

Regulatory reforms for

automated road vehicles

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National Transport Commission

Report outline

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Foreword

The development of technology for automated vehicles is rapidly gaining momentum. Vehicle manufacturers and technology providers are developing a wide range of automated applications, such as systems that assist the vehicle to travel in a road lane, to systems that provide complete (driverless) control of the vehicle's operation.

Automated road vehicles offer the possibility of fundamentally changing how transport is provided and the resulting effect on society. It is likely this technology can improve road safety, mobility, productivity and environmental efficiency. However, to unlock these benefits we need a regulatory framework that removes unnecessary legal barriers to automated road vehicles, supports on-road trials of the technology and yet ensures that these vehicles will operate safely in our community.

One of the challenges facing Australia is ensuring that regulations and policies are nationally-consistent. It is also imperative that we understand that the technology is developed in a global market. Consequently, the National Transport Commission's goal is to avoid a patchwork of conflicting regulatory requirements in different states and territories. Our aim is to ensure that the regulatory framework for automated vehicles is timely and responsible, and that regulations promote, not discourage, innovation and competition.

This policy paper concludes a one-year project to identify and examine potential and real regulatory barriers to automated vehicles, to consult on options, and to make recommendations to the Transport and Infrastructure Council in support of future reform. These recommendations establish a phased reform program in step with the likely commercial deployment of the technology, and the development of international standards and conventions. We want to ensure that we do not regulate too early – which could create artificial barriers to emerging technologies – or regulate too late and stop proven safety-related technologies from being deployed.

The policy findings and recommendations set out in this paper reflect extensive legislative analysis and consultation with a wide range of government and industry stakeholders, including vehicle manufacturers, motoring groups, law societies, researchers, insurers, police and road and transport agencies. We received more than 80 submissions to an issues paper and discussion paper. I would like to thank each organisation and individual who contributed to this important national reform process and encourage them to continue to work with us on the more detailed reforms to follow.



David Anderson PSM
Chairman and Commissioner

Executive summary

Automated vehicles offer the possibility of fundamentally changing the transport task and society. It is likely this technology can improve road safety, mobility, productivity and environmental outcomes. However, current regulations do not adequately support automated road vehicles and there is uncertainty about how and when current polices and regulations will be adapted. There is also a risk that, without a national and coordinated response to automated vehicle reform, Australia's complex regulatory framework will result in inconsistent regulation of automated vehicles across states and territories.

In this policy paper, the National Transport Commission (NTC) recommends that the Commonwealth and state and territory governments support on-road trials, remove unnecessary legal barriers, and provide for the safe operation of automated vehicles. These reforms should be undertaken in a phased approach, with near-term, medium-term and long-term priorities, based on an assessment of when different levels of automated vehicles are likely to be commercially available in Australia.

In November 2015 the Transport and Infrastructure Council tasked the NTC to identify any regulatory or operational barriers associated with the introduction of road and rail vehicles that are more automated. The NTC project has identified:

- There are no regulatory barriers to automated rail (including light rail) in Australia, and the NTC project will not be considering automated rail further.
- Current regulations can support vehicles that have partial or conditional automation, but control of the vehicle needs to be clarified.
- There are legal barriers to highly and fully automated road vehicles.
- A nationally consistent regulatory framework can support automated road vehicles. The regulatory framework should be underpinned by nationally agreed policy principles.

The NTC has identified regulatory barriers

The NTC has identified regulatory barriers for highly or fully automated road vehicles and a number of actions that could increase industry and consumer certainty for vehicles that are conditionally automated or still require a human driver.¹ In assessing current regulations and policy settings the NTC has identified the following issues:

1. Supporting on-road trials and demonstrations
 - There are currently no nationally-consistent guidelines or conditions for on-road trials of automated vehicle technology.
2. Supporting automated driving that requires a human driver
 - It is unclear who is in control of an automated vehicle when the human driver must monitor the automated driving system and intervene if requested.
 - The enforcement interpretation of *proper control* that requires a human driver to have at least one hand on the steering wheel is likely to become outdated.

¹ Page 23 explains the different levels of driving automation referred to in this policy paper.

3. Automated driving that does not require a human driver

- There is no regulatory framework in place for governments to ensure the safe operation of automated vehicles that do not require a human driver.
- Road rules and other laws, including many compulsory third-party insurance schemes, assume a human driver and would not apply in the same way to vehicles that do not have a human driver.
- It is uncertain how government agencies would access automated vehicle data, and in what circumstances.
- Current Australian Design Rules (ADRs) and in-service vehicle standards have vehicle standards that require a human driver. They also do not have regard to other matters that are likely to be relevant to automated vehicles, such as security and behavioural compliance with road rules.

Additional issues should continue to be monitored by governments as the technology develops. These include potentially increased safety risks related to vehicle modification, maintenance and repair, resolving complex liability scenarios, privacy protection and access to data to determine fault and civil liability.

This policy paper sets out key policy findings and eight recommendations to address these issues.

The policy findings and recommendations reflect extensive engagement with government and industry, including vehicle manufacturers, motoring groups, law societies, researchers, insurers, police and road and transport agencies.

In February 2016 the NTC published an issues paper for consultation, *Regulatory barriers to more automated road and rail vehicles*. The consultation identified key issues and project scope and confirmed that there are no regulatory barriers relating to rail vehicles that are more automated.

In May 2016 the NTC published a discussion paper for consultation, *Regulatory options for automated vehicles*. This paper discussed key issues based on a comprehensive NTC legal audit of Commonwealth and state and territory legislation, summarised stakeholder feedback to the issues paper and canvassed potential options to address the identified issues. The consultation confirmed the key issues and proposed timing and sequencing of reforms.

Who we are

The NTC is an intergovernmental agency charged with improving the productivity, safety and environmental performance of Australia's road, rail and intermodal transport systems. As an independent statutory body, the NTC develops and submits reform recommendations for approval to the Transport and Infrastructure Council, which comprises Commonwealth, state and territory transport, infrastructure and planning ministers.

Automated vehicles are an important part of our work program because they are expected to have a significant impact on transport networks. Our work in this area began in 2015 after the Transport and Infrastructure Council asked us to identify regulatory barriers to safely introducing more automated road and rail vehicles in Australia.

Why national reform is needed

Industry and consumer uncertainty that automated vehicles are legal

Vehicle manufacturers are progressively introducing increased levels of automated driving controls in their vehicles. Automated vehicles could significantly improve road safety outcomes by preventing crashes and reducing deaths and serious injuries, yet the technology cannot be fully used unless our current regulations are reformed. Lack of certainty relating to who or what is in control of an automated vehicle, and the concept of the *driver* in legislation, are the key regulatory barriers to increasingly automated vehicles.

National and international consistency of laws related to automated vehicles

The Australian Government has responsibility for design rules for new vehicles, but state and territory governments have jurisdiction over in-service vehicle standards, road rules, enforcement, registration and licensing. There is a risk that this complex regulatory framework will result in inconsistent regulation of automated vehicles across states and territories. There is also a risk that regulations will be inconsistent with relevant international standards and conventions. This would constitute a significant barrier to the introduction of automated vehicles in what is primarily a global and import-based market.

The phased timing of reforms

The reform program outlined in the recommendations reflects a considered view that the timing of reforms should be phased as near-term (commence as soon as possible), medium-term (commence reforms within two years) and long-term (commence reforms within three to five years). This categorisation has been determined based on key assumptions we have tested with industry through the consultation process. These assumptions are that:

- Demand to trial different levels of driving automation on public roads is already occurring and is expected to increase significantly in the next two to three years.
- Large-scale commercial deployment of increasingly automated vehicles that still require a human driver is expected by 2020.
- Large-scale commercial deployment of automated vehicles that do **not** require a human driver (for some, or all of the journey) is expected after 2020.

Governments seek to ensure that they do not regulate too early – which could create artificial barriers to emerging technologies – or that they regulate too late and stop proven safety-related technologies from being deployed. The NTC therefore recommends that governments adopt a phased reform program, recognising that the program must be sufficiently flexible to reprioritise and address emerging technologies and market developments as required.

Recommended actions

Table 1 presents the recommended actions approved by the Transport and Infrastructure Council. The outcomes, recommended actions and lead agency responsibility are grouped according to near-term, medium-term and long-term reforms.

Note that each recommendation is supported by **policy findings** set out at the end of each relevant chapter.

Table 1: Timing and sequence of actions approved by the Transport and Infrastructure Council

NEAR-TERM REFORMS			
Outcomes	Recommended actions	Lead agency	Timeframe
Government support of on-road trials of automated vehicles for all levels of automated driving	1. That the NTC and Austroads develop national guidelines for on-road field testing and trials of automated vehicles in Australia.	The NTC, in partnership with Austroads	Early 2017 to May 2017
	2. That state and territory road and transport agencies and the National Heavy Vehicle Regulator (NHVR) undertake a review of current exemption powers to ensure they have sufficient powers to undertake and manage on-road trials of automated vehicles, including in relation to vehicle standards, road rules and driver licensing requirements, and to review how cross-border trials could be managed.	State and territory road and transport agencies and the NHVR to undertake reviews, and the NTC to report progress to the Transport and Infrastructure Council.	Early 2017 to 2018
Certainty for industry and governments as to:	3. That the NTC develops national enforcement guidelines that clarify regulatory concepts of control and proper control for partial, conditional, highly and fully automated vehicles. The NTC should develop guidelines that have regard to international standards and best practice and in collaboration with state and territory road, transport and police agencies and public prosecutors.	The NTC	Early 2017 to November 2017
(1) who is in control of an automated vehicle			
(2) how enforcement agencies will apply the 'proper control' requirement in the road rules to all levels of driving automation	4. That Australian transport ministers agree to reaffirm the existing policy position that:	Transport and Infrastructure Council	November 2016
	4.1 The human driver remains in full legal control of a vehicle that is partially or conditionally automated, unless or until a new position is developed and agreed (in alignment with recommendation 3).		
	4.2 The human driver of a partially or conditionally automated vehicle should only undertake non-driving tasks currently permitted by the road rules and existing enforcement policies and guidelines, unless or until a new position is developed and agreed (in alignment with recommendation 3), or an exemption is provided by a road agency.		

MEDIUM-TERM REFORMS			
Outcomes	Recommended actions	Lead agency	Timeframe
A complete regulatory framework to support the safe commercial operation of automated vehicles	5. That the NTC develop a national performance-based assurance regime designed to ensure the safe operation of automated vehicles, with an initial focus on vehicles with conditional automation (level 3). An initial briefing on process and technical performance requirements to be provided to ministers in May 2017.	The NTC	Early 2017 to November 2017
	6. That the NTC develops legislative reform options to clarify the application of current driver and driving laws to automated vehicles, and to establish legal obligations for automated driving system entities.	The NTC	Early 2017 to May 2018
	7. That state and territory governments undertake a review of compulsory third-party and national injury insurance schemes to identify any eligibility barriers to accessing these schemes by occupants of an automated vehicle, or those involved in a crash with an automated vehicle. That, subject to the review of insurance schemes, each state and territory government amends its compulsory third-party insurance schemes in close consultation with each other and industry, and that the resulting reforms are nationally consistent wherever possible.	States and territories to undertake reviews, and the NTC to report progress to the Transport and Infrastructure Council	Early 2017 to 2018
LONG-TERM REFORM			
Outcomes	Recommended actions	Lead agency	Timeframe
A complete regulatory framework to support the safe operation of automated vehicles	The Commonwealth Government should continue with the current approach of engaging with the United Nations Working Party 29 and harmonising ADRs with international vehicle standards. No immediate actions are required by the Transport and Infrastructure Council.	Commonwealth Department of Infrastructure and Regional Development	Ongoing

CLARIFY THEN REFINE			
Outcomes	Recommended actions	Lead agency	Timeframe
Regulation of government access to automated vehicle data to achieve road safety and network efficiency outcomes, efficient enforcement of traffic laws and sufficient privacy protections for users	8. That the NTC develops options to manage government access to automated vehicle data, having regard to achieving road safety and network efficiency outcomes and efficient enforcement of traffic laws, balanced with sufficient privacy protections for automated vehicle users.	The NTC	Late 2017 to November 2018

Near-term reforms

Supporting on-road trials

Industry evaluation of the safety and technology performance of automated vehicles through on-road field testing and trials should be encouraged and supported by governments in Australia. By introducing national guidelines, state and territory governments would establish consistent exemption requirements and conditions for on-road trials of automated vehicles.

National guidelines could support trials of vehicles with any level of automated driving. However, the primary objective of the guidelines should be to establish nationally-consistent criteria to assess on-road trial applications for highly and fully automated vehicles.

To facilitate similar trials and initiatives across Australia, state and territory road and transport agencies should consider developing legislative mechanisms to mutually recognise trials in other jurisdictions. State and territory road and transport agencies could also seek to mutually recognise trial outcomes and share research findings through non-legislative mechanisms.

Each state and territory road and transport agency and the NHVR should also review its exemption powers to ensure that the current legislative framework can: (1) allow agencies to impose appropriate conditions on trial participants; and (2) support automated vehicle trials, particularly in relation to highly and fully automated vehicles that may not require a human driver at all times.

The changing meaning of *control* and *proper control*

To support the deployment of automated vehicles, Australian governments should clarify through national enforcement guidelines: (1) who is in control of an automated vehicle; and (2) how enforcement agencies will apply the *proper control* requirement in the road rules to all levels of driving automation. Definitions of *control* and *proper control* relate primarily to enforcement of Road Rule 297, and agreed enforcement guidelines should be adopted consistently in each state and territory to ensure market certainty.

To provide immediate legal certainty to human drivers in the near term, state and territory governments should agree an enforcement policy position that human drivers continue to have full control and responsibility of a road vehicle until that position is refined through the development of national enforcement guidelines. This position is consistent with the Geneva and Vienna conventions on road traffic.

Medium-term reforms

Safety assurance for vehicles that do not require a human driver

In conjunction with the removal of regulatory barriers, Australian governments should develop a national safety assurance system in close consultation with industry partners and in alignment with international practices. The safety assurance system should establish an approvals process to assess the safety performance and data handling of applications to operate automated vehicles that do not require a human driver some of the time or all of the time.

Preparatory work to develop the safety assurance system should have an initial focus on vehicles with conditional automation, and have regard to scoping:

- nationally agreed safety principles and criteria
- operational models and processes to ensure that the assurance process is nationally consistent, efficient, affordable and creates minimal administrative burden for applicants
- governance and funding options.

The changing meaning of *driver* and *driving* in legislation

Many laws require a human driver. In some highly and fully automated vehicles, there will not be a human driver some of the time or all of the time. Without a human driver, these vehicles could not currently operate legally under the Australian Road Rules and other laws.

Australian governments should clarify how current driver obligations will apply to automated vehicles. To achieve this, Australian governments should provide in-principle support for legislative reform and undertake further exploration of the potential legislative solutions, in step with international developments and maturity of the technology. The legislative approach adopted should be subject to further consultation, legal opinion and the advice of parliamentary counsel.

Priority should be given to ensuring eligibility to compulsory third-party and national injury insurance schemes is not unintentionally restricted by current definitions of *driver* and *driving* in those schemes.

Long-term reform

Vehicle standards for automated vehicles

The highest levels of driving automation are unlikely to require human driver-related features that are currently required by law in the ADRs and in-service vehicle standards.

In the longer term, continued requirements for outdated standards are likely to be a barrier to the large-scale commercial deployment of highly and fully automated vehicles. However, automated vehicles are developed in an international market, and it is important that Australia does not introduce new design rules that are capable of isolating Australia from the global automotive market.

The automotive industry should continue to rely on Commonwealth, state and territory exemptions, granted on a case-by-case basis and the safety assurance system, until international standards for highly and fully automated vehicles are developed and applied in the ADRs and in-service vehicle standards.

The Commonwealth Government should continue with the current approach of engaging with the United Nations Working Party 29 (WP.29) and harmonising ADRs with international vehicle standards. No immediate actions are required by the Transport and Infrastructure Council.

Clarify then refine

Other issues may require government intervention in the coming years, subject to the direction of the technology and the automated vehicle market, as well as the extent to which industry can minimise identified safety, security or privacy risks without increased regulation.

For these reasons, Australian governments should provide in-principle support to industry development of best practice guidance in relation to modification and in-service compliance, clearly defined liability and clearly defined rules managing commercial access to data. Therefore, except for the regulation of government access to data (recommendation 8), the NTC recommends that no immediate actions are required by the Transport and Infrastructure Council at this time in relation to the following issues.

Vehicle modification and in-service compliance

Modification, maintenance and repair of increasingly automated vehicles could become a higher safety risk compared with conventional road vehicles due to the lack of a human driver as a fall back in the event that a modification causes a vehicle failure. Regulatory oversight of modification (including over-the-air software updates) and vehicle repairs (including non-commercial private repairs) could be warranted in the longer term for highly automated vehicles that do not have human drivers. However, unless evidence emerges of a market failure or unacceptable safety risk, no changes are recommended at this time to current laws and enforcement practices relating to vehicle modification, maintenance and repair.

The national safety assurance system criteria for automated vehicle approvals (recommendation 5) should have regard to the safety impacts of vehicle modification, maintenance and repair. The development of a national safety assurance system will therefore provide Australian governments with a regulatory mechanism to manage the risks of vehicle modification, maintenance and repair in the medium-term.

Clearly defined liability

Assigning fault is likely to become more complex in crashes involving automated vehicles, and the efficient sharing of consistent and reliable data between relevant parties, including insurers, is likely to be critical. However, unless evidence emerges of a market failure that impedes the efficient and reliable assignment of fault, no changes are recommended at this time to current laws and approaches around liability for drivers, manufacturers, technology providers and road managers in regard to automated vehicles. A national safety assurance system can also clarify who is in control of an automated vehicle, and therefore help determine liability in the event of a crash or incident.

There is no evidence currently available that road manager liability provisions are a barrier to innovation or the introduction to automated vehicle technology to market. This should be monitored by road and transport agencies as the technology develops and the extent to which automated vehicles rely on road infrastructure to operate safely becomes clearer.

Clear rules managing access to data

Accessing data for enforcement and regulatory purposes

Some highly automated vehicles are expected to switch control between the human driver and the automated driving system. To ensure the effective administration of road safety laws, in the future enforcement agencies and the courts should be able to identify who is in control of the vehicle at a point in time.

As automated vehicle and data-sharing technology matures, governments should investigate options to regulate access to automated vehicle data, including the identification of suitable technical solutions to facilitate access to and use of the data for approved purposes. The regulation of data access for government purposes should have regard to achieving road safety and network efficiency outcomes and efficient enforcement of traffic laws, balanced with sufficient privacy protections for automated vehicle users.

Accessing data to determine fault and civil liability

The management of third-party access to vehicle event data will underpin the efficient and equitable process of insurance claims. This will reduce costs and increase consumer confidence that human drivers will not be unfairly blamed for crashes or incidents involving automated vehicles. Likewise, vehicle manufacturers seek to ensure that access to event data will not threaten the integrity of vehicle control systems.

The Productivity Commission is currently conducting an inquiry into data availability and use to examine options for collecting, sharing and releasing data in the public and private sectors, while the Australian Competition and Consumer Commission (ACCC) is conducting a study into the new car retailing market that will consider third-party access to vehicle data. Both of these reviews will be completed in 2017, and the Transport and Infrastructure Council should have regard to these reviews before assessing the impacts of further regulation to manage access to automated vehicle data.

The safety assurance system (recommendation 5) could also have regard to who should be able to access vehicle data to determine fault and civil liability, consistent with the Australian Privacy Principles.

Privacy

Privacy concerns represent a potential barrier to the uptake of automated vehicles. Australia should aim for a high level of privacy protection for drivers and occupants of automated vehicles. This is in keeping with emerging international standards relating to cooperative intelligent transport system (C-ITS) technologies.

Manufacturers and technology providers are already required to ensure compliance with the *Privacy Act 1988* (Cwlth) and the Australian Privacy Principles, as they do for other communications systems that have already been developed. As such, no changes are recommended at this time to privacy laws governing automated vehicles and the transmission of personal information (including location data).

The national safety assurance system (recommendation 5) should have regard to ensuring automated driving system entities provide the highest possible level of anonymity and privacy protection for drivers and occupants, and that this be a key focus for governments when considering applications to deploy automated vehicles.

In the event that individuals can be reasonably identified from the use and operation of an automated vehicle (including location data), the Transport and Infrastructure Council should have regard to legislative protections to define the circumstances under which organisations that are exempt from compliance with privacy principles, including enforcement agencies, may access this personal information. This is in keeping with previous council directions regarding the privacy impacts of C-ITS technologies.

Context



Key points

- The National Transport Commission (NTC) has made eight recommendations to the Transport and Infrastructure Council to support on-road trials of automated vehicle technology, to remove unnecessary legal barriers, and to provide for the safe operation of automated vehicles in Australia.
- The policy findings and recommendations set out in this policy paper establish a phased reform program in step with the commercial deployment of automated vehicle technology and the development of international standards and conventions.

Objectives

Automated vehicles are vehicles that have automated one or more element of the driving task and therefore do not require a human driver for at least part of the driving task. There have been significant automated vehicle technology advancements in recent years.

In November 2015, the NTC was asked by the Transport and Infrastructure Council to identify regulatory barriers relating to the safe introduction of more automated road and rail vehicles in Australia.

The objectives of the project are to:

- improve our understanding of the current regulatory system and its ability to continue to support increased vehicle automation (both road and rail)
- identify any regulatory or operational barriers to be removed or overcome and potential time pressures or options (including for trials of automated vehicles)
- identify a nationally consistent approach for regulating automated vehicles.

Project methodology and timeframes

1. Issues paper: In February 2016 the NTC published *Regulatory barriers to more automated road and rail vehicles*. The issues paper was an initial review of regulations in Australia and it provided an overview of current rules and identified key issues and potential solutions. The NTC received 32 submissions.

2. Legislative audit: The NTC undertook an extensive examination of international treaties and Commonwealth, state and territory legislation to identify barriers and issues. This analysis provides a starting point for any future legislative amendments and the complete analysis is contained in the annex to the NTC discussion paper.

3. Discussion paper: In May 2016 the NTC published *Regulatory options for automated vehicles*. The discussion paper confirmed the key issues, summarised stakeholder feedback to the issues paper and discussed potential options to address the identified issues. The NTC received 51 submissions.

A list of submissions made to the NTC is located at the end of this policy paper. Submissions are available on the NTC website under 'Current projects'.

4. Policy findings and recommendations: In November 2016 the Transport and Infrastructure Council approved the NTC's policy findings and recommendations. These policy findings and recommendations are set out in this policy paper.

This policy paper groups the policy findings and recommendations into eight themes:

- **Chapter 2:** supporting on-road trials of automated vehicle technology
- **Chapter 3:** clarifying who is in control of an automated vehicle and the interpretation of *proper control*
- **Chapter 4:** ensuring the safety of vehicles that do not require a human driver for some or all of the time
- **Chapter 5:** adapting legislative concepts of *driver* and *driving* to automated vehicles
- **Chapter 6:** adapting vehicle design and standards
- **Chapter 7:** managing vehicle modification and in-service compliance
- **Chapter 8:** ensuring clearly defined liability
- **Chapter 9:** clarifying access to data in relation to enforcement, insurance and privacy protection.

5. Next steps: The current NTC project concludes with the policy findings and recommendations set out in this paper. New projects to implement the recommended actions will be undertaken by lead agencies from early 2017.

Note: This policy paper is a companion document to the NTC discussion paper *Regulatory options for automated vehicles*. The discussion paper, accessible on the NTC website under 'Current projects', canvasses a broad range of themes not duplicated in this paper, including the benefits of automated vehicles, the strategic context, the role of government and an appraisal of any barriers to automated rail operations.

Key terms used in this paper

Automated driving system means the operating system that controls the automated vehicle functions.

Automated driving system entity means the legal entity responsible for the automated driving system. This could be the manufacturer, operator, legal owner of the vehicle or another entity.

Safety assurance system means a regulatory mechanism for governments to assess the safety performance of an automated vehicle to ensure it can operate safely on the network. It could operate through the introduction of automated vehicle registration, or the accreditation or licensing of the automated driving system entity.

Cooperative Intelligent Transport Systems (or C-ITS) means the use of wireless communications to exchange data between vehicles, and with roadside infrastructure, including data on vehicle movements, traffic signs and road conditions.

See the glossary at the end of this paper for descriptions of specialist and unusual terms used.

What are the problems being addressed?

Regulatory uncertainty

Vehicle manufacturers are progressively introducing increased levels of automated driving controls in their vehicles. Manufacturers and technology developers are seeking to understand whether these technologies comply with current laws, and it is currently unclear whether Australia's current regulatory frameworks – including vehicle standards and road rules, as well as liability and insurance – can support conditional, highly and/or fully automated vehicles on public roads.

Risk of inconsistent regulation

There is a risk that Australia's complex regulatory framework will result in inconsistent regulation of automated vehicles across states and territories. In addition, there is a potential risk that national regulation in Australia will be inconsistent with international standards and conventions. This could be a significant barrier for introducing automated vehicles in Australia, given that Australia is a small market in a globally integrated industry.

Rationale for the timing of reforms

To ensure that regulations are not based on outdated technology or introduced before the safety performance and risks of different automated vehicle applications are known, a phased reform program is recommended.

The timing and sequencing of each reform is set out in Table 1 on page 11 of this paper. The timing of reforms is based on stakeholder feedback and an analysis of market trends.

Submissions to the NTC discussion paper had different views on whether regulatory reforms need to be accelerated for Australia to be fully prepared for the technology (Hurd & McNeill; Mathews Hunt; NHVR) or whether it is essential that governments do not regulate too quickly at the risk of stifling innovation (AAA; HVIA; TMR). However, the proposed timing of reforms is largely supported. A key theme to emerge from the submissions is that the NTC and states and territories should be sufficiently flexible in the reform process to adapt to technology change as they emerge, and to be prepared to accelerate or reprioritise reforms as required (AAA; NSW transport cluster).

The proposed sequence of reforms is also largely supported. However, the NSW transport cluster suggests that amending legislation to establish a safety assurance system for automated vehicles, and changes to the definition of *driver*, should also be priority issues to be addressed as soon as possible (NSW transport cluster, p. 13).

The rationale for the timing and sequencing of reforms is set out below:

Near-term reforms: commence as soon as possible

Many of the regulatory barriers – such as the definition of *driver* in the road rules – can be managed through existing exemption processes until there is large-scale commercial deployment. The issues that should be prioritised in the near-term relate to supporting on-road trials with national guidelines (because trialling the technology is an initial first step towards large-scale deployment) and clarifying the meaning of *control* and *proper control* (because there is already uncertainty around these issues with technology available today).

Other near-term reforms addressed in this policy paper relate to ensuring state and territory legislative exemption powers can effectively support on-road trials and to ensure access to compulsory third-party and national injury insurance schemes will not be inequitably restricted by automated vehicles.

Medium-term reform: commence reforms within two years

The safety assurance system and a legislative review of the concept of *driver* and *driving* are earmarked as medium-term reforms because it is anticipated that they will be relevant to highly automated vehicles that are not expected to be commercially deployed until post 2020. Furthermore, a safety assurance system is a baseline requirement before any of the legal barriers identified by the NTC can be removed. The safety assurance system also enables vehicle standards and modification issues to be actively managed before legislation is adapted over time.

Long-term reform: commence reforms within three to five years

The timing of long-term reform related to vehicle standards is based on the rationale that it will be many years before the commercial introduction of highly or fully automated vehicles that have no human driver and are not required to meet current vehicle standards, such as a steering column and brake pedal requirements. This reform should also be timed to ensure consistency with the development of international standards.

Clarify then refine: commence as the technology and risks become known

The extent to which vehicle modification, liability and access to data issues are potential risks will depend on the development of the technology. For example, vehicle modification will be less of an issue if vehicle components have built-in redundancy, and privacy will not be an issue if automated vehicles do not generate personal information. It is therefore appropriate that industry clarify these issues now but that they are reviewed by governments once the risks can be better evaluated.

Parliament of New South Wales – Staysafe Report

The NTC's work to prepare for increasingly automated vehicles, and the proposed development of a regulatory framework, is consistent with recommendations of the Joint Standing Committee on Road Safety (Staysafe). In September 2016, Staysafe recommended that:

... improved road safety outcomes can be best achieved through a national regulatory framework which will maximise the benefits and minimise the risks of automated vehicle technology. Therefore the Committee recommends that a national regulatory framework for the development and deployment of automated vehicles be developed by the National Transport Commission, in consultation with NSW and other states, and implemented by an agreed date with the following components:

- a) A robust national trialling and testing regime, including collaboration between regulators and manufacturers, and consultation with users
- b) The establishment of agreed benchmarks for setting safety and performance standards for both automated vehicles and users, and other road users, including vulnerable road users
- c) Incorporation of the benefits of international standardisation and/or an international framework
- d) A determination of the liabilities attaching to the manufacture, sale and use of the technology, to be legislated if necessary
- e) An examination of the security of the data systems which underpin the technology, including the development of protocols to facilitate data sharing and address privacy issues
- f) A comprehensive public education campaign about the deployment of the technology, targeting amongst others, drivers of both automated and non-automated vehicles, cyclists, motorcyclists, and pedestrians

- g) The public identification of automated vehicles to make them visually distinctive to other road users, particularly during the trial and testing phase
- h) A programme to determine the impacts of automated vehicle technology on the provision and maintenance of road infrastructure, including consideration of both current arrangements, and any new arrangements required to support vehicle connectivity; and
- i) Transition protocols for managing safe road use by a mixed fleet (Recommendation 1).²

Many aspects of the NTC's reform programme closely align with the Staysafe recommended actions. Some Staysafe recommendations, including aspects related to road infrastructure and public education, are being addressed or considered by other government agencies.

Policy principles

The design of automated vehicle policy and regulation should be based on nationally agreed policy principles. In 2016 Australian governments agreed on policy principles for government action in relation to land transport technology. Automated vehicle policy and regulation should be consistent with these policy principles:

National Policy Framework for Land Transport Technology³ – policy principles

1. Government decision-making on transport technologies will be based on capacity to improve transport safety, efficiency, sustainability and accessibility outcomes.
2. New technologies should be implemented in a way that is consumer centric (i.e. designed to meet the needs of those using the service). This includes consideration of:
 - a) options to deliver transport information and services in a way that is consistent and familiar, and
 - b) the diverse needs of travellers, in particular travellers with a disability, vulnerable road users such as cyclists and pedestrians, and users of multiple modes of transport.
3. Where government investment is required to support the deployment of new technologies, that investment will be evidence based, consistent with long-term strategic planning and will deliver value for money.
4. Where feasible, government agencies will avoid favouring particular technologies or applications, in order to encourage competition and innovation. New applications should support interoperability, backwards compatibility and data sharing, and should account for possible future transitions to other technology platforms.
5. Planning for transport technologies will build on existing infrastructure networks (including public transport) and seek to leverage existing consumer devices (such as smart phones) where appropriate.
6. When considering regulatory action, governments will consider low cost approaches such as collaborative agreements or self-regulation before pursuing formal regulation.
7. If required, best practice regulatory approaches will be adopted to ensure regulation is cost efficient, transparent, proportionate to the risk, fit for purpose and done in consultation with affected stakeholders. This includes adopting relevant international or regional standards, unless there is a compelling reason for a unique Australian requirement.

Where feasible, government agencies should adopt nationally consistent policies and regulations, and support a clear national approach to regulating automated vehicles. In alignment with the *National Policy Framework for Land Transport Technology*, automated vehicle policy and regulation should ensure the continued accountability for the operation of vehicles on public roads, support sustainable funding for transport infrastructure and services, and appropriately consider community expectations of security and privacy. Regulation should be proportionate, performance-based and regularly reviewed.

Increasing vehicle automation is taking place within broader transport trends, including connectivity, big data, the sharing economy and zero-emission vehicles. It is therefore important that policy and regulation of automated vehicle is consistent with these broader transport trends.

² Joint Standing Committee on Road Safety (Staysafe), Parliament of New South Wales, 2016, *Inquiry into driverless vehicles and road safety*, Sydney, p. viii.

³ Transport and Infrastructure Council, 2016, *National Policy Framework for Land Transport Technology*, Canberra.

Classifying automated driving functions

There are different ways in which an automated vehicle can be defined, categorised and understood. The NTC discussion paper suggested that the key to a flexible and performance-based regulatory framework is agreed classification systems for automated driving, and we have adopted the SAE International Standard J3016 *Levels of Driving Automation* because it is the most commonly used approach to make sense of different automated driving applications.

Based on SAE International Standard J3016, levels of automation used in this paper are as follows.

Partially automated means that the automated driving system may take control of steering, acceleration and braking in defined circumstances but that the human driver must continue to monitor the driving environment and the driving task, and intervene if required.

Conditionally automated means that the system drives the vehicle for sustained periods of time. The human driver does not have to monitor the driving environment or the automated driving system, but must be receptive to any system failures and intervene if requested and be the fallback for the dynamic driving task.

Highly automated means that the system drives the vehicle for sustained periods of time in some situations, or all of the time in defined places, and no human driver is required to monitor the driving environment and the driving task, or to intervene, when the system is driving the vehicle.

Fully automated means that all aspects of the driving task and monitoring of the driving environment and the dynamic driving task are to be undertaken by the vehicle system. The vehicle can operate on all roads at all times.

As part of the discussion paper, the NTC sought feedback on the following proposals:

- The SAE International Standard J3016 is the preferred taxonomy to define the levels of driving automation. However, government and industry stakeholders should review this position over time, particularly in reference to any comparative standards adopted by WP.29.
- A classification system for automated vehicles should **not** be embedded in legislation at this time.
- Regulatory policy for automated vehicles, including enforcement guidelines, should use any of the following classification systems, as determined by the purpose for which the classification system is to be used:
 1. classifying automated vehicles based on the level of driving automation
 2. classifying automated vehicles based on behavioural competencies
 3. classifying automated vehicles based on use cases.
- Government and industry stakeholders in Australia should support further standardisation of behavioural competencies and use cases in alignment with international standards and practices.

The submissions to the discussion paper largely agree with this approach, insofar as this approach remains consistent with international standards. Nova Systems suggests that the approach would most benefit from the development of a single classification system that encompasses all three areas (Nova Systems, p. 10). However, VicRoads suggests that the SAE International Standard is too complex for regulatory and consumer purposes, and that a simpler scheme should be adopted that captures the three most important distinctions:

- no automation above driver assistance systems
- automated driving with a human driver present
- driverless vehicles (VicRoads, p. 23).

WA Police prefers the classification to be specific to the technology (ANZPAA, p. 4). Toyota Australia suggests that instead of SAE International Standard J3016, Australia should adopt a Japanese proposal – *Definitions of Automated Driving and General Principles for developing a UN-Regulation* – which Toyota explains is comprehensive and covers levels of automation, system performance requirements and use cases (Toyota Australia, p. 5).

The NTC proposes that regulatory and policy responses should adopt the suggested approach set out in the discussion paper. Simplifying the classification of automated vehicles, or framing the classification of automated vehicles in terms of specific technologies or applications, may be suitable for consumer information purposes, but the use of classification systems for regulatory and policy settings should be consistent with international standards.

The Japanese proposal is a similar approach to SAE International Standard J3016, but Australia should be careful not to adopt a classification system that has not been broadly adopted by the international community.

Policy finding: The NTC recommends that, when it is relevant to classify an automated vehicle based on the level of driving automation, the SAE International Standard J3016 should be used. However, the standard should not be replicated in legislation and the prioritisation of the SAE International Standard J3016 should be reviewed if other international standards are adopted.

Policy finding: The NTC recommends that it is too early to develop an overarching classification system that brings together the three classification approaches based on levels of driving automation, use cases and behavioural competencies.

Other issues to consider

Automated vehicles are a disruptive technology that are likely to have wide impacts on many aspects of the community, including the potential to accelerate the shared economy, improve transport options and transform urban planning and design. These changes have broad-ranging policy implications and, to manage project scope, the NTC is focused on transport-related legislation and closely related regimes, such as insurance and consumer law, in line with our legislative mandate.

This means that a range of other regulatory or policy issues are not being addressed by the NTC or in the recommended actions set out in Table 1 of this policy paper. These are other issues that have been identified by the NTC or through the submission process that governments, vehicle manufacturers, researchers and the community may wish to further consider.

Operational challenges of automated rail

Rail operations in Australia have adopted an accreditation model where rail operators identify and manage safety risks. When applying to introduce automated rail vehicles on the network, a rail operator would have to lodge an application with the Office of the National Rail Safety Regulator that identifies all the risks associated with the operation and clearly shows how these risks may be mitigated so far as is reasonably practicable. Therefore, there are unlikely to be regulatory barriers to introducing more automated trains in Australia.

There may be operational challenges related to automated rail operating on shared systems and interacting with other types of trains, other transport modes or vulnerable road users. However, national or international industry standards could be adopted to help mitigate risks. And industry may, through the Rail Industry Safety and Standards Board, identify that further standards are required as new technologies become available.

Issues being addressed by Austroads

Austroads is focused on the operational aspects of supporting automated vehicles including:

- the design, maintenance and operation of road networks
- evaluating the safety benefits of automated and connected vehicles
- the registration of vehicles, and the training and licensing of drivers.

These projects will address key operational issues that will require close consideration by governments before increasingly automated vehicles can operate safely in Australia. Findings from the Austroads program will be inputs to the recommended actions outlined in this paper.

Other operational and investment issues

Submissions to the NTC discussion paper raised a number of other operational issues that are not currently being addressed by Austroads but could be further investigated by government and industry. These include:

- road manager commitment to, and investment in, vehicle-to-infrastructure connectivity
- nationally-consistent road network infrastructure, including temporary and electronic road signage
- access to accurate and timely road infrastructure data, such as temporary speed zone data
- co-existence of automated vehicles with other road vehicles, including powered two-wheelers and emergency vehicles
- investment in satellite-based augmentation systems to improve the accuracy and integrity of global navigation satellite system (GNSS) location data
- refuelling of automated vehicles.

A number of these issues are being addressed or considered in the Transport and Infrastructure Council's *National Policy Framework for Land Transport Technology Action Plan 2016–2019*.

Broader societal issues

There are also complex policy and planning challenges that relate to broader societal issues that are outside the scope of NTC’s regulatory reforms for automated vehicles, but are being further investigated both in Australia and overseas, or will require further consideration as the technology develops. These include issues related to:

- access equality – optimising mobility for older people and people with disabilities
- education of end users, other road users and vulnerable road users
- impacts on traffic and congestion and network planning
- land use planning
- urban parking
- public transport demand
- ridesharing and taxi reform
- issues related to changing job opportunities
- environmental impacts, including the potential for higher carbon emissions resulting from highly intensive on-demand passenger services.

In conclusion, while these issues may be out of scope for the NTC automated vehicle project, they will be important issues for governments to consider, in terms of both ensuring operational efficiency and addressing broader societal issues. The NTC is undertaking strategic analysis using scenario planning techniques that will help governments explore some of these issues using a number of plausible transport futures. Government agencies are also undertaking transport demand modelling to explore the potential impacts of shared and automated vehicles.

2

Supporting on-road trials

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- Governments and industry strongly support the development of nationally consistent guidelines to approve on-road trials of automated vehicles. Guidelines should be based on international best practice.
- Some state and territory governments may seek to amend current exemption powers to ensure they can adequately exempt highly and fully automated vehicles from relevant laws, and that nationally consistent trial conditions can be imposed on trial participants.

Issues

Testing of automated vehicles on public roads in Australia will be important to ensure that different automated vehicles can operate safely. Field tests and trials can also build public understanding and confidence in automated vehicles.

A range of trials and demonstrations are planned by governments and industry in Australia in the next few years. The Commonwealth Government and all state and territory road transport agencies have exemption powers that could be used to allow automated vehicles to operate on public roads that would otherwise not meet design standards or be able to comply with particular road rules. Alternatively, road agencies can temporarily close roads to general public use to test or demonstrate an automated vehicle.

There are some challenges with general exemption powers or road closures:

- Exemption powers are broad in scope and there is a high risk that a patchwork of trial standards and processes will develop across states and territories.
- This could result in a lack of national consistency in relation to trial terms and conditions, insurance and driver skill requirements.
- Reliance on exemption powers could be a higher cost and time-intensive option for industry.
- Closing public roads will not address key technical issues to be tested such as how automated vehicles interact with other road users.

States and territories need to have appropriate exemption powers to support on-road trials. It is possible that legislation in some states and territories could be amended to ensure they have sufficient exemption powers and can attach conditions or requirements to the exemption. For example, some jurisdictions do not have general exemption powers but rely on exemption powers for vehicle standards or roads rules. These may not be sufficiently broad-based to cover higher levels of automation that do not have a human driver. Likewise, some jurisdictions may have exemption powers but are not able to attach conditions to those exemptions.

The NTC is working with the states and territories to identify potential gaps in exemption powers and to identify legislative solutions to support the safe operation of on-road trials of automated vehicles. Any legislative improvements could be undertaken in parallel to developing national guidelines to support on-road trials.

Steps are being made towards supporting trials

To support automated vehicle trials, Victoria has released guidance to assist vehicle manufacturers and technology providers to test automated vehicles on Victorian roads.⁴ According to the guidance, depending on the vehicle's level of driving automation, on-road testing of automated vehicles may occur using the existing regulatory framework or with special approvals issued by VicRoads under exemption powers.

The guidance is based on the United Kingdom's *The Pathway to Driverless Cars: A code of practice for testing*. Victoria-specific adjustments have been made to the code to align it with local conditions and to refer to Victoria's suite of road transport legislation. In addition, general requirements have been added to ensure that parties proposing to test automated vehicles comply with all existing Victorian laws and that vehicles are roadworthy and meet relevant vehicle standards requirements. The UK code (with Victorian adjustments) will be used as an interim position in Victoria while national guidelines are developed. In cases where the automated vehicle meets Victoria's existing regulatory requirements – for example, because a human driver is in control of the vehicle – VicRoads' guidance material can be used without additional regulatory exemptions or approvals.

In relation to automated vehicles that do *not* meet the existing regulatory requirements, the guidance requires parties proposing to test noncompliant vehicles to apply to VicRoads for special approvals prior to commencing any on-road testing.

South Australia passed legislation in March 2016 to support automated vehicle trials.⁵ This legislation allows for trial authorisation to be conditional or unconditional, including a condition requiring compliance with guidelines to be prepared or adopted by the minister. As with trial guidelines seen internationally, the legislation requires the minister to be satisfied that public liability insurance is in place.

These ministerial guidelines could be based on national guidelines adopted by all states and territories.

The legislation also requires reasonable steps to be taken to ensure commercially sensitive or confidential information relating to the trial is not published or made public. The minister is required to report back to parliament within six months of a trial completion, and the report must contain information required by the regulations in relation to the trial.

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on how governments should support on-road trials of automated vehicles. The following four options were canvassed:

- **Option 1:** Continue current approach – rely on exemptions, granted on a case-by-case basis.
- **Option 2:** Option 1, plus support industry development of a code of practice to undertake on-road trials.
- **Option 3:** Option 1, plus introduce national guidelines to support a consistent approach to on-road trials.
- **Option 4:** Develop uniform legislation to support on-road trials, applied in state and territory road safety laws.

The NTC supported option 3.

⁴ Accessed on 15 July 2016 at <https://www.vicroads.vic.gov.au/safety-and-road-rules/vehicle-safety/automated-and-connected-vehicles/testing-of-automated-vehicles>.

⁵ *Motor Vehicles (Trials of Automotive Technologies) Amendment Act 2016 (SA)*.

The discussion paper asked the following questions for stakeholder consideration:

Question 1a: Do you agree that automated vehicle trials should be supported with national guidelines? If not, why?

Question 1b: What key conditions should be included in any national guidelines?

Feedback from the discussion paper

Strong support for national guidelines to support trials

State and territory governments strongly support the development of national guidelines. While it is recognised by governments that there will continue to be an approvals process in each jurisdiction, nationally consistent trial conditions are highly valued for demonstrating safety, increasing community awareness and positioning Australia in the global market to attract technology innovation. Where possible, jurisdictions should make efforts to agree to key principles to ensure consistent treatment and access to the road network based on the vehicle's level of autonomous driving and compliance with vehicle standards and road rules (VicRoads, p. 8). Mutual recognition of trials in different states and territories may be more difficult to achieve without legislative amendments, given that jurisdictions presently do not have specific legislative powers to recognise exemptions in other jurisdictions. However, the same outcome can be partly achieved through imposing consistent trial conditions.

Guidelines are preferable to legislation as they allow the flexibility to be quickly amended and updated, if required (TMR, p. 2). Where possible, governments should be collaborative and encouraged to consult with each other when assessing trial applications.

From an enforcement perspective, there is strong support for national guidelines, ensuring that the enforcement of road rules and vehicle standards in relation to emerging vehicle technologies is consistent across Australian states and territories. WA Police recommends that the guidelines are as compatible with current enforcement regulations as possible, in order to limit the amount of future 'technology specific' regulation (ANZPAA, p. 2), while Victoria Police recommends that national guidelines be legally binding on parties, with an emphasis on conditions that 'must' be met, rather than 'should' be met (ANZPAA, p. 12).

Industry submissions also strongly support national guidelines. This approach could achieve consistency across jurisdictions and lower implementation costs. The current niche nature of automated vehicle trials means they are suited to approvals being granted on a case-by-case basis (Gas Energy Australia, p. 1). However, trials and demonstrations should not be delayed until the implementation of national guidelines (Verless, p. 3).

Trial conditions should be based on international best practice

The substance of trial conditions was considered in a number of submissions. The NTC was directed to a number of existing guidelines, codes and international standards that could be further explored in the development of Australia's own national guidelines, including guidelines and codes in the United Kingdom, New Zealand and Japan. There are also industry-specific codes that may be of value, such as the *Safe mobile autonomous mining in Western Australia* code of practice (Government of Western Australia, 2015), developed by an industry advisory committee and approved by the WA minister for mines and petroleum.

Guidelines should ensure that the same or similar technologies can be used in all jurisdictions, however, should not be so prescriptive as to limit innovation between jurisdictions (TMR, p. 2). There was broad agreement that the trial conditions should relate to safety performance, driver training, licensing requirements and the provision of data to the relevant road agency. The Western Australian Government provided a proposed set of relevant conditions that are broadly similar across many submissions:

1. minimum safety requirements
2. an entity clearly responsible for the vehicle
3. the need to obey relevant traffic laws
4. use of personal protective equipment
5. a risk assessment incorporated into a safety management plan
6. test driver/operator licensing and training requirements
7. insurance requirements
8. communication with relevant government agencies
9. a broader communication strategy for notifying and educating the public
10. access to test data
11. incident reporting (WA transport portfolio, p. 2).

National guidelines could benefit from additional conditions including:

- specific conditions under which the trial will be allowed to proceed, such as:
 - areas or roads the vehicle can operate on
 - spectrum requirements
 - time of day
 - road types and infrastructure requirements
 - weather conditions
 - interaction with light rail and vulnerable road users
- clearly defined research aims and outcomes that are to be delivered by the trial (TIC, p. 2)
- clear responsibility for liability (GHD, p. 3)
- demonstrated compliance with work health and safety laws (Nova Systems, p. 4)
- appropriate explanation of the capabilities and limitations of the technology (Nebot, p. 1).

A number of submissions recommended that the national guidelines draw from international experiences, particularly the United Kingdom's code of practice. However, TMR notes that a limiting factor associated with the UK code is the requirement to have a test driver present in the vehicle at all times. Arguably, this does not allow for trials of some highly automated vehicles such as low-speed driverless shuttle buses (TMR, p. 2).

Based on government and industry feedback, it is clear that consistent guidelines should relate not only to the requirements of the trial participants, but that the same thresholds to operate an automated vehicle trial are introduced in each jurisdiction. This would help ensure that an automated vehicle of a particular automated driving function, safety performance and competency will be treated the same across the states and territories. To facilitate a collaborative approach between governments, the Australian Driverless Vehicle Initiative (ADVI) suggests that a centralised database is developed and made available to jurisdictions when considering trial applications, underpinned by a mutual recognition scheme (ADVI, p. 3).

Conclusions

The NTC recognises the strong support expressed by stakeholders for developing national guidelines to undertake automated vehicle trials. National guidelines are a flexible mechanism that can underpin innovation and the safe testing of automated vehicles in Australia. National guidelines can facilitate collaborative research, support Australian competitiveness and reduce administrative costs.

Industry evaluation of the safety and technology performance of automated vehicles through on-road field testing and trials should be encouraged and supported by Australian governments. State and territory governments should seek to establish consistent exemption requirements and conditions for on-road trials of automated vehicles.

National guidelines should ensure as much as possible that all jurisdictions:

- grant participants similar access to the network
- subject participants to similar conditions of use
- grant the same exemptions based on similar laws
- facilitate information sharing about trial and research outcomes between jurisdictions.

National guidelines should be developed as a priority, near-term action by governments, in close consultation with industry stakeholders. The development of national guidelines by the NTC and Austroads is consistent with action 2 of the *National Policy Framework for Land Transport Technology Action Plan 2016–2019* to develop national operational guidelines to support the on-road use of automated vehicles (Transport and Infrastructure Council, 2016).

Under current exemption laws, each state and territory would need to use its own exemption powers to allow a trial in its jurisdiction, even if a trial had been approved in another state or territory. This will potentially create additional regulatory burdens for trial applicants wishing to test vehicles across different states or territories. Therefore, state and territory road and transport agencies should consider developing legislative mechanisms to mutually recognise trial exemptions in other jurisdictions. State and territory road and transport agencies could also share research findings through non-legislative mechanisms.

Policy finding: While national guidelines could support trials of vehicles with any level of automated driving, the primary objective of the guidelines should be to establish nationally consistent criteria to assess on-road trial applications for highly and fully automated vehicles.

Policy finding: Each state and territory road and transport agency should review its exemption powers to ensure that the current legislative framework can: (1) allow road agencies to impose appropriate conditions on trial participants; and (2) support automated vehicle trials, particularly in relation to highly and fully automated vehicles that may not have or require a human driver. The NTC acknowledges that state and territory road and transport agencies may need to undertake additional legislative reviews as the technology develops.

Recommendation 1: That the NTC and Austroads develop national guidelines for on-road field testing and trials of automated vehicles in Australia.

Lead agency: The NTC, in partnership with Austroads.

Timeframe: Proposed national guidelines submitted to the Transport and Infrastructure Council in May 2017.

Recommendation 2: That state and territory road and transport agencies undertake a review of current exemption powers to ensure they have sufficient powers to undertake and manage on-road trials of automated vehicles, including in relation to vehicle standards, road rules and driver licensing requirements, and to review how cross-border trials could be managed.

That, subject to the review of exemption powers, state and territory governments amend current exemption powers to support on-road trials of automated vehicles.

Lead agency: States and territories to undertake reviews, and the NTC to report progress to the Transport and Infrastructure Council.

Timeframe: Commence state and territory reviews from early 2017. Any necessary legislative amendments to current exemption powers adopted by 2018.

3

Clarifying the meaning of *control* and *proper control*

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- Resolving who has legal control of an automated vehicle, particularly vehicles that are conditionally automated, is a critical near-term reform necessary to provide manufacturers, insurers and consumers with legal certainty.
- Governments and industry support the development of national enforcement guidelines to clarify a policy position on the application of legal concepts of *control* and *proper control* to automated vehicles.
- To provide near-term direction for industry, insurers and consumers, the Transport and Infrastructure Council reaffirms that the existing policy position on control applies to automated vehicles and that a human driver in a vehicle that is partially or conditionally automated remains in control of his or her vehicle.

Issues

Who or what is in control of an automated vehicle?

Our road transport laws are based on the principle that the driver is in control of the vehicle. This approach is underpinned by the road rules, international convention and common law, and ensures that the driver is responsible for the actions of the vehicle.

Under the SAE International Standard J3016 on *Levels of Automated Driving*, control of a highly or fully automated vehicle is likely to be clear: by definition, the automated driving system is in control of the vehicle for defined periods of time, or all of the time (in the medium term, this should be reflected in changes to the legislative meaning of *driver*, as discussed in Chapter 5). Likewise, control of a partially automated vehicle is likely to be clear: the automated functions are drivers' aids and the human driver remains in control of the vehicle.

While some Australian jurisdictions have included broad concepts of a person being *in charge* of a vehicle – for example, in relation to eligibility criteria to access third-party insurance – the issue of control is less clear if the human driver is only required to be receptive to system failures and to take back control if requested. If the human driver is not engaged in undertaking the dynamic driving task, as with vehicles that are conditionally automated, it remains to be seen whether the human driver has control of, and subsequently legal responsibility for, the vehicle. For example, is the human driver or the automated driving system in control of a valet parking manoeuvre? Does it make a difference if the human driver is not seated in the vehicle but is standing within close range and monitoring the vehicle self-parking, with the ability to stop the vehicle by remote control? What if the vehicle parks itself in a multi-level carpark based on directions of a human who is no longer in sight of the vehicle? In the longer term these issues could be addressed in legislation.

We are also yet to see this issue resolved in international law or Australian case law, although recent amendments to the Vienna Convention on Road Traffic have confirmed that the human driver remains in control of a vehicle that uses drivers' aids, thereby clarifying the matter in relation to partial automation.

The German Parliament is currently considering a transport bill that would allow drivers of automated vehicles to no longer have to pay attention to traffic or concentrate on steering while driving but remain seated in the driver's seat so as to intervene in an emergency.⁶ This would clarify the law for partially automated vehicles and many situations related to vehicles that are conditionally automated.

The United States Department of Transport (DOT) has also given consideration to principles of control and responsibility based on different levels of driving automation. The DOT's *Federal Automated Vehicles Policy* groups vehicles with conditional automation (level 3 vehicles) with highly automated vehicles because the automated driving system – not the human driver or operator – monitors the driving environment. The *Federal Automated Vehicles Policy* provides that:

Using the SAE levels, DOT draws a distinction between Levels 0–2 and 3–5 based on whether the human operator or the automated system is primarily responsible for monitoring the driving environment. Throughout this Policy the term “highly automated vehicle” (HAV) represents SAE Levels 3–5 vehicles with automated systems that **are responsible for monitoring the driving environment**. [Emphasis in the original text.]⁷

Resolving the issue of control will be critical to the introduction of vehicles that have conditional automation, because if a human driver is still in control of the automated vehicle he or she is driving, then they are legally responsible for ensuring the vehicle operates safely and in compliance with the road rules. They would continue to have to be qualified to drive the vehicle and be capable of doing so. Clarifying legal control will therefore have significant implications for driver licensing, enforcement and helping to resolve liability complexities (discussed in Chapter 8).⁸

The driver must have proper control of the vehicle

The Australian Road Rules have a performance-based requirement that a driver exercises *proper control* of the vehicle:

A driver must not drive a vehicle unless the driver has proper control (Rule 297(1)).

To date, this rule has been consistently interpreted by police agencies in Australia as meaning that a driver does not have proper control unless he or she is sitting in the driver's seat with at least one hand on the steering wheel. Western Australia is the only jurisdiction that has legislated a requirement to sit behind the steering wheel.⁹

The intent of Rule 297 – that the vehicle is properly controlled – is likely to remain highly relevant to automated vehicles. The key issue is that the current interpretation of Rule 297 does not contemplate automated vehicles that could feasibly operate safely without a human driver keeping at least one hand on the steering wheel, or even sitting in a driver's seat.

Alternatively, the requirement for the driver to have *proper control* may take on new requirements, particularly for vehicles that have conditional automation, or in a vehicle that is highly automated some of the time. In these vehicles, the driver must remain sufficiently vigilant and alert to supervise the automated driving system or to take back control at a point in time. In the longer term, the concept of *proper control* could relate to the technology specification and maintenance of the automated driving system, rather than the human behaviours of the occupants in the vehicle.

The regulatory challenge is to ensure that the requirement for a driver to have *proper control* continues to be as performance-based as possible, and to ensure that we do not build-in prescriptive requirements that diminish the law's capacity to target unsafe behaviours.

6 Accessed on 22/07/2016: <https://www.2025ad.com/in-the-news/news/dobrindt-driverless-laws/>

7 National Highway Safety Administration, 2016, *Federal Automated Vehicles Policy*, Washington, D.C., p. 10.

8 See Chapter 8, p. 55.

9 Section 263 of the *Road Traffic Code 2000* (WA).

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on the following three options:

- **Option 1:** Continue current approach – industry develops its position on the meaning of *control* and *proper control* and the concept is tested in the courts.
- **Option 2:** That governments develop national enforcement guidelines to clarify a policy position on the meaning of *control* and *proper control* for automated vehicles.
- **Option 3:** That governments amend the Australian Road Rules and state and territory traffic laws to clarify the meaning of *control* and *proper control* for automated vehicles.

The NTC supported option 2.

The discussion paper asked the following questions for stakeholder consideration:

Question 2a: Do you agree that issues of *control* and *proper control* should be addressed through national enforcement guidelines? If not, why?

Question 2b: How should *control* and *proper control* be defined?

Feedback from the discussion paper

The majority of government and industry stakeholders support the development of national enforcement guidelines to clarify a policy position on the meaning of *control* and *proper control* for automated vehicles (option 2).

However, a number of stakeholders note that as guidelines do not have legal enforceability, there may be a need to amend road rules and other legislation as the technology matures and case law and international conventions are developed, or in order to enable certain automated driving operations. For example, Road Rule 213 has requirements for a driver to make the motor vehicle secure, including a requirement to switch off the engine if the driver is moving more than three metres from the vehicle. Without amendments to this rule, valet parking applications currently under development by some vehicle manufacturers may not be able to operate in compliance with that specific road rule.

The NSW transport cluster agrees in principle that option 2 is a useful starting point but also suggests that including definitions of *control* and *proper control* in the road rules would complement the national guidelines. NSW transport cluster suggests that the road rules should define control for both humans and machines, have regard to the different types and functions of automated vehicles, and ensure there are practical means for law enforcement agencies to establish who was controlling the vehicle at a point in time. NSW transport cluster proposes that the agreed definition should ensure that the vehicle occupant is in a position to take all reasonable steps required to prevent the vehicle being involved in a crash.

Similarly, VicRoads is supportive of national enforcement guidelines, however, notes that there will likely be a need to immediately amend certain traffic laws if they are in conflict with the intent of the enforcement guidelines. WA transport portfolio suggest that national enforcement guidelines should be developed, followed by appropriate amendments to legislation where needed to align with the national guidelines. Police agencies also support option 2, in addition to the removal of any legal barriers.

TMR supports national enforcement guidelines and considers that the early adoption of regulation would likely limit the advances in new and emerging technologies. TMR suggests that while it may be possible to create a regulatory arrangement where the human driver and automated driving system share vehicle control and responsibility, this would create significant complexity.

Most manufacturers and insurers support governments clarifying the meaning of control to provide certainty in the near term (option 2) but suggest that the eventual aim should be to provide certainty and national consistency through legislation (option 3).

Tesla considers that concepts of *control* and *proper control* are integral to Australia's transport laws and suggests that it is important to establish clarity in the context of automated vehicles. Tesla advises governments to 'adopt a technology-neutral approach that takes into account the multiple ways that drivers will be able to control vehicles' (Tesla, p. 4).

The NHVR suggests that legal advice be obtained to clarify the enforceability of national enforcement guidelines and their standing in court proceedings. The NHVR also considers that the legal responsibility for ensuring a commercial vehicle is properly controlled should sit with a single nominated entity, and it should be the entity's responsibility to ensure, so far as is reasonably practicable, that the automated driving system is properly controlled.

The ADVI suggests that, without legislative amendment, police and courts who are independent of government direction may alternatively define these terms, which would lead to uncertainty for manufacturers, technology developers and consumers. The ADVI notes the need to ensure that any regulatory approach is flexible enough to respond to emerging issues but firm enough to enable the management of the whole system.

Conclusions

It is clear from the stakeholder feedback that clarifying what constitutes *control* and *proper control* are priority issues, given that vehicles with conditional automation are anticipated to be deployed within the next five years. The aim of governments in Australia should be to provide enforcement certainty to industry, consumers and insurers so as to support the uptake of technologies that could significantly improve road safety outcomes.

The feedback indicates overwhelming support for developing national enforcement guidelines to clarify a policy position on the meaning of *control* and *proper control* for automated vehicles, and at the very least, for governments to provide policy certainty in the near term to support close-to-market applications, such as valet parking. In the medium term, adapting driver legislation to recognise the automated driving system entity, outlined in Chapter 5, should also help to clarify issues of control, by clearly identifying the automated driving system entity responsible for the vehicle.

The changing nature of control will impact on the driving tasks required of human drivers and, consequently, driver licensing schemes are likely to be adapted for automated vehicles. The 2016 Austroads project, undertaken by the Australian Road Research Board (ARRB) to investigate the impacts of automated vehicles on driver licensing, identified an emerging international consensus on the continued need for driver licensing if an automated vehicle requires a human to operate the vehicle at any point. For conditional and highly automated vehicles, there may also be a case for additional training, modified training requirements or periodic license retesting.

Policy finding: To support the regulatory framework for automated vehicles, Australian governments should clarify through national enforcement guidelines: (1) who is in control of an automated vehicle; and (2) how enforcement agencies will apply the *proper control* requirement in the road rules to all levels of driving automation. Definitions of *control* and *proper control* relate primarily to enforcement of Road Rule 297, and agreed enforcement guidelines should be adopted consistently in each state and territory to ensure market certainty.

Policy finding: National enforcement guidelines should be agreed and adopted in the near term. As the technology matures and the legal concepts are interpreted by Australian case law or settled in international driving conventions, concepts of *control* and *proper control* in relation to different levels of automated driving should be addressed by amendments to the road rules.

Policy finding: States and territories should ensure current laws relating to *proper control* do not unintentionally restrict the safe introduction of automated vehicles. For example, Western Australian laws that explicitly define *proper control* to mean the driver must be in the driver's seat may have to be amended, subject to the nationally agreed position on what should constitute *proper control* of vehicles with different levels of automated driving.

Policy finding: To provide immediate legal certainty to human drivers, state and territory governments should agree on an enforcement policy position that human drivers continue to have full control and responsibility of a road vehicle with automated functions until that position is refined through the development of national enforcement guidelines, or unless an exemption is granted by a state or territory road agency. This position is consistent with the Geneva Convention on Road Traffic.

Policy finding: The changing nature of control will impact on the driving tasks required of human drivers and, subsequently, driver licensing schemes are likely to be adapted for automated vehicles. Reforms to driver licensing schemes to ensure they remain relevant to conditional and highly automated vehicles therefore appear likely in the longer term.

Recommendation 3: That the NTC develops national enforcement guidelines that clarify regulatory concepts of *control* and *proper control* for partial, conditional, highly and fully automated vehicles. That the NTC develops guidelines having regard to international standards and best practice and in collaboration with state and territory road and police agencies, the NHVR and public prosecutors.

Lead agency: The NTC.

Timeframe: Commence reforms from early 2017. Proposed national guidelines submitted to the Transport and Infrastructure Council in November 2017.

Recommendation 4: That Australian transport ministers agree to reaffirm the existing policy position that:

- The human driver remains in full legal control of a vehicle that is partially or conditionally automated, unless or until a new position is developed and agreed (in alignment with recommendation 3).
- The human driver of a partially or conditionally automated vehicle should only undertake non-driving tasks currently permitted by the road rules and existing enforcement policies and guidelines, unless or until a new position is developed and agreed (in alignment with recommendation 3), or an exemption is provided by a road agency.

Lead agency: Transport and Infrastructure Council.

Timeframe: November 2016.

4

Safety assurance for vehicles that do not require a human driver

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- There is unanimous support for a national safety assurance system for automated vehicles that do not require a human driver. The assurance should be risk-based and follow a safety case approach, with applicants demonstrating the safe performance of the automated vehicle.
- In the longer term, automated vehicles could be integrated into the existing regulations as international standards and Australian Design Rules (ADRs) for automated vehicles are developed.
- The NTC recommends that preparatory work to develop a national safety assurance system is progressed in 2017, with a system implemented by 2020.

Issues

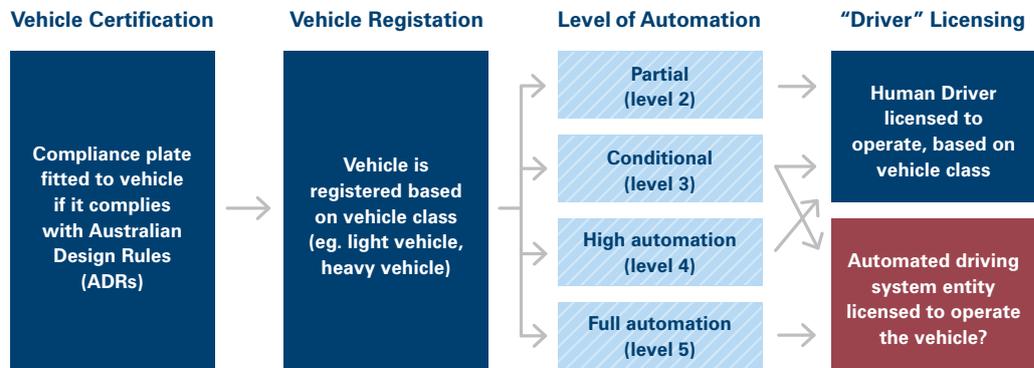
The role of governments in the deployment of automated vehicles is a key issue for the community to consider. Should the evidence indicate that automated vehicles offer significant safety, mobility, productivity and environmental net benefits, a case exists that governments should at a minimum ensure that current laws are not a barrier to their uptake.

If the current regulatory barriers are removed, automated vehicles can be regulated by ADRs, in-service vehicle standards, registration and road rules within the current regulatory framework. Industry is also incentivised to provide safe products through the Australian Consumer Law and contracts.

However, current driver licensing requirements will not apply to automated vehicles that do not have a human driver. At issue is whether, in the absence of a driver licensing regime, a safety assurance system is needed to ensure the safe operation of automated vehicles. This issue is being explored by jurisdictions in other regions (including the United States and the United Kingdom), and there is currently no general international consensus on how highly or fully automated vehicles should be tested and approved for large-scale commercial deployment on public roads.

Figure 1 illustrates that, without introducing a safety assurance system, if the driver is the automated driving system entity, governments do not currently have a mechanism to regulate the vehicle. A safety assurance system could take the form of an automated vehicle operator licence, registration or accreditation regime.

Figure 1: How automated vehicles are challenging the current regulation of drivers



The discussion paper outlined possible principles and performance criteria that could be included as part of the safety assurance system. These examples are replicated in **Figure 2**.

Figure 2: Examples of potential safety principles and criteria that could be adopted as part of the safety assurance system for automated vehicles

Potential safety principles – for all automated vehicles
<ol style="list-style-type: none"> 1. Automated vehicles must comply with all relevant safely requirements before being allowed to operate on publicly-accessible roads or infrastructure. 2. Automated vehicles must only operate on roads and infrastructure consistent with their approved behavioural competencies.
Potential performance criteria – for all automated vehicles
<ol style="list-style-type: none"> 1. The applicant has demonstrated that the vehicle is compliant with the ADRs applicable to it, or has a relevant ADR exemption. 2. The applicant has demonstrated that the vehicle can operate in compliance with relevant road safety and traffic laws. 3. The applicant has demonstrated that the maximum speed of the vehicle is based on a risk assessment that considers the applicable operational environment, occupant protection and vehicle mass. 4. The applicant has demonstrated that, for wherever the vehicle operates, the vehicle can safely manage: <ul style="list-style-type: none"> • responding to temporary speed zones (such as roadworks) • responding to traffic controls (such as stop signs, variable speed signs and traffic lights) • all likely road conditions (such as unsealed roads) • all likely environmental conditions (such as dust storms or flooding) • interaction with trains and light rail (such as railway level crossings) • interaction with vulnerable road users (such as compliance with one metre clearance for cyclists). 5. The vehicle has real-time monitoring of driving performance and incidents, including event data records in the lead up to any crash or near miss that identifies which party was in control of the vehicle at the relevant time. 6. The vehicle operates with functionality to provide road agencies with crash and near-miss data. 7. The vehicle operates with the minimum required standards of security, mapping, privacy and data management protocols. 8. The applicant has vehicle insurance valued at a specified amount that covers personal injury, third-party damage and damage to infrastructure, public liability and professional indemnity.
Additional criteria for automated vehicles that require human intervention or monitoring
<ol style="list-style-type: none"> 1. The automated vehicle must meet any international standards or agreed guidelines for human machine interfaces, and allow, when relevant, human drivers to safely disengage and re-engage the driving task. 2. Human drivers are provided with appropriate training to safely disengage and re-engage the driving task.
Additional criteria for highly or fully automated vehicles
<ol style="list-style-type: none"> 1. There is an identifiable entity that has legal responsibility for a highly or fully automated vehicle. 2. The automated vehicle must be capable of coming to a controlled stop without human intervention.

This approach would require the applicant to demonstrate to a regulator that the automated vehicle and operating system is safe, and how the vehicle and the operating system meet the principles and performance criteria. This approach is consistent with safety accreditation models adapted in the rail, aviation and mining sectors and would require governments to develop processes and procedures to validate the claims made by the applicant. This approach is also similar to the performance-based standards (PBS) scheme administered by the NHVR. The PBS scheme offers heavy vehicle operators the potential to achieve higher productivity and safety benefits by submitting applications for innovative vehicle designs for approval against performance-based criteria.

How the safety assurance system would interact with current regulations

How the safety assurance system would interact with current regulations, including the ADRs, in-service vehicle standards and the roads rules, is a key issue to be investigated and agreed by governments. The safety assurance system is primarily focused on safety criteria required *in addition to* current regulations or instead of current driver licensing, and it is therefore likely that the majority of the current regulations would continue to apply to vehicles approved under the safety assurance system. This will be more likely to be the case if the definition of *driver* and *driving* is amended in parallel to the implementation of the safety assurance system.

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on the following two options:

- **Option 1:** Governments amend the current regulatory framework by removing barriers for more highly automated vehicles to enter the market, and allow industry to self-regulate the safe operation of automated driving functions.
- **Option 2:** Governments implement a national safety assurance framework to oversee the deployment of automated vehicles that do not require a human driver, in conjunction with removing legal barriers

The NTC supported option 2.

The discussion paper asked the following questions for stakeholder consideration:

Question 3a: Do you agree that governments should oversee the safe operation of automated vehicles through the development of a national safety assurance framework? If not, why?

Question 3b: What objectives and criteria should such a framework include?

Feedback from the discussion paper

Unanimous support for a safety assurance system

Submissions to the discussion paper consistently provide in-principle support for a national safety assurance system to ensure the safe operation of automated vehicles that do not require a human driver some or all of the time. There is no government or industry support for option 1, the removal of regulatory barriers for highly automated vehicles without additional regulatory oversight.

The NSW transport cluster (p. 5) provides a rationale for the role of government in a national safety assurance system:

The transition to automated road vehicles, where the human responsibility is diminished, will require an enhanced level of safety assurance that replaces the current 'driver is accountable' safety legislation. Governments should be involved in this space because the community would expect them to continue to take ultimate responsibility for road safety.

VicRoads notes that a national framework could have regard to both safety criteria and establishing a national process to undertake vehicle assessments against the framework. Determining which parts of the network can be used by vehicles will remain a matter for road managers based on the safety case of a vehicle application, with the framework encouraging national consistency but any local issues being recognised and catered for. Conversely, TMR suggests that the system be administered nationally by the Commonwealth Department of Infrastructure and Regional Development, similar to the existing motor vehicle import scheme. TMR observes that 'it would be highly undesirable if an automated vehicle provider were required to gain approval to sell their vehicles or services in each jurisdiction separately, particularly if the requirements differed between jurisdictions' (TMR, p. 5).

A key issue, therefore, is the extent to which state and territory road managers should be involved in the vehicle application process to ensure that automated vehicles only operate on parts of their network that are 'fit for purpose' and taking into account local issues.

There was general agreement across submissions that the development of a safety assurance system is a medium-term action (established by 2020), recognising that a framework would not be required for lower levels of automation that are expected to be commercially deployed pre-2020.

It was also stressed that a 'two model system' where automated vehicles are subject to a different regulatory process from other vehicles is likely to cause confusion in the longer term. It is therefore feasible that a safety assurance system could be a medium-term solution, until the safety performance of automated vehicles is well established and new ADRs are developed in alignment with international standards. On the other hand, there may be a continued need for governments to oversee the safe operation of automated vehicles in addition to new ADRs.

Manufacturers support the development of a national safety assurance system, but advise that the safety criteria should be consistent with other regions (particularly Europe) and should be developed in conjunction with the vehicle industry (FCAI, p. 8).

Assurance should focus on safety performance and data

A number of submissions suggest that the draft safety principles and criteria for a safety assurance system (contained in **Figure 2**, p. 38) are a useful starting point.

The submissions emphasise that safety assurance should:

- be nationally consistent
- adopt a safety case approach based on the risk profile of the application, with responsibility of the applicant to demonstrate the safety performance of the automated vehicle
- manage where and how the vehicle can operate
- ensure the ability for agencies and the NHVR to read and interpret reliable data, including crash data and who was in control of the vehicle at a point in time
- include human-machine interface requirements
- address vehicle modification and maintenance, including over-the-air software updates

- ensure safety redundancy
- include a mechanism to ensure offshore entities can be held legally responsible for their vehicles and systems
- be technology-neutral and consistent wherever possible with international developments, taking into consideration international testing results
- manage minor road rules breaches
- be aligned with the *National Road Safety Strategy 2011–2020*.

TMR suggests that a legislative mechanism should establish the framework, but the requirements of the framework should not be hardwired in legislation. The Intelligent Access Program for heavy vehicle access to the road network provides a potential legislative model.

Conclusions

The NTC recognises the strong support expressed by stakeholders for developing a national safety assurance system for vehicles that do not require a human driver. The safety assurance system should be risk-based and adopt a safety case approach, with applicants demonstrating the safe performance of the automated vehicle. **Figure 2** (on p. 38) includes potential safety-related criteria for a framework and provides a starting point for further discussion. Where relevant, the framework should be based on international practices and recognise testing outcomes undertaken overseas.

A national safety assurance system should support commercial deployment of automated vehicles. Prior to the development of a safety assurance system, automated vehicle applications for trials or niche deployment should be considered on a case-by-case basis through existing exemption powers. In the longer term, automated vehicles should be integrated into the existing regulations as international standards and ADRs for automated vehicles are developed; however, there may be a continued need for governments to oversee the safe operation of automated vehicles in addition to new ADRs.

As defined on page 19, a safety assurance system means a regulatory mechanism for governments to assess the safety performance of an automated vehicle to ensure it can operate safely on the network. It could operate through the introduction of automated vehicle registration, or the accreditation or licensing of the automated driving system entity.

A national safety assurance system should be a delegated function approved by parliaments, based on laws that allow decision-makers to grant automated vehicle access to the road network.

Responsibility for the national safety assurance system, and the roles of the Commonwealth, state and territory road and transport agencies and the NHVR in the approval processes, require further consideration and discussion. The Commonwealth can provide a nationally consistent approvals process in parallel to its responsibilities under the *Motor Vehicle Standards Act*; on the other hand, state and territory road agencies have oversight of their infrastructure and can take into consideration local roads and other issues if they have a role in the approvals process. They also have responsibility for in-service vehicle compliance. Roles and responsibilities should be progressed in close consultation with government and industry through the preparatory work to develop a safety assurance system, to be undertaken next year.

The NTC suggests that if the states and territories do have administrative responsibility for the safety assurance system, the approval of an automated vehicle in one jurisdiction should be mutually recognised in every state and territory so that industry does not have to duplicate applications.

Policy finding: In conjunction with the removal of regulatory barriers, Australian governments should develop a national safety assurance system in close consultation with industry partners and in alignment with international practices. The safety assurance system should establish an approvals process to assess the safety performance and data handling of applications to operate automated vehicles that do not require a human driver some of the time or all of the time.

Preparatory work to develop the national safety assurance system should have regard to scoping:

- nationally agreed safety principles and criteria
- operational models and processes to ensure that the safety assurance system is nationally consistent, efficient, affordable and creates minimal administrative burden for applicants
- enforcement
- road access
- governance and funding options.

Recommendation 5: That the NTC develop a national performance-based assurance regime designed to ensure the safe operation of automated vehicles, with an initial focus on vehicles with conditional automation (level 3).

Lead agency: The NTC.

Timeframe: An initial briefing on process and technical performance requirements to be provided to ministers in May 2017. Detailed implementation plan submitted to ministers in November 2017.

1
5

Clarifying the meaning of *driver* and *driving*

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- Many transport-related laws require a human driver. In some highly and fully automated vehicles, there will not be a human driver some of the time or all of the time. Without a human driver, these vehicles could not currently operate legally under the Australian Road Rules and other laws.
- Most industry and government submissions support expanding the definition of *driver* and *driving* in relevant legislation, commencing work within two years, with priority given to amending compulsory third-party insurance schemes.
- The NTC recommends that Australian governments should at this preliminary stage provide in-principle support for legislative reform and undertake further exploration of the potential solutions, in-step with international developments and maturity of the technology.

Issues

Driving, in its most basic sense, is focused on route finding, route following, velocity control, collision avoidance, rule compliance and vehicle monitoring (ARRB, p. 3, quoting Brown, 1986). With the emergence of automated vehicles, the vehicle monitoring function is likely to increase for human drivers, as the other functions transition to the automated driving system.

In addition to these driving functions, drivers have a range of other legal responsibilities including responsibility for passengers to comply with laws (such as wearing seatbelts) and responsibility for the vehicle (such as mass, dimension and loading obligations for heavy vehicle drivers).

As vehicles become more automated, the notion that the human driver is in control and therefore responsible for the vehicle is stretched to the point that, in highly and fully automated vehicles, it could be said that the automated driving system entity is the driver. This paradigm was not envisaged when the road rules and other relevant laws were drafted and the driver was clearly defined and understood to be human.

The 1968 Vienna Convention on Road Traffic requires a driver to be responsible for the vehicle. The Convention states that 'every moving vehicle or combination of vehicles shall have a driver' (Article 8.1) and the driver must be in control of the vehicle (Article 13).¹⁰ Likewise, the Australian Road Rules could not function without a legal person being responsible for the actions of the vehicle. The human driver is an identifiable legal entity who can be held responsible for any incidents or breaches while he or she is, or should be, in control of the vehicle.

In civil tort law and criminal law there must also be a legal person responsible for the actions of the vehicle for any civil liability or criminal offence to be committed.

¹⁰ In March 2016 the Convention was updated to provide that vehicle systems that influence the way vehicles are driven shall comply with this provision. This would suggest that the human driver is still in control for partially or conditionally automated vehicles.

The NTC has undertaken a comprehensive analysis of current legislation and identified a range of laws that assume a human driver. The annex to the discussion paper, available on the NTC website, provides the complete analysis. The following regimes have driver obligations and could be a barrier to highly or fully automated vehicles without further amendments:

- Australian Road Rules and state and territory road safety and traffic legislation
- heavy vehicle law
- tolling legislation
- criminal law
- passenger transport legislation
- dangerous goods law
- accident compensation schemes.

At issue is whether current laws should be updated to ensure that:

- automated vehicles can meet all relevant legal obligations, including compliance with the Australian Road Rules
- where appropriate and relevant, other entities, such as the automated driving system entity, share or hold obligations that are currently held by the driver
- there continues to be a legal entity responsible for the vehicle.

Any amendments to the definition of *driver* or *driving* were considered in the discussion paper to be medium-term reforms (work should commence within two years) because partial and conditionally automated vehicles that are more likely to be seen in the near term, will continue to have a human driver and the issues relating to the legislative concept of *driver* and *driving* will not be relevant.

Amendments to the road rules could also clarify who is in control of vehicles with different levels of driving automation. In doing so, these amendments would build on the near-term national enforcement guidelines for *control* and *proper control* discussed in Chapter 3.¹¹

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on how to address the definition of driver. The following two options were canvassed:

- **Option 1:** Continue current approach – rely on exemptions, granted on a case-by-case basis.
- **Option 2:** Expand the meaning of *driver* in relevant legislation to:
 - include an automated driving system; and
 - ensure that a legal entity must be responsible for the automated driving system; and
 - ensure that the intent of the law can apply to an automated driving system.

The NTC supported option 2.

¹¹ See Chapter 3, p. 30.

The discussion paper asked the following questions for stakeholder consideration:

Question 4a: Do you agree that the definition of *driver* and *driving* should be amended in relevant legislation? If not, why?

Question 4b: What should be the legal obligations of the entity responsible for the automated driving system?

Question 4c: Are there additional legislative regimes that use the definition of *driver* that should be considered in any future reforms of the definition?

Feedback from the discussion paper

State and territory governments recognise that, in the longer term, legislative reforms will be warranted to accommodate automated vehicles, but there are different views on what those legislative reforms should entail, when they should be implemented, and how governments should accommodate automated vehicles in the interim.

Both TMR and VicRoads suggest that in the longer term a separate legislative framework should be developed for automated vehicles. In this interim period, TMR, the WA transport portfolio and the Department of State Growth (Tasmania) support expanding the current definitions of *driver* and *driving*. VicRoads and Victoria Police (in the ANZPAA submission) on the other hand support the current exemption framework, suggesting that changing the meaning of *driver* and *driving* is not a viable solution, could inadvertently affect existing interpretations of the law and create an unwarranted shift in obligations from the human driver to the automated driving system entity. VicRoads also notes that penalties for the automated driving system entity may also have to change, shifting from fines and demerit points to loss of access or safety-related recalls (VicRoads, pp. 14–15).

Industry has different views on how the changing nature of *driver* and *driving* should be addressed, but generally agree that the issue is a priority and needs to be clarified. Common points raised by industry are that:

- Changes should be based on international frameworks wherever possible, including the Informal Group on ITS and Automated Driving and WP29.
- Amendments should be technology-neutral.
- The approach taken should be nationally consistent across states and territories.
- There are alternative solutions to expanding the definition of *driver* to be further explored, including the introduction of new legal actors, such as the *operator* (AAA, p. 11) or the *controller* of the vehicle (GHD, p. 4). Legal obligations of an operator could be based on definitions used in aviation and rail (Toyota, p. 4).

Access to compulsory third-party insurance schemes

A number of law firms and insurers emphasise that any automated vehicle eligibility restrictions to compulsory third-party insurance schemes need to be addressed as a priority reform. The central issue relates to current eligibility criteria in a number of jurisdictions that require a driver to be in control of the vehicle for a claim to be made.

The Law Institute of Victoria (LIV) provides a comprehensive rationale for ensuring drivers and occupants of automated vehicles – and others who interact with automated vehicles, such as pedestrians – are eligible to access compulsory third-party insurance. The LIV (p. 3) submits that:

... parity in respect of the damages recoverable be ensured (with a notable disparity between caps on damages under the Act, compared to those under the Australian Consumer Law for product liability claims). It would be envisaged that the following positive impacts could flow from this:

- A person suffering personal injury, or the dependents of a person who has been fatally injured, as a result of a tort associated with the driving of an automated vehicle (whether the tort is committed by another natural person as a third-party driver or by the design/manufacture of the vehicle and/or its software/components) can expect equality in terms of the caps on damages obtainable;
- Manufacturers, their insurers and the [Transport Accident Commission] would have a clear understanding of the maximum they could be liable for in respect of damages in the event of tortious conduct (irrespective of where fault is causally attributed)
- It would prevent potential, actual, or perceived party or action ‘shopping’ by Plaintiffs in choosing a cause of action and/or Defendant/insurer to maximise the quantum of damages obtainable
- In the event of apportionment of liability and/or recovery proceedings as between multiple Defendants (and their insurers), the extent of liability would be known, as common law damages caps would be in place.

The expansion of the definition of *driver* in third-party insurance legislation would prevent the creation of potential exclusions to eligibility under state and territory schemes ‘which cannot reasonably be justified. For example a pedestrian injured by an automated vehicle or a vehicle in automated mode should not be excluded from the scheme. If this is not addressed, there could be a public backlash, which may impact community acceptance of the technology’ (LIV, p. 2).

The Griffith University and Flinders Law School submission clearly sets out the equity principle – that an individual sustaining an injury in an automated vehicle should not be worse off ‘than if the vehicle had been driven by a human driver’ (Brady, et. al., p. 6).

At issue is the potential uncertainty as to whether current insurance schemes, including national injury insurance schemes for catastrophic injuries, will apply to automated vehicles if a driver cannot be identified. This is a threshold issue that varies across jurisdictions, but, in order to access compensation, schemes generally require either a:

- person driving the vehicle, or
- personal injury caused by a collision (or action taken to avoid a collision), or
- vehicle running out of control, or
- defect in a vehicle causing the vehicle to run out of control.¹²

A crash caused by an automated vehicle may or may not meet one of these eligibility requirements, and therefore the concepts of *driver* and *driving* in the schemes are potentially ambiguous. The Griffith University and Flinders Law School submission recommends that one way to address this issue is to replace the term *driving* with *use or operation*, which is the term currently used in the NSW scheme (Brady, et. al., p. 17).

A further issue is that, in some schemes, such as ACT’s, the term *driver* relates to the person ‘in control of the vehicle’. This concept is more closely associated with the dynamic driving task, which is more likely to be undertaken by the automated driving system compared with the more broadly defined ‘person in charge of the vehicle’ that has been adopted in other schemes such as the Traffic Accident Commission (TAC) scheme in Victoria. Clearly, a threshold test based on the concept of ‘the person in charge of the vehicle’ is less likely to be a barrier to compensation compared with the more restrictive concept of the person who is ‘in control of the vehicle’.

The Insurance Council of Australia also suggests that the road rules ‘must, in due course, be amended to provide absolute certainty regarding what constitutes control over a vehicle’ (ICA, p. 2).

¹² See, for example, *Motor Accident Insurance Act 1994* (Qld), section 5(1)(a). The Griffith University and Flinders Law School submission provides a comprehensive analysis of threshold eligibility criteria in each insurance scheme in Australia.

IAG Limited goes further, strongly recommending alignment of compulsory third-party insurance schemes that are currently a mix of ‘fault’ and ‘no-fault’ across states and territories as a priority reform. This is so that all consumers in Australia can access the same level of personal injury cover within a clear national liability framework (IAG, p. 17).

Some in industry disagree that amendments to the definition of *driver* and *driving* should be a priority. Toyota Australia suggests that it is premature to amend the legislation without a clearer understanding of the new technologies, and any amendments would need to have a broad definition.

VicRoads agrees that any issues with eligibility to Victoria’s accident compensation scheme need to be addressed (VicRoads, p. 21). TMR also suggests that ultimately there may be a need for nationally consistent legislation to address compulsory third-party insurance issues (TMR, p. 9).

Other government agencies are in favour of industry-led guidance at this time. The TAC emphasises that any definitional changes to capture automated vehicles in the scheme would also have an impact on the definition of a ‘transport accident’ and TAC charges. The TAC therefore suggests that further work needs to be undertaken to ensure that a number of options are thoroughly considered before changes at the national or state level are made (TAC, p. 2).

Clarify the meaning of *driving*

Any statutory amendments could also have regard to clarifying what constitutes *driving*, and whether the activities of ignition, path-setting and monitoring and being ‘in charge of the vehicle’ constitute driving, or whether driving is primarily related to control of the vehicle’s propulsion and direction. The case law is not unanimous (Maurice Blackburn Lawyers, p. 2), and legislative change may be required to clarify the issue for highly and fully automated vehicles.

Conclusions

Many national, state and territory laws require a human driver. This includes the road rules, road traffic and safety laws, passenger transport laws, the Heavy Vehicle National Law (HVNL), compulsory third-party insurance schemes, tolling legislation and some criminal offences. Unless the definition of *driver* and *driving* is amended to allow for highly and fully automated vehicles, these laws are regulatory barriers to highly and fully automated vehicles.

The NTC recognises that there are diverse views from within government and industry on how the legal obligations of the driver should be reformed, and when. It is clear from submissions that identifying who the driver is – and the obligations of an automated driving system entity – need to be clearly defined to provide enforcement, industry and consumers with confidence that a highly and fully automated vehicle can legally operate in Australia. A review of current insurance schemes to ensure occupant eligibility of automated vehicles is also clearly warranted.

Based on stakeholder feedback, it is likely that, in the longer term, a new regulatory framework for automated vehicles will be required. The key issue is what steps need to be taken by governments to address the changing nature of *driver* and *driving* in current laws in the intervening period. There was support for different approaches:

- Do not change the current approach – rely on exemptions and don’t reform *driver* definitions until there is greater technology certainty.
- Expand the definition of *driver* and *driving* to capture the automated driving systems entity.
- Leave existing definitions of *driver* and *driving*, but create parallel obligations for the automated driving system entity.

On balance, most industry and government submissions support expanding the definition of *driver* and *driving* in relevant legislation to recognise the role of the automated driving system entity, and support commencing work within two years.

The optimal treatment of the automated driving system entity in legislation could be achieved in different ways. The NTC recognises that expanding the definition of *driver* and *driving* in relevant legislation may be a complex solution with potentially unintended consequences on human driver responsibilities. Therefore, this preparatory work would need to assess a range of options to recognise automated vehicles in laws that refer to a driver, or driving functions.

Policy finding: Australian governments should provide in-principle support for legislative reform and to undertake further research of the potential legislative solutions, in step with international developments and maturity of the technology. The legislative approach adopted should be subject to further consultation, legal opinion and the advice of parliamentary counsel.

Policy finding: Priority should be given to ensuring eligibility for compulsory third-party and national injury insurance schemes is not unintentionally restricted by current definitions of *driver* and *driving* in those schemes, and that under those schemes individuals involved in automated vehicle crashes are not worse off than human-driven vehicle crashes.

Timing of proposed reforms

Policy finding: Large-scale commercial deployment of highly or fully automated vehicles is not expected until after 2020. The legislative concepts of *driver* and *driving* should not be amended to allow for highly and fully automated vehicles until a safety assurance process is designed, agreed and implemented by Australian governments. Exemption powers should support trials of highly and fully automated vehicles in the interim period.

Therefore, while preparatory work should be undertaken over the next two years, the removal of legislative barriers relating to concepts of *driver* and *driving* should not commence until 2018.

Recommendation 6: That the NTC develops legislative reform options to clarify the application of current *driver* and *driving* laws to automated vehicles, and to establish legal obligations for automated driving system entities.

Lead agency: The NTC.

Timeframe: Early 2017 to May 2018.

Recommendation 7: That state and territory governments undertake a review of compulsory third-party and national injury insurance schemes to identify any eligibility barriers to accessing these schemes by occupants of an automated vehicle or those involved in a crash with an automated vehicle.

That, subject to the review of insurance schemes, each state and territory government amends its compulsory third-party insurance schemes in close consultation with each other and industry, and that resulting reforms are nationally consistent wherever possible.

Lead agency: States and territories to undertake reviews, and the NTC to report progress to the Transport and Infrastructure Council.

Timeframe: Legislative amendments to state and territory compulsory third-party and national injury insurance schemes completed by 2018.

6

Vehicle design and standards

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- Stakeholders broadly support continuing to align ADRs with international standards in order to prevent unnecessarily restricting safety-related technologies from entering the Australian market.
- Current ADRs and in-service vehicle standards will not affect automated vehicles that require a human to monitor and intervene if requested.
- In the longer term, new ADRs could be developed in alignment with international standards.
- Until the development of new international vehicle standards and the large-scale commercial deployment of highly automated vehicles that do not require a human driver, exemption powers and the national safety assurance system can support trials and niche deployment of automated vehicles that do not require a human driver.

Issues

The highest levels of driving automation will have no requirements for a human to drive, monitor or intervene in the operation of the vehicle. They can be understood as ‘self-driving’ and would have only passengers or freight. These automated vehicles potentially have the highest societal benefits, particularly in terms of productivity (no human drivers) and mobility (they can be used by unlicensed humans).

Vehicles that have no components of human driving will not need human driver-related features such as a steering column, control panels, mirrors and brake pedals. These features are currently required by the ADRs and in-service vehicle standards. If new vehicle standards were not introduced in due course, highly and fully automated vehicles could not operate in Australia without an exemption or without redundant components.

Additional vehicle standards could also be introduced for highly and fully automated vehicles.

These could include standards relating to compliance with the road rules (how the vehicle behaves on the road and with other traffic), security and communication with other vehicles and infrastructure.

However, it is important that Australia is aligned with the United Nations Economic Commission for Europe (UNECE) vehicle standards, and it is Australian Government policy to continue to harmonise ADRs with these standards. By continuing to align with UNECE standards, Australia does not introduce new design rules that may isolate Australia from the global automotive market. This should ensure that governments do not regulate automated vehicle standards too early – which could create artificial barriers to emerging technologies – or that they regulate too late and stop proven safety-related technologies from being deployed.

Standards for vehicles that still require a human driver

In the near to medium term, we expect to see large-scale commercial deployment of vehicles that will still require a human driver to undertake aspects of the dynamic driving task. This includes vehicles with partial or conditional automation but also includes those highly automated vehicles that require a driver some of the time. It is highly likely that these vehicles will continue to require existing ADRs.

Vehicle standards that may become outdated

The NTC's legislative analysis (available on the NTC website) identified up to 16 current ADRs that could be outdated in future automated vehicles that will not require a human driver to undertake any aspect of the dynamic driving task, or to intervene if requested. Examples of ADRs that may not be required in the future or may need significant amendments include:

- ADR 10 – Steering column
- ADR 14 – Rear view mirrors
- ADR 21 – Instrument panel
- ADR 35 – Commercial vehicle brake system.

The continued requirement to include these ADRs in new vehicles could be a barrier to highly and fully automated vehicles that do not require a human driver. These ADRs are harmonised with UNECE standards, and other states that are signatories to these standards would have similar barriers. However, it is not anticipated that there will be large-scale commercial deployment of these vehicles until after 2020, and the NTC has therefore categorised potentially outdated vehicle standards as a long-term issue to address.

Vehicle standards that may need to be adapted

Some ADRs may need to be adapted for automated vehicles. For example, ADR 31 provides that a vehicle's brake system must be able to be operated by the driver 'from his driving seat without removing his hands from the wheel'. Clearly, the intent of the vehicle standard – to ensure a functioning brake system – should continue to be required for automated vehicles, but the engineering specification could be updated to remove the connection between the brake system and the human driver.

Any changes should only apply to relevant automated vehicles in parallel to the existing ADRs. The existing ADRs would continue to apply to lower levels of automation.

New vehicle standards to ensure safe technology

The NTC discussion paper suggested that, due to the emerging capabilities of automated vehicles, it may be appropriate to introduce additional vehicle standards to manage new risks. Future ADRs could relate to the following.

Demonstration that the vehicle can comply with the Australian Road Rules

In the event that automated vehicles take on greater responsibility for the safe driving of the vehicle, the ADRs may have a role ensuring new and imported vehicles are safe and comply with the road rules.

One approach may be to develop an ADR that sets out a performance-based requirement for vehicles to be compliant with the road rules. Unless road rules are fully standardised across all states and territories, such an Australian profile would require subsets for each jurisdiction, and it could be the manufacturers' responsibility to ensure that each subset remains current.

An alternative approach would be to continue to rely on the safety assurance system process to ensure that highly and fully automated vehicles are operating in compliance with the road rules.

Sufficient protection and management of security and access to data

Automated vehicles will rely on technology to operate safely. Automated vehicles could become highly susceptible to malicious attacks, particularly those automated vehicles that do not have a human driver to intervene in the event of a cyberattack that takes control of the vehicle, or causes the vehicle to behave in an unintended way. Automated vehicles will likely exchange data via cloud services and roadside infrastructure, and this exchange could create additional cybersecurity risks. Given the increased likelihood and consequence of cybersecurity attacks and interventions of malicious intent, minimum standards for trusted access to data and protection from cybersecurity attacks may be warranted.

Safe communication between vehicles

Standards could relate to ensuring automated vehicles safely communicate with other vehicles and infrastructure. Developing C-ITS international standards provide an example of a communication requirement that could be embedded in ADRs at a future time. However, the necessity of requiring standardised communications protocols will depend on the extent to which automated vehicles will come to rely on vehicle-to-vehicle and vehicle-to-infrastructure communications to operate safely.

Risks and issues related to security, data and communications could also be relevant to partially and conditionally automated vehicles.

UNECE Working Party 29

It is important to note that there are international processes in place to review, monitor and progress the development of international standards. UNECE WP.29, the international vehicle regulatory standards-setting organisation, has set up an informal working group to examine C-ITS and automated driving standards. The Commonwealth Department of Infrastructure and Regional Development represents the Australian Government at WP.29.

WP.29 is currently investigating the development of internationally harmonised regulations for automated vehicles, although at this stage the working group has primarily focused on specific automated driving applications. For example, WP.29 is currently focused on developing standards for automated steering, lane keeping and automated lane change (FCAI, p. 11).

It is important that Australia continues to remain engaged in WP.29 and any international developments of vehicle standards for automated vehicles, or related technologies.

Vehicle standards managed through the safety assurance system in the medium term

In the medium term prior to the development of new ADRs in step with international vehicle standards, safety-related performance for automated driving systems could be addressed through the safety assurance system (discussed in Chapter 4).¹³

¹³ See Chapter 4: Safety assurance for vehicles that do not require a human driver, p. 37.

We saw in Chapter 4 that the NTC discussion paper canvassed an extensive range of vehicle-related performance criteria that the safety assurance system could address. For example, automated vehicle performance could be assessed based on the applicant demonstrating that wherever the vehicle operates, the vehicle can safely manage:

- responding to temporary **speed zones** (such as roadworks)
- responding to **traffic controls** (such as stop signs, variable speed signs and traffic lights)
- all likely **road conditions** (such as unsealed roads)
- all likely **environmental conditions** (such as dust storms or flooding)
- interaction with **trains and light rail** (such as railway level crossings)
- interaction with **vulnerable road users** (such as compliance with one metre clearance for cyclists) (NTC discussion paper, p. 62).

These criteria for vehicle performance standards are examples only for discussion purposes. The NTC will work closely with governments and industry to refine the performance criteria, which should remain flexible and in alignment with international standards and best practice as they develop.

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on regulatory options for automated vehicle standards. The following two options were canvassed:

- **Option 1:** Continue current approach – rely on exemptions, granted on a case by case basis, until international standards are developed.
- **Option 2:** Adopt new ADRs that support highly and fully automated vehicles.

The NTC supported option 1 and proposed that, in the longer term, governments should adopt new ADRs and in-service vehicle standards for automated vehicles, in step with the development of international standards.

The discussion paper asked the following question for stakeholder consideration:

Question 6: Do you agree that governments should continue to rely on vehicle standards exemptions at this point in time? If not, why?

Feedback from the discussion paper

Strong support for keeping ADRs in line with international standards

Governments and industry strongly support option 1, maintaining the current ADRs and continuing to harmonise ADRs with the UNECE standards. Any unique Australian standards that are out of step with international standards could unnecessarily restrict the introduction of safety-related vehicle technology in Australia.

State and territory road and transport agencies note the fast pace of technology change. As such, a regulatory framework for automated vehicles should be 'robust, responsive to technological change and market evolution, and ... not get in the way of innovation' (NSW transport cluster, p. 1).

Industry submissions note that it is critical that Australia continues to adopt the UNECE standards given the increasingly global automotive market. This approach will support Australia's economic future and ensure access to the economic, road safety and environmental benefits of automated vehicle technology (IAG, p. 2).

A number of stakeholders anticipate that option 2, to adopt new ADRs to support highly and fully automated vehicles, is likely in the future, but it is not yet clear what technology will be used and it is considered too early to introduce new design rules for automated vehicles.

The NHVR does not support option 1, recommending that Australia not be a follower of automated vehicle standards. In the NHVR's view, the Commonwealth Department of Infrastructure and Regional Development should take an active role in the working groups developing standards for automated vehicles (NHVR, p. 5).

Stakeholders generally agree that vehicle exemptions, provided by the Commonwealth Department of Infrastructure and Regional Development for light vehicles and the NHVR for heavy vehicles, can support on-road testing and niche deployment of automated vehicles prior to large-scale commercial deployment.

Vehicle categorisations may become outdated

An issue that is closely linked to automated vehicles relates to current vehicle categorisations in Australia. Europe and the United States have developed new vehicle categorisations to support low-speed urban passenger shuttles, which could be an early application of automated vehicle technology. The Royal Automobile Club of Western Australia, for example, is currently trialling a Navya shuttle operation in South Perth.

VicRoads observes that the limited options for vehicle classes in Australia could be a barrier to potentially widespread automated vehicle types that do not meet current standard vehicle weight or size limits. VicRoads suggests that expanding the existing categories to cater for new forms of vehicles should therefore be further investigated (VicRoads, p. 18).

The NTC has developed a candidate proposal to review barriers in the existing vehicle classifications for more innovative vehicles. The next step is for the NTC to work with our stakeholders about the priority of this and other candidate proposals before recommending to the Council which candidate proposals should proceed to the business case development stage.

As identified by the ARRB in its recent investigation on the impacts of automated vehicles on registration, new vehicle standards and compliance could also result in reforms to in-service roadworthiness processes and registration requirements.

Conclusions

There are unlikely to be any barriers in the current ADRs until the large-scale commercial deployment of automated vehicles that do not require a human driver. There is a risk that if Australia develops new ADRs before the development of international standards, we could potentially stifle technology innovation and restrict access to the global automotive market. There is strong support from government and industry stakeholders to continue to harmonise the ADRs with UNECE standards, and to continue to engage with WP29.

It is increasingly possible that low-speed urban passenger shuttles could be one of the first types of automated vehicles operating on public roads in Australia. Yet today, these shuttles can only operate under an exemption, and there are no ADRs or regulatory mechanisms to permit large-scale deployment of low-speed urban passenger shuttles. The Commonwealth, state and territory governments could therefore consider developing vehicle categories to facilitate the commercial importation of low-speed urban passenger shuttles.

Policy finding: The highest levels of driving automation are unlikely to require human driver-related features that are currently required by law in the ADRs and in-service vehicle standards. Highly and fully automated vehicles could also warrant new standards to ensure they can operate securely, safely and in compliance with road rules. These reforms should be in close alignment with international developments.

Policy finding: In the longer term, vehicle registration requirements and processes may need to be adapted to take into consideration emerging vehicle standards and to ensure that highly and fully automated vehicles safely operate in-service. Vehicle registration requirements may also have to be adapted to accommodate new vehicle categorisations. These reforms should be in close alignment with international developments.

Policy finding: The automotive industry should continue to rely on Commonwealth, state and territory exemptions, granted on a case-by-case basis, until international standards for highly and fully automated vehicles are developed and applied in the ADRs and in-service vehicle standards.

Policy finding: The Commonwealth Government should continue with the current approach of engaging with WP.29 and harmonising ADRs with international vehicle standards.

Based on these policy findings, no immediate actions are required by the Transport and Infrastructure Council.

7

Vehicle modification and in-service compliance

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- Modification, maintenance and repair of increasingly automated vehicles could become a higher safety risk compared with conventional road vehicles. Vehicle modification could include over-the-air software updates by manufacturers, non-commercial modifications and after-market fitment of automated vehicle technologies.
- Government and industry stakeholders broadly agree that the nature of these potential risks may require additional regulatory oversight; however, government intervention may not be warranted until any increased risks to safety can be evaluated.
- Australian governments should provide in-principle support to developing best practice modification, maintenance and repair standards that address automated vehicle issues, led by the automotive and repair sectors.

Issues

New vehicles are subject to ADRs when they are introduced to market. Vehicles must continue to comply with those rules, as well as additional in-service rules under state and territory law, while they are in use. In-service vehicle standards for each state and territory are based on the Australian Light Vehicle Standards Rules (ALVSRs). In-service standards for heavy vehicles in most jurisdictions are set out in the HVNL and Regulations.

Like ADRs, in-service vehicle standards relate to physical components of the vehicle to ensure safety and compliance with emissions standards. Current standards do not have regard to other potentially safety-critical factors that could be relevant to an automated vehicle, such as security or sensors.

A vehicle could be modified under very different scenarios. Automated vehicle modification or repair could include:

- modifications directly undertaken by the manufacturer – including over-the-air software updates that modify the performance of the vehicle
- commercial modifications undertaken by a licensed third-party repairer
- non-commercial modifications – such as a ‘backyard’ modification by the vehicle owner
- aftermarket fitment of automated vehicle technology by a third party.

Modification risks

Vehicles have complex control systems and sensor technologies, which are expected to increase in sophistication as vehicles become increasingly automated. The potential safety risk relates to the extent to which modifications or repairs disrupt the intended performance of automated vehicle technology and thereby place vehicle occupants and other road users at risk.

As was noted in the NTC discussion paper, the potential safety risks not only include third-party repairers and aftermarket fitment, but potentially software updates that are authorised and generated by the vehicle manufacturer and are currently unregulated by governments (NTC discussion paper, p. 90).

Vehicles retrofitted with automated functionality are another consideration. Aftermarket fitment could be self-regulated by industry. There are also international examples of voluntary codes of practice, such as the Motor Industry Code of Practice in the UK and the Right to Repair Agreement in the United States, which provide minimum levels of information from manufacturers to independent repair facilities.

Alternatively, there could be a role for governments to oversee aftermarket automation because of the high risk to road safety if the aftermarket device is incorrectly fitted or does not function as expected. Increased regulatory oversight may therefore be appropriate if the impact of unregulated automated vehicle modification poses an unacceptable safety risk to the community.

Mitigating factors

The risk profile of vehicle modification will depend on the extent to which there are safety redundancies built into the vehicle if one part of the system fails because of a substandard modification.

Commercial modifications and repairs to automated vehicles will be subject to Australian Consumer Law, which provides an important regulatory safety net to ensure that products or services sold in Australia are safe and fit for purpose.

The issue of vehicle modification also interacts with manufacturer liability if the warranty is voided because of an unauthorised modification. This could mitigate the occurrence of non-commercial modifications by vehicle owners.

It is noted that mandatory vehicle roadworthiness checks by accredited third parties also have regard to vehicle compliance with in-service vehicle standards, but the frequency of roadworthiness checks varies across jurisdictions.

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on how governments should address modification issues for automated vehicles. The following three options were canvassed:

- **Option 1:** Continue current approach – relying on the current regulatory framework to detect and manage non-compliance with in-service vehicle standards.
- **Option 2:** Governments support industry development of modification standards that address automated vehicle issues.
- **Option 3:** Develop national legislation to administer an automated vehicle licensing modification regime, developed as part of the deployment framework for automated vehicles.

The NTC supported option 2, recognising that further understanding the potential risks that could arise from vehicle modifications, or from vehicles becoming noncompliant while in service, is required to justify additional regulatory oversight.

The discussion paper asked the following question for stakeholder consideration:

Question 7: Do you agree with the development of industry-led standards to address modification of automated vehicles? If not, why?

Feedback from the discussion paper

Stakeholders expressed a wide range of views regarding the further regulation of vehicle modification, maintenance and repair. While most stakeholders support some form of oversight because of the potential safety implications of modification, maintenance and repair, there were different views on whether oversight should be managed within the current regulatory framework, by an industry-led code, or a legislated automated vehicle licensing regime.

The Australian Automobile Association (AAA) suggests that industry standards should be performance-based and technology-agnostic and that the responsible parties and processes for certification of vehicle modifications should be clear and unambiguous (AAA, p. 14). Manufacturers are seeking more detail about the types of modifications under consideration and the level of expertise of the industry parties that would be part of the development of any aftermarket modifications before supporting a preferred option (Bosch p. 4; FCAI p. 12). The Heavy Vehicle Industry Association (HVIA) suggests that governments need to give further consideration to issues related to heavy vehicle combination vehicles. In particular, that the systems put in place need to be able to assess the compliance of the individual component vehicle and the compliance of the combination as a whole (HVIA, p. 7).

Some manufacturers emphasise that, due to the critical nature of vehicle modifications, software updates should only be directly undertaken by the vehicle manufacturer or licensed third parties. There is a concern that the development of industry standards for the aftermarket modification of vehicles could result in unauthorised and unsafe aftermarket fitment. In the event that industry standards are developed, manufacturers seek extensive input into their development to mitigate these risks (Bosch, p. 4; Toyota, p. 5).

TMR agrees that automated vehicle modification and in-service vehicle compliance could be included as part of a government-developed national safety assurance system (TMR, p. 8), while the WA transport portfolio supports national legislation of a vehicle modification licensing regime, on the grounds that an industry code may not be sufficient to ensure community safety given the complexity and interconnectedness of vehicle engineering systems (WA transport portfolio, p. 6). VicRoads suggests that an industry code could be managed and enforced at the state and territory level (VicRoads, p. 19). The NSW transport cluster emphasises a collaborative approach to future reforms of vehicle modifications that actively involves vehicle manufacturers, aftermarket component suppliers and modifiers, and road safety regulators.

Government and industry may also need to consider vehicle modification relating to scheduled maintenance requirements and modifications to accommodate disability access to automated vehicles (AARC, p. 7; VicRoads, p. 20).

Access to data is a linked issue to vehicle modification, maintenance and repair, given that access to vehicle driving system data can impact on the service-level quality of modification, maintenance and repairs to automated vehicles. This broader data access issue is discussed further in Chapter 9.¹⁴

¹⁴ See Chapter 9: Data, p. 58.

Conclusions

The submissions to the NTC discussion paper highlight that there could be potential safety risks associated with modifying and repairing automated vehicles. However, there are different views on the role of government to regulate or manage potential risks in addition to the current regulatory framework, which is primarily based on ALVSRs and roadside enforcement detection of vehicle non-compliance.

Any increased government oversight of vehicle modification or repair would be a significant regulatory burden on manufacturers, technology providers and repairers. Therefore, changes to the current regulatory framework would only be warranted when sufficient evidence emerges that there is a market failure or unacceptable risk to safety due to automated vehicle modification, maintenance and repairs.

Policy finding: Regulatory oversight of modification (including over-the-air software updates) and vehicle repairs (including non-commercial private repairs) could be warranted in the longer term for highly and fully automated vehicles. However, unless evidence emerges of a market failure or unacceptable safety risk, no changes are recommended at this time to current laws and enforcement practices relating to vehicle modification, maintenance and repair.

Policy finding: Australian governments should provide in-principle support to developing best practice modification, maintenance and repair standards that address automated vehicle issues, led by the automotive and repair sectors. Industry guidance could clarify what are acceptable over-the-air software updates and aftermarket modifications.

Policy finding: Safety assurance system criteria for automated vehicle approvals (recommendation 5) should have regard to the safety impacts of vehicle modification, maintenance and repair. The development of a national safety assurance system will therefore provide Australian governments with a regulatory mechanism to manage the risks of vehicle modification, maintenance and repair in the medium term.

Based on these policy findings, no immediate actions are required by the Transport and Infrastructure Council.

Liability

8

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- Liability is well established, but assigning fault in crashes involving automated vehicles could be more complex.
- Liability can be clarified if the following actions are undertaken:
 - clarifying whether human monitoring of the vehicle constitutes control of the vehicles (recommended in Chapter 3)
 - clarifying the definition of *driver* to ensure access to compulsory third-party and national injury insurance schemes (recommended in Chapter 5)
 - managing third-party access to data (recommended in Chapter 9).
- The NTC further recommends the development of industry guidance, including information about liability and education campaigns, to clarify how liability will apply to different automated vehicles.

Issues

Liability risks could prevent the deployment of automated vehicles, or severely reduce their functionality or scope of operations, if manufacturers become excessively cautious. At the same time the threat of future litigation also acts as an incentive, ensuring rigorous testing and research before any public release.

The discussion paper identified the following issues in relation to automated vehicle liability:

- current liability laws are well-established but assigning fault could be more complex
- access to vehicle data is a critical issue for some insurers
- there may be limitations on road manager liability.
- access to compulsory third-party insurance schemes could be restricted.

Access to vehicle data is considered in Chapter 9, as there are common data access issues related to insurance, vehicle repair, enforcement and privacy that extend beyond liability issues. **Access to compulsory third-party insurance schemes** was considered in Chapter 5, as the issue relates to the definition of *driver* in those schemes.

Manufacturers are already subject to product liability, and this is likely to become more important as vehicles increasingly rely on automated driving systems. The added complexity of automated vehicles relates primarily to the following factors:

- **complexity of the automated vehicle operating environment** – more parties could be responsible for a crash, including government and private road managers, if automated vehicles become dependent on road infrastructure to operate safely
- **continued interaction between human and machine** – some automated vehicles will require humans to take over the driving task at different times, and some automated vehicles will require a human driver to monitor the automated driving system (this will potentially lead to complex shared liability scenarios)
- **new kinds of crash causes** – automated vehicle crashes could be caused by cybersecurity breaches, software bugs or failing sensors.

Clarifying whether human monitoring of the automated driving system constitutes control of an automated vehicle, and recognising the automated driving system entity in the road rules, will help clarify liability. It is therefore important to consider regulatory options to address liability in the context of the overall package of recommendations being considered by the Transport and Infrastructure Council.

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on how governments should support resolution of liability issues for automated vehicles. The following three options were canvassed:

- **Option 1:** Continue current approach – rely on existing liability regimes to resolve liability issues on a case-by-case basis.
- **Option 2:** Option 1, plus governments supporting the development of industry guidance, including information about liability and education campaigns.
- **Option 3:** Governments agree to develop nationally consistent legislation for some or all of the following areas:
 - **3a:** clarify legal liability for automated vehicle parties, based on levels of automation
 - **3b:** regulate third-party access to automated vehicle event data information for prescribed purposes
 - **3c:** harmonise road manager liability provisions
 - **3d:** address compulsory third-party insurance issues and potential barriers.

The NTC supported option 2.

The discussion paper asked the following question for stakeholder consideration:

Question 8: Do you agree that governments should support industry-led guidance to address automated vehicle liability issues? If not, why?

Feedback from the discussion paper

In this chapter, feedback to the discussion paper is grouped according to the following themes:

- whether current liability laws are sufficient.
- limitations on road manager liability.

Current liability laws are sufficient

Stakeholders generally agree that the current liability framework is sufficiently robust to accommodate automated vehicles. The greatest uncertainty in relation to liability is the issue of who is in control of a vehicle with different levels of driving automation. Therefore, if governments and industry can clarify the meaning of *driver* and *control* – and therefore responsibility for a crash or incident – for many stakeholders (particularly insurers) the issue then becomes one of access to relevant data.

The AAA (p. 15) provides a clear summary of the challenge relating to liability:

Several vehicle manufacturers have announced that they would accept fault if accidents occurred when the vehicle was in full autonomous mode. Given this information, the AAA does not consider liability issues to be a significant barrier to the uptake of highly automated vehicles. However, the AAA considers that industry led guidance, supported by Government, would support community acceptance and take up of the technology and is thus supported by the AAA.

Given the complexities of assigning fault in automated vehicles and the pace of technology change, many stakeholders support industry-led guidance to address the issues. As noted by Maurice Blackburn Lawyers, ‘the current legal frameworks of product liability law (the Australian Consumer Law), tort law and contract law are sufficiently dynamic and robust to adapt to the challenges that the new technology will present’ (Maurice Blackburn Lawyers, pp. 3–4), and the current level of uncertainty makes it difficult to support any near-term legislative changes (NSW transport cluster, p. 11).

Insurer IAG Limited raises concerns that clarifying legal liability in legislation – particularly based on levels of driving automation – would need to be carefully approached. IAG’s (p. 13) concern is that:

... passing legislation that covers one aspect of potential liability would only be a piecemeal and incomplete response to legal liability for [automated vehicles]. In any event, as technology changes, such laws may well become obsolete because levels of automation will change.

This broad view in support of an industry-led guidance approach is held by most road and transport agencies, police, the AAA, the HVIA, Robert Bosch (Australia), Verless and the Truck Industry Council. Other stakeholders, including the Federal Chamber of Automotive Industries (FCAI) and the Department of State Growth (Tasmania), agree with a non-legislative solution but suggest the existing liability regimes should adequately address the issues without additional guidance material.

Some stakeholders, such as the Queensland Motor Accident Insurance Commission (included in the Queensland TMR submission), Nova Systems and the Motorcycle Council of New South Wales, favour legislative reform, primarily to reduce legal uncertainty. For example, the Motorcycle Council suggests that the general public will require assurances that the entity responsible for the automated driving system is liable for the actions of that vehicle when in automated mode. Kate Mathews Hunt, a researcher from Bond University, observes that there are specific concerns as to cost and evidential issues under Australian consumer law and statutory defences that may discriminate against claims for automated vehicle personal injury or property damage: ‘it would be far clearer and more readily adaptable to specifically enact provisions covering liability to cover the various shades of [automated vehicles] – including addressing the various degrees of autonomy and potential variations in driver liability which may result’ (Mathews Hunt, p. 9).

Many submissions note the complexity of automated driving systems and the possibility of numerous entities responsible for different aspects of the driving system. It could be a challenge to identify a single automated driving system entity. VicRoads suggests that different responsible entities could be identified, including the manufacturer, registered operator and data manager. VicRoads suggests that a ‘chain of responsibility’ model could be adopted, similar to the HVNL, which is sufficiently flexible and robust to allocate legal obligations to different parties that influence the operation of the automated driving system.

The NHVR recommends that the matter be referred to a suitably qualified organisation, such as a law reform commission. This group could then provide advice on the available courses of action to meet the desired outcome (NHVR, p. 7).

Limitations on road manager liability

With broad agreement among stakeholders that legislative solutions to address liability complexities should not be undertaken at this time, there was limited feedback specifically on the issue of road manager liability.

Transurban acknowledges that if new road infrastructure or roadside equipment is required for automated vehicles, the policy rationale underpinning the current liability regime for road authorities and its application to the maintenance and operation of ITS infrastructure should be considered (Transurban, p. 6). IAG supports nationally consistent legislation to harmonise road manager provisions (IAG, p. 11).

The Department of State Growth (Tasmania) notes that increased road manager liabilities could result in a very conservative approach to the types of infrastructure they permit automated vehicles to operate on. VicRoads acknowledges that automated vehicles should 'precipitate road manager reviews of their road management plans, particularly as automated vehicles may become reliant on authorised digital infrastructure assets such as speed signs and zones, and bridge heights among others' (VicRoads, p. 21). However, VicRoads also recognises that if road managers do not accept liability for road infrastructure, including digital infrastructure assets, this could become a barrier to deployment as vehicle manufacturers may lose confidence in supplying vehicles to these unsupported environments.

Conclusions

The submissions indicate a general preference from government and industry not to legislate who is liable for automated vehicles at this time. Potential future legislative amendments relate primarily to specific issues, namely third-party insurance scheme eligibility (discussed in Chapter 5), access to data (discussed in Chapter 9) and, potentially, road manager liability.

Policy finding: Assigning fault is likely to become more complex in crashes involving automated vehicles, and the efficient sharing of consistent and reliable data between relevant parties, including insurers, is likely to be critical. However, unless evidence emerges of a market failure that impedes the efficient and reliable assignment of fault, no changes are recommended at this time to current laws and approaches around liability for drivers, manufacturers, technology providers and road managers in regard to automated vehicles. Given that the complexities of liability will likely increase with the emergence of highly and fully automated vehicles it is likely too soon for governments to take legislative action.

Policy finding: Consumers would benefit from industry guidance about how automated vehicles will affect liability.

Policy finding: There is no evidence currently available that road manager liability provisions are a barrier to innovation or the introduction to automated vehicle technology to market. This is in part because it is not yet clear to what extent automated vehicles will rely on roadside infrastructure service delivery to operate safely. However, government and private road managers should continue to monitor the potential impact of current liability provisions on automated vehicle deployment.

No immediate actions are required by the Transport and Infrastructure Council.

9

Data

Near-term reform

Medium-term reform

Long-term reform

Clarify then refine

Key points

- To ensure the effective administration of road safety laws, enforcement agencies, insurers and the courts should be able to identify who is in control of an automated vehicle that can switch control between the human driver and the automated driving system.
- Privacy principles may be sufficiently robust to regulate private sector access to personal information, but some in industry seek greater certainty about access to vehicle data for commercial purposes.

Vehicle data is a key component for increasingly automated vehicles. On the one hand it is highly probable that access to data will help solve operational challenges, such as identifying who is in control of an automated vehicle at a point in time to determine responsibility for road safety non-compliance and civil liability. Accessing data is also a key issue for in-service vehicle maintenance. On the other hand, access to data raises security and privacy challenges. Governments and industry therefore seek to ensure clearly defined data uses related to what information is captured, by whom, for what purposes and in what circumstances third parties can access it.

In this chapter we consider three vehicle data issues:

- accessing data for enforcement and regulatory purposes (9.1)
- accessing data to determine fault and liability (9.2)
- protecting privacy (9.3).

9.1 Accessing data for enforcement and regulatory purposes

Issues

In a highly automated vehicle there could be times when the human driver is in control and times when the automated driving system is in control. For example, a vehicle with highway driving assist functionality may be designed to be automated only when operating on motorways in a defined speed range. At all other times, the vehicle would be operated by a human driver.

The challenge for authorised officers will be to know who was driving the vehicle at a point in time – the human driver or the automated driving system. This will also be a critical issue if the authorised officer is to assess by a visual inspection whether the vehicle is being operated with proper control. The underlying issue is who should access vehicle data and under what circumstances – should authorised officers have access to automated vehicle data for enforcement purposes, or should it remain the obligation of the driver or registered operator to identify the at-fault party?

Under the current legal framework the driver or registered operator receives any infringement notices. In order for a human driver to prove that they were not in control of an automated vehicle at the time of an offence, the driver would have to negotiate with the automated driving system entity to obtain the documentary evidence supporting their position that the system was at fault.

For camera-related offences, the registered operator could nominate the automated driving system entity as the responsible party, but it is not clear at this stage what evidence the automated driving system entity would be required to provide to the enforcement agency, or what process would transpire between the registered operator and the automated driving system entity to confirm fault.

There are a number of issues with the current approach:

- There are potentially limited incentives for the automated driving system entity to provide data that will demonstrate that the system had committed an offence and that the entity is therefore responsible.
- There are no regulatory requirements to compel the automated driving system entity to provide the data, or to provide the data in a format that can identify the at-fault party.
- There is no certainty that the data provided by the automated driving system will be an accurate record of who was in control of the vehicle at the relevant time.

In addition to enforcement activities, there may be other reasonable purposes for which governments seek to access automated vehicle data, including other road safety outcomes (such as crash investigations) and data collection to improve network efficiency and investment. Any potential regulation of data access for government purposes could therefore have regard to achieving road safety and network efficiency outcomes and efficient enforcement of traffic laws, balanced with sufficient privacy protections for automated vehicle users.

Discussion paper proposals

As part of the discussion paper, the NTC sought feedback on the following three options:

- **Option 1:** Enforcement agencies continue current approach – in the event of an offence, agencies take action against the human driver or registered operator.
- **Option 2:** Enforcement agencies collaborate with industry to develop technology interfaces that enable police to identify automated vehicles and also identify who was responsible for a vehicle at a point in time.
- **Option 3:** Amend state and territory road safety and traffic legislation to deem the automated driving system entity of a highly automated vehicle to be responsible for vehicle-related offences.

The NTC supported option 1 but suggested that governments further investigate options as the technology and market develops. In the longer term, we suggested that it may be appropriate to place the legal onus of responsibility for highly automated vehicles on the automated driving system entity, given that this entity will hold the data to demonstrate who was in control of the vehicle at a point in time. In any of these options, access to data by third parties (or the provision of data to third parties) is critical to maintaining the intent of the law.

The discussion paper asked the following question for stakeholder consideration:

Question 5: Do you agree that the driver or registered operator should be deemed responsible for the actions of the automated vehicle, and for governments to further investigate options as the technology and market develops? If not, why?

Feedback from the discussion paper

There was strong support for continuing to hold the driver or registered operator of the vehicle responsible for the actions of the automated vehicle. Many stakeholders note that this is the most feasible solution for the foreseeable future, but should automated vehicles be widely deployed, further consideration should be given to option 3.

The NSW transport cluster states that allocating responsibility to the driver or registered operator is the best approach as long as the human driver has the ultimate control over the execution of the driving task (NSW transport cluster, pp. 8–9).

While there is general agreement that the provision of vehicle data will likely be critical to determine responsibility in a crash or incident, there are different views on the types of data that should be generated, who should access it and under what circumstances. The WA transport portfolio notes, for example, that using data as evidence will require accurate record-keeping systems that monitor who was in control at a specified time, including immediately before and after an incident (WA transport portfolio, p. 3). The WA transport portfolio also suggests that governments should consider mandating event data recorders and minimum standards in the medium to longer term.

Identifying responsibility for a vehicle was a key issue raised by police agencies in many states, especially in relation to roadside enforcement. The HVIA suggests that it may be necessary for authorised officers to access the in-vehicle data at the time of the offence to limit scope for someone to tamper with the data after the event (HVIA, p. 4). As operating system data may be required for judicial purposes, courts must be able to establish the integrity of both the data and the automated driving system.

Police agencies seek to ensure that there is an Australian corporate entity capable of being prosecuted in an Australian jurisdiction (ANZPAA, p. 5). The location of cloud-based data is also an issue, and police agencies support legislative requirements to provide agencies with relevant data for enforcement purposes (ANZPAA, p. 17). This could be a criterion incorporated into the proposed safety assurance system, but stakeholders note that the effectiveness of any process should be monitored and options to legislate data access further explored if required (NT Government, p. 4; TMR, p. 9). Data access standards should be performance-based and consistent with international standards (HVIA, p. 4).

The NTC notes that the options and questions set out in Chapter 8 of the NTC discussion paper used the term 'deemed.' We would like to clarify that the use of 'deemed' in Chapter 8 was not intended to mean that deemed liability would be applied to particular parties under options 1 or 3. Rather, it was meant to convey that, in the event of an offence, the human driver or registered operator could be held liable subject to evidence as to their capacity to control the actions of the automated vehicle. This is consistent with the approach in relation to vehicles and the responsibility of parties as currently taken by enforcement agencies.

Conclusions

Policy finding: Some highly automated vehicles are expected to switch control between the human driver and the automated driving system. To ensure the effective administration of road safety laws, enforcement agencies, regulators and the courts should, in the future, be able to identify who is responsible for a vehicle at a point in time.

Policy finding: In the near and medium term, in the event of a road traffic offence, enforcement agencies should continue to take action against the human driver or registered vehicle operator. It should be the responsibility of the human driver or registered vehicle operator to nominate another party as responsible for the offence.

Policy finding: As automated vehicle and data-sharing technology matures, governments should investigate options to manage access to automated vehicle data, including the identification of suitable technical solutions to facilitate access to and use of the data for approved purposes.

Policy finding: In highly or fully automated vehicles where the automated driving system is controlling the vehicle most or all of the time, the automated driving system entity should have legal responsibility for vehicle-related compliance with road traffic laws. It is therefore appropriate that, at a future time when there is large-scale commercial deployment of highly or fully automated vehicles, the automated driving system entity has prima facie responsibility for the vehicle.

Recommendation 8: That the NTC develops options to manage government access to automated vehicle data, having regard to achieving road safety and network efficiency outcomes and efficient enforcement of traffic laws, balanced with sufficient privacy protections for automated vehicle users.

Lead agency: The NTC.

Timeframe: Recommendations submitted to the Transport and Infrastructure Council in November 2018.

9.2 Accessing data to determine fault and liability

Issues

In Chapter 8 we discussed the increased complexity of assigning fault in civil liability investigations. In this section we explore the potential opportunities that regulating third-party access to data may have to resolve some of these complexities.

From a data perspective, two key issues were identified in the NTC discussion paper:

- 1. Event data recorder** – the functionality of automated driving systems to accurately record driving events over a specified period leading up to an incident and to identify whether the human driver or the system was in control of the vehicle, so that responsibility can be allocated.
- 2. Access to the event data recorder** – processes for third parties, primarily insurers, to access the event data recorder in a format that enables the third-party to interpret the data to identify and agree fault.

Event data recorders in road vehicles are not new. Insurers have been using ‘black box’ technology for a number of years to encourage drivers to operate their vehicles safely and to adjust premiums based on driving behaviours. In July 2016 the Federal Transport Ministry in Germany announced a legislative intention that future vehicles equipped with autopilot functionality should be required to have an event data recorder to determine liability in case of a crash or incident.

The timely and accurate provision of event data information to third-party insurers should facilitate efficient claims resolution and clarify fault attribution in complex automated vehicle scenarios. This should increase consumer confidence that human drivers will not be unfairly blamed for crashes or incidents involving automated vehicles, and thereby increase the market uptake of safer and more efficient road vehicles.

At issue is the extent to which event data information can be shared with third parties securely and without negatively impacting on the integrity of vehicle control systems and manufacturers’ proprietary information. There is a potential imbalance of power between the consumer and the automated driving system entity in terms of obtaining the data to support a claim that the human driver was not in control of a vehicle at a relevant point in time. Without legal obligations to provide this information there are reduced incentives for a vehicle manufacturer to provide the relevant data accurately and in a readable format.

Other government reviews

Private sector third-party access to data is a significant societal issue that is much broader than automated vehicle policy and regulation. The Productivity Commission is currently undertaking a public inquiry to investigate ways to improve the availability and use of public and private sector data. The inquiry will look at many of the issues that relate to automated vehicles including the options for collecting, sharing and releasing data. The inquiry is expected to report to the Australian Government in March 2017.

The Australian Competition and Consumer Commission (ACCC) is conducting a study into the new car retailing market that will consider third-party access to vehicle data, including telematics-generated data, from a market and competition perspective. The market study is expected to be released in the second-half of 2017.

Discussion paper proposals

In relation to data access, the following options were canvassed in the discussion paper:

- **Option 1:** Continue current approach – rely on existing liability regimes to resolve liability issues on a case-by-case basis.
- **Option 2:** Option 1, plus governments support the development of industry guidance, including information about liability and education campaigns.
- **Option 3b:** Governments agree to develop nationally-consistent legislation to regulate third-party access to automated vehicle event data information for prescribed purposes.

The NTC supported option 2.

Feedback from the discussion paper

The issue of liability and its relationship to data is regarded by stakeholders as a complex issue that warrants further review by governments. Although the procedure for discovery in civil proceedings is well known and provided for in the relevant court rules, this does not necessarily address the issue of capture and preservation of crucial data going to fault in the operation of an automated driving system. This leaves a question around access to that data as part of civil proceedings, which may take place quite some time after the relevant tortious event (Maurice Blackburn Lawyers, p. 4).

Regulation of data access should be comprehensive and nationally consistent (IAG, p. 11). However, many stakeholders agree that legislative action to address data access issues should develop in step with the deployment of increasingly automated vehicles.

System security is a key issue for vehicle manufacturers. According to vehicle manufacturers, third-party access to event data is likely to result in access to the vehicle's operating system, which would result in significant safety and security issues that will be exacerbated when that data relates to an automated and connected vehicle. For these reasons, FCAI supports option 2 (FCAI, p. 14).

Alternatively, insurers and legal professionals generally support the regulation of third-party access to vehicle data. Legislation would provide the most clarity for industry and consumers and significantly reduce costs in determining liability. IAG suggests that industry guidance on liability and education campaigns would not suffice in an environment where an increasing number of complicated claims are likely to arise (IAG, p. 11). IAG considers there is a need to both:

- ensure a standardised, secure and open-access platform for future in-vehicle applications or services
- ensure that consumers can readily access data generated by their vehicle and can choose to share it (IAG, pp. 7–8).

As such IAG strongly recommends that the NTC defer to the Productivity Commission Review into Data Availability.

Maurice Blackburn Lawyers (p. 4) provides a concise rationale for further regulation:

Currently, the only mechanism for a vulnerable injured person to access event data is through a direct request to the owner of the data, which could be refused, or through discovery processes as part of actual or anticipated legislation. We submit that this creates a significant disadvantage to the injured person, and affords an inequitably powerful position to the owners of the data (likely manufacturers) who, as the potential defendant, have an interest in protecting the data. Therefore, we submit that legislation should be amended to enable vulnerable road victims to have early and transparent access to event data in order to ensure issues of fault are dealt with expediently and avoiding issues of power imbalance.

TMR also suggests that while industry guidance would be a flexible solution, it may not provide sufficient legal certainty (TMR, p. 9). Likewise, the WA transport portfolio supports a rigorous governance framework around information management.

However, a number of stakeholders, including VicRoads and the NSW transport portfolio, support option 2, with industry being responsible in the first instance for agreeing on ways to manage data capture and access. However, there could be a need for government oversight and legislative codification in the future (Nova Systems, p. 9; Toyota, p. 14; TIC, p. 6). The Law Institute of Victoria notes that policy and regulation should ensure that the interests of manufacturers and insurers are not elevated above those of consumers (LIV, p. 3), while the Insurance Council of Australia suggests that collecting empirical data as the technology develops would be useful to help inform best policy directions, including how best to respond to liability and privacy challenges that arise from automated technology (ICA, p. 2).

Data access for civil matters raises a number of related issues, including data ownership and cloud-based data as a component of public infrastructure (ADVI, p. 6). Security of the systems would also need to be established to prevent commercial and even potential criminal exploitation of the relevant data. Such safeguards could be similar to section 27 of the *Civil Procedure Act 2010* (Vic), which provides that documents and information obtained for the purpose of a civil proceeding cannot be used for a purpose other than for that civil proceeding (LIV, p. 3).

Conclusions

Accessing event data information raises complex operational issues related to the security and integrity of event data and vehicle operating systems, as well as to justice issues regarding vulnerable road users having timely and efficient access to information to progress a claim to compensation. It is likely that if the process to access event data is not clearly defined and sufficiently robust, consumer uptake of automated vehicle technology could be negatively impacted. However, unless evidence emerges of a market failure that impedes the efficient and accurate access to event data, it is likely to be too soon for governments to intervene and legislate access to data.

The safety assurance system (recommendation 5) should also have regard to accessing to data to determine fault and civil liability.

It is also important that decisions made in relation to automated vehicles are made in reference to broader societal issues relating to private sector access to data more generally. The Productivity Commission is currently conducting an inquiry into data availability and use to examine options for collecting, sharing and releasing data in the public and private sectors, while the ACCC is conducting a new car retailing market study that will consider third-party access to vehicle data. Both of these reviews will be completed in 2017.

Policy finding: The management of third-party access to vehicle event data will underpin the efficient and equitable process of insurance claims. This will reduce costs and increase consumer confidence that human drivers will not be unfairly blamed for crashes or incidents involving automated vehicles. Likewise, vehicle manufacturers seek to ensure that access to event data will not threaten the integrity of vehicle control systems.

Policy finding: The regulation of data access to facilitate insurance claims involving automated vehicles should be reconsidered by the Commonwealth, state and territory governments after the release of the Productivity Commission's inquiry into data availability and use and the ACCC's new car retailing market study.

Policy finding: Performance criteria in the proposed safety assurance system should include requirements for the automated vehicle: (1) to accurately record events leading up to an incident and to identify whether the human driver or the system was in control of the vehicle; and (2) for the applicant to ensure access to vehicle event data in a format that enables authorised third parties to interpret the data in order to identify and agree fault.

No immediate actions are required by the Transport and Infrastructure Council.

9.3 Protecting privacy

Issues

Australia has existing privacy protections that will apply to automated vehicle information. In the event that automated vehicles generate personal information, the entities responsible for collecting and handling that information will be subject to privacy laws: namely the Australian Privacy Principles contained in the *Privacy Act 1988* that applies to commercial entities with a turnover of more than \$3 million and Commonwealth government agencies, and Information Privacy Principles that apply to most state and territory government agencies.

Automated vehicles will also be regulated by Commonwealth, state and territory surveillance device laws that prohibit covert surveillance of individuals through the use of surveillance tracking devices. Surveillance laws provide that a person shall not use a tracking device to determine the geographical location of a person without the express or implied consent of that person. Therefore, the privacy risks associated with automated vehicles could be managed using the current privacy and surveillance frameworks operating in Australia.

The discussion paper considered whether there is anything unique or high risk about automated vehicles that would potentially benefit from privacy protections in addition to the Australian Privacy Principles and the application of the Privacy Act, state-based privacy regimes and surveillance laws. The privacy risks of automated vehicles will primarily depend on the technologies adopted and the extent to which automated vehicles generate personal information. For example, the extent to which the C-ITS information transferred between the automated vehicle and a third party or infrastructure provider may identify the occupants of the vehicle.

Protecting personal information will be dependent on answering two key questions:

- *Will automated vehicles generate personal information?* Wherever possible, automated vehicles should not generate personal information in accordance with the 'reasonably identifiable test' in the Australian Privacy Principles. This is consistent with a 'privacy-by-design' approach preferred by privacy and consumer groups.
- *Will consumers be able to opt out from using automated technologies that generate personal information?* Wherever possible, automated vehicle users should have the choice to be able to benefit from the transport service without having to release their personal information.

The NTC discussion paper suggested that protecting the privacy of users will be a significant factor in ensuring consumer confidence in the use of automated vehicles, particularly given that automated vehicles are likely to have accurate GNSS capability and therefore generate data that could map the location history of a vehicle and its occupants. Therefore, clear guidance about what information is collected and clearly defined primary and secondary purposes for which it will be used is likely to be central to public acceptance of automated vehicles.

Government access to personal information

A second privacy issue relates to *government access* to personal information, usually in the context of enforcement. The Privacy Act has a low threshold to exempt enforcement activities from the Australian Privacy Principles, and the benefits of automated vehicles may not be realised if consumers are uneasy about government access to their personal information, or if government access is inconsistent or unclear.

One approach canvassed in the NTC issues paper is the decision by the then Standing Council on Transport and Infrastructure in 2013 to agree in principle to stronger privacy restrictions for government access to C-ITS data (in the event that C-ITS data is reasonably identifiable). The council approved the following recommendation:

Recommendation 4: In the event that individuals can be reasonably identified from the safety data message broadcast by C-ITS devices, that specific legislative protections are developed to define in what circumstances organisations that are exempt from compliance with privacy principles, including enforcement agencies, may access C-ITS personal information.¹⁵

A similar approach could be adopted in relation to government access to data generated by automated vehicles. It is noted, however, that should the data messages generated by C-ITS be found to constitute personal information, and the council's 2013 decision is implemented, then that legislative protection will extend to automated vehicles that use C-ITS. But without further agreement by the Transport and Infrastructure Council, the 2013 decision would not apply to other technologies used by automated vehicles that could generate personal information, including GNSS location information.

Discussion paper proposals

In relation to privacy, the following options were canvassed in the discussion paper:

- **Option 1:** Continue current approach – regulate privacy protection through Australian Privacy Principles and state-based Information Privacy Principles.
- **Option 2:** Option 1, plus governments and industry develop best-practice guidance for automated vehicles.
- **Option 3:** Governments legislate access to automated vehicle data, including identifiable location information.

The NTC supported option 1 and considered that privacy principles may be sufficiently robust to regulate private sector access to personal information generated within automated vehicles, but government access to automated vehicle data, for enforcement, infrastructure or other purposes, may warrant additional legislative privacy protections.

The discussion paper asked the following question for stakeholder consideration:

Question 9: Do you agree that personal information generated by automated vehicles should continue to be regulated by privacy principles and with no additional legislative controls at this time? If not, why?

¹⁵ National Transport Commission, 2013, *Cooperative Intelligent Transport Systems: Final policy paper*, Melbourne, p. 26.

Feedback from the discussion paper

Most stakeholders agree that, until the privacy risks of different technologies used in automated vehicles are better known, the current privacy principles are sufficient to manage personal information generated by automated vehicles. Future legislative action may be warranted, subject to an assessment of the privacy risks and whether those risks are sufficiently regulated by the Australian Privacy Principles. Legislative action may be particularly relevant to government access to personal information, and VicRoads notes that in Victoria, current provisions will not restrict enforcement agencies from accessing automated vehicle data, which may need to be further reviewed as the technology develops (VicRoads, p. 17).

Privacy protections should not restrict reasonable commercial access to vehicle data. The AAA notes that data should be permitted to be passed on to nominated third parties such as preferred vehicle repairers or roadside assistance providers (AAA, p. 16).

Some stakeholders support option 3, legislating access to automated vehicle data, including identifiable location information. The Motorcycle Council of New South Wales supports a legislative approach because existing privacy principles are poorly enforced (Motorcycle Council of NSW, p. 6), while Ms Mathews Hunt observes that automated vehicles are a potentially highly intrusive form of data collation and the Australian Privacy Principles are flawed because they rely on a consent model when consumers often do not understand what data is being collected and how it is being used (Mathews Hunt, pp. 10–12). Victoria Police also supports legislative action but to introduce a positive obligation on drivers to provide enforcement agencies with relevant vehicle data (ANZPAA, p. 6).

Conclusions

The privacy risks of automated vehicles will primarily depend on the technologies adopted and the extent to which automated vehicles generate personal information. Therefore, while legislative controls on the use and access to automated vehicle personal information by governments may be warranted in the longer term, until the privacy risks are better known the current application of privacy and surveillance laws should sufficiently protect consumers' privacy.

Policy finding: Privacy concerns represent a potential barrier to the take-up of technology that could significantly improve road safety. Australia should aim for a high level of privacy protection for drivers and occupants of automated vehicles. This is in keeping with emerging international standards relating to C-ITS technologies.

Policy finding: Manufacturers and technology providers are already required to ensure compliance with the Privacy Act and the Australian Privacy Principles, as they do for other communications systems that have already been developed. As such, at this time no changes are necessary to privacy laws governing automated vehicles and the transmission of personal information (including location data).

Policy finding: The safety assurance system (recommendation 5) should have regard to ensuring applicants provide the highest possible level of anonymity and privacy protection for drivers and occupants, and that this be a key focus for governments when considering applications to deploy automated vehicles.

Policy finding: In the event that individuals can be reasonably identified from the use and operation of an automated vehicle (including location data), the Transport and Infrastructure Council should have regard to legislative protections to define the circumstances in which organisations that are exempt from compliance with privacy principles, including enforcement agencies, may access this personal information. This is in keeping with previous council directions regarding the privacy impacts of C-ITS technologies.

Policy finding: In the longer term, the Commonwealth, state and territory governments should consider developing nationally consistent legislation to regulate government agency access to automated vehicle data, in alignment with privacy principles. Legislation could address broader data access issues, including access to data to support crash analysis, network performance monitoring and infrastructure planning.

No immediate actions are required by the Transport and Infrastructure Council.

Glossary

Term or title	Abbreviation	Description
Australian Competition and Consumer Commission	ACCC	Competition regulator and national consumer law champion for Australia. Promotes competition, fair trading and regulation of national infrastructure.
Australian Design Rules	ADRs	National standards for safety, anti-theft and emissions in vehicle design.
Australian Light Vehicle Standards Rules	ALVSRs	National in-service standards for light vehicles, primarily based on the ADRs.
Australian Privacy Principles	APPs	Standards for how Commonwealth agencies, private sector and not-for-profit organisations must handle, use and manage personal information.
Australian Road Rules	–	Model road rules developed by the NTC and applied in state and territory legislation.
Austrroads	–	The association of Australasian road transport and traffic agencies.
automated driving system	–	In-vehicle operating system that controls the automated vehicle functions.
automated driving system entity	–	The legal entity responsible for the automated driving system.
conditionally automated	–	An automated vehicle where the system drives the vehicle for sustained periods of time, but the human driver must be receptive to system errors and be the fallback for the dynamic driving task.
Cooperative Intelligent Transport Systems	C-ITS	The use of wireless communications to exchange data between vehicles, and with roadside infrastructure, including data on vehicle movements, traffic signs and road conditions.
fully automated	–	An automated vehicle where all aspects of the driving task and monitoring of the driving environment and the dynamic driving task are undertaken by the vehicle system. The vehicle can operate on all roads at all times.
Global Navigation Satellite System	GNSS	System that provides geospatial positioning based on longitudinal, latitudinal and altitudinal data.
Heavy Vehicle National Law	HVNL	National laws regulating heavy vehicles in Australia.

Term or title	Abbreviation	Description
highly automated	–	An automated vehicle where the system drives the vehicle for sustained periods of time in some situations, or all of the time in defined places, and no human driver is required to monitor the driving environment and the driving task, or intervene, when the system is driving the vehicle.
highway driving assist	–	Technology that allows a vehicle to maintain an appropriate speed, lane position and safe distance to other vehicles.
human-machine interface	HMI	Interface between a human operator and a machine. Includes functional and ergonomic design of the interface (human factors).
Information Privacy Principles	IPPs	State privacy principles regulating public sector accesses to and handling of personal information.
National Transport Commission	NTC	Independent statutory body that contributes to the achievement of national transport policy objectives by developing regulatory and operational reform of road, rail and intermodal transport.
Office of the National Rail Safety Regulator	ONRSR	National rail safety regulator.
partially automated	–	An automated vehicle where the automated driving system may take control of steering, acceleration and braking in defined circumstances, but the human driver must continue to monitor the driving environment and the driving task, and intervene if required.
Society of Automotive Engineers	SAE	International association for automotive engineers.
Transport and Infrastructure Council	–	Group comprising Commonwealth, state, territory and New Zealand ministers with responsibility for transport and infrastructure issues, as well as the Australian Local Government Association.
United Nations Economic Commission for Europe	UNECE	Organisation promoting pan-European economic integration. Brings together 56 countries from Europe, Central Asia and North America to work together on economic and sectoral issues.
United Nations Working Party 29	WP.29	International regulatory forum within the institutional framework of the UNECE Inland Transport Committee.
use case	–	Method to classify different automated vehicles based on specific applications or functions, such as auto parking assist, automated highway driving or truck platooning.
Vienna Convention on Road Traffic	–	International treaty on road traffic signed in 1968 designed to facilitate cross-national road traffic standards.

Submissions to the NTC discussion paper

Name of organisation	Abbreviation	Description
AARC		Automotive testing ground and engineering service provider
Australia New Zealand Policing Advisory Agency	ANZPAA	Four submissions from individual police jurisdictions: South Australia Police, Western Australia Police, ACT Policing and Victoria Police
Australasian New Car Assessment Program	ANCAP	Independent vehicle safety advocate
Australian Academy of Technology and Engineering		Independent body of Australian scientists and engineers.
Australian Automobile Association	AAA	National peak body for Australia's motoring clubs
Australian Automotive Aftermarket Association		National organisation of manufacturers, distributors, wholesalers, importers, mechanical repair and modification services and retailers of automotive parts, accessories, tools and equipment who service the automotive aftermarket industry
Australian Driverless Vehicle Initiative	ADVI	Initiative led by ARRB to support deployment of automated vehicles in Australia (members include vehicle insurers)
Australian Trucking Association	ATA	National peak body for the Australian trucking industry
Austroroads		The association of Australasian road transport and traffic agencies.
Brady, et. al.		Mark Brady and Dr Kieran Tranter (Griffith Law School); and Tania Leiman and Dr Kylie Burns (Flinders University)
Department of State Growth		Department of the Tasmanian Government
Department of Transport Northern Territory	NT Government	Department of the government of the Northern Territory
Federal Chamber of Automotive Industries	FCAI	National peak body for manufacturers and importers of light vehicles and motorcycles
Gas Energy Australia		National peak body representing the downstream gas industry
Geoscience Australia		Public sector geoscience organisation that advises on the geology and geography of Australia
GHD Pty Ltd	GHD	Professional services company
H2H Energy		Company providing customised hydrogen system solutions

Name of organisation	Abbreviation	Description
Heavy Vehicle Industry Association	HVIA	Peak body for the heavy vehicle industry
IAG Limited	IAG	General insurance group
Insurance Commission of Western Australia		Insurance commission
Insurance Council of Australia	ICA	National peak body for the general insurance industry
Rannila, Jukka		Citizen of Finland
Law Institute of Victoria	LIV	Professional association for Victorian solicitors and lawyers
Law Society of South Australia		Professional association for South Australian solicitors and lawyers
Mathews Hunt, Kate		Researcher, Bond University
Maurice Blackburn Lawyers		Compensation and social justice law firm
Motorcycle Council of New South Wales	Motorcycle Council of NSW	Council for New South Wales motorcycle clubs, associations and ride groups
Motor Trades Association of Queensland	MTAQ	Peak body representing the interests of employers in the retail service and repair sectors of Queensland’s automotive industry
National Heavy Vehicle Regulator	NHVR	Independent regulator for vehicles over 4.5 tonnes gross vehicle mass in all states and territories except Western Australia and the Northern Territory
Nebot, Eduardo		Director, Australian Centre for Field Robotics, University of Sydney
Nova Systems		Professional service provider, specialising in the provision of engineering and management services to industry and government.
NSW transport cluster		New South Wales government, consisting of Transport for New South Wales and Roads and Maritime Services
Occupational Therapy Australia		Professional association representing occupational therapy in Australia
Orbit City Labs		Start-up company within emerging technology
Queensland TMR	TMR	Department of Transport and Main Roads in Queensland
Rannila, Jukka		Citizen of Finland
Roads Australia		Industry association for all areas of the road sector
Robert Bosch Australia	Bosch	A global supplier of technology and services
SA Freight Council		Industry based association for freight and logistics

Name of organisation	Abbreviation	Description
Steven Hurd and Jeff McNeill	Hurd & McNeill	Joint submission from two individuals
Tesla Motors	Tesla	Vehicle manufacturer
Toll Group	Toll	Freight and logistics operator
Toyota Australia	Toyota	Vehicle manufacturer
Transoptim		Consulting firm in transport network operations and ITS
Transport Accident Commission	TAC	Victorian Government organisation that promotes and improves road safety and supports those who have been injured on Victoria's roads.
Transurban		Manager and developer of urban toll road networks in Australia and the United States
Truck Industry Council	TIC	Peak body for heavy vehicle manufacturers and distributors
Nebot, Eduardo		Director, Australian Centre for Field Robotics, University of Sydney
Verless		Franklin Regal Pty Ltd, trading as Verless
VicRoads		Road management agency, Victoria
Victorian Taxi Association		Represents the interests of taxi operators across Victoria
Vlacic, Ljubo		Professor, Griffith University
Warren Centre for Advanced Engineering		University of Sydney research institute
WA transport portfolio		Western Australia Department of Transport and Main Roads

Submissions can be accessed on the NTC website under 'Current Project'/ Preparing for more automated road and rail vehicles: <http://www.ntc.gov.au/submissions/history/?rid=91793&pid=8247>.

