



Overview of Ministry's Autonomous Vehicles Work Programme

Reason for this briefing	This briefing provides you with information on the work underway in the Ministry around Autonomous Vehicle technologies.
Action required	Note the contents of this briefing.
Deadline	20 November 2019
Reason for deadline	The briefing provides background information prior to your Transport Infrastructure Council meeting in Melbourne on 22 November 2019.

Contact for telephone discussion (if required)

Name	Position	Telephone	First contact
Richard Cross	Manager, Strategic Policy and Innovation	[REDACTED]	✓
[REDACTED]	Principal Adviser, Strategic Policy and Innovation	[REDACTED]	
[REDACTED]	Adviser, Strategic Policy and Innovation	[REDACTED]	

MINISTER'S COMMENTS:

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Date:	14 November 2019	Briefing number:	OC191125
Attention:	Hon Phil Twyford Minister of Transport	Security level:	In Confidence

Minister of Transport's office actions

- ☒ *Noted* ☐ *Seen* ☐ *Approved*
- ☐ *Needs change* ☐ *Referred to*
- ☐ *Withdrawn* ☐ *Not seen by Minister* ☐ *Overtaken by events*

Purpose of this Briefing

1. This briefing provides an overview of the current state of autonomous vehicle technologies, and the work we are doing to ensure that the transport system of New Zealand is prepared for them. Our work includes ensuring that the regulatory system of New Zealand provides appropriate frameworks and timely safeguards to manage the risks associated with autonomous vehicles (AVs).
2. We are providing this now because the discussion on autonomous vehicles will be a key agenda item at the Transport Infrastructure Council meeting in Melbourne on 22 November 2019, which you are attending.

Executive Summary

3. The increased focus on developing AV technologies internationally has led us to review the current and future opportunities and risks associated with AVs in New Zealand. Our aim is to provide timely regulatory guidelines and to have appropriate mechanisms in place before the widespread deployment of AVs.
4. There are two distinct deployment pathways for autonomous vehicles. One pathway will be through managed fleets of fully autonomous vehicles in contained urban areas. It is likely to be several years before we see large fleets of autonomous vehicles in New Zealand, but when they do arrive, they are likely to be deployed quickly and in large numbers. The other pathway is through a gradual increase in the number of vehicles with autonomous features designed to reduce the number of tasks performed by the human driver. These vehicles are already beginning to enter the vehicle fleet. For example, new Tesla vehicles are capable of operating autonomously in certain conditions. Each pathway requires a different regulatory approach to ensure the safe operation of AVs on roads. These pathways and expected timeframes are set out further in this briefing.
5. Over the last 12 months, we have re-scoped the focus of our work on AVs. A copy of the background paper to the work programme is enclosed in Appendix 1. The paper sets out four key themes for our work programme, and outlines our current knowledge and key gaps. The themes of our work may shift in the future, due to the rapid evolution of AV technology and the possibility of new risks emerging. The four current themes are:
 - 5.1. Safety of AVs
 - 5.2. Liability Issues
 - 5.3. Cybersecurity and Data
 - 5.4. Social and Economic Aspects

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7. As part of our work programme, we have been engaging with New Zealand Transport Agency (NZTA), the industry, and our international counterparts, including the National Transport Commission (NTC) and the Office of Future Transport Technology (OFTT) in Australia, to establish ongoing working relations and to collaborate on identifying solutions to the regulatory issues associated with AVs.
8. We aim to continue our engagements to better scope international developments on AVs and to reinforce our position in AVs regulation, especially in the World Forum for Harmonization of

Vehicle Regulations (WP.29) established by the United Nations Economic Commission for Europe (UNECE). Our Australian counterparts are currently participating in WP.29 meetings and can communicate our regulatory concerns when we cannot attend these meetings due to capacity and resource restraints.

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it is important that we start communicating a clear direction to the industry, stakeholders, and the public about the likely future regulatory approach to AVs. As the technology continues to advance, the public will increasingly look to us for reassurance that we are aware of and prepared for the regulatory challenges, and that we are planning and working to ensure that AVs make a positive contribution to the transport system.

Autonomous vehicles are vehicles that are capable of sensing and scanning their environment and moving with little or no human input

10. Autonomous vehicles have five levels of automation. Based on the definition set out by the Society of Automotive Engineers (SAE International), at levels 0, 1, and 2 automation, the human driver monitors the environment. At levels 3, 4, and 5, the vehicle mainly or fully monitors the environment. These levels are explained in Figure 1.

Figure 1: Levels of automation in AVs

SAE LEVEL 0		SAE LEVEL 1		SAE LEVEL 2		SAE LEVEL 3		SAE LEVEL 4		SAE LEVEL 5	
What does the human in the driver's seat have to do?						You are <u>not</u> driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”					
You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering						When the feature requests, you must drive		These automated driving features will not require you to take over driving			
You must constantly supervise these support features: you must steer, brake or accelerate as needed to maintain safety											
These are driver support features						These are automated driving features					
What do these features do?						These features are limited to providing warnings and momentary assistance		These features provide steering OR brake/acceleration support to the driver		These features provide steering AND brake/acceleration support to the driver	
						These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions			
Example Features						• automatic emergency braking • blind spot warning • lane departure warning		• lane centering OR • adaptive cruise control		• lane centering AND • adaptive cruise control at the same time	
						• traffic jam chauffeur		• local driverless taxi • pedals/steering wheel may or may not be installed		• same as level 4, but feature can drive everywhere in all conditions	

11. The benefits of autonomous vehicles are currently uncertain. Some experts claim that autonomous vehicles may increase road safety, reduce the road toll, reduce congestion, and (assuming they are electric) reduce greenhouse gas emissions. However, there is much uncertainty around the implications of deploying autonomous vehicles on roads, primarily due

to the fact that these vehicles are only at the testing and trialling phase in most countries, and their real-world benefits for the transport system are yet to be seen.

Based on our engagements, we have identified two deployment pathways for AVs and several potential timeframes for their operation at different levels of automation

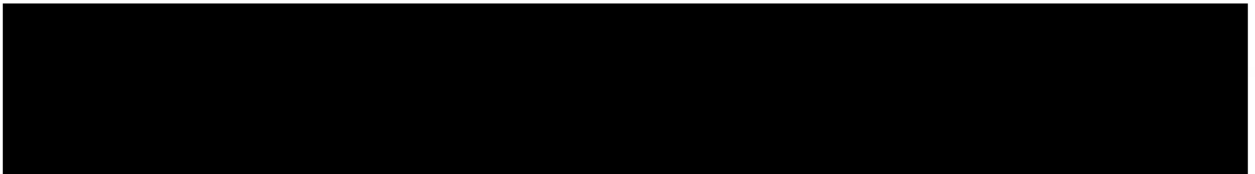
12. Based on our engagements with vehicle manufacturers, other government agencies and academia, we think there are two different and concurrent pathways for AVs deployment. One pathway focuses on the deployment of managed fleets of fully autonomous vehicles (often referred to as robo-taxis), operating in contained urban areas. This concept is being developed by companies such as Waymo (a subsidiary of Google), Uber, and Cruise Automation (a subsidiary of General Motors). The other pathway aims to gradually increase the number of vehicles with increasing levels of automation in the existing public and private fleets. These vehicles are already beginning to enter the vehicle fleet. For example, new Tesla vehicles are capable of operating autonomously in certain conditions, and there are approximately over 400 of these vehicles in New Zealand. Each pathway will require a different regulatory approach.
13. There are also different perspectives about the timeframes of deploying autonomous vehicles. The timeframes for the deployment of AVs are still highly uncertain, but based on our engagements, our best estimates are:
 - 13.1. Within the next two to three years: we expect more private vehicles with autonomous features in Australia and New Zealand, including vehicles capable of operating without any human input on certain roads (such as motorways and dual carriageways), and limited testing of small autonomous shuttles in areas such as retirement villages or university campuses.
 - 13.2. Within the next three to five years: we might see the first vehicles at level 4 automation operating on public roads within confined urban environments in Australia and New Zealand. These vehicles are likely to be deployed in large numbers, and we may have a relatively short notice prior to their deployment.
14. We think it will be at least 10 years, and probably considerably longer, before fully autonomous vehicles capable of operating in any environment are deployed on New Zealand roads. Level 5 vehicles still require significant improvements in sensor technology and data handling, and the cost of developing the technology to a point where they can operate in any environment is likely to be prohibitive given that the majority of passenger trips occur in urban areas.
15. Currently, some developers of the AV technology are looking at use cases for both individual private ownership and managed fleets to understand the merits and detriments of each pathway. Some manufacturers, however, have chosen a specific pathway and are developing their frameworks accordingly.

Our work programme focuses on the key regulatory issues for AVs in New Zealand

16. The increased focus on developing AV technologies internationally, and the fast development of AVs technologies has led us to review the opportunities and risks associated with AVs in New Zealand. Our aim is to provide timely regulatory guidelines and safeguards and to have appropriate mechanisms and pre-emptive measures in place before the widespread deployment of AVs.

17. The previous Government had a strong focus on autonomous vehicles as a part of the Intelligent Transport Systems Technology Action Plan 2014-2018. However, we are currently refocusing our work on AVs to review and consider their critical regulatory aspects.

18.



19. Through the AVs work programme, we identified four key themes for our regulatory approach that were concluded based on our extensive research on the background and progress of AVs in Australia, the United Kingdom, Singapore, and other countries that are currently testing and trialling AVs. These four themes are:
- 19.1. **Safety:** to understand the key safety issues of autonomous vehicles in their interaction with infrastructure and vulnerable road users.
 - 19.2. **Liability:** to identify main concerns and responsibilities in accidents that involve AVs, and to address insurance uncertainties when the role of the driver is minimised or eliminated at higher levels of automation.
 - 19.3. **Cybersecurity:** to determine security risks of AVs and identify the most appropriate arrangements around data access, interpretation, storage, de-identification, privacy, and protection.
 - 19.4. **Social and economic issues:** to evaluate and analyse the impacts of autonomous vehicles on the future of transport, and on relevant issues such as the environment, pollution, congestion, energy demand, affordability, inclusivity, and depreciation.
20. A copy of the draft background paper is enclosed in Appendix 1. This paper is the summary of our current knowledge about the regulatory challenges and the existing gaps in the national and international literature of AVs. This paper is currently unpublished as it is subject to change in near future.

We have been engaging with NZTA, industries, private sector, and our international counterparts to maximise our scope and influence on AVs regulatory trends

21. We have engaged with NZTA to learn about its perspectives and concerns about autonomous vehicles and to incorporate its views into our work programme. We have also invited NZTA to attend several regulatory workshops and meetings. We are planning to adopt an engagement plan with NZTA around AVs work programme for 2020.
22. As part of our engagement, we recently visited Australia to meet with experts on autonomous vehicles. During our visit, we met with the Australian Government, academia, and the private sector.
23. The key Australian Government agencies currently working on autonomous vehicles are the National Transport Commission (NTC) and the Office of Future Transport Technology (OFTT) in the Department of Infrastructure, Transport, Cities, and Regional Development.
- 23.1. National Transport Commission is currently reviewing Australian Road Rules to prepare Australia for the safe deployment of autonomous vehicles. NTC works with industries and road agencies across states and territories to harmonise regulations.

- 23.2. Office of Future Transport Technology coordinates across portfolios related to future transport technologies and develops land transport policy frameworks and action plans. OFTT has an intermediary policy role by considering international trends and commonwealth strategic priorities, and communicating policies to NTC, states, and territories.
24. NTC and OFTT are considering and addressing many of the regulatory gaps and challenges created by autonomous vehicles that we are also concerned about and are working on. In particular, NTC, as the lead agency with considerable expertise on autonomous vehicles, can help shed light on many regulatory issues relevant to AVs. NTC has also been producing regulatory impact statements, discussion papers, issues papers, and regulatory proposals since 2015. We can directly adopt many of its recommendations into our work programme, and tailor them to suit New Zealand-specific circumstances.

Our continued engagements will ensure the alignment of our policies with our Australian counterparts and will reinforce our position in international regulatory forums

25. Frequent and ongoing engagements with NTC and OFTT, as the key organisations in AVs regulation, is crucial in our work. These engagements will also help us better scope the international regulatory environment. Currently, the Global Forum for Road Traffic Safety (WP.1), and the World Forum for Harmonization of Vehicle Regulations (WP.29), which are both established by the United Nations Economic Commission for Europe (UNECE), are working on regulatory issues of autonomous vehicles in different sub-sessions that meet quarterly.
26. WP.1 and WP.29 make key decisions on the regulatory requirements for autonomous vehicles. While we are not participating in the decision-making process, many decisions of these meetings have binding impacts on safety and regulatory approaches to autonomous vehicles in New Zealand regardless of our participation in the meetings. Therefore, it is important for us to work with our Australian counterparts to stay informed of the discussions at these meetings, to be able to adopt strategies to influence the decisions of the Working Parties when necessary, and to communicate our interests in the Working Party meetings.
27. Australia joined WP.29 sessions mid-2018 and has been attending the meetings ever since. We currently do not have the resources and capacity to attend the meetings of WP.1 and WP.29. However, we are exploring how we can work more closely with Australia, for example by communicating our priorities and challenges to the attending Australian delegates. Having said that, it is equally important for the Australian parties to understand the perspectives and priorities of New Zealand to ensure appropriate communication in international forums.

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We think it is important to improve our external communications on AV issues

28.



- 28.1. Continuing our engagement with our international counterparts, specifically NTC and OFTT, to learn from them and where appropriate, influence any policies they develop that could also impact the New Zealand market.
- 28.2. Sending a clear direction and a strong signal to stakeholders, the industry, and the public about our policies and priorities on autonomous vehicles, by producing a

discussion paper setting out the key regulatory issues in New Zealand. We intend to draft this paper before the end of 2020.

- 28.3. Publishing more information on our website to provide reassurance that we have been engaging with experts on AVs, that we are aware of the existing challenges and are prepared for them, and that we are working on these issues to ensure the safe integration of autonomous vehicles into our transport system.

Recommendations

29. The recommendation is that you:

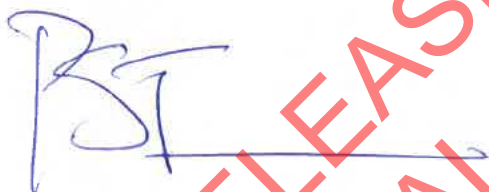
- (a) **Note** the contents of this briefing.

Yes/No ☒



Richard Cross
Manager, Strategic Policy and Innovation

MINISTER'S SIGNATURE:



DATE:

21.11.19

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Appendix 1

Autonomous Vehicles Background Paper

October 2019

Disclaimer: This document represents the preliminary thinking of the Ministry of Transport on Autonomous Vehicles, and doesn't represent New Zealand Government Policy.

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Ministry of Transport: An Introduction

The Ministry of Transport (The Ministry) is Government's principal adviser on transport policy. It provides advice to the Government on issues across the transport system, and the regulatory framework that supports it. The Ministry also advises the Government on the appropriate mechanisms for raising revenue for the transport system, and how that revenue should be spent to maximise value from its investments. Links to some of the Ministry's key documents are below:

- Transport Outcomes Framework: <https://www.transport.govt.nz/multi-modal/keystrategiesandplans/transport-outcomes-framework/>
- Government Policy Statement on Land Transport: <https://www.transport.govt.nz/multi-modal/keystrategiesandplans/gpsonlandtransportfunding/>
- Public Transport 2045: <https://www.transport.govt.nz/multi-modal/keystrategiesandplans/public-transport-2045/>
- Government's Statement of Intent 2018-2022: <https://www.transport.govt.nz/assets/Uploads/About/Documents/1f42932f78/Statement-of-Intent-2018-2022.pdf>

The Ministry is responsible for preparing changes to legislation within the transport portfolio, and collaborates with relevant departments on changes to legislation that may relate to the wider transport system. The Ministry also provides leadership across the transport system and in the wider government sector, making connections and influencing across the network of transport users, providers, and regulators.

In the autonomous vehicle technologies space, the Ministry works closely with the New Zealand Transport Agency (NZTA). The NZTA is a Crown entity responsible for planning land transport networks, investing in land transport, and managing the State highway network.

Autonomous Vehicles in New Zealand

Background

Autonomous vehicles in New Zealand were first discussed in the Intelligent Transport Systems (ITS) Technology Action Plan 2014-18. The plan included a vehicle standards map (originally initiated as part of the Safer Journeys Action Plan for 2013-15), to identify existing and emerging vehicle technologies that could improve safety or efficiency, such as autonomous emergency braking. The plan also included radio spectrum allocation and standards to enhance Cooperative Intelligent Transport Systems (C-ITS) and to enable vehicles and infrastructure to communicate directly with each other in a much faster and more secure way.

Another key action within the plan was a scan of all transport legislation to identify unnecessary barriers to the continued deployment of autonomous technologies in New Zealand. This was driven by the increasing introduction of advanced driver assistance systems (ADAS) and semi-autonomous vehicles.

Currently, the Government of New Zealand is working on exploring the best pathways to regulate autonomous vehicles entering the country. There are many challenges in New Zealand that will have an impact on the deployment of autonomous vehicles (AVs). New Zealand does not have a vehicle manufacturing industry, or a strong focus on Research and Development into autonomous

vehicle technology (with the exception of the Ohmio Shuttle, being developed by HMI technologies). Its domestic vehicle market is small. The country's low population density creates challenges, particularly around infrastructure investment for AV deployment outside main cities.

However, New Zealand has a strong reputation for excellent governance and the effectiveness and agility of legislative processes, and is highly regarded as a place to develop new technologies. New Zealand also has a single jurisdiction, with no state and federal jurisdiction challenges to navigate. These features highlight the advantages of regulating autonomous vehicle technologies in New Zealand.

Autonomous Technologies in New Zealand

In New Zealand, other autonomous and unmanned technologies are already in use in the aviation and maritime areas. The use of Unmanned Aerial Vehicles (UAVs), for civilian purposes, such as surveying, emergency management, agriculture, asset management, and mapping inaccessible areas is growing rapidly. A number of companies are testing and trialling remotely controlled drones or UAVs, including Zephyr Airworks (a subsidiary of Kitty Hawk - which is testing and developing an autonomous e-VTOL aircraft in New Zealand). In the maritime environment, unmanned vessels such as the 'Sea Explorer' glider surveying submarine are already in operation. The New Zealand Ports of Auckland are operating automated straddle carriers at its container terminal, significantly improving the efficiency of unloading ships and loading trucks with container imports.

At Christchurch Airport, Ohmio, is testing a fully autonomous shuttle for public use in restricted areas. The autonomous 20-person shuttle runs along a pre-programmed route, without the need for a driver. The body of the vehicle is 3D printed, which makes this vehicle ground-breaking in terms of design and construction. In June 2019, the public were provided an opportunity to ride in the shuttle, contributing to the understanding around AVs and the potential opportunities they provide.

Regulatory Settings for Autonomous Vehicles

Current Regulatory Settings

The current regulatory framework in New Zealand is prescriptive in nature. This framework currently provides adequate regulation for vehicles with automated features such as lane-keep assist, collision mitigation systems, and automated emergency braking systems. However, the framework is unlikely to remain fit-for-purpose for vehicles at higher levels of automation (level 3 and above), primarily due to its prescriptive nature (e.g. newer vehicles are already displaying different physical components and features to conventional road vehicles).

Currently, New Zealand grants exemptions to vehicles entering the country that do not comply with existing prescriptive compliance standards. The NZTA is the organisation that has the power to grant exemptions pursuant to Section 166 of the New Zealand Land Transport Act 1998. This requires the assessment and evaluation of each individual case, a process that is both time consuming and resource intensive. Granting exemptions on a case by case basis is not considered to be a sustainable approach to managing the increasing influx of novel or innovative vehicles, including vehicles with autonomous features.

Current regulatory settings also need to be reviewed in line with the potential safety and liability concerns raised by AVs. Addressing these concerns may require a revision of existing regulation, or the creation of a separate set of regulations for these vehicles. In addition to this, there is a

need to understand whether current legislation around privacy and cyber security, (for example), will also support the positive outcomes New Zealand is seeking from the deployment of autonomous vehicles on New Zealand public roads. Aligned to this is the need to understand the implications on driver licencing that AVs may have. Underpinning this challenge is ensuring that regulations put in place comply with our international obligations under 1958 and 1998 United Nations Agreements on Road Vehicle Standards.

In addition, the New Zealand Ministry for the Environment is considering the requirement of a climate impact policy assessment (CIPA) for all the policies that might increase or decrease greenhouse gas emissions. This requirement reflects the importance of considering emission patterns in every policy and strategy in New Zealand, and needs careful consideration in autonomous vehicles work programme.

Ensuring that New Zealand has a fit-for-purpose regulatory framework that is flexible enough to accommodate changing technologies, is a key driver for our current work. This may require a revision of our current regulatory settings, where we opt for a goal-based approach, as opposed to a prescriptive one. The table below provides a summary of different regulatory approaches, and how they might apply to AVs.

Table 1: Regulatory Approaches to Validate AVs Safety

Regulatory approaches	Description	Effect	Where are the detailed rules?	Decision	Autonomous vehicle worked example
Goal-based	Mandatory principles or performance requirements specified in law	Risk tolerant Flexible	Individual firms Regulator guidance Codes of practice Industry standards Court decisions	Judicial	A manufacturer, importer, vendor and person in control of an automated vehicle, must ensure, so far as is reasonably practicable, that every autonomous vehicle is without risk to the safety of road users
Goal-based plus an approval process	Mandatory principles or performance requirements with scope to develop novel and tailored 'how to' solutions, with an approval process	Risk averse Mixed	Safety cases Safety management systems Authorisations Licences	Administrative	The responsible entity for an autonomous vehicle must have and implement an approved safety case for the operation of the vehicle
Prescriptive	Mandatory and detailed rules specified in law	Risk averse Certain	Legislation (primary, secondary) Standards incorporated by reference	Legislative	Every automated vehicle must meet the requirements set out in the rule, and compliance must be tested at each warrant of fitness

Autonomous Vehicles Work Programme

The Ministry has identified four key themes for its Autonomous Vehicles Work Programme. These themes are the priority areas that have been identified to be addressed by the Ministry over the next 6-12 months. These areas are set out below.

Theme One: Safety

Regulatory Challenges

The safe regulation of new vehicle technologies, and in particular Autonomous Vehicles (AVs), is the primary focus of our work programme. Our current regulatory settings mean that there is no explicit requirement in the Land Transport Act 1998 (LTA) for a driver to be present in a vehicle on the road. This means that driverless vehicles could theoretically be operated on New Zealand roads lawfully now, provided they otherwise complied with relevant vehicle standards. These settings are not ideal, given our level of understanding around the interaction between AVs, infrastructure, and other road users.

Ensuring public safety requires regulatory settings that ensure the safety of the driver, other road users, and the general public. We need to understand what an effective regulatory framework looks like, including; the level of risk tolerance we are willing to accept, the balance of flexibility in the system versus certainty for users, and the expertise, resources, and systems we need to administer it.

Consideration will need to be given to whether regulation will require supporting infrastructure to be effective, for example, separate lanes for autonomous vehicles during the early days of adoption, and the relevant potential costs. Any new regulation will also need to support existing legislation and not unduly constrain innovation, or prohibit the development and uptake of new vehicle technologies.

Knowledge Gaps

There is a great deal of uncertainty around the extent to which commercially produced AVs will be reliant on external networks to operate safely on public roads. The development pathways of different countries (relying on external connectivity versus in-built sensors, LiDAR and radar), will have implications for New Zealand as a technology taker, as well as being reliant on overseas vehicle manufacturers for vehicle options. Some of the questions we are seeking answers to include:

- To what extent will V2V and V2I requirements necessitate investment in New Zealand's infrastructure and communications networks?
- Could network requirements be addressed through developing a regional satellite-based augmentation system (SBAS) that improves the accuracy of positioning and minimises the blackspot risks?
- How will connected and/or autonomous vehicles respond to a loss in connectivity?

Understanding safety concerns around level 3 AVs raises an additional set of questions we will need answers to.

- What are the safety concerns of system deactivation delay when immediate human take-over could compromise safety?

- What are the implications of taking a minimal risk approach to the Operational Design Domain (the conditions in operating conditions under which a given driving automation system or feature thereof is specifically designed to function)?
- What are safe secondary activities for drivers (done when not driving) in level 3, 4, and 5 autonomous vehicles? How are these activities regulated under existing legislation e.g. driving while using a cell phone?
- Does an autonomous vehicle know its limits and understand when it should return control to the driver and rely on the decisions of the driver?
- And, understanding how to get clarity on automatic software upgrades to higher levels of autonomy, and what this means for other road user safety, 'driver' compliance and traffic enforcement?

Theme Two: Liability

Regulatory Challenges

As indicated, there is no explicit requirement in the Land Transport Act 1998 (LTA) for a driver to be present in a vehicle on the road. However, the implication in the LTA, and the Land Transport (Road User) Rules 2004, is that a (human) driver is present, as offence provisions are mainly directed towards drivers (and not the vehicle or its owner). If there is no driver, then many of the offence provisions under these pieces of legislation will not be applicable.

Accordingly, there are potential liability/legal issues in relation to non-compliance with New Zealand road traffic laws. What needs to be understood is what level of risk this exposes New Zealand to with the greater introduction of autonomous features. While level 4 and 5 automation may still be some way away, level 3 automation is already available in some vehicles in New Zealand (as at August 2019 there were approximately 400 Tesla Model 3's with level 3 capability).

Aligned to this is understanding how the insurance industry and the courts may respond to the lack of clarity around liability in current legislation. New Zealand's current regulations under Accident Compensation Act 1982 provide that the insurance scheme that covers personal injury and administered by the Accident Compensation Corporation (ACC) extends to vehicles operating in the country. However, there is ambiguity around the applicability of this regulation to fully autonomous vehicles where the role of the driver is minimised or eliminated.

One approach to resolve liability issues could be addressed through a tiered approach that reviews the allocation of liability/responsibility between driver, owner, importer, operator, manufacturer and/or regulator. This approach is based on identifying the party best placed to manage the risks, and subsequently be held to account when an incident occurs.

Knowledge Gaps

To ensure that concerns around liability can be addressed effectively, we need to understand the implications of current regulations, at each level of automation. We have begun exploring this issue with our legal teams and partner agencies to quantify the lead-in times required to make legislative changes, and to ensure that there is some clarity for all parties around their responsibilities as soon as possible.

There is a need for us to ensure that new approaches to address the issue of liability in autonomous vehicles work programme is consistent with other New Zealand regulatory frameworks, and clear in setting out guidelines, rules, and responsibilities of legal entities.

We also need to understand and assess the importance of data management concerns in addressing liability issues, in particular, what data should be accessible by enforcement agencies in the case of incidents to assign liability? Additionally, what data should be collected to support the accurate pricing for insurance around AVs?

Theme Three: Cyber Security & Data

Regulatory Challenges

Deploying autonomous vehicle technologies could create an increased risk of hacking and manipulation to have them perform in a manner that is not in the public interest, including for illegal activity (e.g. to help facilitate criminal activities, used as a weapon by terrorist organisations, by protestors to cause disruption and raise the profile of their causes, or by rival companies to undermine their competition). Identifying, assessing, and regulating for minimising known risks, and scanning emerging risks, will be essential to build public confidence around autonomous vehicle technologies.

As well as public safety, privacy concerns will need to be addressed in regulation. New Zealand currently has privacy protection mechanisms in its Privacy Act 1993. Many issues related to privacy issues and access to the data generated by autonomous vehicles may be addressed in the Privacy Bill that is under development and could be in force as early as 2020. As written, the provisions of the Privacy Bill should increase confidence for individuals that their personal information, however and wherever it is collected and stored, is secure and will be treated properly. We need to understand if the provisions of the new Privacy Bill can be applicable in the AV space.

Knowledge Gaps

Autonomous vehicles generate and store significant amounts of personal information, location data, route history, owner preferences, and other sensitive information about individuals. An autonomous vehicle could potentially produce tens of gigabits of data per second, which is the equivalent to thousands of internet users. Understanding what data should be available to the Government, how this data could be stored, used, and filtered, and how it can be obtained (via regulation, agreements, volition, etc.) needs to be worked through.

Furthermore, the sensitivity of the data, and the reliance on it as potential evidence that might be needed in times of incidents, makes the data more valuable and creates risks such as data monetisation, exposure, and manipulation. Understanding what protections are required around the generation and storage of data, and the definition of proper arrangements to share and access sensitive information are important aspects in managing autonomous vehicle technologies.

Theme Four: Social and Economic Aspects

Fully autonomous vehicles may revolutionise the concept of transport in New Zealand. These vehicles might increase the safety of the transport system. They don't use phones, go over speed limits, or drive when impaired by fatigue, alcohol consumption, or drug use. It has been suggested that fully autonomous vehicles could decrease transport costs, reduce congestion and air pollution, increase public access and mobility, and facilitate freight deliveries.

However, it is less certain when these benefits could be realised, whether they will be equally shared across society, and how much Government's intervention/regulation will be required to ensure positive transport outcomes, and to minimise negative ones. While fully autonomous vehicles could provide much needed opportunities for people who are transport-disadvantaged due to a disability, old age, or other debilitating conditions, provide services to people with memory or vision loss, and improve the quality of life for many people, the accessibility, inclusivity, and affordability of such options are unknown. AVs could also discourage the use of more active modes of travel.

It is also believed that autonomous vehicles have the potential to reduce road crashes, increase safety, and create a smoother traffic flow. The concurrent deployment of autonomous vehicles with the existing vehicle fleet may however result in the opposite as autonomous and non-autonomous vehicles struggle to co-exist. There may also be unforeseen/unexpected challenges created by pedestrians and those using micromobility travel options.

The variation and inconsistency between manual and autonomous vehicles and other road users could increase road crash rates during the transition to autonomous vehicles. Recognising these challenges and building suitable mitigations is a key element to supporting AV deployment. There needs to be early needs-based assessments of risks, transparent communication of those risks to the public, and timely engagement with the public to promote awareness, alleviate public unease and build trust.

There are many more elements to investigate, even down to the question of vehicle and component depreciation for businesses. We are uncertain how autonomous vehicles will depreciate. Autonomous vehicles use advanced cameras, radar, LiDar, and other technologies that are costly to replace. The long-term repair and maintenance of these expensive parts are matters that need consideration in relevant business models for trial and deployment of autonomous vehicles.

Exploring a way to conduct an impact evaluation of the abovementioned points and understanding and incorporating the views and benefits of the public in that assessment is a key element to our work programme.