

The Toyota logo, consisting of the word "TOYOTA" in a bold, red, sans-serif font, is centered on a white background.

Submission by
Toyota Australia
to the
**2017 NTC Discussion Paper on Regulatory Options
to assure Automated Vehicles Safety**
July 2017

Contents

Key facts.....	3
Summary of key points.....	4
Overview	7
1. Role of Government in regulating Vehicles & Driving	8
2. What is safe for automated vehicles	9
3. Testing Methodology – Assess & Validate AV Safety?	10
4. Assessment criteria for a safety assurance system	10
5. Option 1 – Continue Current Approach	12
6. Option 2 – Self Certification.....	12
7. Option 3 – Pre Market Approval	13
8. Option 4 – Accreditation	13
9. Implementation	13
10. Access to Road Network	14
11. How to ensure Compliance?	14

Key facts

Toyota Australia facts and statistics	<ul style="list-style-type: none"> ▪ Presence in Australia since 1959 ▪ 14 consecutive years as Australia’s best-selling automotive brand with 17.8% market share in 2016 ▪ 3,900 employees ▪ 2016 production and sales: <ul style="list-style-type: none"> ○ Toyota domestic sales: 209,610 <ul style="list-style-type: none"> ○ Passenger: 87,572 (42%) ○ SUV: 63,099 (30%) ○ Light commercial: 58,939 (28%) ○ Lexus domestic sales: 9,028 <ul style="list-style-type: none"> ○ Passenger: 3,523 (39%) ○ SUV: 5,505 (61%) ○ Australian vehicle production: 92,766 ○ Vehicles exported: 60,805 ○ Australian engine production: 92,766 ○ Engines exported: 7,343 ○ Export countries: 13
Toyota/Lexus dealership facts and statistics	<p>229 dealers nationally Approximately 13,000 employees</p>

Summary of key points

<p>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?</p>	<p>The Australian government should continue its participation in international discussions UN WP.29 & WP.1 on Intelligent Transport Systems and Automated Driving.</p> <p>Toyota recommends a holistic and co-operative approach between vehicle manufacturers, government infrastructure entities and representatives of road users in developing a regulatory framework to support automated vehicles.</p>
<p>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?</p>	<p>The government should be aiming for a safety outcome that is safer than conventional vehicles and drivers.</p> <p>There is an expectation that for vehicles with level 3 automation & beyond, the system needs to make decisive decision faster and contribute to a safety outcome which is safer than conventional vehicles and drivers.</p>
<p>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?</p>	<p>Onus should be placed on the automated driving system entity to demonstrate the methods they have adopted to identify and mitigate safety risks. There should however, be considerations on levels of automation which are classified as "automated driving system" as well as records of human intervention on the "automated driving system" when an incident involving safety occurs.</p>
<p>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?</p>	<p>The proposed assessment criteria is a good base line considering there are no definitive current guidelines globally. However, any approach should be nationally and not state based as this would ensure consistency across all jurisdictions.</p>
<p>Question 5: Should governments adopt a transitional approach to the development of a safety assurance system? If so, how would this work?</p>	<p>Toyota agrees that a transitional approach should be adopted. The reformation of current vehicle standards should be a staged approach in accordance with the emerging technological developments to minimise changes in legislation and regulation. In order to support the safe introduction of automated vehicles into Australia, Toyota Australia believes the following steps are required (i.e. Phase 1: Continue Current Approach, Phase 2: Self-Certification and Phase 3: Pre-Market Approval)</p>
<p>Question 6: Is continuing the current approach to regulating vehicle safety the best option for the safety assurance of automated vehicle functions? If so, why?</p>	<p>Continuing the current approach to regulating vehicle safety is viable in the short term but is not the best option for the safety assurance of automated vehicle functions in longer term.</p> <p>While there are a number of benefits associated with this approach as stipulated in the NTC paper, Toyota Australia considers these short-term advantages. This is because the disadvantages of this approach pose risks that may render high costs to the society.</p>

<p>Question 7: Is self-certification the best approach to regulating automated vehicle safety? If so, should this approach be voluntary or mandatory? Should self-certification be supported by a primary safety duty to ensure automated vehicle safety?</p>	<p>Toyota Australia believes that self-certification is the best approach to regulating automated vehicle safety in the near future as it provides the highest level of balance between all assessments criteria stipulated in the NTC paper.</p>
<p>Question 8: Is pre-market approval the best approach to regulating automated vehicle safety? If so, what regulatory option would be the most effective to support pre-market approval?</p>	<p>Toyota Australia agrees that pre-market approval provides the highest level of certainty for the safe operation of automated vehicles.</p> <p>However, this approach does not meet certain assessment criteria at this stage (i.e. inflexibility, high cost and long lead time). Hence, with the above reasons, it is not the best approach to regulate automated vehicle safety currently.</p> <p>Toyota Australia however believes that pre-market approval should be a main contender as an option for future automated vehicle safety regulation.</p>
<p>Question 9: Is accreditation the best approach to regulating automated vehicle safety? If so, why?</p>	<p>Toyota Australia does not believe that accreditation is the best approach to regulating automated vehicle safety.</p> <p>While this approach provides a comprehensive, risk-based and proven framework within which safety could be regulated;</p> <ul style="list-style-type: none"> - The process is complex and expensive. - There may only be insignificant learnings from rail, aviation and other industries as the automotive industry is very different. - To NTC's knowledge, there are no other countries considering an accreditation approach to automated vehicle safety. Hence, pursuing this approach creates uniqueness in Australia and is not in the spirit of global harmonisation.
<p>Question 10: Based on the option for safety assurance of automated vehicle functions, what institutional arrangements should support this option? Why?</p>	<p>Per NTC's paper, the responsibility for motor vehicle safety is currently shared between the Commonwealth and the states and territories and the proposed safety assurance system may consist of initial and ongoing safety assurance.</p> <p>As such, Toyota Australia believes that the Commonwealth should be responsible for the initial portion of the safety assurance system. This responsibility should closely follow how the current Conformity of Production (COP) is currently conducted by the Department of Infrastructure and Regional Development (DIRD).</p> <p>For ongoing safety assurance, the state and territories should be responsible for managing their own safety assurance systems per current practice (i.e. state regulations which relate to in-service requirements).</p>

<p>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?</p>	<p>Toyota Australia believes that automated vehicles' access to the road network should be managed and a national safety assurance process would be the most suitable approach.</p> <p>Having a national government agency making binding decisions about suitability for registration and access would ensure national consistency and provide clear roles between government agencies. It also reduces red-tape by reducing administrative costs and time for all parties.</p>
<p>Question 12: How should governments ensure compliance with the safety assurance system?</p>	<p>Toyota Australia supports in principle NTC's suggestion that compliance could be encouraged and enforced through a primary safety duty that requires safe automated vehicles and imposes associated penalties and / or specific sanctions and penalties for the automated driving system entity, depending on the nature of the relevant offence.</p> <p>Ultimately, the most appropriate method to ensure compliance with the safety assurance system would be largely dependent on the agreed regulatory model and hence, should be explored further once a decision is made. This would involve further discussion as to the circumstances, extent and time limits of liability for a party to whom the duties apply.</p>

Overview

Toyota Australia welcomes the opportunity to provide input to the NTC 'Regulatory Options to assure Automated Vehicles Safety' discussion paper. Automated vehicles present a potentially evolutionary shift in the way in which transport is undertaken across the globe, and Toyota fully recognises and is optimistic about the associated benefits for both individuals and society as a whole, including improved road safety, increased productivity and better environmental outcomes.

Based on the speed of advancement in this field both locally and internationally, Toyota Australia welcomes the purpose and objective of the discussion paper to explore what regulatory measures are necessary to ensure assurance for "Safety" in the Australian marketplace. Based on our status as a global OEM, Toyota Australia is also strongly in favour of a globally harmonised regulatory approach as well as the consistent application of the regulatory regimes across national jurisdictions. This approach will ensure that technological advancements made overseas are able to be implemented in the local market without undue delay.

While there are numerous benefits and opportunities surrounding automated vehicles, Toyota Australia also recognises the regulatory challenges that exist in adopting this technology. These include the different types of automation that a vehicle may possess, ranging from driver assistance to high or full automation, as well as the scenario that will inevitably occur during a transition phase whereby a certain portion of automated vehicles on the road are interspersed with traditional models. With these challenges in place, Toyota Australia is supportive of the approach undertaken by the NTC in prioritising regulatory options to facilitate introduction.

Also, in the spirit of harmonisation and as DIRD is participating in ongoing meetings within UN WP.29 & WP.1 on Intelligent Transport Systems and Automated Driving, the outcome of these discussions should be regularly monitored together with discussions within informal groups such as ITS AD IG, ACSF IG and WP1 AD IG¹.

While the scope of the NTC review focuses on automated vehicles, Toyota Australia also envisages that there will be numerous regulatory changes required to cater for the continuing advancements in cooperative intelligent transport systems (C-ITS), and that joint consideration for both types of technology will become more important into the future.

All options listed by NTC on this paper need to be reviewed earnestly as any regulatory measures do not add unnecessary barriers to the current processes.

¹ ITS AD IG refers to Intelligent Transport Systems and Automated Driving Informal Group. ACSF IG refers to Automatically Commanded Steering Function Informal Group.

1. Role of Government in regulating Vehicles & Driving

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?

Toyota Australia supports NTC's work in initiating extensive discussions on the implementation of a national safety assurance framework to oversee the deployment of automated vehicles that may operate without the control of human drivers. This framework should be part of a longer term approach to accommodate the evolving nature of technology in this space. Although existing regulations can still be applied to current technology, they should also be developed with foresight for emerging technologies.

The road rules and traffic laws need to be consistent nationwide and amended to clarify the meaning of control and proper control across vehicles with all various levels of automation. The Australian government should continue its participation in international discussions UN WP.29 & WP.1 on Intelligent Transport Systems and Automated Driving. The Australian Road Rules should then be aligned with an internationally accepted position based on the outcomes of those discussions.

Toyota recommends a holistic and co-operative approach between vehicle manufacturers, government infrastructure entities and representatives of road users in developing a regulatory framework to support automated vehicles. The use of automated vehicles also needs to be considered based on their operation in a system as they may operate with external entities (i.e. non-automated vehicles and infrastructure) that affect their driving control or patterns. Other examples include vulnerable road users (VRU) (e.g. pedestrians, motorcyclists, cyclists) and potential "non-automated" and "non-connected" vehicle interaction.

In considering the conditions to include in the national guidelines, it is imperative to utilise best practice from around the globe. To ensure safe vehicles, safe people, safe roads and safe speeds.

2. What is safe for 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?

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/Deceleration	Monitoring of Driving Environment	Fallback Performance of Dynamic Driving Task	System Capability (Driving Modes)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the <i>human driver</i> of all aspects of the <i>dynamic driving task</i> , even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the <i>driving mode</i> -specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the <i>driving mode</i> -specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	System	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the dynamic driving task with the expectation that the <i>human driver</i> will respond appropriately to a <i>request to intervene</i>	System	System	Human driver	Some driving modes
4	High Automation	the <i>driving mode</i> -specific performance by an automated driving system of all aspects of the <i>dynamic driving task</i> , even if a <i>human driver</i> does not respond appropriately to a <i>request to intervene</i>	System	System	System	Some driving modes
5	Full Automation	the full-time performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> under all roadway and environmental conditions that can be managed by a <i>human driver</i>	System	System	System	All driving modes

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From internal research as well as research papers as presented @ ITS World Congress 2016, there has been evidence of data which supports "Automated" vehicles should be safer than "Conventional" vehicles as 93%¹ of accidents are caused by human error. Therefore, there is an expectation that for vehicles with level 3 automation & beyond, the system needs to make decisive decision faster and contribute to a safety outcome which is safer than conventional vehicles and drivers.

The NTC listed 4 challenges to the existing notion of road safety in Australia, which is linked to the concept of road-toll. These challenges include;

- 1) High KMs, various circumstances and thorough analyses required – Toyota Australia fully agrees with the points raised by NTC in this paragraph but believes that these issues can be resolved with relative ease with extensive trials involving automated vehicles. These trials would be most effectively run with strong and close collaboration between the industry and the government. Once sufficient data is collected and interpreted (stakeholders would have to agree on the level of data deemed sufficient), the automated vehicle at that point in time can then be assessed as safe, or safer than a human-driven vehicle.

- 2) Complex operational design domains and limited type of vehicle and driver being trialled to measure safety levels – Similar to above, conducting extensive trials covering different types of conventional vehicle and driver (i.e. at high and low speeds) would overcome this issue. Additionally, the type of trials conducted should be recorded and the trial types which have not been performed considerably should be promoted to parties who wish to participate in trials. In turn, a wider range of data can be obtained for safety assessment purposes.
- 3) Nova Systems proposal, whereby safety is defined and measured according to the rate of technical failure and incidents that result in harm to people – Toyota Australia believes that the proposal by Nova Systems and the traditional road safety approach should be combined to measure and define safety. Hence, the notion of road safety would then be linked to road toll and the rate of failure which results in harm to road users. This approach would result in more accurate data analysis as well as providing better assessment of the overall safety of automated vehicles.

To summarise, NTC raised a number of challenges in this section and they include the requirements of various trial circumstances and complex operational design domains. Toyota Australia acknowledges these challenges and believes that in order to achieve the best possible outcome for the safe roll-out of automated vehicles, the government should support extensive trial with various types of conditions and vehicles.

²NHTSA's 2008 National Motor Vehicle Crash Causation Survey

3. Testing Methodology – Assess & Validate AV Safety?

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?

Toyota Australia believes that onus should be placed on the automated driving system entity to demonstrate the methods they have adopted to identify and mitigate safety risks. This approach would then reduce the road user's exposure to risk from automated technologies that are in vehicles but not covered in the automated vehicle design standards.

There should however, be considerations on levels of automation which are classified as "automated driving system" as well as records of human intervention on the "automated driving system" when an incident involving safety occurs.

4. Assessment criteria for a safety assurance system

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?

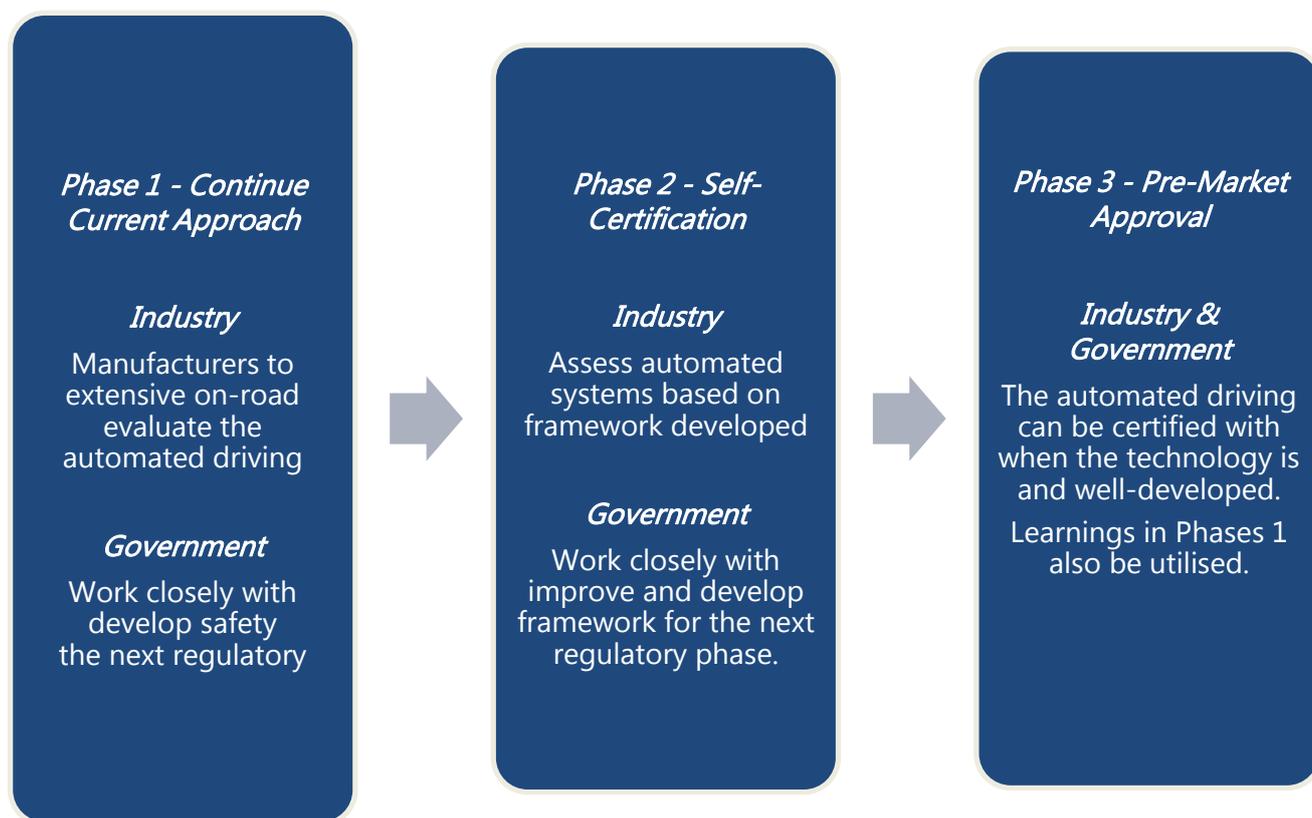
The proposed assessment criteria is a good base line considering there are no definitive current guidelines globally. However, any approach should be nationally and not state based as this would ensure consistency across all jurisdictions.

Question 5: Should governments adopt a transitional approach to the development of a safety assurance system? If so, how would this work?

It is welcoming for NTC to suggest and agreed by Toyota that a transitional approach is considered. Toyota understands that a single option may not be practicable without amendments and therefore it is potentially

better for an option to evolve as vehicles and system standards are developed internationally and technologies are tested. Apart from developing technologies, the existence of mixed fleet on roads would also be better catered for with a transitional approach to the safety assurance system. The reformation of current vehicle standards should be a staged approach in accordance with the emerging technological developments to minimise changes in legislation and regulation.

In order to support the safe introduction of automated vehicles into Australia, Toyota Australia believes the following steps should be considered.



5. Option 1 – Continue Current Approach

Question 6: Is continuing the current approach to regulating vehicle safety the best option for the safety assurance of automated vehicle functions? If so, why?

Continuing the current approach to regulating vehicle safety is viable in the short term but is definitely not the best option for the safety assurance of automated vehicle functions in the long-run.

While there are a number of benefits associated with this approach as stipulated in the NTC paper, Toyota Australia considers these short-term advantages. This is because the disadvantages of this approach pose risks that may render higher costs to the society.

For instance, as the current ADRs do not cover automated technologies and if incidents impacting the safety of road users occur when these technologies are publicly rolled out, it would be detrimental to the future deployment of the automated driving systems. It would involve not only monetary compensation costs but also negatively impact the public's perception and trust towards these technologies, defeating the purpose of introducing automated driving systems which is to improve the safety of road users.

6. Option 2 – Self Certification

Question 7: Is self-certification the best approach to regulating automated vehicle safety? If so, should this approach be voluntary or mandatory? Should self-certification be supported by a primary safety duty to ensure automated vehicle safety?

Toyota Australia believes that self-certification is the best approach to regulating automated vehicle safety in the near future as it provides the highest level of balance between all assessments criteria stipulated in the NTC paper.

As to whether or not the statement of compliance against the safety principles and criteria should be mandatory, given that the technology levels of automated driving systems are still in the fledgling stages, the statement of compliance by manufacturers should be voluntary initially. This regulatory process should be flexible and be able to adapt with the technology development such that when a point of maturity is achieved and upon agreement across various stakeholders, a decision can then be made on whether or not to mandate self-certification. Ultimately, when the technologies are fully mature, Toyota Australia believes that having a mandatory statement of compliance would add additional rigour to the process and establish a more level playing field for industry, without significantly more regulation or oversight by government.

Toyota Australia believes that it is vital to utilise best practice from around the globe and NHTSA's approach in the Federal Automated Vehicle Policy should be used as a basis and guide to develop the high-level safety principles and criteria for the self-certification process in Australia.

7. Option 3 – Pre Market Approval

Question 8: Is pre-market approval the best approach to regulating automated vehicle safety? If so, what regulatory option would be the most effective to support pre-market approval?

Toyota Australia agrees that pre-market approval provides the highest level of certainty for the safe operation of automated vehicles. However, this approach does not meet certain assessment criteria at this stage (i.e. inflexibility, high cost and long lead time). Hence, with the above reasons, it is not the best approach to regulate automated vehicle safety currently.

Toyota Australia however believes that pre-market approval should be a main contender as an option for future automated vehicle safety regulation. Currently a large portion of vehicle technologies and testing procedures are still in development phase. Thus, the introduction of pre-market approval could obstruct safety-related innovations and result in delays in the launch and assessment of new models of automated vehicles. At a point in time where the automated vehicle system technologies are mature and testing procedures are widely developed and proven across the globe, pre-market approval may be the most effective way to regulate automated vehicles.

8. Option 4 – Accreditation

Question 9: Is accreditation the best approach to regulating automated vehicle safety? If so, why?

Toyota Australia does not believe that accreditation is the best approach to regulating automated vehicle safety.

While this approach provides a comprehensive, risk-based and proven framework within which safety could be regulated;

- The process is complex and expensive.
- There may only be insignificant learnings from rail, aviation and other industries as the automotive industry is very different.
- To NTC's knowledge, there are no other countries considering an accreditation approach to automated vehicle safety. Hence, pursuing this approach creates uniqueness in Australia and is not in the spirit of global harmonisation.

9. Implementation

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

Per NTC's paper, the responsibility for motor vehicle safety is currently shared between the Commonwealth and the states and territories and the proposed safety assurance system may consist of initial and ongoing safety assurance.

As such, Toyota Australia believes that the Commonwealth should be responsible for the initial portion of the safety assurance system. This responsibility should closely follow how the current Conformity of Production (COP) is currently conducted by the Department of Infrastructure and Regional Development (DIRD).

For ongoing safety assurance, the state and territories should be responsible for managing their own safety assurance systems per current practice (i.e. state regulations which relate to in-service requirements).

Toyota Australia believes that the suggestion above would result in no significant changes for the regulators and industry as well as ensuring national consistency.

10. Access to Road Network

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?

Toyota Australia believes that automated vehicles' access to the road network should be managed and a national safety assurance process would be the most suitable approach.

Under the continued current approach option and self-certification regulatory options, state and territory governments will manage the road access. Hence, they would have the power to limit the access of automated vehicles to parts of the road network. Toyota Australia believes that this method has a high potential of creating unnecessary barriers for all parties including the government, OEM and the consumers when purchasing automated vehicles as well as creating inconsistency across all different states and territories in Australia.

There may be an argument to the point above where the nature of the road design, infrastructure and weather is different across different states and territories. However, this issue can be resolved through close cooperation between the industry and government during trial stages to work towards ensuring the suitability of the operational design domain for automated vehicles.

Having a national government agency making binding decisions about suitability for registration and access would ensure national consistency and provide clear roles between government agencies. It also reduces red-tape by reducing administrative costs and time for all parties.

11. How to ensure Compliance?

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

Toyota Australia supports in principle NTC's suggestion that compliance could be encouraged and enforced through a primary safety duty that requires safe automated vehicles and imposes associated penalties and / or specific sanctions and penalties for the automated driving system entity, depending on the nature of the relevant offence.

Traffic offences caused by an automated driving system (and without input from a human operator) could be taken as evidence of a breach of a primary safety duty. In such circumstances, a failure to comply with the primary safety duty could result in penalties for the automated driving system entity.

Ultimately, the most appropriate method to ensure compliance with the safety assurance system would be largely dependent on the agreed regulatory model and hence, should be explored further once a decision is made. This would involve further discussion as to the circumstances, extent and time limits of liability for a party to whom the duties apply.