also including reduced imprisonment (in the NT about 82% of all prisoners are Indigenous and driving offenders make up about 25% of the prison population) and improved access to jobs, training, education and health services.

An Austroads project demonstrating the application of the Safe System with an Indigenous community in Western Australia was completed in 2012 (Senserrick 2013). The project highlighted the need for improved cooperation between agencies if more projects of this nature are to be carried out. It concluded that national coordination and leadership would be required to achieve the necessary level of cooperation and funding to ensure Indigenous communities benefit from the Safe System approach to road safety.

8.4.2 Relationship to the NRSS

Examples of relevant activities are given in the “First Steps” agenda, notably as items under Safe Roads (5. Ensure that roads in and around Indigenous communities are included in infrastructure treatment programs and 7. Implement and evaluate Safe System demonstration projects in specific local government areas and Indigenous communities) and Safe People (27. Implement programs addressing the road safety needs of Indigenous communities and disadvantaged groups). There are no specific actions for Indigenous road safety in the "Future Steps" agenda in the NRSS.

8.4.3 Potential Actions

National Indigenous Road Safety Forums were held every two years from 2002 to 2010. The five forums were convened by the Department of Infrastructure and Regional Development. Engaging effectively with Aboriginal and Torres Strait Islander people and organisations about road safety requires targeted and persisting effort, and openness to perspectives in which road safety is seen in a wider context. The relatively few people actively involved in such work tend to be dispersed geographically and organisationally and they lack opportunities to consult, share expertise and develop coherent priorities and methods. The forums provided a valuable opportunity for these activities and it is recommended they be held on an annual basis.

The 2010 Indigenous Road Safety Forum recommended a fund for Indigenous road safety projects that produce measurable change, sustainability and capacity for replication in other settings, which would itself require establishment of a national leadership function. It is recommended that this fund be considered again and the mechanisms further developed.

8.5 Speed Management

8.5.1 Background

Speed management is a core component of a Safe System and remains the best opportunity for a rapid reduction in road trauma. Since 2011 some attempts at implementing safer speed limits have been made, however only limited progress has been made on major urban and rural arterial roads.

The most significant speed limit change has occurred on South Australian rural arterial roads, where 700 km of road was reduced from 110 to 100 km/h. A proposal to reduce speed limits from 100 to 90 km/h on all sealed rural roads in Tasmania outside of national highways was withdrawn in 2013 due to a public backlash. However, a reduction from 100 to 80 km/h in the default limit on unsealed roads was successfully implemented. An open speed limit trial was initiated on a 200 km length of road in the Northern Territory in February 2014, and this clearly represents a deviation from the NRSS Safe System principles.

Local Government Authorities in several capital cities have implemented reductions to 40 km/h limits in selected CBD areas including Melbourne, Adelaide, Canberra and Hobart. A planned extension of the existing 40 km/h area was recently announced for Sydney. As a result of a speed limit review, Victoria is rationalising speed zones on its network by both increasing and decreasing speed limits and eliminating 70 and 90 km/h zones in the long term.

Regular speed surveys from WA and SA broadly indicate that mean speeds in metropolitan areas are trending downwards and the proportion of vehicles exceeding the speed limit is reducing. This effect does not appear to be replicated on rural roads.

Consultation with the ASTF members indicated a level of speed enforcement reform since 2011, mainly in relation to the introduction of fixed and point-to-point speed cameras in several jurisdictions.

Guides to assist in speed limit setting and speed management, including enforcement, have been published by Austroads. Two of the guides address model national guidelines for setting speed limits at high-risk locations and methods for reducing speeds on rural roads. No evidence was found that suggested these were being applied in a systematic manner by Austroads members.

8.5.2 Relationship to NRSS

The critical role of speed in the Safe System was recognised by the NRSS and Safe Speeds was treated as a cornerstone area. The “First Steps” agenda lists seven actions that cover a range of road safety issues:

- Improve compliance with speed limits across the road network
- Improve the use of sanctions to more effectively deter people from speeding
- Develop a national public information campaign
- Review speed limits where risk levels are high and engineering solutions are not feasible or cost-effective
- Develop new risk-based national speed limit guidelines for different road categories/functions
- Facilitate the implementation of ISA
- Increase the effective application of chain of responsibility legislation (for heavy vehicles).

Implementation has been limited, with modest gains achieved in the areas of enforcement and speed limit reform. Chain of responsibility legislation is being utilised to varying degrees in jurisdictions. A recent ETSC report has identified ISA as the most effective driver assist technology but only New South Wales has made advances in this area. A number of Austroads reports have been prepared on measures to manage speed and optimise speed enforcement.

The "Future Steps" agenda has five steps relating to ISA, more appropriate speedometer displays, point-to-point cameras and heavy vehicle regulation options. There still remains significant potential to pursue trauma reductions through speed limit reform and mass speed limit compliance.

8.5.3 Potential Actions

The stakeholder consultation suggested further exploration of technological solutions to speed management, including extending the use of ISA and improved enforcement using point-to-point technology. It was also suggested that a national approach be adopted to speed management and speed-related media campaigns. These items were also listed in the “First Steps” agenda.

Given the crucial role of speed in a Safe System, the broad actions listed in the "First Steps" and "Future Steps" agendas all have merit and any speed reductions that can be achieved in the system are considered worthwhile. Much of the activity related to speed management needs to occur on an ongoing basis and is already happening amongst the jurisdictions.

It is therefore recommended that the actions from the First and Future Steps agendas be pursued more vigorously; particularly further reducing speed limits on rural arterials and local government roads and in urban areas where road space is shared with vulnerable road users.

Further opportunities need to be considered from the Intelligent Transport Systems (ITS) area beyond ISA, including the extended use of C-ITS; this is discussed further in a later section.

8.6 Remote Areas

8.6.1 Background

The data analysis has shown that deaths are reducing at a slower rate on rural and remote roads than in urban areas.

Remote areas present a particular challenge; low volumes mean investment in infrastructure on these roads is always going to be given a low priority by traditional assessment methods and traditional enforcement is unlikely to be effective given the vast distances, extremely limited enforcement resources and infrequency of vehicles.

In time, vehicle safety technology may be the most effective countermeasure for remote areas where single vehicle road departures are a significant issue. The increasing use of ESC, for example, would be expected to result in a reduction in loss of control crashes in these areas. Unfortunately new technology takes considerable time to be taken up by the majority of the fleet, and those most at risk, such as young drivers in remote areas, are likely to be amongst the last to receive the benefits.

Stakeholders suggested development of a separate remote area strategy following the Western Australian model from 2009. This would need to include the potential of vehicle technologies and low cost infrastructure solutions that address core Safe System issues. One stakeholder suggested a better acknowledgement of remote area road safety challenges and stated that remote areas are a national issue and need to be addressed at the national level.

8.6.2 Relationship to the NRSS

Neither the "next steps" agenda nor the "Future Steps" agenda contain specific items addressing safety in remote areas.

8.6.3 Potential Actions

The stakeholders interviewed felt that a first step in addressing remote area safety would be to acknowledge it as a national issue. The ASTF could consider developing a remote areas forum to share remote area experiences, a set of web based resources which can be used to help address remote area issues or, as was done in Western Australia, develop a specific remote areas road safety strategy.

8.7 Vehicle Safety

8.7.1 Background

Improvements to vehicles have been a major contributor to trauma reductions for over 15 years through improvements in crashworthiness and occupant protection. These improvements will continue to deliver trauma reductions throughout the life of the NRSS as more and more new vehicles achieve high safety standards and the older vehicles driven by the most at risk drivers improve over time. A 10-year old vehicle in 2020 will have been manufactured in 2010 when nearly 70% of new vehicles received a four- or five-star ANCAP rating and were fitted with ESC.

ESC has been required by ANCAP for a five-star rating since 2008, and it has been required by regulation for new model light passenger vehicles since 2011 and all new light passenger vehicles since 2013. A significant reduction of loss of control crashes is expected as the proportion of the fleet fitted with ESC increases.

New technologies are now being developed to assist in crash avoidance as well as occupant protection but these are likely to have most impact in trauma reductions as part of the next national road safety strategy. AEB holds the most potential, with possible reductions of up to 30% in fatalities and 40% in injuries. AEB is likely to benefit both vehicle occupants and vulnerable road users. As noted elsewhere, vulnerable road user safety is not improving at the rate of other road user safety and this technology is capable of making a positive contribution, especially in lower speed urban environments. LDW also has the potential to reduce fatalities by 7% in Australia, and given the challenge of rural and remote roads may be a worthwhile technology to promote, if infrastructure can be optimised for its use.

ISA appears to have the second highest potential to prevent crashes after AEB. Fatality and serious injury reductions in Australia have been estimated at 7% for advisory and 25% for limiting ISA if every vehicle in the fleet was equipped. The availability of accurate and reliable digital speed maps remains a challenge for the deployment of ISA in Australia, although in 2014 New South Wales made their map available via a smartphone application.

A rapid take up of technologies into the vehicle fleet will bring forward the benefits of these technologies. The Australian automotive market is characterised by low entry barriers and a high level of competition. The result is a significant fragmentation of the market, with more vehicle brands and models available to Australian consumers compared with almost anywhere in the world including China, Japan and the USA. The resultant strong competition means that regulation, plus good, easily understood consumer information is vital to ensure the safety of vehicles and to promote vehicle choice based on issues other than price. This will be even more important with the demise of the local manufacturing industry, to ensure that the vehicles being imported are the safest versions available and to ensure manufacturers are forced to compete on safety ratings as well as price.

Stakeholders commented that the Motor Vehicles Standards Act is currently under review and expressed concern that vehicle safety not be compromised as a result of changes to the Act.

8.7.2 Relationship to the NRSS

The “First Steps” agenda recognised the importance of both encouraging ANCAP and strengthening regulation. Implementation of the "First Steps" agenda has been strong in these areas and Stakeholders considered this the most successful area of the NRSS. The "Future Steps" agenda also contains an impressive list of actions in the vehicle technology area.

8.7.3 Potential Actions

The main recommendation for this area is that the current First and Future steps agendas are vigorously pursued and opportunities taken to accelerate the uptake of technologies into the vehicle fleet.

8.8 Cooperative ITS

8.8.1 Background

There have been considerable developments in ITS since 2011. Most significant has been the imminent feasibility of Connected Vehicle solutions otherwise known as C-ITS.

The literature review revealed that C-ITS has huge potential to make roads safer and studies have been performed or are currently underway both nationally and internationally. Research and technical capacity exists within Australia but there is no clear path to implementation and a variety of approaches and implementation scenarios are possible.

Austroads published a C-ITS Strategic Plan in August 2012, highlighting the need for leadership across six key areas: policy requirements, international and national engagement, technical requirements, platform development, trials and demonstrations, and marketing and communications. A work plan has been developed, to move towards establishing the expertise and knowledge to set up the necessary pre-conditions to allow C-ITS platforms to operate in Australia. In December 2013, the NTC published its final paper outlining policy implications of C-ITS in the areas of liability, privacy, compliance and enforcement and driver distraction, and identified where further work is required from these perspectives.

There is a high level of confidence that V2V and V2I technologies can deliver considerable safety benefits. Australian studies of V2V estimate injury reductions to be in the order of 17% to 35% across various injury types. When combined with AEB, a 35% reduction in fatalities and 55% reduction in injuries are thought possible.

While V2V has no dependence on the surrounding infrastructure, it requires both vehicles to have the technology in order to avoid the crash. This limits the usefulness of V2V, as even if 50% of vehicles were V2V equipped, it would only be useful in 25% of two-vehicle encounters. Although V2I may eventually overcome this limitation, the interim contribution of autonomous active safety systems (in particular AEB) should not be overlooked.

8.8.2 Relationship to the NRSS

Although ITS was mentioned in the NRSS, the rapid changes since 2011 mean that the area needs to be revisited.

8.8.3 Potential Actions

Although it is possible that the major benefits of C-ITS will be realised after the end of this strategy, actions need to be taken now to ensure that Australia is ready to take advantage of the benefits available. It was suggested by one stakeholder that an early announcement of Government policy directions would help car manufacturers line up their development cycles for new model vehicles.

The stakeholder consultation reported that much more effort is needed to research and better understand this area if we are to capitalise on the opportunity and the capability available to Australia.

The NRSS agenda needs to be aligned with the Austroads C-ITS Strategic Plan and ensure that a safety perspective guides major policy positions. Given the potential paradigm shift in traffic management possible with C-ITS, it would be a missed opportunity if solutions were primarily based on traffic efficiency.

There is ongoing Austroads and NTC work in the area but further research efforts are required to understand how safety benefits can be maximised from C-ITS. This includes the development of measurement and assessment tools that are able to quantify safety impacts for ongoing policy development. This research needs to include the interactions between C-ITS and active safety technologies such as AEB and ISA and consider both new vehicle and aftermarket retrofit devices.

8.9 Communication Strategies

8.9.1 Background

Communication of road safety messages is essential in gaining support for road safety initiatives. All jurisdictions face similar challenges in communicating Safe System principles and shifting community perceptions in favour of interventions that will work. The TAC's preparedness to develop single national campaign collateral to promote autonomous emergency braking technology as a consumer preference suggests an approach that could be used to promote greater community understanding of wider system issues, such as travel speed.

8.9.2 Relationship to the NRSS

The "First Steps" agenda contained no coverage of communication approaches for road safety messages, such as the potential afforded by social media.

8.9.3 Potential Actions

The literature review found some innovative and promising communication campaigns reflecting a variety of approaches that could be explored in future actions. Development of resources and guidelines to assist jurisdictions in communication activities could be an action promoted by the NRSS.

8.10 Monitoring Serious Injuries and Crashes

8.10.1 Background

Road safety has long relied upon road death measures as the main outcome indicator. It has been recognised that this provides an incomplete basis for planning and monitoring because initiatives directed to reducing deaths are not necessarily effective at reducing other harm, particularly persisting disability.

Measurement of serious road related injuries is necessary because of the large numbers of cases (with over 30,000 cases admitted to hospital per year), the substantial burden of disability resulting from many of the cases, and the differences in trends and other aspects of the data between road deaths and serious cases. For example, serious injuries are not reducing at the same rate as fatalities and include higher proportions of cyclist and motorcyclist cases.

It is not feasible to provide a succinct prescription and plan for measuring serious road related injuries in Australia. This is because relevant knowledge and methods are developing quickly and the problem has fairly complex trade-offs and substantial uncertainties including cost, the data items required and ethical concerns.

Measurements can be provided, and the most appropriate primary national data source at present is the NHMD. There is potential to improve what is provided now but by how much and by when this improvement can occur depends in large part on the willingness of agencies to specify and agree upon requirements and to invest in projects to put improvements into place.

The Road Safety Committee of the Parliament of Victoria has recently published the report of its extensive investigation into measuring serious road related injuries. The findings and recommendations concerning monitoring of serious injuries are thoughtful and consistent with what is required if consistent, good quality measurement is to be achieved nationally.

As concluded by the Committee, the use of more than one measure of serious consequences of road injuries is both desirable and practicable. Three measures have been identified: all road related cases admitted to hospital, a HHTL subset of the admitted cases and a rating of hospitalised cases in terms of anticipated disability.

A measure based on all hospitalised cases has the advantage of conceptual simplicity, but is not a reliable basis for comparisons between places or over time because factors other than the occurrence of cases such as the availability of hospital beds, changes in treatment, admission practices and counting rules influence the number of admissions.

A measure based on the subset of HHTL cases reduces the concern about reliable comparisons, as these types of cases are likely to be admitted despite the other factors mentioned above. It also focuses attention on cases that are likely to be more severe in terms of persisting adverse effects on health, well-being and functioning, often referred to as disability. However, this measure is not designed to function as a measure of disability.

Estimates of long-term impacts of injuries are intended to summarise disability. Two aspects of disability are particularly important: severity and duration. Measures of this type can be framed in several ways; the most direct method would be to estimate the number of cases whose profile of injury can be expected to result in more than a chosen threshold severity and duration of disability.

Data on all hospitalisations and those providing a threat to life can be provided now, although there is potential to improve both. Measures of ongoing disability require some further development including decisions concerning how best to frame the information for the purpose of road safety.

All three types of measure require collection and preparation of suitable case data. Measures of threat to life and ongoing disability also require sets of special values (weights) that can be applied to the cases and have known associations with the outcomes of interest. Separate studies are required to generate and validate the weights. Once suitable weights are available they can be applied to the case data based on information that can be recorded fairly soon after injury. A major advantage of this approach for disability is that it is not necessary to follow up each case until it has become clear that disability has resolved or stabilised, which may take years in severe cases.

Two characteristics which have become a familiar part of statistics on road deaths are likely to set up expectations that will probably be unhelpful if applied uncritically to measures of serious cases: exact precision and high timeliness.

It is much more difficult, time-consuming and expensive to determine whether a person injured in a road crash was at a particular risk of dying while in hospital, or whether the person has stabilised with a particular degree of disability at, say, two years after the crash, than to determine whether a person injured in a road crash has died within 30 days. Moreover, the number of serious cases is much larger than the number of fatal cases.

The use of weights to predict threat to life or ongoing disability should not be thought of as ways to obtain an exact count of cases, each of which definitely had the specified threshold threat to life or definitely will have some defined severity and duration of disability. Rather, they are methods capable of providing reasonable estimates of specific types of cases.

Obtaining case counts on which to base these measures warrants attention. Counts of serious cases of the three types described here would be very difficult and expensive to obtain except by use of health sector administrative data. Fundamentally, that is because the best practicable basis for grouping cases in ways required for these measures is to use the information on diagnoses that is recorded in the course of delivering care and then systematically summarised and coded as part of hospital record-keeping.

Two types of health sector data source can be considered: routine hospital separations data; and data from specialised trauma services, collected in trauma registers. Both types of source collect data on the hospitalised cases that present a HTTL, but only the former source includes the majority of admitted cases, including those that do not present a HTTL, but may result in non-trivial disability (e.g. many types of limb injuries do not meet the typical selection criteria for trauma registers). Ideally both types of information would be used. However, at present, there is only an established national source for the former. Hence, the recommendation at this time is to concentrate on routine hospital separations data.

The practical limit on timeliness of measures is the time required to obtain coded information from the hospital separations data. A basic consideration is that the relevant hospital administrative system comes into play when a patient has left hospital. While that occurs within a few days for most cases, some severe cases remain in hospital for many months (e.g. complete spinal cord injury at neck level).

Coded case data for public hospital cases are normally compiled by state and territory health agencies within a small number of months after case separation. The national compilation by the AIHW is done on an annual basis, and the most recent file was complete by about ten months after the end of the financial year to which it referred. Much of the time taken to finalise the national file is required to deal with cross-border flows of cases and so does not affect the national data.

A weakness of hospital separations data files in their basic and usual form is that they count episodes of admitted patient care, not injury cases. A seriously injured person may be admitted to one hospital, transferred to another, spend some time there in an intensive care unit, then in an orthopaedic surgery unit, then in a rehabilitation unit. Each of those episodes would result in a separation record. Datasets are not routinely set up so as to allow person-and-case specific data to be derived from separations records.

A further practical consideration is that hospital data is recorded on a financial year basis while road safety data is usually considered by calendar year. This mismatch of reporting periods can introduce further delays into the system.

There has been considerable work in individual states and territories to improve serious injury reporting. Road safety agencies in some jurisdictions (notably New South Wales and Victoria) have established or are establishing arrangements with health agencies to obtain person-linked hospital data, link these data with ‘police’ crash data; and also link these with deaths data. Victorian work is providing a unique basis for developing and applying weights required for measures of severity and longer outcomes of injury. This work includes routine follow-up for two years and measurement of disability of all survivors to discharge who meet the inclusion criteria for the state trauma registry and of fracture cases who are discharged from four hospitals. These capabilities and others (notably established facilities in NSW, WA, SA and the NT for anonymised whole-population data linkage) are world leading. The relevant objective is to make the most of them for the specific purpose of producing reliable measures of serious road- related injuries that are as timely as possible.

8.10.2 Potential Actions

Four actions are proposed which are capable of improving relevant attributes of measures of serious road-related injury in Australia. The first two are specific; they involve minimal cost and can improve timeliness somewhat. The third is capable of improving the validity of case counts. The work required will involve some cost, but the main uncertainty is whether relevant data custodians will provide or enable production of the necessary data. The fourth action is aimed at providing a succinct and detailed specification for monitoring serious road- related injuries in Australia.

- Frame specifications for road -related injury tables and indicators based on the NHMD in terms of periods of hospital separation ending 30 June and 31 December. This would allow reporting of serious road-related injuries in terms of calendar year or financial year and avoid unnecessary omission of data for the latest six months, which occurs if only calendar year reporting is specified (because the NHMD is released annually in years to 30 June).
- Seek approval in advance from state and territory health agencies for the release of jurisdiction-specific tables of road-related injury estimates. A request to state and territory health agencies for prior approval for the release of specified tables of road-related injury data for road safety purposes would, if approved, obviate the need to await approval after table preparation, with an unpredictable period typically of some months.
- Facilitate development of a standard national file of person-linked hospital separations data for road safety purposes. This will enable more reliable national case counts than are provided by the current estimation process. The fundamental requirement is approval by the state and territory health agencies, which might be facilitated by a request from road safety agencies, preferably prepared in consultation with the AIHW. Time and cost to prepare files will depend on the precise nature of what is permitted. The resulting file will be more useful if it is also linked with deaths data; the costing and assessment of feasibility of that extension should be included in the project.
- Support a process of collaboration between states, territories and the Commonwealth, concerning adoption of standards for case inclusion, use of linked data, and methods for deriving and applying weights for HTTL and disabling road-related injury cases. The process will require participation of road safety agencies and health agencies to enable consistent national measurement of serious road-related injury in a way that draws on developments and capabilities in all jurisdictions, and recognises that these differ.

8.11 Infrastructure Investment

8.11.1 Background

The stakeholder consultation revealed support for both increased infrastructure investment and modified targeting of the available funds. There was support for more aggressive investment to address trauma on country roads, and trauma facing vulnerable road users on urban roads; priorities identified by both the analysis of crash data and the literature review and recognised in the “First Steps” agenda.

A common view held by stakeholders was that stronger safety performance could be leveraged from commonwealth infrastructure funding, and that project proposals put forward for funding can be justifiably more focussed on safety improvement. The literature review supported the need for further investment in the safety of the road network and highlighted particular needs on rural roads and to cater for vulnerable road users.

If the total rate of funding remains largely the same, it may be possible to leverage more safety with effective analytical systems. The analytical alignment between AusRAP and ANRAM provides an opportunity to make policy decisions regarding the level of safety to be experienced by road users, similar to the New Zealand decision to set a four-star New Zealand Road Assessment Programme (KiwiRAP) safety rating as a performance criterion for all major road development projects.

8.11.2 Relationship with the NRSS

The “First Steps” agenda included recommendations to increase safety related funding and change the priorities for infrastructure investment. Achievements included a significant long-term commitment to funding from TAC in Victoria, and MAC in South Australia has also made a substantial one-off investment.

The completion of ANRAM to assist in prioritising projects and steps towards introducing WTP values in the economic analysis of potential major projects are also achievements that provide a platform for further gains.

The “Future Steps” agenda is focussed on more specific infrastructure treatments such as facilities to assist cyclists and motorcyclists and low cost treatments on rural roads.

8.11.3 Potential Actions

The “next steps” and “Future Steps” actions are still relevant to the new action plan and a study to establish best safety management practices and processes for prioritising and developing infrastructure projects may be useful in completing some of these actions.

More formal expectations of state and territory investment alignment with the NRSS could be set by linking project identification and development decision making to the state and territory road safety leaders.

There has been support to reset the socioeconomic value used in the appraisal of transport projects to better reflect community demand for road safety through the WTP approach adopted by many countries around the world. The New South Wales WTP measure still represents the most appropriate national measure until a full national study is conducted. It is noted that the Victorian Parliamentary Committee Inquiry into Serious Injury did not support the step towards applying WTP values.

8.12 Coordination with Urban Planning

8.12.1 Background

Although fatal crashes are reducing in urban areas there is still a major problem with serious injury crashes. This is demonstrated by the limited reduction in such injuries shown by the hospital separations data. The planning context within which towns and cities are managed will play an important role in determining the extent to which these injuries are reduced, particularly in relation to encouraging active travel and injuries to vulnerable road users.

A current major research project in this area is being undertaken by MUARC, and the Institute for Road Safety Research (2012b) has stressed the importance of mobility management of reducing car travel by encouraging drivers to use other modes or find alternatives to travelling.

The recent Victorian Parliamentary Inquiry into Serious Injury highlighted the issue of bringing together urban planning and road safety. That committee noted the absence of a link to road safety in city plans and to urban planning in road safety strategies. The report considered active engagement of road safety with planning to be essential in encouraging increased use of active transport modes. The inquiry also endorsed the Organisation for Economic Co-operation and Development (OECD) recommendation that a functional road hierarchy catering for all modes is fundamental to producing a Safe System urban design.

There are clear indications of the need for engagement between safety, transport planning and urban design professionals but there has been limited success in making this happen. The Dutch Sustainable Safety approach has had some success and this is being extended, with regional governments in the Netherlands providing specific resources to make sure this engagement happens with transport policy and urban planning professionals.

8.12.2 Relationship to the NRSS

The “Future Steps” agenda includes an action to engage with urban planners but is mainly concerned with roadside development. Recent literature and the Victorian review suggest that the integration needs to be much wider than this if the community goal of increased active transport is to be achieved safely.

8.12.3 Potential Actions

There is a need for road safety professionals to connect with urban and transport planners to improve the safety and amenity of urban areas. It is recommended that the ASTF commence development of a process to encourage this communication.

8.13 Workplace Road Safety

8.13.1 Background

Work-related road crashes in Australia account for about half of all occupational fatalities. A recent review in South Australia suggested workplace crashes account for at least 6% of all road related fatalities, and workers travelling to and from work account for about another 6%, although the data is unreliable (Mackenzie, Searson and Anderson 2013).

Despite the road being the dominant setting for occupational fatalities, not all government agencies with occupational safety and health responsibilities identify work related road trauma as an occupational safety priority. Safe Work Australia includes work related road trauma in its Notifiable Fatalities Monthly Report. In February it reported, “there were 19 work-related notifiable fatalities during February 2014; 12 workers and 7 bystanders. Of these fatalities, 11 people died as a result of incidents on public roads.” Commuters are excluded from this report series, as are bystander fatalities if the bystander was considered to be at fault. The report notes that changes have been made to include more work related road trauma, and that “nonetheless, the number of deaths may still be under-reported.”

Safe Work Australia identifies road transport as one of seven priority industries. It is likely that a substantial portion of work related road trauma occurs outside of the road transport industry, and across each of the six other priority industries. Employers and fleet managers have a pivotal role in the composition of the vehicle fleet, and influence the safety of very high volumes of trips each day, and so play an important role in the safety of the road transport system as a whole. A recent report from the Transport Research Laboratory in the United Kingdom (Helman et al 2014) suggested a strategy for occupational road safety should be part of any national road safety strategy.

Assistance is available to organisations wishing to improve their road safety record. The NTC has developed the successful NRSPP (NTC 2013), and a new standard for road safety traffic management, ISO 39001, has been released by the International Standards Organisation (ISO 2012). This standard provides a framework for all organisations to understand their capacity to reduce road trauma.

Heavy vehicle transport safety is a major component of the workplace safety issue. The literature review found that fitting heavy vehicles with safety technology to assist drivers, or address behavioural issues such as restraints, alcohol, fatigue and speed, would produce positive cost-benefit results due to the high exposure of heavy vehicles and the high severity of heavy vehicle crashes.

8.13.2 Relationship with the NRSS

Workplace road safety was identified as an issue to be addressed in the way forward for the NRSS but was not specifically included in the First or Future Steps agendas.

An action to generally encourage the adoption of ISO 39001 was included in the “First Steps” agenda, and an Austroads project is being carried out to assist in its implementation.

Actions to encourage the use of new technology in heavy vehicles were included and ABS has been mandated for heavy vehicles from 1 July 2014 and work on ESC is underway.

8.13.3 Potential Actions

Engagement with occupational safety and health agencies is important and could build on the progress of the NRSPP.

There is still an unclear picture of the scale of work-related road trauma. Incorporating purpose of trip data in crash reports could be considered to provide a more complete picture of this significant issue.

Consideration could also be given to the establishment of an investigation capability within the ATSB for heavy vehicle crashes, aimed at identifying system failures rather than assigning individual blame, as is the case with rail transport and aviation investigations.

Safety technology needs to be a sustained focus of national heavy vehicle regulatory activity.

8.14 National Leadership

8.14.1 Background

Internationally, road safety management is a growing focus of attention as various institutions and jurisdictions recognise that the limits to improved road safety performance are, in part, shaped by the capacity of the road safety management system operating in a country. Road safety strategies from Sweden, the Netherlands and the United Kingdom, generally acknowledged as leading road safety countries, all recognise the importance of leadership in achieving road safety gains (Institute for Road Safety Research (SWOV) 2006, Swedish Road Administration 2006, Department for Transport 2011). A report commissioned to support the development of the British strategy (Department for Transport 2009) found that high-level commitment is essential to a successful strategy. The report also concluded that when assessing the success of a strategy “Variation between countries is not the issues they identify but the extent to which the actions are embraced”.

Many of the stakeholders engaged during the course of this review, as well as some members of the ASTF, identified the lack of national road safety leadership as a barrier to the effective implementation of the NRSS. This is the case whether national leadership is considered in terms of the Commonwealth’s capacity to act nationally in its own right, or in terms of the joint national decision making by all States and Territories and the Commonwealth, through the Transport and Infrastructure Council ..

Stakeholders thought that the accountability for road safety is unclear and does not assist the leadership task. The Department of Infrastructure and Regional Development has significant functional responsibilities for vehicle regulation, allocation of road infrastructure funding and collection of national crash data. It engages with state and territory governments through well-established processes, and leads a wider stakeholder engagement group relating to vehicle safety, which has a reporting relationship with national bodies.

There was concern amongst stakeholders about a lack of engagement in the implementation of the NRSS. The Commonwealth initiated the National Road Safety Forum in 2012 as an annual event to engage stakeholders on road safety issues. Outside of the vehicle safety arena, and the activity in individual States and Territories, this appears to be the only standing formal arrangement for engagement with non-government stakeholders.

8.14.2 Relationship to the NRSS

Improvement in institutional structures, capacities and delivery arrangements at a national level was identified as part of the “First Steps” agenda, and the Transport and Infrastructure Council and TISOC governance arrangements have been modified to improve national oversight and coordination of the NRSS and provision of policy advice to Commonwealth, state and territory governments.

The ASTF is responsible for coordinating and monitoring implementation of the NRSS, and is accountable for this through the TISOC and the Transport and Infrastructure Council, which are both chaired by the Commonwealth.

8.14.3 Potential Actions

Addressing national leadership of road safety requires attention to both the national leadership exercised by the Commonwealth in its own right and the national leadership exercised by the Transport and Infrastructure Council. The ASTF could consider a review of governance and management arrangements for road safety to assist subsequent decision-making. Internationally, a common tool for addressing these matters is a road safety management capacity review and this methodology (or aspects of it) would be useful.

Institutional strengthening of the Commonwealth's lead agency function, and Austroads' national safety function, is important. Several stakeholders referred to insufficient funding being allocated to strategic national road safety issues. A review could include consideration of more resources being applied to the Austroads leadership function, and to a senior Commonwealth leadership function with a dedicated safety mandate.

Many of the non-government stakeholders referred to a lack of engagement on the national road safety issue. Consideration could be given to establishing and formalising a strong stakeholder engagement process.

9. Recommendations

In addition to the priority areas the review also identified a number of broader issues for consideration in the development of a new action plan. These issues were raised in the consultation with the ASTF members and the wider group of stakeholders and also during the assessment of the extent of implementation of the First Steps agenda. Recommendations to address these issues are listed below:

1. The “Future Steps” agenda included in the current strategy covers 26 items most of which were supported by one or more components of the strategy review. We recommend that the priority areas identified by this review be considered with the current “Future Steps” agenda when developing the next NRSS Action Plan. We also recommend that the next action plan allows for the ongoing activity required for some of the items identified in the “First Steps” agenda. Brief reviews of the First and Future Steps agendas are provided as Appendix K and Appendix L.
2. The “Future Steps” are currently framed in a similar manner to the “First Steps” agenda so, whilst addressing important road safety issues, they do not make clear the details of the actions required. For some items the implementation process is clear, others require the development of an implementation plan, often with extensive consultation, whilst others require additional research and development. We recommend that a clear statement of implementation and parameters of success for each identified action be included in the next action plan.
3. The First and Future Steps agendas include actions that are the responsibility of the Commonwealth, the Transport and Infrastructure Council, Austroads or individual States and Territories. Stakeholders reported that they found this confusing and a barrier to their engagement with the strategy. We recommend that the next Action Plan clearly delineate the responsibility for each action.
4. The NRSS and the First and Future Steps agendas include a differentiation between Responsible and Irresponsible road use. We are concerned that this distinction perpetuates the “blame the driver” attitude still common in the media and the community. The negative consequences of such attitudes are clearly defined in the recent book “Eliminating Serious Injury and Death from Road Transport” by Johnston, Muir and Howard (Johnston et al 2014). The Safe System philosophy is to provide a safe road transport system that both protects and controls the behaviours of road users. We therefore recommend that the next action plan does not include the separation of responsible and irresponsible in the road user section.
5. Many of the stakeholders interviewed felt isolated from the strategy implementation and management and felt there was a lack of transparency in these functions. We recommend that the new action plan include a well-defined method for engaging with other government and non-government agencies in the ongoing implementation of the strategy.
6. There is a clear need to understand what is happening at all severity levels of road related injury. Serious injuries account for a large part of the cost of road trauma and the hospital data demonstrates that crash patterns and trends are different for fatal and serious crashes. We recommend that the new action plan place a high priority on developing a method for monitoring serious injuries and that any action build on the outcomes of the Victorian Parliamentary Inquiry.
7. It is important to the ongoing implementation and direction of the strategy to understand how gains have been achieved and what can be expected from different countermeasures in the future. Various methods to model the impacts of countermeasures can be used. Recent developments from CASR, MUARC and the Swedish Transport Administration provide new approaches that could be considered for future modelling in addition to the MUARC METS model that was initially used to contribute to the strategy. A description of the recent CASR modelling is provided in Appendix M.
8. Although the strategy outlines the main priorities and activities until 2020, it also acknowledges that ongoing research and development is required to identify new areas or changes in crash patterns, identify gaps in data and evaluate programs as they are implemented. Research and development is also important in sustaining the national capacity in road safety and extending the understanding of Safe System principles and implementation to policy makers, practitioners and the wider community.

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Appendix A Data Sources

The data sources used in the review include the following. Some of these sources provide state-based data and some provide only summaries at the national level.

Fatal Crashes and Fatalities

- Australian Road Deaths Database 2005-13 - Provided by the Bureau of Infrastructure, Transport and Regional Economics (BITRE)
- National Crash Database 2008-12 - Provided by BITRE

Injuries

- National Crash Database 2008-12 - Provided by BITRE
- AIHW National Hospital Morbidity Database 2001-10

Vehicle Safety

- Average Age of the Vehicle Fleet - Australian Motor Vehicle Census 2008-13
- Vehicle Sales - Key Automotive Statistics 2004-12
- Vehicle Safety Reports - Polk ANCAP Ratings 2008-13
- Vehicle Safety Report - Polk Safety Features 2005-13

Travel Speeds

- Speed Surveys WA 2000-12 - Provided by Main Roads WA
- Speed Surveys SA 2002-13 – Provided by the SA Department of Planning, Transport & Infrastructure

Exposure

- Vehicle Kilometres Travelled Database 2005-12 - Provided by BITRE
- Vehicle Registrations 2005-13 - Provided by BITRE
- Population by State 2005-13 - Provided by BITRE

Other Documents

- Search of published literature
- NRSS Implementation Status Reports 2012 and 2013
- State strategies and action plans
- Unpublished reports provided by ASTF members
- Search of changes to state legislation and regulation
- Changes to black spot, road safety and general road infrastructure spending from various websites and press releases

Consultation

- Consultation with members of the ASTF
- Consultation with a wider group of government and non-government stakeholders.

Appendix B Questions for Initial Consultation with Jurisdictional Members of the Austroads Task Force

1. What do you think have been the three major initiatives implemented in your jurisdiction since 2011?
2. What do you consider to be the three major road safety achievements at the national level since 2011?
3. What role has national leadership or cooperation played in these achievements?
4. What is your impression of the acceptance of Safe System principles at different levels of your organisation and in your partner agencies?
5. What, if any, changes have been made to methods of monitoring crashes, injuries and related behaviours since 2011?
6. Open question to allow discussion of other items nominated by the ASTF.

Appendix C Questions for Consultation with Stakeholder Groups

1. How does your organisation contribute to road safety? Can you nominate any initiatives undertaken by your organisation towards improving road safety since 2011?
2. What do you consider to be the three major road safety achievements at the national level since 2011?
3. Who are your key road safety partners?
4. Are you familiar with the Safe System framework for road safety? If so, what is your impression of the acceptance of Safe System principles within your organisation and amongst your road safety partners?
5. What road safety issues, if any, do you think need to be addressed at the national level?
6. What barriers, if any, do you think exist to addressing these issues?
7. Open question to allow discussion of other items nominated by the participants.

Appendix D Stakeholder Groups

Amy Gillett Foundation

ANCAP Australasia Pty Ltd

Australasian College of Road Safety

Australian Automobile Association

Australian Bicycle Council

Australian Logistics Council (invitation declined)

Australian Motorcycle Council

Australia New Zealand Policing Advisory Association

Australian Trucking Association

Federal Chamber of Automotive Industries

Local Government Association of New South Wales

Motor Accident Commission

National Transport Commission

Pedestrian Council of Australia

Transport Accident Commission

Royal Australasian College of Surgeons

Road Safety Education Reference Group

Appendix E Performance Indicators

The following tables show the agreed performance indicators used to monitor the progress of the NRSS. Results for the main performance indicators to 2012 were included in the Implementation Status Report published by the Transport and Infrastructure Council in 2013 and where possible these have been continued to include results for 2013. Values shown in red are additions to the table in the 2013 report. Where data from the BITRE annual report (2013) and the Implementation Status Report (November 2013) differ, the annual report numbers are displayed.

Measure	2008-10	2012	2013
High Level Outcome Measure			
Number of deaths from road crashes	1,426	1,299	1,193
Number of crashes resulting in death	1,297	1,189	1,106
Number of deaths per 100,000 population	6.6	5.7	5.2
Number of deaths per 100 million vehicle kilometres travelled	0.65	0.56	0.56
Number of deaths per 10,000 registered vehicles	0.91	0.76	
Number of vehicle occupant deaths per 10,000 registered motor vehicles	0.65	0.54	0.47
Number of motorcyclist deaths per 10,000 registered motorcycles	3.77	3.14	2.86
Safe Roads			
Number of deaths from head-on crashes	272	270	
Number of deaths from single-vehicle crashes	651	556	558
Number of fatal single vehicle crashes	609	520	523
Number of deaths from intersection crashes	301	288	
Number of deaths from multiple vehicle crashes	584	573	477
Number of fatal multiple vehicle crashes	508	503	428
Number of deaths from crashes occurring on:			
• metropolitan roads	492	450	
• regional roads	787	733	
• remote roads	135	103	
Safe Speeds			
Number of deaths from crashes where vehicle speed was a contributory factor	Unknown		
Speeds at designated sites across the network (WA and SA)			
Western Australia			
WA Metro Mean free speed (2010 and 2012)			
• 60 km/h sites	58.4[1]	58.2	
• 80 km/h site	77.9[1]	76.6	
WA Rural Mean free speed (2009 and 2012)			
• 100 km/h	98.2[2]	89.3	
• 110 km/h	102.3[2]	102.5	
Percentage of vehicles speeding			
WA Metro (2010 and 2012)			
• 60 km/h	46.6[1]	44.3	
• 80 km/h	39.9[1]	34.8	
WA Rural (2009 and 2012)			
• 100 km/h	43.3[2]	17.1	
• 110 km/h	30.3[2]	33.7	
Percentage of vehicles >10km/h above speed limit			

Measure	2008-10	2012	2013
WA Metro (2010 and 2012)			
• 60 km/h	7.1[1]	5.4	
• 80 km/h	5.7[1]	4.3	
WA Rural (2009 and 2012)			
• 100 km/h	12.3[2]	3.8	
• 110 km/h	5.6[2]	6.8	
South Australia (2010, 2012 and 2013)			
SA Metro Mean free speed			
• 50 km/h Collectors	49.7	49.3	48.9
• 60 km/h sites	56.1	56.2	55.6
SA Rural Mean free speed			
• 100 km/h	97.1	96.8	97.4
• 110 km/h	103.2	102.2	102.4
Percentage of vehicles speeding			
SA Metro			
• 50 km/h Collectors	50.6	48.6	45.6
• 60 km/h	26.5	24.5	18.7
• SA Rural			
• 100 km/h	42.3	39.4	42.5
• 110 km/h	28.4	21.6	22.7
Percentage of vehicles >10 km/h above speed limit			
SA Metro			
• 50 km/h Collectors	7.5	6.5	5.7
• 60 km/h	1.2	1.0	0.7
SA Rural			
• 100 km/h	9.4	8.2	8.7
• 110 km/h	3.8	2.9	2.9
Safe Vehicles			
Average age of the Australian vehicle fleet	9.96[3]	10.0	10
Percentage of new vehicles sold with a 5-star ANCAP rating	40.3[3]	56.7	65.0
Percentage of new passenger vehicles sold with a 5-star ANCAP rating	49.5[3]	75.6	80.2
Percentage of new commercial vehicles sold with a 5-star ANCAP rating	4.2[3]	28.1	31.1
Percentage of new vehicles sold with key safety features			
• ESC	57.2	88.7	93.0
• Pre-collision safety system	1.3	2.5	5.2
Safe People - responsible road use			
Number of young driver and motorcycle rider deaths	222	175	
Number of deaths from crashes involving a young driver or motorcycle rider (aged 17-25 years)	469	382	
Number of older driver and motorcycle rider deaths	114	121	
Number of deaths from crashes involving an older driver or motorcycle rider (aged 65+ years)	207	226	
Number of young road user deaths (17-25)	358	284	229
Number of older road user deaths (over 65)	225	245	276
Number of motorcyclist deaths	234	199	213
Number of bicyclist deaths	32	33	50
Number of pedestrian deaths	186	174	157

Measure	2008-10	2012	2013
Number of deaths from crashes involving a heavy vehicle	252	266	193
Number of fatal crashes involving a heavy vehicle	234	208	196
Safe People - irresponsible road use			
Number of drivers and motorcycle riders killed who had a blood alcohol concentration (BAC) above the legal limit	186	130	
Number of deaths from crashes involving a driver or motorcycle rider killed who had a blood alcohol concentration (BAC) above the legal limit	263	170	
Number of deaths from crashes involving an unlicensed driver or motorcycle rider	174	152	
Number of vehicle occupants killed who were not wearing a restraint	216	154	

[1] Data displayed is 2010, not the average of 2008-2010

[2] Data displayed is 2009, not the average of 2008-2010

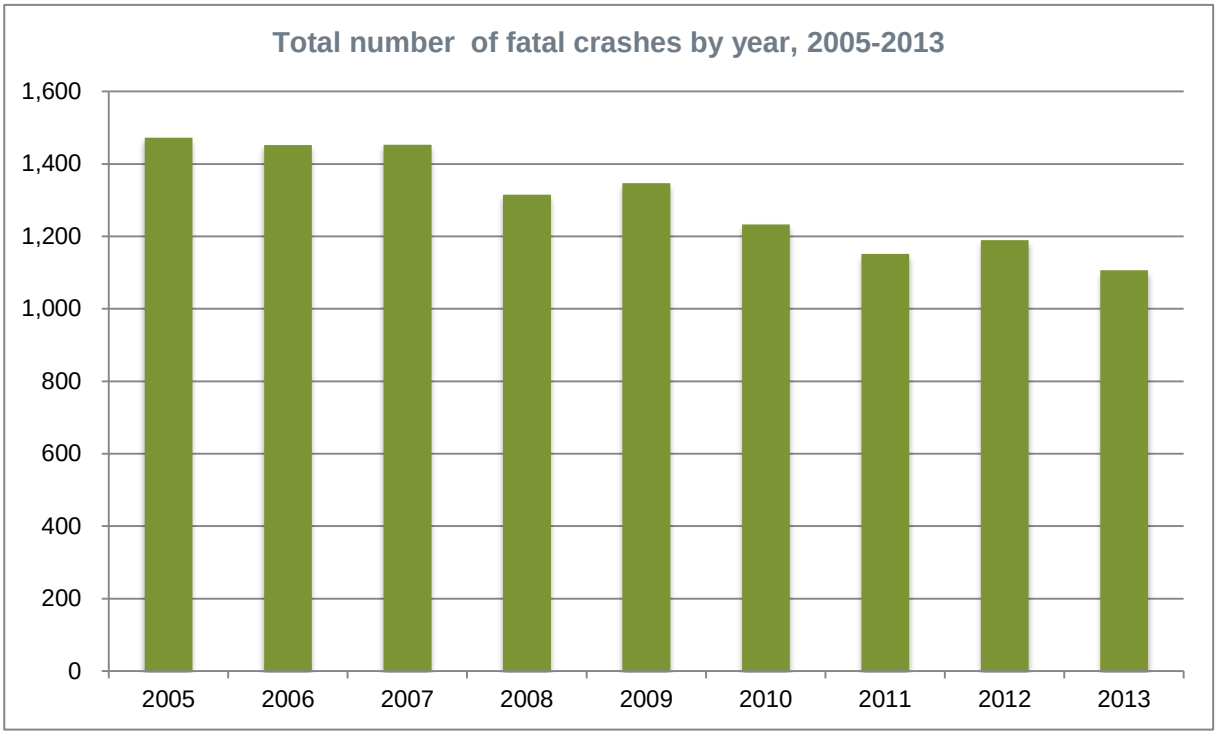
[3] Data displayed is 2010, not the average of 2008 – 2010.

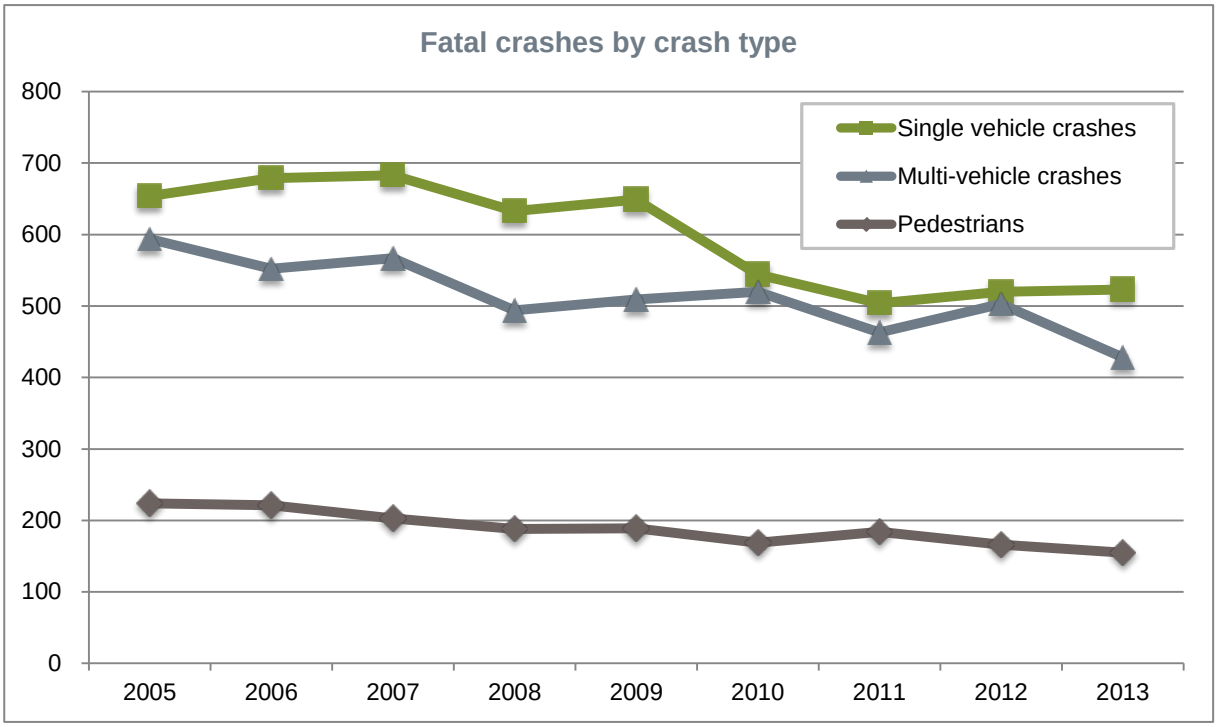
Sources:

- Road Deaths Annual Summary 2013 (BITRE)
- National Road Safety Strategy progress report (Implementation Status Report) November 2013
- Australian Road Deaths Database 2005-13 - Provided by the Bureau of Infrastructure, Transport and Regional Economics (BITRE)
- National Crash Database 2008-12 - Provided by BITRE
- Average Age of the Vehicle Fleet - Australian Motor Vehicle Census 2008-13
- Vehicle Sales - Key Automotive Statistics 2004-12
- Vehicle Safety Reports - Polk ANCAP Ratings 2008-13
- Vehicle Safety Report - Polk Safety Features 2005-13
- Speed Surveys SA 2002-13 – Provided by the SA Department of Planning, Transport & Infrastructure
- Radalj T. & Sultana S, Trends in driver speed behaviours on Perth metropolitan road network 2000 to 2012, Main Roads Western Australia, 2012.
- Radalj T. & Sultana S, Trends in driver speed behaviours on Western Australian Rural Road Network 2000 to 2012, Main Roads Western Australia, 2012.

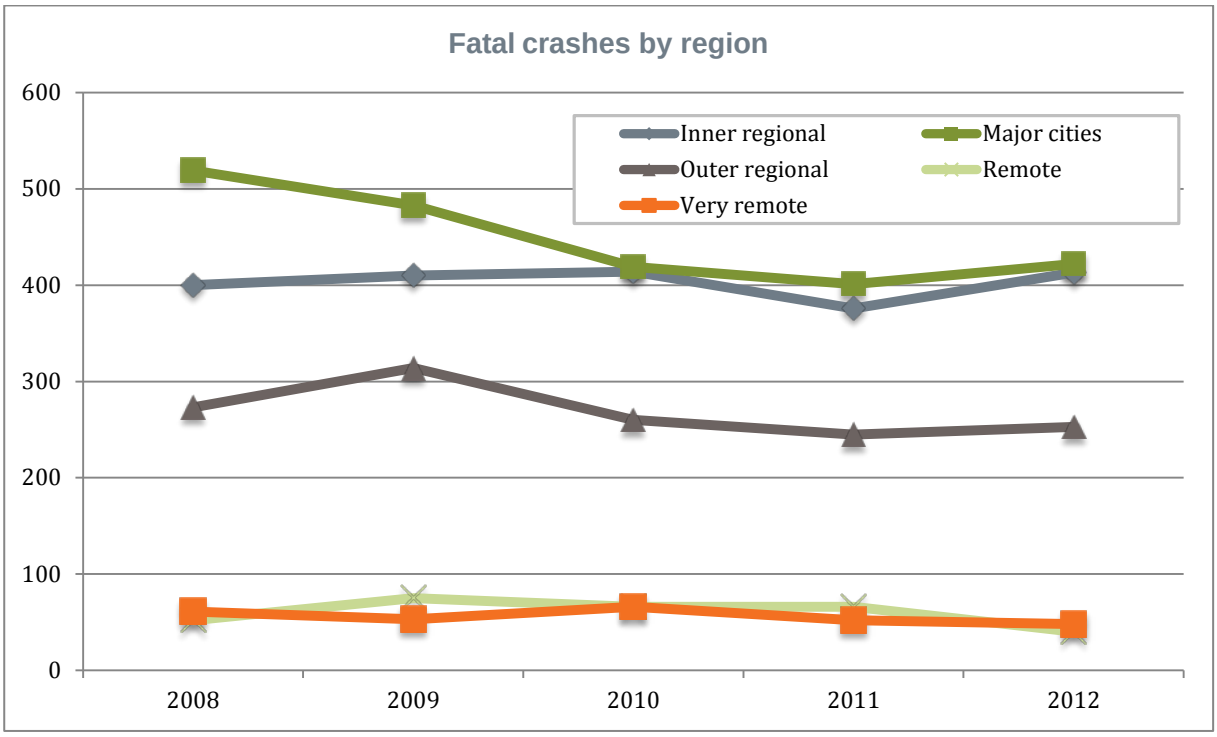
Appendix F Fatal and Injury Crash Data

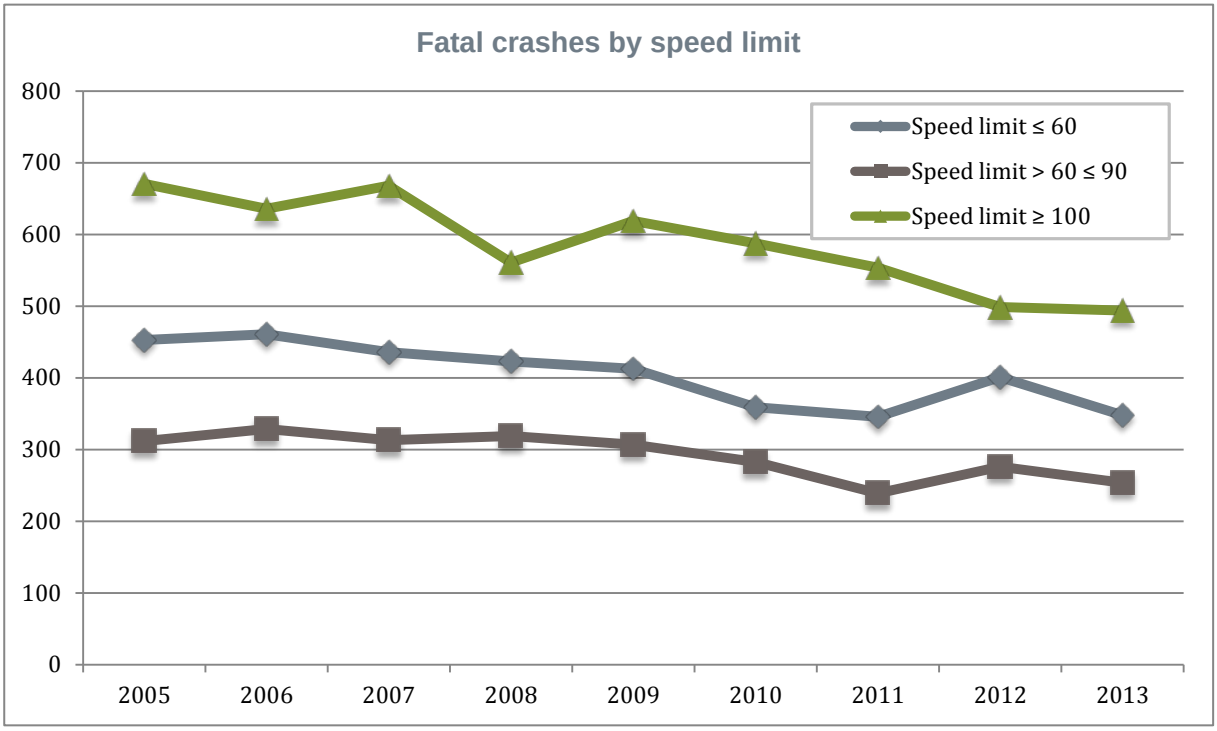
F.1 Fatality Data

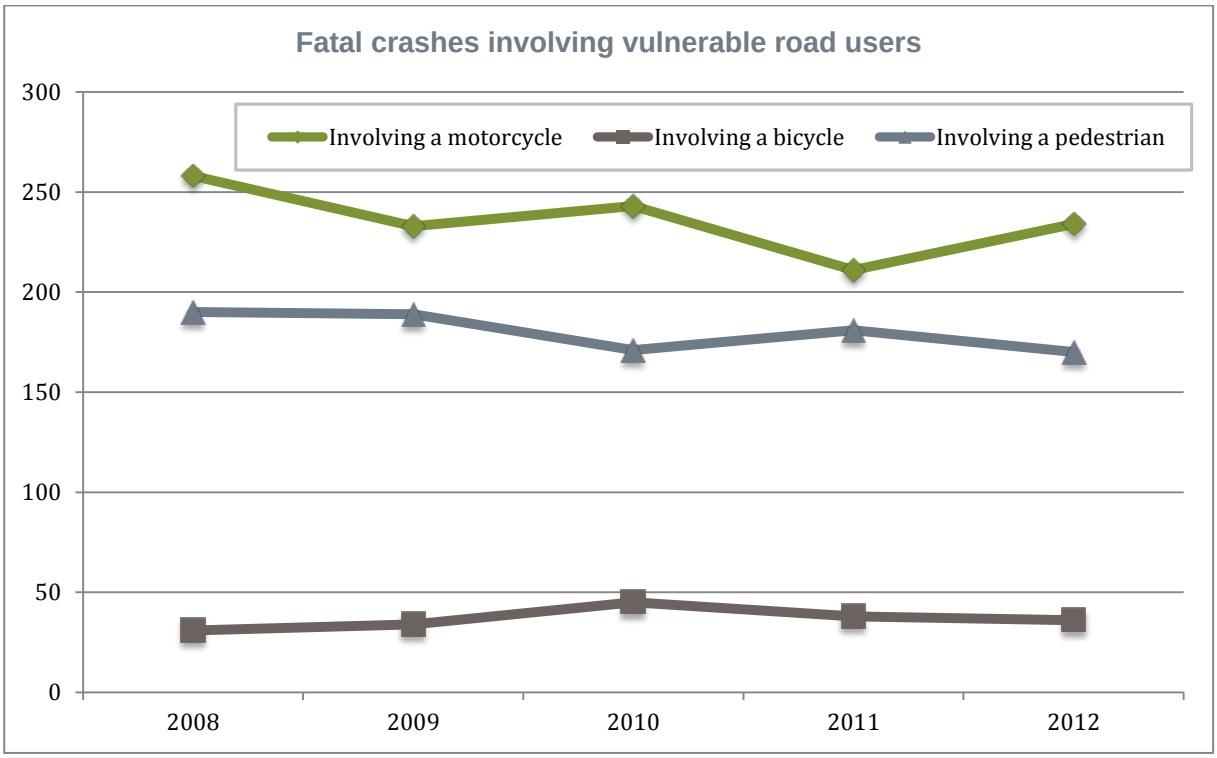


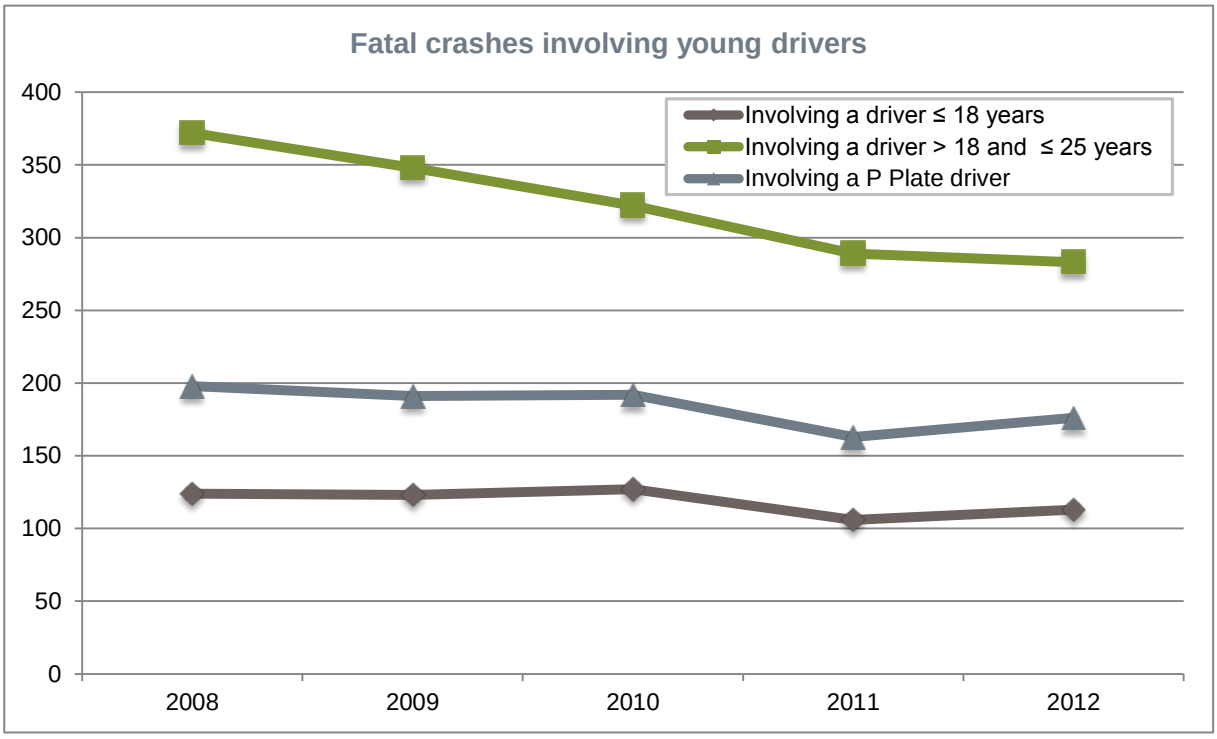


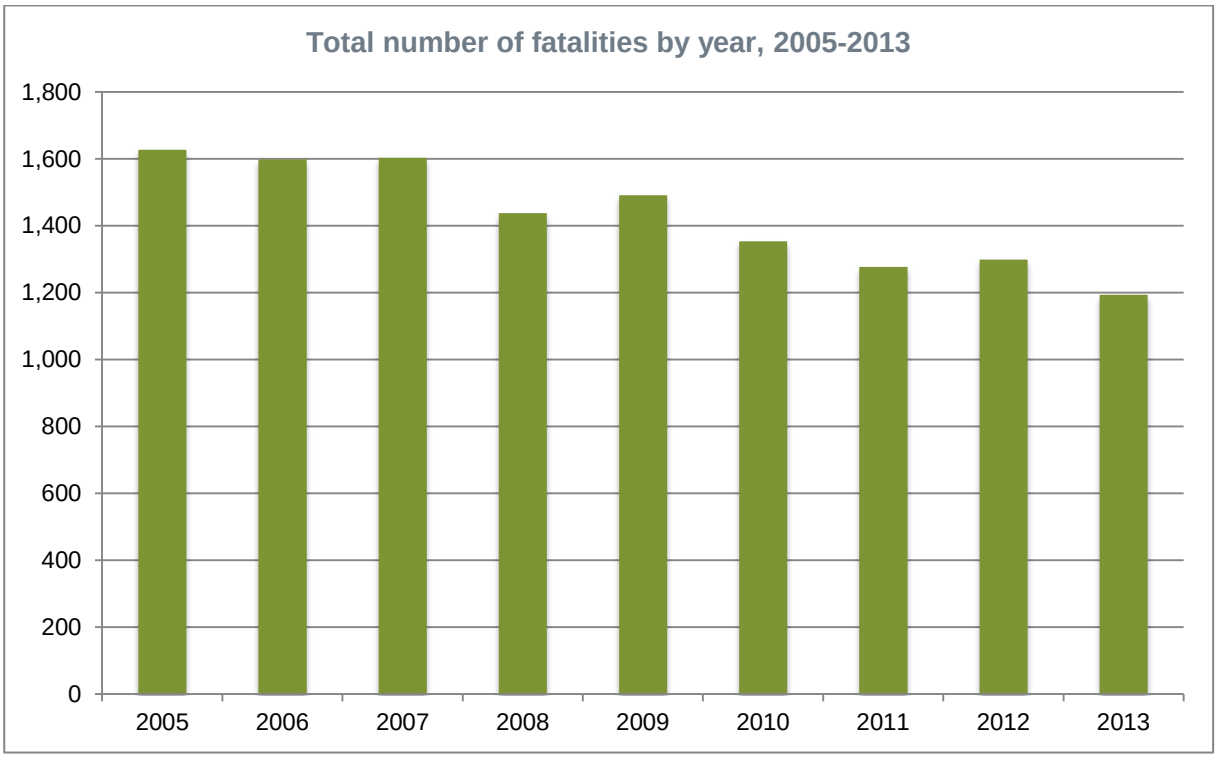
Note that BITRE use 'Single' and 'Multiple' to refer to the number of vehicles involved in a fatal crash where there is no pedestrian killed.

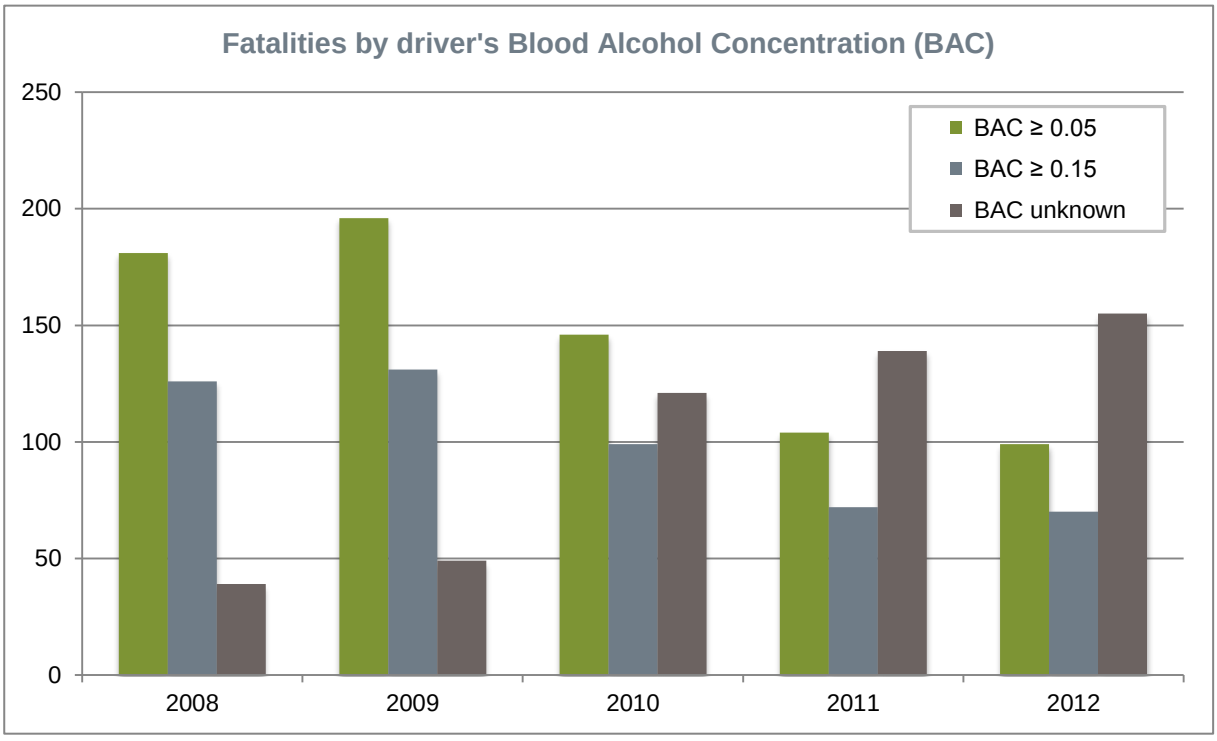

Fatal crashes by region
600
500
400
300
200
100
0
2008
2009
2010
2011
2012
Inner regional
Major cities
Outer regional
Remote
Very remote

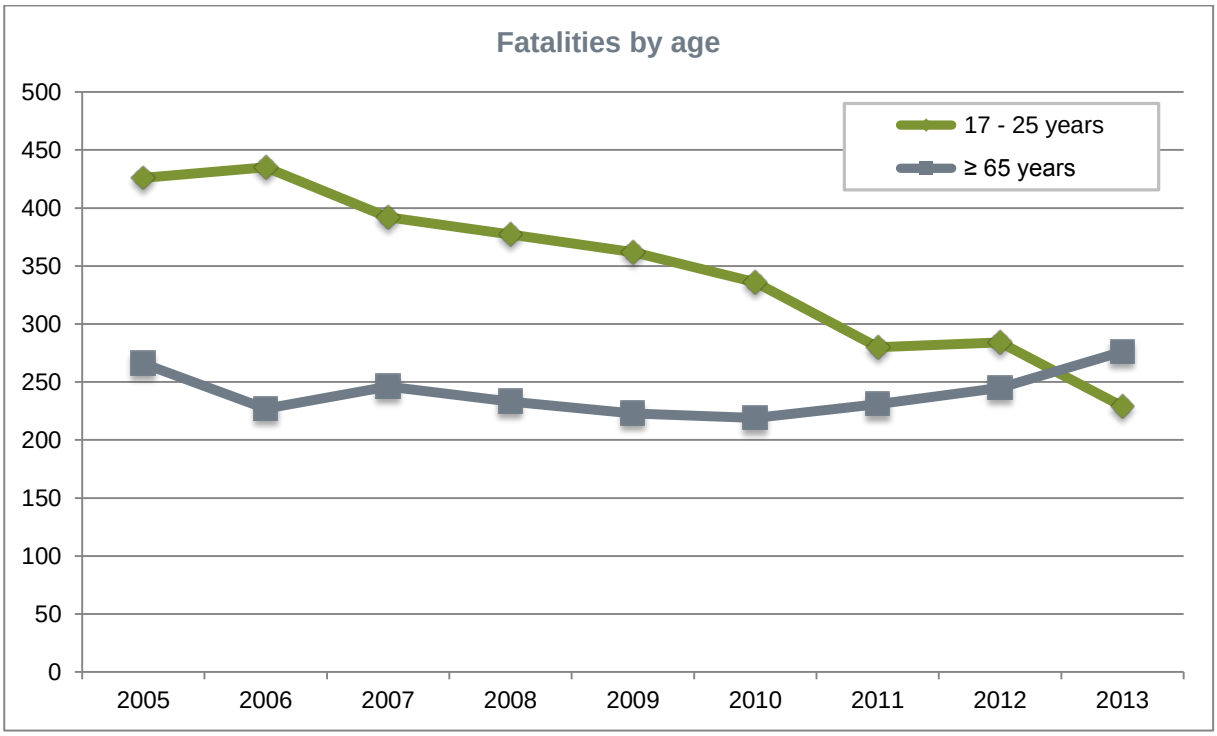

Fatal crashes by speed limit
800
700
600
500
400
300
200
100
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
Speed limit ≤ 60
Speed limit > 60 ≤ 90
Speed limit ≥ 100

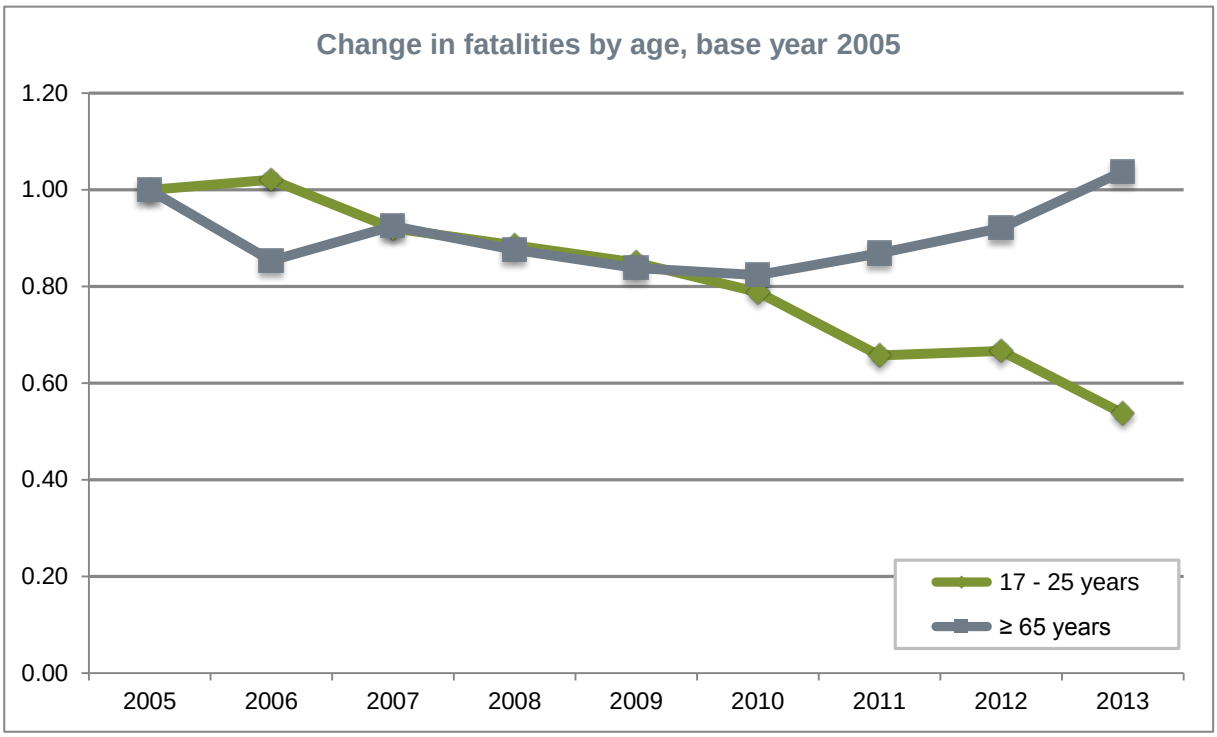

Fatal crashes involving vulnerable road users
300
250
200
150
100
50
0
Involving a motorcycle
Involving a bicycle
Involving a pedestrian
2008
2009
2010
2011
2012

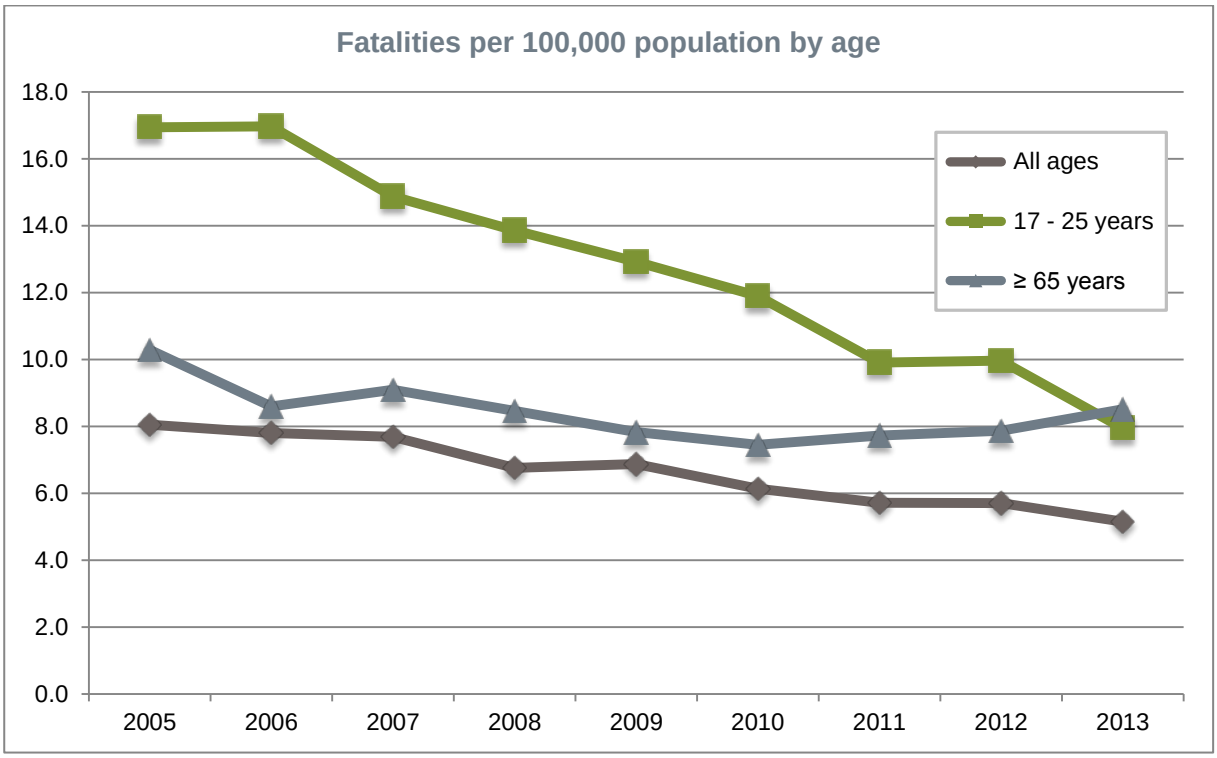

Fatal crashes involving young drivers
400
350
300
250
200
150
100
50
0
Involving a driver ≤ 18 years
Involving a driver > 18 and ≤ 25 years
Involving a P Plate driver
2008
2009
2010
2011
2012

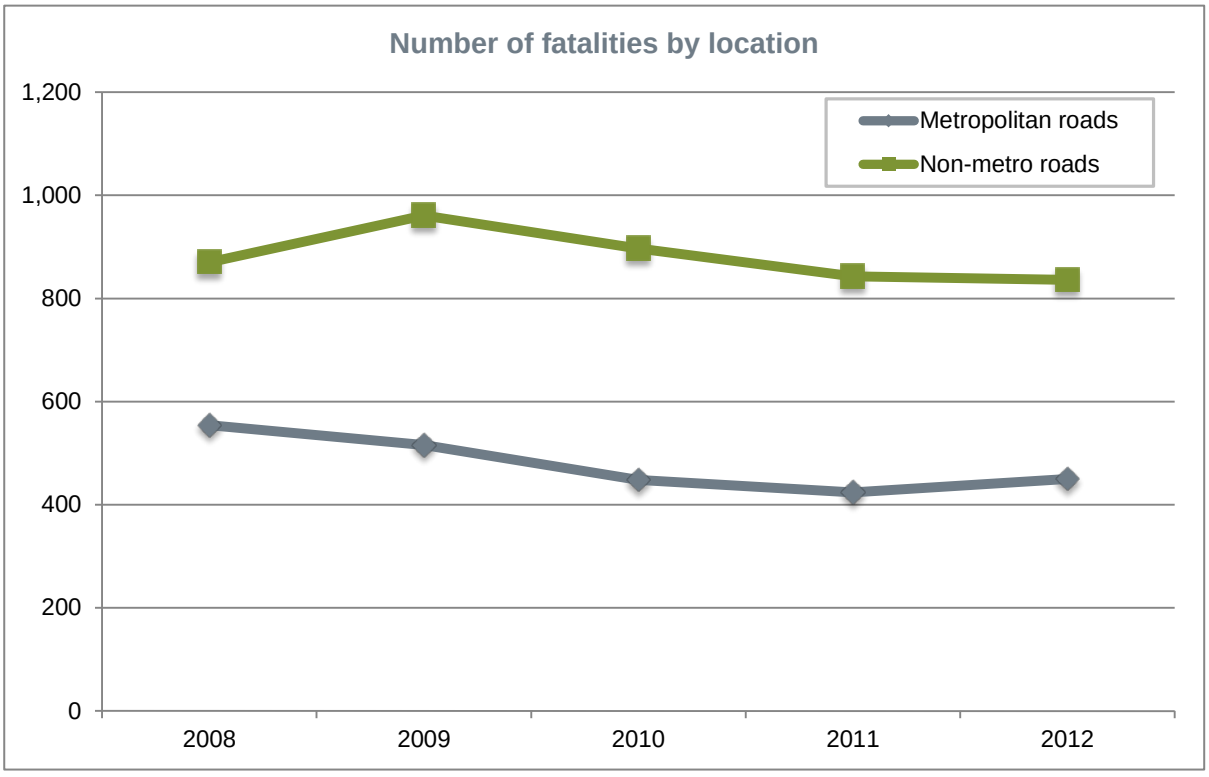

Total number of fatalities by year, 2005-2013
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2005
2006
2007
2008
2009
2010
2011
2012
2013

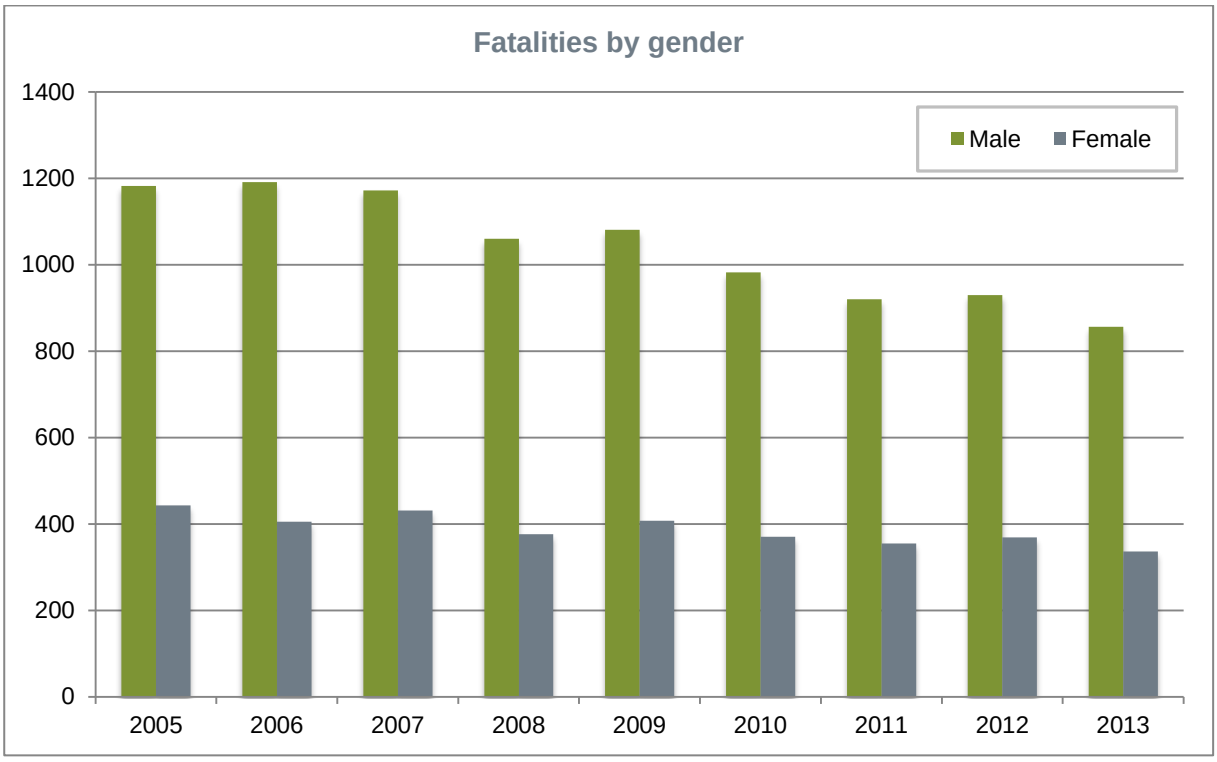

Fatalities by driver's Blood Alcohol Concentration (BAC)
250
200
150
100
50
0
BAC ≥ 0.05
BAC ≥ 0.15
BAC unknown
2008
2009
2010
2011
2012

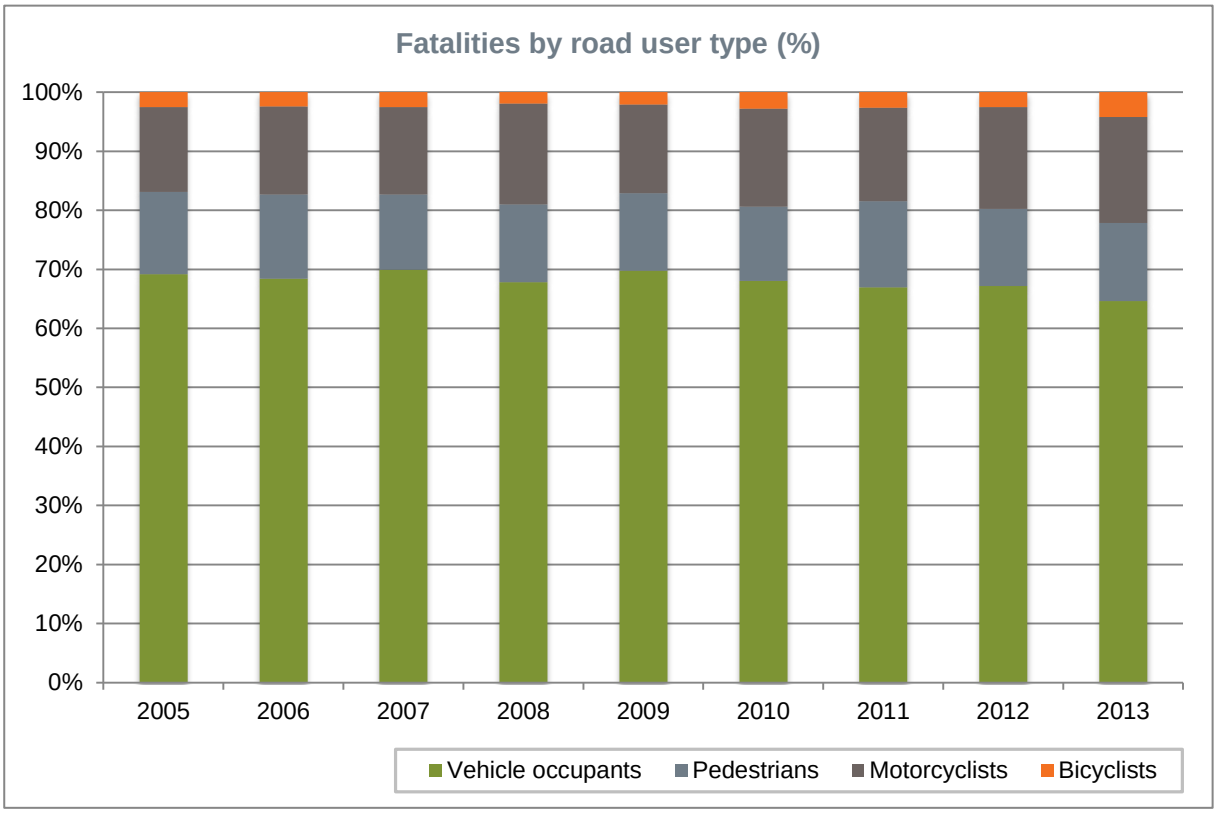

Fatalities by age
500
450
400
350
300
250
200
150
100
50
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
17 - 25 years
≥ 65 years

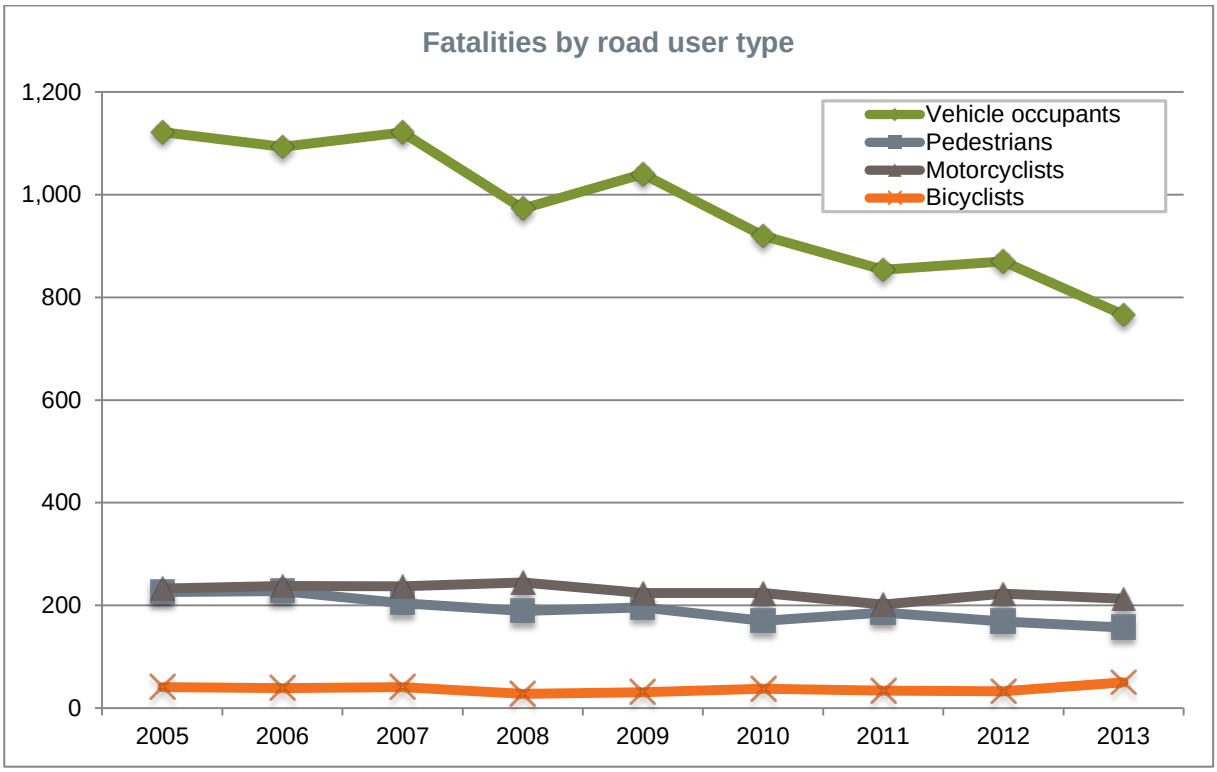

Change in fatalities by age, base year 2005
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2005
2006
2007
2008
2009
2010
2011
2012
2013
17 - 25 years
≥ 65 years

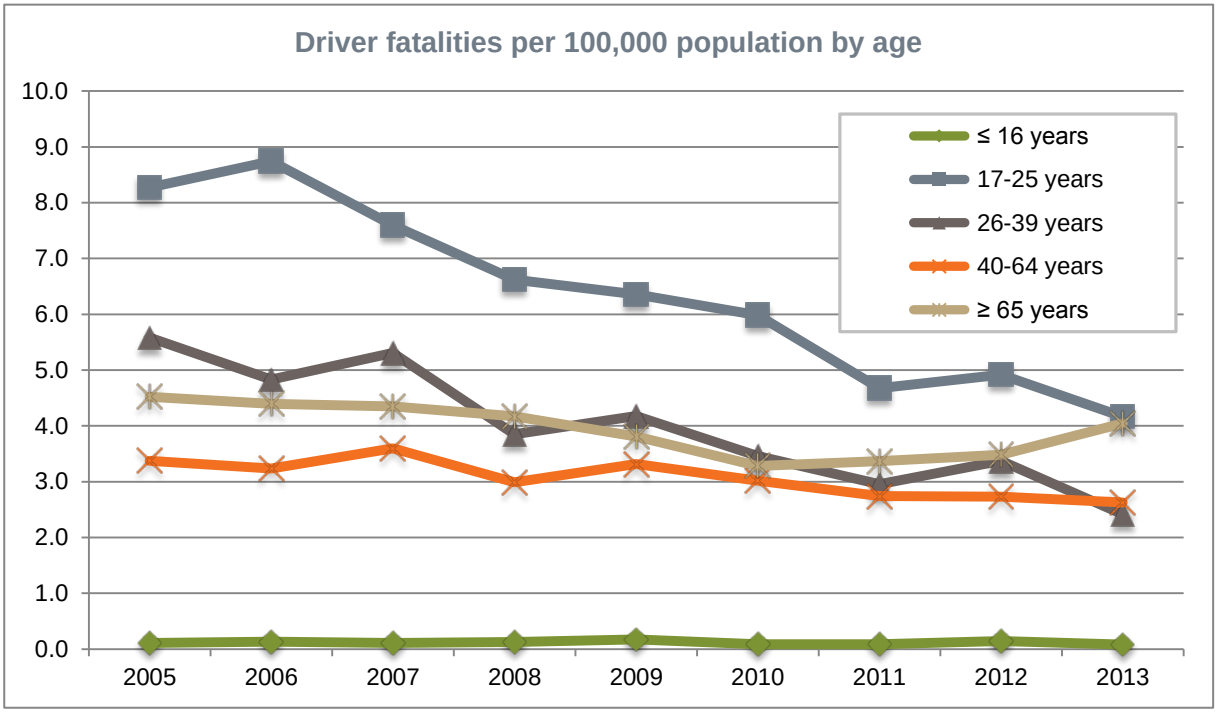

Fatalities per 100,000 population by age
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2005
2006
2007
2008
2009
2010
2011
2012
2013
All ages
17 - 25 years
≥ 65 years

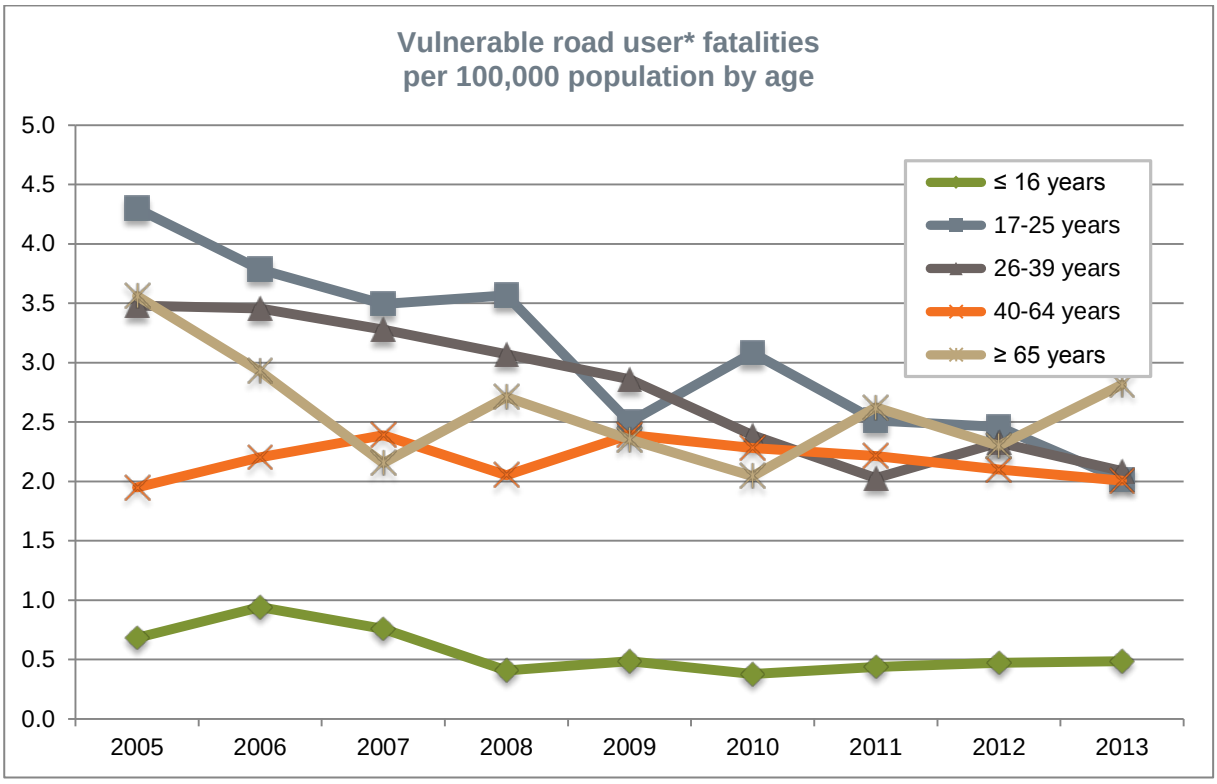

Number of fatalities by location
1,200
1,000
800
600
400
200
0
2008
2009
2010
2011
2012
Metropolitan roads
Non-metro roads


Fatalities by gender
1400
1200
1000
800
600
400
200
0
Male
Female
2005
2006
2007
2008
2009
2010
2011
2012
2013

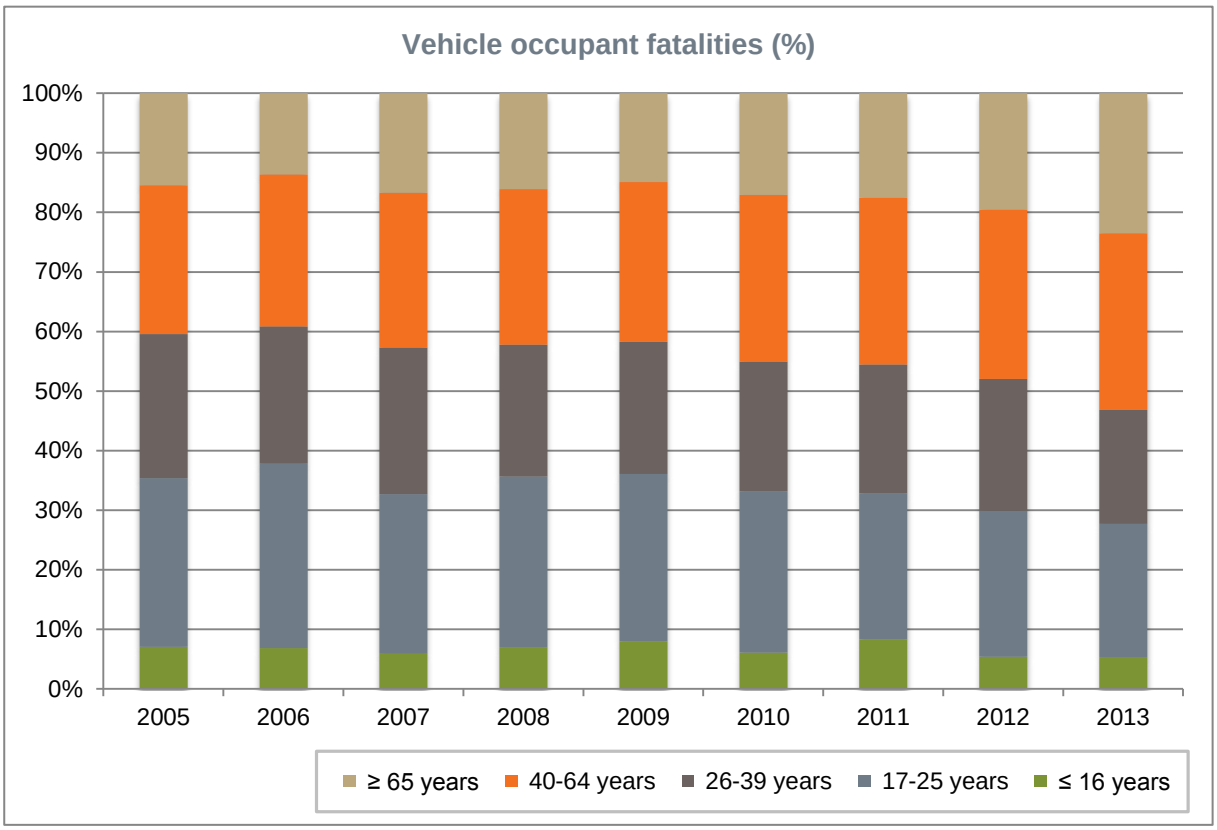

Fatalities by road user type (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2005
2006
2007
2008
2009
2010
2011
2012
2013
Vehicle occupants
Pedestrians
Motorcyclists
Bicyclists

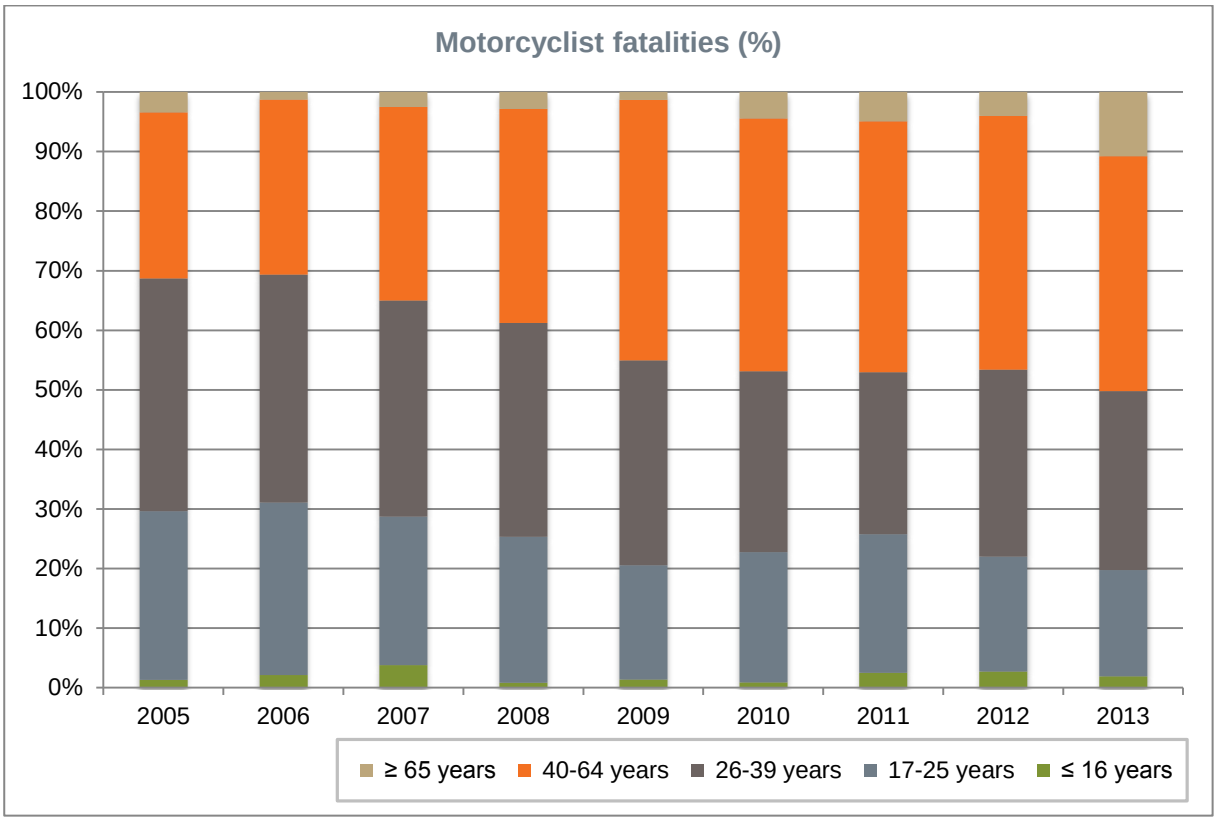

Fatalities by road user type
1,200
1,000
800
600
400
200
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
Vehicle occupants
Pedestrians
Motorcyclists
Bicyclists

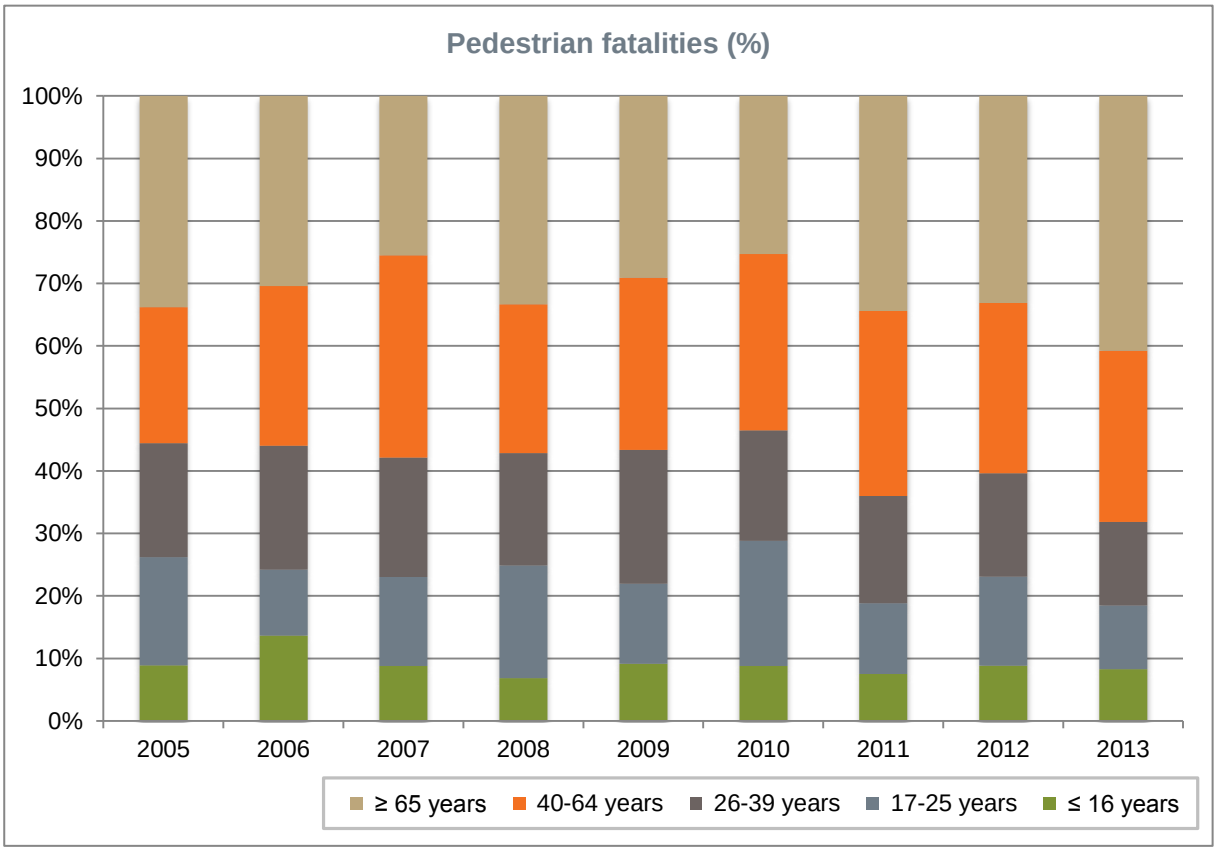

Driver fatalities per 100,000 population by age
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2005
2006
2007
2008
2009
2010
2011
2012
2013
≤ 16 years
17-25 years
26-39 years
40-64 years
≥ 65 years

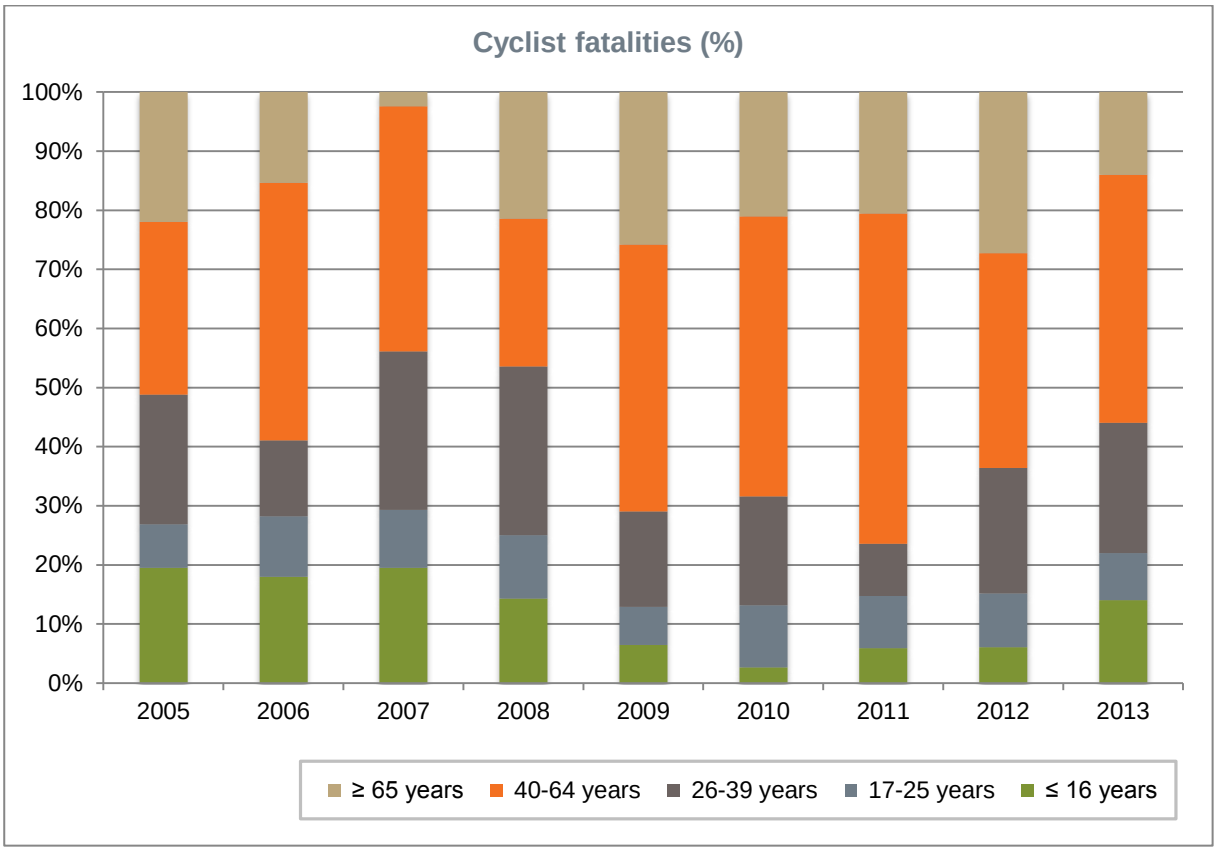


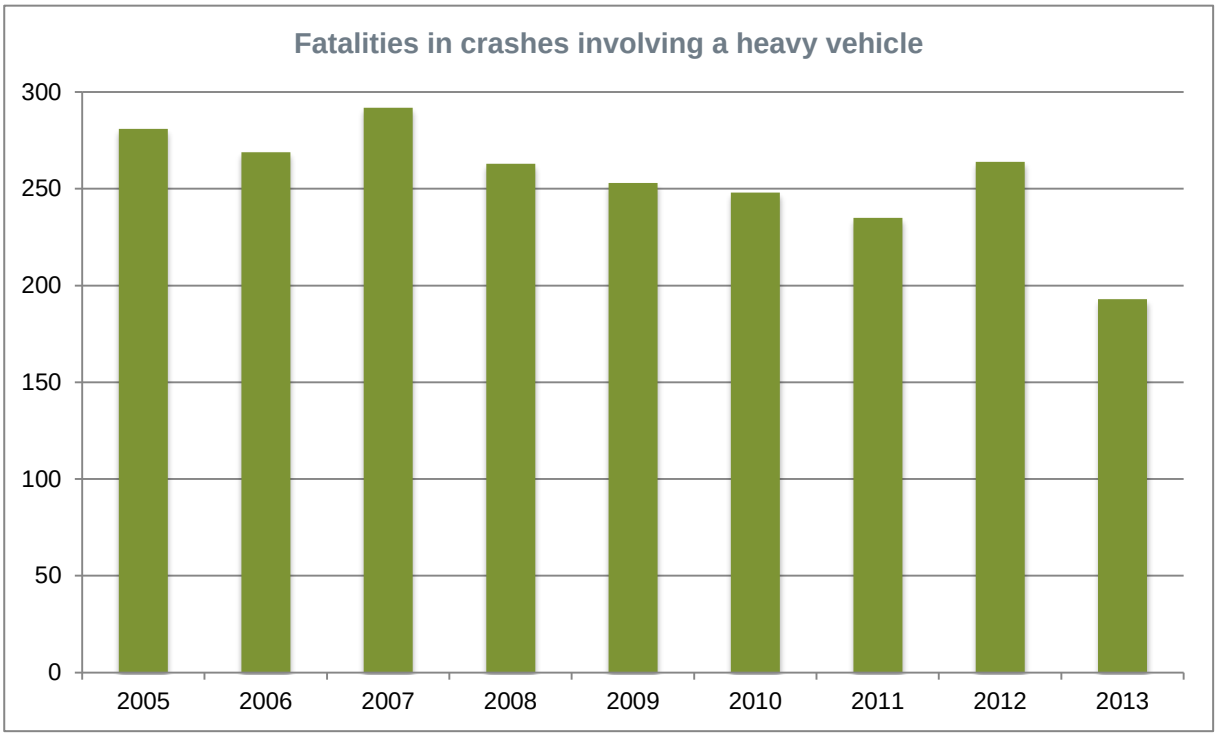
** Includes pedestrians, cyclists and motorcyclists.*

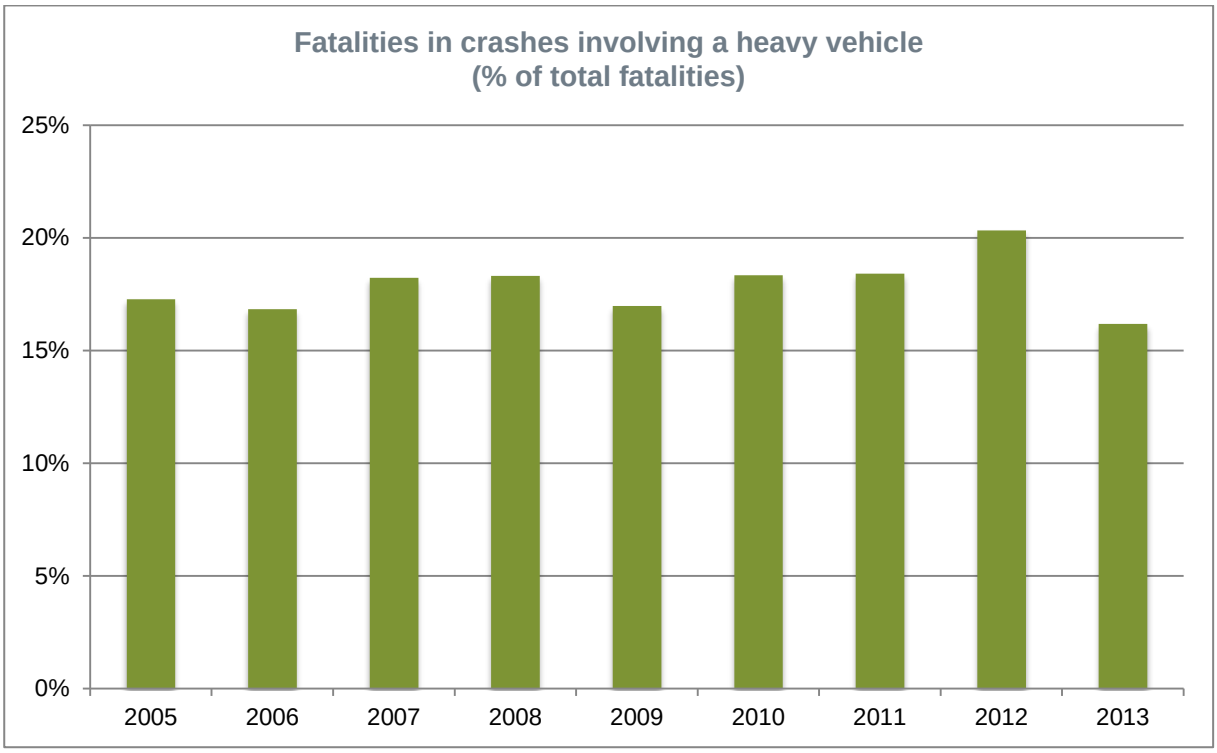


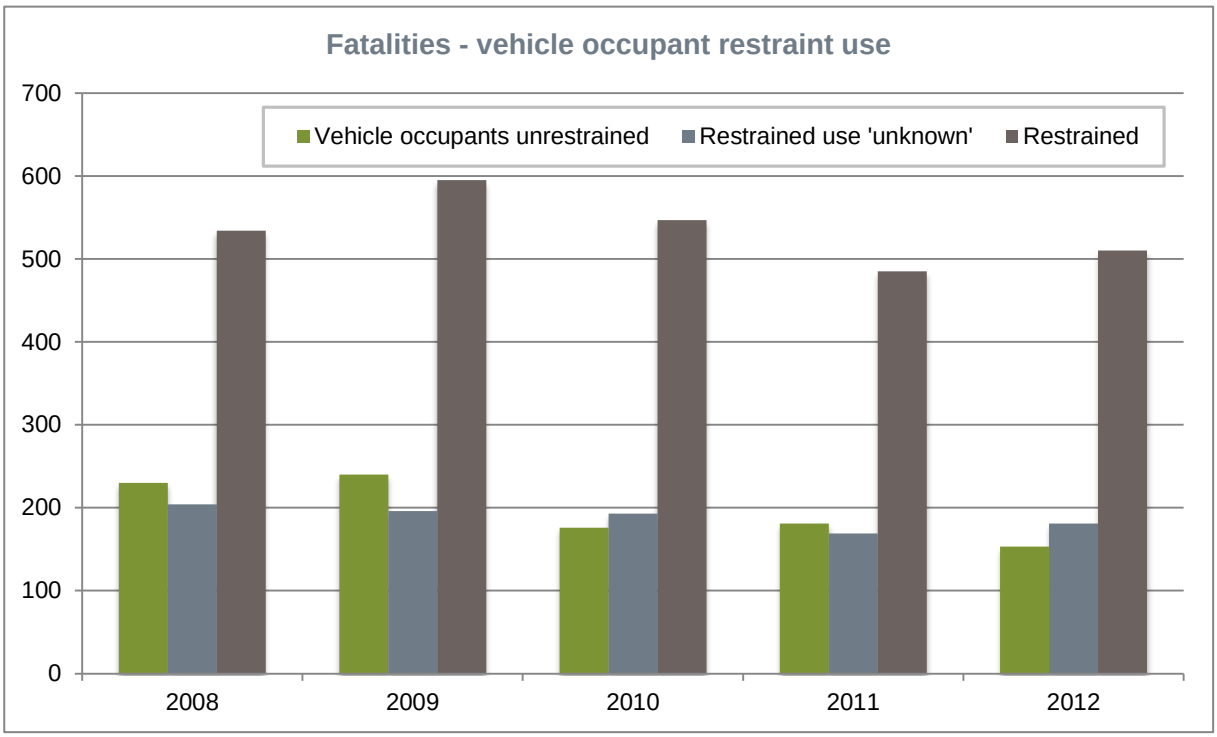

Motorcyclist fatalities (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2005
2006
2007
2008
2009
2010
2011
2012
2013
≥ 65 years
40-64 years
26-39 years
17-25 years
≤ 16 years

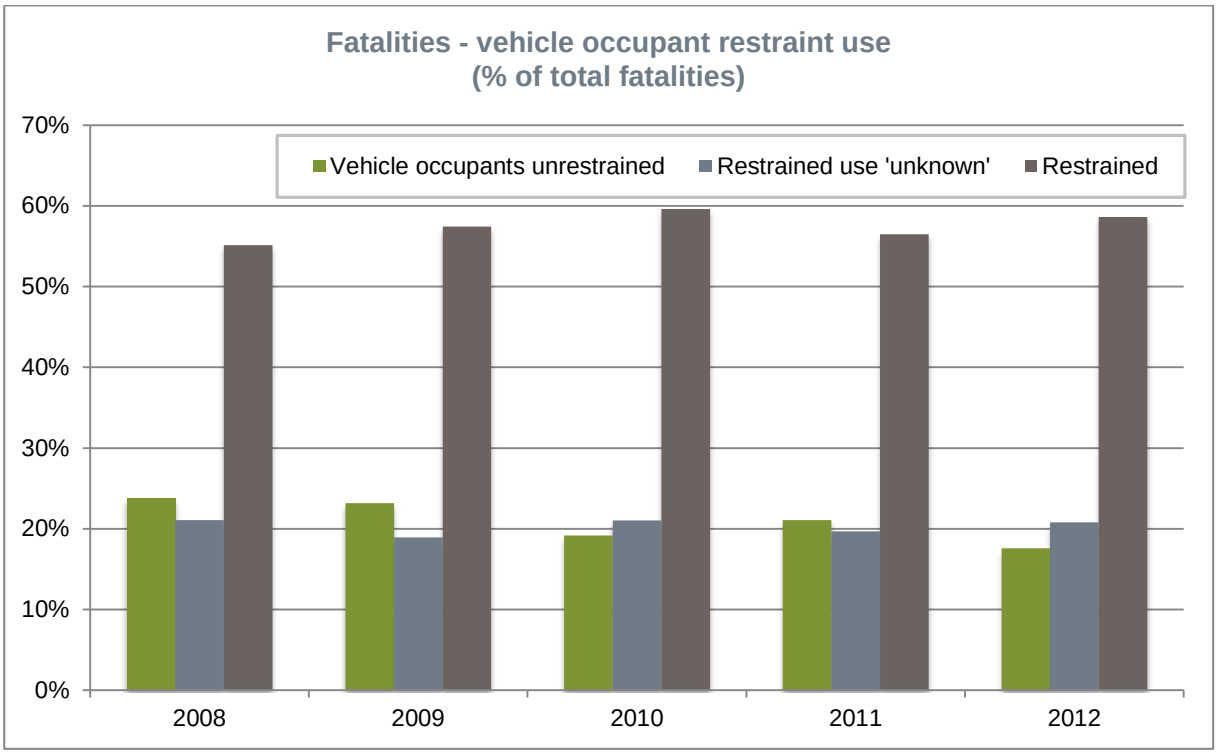

Pedestrian fatalities (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2005
2006
2007
2008
2009
2010
2011
2012
2013
≥ 65 years
40-64 years
26-39 years
17-25 years
≤ 16 years


Cyclist fatalities (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2005
2006
2007
2008
2009
2010
2011
2012
2013
≥ 65 years
40-64 years
26-39 years
17-25 years
≤ 16 years


Fatalities in crashes involving a heavy vehicle
300
250
200
150
100
50
0
2005
2006
2007
2008
2009
2010
2011
2012
2013

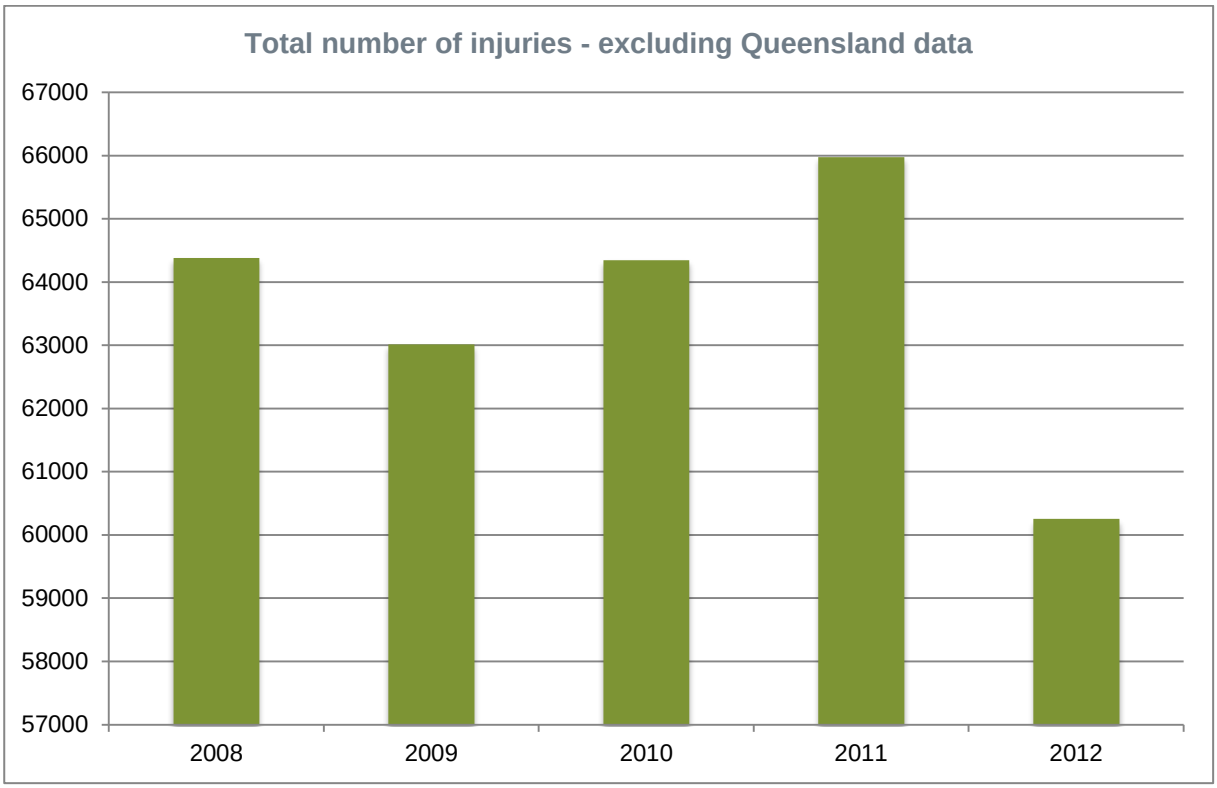

Fatalities in crashes involving a heavy vehicle
(% of total fatalities)
25%
20%
15%
10%
5%
0%
2005
2006
2007
2008
2009
2010
2011
2012
2013

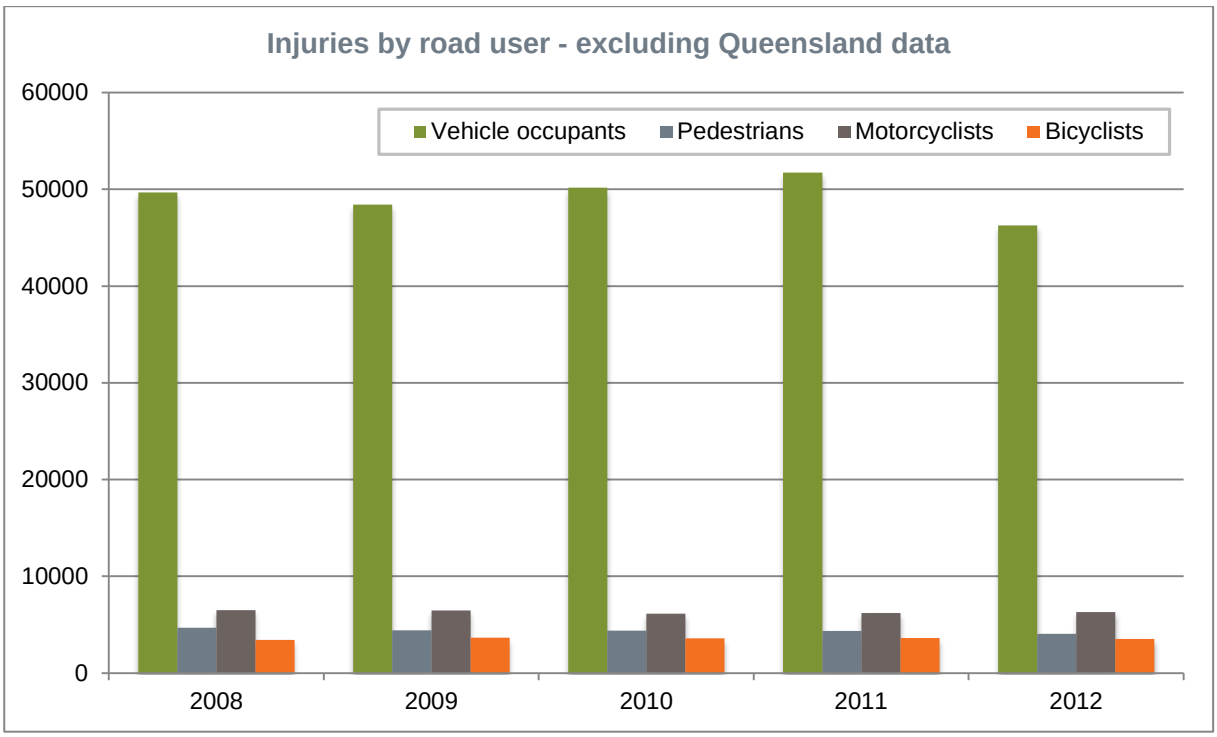

Fatalities - vehicle occupant restraint use
Vehicle occupants unrestrained
Restrained use 'unknown'
Restrained
700
600
500
400
300
200
100
0
2008
2009
2010
2011
2012

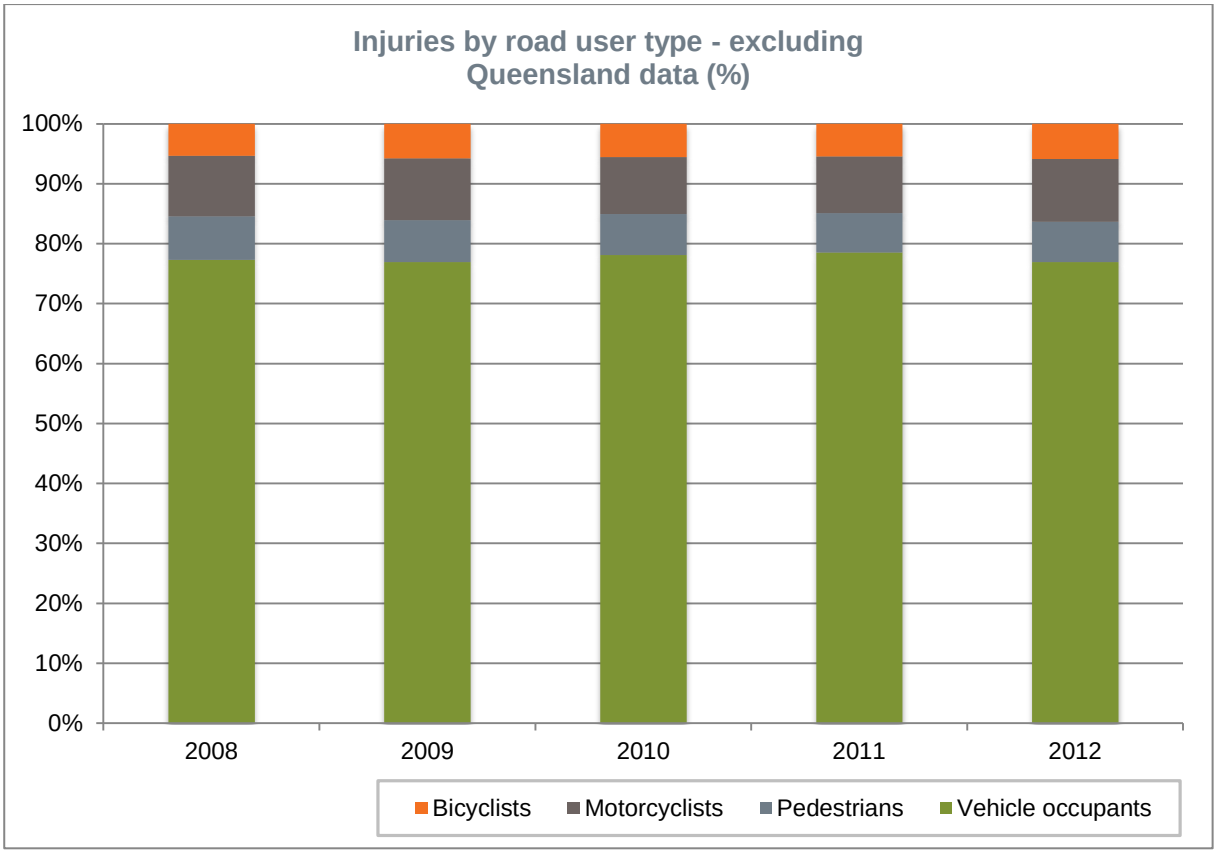


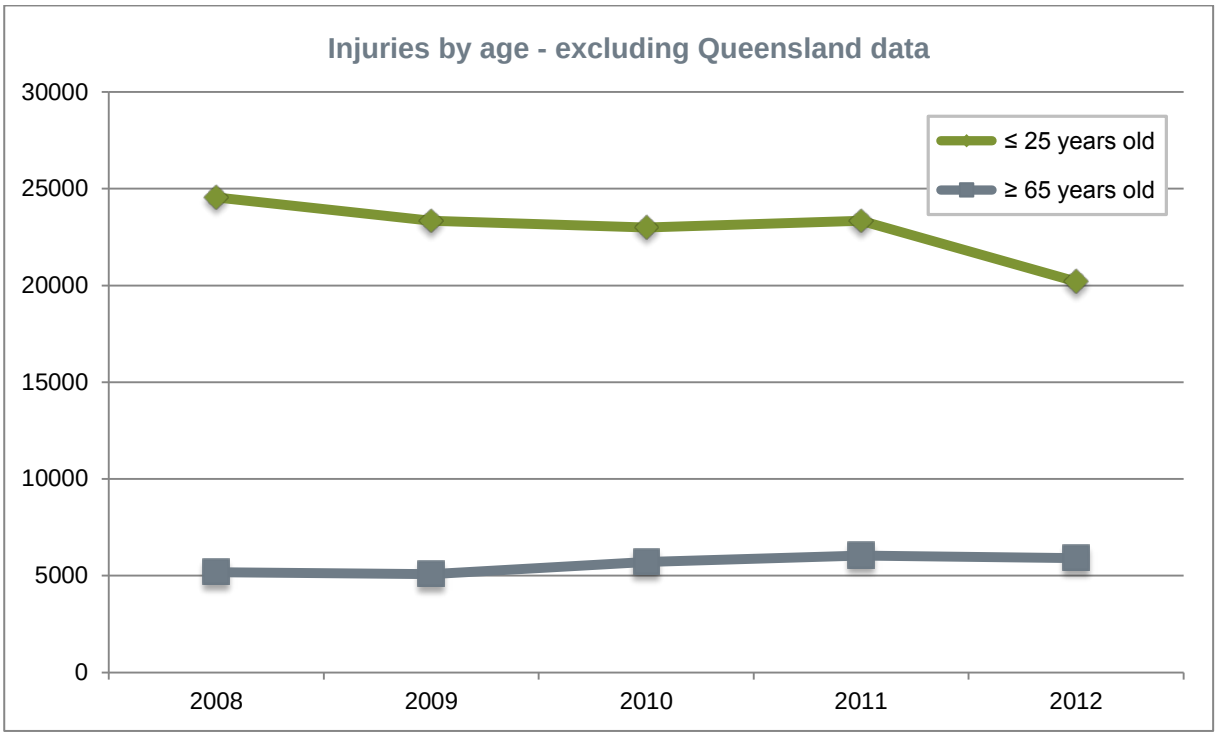
F.2 Injury Data

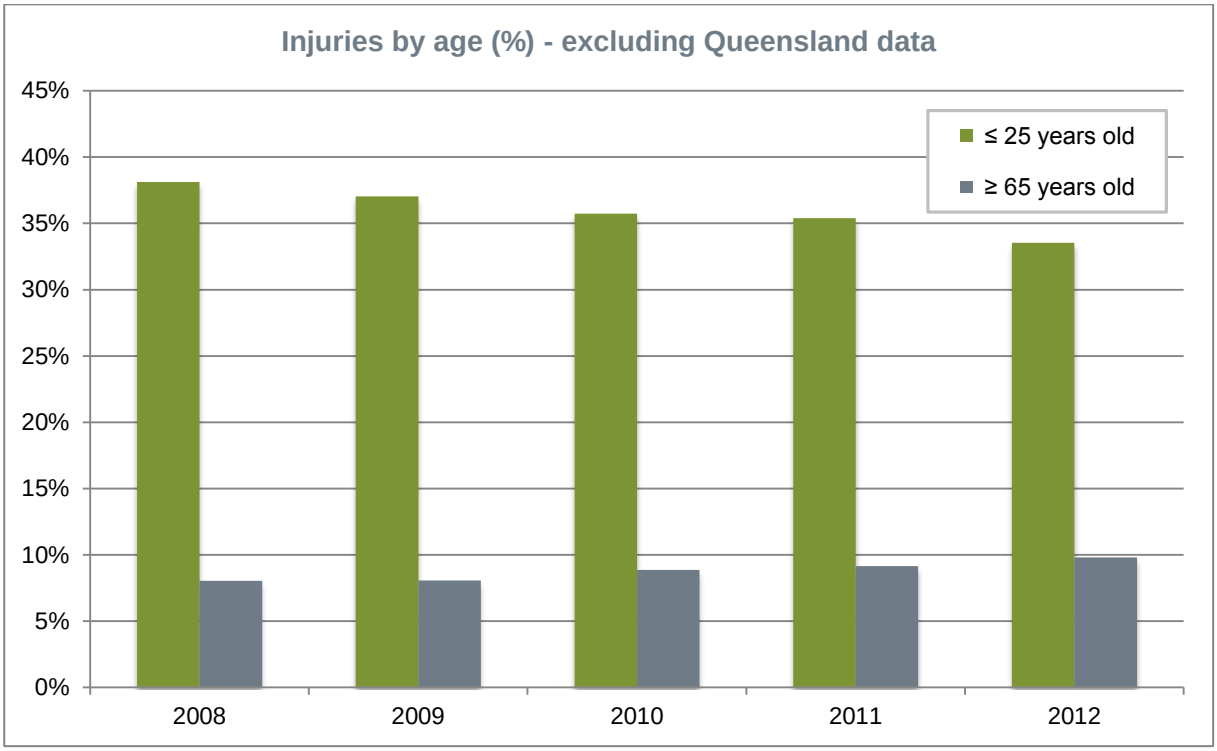
Serious injury and injury data were obtained from BITRE for 2008-2012. The differences between states and changes in reporting procedures during the period meant it was difficult to combine even the all injury data to obtain a reliable national figure. There were also issues in using data for the individual states, as practices changed from year to year. Queensland injury data was unavailable for the period of review and that state has been excluded from the injury graphs that follow.



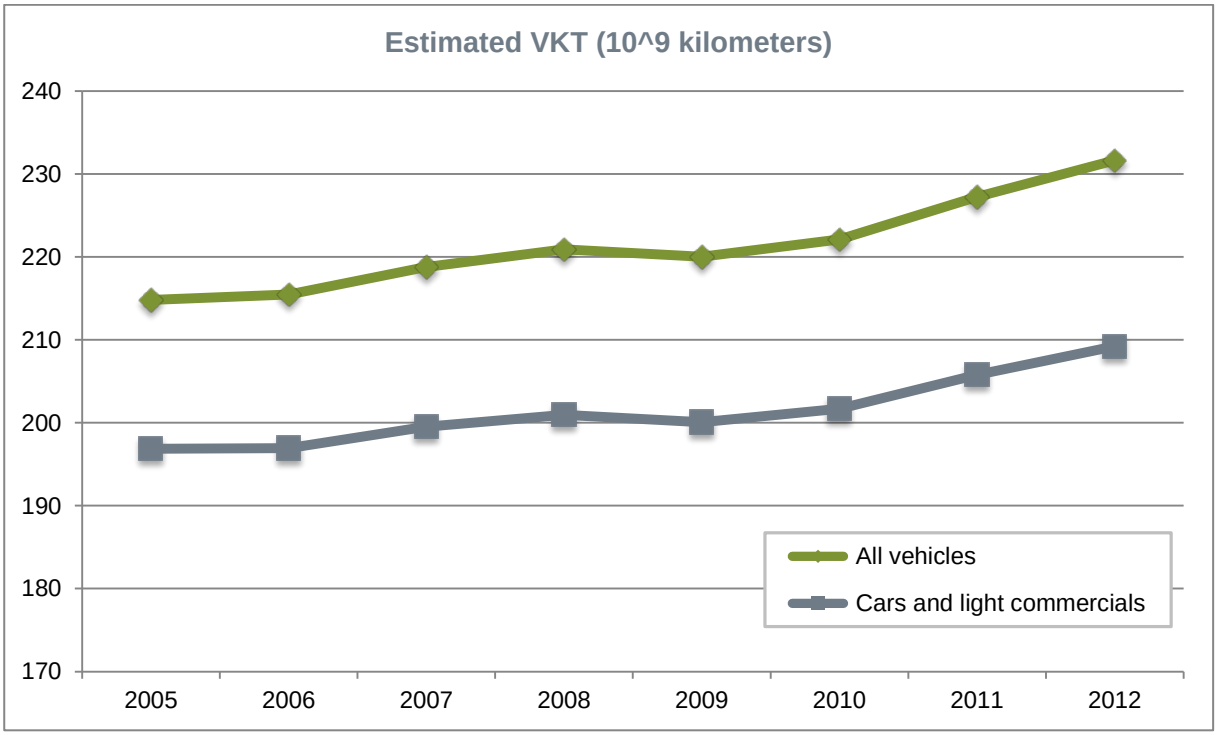

Injuries by road user - excluding Queensland data
60000
50000
40000
30000
20000
10000
0
Vehicle occupants
Pedestrians
Motorcyclists
Bicyclists
2008
2009
2010
2011
2012

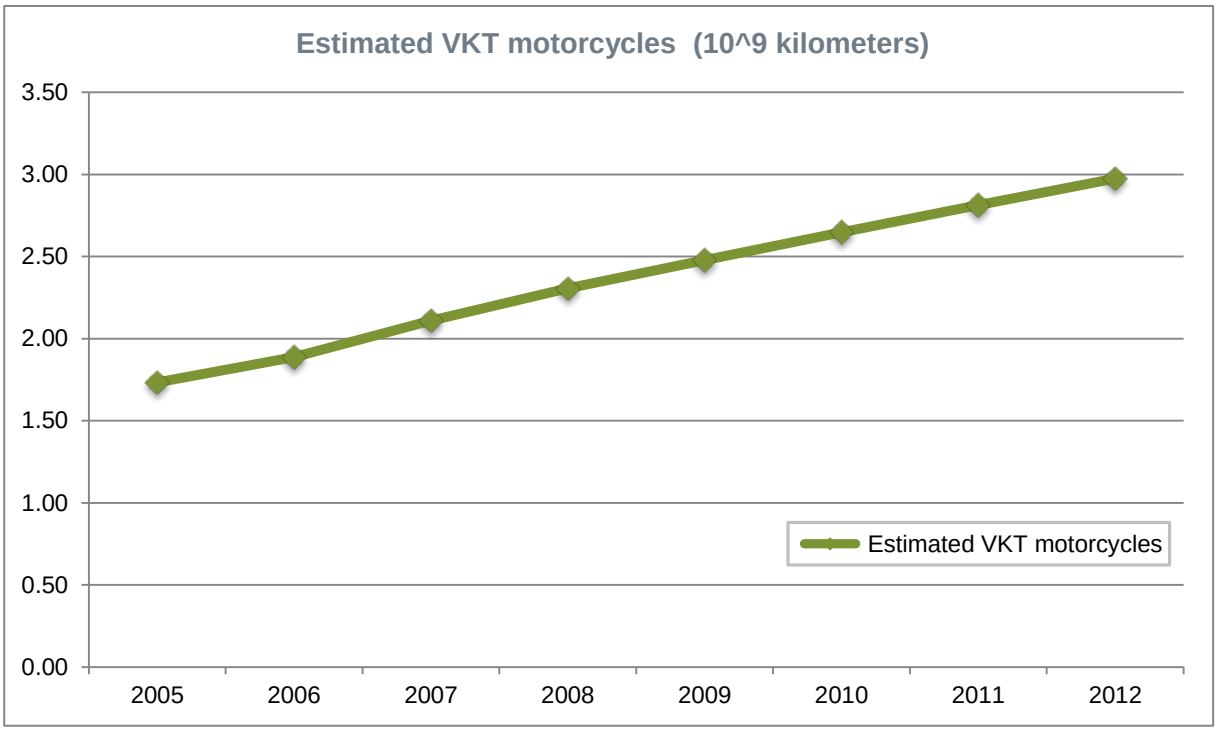

Injuries by road user type - excluding Queensland data (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2008
2009
2010
2011
2012
Bicyclists
Motorcyclists
Pedestrians
Vehicle occupants

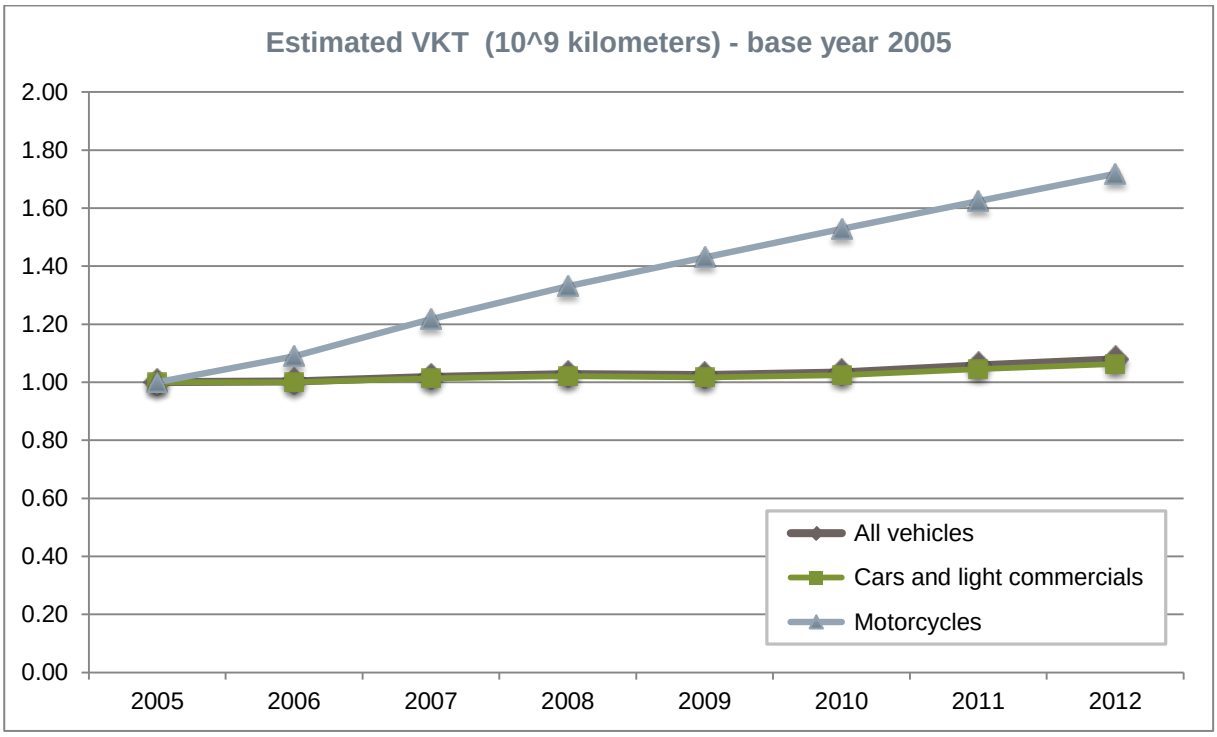

Injuries by age - excluding Queensland data
30000
25000
20000
15000
10000
5000
0
2008
2009
2010
2011
2012
≤ 25 years old
≥ 65 years old

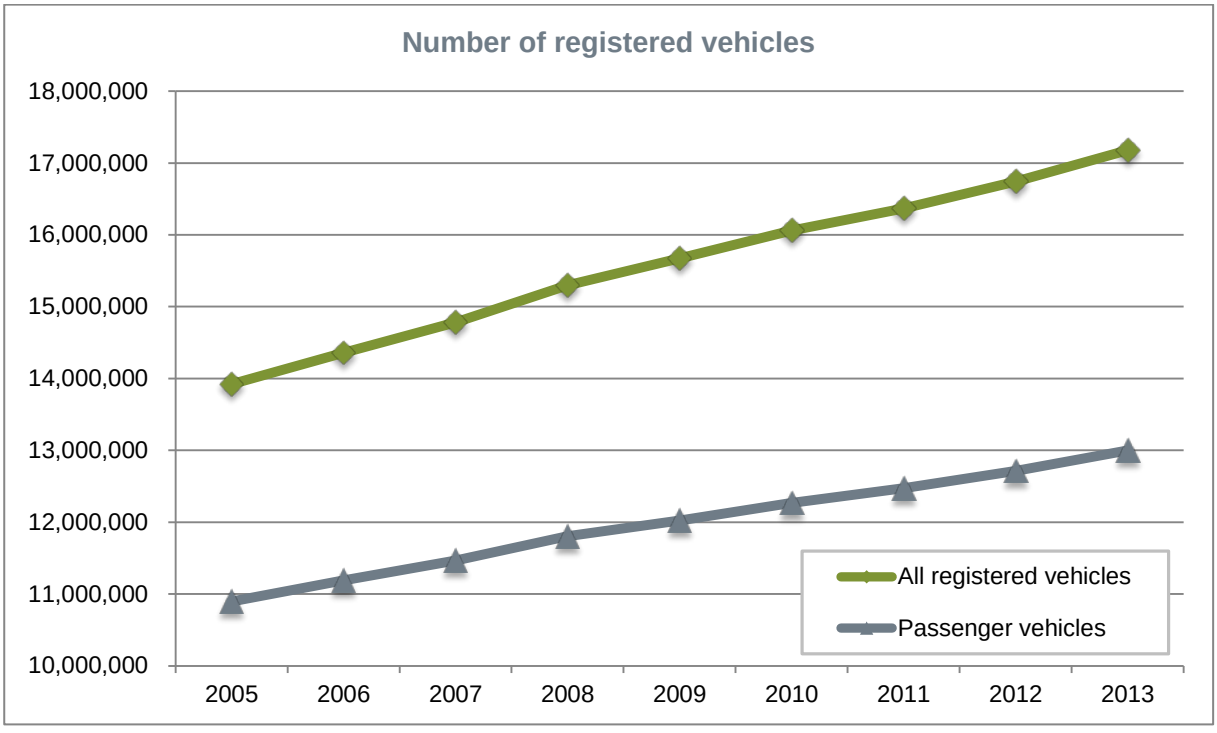

Injuries by age (%) - excluding Queensland data
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
2008
2009
2010
2011
2012
≤ 25 years old
≥ 65 years old

Appendix G Exposure Data

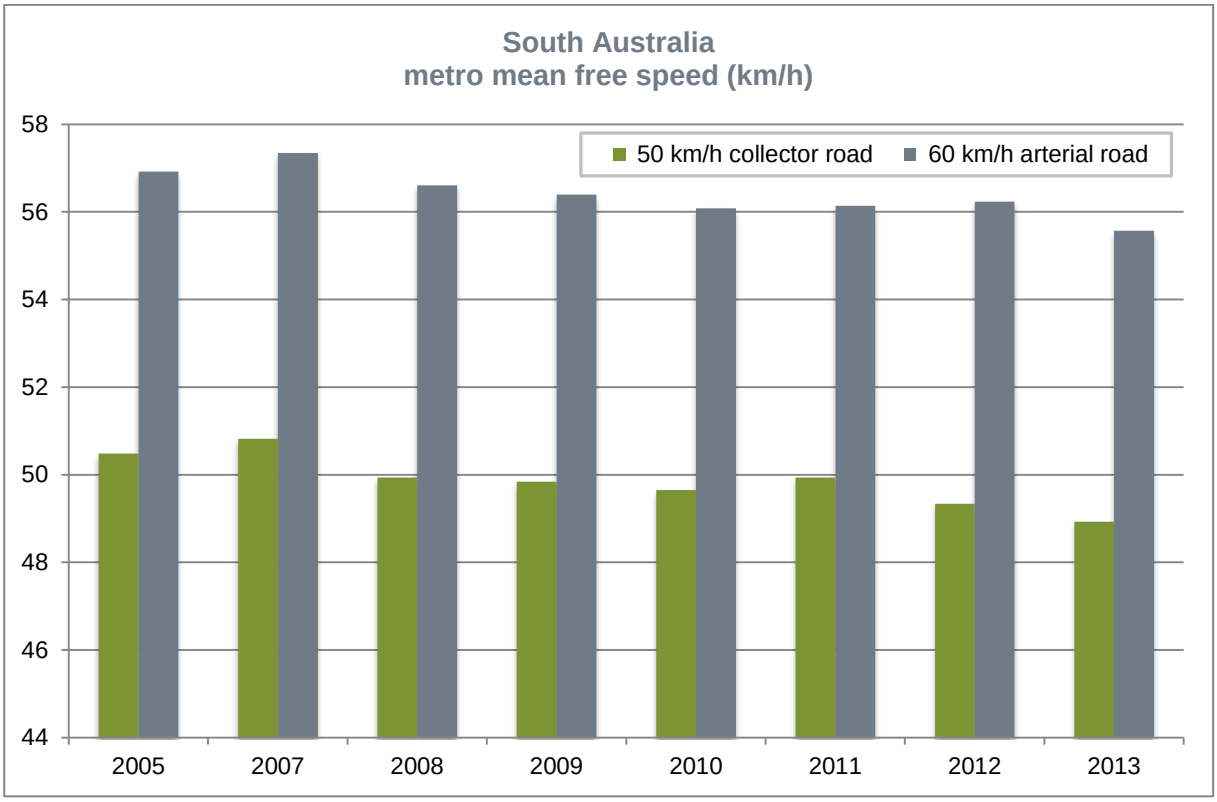


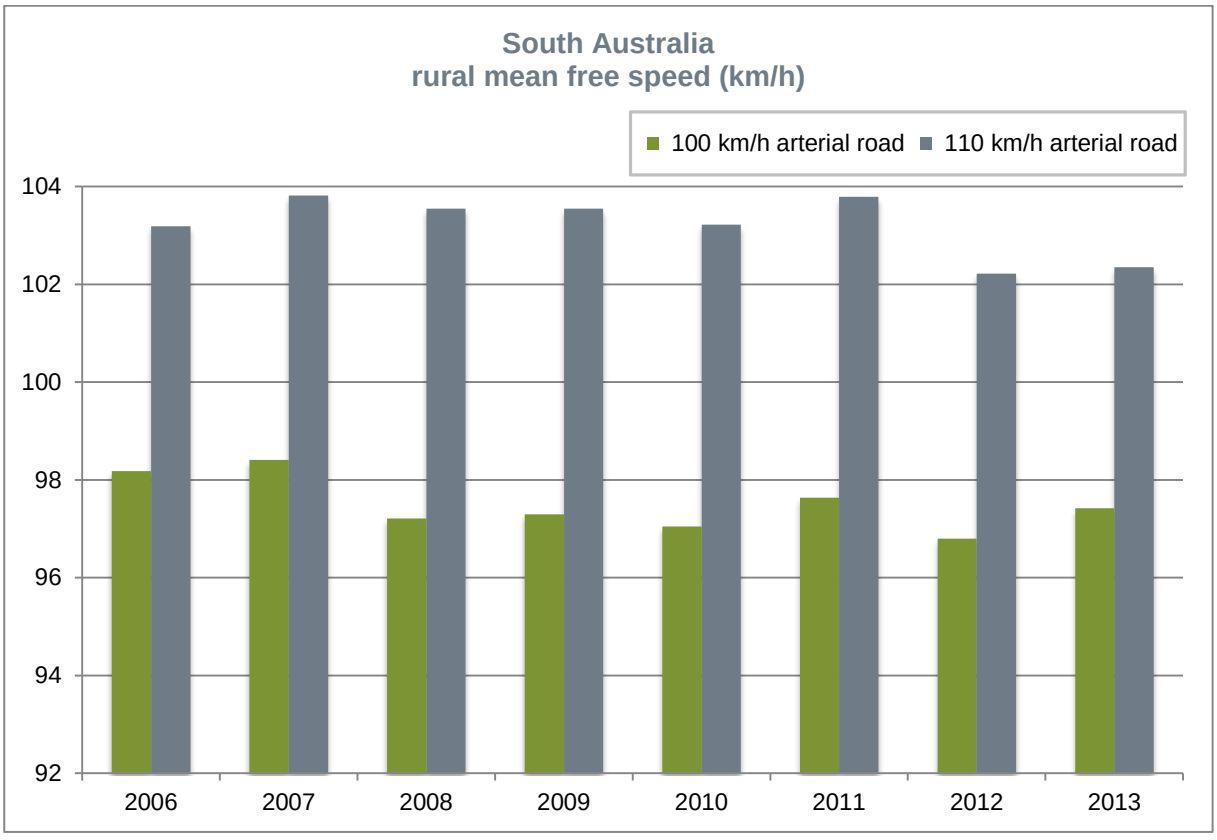



Estimated VKT (10^9 kilometers) - base year 2005
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2005
2006
2007
2008
2009
2010
2011
2012
All vehicles
Cars and light commercials
Motorcycles

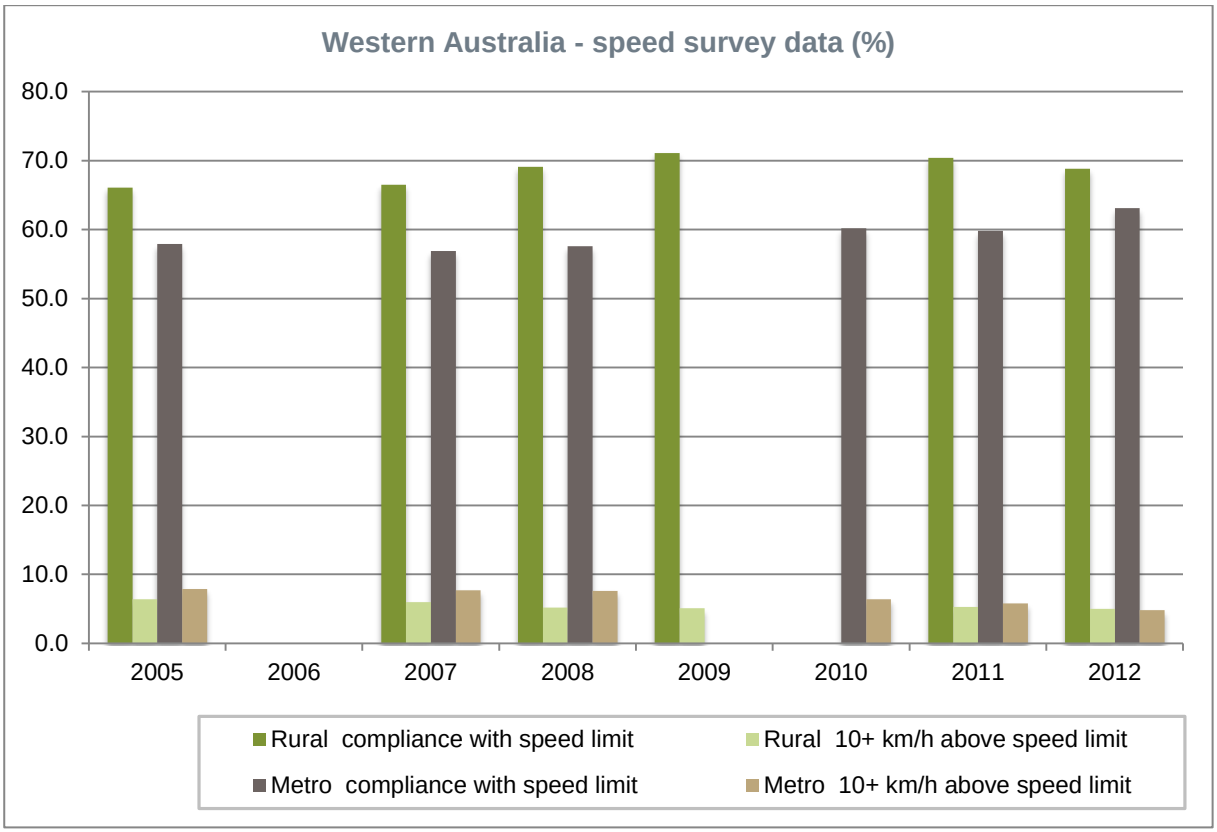

Number of registered vehicles
18,000,000
17,000,000
16,000,000
15,000,000
14,000,000
13,000,000
12,000,000
11,000,000
10,000,000
2005
2006
2007
2008
2009
2010
2011
2012
2013
All registered vehicles
Passenger vehicles

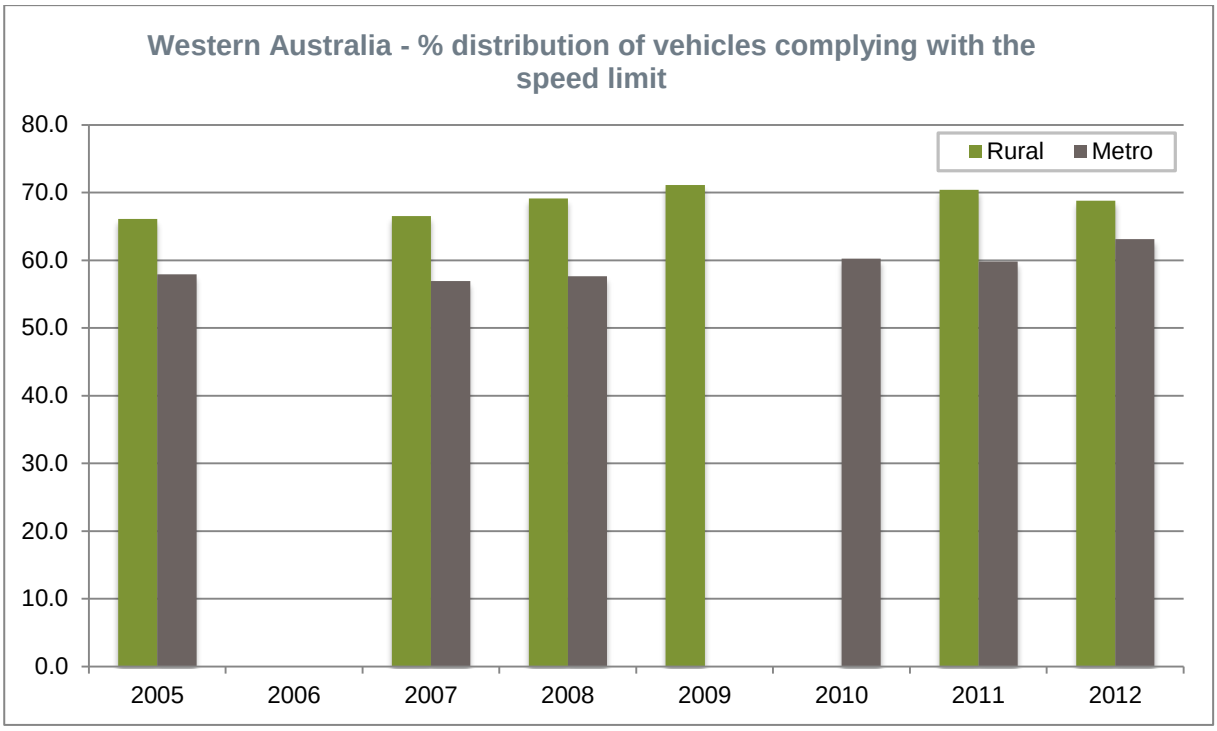
Appendix H Speed Survey Data

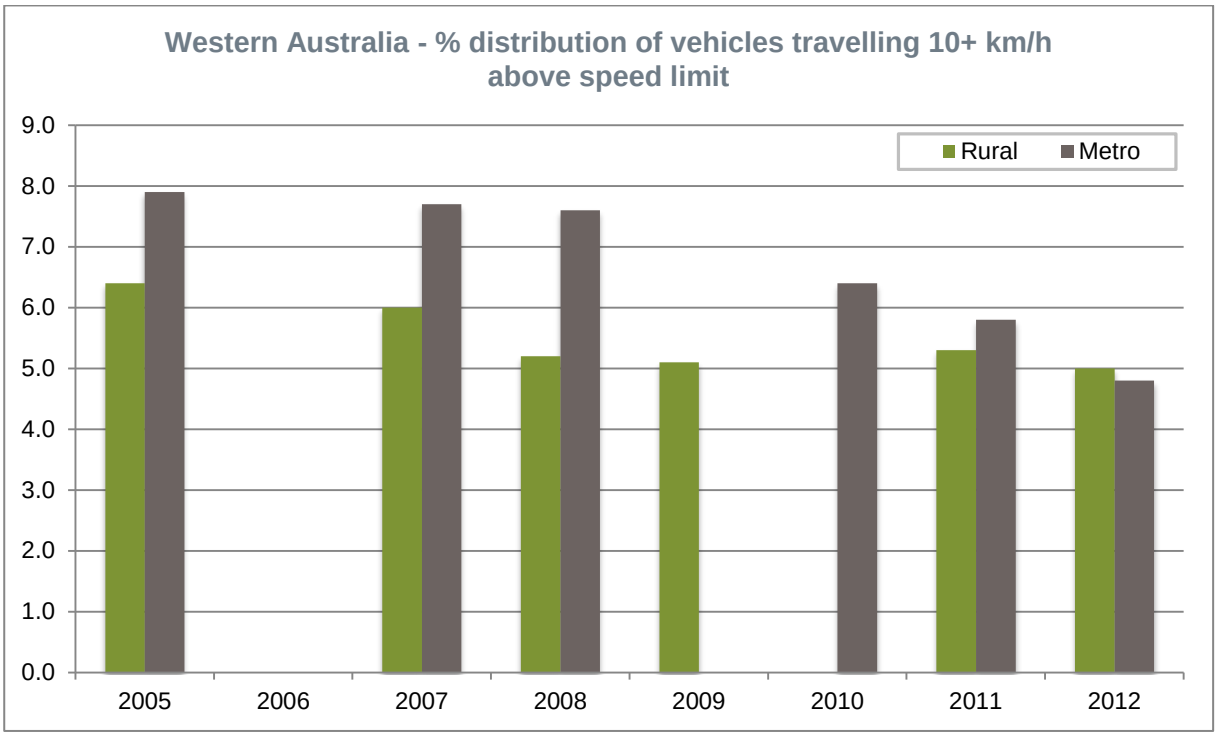




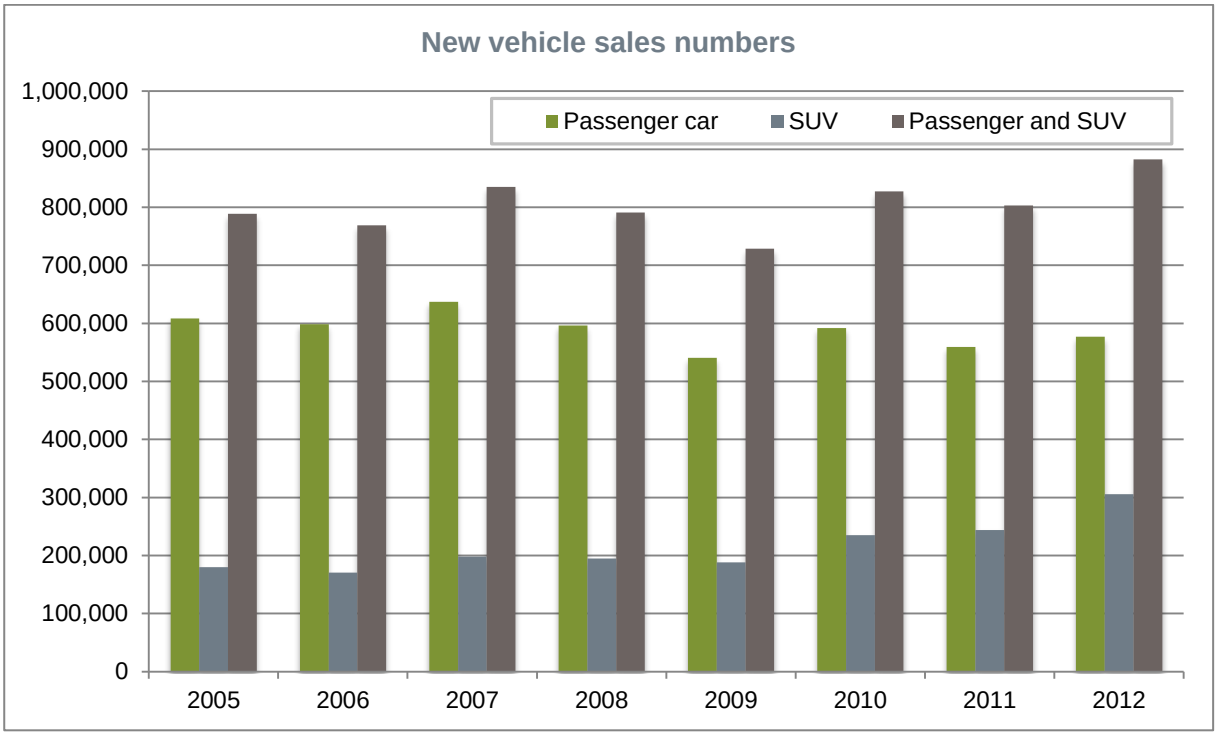
Western Australia speed survey graphs: There is no data available or only part of the data available for the years 2006, 2009 and 2010.

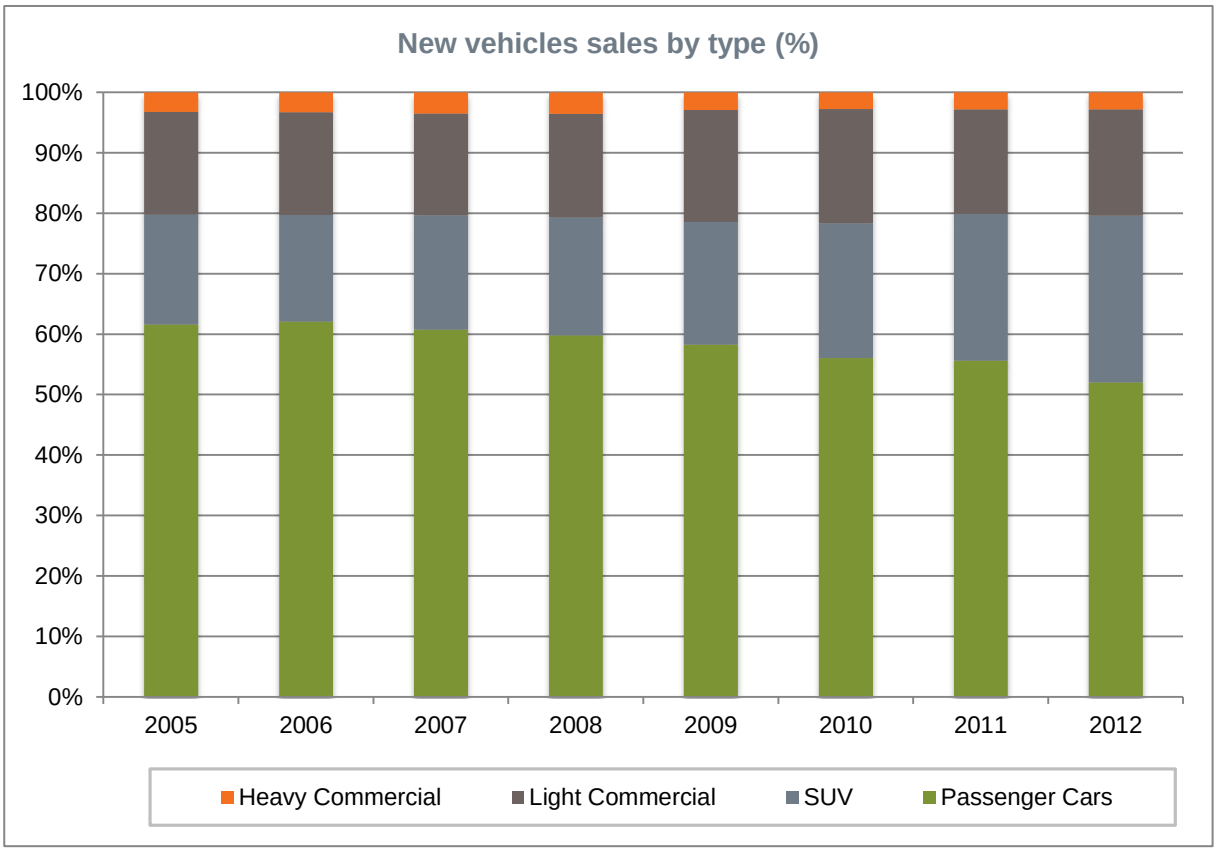


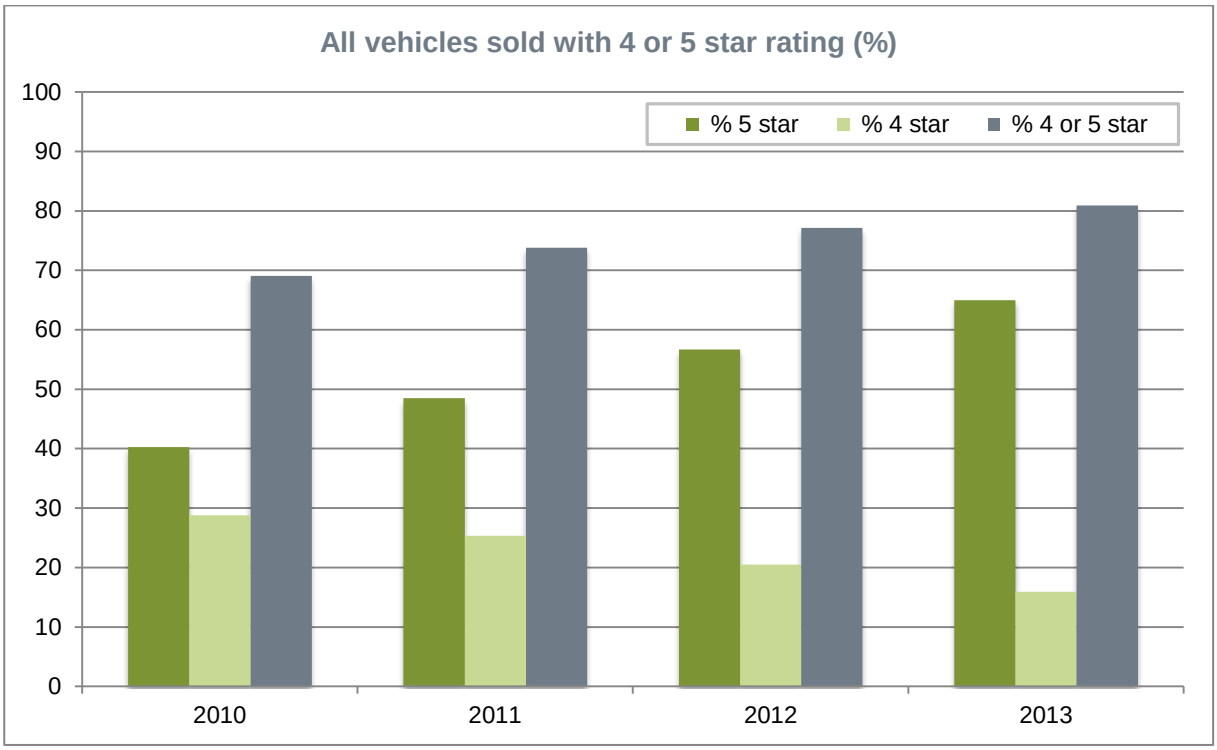


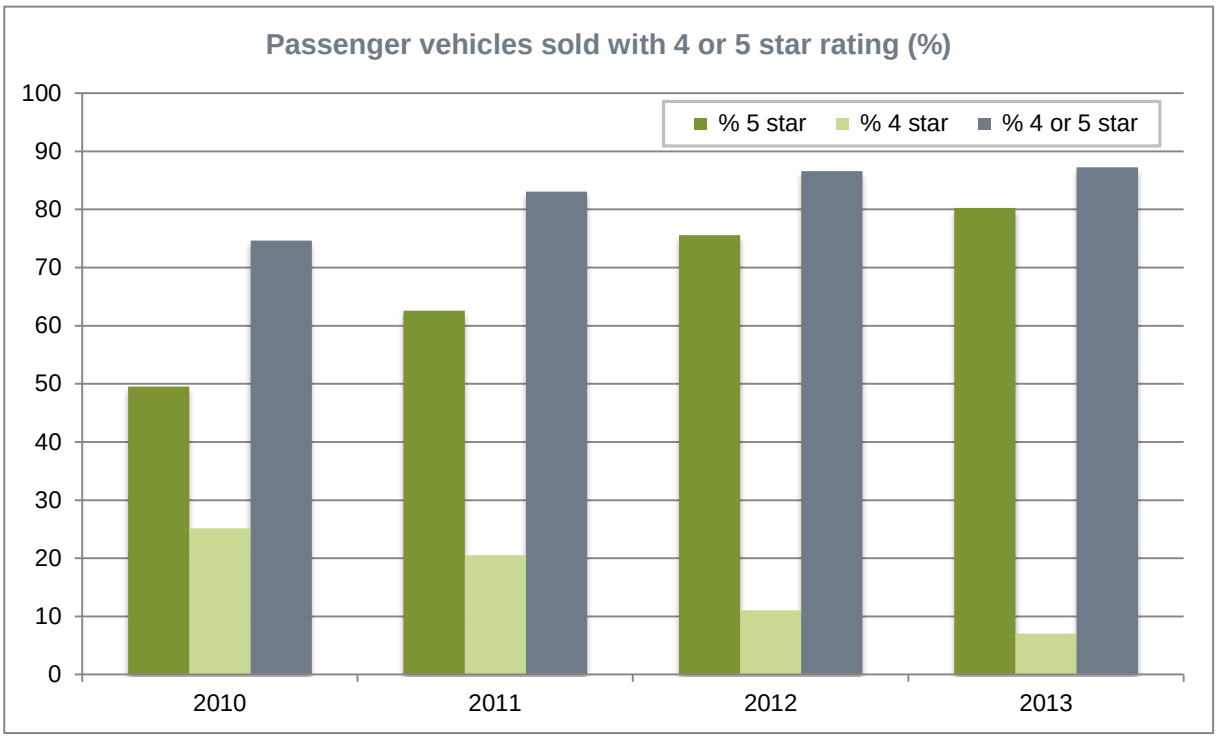

Western Australia - % distribution of vehicles travelling 10+ km/h above speed limit
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Rural
Metro
2005
2006
2007
2008
2009
2010
2011
2012

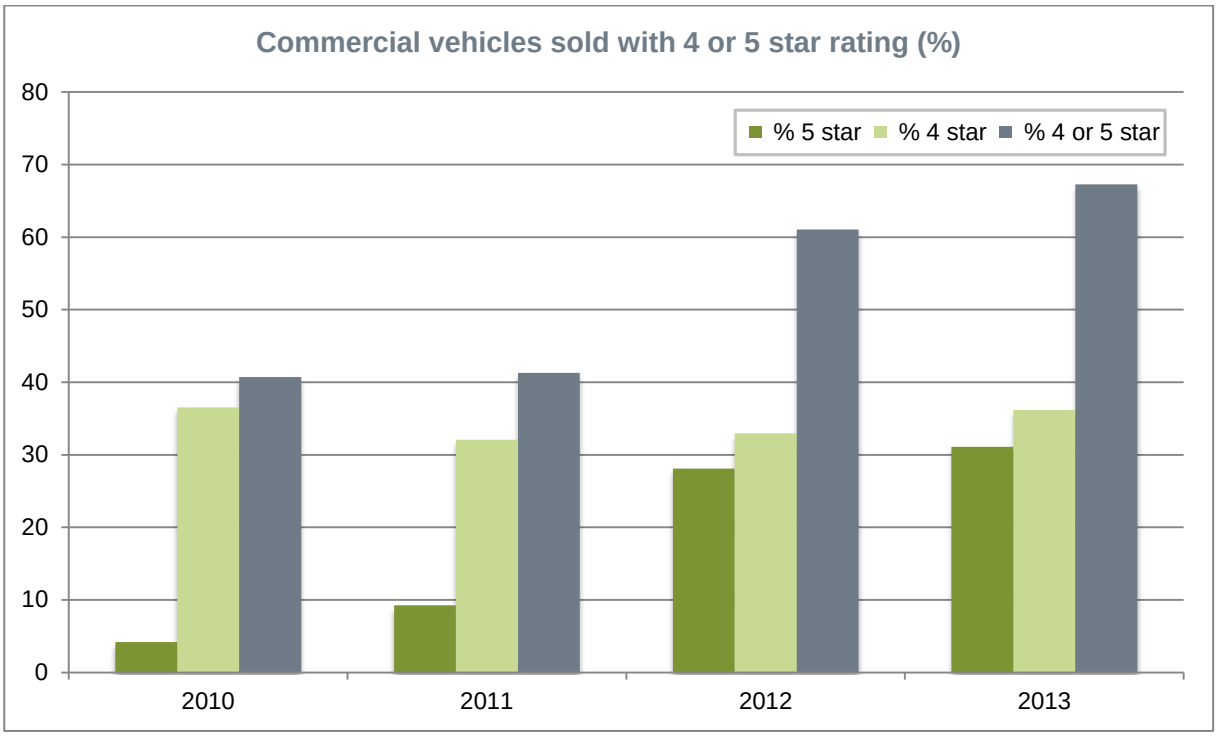
Appendix I New Vehicle Sales

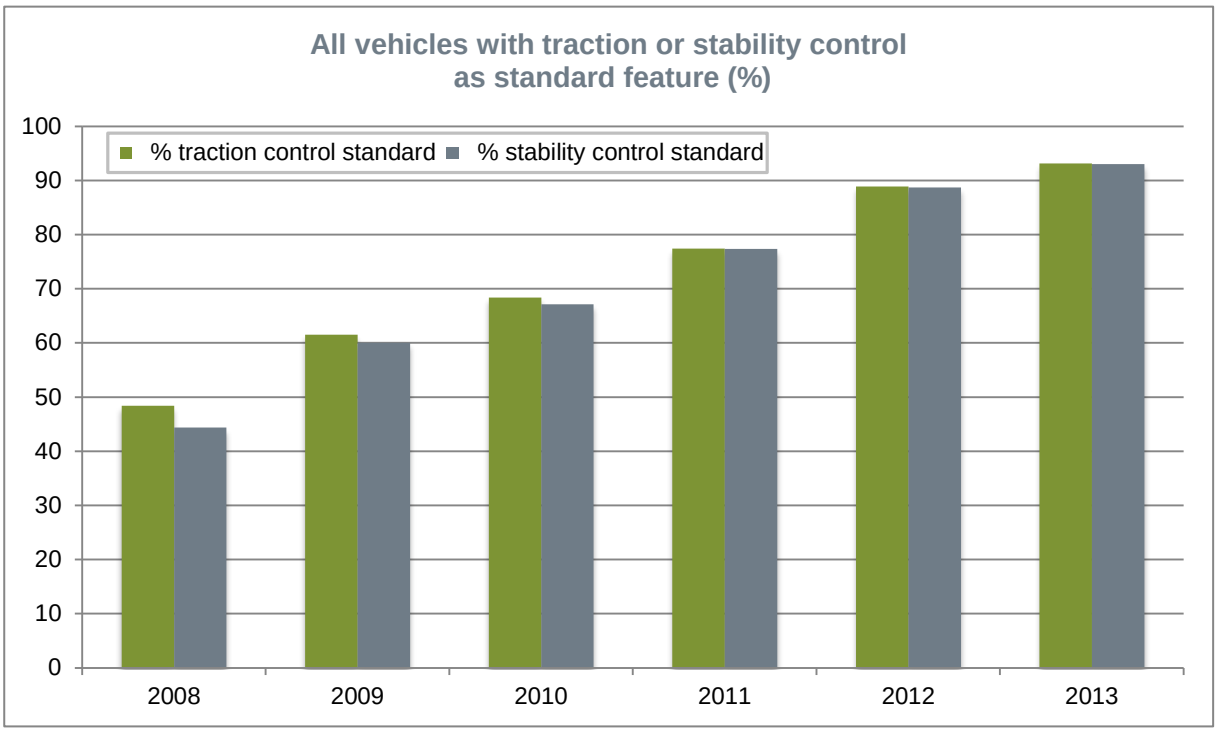


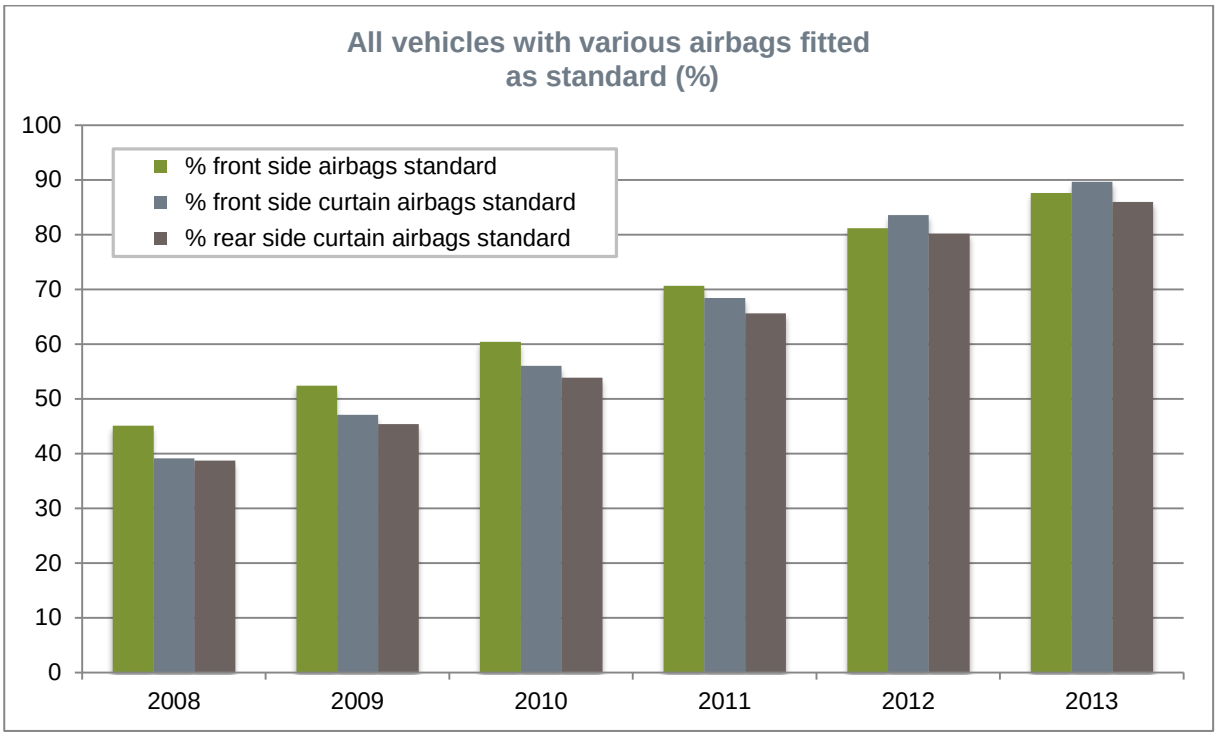


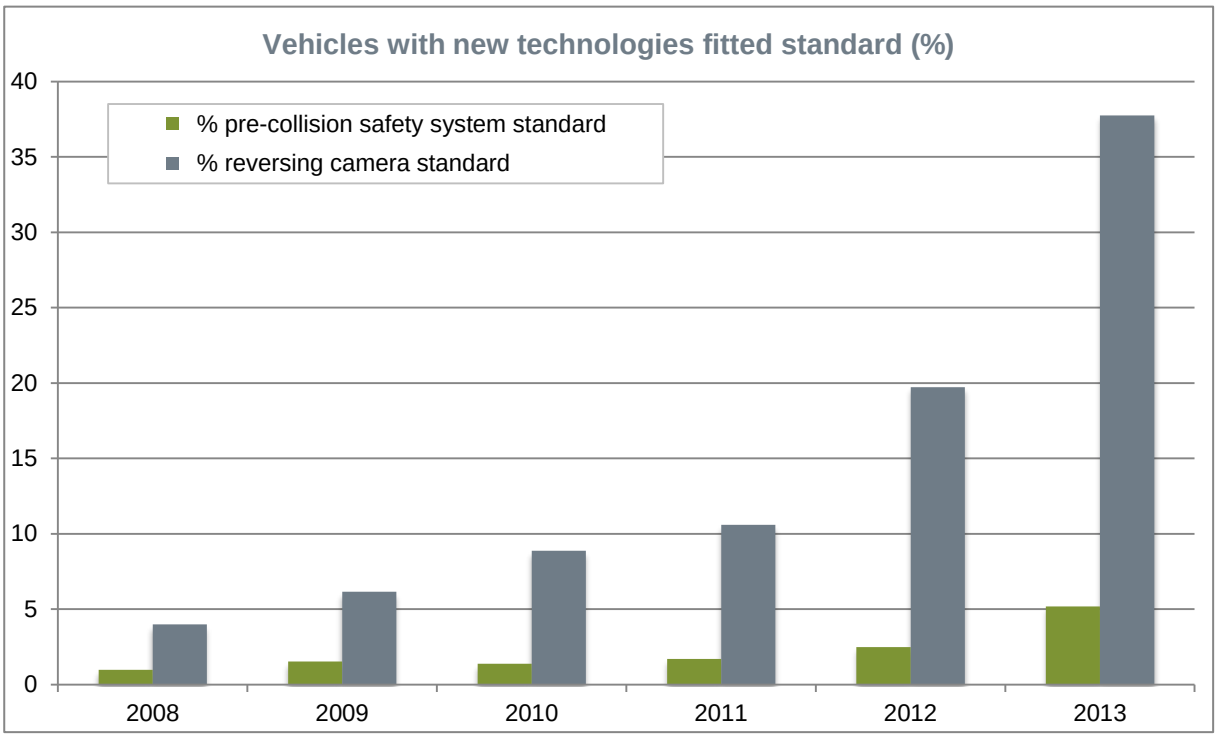

All vehicles sold with 4 or 5 star rating (%)
100
90
80
70
60
50
40
30
20
10
0
% 5 star
% 4 star
% 4 or 5 star
2010
2011
2012
2013


Passenger vehicles sold with 4 or 5 star rating (%)
100
90
80
70
60
50
40
30
20
10
0
% 5 star
% 4 star
% 4 or 5 star
2010
2011
2012
2013


Commercial vehicles sold with 4 or 5 star rating (%)
80
70
60
50
40
30
20
10
0
% 5 star
% 4 star
% 4 or 5 star
2010
2011
2012
2013


All vehicles with traction or stability control as standard feature (%)
100
90
80
70
60
50
40
30
20
10
0
% traction control standard
% stability control standard
2008
2009
2010
2011
2012
2013


All vehicles with various airbags fitted as standard (%)
100
90
80
70
60
50
40
30
20
10
0
% front side airbags standard
% front side curtain airbags standard
% rear side curtain airbags standard
2008
2009
2010
2011
2012
2013


Vehicles with new technologies fitted standard (%)
40
35
30
25
20
15
10
5
0
% pre-collision safety system standard
% reversing camera standard
2008
2009
2010
2011
2012
2013

Appendix J Analysis of Hospital Separations Data

This Appendix expands on and provides background to the exploration of hospital data provided in the body of the report. The Appendix provides a description of data sources and methods, an expanded set of results, and tables containing the values presented in the figures.

J.1 Introduction

This Appendix reports on the statistical examination, foreshadowed in the project application, of whether there have been changes in trauma patterns which may require a change in priorities or emphasis for the strategy.

The serious injury case data are from the National Hospital Morbidity Database (NHMD), made available by the Australian Institute of Health and Welfare (AIHW). The authors are responsible for the use made of the NHMD data in this report.

The data considered include all cases where the main reason for admission was injury and the external cause of injury was land transport. That includes cases in which the injured person was injured while using a motor vehicle or bicycle, or was a pedestrian injured in an event involving a land transport vehicle. Cases recorded as intentional (intentional self-harm or assault) and those specified as having undetermined intent were not included. In keeping with other work on hospitalised injury conducted for road safety agencies, cases in which the person died in hospital were generally omitted (the rationale for this is to minimise double counting when such data are considered with road deaths data). Also in keeping with other work conducted for road safety agencies, the term serious injury case is used to refer to all admitted cases of transport injury. Further information on data sources and methods are provided at the end of the appendix (Data and Methods).

The main distinctions drawn when analysing the data were:

- Whether the injurious event occurred ‘in traffic’ (a near synonym for ‘on road’ in this context).
- Whether the injury sustained met an operational definition of posing a HTTL. These cases comprise about one-quarter of all admitted transport injury cases.
- The remoteness of the place of residence of the injured person, divided into five zones.
- The mode of transport of the injured person.
- The age and sex of the injured person.

Values are presented, variously, as case numbers, proportions and incidence rate ratios (IRRs). The IRRs show how population-based rates vary from a reference value after allowing for several variables. In the material presented here, IRRs are presented for the ten calendar years 2001 to 2010, with 2001 as the reference year. Values for later years are ratios of the annual rates divided by the rate in the baseline year. Except where specified otherwise, the IRRs are all adjusted for age, sex and the remoteness zone of residence of the injured person.

J.2 Investigation

Five themes are reported upon:

- Trends in serious injury in relation to trends in road deaths
- Comparison of the main transport user groups: which account for trends in serious injury
- Comparison of trends in traffic cases with non-traffic cases
- Comparison of trends for residents of major cities with those for residents of other places
- Selective consideration of differences by age and sex

J.3 Overview of data

Serious injury land transport cases rose from 45,652 in 2001 to 50,907 in 2010. The serious injury cases recorded as occurring in traffic numbered 27,343 in 2001 and 32,775 in 2010. About two-thirds of cases are males and in about one-quarter of the cases, the injuries sustained meet the operational definition of HTTL.

Five types of road user account for about 95% of serious injury cases that occurred in traffic: drivers, passengers, pedestrians, motorcyclists and cyclists. (Note that in the shorthand used here, the two motor vehicle types do not include motorcyclists.)

Annual case-counts of traffic cases for two of these types rose substantially: motorcyclists and cyclists. The absolute rise in annual case numbers was somewhat larger for motorcycle riders than for cyclists. However, the relative rise was larger for cyclists, and the upward trend in the second half of the period was larger for cyclists than for motorcyclists. These two types of road user accounted for 29% of traffic cases in 2001, rising to 38% in 2010. The proportion rose from 22% to 34% of HTTL traffic cases.

Annual case-counts for motor vehicle driver traffic cases also rose. However, the absolute increase in case numbers was smaller than for motorcyclists or cyclists, and the percentage rise was much smaller than for those types.

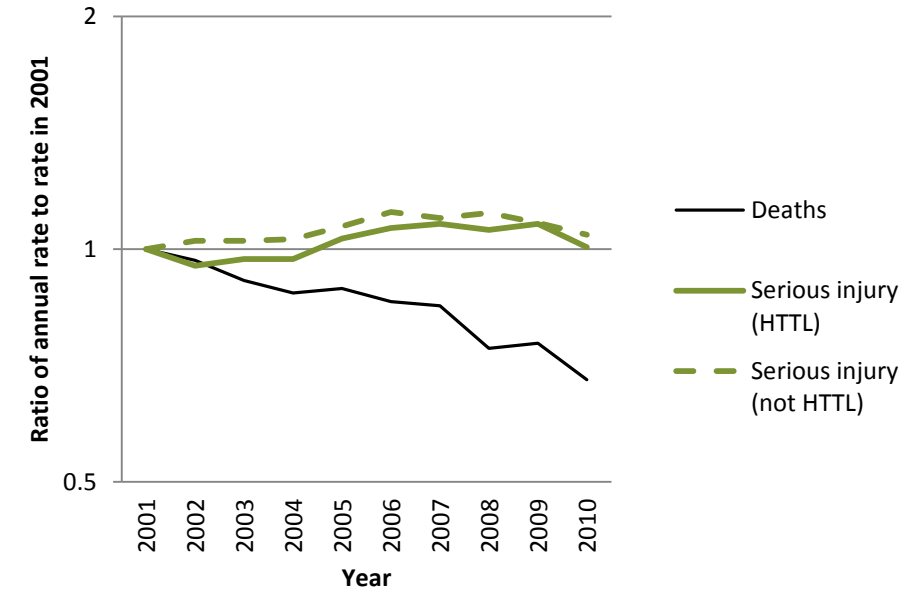
Annual case-counts for the other main types of traffic cases, involving motor vehicle passengers and pedestrians, declined a little during the decade.

J.4 Road Deaths Declined While Serious Injuries Did Not

Rates of hospitalised serious injury rose by about 10% from the base-year, then returned to about the level in 2001, while death rates have fallen by almost one-third (Figure J1; crude rates are presented in this figure).

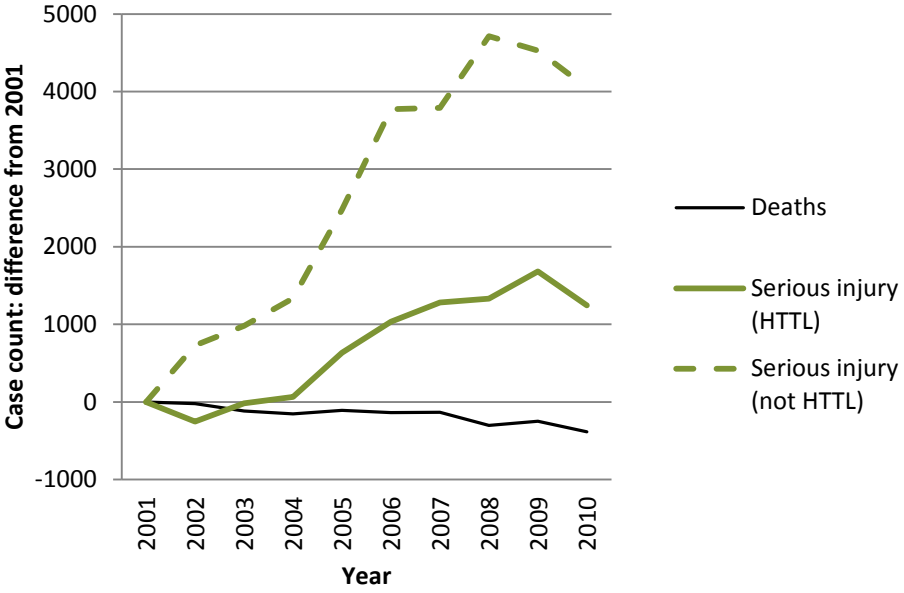
Trends in rates of hospitalised injury were similar for the HTTL subset of cases and for the less severe majority of serious injury cases.

Figure J1: Fatal and serious road traffic injury in Australia 2001-2010: ratio of annual rate to rate in 2001



While the percentage decline in deaths was greater than the percentage rise in serious injury cases, the absolute number of additional serious injury cases was much larger than the absolute reduction in the number of deaths. Hence, the decline in deaths does not account for the rise in serious injury cases, not even for the rise in HTTL cases (Figure J2).

Figure J2: Fatal and serious road traffic injury in Australia 2001-2010: difference between annual case number and case number 2001

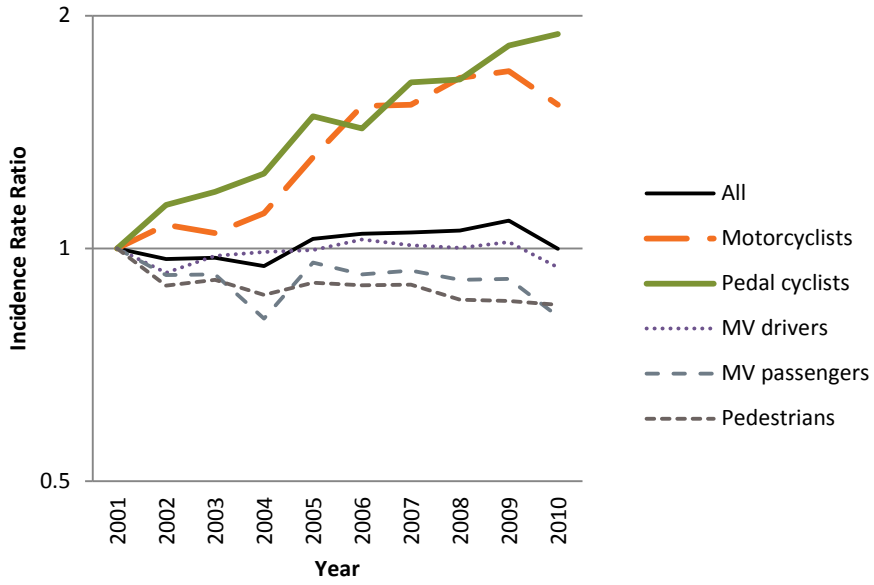


J.5 Motorcyclists and Cyclists Accounted for the Rise in Serious Injury

Figure J3, and similar figures that follow, show how population-based rates changed from the base year (2001) after taking account of changes in distribution of age, sex and remoteness of place of residence. An Incidence Rate Ratio (IRR) of 2 means that the adjusted rate in a particular year was twice that in 2001 and an IRR of 0.5 means that the adjusted rate was half that in 2001.

Figure J3 shows data for HTTL cases that occurred in traffic, for all types of road users combined and separately for each main type of user. IRRs of cases involving passengers and pedestrians declined, and those for driver cases changed little. The figure shows that, in contrast, population-based rates of traffic injury involving motorcycle riders and cyclists rose substantially.

Figure J3: Life-threatening road traffic injury in Australia 2001-2010 by road user type: ratio of annual rate to rate in 2001



The pattern shown in Figure J3 is for males and females combined, for people of all ages and for Australia as a whole, and is restricted to cases reported as having occurred in traffic. The next set of figures show trends for selected sub-groups.

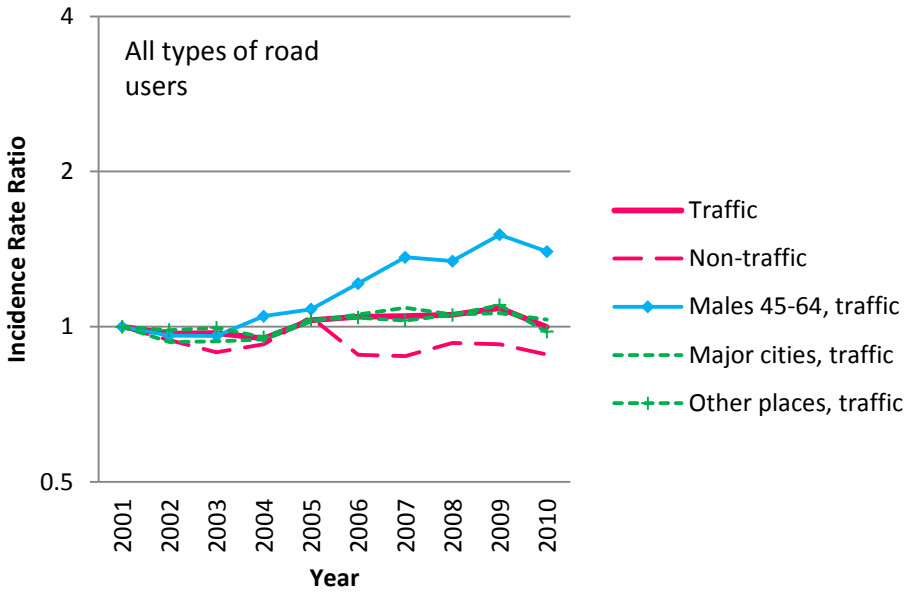
Choice of groups: Previous work has shown that the rise in motorcyclist and cyclist cases has been particularly prominent for middle-aged males. Despite the general lack of good data on the extent of on-road cycling, there have been some indications that the recent increase has been particularly large in major cities. Also, many cyclist and motorcyclist cases occur off-road, and it may be informative to know whether trends for these user types are similar for traffic and non-traffic cases.

Figures J4 to J7 show trends in IRR for five sub-groups of HTTL cases: all cases in traffic; all cases in non-traffic settings; traffic cases involving males aged 45 to 64 years; traffic cases involving residents of major cities; and traffic cases involving residents of places other than major cities. Each figure includes different road user types.

Trends in IRR for these five groups, when HTTL cases involving all road user types are included, are shown in Figure J4. The three figures that follow it show similar information but for three subsets of road users: all types except motorcyclists and cyclists; motorcyclists alone; and cyclists alone.

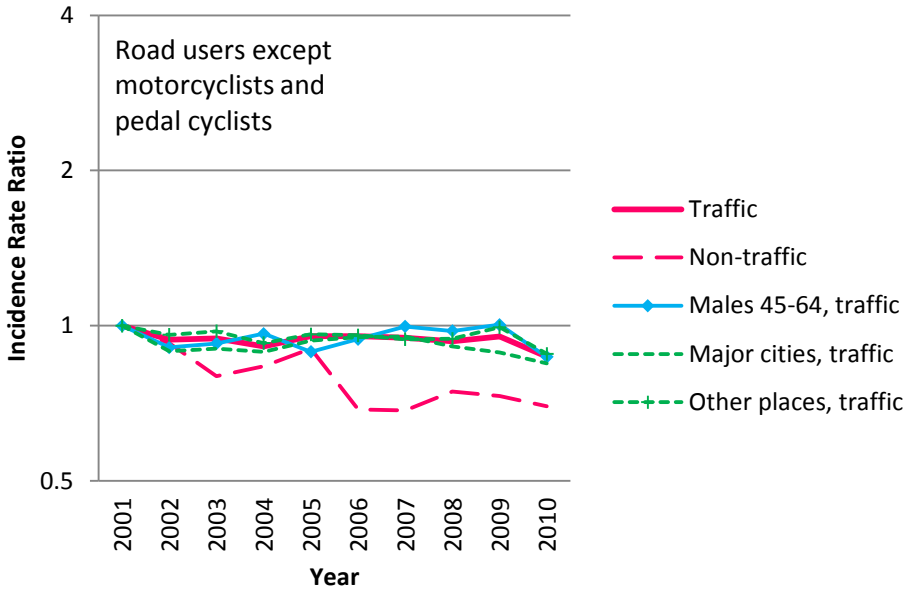
Overall rates for traffic cases were similar in the first and last years, but some elevation in other recent years (Figure J4). Trends were similar for residents of major cities and for residents of other places. Rates of traffic injury for middle-aged males rose markedly.

Figure J4: Life-threatening road traffic injury in Australia 2001-2010 of all types of road users: ratio of annual rate to rate in 2001



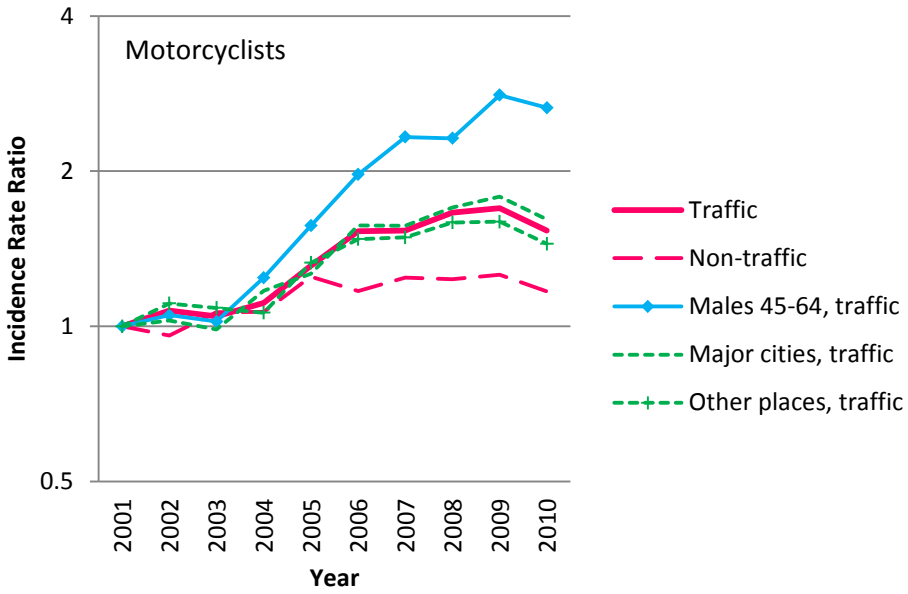
When motorcyclist and cyclist cases are put aside, trends in IRR show a small decline in traffic cases and a marked decline in non-traffic cases (Figure J5). Rates of traffic cases involving middle-aged males were similar to those for other road users.

Figure J5: Life-threatening road traffic injury in Australia 2001-2010 of all road user types except motorcyclists and cyclists: ratio of annual rate to rate in 2001



Rates of motorcyclist cases rose, particularly from 2004 (Figure J6). Rates of motorcyclist cases in traffic rose more than rates of non-traffic cases. Rates of motorcyclist cases in traffic for middle-aged males trebled. Rates of motorcyclist cases rose slightly further for residents of major cities than for residents of more remote regions.

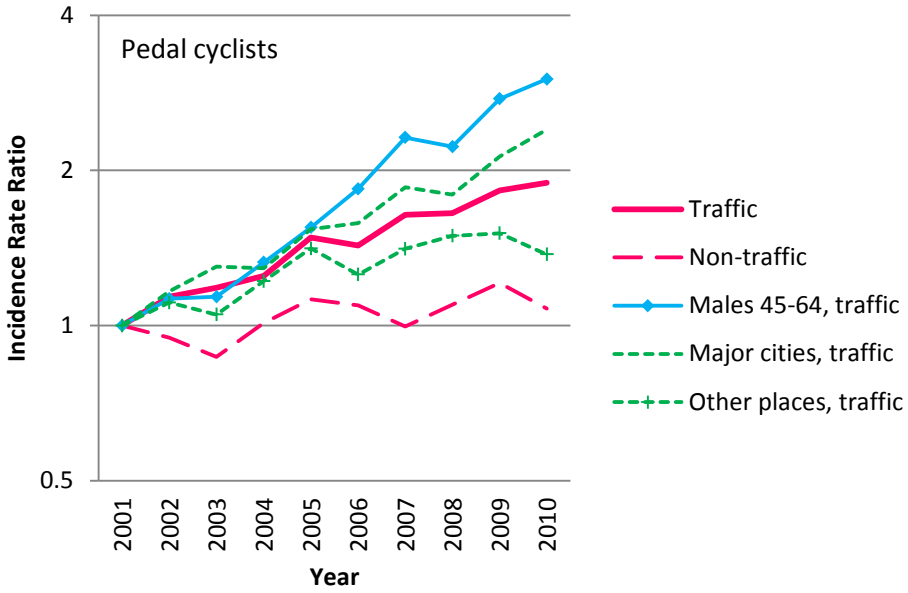
Figure J6: Life-threatening road traffic injury in Australia 2001-2010 of motorcyclists: ratio of annual rate to rate in 2001



Rates of cyclist cases also rose substantially (Figure J7). Cyclist cases in traffic rose more than non-traffic cases, and rates for middle-aged males more than trebled.

Rates of cyclist traffic cases rose further for residents of major cities than for residents of other places.

Figure J7: Life-threatening road traffic injury in Australia 2001-2010 of cyclists: ratio of annual rate to rate in 2001



J.6 Commentary

In this period, all of the rise in rates of life-threatening serious injury cases was accounted for by the rise in motorcyclist and cyclist cases. Rates of HTTL cases involving injury of road users other than motorcyclists and cyclists declined slightly in the study period.

The increase chiefly comprised traffic (on-road) cases and was particularly high for middle-aged males. Rates of cyclist cases rose more for residents of major cities than for people who lived elsewhere.

The data show a modest rise in overall (all user types) rates of non-traffic cases in the first half of the period, then little change. In contrast, if attention is restricted to injured road users other than motorcyclists and cyclists, the rate of non-traffic cases declined during the period.

Previous work has shown that rates of HTTL road injury involving motorcyclists and cyclists have risen to a particularly large degree for middle-aged males (AIHW, 2012). The work reported here confirms that. In particular, rates for men aged 45-64 who were injured as motorcyclists or cyclists rose substantially more than the all-ages rate for persons. However, trends in rates for men aged 45-64 injured as other types of road users (i.e. as drivers or passengers, or as pedestrians) were much the same as those for persons of all ages.

Rates of serious and HTTL traffic injury generally rise with remoteness of place of usual residence. The main exception to this is rates of traffic injuries sustained as a cyclist, which tend to decline with increasing remoteness of residence.

A separate matter is whether trends over time differ with remoteness. Despite relatively high rates of serious injury for residents of the remote and very remote zones, absolute numbers of cases per year were not large. Because of this constraint, analysis was undertaken for the residents of the Major Cities zone (mainly capital cities) and for all other zones combined.

Considering all injured road-users except motorcyclists and cyclists, trends in rates were similar for the major cities zone and for the other zones combined: neither changed much in the study period.

The rates of cases of injured motorcyclists and cyclists showed steeper upward trends for the major cities zone than for the other zones combined. This difference was more marked for cyclists than for motorcyclists.

Why have trends for deaths and serious injury rates moved in opposite directions? Crude rates of total road fatal injury and cases of serious injury show strikingly divergent trends in the decade considered. The differentials are similar when rates are age-adjusted.

As shown above (Figures J4 to J7), stratification by road user type reveals that two road-user types, motorcyclists and cyclists, accounted for the rise in the rates of hospitalised serious cases. Results shown in the figures are for HTTL cases, but the pattern is similar if both HTTL and less life-threatening cases are included. Further stratification shows that the rise in rates for these case types was particularly marked for middle-aged males and for residents of the major cities remoteness zone.

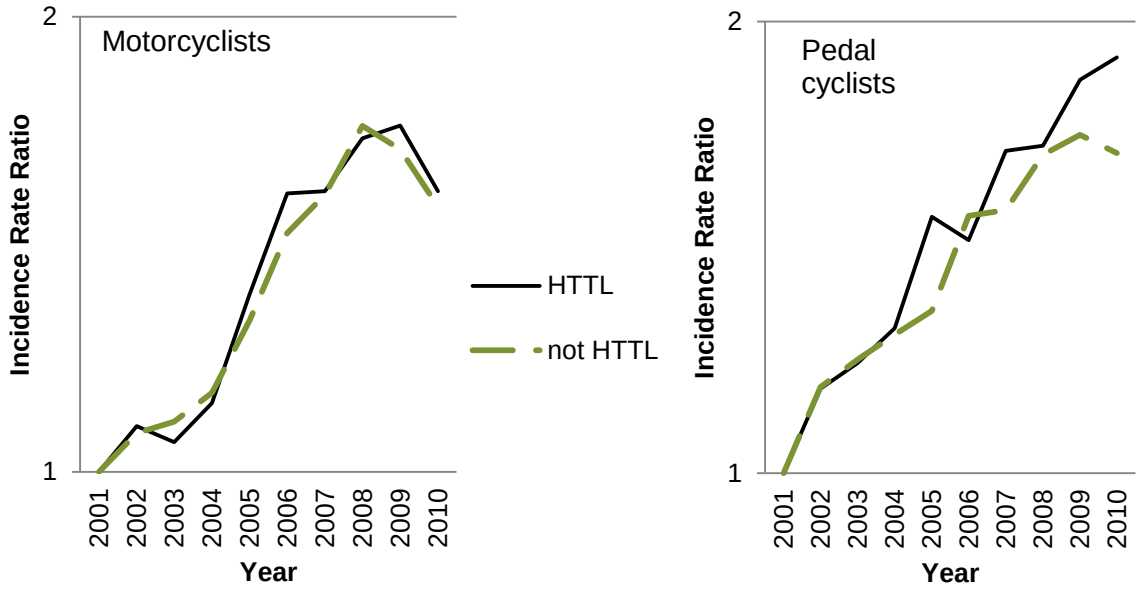
It is important to note that the absolute size of increase in hospitalised cases was many times larger than the absolute size of the decline in mortality (Figure J2).

While cyclist cases are sometimes fatal, they tend to be less lethal than other case types. An indication of this is the fact that the decade-long large increase in hospitalised cyclist cases was not (at least until 2013 road deaths data) reflected in a similar rise in fatalities. Hence, relatively low average lethality of at least one of the two main components of the rise in hospitalised cases may well be part of an explanation of the differential trend.

Figure J8 shows IRR for life-threatening and non-life-threatening injury cases involving motorcyclists and cyclists. Cases of both greater and lesser severity increased to a similar extent. However, the proportion of serious traffic injury cases that were HTTL differed between road user groups, being about 20% for cyclist cases, 25% for motorcyclist cases, 30% for MV driver cases and 35% for pedestrians. As noted above, the proportion of all serious injury in traffic cases that were motorcyclists or cyclists rose during the period considered here. Hence, while the overall rate of serious road injury cases rose, the mix of user types shifted towards those types that tend to be somewhat less severe.

Proportion HTTL is only one of several ways in which case severity can be assessed. It was beyond the scope of this analysis to undertake a deeper investigation of patterns of case severity, but these findings suggest that it might be fruitful to do so.

Figure J8: Life-threatening and other road traffic injury in Australia 2001-2010 of motorcyclists and cyclists: ratio of annual rate to rate in 2001



Hence, part of the differential trend (mortality vs. serious injury) may be explained by the relatively low mean lethality of the case types that account for the increase in overall age-adjusted rate of serious injury cases. (It should be noted, however, that lower lethality does not necessarily imply that such cases present a low risk of resulting in persisting disability.)

J.7 Are There Plausible Alternative Explanations for these Observations?

This section presents a consideration of ways in which factors related to data systems and/or methods might possibly contribute to the observed divergence of trends in road deaths (declining) and hospitalised road injuries.

Assessing severity of injuries: Six editions of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) were applied to case data during the period considered. However, the injury chapter changed very little. The same set of weights for assigning severity was applied to data for the whole period. That allows comparison of severity over the period, subject to certain provisos. The absolute values of diagnosis specific probability of death weights reflect practice at the period of the data used to generate them. The weights used here are based on data near the middle of the reported period. Improvements in therapy may lead to increasing survival with given injuries over time, and the weights are not designed to detect this. There was a small increase in the average number of injury diagnoses recorded per case during the period studied. That might reflect changing nature of admitted cases but might also reflect more thorough documentation and coding of cases over time. If the latter is the main explanation, then, in combination with the multiplicative ICISS method used, that change can be expected to have produced a small increase in the number of cases that met the criterion for HTTL.

Coding of external causes: It is likely that the NHMD cases with codes indicating occurrence ‘in traffic’ are not exactly equivalent to ‘serious road injury’ as defined by road safety agencies. First, an unknown proportion of cases were assigned to ‘traffic’ categories on the basis of the ICD-10 rule that cases involving road vehicles should be assumed to occur on-road unless the record states otherwise. That assumption will not always be correct, and the extent to which it is incorrect might differ between vehicle types.

Second, while the definition of ‘road’ in the Australian Road Rules and regulations that follow the Rules has similar scope to the definition of ‘public highway or street’ given in the ICD-10, the Australian Road Rules concept of ‘road related area’ appears to extend beyond the ICD-10 concept of ‘public highway or street’. Hence, even if information is available on the place of occurrence of (for example) cases in which injury results from events that occur in car parking areas that satisfy the definition of ‘road related area’, coding that follows the ICD-10 definitions would probably not record them as occurring ‘in traffic’.

While both of these factors could lead to a degree of mismatch between injury cases identified as occurring ‘in traffic’ on the basis of hospital data and the road safety sector’s ideal for a measure of ‘serious road injury, any such mismatch will be more important if its extent changes over time than if it is more or less constant. There is no specific indication of substantial change over time in the extent of any divergence between ‘in traffic’ cases and the road sector theoretical definition. However, such change could occur and warrants investigation.

Deaths in hospital: Deaths in hospital of cases coded as injuries in traffic account for about one-quarter of all road deaths. These cases are normally omitted from the National Injury Surveillance Unit reports for the Department of Infrastructure and Regional Development, in order to minimise double counting of cases (i.e. in road deaths data and in serious injuries data). The in-hospital death cases were included in part of the work reported here, to enable checking for change over time and other characteristics. The number of in-hospital traffic injury deaths declined in the study period. The annual number of cases declined by about one-fifth, mostly in the last couple of years, a somewhat lower reduction than occurred in total road deaths in the same period. Overall in-hospital mortality of traffic cases fell from about 1.2% of cases to about 0.8% in the decade. The proportion differed substantially between road user types, being lowest for cyclist cases, which fluctuating between 0.2% and 0.3% mortality after a decline early in the period. Data linkage studies can allow formal checking of the extent to which deaths in hospital of people coded as ‘in traffic’ cases correspond to cases counted as road deaths by road safety agencies.

J.8 Summary

National hospital separations data for the decade 2001 to 2010 (inclusive; calendar years of separation from hospital) were examined. The case data are from the AIHW National Hospital Morbidity Database. The data include all cases where the main reason for admission was injury and the external cause of injury was land transport. This includes cases in which the injured person was injured while using a motor vehicle or bicycle, or was a pedestrian injured in an event involving a land transport vehicle.

Serious injury land transport cases rose from 45,652 in 2001 to 50,907 in 2010. The serious injury cases recorded as occurring in traffic numbered 27,343 in 2001 and 32,775 in 2010. About two-thirds of cases are males, and in about one-quarter of the cases the injuries sustained meet the operational definition of HTTL.

Five case types account for about 95% of traffic cases: drivers, passengers, pedestrians, motorcyclists and cyclists.

Annual case-counts of traffic cases for two of these types rose substantially: motorcycle riders and cyclists. The absolute rise in annual case numbers was somewhat larger for motorcycle riders than for cyclists. However, the relative rise was larger for cyclists, and the upward trend in the second half of the period was larger for cyclists than for motorcyclists. These two types accounted for 29% of traffic cases in 2001, rising to 38% in 2010. They rose from 22% to 34% of HTTL cases.

Annual case-counts for motor vehicle driver traffic cases also rose. However, the absolute increase in case numbers was smaller than for motorcyclists or cyclists, and the percentage rise was much smaller than for those types.

Annual case-counts for the other main types of traffic cases, involving motor vehicle passengers and pedestrians, declined a little during the decade.

Hospitalised serious injury rose by about 10% from the base-year and then returned to about the level in 2001; while death rates fell by almost one-third. The absolute number of additional serious injury cases was much larger than the absolute decline in deaths. Hence, the decline in deaths does not account for the rise in serious injury cases, not even for the rise in HTTL cases.

In this period, the rise in rates of life-threatening cases was due to the rise in motorcyclist and cyclist cases. Rates of HTTL cases involving injury of road users other than motorcyclists and cyclists declined slightly in the study period.

The increase chiefly comprised traffic (on-road) cases and was particularly high for middle-aged males. Rates of cyclist cases increased more for residents of major cities than for others.

Previous work has shown that rates of HTTL road injury involving motorcyclists and cyclists have risen to a particularly large degree for middle-aged males. The work reported here confirms that. In particular, rates for men aged 45-64 injured as motorcyclists and cyclists rose substantially more than all-ages persons rates. However, rates for men aged 45-64 injured as other types of road users were much the same as the all-ages rates for males and female combined.

J.9 Data and Methods

Data: Deaths (Figures J1 and J2)

The road deaths data used for Figures J1 and J2 are from the Bureau of Infrastructure, Transport and Regional Economics (BITRE) Australian Road Deaths Database [www.bitre.gov.au/statistics/safety/fatal_road_crash_database.aspx].

Data: Serious injuries: traffic and non-traffic (Figures J1 to J8)

Case counts were taken from the AIHW National Hospital Morbidity Database. The AIHW enabled use of the data but the authors are responsible for the use of the data in this report. The selection criteria are:

- Admitted patient episodes for an Australian hospital that ended in the period 1 January 2001 to 31 December 2010.
- Principal diagnosis is any code in ICD 10 Chapter XIX Injury, poisoning and certain other consequences of external causes codes (S00–T98).
- First reported external cause of morbidity is any code in the range V00–V89 from the transport accident section of Chapter XX External causes of morbidity and mortality in ICD 10.
- Mode of admission field has any value except the one indicating that transfer from another acute care hospital had occurred (omitted to reduce multiple counting of cases that involved more than one episode of care in hospital).
- Mode of separation field has any value except the one indicating that the person died while in hospital.

HTTL serious injury cases were selected on the basis of having an ICD based Injury Severity Score (ICISS) of less than 0.941. ICISS is a measure of injury severity based upon a patient's injury diagnoses. The ICISS measure for this report is based upon ICD 10 AM coding and was derived using Australian hospital separations data (Stephenson et al. 2004). ICISS involves calculating a Survival Risk Ratio (SRR), that is, the proportion of all cases with each individual injury diagnosis code as a proportion of the total number of patients with that diagnosis code. Thus, a given SRR approximates the likelihood that a patient will survive a particular injury, given survival long enough to allow admission to hospital. Each patient's ICISS (survival probability) is the product of the probabilities of surviving each of their injuries individually. Hence, for a patient with a single injury code, ICISS is equal to the SRR for that injury, while for a patient with multiple injury codes, ICISS is equal to the product of the SRRs for all of those injuries. A patient's ICISS can vary from 0 (most life threatening) to 1 (least life threatening). In keeping with previous work, cases with ICISS below 0.941 were considered to be HTTL.

Code-range V00–V89 includes unintentional injury due to transport except cases due to water, air or space transport. Road traffic injury is estimated by further restricting cases to those with codes meeting the selection criteria in which the first reported external cause code describes the injurious event as having occurred 'in traffic'. 'In traffic' is defined in the ICD-10 as cases "occurring on the public highway [i.e. originating on, terminating on, or involving a vehicle partially on the highway]." Hospital records do not always specify whether a case occurred 'in traffic'. ICD-10 instructions direct coders to assume that such cases occurred in traffic unless the injurious event involved only off-road motor vehicles, defined as cases classifiable to V83–V86.

Cases in which the injured person was an animal-rider or the occupant of an animal-drawn vehicle are classifiable to ICD-10 categories that do not distinguish cases in traffic from non-traffic cases (V80). These were not included as either traffic nor non-traffic cases.

Cases in which the injured person was an occupant of a railway train or railway vehicle were included as being 'in traffic' if classified to V81.1 and as non-traffic if classified to V81.0, which specify these settings of occurrence. Cases classified to V81.2 to V81.9 were not included in either traffic nor non-traffic estimates. Similarly, cases in which the injured person was an occupant of a streetcar were included as being in traffic if classified to V82.1 or V82.9 and as non-traffic if classified to V82.0. Cases classified to V82.2 to V82.8 were not included in either traffic nor non-traffic estimates.

The criteria above omit transport-related cases coded as being due to intentional self-harm or assault, or in which intent was undetermined. They also omit cases in which the person was examined and observed in hospital after a transport crash but no injury or disease was recorded in the principal diagnosis field, and cases where a condition other than injury was recorded as the principal diagnosis.

Cases were classified as being due to a Road Vehicle Traffic Crash (RVTC) if they met the other case criteria and had a first reported ICD 10 external cause code which refers to occurrence in traffic, namely: V00–V06.[1], V09.2, V09.3,

V10–V18.[4,5,9], V19.[4,5,6,9], V20–V28.[4,5,9], V29.[4,5,6,9], V30–V38.[5,6,7,9], V39.[4,5,6,9], V40–V48.[5,6,7,9], V49.[4,5,6,9], V50–58.[5,6,7,9], V59.[4,5,6,9],

V60–V68.[5,6,7,9], V69.[4,5,6,9], V70–V78.[5,6,7,9], V79.[4,5,6,9], V81.1, V82.1, V82.9, V83–V86.[0,1,2,3], V87, V89.2, V89.3.

Key: the list above has been abbreviated as demonstrated by these examples. V00–V06.[1] refers to all ICD-10 categories in the range V00 to V06 where the fourth character is 1 (i.e. V00.1, V01.1 and so on to V06.1). V10–V18.[4,5,9] refers to all ICD-10 categories in the range V10 to V18 where the fourth character is any of 4, 5 or 9.

Cases were classified as being due to a Road Vehicle non-Traffic Crash (RVnTC) if they met the other case criteria and had a first reported ICD 10 external cause code which refers to occurrence in non-traffic circumstances, namely: V00–V06.[0], V09.0, V09.1, V10–V18.[0,1,2], V19.[0,1,2,3], V20–V28.[0,1,2], V29.[0,1,2,3],

V30–V38.[0,1,2,3], V39.[0,1,2,3], V40–V48.[0,1,2,3], V49.[0,1,2,3], V50–58.[0,1,2,3], V59.[0,1,2,3], V60–V68.[0,1,2,3], V69.[0,1,2,3], V70–V78.[0,1,2,3], V79.[0,1,2,3], V81.0, V82.0, V83–V86.[5,6,7,9], V88, V89.0, V89.1.

Population estimates (Figures J1 and J3 to J8)

Population data are from ABS tables of the estimated resident population as at 30 June of each year (i.e. the mid-point of each calendar year of case data).

Calculation of incidence rate ratios (Figures J3 to J8)

The charted values are incidence rate ratios (i.e. annual incidence rates divided by the corresponding rate for the baseline year, 2001). The values are all adjusted for age, sex and remoteness. Analysis was done in Stata/SE 13.1, using command –nbreg– to produce the adjusted incidence rate ratios. Negative binomial regression is a suitable count-based method, though the choice was not critical as the purpose here is descriptive rather than hypothesis testing. Formal model testing was not done, for the same reason.

The method was as follows: the file used for analysis was derived from the NHMD and population tables as described above. Indicator variables were made for the categories of interest (i.e. one for each of the charted series; see table notes). The resulting file was collapsed on age group, sex, remoteness zone and year, summing the indicator variables. The population data were merged with the prepared case data, and models were run.

The models omit records with missing value for any of the covariates, which is very uncommon except for remoteness, and modest for that item (0.9% to 1.6% per year).

Data tables

The values presented in Figures J1 to J8 are presented in Tables J1 to J8. The data sources and most aspects of analysis for these tables are described above. Aspects that differ between tables are described in notes below each table.

Table J1 (data in Figure J1): Fatal and serious road injury in Australia: annual population-based rates as a proportion of the rates in 2001

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Deaths	1	0.97	0.91	0.88	0.89	0.86	0.84	0.74	0.76	0.68
Serious injury (HTTL)	1	0.95	0.97	0.97	1.03	1.06	1.08	1.06	1.08	1.01
Serious injury (not HTTL)	1	1.02	1.02	1.03	1.07	1.12	1.10	1.11	1.08	1.04

Note: Case counts underlying the rates are from BITRE (deaths) and AIHW National Hospital Morbidity Database (serious injury).

Table J2 (data in Figure J2): Fatal and serious road injury in Australia: annual case counts as differences from the counts in 2001

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Deaths	0	-22	-116	-154	-110	-139	-134	-300	-249	-385
Serious injury (HTTL)	0	-252	-17	67	635	1035	1281	1330	1682	1243
Serious injury (not HTTL)	0	728	981	1337	2480	3771	3789	4712	4528	4050

Note: Case counts underlying the differences are from BITRE (deaths) and AIHW National Hospital Morbidity Database (serious injury).

Table J3 (data in Figure J3): Life-threatening road traffic injury in Australia 2001-2010 by road user type: ratio of annual rate to rate in 2001

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
All	1	0.969	0.973	0.949	1.029	1.045	1.048	1.055	1.086	0.999
Motorcyclist	1	1.073	1.047	1.111	1.311	1.529	1.534	1.662	1.695	1.534
Cyclist	1	1.138	1.184	1.249	1.482	1.430	1.640	1.653	1.829	1.893
MV driver	1	0.930	0.978	0.990	0.995	1.027	1.009	1.002	1.019	0.945
MV passenger	1	0.924	0.926	0.812	0.959	0.926	0.936	0.911	0.913	0.817
Pedestrian	1	0.895	0.911	0.871	0.903	0.896	0.898	0.858	0.855	0.846

Notes: the ICD-10 code ranges used for rows in this table are: All RVTC is as specified above; Motorcyclist V20–V28.[4,5,9], V29.[4,5,6,9]; Cyclist V10–V18.[4,5,9], V19.[4,5,6,9]; MV driver V30–V38.[5], V39.4, V40–V48.[5], V49.4, V50–58.[5], V59.4, V60–V68.[5], V69.4, V70–V78.[5], V79.4; MV passenger V30–V38.[6,7], V39.5, V40–V48.[6,7], V49.5, V50–58.[6,7], V59.5, V60–V68.[6,7], V69.5, V70–V78.[6,7], V79.5; Pedestrian V00–V06.[1], V09.2, V09.3. Incidence rate ratios were adjusted for age, sex and remoteness of residence.

Table J4 (data in Figure J4): Life-threatening road traffic injury in Australia 2001-2010 for all types of road users: ratio of annual rate to rate in 2001

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Traffic	1	0.969	0.973	0.949	1.029	1.045	1.048	1.055	1.086	0.999
Non-traffic	1	0.943	0.892	0.925	1.044	0.882	0.877	0.930	0.925	0.883
Male 45-64, traffic	1	0.962	0.960	1.049	1.081	1.213	1.364	1.341	1.509	1.399
Major cities, traffic	1	0.933	0.937	0.945	1.023	1.057	1.088	1.056	1.063	1.033
Other places, traffic	1	0.985	0.995	0.954	1.033	1.042	1.028	1.054	1.101	0.978

Notes: the ICD-10 Traffic and non-traffic were specified as stated above. Age and sex are as stated in the NHMD. *Major cities* includes cases where the place of usual residence of the injured person was in the Major Cities zone as specified in the ABS ASGC remoteness areas classification. *Other places* includes cases where the place of usual residence of the injured person was anywhere other than a major city. Incidence rate ratios were adjusted for age, sex and remoteness of residence.

Table J5 (data in Figure J5): Life-threatening road traffic injury in Australia 2001-2010 of all road user types except motorcyclists and cyclists: ratio of annual rate to rate in 2001

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Traffic	1	0.939	0.945	0.912	0.955	0.954	0.947	0.933	0.953	0.871
Non-traffic	1	0.925	0.798	0.834	0.902	0.688	0.685	0.745	0.730	0.697
Male 45-64, traffic	1	0.907	0.924	0.965	0.890	0.942	0.997	0.977	1.004	0.870
Major cities, traffic	1	0.892	0.903	0.889	0.936	0.950	0.954	0.912	0.888	0.845
Other places, traffic	1	0.960	0.975	0.925	0.962	0.958	0.941	0.943	0.993	0.882

Notes: Specification as for Table J4 except that cases where the injured person was recorded as a motorcyclist or cyclist were omitted. Incidence rate ratios were adjusted for age, sex and remoteness of residence.

Table J6 (data in Figure J6): Life-threatening road traffic injury in Australia 2001-2010 of motorcyclists: ratio of annual rate to rate in 2001 after adjustment for age, sex and remoteness of residence

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Traffic	1	1.073	1.047	1.111	1.311	1.529	1.534	1.662	1.695	1.534
Non-traffic	1	0.960	1.065	1.066	1.249	1.171	1.244	1.235	1.260	1.168
Male 45-64, traffic	1	1.051	1.021	1.243	1.568	1.971	2.329	2.316	2.810	2.655
Major cities, traffic	1	1.026	0.986	1.172	1.264	1.570	1.567	1.700	1.785	1.613
Other places, traffic	1	1.108	1.086	1.063	1.328	1.477	1.488	1.590	1.596	1.447

Notes: Specification as for Table J4 except that cases were restricted to those where the person was recorded as having been motorcycling when injured. Motorcyclist, traffic V20–V28.[4,5,9], V29.[4,5,6,9]; motorcyclist, nontraffic V20–V28.[0,1,2], V29. [0,1,2,3]. Incidence rate ratios were adjusted for age, sex and remoteness of residence.

Table J7 (data in Figure J7): Life-threatening road traffic injury of cyclists in Australia 2001-2010: ratio of annual rate to rate in 2001

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Traffic	1	1.138	1.184	1.249	1.482	1.430	1.640	1.653	1.829	1.893
Non-traffic	1	0.948	0.870	1.012	1.126	1.094	0.996	1.098	1.211	1.079
Male 45-64, traffic	1	1.128	1.138	1.327	1.551	1.841	2.317	2.223	2.753	3.006
Major cities, traffic	1	1.166	1.302	1.293	1.538	1.581	1.856	1.795	2.129	2.400
Other places, traffic	1	1.109	1.050	1.220	1.412	1.256	1.409	1.494	1.511	1.374

Notes: Specification as for Table J4 except that cases were restricted to those where the person was recorded as having been cycling when injured. Cyclist, traffic V10–V18.[4,5,9], V19.[4,5,6,9]; cyclist, nontraffic V10–V18.[0,1,2], V19.[0,1,2,3]. Incidence rate ratios were adjusted for age, sex and remoteness of residence.

Table J8 (data in Figure J8): Life-threatening and other road traffic injury of motorcyclists and cyclists in Australia 2001-2010: ratio of annual rate to rate in 2001

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Motorcyclists, traffic: HTTL	1	1.073	1.047	1.111	1.311	1.529	1.534	1.662	1.695	1.534
Motorcyclists, traffic: not HTTL	1	1.061	1.080	1.128	1.260	1.439	1.526	1.694	1.635	1.498
Cyclists, traffic: HTTL	1	1.138	1.184	1.249	1.482	1.430	1.640	1.653	1.829	1.893
Cyclists, traffic: not HTTL	1	1.141	1.190	1.237	1.282	1.484	1.497	1.630	1.680	1.634

Notes: Motorcyclist, traffic V20–V28.[4,5,9], V29.[4,5,6,9]; cyclist, traffic V10–V18.[4,5,9], V19.[4,5,6,9]. Incidence rate ratios were adjusted for age, sex and remoteness of residence.

Appendix K First Steps Agenda

The following Table lists the items in the First Steps agenda listed in the original NRSS document and provides comment on the extent of implementation. The items were assessed under four headings: research, planning, legislation or regulation and other action, and rated as commenced, progressed or completed. If the authors could identify no evidence of activity no rating was provided. The main sources of information were the Implementation Status report published by the Transport and Infrastructure Council in 2013 and the consultation with the members of the ASTF and wider group of stakeholders. The general nature of many of the items listed as First Steps meant that it was difficult to objectively assess how fully they had been implemented.

FIRST STEPS (from existing strategy) – ✓ Action commenced ✓✓ Action progressed ✓✓✓Actions completed

Ref no.	Action	2013 Status Report	Research	Plan	Legislation or Regulation	Other Action	Comments
	Safe Roads						
1	Road authorities at all government levels will ensure that Safe System principles are applied to all new road projects, including road upgrades.	Amber	✓✓	✓✓			• Austroads projects
2	Modify infrastructure funding guidelines and agreements to increase the safety benefits resulting from expenditure on roads.	Amber		✓✓		✓✓	• TAC and MAC road safety infrastructure funds • Bruce Highway Upgrade
3	Target infrastructure treatments to:						
3a	Address run-off-road and head-on casualty crashes. Road sections prioritized according to crash history will be treated with infrastructure treatments such as protective barriers (for example, wire rope), and/or reduced speed limits.	Amber	✓✓✓	✓✓			• Austroads report • Programs developed
3b	Address serious casualty crashes at intersections. Sites prioritised according to crash history will be treated with infrastructure treatments and/or speed reduction measures.	Amber	✓	✓✓			
3c	Address safety issues for vulnerable road users, for example: safety improvements on popular motorcycle routes; infrastructure improvements for bicyclists, older road users, people accessing public transport and pedestrians.	Amber	✓✓	✓✓		✓✓	• Walking and cycling strategies in place including infrastructure improvements
3d	Address safety on key arterial routes, prioritised by crash history. Route safety reviews to be undertaken and findings implemented.	Amber		✓✓✓			
4	Develop a nationally agreed approach to applying the willingness-to-pay (WTP) methodology to value safety.	Amber	✓✓✓			✓✓	• Austroads report • NSW and WA adopted WTP • Victorian report into serious injury recommended against WTP
5	Ensure that roads in and around Indigenous communities are included in infrastructure treatment programs.	Amber				✓	• Extent of action unknown
6	Complete Austroads risk-based assessment model; and then systematically assess risk levels for highest volume roads and prioritise road sections for safety improvement.	Amber	✓✓	✓		✓	• ANRAM has been developed and trials underway
7	Implement and evaluate Safe System demonstration projects in specific local government areas and Indigenous communities.	Amber	✓✓			✓	• Austroads report • Some trials underway

Ref no.	Action	2013 Status Report	Research	Plan	Legislation or Regulation	Other Action	Comments
	Safe Speeds						
8	Improve compliance with speed limits across the road network.	Amber	✓✓	✓✓	✓	✓	• Austroads report • Speed surveys from SA and WA show compliance improving • Point to Point systems being introduced in most states • Enhanced Enforcement Programs in NSW
9	Improve the use of sanctions to more effectively deter people from speeding.	Amber	✓		✓		• Penalty review • Some penalty increases
10	Develop a national public information campaign about the community safety benefits of complying with speed limits. This will provide education resources suitable for use by government agencies, local governments and community forums.	Amber	✓				• Austroads project • NRSC project to develop resources
11	Review speed limits where risk levels are high and engineering solutions are not feasible or cost-effective.	Amber	✓✓				• Austroads research completed • Speed limit reductions in rural areas in SA and Tasmania • Speed limit reductions in city areas in most jurisdictions
12	Develop new risk-based national speed limit guidelines for different road categories / functions. Guidelines should encourage consistent limits based on measured risk/crash rates, while minimising multiple speed zones over short distances.	Amber	✓✓				• Austroads research underway
13	Facilitate the implementation of Intelligent Speed Adaptation (ISA) systems.	Amber	✓✓	✓		✓	• National working group on ISA and some trials underway on safety features for government fleets • Research on potential of insurance incentives completed
14	Increase the effective application of chain of responsibility legislation to prosecute heavy vehicle speeding (including speed limiter) offences, and harmonise legislation to assist cross-border enforcement.	Amber		✓		✓	• Working group set up • Action in some states

Ref no.	Action	2013 Status Report	Research	Plan	Legislation or Regulation	Other Action	Comments
	Safe Vehicles						
15	Facilitate the adoption of nationally-agreed best-practice fleet purchasing policies.	Amber					• Research through SVSEG • NTC project on corporate road safety (National Road Safety Partnership Project) • Some jurisdictions implemented policies for 5 star government fleets
16	Improve safety regulations for new vehicles.						
16a	Improve the ADR process to ensure that minor changes to UNECE regulations are accepted automatically, timely consideration is given to new and amended UNECE regulations and GTRs, and priority is given to implementing new and amended ADRs that can deliver the greatest safety benefits.	Green			✓✓✓		• Completed
16b	Subject to the final outcomes of Regulatory Impact Statements (RISs), mandate the following vehicle safety features for new vehicles: advanced seatbelt reminders (driver's seat); provision for ISOFIX child restraint fittings; ESC in light commercial vehicles; Anti-lock Braking systems (ABS)/load proportioning brake systems for heavy vehicles and trailers.	Green			✓✓✓		• Completed or in process
16c	Prepare RISs to consider mandating of ABS for motorcycles, increased heavy vehicle cabin strength, ESC and Lane Departure Warning Systems for heavy vehicles, and Brake Assist Systems for light passenger vehicles.	Amber		✓✓	✓		• In process or scheduled
16d	Lead international development of a pole side impact, which will require strong protective measures for vehicle occupants involved in side impacts, including provision of effective side curtain airbags or other airbag configurations.	Green				✓✓✓	• Completed
17	Improve and promote the ANCAP program:						
17a	Expand the ANCAP program to increase the coverage of crash test results across the full range of new vehicles on the Australian market, including light commercial vehicles, and develop a crash test standard and protocol for rollover crashes.	Green					• There is now extensive coverage of the new car market • Not involved in rollover as other safety technologies will pre-empt the need for this
17b	Support the implementation of a national 'Stars on Cars' program to increase consumer demand for safe vehicles through the promotion of ANCAP safety ratings.	Green					• There is no national program but is probably not needed now as ANCAP "brand' is going well

Ref no.	Action	2013 Status Report	Research	Plan	Legislation or Regulation	Other Action	Comments
17c	Encourage vehicle manufacturers to support ANCAP through provision of vehicles ahead of their release to the market.	Green.					• This is now the standard
18	Encourage vehicle manufacturers to develop industry codes of practice committing to incorporation of vehicle safety features, while ensuring that safety features are not packaged only with luxury or comfort features.	Amber		✓			• No identifiable action
19	Investigate incentives relating to vehicle purchases.	Amber	✓✓			✓	• Two NRSC research projects completed • Investigation by jurisdictions • Some action by insurance companies
20	Evaluate community concerns and work with vehicle industry to ensure vehicle advertising avoids display and promotion of unsafe and illegal behaviours.	Green	✓✓✓				• National community survey • FCAI review
21	Strengthen regulation of post-production modifications and additions (for example, limiting the raising of vehicles) which may compromise the safety of the vehicle as manufactured.	Amber	✓		✓		• Reviews being undertaken • Some changes made by jurisdictions
22	Investigate further regulation of speed and other safety features for powered alternative vehicles (for example, mobility scooters and power-assisted bicycles).	Green			✓✓✓		• Completed
23	Investigate options to maximize the efficiency and safety of restricted-access heavy vehicle operations.	Amber	✓				• NTC and National Heavy Vehicle Regulator investigating options
24	Investigate technology-based options to minimize driver distraction from in-vehicle devices.	Amber	✓✓				• Variety of research undertaken • New technology being developed • No program of actions agreed
	Responsible road use						
25	Improve driver and rider licensing arrangements.	Amber					• Austroads review Most jurisdictions have strengthened GLS • Investigation of GLS for motorcycles underway • Some changes to assessment practices for heavy vehicles
26	Develop and implement a national helmet assessment and rating program to stimulate market demand for the safest motorcycle helmets – and examine options for other protective gear.	Amber		✓			• Options developed
27	Implement programs addressing the road safety needs of Indigenous communities and disadvantaged groups.						

Ref no.	Action	2013 Status Report	Research	Plan	Legislation or Regulation	Other Action	Comments
27a	Develop and implement programs to increase the opportunities for driving practice for disadvantaged learner drivers, particularly in Indigenous communities.	Amber	✓✓	✓✓			• Austroads project • Major NT trial
27b	Implement locally relevant and culturally appropriate Indigenous community education campaigns promoting key road safety messages.	Green				✓✓✓	• Materials have been developed
27c	Implement education campaigns to meet the road safety needs of culturally and linguistically diverse groups.	Amber				✓	• Some progress by most jurisdictions
28	Implement, and promote the use of, new Fitness to Drive guidelines to improve the management of at-risk and medically-impaired drivers.	Green	✓✓✓			✓✓✓	• New guidelines published and being implemented
29	Pilot electronic work diaries for heavy vehicle drivers as an alternative to paper-based diaries to improve fatigue management.	Green		✓		✓✓✓	• Pilot being conducted by NSW
30	Mandate seatbelt wearing for taxi drivers.	Green			✓✓✓		• Completed
31	Pilot operational field trials of driver and vehicle devices that measure drowsiness crash risk using metrics based on ocular dynamics or carriageway position, including back-to-base monitoring of data.	Amber	✓			✓	• NSW has piloted some devices
32	Develop public information campaigns and education resources about fatigue for all road users, with a particular focus on educating novice drivers.	Amber	✓			✓	• Fatigue campaigns ongoing
33	Expand the provision of rest areas, including in regional towns (‘rest towns’), to help motorists manage fatigue.	Amber				✓✓	• Action is ongoing
	Irresponsible road use						
34	Work in partnership with police to strengthen the deterrence effects of random breath testing programs (RBT) and random roadside drug testing programs, and to improve public awareness of these programs.	Amber	✓				• Austroads project on the best practice
35	Review, in consultation with stakeholders and the community, the application of BAC limits currently applying to certain licence categories.	Amber	✓				• Austroads project
36	Alcohol interlocks.		✓		✓✓		• Austroads project New interlock schemes in ACT, NSW, TAS • Enhanced schemes elsewhere
37	Expand the use of vehicle sanctions for repeat drink and drug driving offences.	Amber			✓		• Some jurisdictions introduced enhanced sanction

Ref no.	Action	2013 Status Report	Research	Plan	Legislation or Regulation	Other Action	Comments
38	Review (with liquor control commissions and the health and police sectors) the adequacy of operating responsibilities applying to venues for responsible alcohol serving.	Green				✓✓	• Improved training requirements
39	Mobile phones.	Amber	✓		✓	✓	• Austroads project on distraction • Publicity option • Enforcement and technology options being explored
40	Address the risk associated with unlicensed drivers and unregistered vehicles:						
40a	Increase traffic surveillance to improve detection of unregistered vehicles and unlicensed drivers.	Green	✓✓			✓✓✓	• Austroads report • Introduction of ANPR
40b	Extend the use of vehicle sanctions to drivers of unregistered vehicles, and unlicensed or suspended drivers.	Amber			✓	✓	• Some jurisdictions have extended sanctions
41	Assess the risks on school bus routes and address risks through infrastructure improvements, vehicle safety features such as seatbelts and road user awareness programs.	Amber				✓✓	• Ongoing activity
42	Review international best practice and identify cost-effective interventions for dealing with high risk and repeat traffic offenders.	Amber	✓				• Research at jurisdiction level
	Making it happen						
43	Examine the scope to improve institutional structures, capacities and delivery arrangements at a national level to optimise road safety efforts ahead of a scheduled review of this strategy in 2014.	Amber				✓	• Modified arrangement at national level
44	If adopted by the International Standards Organisation, consider adopting and promoting the new standard for road traffic safety management systems (ISO 39001) – this is intended for all organisations wishing to reduce death and serious injury related to road travel, and will help them to define their contribution to this goal.	Amber	✓			✓	• Austroads project
45	Engage with organisations that can influence and build community support for road safety.	Green				✓	• Although work has been done stakeholders criticized lack of engagement
46	Explore opportunities to secure alternative sources of funding or shared funding arrangements for road safety activities, including targeted infrastructure investment.	Amber					• TAC and MAC infrastructure funds major achievement

Ref no.	Action	2013 Status Report	Research	Plan	Legislation or Regulation	Other Action	Comments
47	Explore the allocation of monies collected for penalties imposed for camera detected offences, in excess of the administrative cost, to road safety education and awareness programs, injury rehabilitation programs, and road funding to improve the safety of sections of state and territory controlled roads.	Green				✓✓✓	• Achieved
48	Develop and maintain a National Road Safety Strategy website as a prime means of sharing road safety information and reporting on progress.	Green				✓✓✓	• Achieved
49	Ensure public education campaigns and resources are aligned with the Safe System objectives of this strategy.	Green				✓✓	• Stakeholders suggested tis could be improved
50	Work with local government to promote the development and implementation of local or regional road strategies.	Green				✓✓	• Stakeholders commented this could be improved
51	From 2012 each Minister responsible for road safety (state, territory and federal) to report annually to their parliament on the progress in road safety, including safety performance indicators.	Green				✓✓	• Achieved
52	A review of the strategy will be undertaken before the end of 2014, including an assessment of implementation progress, a review of the strategy objectives and targets, and identification of priority actions for the next three years.	Amber	✓✓				• Being undertaken
53	Publish and regularly update the key statistical measures of road safety progress.	Amber	✓✓			✓✓	• Being undertaken by BITRE
54	Present an annual report to the Australian Transport Council documenting progress in implementing this strategy.	Green				✓✓✓	• Achieved
55	Work towards the adoption of nationally consistent road crash classification definitions and the development of an improved national serious injury database.	Amber				✓✓	• Being developed by BITRE
56	Work towards the creation of a national vehicle safety database to provide real-time research data on the characteristics of the Australian vehicle fleet and crashes.	Amber	✓				• Being investigated by the Department of Infrastructure and Regional Development
57	Ensure that jurisdictional and Austroads road safety research programs adequately support the objectives of this strategy.	Green				✓✓✓	• Achieved
58	Consider the scope for road safety management capacity reviews within each jurisdiction.	Amber				✓✓	• Reviews conducted by three states
59	Review the training of road safety specialists and the value of offering more formal training/education opportunities in road safety.	Amber				✓✓	• Stakeholders suggested more work needed

Appendix L Future Steps Agenda

The following table shows the Future Steps listed in the original NRSS document. An indication of support is provided for each step in the context of supporting research, indications from crash and injury databases and feedback from the ASTF and road safety stakeholders. The indications are based on the subjective judgments of the authors and are intended to provide an overview of which Future Steps have conditions that would readily allow them to be advanced. Where the cell is blank the authors were unable to make a judgment on the level of support that existed, due to a lack of evidence, pre-existing analyses or indications from stakeholders and the ASTF. The comments column reflects how each action could be more precisely specified, given the observations made about the non-specific nature of the First Steps actions.

FUTURE STEPS (from existing strategy)– What else will be considered?

✓ Some support ✓✓ Support ✓✓✓Strong support

Ref no.	Action	Lit Review & Background	Crash Data	Hospital Data	Consultation ASTF	Stakeholder Consultation	Comments
	Safe Roads						
	Implementing innovative infrastructure safety treatments where feasible and cost-effective, including 2+ 1[1] schemes and new types of safety barriers on major highways.	✓✓	✓✓		✓✓	✓✓✓	• Needs $ or Km target
	Working with local governments to develop and deliver infrastructure improvement strategies that include cost-effective safety treatments (for example, flexible barriers, roundabouts, shoulder sealing, rumble strips).	✓✓	✓✓		✓✓	✓✓✓	• Needs more specific action
	Implementing infrastructure measures to physically separate bicyclists and motor vehicles on higher-speed roads with significant bicycle usage.	✓✓✓	✓✓✓	✓✓✓	✓✓	✓	• Needs a target
	Introducing motorcycle black spot/black length programs in all jurisdictions, potentially funded by a levy on compulsory third-party injury insurance for motorcyclists (as Victoria has done).	✓✓✓	✓✓✓	✓✓✓	✓	✓✓✓	• Needs more specific action
	Improving land use planning to reflect Safe System principles, including greater control of roadside development for safety.	✓			✓	✓	• Needs more specific action
	Safe Speeds						
	Investigating the case for promoting or mandating speedometer displays which place more emphasis on the range of Australia's legally permissible speeds, and limit the display of higher speeds.				✓✓	✓	
	Promoting or mandating speed governing and ISA in a broader range of vehicles.	✓✓	✓✓		✓✓	✓✓	• Needs target % of new vehicles
	Developing telematics as a regulatory tool for heavy vehicle speeding.		✓			✓	• Needs more detail
	Improving the effectiveness of registration sanctions for heavy vehicles that have non-operational speed limiters.						•
	Working with toll road operators to implement point-to-point speed enforcement on motorways.		✓		✓	✓	• Not just toll roads • Needs target

[1] 2+1 roads are created using wire-rope barriers to create two lanes in one direction and one lane in the other, alternating every few kilometres

Ref no.	Action	Lit Review & Background	Crash Data	Hospital Data	Consultation ASTF	Stakeholder Consultation	Comments
	Safe Vehicles						
	Mandating the following vehicle safety features for new vehicles, subject to the outcomes of a RIS: Advanced Emergency Braking Systems for heavy and possibly light vehicles; battery and system safety and protection of servicing and emergency services personnel for electric and hybrid vehicles; crash protection of occupants from high voltage vehicle systems; rear impact injury mitigation (head restraints); adaptive lightingl6; the expansion of advanced seat belt reminders or interlocks to other vehicle categories and seating positions.	✓✓✓	✓✓✓		✓	✓✓	• Needs a detailed plan for each technology
	Investigating the scope for regulatory action to further improve stability, traction and braking standards on motorcycles supplied to the Australian market.	✓✓	✓✓✓	✓✓✓	✓	✓✓	• There is clear support for motorcycle ABS and an implementation plan is required
	Working with ANCAP, so that it continues to encourage the latest high benefit vehicle safety innovations in areas where regulation cannot be justified or is still being developed and supplements regulatory crash test requirements.	✓✓			✓	✓✓✓	• Needs more specific action
	Introducing automatic crash notification similar to the European eCall system.					✓	• More research needed
	Developing telematics as heavy vehicle regulatory tools to enforce speed and mass limits, to minimise road damage and maintain optimal vehicle braking and handling performance.				✓	✓	• Needs more specific action
	Working with industry to secure good community understanding of vehicle safety ratings systems, including evaluating the case to mandate display of safety ratings at point of sale on all new vehicles.	✓✓	✓		✓✓	✓	• Supported specifically for older drivers
	Implementing international standards to improve light commercial vehicle safety and achieve alignment with best practice passenger vehicle standards.				✓	✓	• Needs implementation plan
	Review the current ADRs for vehicle occupant protection with a view to raising the safety standards of Australia's vehicle fleet.	✓✓			✓	✓✓	• Needs target
	Working with the vehicle industry and emergency services to ensure that vehicle design and manufacture does not compromise the safety and efficiency of road crash rescue operations.	✓					• Further investigation needed
	Safe People – responsible road use						
	Addressing the substantial increase in crash risk at the beginning of the unrestricted licence period through more gradual relief from the provisional licensing restrictions.				✓✓	✓	• Needs research
	Continuing to explore the case for a national post-licence driver education program, taking account of evaluation results of driver education interventions with proven road safety benefits.					✓	• More research needed

Ref no.	Action	Lit Review & Background	Crash Data	Hospital Data	Consultation ASTF	Stakeholder Consultation	Comments
	Promoting alternative mobility options for older drivers through local government community transport programs.	✓✓	✓		✓	✓	• More development needed • Target demonstration projects
	In partnership with agencies responsible for delivering school education, developing road safety resources for parents of pre-school children, and for primary and secondary school students prior to licensing.				✓	✓	• More research needed
	Developing educational and regulatory interventions to minimise the effects of driver distraction.						• Current evidence is not clear
	Investigating the use of new technologies to minimise driver error and automatically monitor driver performance.	✓✓					
	Safe People – irresponsible road use						
	In consultation with stakeholders and the community, examining the scope to reduce the legal blood alcohol concentration (BAC) limit for all drivers.						• Research needed
	Developing national workplace random drug testing standards for commercial vehicle industry application. Companies with testing regimes in place which meet this standard would have a defence against chain of responsibility prosecutions for drug driving.						• Research needed
	Investigating the use of emerging roadside drug testing technology to apply to other illicit and licit drugs.				✓	✓	• Research needed
	Compulsory blood testing for drugs and alcohol for all drivers involved in serious casualty crashes.		✓				• Needs more justification
	Monitoring and assessing the evidence on driver distraction associated with mobile phones and other communication devices, for identification of potential countermeasures (including for professional drivers).				✓	✓	
	Examining the use of seatbelt interlocks and other regulatory means to increase seatbelt wearing by heavy vehicle drivers.	✓			✓	✓	• Not only heavy vehicles

Appendix M Recent Modelling of Strategy Outcomes

Age-period-cohort models of recent trends in driver casualty rates, and the future projection of driver casualty numbers

Robert Anderson, Centre for Automotive Safety Research

Introduction

As described elsewhere in this review, the patterns in crash data suggest that risk is declining on the nation's roads. The underlying factors that have driven the decline remain to some extent unclear, although there is no reason to doubt that the contributions of the multifaceted approach to reducing crash numbers over several decades is central to the decline.

The main types of system change usually cited as being responsible for the declines in risk are those to do with safer vehicles, safer speeds, safer road users and safer infrastructure. However the relative contribution of each of these factors to the decline in aggregate crash risks is not well understood. A clearer understanding of the importance of these factors would aid in focusing efforts on the most effective road crash countermeasures in the future.

Broadly speaking, factors that affect crash numbers can be divided into two groups: the first consists of those factors that are influenced by explicit road safety actions. For example, speed in response to speed limits and enforcement, young driver exposure via stricter licensing conditions, and reductions in conflicts via infrastructure improvements are examples of such factors. The second group consists of factors that might be described as background factors. Background factors may be hugely influential as they include changes in population, the distance travelled, the numbers of vehicles and the evolving nature of vehicles operated.

The two groups of factors may also be divided along quite different lines: road safety actions and background changes can be categorised according to whether the effect of the changes made at a particular time are likely to felt immediately by all (or most) of the target population, or whether the effect applies only to new units in the transport system rather than to ones already in the system. This distinction is important, as successful road safety actions of the first kind will have an immediate influence on the crash risk of a targeted population, whereas safety improvements of the second kind, and specifically vehicle improvements, cannot affect existing vehicles in the system. In fact, the effect of an improvement to new vehicle safety will only rise to its maximum once all pre-existing vehicles are no longer operating on the roads.

Improvements to new vehicle safety can be expected to have creeping, but increasing and long lasting effects that may take more than a decade to be felt. The existence of such effects also means that some of the declines in future crash risk must be attributable to historical improvements in vehicles.

In this Section, a model is proposed that takes account of both kinds of effects. In a sense it weighs up the relative contributions of vehicle and non-vehicle based road safety measures on changes in crash rates. The model examines historical crash data, but can, within reason, be used to project future crash numbers.

To understand how each kind of systematic change is affecting crash numbers, the effect of each factor has to be disentangled from the others – something that is not all that easy to achieve in practice. In the present analysis, a special technique called age-period-cohort modelling is used to explain fatality crash rates are affected by changes in vehicle design, vehicle age, and year-to-year (non-vehicle) changes affecting road safety. Once various effects are identified, the consequences of further action (or inaction) with regard to vehicle safety and road safety on future crash numbers will be examined. The method is described in detail in Anderson and Searson (2014).

Age Period Cohort model of driver fatalities in cars and station wagons

In Anderson and Searson (2014), an age-period-cohort model was proposed to describe changes in the rate of driver fatalities in single passenger-vehicle crashes. The purpose of this model was to examine the effects of vehicle changes on crash numbers over time; driver fatalities in single passenger-vehicle crashes were chosen in order to examine effects in a way that would not be confounded by difficult-to-control-for factors such as vehicle occupancy, other vehicles in the crash and so on. The results are likely to be generalisable to other crash types in which any occupant of a passenger vehicle is killed.

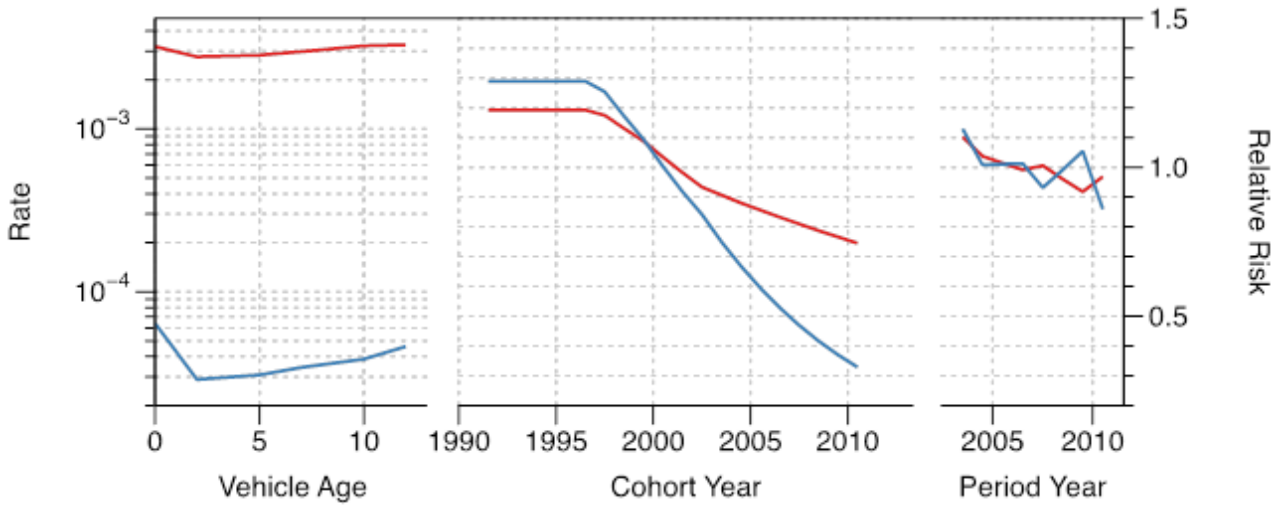
Age-period-cohort (APC) modelling attempts to overcome a technical problem in the analysis of crash data. The problem arises from the fact that while vehicle-design related injury risk is likely to have been changing substantially over recent years, crash risk also appears to change as vehicles age (Lécuyer and Chuoinard, 2006). A general increase in risk as a vehicle ages is likely to reflect the nature of how and where the vehicle is driven, and the risk profile of the drivers of those vehicles. Concurrently, there is likely to be reductions in risk created by conditions separate from the vehicle (road-safety related changes to infrastructure, speed limits, other legislation, enforcement and behaviour). The nature of these concurrent effects means that distilling the effects of changes in vehicle design in historical crash data is not straightforward.

APC models are usually associated with the study of human health where the rate of disease in a given period might depend separately on a person's age, the year they were born (their cohort) and the period itself. The technical challenges presented in the study of human disease (where disease rates may depend on a person's age, their birth year, and the calendar year) are the same as the type of challenge presented by the entangled effects of vehicle age, crash period and vehicle cohort.

In the model proposed by Anderson and Searson (2014), vehicle safety changes are represented by the year that vehicles were built, and road safety improvements are represented by the crash periods (calendar years) being considered. The casualty rate is expressed as crashes per registered vehicle. The results of the analysis show the crash rate across vehicle ages, with the effect of vehicle build year and the effect of period were shown as separate effects.

For this review, the model is extended to all driver casualties (fatal and injury) in cars and station wagons in New South Wales that occurred between 2003 and 2010. The results of the analysis are shown in Figure M1. For technical reasons, the model requires at least one assumption to be made for effects to be "pinned down". In this model, it has been assumed that each cohort has been at least as safe as any preceding cohort (i.e. vehicles have never become less safe, on average, with each successive cohort), but moreover, that vehicle cohorts did not improve either in the early 1990s. Because of the way the model is constructed, this also has the effect of maximising the effect of period in the model (i.e. the effect of road safety measures and other factors that relate to period).

Figure M1: Casualty rates (per registered vehicle) by vehicle age, and effects of vehicle cohort and crash period on the rates of driver fatalities (blue) and all driver casualties (red) in car/station wagon crashes in NSW



It can be seen that rates are at a minimum at about vehicle age two and rise thereafter for both all-severity injury and fatal crash rates. The effect of vehicle cohort is clear, with the risk of death or injury associated with vehicles built after the late 1990s dropping sharply with cohort. For both injury and fatal crashes, the effect of period is a reduction in the rate of about 0.02 per calendar year. Hence the model suggests that the difference between the recent declines in vehicle occupant fatal crashes and the more muted declines in vehicle occupant injury crashes are likely to be due to the differential effect of vehicle design on fatal and injury risk.

The results above can be used to estimate the relative effects of vehicle design and other road safety measures on driver casualty rates. The limitations of the data used to derive the results in Figure M1 mean that the results are restricted to effects on rates of crashes involving vehicles less than 12 years of age. Hence, for the purposes of the present analysis, the age and cohort effects were extrapolated for vehicles older than 12 years of age, and for vehicles built before 1991. This allowed the model to be used to predict the total number of passenger vehicle driver casualties in the period 2003 – 2010. When this is done and the effects aggregated over the vehicle population in each year, the model does a reasonable job of predicting the total number of drivers injured or killed in car/station wagon crashes in New South Wales over the period 2003-2010. This is shown for driver fatalities in Figure M2 and for driver injuries in Figure M3. The differences between the model prediction and the actual numbers arise from the fact that the model is based on about half the data, but is extrapolated to apply to the whole dataset.

Figure M2: Modelled and actual number of drivers killed in car/station wagon passenger crashes in NSW

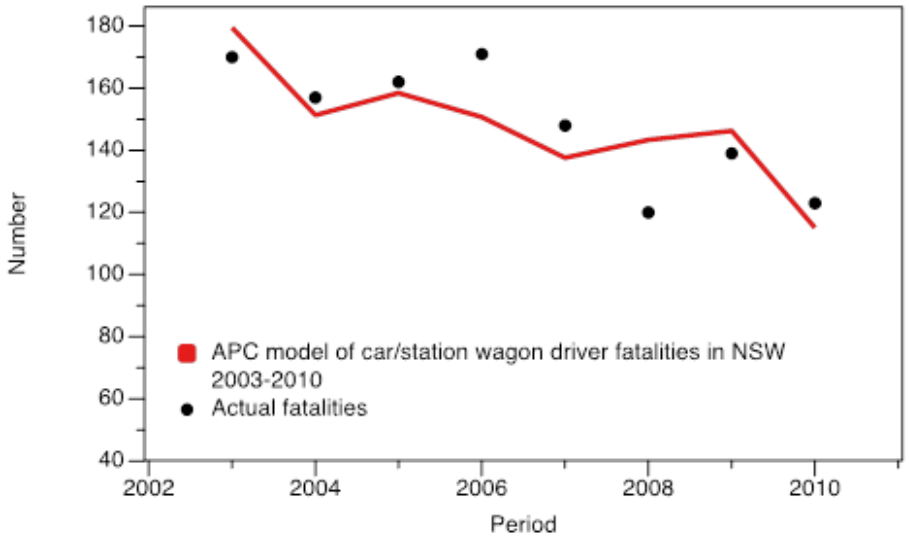
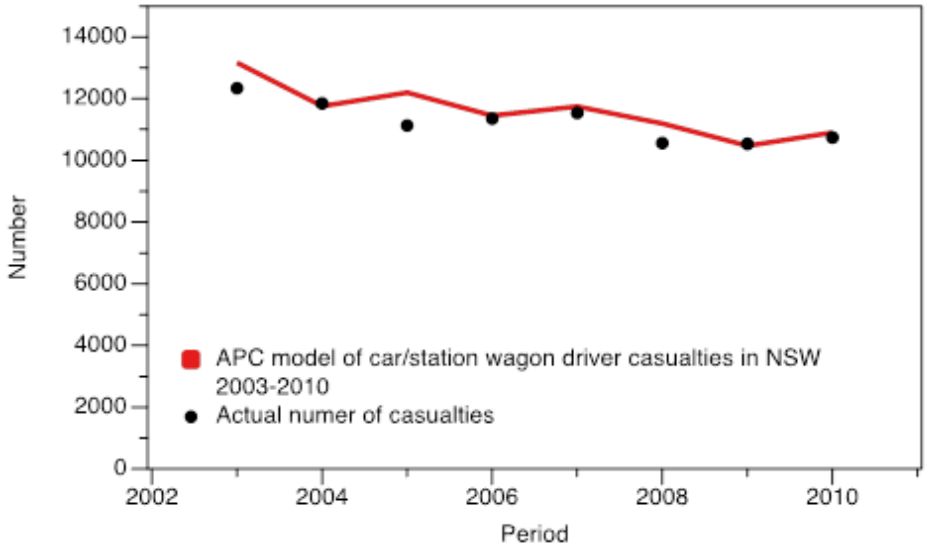


Figure M3: Modelled and actual number of drivers injured or killed in car/station wagon crashes in NSW



Using the model to explain past changes in the number of fatalities

The APC model aggregates the effects of vehicle improvements (cohort effects), road safety improvements (period effects) and vehicle age effects over the population of cars and station wagons in New South Wales. The individual effects of vehicle improvements and road safety improvements can be examined by selectively "switching off" the effects shown in Figure M1. In doing so, it is possible to estimate the influence that vehicle and road safety improvements have had on passenger vehicle casualties in the recent past.

The effects of each kind of improvement will be examined by considering the counterfactuals:

- that there was no improvement in road safety (i.e. no change in period effects) in New South Wales after 2003, and
- that vehicle safety did not improve (i.e. no change in cohort effects) from 1995 onwards.

These are operationalised in the model by replacing the period and cohort effects shown in Figure M1 with lines of zero slope, passing though the risk values for period 2003 and cohort 1995 respectively, but keeping all other elements of the model unchanged.

Figures M4 and M5 show how the numbers of drivers killed or injured in a car or station wagon crash might have been different had it not been for the effects suggested in the APC model. If neither period or cohort effects had reduced risk, then the model suggests that fatalities and injuries would have been 20% higher in 2010 than they were in 2003, and around 70% higher than they actually were.

Figure M4: Model predictions of changes to the number of fatally injured drivers and predictions of counterfactual assumptions about improvements to road safety (period effects) and vehicle safety (cohort effects)

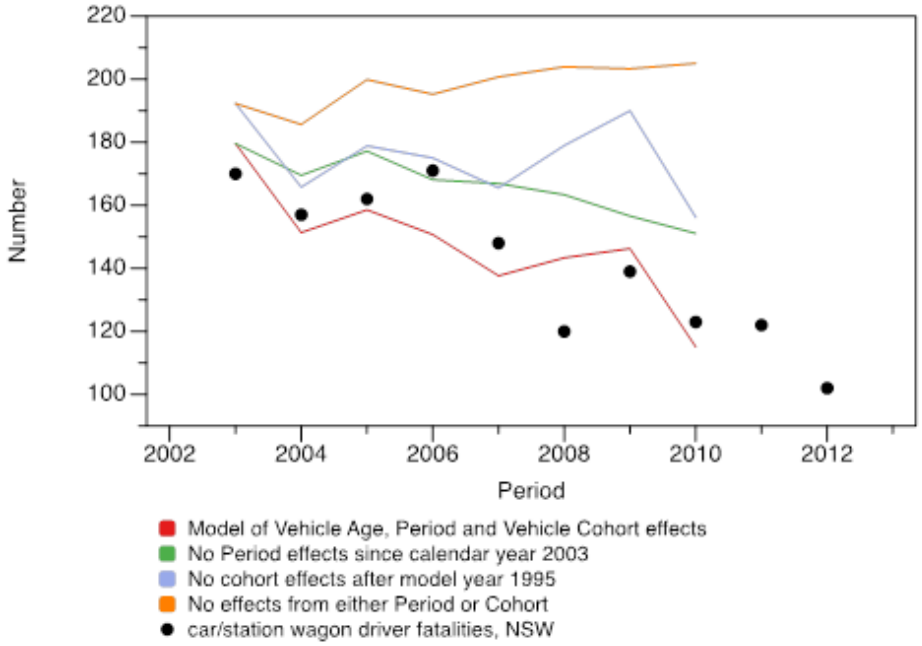
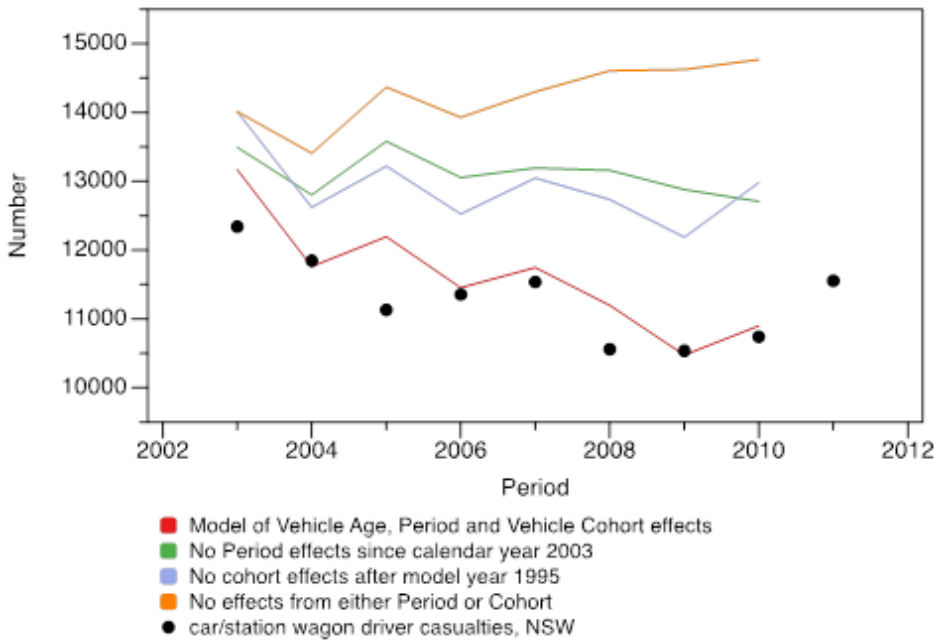


Figure M5: Model predictions of changes to the number of driver casualties, and predictions of counterfactual assumptions about improvements to road safety (period effects) and vehicle safety (cohort effects)



Using the model to make projections

The same kind of reasoning can be used to project future numbers of driver fatalities and injuries. Rather than counterfactuals, projections of the model can be made assuming that current rates of improvement continue, or that either improvement aligned with future periods, or improvements to future cohorts, (or both) cease forthwith.

The different futures imagined by the considering these alternatives are shown in Figure M6 for fatally injured drivers and in Figure M7 for injured drivers.

Figure M6: Projections of the number of fatally injured drivers from the model with different assumptions about future improvements to road safety and vehicle safety

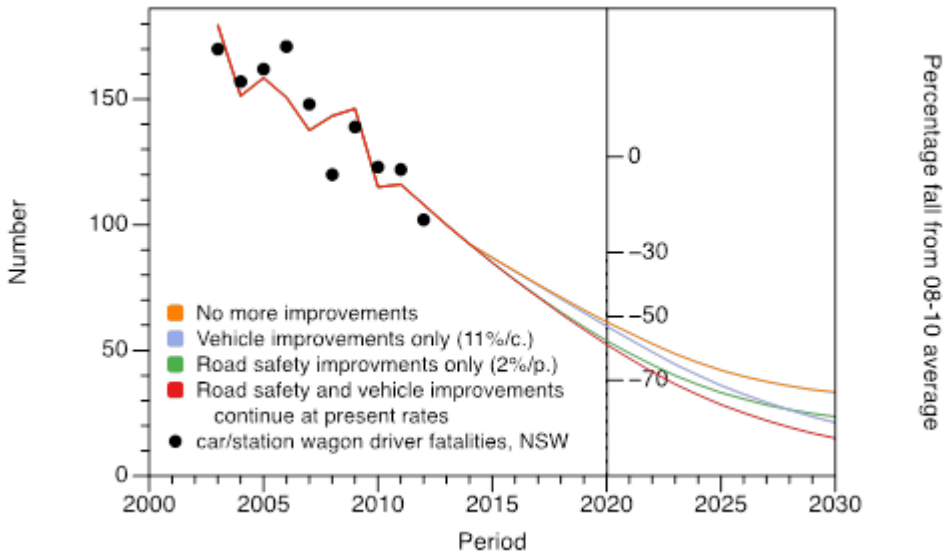
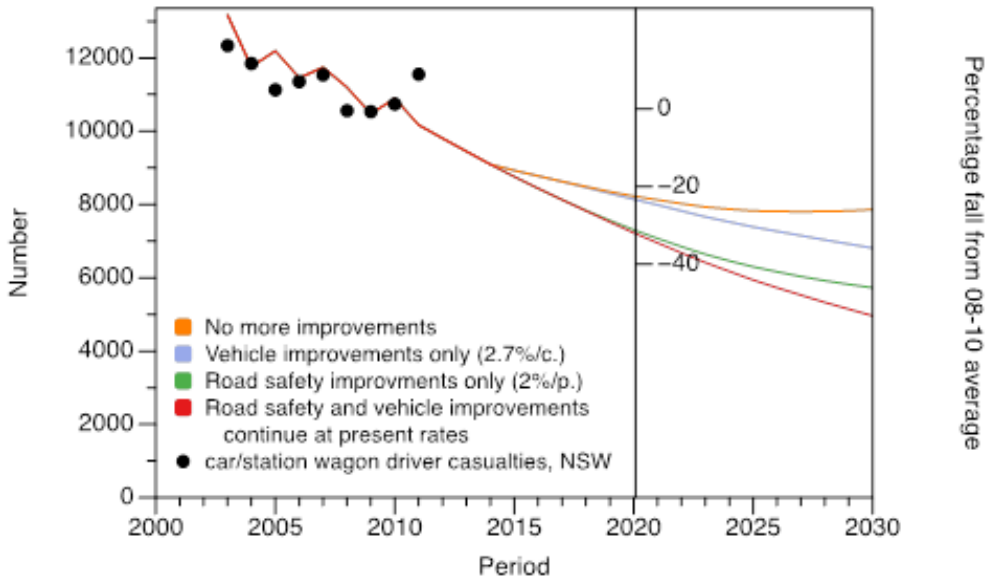


Figure M7: Projections of the number of driver casualties (all severities) from the model with different assumptions about future improvements to road safety and vehicle safety



The results shown in Figures M6 and M7 suggest that cessation of all further improvements to the safety of the road system or to vehicles will not halt the downward trend in fatalities and injuries. As the vehicle fleet is turned over, and the oldest vehicles are replaced with newer vehicles, risk is likely to be lowered. By 2020, the number of drivers killed in passenger vehicle crashes would be likely to be 50% lower than they were in 2008-2010. However continued improvements to road and vehicle safety at current rates is likely to reduce driver deaths in passenger vehicle crashes by about 60%. The effect on driver injuries is more muted, as the effect of vehicle cohort on injury rates is less than it is for fatality rates. An absence of further improvement in non-vehicle related road safety measures might result in a 15% decline in driver injuries, whereas continuous improvement at 2 per cent per annum will result in a decline of about 30%.

It is apparent that non-vehicle related changes have the greatest potential to reduce injury and death before 2020. This deserves some comment - the results do not indicate that vehicle improvements have had only a minor role on casualty risks in the present and in the future. In fact, projecting the plots in Figures M4 and M5 suggests that vehicle improvements since the 1990's account for the major share in the decline in occupant fatalities in recent time and those to be seen by 2020 and beyond. What the results do indicate is that in respect of crash numbers, past improvements to vehicles are likely to be far more influential than future marginal vehicle improvements, as long as those past improvements are maintained in future cohorts of vehicles.

Limitations

The results above, and particularly the relative contributions of vehicle safety and non-vehicle related road safety, are to some extent a reflection of the assumption about the progress of vehicle safety made at the outset of the analysis. For example, it is possible to construct a model that attributes no effects to period at all, but reassigns that risk over vehicle age and vehicle cohort. However, there is reason to prefer the model presented here. Anderson and Searson (2014) analysed the ratio of fatalities to injuries; in this case, a zero period effect is quite plausible, and the cohort effect is likely to represent vehicle secondary safety. The result showed that vehicles did not change in respect of vehicle secondary safety through the 1990s, and hence a zero slope for vehicle effects before about 1995 is appropriate.

Generalising to all road deaths and injuries

The preceding analysis is an illustration of how road and vehicle safety effects are driving changes in the number of fatalities in one particular casualty type. It is reasonable to ask how generalisable such results are likely to be to all road injuries and deaths.

With respect to the effect of vehicle improvements the flowing points might be made:

- The cohort effects shown in Figure M1 is the effect of vehicle safety on driver injury and fatality risk. It is likely to apply in respect of all passenger vehicle occupant injuries. It is unlikely to apply to vulnerable road user, motorcycle or heavy vehicle crash casualties.
- The period effect shown in Figure M1 is the aggregate effect of speed reductions (through speed limit setting, compliance and congestion), roadside improvements, and any general reductions in driver riskiness (e.g. drink driving) or compliance that may have occurred over the period. There is no reason to think that these changes would not also apply to many classes of casualties. The rate at which non-vehicle aspects of road safety changes can be achieved depends on the extent to which it is feasible to continue to reduce vehicle speeds, vehicle conflicts and the rate of driver non-compliance with safe driving practices.

It is possible to imagine that there are certain crash types that are less likely to be affected by the kinds of changes mentioned above, and where increased exposure with time may counteract the period effects seen in Figure M1 that are generalisable to other crash types. These might include bicycle fatalities, motorcycle fatalities and certain types of fatalities in crashes involving heavy vehicles.

Other models of the effect of future improvements on numbers of people killed and injured in road crashes.

The modelling approach presented above gives a sense of the contributions being made by the broad areas of vehicle safety improvement and non-vehicle road safety measures. However, the analysis is blunted to the extent that it does not indicate what kind of measures should be undertaken in order to sustain ongoing reductions in road crash casualty risks.

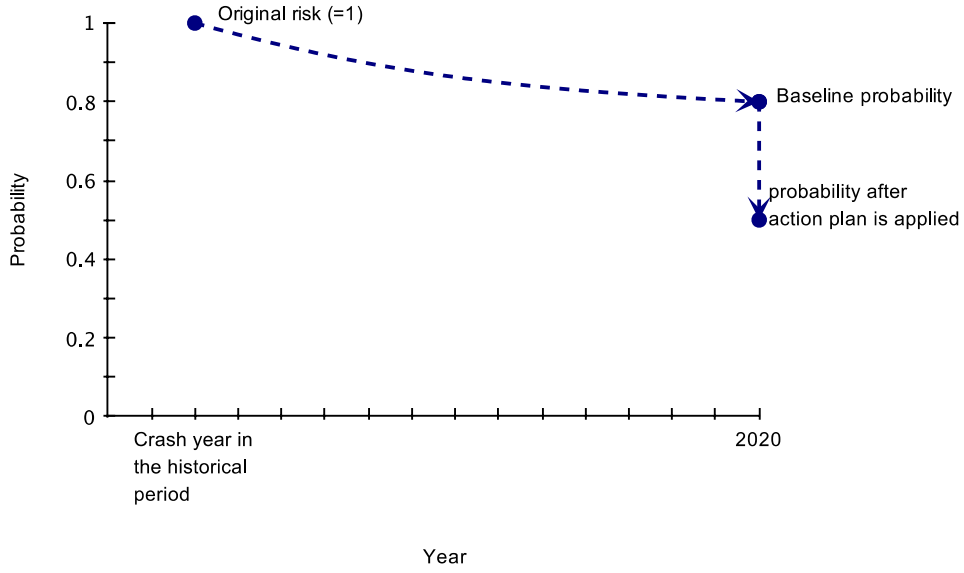
Another more commonly used approach to estimate future numbers of road casualties, and how those numbers might be further reduced by improving elements of the Safe System, is described briefly here. That approach is to disaggregate records of historical crashes and examine how each class of crash might be affected by proposed road safety changes. This kind of approach has been used in the past by Monash University Accident Research Centre, The Swedish Roads Administration and, more recently, the Centre for Automotive Safety Research (CASR).

CASR has been building such a model for the South Australian Department of Planning, Transport and Infrastructure, who wanted to ensure that efforts being made by government agencies in South Australia would achieve reductions in line with targets set out in the state's Road Safety Strategy "Towards Zero Together".

In the case of CASR's model, crash data were disaggregated to the level of individual people killed or injured in a road traffic accident in South Australia over a six year period to 2010. In the model, each crash is examined to estimate how the probability of that kind of crash reoccurring in 2020 might be affected by changes to several elements of the Safe System. Hence, data were extracted on the driver(s) of vehicles in the crash, the vehicles involved in the crash and location of the crash (including details such as the road type and prevailing speed limits). The model takes account of changes to vehicles, general declines in risk and population changes, as well as several changes to be proposed in action plans between now and 2020, covering licensing, speed limit setting and infrastructure improvements.

Figure M8 shows the concept behind the approach. Each crash in the model is projected into the future (to 2020). The probability that the crash will "reoccur" in 2020 is estimated by considering two types of changes: the first type of change is a result of background systematic changes the most important of which is the renewal of the passenger vehicle fleet; the second type of change is a result of road safety actions as they apply to that crash. This includes changes in speed limits, changes in licensing regulations and infrastructure improvements.

Figure M8: Conceptual operation of the model as applied to the probability of a single casualty/fatality in the historical period. The probability that such a casualty/fatality will recur in 2020 is affected by background changes and relevant elements of the road safety action plan



The advantage of this kind of approach is that the modelling becomes very transparent. It is possible to see how individual road safety actions affect crashes at the level of an individual crash, up to the effect on the total number of crashes.

An example is given below. Table M1 shows relevant details of the crash related to a single casualty in the model. This information is used to estimate how likely it would have been that this crash would have occurred, had the expected conditions in 2020 prevailed at the time of the crash. The results of this process are shown in Table M2. In this case, the prevalence of this kind of crash is expected to be 0.42 of what it was at the time of the crash.

When repeated over all crashes, a picture emerges of how casualties are likely to change by 2020.

There are some potential weaknesses of this kind of approach however:

- There may be a tendency to underestimate risk reductions if not all background effects or road safety measures are taken into account. The addition of a general effect can be included as a catch-all for unmodelled effects, but it is difficult to know how big such a factor should be.
- Only interventions with effects that are estimable can be included. Unless it is known which crash types will be affected and by how much by each intervention, it is difficult to model effects.

Table M1: Relevant details of a single casualty

Characteristic	Value
Crash Number	XXXXXXXX
Road 1	BARRIER HIGHWAY
Road 2	
Road 3	
Location	APX 400M S OF NAVAN CEMETERY RD @376.70
Running Distance	377.1 km
Local Gov Area	Clare and Gilbert Valleys DC
Statistical Area	Country
Road Type	Not Divided
Horizontal Alignment	Straight Road
Speed Limit	110
Crash Type	Roll Over
Crash Severity	Admitted
Date	X/XX/05
Road Surface	Sealed
Lat:Long	-XX.XXXXXX:XXX.XXXXXX
Licence Type	Full
Sex	Male
Age	49
BAC	zero
Occupants	2
Seatbelt	Fitted - Worn
Crash Description	DRIVING XXXXXX STATION SEDAN XXXXXX SOUTH ALONG BARRIER HIGHWAY ABOUT 5 KM SOUTH OF RIVERTON. STATES SWERVED TO MISS KANGAROO, LOST CONTROLAND ROLLED OVER
Severity	Admitted
Position	Driver

Table M2: Projection of the probability of the single casualty to 2020

	Crash characteristics		2020 projection			
	Characteristic	Description	Case/model parameter	Value	Probability	Value
Background changes	Crash year	2005	2020-crash year	15	$p_{exposure}$	1.084
	Crash type	Loss of control	N_{ESC}	1.01	p_{ESC}	0.72
	Vehicle year	2003	$f_{ESC_{2020}}$	0.96		
	Vehicle age	2 years	$year\ difference$	15	$p_{crashworthiness}$	0.68
Safer system changes	Speed limit	110 km/h	Reduced limit	100 km/h	p_{speed}	0.8
	On “safer roads list”	No (outside applicable run distance)	-	-	$p_{safer\ roads}$	1
	Driver age	49	unchanged	49	p_{GLS}	1
Result					$p_{safer\ system}$	0.8
					$p_{background}$	0.53
					$\boldsymbol{p_{2020}}$	0.42

N_{ESC} = Adjustment for prevalence of ESC for vehicle year cohort

$f_{ESC_{2020}}$= Expected deployment of ESC in the vehicle cohort of the crashed vehicle in its 2020 projection (vehicle year + year difference)

$p_{crashworthiness}$ in this example is a uniform 2.5% improvement in crashworthiness per year of manufacture

Expanding to a national level

- Data demands would be great – for example, it would not be possible to construct such a model in a spreadsheet.
- Data would need to be uniform and complete with fields covering crash severity, crash location (consistent road names, run distances intersections), traffic controls, error types, crash types, driver age, vehicle year, vehicle type, licence type, occupant position, seat belt use and so on.
- If infrastructure and speed limit changes were to be considered in the model, then inclusion and/or exclusion lists or roads/intersections from the interventions to be modelled would be needed. These would need to be identical in coding to the crash data, so that all affected (or non-affected) crashes could be identified. This would be required from all jurisdictions.

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Austroads

Level 9, 287 Elizabeth Street
Sydney NSW 2000 Australia

Phone: +61 2 9264 7088

austroads@austroads.com.au
www.austroads.com.au