

Review of 'Guidelines for trials of automated vehicles in Australia'

May 2020

Discussion paper

Report outline

Title	Review of 'Guidelines for trials of automated vehicles in Australia'
Type of report	Discussion paper
Purpose	For public consultation
Abstract	<p>This discussion paper reviews the National Transport Commission (NTC) and Austroads' <i>Guidelines for trials of automated vehicles in Australia</i>. The guidelines were released in 2017 to support nationally consistent conditions for automated vehicle trials in Australia. The NTC has undertaken research and targeted consultation to present potential updates to the guidelines that aim to benefit trialling organisations and road transport agencies. Updates could include: further detail about requirements; alignment with the future commercial deployment framework; clarifying the application of the guidelines to other technologies; and improving administrative processes. The NTC is seeking views on these proposals and any other relevant matters.</p>
Submission details	The NTC will accept submissions until Friday 3 July 2020 online at www.ntc.gov.au .
Attribution	<p>This work should be attributed as follows, Source: National Transport Commission 2020, <i>Review of 'Guidelines for trials of automated vehicles in Australia': Discussion paper</i>, NTC, Melbourne.</p> <p>If you have adapted, modified or transformed this work in anyway, please use the following, Source: based on National Transport Commission 2020, <i>Review of 'Guidelines for trials of automated vehicles in Australia': Discussion paper</i>, NTC, Melbourne.</p>
Key words	automated vehicles, trials, emerging technology, safety management, traffic management, data, insurance, evaluation, importation
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Have your say

What to submit

We are seeking views on the consultation questions in this discussion paper, as well as any other views you have on the trial guidelines or automated vehicle trials that may be relevant. We would like to hear in particular from Commonwealth and state and territory road transport and enforcement agencies, trialling organisations and those interested in running automated vehicle trials in Australia, local councils, road managers, insurance bodies, road user groups and groups representing the disabled, vulnerable and ageing communities.

When to submit

We are seeking submissions on this discussion paper by Friday 3 July 2020.

How to submit

Any individual or organisation can make a submission to the NTC.

Making a written submission

 Visit www.ntc.gov.au and select 'Submissions' in the top navigation menu.

Submitting by other methods

 Register your interest for an online meeting or tell us how you would like to be involved by emailing automatedvehicles@ntc.gov.au.

Where possible, you should provide evidence, such as data and documents, to support the views in your submission.

Publishing your written submission

Unless you clearly ask us not to, we publish all the written submissions we receive online. We will not publish submissions that contain defamatory or offensive content.

The *Freedom of Information Act 1982* (Cwlth) applies to the NTC.

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Executive summary

The National Transport Commission and Austroads' *Guidelines for trials of automated vehicles in Australia* were released in May 2017 to support nationally consistent conditions for automated vehicle trials in Australia. The guidelines were intended to:

- provide certainty and clarity to industry regarding expectations when trialling in Australia
- help agencies manage trials in their own jurisdictions as well as across state borders
- establish minimum standards of safety
- help assure the public that roads are being used safely
- help raise awareness and acceptance of automated vehicles in the community.

Transport and infrastructure ministers directed that the guidelines should be reviewed every two years. We began this review of the guidelines in 2019 and it is the first to take place since they were published. The purpose of this discussion paper is to assess how well the guidelines are working in practice and to seek broader stakeholder views on any required changes.

Context

Since the guidelines were published in May 2017 there have been a number of developments in trialling and the development of regulatory frameworks for automated vehicles:

- Trials have now taken place in every Australian state and territory, and trialling organisations and road transport agencies can share their experience of the application, approval and operation of trials.
- There has been further development of the regulatory framework for the commercial deployment of automated vehicles, which will eventually succeed the trials framework.
- International guidance has further evolved.

The objectives of the review are to identify:

- whether the guidelines have assisted governments and trialling organisations
- challenges faced by governments and trialling organisations using the guidelines or in applying for, approving, operating and evaluating trials
- additional requirements governments have placed on trialling organisations
- whether the guidelines should be updated to ensure a nationally consistent and safe approach to automated vehicle trials in Australia.

Consultation topics

In late 2019 the NTC undertook targeted consultation and a review of international guidance to inform this discussion paper. Through this consultation we have learned that trialling organisations and road transport agencies have found the guidelines useful, particularly as a starting point to guide trialling organisations as they prepare their trial applications. We have also learned that the guidelines could provide further detail to assist trialling organisations

and to provide some consistency in applications for road transport agencies. As well, we have learned that there are a number of differences in trial requirements and application processes across states and territories, which has led to differing experiences in gaining approvals for trials.

Consultation topics in this discussion paper fall under five broad categories:

- content and level of detail in the current guidelines (chapter 3)
- application of the guidelines (chapter 4)
- administrative processes and harmonisation (chapter 5)
- other automated vehicle trial issues outside the scope of the guidelines (chapter 6).

There could be a number of updates to the guidelines that will benefit both trialling organisations and road transport agencies. These include

- further detail about safety, traffic management and data and information requirements;
- further alignment with future safety requirements for commercial deployment;
- clarifying the application of the guidelines to other technologies, operating domains and types of trials; and
- improving the efficiency of administrative processes at the point of application.

We are seeking views from stakeholders on the potential updates discussed in this paper and on any other useful changes. We want to ensure the guidelines support safe and innovative trials in Australia. This will help Australia gain the safety and productivity benefits of this technology.

Next steps

We are seeking written submissions and feedback through other methods by Friday 3 July 2020. During the consultation period we will also undertake broader consultation with stakeholders through meetings.

Following this we will develop a policy paper and updated guidelines for the approval of transport and infrastructure ministers in November 2020.

List of questions

- Question 1:** Should the guidelines be updated to improve the management of trials (section 3 of the guidelines) and, if so, why? Consider in particular:.....22
- Question 2:** Should the guidelines be updated to improve the safety management of trials (section 4 of the guidelines) and, if so, why? Consider in particular:.....26
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1 About this project

Key points

- We are reviewing the *Guidelines for trials of automated vehicles in Australia* to ensure they continue to encourage a nationally consistent and safe approach to automated vehicle trials.
- We have undertaken targeted consultation to inform this discussion paper and will undertake further public consultation to develop updated guidelines by the end of the year.

1.1 Project objectives

The *Guidelines for trials of automated vehicles in Australia* were released in May 2017 to support nationally consistent conditions for automated vehicle trials in Australia. The guidelines cover criteria for trialling organisations that relate to the management of trials, safety, insurance, and data and information. The guidelines were developed to:

- provide certainty and clarity to industry regarding expectations when trialling automated vehicles in Australia
- help agencies manage trials in their own jurisdictions as well as across state borders
- establish minimum standards of safety
- help assure the public that roads are being used safely
- help raise awareness and acceptance of automated vehicles in the community (National Transport Commission, 2017).

Transport and infrastructure ministers directed that the guidelines be reviewed every two years. This review of the guidelines, which began in late 2019, is the first to take place since they were published.

Trialling organisations and states and territory governments have applied the guidelines since publication. There may be useful learnings that could warrant updates to the guidelines. Differences in trial application requirements have also emerged as states and territories impose jurisdiction-specific requirements and processes for applications.

The objectives of the review are to identify:

- whether the guidelines have assisted governments and trialling organisations
- challenges faced by governments and trialling organisations using the guidelines or in applying for, approving, operating and evaluating trials
- jurisdiction-specific requirements governments have placed on trialling organisations
- whether the guidelines should be updated to further ensure a nationally consistent and safe approach to automated vehicle trials in Australia.

1.2 Background

Automated vehicles have the potential to provide a significant range of benefits to Australian society. These include:

- improvements to road safety (by reducing human error)
- improved access and mobility options
- more efficient traffic flow and reductions in congestion
- a reduction in the costs associated with congestion
- productivity for vehicle occupants (by allowing them to undertake tasks other than driving)
- fuel efficiency and reduced emissions (ACEA European Automobile Manufacturers Association, 2019).

On-road trials are necessary to ensure automated vehicles can operate safely and efficiently in Australian conditions. They are also important for building public understanding and confidence in the technology.

Vehicles cannot operate in automated driving mode on public roads due to existing legal barriers. Organisations seeking to run automated vehicle trials require state and territory road transport agencies to provide permits or exemptions from legislative obligations in the Australian Road Rules and other road transport legislation.

States and territories can impose conditions on these permits and exemptions to ensure safety. In 2016 we identified a risk that different road agencies will set different conditions on exemptions or permits for trials, which could add unnecessary cost for industry or potentially make cross-border trials impractical.

In November 2016 the Transport and Infrastructure Council agreed to the NTC and Austroads developing national guidelines for 'on-road field testing and trials of automated vehicles in Australia' (National Transport Commission, 2016, p. 11) The NTC led consultation on the scope of the guidelines. The council also directed state and territory road transport agencies and the National Heavy Vehicle Regulator to undertake a review of current exemption powers to ensure they had 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. This review was completed in 2018. Some states found that exemption powers were not sufficient and enacted legislation to enable trials.¹

The guidelines were developed to ensure a level of national consistency in trials across the country by forming the basis for conditions a trialling organisation would need to meet to receive an exemption or permit to trial an automated vehicle on a public road. To apply for a permit or exemption, trialling organisations must address the criteria in the guidelines (including explaining why particular criteria are not relevant in their circumstances).

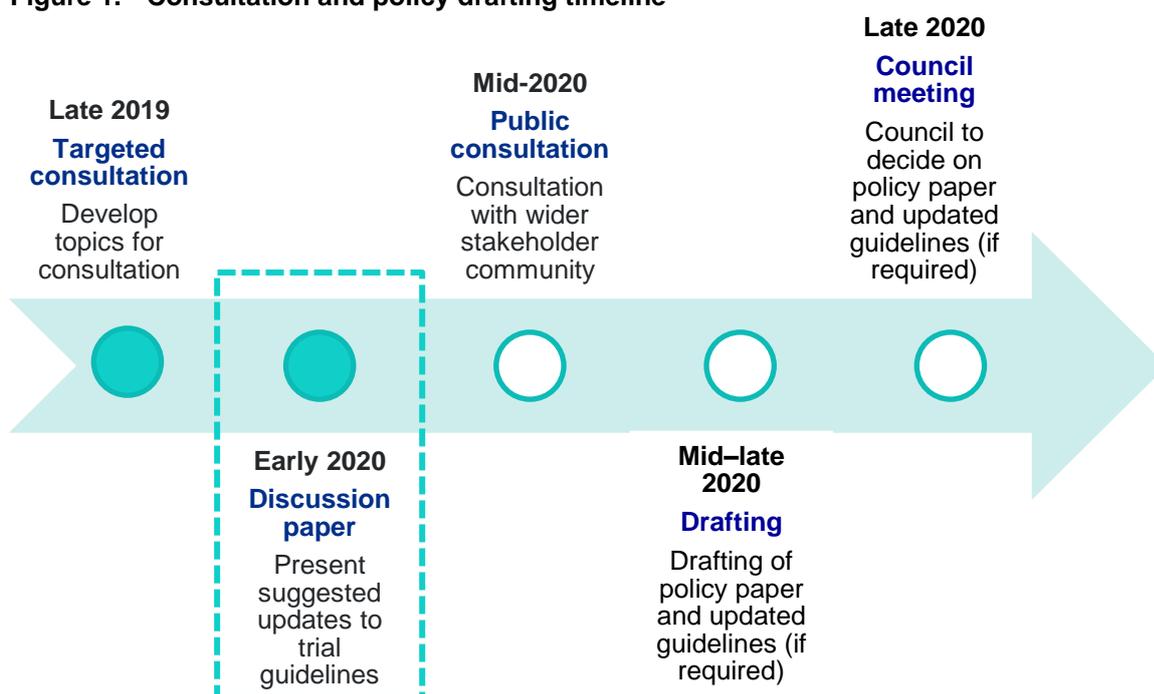
¹ *Motor Vehicles (Trials of Automotive Technologies) Amendment Act 2016 (SA), Transport Legislation Amendment (Automated Vehicle Trials and Innovation) Act 2017 (NSW), Road Safety Amendment (Automated Vehicles) Act 2018 (Vic).*

1.3 Our approach to reviewing the guidelines

From late 2019 to early 2020 we undertook targeted consultation with a range of government agencies and industry organisations currently involved in trialling automated vehicles in Australia. We held meetings with the organisations to discuss their experience with using the guidelines and with going through the trial application and approval process. The feedback received from these meetings has helped inform this discussion paper. We discuss this feedback further in the following chapters.

Following release of this discussion paper we will consult more broadly with stakeholders and the public and seek written submissions. Feedback will be analysed and used to develop a final policy paper and updated guidelines (if required). These will be delivered to transport and infrastructure ministers at the end of 2020 for approval and public release (see Figure 1).

Figure 1. Consultation and policy drafting timeline



1.4 Related work and interdependencies

1.4.1 Austroads – future vehicles trials lessons learned repository

Austroads is exploring the potential to establish a ‘lessons learned’ repository for Australian and New Zealand trials of automated vehicle technologies, connected vehicle technologies and zero and low-emission vehicle technologies. If established, the repository will be populated with the outcomes and lessons from previous and future trials and made available to governments, trialling organisations and the public.

Currently, Austroads publishes basic information about all current and past trials on its website.²

² See <https://austroads.com.au/drivers-and-vehicles/future-vehicles-and-technology/trials>.

1.4.2 Safety assurance for commercial deployment of automated vehicles

Beyond the trials framework, ministers have agreed a safety assurance approach to the first supply of automated vehicles for commercial deployment. Entities seeking to bring automated driving systems (ADSs) to market in Australia will need to self-certify that they have met a set of safety criteria and obligations to be granted a type approval under the *Road Vehicle Standards Act 2018* (Cth). The entity, called the Automated Driving System Entity (ADSE), will be responsible for assuring the safety of the vehicle type for the life of the vehicle. Once the ADSE receives type approval, its vehicles can be deployed anywhere on the road network (subject to any type approval or registration conditions).

The NTC is now leading development of a safety assurance approach for the safety of commercially deployed automated vehicles once they are on the road ('in-service'). We ran a public consultation in 2019 on the parties to be regulated, the types of duties, governance arrangements and legislative options. We will provide recommendations to ministers on the in-service approach in 2020.

1.4.3 Motor accident injury insurance and automated vehicles

The NTC consulted on an ongoing national approach to insurance as part of developing the regulatory framework for the commercial deployment of automated vehicles. Transport and infrastructure ministers have agreed that all jurisdictions' motor accident insurance schemes (compulsory third party and national injury insurance schemes) should provide access for injuries and deaths caused by ADS that are engaged. The Board of Treasurers (state and territory treasurers) is currently considering this decision. If endorsed, jurisdictions will review their motor accident insurance schemes with a view to changing them to cover automated driving. These changes should reflect a number of principles including that

'no person is better or worse off, financially or procedurally, in the relevant jurisdiction if they are injured by a vehicle whose ADS was engaged than if they were injured by a vehicle controlled by a human driver'.

This principle is already reflected in the guidelines, which state in the *Insurance* section: 'As a key principle in assessing trial applications, states and territories will aim to ensure that any road user injured by an automated vehicle trial is no worse off than if they were injured by a human-operated vehicle'.

1.4.4 Government access to vehicle generated data

The NTC is also considering the ongoing framework for government access to data generated by vehicles, including automated vehicles. This data has the potential to help road transport agencies create public value by enhancing network operations, investment, maintenance, planning and road safety. In 2020 we will be consulting on ways for government to access vehicle generated data without raising commercial, privacy, security issues or disincentives to deploying technology.

1.4.5 Austroads – infrastructure

Austroads is undertaking a range of projects to support road transport agencies to deliver an improved road network that leverages the benefits of emerging technologies while minimising the risks that change might bring. Projects have included research and testing on the infrastructure changes required to support automated vehicles on rural and metropolitan highways and freeways.

2 Context of the review

Key points

- There have been a number of automated vehicle trials and regulatory developments in Australia and internationally since the guidelines were published.
- These developments have raised several issues that may be relevant to the guidelines. Our examination of these issues has helped to inform the consultation topics in this discussion paper.

2.1 Overview

Since the guidelines were published in May 2017 there have been a number of relevant developments in trialling and in developing regulatory frameworks for automated vehicles. In this chapter we set out some of these developments, which have informed the consultation topics we present later in this paper.

2.2 Australian context for automated vehicle trials

2.2.1 Current state of trials in Australia

Since the guidelines were published there have been a number of relevant developments in Australia.

- Approximately 15 automated vehicle trials have taken place in Australia, and trials have occurred in every state and territory. Governments have actively encouraged and in some cases part-funded these trials. The majority have been trials of automated shuttle buses in limited operating domains. No trials have taken place across state boundaries.
- South Australia, New South Wales and Victoria have enacted legislation to enable trials, and other jurisdictions allow trials through permit or exemption schemes. Victoria has also developed its own trial guidelines.
- Differences in application and approvals processes and trial requirements have emerged across states and territories. Some trial applicants have found the trial application process simpler in some jurisdictions than others.
- Some applicants for small automated vehicle (sometimes known as ‘footpath delivery robots’) trials have used the guidelines as a basis for applications.
- Australia has not had any large-scale pre-deployment testing as has been seen in the United States (US), but there has been some interest from organisations in trialling larger quantities of automated vehicles.
- Some trialling organisations have noted challenges in importing their trial vehicles.
- Some government agencies have noted challenges in sharing trial learnings across governments.

2.2.2 Findings from targeted consultation about trial guidelines

As noted in the previous chapter, we undertook targeted consultation with a range of government agencies and industry organisations to inform this discussion paper. There was consistent feedback that the guidelines were a useful guide to understanding what was necessary in applying for trials and assessing applications. However, there was some indication that, though the guidelines were a good baseline, road transport agencies introduced additional requirements on trialling organisations either through jurisdiction-specific standardised rules or requirements tailored to the trial. Most trialling organisations also detailed difficulties understanding application processes or knowing how to meet requirements to receive trial approvals. Trialling organisations that had applied for trials in multiple jurisdictions also noted widely variable experiences with application processes depending on the state or territory and the type of trial.

2.2.3 Agreement to safety criteria for the first supply of automated vehicles for commercial deployment

As noted in the previous chapter, ministers have agreed a safety assurance approach to the first supply of automated vehicles for commercial deployment. Entities seeking to deploy automated vehicles will need to self-certify that they have met a set of safety criteria and obligations to be granted a type approval under the Road Vehicle Standards Act (the safety criteria are listed in Appendix A). A safety assurance approach for the in-service safety of automated vehicles for commercial deployment is currently being developed.

We have considered the safety criteria in developing the consultation topics in this discussion paper. We consider it important to align the guidelines with the safety criteria where relevant and appropriate to allow for a more seamless transition for trialling organisations wishing to seek approval for commercial deployment in the future. This alignment must be balanced with the lower risks present in trial conditions that occur in more controlled environments compared with commercially deployed automated vehicles that may be able to access the entire road network. In the consultation topics we note instances where alignment with the safety criteria may be useful. We also note there are additional minor language changes that could be made to further align the guidelines with the safety criteria.

The Commonwealth Department of Infrastructure, Transport, Regional Development and Communications is developing the regulatory instruments to implement the first supply approach. We will continue to monitor the development of this approach to look for opportunities to align the guidelines.

2.3 International context for automated vehicle trials

When the guidelines were being developed in 2017 the NTC had undertaken a comparative analysis of the rules for managing automated vehicle trials in overseas jurisdictions. The analysis provided a baseline and point of contrast for the content that was proposed for the guidelines.³

To inform the discussion in this paper, the NTC has now conducted a desktop audit of the rules for automated vehicle testing in a sample of overseas jurisdictions (New Zealand, the United Kingdom (UK), Canada, Japan, Singapore, California, Arizona, Nevada, Sweden,

³ See the NTC's discussion paper *National guidelines for automated vehicle trials (November 2016)*, which can be accessed on the [NTC's website](#).

Netherlands). The approaches taken by jurisdictions to specific issues are discussed throughout this paper, where relevant. Some observations from the audit are below.

2.3.1 Types of trials

Trials overseas include the testing and validating automated vehicle technologies, as well as their application in different environments:

- ride hailing services and ride sharing services⁴
- on-road trials of commuter shuttles⁵
- personal delivery services/footpath delivery robots⁶
- passenger pods⁷
- truck platooning⁸
- automated trucking/freight services⁹

2.3.2 Regulatory developments

- In February 2019, the UK updated its non-statutory *Code of Practice: Automated vehicle trialling* that applies to testing automated vehicles. The updated code of practice is prescriptive in relation to engagement with road and enforcement authorities and data recording and sharing (it specifies minimum data recording capabilities). It requires the publication of a safety management plan.¹⁰ In 2018 the UK enacted the Automated and Electric Vehicles Act 2018, extending the requirement for compulsory motor vehicle insurance to automated vehicles.¹¹
- In 2018, Transport Canada (Canada's federal transportation department) published two sets of guidelines for automated vehicle testing. The *Testing Highly Automated Vehicles in Canada* guidelines clarify the roles and responsibilities of the different levels of government involved in facilitating trials and establish voluntary minimum safety requirements that trial organisations are expected to follow.¹² The *Canadian Jurisdictional Guidelines for Safe Testing and Deployment of Highly Automated*

⁴ In 2017, Waymo launched an app based commercial automated vehicle ride hailing service in Phoenix. Japan has been testing automated commercial ride sharing services on controlled test routes in high density environments in Yokohama (Lyons, 2018) and Tokyo (England, 2018).

⁵ In 2019, Singapore trialled an on-demand automated shuttle that users could summon via an app (Intelligent Transport, 2019). Three areas in Singapore will use automated buses and shuttles for off-peak and on-demand commuting from 2022 (KPMG International, 2019). In December 2019, Canada completed a trial of an electric autonomous shuttle on public roads in Quebec (Keolis Candiac, 2020).

⁶ Small footpath delivery robots have been tested in many countries to deliver things like parcels, groceries and meals (these have also been trialled in Australia).

⁷ The UK has trialled automated passenger pods on pavements as a last/first mile and mobility solution (Burgess, 2018).

⁸ In the European Union, ENSEMBLE, a consortium of Europe's big six truck manufacturers has announced that multi brand platooning will be trialled on European roads by 2021 (Ensemble, 2020). Canada (Ventezou, 2019) and Japan (Garnsey, 2018) have also conducted truck platooning trials. 20 US states have approved truck platooning (Scribner, 2019).

⁹ The US postal service has begun testing driverless delivery vehicles between Phoenix and Dallas (Barkho, US Postal Service Begins Testing Driverless Delivery Vehicles, 2019). The US army is trialling automated combat trucks (Barkho, The Army Is Getting Driverless Vehicles Before the Public, 2019).

¹⁰ The UK's *Code of Practice: Automated vehicle trialling* can be accessed on the [UK government website](#).

¹¹ The UK's Automated and Electric Vehicles Act 2018 can be accessed on the [UK legislation website](#).

¹² The *Testing Highly Automated Vehicles in Canada* guidelines can be accessed on the [Government of Canada website](#).

Vehicles aim to create a pathway towards consistency and interoperability in cross-jurisdictional testing.¹³ In January 2019, Ontario made legislative changes to its automated vehicle pilot program to allow for testing of driverless automated vehicles subject to full human oversight on public roadways (Ontario Ministry of Transportation, 2020)

- Since 2011, when Nevada became the first state in the US to pass legislation authorising automated vehicles, 29 American states have enacted automated vehicle related legislation and governors in 11 states have issued automated vehicle related executive orders (National Conference of State Legislatures, 2020). There is no automated vehicles legislation at the federal level, though there have been recent reports of a draft automated vehicle Bill that is before Congress (Razdan, 2020).
- In October 2018, the US Department of Transportation (USDOT) released *Preparing for the Future of Transportation: Automated Vehicles 3.0*. The paper described the USDOT's strategy to address barriers to automated vehicles and introduced guiding principles for automated vehicle innovation. USDOT has also recently consulted on a policy document *Ensuring American Leadership in Automated Vehicle Technologies Automated Vehicles 4.0*. The policy document establishes government principles to ensure a standard federal approach to automated vehicles focusing on three key areas: protecting users and communities, promoting efficient markets and facilitating coordinated efforts (United States Department of Transportation, 2020).
- In February 2020, the US National Highway Traffic Safety Administration granted Nuro Inc's low-speed electric delivery vehicle, the 'R2X', a temporary exemption from certain low-speed federal vehicle standard requirements on the basis the exemption would not lower the safety of the R2X. The terms of the exemption include mandatory reporting of information about the operation of the R2X and outreach to communities where the R2X will be deployed. The R2X is designed to have no human occupant and operates exclusively using an ADS. The exemption permits Nuro to produce and deploy no more than 5,000 R2 vehicles during the two-year exemption period (United States Department of Transportation, 2020). Nuro intends to deploy these vehicles as part of a local delivery service for restaurants, supermarkets and other businesses.
- In September 2018, California amended its regulations to permit testing without a driver present in an automated vehicle (though a remote operator overseeing the car is still required). The Department of Motor Vehicles has issued one driverless testing permit so far – to Waymo (State of California – Department of Motor Vehicles, 2020). As of 30 November 2019, Waymo had reported no miles driven on public roads for this permit (Shaw, 2020). California also permits 'deployment', which is defined as 'the operation of an autonomous vehicle on public roads by members of the public who are not employees, contractors, or designees of a manufacturer or for purposes of sale, lease, providing transportation services for a fee, or otherwise making commercially available outside of a testing program'.¹⁴ From 16 December 2019, California introduced a permit system for testing and deploying light duty automated delivery vehicles.¹⁵
- In March 2018, the Governor of Arizona issued an Executive Order that established requirements for testing and operating automated vehicles without a person in the vehicle. An entity wishing to test an automated vehicle without a driver must first

¹³ The *Canadian Jurisdictional Guidelines for Safe Testing and Deployment of Highly Automated Vehicles* can be accessed [Canadian Council of Motor Transport Administrators website](#).

¹⁴ §228.02, Article 3.8, *Autonomous Vehicles – Order to Adopt*, Title 13, Division 1, Chapter 1 can be accessed on the [State of California Department of Motor Vehicles website](#).

¹⁵ The regulations can be accessed on the [State of California Department of Motor Vehicles website](#).

submit a written statement to the Arizona Department of Transportation certifying compliance with the rules of the Executive Order.¹⁶ In 2018, Arizona also passed legislation authorising the operation of personal delivery services (delivery robots) on footpaths and pedestrian crossings. The law expires in September 2020 unless lawmakers remake the law.¹⁷

¹⁶ Executive Order 2018-04 Advancing Autonomous Vehicle Testing and Operating; Prioritizing Public Safety can be accessed on the [Arizona Department of Transportation website](#).

¹⁷ HB2422 can be accessed on the [Arizona legislation website](#).

3 Content and level of detail in the current guidelines

Key points

The guidelines are high level in nature to provide a balance between ensuring safety and encouraging innovation. However, there may be some areas where further prescription or detail would provide clarity to trialling organisations and promote greater national consistency.

3.1 Overview

The guidelines provide a flexible mechanism to encourage innovation while maintaining safety. They are pitched at a high level so they can accommodate a range of different automated vehicle technologies and applications, and the management of trials will allow for these differences.

The guidelines cover four key areas: management of trials; the safety management plan; insurance; and data and information.

The guidelines state that trialling organisations should address all criteria set out in the guidelines when they apply for a trial. However, if some criteria are not relevant, the trialling organisation can explain in its application why these criteria should not apply.

We are aware that states and territories impose further conditions on trialling organisations to ensure safety on their roads. Our targeted consultation has shown there may be some topics in the guidelines where trialling organisations and governments would find further prescription or detail useful – to provide some clarity on how to meet requirements set by states and territories. Further prescription may also result in more nationally consistent conditions but could reduce flexibility.

3.2 Management of trials

The guidelines require trialling organisations to provide a high-level description of the technology being trialled. This allows road agencies to understand the intent of the trial and for emergency services to understand any particular risks. Providing this information would not need to infringe on intellectual property.

Management criteria in the guidelines are:

- trial location
- description of the technology being trialled
- traffic management plan
- infrastructure or network requirements
- engagement with the public and other stakeholders
- managing change.

As with the other elements of the guidelines, it is for the trialling organisation to explain why a criterion is not relevant to its trial application.

3.2.1 Traffic management plan

The guidelines require trialling organisations to provide a traffic management plan outlining anticipated traffic risks and mitigating actions. This could include consideration of matters including:

- traffic density/vehicles
- pedestrians
- signage
- irregular events – construction, crash scenes, road detours, flooding
- complex intersections and merges
- regional variations in road design
- rail–road interfaces.

We heard from stakeholders that traffic management plans are expensive, generally requiring a qualified third party to prepare. The comprehensiveness of the traffic management plan was also questioned, with differences in the detail required depending on the particular state and local parties involved. One stakeholder also mentioned it was unclear why the trialling organisation needed to provide a traffic management plan when the local council involved needed to prepare its own plan anyway. Another stakeholder pointed out traffic management plans may be difficult to prepare for heavy vehicle trials because they would most likely operate in much larger areas.

We are interested in hearing further views on challenges in submitting and approving traffic management plans. In particular, we are interested in examples and learnings about the appropriate standard of traffic management plans that have been approved.

3.2.2 Trial location

The guidelines require trialling organisations to clearly set out the proposed trial location. They state this could be specific roads, routes or regions. They also state other elements of the vehicle’s operational design domain (ODD) should be described in detail.¹⁸ Road transport agencies’ decision on suitability will depend on factors including: the type and level of automation; any safety considerations relevant to the road network such as proximity to built-up areas; speed limits; and traffic congestion.

One trialling organisation considered that jurisdictions were interpreting the requirement to set out the trial location differently. Some required set maps and routes. Others used an approach focused more on the ODD. The trialling organisation noted that an approach focused on ODD allowed more flexibility because automated vehicle technology will continue to improve and be able to deal with changing road surfaces and environments.

Ministers have agreed to safety criteria that ADSEs must meet at first supply. ADSEs must:

- identify the ODD of the ADS

¹⁸ The ‘operational design domain’ is the specific conditions an ADS or feature is designed to function in. (for example, locations, weather conditions, driving modes).

- demonstrate how it will ensure the ADS is able to operate safely within the ODD and be incapable of operating outside of it
- show how the ADS is able to transition to a minimal risk condition when outside the ODD.

The ADSE must also outline how it will review and manage changes to the ODD, with significant changes requiring reapproval.

Stakeholder feedback to the 2016 discussion paper also strongly supported requiring trialling organisations to propose trial locations as part of its application rather than assuming access will be allowed anywhere on the road network. The Victorian guidelines explicitly require the trialling organisation to provide the trial location (which can consist of maps) and separately require details of the ODD (which may include road types, and traffic, weather and infrastructure conditions). The Victorian guidelines explain that trial location information may assist applicants to become aware of potential road infrastructure or safety issues – for example, identifying areas with school zones, elderly residential homes or roadworks.

We consider that state and territory governments should be able to limit trial locations and request set maps and routes if they consider this necessary to ensure safety. However, we encourage the increasing use of an ODD approach to provide flexibility for trialling organisations moving to larger scale deployments and to prepare for the approach that will be taken for approvals at first supply when automated vehicles become ready for commercial deployment. We therefore consider that the guidelines could be clarified to state that trial location could either be specific roads, routes or regions and/or the vehicle's ODD.

3.2.3 Engagement with the public and other stakeholders – enforcement agencies

The guidelines require trialling organisations to set out how they intend to engage with the public and other key stakeholders as part of the trial. Examples of stakeholders given are local government authorities, road user groups, emergency services, infrastructure managers and public transport providers. It is not clear that enforcement agencies (police) are included in the definition of emergency services.

Some jurisdictions place importance on engagement with law enforcement authorities. For example, Ontario, California and Arizona require trialling organisations to prepare law enforcement engagement plans. The Netherlands notes that local police with jurisdiction in the trial area should be informed and consulted. Japan requires approval from the National Police Agency before a trial can occur on public roads.

We consider it important that the guidelines clearly state that trialling organisations should engage with enforcement agencies as part of the trial.

3.2.4 Purpose of the trial

The guidelines currently do not reference a requirement to provide the purpose or outcomes sought from the trial. Singapore and Sweden require trialling organisations to state the objectives or purpose of their trial in their application.

We are aware that the purpose of the trial may be an important consideration for road transport agencies in approving a trial. We also consider understanding the purpose of the trial from the start may help road transport agencies when they evaluate trials on their completion. We therefore consider adding a requirement for trialling organisations to explain the purpose of their trial will be a useful update to the guidelines.

Question

1. Should the guidelines be updated to improve the management of trials (section 3 of the guidelines) and, if so, why? Consider in particular:
 - the standard of evidence required in a traffic management plan
 - the definition of ‘trial location’
 - the stakeholders trialling organisations should engage with
 - requirements to state the purpose of a trial

3.3 Safety management plan

Trialling organisations must develop a safety management plan outlining all key relevant safety risks for their trial and how they will be mitigated or eliminated. The guidelines set out key safety criteria and mitigations that should be addressed in the safety management plan. However, if some criteria are not relevant, companies can explain why.

The safety management plan reflects the NTC’s and stakeholders’ preference for a safety management system approach for trials.¹⁹ This approach supports innovation by allowing industry to determine the best way to manage risk while maintaining safety assurance for the community.

3.3.1 Standard of evidence required

Though the safety management plan provides a flexible approach to providing safety assurance similarly to feedback received about traffic management plan requirements, we are aware there may be confusion about what evidence needs to be provided for a state or territory government to approve a safety management plan. We have heard that approval of the safety management plan in particular has become an iterative and resource-intensive process between trialling organisations and state/territory road agencies.

As in the NTC/Austrroads guidelines, many jurisdictions state the safety risks that should be addressed in their own requirements for trialling organisations, or even set out more prescriptive safety requirements, but do not provide further detail about the evidence required. Guidance in Singapore is even more high level, requiring only that applicants must provide supporting documents that state the vehicle and ADS are safe for use in the intended manner in the trial.²⁰ There is no further guidance about the content of supporting documentation.

The Victorian guidelines provide more detail about the issues that must be considered in order to meet some of the safety criteria. An example is below:

¹⁹ Feedback to the NTC’s 2016 *National guidelines for automated vehicle trials: Discussion paper* showed that all submitters supported adopting a safety management approach (National Transport Commission, 2017).

²⁰ Road Traffic (Autonomous Motor Vehicles) Rules 2017 (Singapore) s 5(2)(b)(vi).

Safety criteria	NTC/Austrroads guidelines	Victorian guidelines
Fitness for duty	'[Consider how] to ensure the driver or operator of a trial vehicle is fit to drive or operate the vehicle.'	<p>'Requirement: Applicants should ensure that the vehicle supervisor of a trial vehicle is fit to drive or operate the vehicle. This could include requiring zero blood or breath alcohol concentration or consumption of illicit drugs, limiting driving hours and scheduling breaks.</p> <p>Issues to be considered: The fitness to drive obligations should be outlined in the safety management plan for an ADS trial and are intended to align with the applicant's obligations under the Occupational Health and Safety Act 2004 and the Heavy Vehicle National Law (Victoria). VicRoads may also require evidence of meeting Austrroads' <i>Assessing Fitness to Drive for commercial and private drivers.</i>'</p>

South Australia also provides a risk register template that can be used as a reference to complete a safety management plan. Fields that should be filled include causes, consequences and likelihood of risks, and a description of control and mitigation.

We are interested in hearing further views on the process for submitting and approving safety management plans. In particular, we are interested in examples and learnings about the appropriate standard of evidence for safety management plans that have been approved.

3.3.2 Monitoring human drivers or operators

The guidelines note that where there is a human driver, associated human factor risks will need to be considered.

In 2018 a fatal crash occurred in Arizona involving an Uber trial automated vehicle with a safety driver. A pedestrian who had been crossing the road away from a crossing was killed. The US National Transportation Safety Board found that the safety driver had been visually distracted by her cell phone in the time leading up to the crash. It found that her 'prolonged visual distraction, a typical effect of automated complacency, led to her failure to detect the pedestrian in time to avoid the collision (National Transportation Safety Board, 2019, p. 57). The safety board also considered Uber had inadequate oversight of its vehicle operators. It found that Uber 'did not adequately recognize the risk of automation complacency and develop effective countermeasures to control the risk of vehicle operator disengagement, which contributed to the crash' and that though it 'had the means to retroactively monitor the behaviour of vehicle operators and their adherence to operational procedures, it rarely did so' (National Transportation Safety Board, 2019, p. 58).

We consider it would be useful for the guidelines to have an explicit requirement to specify how trialling organisations will monitor and address human driver or operator inattention.

3.3.3 Risks to other road users

The guidelines state that the trialling organisations must consider risks to other road users including drivers and riders of motor vehicles, cyclists, pedestrians and passengers.

In the 2018 Uber crash, the pedestrian crossed the street in front of the approaching vehicle at night and at a location without a pedestrian crossing. This was a violation of Arizona

statutes. The National Transportation Safety Board found that the ADS was unable to 'correctly classify and predict the path of the pedestrian crossing the road midblock' (National Transportation Safety Board, 2019, p. 57).

We consider it would be useful for the guidelines to explicitly require trialling organisations to consider unpredictable behaviour such as driver, rider and pedestrian noncompliance with the road rules.

3.3.4 Interaction with enforcement and emergency services

The guidelines do not reference interaction with enforcement and emergency services as part of the safety management plan.

The first supply safety criteria require an applicant to demonstrate how police can access information about whether the ADS is engaged at a given time, the level of automated engaged and any handover of control requests. They also require applicants to ensure safe interaction with emergency services (for example, police, fire and ambulance services) more broadly when the ADS is engaged, both on the road and at the roadside.

The Victorian guidelines requires trialling organisations to clarify whether the ADS can recognise: police and enforcement officers and emergency workers and their vehicles; blue or red flashing lights; hazard warning lights; and sirens and alarms. They must also explain: how the automated vehicle will be identified and how to recognise it is in automated mode; how the automated vehicle will respond to direction from enforcement and emergency officers; how information about whether a human or ADS was in control at a particular time can be accessed; and how the ADS can be disengaged and removed from the road.

The Canadian jurisdictional guidelines further asks trialling organisations to ensure automated vehicles have safety systems or procedures that allow first responders to immobilise or otherwise disable the vehicle post-crash, to prevent movement or subsequent ignition of the vehicle. Information about these systems and procedures should be made available to the local first responder community. In Arizona, trialling organisations must instruct first responders how to interact with automated vehicles in emergency and traffic enforcement situations. Arizona, Ontario and California also require trialling organisations to have a law enforcement interaction plan.

We consider the guidelines should be updated to reference interaction with enforcement and emergency services as part of the safety management plan.

If the guidelines were updated in this way, they could include a high-level requirement. For example, they could require the trialling organisation 'to consider interaction with enforcement and emergency services on the road and at the roadside'. This would be consistent with the current level of detail within the guidelines. Alternatively, the guidelines could specify requirements for interaction with enforcement and emergency officers during the trial such as:

- how the ADS will recognise enforcement and emergency officers and their vehicles
- how enforcement agencies can access accurate information about whether the ADS is engaged at a given time if there is no driver or operator
- how the ADS will respond to handover requests from enforcement and emergency officers if there is no driver or operator
- how the ADS will facilitate access by enforcement and emergency officers to this information at the roadside.

3.3.5 Recognition of pre-trial tests

The guidelines require trialling organisations to undertake pre-trial testing of the vehicle at a test facility such as a closed track. We heard that in some cases trialling organisations are required to undertake pre-trial tests in one jurisdiction, even though they have recently undertaken testing in another jurisdiction that has been approved as safe. Some organisations considered this unnecessary duplication. We also heard that pre-trial testing will increasingly be done internationally, and that local requirements to undertake similar tests were, again, unnecessary.

However, we also heard the opposing view – that states and territories should be able to require pre-trial testing again even where similar tests had already been taken – and that this was not too onerous a task for trialling organisations.

The guidelines leave open the matter of whether pre-trial tests used for trials in other jurisdictions should be recognised in trial applications in another jurisdiction. The matter is at the state or territory's discretion. We consider it should continue to be up to the trialling organisation to show it has undertaken appropriate pre-trial testing, in any jurisdiction, but that it should be at the state or territory's discretion to require further testing even where similar tests have been undertaken. Given a state or territory will be accountable for the safety of trials on its public roads, it seems fit that state/territory governments should ultimately have comfort that appropriate pre-trial tests have been undertaken. However, we seek views on the best way for road transport agencies to assess any pre-trial tests.

3.3.6 Additional criteria for the safety management plan

The guidelines list key safety criteria and mitigations that should be addressed in the safety management plan:

- security
- risks to other road users
- risks to road infrastructure
- system failure
- transition processes
- whether there is a human driver
- pre-trial testing
- training for the driver or operator
- fitness-for-duty
- vehicle identifiers.

There may be other safety risks that safety management plans could address. For example, South Australia also requires consideration of occupant safety. Canadian guidelines recommend that trialling organisations consider human-machine interaction inside and outside of the vehicle (this is also a safety criterion in the Australian first supply framework). The same guidelines also note that software and hardware updates to the ADS in the trial period should be safely managed and road transport agencies should be notified of changes. In Sweden, applicants must show how it will ensure that accidents, incidents and other deviations are investigated and that preventive measures are taken. In the UK, trialling organisations must also have a process in place to handle the absence of a response from a safety driver.

As noted in section 2.2.3, we have stated in this discussion paper where a suggested change will further align the guidelines with the first supply safety criteria for the commercial deployment of automated vehicles. There may be further elements of the first supply safety criteria that it would be useful to capture within the guidelines that we have not presented in this discussion paper. We note that all aspects of the safety criteria will not be necessary for trials that will operate in more controlled circumstances and in limited parts of the road network. However, alignment will give trialling organisations seeking to commercially deploy vehicles in the future a better understanding of the requirements they will be expected to meet.

Question

2. Should the guidelines be updated to improve the safety management of trials (section 4 of the guidelines) and, if so, why? Consider in particular:
 - the standard of evidence required
 - human driver or operator inattention
 - road user behaviour that does not comply with road rules
 - interaction with enforcement and emergency services
 - pre-trial testing
 - any additional key safety criteria. Consider the safety criteria for the first supply of automated vehicles for commercial deployment (Appendix A).

3.4 Insurance

The guidelines state that trialling organisations must demonstrate they have appropriate insurance to protect against the risks associated with the trial. The guidelines also state that as a key principle in assessing trial applications, states and territories will aim to ensure any road user injured by an automated vehicle trial is no worse off than if they were injured by a human-operated vehicle. This principle is consistent with the decision of transport and infrastructure ministers on the approach to motor accident injury and insurance for automated vehicles once they are commercially deployed (as noted in section 1.4.3).

In Australia, there are a number of insurance products available to cover trials including compulsory third party insurance, comprehensive vehicle insurance, public liability insurance, product liability insurance and self-insurance. The availability of insurance products varies from state to state.

In 2016 we consulted on whether the guidelines should prescribe insurance requirements or only require trialling organisations to hold 'appropriate insurance'. Most stakeholders did not support a prescriptive approach because:

- this would allow trialling organisations to tailor insurance policies to suit their trial
- existing prescribed compulsory third party insurance may not provide cover for automated vehicle trials.

The guidelines therefore require trialling organisations to demonstrate that they hold appropriate insurance to protect against risks associated with the trial, but the type and amount of insurance is not specified.

Some overseas guidelines specify minimum amounts of insurance required (for example, Canada, California, Nevada), while others only state that insurance must be held (for example, New Zealand, Japan, Netherlands, Sweden).

Some Australian states and territories have separately prescribed the type of insurance, and in some cases the minimum amount of that insurance, required for a trial in its jurisdiction. Differences have emerged, though this may partly be due to the specific schemes available in each jurisdiction. For example, South Australia requires public liability, Victoria and New South Wales require public liability of at least \$20 million and compulsory third party, and Queensland requires comprehensive insurance of at least \$20 million. Other insurances such as workers compensation may also apply, and ministers have the right to specify any other insurance policy required for an individual trial.

Feedback from targeted consultation has largely indicated that trialling organisations and governments still consider prescriptive requirements about the type and amount of insurance required may not be necessary. Reasons included the appropriateness of a high-level approach for an emerging industry and the fact that insurance requirements might necessarily differ depending on the amount of risk associated with the type of trial.

Feedback did show there was interest in the reasons for the types of insurance required, that there was sometimes confusion about who needed to apply for insurance and what was covered when multiple partners were involved (for example, where one partner owned the trial vehicle and another operated the trial), and that there were potential gaps in insurance coverage.

We consider a high-level requirement to hold appropriate insurance remains appropriate for trials of emerging technology. However, we are interested in views on this matter, particularly from stakeholders who have had experience obtaining or providing insurance for automated vehicle trials to date.

Questions

3. What issues have been encountered when obtaining or providing insurance?
4. Are the current insurance requirements sufficient (section 5 of the guidelines)? If not, how should they change?

3.5 Data and information

The guidelines require trialling organisations to provide certain data and information to the road transport agency:

- data and information about serious incidents (crashes or contraventions of law) (initial report within 24 hours, full report within seven days)
- information about other incidents (near-misses, human operator taking back control, public complaint) (monthly report)
- an end-of-trial report on research outcomes.

3.5.1 Incident reporting

The guidelines require data and information about serious incidents (defined as crashes or contraventions of law) and other incidents (defined as near-misses, human operator taking back control and public complaint).

Consistency of reporting requirements

For serious incidents, data must be provided in a form that can be easily read and interpreted by the road transport agency. The guidelines note that this data could include:

- time, date, location
- automation status (for example, automated system, human driver, transitioning)
- traffic conditions (for example, empty road, in heavy traffic)
- road and weather conditions
- vehicle information (speed, brake/throttle applications)
- sensor information in relation to other road users and the surrounding road environment
- the identity of the vehicle operator at the time of the incident.

Though this guidance is provided, we have heard from road transport agencies that there is little consistency in incident reporting. We are interested in views on whether the guidelines could be updated to assist with providing for further consistency in reporting and, if so, how.

Disengagements

Disengagements in vehicles without a human operator

In the NTC/Austrroads guidelines, incidents where a human operator takes back control from the ADS should be reported to the road transport agency monthly. This could be defined as a type of 'disengagement'. There is no equivalent requirement for reporting on disengagements in automated vehicles without a human driver.

In California, disengagements are defined as:

- where there is a human operator – deactivation of automated driving mode when a failure of the technology is detected or when the safe operation of the vehicle requires a human driver to take immediate manual control of the vehicle
- where there is no human operator – when the safety of the vehicle, the occupants of the vehicle or the public requires that the automated technology be deactivated.

We are likely to see trialling organisations wanting to trial vehicles without a human operator present as the technology develops. It may therefore be useful for the guidelines to specify a monthly reporting requirement for 'disengagements' in vehicles without a human operator as well. This section should be read in the context of the below section on comprehensive or public reporting on disengagements.

Comprehensive or public reporting on disengagements

We are aware that road transport agencies may be interested in aligning reporting requirements on disengagements with the approach in other jurisdictions. Canada requires reporting on any 'unplanned disengagements'. In California, trialling organisations must report annually on the amount of disengagements in a trial. These reports are made public. As noted above, the NTC/Austrroads guidelines include the disengagements concept in the definition of 'other incidents' that must be reported monthly; however, there is no prescriptive

requirement to publish data on each disengagement as is the case in California.²¹ We are also not aware if road transport agencies are enforcing this monthly reporting.

Public reporting on disengagements may provide a useful mechanism to engage the public with progress in automated vehicle trials. However, we are aware that trialling organisations in other countries have questioned the value of disengagements as an indication of an automated vehicle's safety, given the many reasons why the vehicle or the operator may disengage or choose to disengage. For example, disengagements may rise over time as vehicles are trialled in more complex environments, which is not necessarily an indication of a decrease in safety. As well, trialling organisations might trial vehicles in very different operating domains, and therefore disengagements have limited value as a tool to compare the safety records of trialling organisations against each other.²² We are also aware that disengagements may occur multiple times a day and may therefore lead to a greater burden on trialling organisations if more comprehensive reporting is required.

There may be other metrics that can be used for more comprehensive or public reporting on the progress being made in automated vehicle trials, which could potentially provide a more complete indication of safety across trials. For example, the Rand Corporation has published a framework that assesses various performance measures in different settings such as simulations, closed courses and public roads, with and without a human driver, at different stages of development, testing and deployment (Laura Fraade-Blanar, 2018). This complexity must, however, be balanced with the need for accessibility if this type of reporting is meant to be a useful tool for communication to the public. We are seeking views on disengagement reporting and whether the requirements in the guidelines are fit for purpose or if they should be updated.

Serious incidents

The guidelines define serious incidents as crashes or contraventions of law. International guidance similarly focuses reporting on crashes and existing reportable offences and, in some cases, disengagements.

The Victorian guidelines have a broader definition of a serious incident that also includes:

- theft or carjacking of an automated vehicle
- tampering with or unauthorised modifications of an automated vehicle
- failure of an automated vehicle that would impair the reliability, security or operation of the ADS.

The guidelines state that an initial report on a serious incident must be provided to the road transport agency within 24 hours, and a full report within seven days. We are interested in views about whether the definition of serious incident in guidelines, and hence the incidents subject to this reporting, remains appropriate.

3.5.2 Broader data recording requirements

The guidelines do not have data recording requirements that go beyond specifying the data that should be provided for serious incident reporting, as outlined in section 3.5.1.

²¹ For example, see 2019 disengagement reports:

https://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/disengagement_report_2019

²² For example, see relevant article here: <https://www.wired.com/story/how-self-driving-car-makers-measure-progress/>.

The first supply safety criteria for commercial deployment has a data recording and sharing obligation that requires the ADSE to explain how it will ensure:

- the vehicle has real-time monitoring of driving performance and incidents, including event data records in the lead-up to any crash that identifies which party was in control of the vehicle at the relevant time
- the vehicle can provide road agencies and insurers with crash data
- relevant parties (including police) receive information about the level of automation engaged at a point in time if required
- individuals receive data to dispute liability (for example, data showing which party was in control to defend road traffic infringements and dispute liability for crashes) when the individual makes a reasonable request
- data is provided in a standardised, readable and accessible format when relevant
- data is retained to the extent necessary to provide it to relevant parties (the amount of time data is retained may depend on the purpose(s) the information could be used for – for example, law enforcement, insurance)
- data relevant to the enforcement of road traffic laws and the general safe operation of the ADS (including data relevant to crashes) is stored in Australia. This does not require the applicant to store the data exclusively in Australia.

Many jurisdictions have only high-level data recording requirements. However, there are some that have more comprehensive guidance and requirements. Singapore places requirements on what data should be recorded, including geolocation, speed, status of vehicle (whether operating manually or in autonomous mode), operator override history, sensor data and camera/video footage. The UK has very prescriptive recommendations for the minimum data that should be recorded (outlined below).

UK code of practice: Automated vehicle trialling²³

Data recording

Vehicle trials will typically generate a large amount of data. It is recommended that data recorders should record, at a minimum at 10Hz, the following information:

- Details of the automated system i.e. software version, hardware specifications;
- Whether the vehicle is operating in manual or automated mode;
- Longitudinal acceleration in the vehicle's direction of travel;
- Lateral acceleration when the vehicle moves sideways;
- Vertical acceleration when the vehicle mounts a kerb, central island, speed hump or other object which causes the vehicle to rise;
- Vehicle speed;
- Steering command and activation;
- Braking command and activation;

²³ Centre for Connected & Autonomous Vehicles (Feb 2019)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776511/code-of-practice-automated-vehicle-trialling.pdf p 19.

- Operation of the vehicle's lights and indicators;
- (If applicable) Operation of the vehicle's ignition;
- Geo-location;
- Connectivity, network access, and latency;
- Use of the vehicle's audible warning system (for example a horn);
- Sensor data concerning the presence of other road users or objects in the vehicle's vicinity;
- Remote commands which influence the vehicle's movement (if applicable); and
- Any intervention made by the safety driver or safety operator, including the time of such intervention.

Nevada specifies the crash data that should be recorded. The vehicle must record sensor data for at least 30 seconds before a collision occurs between the autonomous vehicle and another vehicle, object or natural person while the vehicle is operating in autonomous mode. This data must be captured and stored in a read-only format so the data is retained until extracted by an external device capable of downloading and storing the data. The data must be preserved for three years after the date of the collision.

We consider the guidelines strike a balance between high-level guidance and prescription in relation to incident reporting by stating the information that should be reported to the road transport agency but not explicitly stating types of data that should be recorded. We consider prescriptive requirements about the data that must be recorded such as those in the UK may not be necessary for road transport agencies in terms of the information they need to ensure safety of the trial.

However, it may be useful for the guidelines to further align with the safety criteria for commercial deployment by having some basic requirements on trialling organisations to show how they will record relevant data. For example, they could specify that trialling organisations should be able to demonstrate:

- how they will record data relevant to serious incidents, including data records in the lead-up to a crash
- that they will be able to provide this data to road transport agencies, enforcement agencies, insurers and individuals who want to dispute liability
- that data will be retained as long as necessary to provide it to the above parties
- that data will be provided in an accessible format to the road transport agency.

At this stage we are not suggesting an explicit timeframe for sensor recording before a crash as required in Nevada because this would go further than the first supply safety criteria agreed by ministers.

3.5.3 Reporting on trial outcomes

The guidelines state that trialling organisations must provide an end-of-trial report on research outcomes. This would be a high-level summary and would not need to include commercially sensitive information. There is no further information about what should be included.

Sweden and Victoria explicitly require an end-of-trial report, and in New Zealand and Canada end-of-trial reporting is encouraged. There is no guidance about what should be

included in these reports. The other jurisdictions audited do not have an explicit requirement to report on trial outcomes at the end of a trial.

The Victorian guidelines specify the trial outcomes that an end-of-trial report might include:

- what worked well
- what went wrong
- what was learnt
- community concerns about the trial
- road infrastructure issues
- road environment issues
- public complaints or other community issues regarding the trial.

We consider it useful for the guidelines to provide this type of guidance about what could be included in an end-of-trial report. This would give trialling organisations direction about the matters the report should cover without imposing extra burden. It would also give road transport agencies a clear and consistent overview of trial outcomes and learnings in their jurisdiction, which should help to inform further trial approval decisions. This consistency may also aid road transport agencies to develop their own, more consistent government reporting across states and territories.

Question

5. Should the guidelines be updated to improve the provision of relevant data and information (section 6 of the guidelines)? Consider in particular:
 - serious and other incidents, including:
 - consistency of reporting requirements
 - disengagements
 - definition of a serious incident
 - broader data recording requirements
 - research outcomes and end-of-trial reports.

3.6 Additional information for trialling organisations in the guidelines

The guidelines provide useful background information for trialling organisations as well as the guidelines themselves. For example, they contain information about vehicle and driver regulation in Australia, trials that do and do not require an exemption or permit, other relevant Australian laws, and contact details for relevant Commonwealth and state and territory government agencies.

Some stakeholders have suggested the guidelines could provide further useful information to enable them to be used as a 'one-stop shop' for national information on trials. For example, stakeholders noted confusion about the complete process of initiating a trial – from importation to operation. Although the guidelines are only meant to be used at the trial application stage as a reference document for organisations looking to trial in Australia, it may be useful to include more information about the full process in the guidelines.

The Victorian guidelines are contained within a Gazette notice²⁴ that also includes relevant detail for trial applicants such as definitions, detailed information about trialling organisations' other potential legislative obligations, and information about the application process.

We also heard that it might be useful for there to be a repository of all state and territory trial requirements. We agree that this would be useful; however, this information may also date quickly. States and territories also place differing requirements on trials depending on the level of risk involved. The guidelines could, however, include some basic references to enacted state and territory automated vehicle trial legislation or any road transport agency webpages that outline trial requirements.

Now that a number of trials have taken place, the guidelines could also provide basic information or examples of trials to date, or reference the Austroads website, which sets out all past and current trials (mentioned in chapter 1).

Question

6. Is there any additional information the guidelines should include for trialling organisations?

²⁴ (Victorian Guidelines for Trials of Automated Vehicles, 2018)

4 Application of the guidelines

Key points

- The guidelines apply to automated vehicles that require an exemption or permit from state and territory road and traffic rules and that will be trialled on public roads.
- Organisations involved in trials of other types of technology or trials that operate in other domains may also find the guidelines useful to ensure they are appropriately managing all risks associated with their trials.

4.1 Overview

The guidelines state that ‘prior to commencing an automated vehicle trial, a trialling organisation should contact the relevant road transport agency to determine if any exemptions or permits to test on roads are required’.²⁵

As such the guidelines contemplate the testing of automated vehicles:

- that *require an exemption or a permit* (because they do not meet vehicle standards, road rules or traffic laws)
- to operate on public roads.

The guidelines do not specifically address:

- trials conducted on private land or on road-related or non-road-related areas
- trials of SAE level 1 and level 2 with innovative technologies²⁶ (which do not require an exemption or permit).

In the NTC’s November 2016 policy paper *Regulatory reforms for automated road vehicles*, we noted that the ‘national guidelines could support trials with any level of automated driving. However, the primary objective of the trials should be to establish nationally-consistent criteria to assess on-road trial applications for highly and fully automated vehicles’ (National Transport Commission, 2017).

The guidelines state that where a trialling organisation does not require an exemption or a permit, the organisation is still encouraged to follow the guidelines.²⁷ Anecdotally, we are aware of road transport agencies recommending using the guidelines for trials of technology that may not require an exemption or permit (for example, automated tractors on private land).

²⁵ Paragraph 2.1

²⁶ The Society of Automotive Engineers International defines six levels of driving automation from level 0 (no automation) to level 5 (full vehicle autonomy). Levels 3–5 vehicles are fitted with an ADS and are considered automated vehicles. When the ADS is operating, it is in control of the dynamic driving task instead of the human driver. Level 1 and 2 vehicles incorporate automated driver assistance systems, where the driver still remains in control of the vehicle while the automated features are operating (SAE International, 2018).

²⁷ Paragraph 2.3

The NTC is seeking feedback on whether the guidelines should be explicitly expanded to include other operating domains and technologies.

4.2 Operating domains

Automated vehicle trials are being carried out in Australian jurisdictions in a range of road, road-related and off-road environments.

Currently, trialling entities must demonstrate to the relevant road transport agency, during the process of applying for a permit or exemption, that they have addressed the criteria in the guidelines. The guidelines also provide a baseline for ongoing conditions that are applied to permits or exemptions for testing automated vehicles.

It may not always be clear when an exemption or a permit is required to carry out testing. For example, in environments such as university campuses and car parks, whether a permit or an exemption is required may depend on the level of public access to an area.

The guidelines are intended to establish minimum standards of safety. They also advise trialling organisations to set out how they intend to engage with public stakeholders including local government authorities, emergency services and law enforcement agencies before and during the trial. Trials that do not require a permit or an exemption (for example, a trial carried out on private land) may pose safety (and other) concerns that a trialling organisation may not have turned its mind to.

The guidelines are not mandatory rules. Where no exemption or permit is needed to trial an automated vehicle, there is no mechanism for road transport agencies to require the trialling organisation to demonstrate that it has addressed the guidelines. Thus, trialling entities may fail to consider the guidelines, and the safety (and other) benefits that are intended through applying the guidelines may not be achieved. However, even if the guidelines were applied to all operating domains, it would not be possible to enforce application if no permit or exemption is needed. Companies may still choose to use them to demonstrate that they are complying with best practice as part of satisfying requirements under other regimes such as occupational health and safety.

In the UK, no permit is required to trial any level of automated technology provided there is a driver or operator, in or out of the vehicle, ready to take control of the vehicle. The UK's *Code of Practice: Automated vehicle trialling* acknowledges this but goes on to state that '[f]ailure to follow the Code may be relevant to liability in any legal proceedings. Similarly, compliance with the expectations set by the Code does not guarantee immunity from liability in such circumstances'.²⁸ The UK code of practice also notes that '[i]t has not been developed with a view to ... trials and pilots carried out on private test tracks or other areas not accessible by the public. Those undertaking such trials are nonetheless encouraged to consider whether the guidelines may be relevant'.²⁹

²⁸ Para 1.5.

²⁹ Para 1.10.

4.3 Technology applications

4.3.1 Small automated vehicles

Other technologies that are being trialled in Australia and internationally include small automated vehicles (SAVs), which are used to make deliveries mainly on footpaths and other road-related areas. For example, Australia Post conducted a trial of SAVs to deliver packages to customers' doors in Brisbane in 2017 (Crozier, 2018). SAVs are an immediate example of emerging automated vehicle applications that may not be subject to the licensing/registration requirements that apply to conventional vehicles across all states and territories.

After the release of the guidelines, the NTC became aware that some organisations wishing to trial SAVs on footpaths and other road-related areas have used the guidelines as the basis for their applications for a permit. Relevant road transport agencies have taken the approach of treating the SAVs as a vehicle and applied conditions to address local safety risks via a permit.

The NTC currently recommends that road authorities use the guidelines to assess applications for automated vehicles trials on footpaths or other road-related areas. We committed to considering whether the guidelines should explicitly refer SAV trials in the first review of the guidelines.

Internationally, there are examples of commercial deployments of SAVs. For example, as mentioned previously, Arizona and California authorise the operation of SAVs on footpaths and pedestrian crossings.

4.3.2 Autonomous pods

In 2017, South Australia trialled a driverless cargo pod designed for short passenger or freight journeys, such as within industrial sites, residential communities or airports, at low speed of around 8 km/hour (Government of South Australia – Department of Planning, Transport and Infrastructure, 2017).

As noted in section 2.3.1 of this paper, the UK has been trialling autonomous pods that carry up to four passengers on footpaths as a first/last mile transport solution. Autonomous pods (pods that carry up to four passengers or cargo) are another example of an emerging technology that may not fit well within conventional road transport legislation. They are not personal mobility devices, which are typically designed to carry one person over short to medium distances. Their potential use includes operation on footpaths and private land, rather than public roads. There may therefore be no requirement for a permit or an exemption from road authorities.

The UK code of practice specifically brings 'a wide range of road vehicles, from new types of road vehicles such as smaller automated pods and shuttles, through to more conventional vehicle types such as passenger, goods, and public service vehicles' within the scope of the code.³⁰

As noted in the preceding discussion, the guidelines are intended to establish minimum standards of safety. They also encourage trialling organisations to think about how they intend to engage with relevant public stakeholders. However, because the guidelines are not

³⁰ Paragraph 1.9, UK code of practice

mandatory rules, it would be difficult to enforce application if no permit or exemption is needed. However, the guidelines could nevertheless recommend (or encourage) compliance with the guidelines.

4.3.3 SAE level 1 and level 2 vehicles with advanced driver assistance technologies

The guidelines generally apply to automated vehicles – those with conditional, high or full automation (SAE levels 3–5 – see footnote 26). Trials of SAE level 1 and 2 vehicles fitted with advanced driver assistance technologies such as cooperative intelligent transport systems (C-ITS) are also underway across Australia. C-ITS systems generally do not interact with the vehicle’s dynamic driving system and operate at levels 1 and 2 automation. However, one exception, cooperative adaptive cruise control (CACC), is currently used for vehicle platooning. This system, which operates at level 1 within a lead vehicle, can create functionality in the following vehicles of the platoon that is up to level 4 automation.

Organisations trialling level 1 and 2 vehicles fitted with advanced driver assistance technologies such as CACC that can affect the dynamic driving task in some way may benefit from considering the guidelines to ensure appropriate safety management processes are in place.

Questions:

7. Should the guidelines apply to any other emerging technologies (discussed in chapter 4 or other technologies) and operating domains?

4.4 Heavy vehicles

The guidelines apply to both light and heavy automated vehicle trials. To date there have not been many trials involving automated heavy vehicles in Australia. New South Wales is currently trialling heavy vehicle safety applications using C-ITS (Transport for New South Wales, 2020).

As mentioned in section 2.3 of this paper, international jurisdictions have been trialling heavy vehicle truck platooning.

Heavy vehicles present different risks to public safety and infrastructure than light vehicles. For instance, because of their larger size and mass, they may pose a higher risk in a crash. Also, unlike light vehicles that are regulated by state and territory legislation, heavy vehicles are regulated under the National Heavy Vehicle Law by the National Heavy Vehicle Regulator.

When the guidelines were developed in 2017, the NTC acknowledged these differences and noted that particular matters and criteria relevant to the trials of the heavy vehicles will be included in the national guidelines. The guidelines state (in section 2.5) ‘[t]rialling organisations may need to consider and include additional mitigation factors in their safety management plan to address any additional risk posed by their heavy vehicle trial. This may include consideration of network access, community consultation and engagement’. Thus, the guidelines allow jurisdictions the flexibility to require trialling organisations to consider more specific issues that may be of more relevance to heavy vehicle trials (for instance infrastructure and route selection issues) without being prescriptive of the requirements.

Question

8. Are there any additional criteria or additional matters relevant to the trials of automated heavy vehicles that should be included in the guidelines?

4.5 Large trials

There have not yet been any trials of larger numbers of automated vehicles in Australia. We are aware, however, that there may be interest in larger trials in the future. Large trials of automated vehicles are already taking place in other countries, in particular the US.

The guidelines do not restrict the number of automated vehicles allowed in a trial. They state that the number of vehicles that will be approved to trial will be determined by the road transport agency based on how the trialling organisation satisfies the relevant criteria. This will include how traffic risks will be managed under the traffic management plan.

This should also be balanced with the intention that the guidelines do not support broad, commercial deployment of automated vehicles – this should fall under the forthcoming safety assurance system for the commercial deployment of automated vehicles.

We are aware that there may be practical barriers to larger trials. Under the *Motor Vehicle Standards Act 1989* (MVSA), applications to import trial vehicles typically involve no more than one to three vehicles of a type (this is discussed in chapter 6). So far, no trialling organisation has applied to the Commonwealth to import a larger number of automated vehicles for a trial.

We consider the guidelines should continue to allow large trials. Larger trials will be an important step between small trials and commercial deployment, where automated vehicles will have access to the whole road network. It will give trialling organisations the opportunity to test things like: software and machine learning; how a vehicle operates across different environments and different sets of state and territory road rules; mapping; operating centres; and maintenance services. These types of learnings will not be gained from small trials of one to two vehicles, as we have seen in Australia so far.

Questions

9. Are there currently any regulatory or other barriers to running larger trials? If so, how should these barriers be addressed? (Consider the guidelines, state and territory exemption and permit schemes, and Commonwealth importation processes.)

4.6 Commercial passenger services

The guidelines allow automated vehicles to be commercial in nature – for example, offering a ridesharing service for a fee. However, in some states and territories there may be legislative barriers to this occurring, such as requirements for passenger services to have a driver. Or there may be different standards that must apply generally because the vehicles are taking passengers, such as compliance with disability standards and standards for the level of service provided.

In the Phoenix Easy Valley area in Arizona, Waymo LLC is operating a commercial ride-hailing service called Waymo One, where riders can order and pay for their automated

vehicle journey via an app. By way of contrast, in California, four companies (including Waymo) have been given permission to provide on-demand passenger services in automated vehicle trials on the condition that they do not accept monetary compensation for those services.

We consider the guidelines should continue to allow commercial passenger services in trials. This will help trialling organisations to determine whether commercial business models might be viable in any future deployment.

Question

10. Should the guidelines continue to allow commercial passenger services in automated vehicle trials? If so, should the guidelines reference additional criteria that trialling organisations should be subject to, and what should these criteria be?

5 Administrative processes and harmonisation

Key points

- States and territories have developed different administrative processes for the application and approval of trials.
- Some states and territories are seen as having more streamlined systems than others.
- There are practical barriers to running cross-border trials in Australia.

5.1 Overview

The guidelines focus on the substance of trial conditions, rather than the form in which applicants seek an approval for an on-road trial of an automated vehicle. In the 2017 policy paper, we specifically noted that administrative processes to approve a trial were out of scope of the guidelines.

Different processes for approving automated vehicle trials have now developed in every state and territory. We have heard from stakeholders that they have found the application process easier to navigate in some jurisdictions than others. We are also aware that different application and approval processes could affect the facilitation of cross-border trials.

The national guidelines were intended to provide some national consistency for trialling organisations in the conditions they would be expected to meet to run a trial. Divergence in administrative processes could in itself result in material differences in trialling organisations' expectations of how to run a trial in Australia.

5.2 Administrative processes for trial applications

5.2.1 Application and approval processes

Our targeted consultation revealed that very different application and approval processes have developed across states and territories. Some states and territories were said to have more streamlined approvals processes than others, in particular when it came to having all the right people in the room to discuss an application (discussed further in section 5.2.2). This varied also according to whether there was need for ministerial approval for the trial, and how great the level of risk to public safety was.

Another key concern was the iterative nature of the application process. All trialling organisations we spoke with found the process involved repeated back and forth with state and territory road transport agencies on the content of submitted documents, without a clear understanding of the required standard of documentation at the beginning of the process. This may be somewhat helped by addressing some of the issues discussed in chapter 3 and also as road transport agencies become more experienced in assessing applications. However, while an iterative process can be useful in that it means organisations are working closely together, stakeholders identified the extent of back and forth in some jurisdictions as a key area of frustration, adding considerable time and expense to their project plans.

Some organisations felt that templates might help, while other trialling organisations considered this may be overly prescriptive and inflexible. Some considered instead that example documents would be useful. Some considered that each state and territory should have an easy-to-follow checklist of trial application requirements. Some organisations noted that it may be useful to have a centralised repository of all state and territory requirements, or at least a reference to where they could be found.

5.2.2 Engagement with relevant decision-makers

Some trialling organisations noted the importance of having all relevant government decision-makers in the same room to discuss their trial applications. There were varying experiences of how easy it was to organise this depending on the state or territory involved.

There was feedback that the system in South Australia seems to work well. South Australia has an Automated Vehicles Trials Advisory Committee, which consists of key officers across the areas of safety, registration, regulation, risk and assurance, vehicle standards, legislation and legal, bus and rail operations, traffic services and other agencies such as South Australia Police and on occasion the South Australian CTP Insurance Regulator. The committee evaluates trial applications and acts as a 'one-stop shop', providing collective expertise to trial organisations and recommendations to the minister to approve trials.

The American Association of Motor Vehicle Administrators recommends that jurisdictions should establish a committee to develop strategies for addressing the testing and deployment of automated vehicles in their jurisdiction, though it does not specify that this committee should have responsibility for trial approvals, only that it should be informed of applications for trials and the relevant agency's response. The committee should include representatives from (among others) the governor's or chief executive's office, motor vehicle administration, the Department of Transportation, local law enforcement, the Office of Highway Safety, the Office of Information Technology, the insurance regulator, offices representing the ageing and disabled communities, toll authorities, transit authorities and local government (American Association of Motor Vehicle Administrators, 2018, p. 14).

We consider it may be useful for road transport agencies to assist trialling organisations by coordinating engagement with all relevant government bodies whose input will be necessary for approving a trial application. This could be through a formal body like a trial committee, or more informal means such as taking the lead in setting up joint meetings.

Question

11. What challenges have you faced with administrative processes when applying for approving trials of automated vehicles, and how could these be addressed?

5.3 Cross-border trials and harmonisation of processes

Once the regulatory framework for the commercial deployment of automated vehicles is operational, automated vehicles will have access to the entire road network. Cross-border trials will be an important step in ensuring that automated vehicles can manage road rule and infrastructure changes as they cross jurisdictional boundaries in Australia.

There have been no cross-border trials of automated vehicles to date. In our targeted consultation, some organisations mentioned that cross-border trials may be important in freight and platooning trials in the future. Consistency and avoiding duplication were seen as important requirements in being able to apply for cross-border trials.

The guidelines state that trialling organisations should nominate states and territories in an application if they intend to run trials in more than one state. However, though cross-border trials are possible, the administrative processes a trialling organisation would have to undertake would result in a cost and compliance burden that may act as a disincentive.

States and territories have their own permit and exemption mechanisms for trials, and though the guidelines support these mechanisms, they do not amend or replace them. States and territories do not have statutory authority to recognise an exemption from road rules or traffic laws authorised in another jurisdiction. Therefore, a trialling organisation would need to apply for an exemption or permit in each jurisdiction in which it intended to run a cross-border trial.

Canadian guidelines recommend that Canadian jurisdictions recognise a permit issued by another jurisdiction for the purpose of testing (Canadian Council of Motor Transport Administrators, 2018, p. 30). However, we are unaware of any jurisdictions that have implemented this recommendation.

In the 2016 discussion document we identified two potential mechanisms to better enable cross-border trials (National Transport Commission, 2016, p. 36):

- establishing a mutual recognition framework between states and territories to enable trials to operate across jurisdictional borders with a single application approved by one state or territory (for example, driver licensing)
 - this would require states and territories to establish legislative processes to recognise trial exemptions approved in other jurisdictions
- establishing a single national automated vehicle trial application framework and approvals process
 - this would require national or model legislation to create a single, nationally consistent exemption and application process.

The 2017 policy paper recommended that states and territories work together to ensure automated vehicle trials approved in other states and territories are recognised as appropriate within their jurisdiction.

Establishing a single national scheme would require significant legislative reform and coordination between states and territories. It might also mean that individual states and territories have less discretion over the trials they allow on their public roads. It would, however, ensure a clear, single application process for a cross-border trial while also resolving some of the inconsistencies in administrative processes outlined in the previous section.

A mutual recognition framework would require legislative reform and coordination between states and territories, but to a lesser extent. It would also result in a clear process for trialling organisations to apply for a cross-border trial without multiple trial applications. However, it could result in perverse outcomes, such as trialling organisations making applications in jurisdictions where they consider they might be approved more easily.

There may also be other, non-regulatory ways to facilitate cross-border trials. For example, applications for a cross-border trial could be made in all relevant states and territories, but each road transport agency could cooperate when assessing applications to ensure a consistent outcome.

Questions

12. Are there any other barriers to cross-border trials? Is there a need to change current arrangements for cross border trials?

6 Other automated vehicle trial issues outside the scope of the guidelines

Key points

- There are a number of issues relevant to automated vehicle trials that are of importance to trialling organisations and road transport agencies but that do not necessarily fit within the scope of the guidelines themselves.
- These issues include government evaluation frameworks and shared learnings, importation barriers and how trials would transition to commercial deployment.

6.1 Overview

There are a number of issues that affect trialling organisations and road transport agencies that are not within the scope of the guidelines themselves but are specifically designed for trialling organisations to prepare trial applications. We set them out here for completeness and to seek feedback. This feedback will be communicated to other agencies and may potentially lead to government action or recommendations to ministers but will not result in updates to the guidelines that are targeted at trialling organisations.

6.2 Government evaluation frameworks and shared learnings

Evaluation is an important part of completing any government initiative or decision. We are aware that some road transport agencies have frameworks for evaluating trials, assessing issues like infrastructure performance, community acceptance and approvals processes. We are also aware there may be government interest in having a more standardised evaluation framework across states and territories.

A standardised evaluation framework may facilitate shared learnings across states and territories. Shared learnings may aid road transport agencies in making decisions about new trials they approve and help to avoid duplication and overlap. For example, many trials have involved automated shuttle buses operating in limited operational domains, which are likely to have produced similar safety lessons. Shared learnings could also be useful to governments in their role as infrastructure providers as they prioritise infrastructure development to support automated vehicles.

Shared learnings will also be useful to the NTC and governments as we develop the regulatory safety frameworks for the commercial deployment of automated vehicles.

Related to this issue is how to treat commercially sensitive information. Trialling organisations will provide their own end-of-trial report on trial outcomes to the road transport agency (as noted in section 3.5.3). The guidelines state that where trial applicants provide commercially sensitive information, road transport agencies will respect the confidentiality of such information and the trialling organisation's intellectual property. Similar provisions about protecting confidential information are included in Singapore's legislation and the Canadian guidelines. We are interested in views on how such information should be handled if a government evaluation and shared learnings framework is developed.

Questions

13. Should there be a more standardised government evaluation framework for automated vehicle trials? If so, what are the trial issues that should be evaluated?
14. Should the results of evaluations be shared between states and territories? If so, how should commercially sensitive information be treated?

6.3 Importation process for automated vehicle trials

The guidelines apply to the application a trialling organisation makes to a state or territory road transport agency for a permit or exemption to run an automated vehicle trial. Prior to this, the trialling organisation will generally import their vehicle or vehicles into the country.

The importation process is administered by the Department of Infrastructure, Transport, Regional Development and Communications under the *Motor Vehicle Standards Act 1989* (Cth) (MVSA) and the *Motor Vehicle Standards Regulations 1989* (Cth). Stakeholders have told us that navigating the importation process can be challenging for trialling organisations.

6.3.1 Limits of import options

Automated vehicles, such as automated shuttle buses, do not currently comply with Australian Design Rules or have their own import option under the MVSA or the associated Regulations. However, they can be imported for trials through a discretionary approval import option or test and evaluation vehicle import option under the MVSA and Regulations.

It is legally possible to import a large number of automated vehicles, but these types of approvals are not intended to be for large-scale commercial deployments. It is expected that the number of vehicles of a type approved are restricted to the minimum number necessary for the trial – generally between one and three. It is likely that trialling organisations will eventually want to trial larger amounts of automated vehicles, as noted in section 4.5. We are yet to see how the importation framework under the MVSA would support this.

We have also heard that the lack of a specific import option for automated vehicles and the use of discretionary approvals means that there is a lack of predictability and consistency between approvals. We also understand that as a result of receiving approvals under the test and evaluation option, vehicles must be returned in four years' time or destroyed, which trialling organisations regard as a perverse outcome for vehicle trials.

The Department has advised that the Commonwealth's existing legislative framework provides a mechanism to assure the safety of vehicles at any level of automation being supplied to the Australian market for the first time. There are three import approval pathways:

- type approval for supply in unlimited numbers of 'standard' vehicles that fully meet all Australian Design Rules (including any for ADS) that apply to the vehicles
 - this pathway would best support the entry of automated vehicles on a commercial scale
- type approval for supply in unlimited numbers of 'non-standard' vehicles that meet a sufficient number of Australian Design Rules that apply for the vehicle to be considered suitable for use on public roads, where international standards or Australian Design Rules are not yet developed to take account of particular

technology, or the fitment of an advanced technology results in noncompliance with an applicable Australian Design Rule

- this would be the likely pathway to initially support large-scale trials for commercial viability, noting that states and territories may need to make registration for in-service use subject to conditions that mitigate risks of areas of non-compliance with the applicable Australian Design Rules
- concessional approvals – vehicle-by-vehicle approvals for vehicles that are not eligible for type approval but where granting an approval would not be inconsistent with the objects of the Motor Vehicle Standards Act
 - this is the pathway currently used to approve vehicles being used in existing technology trials.

6.3.2 Import application process

We are aware that the import approval process can be confusing for trialling organisations, particularly organisations using the process for the first time. Organisations have found the process lengthy, costly, confusing and not repeatable. This has led to many organisations paying other organisations to help navigate the application process, which adds another cost. Often trialling organisations are paying for storage of trial vehicles as the import application process progresses as well, further adding to costs.

One trialling organisation noted that challenges in the importation process had occurred in all four trials they had been involved in. The varying and unknown timelines made it particularly difficult when running 12-month projects. They considered a more stringent timeline with clearer steps would be more helpful, even if it was longer.

6.3.3 Taxes

Taxes such as the luxury car tax (LCT) and goods and services tax can also add to the costs of an automated vehicle trial. We are aware that the LCT in particular is seen as greatly increasing the cost of trials and that trialling organisations have found it a significant barrier to importing vehicles. The LCT is a tax on cars (of less than two tonnes and fewer than nine passengers) with a value above a threshold. It is imposed at the rate of 33 per cent on the amount above that threshold. This could add significant costs to import vehicles fitted with advanced sensor systems; for example, a LIDAR system could be \$70,000 on its own. We are aware the trialling organisations find the LCT a significant barrier to importing vehicles. Stakeholders have told us that the application of the LCT is unclear, with some trialling organisations having to pay it for automated shuttle buses, which they interpret as not being a 'car' for the purposes of the tax. The LCT will also be a greater burden should larger trials occur. While we note the feedback, taxation issues are beyond the scope of this work.

Question

15. What works well in the automated vehicle importation process, and what are the challenges?

6.4 Transition to commercial deployment

The guidelines and the associated state and territory exemption or permit processes are not intended to cover large-scale commercial deployments. As noted in chapter 1, the NTC and governments are continuing to develop the framework for commercial deployment of automated vehicles.

However, under the current trials framework, applications can be made for:

- trials of any type of automated vehicle technology
- trials of any size
- trials of a commercial or non-commercial nature
- trials across jurisdictional borders.

This is subject to the practical limitations discussed in other sections of this discussion paper. Resolving some of these issues may assist with running trials that are more like early deployments or where companies may want to be able to transition to a deployment in the future.

We have also sought to further align the guidelines with the first supply safety criteria to ease the eventual transition with the commercial deployment framework. The guidelines will be reviewed every two years, and we envisage further aligning the guidelines with the developing commercial deployment framework as part of these reviews.

We are seeking views on whether there are further actions that should be taken to facilitate the transition of trials to commercial deployment.

Question

16. Is there anything further that should be done to facilitate a transition from trial to commercial deployment?

17. Are there any matters that the NTC should consider in its review of the guidelines?

7 Conclusion and next steps

Key points

We are seeking submissions to this discussion paper by Friday 3 July 2020. Following the close of the consultation period we will develop a policy paper and updated guidelines for approval by transport and infrastructure ministers in November 2020.

7.1 Conclusion

The guidelines have been in use since May 2017. Through our targeted consultation we have learned that trialling organisations and road transport agencies have found them useful, particularly as a starting point to guide trialling organisations as they prepare their automated vehicle trial applications. We have also learned that there may be further detail that the guidelines could provide to assist trialling organisations and to provide some consistency in applications for road transport agencies. As well, we have learned that there are a number of differences in further trial requirements and application processes across states and territories, which has led to differing experiences in gaining approvals for trials.

In this discussion paper we have set out a number of potential updates to the guidelines that we consider could address these issues and benefit trialling organisations and road transport agencies. These potential updates include:

- Providing further detail in the guidelines about safety, traffic management and data and information requirements;
- further alignment with safety requirements that will be in place for automated vehicles at commercial deployment;
- clarifying the application of the guidelines to other technologies, operating domains and types of trials; and
- improving the efficiency of administrative processes at the point of application.

7.2 Next steps

We are seeking views from stakeholders on the consultation topics presented in this discussion paper and any other matters relevant to the guidelines and automated vehicle trials. The period for written submissions and other feedback will close on Friday 3 July 2020. Further information on providing a submission can be found on page 3.

During the consultation period we will undertake broader consultation with stakeholders. Following this, we will develop a policy paper and updated guidelines for the approval of transport and infrastructure ministers in November 2020.

Appendix A Safety criteria and obligations for the first supply of automated vehicles for commercial deployment

A1.1 Safety criteria

A1.1.1 Safe system design and validation process

The applicant must explain why it chose particular design, validation and verification processes, and how these ensure a safe technology is developed and maintained for the life of the automated driving system (ADS). The life of the ADS should be set by the applicant and represent the amount of time the applicant proposes to support the ADS, including by way of software upgrades. The applicant's design and verification processes should cover all safety-critical issues such as unsafe maintenance, repairs, physical modifications and other system failure, as well as the ADS reaching the end of its life and no longer being supported by the applicant. For example, the applicant could design the ADS to disengage (temporarily or permanently) or for back-up systems to take over where safety-critical issues arise or the system otherwise fails.

Where the ADS is supplied as an aftermarket device (rather than a device already fitted to the vehicle), compatibility (that is, the vehicle types the ADS can be fitted to) should be specified as an element of system design.

The applicant should document decisions relating to the choice of design, validation and verification processes and include empirical evidence or research to support the safety assertions made. Such documentation could explain why particular processes were chosen. Where applicable, the applicant should use guidance, industry best practices, design principles and standards developed by established standards organisations.

A1.1.2 Operational design domain

The applicant must identify the operational design domain (ODD) of the ADS and demonstrate how it will ensure the ADS is:

- able to operate safely within its defined ODD
- incapable of operating in areas outside of its defined ODD
- able to transition to a minimal risk condition when outside its defined ODD.

This could include documentation outlining the process for assessing and verifying the ADS's functionality both within and outside the defined ODD.

The applicant should also outline how it will review and manage changes to the defined ODD. Major changes to the ODD are likely to be significant modifications requiring the applicant to submit a new Statement of Compliance for approval before introducing the change into the market.

A1.1.3 Human-machine interface

The applicant must outline how the human-machine interface (HMI) will facilitate interaction between the ADS and relevant parties (both internal and external to the vehicle) that allows the vehicle to operate safely.

In relation to human drivers and occupants, elements of the HMI interaction link with the education and training criterion. The information communicated by the HMI should include, but is not limited to:

- communicating to the human driver when it is safe for the driver to engage the ADS
- informing the human driver if the ADS is engaged and the level of automation engaged
- requesting the human driver or fallback-ready user take back control of the vehicle with sufficient time for the human driver or fallback-ready user to respond, including in an emerging hazard situation. In addition, the applicant should outline the safeguards to ensure a fallback-ready user is actually ready to take back control. This could include monitoring by the ADS of human readiness to take back control and alert systems where such readiness is not apparent
- drawing attention to potential safety risks related to human monitoring and readiness to re-engage with the driving task
- informing vehicle occupants of the ADS's current and intended actions to allow occupants to predict vehicle behaviour
- indicating whether the ADS is functioning properly or experiencing a malfunction.

In relation to parties external to the vehicle, information such as the ADS's state of operation should be communicated by the HMI via an external communication interface. This could, for example, take the form of an external screen.

The applicant must also outline how it designed and verified the HMI and reference any appropriate international standards or agreed guidelines for HMIs.

A1.1.4 Compliance with relevant road traffic laws

The applicant must demonstrate how it will ensure the vehicle operates in compliance with relevant road traffic laws when the ADS is engaged. In particular, how the ADS will comply with:

- relevant road traffic laws, including any variations in each state and territory
- amendments to the relevant road traffic laws when they come into force.

This could include documentation outlining the process for assessing and verifying the ADS's compliance with relevant road traffic laws and the process for updating the ADS to comply with amendments to those laws.

The applicant must also demonstrate how the ADS will respond in a safe way where strict compliance with relevant road traffic laws is not possible. This requirement closely links with the on-road behavioural competency criterion.

A1.1.5 Interaction with enforcement and other emergency services

The applicant must demonstrate how it will ensure that police can access accurate information about whether the ADS is engaged at a given time, the level of automation engaged and any handover of control requests. The applicant should also demonstrate how it may facilitate access by police to this information in real time at the roadside.

The applicant must demonstrate how it will ensure safe interaction with emergency services (including but not limited to police, fire and ambulance services) more broadly when the ADS is engaged. This includes interactions on-road and at the roadside.

A1.1.6 Minimal risk condition

The applicant must demonstrate how the ADS will detect that it cannot operate safely and the steps the ADS will take to bring the vehicle to a minimal risk condition.

This could include documentation outlining the process for verifying the ability of the ADS to detect and respond to such circumstances. The steps the ADS must take to bring the vehicle to a minimal risk condition are likely to vary depending on the reason why the ADS cannot operate safely, other traffic and road users present, and on the level of automation engaged. Therefore, a range of approaches to bring the vehicle to a minimal risk condition may need to be considered.

A1.1.7 On-road behavioural competency

The applicant must demonstrate how the ADS will appropriately respond to foreseeable and unusual conditions that may affect its safe operation and interact in a predictable and safe way with other road users. This could include documentation outlining the process for verifying the ADS's:

- object and event detection and response capabilities
- crash avoidance capabilities
- ability to respond to unusual events within its ODD
- on road interaction with other road users, including vulnerable road users.

A1.1.8 Installation of system upgrades

The applicant must demonstrate how it will manage system upgrade risks. This includes ensuring safety-critical system upgrades to the ADS are installed and do not result in the operation of an unsafe ADS.

The applicant must explain how it will notify registered owners/operators that a safety-critical upgrade has been installed, or is available and needs to be installed. For such safety-critical upgrades, the applicant must also demonstrate how it will:

- detect failures to install upgrades (including failures of automatic updates, failures by registered owners/operators to take action when an upgrade is available or failures in receipt of over-the-air software updates)
- detect system failures once upgrades are installed
- ensure the ADS is safely disengaged if such failures occur.

This could include documentation outlining the process for verifying the ADS's ability to:

- update automatically and notify the registered owner/operator of the update
- notify the registered owner/operator of available system upgrades
- detect and respond to failures to install upgrades
- detect and respond to any system failures following the installation of upgrades.

A1.1.9 Verifying for the Australian road environment

The applicant must demonstrate how it has considered the Australian road environment in designing, developing and verifying the ADS, including its forward planning processes to ensure compliance with changes to the road environment (such as changes to road infrastructure).

This could include documentation outlining the process for verifying the response of the ADS to the Australian road environment such as interaction with road signs in various states and territories and interaction with Australian flora and fauna.

A1.1.10 Cybersecurity

The applicant must demonstrate:

- the capacity and competency of the ADS to minimise cybersecurity threats and vulnerabilities, including risks of cyber intrusion and other data security breaches
- the ADS's ability to detect and minimise the consequences of cyber intrusions and data security breaches that occur. Relevant consequences include those on road user safety and consequences for individual privacy following a data breach. One way to minimise negative effects on safety could be to include a manual override mechanism
- the applicant's processes for maintaining the ADS's capacity and competency to minimise cybersecurity threats, vulnerabilities and consequences of intrusions and breaches over the life of the ADS.

The applicant should refer to relevant legislation, industry standards and guidance for vehicle cybersecurity (domestic and international) and explain how it has incorporated these into its processes for designing, developing and maintaining the ADS.

A1.1.11 Education and training

The applicant must outline the education and training it will provide to relevant parties about its ADS and how this will minimise the safety risks of using and operating the ADS.

Education and training should consider different types of vehicles (including light and heavy vehicles) and different types of vehicle users. Without limiting the education and training to be provided, such education and training should consider:

- training human drivers and fallback-ready users to safely disengage and re-engage the ADS and the driving task
- informing human drivers of their obligations and responsibilities, particularly any fallback-ready user obligations
- informing consumers of the ADS's capabilities by clearly describing its automated capability, its level of automation, use limitations, restrictions on modifications and any restrictions of the automated technology such as the ODD
- facilitating the maintenance and repair of the ADS, including post-crash before it is put back in service
- facilitating employee, dealer and distributor understanding of the technology and operation so relevant information can be accurately conveyed to consumers and purchasers
- ongoing education as required, including education and training to end users who are not the original vehicle owner and to communicate the impact of upgrades.

The development of education and training should be well documented. Such documentation could explain the reasons for the education and training chosen and how it will facilitate proper and safe use of the applicant's ADS. The ADSE should also make use of best practice or standards.

A1.2 Obligations

A1.2.1 Data recording and sharing

The applicant must outline the ADS data it will record and how it will provide the data to relevant parties. Without limiting the data to be recorded and shared, the applicant must explain how it will ensure:

- the vehicle has real-time monitoring of driving performance and incidents, including event data records in the lead-up to any crash that identifies which party was in control of the vehicle at the relevant time
- the vehicle can provide road agencies and insurers with crash data
- relevant parties (including police) receive information about the level of automation engaged at a point in time if required
- individuals receive data to dispute liability (for example, data showing which party was in control to defend road traffic infringements and dispute liability for crashes) when the individual makes a reasonable request
- data is provided in a standardised, readable and accessible format when relevant
- data is retained to the extent necessary to provide it to relevant parties (the amount of time data is retained for may depend on the purpose(s) the information could be used for – for example, law enforcement, insurance)
- data relevant to the enforcement of road traffic laws and the general safe operation of the ADS (including data relevant to crashes) is stored in Australia. This does not require the applicant to store the data exclusively in Australia.

In responding to this criterion, the applicant should note that the Privacy Act 1988 places limits on the collection, use and disclosure of personal information, which may limit the data the applicant can record and share.

A1.2.2 Corporate presence in Australia

The applicant must provide evidence of its corporate presence in Australia.

A1.2.3 Minimum financial requirements

The applicant must provide evidence of its current financial position, its grounds for claiming it will have a strong financial position in the future and the level of insurance held.

Glossary

Term	Definition
Australian Design Rules	National standards for safety, anti-theft and emissions in vehicle design.
Australian Road Rules	National model law intended to provide the basis for nationally consistent road rules in each jurisdiction. These rules do not, by themselves, have any legal effect.
Austroroads	The peak organisation of Australasian road transport and traffic agencies.
Automated driving system (ADS)	The hardware and software collectively capable of performing the entire dynamic driving task on a sustained basis. It is a type of driving automation system used in vehicles with SAE levels 3, 4 or 5 of automation as established in standard SAE J3016 by the Society of Automotive Engineers International (SAE).
Automated Driving System Entity (ADSE)	The legal entity that certifies that the ADS can safely perform the driving task in place of a human driver in the framework for the commercial deployment of automated vehicles. The ADSE will self-nominate by seeking type approval for the ADS under the <i>Road Vehicle Standards Act 2018</i> (Cth).
Automated vehicles	A vehicle with conditional to full automation (SAE levels 3–5). It is a vehicle that has an automated driving system, which means that it is capable of performing the entire dynamic driving task on a sustained basis without human input. It is distinct from vehicles with automated features to assist a driver (SAE levels 1–2), which still require a human driver to perform part of the dynamic driving task.
Department of Infrastructure, Transport, Regional Development and Communications	Department of the Commonwealth government responsible for administering the <i>Road Vehicle Standards Act 2018</i> (Cth).
Dynamic driving task	All the operational and tactical functions required to operate a vehicle in on-road traffic. This includes steering, acceleration and deceleration, object and event detection and response, manoeuvre planning and enhancing conspicuity through lighting signalling, etc. The dynamic

	driving task excludes strategic functions like trip planning, such as where and when to travel and route selections
First supply	The market entry of motor vehicles to Australia.
Inservice	Vehicles supplied to the Australian market and are now in use.
<i>Motor Vehicle Standards Act 1989 (Cth)</i>	Commonwealth legislation to control the safety, environmental and anti-theft performance of all new and used vehicles entering the Australian market for the first time. The <i>Road Vehicle Standards Act 2018 (Cth)</i> replaces this Act.
Operational design domain (ODD)	The specific conditions under which a driving automation system or feature is designed to function (for example, locations, weather conditions, driving modes).
<i>Road Vehicle Standards Act 2018 (Cth)</i>	Commonwealth legislation to control the safety, environmental and anti-theft performance of all new and used vehicles entering the Australian market for the first time, and to set national road vehicle standards. It will replace the <i>Motor Vehicle Standards Act 1989 (Cth)</i> once fully commenced.
Society of Automotive Engineers (SAE)	A global professional association and standards-developing organisation for engineering professionals. It established the levels of vehicle automation in its technical document J3016.
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.

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