



National guidelines for automated vehicle trials
Discussion paper
November 2016



National Transport Commission



Report outline

Title	National guidelines for automated vehicle trials
Type of report	Discussion paper
Purpose	The purpose of this paper is to seek stakeholder feedback on options for national guidelines to support automated vehicle trials.
Abstract	<p>This discussion paper:</p> <ul style="list-style-type: none">• proposes key criteria for inclusion in national guidelines• identifies key issues for supporting trials based on a detailed comparison of trial frameworks in other jurisdictions both in Australia and internationally.
Submission details	<p>Submissions will be accepted until Monday 16 January 2017 online at www.ntc.gov.au or by mail to:</p> <p>Att: Automated Vehicle Team National Transport Commission Level 15/628 Bourke Street Melbourne VIC 3000</p>
Key words	automated vehicle, regulation, trials, vehicle standards, Australian Design Rules, Australian Road Rule, liability, insurance, privacy, security
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Executive summary

Automated vehicles offer potential long-term road safety benefits. On-road trials are necessary to ensure that automated driving systems can operate safely and efficiently in Australian conditions. However, the lack of a common approach from state and territory road transport agencies on how they will regulate and support trials of automated vehicles is creating uncertainty for industry and the risk of inconsistency between states and territories.

The development of national guidelines seeks to promote Australia as a test bed for automated vehicles, while ensuring public safety. National guidelines provide a more flexible mechanism than legislation to encourage innovation and help ensure that trialling organisations face similar trial conditions across Australia.

Why guidelines are needed

Highly or fully automated vehicles cannot legally operate on public roads due to existing legal barriers.¹ Organisations seeking to run automated vehicle trials will require state road agencies to provide exemptions from these legislative obligations. This could include exemptions from obligations in the Australian Road Rules or other state road transport legislation.

Road transport agencies also have a responsibility to ensure road safety. Agencies will seek to impose conditions on these exemptions to ensure safety, for example by limiting the roads on which the trial can be run or requiring a safety management plan to be developed.

There is a risk that different road agencies will set different conditions on the exemptions they provide for automated vehicle trials. Different conditions could add unnecessary cost for industry or potentially make cross-border trials impractical.

In November 2016, transport and infrastructure ministers asked the NTC to develop guidelines on automated vehicle trials. If adopted and applied by state road transport agencies, the guidelines will ensure a level of consistency in trial conditions across the country, whilst maintaining flexibility.

National guidelines are 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 states 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.

Key areas guidelines would cover

In supporting trials of automated vehicles, governments must ensure:

- that trials are safe, including ensuring that they are only run in appropriate conditions
- that trialling organisations are managing safety risks appropriately
- that trialling organisations can manage liability
- that any crashes can be appropriately investigated
- that trials may move across borders where appropriate.

In order to address these requirements, this discussion paper sets out a number of areas that guidelines could potentially cover, in particular:

- management of trials
- safety management plans
- insurance
- data and information
- cross-border issues

¹ The National Transport Commission (NTC) identified 716 legislative provisions that could be regulatory barriers to the use of more automated vehicles in Australia.

- heavy vehicles

Throughout the paper, the NTC has provided its preferred option for each issue as a starting point for discussion. Below is a summary of what the guidelines would cover, based on these preferred options.

Summary of key NTC proposals for guidelines for trials of automated vehicles

1. Application of guidelines

1.1 Where a trialling organisation requires an exemption to run an automated vehicle trial, the organisation must demonstrate that they have addressed each issue set out in the guidelines. The guidelines have:

- essential components that apply to every trial
- optional components that may be included at the discretion of the road transport agency, depending on the nature of the trial.

1.2 Where a trialling organisation does not require an exemption to operate, the organisation is still encouraged to follow the guidelines to ensure that their vehicles are operating safely.

2. Management of trials

2.1 Trialling organisations must propose a specific operational design domain, including the location(s) proposed for the trial.

2.2 Unless a specific exemption has been granted by the relevant road transport agency, trialling organisations must comply with all existing:

- road rules and traffic laws
- vehicle standards
- privacy and surveillance laws.

2.3 Trialling organisations should consider whether the trial requires them to:

- develop a traffic management plan
- inform road transport agencies of infrastructure or network requirements and how they will manage changes to infrastructure (such as roadworks)
- engage with the public and other stakeholders.

2.4 Road agencies may designate these as essential criteria depending on the nature of the trial.

3. Safety management plan

3.1 Trialling organisations must develop a safety management plan outlining all key safety risks for the trial and how they will be mitigated or eliminated. The safety management plan must be provided as part of the application and should include specific consideration of:

- security of the automated system
- appropriate system failure warnings for the vehicle
- appropriate transition processes for vehicles that can move between automated and manual driving modes
- whether a human driver will be in the vehicle
- any other relevant safety risks for the trial.

Note that a human driver will be required in the vehicle unless a specific exemption has been granted.

3.2 Safety management plans may also consider criteria such as:

- pre-trial testing of the vehicle at a test facility
- training for the driver or operator
- fitness for duty of drivers
- vehicle identifiers

Road agencies may designate these as essential criteria, depending on the nature of the trial.

4. Insurance

4.1 Trialling organisations must demonstrate that they have appropriate insurance.

5. Data and Information

5.1 Trialling organisations must collect and provide the appropriate road agency data on any crashes that occur as part of the trial.

5.2 Additional data provision could also include:

- ongoing data updates
- trial outcomes
- data on network operation and conditions.

Road agencies may designate these as essential criteria, depending on the nature of the trial.

Who we are

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

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

Consultation

This document has been developed for discussion with industry and government stakeholders; their feedback will inform the development of national guidelines for trialling of automated vehicles. In addition to requesting feedback on a preferred option we are also requesting feedback on a range of questions.

Question 1: Do you agree that national guidelines should provide the basis for conditions of an exemption? If not, why?

Question 2: How should road transport agencies use the guidelines in relation to exemptions?

Question 3: Should national guidelines take a safety management approach? If not, what other approach do you suggest?

Question 4: Are there additional criteria that should be included in the guidelines?

Question 5: Do you support the guidelines including prescribed insurance? If so, what kind of insurance should be prescribed?

Question 6: If trialling organisations are required to collect crash data and share it with road transport agencies, what data should be required?

Question 7: How should an automated vehicle 'incident' be defined? What data should be required for such incidents?

Question 8: How important is it that state and territory road transport agencies facilitate cross-border trials of automated vehicles? How could governments enable cross-border trials?

Question 9: Are there any unique issues for heavy vehicles that require special consideration in guidelines for automated vehicle trials?

1 Context

Key points

- On-road trials are necessary both to ensure that automated systems can operate safely in Australia and to build public understanding and confidence.
- National guidelines endorsed by all Australian governments provide an opportunity to ensure trial conditions and expectations are harmonised across jurisdictions.
- The National Transport Commission will submit proposed guidelines to the Transport and Infrastructure Council in May 2017.

Automated vehicles offer the possibility of fundamentally changing the transport task and society. Industry evaluation of automated vehicles through on-road field testing and trials is already happening in Australia. Government are actively encouraging and supporting trials. On-road trials of automated vehicles are necessary to ensure that automated systems can operate safely and efficiently in Australian conditions, and for building public understanding and confidence. Nationally-agreed trial conditions would provide certainty regarding the expectations of trials and simplify the application process.

1.1 Project objectives

Automotive manufacturers and technology developers are using trials to evaluate the safety and technology performance of automated vehicles in Australia. National guidelines provide an opportunity to ensure minimum standards of safety and infrastructure protection are agreed by state and territory road transport agencies.

This project aims to develop a single, nationally-agreed set of guidelines to support automated vehicle trials. This will support the implementation of standardised trial conditions by state and territory road transport agencies.

This discussion paper aims to:

- provide a comparative analysis of potential issues to implement safe trials and propose options to resolve these issues
- provide a comprehensive analysis of existing trial conditions developed in other jurisdictions, including the United Kingdom, New Zealand, Japan and the United States.

The National Transport Commission (NTC) is collaborating with Austroads to develop the national guidelines, in close consultation with government and industry. We are aiming to finalise national guidelines for the Transport and Infrastructure Council to consider in May 2017.

What is the problem?

Different approaches from state and territory road transport agencies to regulating trials of transport technology create uncertainty and cost for industry. Inconsistent or unclear trial requirements could deter industry from trialling in Australia and reduce the potential economic, environmental and safety benefits of the technology.

As part of allowing trials of automated vehicles, governments must ensure:

- that trials are safe, including ensuring that they are only run in appropriate conditions
- that trialling organisations are managing safety risks appropriately
- that trialling organisations can manage liability
- that any crashes can be appropriately investigated
- that trials may move across borders where appropriate.

In order to address these requirements, this discussion paper sets out a number of areas that guidelines could potentially cover, in particular:

- management of trials
- safety management plans

- insurance
- data and information
- cross-border issues
- heavy vehicles

Benefits of supporting automated vehicle trials

National guidelines would be an effective means by which to promote Australia as a test-bed for automated vehicles.

Guidelines would provide a more flexible mechanism than legislation to encourage innovation, whilst maintaining safety. Guidelines can accommodate a range of different automated vehicle technologies and applications. The risks for a trial of a single, low-speed, driverless shuttle on a set route, will be different from those for a trial of a fleet of heavy vehicles on high-speed motorways. The legal regime for trials needs to allow for these differences.

National guidelines could also facilitate collaborative research, support Australian competitiveness and reduce administrative costs.

If national guidelines are adopted and applied by all jurisdictions, trialling organisations will have similar trial conditions, regardless of which state or territory the trial is conducted in. This also facilitates cross-border trials. National guidelines could also allow greater information sharing, where appropriate, about trial and research outcomes between jurisdictions.

Project mandate

Following the discussion paper '*Regulatory options for automated vehicles*' (May 2016), the NTC developed a number of recommendations for the Transport and Infrastructure Council. Recommendation 1 was that the NTC and Austroads develop national guidelines for on-road field testing and trials of automated vehicles in Australia. In November 2016 the council approved this recommendation:

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

Lead agency: *The NTC, in partnership with Austroads*

Timeframes: *Early 2017 to May 2017*

Scope

We propose that the national guidelines focus on the substance of the trial conditions, rather than the form in which applicants would seek an approval for an on-road trial of an automated vehicle.

The Commonwealth Government can exempt new and imported vehicles from Australian Design Rules (ADRs), while the states and territories have exemption powers in relation to the road rules, traffic laws and in-service vehicle standards. At this stage, we do not propose that the national guidelines would impact on these exemption powers or that the process to develop national guidelines for automated vehicle trials would result in harmonised application or approvals processes. We are however seeking feedback on whether that should be a long-term aim for states and territories to achieve a single exemption process. **Table 1** sets out the proposed scope of national guidelines.

Table 1: proposed scope of the national guidelines for automated vehicle trials.

Proposed in scope of national guidelines
Conditions set by road transport agencies for an exemption, including: <ul style="list-style-type: none"> • management • safety • data and information sharing • insurance.
Proposed out of scope for national guidelines
The legal or administrative framework to support trials in each jurisdiction, including: <ul style="list-style-type: none"> • exemption powers • legislation to mutually recognise trials in other states or territories • administrative processes to approve a trial • application fees • additional matters based on local needs or the risk profile of the application.

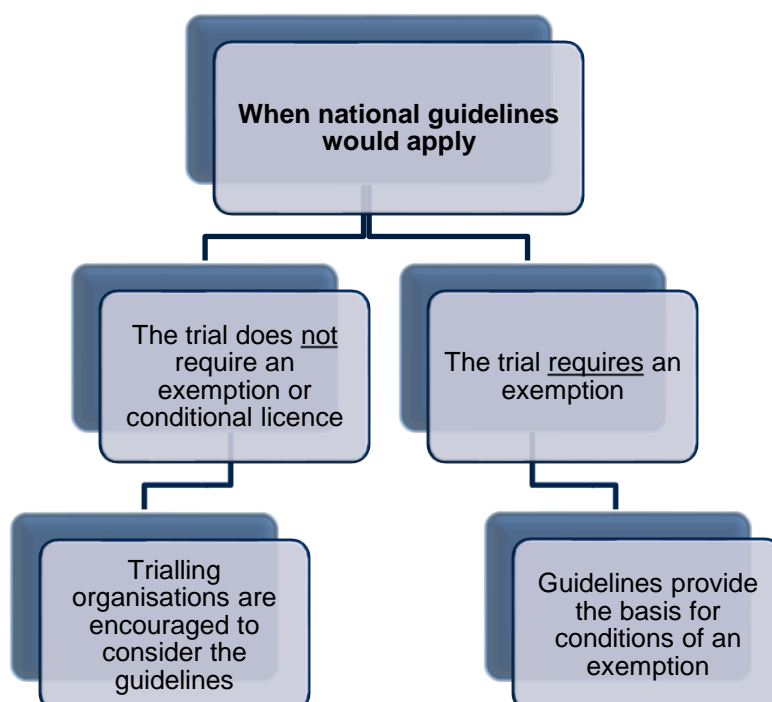
1.2 When would national guidelines apply?

If a proposed trial vehicle complies with existing vehicle standards, and is used in compliance with road rules and other traffic laws, it can operate on public roads without the need for an exemption or a conditional licence. Road transport agencies will have no mechanism to impose conditions on these vehicles and therefore be unable to compel trialling organisations to follow the guidelines. Trials of lower levels of automation would fall into this category.

In these instances trialling organisations would be encouraged to consider the criteria in the guidelines as a way of ensuring that they are operating safely on the road and as a point of reference for any discussions with road transport agencies. In addition, in the event of an incident involving the automated vehicle, compliance with the guidelines could be considered relevant in demonstrating that the trialling organisation took appropriate steps to ensure safety.

If an automated vehicle does not comply with the existing vehicles standards or road rules and traffic laws, it would require an exemption or conditional licence to operate on public roads. When an exemption or conditional licence is granted by road transport agencies, the guidelines would provide criteria, including a safety management plan. The guidelines would provide the conditions that road transport agencies would attach to an exemption or a conditional licence (see **Figure 1**).

Figure 1: Proposed application of the guidelines.



Question 1: Do you agree that national guidelines should provide the basis for conditions of an exemption? If not, why?

1.3 How would national guidelines be used as part of an exemption process?

If it is agreed that guidelines are used to provide the basis for conditions of an exemption with each matter to be addressed in a safety management approach, then there are three ways the guidelines could be used by road transport agencies:

1. All criteria discussed here form a catalogue that road transport agencies can select from and require trialling organisations to address. The catalogue of criteria would give road transport agencies a flexible approach that can be specifically tailored to the risks of each trial. However, this approach is less likely to result in national consistency.
2. All criteria discussed here are divided into agreed lists of 'essential' and 'optional'. In this case agencies can supplement the 'essential' list, which would always be addressed by trialling organisations, with additional criteria as appropriate. This would result in more national consistency than option 1, but also provide agencies with the ability to include further criteria to be addressed where necessary. The NTC's proposed guidelines in the executive summary illustrate this option.
3. All criteria must be addressed, and an assessment of whether or not each one constitutes a risk in the context of the trial that is proposed must be completed by trialling organisations. This would be the most consistent and thorough of the three options. However this approach could result in more administration for both trialling organisations and agencies. Such requirements could deter industry from trialling in Australia.

Notifying agencies about a trial and application processes will be dependent on whether an exemption is necessary. Where an exemption is not required, trialling organisations would still be encouraged to follow the guidelines. Based on feedback to date, the NTC proposes that the guidelines would set out essential and optional criteria, as per option 2 above.

Question 2: How should road transport agencies use the guidelines in relation to exemptions?

1.4 A safety management system approach

The NTC is proposing a safety management approach to trials, where the guidelines form the framework for a safety management plan. A safety management system approach is a co-regulatory, risk-based approach to identifying and managing safety risks.

Adopting a safety management system approach, trialling organisations would demonstrate to the relevant road transport agencies that they have identified safety risks and how those risks are to be managed. Under Australian rail safety and workplace health and safety law, operators, employers and other parties must ensure 'so far as is reasonably practicable' (SFAIRP) the safety of their operations. But other thresholds have been applied internationally that potentially result in a different threshold, the most common in work health and safety regimes being 'as low as reasonably practicable' (ALARP).

A safety management system approach enables road transport agencies to provide a clear pathway for the technology while ensuring the community is both protected and reassured of the safety of approved trials. A safety management system approach also supports innovation by allowing industry to determine the best way to manage risk. The disadvantages of a safety management system approach are that:

- without agreed standards for automated vehicles, the road transport agencies may not be able to test or validate the safety management system
- they can make applications more complex and expensive to prepare;
- they may require more follow-up and audits by the road transport agencies.

Ensuring the safe operation of vehicles involved in on-road trials will be a primary objective of trial participants, and road transport agencies. Trialling organisations would need to demonstrate to road transport agencies how their vehicle can be safely used on the road and how the safety of other road users and the general public will be assured against the conditions of the exemption. In addition, trialling organisations will need to demonstrate how they will manage any potential impact on road infrastructure and public amenity.

Question 3: Should national guidelines take a safety management approach? If not, what other approach do you suggest?

2 Consultation

Key points

- Any individual or organisation can make a submission to the NTC.
- We are seeking submissions on this discussion paper by **Monday 16 January 2017**.

Your feedback will inform the development of national guidelines for the trial of automated vehicles. Your views on this paper will therefore be essential and we encourage you to make a submission.

2.1 Background

The NTC published a discussion paper in May 2016 – ‘*Regulatory options for automated vehicles*’ (NTC, 2016) – which examined the legislative barriers to increasing vehicle automation and proposed potential options to address these barriers. The NTC received 51 submissions in response to the discussion paper, including submissions from road transport agencies, vehicle manufacturers, technology providers and insurers.

The discussion paper proposed that in the short term, national guidelines for trials of automated vehicles should be developed. Government and industry stakeholders strongly supported the development of national guidelines for automated vehicle trials.

2.2 Project method

This document has been developed for discussion with industry and government stakeholders. It is based on a comparative analysis of existing trial conditions developed in other jurisdictions, including the United Kingdom, New Zealand, Japan and the United States. They provide a baseline and point of contrast when thinking about what conditions or requirements road transport agencies need in Australia.

Nine existing guidelines, codes or legislative schemes were compared.² These were:

- **New Zealand** – *Testing Autonomous Vehicles in New Zealand* (NZ Ministry of Transport , 2016)
- **Japan** – *Guidelines for Public Road Testing of Automated Driving Systems* (Japan, National Police Agency, 2016)
- **United Kingdom** – *Code of Practice for testing* (UK Department of Transport, 2015) (“the UK Code”)
- **Florida** – *Laws of Florida Ch. 2016-239* (State of Florida, Department of State, 2016)
- **Nevada** – *Nevada Administrative Code Chapter 482A – Autonomous Vehicles* (State of Nevada: Department of Motor Vehicles , 2016)
- **South Australia** – *Motor Vehicles (Trials of Automotive Technologies) Amendment Act 2016* and supplementary advice on the department’s website (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016)
- **Victoria** – the UK code, with a Schedule of Amendments (VicRoads, 2016)
- **Western Australia mining** – *Code of Practice: Safe mobile autonomous mining in Western Australia* (Government of Western Australia: Department of Mines and Petroleum, 2015)
- **SAE International Standard** – *SAE J3018: Guidelines of Safe On-Road Testing of SAE Level 3, 4 and 5 Prototype Automated Driving Systems (ADS)* (SAE International, 2016).

² The NTC has prepared a comparative analysis of each scheme. This analysis is available on request.

Key terms used in this paper

Levels of automation referred to throughout this paper are based on the SAE International Standard J3016 (SAE International, 2016):

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

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

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

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

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

How to make a submission

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

To make an online submission, please visit www.ntc.gov.au and select 'Submissions' from the top navigation menu.

Alternatively, you can mail your comments to:

Att: Automated Vehicle Team
National Transport Commission
Level 15/628 Bourke Street
Melbourne VIC 3000
Australia

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

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

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

When to submit

We are seeking submissions on this discussion paper by **Monday 16 January 2017**.

Next steps

Based on the feedback received in submissions, the NTC will develop guidelines for ministers to consider at their May 2017 Transport and Infrastructure Council meeting. If ministers endorse the guidelines, state and territory and government will then need to adopt the guidelines in their jurisdiction.

3 Management of trials

Key points

- Road agencies will seek to ensure appropriate management of trials, for example by limiting access to certain parts of the road network or requiring a traffic management plan.
- Trial management could include trial vehicle compliance with existing road rules and traffic laws, vehicle standards (where there is not an exemption in place) and privacy laws and principles.

The safe management of automated vehicle trials by trialling organisations and by road transport agencies will play a key role in ensuring the safe on-road testing of automated systems. This chapter discusses what aspects of managing automated vehicle trials could be included in national guidelines and explores existing solutions from other jurisdictions that could be adopted within Australia.

3.1 Should trials be allowed anywhere on the road network?

One of the most significant restrictions road transport agencies could impose on automated vehicle trials is limiting network access. Restricting automated vehicles' access to the road network is unlikely to be warranted where vehicles do not require an exemption or a conditional licence. It will likely to be an issue for vehicles requiring an exemption as these vehicles may only be capable of driving on certain roads.

Some existing codes and guidelines do not specifically restrict where a trial can be undertaken, thereby allowing trials to take place anywhere on the road network. For example, in New Zealand, the UK, Japan, Victoria, and Florida, if a trial vehicle complies with existing road rules, a trial can take place anywhere on the network.

Some jurisdictions, however, require the locations or areas where the trials are to be undertaken to be specified in the exemption or authorisation process. In Nevada the location of the trial is a critical issue to be approved as part of the application process (State of Nevada: Department of Motor Vehicles , 2016). On approval, a certificate identifying the authorised geographic locations is provided and is required to be carried in the vehicle at all times (State of Nevada: Department of Motor Vehicles , 2016). The South Australian legislation states (s. 134D) that 'an authorisation notice must specify the area or areas of the State in which the trial may be undertaken' (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016).

Where a vehicle does not require an exemption there is no power for road transport agencies to limit access to the road network. An agency could only enforce such a limitation where it was a condition of an exemption.

The NTC is seeking feedback on whether providing the trial location should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include reference to trial location.
2. Guidelines include providing the trial locations as an option for road transport agencies to add.
3. Guidelines require trialling organisations to propose trial locations as part of their application.

Trial vehicles will likely only be able to operate safely on limited areas of the network. The safety of the road network is the priority of road transport agencies. The location of trials should be known to road transport agencies when granting an exemption.

For these reasons the NTC supports option 3.

3.2 Should trials require a traffic management plan?

Preparation of a detailed traffic management plan and implementation of controlling measures could help ensure the safety of all road users and the general public and minimise disruption to other road users. A traffic management plan may also assist in assuring the smooth operation of the testing vehicle on the road network.

A traffic management plan was used in Western Australia as part of the Royal Automobile Club of Western Australia trial of a Navya shuttle (Royal Automobile Club of WA, 2016). A traffic management plan helps inform the road transport agencies of the trials anticipated traffic risks and mitigating actions in place. Western Australia's autonomous mining code of practice states that 'to achieve the desired safety outcomes, the design and function of operational practices should adequately address traffic management and associated procedures to govern interactions between autonomous equipment, manned equipment and pedestrians' (Government of Western Australia: Department of Mines and Petroleum, 2015).

The NTC is seeking feedback on whether the development of a traffic management plan should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include a traffic management plan.
2. Guidelines include a traffic management plan as an option for road transport agencies to add.
3. Guidelines include a traffic management plan as an essential criterion for any trial.

While a traffic management plan may not always be necessary, it is an effective tool for managing trials and would complement the safety management approach.

For these reasons the NTC supports option 2.

3.3 How should trials manage infrastructure and network requirements?

Understanding infrastructure and network requirements to support on-road trials is important in order to allow road transport agencies to prepare for and support the trial appropriately. Agencies are likely to have limited capacity and budget to provide major infrastructure support, but it is possible that through engagement with trialling organisations some assistance could be provided or an agreement reached as to how changes to infrastructure will be managed.

There are also benefits in a road agency understanding a vehicle's Operational Design Domain (ODD) and the infrastructure requirements to operate in an automated driving mode. This would not require road or transport agencies to manage infrastructure differently but it would be important to understand when assessing safety.

The UK code states (at 3.7) that 'any specific infrastructure requirements that are considered necessary to support testing, including traffic signing, will need to be agreed with the appropriate authorities responsible for the roads' (UK Department of Transport, 2015). Victoria has replicated this section.

In Japan, notifying the relevant bodies especially in relation to the road network and infrastructure is specified in the guidelines (Japan, National Police Agency, 2016). The guidelines state that notification should be made well in advance of the trial commencing. Trialling organisations should also 'seek advice' in relation to traffic accidents or congestion, any scheduled road construction work or the environment and structure of the roads in the location where the trial will be conducted (Japan, National Police Agency, 2016).

The network requirements and road environment are also given detailed consideration in the SAE International guidelines, though contacting agencies to source this information or share requirements is not mentioned (SAE International, 2016). In the guidelines on South Australia's website 'information on expected performance and other requirements from road infrastructure (if any)' is one of the specified minimum requirements of an application (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016).

The NTC is seeking feedback on whether infrastructure and network requirements should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not reference infrastructure requirements.
2. Guidelines include notification of infrastructure requirements as an option for road transport agencies to add.
3. Guidelines require trial applicants to notify road transport agencies of infrastructure requirements.

It is likely that road transport agencies will have limited resources to support trials, so major infrastructure additions are unlikely. However, knowledge of requirements is useful in assessing safety. Road transport agencies could provide support in some trials or assistance in managing any changes to infrastructure (such as roadworks) during the course of a trial.

For these reasons the NTC supports option 2.

3.4 Should trialling organisations document what is being trialled?

Understanding the automated vehicle technology being trialled is likely to support coordinated and cooperative research, minimise potential safety and network risks and inform future policy decisions. However, such additional requirements could also increase the administrative work for road transport agencies and trialling organisations. Trialling organisations may also be reluctant to reveal elements of the technology being trialled for intellectual property or commercial competition reasons.

In Victoria, in the case of a fully automated vehicle, trialling organisations need to contact VicRoads and provide information about the test vehicle, the nature of the testing (including the level of vehicle automation) 'and any other information that may assist' (VicRoads, 2016).

In Japan it is suggested that trialling organisations notify emergency services and the relevant department or agency of their Public Road Testing Plan. This plan specifically includes the type of system being tested and the functions of the test vehicle/automated driving system (Japan, National Police Agency, 2016).

The Western Australian mining code states that emergency response teams should have an understanding of how the system works and the controls required (Government of Western Australia: Department of Mines and Petroleum, 2015).

The guidance from South Australia asks for details of anticipated tests, including automated vehicle staging (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016). The SAE International standard recommends that trialling organisations provide the definition of the automated driving system application being tested, including its specified operational domain and any environmental restrictions (SAE International, 2016).

The NTC is seeking feedback on whether a description of what is being trialled should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not require trialling organisations to provide a description of the technology being trialled.
2. Guidelines include a description of the technology being trialled as an option for road transport agencies to add.
3. Guidelines require trialling organisations to provide a description of the technology being trialled.

Road agencies will require some understanding of the technology being trialled in order to make an assessment on the safety of the trial. A broad description of what is being trialled would also help in

the case of an emergency. A key issue however is the level of detail about the specific technology. This could vary on a case-by-case basis.

For these reasons the NTC supports option 3.

3.5 Should guidelines include compliance with existing road rules and traffic laws?

To ensure public safety it is crucial that automated vehicles being tested on public roads comply with all relevant road traffic laws, unless an exemption or conditional licence is obtained. Trialling organisations should be required to demonstrate that all tests undertaken comply with all relevant existing laws and that the vehicles involved are roadworthy, meet all relevant vehicle requirements, and can be used in a way that is compatible with existing road traffic law. At issue is whether this needs to be stated in the guidelines.

An example of where such an exemption could be a trial of a vehicle does not have a human driver inside it, so that there is no need for the 'driver' to wear a seatbelt. This trial may need an exemption from the *Transport Operations (Road Use Management) Act 1995*, section 264 'Wearing of seatbelts by drivers', in Queensland or Road Transport (Safety and Traffic Management) Act 1999, section 264 'Wearing of seatbelts by drivers' in New South Wales.

With the exception of the Western Australian code of practice, all codes and guidelines examined explicitly state that trial vehicles must comply with existing road rules and traffic laws. New Zealand's information sheet states (at p. 4) that 'vehicles used on public roads, including test vehicles, must meet the legal requirements set out in New Zealand's land transport rules' (NZ Ministry of Transport, 2016).

Similarly, the SAE guidelines provide that 'managers are responsible for enforcing any rules that test drivers are required to follow' (SAE International, 2016). Florida's legislation states that 'an autonomous vehicle registered in this state must continue to meet federal standards and regulations for a motor vehicle and be capable of being operated in compliance with the applicable traffic and motor vehicle laws of this state' (State of Florida, Department of State, 2016).

The development of national guidelines could include a similar statement for the avoidance of doubt, subject to any exemptions granted by the relevant agency. National guidelines could also provide an opportunity to explain exemption processes for road rules and traffic laws: noting that vehicle exemptions are available on a case by case basis in the guidance would help guide trialling organisations.

The NTC is seeking feedback on whether compliance with existing road rules and traffic laws, in the absence of an exemption, should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include compliance with existing road rules and traffic laws.
2. Guidelines include compliance with existing road rules and traffic laws as essential (except where an exemption has been granted).

Subject to any exemptions, all trials will be required to comply with existing road rules and traffic laws. Stating this explicitly in the guidelines will help to establish legal compliance as a fundamental part of any trial and avoid any doubt over compliance requirements.

For these reasons the NTC supports option 2.

3.6 Should guidelines include compliance with existing vehicle standards?

Linked to the issue of compliance with road rules and traffic laws is whether an explicit statement is required in the guidelines that provides that the trial vehicles must meet existing vehicle standards, including the ADRs and in-service vehicle standards. Meeting the existing vehicle standards is unlikely to be an issue for trials of partially or conditionally automated vehicles but will be of primary importance to fully automated vehicles and some highly automated vehicles.

National guidelines could provide an opportunity to explain exemption processes for ADRs and Australian Light Vehicle Standards Rules (ALVSRs); noting that vehicle exemptions are available on a case-by-case basis in the guidance would help guide trialling organisations.

Vehicle standards are referenced in numerous codes and guidelines. New Zealand (NZ Ministry of Transport, 2016), Victoria (VicRoads, 2016), Japan (Japan, National Police Agency, 2016) and South Australia (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016) all provide that the trial vehicle must meet the existing vehicle standards but that exemptions are available. The UK (UK Department of Transport, 2015), Nevada (State of Nevada: Department of Motor Vehicles, 2016) and Florida (State of Florida, Department of State, 2016) all state that the vehicle must meet existing vehicle standards but do not specify that an exemption process is available.

The NTC is seeking feedback on whether compliance with vehicle standards, in the absence of an exemption should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include compliance with existing vehicle standards.
2. Guidelines include compliance with existing vehicle standards as essential (except where an exemption has been granted).

ADRs, ALVSRs and the Heavy Vehicle National Law (HVNL) are all in place to ensure the safe design and maintenance of vehicles operating on Australian roads. It may be valuable to state clearly in the guidelines that all forms of vehicles will need to be safe and that trials will not provide cover for non-compliant vehicles to operate on the road network. Additionally stating that there is an option to apply for an exemption to import a non-standard vehicle would also help demonstrate that Australia can accommodate various vehicle types.

For these reasons the NTC supports option 2.

3.7 Should guidelines include compliance with existing privacy laws and principles?

Australia has existing privacy protections that will very likely apply to automated vehicle trials. In the event that automated vehicle trials generate personal information, the entities responsible for collecting and handling that information will be subject to privacy laws. This includes the Australian Privacy Principles contained in the *Privacy Act 1988* (Cwlth) that apply to commercial entities with a turnover of more than \$3 million and Commonwealth government agencies, and Information Privacy Principles that apply to most state and territory road transport agencies.

Automated vehicles will also be regulated by Commonwealth, state and territory surveillance device laws that prohibit covert surveillance of individuals through the use of surveillance tracking devices. Surveillance laws provide that a person shall not use a tracking device to determine the geographical location of a person without the express or implied consent of that person.

Privacy issues related to trials have been considered in existing guidelines and codes. For example, Victoria's amendments to the UK code require that any information collected by the participant must be collected and handled in accordance with the *Privacy and Data Protection Act 2014* (Vic) and the *Privacy Act* (VicRoads, 2016).

The NTC is seeking feedback on whether compliance with existing privacy laws and principles should be included in the guidelines and if so, as optional or essential.

Options

1. Guidelines do not include compliance with existing privacy laws and principles.
2. Guidelines include compliance with existing privacy laws and principles as an essential criterion.

All trials will be required to comply with existing privacy laws and principles. Stating this explicitly in the guidelines will help to establish privacy as a fundamental part of any trial.

For these reasons the NTC supports option 2.

3.8 Should trialling organisations be required to engage with the public?

Automated vehicles are a disruptive technology that will have significant impacts on how people drive and interact with other road vehicles. Public acceptance, and public engagement in the testing of automated vehicles, is likely to be essential in terms of raising community awareness and education about how automated vehicles operate. Some groups who could be engaged are:

- local government authorities
- vulnerable road users
- public transport providers.

Numerous guidelines and codes recommend some form of public engagement, but only South Australia provides that the trial assessment process will include consultation with stakeholders, such as local councils, who have a significant interest in proposed trials (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016).

The New Zealand guidance states that advice on whether a communications plan for engaging with the public would be appropriate can be sought from the New Zealand Ministry of Transport (NZ Ministry of Transport, 2016). The UK code provides that testing organisations should consider the benefits of developing a public relations and media communications strategy to engage with the public (UK Department of Transport, 2015). Japan's guidelines specify that an example of an appropriate measure to ensure safety on a public road could include announcing in advance the date and place of the public road testing in order to inform local residents and road users (Japan, National Police Agency, 2016).

Although Western Australia's autonomous mining code does not refer to public consultation, it states the importance of developing a system to ensure affected personnel are consulted about implementation and any potential hazards (Government of Western Australia: Department of Mines and Petroleum, 2015). This is consistent with the code's workplace safety perspective.

The NTC is seeking feedback on whether engaging with the public should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include community consultation and public engagement requirements.
2. Guidelines include community consultation and public engagement as optional criteria for road transport agencies to add.
3. Guidelines include community consultation and public engagement as essential criteria of any trial.

Trials of automated vehicles can help to educate and assure the public about the safety of new technology. Engaging with the public and providing information about trials can help achieve this. However, trials may include technology developments that are highly competitive; original equipment manufacturers may be testing relatively small components of an automated vehicle that do not warrant public engagement.

For these reasons the NTC supports option 2, providing discretion to road agencies as to the level of engagement required.

4 Safety management plan

Key points

- Safety management will be critical for successful trials.
- Safety requirements could include:
 - the pre-trial testing of vehicles
 - human driver considerations
 - driver or operator training requirements
 - driver and operator fitness for duty
 - driver or operator duties
 - transition between human and automated driving modes
 - system failure warnings
 - vehicle identifiers.

Ensuring the safe operation of test vehicles involved in on-road trials will be a primary objective of trial participants and road transport managers. As discussed in 1.4, it is proposed that all trialling organisations applying for an exemption will be required to develop a safety management plan. The question then becomes whether there are specific risks that such a safety management plan must cover.

This chapter discusses safety specific conditions that have been addressed in other jurisdictions and that could be optional or essential criteria in Australia's national guidelines.

4.1 Should guidelines include system security?

Security is critical for ensuring both the safety of trials and the protection of personal information generated by trials. Automated vehicles have the potential to generate significant amounts of location information that could be personal information. They are also potentially vulnerable to external security threats and hacking with associated safety implications. Trials of automated vehicle technology on public roads could provide an opportunity to test the security of the system. However, there is also a risk of malicious hacking.

Most guidelines and codes provide for the protection, security and storage of automated vehicle data. They are generally performance-based and do not prescribe security measures. New Zealand guidance states that 'anyone undertaking testing is responsible for ensuring the security of the data used by automated systems' (NZ Ministry of Transport , 2016).

Likewise, the UK code states that data should be securely stored and should be provided to the relevant authorities upon request (UK Department of Transport, 2015). Japan's scheme provides that participants should ensure appropriate cybersecurity measures (Japan, National Police Agency, 2016). South Australia's guidance acknowledges that the protection of road users is critical and that trial applications should ensure the control of software, including updates or revisions, and development measures for data management and recording protocols (Japan, National Police Agency, 2016).

The NTC is seeking feedback on whether the guidelines should include system security and if so as optional or essential.

Options

1. Guidelines do not include system security.
2. Guidelines include system security as an optional criterion for road transport agencies to add.
3. Guidelines include the system security as an essential criterion of all trials, to be addressed as part of the safety management plan.

Given the possibility of cyber security attacks and interventions of malicious intent, minimum standards for trusted access to data and protection from cybersecurity attacks may be warranted. Trialling organisations should at least consider security issues as part of any trial.

For these reasons the NTC supports option 3.

4.2 Should guidelines ensure a vehicle has been trialled at a test facility before being allowed on public roads?

Trialling at a testing facility, such as a closed track, could provide additional assurance that the automated vehicle technology can be safely deployed on public roads. It is already standard practice for vehicle manufacturers and technology developers to trial vehicles at test facilities.

Vehicle pre-trial testing is also a common feature of many existing codes and guidelines for automated vehicle trials. New Zealand's guidance states that pre-trial testing is expected (NZ Ministry of Transport, 2016), while the UK code states that organisations 'need to ensure that the vehicles have successfully completed in-house trialling on closed roads or trial tracks' (UK Department of Transport, 2015). Japan provides that entities should conduct sufficient trialling on a trial track to verify the vehicle can be driven safely on public roads (Japan, National Police Agency, 2016).

The Western Australian mining code suggests different forms of system trialling by system builders and operators before new technology is operated (Government of Western Australia: Department of Mines and Petroleum, 2015).

South Australia and Florida do not reference pre-testing of the vehicle (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016).

If pre-trial testing is encouraged or required in national guidelines, a number of metrics and standards could be adopted, including:

- hours tested
- kilometres tested
- testing in different environments likely to be encountered on public roads
- third-party checks and audits
- access to test results.

Most existing codes and guidelines do not prescribe a specific metric. However, the Nevada legislation requires 'proof satisfactory to the Department' that the automated vehicle has been driven by trialling organisations for a minimum of 10,000 miles in autonomous mode (State of Nevada: Department of Motor Vehicles, 2016). Furthermore, the Nevada legislation requires 'proof that the vehicles of the applicant have been driven in various conditions for a number of miles that demonstrates the safety of the vehicle or vehicles in those conditions' (State of Nevada: Department of Motor Vehicles, 2016)

Consideration should also be given to the extent to which testing in overseas jurisdictions should satisfy any requirements or criteria in national guidelines in Australia.

The inclusion of any pre-trial testing requirements within the guidelines would require trialling organisations to consider vehicle testing at a test facility or private road prior to an on-road public trial. In the event that pre-trial testing is not conducted, they would need to explain why it is not necessary and demonstrate how else safety risks are to be managed. For example, the on-road trial could be testing a small component of automation and the presence of a trained human driver in the vehicle could be sufficient to manage the safety risk.

The NTC is seeking feedback on whether the pre-trial testing of vehicles should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include any requirement for pre-trial testing of vehicles.
2. Guidelines include the pre-trial testing of vehicles as an optional criterion for road transport agencies to add.
3. Guidelines include the pre-trial testing of vehicles as an essential criterion for all trials, to

be addressed as part of the safety management plan.

Pre-trial testing may not always be needed, for example in cases where minor changes have been made to previously tested vehicles. Trialling organisations could develop other measures that specifically suit their mode of operation.

For this reason the NTC supports option 2.

4.3 Should guidelines require a human in a trial vehicle?

Adopting SAE International Standard J3016 *Levels of Driving Automation* (SAE International, 2016), there are different levels of driving automation based on the extent to which a human undertakes the driving functions (including steering, acceleration and braking), supervises the driving environment, supervises the automated driving system and/or responds appropriately to a request to intervene.

It is likely that vehicle manufacturers and technology providers will seek to trial vehicles across the full spectrum of automated driving levels, so national guidelines should be relevant to both lower and higher levels of driving automation.

A key issue is therefore whether national guidelines should require a human in the trial vehicle to provide safety redundancy by taking back the driving task in the event of an automated driving system failure. However, prescribing human involvement could curb innovation and investment in highly or fully automated vehicles that do not require a human driver.

Not all existing codes and guidelines address the issue of whether there is a need for a human driver in the trial vehicle. The New Zealand guidance states that 'a trial vehicle operator may or may not be in the vehicle during testing' (NZ Ministry of Transport, 2016). In the UK code, a trial operator or driver is required to be in control 'at all times' (UK Department of Transport, 2015). This provides the opportunity for vehicles to be operated from outside the vehicle. In Victoria a similar approach is adopted while further noting that it is a requirement for the driver to have proper control of the vehicle in compliance with the Australian Road Rules (VicRoads, 2016).

The Japanese guidelines require a driver to be in the vehicle. In Nevada, a certificate of compliance issued by the road agency will allow a vehicle to operate without a human in the physical vehicle (Japan, National Police Agency, 2016). If the vehicle does not have a certificate of compliance then the legislation requires two people to be physically present in the vehicle. In Florida, amendments in 2016 removed the need for a human to be present (State of Florida, Department of State, 2016).

An alternative approach would be to incorporate consideration of having a human in the physical vehicle as part of a safety management system. If this approach were to be adopted, trialling organisations would be required to consider whether there should be a human in the physical vehicle to ensure the safe operation of the trial. In the event that a human is not present in the vehicle, they would need to explain in the safety management plan why it is not necessary and demonstrate how the commensurate safety risks are to be managed.

Capturing any human driver considerations in a safety management system would provide additional flexibility, recognising that having a human in the physical vehicle may not always be a relevant issue or necessary. Under a safety management system approach, these risks would be identified and addressed on a case-by-case basis.

Options

1. Guidelines do not allow trials without a human driver or operator present.
2. Guidelines allow testing without a human driver or operator, but require safety issues to be addressed as part of a safety management plan as an essential criterion.

A human driver in the vehicle provides the safest testing environment and will be required unless an exemption has been granted. However removing the human driver at some point will be a part of testing higher levels of automation. This will require careful consideration of the safety risks and how they can be mitigated.

For this reason the NTC supports option 2.

4.4 Should guidelines include driver or operator duties and training?

Automated vehicles being trialled on public roads in Australia could have a range of different duties or tasks required of the human driver or operator of the trial vehicle. Like many aspects of the national guidelines, the safety risk of failing to identify or clarify driver or operator duties or training requirements could depend on the automated application being tested.

Depending on the application being trialled, it may be critical for the safe operation of the trial that the human driver or operator is sufficiently trained to operate the vehicle, respond to any safety incidents and take back control of the vehicle if required. The human driver or operator may have to be highly skilled, undertaking a specialist role.

In these scenarios, driver training could include:

- a certain number of hours driving or operating the vehicle on a test track or private road
- experience under supervision or mentoring
- experience of the relevant human machine interface in a simulator
- desk-based training or certification.

Most existing codes and guidelines require the human driver to have a valid driver's licence, and most have additional training requirements that are generally performance-based.

A number of jurisdictions have specified duties or activities to be undertaken by the human driver or operator. For example, in the UK code the driver or operator must be able to anticipate the need to intervene and resume manual control of the vehicle if necessary (UK Department of Transport, 2015). The UK code also specifies that the trialling organisation is responsible for 'ensuring trial drivers and operators have received the appropriate training and are competent' (UK Department of Transport, 2015).

In Japan the duties are more specific, suggesting that the driver or operator is required to monitor the surrounding traffic and vehicle's condition at all times, as well as be able to operate the vehicle immediately in the event of an emergency (Japan, National Police Agency, 2016). Japan also specifies that, in addition to licensing, a trialling organisation should ensure a driver:

- has a significant amount of driving experience and is a skilled driver
- understands well the mechanism and characteristics of the automated driving system of the trial vehicle
- has driven vehicles using the automated driving system of the trial vehicle at trial facilities and learnt how to operate it in the event of an emergency (Japan, National Police Agency, 2016).

The Nevada legislation states that unless there is approval for the trial to operate without a driver in the physical vehicle, there must be two people with valid drivers' licences in the vehicle. These people 'must be trained in the operation of the autonomous vehicle and have received instruction concerning the capabilities and limitations of the autonomous vehicle' (State of Nevada: Department of Motor Vehicles, 2016). Nevada also states that the drivers must 'each actively monitor for any aberration in the functioning of the autonomous vehicle while it is engaged (State of Nevada: Department of Motor Vehicles, 2016)'.

The SAE standards specify responsibilities under three main groups:

- a. Expert test drivers: specifically skilled and trained personnel who are able to activate, monitor, and de-activate the ADS using experimental software and/or hardware interfaces. Expert drivers are trained to respond correctly to emergency situations due to ADS and/or vehicle failures. Expert test drivers are typically engineers and/or designers of the ADS under test.
- b. Trained test drivers: informed about the ADS, but are NOT specifically qualified to activate, monitor, and de-activate it using experimental software and/or hardware interfaces. Trained drivers are able to respond correctly to emergency situations due to ADS and/or vehicle malfunctions or failures by exercising a dedicated system override that restores the vehicle to non-automated operation.
- c. Novice test drivers: not informed about the ADS, nor trained in its use. Novice test drivers may be accompanied during a test drive by a trained test driver in the front passenger seat

equipped with dual accelerator and/or brake pedals; this trained test driver would be responsible for maintaining safe operation of the test vehicle at all times that a novice test driver occupies the driver's seat. If not accompanied by a trained test driver capable of maintaining operational safety, novice drivers need to be able to respond to emergency situations due to ADS and/or vehicle failures by activating a failsafe switch that automatically restores the vehicle to a minimal risk condition (see SAE J3016) (SAE International, 2016).

The guidance on the South Australian website advises that trialling organisations should provide the minimum following information details: 'trial applicant details, including licences, qualifications and experience of key personnel, drivers or operators'. Applications should also include 'proposed safe work methods to be used during the trial, including associated training' (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016).

Alternatively, the Florida legislation states that a person who holds a valid driver's licence may operate a vehicle in autonomous mode and does not reference training (State of Florida, Department of State, 2016).

In Australia there would also need to be consideration of relevant workplace health and safety legislation (Acts and regulations) for the state or territory where the trial is taking place.

The NTC is seeking feedback on whether driver and operator duties should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include driver or operator duties or training requirements.
2. Guidelines include driver or operator duties and training requirements as optional criteria for road transport agencies to add.
3. Guidelines include driver or operator duties and training requirements as essential criteria to be considered as part of a safety management plan.

Capturing driver or operator duties and training requirements may not always be necessary, but when they are this is best addressed by trialling organisations developing measures that specifically suit their mode of operation.

For this reason the NTC supports option 2.

4.5 Should guidelines include fitness to drive requirements?

A distinction may be made between a driver's competence to operate an automated vehicle and their physical and mental fitness to do so at the time of an on-road trial. For example, a driver may be fully trained in the operation of the trial vehicle being tested, but on the day of the trial be fatigued, affected by drugs or alcohol or be otherwise unfit for duty.

A key question is the extent to which the national guidelines should reference the driver's or operator's fitness to drive or operate the trial vehicle at the relevant time, and, if so, what counter-measures should be included in the national guidelines to satisfy the trialling organisation and road transport agencies.

Fitness for duty requirements could include:

- drug and alcohol testing
- drowsiness testing
- sleep diary and activity questionnaires
- visual checks
- daily limits on driving or operating the trial vehicle.

Identifying appropriate measures to ensure the driver or operator of a trial vehicle is fit to drive or operate the vehicle at the relevant time within a safety management system would be consistent with the health and safety requirements of trialling organisations. As an employer, a trialling organisation must manage identified risks to employees so far as is reasonably practicable. Again, if a human is not required then fitness for duty requirements would not be relevant.

There has not been a consistent approach adopted in relation to fitness for duty in existing codes and guidelines. The New Zealand guidance only states that the driver must be "unimpaired" (NZ

Ministry of Transport , 2016), while the UK code states that the trialling organisation 'should develop robust procedures to ensure that test drivers and operators are sufficiently alert to perform their role and do not suffer fatigue (UK Department of Transport, 2015)'. The UK code suggests that measures to ensure the driver's alertness could include setting limits around the total amount of time per day test drivers or operators perform such a role, and the maximum duration of any one test period (UK Department of Transport, 2015).

Likewise, the SAE standard for testing automated vehicles provides a standard in regard to the maximum number of consecutive hours a test driver may operate a trial vehicle, which should be included as part of the driver's or operator's training (SAE International, 2016).

In Japan, Nevada and Florida there is no reference to managing fitness for duty. Fitness for duty is not referenced in the Western Australian mining code, however the code is framed within the context of work health and safety obligations.

South Australia's guidance states that trial applications should provide information on the 'proposed safe work methods to be used during the trial, including associated training, test driver / operator workload and shift management' (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016).

As above, there would also need to be consideration of relevant workplace health and safety legislation (Acts and regulations) for the state or territory where the trial is taking place.

The NTC is seeking feedback on whether driver and operator fitness for duty should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include driver and operator fitness for duty requirements.
2. Guidelines include driver and operator fitness for duty as an optional criterion for road transport agencies to add.
3. Guidelines include driver and operator fitness for duty as an essential criterion, to be considered as part of a safety management plan.

Driver and operator fitness for duty should be addressed by trialling organisations to provide flexibility to develop measures that specifically suit their mode of operation, but may not be required for all trials.

For this reason the NTC supports option 2.

4.6 Should guidelines include requirements for transitioning between driving modes?

Linked to driver's and operator's duties to drive or operate a vehicle safely is the issue of whether the national guidelines should explicitly address how vehicles safely transition between human and automated driving modes.

There is ongoing discussion among human factors experts, safety advocates and insurers that managing the transition of the driving task between the human and the automated driving system will be one of the most significant safety challenges associated with conditional automation. The safe transition between driving modes is also likely to be a critical issue for those highly automated vehicles that will be fully automated only some of the time.

Most existing codes and guidelines reference transition issues, with varying degrees of prescription. A prescriptive approach could include specific requirements such as:

- visual, aural or haptic signals to inform the driver what mode the vehicle is operating in
- visual, aural or haptic signals to inform the driver within a defined timeframe when the driver must take over the driving task
- defined periods of time in which the driver must resume the driving task
- vigilance controls to ensure driver alertness.

The UK code offers an example of guidance that is largely performance-based. The code states that the trialling organisation should develop a process for transition that can:

- be easily and clearly understood by the test driver
- ensure that the driver is given a clear indication of whether the vehicle is in manual or an automated driving mode
- ensure that the driver is given sufficient warning to resume manual control when necessary
- allow the driver to quickly and easily retake control of the vehicle when necessary (UK Department of Transport, 2015).

Nevada laws state that the vehicle must have a 'system to safely alert the operator of the autonomous vehicle to take control of the autonomous vehicle if a technology failure is detected' (State of Nevada: Department of Motor Vehicles , 2016).

Florida's legislation states that the vehicle must have 'a means to engage and disengage the autonomous technology which is easily accessible to the operator' (State of Florida, Department of State, 2016). The vehicle must also have 'a means, inside the vehicle, to visually indicate when the vehicle is operating in autonomous mode' (State of Florida, Department of State, 2016).

The South Australian guidance has adopted a safety management approach and requests information on 'proposed safe work methods to be used during the trial', rather than requirements specific to transition issues (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016). The Western Australian mining code does not specify a process, but does note that human interaction with systems is a key aspect of safe system operation (Governemnt of Western Australia: Department of Mines and Petroleum, 2015).

The Japan guidelines are more prescriptive. They specify that the trial vehicle should be able to transition between the system and the test driver 'in an appropriate manner'. This may be done by 'giving an audible alarm at the start or end of automated driving, thereby clearly indicating [the] start or end to the test driver' (Japan, National Police Agency, 2016).

The SAE standard recommends that the automated driving system is 'capable of providing real-time information on its operational status, and to alert the human test driver of the necessity to intervene and resume performance of the dynamic driving task' (SAE International, 2016). The standard provides that the information should be provided via a human-machine interface that:

- a. Conveys clearly the state of the [automated driving system]
- b. Displays a request to intervene when it is warranted by operating conditions. If possible, the alerts or provision of information to the drivers should take place prior to the termination or transition into degraded modes
- c. Requests clearly what action is required of the driver. The interface to drivers may include auditory, visual, and haptic signals. In addition, the human-machine interface should recognize the driver interaction that indicates the readiness to take over, as well as the verification of the takeover, so that the [automated driving system] relinquishes dynamic driving task performance to the driver (SAE International, 2016).

The NTC is seeking feedback on whether the safe transition between human and automated driving modes should be included in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include requirements for a process for driving mode transition.
2. Guidelines include requirements for a process for driving mode transition as an optional criterion for road transport agencies to add.
3. Guidelines required a process for driving mode transition as an essential criterion, to be considered as part of a safety management plan.

Driving mode transition may not always be necessary. Where it is, flexibility should be provided to trialling organisations to develop measures that specifically suit their mode of operation.

For this reason the NTC supports option 2.

4.7 Should guidelines include system failure warnings?

Vehicles are expected to increasingly rely on automated driving systems to operate safely, and it is likely that on-road trials will be undertaken to test the effectiveness of emerging technologies. In the context of testing new technologies in different road environments and weather conditions, it may be particularly important that any human driver or operator of the trial vehicle is made aware of any system failures. At issue, therefore, is the extent to which national guidelines should specify system failure warnings to support the safe operation of the on-road trial.

In a similar way to managing transition issues, described in the previous section, existing codes and guidelines generally consider system failure warnings, but with varying degrees of prescription. The most common form of prescription is to specific visual, audial and/or haptic signals to inform the human driver or operator that the system has failed.

The New Zealand guidance states that the vehicle should provide 'adequate warning, such as visual and audible indicators, to allow the operator to re-engage in the driving task before any automated system becomes ineffective' (NZ Ministry of Transport, 2016). The UK code advises that, in the event of a malfunction or failure of the automated driving system, 'the test driver or operator should be made aware with an audible warning which may be accompanied by a visual warning' (UK Department of Transport, 2015).

The Japanese guidance states that the automated driving system should have functionality to request the driver or operator to take over when the system detects it has reached, or is close to reaching, its functional limit, or when the system is detected to have failed (Japan, National Police Agency, 2016). There are no specifications about what form such a system request should take.

Nevada law states that the vehicle must have a 'system to safely alert the operator of the autonomous vehicle to take control of the autonomous vehicle if a technology failure is detected (State of Nevada: Department of Motor Vehicles, 2016). Florida's laws have more detailed requirements that reflect the approach taken in Japan, stating that the test vehicle must:

Have a system to safely alert the operator if an autonomous technology failure is detected while the autonomous technology is engaged. When an alert is given, the system must:

1. Require the operator to take control of the autonomous vehicle; or
2. If the operator does not, or is not able to, take control of the autonomous vehicle; be capable of bringing the vehicle to a complete stop (State of Florida, Department of State, 2016).

The SAE standard states that 'an alert system should be installed in the vehicle to inform the driver of critical malfunctions. The alerts may consist of visual, haptic, and/or audible warnings that cue the test driver to the need to disable the automated driving system and resume driving (SAE International, 2016)'.

The South Australian guidance states that there must be a system in place to deal with a malfunction. It states that as part of a trial application the organisation should provide minimum information including a safety management system that details the 'methods to bring test vehicles into a safe low risk mode in the event of malfunction, overload, etc.' (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016).

It is also noted that 'system failure warnings' may be broader than human-machine interface considerations. It could extend to considering how the trial operator is informed about any system failures, and what processes are in place to suspend the operation safely until the system failure has been rectified, or mitigate the impact of minor failures on road safety. This approach has been adopted by the Western Australian mining code, which states that a system should be designed so that 'if elements of the system fail then the system is designed to fail (shutdown) to a safe condition' (Government of Western Australia: Department of Mines and Petroleum, 2015). The code mentions the use of alarms and warnings for operators, but does not require them.

The NTC is seeking feedback on whether system failure warnings should be included in the guidelines and if so, as optional or essential.

Options

1. Guidelines do not include a requirement for system failure warnings.

2. Guidelines include a requirement for system failure warnings as an optional criterion for road transport agencies to add.
3. Guidelines require system failure warnings as an essential criterion, to be considered as part of a safety management plan.

System failures pose a serious road safety risk that should be considered as part of any trial. The NTC considers that trialling organisations should be encouraged to develop measures to address system failure that specifically suit their mode of operation.

For this reason the NTC supports option 3.

4.8 Should guidelines include visual or other identifiers?

Automated vehicles could have visual or other identifiers that signal to other road users that the vehicle is automated for a number of purposes. These could include:

- for enforcement agencies, a visual identifier (such as a sticker or special registration plates) could communicate that the vehicle is being used as part of a trial
- for enforcement agencies and other road users a visual identifier, such as a light, or a specific cooperative intelligent transport systems (C-ITS) signal could communicate what mode the vehicle is operating in at a given point in time
- for other road users, including vulnerable road users, a visual identifier (such as prominent signage) could communicate that the vehicle may be travelling slowly, or performing differently to human drivers.

Visual or other identifiers can also increase the profile of automated vehicle trials and thereby increase awareness levels, education and public trust in the safety of emerging technologies.

The safety case for visual identifiers will depend on the automated functionality. For example, testing minor changes to a vehicle with conditional automation where a human driver remains in control of the vehicle will have a different risk profile from a driverless passenger shuttle. The importance of communicating with other road users that a vehicle is automated could also depend on the trial objectives. For example, an objective of the trial may be to evaluate how human driving behaviours change when other road users are aware that a vehicle is automated.

For these reasons, the need for visual identifiers is likely to be determined on a case-by-case basis, taking into consideration the automated driving application, the risk profile of the trial and the research objectives. However, it is also noted that national guidelines provide an opportunity to standardise automated vehicle signage and to manage the risk of having different signage in different states and territories.

Several existing codes and guidelines require automated vehicles to be visually identified. The Nevada laws require that an automated vehicle has a test licence and a certificate detailing the testing parameters and limitations of the technology (State of Nevada: Department of Motor Vehicles , 2016). The certificate must be carried at all times and presented to a police officer upon demand. In addition, each vehicle must display the automated vehicle testing licence plates (State of Nevada: Department of Motor Vehicles , 2016).

Likewise, the UK code states that testing organisations should consider providing the vehicle registration details to the local police (UK Department of Transport, 2015). The Japanese guidelines require that the body of the trial vehicle is marked with information indicating that it is being subjected to public road testing of an automated driving system (Japan, National Police Agency, 2016).

The NTC is seeking feedback on whether visual or other identifiers should be included in the guidelines and if so, as optional or essential.

Options

1. Guidelines do not include consideration of visual identifiers.
2. Guidelines include consideration of visual identifiers as an optional criterion for road transport agencies to add.

3. Guidelines require visual identifiers as essential criterion of trials.

Vehicle identifiers may not always be necessary. Where they are, flexibility should be provided to trialling organisations to develop measures that specifically suit their mode of operation.

For these reasons the NTC supports option 2.

Question 4: Are there additional criteria that should be included in the guidelines?

5 Insurance

Key points

- Ensuring automated vehicle trials have appropriate insurance could be a key objective of national guidelines
- A key issue is the extent to which insurance products and the level of insurance should be specified in the national guidelines.

Automated vehicles are expected to result in improved safety outcomes. However, crashes involving automated vehicles will still be possible. For example, by mid-2016, Google had test driven their fleet of vehicles, in autonomous mode, for 2.7 million kilometres (Google, 2016), and its test vehicles had been involved in 14 collisions, of which other drivers were at fault 13 times. In February 2016, a Google self-driving car collided with a bus in autonomous mode while attempting to avoid sandbags blocking its path (Wired, 2016).

There is a clear ongoing need for automated vehicles involved in on-road trials to have insurance to cover injury, property damage and theft. In Australia, a number of insurance products could be available to cover an on-road trial of an automated vehicle. These include:

- compulsory third party insurance
- comprehensive vehicle insurance
- public liability insurance
- product liability insurance
- self-insurance.

5.1 Level and type of insurance

A key issue is the extent to which insurance products and the level of insurance should be specified in the national guidelines. Most existing codes and guidelines require some form of insurance, with the most common threshold being an 'appropriate' level of insurance that covers death, personal injury and property damage.

The majority of existing codes and guidelines do not specify a unitary amount of insurance, with the exception being Nevada and Florida. In Nevada, the level of insurance cover must exceed the minimum requirements for a vehicle registered in the state (State of Nevada: Department of Motor Vehicles, 2016). In Florida, the entity performing the testing must submit to the department an instrument of insurance, surety bond, or proof of self-insurance acceptable to the department in the amount of **\$5 million** (State of Florida, Department of State, 2016).

The New Zealand guidance requires anyone undertaking testing to hold appropriate levels of public liability and professional indemnity insurance to protect against the risks associated with testing (NZ Ministry of Transport, 2016). The UK code requires parties to hold appropriate insurance or otherwise comply with the statutory requirements (UK Department of Transport, 2015). Similarly, Victoria requires parties to hold appropriate insurance to cover public liability and accident damage (VicRoads, 2016).

Japan's guidelines state that entities should ensure the appropriate ability to pay damages by, for example, buying voluntary insurance in addition to the compulsory automobile liability insurance (Japan, National Police Agency, 2016).

South Australian laws require a party undertaking an authorised trial to hold public liability insurance covering death or bodily injury and damage to property caused by, or arising out of, the use of the vehicle on a road (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016). The minimum amount of insurance required is to be set by the relevant minister. In addition, the minister can require that the party acquire any other policy of insurance in relation to the trial.

There is also a question of whether trialling organisations should submit proof of insurance to the relevant road transport agencies as part of the national guidelines. Both Nevada and Florida require entities to submit proof of insurance to their respective motor vehicle departments.

5.2 Compulsory third-party insurance

Compulsory third-party (CTP) insurance is required of all vehicles in all states in Australia. CTP insurance provides the driver with cover for any legal liability for injury or death as a result of an accident for which the insured party is responsible – be it for other drivers, passengers, pedestrians or cyclists.

CTP insurance varies across Australian states and territories. Variations include whether the system is:

- fault or no-fault based;
- included in registration fees or not;
- whether the registered owner can choose their insurer or not.

If a CTP insurance scheme is fault based it means that the party holding the insurance must have been found to have been at fault for a third party to be eligible for compensation from that party.

In jurisdictions with CTP insurance, existing codes and guidelines have dealt with insurance in different ways. The New Zealand guidance provides that the insurance scheme that covers personal injury and administered by the Accident Compensation Corporation extends to trial vehicles (NZ Ministry of Transport, 2016). The South Australian guidance explicitly states that the Motor Accident Commission of South Australia will not cover approved automated vehicle trials but that appropriate public liability insurance must be held by the trialling organisations. The South Australian approach is possible because the automated vehicle laws allow the responsible minister to exempt the trial operators from any state law.

The NTC policy paper, *Regulatory reforms for automated road vehicles* (NTC, 2016), identified that current eligibility requirements in CTP insurance schemes may require a human driver for third parties to access compensation under the scheme. The Transport and Infrastructure Council endorsed state and territory reviews of CTP insurance schemes to ensure eligibility.

It is noted that if a state or territory's CTP insurance scheme cannot cover a highly or fully automated vehicle (because of a requirement to have a human driver to be eligible to access compensation) there are other ways in which insurance coverage could be achieved, including:

- exempting the trial operator from CTP insurance, but requiring the trial operator to hold an appropriate insurance policy that covers the vehicle and the driver
- ensuring the trial vehicle has a human driver or chaperone to meet any driver requirements in motor accident insurance schemes.

The NTC is seeking feedback on whether national guidelines should reference insurance. Three options are detailed below.

Options

1. Guidelines do not include insurance.
2. Guidelines include:
 - a. "appropriate" insurance as an option for road transport agencies to add.
 - b. prescribed insurance as an option for road transport agencies to add.
3. Guidelines include:
 - a. "appropriate" insurance as an essential criterion for any trial.
 - b. prescribed insurance as an essential criterion for any trial.

The most flexible approach is not to specify minimum levels of insurance or insurance products. This allows trialling organisations to tailor insurance policies depending on the trial and the statutory variations in different states and territories, as long as the insurance is appropriate for the extent and risks of the trial.

For these reasons the NTC supports option 3a.

Question 5: Do you support the guidelines including prescribed insurance? If so, what kind of insurance should be prescribed?

6 Data and information

Key points

- Ensuring that data generated is held securely and made available to relevant agencies in the event of a crash is one of the key issues.
- Some jurisdictions request that updates and feedback is provided from trialling organisations.
- Ensuring the security of the vehicle system from hacking is not addressed in great detail in the guidelines examined.

Vehicle data is a key component for increasingly automated vehicles. Third-party access to data could help solve operational challenges, such as identifying who is in control of an automated vehicle at a point in time to determine responsibility and civil liability. In the context of on-road trials and testing, collecting and sharing data can leverage research opportunities, raise community awareness and acceptance, and provide greater certainty for road transport agencies that the safety risks are being adequately identified and managed.

Collecting and providing data is a key issue in a number of jurisdictions. This includes:

- collection and provision of crash data
- ongoing data updates on other incidents or events
- updates on research outcomes
- updates on network conditions.

6.1 Should guidelines include crash data?

The safety case for automated vehicles has not been proven. On-road trials provide a research platform to test and validate the safety of different automated vehicles operating in real-life road environments. Road transport agencies have therefore taken a clear position that providing crash data should be a criterion of an exemption for trial vehicles. However, guidelines and codes have different data-capture and reporting requirements. There would be clear benefits for Australia to adopt a single approach to crash data requirements.

The UK Code (UK Department of Transport, 2015), and as adopted in Victoria (VicRoads, 2016), requires that data indicating who was controlling a vehicle at the time of an incident must be stored and provided to relevant authorities upon request.

Likewise, Nevada's scheme requires data to be captured and stored from 'at least 30 seconds before a collision occurs' (State of Nevada: Department of Motor Vehicles , 2016). This information is required to be preserved for three years, and the participant must submit a report within 10 business days after an incident or any traffic violation (State of Nevada: Department of Motor Vehicles , 2016). The report must include a copy of any accident report prepared regarding an incident and any citation issued to the operator (State of Nevada: Department of Motor Vehicles , 2016).

The SAE guidelines state that although data is legally the property of vehicle manufacturers and vehicle developers, data may be required by other parties in the event of an incident involving personal injury or property damage (SAE International, 2016).

We note that the driver of a vehicle has a personal obligation to report a crash to police under the Australian Road Rules. For example in South Australia this obligation is covered under the *Road Traffic Act 1961*, s 43. The Act states that 'the driver of a vehicle involved in an accident in which a person is killed or injured must— (a) immediately after the accident— (i) stop the vehicle; and (ii) give all possible assistance; and (b) not more than 90 minutes after the accident, present himself or herself to a police officer at the scene of the accident or at a police station...' (Road Traffic Act, SA, 1961). We suggest that compliance with existing road traffic laws, discussed in **chapter 4**, would cover the reporting of an accident involving a vehicle that is part of a trial.

The NTC is seeking feedback on whether crash and incident data collection should be included in the guidelines and if so, as optional or essential.

Options

1. Guidelines do not require the collection and sharing of crash data.
2. Guidelines include the collection and sharing of crash data as an optional criterion for road transport agencies to add.
3. Guidelines require collection and sharing of crash data as an essential criterion for all automated vehicle trials.

Safety is key for all trials. Road agencies will want to understand the nature of any crash involving a trial vehicle.

Data has the ability to provide a large amount of information to trialling organisations, but also to road transport agencies, enforcement officers, insurers and the courts. However, data can also be indecipherable or become an administrative burden on those dealing with it. Prescribing the right package of data will help ensure the information is clear and provides relevant information.

For these reasons the NTC supports option 3.

Question 6: If trialling organisations are required to collect crash data and share it with road transport agencies, what data should be required?

You may wish to consider:

- the time span of the data – for example key vehicle information from 30 secs before and 10 secs after a crash
- how long data must be kept by the trialling organisation – for example three months after the trial is completed or 3 months from the date the data was created
- time limits for handing over the data to authorities – for example within five business days
- the type of data included e.g. acceleration, braking, whether the vehicle was in an automated driving mode and other actions such as steering and indicating.

6.2 Should guidelines include providing ongoing data updates?

Throughout a trial, data updates could be collected and sent in real time to road transport agencies reporting on incidents or non-compliance. Notifications could provide helpful information to ensure the terms of a trial are being met and providing updates to agencies on how the trial is progressing. Equally, excessive or inaccurate data could be an administrative burden for an agency.

Data requirements need clear definition; for example of what constitutes a relevant 'incident'. An incident could be when a trial operator or driver takes back control. Google reported that between September 2014 and November 2015 its engineers took the wheel of the car 341 times while conducting trials in California (Google 2016). This could create a large amount of data for road agencies to analyse.

Australia already has a compliance monitoring model for heavy vehicles, the Intelligent Access Program (IAP). IAP is used to monitor various compliance requirements, including route compliance and mass, for certain types of heavy vehicles. The program is based on non-compliance reporting to agencies, via certified telematics providers. If vehicles are compliant, then the agency does not receive any data.

Agencies need to consider the purpose and practicality of receiving such information; data should only be required where there is a clearly defined policy purpose.

The NTC is seeking feedback on whether collecting and providing incident data should be included as a specific safety requirement in the guidelines and, if so, as optional or essential.

Options

1. Guidelines do not include collecting and providing incident and event data.
2. Guidelines include collecting and providing incident data as an optional criterion for road transport agencies to add.

3. Guidelines require collection and provision of defined incident and event data as an essential criterion for any trial.

The purposes and requirements for incident and event data are still to be defined. Systems would need to be developed to ensure that agencies can manage this data and it is not clear that such data would be needed for all trials.

For these reasons the NTC supports option 2.

Question 7: How should an automated vehicle 'incident' be defined? What data should be required for such incidents?

6.3 Should guidelines require updates on research outcomes?

On-road trials of automated vehicles are expected to have clear objectives. Unlike demonstrations or niche deployments, technology trials should have clearly defined research protocols and metrics that can be measured during, or at the conclusion of, the trial. Road transport agencies may wish to receive information on research outcomes to learn from the trials in order to inform future policy.

Updates can also support transparent and cooperative research, but highly detailed and onerous information requirements could deter innovators from conducting trials in Australia.

Most existing guidelines and codes examined do not mandate research updates.

The Western Australian autonomous mining code requires the recording and reporting of incidents with follow-up consultation with the system builder and the Department of Mines and Petroleum. This requirement covers test environments but also actual mining operations (Government of Western Australia: Department of Mines and Petroleum, 2015). New Zealand invites voluntary feedback from participants (NZ Ministry of Transport, 2016).

In comparison, the South Australian legislation requires the responsible minister to prepare a report in relation to any authorised trial within six months of the completion of the trial (Government of South Australia, Department of Planning, Transport and Infrastructure, 2016). This would suggest that the South Australian Government will require research updates from trialling organisations to meet this legislative requirement.

The NTC is seeking feedback on whether providing updates on research outcomes should be included in the guidelines and if so, as optional or essential.

Options

1. Guidelines do not require trialling organisations to provide research outcomes.
2. Guidelines include providing research outcomes as an optional criterion for road transport agencies to add.
3. Guidelines require trialling organisations to provide research outcomes as an essential criterion for any trial.

Reports on trial outcomes are vital information for road agencies to assess the ongoing safety of different technologies and assess policy issues such as how automated vehicles interact with other users.

For these reasons the NTC supports option 3.

6.4 Should guidelines include providing updates on network operation and road conditions?

As trial vehicles move around on the network much information will be collected about the state of the network and the condition of individual roads. Traffic data, potholes, the condition of line markings or road signs and even hazards could all potentially be reported back to the relevant agency.

The NTC is seeking feedback on whether providing updates on network capacity and road conditions should be included as a specific safety requirement in the guidelines and if so, as optional or essential.

Options

1. Guidelines do not include collecting and sharing of data on network operation and road conditions.
2. Guidelines include collecting and sharing of data on the condition of the network as an optional criterion for road transport agencies to add.
3. Guidelines require collecting and sharing of data on the condition of the network as an essential criterion.

It is clear that trial data could provide useful information to agencies in areas where data may be difficult to gather. However, such data may not be either relevant or easily collected for all trials. Not all agencies may have the capacity to analyse such data. As a result, this would likely be better managed on a case-by-case basis.

For these reasons the NTC supports option 2.

7 Cross-border trials

Key points

- National guidelines can support cross-border cooperation and national consistency, but are not intended to amend state and territory laws.
- There are two potential mechanisms to better enable cross-border trials:
 - 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
 - establishing a single national automated vehicle trial application framework and approvals process.
- Ministers have agreed that states and territories will review how cross-border trials could be managed in the future.

7.1 National guidelines can support cross-border cooperation

National guidelines provide an opportunity for states and territories to support on-road trials through setting nationally consistent conditions.

The national guidelines are intended to support existing regulatory mechanisms to conduct trials on public roads through exemptions. The NTC recognises that states and territories may have different trial processes and procedures within which national guidelines can be referenced and used. It is not the intention that national guidelines necessarily result in amendments to current regulatory mechanisms or policies and procedures to establish on-road trials.

However, trialling organisations may wish to operate an automated vehicle trial on roads that cross jurisdictional boundaries. The automotive and technology industries see Australia as a single market for investment and innovation. To ensure trialling organisations can conduct cross-border trials, states and territories could consider ways they can facilitate such trials.

7.2 Cross-border opportunities to consider for future reforms

There are two potential mechanisms to better enable cross-border trials:

- 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
- establishing a single national automated vehicle trial application framework and approvals process.

Currently no state or territory has statutory authority to recognise an exemption from road rules or traffic laws authorised by another state or territory. If trialling organisations sought to undertake a cross-border trial of an automated vehicle that required an exemption permit, it would be necessary to obtain a permit from each relevant jurisdiction. The risk is that these additional administrative processes make the cost and compliance burden of conducting a trial in Australia too expensive or resource-intensive. Current arrangements could be a barrier to investment in automated vehicle trials in Australia.

In the medium-term states and territories may seek to establish legislative processes to recognise trial exemptions approved in other jurisdictions. Mutual recognition could function similarly to current recognition of driver's licences, despite different rules and conditions for drivers in different jurisdictions. It could also include a mechanism to notify states and territories of a trial that would enter their jurisdiction and potentially provide a platform to share research objectives and key findings.

A longer term objective may be for states and territories to adopt a single, nationally consistent exemption and application processes, with a 'one stop shop' for manufacturers and technology developers to engage with Australian road transport agencies and to conduct automated vehicle research and trials, regardless of whether those trials cross state or territory borders. This could require some form of national or model legislation.

In the near term, adopting and applying national guidelines for any advice or trial conditions granted by jurisdictions is expected to significantly increase national consistency. It will also provide certainty to industry of requirements to conduct an automated vehicle trial.

Establishing either a mutual recognition between states and territories, or a single national scheme, would require significant legislative reforms and coordination between state and territory road transport agencies. The Transport and Infrastructure Council agreed in November 2016 that – as part of their review of exemption powers to support on-road trials of automated vehicles – state and territory road transport agencies review how cross-border trials could be managed. These reviews will be undertaken in parallel with the development and endorsement of national guidelines.

Question 8: How important is it that state and territory road transport agencies facilitate cross-border trials of automated vehicles? How could governments enable cross-border trials?

8 Heavy vehicle trials

Key points

- Due to their size and mass, the trialling of automated heavy vehicles presents different safety risks than those for automated light vehicles.
- A different regulatory regime applies for heavy vehicles in Australia.

The introduction of automated heavy vehicles is both an opportunity to improve transport services and a challenge for transport agencies, infrastructure operators and regulators. Despite the enormous potential to improve outcomes in heavy vehicle freight movement, the challenges and risks posed by automated heavy vehicles will need to be managed effectively if benefits are to be optimised.

8.1 How are trials of automated heavy vehicle trials different from light vehicle trials?

Heavy vehicles are a critical part of the freight network, delivering essential goods, services and jobs for our communities across at times vast distances. Automated heavy vehicles have the potential to fundamentally change the heavy vehicle freight industry and deliver improvements in safety, productivity, customer service, congestion management and environmental performance.

Autonomous heavy vehicles are being developed and in some cases are already operating on public and private roads. For example, in May 2015 the first autonomous truck, Daimler's Freightliner Inspiration, was licensed to operate on a public highway in the US state of Nevada, and in autumn 2015 Daimler launched its first autonomous truck on German highways (PC Mag, 2015). In addition, Rio Tinto currently has 69 automated heavy vehicles in operation at its iron ore mines in Western Australia, which are remotely controlled from Perth (Rio Tinto, 2016).

Unlike light vehicles which are regulated on a state by state basis, heavy vehicles are regulated under the HVNL.³ A single regulator, the National Heavy Vehicle Regulator (NHVR), administers the HVNL. The HVNL established a single national system of laws for heavy vehicles over 4.5 tonnes gross vehicle mass and prescribes requirements related to:

- the vehicle standards heavy vehicles must meet before they can use our roads
- the maximum permissible mass and dimensions of heavy vehicles
- securing and restraining loads on heavy vehicles
- ensuring parties in the chain of responsibility are held responsible for drivers of heavy vehicles exceeding speed limits
- preventing drivers of heavy vehicles from driving while impaired by fatigue (NHVR, 2016).

Due to their size and mass, heavy vehicles present different risks to public safety and infrastructure than light vehicles. Crashes involving heavy vehicles can result in more serious outcomes.

Despite these differences in regulation, the NTC does not consider that separate guidelines for heavy vehicles and light vehicles will be required. Rather, the NTC the guidelines can clarify specific points of importance for automated heavy vehicles trials. For example, any relevant fatigue or chain of responsibility requirements.

The NTC is seeking feedback on whether different guidelines are required for heavy vehicles and light vehicles or whether the guidelines should clarify issues that may be relevant to automated heavy vehicle trials.

³ Western Australia and the Northern Territory are not participating jurisdictions in the Heavy Vehicle National Law scheme.

Options

1. Develop separate guidelines for trialling heavy vehicles and light vehicles.
2. Include heavy vehicles in the guidelines and clarify any specific matters relevant to the trialling of automated heavy vehicles, including the role of the NHVR.

Heavy vehicles would have to comply with existing laws and required exemptions could be administered through existing exemption powers and supplemented by the guidelines.

For these reasons the NTC supports option 2.

Question 9: Are there any unique issues for heavy vehicles that require special consideration in guidelines for automated vehicle trials?

9 Next Steps

We are seeking submissions on this discussion paper by **Monday 16 January 2017**.

Based on the feedback received in submissions, the NTC will develop draft guidelines for ministers to consider at their May 2017 Transport and Infrastructure Council meeting.

If ministers endorse the guidelines, state and territory and government will then need to adopt the guidelines in their jurisdiction.

10 Glossary

Term or title	Acronym	Description
Australian Design Rules	ADRs	National standards for safety, anti-theft and emissions in vehicle design.
Automated driving system	ADS	The hardware and software that are collectively capable of performing the entire Dynamic Driving Task (DDT) on a sustained basis, regardless of whether it is limited to a specific Operational Design Domain (ODD).
Australian Privacy Principles	APPs	Standards for how Commonwealth agencies, private sector and not-for-profit organisations must handle, use and manage personal information.
Australian Road Rules	-	Model road rules developed by the NTC and applied in state and territory legislation.
Austroroads	-	The association of Australasian road transport and traffic agencies.
Automated highway driving	-	A system that takes control of driving and monitoring road environment on specific roads, but the driver monitors the automated driving system.
Conditionally automated	-	The system drives the vehicle for sustained periods of time. The human driver does not have to monitor the driving environment or the automated driving system, but must be receptive to any system failures and intervene if requested and be the fallback for the dynamic driving task.
Cooperative intelligent transport systems	C-ITS	The use of wireless communications to exchange data between vehicles, and with roadside infrastructure, including data on vehicle movements, traffic signs and road conditions.
Dynamic driving task	DDT	All of the real-time operational and tactical functions required to operate a vehicle in on-road traffic, excluding the strategic functions such as trip scheduling and selection of destinations and waypoints.
Fully automated	-	All aspects of the driving task and monitoring of the driving environment and the dynamic driving task are to be undertaken by the vehicle system. The vehicle can operate on all roads at all times.
Highly automated	-	The system drives the vehicle for sustained periods of time in some situations, or all of the time in defined places, and no human driver is required to monitor the driving environment and the driving task, or to intervene, when the system is driving the vehicle.
Human-machine interface	HMI	Interface between a human operator and a machine. Includes functional and ergonomic design of the interface (human factors).
Information Privacy Principles	IPPs	State privacy principles regulating public sector accesses to and handling of personal information.
National Transport Commission	NTC	Independent statutory body that contributes to the achievement of national transport policy objectives by developing regulatory and operational reform of road, rail and intermodal transport.
Operational Design Domain	ODD	The specific conditions under which a given driving automation system or feature thereof is designed to function, including, but not limited to, driving modes.
Partially automated	-	The automated driving system may take control of steering, acceleration and braking in defined circumstances but the human driver must continue to monitor the driving environment and the driving task, and intervene if required.
Society of Automotive Engineers	SAE	International association for automotive engineers.
Transport and Infrastructure Council	-	Council of Commonwealth, State, Territory and New Zealand ministers with responsibility for transport and infrastructure issues, as well as the Australian Local Government Association.

References

- Google. (2016, June). *Google Self-Driving Car Project*. Retrieved August 2016, from <https://static.googleusercontent.com/media/www.google.com/en//selfdrivingcar/files/reports/report-0616.pdf>
- Government of South Australia, Department of Planning, Transport and Infrastructure. (2016). *Driveless Vehicles*. Retrieved August 2016, from <http://www.driverlessvehicles.sa.gov.au/>
- Government of Western Australia: Department of Mines and Petroleum. (2015). *Safe mobile autonomous mining in Western Australia – code of practice*. Retrieved August 2016, from http://www.dmp.wa.gov.au/Documents/Safety/MSH_COP_SafeMobileAutonomousMiningWA.pdf
- Japan, National Police Agency. (2016, May). *Guidelines for Public Road Testing of Automated Driving Systems*. Retrieved August 2016, from <http://www.npa.go.jp/koutsuu/kikaku/gaideline.pdf>
- NHVR. (2016). *Heavy Vehicle National Law and Regulations*. Retrieved August 2016, from <https://www.nhvr.gov.au/law-policies/heavy-vehicle-national-law-and-regulations>
- NTC. (2016). *Current projects / Preparing for more automated road and rail vehicles*. Retrieved 2016, from <http://www.ntc.gov.au/current-projects/preparing-for-more-automated-road-and-rail-vehicles/>
- NZ Ministry of Transport. (2016). *Testing Autonomous Vehicles in New Zealand*. Retrieved August 2016, from <http://www.transport.govt.nz/assets/Uploads/Our-Work/Images/T-Technology/Testing-Autonomous-Vehicles-in-New-Zealand.pdf>
- PC Mag. (2015, October 6). *Daimler Tests Autonomous Truck on Germany's Autobahn*. Retrieved August 2016, from <http://au.pcmag.com/cars-products/37671/news/daimler-tests-autonomous-truck-on-germanys-autobahn>
- Rio Tinto. (2016). *Mine of the Future*. Retrieved August 2016, from Rio Tinto: <http://www.riotinto.com/australia/pilbara/mine-of-the-future-9603.aspx>
- Royal Automobile Club of WA. (2016, August 2016). *Australia's first driverless bus is on the open road*. Retrieved September 2016, from <https://rac.com.au/about-rac/media/media-releases/august-2016/australias-first-driverless-bus-is-on-the-open-road>
- SAE International. (2016a). *Automated Driving: Levels of driving automation are defined in new SAE International standard J3016*. Retrieved August 2016, from http://www.sae.org/misc/pdfs/automated_driving.pdf
- SAE International. (2016b). *Guidelines for Safe On-Road Testing of SAE Level 3, 4, and 5 Prototype Automated Driving Systems (ADS)*. Retrieved August 2016, from http://standards.sae.org/j3018_201503/
- State of Florida, Department of State. (2016). *State Library and Archives of Florida*. Retrieved August 2016, from http://laws.flrules.org/search/google?cx=011660464153745793162%3Aorhh8qrepy0&cof=FORID%3A11&query=autonomous+vehicles&op=Search&form_build_id=form-6cee4872b279df8b9d664fc0af43c7b&form_id=google_cse_searchbox_form
- State of Nevada: Department of Motor Vehicles. (2016). *Autonomous Vehicles*. Retrieved August 2016, from <http://www.dmvnv.com/autonomous.htm>
- UK Department of Transport. (2015). *The Pathway to Driverless Cars: A code of practice for testing*. Retrieved August 2016, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/446316/pathway-driverless-cars.pdf
- VicRoads. (2016, October). *Testing of automated vehicles*. Retrieved August 2016, from <https://www.vicroads.vic.gov.au/safety-and-road-rules/vehicle-safety/automated-and-connected-vehicles/testing-of-automated-vehicles>
- Wired. (2016, February 29). *Googles self-driving car caused its first crash*. Retrieved August 2016, from <https://www.wired.com/2016/02/googles-self-driving-car-may-caused-first-crash/>