Submission
No 16

DRIVERLESS VEHICLES AND ROAD SAFETY

Organisation: Australian Driverless Vehicle Initiative (ADVI)

Name: Mr Peter Damen

Position: Chair, Executive Steering Committee

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Mr Greg Aplin MP,
Chair of the Staysafe Committee (Joint Standing Committee on Road Safety)
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Dear Chair,

Driverless Vehicles and Road Safety (Inquiry)

Please find attached response to the inquiry into driverless vehicle technology and road safety in New South Wales.

The committee demonstration and discussion held with Australian Driverless Vehicle Initiative (ADVI) members on 14 March 2016 will also add to this written response.

Not since the invention of the internal combustion engine over 100 years ago has the world been on the brink of such a major transport revolution. Driverless vehicle technologies bring significant global economic, environmental, safety and social benefits, but such major change also brings major challenges.

Our current mindset of how we own and use vehicles will be tested.

The driverless and connected vehicle remains a complex technology and will require the provision of a more flexible approach to industry by supporting new technologies and innovations for the transport system.

Vehicle technologies have shown a significant benefit to Road Safety, recent technologies such as Electronic Stability Control have already delivered a saving for the Australian community, with the benefits expected to increase as this technology becomes more prevalent within the Australian vehicle fleet. Australian research has also clearly shown that the avoidance and effect of road crashes could be greatly reduced if all Australians had access to the safest vehicles in class.

However, the benefits of current vehicle safety technology and rate of change are not enough. The road toll in NSW during 2015 was the highest in three years, as at 27 April 2016 the NSW road toll is already significantly higher than at the same time last year, 131 lives lost and hundreds of seriously injured road users.

It remains imperative that Australians ask for the latest technologies from vehicle manufacturers and demand that governments have flexible legislation in place ready to accept the latest in proven driverless technology safety features.

Given the convenience features the driverless car will bring the community, it is likely that this technology will be demanded, bringing a rapid uptake of these convenience features into the fleet, along with the road safety benefits they will provide. It is therefore imperative that the safe and successful transition of driverless vehicles onto Australian roads is enabled by government.

Thank you and the committee for your time on 14 March 2016 and we encourage the committee to consider the following key recommendations summarised below and expanded on in more technical detail within the attached.

1. The rapid availability and advancement of automated vehicle technology will require a new approach to how Government, industry and innovators work to enable its early introduction to the Australian market.
2. The need for the NSW Governments to eliminate barriers, by having an agile legislative framework to enable the early introduction of proven technology to deliver the road safety benefits to NSW.
3. The key role of the ADVI collaboration, which includes TfNSW and many other NSW based organisations, to inform, through the early engagement of industry, government and academia, a consistent, safe and effective policy across Australia.
4. The acknowledgement that Australia through a coordinated national collaborative approach (ADVI) can rapidly accelerate the social, economic and environmental benefits from the reduction of crashes on the road network.

As this global sector continues to develop at a rapid rate I am happy to further discuss this submission and developments as they arise with the committee. This will enable continued engagement with your parliamentary process as things progress towards the driverless future in NSW.

Yours sincerely

[redacted]

Peter Damen
Chair, Executive Steering Committee
Australian Driverless Vehicle Initiative

AUSTRALIAN DRIVERLESS VEHICLE INITIATIVE

THE AUSTRALIAN DRIVERLESS VEHICLE INITIATIVE

Who are we?

In mid-2014, the ARRB Group started advocating for driverless vehicle technology, and lobbied for the creation of a funded partnership program. Following an industry roundtable event later that year, the Australian Driverless Vehicles Initiative (ADVI) was launched on 21 July 2015 in Adelaide by the Hon Jay Weatherill, Premier of South Australia.

Led and coordinated by ARRB, the ADVI initiative is now a cooperative partnership program comprising more than 50 Australian and international organisations, and is funded by a range of government, industry and academic research partners.

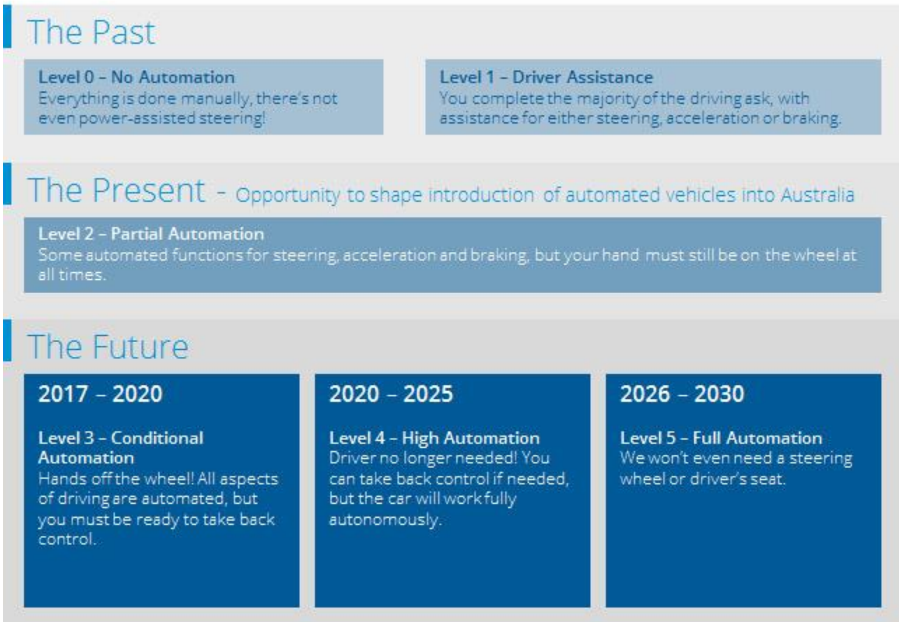
The ADVI initiative is managing the safe and successful introduction of driverless vehicles onto Australian roads, and will ultimately position Australia as an international role model in the development of new technologies and attract developers, innovation and investors.

ADVI's role is to investigate and help inform the development of robust national policy; performance criteria; legislation; regulation; business models and operational procedures; and processes to pave the way for the introduction of self-driving vehicles to Australian roads.

Running parallel with those efforts, work is also underway to raise public awareness and encourage a change in mindset through knowledge-sharing, demonstrations, and simulated and in-field investigation trials.

What is a driverless vehicle?

Many modern cars have some form of partial automation (level 2), with adaptive cruise control, and self-park systems becoming common place. Within the context of the ADVI initiative, the term '*driverless*' refers to all vehicles with level 3 or above automation, as shown in the chart below. This means that at a minimum a driver does not have their hands on the steering wheel and while all aspects are automated, the driver is still ready to take over control.



The ADVI initiative will look to shape the introduction of driverless vehicles into Australia to ensure suitable and adequate policies are in place to take advantage of these technologies, whilst providing increased mobility for citizens, and maintaining a safe environment for all.

Is Australia ready for self-driving vehicles?

There is a great deal of work to be done – especially legislative, policy and infrastructure changes – before we see these types of vehicles on Australian roads. One of the biggest challenges is the lack of consistency across States and Territories when it comes to policy and infrastructure.

While these technologies will continue to develop in the years ahead, the transition from semi-automated to fully driverless technology can be expected within the decade, as shown in the diagram below.

While driverless vehicles are sure to be seen as disrupting technology when it comes to the mobility of people and movement of freight, the introduction of this technology is inevitable, and under the right circumstances, we could see a 50-75% autonomous fleet mix between 2035 and 2045.[1]

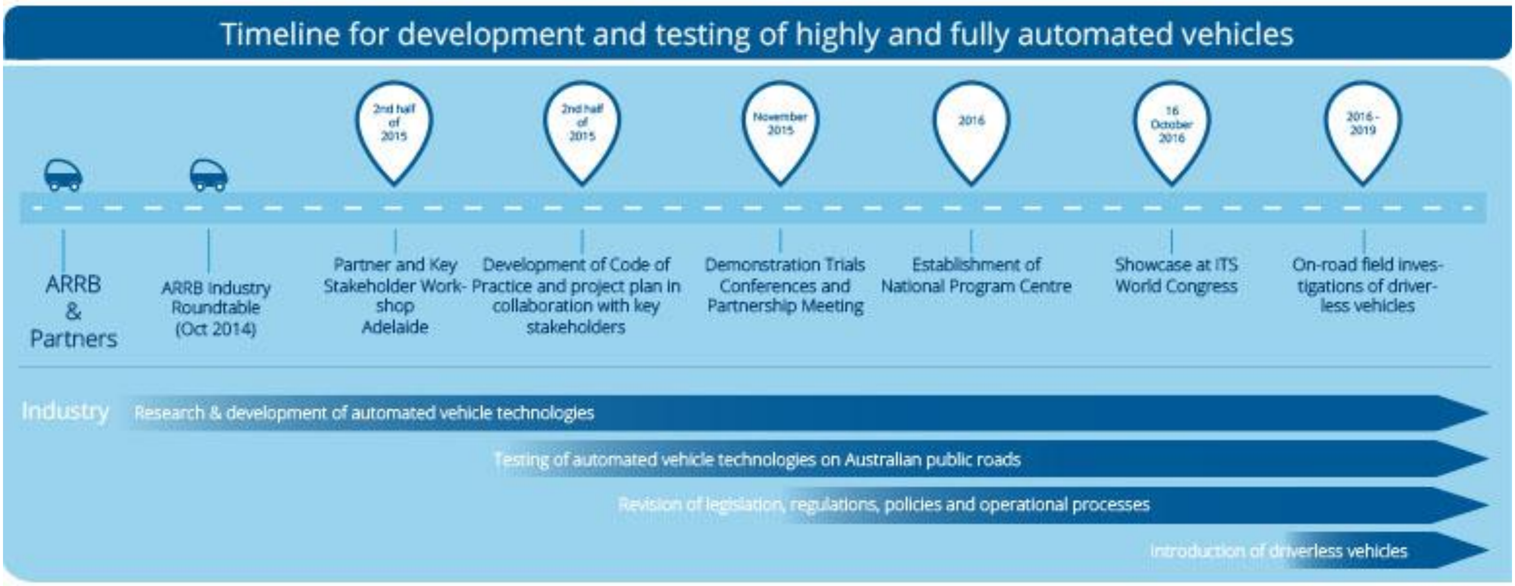
What are the benefits?

Driverless vehicles have the potential to provide significant economic, environmental and social benefits including improved social inclusion. This technology will make driving easier and safer, allow people to be more productive and offer greater mobility to a wider range of people than ever before, reduce emissions, and ease congestion.

Why is this technology important?

Road transport is the life blood of Australia. While the movement of people and freight drives the economy and our ability to directly interact with each other, driving still remains the number one risk for injury or fatality for most Australians as part of their daily life.

With road accidents estimated to cost the community more than $27 billion per annum[2] the opportunity exists to reduce these significant risks and costs through driverless vehicle technology. A reduction of up to 90 percent of accidents, combined with a potential savings of $24.3 billion[3] in reduced road trauma means that this is the biggest road safety opportunity in history.



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[2] ATC. (2011). National Road Safety Strategy 2011-2020. Canberra: Australian Transport Council
[3] McKinsey & Company. (2015, June). Ten ways autonomous driving could redefine the automotive world. Retrieved from http://www.mckinsey.com/insights/automotive_and_assembly/ten_ways_autonomous_driving_could_redefine_the_automotive_world

Staysafe Committee inquiry into driverless vehicles and road safety in NSW

Response from the Australian Driverless Vehicle Initiative

Term of Reference 1.

The capacity of driverless vehicle technology to deliver improved road safety outcomes including a lower road toll, and fewer accidents and injuries to drivers, pedestrians and other road users.

Automated vehicles (AVs) are those in which at least some aspects of a safety-critical control function (e.g. steering, throttle, or braking) occur without direct driver input (NHTSA, 2013).

AVs are expected to incorporate a wide range of technologies (e.g. radar, lidar, global positioning, digital maps, camera vision systems, etc) capable of performing dynamic driving functions that have, traditionally, been performed by humans. These driving functions include route finding, route following, velocity control, collision avoidance, rule compliance and vehicle monitoring (Brown, 1986). AVs already exist that are capable of performing some or all of these dynamic driving tasks.

The Society of Automotive Engineers (SAE) Standard *J3016: Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems* (SAE, 2014) differentiates between six levels of vehicle automation, ranging from Level 0 (No Automation) to Level 5 (Full Automation). (See Table 1, below). Notable is Level 3 – the level at which there is requirement for the driver to take back control of an automated in the event of vehicle system malfunction or inability to function autonomously.

Table 1: Levels of Vehicle Automation defined by the SAE (2014)

Level	Name	Narrative definition	Execution of steering and acceleration/ deceleration	Monitoring of driving environment	Fallback performance of *dynamic driving task*	System capability (*driving modes*)	BASt level	NHTSA level
***Human driver* monitors the driving environment**								
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a	Driver only	0
1	Driver Assistance	the *driving mode*-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 *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes	Assisted	1
2	Partial Automation	the *driving mode*-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 *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes	Partially automated	2
***Automated driving system* ("system") monitors the driving environment**								
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes	Highly automated	3
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes	Fully automated	3/4
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**	-	

Automated vehicle developers are introducing increasing levels of automated control in their vehicles, but along different deployment paths. Vehicle manufacturers appear to be going down an iterative path, starting with automated vehicles that require a human driver to monitor the vehicle and to intervene if required, and progressing stepwise towards full automation. Others (e.g. Google) have focussed on developing highly automated vehicles that can drive themselves, but only along restricted routes.

Automated vehicles are not yet 100% reliable and safe (Martens & van den Beukel, 2013). Therefore, in situations in which the automation fails or is limited (e.g., sensory degradation in poor weather conditions; inability of on-board computer algorithms to make a safe decision), the driver will be expected to take control of the vehicle and resume manual driving. This is a requirement for drivers of Level 3 vehicles (see Table 1). For this transition of control to occur safely, it is imperative that the driver fully understands the capabilities and limitations of the automation and maintains full awareness of what the vehicle is doing and when intervention might be needed (Cummings & Ryan, 2014).

Automated vehicles have great potential to improve road safety, reduce congestion, improve productivity and confer many other benefits (Levitan & Bloomfield, 1988). For example, by automating driving functions that are prone to human error, it is assumed that automated vehicles will reduce, and even eliminate, road crashes. Some claim that, because human error contributes to around 90% of all cashes in road transport, that automated vehicles have potential to eliminate 90% of all crashes (Fagnant & Kockelman, 2014). However, such projections should be regarded with a degree of caution. There are for several reasons for this.

Firstly, although drivers make errors from time to time, many of these errors are themselves induced by poor road design (e.g. confusing intersection design; visual clutter; etc) rather than any driver limitation. Thus, such estimates of the potential for automated vehicles to eliminate human error may be optimistic.

Secondly, automated vehicles have potential to create new risks that may undermine their predicted safety benefits. As noted, Level 3 vehicles will require drivers to take back control of the vehicle when requested by the vehicle. Although vehicle manufacturers assert that drivers will be given ample time to take back control when a takeover request is issued, such advanced warning may not be possible in all situations; in which case drivers may not be able to safely take back control.

Thirdly, it is not known at this point in time how the drivers of non-autonomous vehicles will interact with drivers of automated vehicles. There is already evidence of inadequate communication between Google cars and other road users in the United States. Google vehicles have not in some situations (e.g. at intersections when signals turn green) behaved in ways expected by other road users, resulting in minor property crashes; and a recent crash between a Google car and a bus in the US highlighted the difficulties in programming self-driving vehicles to anticipate, perceive and react to potential and actual hazards in the way that skilled drivers do.

Finally, highly automated vehicles have not yet travelled long enough distances to enable accurate estimates to be made of their potential crash reduction benefits. Although manufacturers and technology companies can create many simulated tests though computing rather than physical on-road testing, potentially reduces the requirement for traditional and lengthy on-road testing. Google have claimed to perform virtual road testing in parallel with traditional on-road tests with their simulators 'driving' more than 3 million miles a day. Furthermore the use of deployed technology within the community will also act to reduce the need for traditional testing methods. For example, Tesla vehicles through the early deployment of autopilot technology and cloud based technology to capture the real world data have estimated to travel as many miles in 3 months as the Google cars have driven in 7 years.

Human Factors Issues

With increasing automation, the role of the human, as a ' driver ', will change. Gradually, the role of 'driver' will change to that of 'supervisor' (of automation) and, ultimately, to that of 'passenger'. The social interaction between road users will also change with greater automation, in ways that are not yet understood.

Formally, this shift is beginning to occur with amendments to the amendments to the 1968 Vienna Convention on Road Traffic (Amendments to Article 8 and Article 39 of 1968 Convention on Road Traffic) attained on 23 March 2016.

Cunningham and Regan (2015), and others (e.g. NHTSA, 2013 & Van Nes and Duivenoorden, 2016) have highlighted a number of human factors issues that will be critical to understand and address in order to ensure the safe transition from manual to automated driving. These are summarised briefly below, and following that some general recommendations are made for research to support our understanding of these issues.

Interaction of the driver with new technology in the vehicle

Key issues here include:

- Transition of control between vehicle and driver:
  - the ability of drivers, in Level 3 vehicles, to take back control safely from a vehicle following a takeover request
  - the ability of drivers, in Level 3 vehicles, to drive safely when over-riding control of the vehicle in situations that might be better handled by the vehicle
- Mode awareness – the ability of drivers, in Level 3 vehicles, to know what functions they are controlling and what functions the vehicle is controlling, and how to support situation awareness of the state of automation.
- Driver state – whether or not the driver of a Level 3 vehicle is in a fit state (not drunk, situationally unaware, distracted, inattentive, drugged or fatigued) to safely take back control from a vehicle following a takeover request, and how to assess and manage this.
- HMI design:
  - How to design the human machine interface to support the safe and timely transition of control between vehicle and driver and vice versa.
  - How to allow design and allow for customisation/personalisation of the user interface in ways that do not compromise safety (e.g. allowing the driver to make a partially or fully automated vehicle drive more or less conservatively)
  - How to keep drivers of partially automated vehicles involved in the driving task and aware of the vehicle status and road traffic situation (i.e., keep the driver 'in-the-loop').

Interaction of automated vehicles with other vehicles and road users. This concerns:

- Interaction with other vehicles:
  - Interaction between vehicles with different levels of automation (non-, partly-, highly-, and fully automated) - discussed below.

- Interaction with vulnerable road users (VRUs):
    - The ability of vulnerable road users to recognise the intent and predictability of partly and fully automated vehicles – failure to be able to do so could compromise safety.
    - The ability of automated vehicles to identify the intent and predictability of VRUs.

General human factors issues (discussed in Cunningham & Regan, 2015)

- Trust – over-reliance on automation may result in drivers failing to question the performance of automation. Drivers of partially automated vehicle over-reliant on the technology may be more likely to lose manual control skills, which may be problematic when required to drive manually control vehicles. Too little trust may result in the technology being ignored and negating its potential safety benefits. The issue is how to ensure that trust is at an optimal level.
- Acceptance – if automated vehicles are not acceptable to drivers, passengers and other road users, there will be no demand for them, they will not be used and, hence, they will not yield the intended safety and other benefits. Lack of acceptance may also lead to system misuse and even abuse. The challenge here is to determine how to optimise driver and road user acceptance of automated vehicles.
- Driver underload and overload - when drivers are exposed to prolonged periods of automation, this may lead to a loss of vigilance, which can lead in turn to reduced situation awareness and an inability to cope with a sudden increase in demand and, in turn, overload; which may occur when drivers of Level 3 vehicles are required to take back control of the vehicle in response to a takeover request.
- Behavioural adaptation – it is not known how drivers will adapt to partially and fully automated vehicles. There is potential for safety to be undermined if drivers adapt in ways which yield unsafe behaviours. Some drivers, for example, may fail to disengage cruise control when negotiating curves that have a lower speed limit than the pre-set cruise speed.
- Misuse and abuse - misuse of partially automated vehicles is possible when a driver attempts to operate the vehicle outside of it's design parameters – for example in an area in which it cannot function autonomously.

  Abuse may occur when other road users attempt to take advantage of the vehicle's pre-programmed "driving style" (e.g. by cutting in between AVs), or by interfering with vehicle sensors (e.g. throwing mud onto forward facing cameras on vehicle windscreens)

- Skill degradation – drivers of partially automated vehicles that rely on automation may fail to use their manual driving skills over long periods of time. This may diminish their ability to take back control of a Level 3 automated vehicle if requested; or to take control voluntarily of a self-driving vehicle that allows for manual control.
- Motion sickness - Sivak and Schoettle (2015) purport that up to 10% of American adults are expected to experience motion sickness often in autonomous vehicles. The challenge is how to manage this, through vehicle design and driver education.
- Individual differences – how can we ensure (through design, training or licensing) that partially automated vehicles can be driven safely by different driver sub-groups (elderly, young, impaired)

In summary, the success of the technology in being able to deliver its intended safety benefits will depend critically on understanding and managing these human factors issues.

The following recommendations are made for research that is needed to investigate and understand these human factors issues, in order to support countermeasure development:

Research:
Global research will continue to inform the transport and industry sectors as well as Governments and policy makers.
Importantly; Australian conducted research is required and we cannot solely rely on research conducted in other countries. Australia continues to have specific unique driver behaviours, environmental and road conditions and fleet mix which requires Australian conducted research around the interaction of new vehicle technologies.

New research is required to inform training, testing, licensing and vehicle design. It is recommended that a program of research be undertaken that aims to increase understanding and knowledge of the following issues with the aim of ensuring a safe transition to fully automated vehicles:

- To investigate appropriate means by which drivers may take back control of the vehicle (or vice-versa) in different driving situations, in different environments, and in different driver states (eg when distracted, fatigued).
- To investigate situations in which drivers might misuse and abuse automated vehicles and how automation might be used to monitor the driver for evidence if these behaviours.
- To understand user requirements for the personalisation and customisation of the human machine interface and determine options for customisation that do not compromise safety
- To understand what drivers do in automated vehicles when the vehicle is in control. Where they look. What they attend to. What they touch. This will inform vehicle design and education programs.
- To understand the situations under which drivers of partially automated vehicles are reluctant to take control of the vehicle and cede control back to the vehicle.
- To understand the situations in which drivers seek to over-ride the vehicle to regain manual control.
- To understand the causes and effects of “mode confusion” - the propensity for drivers to forget who is in control of an automated function– vehicle or driver.
- To understand the conditions under which drivers and road users misuse or abuse automated vehicles – for example, use them in situations in which they cannot drive autonomously; tamper with sensors that support automation; etc
- To investigate how drivers react in “conflict situations” - situations in which it is likely that a conflict with another vehicle or road user will occur, but which the vehicle is expected to handle.
- To understand how other road users interact with autonomous vehicles – for example, whether they abuse them (e.g. cut in front of them, on the expectation that the vehicle will yield to them).
- To gauge public acceptance and trust of automated vehicles. When would they use them? Which functions do they trust the vehicle to perform safely? Do they want the option to drive an automated vehicle manually, even though it is fully automated? Do they want to be able to personalise the way in which the vehicle operates? (e.g. to make drive more or less conservatively). What factors influence

driver acceptance (e.g. false alarm rates, nuisance warnings, automation system availability and reliability, etc)

- To understand how differences in driver age, gender and other factors influence driver and passenger use, adaptation to and acceptance of automated vehicles.
- To test the ability of fully automated vehicles to anticipate, perceive and respond to other vehicle and road users.
- To understand what driving skills deteriorate, and at what rate, with prolonged exposure to vehicle automation.
- To investigate the propensity for drivers of automated vehicles to suffer from motion sickness and research ways of mitigating against motion sickness.
- HMI design - to design and evaluate communication methods between the driver and vehicle to ensure safe operation of automated vehicles, especially during the transfer of control from vehicle to driver.

Terms of Reference 2 and 3

2. The extent to which current road safety policies and regulations in NSW anticipate the introduction of driverless vehicle technology, including driverless heavy vehicles, and any regulatory and policy changes which will be required

3. The preparedness of NSW road safety regulators to meet the challenges extended by driverless vehicle technology

Regulatory changes to accept he future of fully driverless vehicle will be required at a global, national, state and local government level. While state based regulations can be amended to allow for on-road testing of advanced vehicle technologies, like what has been achieved in South Australia, to allow the use of these technologies within the community, considered amendments will require support from all jurisdictions allowing for amendments across multiple sets of complex legislation.

Driverless vehicles will bring amendments to not only road safety policies and regulations but require amendments to others such as telecommunications, insurance, risk and passenger transport.

A consistent national approach in Australia must be pursued to enable new or amended regulations to allow advanced automotive technology on Australian roads. The method of broad and considered consultation with industry to deliver forward thinking model legislation which sets performance based outcomes rather than being overly prescriptive and traditional referencing specific automotive technology will be required. Australia's prompt action will also enable interaction on a global scale and possibly lead to setting model legislation considered by global regulation such as the GTR's and UNECE's.

As noted, the human skills required to drive vehicles will change as vehicles become increasingly automated, and this will have implications for the training, testing and licensing of drivers.

Training:

Education and training will be necessary:

- To support drivers to respond to take-over requests in a timely and safe manner (for Level 3 vehicles).
- To make drivers understand the limitations and capabilities of automated vehicles.
- To make drivers aware of the potential dangers in over-riding control of automated functions in situations more safely handled by the vehicle.

- To make drivers aware of the impact of driver state (e.g. distraction, inattention) on the ability to safely take back control from a vehicle following a takeover request (for level 3 vehicles).
- To support drivers in maintaining manual skills eroded by prolonged exposure to automation that may be required for the operation of Level 3 vehicles, or fully automated driving vehicles that can by driven manually.
- To make drivers and road users aware of issues relevant to safe interaction between non-, partly- and fully-automated vehicles.

Testing:

- For SAE AV levels 0 to 3, it is envisaged that driver skills testing will be required due to the requirement for occasional driver intervention and control.

Licensing:

Special licensing for AV operation may be warranted for the operation of Level 3 AVs, conditional upon certain pre-requisites such as a person having completed a test and training course (or minimum number of hours of operation).

As Level 3 AVs require progressively less likelihood of manual skill loss; for example, through refresher training (as in aviation) or by requiring drivers to de-activate autonomous features in the vehicle on a periodic basis and provide proof of this.

As vehicle automation increases to Level 4 and 5, a new license class may be necessary for those wishing to drive manual vehicles, or to drive AVs manually (if manufacturers provide this option).

Until vehicle automation reaches Level 4 and 5, current license restrictions for non-drivers (e.g. due to impairment, disability etc.) would seem appropriate.

Other (non-human factors) critical issues on the path to higher levels of automation are:

- Policy and legislation:
    - Legislation: Exemption processes, conditions for permitting new systems/AVs
    - Liability
    - Ethical issues
    - Quality assurance: system errors and cybersecurity
    - Protection of data and privacy
    - Systems (safety) effects at different penetration levels of the systems
- Infrastructure and road network:
    - Preparing existing infrastructure for (partly) automated vehicles "Road that cars can read"
    - Smart infrastructure and V2X
    - Impacts of new systems on safety and traffic flow:
        - impact on network level of different degrees of system usage/market penetration
        - Include behaviour in impact assessments

Globally these aspects remain under discussion. The European Transport Safety Council released a statement on 26 April 2016 advising of safety approvals for new cars will need revision to include 'driving tests' for automated and fully-autonomous vehicles. However, in this same statement by the ETSC, we note that there was reference to the ability to override inbuilt vehicle safety technology, ADVI would caution this approach as it could reduce or even eliminate the significant road safety benefits that vehicle technology provides. We recommend that these concerns are better to be considered once there is an expert understanding of the capability of the technology rather from early regulation, which has been the traditional approach.

Term of Reference 4

The experience of other jurisdictions in Australia and overseas in adopting and adapting to driverless vehicle technology

It is expected that Intelligent Transport Systems (ITS) in future traffic and transport systems will play an increasingly prominent role and will affect the number of victims of road accidents.

The latest forecast in the Netherlands is that developments in the field of driver assistance and vehicle automation fatalities could lead to a decline by around 2020 of 10 fatalities per year and a reduction in the number of serious road injuries by 300 per year (Weijermars et al., 2015). For 2030 the forecast is that the number of deaths could reduce by possibly up to 90 per year, and the number of serious road injuries by 3,300 per year. This estimate excludes the impact of electronic stability control, which is expected to reduce the number of fatalities by about 10 per year and the number of serious road injuries by 100 per year for both 2020 and 2030. Taking into account that the Netherlands is one of the best performing countries in terms of road safety, the impacts are likely to be higher in Australia.

Driverless vehicle technology has potential to deliver improved road safety outcomes including a lower road toll, and fewer accidents and injuries to drivers, pedestrians and other road users.

There is not only value in looking towards other states (South Australia) or country's (UK & USA) in the experience with this technology but to also look towards parallel Australian sectors, and the lessons they have learnt in tackling autonomous operation in the public domain. For example the rail and mining sector as well as the transferable experience from the Australian Civil Aviation Safety Authority relating to Remotely Piloted Aircraft and Remotely Piloted Aircraft Systems may be of benefit.

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