



Assuring the safety of automated vehicles  
Policy paper  
November 2017



National Transport Commission

# Report outline

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<b>Title</b>	Assuring the safety of automated vehicles
<b>Type of report</b>	Policy paper
<b>Purpose</b>	Recommendations approved by the Transport and Infrastructure Council in November 2017
<b>Abstract</b>	This policy paper sets out the high-level design of a safety assurance system for automated vehicles in Australia based on mandatory self-certification until the development of international standards for automated driving systems. This paper identifies key steps to implement the safety assurance system by 2020, including legislative and registration changes and the development of administrative functions.
<b>Key words</b>	Automated vehicle, automated driving system, road safety, regulation, safety assurance system, self-certification, Australian Design Rules.
<b>Contact</b>	National Transport Commission Level 3/600 Bourke Street Melbourne VIC 3000 Ph: (03) 9236 5000 Email: <a href="mailto:automatedvehicles@ntc.gov.au">automatedvehicles@ntc.gov.au</a> <a href="http://www.ntc.gov.au">www.ntc.gov.au</a>
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# Foreword

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The introduction of automated vehicles is expected to result in significant community benefits including reduced road trauma and increased mobility, productivity and environmental efficiencies. In higher levels of driving automation, vehicles will be driven by an automated driving system, not a human. In this report, the National Transport Commission outlines the role of regulation to ensure these automated vehicles operate safely on our public roads.

This policy paper sets out a high-level direction for government regulation. It makes the case that, like the current licensing regime for human drivers, the community expects governments to ensure automated driving systems can operate safely, within a defined operational design domain. Without a safety assurance system in place, governments will not have a mechanism to know that automated vehicles are safe, including having minimum cybersecurity measures and behaving safely around vulnerable road users. Importantly, the safety assurance system will be national. It will be underpinned by legislation that regulates and penalises the automated driving system entity, not the vehicle owner, for failure to provide or operate a safe vehicle.

The policy directions and recommendations set out in this paper reflect extensive legislative analysis and consultation with a wide range of government and industry stakeholders including road and transport agencies, manufacturers, automobile clubs, insurers and law firms. I have been encouraged by the consistent level of support for a safety assurance system and in particular by the strong level of agreement that Australia needs a single national approach based on mandatory self-certification until international standards for automated driving systems are agreed and introduced in Australian Design Rules.

I would like to thank each organisation and individual who contributed to this important national reform process and encourage them to continue to work with us on the implementation to follow.



David Anderson PSM  
Chairman and Commissioner

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# Executive summary

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Automated driving systems are already operating on Australian roads in limited trial conditions, primarily low-speed driverless shuttles. We expect to see the commercial deployment of automated driving systems (with automated driving functionality at levels 3–4<sup>1</sup>) from 2020.

There is currently no explicit regulation to ensure the safety of automated driving systems as there is for human drivers today with driver licensing regimes. The Australian Design Rules (ADRs), which set standards for new and imported vehicles, do not yet include automated functionality. Without regulatory oversight, there is a risk that unsafe vehicles will be able to operate on public roads. There is also a risk that, without a single national response to automated vehicle safety, inconsistent regulation will be adopted across different states and territories.

The purpose of this policy paper is to recommend to the Transport and Infrastructure Council a proposed regulatory model to assure automated vehicle safety based on stakeholder feedback to the NTC discussion paper.

In June 2017 the National Transport Commission (NTC) published a discussion paper, *Regulatory options to assure automated vehicle safety in Australia*. The paper consulted on four regulatory models for a safety assurance system:

- 1. Continue current approach** – no additional regulatory oversight, with an emphasis on existing safeguards in Australian Consumer Law and road transport laws.
- 2. Self-certification** – manufacturers make a statement of compliance against principles-based safety criteria developed by government. This could be supported by a primary safety duty to provide safe automated vehicles.
- 3. Pre-market approval** – automated driving systems are certified by a government agency as meeting minimum prescribed technical standards prior to market entry.
- 4. Accreditation** – an accreditation agency accredits an automated driving system entity. The accredited party demonstrates it has identified and managed safety risks to a legal standard of care.

The NTC received 28 submissions including submissions from road and transport agencies, manufacturers, automobile clubs, insurers and law firms.<sup>2</sup> Submissions to the NTC discussion paper clearly indicated that the community expects governments to have a role in ensuring automated vehicles are safe, and there was strong support for a mandatory self-certification approach.

## Recommendations

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At their November 2017 meeting, the Transport and Infrastructure Council:

1. Agreed to adopt the ambition for automated vehicles that “Australia is aiming to have end-to-end regulation in place by 2020 to support the safe, commercial deployment and operation of automated vehicles at all levels of automation”.
2. Agreed the development of a national safety assurance system for automated vehicles, based on mandatory self-certification, transitioning to pre-market approval when international standards for automated driving systems are developed and incorporated into ADRs.
3. Agreed the safety assurance design principles, set out in table 1, subject to a Regulation Impact Statement (RIS) undertaken in early 2018.

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<sup>1</sup> See the glossary at Appendix A for an explanation of the levels of driving automation.

<sup>2</sup> Publicly available submissions to the safety assurance system are available on the NTC website at: <https://www.ntc.gov.au/current-projects/safety-assurance-system-for-automated-vehicles/>.

## Role of government to assure safety

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The safety assurance system should enable government oversight of how automated driving system entities manage automated vehicle safety. The primary role of government regulation should be to assess whether an automated driving system entity has identified and managed safety risks to an agreed standard of care, based on the entity's Statement of Compliance against principles-based safety criteria.

The safety assurance system should support automated vehicles that are safer than human-driven vehicles. Governments and industry should use a combination of metrics to evaluate safety performance, including the rate of technical failure of a product, road trauma and near-misses.

The safety assurance system should support an approach that places the onus on the automated driving system entity to assess and validate automated vehicle safety.

The Transport and Infrastructure Council should review the role of government when technical standards to test and validate automated driving systems are designed, developed and approved by the international community.

## Design of the safety assurance system

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Automated driving systems will, in certain circumstances, be deemed to be 'the driver' once legislative amendments to road rules have been made.<sup>3</sup> This means the safety assurance system will regulate the automated driving system as both a vehicle and as a driver. It is therefore critical that the safety assurance system covers the safety of both new vehicles and modifications to vehicles that are in service, just as governments regulate vehicle standards and vehicle registration today, in addition to driver licensing and driver behaviour.

Some vehicles are likely to have increased automation after market entry. It is also possible that, over time, vehicle maintenance, repairs, modifications and deterioration could impact on the safety of automated vehicles. The safety assurance system should therefore ensure any significant changes to the automated driving system are approved and that legal obligations to maintain a safe vehicle – supported by appropriate penalties and enforcement policy – sufficiently cover low-level changes to the automated driving system.

Based on government and industry consultation, the simplest, cheapest and most efficient approach in the next 10–15 years is for the safety assurance system to have the design features outlined in Table 1.

**Table 1. Design features of the proposed safety assurance system**

1. The safety assurance system will be administered by a government authority, preferably on a national basis. Approval decisions may be made on the advice of a single national government panel consisting of the Commonwealth, states and territories, the NTC, the National Heavy Vehicle Regulator (NHVR) and Austroads.
2. The safety assurance system will manage principles-based safety criteria that capture key safety risks associated with automated vehicles. The safety criteria should include matters relating to:
  - i. the safe operational design domain of the vehicle
  - ii. the human–machine interface
  - iii. on-road behavioural competency, including compliance with traffic law, interaction with vulnerable road users
  - iv. cybersecurity
  - v. driver training
  - vi. the provision of data, including interaction with enforcement agencies.

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<sup>3</sup> Subject to outcomes of the NTC project *Changing driving laws to support automated vehicles*.

3. Automated driving system entities (such as manufacturers) will be required to submit a Statement of Compliance that demonstrates how each of the agreed safety criteria has been managed. A Statement of Compliance must be submitted and approved before the relevant automated driving system or function can be introduced into the market.
4. The automated driving system entity remains responsible for testing and validating the safety of the automated driving system or function. The role of government in the safety assurance system is to satisfy itself that the applicant has processes in place to identify and manage the safety risks. It is not envisaged that the safety assurance process will conduct independent testing or validation activities.
5. To support national consistency and cross-border travel, state and territory road managers will be notified of a safety assurance outcome, but approval of a road manager should not be required for the automated driving system to operate unless the automated driving system forms part of a vehicle that would otherwise require a permit or exemption to access the road network. This is consistent with the current arrangements for new light vehicles.
6. All in-service modifications to the automated driving system that have a **significant** impact on safety performance or material compliance with the original safety assurance system approval, including over-the-air software updates of the vehicle, are anticipated to require approval by the safety assurance system before that **significant** modification is introduced into the market.

## Key issues

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Based on stakeholder feedback, the safety assurance system should address the following key issues.

### Institutional arrangements

The safety assurance system should be administered by a single national regulator, which could be the Commonwealth Department of Infrastructure and Regional Development or some other body. A national advisory panel may support the safety assurance system. The panel should consist of government bodies, including state and territory road transport agencies, Austroads, the NTC and the NHVR, where relevant.

### Access to the road network

Road managers and the NHVR should continue to regulate network access for non-standard vehicles including low-speed driverless shuttles and over-mass heavy vehicles. Road transport agencies should also continue to manage vehicle registration including the power to cancel a vehicle's registration where it does not meet roadworthiness requirements.

If the automated driving system requires specific roadside infrastructure, road managers may need to approve automated vehicle access to particular roads.

If the automated driving system is integrated into a standard vehicle, and there are no specific roadside infrastructure requirements, the operational design domain will be agreed through the safety assurance system process, with no additional network access approval.

### How to ensure compliance

A mandatory self-certification model requires sanctions and penalties targeting automated driving system entities. Sanctions and penalties should be supported by risk-based and targeted auditing capabilities and powers.

Further work on the detail of sanctions and penalties, including the potential application of a primary safety duty, will be addressed in the next phase of safety assurance implementation.

## Implementation

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Implementation of the safety assurance system will require the following changes.

### Legislative changes

A mandatory safety assurance system requires legislative amendments to a number of different laws. Without additional sanctions and penalties, the only available remedy is withdrawal of vehicle registration, which penalises the vehicle owner more than the automated driving system entity, and should be a remedy of last resort. A primary duty on automated driving systems, registered operators and other relevant parties to ensure the safe operation of an automated vehicle would also require legislative change.

An initial assessment by the NTC and the Commonwealth has identified three legislative options to administer the safety assurance system and to address these issues:

1. Use existing subordinate legislation, such as regulation of automated vehicles as non-standard vehicles under the *Motor Vehicle Standards Act 1989* (Cwlth) (MVSA), and/or changes to state and territory road transport laws. Regulation as non-standard vehicles may be transitional and would be suitable while automated vehicles are supplied in small numbers.
2. Expand the MVSA to ensure that type-approval for new supplied vehicles can be withheld if a vehicle type is compliant with all relevant ADRs but the automated driving system has not been approved by the safety assurance system. Note that the Objects of the MVSA would need to be changed to allow any in-service aspects of the automated driving system to be included (which may have constitutional implications).
3. Introduce a Commonwealth Act (or other new transport law) to separately regulate automated driving system entities. The safety assurance system would operate independently of the MVSA, in the same way that the Australian Communications and Media Authority regulates to limit electromagnetic interference from vehicles without reference to MVSA processes and ADR compliance.

### Registration changes

Austrroads has conducted an initial assessment of the impacts on registration and licensing. Impacts on registration systems are likely to be minimal, given that the safety assurance system will operate nationally and not through registration processes. However, registration databases, including information available on the National Exchange of Vehicle and Driver Information System (NEVDIS), would need to capture essential information about the automated driving system.

Detailed work will be undertaken by a national registration working group in 2018 to finalise the new registration fields. Examples could include:

- the level(s) of driving automation
- whether the human driver must supervise the automated driving system
- the automated driving system entity.

### Administrative changes

The safety assurance system is an administrative process and will require administrative functions to be developed. In addition to allocating the safety assurance system to a government agency, actions include:

- the development and implementation of a national advisory panel
- consultation and finalisation of principles-based safety criteria
- systems readiness and capabilities planning, including developing a detailed implementation plan.

The government agency or agencies responsible for developing these functions remains to be determined.

## Next steps

To implement a safety assurance system by 2020, Table 2 outlines the next steps to be completed within the next two years.

**Table 2. Implementation tasks to prepare for the regulation of automated vehicle safety**

Action item	Timing	Action	Lead agency
1	Submit detailed implementation plan and decision RIS to the Council in <b>November 2018</b> .	Undertake detailed implementation planning and a RIS on legislative options to support the safety assurance system.	The NTC
2	Registration recommendations to TISOC in <b>September 2018</b> .	Establish a National Registration Working Group to review and agree changes to registration processes and databases and to make recommendations to TISOC.	Austrroads
3	Make further legislative policy recommendations to Council in <b>November 2018</b> (if required).	A National Safety Legislation Working Group, consisting of Commonwealth, state and territory representatives and the NTC, to review legislative options, and to make recommendations to TISOC and the Council.	The NTC
4	Submit draft Bill(s) to Council in <b>May 2019</b> .	Draft Bill(s) to introduce new transport laws and/or amend existing laws to address the legislative requirements to give effect to the safety assurance system.	The NTC
5	Submit safety criteria to TISOC for approval in <b>September 2019</b> .	Finalise principles-based safety criteria in close consultation with governments and industry.	The NTC
6	Implement registration systems changes by the <b>end of 2019</b> .	Make subsequent changes to registration processes and databases to ensure essential information relating to automated vehicles is efficiently captured in registration systems.	Austrroads and states and territories
7	Parliament(s) pass bill(s) into legislation by the <b>end of 2019</b> .	Legislation to establish and give effect to the safety assurance system – would be undertaken in parallel to changes to Compulsory Third Party insurance and road transport laws to recognise the automated driving system entity.	Either/both Commonwealth and state and territory parliaments
8	Report progress of functional readiness to TISOC in September 2018 and in September 2019.  Functions, including the panel, to be established by <b>early 2020</b> .	Develop functions to support the safety assurance system including a gap assessment of skills and capabilities, detailed budget planning and establishing the national panel.	Either/both Commonwealth and state and territory governments

# 1 Context

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## Key points

- This policy paper sets out the high-level design of a safety assurance system for automated vehicles in Australia based on mandatory self-certification until the development of international standards for automated driving systems. This paper identifies key steps to implement the safety assurance system by 2020, including legislative and registration changes and the development of administrative functions.
- The development of the safety assurance system is part of a broader national reform program, which includes other projects being undertaken by the National Transport Commission, the Commonwealth and Austroads to prepare Australia for vehicles with automated functions.

## 1.1 Objectives

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The objective of this project is to develop a national safety assurance system for automated vehicles in Australia. This project forms a key component of the National Transport Commission's (NTC's) overall goal to have end-to-end regulation in place by 2020 to support the safe, commercial deployment of automated vehicles at all levels of automation.

This paper sets out the policy directions and recommendations relating to the principles-based design of a safety assurance system for vehicles with conditional, high and full automation and identifies key next steps to implement the safety assurance system by 2020.<sup>4</sup>

The policy directions and recommendations are grouped into seven key themes:

- **Chapter 2:** Role of government to assure safety
- **Chapter 3:** Assessment criteria for the design of the safety assurance system
- **Chapter 4:** Design of the safety assurance system
- **Chapter 5:** Institutional arrangements
- **Chapter 6:** Access approval to the road network
- **Chapter 7:** How to ensure compliance
- **Chapter 8:** Next steps.

## 1.2 About the NTC

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The NTC is an independent statutory body charged with improving the productivity, safety and environmental performance of Australia's road, rail and intermodal transport systems. As an independent statutory body, we develop and submit 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.

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<sup>4</sup> For a description of the levels of driving automation refer to the NTC's discussion paper, available at: [http://www.ntc.gov.au/Media/Reports/\(6608D654-9FBD-175D-D067-AC80AECE5FB8\).pdf](http://www.ntc.gov.au/Media/Reports/(6608D654-9FBD-175D-D067-AC80AECE5FB8).pdf) (accessed 16/08/2017).

## 1.3 Consultation

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In June 2017 the NTC published a discussion paper<sup>5</sup> seeking feedback on how Australia should regulate the safety of automated vehicles. The discussion paper assessed regulatory options against proposed assessment criteria and canvassed issues relating to the role of government, the evaluation and validation of safety, institutional arrangements, road access and compliance.

We received 26 public submissions and two confidential submissions.<sup>6</sup> These submissions came from road and transport agencies, manufacturers, automobile clubs, insurers and law firms. Based on stakeholder feedback to the discussion paper, this policy paper was developed and submitted to the Transport and Infrastructure Council in November 2017.

## 1.4 Background

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### 1.4.1 Project mandate

In November 2016 the Transport and Infrastructure Council agreed to recommendation 5 in the NTC's policy paper, *Regulatory reforms for automated road vehicles*:<sup>7</sup>

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

### 1.4.2 What is the problem?

#### ***Current regulations do not have regard to automated vehicle safety***

Manufacturers will be developing vehicles able to operate on at least some parts of the Australian road network for extended periods without the input of a human driver. Vehicles operating at conditional automation are likely to be introduced onto the market in the near future, and vehicles operating at high automation (Level 4) may be commercially released on the market from 2020.

Governments already regulate transport to ensure safety, security, efficiency and environmental outcomes. Australia has general consumer and product liability laws and extensive regulation covering vehicle standards and the operation of vehicles on Australian roads. However, existing regulations have not been designed for emerging technologies that have significantly different risks and challenges from vehicles on the roads today.

Australia has an established type-approval process for pre-market approval of new and imported vehicles that is based on the Australian Design Rules (ADRs) and allows self-testing by manufacturers. The current pre-market approval process administered by the Commonwealth Department of Infrastructure and Regional Development does not have regard to automated driving systems or related technology because no relevant United Nations (UN) standards or ADRs have been developed. It is likely to be 10–15 years before a comprehensive suite of automated vehicle standards can be designed and integrated into the current approvals processes.

As such, if legislative barriers to automated vehicles were removed, governments would not have a regulatory mechanism to assess their safety.

#### ***The role of government has not been determined***

Governments could choose to rely on existing safeguards to manage the safety of vehicles with automated functions, including consumer guarantees and vehicle recall powers under the Australian Consumer Law. Alternatively, government could agree to a more proactive oversight of the safety of vehicles with automated functions because the technology is new and the safety performance of these vehicles is unknown.

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<sup>5</sup> *Regulatory options to assure automated vehicle safety in Australia – Discussion paper* (June 2017), available at: [http://www.ntc.gov.au/Media/Reports/\(6608D654-9FBD-175D-D067-AC80AECE5FB8\).pdf](http://www.ntc.gov.au/Media/Reports/(6608D654-9FBD-175D-D067-AC80AECE5FB8).pdf) (accessed 16/08/2017).

<sup>6</sup> A list of stakeholders who made a public submission is provided at Appendix B.

<sup>7</sup> Available at: [http://www.ntc.gov.au/Media/Reports/\(32685218-7895-0E7C-ECF6-551177684E27\).pdf](http://www.ntc.gov.au/Media/Reports/(32685218-7895-0E7C-ECF6-551177684E27).pdf) (accessed 16/08/2017).

If the role of government in assessing the safety of vehicles with automated functions has not been decided by the time these vehicles are commercialised, this could create uncertainty for industry, insurers and consumers.

### **Risk of inconsistent regulation**

There is a risk that, unless a national safety assurance system is agreed and implemented, there will be inconsistent regulation of vehicles with automated functions across states and territories. Road managers could have different technical standards, testing procedures and roadworthiness requirements, while opportunities to leverage off a single government agency and reduce duplication of resources and capabilities would be lost. Inconsistent regulation could also constrain cross-border activity and potentially obstruct safety innovation.

There is also a risk that a nationally agreed approach will be inconsistent with international standards, conventions and practices.

### **1.4.3 International developments**

The NTC discussion paper outlined a number of international developments relating to the regulation of vehicles with automated functions. International approaches to regulating safety are still at the very early stages. There is no internationally agreed approach.

In the United States, in September 2017 the National Highway Transport Safety Administration (NHTSA) released *Automated Driving Systems 2.0: A Vision for Safety*,<sup>8</sup> which replaces the NHTSA's *Federal Automated Vehicles Policy*. The revised policy does not introduce a mandatory pre-market safety assessment process for manufacturers. Rather, it contains 12 safety design elements that manufacturers could consider when developing automated driving systems.

The NHTSA's revised approach is closest to the self-certification option in the NTC's discussion paper. The potential safety risks of adopting voluntary self-certification in the United States are minimised by the NHTSA's enforcement powers and activities to assess in-service vehicle safety. The same safeguards are not available in Australia.

In addition, in September 2017 the United States House of Representatives passed a Bill to implement the *Safely Ensuring Lives Future Deployment and Research In Vehicle Evolution Act* (known as the 'SELF DRIVE Act'), which is now with the Senate.<sup>9</sup> The Bill provides that within 24 months after enactment, the Secretary of Transportation must issue a final rule requiring automated driving system entities to submit a safety assessment certification regarding how safety is being addressed. The Bill also provides that, in the interim, manufacturers should adhere to the NHTSA's approach.

### **1.4.4 Independent report on a safety assurance system**

In late 2016 the NTC commissioned Nova Systems<sup>10</sup> to provide an independent report setting out the options for developing an integrated national safety assurance system that would support routine use of automated vehicle functions. This included potential governance and process models, technical performance requirements and safety validation.

## **1.5 Key terms used in this paper**

**Automated driving system** means the hardware and software that are collectively capable of performing the entire dynamic driving task on a sustained basis. It is a type of driving automation system used in vehicles operating in conditional, high and full automation mode.

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<sup>8</sup> NHTSA's policy is available at: [https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0\\_090617\\_v9a\\_tag.pdf](https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf) (accessed 25/09/2017).

<sup>9</sup> The Bill for the SELF DRIVE Act is available at: <https://www.congress.gov/115/bills/hr3388/BILLS-115hr3388rfs.pdf> (accessed 25/09/2017).

<sup>10</sup> The Nova Systems report can be accessed on the NTC website at: [http://www.ntc.gov.au/Media/Reports/\(CC251F04-967B-854A-F73A-E3BF99DABC44\).pdf](http://www.ntc.gov.au/Media/Reports/(CC251F04-967B-854A-F73A-E3BF99DABC44).pdf)

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

**Dynamic driving task** means all the operational and tactical functions required to operate a vehicle in on-road traffic.

**Operational design domain** means the specific conditions under which an automation system is designed to function including, but not limited to, driving modes.

**Safety assurance system** means a regulatory mechanism to provide oversight of the safety performance of an automated vehicle to assure it can operate safely on the network.

## 1.6 Scope

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This paper is focused on the principles-based design of a safety assurance system for vehicles with conditional, high and full automation and the key next steps to implement the safety assurance system by 2020.

The following areas are **outside the scope** of this paper:

1. A detailed analysis of how a safety assurance system would affect existing vehicle registration and driver licensing regimes. This issue is being explored by Austroads in parallel with the NTC's work.
2. An assessment of existing entities that could undertake the government agency role in a safety assurance system. This assessment is expected to take place in the next phase of work, once the Transport and Infrastructure Council has agreed a preferred model.
3. Detailed project planning and implementation of a safety assurance system. This assessment is expected to take place in the next phase of work once the Transport and Infrastructure Council has agreed a preferred model. A principles-based implementation plan is outlined in chapter 8.
4. Finalisation of any automated vehicle principles-based safety criteria that would form part of the safety assurance system. The development and finalisation of these criteria is expected to take place in 2019.
5. Safety assurance of automated rail vehicles or other non-standard vehicles such as land-based drones.

## 1.7 Interaction with other NTC projects and the broader national reform program

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The NTC's overall goal is to have end-to-end regulation in place by 2020 to support the safe, commercial deployment of automated vehicles at all levels of automation. The safety assurance system is part of this broader national reform program, which includes the following projects:

- **Developing nationally-consistent guidelines for automated vehicle trials:** a project to develop national guidelines governing conditions for trials of vehicles with automated functions. We delivered this project in May 2017.
- **Clarifying control of automated vehicles:** a project to develop national enforcement guidelines that clarify regulatory concepts of *control* and *proper control* for automated vehicles. Proposed national enforcement guidelines were submitted to the Transport and Infrastructure Council in November 2017.
- **Changing driving laws to support automated vehicles:** a project to develop legislative reform options to clarify the application of current driving laws to vehicles with automated functions, and to establish legal obligations for automated driving system entities. We will submit reform options to the Transport and Infrastructure Council in May 2018.
- **Clarifying regulatory access to data:** a project to scope the circumstances under which government agencies should be able to access and use data generated by vehicles with

automated functions. We will submit reform options to the Transport and Infrastructure Council in November 2018.

In addition to these NTC projects, the following work is being undertaken by other agencies:

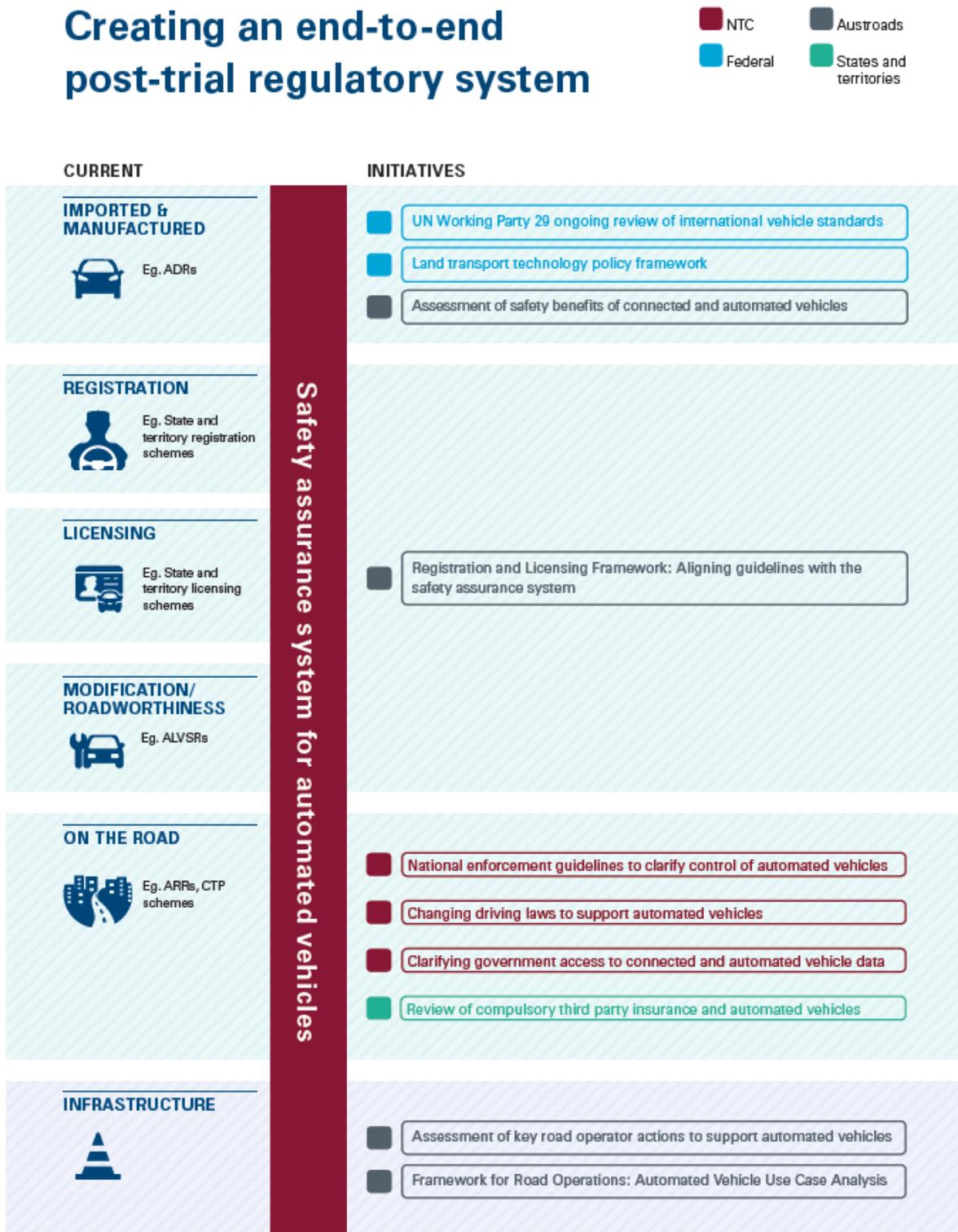
- The Commonwealth Department of Infrastructure and Regional Development continues to participate in developing new and updated UN vehicle standards, and are participants of UN Working Party 29
- Austroads is currently undertaking a project to assess how registration and licensing operations can best be aligned with a safety assurance system. Austroads' assessment suggests that the impacts on registration and licensing are likely to be minimal, given that the safety assurance system will operate nationally and not through registration processes. However, registration databases, including information available on the National Exchange of Vehicle and Driver Information System (NEVDIS), could capture essential information about the automated driving system.

The NTC notes that detailed work will be undertaken by a national registration working group in 2018 to finalise new registration fields.

The NTC continues to collaborate closely with the Commonwealth, Austroads and state and territory governments to ensure an integrated regulatory system for deploying vehicles with automated functions can be delivered.

Figure 1 shows the existing end-to-end regulatory process and the projects underway at each stage to prepare for more vehicles with automated functions.

Figure 1. End-to-end regulatory process and projects



## 2 Role of government to assure safety

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### Key points

- The safety assurance system should enable government oversight of how automated driving system entities manage automated vehicle safety. The primary role of government regulation should be to assess whether an automated driving system entity has identified and managed safety risks to an agreed standard of care, based on the entity's Statement of Compliance against principles-based safety criteria.
- The safety assurance system should support automated vehicles that are safer than human-driven vehicles. Governments and industry should use a combination of metrics to evaluate safety performance, including the rate of technical failure of a product, road trauma and near-misses.
- The safety assurance system should support an approach that places the onus on the automated driving system entity to assess and validate automated vehicle safety.
- The Transport and Infrastructure Council should review the role of government when technical standards to test and validate automated driving systems are designed, developed and approved by the international community.

### 2.1 Introduction

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It is likely that the development of automated vehicle technology will improve safety risks attributable to human-related error. However, safety risks attributable to vehicle operational or technical faults could increase.

The NTC discussion paper reflected that today, while human activities are highly regulated, vehicle regulation is relatively light-touch. Regulation of initial vehicle technical integrity uses a form of pre-market approval where vehicle manufacturers provide evidence to show their vehicles comply with the ADRs. Regulation of ongoing technical integrity is enforced through roadside vehicle checks and periodic vehicle inspections (annual, at transfer of ownership or other, depending on the state or territory).

At issue is how government regulation should adapt to the likely increased safety risk of vehicle technical integrity at both first supply and in-service.

### 2.2 Stakeholder feedback

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Stakeholders provided clear and consistent feedback that government has a role in automated vehicle safety assurance. Explicit regulation was supported.

Stakeholders recognised that there is currently no definitive way to measure and quantify automated vehicle safety but generally agreed that automated vehicles should be safer than conventional vehicles if governments are going to allow them to operate on public roads.

In this section, we summarise feedback on questions 1, 2 and 3 in the discussion paper:

- Question 1: Should government have a role in assessing the safety of automated vehicles or can industry and the existing regulatory framework manage this? What do you think the role of government should be in the safety assurance of automated vehicles?
- Question 2: Should governments be aiming for a safety outcome that is as safe as, or significantly safer than, conventional vehicles and drivers? If so, what metrics or approach should be used?
- Question 3: Should the onus be placed on the automated driving system entity to demonstrate the methods they have adopted to identify and mitigate safety risks?

## 2.2.1 There is a need for government regulation

Stakeholders, including manufacturers and state governments, agreed there is a need for government regulation. Automated vehicles will use innovative and emerging technologies that are potentially high-risk, and many stakeholders agreed that community confidence will be diminished if governments do not introduce visible measures to oversee automated vehicle safety. Some stakeholders, such as the Amy Gillett Foundation, noted that the key role of government is to maximise community safety and that this is consistent with the safe system approach to the road transport system.

QBE Group provided a useful overview of why there should be an increased role for government:

- The Commonwealth Government's responsibilities for overseeing vehicle standards will likely require a more comprehensive approach, recognising the greater variety of tasks that automated vehicles will need to perform.
- There is a lack of historical evidence of automated vehicle performance and reliability.
- Vehicle registration checks may become more frequent and comprehensive.

National consistency will be important for manufacturers, consumers and insurers. Manufacturers, such as Toyota Australia, also emphasised that regulation – including Australian Road Rules and ADRs – needs to be aligned with international standards and developments.

Furthermore, it is possible that some automated vehicles will rely on third parties or other systems to operate safely, or to their full safety potential. This includes vehicles that could rely on cooperative intelligent transport systems (C-ITS) to communicate with other vehicles, infrastructure and road users (including vulnerable road users). If this is the case, stakeholders such as Toyota Australia emphasised that the regulatory framework needs to support and have oversight of this operating system to ensure the safe interaction between third parties.

Stakeholders, such as NatRoad, noted that while the safety benefits of regulation may seem apparent, the benefits need to outweigh the cost of regulation to industry and consumers. The Western Australia (WA) Transport Portfolio suggested that the benefits of well-developed regulation, although imposing some regulatory burden, are likely to exceed any costs imposed on industry and consumers.

## 2.2.2 A co-regulatory approach is supported, until standards are developed

The NTC discussion paper suggested that regulatory intervention does not necessarily entail explicit regulation. The role of government may be to support industry through quasi-regulation (where governments influence businesses to comply with standards) or co-regulation (where industry develops and administers its own arrangements, but with legislative backing).

Some stakeholders recognised that a transitional approach towards explicit regulation may be appropriate because at this stage technical standards and testing procedures do not exist for governments to explicitly test, validate and approve automated technologies. NatRoad noted that it will be difficult for government to assess automated vehicle risks with any certainty while the technology is still being developed.

A key issue for many stakeholders was ensuring that safety regulation does not stifle innovation and technology take-up, particularly at this early stage of development. This view was reflected in the Australian Automobile Association (AAA) submission, which proposed that:

*... while regulation will have an important role to play in managing and enforcing what vehicles will be accepted, it should be up to the manufacturer to warrant that the vehicle has been designed and manufactured to deliver safe and efficient automated transport in line with relevant international standards and best practice (AAA submission, pg. 2).*

However, while there was general acceptance for industry to manage safety risks and to self-regulate at this early stage, some submissions recognised that the community will have expectations that key safety risks are properly managed. For example, the Amy Gillett Foundation stated that manufacturers must ensure new technologies will detect and avoid cyclists, as well as protecting vehicle occupants.

PwC recommended that an automated driving system entity should only be entitled to supply an automated vehicle if they have demonstrated to government's satisfaction that the safety risks have been appropriately addressed during the design, manufacture and testing process. PwC suggested that the approach taken in rail and aviation safety should be further considered.

Road transport agencies suggested that the onus may be on industry to ensure their products are safe, but governments could also have a role to provide regulatory oversight and to ensure manufacturers have undertaken reasonable measures to provide a safe product to market.

### **2.2.3 Automated vehicles must be safer**

Automated vehicles are expected to result in increased road safety benefits and a net reduction in deaths and injuries. The NTC discussion paper consulted on whether governments should be aiming for a safety outcome that is as safe as, or is significantly safer than, conventional vehicles.

Underpinning this issue is a key question: If the safety assurance system requires a significant safety improvement, yet the manufacturer can only demonstrate<sup>11</sup> a marginal safety improvement, should the technology be approved for use on public roads?

All stakeholders, including manufacturers, agreed that the standard should be a safer outcome than conventional vehicles. As noted by QBE Group, without a higher safety standard, community acceptance of the technology will be difficult to achieve.

In addition, some stakeholders supported a standard of safety that is significantly safer than conventional vehicles. This included submissions from the WA Transport Portfolio,<sup>12</sup> PwC, Australian Trucking Association (ATA), AECOM and Australia and New Zealand Driverless Vehicle Initiative (ADVI). ADVI argued that an ambitious safety target would drive increased safety performance, and PwC suggested that if automated vehicles are significantly safer, the community will more likely accept technical failure when – from time to time – it would inevitably happen. The Law Institute of Victoria submitted that the standard should be significantly or materially safer.

There were a number of complexities raised by stakeholders in relation to developing a standard of safety including:

- whether the safety performance of an automated vehicle is compared to a novice, average or expert human driver (NatRoad and ATA)
- what society deems acceptable will evolve as the technology matures (Transurban)
- the safety standard should be a 'rolling benchmark' as the technology matures, and existing protections in ADRs must continue to apply, if applicable (Australasian New Car Assessment Program (ANCAP))
- measuring safety should include the impact of the automated vehicle on other road users – not prioritising the safety of the human inside the vehicle (Amy Gillett Foundation)
- there are other measures that need to be considered in addition to safety, including reliability, mobility, efficiency and sustainability (ADVI).

### **2.2.4 The onus should be on industry to measure and quantify automated vehicle safety**

There was strong agreement among stakeholders that the onus should be on the automated driving system entity to demonstrate the methods it has adopted to identify and manage safety risks. This view is consistent with the broad agreement among stakeholders that a mandatory self-certification approach should be adopted in the near term.

A number of stakeholders, including the Queensland Department of Transport and Main Roads (TMR), suggested that this approach should be reassessed as international standards and testing procedures are developed, agreed and implemented.

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<sup>11</sup> Stakeholder views on how to measure safety are discussed in the next section.

<sup>12</sup> The WA Transport Portfolio noted the University of Michigan has suggested that the concept of automated vehicles being required to be 90 per cent safer than human-driven vehicles should determine the safety target, with an 80 per cent confidence level. See: [https://mcity.umich.edu/wp-content/uploads/2017/05/Mcity-White-Paper\\_Accelerated-AV-Testing.pdf](https://mcity.umich.edu/wp-content/uploads/2017/05/Mcity-White-Paper_Accelerated-AV-Testing.pdf).

AECOM observed that a national legislative power is necessary, and governments will need to set minimum safety requirements, but the actual testing should be flexible to avoid gaps and inconsistent treatment of different technologies and applications.

PwC provided a persuasive summary of the reasons for placing the onus on the automated driving system entity. In PwC's view, this approach:

- is technology-neutral and will facilitate private sector innovation
- provides a structured and systematic approach to ensuring a vehicle is safe
- aligns with what a prudent and competent manufacturer will want to do in any event, to discharge its duty of care in tort
- avoids the need for government to work out the tests that should be conducted, or to wait for other governments to do so
- recognises those closest to the development of the technology are likely to be much better equipped than government to work out the testing that should be done
- will enable risk management processes and tests to evolve quickly as industry standards and best practice emerge
- will enable manufacturers to complete many tests at their preferred location
- is consistent with the primary responsibility for managing the safety risk remaining with the manufacturer, rather than a regulator.

Stakeholders generally agreed that there was merit in a forward-looking safety metric, as outlined by Nova Systems and based on repeatable testing of the measured rate of when a technical product or thing will fail. There was broad agreement that a forward-looking safety metric could complement (but not replace) traditional retrospective and longitudinal metrics related to road trauma. It was further noted by ADVI that the conventional measurement of safety is problematic because it is generally measured over time, typically over a five-year period.

In summary, stakeholders recognised a number of methods to define and measure safety outcomes. Metrics included:

- the rate of technical failure of a product or thing
- the rate of incidents that cause harm to people
- the rate of incidents that do not cause harm to people (near-misses)
- a measure of fatalities and injuries
- perceptions of safety in the community.

Many stakeholders stated that the measure of fatalities was not a sufficient measure by itself. The number of fatalities and injuries was considered problematic because of the retrospective nature of that methodology being applied to new technologies and innovations. Toyota Australia, for example, suggested a combination of all metrics, noting the complexity and diversity of operational design domains. However, while the AAA agreed that all the metrics were valid, the automobile association stated that greater weight should be added to metrics that track road trauma.

In relation to the rate of technical failure, AECOM recommended consideration of a system used in the American Society of Civil Engineers' *Automated People Mover Standards* (ASCE 21-13) where risk assessment is established through Mean Time Between Hazardous Events.

Data collection was recognised as essential if the safety risks and performance of different types of automated vehicles are to be comprehensively understood. QBE Group recommended that there would be benefit in collecting information related to the rate of incidents, including near-misses, to monitor and address safety risks. ADVI recommended mandatory data recording of safety incidents. Toyota Australia recommended extensive trials to collect sufficient data, with wide access to trial data so that researchers and governments can better understand the research gaps. Toyota Australia also noted that data recording should distinguish between incidents caused by the automated driving system and incidents that result from human intervention or behaviours.

Transurban further recommended ongoing attitudinal research to measure community attitudes and understanding of automated vehicles.

## 2.3 Conclusions

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### 2.3.1 Role of government

The NTC notes there was unanimous support for government oversight of automated vehicle safety. The role of government is to improve road safety and to build consumer confidence that automated vehicles are safe.

Until international standards for automated vehicle safety are agreed, automated driving system entities should develop and administer their own arrangements to manage automated vehicle safety. The role of government should be to assess whether an automated driving system entity has identified and managed safety risks to an agreed standard of care, based on the entity's Statement of Compliance against principles-based safety criteria (discussed in detail in chapter 4).

The NTC notes that road transport agencies propose they have a role in ensuring manufacturers have undertaken reasonable measures to provide a safe product to market. This rationale underpins the preferred option (discussed in chapter 4), which is based on mandatory self-certification model.

In many respects, this is a co-regulatory approach to safety: industry develops and administers its own arrangements to manage automated vehicle safety, but government provides legislative backing to enable the enforcement of the arrangements. This would include sanctions and penalties if the manufacturer (the automated driving system entity) fails to submit a Statement of Compliance.

The NTC agrees with stakeholders that the benefits of regulation need to outweigh the cost to businesses and individuals. The NTC will undertake a Regulation Impact Statement (RIS) on the preferred legislative model. The RIS process will identify and quantify the benefits and costs of the regulation of automated vehicles in addition to current regulation of new and in-service vehicles.

### 2.3.2 Standard of safety

The NTC agrees that automated vehicles should be significantly safer than human-driven vehicles. However, incremental improvements in road safety should not be discouraged, and the safety assurance system should approve automated driving systems so long as automated vehicles will be safer than human-driven vehicles.

### 2.3.3 How safety should be measured

The evaluation and validation of automated vehicle safety should be the responsibility of the automated driving system entity. The 'automated driving system entity' is the entity that submits a Statement of Compliance to a government agency prior to the introduction of an automated driving system to the Australian market. The majority of stakeholder views, including the reasoning outlined above by PwC, are consistent with this policy direction.

Industry and governments should rely on a wide range of metrics to measure automated vehicle safety, including the rate of technical failure, the rate of incidents that cause harm to people and the rate of near-misses. This should include measures related to road trauma, and the NTC agrees that road trauma data should have the greatest weight on policy decision making and safety assurance approvals.

Where possible, industry should collect and make available to government and researchers information related to the rate of technical failure and incidents, both in trials and commercial deployments. This will increase community confidence and help identify research gaps and opportunities.

Where possible, Australia should follow any international consensus on the definition and measurement of safety. International consensus will likely emerge as the technology matures and automated vehicle numbers grow.

The NTC agrees that the safety assurance system could be used to ensure key safety outcomes are realised, such as protection of vulnerable road users. This can be achieved through the principles-based safety criteria, which is intended to be finalised once the direction of the safety assurance system has been agreed by the Transport and Infrastructure Council.

### 2.3.4 Policy directions

**Policy direction:** The safety assurance system should enable government oversight of how automated driving system entities manage automated vehicle safety. The primary role of government regulation should be to assess whether an automated driving system entity has identified and managed safety risks to an agreed standard of care, based on the entity's Statement of Compliance against principles-based safety criteria.

**Policy direction:** The safety assurance system should support automated vehicles that are safer than human-driven vehicles. Governments and industry should use a combination of metrics to evaluate safety performance, including the rate of technical failure of a product, road trauma and near-misses.

**Policy direction:** The safety assurance system should support an approach that places the onus on the automated driving system entity to assess and validate automated vehicle safety.

**Policy direction:** The Transport and Infrastructure Council should review the role of government when technical standards to test and validate automated driving systems are designed, developed and approved by the international community.

# 3 Assessment criteria for the design of the safety assurance system

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## Key points

- Stakeholders supported the assessment criteria to evaluate the regulatory options. We made the following improvements based on stakeholder feedback:
  - The safety criterion now includes security, privacy and occupant and other road user safety.
  - The regulatory efficiency criterion now includes impacts on industry.
  - The other policy objectives criterion now includes achieving consumer confidence.
- Governments should adopt a transitional approach to developing the safety assurance system.

## 3.1 Introduction

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The NTC discussion paper proposed eight assessment criteria to evaluate the regulatory options for the safety assurance system. These assessment criteria were used to identify the benefits and disadvantages of no change, self-certification, pre-market approval and accreditation options. The assessment criteria were based on a review of existing literature, *Better Regulation Handbook* guidance, initial stakeholder feedback and the independent report prepared by Nova Systems.

The assessment criteria relate to the design of the regulatory model for a safety assurance system. These are distinct from, and separate to, principles-based safety criteria that applicants in the safety assurance system will respond to as part of the Statement of Compliance (this process is discussed in more detail in chapter 4).

The discussion paper proposed the following assessment criteria:

### 1. Safety

Automated vehicles must be designed to operate safely, and safety is a primary regulatory objective. Public acceptance and use of automated vehicles will be limited unless there is certainty that automated vehicles have been designed and constructed to operate safely.

### 2. Innovation, flexibility and responsiveness

The safety assurance system must allow for ongoing and unforeseen technical innovation. Equally, the model should allow government to respond and adapt to the changing market and changing business models and to work with international standards if and when they are developed.

### 3. Accountability and probity

The model should ensure the decision-making process is transparent, accountable and, where appropriate, appealable. There should always be a legal entity (whether a human person or a corporation) responsible for the initial and ongoing safety of the automated driving system.

### 4. Regulatory efficiency

The model should be as efficient as possible and result in the least regulatory cost for industry and government, proportionate to the risk. The model should minimise structural, organisational and regulatory change necessary to implement the model.

## 5. International and domestic consistency

The model should support a single national approach, or state-based approaches that are nationally consistent. The model should support international consistency.

## 6. Safe operational design domain

The model should be able to take into consideration the operational design domain of an automated driving system. The operational design domain could include geographic, roadway, environmental, traffic, speed or temporal limitations.

## 7. Other policy objectives

Where it is reasonable, appropriate and in alignment with government policy to do so, the safety assurance system should be able to support other policy objectives. These could include cybersecurity, traffic management, environmental protection and the provision of data for enforcement or insurance purposes.

## 8. Timeliness

The safety assurance system should be scoped, designed, funded and implemented within the next two years.

Bearing in mind the timeliness criteria, the NTC discussion paper also sought feedback on whether a transitional approach should be adopted. A transitional arrangement would allow an interim approach to be in place and operational within the next two years while also allowing a more mature regulatory model to be implemented in the long term as technology and international standards develop.

## 3.2 Stakeholder feedback

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Stakeholder feedback supported the proposed assessment criteria to evaluate the regulatory options. Some stakeholders suggested additional detail for some of the assessment criteria. These improvements have been reflected in the finalised assessment criteria, outlined in Table 3.

In this section we summarise feedback on questions 4 and 5 in the discussion paper:

- Question 4: Are the proposed assessment criteria sufficient to decide on the best safety assurance option? If not, what other assessment criteria should be used for the design of the safety assurance system?
- Question 5: Should governments adopt a transitional approach to the development of a safety assurance system? If so, how would this work?

### 3.2.1 Stakeholders supported the proposed assessment criteria

In response to question 4, stakeholders were consistently supportive of the proposed assessment criteria. National consistency was a key objective across many of the submissions. The ADVI submission provided a concise summary of why national consistency matters:

*It is important that Australia is an early adopter of AV technology and proactively [implements] and pursues opportunities. This requires a single approval process in place of the current fragmented approach currently provided through the involvement of nine (9) governments. Australia comprises about 1.5% of global vehicle sales and cannot afford this level of complexity if it is to realise the significant benefits that may be achieved (ADVI submission, pg. 7).*

The following improvements were recommended.

In response to safety as an assessment criterion, the Amy Gillett Foundation stated that, without a comprehensive definition of 'safety', vulnerable road users needed to be explicitly considered. The Foundation stated that safety should not be interpreted as only applying to vehicle occupants.

In response to the accountability and probity criterion, the ATA stated that the assessment criteria should ensure it is clear who is responsible for the vehicle for maintenance and repairs, particularly given that a heavy vehicle is likely to have multiple owners and operate in markedly different

conditions during its lifespan. ADVI also suggested that accountability and probity should include a requirement for insurance and clarifying that an entity is legally accountable in an Australian jurisdiction.

In response to the regulatory efficiency criterion, the ATA stated that it should include minimising structural and organisational change in order to implement a regulatory option, and the model should likewise not affect the structure of the freight industry or discriminate against small business.

In relation to the support of other policy objectives criterion, AECOM suggested interoperability with the safety policies of other applications, or group of applications, such as C-ITS.

Robert Bosch (Australia) (Bosch) suggested that all areas of the safety assessment from the 2016 NHTSA *Federal Automated Vehicles Policy* be addressed. This would include policy areas such as data recording and sharing, consumer education and training, post-crash behaviours, privacy, registration and certification, ethical considerations, vehicle cybersecurity, human-machine interface, crashworthiness and validation methods.

The WA Transport Portfolio suggested a number of additional areas be addressed, including security and cybersecurity, privacy and data specifications.

The AAA proposed that the criteria should be weighted. The Truck Industry Council noted that the criteria should be reviewed periodically to ensure they remain aligned with evolving technology and public expectations. Transport Certification Australia (TCA) noted that there was potential for overlap between some of the criteria. Transurban recommended a criterion related to market influence pragmatism, noting Australia's small percentage of the global vehicle market and limited ability to influence global standards.

Submissions received did not suggest changes or additions to innovation, flexibility and responsiveness, international and domestic consistency or timeliness criteria. As noted above, international and domestic consistency was explicitly supported in a number of submissions.

### 3.2.2 Stakeholders supported transitional arrangements

Stakeholders supported adopting a transitional arrangement, with a number of submissions noting that a flexible and an evolving approach would be crucial. For example, QBE Group noted that a transitional approach was likely to prevent regulatory hurdles from delaying the rollout of the technology, while TMR stated that a transitional approach would facilitate responsiveness to emerging technologies.

The AAA observed that a transitional arrangement will be appropriate given that it will be some years before regulators in other countries develop their own standards, tools and capabilities. The AAA also noted that:

*A staged, hybrid system may maximise the protective function of the current system while still allowing some agility that supports innovation. Any initial 'teething' problems could be mitigated by falling back on current, proven systems and processes (AAA submission, pg. 5).*

ADVI suggested that self-certification transitioning into pre-market approval would assure the safe deployment of automated vehicles.

## 3.3 Conclusions

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### 3.3.1 Improvements to the assessment criteria

Based on stakeholder feedback the following improvements have been made to the assessment criteria:

- Safety criterion: This assessment criterion now specifically identifies the following safety issues: security, privacy, ethics, data collection, human-machine interface, crashworthiness, occupant and other road user safety, additional technology such as C-ITS, insurance and validation methods. These matters are expected to be key elements in

the principles-based safety criteria used in the safety assurance system, but it is appropriate that they are flagged in the design criteria for the regulatory model.

- **Accountability and probity criterion:** This assessment criterion now specifically seeks to ensure certainty about who (whether an individual or a corporation) is responsible and legally accountable for the automated driving system throughout the lifespan of a vehicle.
- **Regulatory efficiency criterion:** This assessment criterion now specifically seeks to ensure the effect of the safety assurance system is minimised where possible.
- **Other policy objectives criterion:** This assessment criterion now references consumer confidence as an additional policy objective.

### 3.3.2 Policy directions

**Policy direction:** The finalised assessment criteria used to evaluate the regulatory options should be the criteria outlined in Table 3.

**Policy direction:** Governments should adopt a transitional approach to developing the safety assurance system.

**Table 3. Finalised assessment criteria for the design of the safety assurance system**

Criteria	Description
1. <b>Safety</b>	<ul style="list-style-type: none"> <li>• The model should support automated vehicle safety including ongoing safety over the lifespan of the vehicle.</li> <li>• The model should allow for specific issues to be addressed including security, privacy ethics, data collection, human–machine interface, crashworthiness, occupant and other road user safety, additional technology such as C-ITS, insurance and validation methods.</li> </ul>
2. <b>Innovation, flexibility and responsiveness</b>	<ul style="list-style-type: none"> <li>• The model should be technology-neutral and allow innovative solutions.</li> <li>• The model should allow government to respond and adapt to the changing market and evolving technology.</li> </ul>
3. <b>Accountability and probity</b>	<ul style="list-style-type: none"> <li>• The model should ensure the decision-making process is transparent, accountable and, where appropriate, appealable.</li> <li>• The model should provide certainty about who (whether an individual or a corporation) is responsible and legally accountable for the automated driving system throughout its lifespan.</li> </ul>
4. <b>Regulatory efficiency</b>	<ul style="list-style-type: none"> <li>• The assurance process should be as efficient as possible and result in the least cost for industry and government, proportionate to the risk.</li> <li>• The process of assurance should minimise structural, organisational and regulatory change necessary to implement the model.</li> <li>• Effects on industry are minimised where possible.</li> </ul>
5. <b>International and domestic consistency</b>	<ul style="list-style-type: none"> <li>• The model should support a single national approach, or state-based approaches that are nationally consistent.</li> <li>• The model should support international consistency, where possible. International approval processes and standards should be recognised, where appropriate.</li> </ul>
6. <b>Safe operational design domain</b>	<ul style="list-style-type: none"> <li>• The model should be able to take into consideration the operational design domain of an automated driving system.</li> </ul>
7. <b>Other policy objectives</b>	<ul style="list-style-type: none"> <li>• The model should be able to support non-safety policy objectives such as traffic management, environmental protection, consumer confidence and the provision of data for enforcement or insurance purposes.</li> </ul>
8. <b>Timeliness</b>	<ul style="list-style-type: none"> <li>• The model should be able to be implemented and operational when the technology is ready.</li> </ul>

# 4 Design of the safety assurance system

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## Key points

- In the interim period (approximately 2020–2030), the safety assurance system will be developed based on a mandatory self-certification approach. This approach has the following features:
  - Automated driving system entities will be required to submit a Statement of Compliance against principles-based safety criteria for approval before the relevant automated driving system or function can be introduced into the market.
  - The automated driving system entity, rather than government, will be responsible for testing and validating the safety of the automated driving system or function. The role of government is to satisfy itself that the applicant has processes in place to identify and manage the safety risks.
  - All significant modifications to the automated driving system or function must also be approved before being introduced into the market.
- In the long term a pre-market approval model based on ADRs for automated driving systems is anticipated to be the preferred approach for regulating vehicle safety. This approach (along with accreditation) will be considered further when international standards are developed and the automated vehicle market is more mature.

## 4.1 Introduction

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The NTC discussion paper outlined four regulatory options for the safety assurance of automated vehicles. The four options were based on our assessment of the current regulatory framework and a review of safety literature and international developments.

In this chapter we summarise feedback to questions 6–9 that relate to the following options.

### Option 1: Continue current approach

Under this option the current system for managing new and imported vehicles and their operation would continue. Safety would be managed through existing safeguards (such as road rules and the Australian Consumer Law) without additional regulatory oversight.

In the longer term the ADRs and in-service vehicle standards could be updated with automated driving standards to align with any UN standards that are developed.

The NTC discussion paper identified that this option comes with a number of challenges, most notably the gap between automated technologies emerging and new international standards being developed. While there are existing safeguards, safety risks relating to the vehicle's operational design domain and factors such as cybersecurity would remain unregulated.

### Option 2: Self-certification

Under this option an automated driving system entity would self-certify the safety of an automated vehicle or automated driving system. Self-certification could be voluntary or mandatory and could be supported by a primary safety duty to provide safe automated vehicles.

The NTC discussion paper noted that self-certification, like option 1, would rely on existing safeguards but would encourage or require manufacturers to make a Statement of Compliance against principles-based safety criteria developed by government. A mandatory process would introduce additional rigour.

### Option 3: Pre-market approval

Under this option automated driving systems would be certified by a government agency as meeting minimum prescribed technical standards prior to market entry (including reporting in-service safety-critical events or changes to functionality). This process would be in addition to existing requirements to demonstrate compliance with ADRs.

The NTC discussion paper noted that while pre-market approval would arguably provide the highest certainty for government and consumers, it could be resource-intensive and time consuming because it involves testing automated driving systems on an application-by-application basis. It is also likely to cause approval delays while standards and test procedures are developed for new technologies or applications.

### Option 4: Accreditation

Under this option an accreditation agency would accredit an automated driving system entity. The accredited party would need to demonstrate it has identified and managed safety risks to a legal standard of care such as 'so far as is reasonably practicable'.

The NTC discussion paper noted that this approach could provide a comprehensive, risk-based framework within which safety could be regulated. However, it would require major reform and be difficult to administer if there was a high number of automated driving system entities.

## 4.2 Regulating safety in the interim period

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### 4.2.1 Stakeholder feedback

Stakeholders agreed that continuing the current approach to regulating vehicle safety (option 1) is not an option for the safety assurance of automated vehicles. For example:

- WA Transport Portfolio and NatRoad stated that to ensure automated vehicle safety a higher level of regulatory oversight and a more comprehensive set of regulatory tools is required.
- ADVI stated that the current approach does not provide sufficient protections relating to after-market modification.
- Another road transport agency noted that a reactive approach to safety assurance is not proportionate to the risks of automated driving.

AECOM, Toyota Australia, the AAA and the Truck Industry Council noted that continuing the current approach may only be appropriate in the very short term while an alternative is being developed.

In the interim period the majority of stakeholders supported either mandatory self-certification or a hybrid approach based on options 2, 3 and 4.

The NRMA and the AAA supported self-certification because it is flexible, is efficient, supports innovation and can be implemented in a short timeframe. Toyota Australia noted that self-certification is the best approach to regulating safety in the near future because it provides the highest level of balance between all assessment criteria in the NTC's discussion paper.

PwC stated that self-certification should be mandatory to ensure government has the final say on whether the manufacturer has demonstrated that the vehicle or any significant modification is safe. ADVI similarly stated that self-certification should be mandatory, otherwise it would not adequately manage in-service usage or the risk of after-sale modification. ADVI noted that if a mandatory scheme is not currently possible, industry should at least be required to submit its self-certification to government. Toyota Australia and NatRoad noted that mandatory self-certification would provide a more level playing field for manufacturers.

A number of stakeholders commented on the importance of a self-certification approach being supported by a primary safety duty. For example:

- AECOM suggested that self-certification could be supported by a primary safety duty to ensure the vehicle remains inside its operational design domain.

- The Amy Gillett Foundation noted that a primary safety duty is important because it creates a reasonable safeguard for evolving automated vehicle technology.
- The Law Institute of Victoria supported a legislated primary safety duty if it complements the overall regulatory regime and consideration is given to how it may apply with respect to servicing, modification and repair.

A number of stakeholders supported a hybrid approach in the interim period:

- TMR suggested an approach incorporating elements of both self-certification and pre-market approval. Under this approach, industry would self-certify that an automated driving system is safe, but the lodgement of a Statement of Compliance would be mandatory. In addition, government would have to approve the automated driving system prior to operation and following any significant in-service changes. TMR noted this approach achieves timely implementation without inhibiting innovation.
- WA Transport Portfolio cautiously supported mandatory self-certification and noted that elements of pre-market approval or accreditation could be adopted where it may improve safety outcomes for the community. WA Transport Portfolio also noted that automated driving system entities would have greater knowledge of system design and performance than regulators and should therefore bear primary responsibility for identifying and managing risk.
- The Australian Academy of Technology and Engineering (ATSE) and ANCAP supported a hybrid approach incorporating pre-market approval to ensure there is a level of independent assessment. While supporting the core attributes of pre-market approval, ATSE believes that elements of self-certification requiring manufacturers to carry out testing of new vehicles should be adopted.
- PwC stated that mandatory self-certification should be a pre-condition to the supply of the vehicle in Australia. Such an approach incorporates pre-market approval based on the supplier satisfying government that the completed testing is sufficient to discharge the supplier's primary safety duty, and would provide a high level of certainty without the unnecessary burdens contained in option 3.
- NatRoad stated that self-certification or accreditation, or a hybrid of these two options, is the most feasible because it would place responsibility for managing safety on the entity best placed to control safety risks (that is, the automated driving system entity).
- TCA noted that a regulatory framework based purely on one of option 2, 3 or 4 may not be flexible enough to balance the traditional objectives of an approval process but also provide assurances for in-service operation and corresponding re-approval processes. As such, it may be appropriate for the NTC to consider a framework that is inclusive of options 2, 3 and 4.

The Motorcycle Council of NSW and one national transport peak body considered that accreditation may be appropriate in the interim period because self-certification will not entirely allay the community's concerns. QBE Group similarly noted that accreditation would be the best approach in the interim period because it is likely to build public trust and place the onus on automated driving system entities to manage safety risks.

The Law Institute of Victoria stated that self-certification may contain an inherent conflict of duties for manufacturers given the commercial advantages associated with delivering the first vehicles to the market and the necessity to reduce compliance costs. As such, the Law Institute of Victoria suggested that pre-market approval is the best option despite the creation of a potential delay in implementation because it provides a high level of certainty for government and consumers. The Law Institute of Victoria noted that accreditation also potentially satisfies its concerns.

Conversely, a number of stakeholders noted that pre-market approval is not appropriate in the interim period because it would take too long to implement and may not provide the necessary flexibility while automated vehicle technologies are being developed.

One road transport agency stated that the measure of what is safe is not static and will change with the external environment and when new information is obtained. As such, the road transport agency noted that the safety assurance system should require the safe operation of the automated driving system to be managed on an ongoing basis.

## 4.2.2 Proposed approach in the interim period

Stakeholders strongly preferred that a safety assurance system based on a mandatory self-certification approach be introduced in the interim period. The NTC recognises that many stakeholders considered such a model should be supported by a primary safety duty.

Based on this feedback, the design features of the proposed safety assurance system are outlined in Table 4.

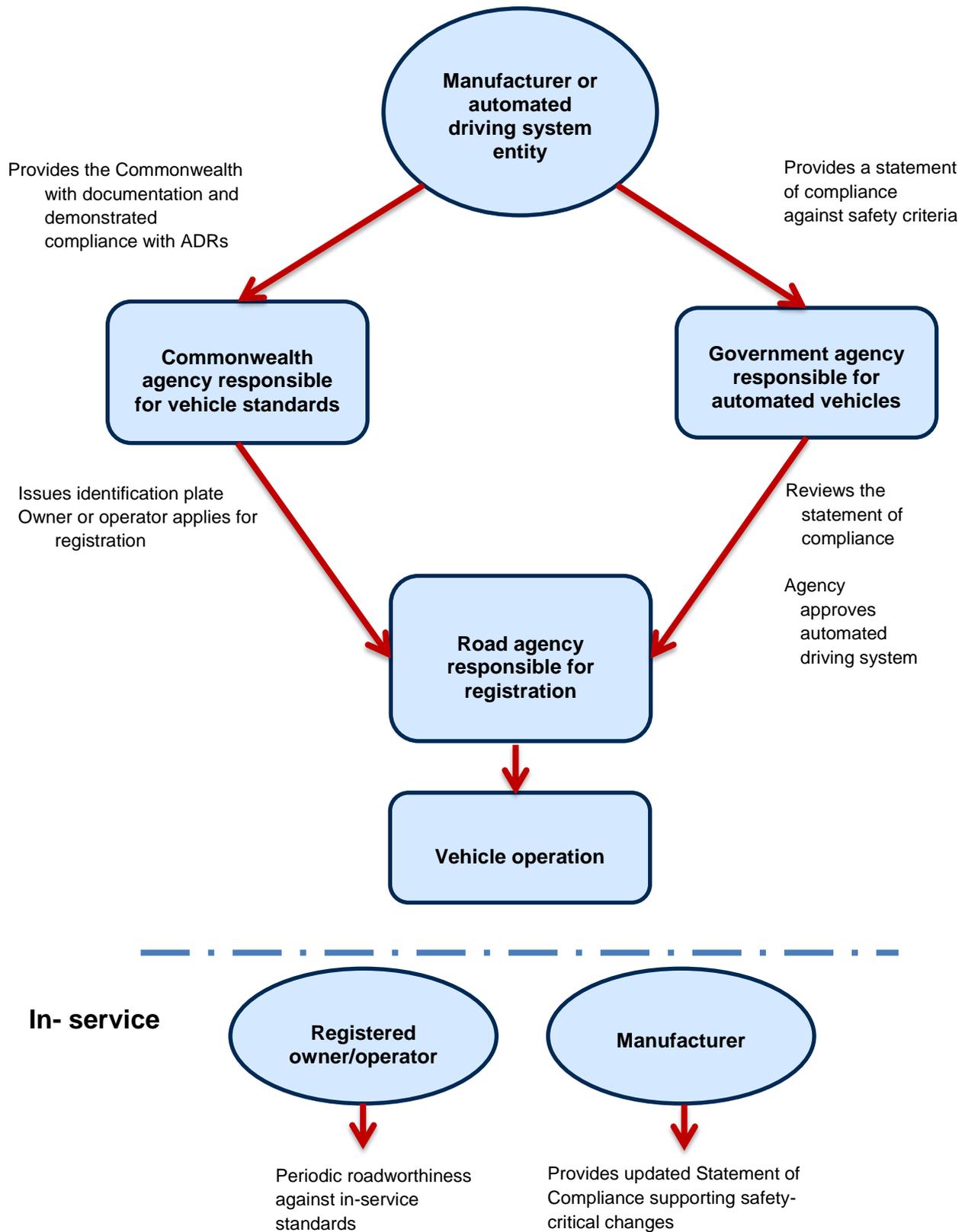
**Table 4. Design features of the proposed safety assurance system**

1. The safety assurance system will be administered by a government authority, preferably on a national basis. Approval decisions may be made on the advice of a single national government panel consisting of the Commonwealth, states and territories, the NTC, the National Heavy Vehicle Regulator (NHVR) and Austroads.
2. The safety assurance system will manage principles-based safety criteria that capture key safety risks associated with automated vehicles. The safety criteria should include matters relating to:
  - i. the safe operational design domain of the vehicle
  - ii. the human–machine interface
  - iii. on-road behavioural competency including compliance with traffic law, interaction with vulnerable road users
  - iv. cybersecurity
  - v. driver training
  - vi. the provision of data, including interaction with enforcement agencies.
3. Automated driving system entities (such as manufacturers) will be required to submit a Statement of Compliance that demonstrates how each of the agreed safety criteria has been managed. A Statement of Compliance must be submitted and approved before the relevant automated driving system or function can be introduced into the market.
4. The automated driving system entity remains responsible for testing and validating the safety of the automated driving system or function. The role of government in the safety assurance system is to satisfy itself that the applicant has processes in place to identify and manage the safety risks. It is not envisaged that the safety assurance process will conduct independent testing or validation activities.
5. To support national consistency and cross-border travel, state and territory road managers will be notified of a safety assurance outcome, but approval of a road manager should not be required for the automated driving system to operate unless the automated driving system forms part of a vehicle that would otherwise require a permit or exemption to access the road network. This is consistent with the current arrangements for new light vehicles.
6. All in-service modifications to the automated driving system that have a **significant** impact on safety performance or material compliance with the original safety assurance system approval, including over-the-air software updates of the vehicle, are anticipated to require approval by the safety assurance system before that **significant** modification is introduced into the market.

The safety assurance system is not intended to approve minor modifications, vehicle maintenance, repair or other non-technological modifications (such as bodybuilding) that a vehicle owner may undertake, or commission a third party to undertake on his or her behalf.

Figure 2 illustrates in a simplified way how the safety assurance could interact with existing regulatory mechanisms, but the finalised process will depend on the legislative option that is adopted.

**Figure 2. How the safety assurance system could work**



The NTC has evaluated this approach against the finalised assessment criteria outlined in chapter 3. This evaluation is set out in Table 5.

**Table 5. Evaluation of mandatory self-certification against the finalised assessment criteria**

<b>Approach based on mandatory self-certification</b>	Are safety risks managed?	Is the model flexible and does it support innovation?	Does it support legal accountability and probity?	Is the regulatory approach efficient?
				
	Does it support consistency?	Can it evaluate a safe operational design domain?	Can the model support other policy objectives?	Can it be implemented within two years?
				

*f = fully meets; p = partially meets*

An approach based on mandatory self-certification **fully meets** six criteria. This approach:

- provides community and government with a high level of certainty that the safety risks are being managed. The automated driving system or function is not supplied to the Australian market until the applicant’s processes for identifying and managing safety risks have been approved. In addition, any significant modifications will need to be approved before being introduced into the market. The specific issues identified by the safety criterion in Table 3 are expected to be key elements in the principles-based safety criteria
- would support evolving technology and a changing market
- ensures there is always a legal entity responsible for the automated driving system. Responsibility for managing safety is placed on the automated driving system entity, which is the entity best placed to control safety risks
- would support a single national approach and allow for international consistency because it could be adapted as international approaches are developed
- provides a mechanism to support other policy objectives. The principles-based safety criteria could include matters such as cybersecurity and provision of data
- can be implemented within a two-year timeframe, which is important because vehicles operating at high automation may be commercially released on the market from 2020.<sup>13</sup>

An approach based on mandatory self-certification **partially meets** two criteria. This approach:

- will have some costs for government and industry. Whether or not the assurance process is as efficient as possible and results in the least cost for industry and government proportionate to risk will depend on the legislative option chosen to give effect to the safety assurance system and the administrative processes that are implemented

<sup>13</sup> Until the changing driver laws and safety assurance reforms are implemented in 2020, vehicles operating with conditional automation will be managed through the national enforcement guidelines for automated vehicles.

- requires automated driving system entities to explain how the safety risks associated with the operational design domain of the vehicle have been managed but does not go as far as evaluating a safe operational design domain.

The NTC considers that the approach set out in Table 4 recognises that safety will be a dynamic concept as the technology advances. In its Statement of Compliance, the automated driving system entity would need to explain how it would identify and manage the safety risks associated with each of the principles-based safety criteria. This is likely to require the automated driving system entity to explain how it would respond to changes in the external operating environment. As an example, in relation to safety risks associated with a safe operational design domain, the automated driving system entity may need to demonstrate its processes for planning for new or changed hazards being introduced into the vehicle's operational design domain. Similarly, the automated driving system entity may need to demonstrate its processes for ensuring the vehicle can operate in compliance with relevant road traffic laws when amendments to those laws are made.

A primary safety duty could also be implemented to support the mandatory self-certification approach (discussed in detail in chapter 7). A primary safety duty would not be prescriptive and would therefore accommodate significant advances in safety technology. This would raise the standards of what constitutes a safe vehicle.

The NTC understands that a self-certification approach was not supported by some stakeholders primarily because it may not provide optimum certainty for consumers and government. These stakeholders considered that pre-market approval or accreditation would be the most appropriate options even in the interim period. The NTC recognises that pre-market approval may provide the highest level of certainty and consistency for the community and for government. However, it is unlikely to be implemented within a two-year timeframe and may cause delays in the development of automated vehicle technologies while technical standards and test procedures are developed. This may mean Australia misses out on safety benefits.

Accreditation is also unlikely to be implemented within a two-year timeframe because it would require new institutional arrangements and a new approach to regulating aspects of road vehicles. In addition, under an accreditation model, the automated driving system entity would be accredited for the operation of a specified automated driving system. Depending on the commercial deployment models adopted, there may also be too many parties requiring accreditation for this option to work.

The NTC notes that the proposed approach based on mandatory self-certification is much more rigorous than what was contemplated by option 2 in the NTC discussion paper and, as outlined in Table 5, fully meets a greater number of the assessment criteria. As such, the NTC considers that the proposed approach is likely to provide a greater level of certainty for the community and government as compared with the option 2 circulated for consultation.

## 4.3 Regulating safety in the long term

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### 4.3.1 Stakeholder feedback

Many stakeholders recognised that, as international approaches are formalised, it may be appropriate to move to a more mature regulatory model that utilises international standards. In the long term the majority of stakeholders supported a pre-market approval or accreditation model (or both), as these models have benefits beyond continuing the current approach and self-certification.

One transport department noted the shift to a more mature regulatory model will be gradual. Specific self-certification requirements will move to pre-market approval as international standards become available.

A number of stakeholders commented on the benefits of pre-market approval:

- Toyota Australia, the Law Institute of Victoria, ADVI and the AAA stated that pre-market approval provides the highest level of certainty and consistency for the community and for government, and the QBE Group noted that pre-market approval is likely to build and maintain public confidence and trust.

- The Royal Automobile Club of WA (RAC) considered that a set of guiding principles applying to automated driving systems could be better assured under the pre-market approval approach.
- Bosch noted that a pre-market approval structure would ensure comprehensive testing and restrict unsafe features from reaching the market.
- The Motorcycle Council of NSW stated that pre-market approval would provide the highest level of certainty that vehicles with automated functions will be able to interact safely with motorcycles.

Some stakeholders indicated a preference for the accreditation model:

- Arup stated that a safety assurance system should take into consideration the *Safe System* and therefore consider the relationship between the vehicle, the road, the user, supporting road infrastructure and emergency services. Arup suggested that accreditation would be the best approach to consider the entire *Safe System*.
- NatRoad outlined a number of benefits for heavy vehicles, including safety being assured through the automated driving system's life cycle and not just at market entry, and requirements on the accredited party to report safety-critical events.

However, Toyota Australia, ADVI, the ATA, PwC and the Truck Industry Council stated that an accreditation model would not be appropriate in the future for the following reasons:

- The automotive industry is very different from industries that are currently regulated using an accreditation model (such as rail, shipping and aviation) because there are large numbers of suppliers and operators. There are too many parties that need accreditation for this option to work.
- Accreditation is complex because it requires authorities to have detailed knowledge and understanding of technology and business models in order to properly set standards.
- Accreditation is expensive and potentially cost-prohibitive for businesses.
- Accreditation is inconsistent with approaches presently being considered in other countries.

One road transport agency noted that the scope of any international standards for automated driving systems is yet to be determined. It is not clear whether international standards would be adequate as a complete substitute for the interim arrangements. As such, the road transport agency suggested a formal review of the interim arrangements, and the implications of adopting international standards, should be conducted at a suitable time.

NatRoad noted that the accreditation model could be implemented more easily for heavy vehicles than for light vehicles because there are likely to be fewer automated driving system entities to regulate.

## 4.4 Conclusions

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Feedback from stakeholders indicated a strong preference for the safety assurance system to align with international standards and be based on a more mature regulatory model (such as pre-market approval or accreditation) in the long term.

The NTC understands that pre-market approval would provide the highest level of certainty and consistency and therefore consumer trust and confidence. Australia already has an established type-approval process for pre-market approval of vehicles based on the ADRs. As international standards develop, standards for automated driving systems could be incorporated into the ADRs. In this way, the safety assurance system could be integrated into current approval processes over time.

The NTC recognises that the scope of any international standards for automated driving systems is unclear at this stage. As such, the adequacy of international standards will need to be evaluated prior to adoption. In addition, it is likely that the move from mandatory self-certification to pre-market approval will occur gradually, with some self-certification elements potentially still

remaining, even in the long term. The NTC also notes that, unlike the ADRs, the safety standards themselves could be dynamic rather than static.

Accreditation models have generally been adopted where there are only a few entities to regulate such as in rail, shipping and aviation. As discussed in section 4.2.2, there may be too many parties for accreditation to work in road transport. While there may be fewer entities to regulate in the heavy vehicle industry, the NTC considers that the approach to regulating vehicle safety should be consistent across different vehicle types (discussed in detail in section 5.3.3). As such, while accreditation is a possible approach to regulating safety in the long term, its viability will depend on how the market develops and future business models.

Ensuring in-service safety performance is a key element of the safety assurance system. The proposed model can support the evaluation of in-service safety performance of automated vehicles in two ways:

- noncompliance with specific requirements agreed in the Statement of Compliance – this could be supported by a principles-based safety criterion that requires the automated driving system entity to set out the process it will undertake to address emerging safety risks while the automated driving system is in service
- a review of performance outcomes that identifies a safety issue – this could be supported by a primary safety duty, with graduated offences based on the seriousness of the issue on road safety.

#### 4.4.1 Policy directions

**Policy direction:** In the interim period (approximately 2020 to 2030) the safety assurance system will be developed based on a mandatory self-certification approach. This approach has the following features:

- Automated driving system entities will be required to submit a Statement of Compliance against principles-based safety criteria for approval before the relevant automated driving system or function can be introduced into the market.
- The automated driving system entity, rather than government, will be responsible for testing and validating the safety of the automated driving system or function. The role of government is to satisfy itself that the applicant has processes in place to identify and manage the safety risks.
- All significant modifications to the automated driving system or function must also be approved before being introduced into the market.

**Policy direction:** In the long term a pre-market approval model based on ADRs for automated driving systems is anticipated to be the preferred approach for regulating vehicle safety. This approach (along with accreditation) will be considered further when international standards are developed and the automated vehicle market is more mature.

#### 4.4.2 Recommendations

The Transport and Infrastructure Council has approved the following recommendations.

**Recommendation 1:** That the Council adopt the ambition for automated vehicles that “Australia is aiming to have end-to-end regulation in place by 2020 to support the safe, commercial deployment and operation of automated vehicles at all levels of automation”.

**Recommendation 2:** That the Council agree the development of a national safety assurance system for automated vehicles, based on mandatory self-certification, transitioning to pre-market approval when international standards for automated driving systems are developed and incorporated into the ADRs.

**Recommendation 3:** That the Council agree the safety assurance design principles set out in table 4, subject to a Regulation Impact Statement undertaken in early 2018.

# 5 Institutional arrangements

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## Key points

- A single national regulator, which could be the Commonwealth Department of Infrastructure and Regional Development or some other body, should have primary responsibility for the safety assurance system for automated vehicles.
- A national advisory panel should support the safety assurance system. The panel should consist of government bodies, including the Commonwealth, state and territory road transport agencies, Austroads, the NTC and the NHVR, where relevant.

## 5.1 Introduction

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The NTC discussion paper sought feedback on institutional arrangements for the safety assurance system. This included consultation on the types of government bodies that could be responsible for government-related functions such as approvals, administration and regulation.

Motor vehicle safety regulation is currently shared between the Commonwealth and the states and territories. The Commonwealth is responsible for vehicle standards at first supply and administering the Australian Consumer Law. States and territories are responsible for in-service standards, registration and driver licensing. Heavy vehicle standards are regulated by the NHVR. The NTC discussion paper reflected that this mix of regulatory responsibilities adds complexity to the development of a safety assurance system and the possible institutional arrangements to oversee the safety assurance system.

The NTC discussion paper outlined five institutional approaches for consultation:

- **Option 1:** The Commonwealth manages automated vehicle safety assurance.
- **Option 2:** A national entity manages automated vehicle safety assurance.
- **Option 3:** One state or territory manages the safety assurance system for all states and territories.
- **Option 4:** States and territories manage automated vehicle safety assurance individually.
- **Option 5:** A fully commercial, quasi-governmental entity manages automated vehicle safety assurance.

Any of these institutional arrangements could be applied to the preferred regulatory option of mandatory self-certification discussed in chapter 4.

## 5.2 Stakeholder feedback

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Stakeholders generally agreed that a national body should have responsibility for the safety assurance system for automated vehicles.

In this section we summarise feedback on question 10 in the discussion paper:

- Question 10: Based on the option for safety assurance of automated vehicle functions, what institutional arrangements should support this option? Why?

### 5.2.1 The safety assurance system should be administered nationally

Stakeholders agreed that Australia should have a single national safety assurance process.

Many stakeholders, including road transport agencies, ADVI, PwC and the AAA, suggested that the Commonwealth Department of Infrastructure and Regional Development should be the national

body responsible for the safety assurance system. The ATA, for example, submitted that there is no case for establishing another national agency in the transport portfolio.

Other stakeholders, such as the Amy Gillett Foundation, NatRoad and the Truck Industry Council, agreed that it should be managed by a national entity but did not specify the Commonwealth department.

The WA Transport Portfolio and another road transport agency emphasised that institutional arrangements should be considered after a preferred regulatory model is agreed by the Transport and Infrastructure Council.

### **5.2.2 There should be a single safety assurance system**

Stakeholders provided consistent feedback that a safety assurance system managed by states and territories is the least desirable outcome, particularly for first supply to the market.

Stakeholders agreed that a state-based approach will likely result in inconsistent arrangements and unnecessary duplication of effort. There were also concerns that many road agencies do not have the capabilities and expertise to undertake safety assurance. This included safety assurance for vehicles that have increased automated functionality while in service – there was broad agreement that significant modification should be approved by the same body that undertakes initial assurance of automated vehicles. This will further ensure consistent regulation of automated driving systems through the life cycle of the vehicle.

Adopting this approach, states and territories would not have primary responsibility for automated vehicle safety assurance. However, road transport agencies would necessarily provide a range of related functions to support the safety assurance process including:

- additional fields in registration systems to capture critical automated vehicle information
- participating in the national advisory panel to ensure safety assurance approvals adequately consider in-service safety and compliance and address transport planning and other local issues
- approving network access of automated vehicles that require a permit or exemption (for example, low-speed driverless shuttles and over-sized or over-mass heavy vehicles)
- enforcing provisions in legislation and regulations relating to registration and licensing.

Toyota Australia took a different approach. The vehicle manufacturer recommended that states and territories be responsible for in-service safety of automated vehicles, given their current responsibilities for in-service compliance with vehicle standards.

The ATA and NatRoad suggested an alternative to a single-body approach. In relation to heavy vehicles, both organisations agreed that a national body should be responsible for safety assurance at first supply but that the NHVR should be responsible for in-service compliance.

### **5.2.3 A fully commercial, quasi-governmental entity was not generally preferred**

Few stakeholders supported a fully commercial, quasi-governmental entity managing the safety assurance system (option 5). QBE Group noted that this approach could be easier to implement, establish a degree of independence from government and potentially be more accessible for industry. QBE Group commented that ANCAP could be a candidate for this role, given its links to other vehicle safety programs and the high level of public confidence in and knowledge of ANCAP safety ratings.

ANCAP's submission acknowledged that its model for testing and assessing safety features was referred to by the NTC as an example of option 5. ANCAP supported exploring institutional models further but did not indicate a strong view that it should be the commercial, quasi-governmental body responsible for the safety assurance system.

## 5.3 Conclusions

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### 5.3.1 The safety assurance system should be administered by a single national body

Automated driving systems that are integrated into light or general access vehicles will be able to operate across the national network, limited only by the agreed operational design domain. Given that automated vehicles will be operating within a single market, the safety assurance system should be administered by a single national entity.

One entity responsible for the safety assurance system will avoid potential duplication of effort, inconsistent application of the principles-based safety criteria and market uncertainty.

The Commonwealth Department of Infrastructure and Regional Development is best placed to undertake this national role, given its existing responsibility for vehicle standards. At this stage, given the nominal scale of automated vehicles being commercialised, a separate national entity responsible for automated vehicle safety is unlikely to be warranted.

Road transport agencies will have a continued role in automated vehicle safety, given the linkages with registration, roadworthiness and driver licensing. Each of these areas of regulation is expected to be impacted by automated vehicles. Road transport agencies will also have a role approving some vehicles to specific parts of the road network, such as low-speed driverless shuttles and over-sized or over-mass heavy vehicles. The role of road transport agencies in relation to road access is discussed in chapter 6.

The NTC agrees with stakeholders that the optimum institutional arrangements will be dependent on the agreed regulatory model. We note the views of some road transport agencies that institutional arrangements should be considered after transport ministers make a decision on the regulatory model.

### 5.3.2 Interaction with ANCAP and similar bodies

Other commercial and quasi-government bodies, such as ANCAP, have an important role in providing guidance on emerging safety products and technologies and increasing consumer confidence in automated driving systems. However, because the safety assurance system will have mandatory components, the body administering the system will require enforcement powers, including powers to issue sanctions and penalties. These features favour a government agency administering the safety assurance system rather than a commercial and quasi-government body.

### 5.3.3 Interaction with heavy vehicle schemes

The ATA and NatRoad raised the role of the NHVR and the relationship between the safety assurance system and heavy vehicle approvals.

The NTC suggests that the safety assurance system should be separate from existing heavy vehicle processes and schemes. These schemes include Performance-Based Standards (PBS), the National Heavy Vehicle Accreditation Scheme, Concessional Mass Limits and Higher Mass Limits. These schemes are not contingent on automated driving systems and the safety assurance system can function separately and concurrently to existing schemes.

From a safety assurance perspective, there is not a significant difference between automated driving systems used in light or heavy vehicles. The safety assurance system will be focused on ensuring that automated driving systems will be able to drive a vehicle safely and be able to safely operate on public roads, regardless of whether that technology is integrated in light or heavy vehicles.

The same safety issues will need to be considered for light and heavy vehicles, such as:

- Does the automated driving system comply with road traffic laws?
- Does the automated driving system operate safely around other road users?
- Is there a safe and effective human-machine interface?

- Is the automated driving system secure from cyberattack?

Heavy vehicles have a different risk profile from light vehicles. However, the core safety criteria and assurance process remain the same. For these reasons, we recommend that the safety assurance system should include both light and heavy vehicles, and automated driving systems used in heavy vehicles should not be assessed separately, either by the NHVR or another body.

This approach reduces the risk of duplication and uncertainty and is consistent with stakeholder support for a single national approach.

#### 5.3.4 Policy directions

**Policy direction:** A single national regulator, which could be the Commonwealth Department of Infrastructure and Regional Development or some other body, should have primary responsibility for the safety assurance system for automated vehicles.

**Policy direction:** A national advisory panel should support the safety assurance system. The panel should consist of government bodies, including the Commonwealth, state and territory road transport agencies, Austroads, the NTC and the NHVR, where relevant.

# 6 Access approval to the road network

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## Key points

- Road managers and the NHVR should continue to regulate network access for non-standard vehicles including low-speed driverless shuttles and over-mass heavy vehicles. Road transport agencies should also continue to manage vehicle registration including the power to cancel a vehicle's registration where it does not meet roadworthiness requirements.
- If the automated driving system requires specific roadside infrastructure, road managers may need to approve automated vehicle access to particular roads.
- If the automated driving system is integrated into a standard vehicle, and there are no specific roadside infrastructure requirements, the operational design domain will be agreed through the safety assurance system process, with no additional network access approval.

## 6.1 Introduction

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State road agencies and local governments manage access to the road network. A key issue for the safety assurance system is whether road managers should assess and determine automated vehicle road access in addition to the safety assurance process. Alternatively, it may be safe and appropriate for general access vehicles to have access to the road network once they have safety assurance approval, limited only by their agreed operational design domain.

Managing automated vehicle access to the road network is also likely to become more complex should the operational design domain be dynamic and change depending on variable factors such as weather conditions or roadworks.

Based on the proposed design of the safety assurance system, road managers would have substantial input on automated vehicles safety through participation in the national advisory panel. This panel would serve as part of the safety assurance system process to ensure local network and community considerations are adequately addressed while achieving national consistency through a single approvals process. The national advisory panel is discussed in more detail in chapter 8.

### Challenges with controlling network access

A number of challenges relate to states and territories managing automated vehicle access to the road network as a secondary step to the safety assurance system.

1. **Timeliness.** A two-stage process is likely to reduce the timeliness of approvals, particularly in a dynamic environment where industry will be seeking approvals of safety-critical modifications in in-service vehicles. In this situation, a delay in the safety assurance approval process could result in unsafe outcomes if the application is for a significant modification.
2. **Cross-border complexities.** Automated driving systems that are integrated into standard vehicles will not be limited by permits or exemptions, and they will be able to cross state and territory borders. Therefore, if road managers seek to approve standard vehicle access to the network, all road managers (including local road managers and commercial road operators) would have to agree to an approval.
3. **Automated driving systems will be integrated into standard vehicles.** Registration processes are similar across Australia as vehicle registration has been the subject of intergovernmental agreements for national consistency. Generally, registration must be granted if an applicant satisfies certain requirements, including that the vehicle complies with the ADRs and has been provided with an identification plate. Therefore, if road managers sought to introduce a secondary step in the safety assurance approval process, based on network access, it is likely that all vehicles with automated driving systems would require non-standard registration.

4. **Duplicated skills and capabilities.** Stakeholder feedback from road transport agencies indicated that road managers do not have the skills and capabilities to assess automated driving systems against the principles-based safety criteria. There is also a risk of duplication, both between road managers and with the Commonwealth Department of Infrastructure and Regional Development's role.
5. **Infrastructure protection is unlikely to be an issue.** Today, road managers primarily restrict vehicle access on the grounds of safety or infrastructure protection, particularly in the context of over-mass heavy vehicles. Infrastructure protection is unlikely to be an issue for automated driving systems integrated into standard light vehicles.

The PBS scheme is an example of a two-step process – the approval of a vehicle by the NHVR and the approval of access to a specific part of the road network by the road manager. The additional assessment by each relevant network manager is underpinned by safety and asset protection objectives but has resulted in some approval delays and uncertainty for industry.

The NTC discussion paper proposed three potential approaches for managing automated vehicle access to the road network:

- **Option 1:** The registration authority or road manager approves access based on its own assessment of the vehicle's operational design domain.
- **Option 2:** The registration authority or road manager approves access based on advice from the government agency responsible for the safety assurance system.
- **Option 3:** The automated driving system entity and the government agency responsible for the safety assurance system agree on the operational design domain. The agency notifies the relevant road managers of the approval or accreditation. Road managers do not approve road network access.

For reasons provided above, we suggested in the NTC discussion paper that a safety assurance system should incorporate network access considerations (if any) within the assessment of a vehicle's operation design domain (option 3). We suggested that there should not be a secondary process related to network access.

## 6.2 Stakeholder feedback

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Stakeholders largely agreed that road managers should not approve road network access for automated driving systems integrated into standard vehicles.

In this section we summarise feedback to question 11 in the discussion paper:

- Question 11: How should governments manage access to the road network by automated vehicles? Do you agree with a national approach that does not require additional approval by a registration authority or road manager?

### 6.2.1 Stakeholders support a national approach

Road transport agencies generally agreed that the safety assurance system should be a national approach and did not seek to introduce a second approval step to allow an automated vehicle network access.

One transport department observed that UN Working Party 29 has indicated its intention to require automated driving systems to permit activation only in the circumstances for which it was designed.<sup>14</sup> If adopted, this would significantly reduce the need for access approval. The WA Transport Portfolio agreed that a national body should have a coordinating role to ensure national consistency but suggested that particular roads might need adaption for automated vehicles capabilities such as specific roadside infrastructure.

Most industry and consumer groups supported a single national approach that incorporates road network access into the safety assurance process wherever possible, particularly given the risk of duplication and delay associated with a two-tier approach.

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<sup>14</sup> A proposal for the Definitions of Automated Driving under WP.29 and the General Principles for developing a UN Regulation, ITS/AD-11-06.

For example, AECOM and the Truck Industry Council agreed that once a national approach has been developed and implemented there should be no additional approval required at the registration authority or road manager level. PwC also agreed that the safety of the automated vehicle should be assessed centrally while states and territories continue to manage registrations, but without additional assessment of the automated vehicle.

NatRoad supported a single national approvals approach, but noted the process needs to involve road managers, or there is a risk that some types of automated vehicle will be incompatible with the operating environment.

The Motorcycle Council of NSW supported road manager approval of access based on its own assessment of the vehicle (option 1) because it provides a final safeguard after the safety assurance approval process.

## 6.3 Conclusions

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### 6.3.1 Automated driving systems integrated into standard vehicles should not require additional road access approval

The NTC notes that most stakeholders strongly supported a single national approach. Unless the automated driving system is integrated into a non-standard vehicle or requires specific infrastructure, an automated vehicle would be registered as a standard vehicle and additional road access approval would not be warranted.

The NTC recognises community expectations that road managers will endeavour to ensure the safe use of the road network and, at a minimum, be mindful of the types of automated vehicles being used on the network. For these reasons, the NTC recommends road manager representation on the national advisory panel. Membership and active participation on the national advisory panel will provide an opportunity to ensure local issues and network-related challenges are adequately dealt with before an automated driving system integrated into a standard vehicle is approved for use on public roads.

### 6.3.2 Approvals may vary according to the type of automated driving system

The independent Nova Systems report commissioned by the NTC suggested that different automated vehicle technologies address variation in the operational design domain in three ways:

- Type 1: These are vehicle systems that assess the environment dynamically and decide continuously if the environment being encountered is suitable to operate in.  
*These vehicles would be unlikely to require access approval by a network manager.*
- Type 2: These are vehicle systems where the suitable operating environment is predetermined by an analysis of the road network and then compatible or supported roads are added into the guidance system database. Using its location the vehicle then determines if it can safely engage an automated function. Environmental factors are also included such as light and weather conditions.  
*These vehicles would be unlikely to require access approval by a network manager.*

- Type 3: These are vehicle systems operating on a closed road network or a fixed predetermined road network where compatibility can be pre-surveyed. They may require specific infrastructure requirements.  
*These vehicles could require access approval by a network manager.*

Nova Systems suggested that each of these vehicle types could warrant a different approach to achieve road safety outcomes. The safety assurance system should be used to assess the extent to which an automated driving system can dynamically evaluate its environment and operational design domain. If necessary, the safety assurance system should coordinate input from a specific network manager.

This approach will accommodate the WA Transport Portfolio's concerns that road managers may need to approve access if particular roads need to be adapted with specific roadside infrastructure (what Nova Systems has categorised as 'Type 3' automated vehicles).

The NTC notes the intention of UN Working Party 29 to require automated driving systems to permit activation only in the circumstances for which it was designed. If this is the case, it establishes an important safeguard against automated driving systems from operating in unsafe environments and further reduces any rationale for introducing network approval processes.

### 6.3.3 Policy directions

**Policy direction:** Road managers and the NHVR should continue to regulate network access for non-standard vehicles including low-speed driverless shuttles and over-mass heavy vehicles. Road transport agencies should also continue to manage vehicle registration including the power to cancel a vehicle's registration where it does not meet roadworthiness requirements.

**Policy direction:** In circumstances where the automated driving system requires specific roadside infrastructure, road managers may need to approve automated vehicle access to particular roads.

**Policy direction:** In circumstances where the automated driving system is integrated into a standard vehicle, and there are no specific roadside infrastructure requirements, the operational design domain will be agreed through the safety assurance system process, with no additional network access approval.

**Policy direction:** Future regulation should take into account the need to match vehicle capabilities with an operational design domain and enforcement.

# 7 How to ensure compliance

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## Key points

- A mandatory self-certification model requires sanctions and penalties targeting automated driving system entities. Sanctions and penalties should be supported by risk-based and targeted auditing capabilities and powers.
- Further work on the detail of sanctions and penalties, including the potential application of a primary safety duty, will be addressed in the next phase of safety assurance implementation.

## 7.1 Introduction

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The NTC discussion paper sought initial feedback on how governments should ensure automated driving system entities and other relevant parties are compliant with the requirements of the safety assurance system.

There are a number of scenarios where noncompliance may become a road safety issue, including the following:

- A vehicle manufacturer introduces a new model onto the market that has automated driving system functionality and does not seek safety assurance approval and does not submit a Statement of Compliance against principles-based safety criteria.
- A vehicle manufacturer sells a vehicle onto the market with partial driving automation. There is no automated driving system and no requirement for safety assurance system approval. However, while in service the manufacturer introduces a software update that introduces conditional driving automation. The manufacturer does not seek approval for the modification prior to the update.
- A vehicle is operating with an automated driving system is engaged. The vehicle fails to stop at a red light.
- A registered operator of a privately owned conventional vehicle purchases automated technology on the internet. He personally installs the technology in his vehicle, which, when engaged, drives the vehicle without human assistance. No approvals process is undertaken to ensure the technology is safe.

There are existing penalties and sanctions that provide some level of regulatory coverage in these scenarios. These include consumer guarantees for safe products in the Australian Consumer Law, state and territory powers to remove vehicles from public roads, and prescriptive penalties for failure to comply with specific road traffic laws.

Each of these existing schemes has limitations. For example, deregistration is retrospective and punishes the registered owner when the fault may be the automated driving system entity's. Australian Consumer Law protections are likewise retrospective, and the primary intervention is vehicle recall, which may not always be proportionate if the unsafe condition of the vehicle can be rectified through other means. Consumer law also does not cover personal or 'backyard' vehicle modifications.

Road traffic offences are largely inadequate for automated driving system entities. For example, if a vehicle drives through a red light with the automated driving system engaged, it is more likely to be due to a technical failure than human error. In this case, the fault may be a systemic issue across that model of vehicle and constitute a significant safety hazard. If that is the case, sanctions such as an enforceable undertaking for the manufacturer to resolve the technical issue (with appropriate corporate penalties if it fails to do so) are probably more appropriate than a \$400 infringement notice and three demerit points.

The NTC discussion paper sought feedback on whether the safety assurance system should be underpinned by additional mechanisms to ensure compliance such as:

- a primary safety duty for parties to provide safe automated vehicles with associated penalties (as discussed below, a primary safety duty could also be an additional safety mechanism)
- specific offences attached to the pre-market approval and accreditation options
- a range of sanctions to assist regulators in securing effective compliance.

The NTC discussion paper noted that the compliance approach will depend significantly on the regulatory model agreed by the Transport and Infrastructure Council. Given the strong preference for a mandatory self-certification approach (discussed in chapter 4), it is clear that – at a minimum – sanctions and penalties will be necessary to ensure automated driving system entities submit a Statement of Compliance to demonstrate how they have met the principles-based safety criteria.

### **7.1.1 A primary duty to provide or maintain safe automated vehicles**

In addition to sanctions and penalties directed to the automated driving system entity, the NTC discussion paper proposed that a primary safety duty may be necessary to prevent unsafe behaviours that are not prescribed offences.

A primary safety duty is a statutory duty of care that imposes a legal obligation on the party or parties it applies to. A primary safety duty to ensure automated vehicle safety could apply at first supply of the vehicle to market, or be an ongoing duty throughout the life cycle of the vehicle. A primary safety duty to ensure automated vehicle safety could be based on a number of existing models, including Work Health Safety (WHS), rail safety law, the Heavy Vehicle National Law (HVNL) and civil and criminal negligence.

A primary safety duty could be applied to a range of parties such as manufacturers, suppliers and automated driving system entities. However, the duty could also cover registered operators (or vehicle owners). This is because the safety assurance system is expected to cover first supply and significant modifications (such as software upgrades that result in increased driving automation). As noted in chapter 4, the safety assurance system is not intended to approve minor modifications, vehicle maintenance, repair or other non-technological modifications (such as bodybuilding) that a vehicle owner may undertake, or commission a third party to undertake on his or her behalf.

In this scenario a primary duty on the registered operator or vehicle owner to maintain a safe vehicle may provide increased community confidence that the integrity of the automated vehicle is not degraded or undermined by vehicle owners after first supply.

More information about how sanctions, penalties and a primary safety duty could operate is outlined in chapter 12 of the NTC discussion paper.

## **7.2 Stakeholder feedback**

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Stakeholders agreed that the best way to ensure compliance with the safety assurance system will depend on the agreed regulatory model. Many stakeholders recognised that a mandatory self-certification model requires an offence for supplying an automated driving system without a safety assurance approval. Most stakeholders supported the introduction of a primary safety duty.

In this section we summarise feedback to question 12 in the discussion paper:

- Question 12: How should governments ensure compliance with the safety assurance system?

### **7.2.1 Support for penalties and sanctions**

Stakeholders largely agreed there will be a need for sanctions and penalties to underpin the safety assurance system.

QBE Group observed that vehicle manufacturers will presumably have strong incentives to ensure their vehicles are safe. As with the airline industry, the public is likely to have very high safety expectations of automated vehicles, and a single incident could have a significant negative impact on a manufacturer's reputation and, consequently, vehicle sales. However, QBE Group agreed that this should not be relied upon alone and that a compliance framework should be in place.

There was limited feedback about the scale of penalties. However, the Amy Gillett Foundation stated that for breaches that are caused by technical or design fault, penalties related to the manufacturer should include a corporate multiplier, and that in addition to a monetary penalty, relevant breaches must also require corrective action from the responsible entity across their entire vehicle fleet. The foundation also stated that regulation should safeguard against manufacturers passing on the cost of penalties to consumers. One transport department emphasised that the safety assurance system should facilitate best practice approaches such as risk-based interventions and graduated compliance measures.

Transurban commented that automated vehicles are likely to be deployed in highly diverse road conditions, which may warrant a mix of approaches. For example, some high-volume road environments could facilitate automated monitoring of vehicle use to confirm compliance, whereas regional roads may require a similar mix of regular and random roadside inspection procedures as exist currently.

The ATA recommended that governments ensure compliance by amending the MVSA and state legislation for in-service vehicles, in addition to amendments to the HVNL to support in-service requirements.

ANCAP noted that it has a process in place for reporting to the Department of Infrastructure and Regional Development any irregularities observed in ANCAP tests that may affect regulatory compliance. This quasi-regulatory role could continue with the development and introduction of automated vehicles, and would support any explicit sanctions and penalties.

### **7.2.2 Penalties and sanctions should be supported by auditing activities**

The Truck Industry Council strongly recommended that any sanctions and penalties should be supported by an auditing process, similar to the current process undertaken by the Department of Infrastructure and Regional Development for auditing identification plate approvals. The Council suggested that this approach would be highly effective in a self-certification environment and in dealing with a range of different manufacturers and technology providers that have varying risk profiles.

### **7.2.3 Support for a primary safety duty**

Many stakeholders supported the introduction of a primary safety duty. This included TMR, the WA Transport Portfolio, Toyota Australia, PwC, the Law Institute of Victoria, Maurice Blackburn Lawyers, NatRoad, AECOM and ADVI. A number of stakeholders supported a primary safety duty as an additional requirement to underpin prescriptive offences, and to ensure consistency with WHS and consumer laws.

By way of example, PwC recommended that a primary safety duty be imposed on a person who supplies to the market, or operates, a vehicle with conditional, high or full automation. The duty should require the responsible party to:

- a) ensure, so far as is reasonably practicable, that the automated driving system is safe if it is used for a purpose for which it was supplied
- b) ensure, so far as is reasonably practicable, that such testing and examination of the automated driving system as may be necessary for compliance with the above duty is carried out
- c) take such action as is necessary to ensure, so far as is reasonably practicable, that there will be available in connection with the use of the thing adequate information about
  - i. the use for which the automated driving system is supplied
  - ii. the results of any testing or examination referred to in paragraph (b)
  - iii. any conditions necessary to ensure, so far as is reasonably practicable, that the automated driving system is safe if it is used for a purpose for which it was supplied.

PwC also noted that the MVSA currently does not allow the Responsible Minister to introduce a primary duty at the point of first supply of an automated driving system.

The Law Institute of Victoria stated that consideration should be given as to how a primary safety duty may apply over the life of an automated vehicle, especially with respect to servicing, modification and repair. The Institute suggested that a primary safety duty that is in line with the model WHS Act may be able to encompass the ongoing service, modification and repair of an automated vehicle without imposing excessively onerous regulatory obligations on a relevant party.

Maurice Blackburn Lawyers welcomed a primary safety duty with a standard of care such as 'so far as is reasonably practicable' – given that the courts would interpret the meaning of 'so far as is reasonably practicable' according to contemporaneous standards of safety and technology. In Maurice Blackburn Lawyers' view, this would ensure the standard of safety required continues to grow and evolve as technology becomes able to achieve higher levels of safety.

Toyota Australia suggested that a road traffic offence could be taken as evidence of a breach of a primary safety duty. The Amy Gillett Foundation suggested that a primary safety duty would only be appropriate for a vehicle operating with high or full automation.

## 7.3 Conclusions

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### 7.3.1 Sanctions and penalties will be necessary

A mandatory self-certification model cannot operate without sanctions and penalties for failure to submit a Statement of Compliance. In addition to this basic requirement, the safety assurance system would benefit from additional sanctions and penalties to ensure ongoing reporting and that significant modifications are reapproved through the safety assurance system.

The NTC agrees that existing road traffic infringements could be used as evidence to identify broader system technical failures, and they could underpin alternative enforcement action, whether that be sanctions and penalties aimed at the automated driving system entity, or action related to a breach of a primary safety duty. The NTC agrees that, based on the mandatory self-certification model, targeted and intelligent auditing of operating systems and processes may be warranted. If agreed, auditing powers may need to be introduced to support the safety assurance system. The safety assurance system should also facilitate best practice approaches such as risk-based interventions and graduated compliance measures.

### 7.3.2 A primary safety duty has significant merit

The NTC recommends a primary safety duty is further considered. A primary safety duty would be consistent with similar safety schemes, such as general responsibilities in WHS, rail and heavy vehicle regulation, and would provide a general safety requirement capable of covering unsafe behaviours that are otherwise overlooked by prescriptive offences.

A primary safety duty would also cover minor modification, non-commercial repairs and modifications and other activities not explicitly regulated by the safety assurance system.

### 7.3.3 Legislative options to give effect to compliance actions will be considered in the next phase of work

A number of stakeholders, including the ATA, made observations in relation to which Acts and regulations should be amended to introduce appropriate sanctions and penalties. The NTC considers that it is too early in the reform process to determine detailed sanctions and penalties, including offences, quantum and legislative instruments. These issues depend on the next phase of implementation, which will assess legislative options to support the mandatory self-certification model.

### 7.3.4 Policy directions

**Policy direction:** Sanctions and penalties targeting automated driving system entities will be required in a mandatory self-certification model. Sanctions and penalties could be supported by risk-based and targeted auditing capabilities and powers.

**Policy direction:** Further work on the detail of sanctions and penalties, including the potential application of a primary safety duty, will be addressed in the next phase of safety assurance implementation.

# 8 Next steps

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## Key points

- The NTC will undertake a RIS on the legislative options to underpin the safety assurance system in early 2018.
- The next phase of reform (2018–2020) has three components:
  - Develop legislative options to underpin the safety assurance system, including sanctions and penalties, and options relating to developing a primary safety duty.
  - Agree changes to registration processes to capture key automated vehicle information in registration databases.
  - Agree administrative functions and requirements, including the allocation of the safety assurance system to a government agency, the development of a national advisory panel, principles-based safety criteria, systems readiness and capability planning.

## 8.1 Introduction

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Based on market forecasts, the NTC is planning for the proposed end-to-end regulatory process to be operational by mid-2020. This will require a range of changes to be implemented, including recognition of the safety assurance system in legislation, penalties and sanctions and limited changes to registration processes.

The safety assurance system will require an automated driving system entity to make an application for approval. Therefore, the safety assurance system can only be implemented in parallel with, and not before, the changes to road traffic laws that recognise such entities. *Changing driving laws to support automated vehicles* is a separate NTC project that also aims to deliver reforms at the same time as implementing the safety assurance system.

## 8.2 Legislative changes

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Legislative change is required to make the safety assurance system mandatory. A detailed review by an NTC-led national safety legislation working group will be undertaken to evaluate legislative options in 2018.

It is possible that the legal recognition of the safety assurance system can be incorporated into the definition of an automated driving system in state and territory legislation. If this approach were adopted, a legislative nexus can be established between the changes to driving legislation and the safety assurance system. However, a number of outstanding legislation-related issues need to be addressed within the next two years. This includes:

- how sanctions and penalties will be introduced for noncompliance by automated driving system entities
- whether the safety assurance system should be underpinned by a primary duty on relevant parties to provide a safe vehicle
- whether state and territory transport laws will need to be amended to enable road agencies to refuse registration when a vehicle type has met ADRs but the automated driving system has not been approved
- ensuring an efficient legislative mechanism is in place that can approve significant modifications by the safety assurance system before entry to the market – this could include state and territory laws defining what a significant modification is.

An initial assessment by the NTC and the Commonwealth has identified three legislative options to administer the safety assurance system and to address these issues:

1. Use existing subordinate legislation such as regulation of automated vehicles as non-standard vehicles under the MVSA and/or changes to state and territory road transport laws. Regulation as non-standard vehicles may be transitional and would be suitable while automated vehicles are supplied in small numbers.
2. Expand the MVSA to ensure that type-approval for new supplied vehicles can be withheld if a vehicle type is compliant with all relevant ADRs but the automated driving system has not been approved by the safety assurance system. Note that the Objects of the MVSA would need to be changed to allow any in-service aspects of the automated driving system to be included (which may have constitutional implications).
3. Introduce a Commonwealth Act (or other new transport law) to separately regulate automated driving system entities. The safety assurance system would operate independently of the MVSA, in the same way that the Australian Communications and Media Authority regulates to limit electromagnetic interference from vehicles without reference to MVSA processes and ADR compliance.

The NTC will undertake a RIS on regulatory options.

### **8.3 Impacts on registration and licensing**

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Austrroads has conducted an initial assessment of the impacts on registration and licensing.

Automated vehicles are not expected to have any impacts on driver licensing regimes at this stage. Impacts on registration systems are likely to be minimal, given that the safety assurance system will operate nationally and not through registration processes. However, registration databases, including information available on NEVDIS, will capture essential information about the automated driving system.

Detailed work will be undertaken by a national registration working group in 2018 to finalise the new registration fields. Examples could include:

- the level of driving automation
- whether the human driver must supervise the automated driving system
- the automated driving system entity.

Other registration arrangements to be addressed by a national registration working group will include impacts on roadworthiness inspections, cancellation of registration and write-off of automated vehicles. The safety assurance system is not expected to result in substantive changes to driver licensing regimes for human drivers in the foreseeable future. Safety requirements relating to human behaviour could be included in the principles-based safety criteria.

Austrroads will update TISOC on the progress of new registration arrangements in September 2018.

### **8.4 Administrative changes**

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The safety assurance system will involve an administrative process and will require administrative functions to be developed. In addition to allocating the safety assurance system to a government agency, actions include:

- the development of a national advisory panel
- consultation and finalisation of principles-based safety criteria
- systems readiness and capabilities planning.

#### **8.4.1 Development of a national advisory panel**

A national advisory panel may need to be agreed and formed.

Based on the proposed design for a safety assurance system, a single government agency, either the Commonwealth Department of Infrastructure and Regional Development or another body, will be the decision-maker in relation to all applications for automated driving systems, regardless of whether the automated driving system is integrated into a new or in-service vehicle. The national advisory panel is a consultative forum designed to ensure states and territories, the NTC and the NHVR participate in the safety assurance process and are aware of different automated driving systems being permitted onto the road network.

#### **8.4.2 Principles-based safety criteria**

The mandatory self-certification model requires the development of principles-based safety criteria against which applicants must make a Statement of Compliance. The principles-based safety criteria are intended to capture critical safety risks associated with automated vehicles such as:

- compliance with relevant road safety and traffic laws
- demonstrated safe performance when the automated driving system is engaged within a defined operational design domain, including consideration of
  - appropriate speeds and responding to temporary speed zones (such as roadworks)
  - responding to traffic controls (such as stop signs, variable speed signs and traffic lights)
  - all likely road conditions (such as unsealed roads)
  - all likely environmental conditions (such as dust storms or flooding)
  - interaction with trains and light rail (such as railway level crossings)
  - interaction with vulnerable road users (such as compliance with one metre clearance for cyclists).
- the human–machine interface
- cybersecurity
- driver training
- a process to manage authorised modifications
- a process to manage deteriorated or unsafely modified vehicles
- privacy
- appropriate insurance
- the provision of data, including crash and near-miss data, and interaction with enforcement agencies.

The NTC plans to consult with governments, industry and road safety groups on the content of the principles-based safety criteria in 2018–19.

#### **8.4.3 Systems readiness and capability planning**

The entity responsible for the safety assurance system will need to develop system readiness and capability planning to administer the safety assurance system. This will include:

- building skills and capabilities to review applications
- development of business rules and processes
- IT system changes
- marketing and educational resources
- coordination with other core functions including existing MVSA approval processes.

Further work on systems readiness and capability planning will be developed as part of detailed implementation planning in 2018.

Table 6 sets out the principles-based implementation tasks to prepare for the safety assurance system.

**Table 6. Implementation tasks to establish the safety assurance system**

Action item	Timing	Action	Lead agency
1	Submit detailed implementation plan and decision RIS to the Council in <b>November 2018</b> .	Undertake detailed implementation planning and a RIS on legislative options to support the safety assurance system.	The NTC
2	Registration recommendations to TISOC in <b>September 2018</b> .	Establish a National Registration Working Group to review and agree changes to registration processes and databases and to make recommendations to TISOC.	Austrroads
3	Make further legislative policy recommendations to Council in <b>November 2018</b> (if required).	A National Safety Legislation Working Group, consisting of Commonwealth, state and territory representatives and the NTC, to review legislative options, and to make recommendations to TISOC and the Council.	The NTC
4	Submit draft Bill(s) to Council in <b>May 2019</b> .	Draft Bill(s) to introduce new transport laws and/or amend existing laws to address the legislative requirements to give effect to the safety assurance system.	The NTC
5	Submit safety criteria to TISOC for approval in <b>September 2019</b> .	Finalise principles-based safety criteria in close consultation with governments and industry.	The NTC
6	Implement registration systems changes by the <b>end of 2019</b> .	Make subsequent changes to registration processes and databases to ensure essential information relating to automated vehicles is efficiently captured in registration systems.	Austrroads and states and territories
7	Parliament(s) pass bill(s) into legislation by the <b>end of 2019</b> .	Legislation to establish and give effect to the safety assurance system – would be undertaken in parallel to changes to Compulsory Third Party insurance and road transport laws to recognise the automated driving system entity.	Either/both Commonwealth and state and territory parliaments
8	Report progress of functional readiness to TISOC in September 2018 and in September 2019. Functions, including the panel, to be established by <b>early 2020</b> .	Develop functions to support the safety assurance system including a gap assessment of skills and capabilities, detailed budget planning and establishing the national panel.	Either/both Commonwealth and state and territory governments

# Appendix A: Glossary

Term <sup>15</sup>	Definition
Australian Design Rules (ADRs)	National standards for safety, anti-theft and emissions in vehicle design.
Australian Road Rules	National model law intended to provide the basis for nationally consistent road rules in each jurisdiction. These rules do not, by themselves, have any legal effect.
Austrroads	The association of Australasian road transport and traffic agencies.
automated driving system	In-vehicle operating system that controls the automated vehicle functions.
automated driving system entity	The legal entity responsible for the automated driving system.
conditionally automated*	An automated vehicle where the system drives the vehicle for sustained periods of time, but the human driver must be receptive to system errors and be the fall-back for the dynamic driving task.
dynamic driving task*	<p>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, and including without limitation:</p> <ol style="list-style-type: none"> <li>1. Lateral vehicle motion control via steering (operational);</li> <li>2. Longitudinal vehicle motion control via acceleration and deceleration (operational);</li> <li>3. Monitoring the driving environment via object and event detection, recognition, classification, and response preparation (operational and tactical);</li> <li>4. Object and event response execution (operational and tactical);</li> <li>5. Manoeuvre planning (tactical); and</li> <li>6. Enhancing conspicuity via lighting, signalling and gesturing, etc. (tactical).</li> </ol>
fully automated*	An automated vehicle where all aspects of the driving task and monitoring of the driving environment and the dynamic driving task are undertaken by the vehicle system. The vehicle can operate on all roads at all times.
Heavy Vehicle National Law (HVNL)	National laws related to the regulation of heavy vehicles over 4.5 tonnes. Operational in all Australia states and territories except Western Australia and the Northern Territory.
highly automated	An automated vehicle where the system drives the vehicle for sustained periods of time in some situations, or all of the time in defined places, and no human driver is required to monitor the driving environment and the driving task, or intervene, when the system is driving the vehicle.
human-machine interface	Interface between a human operator and a machine. Includes functional and ergonomic design of the interface (human factors).

<sup>15</sup> Terms marked with an asterisk are quoted from SAE International Standard J3016

<i>Motor Vehicle Standards Act 1989</i> (MVSA)	Commonwealth legislation to control the safety, environmental and anti-theft performance of all new and used vehicles entering the Australian market for the first time.
National Heavy Vehicle Regulator (NHVR)	The NHVR administers one set of laws for heavy vehicles under the HVNL, delivering a comprehensive range of services under a consistent regulatory framework.
National Highway Traffic Safety Administration (NHTSA)	An agency of the Executive Branch of the United States Government and part of the Department of Transportation.
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*	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*	An automated vehicle where the automated driving system may take control of steering, acceleration and braking in defined circumstances, but the human driver must continue to monitor the driving environment and the driving task, and intervene if required.
National Exchange of Vehicle and Driver Information System (NEVDIS)	A national system that exchanges information about vehicles and driver licences, managed by Austroads.
Performance-Based Standards (PBS scheme)	A government program in Australia that approves heavy vehicle designs using performance-based standards. It enables industry to achieve higher productivity and safety through innovative and optimised vehicle design.
Rail Safety National Law (RSNL)	The <i>Rail Safety National Law (South Australia) Act 2012</i> establishes the Office of the National Rail Safety Regulator as the body responsible for rail safety regulation in that state or territory. Each state and territory replicates that law so that it applies in that jurisdiction.
Department of Infrastructure and Regional Development	Department of the Australian Government responsible for administering the MVSA.
system failure*	A malfunction in a driving automation system and/or other vehicle system that prevents the driving automation system from reliably sustaining dynamic driving task performance (partial or complete).
Transport and Infrastructure Council	Group comprising Commonwealth, state, territory and New Zealand ministers with responsibility for transport and infrastructure issues, as well as the Australian Local Government Association.
United Nations Working Party 29	International regulatory forum within the institutional framework of the UNECE Inland Transport Committee.

## Appendix B: Public submissions

Name of organisation	Abbreviation	Description
AECOM	–	Consultancy firm
Amy Gillett Foundation	–	National organisation to reduce serious injury and death of cyclists
Arup	–	Consultancy firm
Australia and New Zealand Driverless Vehicle Initiative	ADVI	Initiative led by the Australian Road Research Board to support deployment of automated vehicles (members include government agencies and insurers)
Australasian New Car Assessment Program	ANCAP	Independent vehicle safety advocate
Australian Academy of Technology and Engineering	ATSE	Peak body for transport engineers
Australian Trucking Association	ATA	National peak body representing trucking operators
Australian Automobile Association	AAA	National peak body representing automobile clubs
Department of Transport and Main Roads	TMR	Department of the Government of Queensland
Insurance Australia Group	IAG	General insurance group
Maurice Blackburn Lawyers	–	Law firm
National Roads and Motorists' Association	NRMA	Automobile club
Law Institute of Victoria	–	Peak body for legal professionals
Motorcycle Council of NSW	–	Peak body for motorcycle clubs, associations and ride groups
National Road Transport Association	NatRoad	Road transport industry association
New South Wales Transport Cluster	-	Transport for NSW, Roads and Maritime Services
Price Waterhouse Coopers	PwC	Professional services firm
QBE Group	-	Insurance provider
Royal Automobile Club of Western Australia	RAC	Automobile club
Robert Bosch (Australia)	Bosch	A global supplier of technology and services
SNC Lavalin	-	Consultancy firm
Toyota Motor Corporation Australia	–	Subsidiary of Toyota Motors Corporation, Japan
Transport Certification Australia	TCA	National government body that certifies transport telematics systems
Transurban	–	Manager and developer of urban toll road networks in Australia and the United States
Truck Industry Council	–	Peak body for heavy vehicle manufacturers and distributors
Western Australia Transport Portfolio	WA Transport Portfolio	Department of Transport, Main Roads and the Public Transport Authority (WA)

Public submissions are available on the NTC website at:  
<https://www.ntc.gov.au/submissions/history/?rid=153777&pid=9404>.